BP – SCOTIAN BASIN EXPLORATION DRILLING PROJECT

Responses to Information Requests

March, 2017

TABLE OF CONTENTS

Information Request (IR) IR-001

Applicable CEAA 2012 effect(s)[1]: All

EIS Guidelines Reference: Part 1, 3.3.2 Valued components to be examined; Part 2, 6.3.1 Fish and fish habitat; 3.3.3 Marine mammals; 6.3.4 Marine turtles; 6.3.5 Migratory birds

EIS Reference: 6.2.5 Assessment of Project-Related Environmental Effects; 7.2.5 Criteria for Characterizing Residual Environmental Effects and Determining Significance; 7.2.8.3 Characterization of Residual Project-Related Environmental Effects; 7.3.5 Criteria for Characterizing Residual Environmental Effects and Determining Significance; 7.4.5 Criteria for Characterizing Residual Environmental Effects and Determining Significance; 7.5.5 Criteria for Characterizing Residual Environmental Effects and Determining Significance

Context and Rationale: For some valued components, the definitions for the characterization of the magnitude of residual effects are not clear.

The *Operational Policy Statement: Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012* states that if categories such as “low,” “moderate,” or “high” are used to describe magnitude of residual effect, each should be clearly defined and the rationale for identifying an effect as low, moderate, or high should be clearly documented. In the EIS (sections 7.2.5, 7.3.5, 7.4.5, 7.5.5), the magnitude of effects on fish and fish habitat, to marine mammals and turtles, to migratory birds, and to special areas is defined using terms such as “range of natural variability,” “population viability,” and “exceeds the limits of population viability,” however the meanings of those terms are not clear.

Specific Question or Request: For fish and fish habitat, marine mammals and sea turtles, and migratory birds:

- Clarify how the “range of natural variability” is defined, and how residual effects can be determined to be within this range for all species included in the valued component if using qualitative definitions. For example, the Project will introduce underwater noise that could cause injury or behaviour change in fish close to the source of the noise (EIS section 7.2.8.3), which is described as a low magnitude effect (*i.e.* within the range of natural variability);
- Clarify what population is referred to by “population viability”, how the population of each species is included in the valued component, and if species at risk or of conservation concern are included (*i.e.* is the most sensitive species to disturbance being used as an indicator species?);

  Clarify the difference between “measurable change, but not posing a risk to population viability” (moderate magnitude) and “measurable change that exceeds the limits of natural variability and may affect long-term population viability” (high magnitude).

[1] See legend at end of document for a description of applicable environmental effects

Clarify how population viability is taken into consideration for species at risk. Clarify how a determination of measurable change is made without quantitative analysis; and

- Clarify if the definition of magnitude of residual effects as negligible, low, moderate, or high is based on an average across all species in the valued component (*e.g.* marine mammals and turtles), or reflective of the more at risk species included in that valued component (*e.g.* endangered northern bottlenose whale, blue whale, and leatherback sea turtle). If the former, indicate where the assessment of residual effects on individual species at risk can be found.

Update the magnitude and significance analysis for direct effects and cumulative effects for each valued component as negligible, low, moderate, or high, as needed.

Response:

Clarify how the "range of natural variability" is defined.

The range of natural variability refers to natural fluctuation of a population over generational time periods. Population numbers will naturally rise and fall over time in response to factors such as prey availability, predator populations, disease, and climate effects. In the context of this Environmental Impact Statement (EIS) and using Fish and Fish Habitat as an example, the range of natural variability is where potential Project-related effects are undetectable within the natural life cycle of a species considering fluctuations of year class strength of fish populations primarily due to prey abundance, climate, and predator abundance.

How can residual effects be determined to be within this range for all species included in the valued component if using qualitative definitions?

The percentage of populations affected by Project activities has not been specifically estimated and it would have a high level of uncertainty given the level of sufficient population data being available across various taxa and the value of the method relative to environmental assessment requirements for the Project. However, the characterization of residual effects for each valued component (VC), including the characterization of range of magnitude (range of natural variability), considers the reasonable worst-case scenario, and is therefore considered to provide a conservative indication of effects. For example, any potential mortality caused by underwater sound to a fish that is very close to the underwater noise sources (*i.e.*, within a few metres), would not be detectable at the population level for most species. In this case, a qualitative indication is considered to be sufficient for an understanding of the risk to a population.

Clarify what population is referred to by "population viability".

Population viability refers to the sustainability of a specific population, and the ability of a particular species to persist, avoiding extinction or extirpation. In the context of this EIS, population viability refers to the continuation of a population with the development of the proposed Project.

How is the population of each species is included in the valued component?

Section 5 of the EIS described the existing conditions including life histories for species present within the Regional Assessment Area (RAA). Where information is available, population information is provided for select species. In particular, population status is provided for species at risk (SAR) and species of conservation concern (SOCC).

Are species at risk or of conservation concern included?

Population viability includes all species including SAR and SOCC. The protection of SAR and SOCC are generally the focus of the environmental assessment. The consideration of population viability assumes a reasonable worst-case approach and is therefore considered to provide a conservative indication of effects.

Clarify the difference between "measurable change, but not posing a risk to population viability" (moderate magnitude) and "measurable change that exceeds the limits of natural variability and may affect long-term population viability" (high magnitude).

Moderate magnitude for Fish and Fish Habitat, Marine Mammals and Sea Turtles, and Migratory Birds is defined in the EIS as "a measurable change, but not posing a risk to population viability". In the context of this EIS, an effect could be measurable and outside the range of natural variability within a localized area (*e.g.*, drill cutting discharge within the Project footprint) but not pose a risk to the overall population viability of the species affected. For example, occasional ship traffic associated with the Project may temporarily affect marine mammal's ability to use the area beyond the natural variability; however, once vessel traffic has passed, the marine mammal is able to return to the natural habitat but the population sustainability for that species has not been threatened.

High magnitude is defined as "measurable change that exceeds the limits of natural variability and may affect long-term population viability". A high magnitude change refers to an effect that could be measurable and outside the range of natural variability and also could affect the population sustainability for a species. For example, in the event of an accidental event, an unmitigated blowout incident could result in a measurable change outside the range of natural variability (*e.g.*, mortality of migratory bird species such that it threatens the survival of a population for future generations) or self-sustaining population objectives or recovery goals for listed species are jeopardized according to the significance threshold used in this EIS.

Clarify how population viability is taken into consideration for species at risk.

A conservative approach is taken when determining population viability. While all species are considered for the determination of magnitude, protection of SAR and SOCC is the primary focus. Where Project activities overlap with areas known to support SAR habitat, it is assumed the species may be present in that location (*e.g.*, SAR on Sable Island). A reasonable worst-case approach is used to determine magnitude for each VC. Where SAR are identified (*e.g.*, the northern bottlenose whale), recovery strategies or action plans are considered when determining population viability.

Clarify how a determination of measurable change is made without quantitative analysis.

A quantitative approach is used, where supporting information is available (*e.g.*, where population estimates are available and where scientific literature and modelling provides estimates of zones of influence and likely effects). In instances where data/information is not available for a quantitative analysis, a qualitative approach is applied based on professional judgement and experience of the assessor taking a conservative approach in consideration of potential risk to the species. For example, in the event of an uncontrolled well blowout, quantitative analysis of residual effects (*i.e.*, number of bird mortalities or effects on the fishery) cannot be accurately estimated; therefore, conservatively it is assumed to have a significant effect.

Clarify if the definition of magnitude of residual effects as negligible, low, moderate, or high is based on an average across all species in the valued component.

Measurable change ratings included in the "Summary of Project Residual Environmental Effects" tables for each VC is meant to be illustrative and indicative of a general characterization of residual effects. A more detailed description of effects, including individual SAR is provided in the text, where relevant. As noted above, a conservative approach is used to determine magnitude, and while all species are considered in the VC, the determination is reflective of the reasonable worst-case scenario including SAR included in the VC.

Update the magnitude and significance analysis for direct effects and cumulative effects for each valued component as negligible, low, moderate, or high, as needed.

Ratings included in the "Summary of Project Residual Environmental Effects" tables for each VC are meant to be illustrative and indicative of a general characterization of residual effects. A more detailed description of effects, including individual SAR is provided in the text, where relevant. It is believed that the criteria used for magnitude and significance analysis for direct effects and cumulative effects for each VC provides an adequate overview for each VC, inclusive of SAR and SOCC.

References:

Thomson, F. S.R. McCully, L. Weiss, D. Wood, K. Warr, M, Kirby, L. Kell and R. Law. 2008. Cetacean stock assessment in relation to exploration and production industry sound: current knowledge and data needs. 07-11 Schedule 01. Submitted E&P Sound and Marine Life Programme – International Association of Oil and Gas Producers. 4 July 2008. Available at: http://gisserver.intertek.com/JIP/DMS/ProjectReports/Cat3/JIP-Proj3.3.2_CetaceanStockAssessment_2008.pdf

Information Request (IR) IR-002

Applicable CEAA 2012 effect(s): All

EIS Guidelines Reference: Part 2, 6.3.1 Fish and fish habitat; 6.3.6 Marine mammal; 6.3.4 Marine turtles;

6.3.9 Commercial fisheries; 6.3.6 Federal species at risk

EIS Reference: 7.3.8.3 Characterization of Residual Project-Related Environmental Effects

Context and Rationale: In characterizing the residual effects for each valued component, it is not always clear how the timing of the effect is considered, as described in the *Operational Policy Statement: Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012*.

The EIS Guidelines (6.3.9) require a discussion of how drilling activities correlate to key commercial fisheries windows, and any potential impacts resulting from overlapping periods. The EIS Guidelines (6.3.6) also require a discussion of migration patterns of federal species at risk and related effects (*e.g.* displacement, increased risk of collision). Although the EIS includes a discussion of underwater noise effects on marine mammals during different seasons (section 7.3.8.3), it is not clear how this affects the characterization of residual effects.

Specific Question or Request: For each valued component, describe the timing of any residual effects and assess how that affects the valued component including during the following times:

- A period of migration for species at risk for fish or marine mammals;
- During summer when benthic fauna are more susceptible to smothering;
- When species are using an area for sensitive life stages; and
- When the project area is being used by Indigenous peoples.

Response:

When characterizing the residual effects for each valued component, it is assumed that the timing of each effect could occur at any point during the year. The project will be carried out in multiple phases. The first phase will include the first one or two wells of the program. It is expected that the first phase of exploration drilling will commence in the second quarter of 2018 (refer to Section 2.7 of the Environmental Impact Statement (EIS) and response so IR-008 for further information). After the drilling of the wells in the first phase, the results of those wells will be analyzed to inform the execution strategy for any subsequent wells. Further wells in the program will be drilled in a subsequent phase following this analysis phase. The timing for the subsequent phase of exploration drilling has not yet been confirmed as it is contingent on the outcome of the first phase, however it is assumed that it could occur from 2019. Therefore, as a precautionary measure, it has been assumed that drilling could occur at any point during the year.

The reader is encouraged to reference the following sections and tables for information pertaining to key commercial fisheries windows, migration patterns of various species (including species at risk):

- Table 5.2.3 (fish spawning/hatching periods and locations)
- Table 5.2.5 (groundfish species potential for occurrence)
- Table 5.2.6 (pelagic fish species potential for occurrence)
- Table 5.2.7 (invertebrate species potential for occurrence)
- Table 5.2.8 (fish species at risk potential for occurrence)
- Table 5.2.9 (marine mammals)
- Table 5.2.10 (timing of marine mammals on the Scotian Shelf and Slope)
- Table 5.2.12 (sea turtles)
- Section 5.2.8.1 and 5.2.8.2 (migratory birds migration patterns)
- Table 5.2.15 (migratory birds)
- Section 5.2.8.3 (areas of significance for migratory birds)
- Section 5.3.5.2 (commercial fisheries)
- Table 5.3.6 (fishing seasons for principal commercial fisheries)

Refer to response provided for IR-023 and IR-031 for updates to potential for occurrence tables. The information referenced above (and in IR-023 and IR-031) regarding species migrations patterns, sensitive periods, spawning times and locations, critical habitat, and fishing seasons was used to characterize the potential residual project related environmental effects on each respected valued component. Because the schedule for various Project components has not been confirmed it has conservatively been assumed that the timing of each effect could occur at any point during the year and therefore has potential to overlap with any of the above species and their sensitive or critical life cycle periods.

Information Request (IR) IR-003

Applicable CEAA 2012 effect(s): All

EIS Guidelines Reference: Part 1, 4.2 Study strategy and methodology

EIS Reference: Various – see context

Context and Rationale: The context within with residual environmental effects could occur to each valued component is not described thoroughly enough to support the assessment of direct and cumulative effects.

The *Operational Policy Statement: Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012*[2] advises that the ecological and social context within which potential adverse residual effects may occur be considered in determining significance. It also advises that the determination of significance consider the state (health, status or condition) of valued components that may be impacted by the environmental effects.

The *Technical Guidance for Assessing Cumulative Environmental Effects under the Canadian Environmental Assessment Act, 2012* states that it is important to consider if past physical activities that are no longer physically present, operating, or active continue to affect a given valued component. If the state of the valued component is likely to be stable, then the cumulative effects assessment can address how the baseline will be further affected by additional changes in the environment due to future activities. If the valued component is still changing as a result of past or existing activities, then the analysis has to address two influences: how past and existing activities are expected to affect the future and how future activities will affect the future.

The EIS Guidelines (Part 1, section 4.2) require that the assessment of effects be based on a comparison of the biophysical and human environments between the predicted future conditions with the project and the predicted future conditions without the project, and that it considers the resilience of relevant species populations, communities, and their habitats.

The EIS (section 6.2.4) states existing conditions of the marine physical environment, marine biological environment, and socio-economic environment are described in section 5 to characterize the setting for the Project, support an understanding of the receiving environment, and provide sufficient context for the effects assessment. The EIS assessment methodology (section 6.2.5) describes the context criteria for all valued components as “the current degree of anthropogenic disturbance and/or ecological sensitivity in the area in which the residual effect may occur.” The generic qualitative categories for context are “undisturbed” (area is relatively undisturbed or not adversely affected by human activity) and “disturbed” (area has been substantially disturbed by previous human development or human development is still present). More specific qualitative category descriptions are also provided for each valued component. It is not clear how these generic categories (disturbed or undisturbed) were determined for each VC.

[2] Updated version released in November 2015

When considering cumulative environmental effects, the EIS (section 10.1.2.1) states that the description of existing conditions provides sufficient context for the cumulative effects assessment, assuming that the existing status or baseline conditions of each valued component reflect the influence of other past and present physical activities within the RAA. A description is also provided in section 10.2.1 of how other physical activities have affected or may affect each valued component, providing context to support the cumulative effects assessment.

The EIS provides some comments that inform the context of effects on valued components. For example, regarding existing conditions for fish and fish habitat (section 7.2.6), the EIS briefly describes how "following the collapse of the traditional groundfish stocks (*e.g.* cod, flatfish and Pollock), shellfish stocks have grown significantly in their contribution to revenue and profitability of the Scotian Shelf fishery." However, the EIS also describes the context for commercial fisheries (7.6.8.3) as undisturbed.

Specific Question or Request: For each valued component (VC), provide the criteria or rationale used to determine the ecological and socio economic context and describe the context for residual effects for each VC, including historic stressors and the current trend for the VC. For biophysical VCs, consider whether they are in recovery, in decline, or stable.

Where a species at risk forms part of the VC (or for a few representative species most at risk), describe the risks to that species identified in any recovery strategy or action plan, and the extent to which the residual effects of the Project overlap with those risks.

For the significance analysis for each VC, explicitly discuss how context was considered in the analysis of each significance rating criteria (*e.g.* magnitude, timing, reversibility); provide updates as appropriate to the effects characterizations and significance determinations. Consider both direct project effects and cumulative effects for each VC.

Please clarify if the context for effects on fish and fish habitat (section 7.2.8.3) should be described as disturbed for both changes to risks of mortality or physical injury and changes in habitat quality and use; the former is described as occurring within a disturbed context, the latter as within an undisturbed context.

Response:

For each valued component (VC), provide the criteria or rationale used to determine the ecological and socio-economic context.

Ecological and socio-economic context considers the general characteristics or values of the area and/or ecosystem that may be affected by the Project and/or whether the VC is important to the functioning of an ecosystem and if it supports, or has been affected by anthropogenic activities. Ecological and socio-economic context ratings in the VC residual effects characterization tables are broad and general in nature, indicative of existing levels of anthropogenic disturbance with respect to existing conditions for the VC. Baseline environment (*i.e.*, existing conditions) is described in Section 5 and Section 7 and was used to determine the ecological and socio-economic context/status for each VC. For example, in the Fish and Fish Habitat VC, a disturbed ecological and socio-economic context was selected because of ongoing harvesting of fish species (described in Section 5.3.5 – Commercial Fisheries) and underwater sound and waste discharge associated with marine shipping (described in Section 5.3.4.3 – Marine Traffic) in the Regional Assessment Area (RAA).

The context descriptors in the VC tables represent broad, generic characterizations (along with magnitude, duration, frequency, *etc.*) to summarize and illustrate residual effects "at a glance" for the reader. A more detailed and comprehensive summary of baseline conditions associated with each VC (context, receiving environment, habitats, *etc.*) are provided in overview (Section 5) and VC- specific (Section 7) formats.

Describe the context for residual effects for each VC, including historic stressors and the current trend for the VC. For biophysical VCs, consider whether they are in recovery, in decline, or stable.

For each VC, the ecological and socio-economic context (*i.e.*, baseline conditions including status and relevant trends) is described in Section 5 (Existing Environment). For the biophysical VCs, details on life histories are provided for each species identified as potentially occurring within the Project Area (refer to Sections 5.2.5, 5.2.6., 5.2.7, and 5.2.8). Information on the regional importance, abundance, and distribution of species at risk (SAR) and species of conservation concern (SOCC) is provided in Sections 5.2.5.4, 5.2.6.4, 5.2.7, and 5.2.8.4, along with other key information on habitat requirements, general life history, and recovery strategies. Detail on population status is provided including whether they are in recovery, in decline, or stable. For example, as described in Section 5.2.5.4, the Acadian redfish was noted as experiencing decline over one to two generations in areas where they were historically abundant, although in some areas abundance indices have been stable or increasing since the mid-1990s.

For the socio-economic VCs, details on baseline conditions is provided in Section 5.3 of the EIS. This includes information on the state of the offshore commercial fisheries and traditional fisheries. Section 5.3.5.1 provides a historical overview of the offshore fisheries within the RAA as well as the current state of the fisheries (Section 5.3.5.2).

Where a species at risk forms part of the VC (or for a few representative species most at risk), describe the risks to that species identified in any recovery strategy or action plan, and the extent to which the residual effects of the Project overlap with those risks.

As discussed in Section 5.2.9 of the EIS and in IR-050 there are 24 fish, 10 marine mammal and sea turtle, seven migratory bird SAR and SOCC that may be present on the Scotian Shelf or Slope at various times of the year. Of these, there are 18 species within the RAA with recovery strategies or action plans. The recovery strategies or actions plans describe the potential threats to the SAR. Species identified with potential threats from oil and gas activities are described below. Residual effects of Project activities on SAR, inclusive of species identified below, is discussed in Section 7 of the EIS (Section 7.2 Fish and Fish Habitat; Section 7.3 Marine Mammals and Sea Turtles; and Section 7.4. Migratory Birds). VC assessment included the consideration of secure species as well as species listed under SARA (*i.e.*, SAR) or considered at risk by COSEWIC (*i.e.*, SOCC); and therefore, no changes are required to the residual effects assessment. Additional residual effect details on SAR is provided in IR-050.

Potential threats to the wolffish includes increased offshore exploration and production of petroleum resources in Atlantic Canada from an increased possibility of oil spills, offshore well blowouts, tanker spills and other potential disasters (Kulka *et al.* 2007).

The blue whale uses sounds to investigate their environment, therefore, increasing anthropogenic sound levels from activities such as seismic surveys, shipping traffic, and industrial activities, may affect their hearing range and may affect certain behaviours (Beauchamp *et al.* 2009). For example, studies have shown seismic surveys may cause blue whales to change navigation routes, alter their displacement speed, and modify their dive profiles and feeding (Stone 2003 in Beauchamp *et al.* 2009).

Similar to the blue whale, the fin whale, North Atlantic right whale, and Sowerby's beaked whale are also affected by anthropogenic noise. Loud pulses or continuous sounds produced by offshore development may cause subtle modifications in diving behaviour, interruptions in normal activities, and long or short term avoidance of a particular areas (DFO 2014; DFO 2016a; DFO 2016b).

As noted in the recovery strategy for the Northern bottlenose whale, oil and gas activity around their prime habitat poses the greatest threat to this species from sound produced from drilling and other operations, spills and discarded material, and increased shipping traffic (DFO 2016c).

Acoustic disturbance was also noted as a potential threat in the recovery strategy for the leatherback sea turtle. Underwater sounds within the frequency range detectable by sea turtles includes oil and gas exploration and development which may result in behavioral changes, interference with feeding activities, and avoidance (DFO 2015).).

Recovery strategies and management plans for migratory bird SAR, including ivory gull, barrow's goldeneye, harlequin duck, and piping plover, have noted a potential threat from oil and gas contamination (Environment Canada 2007; Environment Canada 2012; Environment Canada 2013; Environment Canada 2014). Oil spills have the potential to affect the birds, their habitat and their invertebrate prey (Environment Canada 2012).

For the significance analysis for each VC, explicitly discuss how context was considered in the analysis of each significance rating criteria (e.g. magnitude, timing, reversibility)

Context relates to the baseline conditions which is provided for each VC in Section 5 and the respective VC section (Section 7). Context is not explicitly considered for the determination of magnitude, duration, *etc.* when characterizing the effect.

Please clarify if the context for effects on fish and fish habitat (section 7.2.8.3) should be described as disturbed for both changes to risks of mortality or physical injury and changes in habitat quality and use; the former is described as occurring within a disturbed context, the latter as within an undisturbed context.

As described in Section 7.2.8.3, context for changes to risks of mortality or physical injury for Fish and Fish Habitat was estimated to occur within a disturbed ecological and socio-economic context primarily because of ongoing harvesting of fish species in the RAA. Change in Habitat Quality and Use for Fish and Fish Habitat was estimated to occur within a relatively undisturbed ecological and socio-economic context given the relatively low anthropogenic activity affecting fish habitat. As noted above, the context descriptors in the VC tables are broad and generic, intended to illustrate residual effects at a high level for the reader. A more detailed and comprehensive summary of baseline conditions associated with each VC (context, receiving environment, habitats, *etc.*) are provided in overview (Section 5) and VC- specific (Section 7) formats.

References:

Atlantic Leatherback Turtle Recovery Team. 2006. Recovery Strategy for Leatherback Turtle (*Dermochelys coriacea*) in Atlantic Canada. *Species at Risk Act* Recovery Strategy Series. Fisheries and Oceans Canada, Ottawa, vi + 45 pp.

Beauchamp, J., Bouchard, H., de Margerie, P., Otis, N., Savaria, J.-Y. 2009. Recovery Strategy for the blue whale (*Balaenoptera musculus*), Northwest Atlantic population, in Canada [FINAL]. *Species at Risk Act* Recovery Strategy Series. Fisheries and Oceans Canada, Ottawa. 62 pp.

DFO [Fisheries and Oceans Canada]. 2014. Recovery Strategy for the North Atlantic Right Whale (*Eubalaena glacialis*) in Atlantic Canadian Waters [Final]. *Species at Risk Act* Recovery Strategy Series. Fisheries and Oceans Canada, Ottawa. vii + 68 pp.

DFO [Fisheries and Oceans Canada]. 2015. Recovery Strategy for the Leatherback Sea Turtle (Dermochelys coriacea) in Atlantic Canada [Draft]. Species at Risk Act Recovery Strategy Series. Fisheries and Oceans Canada Ottawa. vii + 48 pp.

DFO [Fisheries and Oceans Canada]. 2016a. Management Plan for the fin whale (*Balaenoptera physalus*), Atlantic population in Canada [proposed], *Species at Risk Act* Management Plan Series, DFO, Ottawa, iv +37 p.

DFO [Fisheries and Oceans Canada]. 2016b. Management Plan for the Sowerby's Beaked Whale (*Mesoplodon bidens*) in Canada [Proposed]. *Species at Risk Act* Management Plan Series. Fisheries and Oceans Canada, Ottawa. iv + 48 pp.

DFO [Fisheries and Oceans Canada]. 2016c. Recovery Strategy for the Northern Bottlenose Whale, (*Hyperoodan ampullatus*), Scotian Shelf population, in Atlantic Canadian Waters [Final]. *Species at Risk Act* Recovery Strategy Series. Fisheries and Oceans Canada, Ottawa. vii + 70 pp.

Environment Canada. 2007. Management Plan for the Harlequin Duck (*Histrionicus histrionicus*) Eastern Population, in Atlantic Canada and Québec. *Species at Risk Act* Management Plan Series. Environment Canada. Ottawa. vii + 32 pp.

Environment Canada. 2012. Recovery Strategy for the Piping Plover (*Charadrius melodus melodus*) in Canada. *Species at Risk Act* Recovery Strategy Series. Environment Canada, Ottawa. v + 29 pp.

Environment Canada. 2013. Management Plan for the Barrow's Goldeneye (*Bucephala islandica*), Eastern Population, in Canada. *Species at Risk Act* Management Plan Series. Environment Canada, Ottawa. iv + 16 pages.

Environment Canada. 2014. Recovery Strategy for the Ivory Gull (*Pagophila eburnea*) in Canada. *Species at Risk Act* Recovery Strategy Series. Environment Canada, Ottawa. iv+ 21 pp.

Kulka, D., C. Hood and J. Huntington. 2007. Recovery Strategy for Northern Wolffish (*Anarhichas denticulatus*) and Spotted Wolffish (*Anarhichas minor*), and Management Plan for Atlantic Wolffish (*Anarhichas lupus*) in Canada. Fisheries and Oceans Canada: Newfoundland and Labrador Region. St. John's, NL. x + 103 pp.

Stone, C. J. 2003. The Effects of Seismic Activity on Marine Mammals. Joint Nature Conservation Committee. Peterborough. 78p.

Information Request (IR) IR-004

Applicable CEAA 2012 effect(s): All

EIS Guidelines Reference: Part 1, 3.3.3 Spatial and Temporal boundaries

EIS Reference: Various – see context

Context and Rationale: It is not clear why the spatial boundaries for assessing cumulative effects are identical for all valued components. The Agency's *Technical Guidance for Assessing Cumulative Environmental Effects under the Canadian Environmental Assessment Act, 2012* states that when setting spatial boundaries for cumulative effects assessment, a valued component's geographic range and the zone of influence of the project for the valued component should be considered. For example, spatial boundaries for a migratory species may take into account seasonal migration paths, regardless of jurisdictional boundaries. The guidance further states that administrative, political, or other human- made boundaries may not take into account the spatial pattern of ecosystems; such boundaries may not reflect the spatial distribution of a mobile species.

The EIS (section 10.1.1.2) describes the same regional assessment area (RAA) for the cumulative effects assessment to all six valued components, an area bounded primarily by political boundaries.

Specific Question or Request: Provide the rationale for the spatial scope of the cumulative effects assessment for each valued component, or adjust the scope for any valued components as appropriate.

Response:

The Operational Policy Statement (OPS), Assessing Cumulative Environmental Effects Under the *Canadian Environmental Assessment Act, 2012* as well as the Canadian Environmental Assessment Agency's Technical Guidance for Assessing Cumulative Environmental Effects under the *Canadian Environmental Assessment Act, 2012*. were taken into consideration when determining spatial boundaries for cumulative effects assessment (CEA). The OPS suggests that spatial boundaries encompass potential environmental effects on the selected valued component (VC) of the designated project in combination with other physical activities that have been or will be carried out. Section 1.2 of the guidance document suggests various methods to determine spatial boundaries for CEA including activity-centered spatial boundaries in which boundaries are based on the distribution of physical activities in the vicinity of the project. The guidance document notes that this approach may be useful if the project is located in a remote area with few interacting physical activities.

In Chapter 7 of the Environmental Impact Statement (EIS), where direct Project effects are assessed, VC-specific spatial assessment boundaries are established based on the potential extent of Project-related effects (Local Assessment Area). The CEA presented in Chapter 10 establishes a Regional Assessment Area (RAA) to establish a regional context for the overall assessment, and suggest a reasonable area to account for effects from other physical activities potentially overlapping with Project effects. The RAA was drawn roughly to accommodate the relatively large area that could be affected in the unlikely event of a substantial spill. Overlapping environmental effects from other physical activities on all VCs within their respective LAAs were also reasonably included in this generalized RAA.

The EIS acknowledges that the migratory range of some VCs extends beyond the RAA boundaries and there is potential for individuals of these species to be affected by the combined residual environmental effects of the Project and effects from other stressors within and beyond the RAA boundaries (*e.g.*, migrating sea turtles). However, in many cases, these "external" stressors along the migratory route are reflected in the discussion of species' status and population descriptions. Residual effects from other projects and activities (*e.g.*, fishing, shipping, oil and gas activities) identified within the LAAs and RAA would also resemble residual effects from stressors outside the RAA. The use of political boundaries (*e.g.*, international waters) also suggests an area within which BP and Canada could reasonably influence environmental management of species, and for which there is greater certainty around effects predictions and mitigative solutions. In BP's opinion, there would be no additional environmental management benefit to having multiple RAAs.

Information Request (IR) IR-005 (CNSOPB-3)

Applicable CEAA 2012 effect(s): All

EIS Guidelines Reference: Part 2, 4 Public Consultation and Concerns

EIS Reference: 3 Stakeholder Consultation and Engagement

Context and Rationale: The EIS Guidelines require the proponent to describe the ongoing and proposed consultations and the information sessions that the proponent will hold or that it has already held on the project. The stakeholder consultation log in section 3 of the EIS reflects some consultation with fishers and fisheries associations.

Specific Question or Request: Explain the proponent's approach to consultation and the rationale for deciding which groups to consult in ensuring key issues of concern have been understood and appropriately addressed in the EIS.

Response: BP has identified a list of stakeholders through an evaluation of the economic, social and environmental aspects of the Project, and a review of groups with a potential vested interest in the Project. BP identified stakeholders following consultation with regulatory agencies and government departments and from previous experience in the area following the Tangier 3D WATS seismic survey program.

Stakeholders that have been identified include:

- Federal, provincial and municipal governments;
- Fish producers and fisheries associations;
- Non-governmental stakeholders; and
- The general public

The consultation program for each of the stakeholders is bespoke. It has been determined based on an assessment of potential aspects of the Project which could impact a specific group of stakeholders, regulator feedback and Project specific milestones.

As explained in Section 3.1 of the Environmental Impact Statement (EIS), BP's approach to stakeholder and Indigenous engagement is based on a continuous cycle, made up of a series of iterative steps of informing and engaging stakeholders, understanding their concerns and priorities, reviewing information received through consultation and incorporating it into the planning, design, construction and operation of the Project and then informing and engaging stakeholders again to provide feedback as the Project develops. In this cycle, relationships with stakeholders develop to ensure that issues of concern have been understood and addressed through the EIS, other permitting processes and in Project planning and execution.

Information Request (IR) IR-006 (CNSOPB-7)

Applicable CEAA 2012 effect(s): All

EIS Guidelines Reference: Part 2, 6.3.1 Fish and fish habitat; 6.6.1 Effects of potential accidents or malfunctions

EIS Reference: 8.4.3 Model Scenarios; Appendix C Acoustic Modelling Report; Appendix D

Context and Rationale: The locations selected for modelling of underwater noise, drill waste dispersion, and oil spill trajectory do not coincide. In particular, the deeper water site for oil spill trajectory modelling is approximately 78 kilometres away from the deeper-water noise modelling site and the drill waste dispersion modelling site, which are essentially the same.

Specific Question or Request: Explain why modelling for all potential emissions and discharges was not conducted at the same two locations (*i.e.* same deeper water site and shallow water site).

Response: BP has conducted spill trajectory modelling, acoustic modelling and drilling waste discharge modelling as part of the assessment of potential environmental effects from routine project activity and potential accidental events. Well planning is underway for the drilling program however the final well locations have not yet been confirmed. Subsequently, in light of the Environmental Impact Statement (EIS) Guidelines, the wellsite locations used for modelling purposes were selected at different distances to sensitive receptors and in varying water depths. In preparation for the modelling, the planning team identified three potential well locations within the exploration licences (ELs).

All three locations were located in viable drilling prospects. Site 2, in EL 2432, represents the most likely first well location and falls in 2,652 m water depth. It is 170 km from Sable Island. Site 1 and Site 3 represent the shallowest and deepest locations in the prospect identified by the project team that falls closest to Sable Island, the sensitive receptor most likely to be impacted by a large scale accidental spill event. Site 1 and site 3 both fall in EL 2434. Site 1, the shallowest point in the prospect closest to Sable Island is in 2,104 m water depth and is 105 km from Sable Island. Site 3 is the deepest point in the prospect closest to Sable Island and is in 2,790 m water depth and is 140 km from Sable Island.

In Section 6.6.1 of the EIS Guidelines, it is stated that "Where well locations have not yet been identified, points of origin selected for spill trajectory models should be conservative (*e.g.*, selecting a potential location within the proposed drilling area that is closest to a sensitive feature or that could result in greatest effects)." Furthermore, in the same section of the guidelines it is requested that "A discussion on water depth and its effect on blow-out rate and spill trajectory modelling assumptions must be provided."

The greatest effects are likely to be different for the different activities considered as part of the different modelling assessments completed for the Project.

The spill trajectory modelling carried out for the Project considers how oil moves through the water column and on the water surface following a release of hydrocarbons. It was identified that potential effects could be realized on the shorelines closest to the Project Area, as well as through the water column. The most sensitive receptor, and closest shoreline to the ELs that was identified is Sable Island. BP therefore carried out spill trajectory modelling at two locations to assess the potential effects on Sable Island and other identified sensitivities in and around the ELs. Site 2 was used in order to best represent any potential effects from the most likely well location. In keeping with the EIS guidelines, the well location closest to Sable Island (Site 1) was also selected as a conservative point of origin. Site 1 and Site 2 are in different water depths and therefore it was possible to demonstrate the potential effects of water depth on the spill trajectory modelling.

For the acoustic modelling and drilling waste discharge modelling, an evaluation of the relative effect of proximity to surface sensitivities is less critical as the effects are all subsurface, however the impact of water depth is likely to play a more critical role. Sites 1 and 3 were therefore used. There is a greater difference between the water depths at the two sites so they were selected for the acoustic modelling and drilling waste discharge modelling to demonstrate the influence of water depth on potential environmental effects.

A map of the well locations used as part of the modelling work is shown in Figure 1 below.

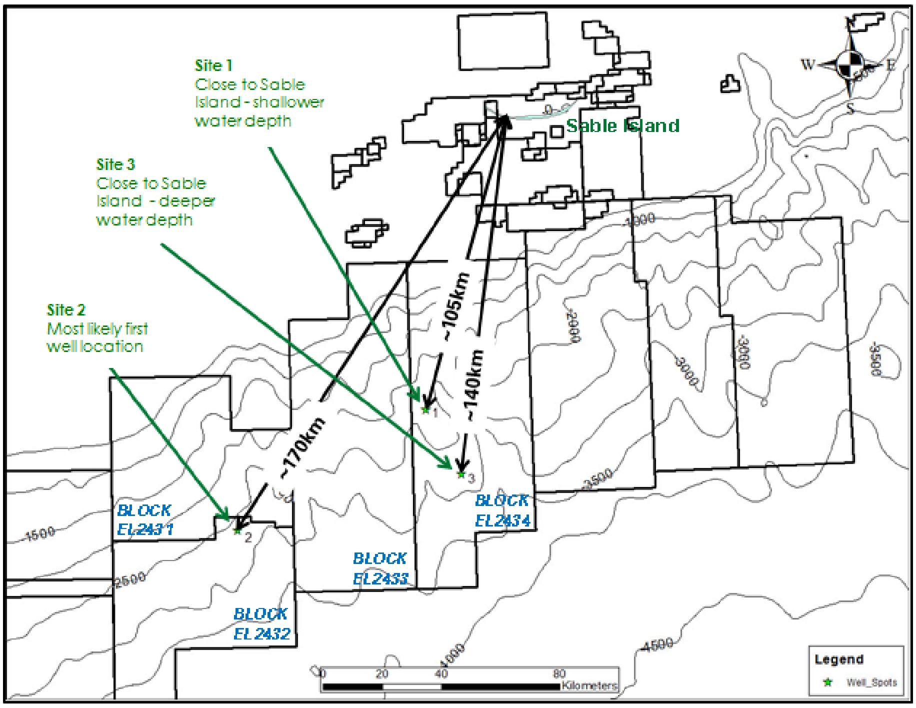


Figure 1 Location of Modelling Sites Relative to the Project Area

Information Request (IR) IR-007

Applicable CEAA 2012 effect(s): All

EIS Guidelines Reference: Part 2, 3.2 Project Activities

EIS Reference: Various – see context

Context and Rationale: The EIS Guidelines require that the EIS include the location of each activity, and the water depths for potential drill sites.

The EIS (section 2.3.2) indicates that the well locations have not yet been finalized. Water depths in the exploration licenses range from 100 metres to more than 3000 metres (section 2.2). Section 6.1.1 says that the area under assessment is the four exploratory licence areas. Section 7.1.1.2 states that for underwater acoustic modelling "two representative wellsites were selected within the viable drilling area and included the deepest and shallowest potential locations within the drilling area." Section 7.1.2.1 of the EIS says that these same two sites, with water depths of 2104 metres and 2790 metres respectively, were used for sediment dispersion modelling.

Specific Question or Request: Clarify if the seven proposed wells would only be drilled in depths between 2104 metres and 2790 metres within the exploration licenses. If this is not the case, please clarify if there are any limits to where drilling could occur within the exploration license areas.

Explain how the effects assessment addresses all geographical areas within the Exploration Licences where potential drilling could occur (*e.g.* shallow and deep, flat and sloped). Do the representative wellsite locations chosen reflect the potentially most sensitive areas with the ELs (*i.e.* highest potential for sensitive benthic habitats)? Would sediment deposition be thicker around wellsites in shallower water where the muds would not be as dispersed given shorter distance to seafloor?

Response: As stated in Section 2.1 of the Environmental Impact Statement (EIS), the EIS scope includes the full geographic range of exploration licences (ELs) 2431, 2432, 2433 and 2434. Water depths across the ELs range from 100 m to more than 3,000 m. Water depths within the geographic range of the Tangiers WATS 3D Seismic Survey however only range from 1,543 m in the shallowest area closest to the shelf to approximately 3,730 m at the deepest point of the submarine canyon systems. Water depths in the 3D seismic study area regionally dip from northwest to southeast as shown in Figure 1 below.

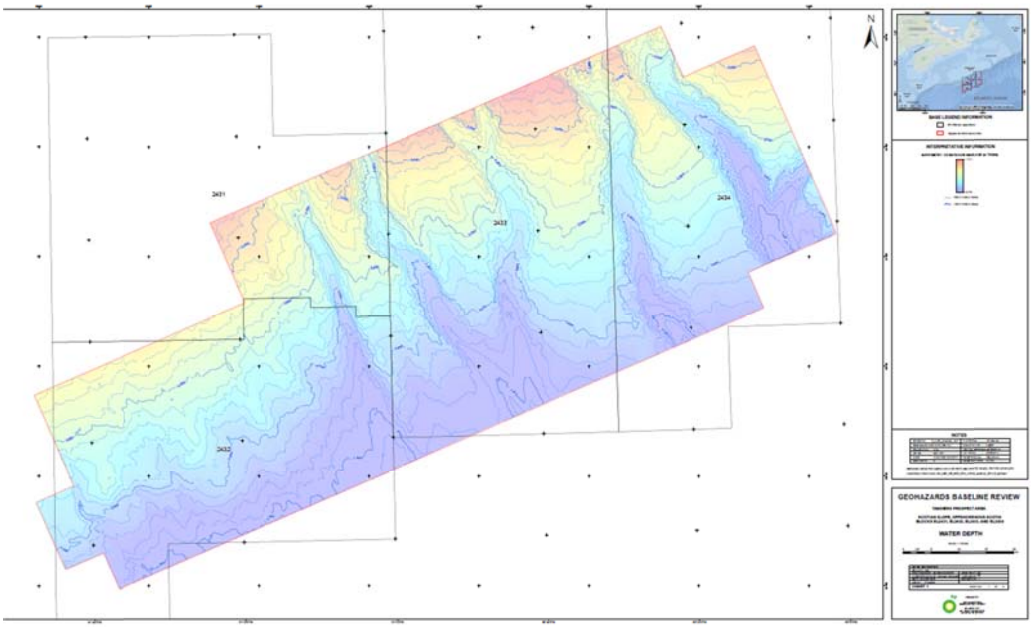


Figure 1 Spatial Extent of the Tangiers WATS 3D Seismic Survey Across the BP's Exploration Licences

As stated in the EIS, well locations are not yet known. For modelling purposes, a number of potential prospects were selected on the basis of preliminary seismic data processing and interpretation. The well locations represent viable drilling prospects and are located at different water depths and proximity to sensitive receptors.

In Section 6.6.1 of the EIS Guidelines, it is stated that "Where well locations have not yet been identified, points of origin selected for spill trajectory models should be conservative (*e.g.*, selecting a potential location within the proposed drilling area that is closest to a sensitive feature or that could result in greatest effects)." Furthermore, in the same section of the guidelines it is requested that "A discussion on water depth and its effect on blow-out rate and spill trajectory modelling assumptions must be provided." BP has sought to maintain consistency with the locations used for cuttings dispersion modelling, acoustic modelling and spill trajectory modelling, and identified three potential well locations within the ELs. The potential well locations included the shallowest and deepest locations in a prospect area close to Sable Island (Sites 1 and 3 respectively), and Site 2 represents the most likely first well location. Combinations of these three sites have been used for the modelling assessments depending on the likely effects on sensitive receptors. Information about the reasoning for why different sites were used for different modelling scenarios is included in the response to IR-006.

The potential impact of water depth on the assessment of environmental effects is discussed throughout the EIS. For example, the effect of water depth on the propagation of underwater sound and the extent of cuttings dispersion are shown in Section 5.1 of Appendix D to the EIS, and Section 5 of Appendix E to the EIS and 7.1.2.1 of the EIS respectively.

The drilling waste dispersion modelling shows that the extent of cuttings dispersion does vary depending on water depth. Deterministic modelling was run at two locations. At Site 1 (shallowest water depth scenario), the predicted deposition footprint was predominantly towards the East and North East for the surface discharges. At Site 3 (deepest water depth scenario) the predicted deposition footprint was predominantly towards the South West and extended over a greater area (by 10 – 15%) than for the shallow water depth well location for thickness thresholds < 0.5 mm. The increased water depth means that finer drill solids released in the surface discharges are transported over a greater distance before settling, with a reduced thickness and concentration of cuttings nearer the release location.

For example, at a deposit thickness threshold of 1 micron, the drilling discharge deposits covered an area of 5,350 hectares at Site 3 compared to 4,870 hectares at Site 1. In contrast, nearer the release site at Site 3 the predicted thickness of deposited drill solids > 1 mm ("visible" thickness threshold), extends circa 360 m from the discharge point in a South Westerly direction at its maximum extent and covers 4.2 hectares. This is less than half the area coverage at Site 1, where the 1mm thickness boundary extends 560 m from the discharge point.

The description of the existing physical, biological and socio-economic conditions presented in Section 5 of the EIS not only covers the range of geographic areas present in the ELs but in many cases extends beyond the ELs to the Regional Assessment Area. Likewise, the analysis of effects assumes that drilling could occur anywhere in the Project Area (defined by the ELs) and has not been restricted to assume certain drilling depths. The scope of the EIS therefore considers the full geographic extent of the ELs.

Information Request (IR) IR-008

Applicable CEAA 2012 effect(s): All

EIS Guidelines Reference: Part 2, 1.2 Project Overview; 3.2 Project activities

EIS Reference: 2.7 Project Schedule

Context and Rationale: The EIS Guidelines require the EIS to describe the "scheduling details, the timing of each phase of the project and other key features" and to include "a detailed schedule including time of year, frequency, and duration of project activities."

The EIS (section 2.7) states that drilling will be carried out in "multiple phases so that initial well results can be analyzed to inform the strategy for subsequent wells." The EIS is clear that up to seven wells are proposed, and describes a number of steps in Figure 2.7.1, however it is not clear what is meant by "multiple phases," the number of phases, and the nature of activities for each phase. Furthermore, the project schedule in Figure 2.7.1 extends to the end of 2020, while the licenses are described in the Executive Summary as extending to 2022.

Specific Question or Request: Clearly describe all possible anticipated phases, the activities in each phase, the time of year, frequency, duration, and scheduling of all phases to abandonment of the last well. Where only approximations can be provided, please explain.

The Agency understands that the drilling program is divided into two phases; the first phase includes the first one or two wells, while the second phase includes any remaining wells. Confirm or correct the Agency's understanding as appropriate.

Response: The Environmental Impact Statement (EIS) is designed to cover the terms of the ELs. The license term ends in 2022. An updated project schedule (originally from Section 2.7 of the EIS) is attached below.

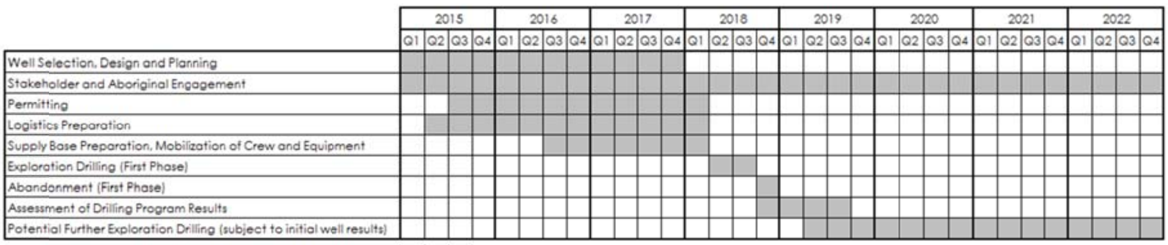


Figure 1 Updated Project Schedule

The Agency is correct in their understanding about the phasing of the drilling program. The project will be carried out in multiple phases. The first phase will include the first one or two wells of the program. After the drilling of the wells in the first phase, the results of those wells will be analyzed to inform the execution strategy for any subsequent wells. Further wells in the program will be drilled in a subsequent phase following this analysis phase. The timing for the subsequent phase of exploration drilling has not yet been confirmed as it is contingent on the outcome of the first phase, however it is assumed that it could occur from 2019.

Drilling could occur all year round, however it is expected that the first phase will commence from the 2nd quarter of 2018, *i.e.*, from April 2018.

In the first phase, one to two wells will be drilled, tested and abandoned. Information about each of these activities is included in Section 2 of the EIS. In summary, the early stages of the Project are dominated by an initial phase of planning and preparation which includes: well selection, design and planning; permitting; stakeholder and aboriginal engagement; logistics support preparation and approvals; and mobilisation of crew and equipment, including the mobile offshore drilling unit (MODU).

For each well in the program phase, the MODU will be mobilised to the well location once the planning and permitting is complete. Once at the location, the MODU dynamic positioning system will be activated and an imagery based seabed survey will be carried out with a remotely operated vehicle (ROV). Refer to the response for IR-021 for more information on the survey objectives and methods. Results of the visual ROV survey will be transmitted to the Canada-Nova Scotia Offshore Petroleum Board (CNSOPB) within 48 hours of survey completion and following agreement with the CNSOPB, drilling will commence. Drilling is described in detail in Section 2.4.2 of the EIS. The conductor section and the surface casing will be the first sections of the well to be drilled and they will be drilled riserless with either water based mud or seawater. Once the surface casing has been installed, the riser and the BOP will be installed. Drilling of the subsequent sections will be carried out using water based mud or synthetic based mud and all cuttings will be circulated back to the MODU for treatment prior to disposal. Well evaluation will be carried out during and after drilling. Well evaluation is described in detail in Section 2.4.3 of the EIS. Well evaluation techniques used during drilling include measurement while drilling and logging while drilling (MWD/LWD), mud logging, drilling parameters evaluation and subsurface pressure evaluation. Well evaluation techniques used after drilling may include wireline logging, vertical seismic profiling and formation testing. Vertical seismic profiling activity is typically short duration, lasting no more than one day. Well flow testing is not anticipated on the first two wells in the program, however if it does occur in subsequent phases, it is likely that it would take place over a one month window at the end of the drilling program, however flaring activity would be limited to short durations within the well test period.

Drilling and well evaluation of each well is estimated to take 120 days. After well evaluation is complete, wells will be plugged and abandoned in line with CNSOPB requirements and BP practices. Well abandonment is described in Section 2.4.4 of the EIS. Each well in the program will be drilled and evaluated and abandoned in a similar manner to that described here.

Information Request (IR) IR-009

Applicable CEAA 2012 effect(s): 5(1)(a)

EIS Guidelines Reference: Part 2, 3.1 Project Components - "… the proponent will describe the management and disposal of wastes (*e.g.* type and constituents of waste, quantity, treatment and method of disposal) including operational discharges from subsea systems and the installation of subsea systems."

EIS Reference: 2.3.2 Offshore Exploration Wells

Context and Rationale: It is stated in several places that during the riserless phase, excess cement may be discharged to the seafloor.

Specific Question or Request: What volume of cement is predicted to be discharged and what are the associated environmental effects? What other management options are available? Are any measures proposed that would mitigate the effects of this activity?

Response: Sections 2.4.2 and 2.8.2 of the Environmental Impact Statement (EIS) describe the plan for the use and disposal of cement for Project operations. Cement is used in drilling operations to secure casing in the well, and to prevent the escape of hydrocarbons around the outside of well casing. Cementing operations happen periodically during the drilling of a well at the end of each section. During the cementing operation, cement is pumped into the casing and the cement circulates down the casing displacing any drilling fluid. Cement then flows up into the annular space between the casing and the formation. The cement solidifies in the annular space in approximately 5 to 6 hours.

As part of well planning, a cement engineer estimates the volume of cement required to complete the operation and successfully fill the annular space. In most cases, an excess cement allowance is added to the estimate since a shortage of cement slurry would result in failure of the operation as the space would not be adequately sealed. Excess cement is used to provide contingency in case irregularities in the formation wall result in the annular space being larger than expected. Excess cement may be discharged out of the wellbore and onto the seafloor during the riserless phase. After the riser has been installed, excess cement slurry from operations will be circulated back to the mobile offshore drilling unit (MODU) and shipped back to shore for disposal.

The final cementing program for the wells has not yet been confirmed however it has been estimated that between excess cement may be discharged to the seafloor during the drilling of the riserless sections. The cement volumes that will be required will be confirmed during the drilling program as logging techniques will confirm the final diameter of the wellbore during drilling. The cementing program, including potential excess cement volumes is likely to be as follows (Table 1) for the riserless section:

Table 1 Cement Volumes for Riserless Section

Section	Casing Size (inches)	Quantity of cement required (Tonnes)	Quantity of cement discharged (Tonnes)
1	36	34-105	0-70
2	22	207-415	0-210

Cement is a safety critical barrier in the well as it prevents the escape of hydrocarbons. The use of excess cement helps to demonstrate that the cement job has been completed and that the annular space has been filled. There are no other management options for cement management and discharge during the riserless phase of drilling however BP will use logging techniques to help improve the accuracy of calculations to estimate how much cement is required. This will help to manage the volume of excess cement. Furthermore, BP will visually monitor the extent of any discharged excess cement through the use of remotely operated vehicle (ROV) surveys. An ROV survey will be conducted at the outset of drilling operations, once during drilling operations and at the end of the drilling program.

The discharge of cement during drilling is common practice and the EIS has accounted for the discharge of cement in the marine environment during drilling. The discharge of cement, along with other drilling wastes as described in the EIS, will contribute to a temporary and localized increase in suspended solids in the water column and sedimentation on the seafloor, potentially resulting in burial and smothering of benthic infauna and epifauna. This effect is predicted to be not significant for fish and fish habitat as concluded in Section 7.2 of the EIS.

Information Request (IR) IR-010

Applicable CEAA 2012 effect(s): 5(1)(a)(i); 5(1)(a)(ii); 5(1)(b)(i)

EIS Guidelines Reference: Part 2, 3.1 Project Components: "….the proponent will describe the management and disposal of wastes including operational discharges from subsea systems and the installation of subsea systems."

EIS Reference: 2.4.3.3 Well Flow Testing

Context and Rationale: It is stated in EIS section 2.4.3.3 that flow testing of wells (in the event that hydrocarbons are discovered in sufficient quantity to merit it) is not expected to be carried out during the initial-phase of drilling (first one or two wells).

Specific Question or Request: Confirm that, unless there is no possibility of testing the first or second wells, the analysis of air emissions and associated effects includes testing those wells. If not, provide an updated analysis or a rationale as to why no update is required.

Response: Although it is unlikely that BP will test the first or second well in the drilling program, the Environmental Impact Statement (EIS) has accounted for well flow testing. The discussion of atmospheric emissions in Section 2.8.1 accounts for possible well testing and has calculated likely greenhouse gas emissions associated with flaring. The analysis of migratory birds (Section 7.4) has also accounted for well testing activities, considering potential effects associated with flaring. No update is therefore required to the EIS.

Information Request (IR) IR-011 (CNSOPB-2)

Applicable CEAA 2012 effect(s): All

EIS Guidelines Reference: Part 2, 3 Project Description

EIS Reference: 2.5 Well Control and Blowout Prevention

Context and Rationale: The EIS states that the BOP will be pressure tested every 21 days. The CNSOPB's standard policy is to pressure test BOPs every 14 days. Any variance on this frequency would require approval from the CNSOPB and the CNSOPB has advised the Agency that it likely would not accept a general schedule of 21 days, but would consider extending a specific test on a case by case basis.

Specific Question or Request: Update the planned pressure testing frequency as required.

Response: Section 2.5 of the Environmental Impact Statement (EIS) outlines BP's approach to well control and blowout prevention.

BP will use blowout preventers (BOPs) that comply with American Petroleum Institute (API) standards, specifically API Standard 53 (Blowout Prevention Systems for Drilling Wells). In light of their critically important role to the safety of the crew, the rig and the wellbore itself, BOPs are inspected, tested and refurbished at regular intervals.

Prior to installation on the well, the BOP will be pressure tested on the mobile offshore drilling unit (MODU) deck, and then again following installation on the well to test the wellhead connection with the BOP. The BOP will be pressure tested periodically throughout the drilling program in line with the Canada-Nova Scotia Offshore Petroleum Board (CNSOPB) Drilling and Production Guidelines. The Guidelines specify that further to the post installation pressure test named above, pressure testing will occur before drilling out any string of casing; before commencing a formation flow test; following repairs or any event that requires disconnecting a pressure seal; and once every 14 operational days. Where well conditions or other hazards preclude pressure testing within the 14 day timeframe, the test may be delayed by no more than 7 days. Pressure testing will be conducted in line with the CNSOPB Guidelines and all pressure test details and results will be recorded.

Information Request (IR) IR-012 (ECCC-IR-27, ECCC-IR-30)

Applicable CEAA 2012 effect(s): 5(1)(b) Federal Lands or Transboundary

EIS Guidelines Reference: Part 2, 6.1.1 Atmospheric environment and climate; 6.3.8 Air quality and greenhouse gas emissions

EIS Reference: 2.8.1 Atmospheric Emissions; 10.1 Cumulative Environmental Effects Assessment Scope and Methods; 10.2 Cumulative Environmental Effects Assessment

Context and Rationale: The EIS refers to IMO efficiency measures (EEDI, or Energy Efficiency Design Index), which only apply to vessels that are 2014 or newer, but doesn't state the age of vessels to be used.

Also, The NO_X Tier III limits for ships may be incorrectly characterized. The EIS seems to indicate all marine vessels will have NO_X Tier III engines, but this requirement only applies to vessels that are 2016 and newer.

Specific Question or Request: Confirm if vessels used during the project will be 2014 or newer vessels, to confirm whether the EEDI will actually impact emission levels. If the assessment provided does not consider the likely age of vessels to be used, update the assessment accordingly.

Provide the expected age distribution of vessels to confirm the applicability of the NO_X Tier III requirements, or describe the expected emissions impact if ships 2015 or older ships are used, and update the assessment accordingly.

Response: The International Maritime Organization (IMO), under MARPOL Annex VI, have set NOx emission limits for marine diesel engines depending on the engine's maximum operating speed (*i.e.*, less than 130 rpm, greater than 130 rpm and less than 2,000 rpm, and greater than 2,000 rpm) and date the vessel was constructed. An overview of these limits are presented in Table 1 below, where the "date" refers to the year the vessel was constructed and "n" refers to an engine's maximum operating speed. Such limits apply to both propulsion and auxiliary engines. Tier I and II limits are global and Tier III limits apply only to Emission Control Areas (EACs) (*i.e.*, the Canadian Coast). For those engines installed on a ship constructed between January 1, 1990 and December 31, 1999, Tier 1 emission limits apply.

Table 1 MARPOL Annex VI NOx Emission Limits

Tier	Date	NOx Limit, g/kWh		
		n < 130	130 ≤ n < 2000	n ≥ 2000
Tier I	2000	17.0	$45 \cdot n^{-0.2}$	9.8
Tier II	2011	14.4	$44 \cdot n^{-0.23}$	7.7
Tier III	2016†	3.4	$9 \cdot n^{-0.2}$	1.96
† In NOx Emission Control Areas (Tier II standards apply outside ECAs).				

Source: DieselNet 2016

The vessels that will be used to support the project have not yet been contracted and consequently the ages of the PSVs are not yet known. Typically, the oldest vessels that would be available are 25 years old, however it is likely that newer vessels would be used. Therefore, depending on the vessels age and the engine's maximum operating speed, NOx emissions could range from 9.8 to 17 g/kWh for older vessels (*i.e.*, 25 years old) and 1.96 to 3.4 g/kWh for newer vessels (*i.e.*, 2016).

The NOx emissions presented in Table 2.8.2 of the EIS for the PSVs were calculated using an uncontrolled NOx emission factor (1.9 lb/MMBtu or 7.9 g/KWh), as published by the US EPA in AP-42: Compilation of Air Emission Factors, Chapter 3.4, "Large Stationary Diesel and All Stationary Dual-fuel Engines" (1996). The NOx emissions presented in the EIS are therefore conservative if using newer vessels (*i.e.*, 2011 or newer). If older vessels are used, the daily NOx emissions would likely be greater than those presented in Table 2.8.2, but would still meet the IMO limits. Atmospheric emissions from the Project therefore do not warrant further assessment.

Table 2.8.2 Daily Criteria Air Contaminant Emissions for the MODU and Support Vessels and Helicopter

	Daily Fuel consumption (tonnes)	Daily Energy consumption (MMBtu)	CO_2 (tonnes per day)	CO (tonnes per day)	NO_x (tonnes per day)	SO_x (tonnes per day)	PM (tonnes per day)
MODU	56	2,380	178	0.9	3.5	0.006	0.1
PSV 1	12	510	38	0.2	0.7	0.001	0.02
PSV 2	12	510	38	0.2	0.7	0.001	0.02
PSV 3	12	510	38	0.2	0.7	0.001	0.02
Helicopter	1.2	51	3.8	0.02	0.07	0.	0.002
TOTAL	**93.2**	**3,961**	**295.8**	**1.52**	**5.75**	**0.009**	**0.18**

References:

DieselNet. 2016. International: IMO Marine Engine Regulations. Available from: https://www.dieselnet.com/standards/inter/imo.php.

Information Request (IR) IR-013 (ECCC-IR-28)

Applicable CEAA 2012 effect(s): 5(1)(b) Federal Lands or Transboundary

EIS Guidelines Reference: Part 2, 6.1.1 Atmospheric environment and climate; 6.3.8 Air quality and greenhouse gas emissions

EIS Reference: 2.8.1 Atmospheric Emissions

Context and Rationale: The EIS states that the types of MODUs (Mobile Drilling Units) and PSVs (Platform Supply Vessels) are not yet decided, so it is not known how conservative or accurate marine air emissions estimates are. The example provided for a semi-submersible diesel powered MODU does not describe whether this is at a high or low-end of the emissions range that could be expected.

Specific Question or Request: Discuss whether emissions could be higher or lower if MODUs and PSVs other than those outlined in the EIS are used for the Project.

Response: Information about potential atmospheric emissions is included in Section 2.8.1 of the EIS. The assumptions made for mobile offshore drilling unit (MODU) fuel consumption was based on a Moss CS60E design, sixth generation harsh environment semi-submersible MODU. The emissions analogue MODU is equipped with 8 HHI HiMSEN 12H32 Tier II diesel engines rated approximately 6,120 kVA AC generators.

It is expected that a similar MODU (*i.e.*, 6^{th} generation, harsh environment semi-submersible) will be used as part of the Project. Emissions may be higher or lower than those presented in the EIS based on the MODU specifications (*e.g.*, engine capacity and load), and the metocean conditions at the time of drilling.

Refer also to the response provided for IR-012 which discusses air emissions associated with platform supply vessels (PSVs). It was assumed for the purposes of assessment that approximately 12 tonnes of fuel would be used per day per PSV. This was based on two to three trips per week per PSV at a service speed of 12 knots. The furthest point in the exploration licences (ELs) from Halifax is 198 nm. Analogue information for PSV fuel consumption was sourced from PSV contractor vessel specifications available online.

Typically, PSV fuel consumption at 12 knots ranges from approximately 10 – 15 tonnes of fuel per 24 hours.

The vessels have not yet been confirmed, and consequently it is possible that emissions may be higher or lower than those provided in the assessment based on metocean conditions and the final vessel specifications.

Information Request (IR) IR-014 (ECCC-IR-29)

Applicable CEAA 2012 effect(s): 5(1)(b) Federal Lands or Transboundary

EIS Guidelines Reference: Part 2, 6.1.1 Atmospheric environment and climate; 6.3.8 Air quality and greenhouse gas emissions

EIS Reference: 2.8.1 Atmospheric Emissions

Context and Rationale: Emissions for the MODU and PSVs are provided but there is insufficient information on how they were estimated.

Specific Question or Request: Provide the basis or reference for the estimate of drilling unit and marine vessel fuel consumption, activity, and air emissions (*i.e.* vessel size, engine size, and Brake Specific Fuel Consumption (BSFC).

Response: Atmospheric emissions have been quantified in Section 2.8.1 of the Environmental Impact Statement (EIS). The mobile offshore drilling unit (MODU) and the platform supply vessel (PSV) contractors have not yet been confirmed however analogue data was sourced for the purpose of the assessment. Analogue MODU and PSVs were selected as representative vessels only and do not indicate which contractors may be used as part of the Project.

The assumptions made for MODU fuel consumption was based on a Moss CS60E design, sixth generation harsh environment semi-submersible MODU. The emissions analogue MODU is equipped with 8 HHI HiMSEN 12H32 Tier II diesel engines rated approximately 6,120 kVA AC generators. The MODU is 122.5 m long by 77.2 m wide.

It is expected that a similar MODU (*i.e.*, 6^{th} generation, harsh environment semi-submersible) will be used as part of the Project. Emissions may be higher or lower than those presented in the EIS based on the MODU specifications (*e.g.*, engine capacity and load), and the metocean conditions at the time of drilling.

A field supply PSV was selected as the analogue for the supply vessel emissions. The PSV used for the basis of the calculations is equipped with 4 x Cat 3516C generator sets, each 2100 ekW giving a total output of 8400ekW. The overall vessel length is 88.3 m. The PSV consumes 13.3m^3 of fuel per day at 12 knots; 6.3 m^3 / day while carrying out dynamic positioning operations; 3.6 m^3 / day while on standby at the MODU and 1.5 m^3 / day while in port. It is expected that that PSVs will make 2 to 3 trips per week between the MODU and the supply base and that a PSV will remain on standby at the wellsite at all times. The final configuration of PSV traffic has not yet been confirmed. On a precautionary basis, 12 m^3 / day / PSV has been used to calculate PSV emissions.

Information Request (IR) IR-015 (CNSOPB-6)

Applicable CEAA 2012 effect(s): All

EIS Guidelines Reference: Part 2, 3 Project Description

EIS Reference: 7.3.4.2 Temporal Boundaries

Context and Rationale: In several sections of the EIS, it is stated that the estimated number of days for drilling each well is 120. Section 7.3.4.2 however, indicates a maximum drilling time of 120 days.

Specific Question or Request: Clarify whether the 120-day drilling timeline is an estimate or a maximum.

Response: The 120 day drilling timeline provided in the Environmental Impact Statement is an estimate.

Information Request (IR) IR-016 (DFO-02)

Applicable CEAA 2012 effect(s): 5(1)(a)(i) Fish and Fish Habitat; 5(1)(a)(ii) Aquatic Species

EIS Guidelines Reference: Part 2, 6.1.2 Marine environment

EIS Reference: section 5.2.2.2 Geohazard Survey, p.5.87, section 7.2.8.3, p. 7.38

Context and Rationale: It is stated on page 5.87 of the EIS that "footage will be captured over an area with a 500-metre radius." However, the proponent has indicated verbally to DFO that the tether limitations may restrict the radius to 200 metres.

The EIS, on page 7.38, predicts that adverse effects on benthic organisms would occur where average drilling waste burial depths are 9.6 millimetres or greater. The EIS predicts that drilling waste thickness greater than 10 millimetres will extend up to 116 metres from the wellsite.

Specific Question or Request: Confirm the area that the geohazard survey would cover. Discuss whether the survey coverage would be sufficient to verify the predicted extent of benthic smothering (average burial depth greater than 9.6 millimetres). Explain whether survey coverage would be sufficient to ensure that sensitive features that may experience deposition (*e.g.* aggregations of habitat-forming corals) would be detected.

Response: BP confirms that footage gathered as part of the remotely operated vehicle (ROV) seabed survey that will be conducted prior to drilling will extend to a 500-metre radius from the wellsite location.

Information about the proposed ROV survey is included in Section 5.2.2.2 of the Environmental Impact Statement (EIS). The seabed survey will be used to confirm information gathered as part of the geohazard baseline review and site specific shallow hazards assessment through a seabed survey. Features such as shipwrecks, debris on the seafloor, unexploded ordnance and sensitive environmental features, such as habitat-forming corals or species at risk will be identified if present.

The ROV seabed survey will be carried out once the mobile offshore drilling unit (MODU) is in place at a proposed wellsite, prior to drilling. The survey will be carried out using an ROV. Footage will be captured over an area with a 500-metre radius in an eight leg pattern in 45 degree increments. Ongoing footage will be captured along each leg of the survey to provide a representation of the complete survey area. If any features of interest, such as benthic communities and epifauna, debris or other anthropogenic features are identified, they will be investigated in greater detail to help the survey team assess the baseline conditions. BP will appoint a marine scientist to support the identification and analysis of any potential environmental sensitivities that may be encountered, such as aggregations of habitat-forming corals or species at risk. If these features are found during the pre-drill ROV survey, the Canada-Nova Scotia Offshore Petroleum Board (CNSOPB) would be notified immediately to discuss an appropriate course of action. This may involve further investigation and/or moving the wellsite if it is feasible to do so. Regardless of whether these features are detected, BP will submit a report to the CNSOPB documenting the survey within 48 hours of survey completion.

Section 7.1.2 of the EIS discusses the drill waste dispersion modelling that was conducted in support of the project. Two representative locations at different water depths were selected, and dispersion modelling was conducted at each to identify the potential extent of deposition from the wellsite. The predicted extent of benthic smothering from the wellsites that were modelled is up to 116 m from the wellsite, using a threshold of 9.6 mm (Neff *et al.* 2004). This is the maximum range based on deterministic modelling for a wellsite in 2,790 metres water depth. It is possible that the extent of benthic smothering may be greater than the 116 m radius identified in the discharge modelling as local metocean conditions at the time of discharge may be different than those used in the deterministic modelling work, however it is considered very likely that this cuttings exceeding a 9.6 mm threshold will fall within the 500 m range captured as part of the seabed survey. Therefore the proposed 500-m radius survey will collect more than sufficient data for baseline conditions.

BP will already have assessed the baseline environment through the geohazard baseline review (GBR) and the site specific shallow hazards assessment. As part of these assessments, BP will have identified habitat suitable for benthic communities, including fluid expulsion features and hardgrounds not related to fluid expulsion. These features will have been avoided as part of well planning activities, specifically when identifying potential wellsite locations to minimise the possibility of encountering benthic habitats. The seabed survey will confirm the results of the GBR and site specific shallow hazards assessment.

References:

Neff, J.M., Kjeilen-Eilersten, G., Trannum, H., Jak, R., Smit, M., and Durell, G. 2004. Literature Report on Burial: Derivation of PNEC as Component in the MEMW Model Tool. ERMS Report No. 9B. AM 2004/024. 25pp.

Information Request (IR) IR-017 (ECCC-IR-02)

Applicable CEAA 2012 effect(s): 5(1)(a)(iii) Migratory Birds

EIS Guidelines Reference: Part 2, 2.2 Alternative means of carrying out the Project; 6.3.5 Migratory Birds; 6.4 Mitigation

EIS Reference: 2.9.2.2 Drilling Waste Management; 7.4.3 Potential Environmental Effects, Pathways and Measurable Parameters; 8.5.3.3 Characterization of Residual Project-Related Environmental Effects

Context and Rationale: The proponent has not yet identified its preferred option for drilling muds, despite the fact that the option of water-based muds is considered both technically and economically feasible in Table 2.9.1.

The EIS states that "Although there are several types of discharges that migratory birds may interact with during drilling of the well and operation of the PSVs, all will be in compliance with the OWTG and in adherence to MARPOL…"

As stated in section 8.5.3.1, O'Hara and Morandin (2010) showed effects of sub-visible sheens on the microstructure of feathers of pelagic seabirds, providing a plausible link between operational discharges of hydrocarbons and increased seabird mortality.

Since birds may be attracted to the MODU and PSVs due to lights and flares, as well as food, the potential for adverse effects on birds in the area of project infrastructure from operational discharges should be adequately addressed.

Specific Question or Request: In assessing alternative means of carrying out the Project, discuss the feasibility of exclusively using water based drilling muds, taking into consideration technical and economic feasibility, as well as environmental considerations, including potential impacts on migratory birds.

Clarify whether the results of O'Hara and Morandin (2010) were considered in the analysis of effects of synthetic based muds (section 8.5.3.3). If not, update the analysis accordingly, or explain why it was not considered necessary.

Response: Drilling fluid and drilling waste discharges are discussed in Section 2.8.2 of the Environmental Impact Statement (EIS). Furthermore, Section 2.9.2.1 includes a comparison between different drilling fluid selections for drilling, specifically using only water based mud (WBM) to drill the whole well or using a combination of WBM and synthetic based muds (SBM) for different sections.

While the analysis of the two drilling fluid design basis options in Section 2.9.2.1 shows that the exclusive use of WBM is both technically and economically feasible, the use of SBM may be necessary while drilling. SBMs may be selected over WBM as they can offer improved lubricity, thermal stability, wellbore integrity and protection against gas hydrates while drilling. The drilling fluid basis of design has not yet been confirmed, however it is possible that either WBM or a combination of WBM and SBM will be used to drill the well.

Although SBMs are known to have environmental benefits compared to oil based muds (Candler *et al.* 1993), they do pose some environmental risk to seabirds. As discussed in the EIS, thin sheens of SBM have been found to change the feather weight and microstructure for pelagic seabirds. Although there are no data on threshold number of affected feathers before an individual bird would begin to be affected by exposure to oil sheen, a spill of SBM could result in increased seabird mortality (O'Hara and Morandin 2010).

The effects of operational discharges of SBM on migratory birds are outlined in Section 7.4.8.3 of the EIS and consider the results of the study by O'Hara and Morandin (2010). The potential for sheen formation as a result of the discharge of cuttings and SBM use was considered low because activity will be carried out in adherence with the Offshore Waste Treatment Guidelines (OWTG) and drill muds will be selected in accordance with the Offshore Chemical Selection Guidelines (OCSG). As discussed in Section 7.4.8.3 of the EIS, cuttings are treated and have only a very small fraction of SBM adhering to them when discharged. In addition, releasing the cuttings at depth further reduces the potential for sheen formation. If the wind and wave conditions were conducive to sheen formation, it would be temporary and limited in size so that only birds in the immediate vicinity of the sheen are likely to be affected. While the risk of mortality for individual birds that encountered the sheen would be increased, the limited nature of this sheen and the likely number of birds affected are such that potential effects are considered minor. However, in consideration of the potential influence of SBM on the feathers of pelagic birds, the magnitude of residual environmental effects from waste management (*i.e.*, particularly operational SBM discharges) on a Change in Risk of Mortality or Physical Injury of migratory birds is now considered "low" instead of "negligible" as indicated in Table 7.4.5 of the EIS. However, with the application of the proposed mitigation and environmental protection measures, the residual environmental effect of a Change in Risk of Mortality or Physical Injury and Change in Habitat Quality and Use on Migratory Birds during routine Project activities is unchanged and is still predicted to be not significant.

The discussion on the likely residual effects from an SBM spill in Section 8.5.3.3 of the EIS also considered the results of O'Hara and Morandin (2010). However, text should be modified as follows to improve clarity.

"There is potential for an SBM spill to result in a surface sheen which in turn could potentially cause a Change in Risk of Mortality or Physical Injury for seabirds present in the immediate area. If the wind and wave conditions were conducive to sheen formation, it would be temporary and limited in size, and only birds in the immediate area of the spill would likely be affected. If migratory birds encountered thin sheens from an SBM spill, they are at greater risk of mortality from effects of SBM on their feather weight and microstructure."

In consideration of the potential influence of SBM sheens on the feathers of pelagic birds, the magnitude of residual environmental effects of an SBM spill on a Change in Risk of Mortality or Physical Injury and Habitat Quality and Use of migratory birds is now considered "moderate" instead of "low" as indicated in Table 8.5.4 of the EIS. However based on the characterisation of residual effects, a SBM release is still predicted to be not significant for Migratory Birds. A summary of the exclusive use of WBM in well drilling, including economic and technical feasibility and environmental considerations, is outlined in Table 2.9.1 of the EIS. Compared to SBMs, WBMs pose a lower risk of a change in mortality or physical injury risk and change in habitat quality and use for migratory birds. WBM released at the seafloor would not interact with surface waters and material released closer to the surface would have a lower potential for sheen formation than SBM. Operational discharges of SBM and WBM will be carried out in adherence with the OWTG, and drill muds will be selected in accordance with OCSG.

References:

Candler, J. E., Rushing, J. H., and Leuterman, A. J. J. 1993. Synthetic-Based Mud Systems Offer Environmental Benefits Over Traditional Mud Systems. Society of Petroleum Engineers. doi:10.2118/25993-MS.

O'Hara, P.D. and Morandin, L.A. 2010. Effects of sheens associated with offshore oil and gas development on the feather microstructure of pelagic seabirds. Marine Pollution Bulletin, 60: 672-278.

Information Request (IR) IR-018 (ECCC-IR-01)

Applicable CEAA 2012 effect(s): 5(1)(a)(iii) Migratory Birds

EIS Guidelines Reference: Part 2, 2.2 Alterative means of carrying out the Project; 6.3.5 Migratory birds;

6.4 Mitigation

EIS Reference: 2.9.2.3 Offshore Vessel Lighting; 2.9.2.4 Well Test Flaring; 7.4 Migratory Birds

Context and Rationale: A catastrophic mortality event at an LNG facility in New Brunswick in the fall of 2013 resulted in the deaths of over 7500 landbirds in one night. ECCC has advised that bird collisions at lit and floodlit structures are also a known problem. In Atlantic Canada, including coastal and offshore Nova Scotia, nocturnal migrants and night-flying seabirds (*e.g.* storm-petrels) are the birds most at risk of attraction to lights and flares. Attraction to lights may result in collision with lit structures or their support structures, or with other birds. Disoriented birds are prone to circling a light source and may deplete their energy reserves and either die of exhaustion, drop into the ocean and perish or drop to the ground (or a hard surface) where they are at risk of depredation. Incineration or partial incineration in flares is also a major concern.

ECCC has advised that bird attraction to flares is a known problem in the offshore with challenges involved in monitoring bird mortality in offshore flares since platform monitoring does not likely accurately measure mortality (*i.e.* affected birds may not land on the MODU, incinerated birds may not leave a carcass). The EIS guidelines require the proponent to analyze alternative means to light the platform at night, and alternative means to flare at night when testing the well, to reduce attraction and mortality of birds, such as installing flare shields.

Specific Question or Request: The proponent rejects spectral modified lighting due to "restricted by commercial availability, limited capability in extreme weather, safety concerns around helicopter approach and landing and lower energy efficiency (Marquenie *et al.* 2014)". Advise whether enquiries have been made with suppliers of spectral modified lights, or whether it was inferred that they would not be available based on Marquenie *et al.* (2014). If they are currently unavailable, clarify whether the proponent is considering platforms which would have the flexibility to change the lighting regime should spectral modified lighting become available in the near future. Clarify whether helicopters for the Project would have windshields rated "Military Clear" (as per Marquenie *et al.* 2014). Clarify the "limited capabilities in extreme weather and lower energy efficiency" associated with spectral modified lighting mentioned by the proponent. Clarify whether any additional benefits or disadvantages of spectral modified lighting in coastal areas or the offshore have been identified in jurisdictions where the lighting has satisfied regulatory requirements (*e.g.*, Netherlands, Germany, United States of America), including effects on birds.

The EIS (Section 2.9.2.3) states that "…red light (570 nm to 650 nm) has been tested on offshore platforms and has demonstrated a reduced effect on marine birds". Clarify which studies have demonstrated a reduced effect on birds by the use of red lights, as Marquenie *et al.* (2014) showed a reduced effect due to green lights.

Explain why the option of avoidance of flaring at night, which the proponent has stated is technically and economically feasible (Table 2.9.4) and that would likely reduce or avoid incidental take of migratory birds, is not the preferred option. Discuss the technical and economic feasibility of installing flare shields or commercially-available enclosed incineration systems.

Response: The response to this IR has been broken up to address the multiple questions raised, as follows:

The proponent rejects spectral modified lighting due to "restricted by commercial availability, limited capability in extreme weather, safety concerns around helicopter approach and landing and lower energy efficiency (Marquenie et al. 2014)". Advise whether enquiries have been made with suppliers of spectral modified lights, or whether it was inferred that they would not be available based on Marquenie et al. (2014). If they are currently unavailable, clarify whether the proponent is considering platforms which would have the flexibility to change the lighting regime should spectral modified lighting become available in the near future."

BP will not be the owner of the mobile offshore drilling unit (MODU) chosen to support Project-related exploration drilling activities and has not yet made any direct enquiries with vendors regarding the availability of spectral modified lights for use in association with the Project. The MODU used for the Project will be an existing drilling unit contracted through a third party drilling contractor and selected based on technical capabilities as well as safety considerations. BP is not aware of any operating MODUs currently equipped with spectral modified lighting that have the technical capability to support the Project.

Should the presence of commercial volumes of hydrocarbons be identified by the Project and a future development scenario be considered, a separate regulatory and environmental assessment (EA) process would be undertaken. In association with the EA undertaken to understand the potential effects of proposed offshore installations, BP would consider the commercial availability, technical capability, and environmental benefit of spectral modified lighting and other alternative lighting opportunities.

Clarify whether helicopters for the Project would have windshields rated "Military Clear" (as per Marquenie et al. 2014).

BP has not yet chosen a helicopter contractor for the Project, and the use of Military Clear windshield ratings is not a regulatory requirement. It has therefore not been determined whether the helicopters for the Project would have windshields rated Military Clear.

Clarify the "limited capabilities in extreme weather and lower energy efficiency" associated with spectral modified lighting mentioned by the proponent.

The limited capabilities in extreme weather and lower energy efficiency identified in Section 2.9.2 of the Environmental Impact Statement (EIS) were not specifically detailed in the Marequenie *et al.* 2014 paper. The paper simply identified these constraints among a number of considerations limiting further offshore implementation of spectral modified lighting. As Project drilling activities are anticipated to occur year-round and the Project Area may experience periods of extreme weather (*i.e.*, high winds, waves and fog), constraints of this nature point out potential technical limitations of this alternative.

Clarify whether any additional benefits or disadvantages of spectral modified lighting in coastal areas or the offshore have been identified in jurisdictions where the lighting has satisfied regulatory requirements (e.g. Netherlands, Germany, United States of America), including effects on birds.

In addition to reduced interaction with migratory birds, Marquenie *et al.* (2014) identified the following benefits of spectral modified lighting in coastal areas or the offshore:

- Creation of safe working conditions; including:
  - less potential interaction between birds and helicopters
  - potential for increased emergency response in some situations (*i.e.*, the human eye is sensitive to the green part of the light spectrum in twilight conditions)
  - comfortable working conditions
  - improved safety for hoisting and lifting operations because of better contrast and less blinding
- Encourages a positive public response

Disadvantages of spectral modified lighting identified by Marquenie *et al.* (2014) include:

- Helicopter approach and landing compromised when windows glazed with a UV-blue filter
- Current limitations in commercial availability
- Current lack of certification by local electrical standards authorities
- Limited extreme weather capability
- Lower energy efficiency

The EIS (section 2.9.2.3) states that "…red light (570 nm to 650 nm) has been tested on offshore platforms and has demonstrated a reduced effect on marine birds". Clarify which studies have demonstrated a reduced effect on birds by the use of red lights, as Marquenie et al. (2014) showed a reduced effect due to green lights.

As identified by Marquenie *et al.* (2014) and others (*e.g.*, Gauthreaux and Belser 2006; Gehring *et al.* 2009), the red part of the spectrum in conventional offshore platform lighting is largely responsible for the prolonged circling phenomenon of birds and removing the long wavelength components of the spectrum reduces the visual and orientation impact on birds (Poot *et al.* 2008; Marquenie *et al.* 2014). Marquenie *et al.* (2014) discuss the results of an experiment which measured the response of migrating birds to spectral modified lighting. Results were found to be statistically significant and demonstrated that the percentage of birds that were influenced by lighting were 80% for white (full) spectrum light, approximately

70% for red light, 30% for green light, and 5% for blue light (Marquenie *et al.* 2014). The complete statement referenced in Section 2.9.2.3 of the EIS refers to spectral modified lighting and not the use of red lights in conventional lighting, and is modified for clarity to read:

"In the North Sea, spectral modified lighting has been tested on offshore platforms and was demonstrated to have a reduced effect on marine birds; particularly the use of green and blue light".

The characterization of the residual environmental effects associated with the presence and operation of the MODU (*i.e.*, as described in Section 7.4.8.3 of the EIS) remains unchanged in consideration of the additional information provided on the effects of lighting on migratory birds.

Explain why the option of avoidance of flaring at night, which the proponent has stated is technically and economically feasible (Table 2.9.4) and that would likely reduce or avoid incidental take of migratory birds, is not the preferred option.

A summary of flaring options is provided in Table 2.9.4 of the EIS. Although the option of reduced flaring (*i.e.*, no flaring during night time or inclement weather) is considered technically and economically feasible, it has not been identified as the preferred option because it could compromise safety and the success of the well test. As indicated in Section 2.4.3.3 of the EIS, it is not currently anticipated that well testing (and therefore flaring) would be carried out on the first two wells drilled in the initial phase of the Project. However, if well testing is carried out, testing would not commence during night time.

Discuss the technical and economic feasibility of installing flare shields or commercially-available enclosed incineration systems.

The use of water curtains during flaring (Photos 1 and 2) are considered technically and economically feasible for the Project. BP commonly uses water curtains where flaring is required in offshore drilling operations around the world. The primary function of water curtains is to protect personnel and equipment on the MODU by limiting the transfer of radiated heat from the flare, thereby mitigating the risk of fire. However, it is expected that birds would be deterred from the general vicinity of the flare based on the positioning of the water curtain (around the flare or to the sides).

Photo 1 Boom Cooling System (Source: Optima 2014)

Photo 2 Rigside Cooling System (Source: Optima 2014)

Enclosed incineration systems are more likely to be present on permanent offshore installations rather than MODUs used for exploration drilling which do not generally contain incineration systems. This technology is therefore not considered applicable to the Project.

References:

Gauthreaux, S.A., Jr. and C.G. Belser. 2006. Effects of artificial night lighting on migrating birds. Pp. 67-93. In: C. Rich and T. Longcore (eds.). Ecological Consequences of Artificial Night Lighting. Island Press, Washington, DC. 478 pp.

Gehring, J., P. Kerlinger and A.M. Mannville. 2009. Communication towers, lights, and birds: Successful methods of reducing the frequency of avian collisions. Ecological Applications, 19: 505-514.

Marquenie, J.M, J. Wagner, M.T. Stephenson, L. Lucas. 2014. Green Lighting the Way: Managing Impacts from Offshore Platform Lighting on Migratory Birds. SPE 168350.

Optima. 2014. The Rig Cooling Specialists. Rig Cooling Systems. Available at: http://www.optimauk.com/complete-cooling-system.html

Poot, H., B. J. Ens, H. de Vries, M. A. H. Donners, M. R. Wernand, and J. M. Marquenie. 2008. Green light for nocturnally migrating birds. Ecology and Society 13(2): 47. [online] URL: http://www.ecologyandsociety.org/vol13/iss2/art47/

Information Request (IR) IR-019 (CNSOPB-1)

Applicable CEAA 2012 effect(s): 5(1)(a); 5(1)(b)(i)

EIS Guidelines Reference: Part 2, 3.1 Project Components: "…the proponent will describe the management and disposal of wastes (*e.g.* type and constituents of waste, quantity, treatment and method of disposal) including operational discharges from subsea systems and the installation of subsea systems."

EIS Reference: Table 2.8.5 Potential Project-Related Liquid Discharges

Context and Rationale: The table indicates that blowout preventer (BOP) testing fluids and other discharges from subsea equipment will be discharged according to the *Offshore Waste Treatment Guidelines* and the *Offshore Chemical Selection Guidelines for Drilling & Production Activities on Frontier Lands* (referred to more commonly as simply the *Offshore Chemical Selection Guidelines*).

The table also says that "BOP fluids are typically freshwater based, seawater soluble chemicals". It is estimated that approximately 5 barrels of BOP testing fluids freshwater based, seawater soluble "chemicals", or other discharges per BOP test would be discharged and 50 barrels would be discharged when the riser is disconnected.

It is not clear what the effects from such discharges would be, or what mitigation measures would be applied to reduce effects.

Specific Question or Request: Provide additional information on the release of BOP fluid into the marine environment. In particular, describe its (typical) components; the various circumstances under which it is released, including any bulk discharges when the riser is recovered to the rig; and the estimated volume in each circumstance (*i.e.* provide sample calculations). Provide amounts expected to be discharged per well and over the life of the Project.

Also provide BOP testing fluids properties (*e.g.* toxicity) and describe the potential effects of the discharged BOP testing fluids and what specific mitigation measures are proposed.

Response: Information about anticipated BOP fluid discharges is included in Table 2.8.5 in Section 2.8.3 of the Environmental Impact Statement (EIS).

Blowout preventers (BOPs) are mechanical devices designed to seal off a well at the wellhead through the deployment of a series of closing mechanisms (information about BOPs are provided in Section 2.5 of the EIS). Typically, BOPs are controlled and operated by hydraulic fluids referred to as BOP fluids. BOP fluids are critical to the reliability and functioning of the BOP control system. BOP fluids are water based and contain a number of additives. The final composition of the BOP fluid that will be used as part of the project has not yet been confirmed, however it is expected that it will contain:

- potable grade freshwater (expected to be at least 95% total fluid composition)
- glycol based antifreeze
- soluble lubricants with corrosion inhibitors

All BOP fluids will be selected in line with the Offshore Chemical Selection Guidelines.

BOP fluid will potentially be released to the marine environment at various times throughout the drilling program, the majority of which were set out in the EIS. The EIS identified potential discharges that could be released throughout the drilling program. The volume of BOP fluids that may be discharged is contingent on the final configuration of the BOP which will be confirmed upon confirmation of the mobile offshore drilling unit (MODU).

A summary of the potential BOP discharges that could occur to the marine environment is presented in Table 1 below. It is possible that up to 211 barrels of BOP fluid could be released per well, of which 155 bbls are a result of routine, planned activity. If seven wells are drilled over the lifetime of the Project, it is possible that up to 1477 bbls of BOP fluid may be discharged.

Routine, planned activity discharges include discharges associated with BOP installation and planned removal and for BOP operations and testing. Upon installation, the BOP will be flushed and function tested. Additonally, when the BOP is retrieved following well abandonment, the control fluid supply and return lines will be drained which will result in a release of BOP fluids. Once the BOP is in place, each operational use of the failsafe valves (*e.g.*, the choke and kill lines) will result in a small discharge of BOP fluid. Furthermore, the BOP will be function tested on a weekly basis which will result in a discharge of approximately 5 bbls.

Additional discharges may occur during non-routine activities associated with the BOP or lower marine riser package (LMRP). The BOP may be retrieved to surface for repair (NB – drilling operations will be suspended when this occurs, riser drilling will not occur without a BOP in place). Additionally, the LMRP will be disconnected as part of riser unlatching which may be required during the drilling campaign for a variety of operational reasons. As explained in Section 8.2.2 of the EIS, the riser that will be used for drilling will be confirmed to have been designed to withstand the meteorological and oceanographic conditions likely to be encountered in the area. Nevertheless, in the approach of an extreme weather event, the riser may be unlatched to prevent damaging the MODU, the BOP or the riser itself and to avoid risk of uncontrolled loss of cuttings or fluid. It is not expected that riser unlatching will occur during drilling, however for the purposes of quantification of potential releases, it has been assumed that there may be one event per well during drilling which may require riser unlatching.

Finally, BOP fluid will be discharged upon BOP activation and when there are non-routine drilling events which may require additional discharges of BOP fluid.

Table 1: BOP Fluid Discharge Estimates

BOP Discharge Event	Routine or Non-routine Activity	Volume per Discharge	Total Volume per Well
Planned BOP installation and removal			
BOP connection – flushing (Planned to occur once per well when the BOP is first connected after completion of riserless drilling)	Routine	Up to 6 bbls	Up to 6 bbls/well
BOP emergency functions testing (Planned to occur upon initial connection)	Routine	Up to 12 bbls	Up to 12 bbls/well
BOP retrieval to surface (Planned to occur at the end of well after abandonment operations have been completed)	Routine	Up to 50 bbls	Up to 50 bbls/well
BOP operations and testing			
Operational use of the failsafe valves (e.g. choke and kill lines).	Routine	Total 0.1 bbls/week	2 bbls/well
Weekly function testing of the BOP control system	Routine	5 bbls/test (i.e., 5 bbls/week)	85 bbls/well
Non routine BOP retrieval or riser unlatching			
Lower marine riser package disconnect or BOP retrieval to surface (i.e. for BOP repair or when the LMRP is retrieved during a weather disconnect)	Non-routine	Up to 50 bbls	Assumed once per well – 50 bbls/well
BOP reconnection – flushing (After an unplanned BOP or LMRP retrieval, the BOP/LMRP will have to be re- connected to continue drilling)	Non-routine	Up to 6 bbls	Assumed once per well – 6 bbls/well
BOP activation			
Anytime an emergency system is activated, all BOP functions discharge control fluid to the marine environment	Non-routine	Unknown	Unknown
Non-routine drilling events may require additional discharges of BOP control fluid.	Non-routine	Unknown	Unknown
Total			**211 bbls/well**

Liquid discharges from the MODU and platform supply vessels (PSVs) were considered as part of the EIS. This includes BOP fluids, although as Project planning has advanced, more details on the predicted timing and volume of BOP fluids has become available, resulting in an increase of predicted BOP discharge volumes. Section 7.1.2 gives an overview of the potential interactions of routine liquid waste discharges with the environment. This is discussed in further detail in Section 7.2.8.1, for fish and fish habitat and Section 7.3.7 for marine mammals. Additional details provided within this response do not affect the discussion of potential or residual effects of these discharges as presented in the EIS. It is stated in the EIS that as a mitigation measure, BOP fluids and other discharges from the subsea control equipment will be managed according to the Offshore Waste Treatment Guidelines and the Offshore Chemical Selection Guidelines.

Information Request (IR) IR-020

Applicable CEAA 2012 effect(s): 5(1)(a)(i)

EIS Guidelines Reference: 6.1.3 Fish and Fish Habitat

EIS Reference: Various – see context

Context and Rationale: The EIS Guidelines (section 6.1.3) require that the EIS describe the following biophysical water and sediment characteristics for areas in which effects are anticipated:

- Location of potential or confirmed fish habitats, description of these habitats - water depth, type of sediment, vegetation, and potential use for spawning, rearing, growth, feeding, migration, and overwintering;
- Quality, thickness, grain size, and mobility of sediments;
- Available bathymetry information for drilling; maximum and mean depths; and
- Benthic flora and fauna and associated habitat, including sensitive features such as corals and sponges.

The EIS (section 6.2.3.4) describes the project area as the footprint of the four Exploration License (EL) areas, covering 13,982 square kilometres (section 2.2), with water depths ranging from 100 metres to more than 3000 metres, and provides the following:

- a summary of the characteristics and distribution of groundfish of commercial, recreational, or aboriginal (CRA) value, pelagic fish of CRA value, invertebrates of CRA value, species at risk, and species of special concern likely to occur in the vicinity of the Project (section 5.2.5);
- a map showing a bathymetric overview of the Scotian Shelf and Slope, identifying the location of the project area (section 5.1.3.1);
- general information about the sediments on the Scotian Shelf and Slope, including the project area (section 5.1.1);
- results of benthic surveys within the project area that were carried out in 2002 (in former ELs 2381 and 2382) in depths ranging from 1500 to 3400 metres (including less than half of the project area), results of earlier nearby benthic surveys at similar depths (section 5.2.2.1);
- Figure 5.2.10, showing surficial seafloor geology built from a geodatabase that includes specific core sampling information such as grain size distribution, shelf and slop surficial geology, and sediment type maps that covers much of the project area (approximately 90 percent) (section 5.2.2.2);
- Figure 5.2.10, showing seafloor geomorphology and infrastructures that covers some of the project area (approximately 60 percent) (section 5.2.2.2);
- reference to information from 3D WATS seismic survey covering 8500 square kilometres,

with water depths 1573 to 3730 metres, that was used to develop the Figure 5.2.10 (section 5.2.2.2); and

- maps showing where corals and sponges have been located in previous surveys of the shallower part of the project area (section 5.2.3).

Specific Question or Request: For the benthic surveys done in 2002 (in former ELs 2381 and 2382), elaborate on the intensity of the survey work done; how many grab samples were collected over what area, and what percentage of the ELs' areas the still-camera transects covered. Clarify the percentage of the current project area that was included in those former ELs.

In order to assess the relevance of information provided in Figure 5.2.10, provide the number of core samples that were used to characterize surficial seabed conditions, the locations of these core samples, and describe the confidence with which this number of samples can be used to characterize the seabed conditions.

Describe how the 3D WATS seismic survey data was used to generate Figure 5.2.10.

Based on the baseline information provided, assess the likelihood that additional coral or sponges are located in or near the project area further to those shown in Figure 5.2.13, taking into account available information available about sediment types, water depths, coral and sponge preferences, and existing coral and sponge locations.

Response: Benthic surveys conducted in 2002 were carried out in exploration licence (EL) 2381 and 2382 by Jacques Whitford Environment Limited (JWEL) to collect substrate samples and benthic photographs in these exploration areas. Sixteen survey stations were established in EL 2381 and EL 2382 (Figure 1). A 0.1 m^2 Van Veen grab was used to collect sediment samples, which were analyzed for biological, physical and chemical characteristics. In total, 16 grab samples were taken from stations within the ELs.

Sixteen still camera transects were completed within the ELs corresponding to the sediment grab stations. A Benthos™ deep-sea camera mounted on a protective frame was deployed from the survey vessel, with the camera shutter triggered by a bottom trigger weight (JWEL 2003). During each transect, the camera was raised and lowered eight times as the vessel drifted over the area of interest. Often, more than eight photos were taken along the transect. The transects ranged in length from 275 m to 1,475 m, with an average length of 636 m and average width for the camera swath of 1 m. These camera transects, therefore, covered an approximate total area of 10,176 m^2. Seventy-seven useable photographs were obtained from ELs 2381 and 2382 (JWEL 2003). Although these survey transects represent less than 1% of the total area of the former ELs 2381 and 2382, the areas that have been surveyed were characteristically consistent between sites along the Scotian Slope and are also consistent with findings reported by Shell Canada Limited during their benthic surveys (see Stantec 2016).

BP's EL 2431 contains approximately 154,430 ha of the former ELs 2381 and 2382 (approximately 54% of the current EL was covered by the former ELs). BP's EL 2432 contains approximately 129,780 ha of the former EL 2381 and 2382 (approximately 46% of the current EL was covered by the former ELs). BP's EL 2433 contains approximately 37,826 ha of the former EL 2381 (approximately 9% of the current EL was covered by the former EL 2381). There is no overlap between BP's EL 2434 and the former ELs 2381 and 2382.

ELs 2381 and 2382 consisted of silt/clay habitats with the exception of two stations which contained sand and were located at the bottom of Dawson Canyon. There were no differences in the macroinvertebrate assemblage due to habitat differences. Ophuroids and burrowing anemones were the most common organisms in the photographs. Eight of the stations contained corals, which were predominantly sea whips (Gorgonacea) with sparse distributions (JWEL 2003). Based on baseline information, there is potential for cold water corals to be found in the Project Area. Corals are more likely to be observed at the edges of banks and in submarine canyons. As a result, there is a higher potential to find these species along the shelf edge and in the various submarine canyons throughout the Regional Assessment Area (RAA).

Prior to drilling, Shell Canada Limited conducted benthic habitat surveys at their proposed drill sites (Cheshire and Monterey Jack), as part of the Shelburne Basin Venture Exploration Drilling program. The purpose of these surveys was to identify potential aggregations of habitat-forming corals or sponges, or species at risk prior to drilling. The locations of these drill sites were in similar habitat to what would be found in the Project Area for the Scotian Basin Exploration Drilling Project. Results from these surveys indicated occasional soft coral (Alcyonacea) and cup coral (*Flabellum* sp.) within the survey areas. Sea pens and sea whips were not common. For both surveys, no aggregations of habitat-forming corals or sponges were identified (Stantec 2016). Similar results are likely to be found within the Project Area.

Figure 5.2.10 in Section 5.2.2 of the EIS presents two maps from the geohazard baseline review (GBR). The maps included show surficial geology and seafloor geomorphology and infrastructures, including water depth and seafloor gradients. These data identify canyon systems.

The maps in Figure 5.2.10 were generated as follows:

- Seafloor geomorphology map:

  A regional three-dimensional digital terrain model (DTM) of the area of interest of the Scotian Slope was created in ArcGIS from the seafloor reflection that was picked on the Wide Azimuth Towed Streamer (WATS) seismic data acquired by BP in 2014. The seismic data consist of a Kirchhoff Pre-Stack Depth Migration (PrSDM) volume with a 25 m by 25 m bin-size. The resulting DTM grid resolution (or grid cell size) is 25 m. This rendered surface was used to map the seafloor and near-seafloor geomorphology (*i.e.*, canyons, seafloor scarps, shallow-buried landslides, *etc.*) and it was then integrated with available information on exiting seafloor infrastructures (*i.e.*, wells, cables, shipwrecks, *etc.*) for a regional geohazards assessment study. A higher resolution seafloor DTM (12.5 m grid cell size), derived from a Pre-stack Time Migration (PrSTM) WATS dataset reprocessed for shallow hazards studies, will be adopted for site-specific well planning support.

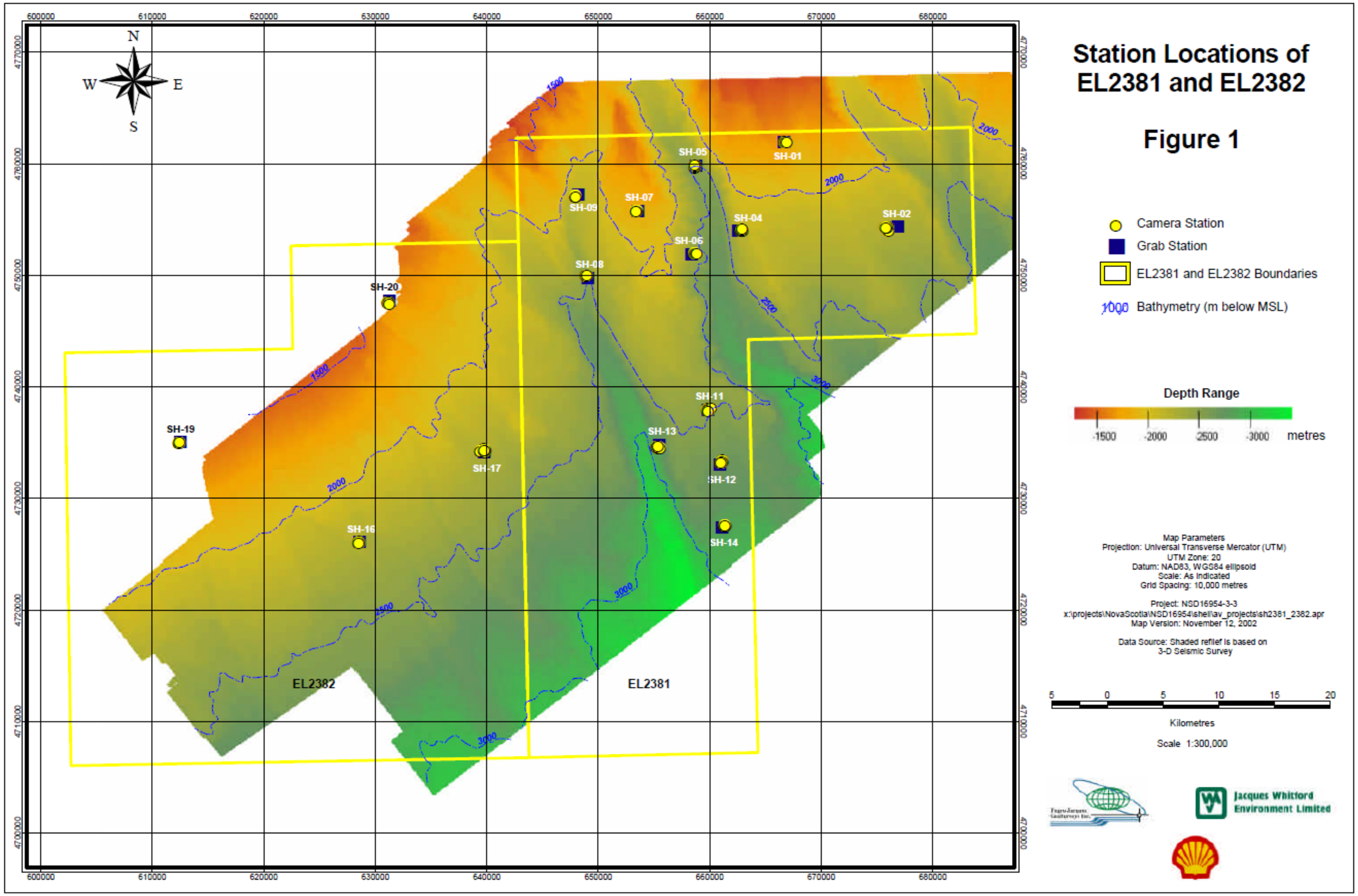
- Surficial geology map:

  In 2013, BP purchased an ArcGIS geodatabase that C-Core compiled by integrating large amounts of publicly available geotechnical, geophysical, and geological data for the Scotian Shelf and Slope areas. These data were collected offshore Nova Scotia over the past decades by the Geological Survey of Canada (GSC) and other organizations such as the Canada-Nova Scotia Offshore Petroleum Board (CNSOPB). The data contained in the C-Core project consist primarily of high-resolution seismic-reflection profiles, seabed samples (piston cores, box cores, and grabs), seafloor photographs, remotely operated vehicle observations, historical seismicity data, and hull-mounted multibeam sonar bathymetry. The existing C-Core surficial maps were integrated with the regional seafloor DTM to generate a comprehensive surficial geology map for a regional geohazards assessment study.

  In addition, an amplitude map of the seafloor reflection has been extrapolated from the PrSDM WATS data to assess the surficial geology and near-seafloor soils variability within the area of interest for a regional geohazards assessment study. The seismic amplitude of the seafloor may be regarded as the equivalent of an acoustic response that is typically recorded with multibeam surveys (even though the latter provide the reflectivity response of the actual sediment-water interface, whereas the seafloor amplitude is a seismic response of the first few meters below seafloor as a function of the seismic wavelet). High-amplitude seismic anomalies, indicative of hard seabed (*i.e.*, shallow proglacial coarse-grained sediments, exposed overconsolidated stratigraphy), occur primarily on the bottom of the canyons, along canyon walls, and widespread to the west of Verrill Canyon. Low-amplitude seismic responses (generally indicative of soft seabed / unconsolidated hemipelagic mud) occur mainly in the inter-canyon ridges. The soil variability map was ground-truthed with a number of piston cores and box cores available in the C-Core ArcGIS geodatabase, as well as with additional piston cores available in the public domain (*i.e.*, Core 99036-29 and Core 2000-042-54, from Piper *et al.* 2012).

As stated in Section 7.2.8.2 of the EIS, BP will conduct an imagery-based seabed survey in the vicinity of wellsites to ground-truth the findings of the GBR. This includes confirming the absence of shipwrecks, debris on the seafloor, unexploded ordnance, and sensitive environmental features, such as habitat-forming corals, or species at risk. The survey will be carried out prior to drilling.

In the event that any habitat forming coral aggregations, epifauna species at risk, or epifauna that cannot be identified are observed, the survey team will alert the project team and the CNSOPB will be notified immediately to discuss an appropriate course of action. This may involve further investigation and/or selecting an alternative wellsite, if it is feasible to do so. The CNSOPB may consult with other regulatory agencies (*e.g.*, DFO) if they determine it is necessary. No drilling activity will occur before a decision is made with the CNSOPB.



Station Locations of EL2381 and EL2382

Figure 1

References:

JWEL [Jacques Whitford Environment Limited]. 2003. Shell Canada Limited Characterization of Benthic Habitat Exploration Licenses 2381 and 2382. Iii + 53pp.

Piper, D.J.W., Deptuck, M.E., Mosher, D.C., Hughes-Clarke, J.E., and Migeon, S. 2012, Erosional and depositional features of glacial meltwater discharges on the eastern Canadian continental margin, In: B. Prather, M. Deptuck, D. Mohrig, B. van Hoorn, and R. Wynn (Eds), Application of the Principles of Seismic Geomorphology to Continental Slope and Base-of-slope Systems: Case Studies from Seafloor and Near-Seafloor Analogues: SEPM Special Publication 99, p. 61-80

Stantec [Stantec Consulting Ltd.]. 2016. Final Report: Shelburne Basin Venture Exploration Drilling Project: Cheshire L-97A Sediment Deposition Survey Report. Prepared for Shell Canada Limited. December 15, 2016.

Information Request (IR) IR-021 (DFO-04)

Applicable CEAA 2012 effect(s): 5(1)(a)(i) Fish and Fish Habitat; 5(1)(a)(ii) Aquatic Species

EIS Guidelines Reference: Part 2, 6.3.1 Fish and fish habitat; 6.3.2 Marine plants; 6.4 Mitigation

EIS Reference: 2.3.2 Offshore Exploration Wells; 7.2.8.2 Mitigation of Project-Related Effects, p. 7.34

Context and Rationale: The EIS Guidelines (section 6.4) require that the mitigation measures included in the EIS be specific, achievable, measurable and verifiable, and described in a manner that avoids ambiguity in intent, interpretation, and implementation. The EIS must also present an assessment of the effectiveness of the proposed technically and economically viable mitigation measures, and describe any other technically and economically feasible mitigation measures that were considered and rejected.

The EIS (section 2.3.2) describes how the locations of the seven proposed wells have not yet been finalized within the project area. The EIS (section 7.2.8.2) describes measures to mitigate effects on fish and fish habitat, and includes a commitment to carry out an imagery-based seabed survey in the vicinity of wellsites once the sites have been determined to confirm the absence of, including among other things, sensitive environmental features such as species at risk or aggregations of habitat-forming corals. If feasible, the proponent would move the drilling location to avoid affecting the sensitive area; if not feasible, the proponent will consult with the CNSOPB to determine an appropriate course of action.

DFO has suggested that the mitigation could be strengthened by having an individual trained in deep- water benthic environments review the seabed survey in real time and has offered to provide guidance to this individual prior to surveying to ensure that the assessment would be consistent with DFO's view.

Specific Question or Request: Describe the procedure planned for surveying the area prior to drilling. Describe the timing of the survey relative to drilling, how the information collected during the survey would be reviewed and by whom.

Describe the conditions under which proceeding to drill on or near a sensitive environmental feature would be requested of the Board. State whether the proponent has a Standard Operating Procedure for what it would consider a threshold for environmental sensitivity that would trigger moving the drilling location. Describe the criteria that would inform a decision as to whether or not to proceed (*i.e.* what features would be considered sensitive?), the qualifications of personnel making the decision, and any parties other than the Board that would be consulted. For example, under what circumstances, if any, does the proponent intend to consult with DFO concurrently with the Board to assist in determining an appropriate course of action that is in compliance with the *Fisheries Act* and the *Species at Risk Act*?

Clarify the factors that would be considered in a determination of whether or not it would be feasible to move the well. Discuss technical and economic limitations and considerations associated with moving the drilling location. Explain how far a drilling location may be moved, taking into consideration the potential presence of sensitive features and the predicted extent of drilling waste.

Advise whether the proponent will employ an individual trained in deep-water benthic environments to review the seabed survey in real time. Provide the proposed qualifications of this individual and state whether DFO's offer to provide guidance to this individual would be accepted. If not, propose an alternative approach that would ensure that the individual reviewing seabed survey is appropriately qualified.

State whether seabed survey footage would ultimately be made available to DFO or other interested parties.

Response: As indicated in Section 5.2.2.2 of the Environmental Impact Statement (EIS), a pre-drill seabed survey will be used to confirm information gathered as part of the geohazard baseline review (GBR). The GBR is being carried out across the full extent of the exploration licences. A detailed wellsite specific assessment will be carried out as part of the site specific shallow hazards assessment which will give a more detailed description of subsurface geological conditions which could pose a potential hazard to drilling activity and a more detailed explanation of seafloor conditions and evaluation criteria for each individual location. The GBR and site specific shallow hazard assessment will be able to identify habitat suitable for benthic communities. These may appear as amplitude anamolies or topographic features such as fluid expulsion features. Such data provide an indication of areas of hard substrate and potential seeps. These provide potential habitat to benthic communities such as cold water coral, soft corals and certain sponges or seep-associated biota Any areas that are identified as favourable for benthic communities will be avoided as part of well planning, however any assumptions made about the absence of habitat suitability or benthic communities, or anthropogenic features such as shipwrecks will be confirmed as part of the pre-drill ROV seabed survey.

Once the mobile offshore drilling unit (MODU) is on location at the proposed wellsite and after pre-drilling checks have been conducted, BP will conduct a visual survey of the seabed around the wellsite using a remotely operated vehicle (ROV).

The pre-drill seabed survey will be used to confirm information gathered as part of the GBR and site specific shallow hazards assessment.

It is expected that the ROV survey will take no more than 24 hours to complete. Footage will be captured over an area with a 500-metre radius in an eight leg pattern in 45 degree increments as shown below in Figure 1.

Ongoing footage will be captured along each leg of the survey to provide a representation of the complete survey area. A live feed of the video footage will be reviewed in real-time by a survey team which will include, at a minimum, an ROV operator, a shallow hazards specialist and a marine scientist. If any features of interest, such as benthic communities, epifauna, debris or other anthropogenic features are identified, they will be investigated in greater detail to help the survey team with their assessment.

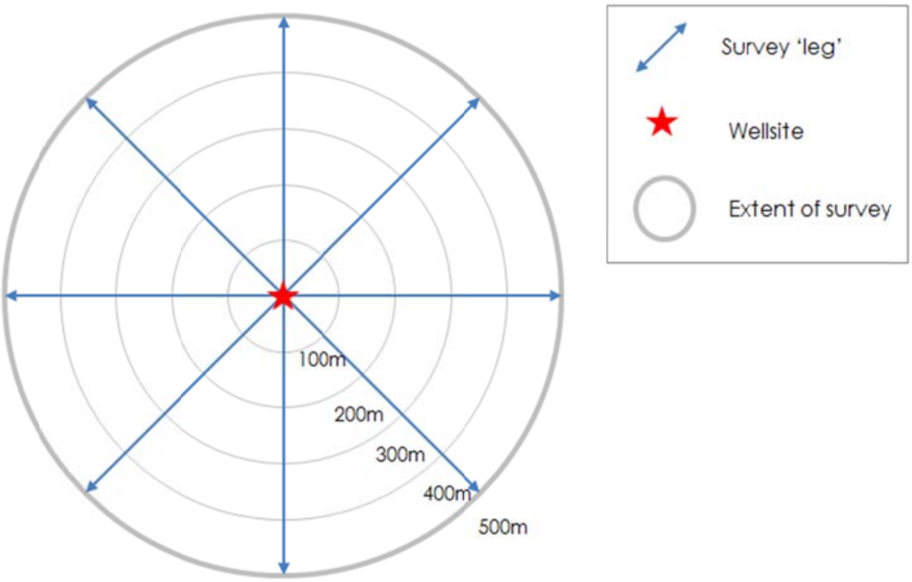


Figure 1 Proposed Survey Design for ROV Surveys

The marine scientist will be engaged to identify and assess environmental sensitivities. The marine scientist will be a deep-water benthic specialist who will be contracted to provide an independent, qualified professional perspective on the benthic habitat and the presence of benthic environmental sensitivities, specifically habitat forming coral aggregations and species at risk. BP will notify the Canada-Nova Scotia Offshore Petroleum Board (CNSOPB) of the details and qualifications of the marine scientist in advance of the survey. In the event that any epifauna is observed, the ROV will be diverted to investigate in greater detail. This may include observing the fauna from a different angle to assist with species identification or to assess the size of the individual or extent of any aggregation.

In the event that any habitat forming coral aggregations, epifauna species at risk, or epifauna that cannot be identified are observed the survey team will alert the project team and the CNSOPB will be notified immediately to discuss an appropriate course of action. This may involve further investigation and/or selecting an alternative wellsite, if it is feasible to do so.

The CNSOPB may consult with other regulatory agencies (*e.g.*, DFO) if they determine it is necessary. No drilling activity will occur before a decision is made with the CNSOPB.

Information Request (IR) IR-022 (DFO-05)

Applicable CEAA 2012 effect(s): 5(1)(a)(i) Fish and Fish Habitat; 5(1)(a)(ii) Aquatic Species

EIS Guidelines Reference: Part 2, 6.2 Predicted Changes to the Physical Environment

EIS Reference: 11.1.1.1 Fish and Fish Habitat, p.11.3; 7.2.5 Criteria for Characterizing Residual Environmental Effects and Determining Significance; 7.2.8.3 Characterization of Residual Project-Related Environmental Effects

Context and Rationale: Additional information is required in the characterization of the duration of project effects on fish and fish habitat.

For fish and fish habitat, the EIS (section 7.2.5) defines duration of effects as medium-term where effects extend through the entire duration of project activities, and long-term where effects extend beyond the duration of project activities and continue after well abandonment.

The EIS (section 7.2.8.3) describes effects of fish mortality or injury associated with the discharge of drill muds and cuttings as expected to subside with time (one to four years), and characterizes these effects as medium-term. However, effects from wells drilled toward the end of the exploration license terms could extend past the duration of project activities. Furthermore, the statement that "habitat altered by the deposition of drill muds and cuttings will become available for use as fish habitat following the completion of drilling operations and is expected to be recolonized by benthic communities in less than 5 years" requires further consideration. The statement appears to be largely based on studies in shallower, more-dynamic, waters than deep water sites.

Specific Question or Request: Provide specific references to studies in deep water environments to support the statement that drill muds and cuttings will be available for use as fish habitat and recolonized by benthic communities in less than five years. Provide rationale for describing the duration of waste discharge effects on fish mortality or physical injury, or effects on habitat quality and use, as medium term; alternately, update the effects characterization.

Response: Garcia *et al.* (2011) monitored the sediment physical/chemical and benthic macrofaunal effects of discharge of water based muds (WBM) and cuttings from the Ballena well in 350 m of water and the Cocuina well in 190 m of water on the Atlantic outer continental shelf. Sediment samples were collected several times after drilling at stations 50, 250, 500, and 1,000 m from each well. It was discovered that the abundance and similarity of the benthic fauna increased to pre-drilling levels at both well sites within approximately one year of drilling (Garcia *et al.* 2011).

Jones *et al.* (2006, 2007, 2012) performed video surveys with a remotely operated vehicle (ROV) in the Laggan, Foinaven and Schiehallion oil fields in 600, 508, and 420 m of water, respectively, in the Faroe-Shetland Channel, a high-energy continental slope area in the northeast Atlantic Ocean. The top-hole sections of each of the wells was drilled with WBM and cuttings were discharged directly to the sea floor. Three years after drilling, megafaunal recovery was underway at the Laggan drill site. There was no post drilling data from the two other drill sites.

Two drilling sites were monitored with ROV video and sediment core analysis in approximately 370 m of water in the Morvin field in the Norwegian Sea northwest of Trondheim, Norway. Gates and Jones (2012) monitored the effects of drilling the top-hole sections of an exploratory drilling well and the disposal of WBM cuttings at the seafloor. Monitoring occurred one day before drilling and 27, 76 days, and three years post drilling. Most of the WBM and cuttings settled into the sediments within 100 m from the discharge site. Visible deposits of cuttings disappeared within a few years, although elevated concentrations of drilling fluid barite in sediments were persistent. The abundance of motile megafauna decreased slightly shortly after drilling. Abundance of these species increased to greater than pre-drilling levels within 76 days of drilling. The abundance of hard-bottom megafauna was not affected by the drilling discharge. Cold water corals tolerated moderate exposure to settling particles from drill waste plumes and there was no effect of plumes on behaviour, growth, or survival. Soft-bottom megafauna populations near the cuttings discharges were adversely affected by burial and recovered slowly over the course of the study (Gates and Jones 2012).

A monitoring study in the Gulf of Mexico (GoM) was conducted to determine the fate and physical, chemical, and biological effects of synthetic based mud (SBM) cuttings discharges from offshore wellsites on the benthic environment of the northern GoM continental shelf and slope (IOGP 2016). In total eight offshore wells were monitored from May 2001 to May 2002, with four sites located on the continental shelf in depths from 37 to 119 m, and four located on the continental slope in depths ranging from 338 to 556 m. Overall, sediment quality and biological communities were not severely affected. Effects were limited to the vicinity of the discharge (less than 250 m) and physical, chemical and biological recovery occurred during the one year period between surveys (IOGP 2016).

In a study in the Campos Basin, effects were studied from discharges of WBM and SBM from the Eagle well in 902 m of water on the Brazilian continental slope (IOGP 2016). In total,159 sediment samples were collected around the well during three surveys: 1) before drilling, 2) after drilling, and 3) one year after the well was drilled. Samples were collected in concentric rings 50, 100, 150, 300, 500, and 2,500 m from the wellsite. It was found that drill cuttings created measurable effects on the benthic macrofauna, with impacts observed out to 500 m from the well. There was nearly complete recovery of the benthic communities within the year between the first and second post drilling surveys (IOGP 2016).

The environmental effects of four paraffin and one olefin SBM cuttings discharges from drilling platforms in 70 to 1,500 m of water offshore Sarawak/Sabah, Malaysia were monitored three and 15 months post drilling (Dorn *et al.* 2007). It was found that benthic macrofaunal community parameters, abundance, species richness, and diversity were not significantly different at near-field (60 to 100 m), mid-field (100 to 350 m) and far-field (7,500 to 16,000 m) stations. It was also observed that these parameters were also not correlated with SBM cuttings concentrations in the sediment. It was concluded that the SBM cuttings did not affect the shallow or deep-water benthic communities (Dorn *et al.* 2007).

A literature review was conducted by the International Association of Oil & Gas Producers on the effects of SBM cuttings on benthic communities (IOGP 2016). Seven field monitoring studies of the fates and effects of SBM cuttings on macro and meiofauna (infauna) communities from 14 wellsites ranging in depth from 70 to 1,500 m were investigated. Observations were made which illustrated that the effects of SBM cuttings were usually less severe at greater water depths (>1,000 m) than at shallow depths, and recovery was more rapid. The effects of the discharges on the macrofaunal communities were usually the greatest within 100 m of the discharge site. The most frequent response of the benthic macrofaunal community was a decrease in total abundance, species richness, and diversity, sometimes associated with a large increase in the abundance of a few opportunistic species in the areas where large amounts of SBM cuttings had accumulated on the sea floor. It was also observed that the abundance and diversity of the meiofaunal community either increased or decreased near the discharge sites.

The studies above serve as evidence for the EIS statement that "habitat altered by the deposition of drill muds and cuttings will become available for use as fish habitat following the completion of drilling operations and is expected to be recolonized by benthic communities in less than five years".

The effects of fish mortality or injury associated with the discharge of drill muds and cuttings are expected to subside with time (one to four years). However, effects from wells drilled toward the end of the exploration license terms could extend past the duration of project activities. As a result of this possibility the residual environmental effects determination for the duration of effects on fish mortality or injury as well as habitat quality and use, associated with waste management has been changed from medium term to long term (see revision to Table 7.2.6, below).

With the application of proposed mitigation measures and environmental protection measures, the residual environmental effects of a Change in Risk of Mortality and Change in Habitat Quality on Fish and Fish Habitat from Project activities and components are still predicted to be not significant.

Table 7.2.6 Summary of Project Residual Environmental Effects on Fish and Fish Habitat

Residual Effect	Residual Environmental Effects Characterization						
	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Socio-economic Context
Change in Risk of Mortality or Physical Injury							
Presence and Operation of MODU (including well drilling and testing operations and associated lights, safety [exclusion] zone and underwater	A	L	PA	MT	C	R	D

Table 7.2.6 Summary of Project Residual Environmental Effects on Fish and Fish Habitat

Residual Effect	Residual Environmental Effects Characterization						
	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Socio-economic Context
sound)							
Waste Management (including discharge of drill muds and cuttings and other drilling and testing emissions)	A	L	PA	~~MT~~ LT	R	R	D
Vertical Seismic Profiling	A	L	LAA	ST	IR	R	D
Change in Habitat Quality and Use							
Presence and Operation of MODU (including well drilling and testing operations and associated lights, safety [exclusion] zone and underwater sounds)	A	L	LAA	MT	C	R	D
Waste Management (including discharge of drill muds and cuttings and other drilling and testing emissions)	A	L	PA	~~MT~~ LT	R	R	D
Vertical Seismic Profiling	A	L	LAA	ST	IR	R	D
Supply and Servicing Operations (including helicopter transportation and PSV operations)	A	L	LAA	MT	R	R	D
Well Abandonment	A	L	PA	ST	IR	R	D

KEY:
See Table 7.2.2 for detailed definitions
N/A: Not Applicable

Direction:
P: Positive
A: Adverse
N: Neutral

Magnitude:
N: Negligible
L: Low
M: Moderate
H: High

Geographic Extent:
PA: Project Area
LAA: Local Assessment Area
RAA: Regional Assessment Area

Duration:
ST: Short-term
MT: Medium-term
LT: Long-term

Frequency:
S: Single event
IR: Irregular event
R: Regular event
C: Continuous

Reversibility:
R: Reversible
I: Irreversible

Ecological/Socio-Economic Context:
D: Disturbed
U: Undisturbed

References:

Dorn, P.B., Rhodes, I.A., Wong, D.C.L., Van Com Pernolle, R., Hinojosa, E.AM., Farmayan, W.F., Ray, J.P., James, B., Hii, K.K., and S. Hj-Kip. 2007. Assessment of the fate and ecological risk of synthetic paraffin based drilling mud dischages offshore Sarawak and Sabah (Malaysia). SPE 108653. Paper presented at the SPE Asia Pacific Health, Safety, Security and Environment Conference and Exhibition, Bankok, Thailand.

Garcia, E., Croquer, A., Bastidas, C., Bone, D., and Ramos, R. 2011. First environmental monitoring of offshore gas drilling discharges in the Deltana Platform, Venezuela. Ciencias Marinas. 37:141-155.

Gates, A.R., and Jones, D.O.B. 2012. Recovery of benthic megafauna from anthropogenic disturbance at a hydrocarbon drilling well (380 m depth in the Norweigian Sea) PLos ONE 7(10): e4414. Doi: 10.1371/journal.pone.0044114.

International Association of Oil & Gas Producers (IOGP) 2016. Report 543: Environmental fates and effects of ocean discharge of drill cuttings and associated drilling fluids from offshore oil and gas operations. 83 pp. + Appendices.

Jones, D.O.B., Gates, A.R., and Lausen, B. 2012. Recovery of deep-water megafaunal assemblages from hydrocarbon drilling disturbance in the Faroe-Shetland Channel. Mar. Ecol. Prog. Ser. 461:71-82.

Jones, D.O.B., Hudson, I.R., and Bitt, B.J. 2006. Effects of physical disturbance on the cold-water megafaunal communities of the Faroe-Shetland Channel. Mar. Ecol. Prog. Ser. 319:43-54.

Jones, D.O.B., Wigham, B.D., Hudson, I.R., and Bett, B.J. 2007. Anthropogenic disturbance of deep-sea megabenthic assemblages: a study with remotely operated vehicles in the Faroe-Shetland Channel, NE Atlantic. Mar. Biol. 151: 1731-1741.

Information Request (IR) IR-023 (DFO-09)

Applicable CEAA 2012 effect(s): 5(1)(a)(i) Fish and Fish Habitat; 5(1)(a)(ii) Aquatic Species

EIS Guidelines Reference: Part 2, 6.1.3 Fish and fish habitat, 6.1.5 Species at risk and species of conservation concern and 6.1.6 Marine mammals

EIS Reference: Tables 5.2.5, 5.2.6, 5.2.7, 5.2.8, 5.2.9, 7.2.3 and 7.2.4

Context and Rationale: It is not clear how the "potential for occurrence" was assessed and categorized as low, moderate, high. Baseline information provided regarding the potential occurrence of some fish and marine mammal species in the project area may be inconsistent or not accurate.

The information presented in Table 5.2.5 regarding the potential for occurrence of groundfish in the project area seems inaccurate. For example, haddock are listed as having low potential to occur despite the inclusion of a corner of the Haddock Box in the project area. Tables 5.2.8 and 7.2.3 indicate high potential of Bluefin Tuna being present in the project area, yet Tables 5.2.6 and 7.2.4 indicate low potential occurrence in the project area, despite the statement on page 7.29 that tuna is among the most commonly harvested species in the project area. Table 5.2.9 indicates a low potential for encountering Northern Bottlenose Whales in the project area yet mapping in Appendix E shows 10 sightings directly in the project Area despite the small population (143 individuals). The indication in Table 5.2.7 that snow crabs have a low potential for occurrence in the project area seems at odds with the statement that there are high concentrations on the Western Bank and its shelf edge. Atlantic Halibut should be noted as "high potential for occurrence in the project area" considering fisheries landings. Silver Hake should be noted as "moderate to high in the project area".

Specific Question or Request: Describe how the "potential for occurrence" was assessed and categorized as low, moderate, high. Review the columns in the tables indicating the potential occurrence of species in the project area to ensure that baseline information presented is accurate and consistent and provide updated tables as necessary. Update the effects assessment, as appropriate, or provide a rationale as to why no update is required.

Response: The potential for occurrence was assessed and categorized as low, moderate, or high based on the analysis of habitat preferences during various life-history stages, distribution mapping, and sightings data for each species within the Project Area. A variety of sources was used to confirm this information including peer-reviewed literature, Canadian Science Advisory Secretariat (CSAS) publications, commercial fishery landings data, Committee on the Status of Endangered Wildlife in Canada (COSEWIC) Status Reports, COSEWIC species Assessments, *Species at Risk Act* (SARA) Management Plans, SARA Action Plans, and SARA Recovery Strategies.

A review of updated mapping (marine mammals) and literature on each species was conducted to confirm and correct any discrepancies between tables throughout the Environmental Impact Statement (EIS). Updates to Tables 5.2.5, 5.2.6, 5.2.7, 5.2.8, 5.2.9, 7.2.3, and 7.2.4 based on the revised mapping and a literature review are shown in track changes. Three marine mammal species, Risso's, Atlantic spotted, and pantropical dolphins, have been added to Table 5.2.9 in response to IR-031.

Table 5.2.5 Groundfish of Commercial, Recreational or Aboriginal Value Potentially Occurring on the Scotian Shelf and Slope

Common Name	Scientific Name	Potential for Occurrence in the Project Area[1]	Timing of Presence
Acadian redfish[2]	*Sebastes fasciatus*	~~Low~~ Low to Moderate	Year-Round
American plaice[2]	*Hippoglossoides platessoides*	Low	Year-Round
Atlantic cod[2]	*Gadus morhua*	Low	Year-Round
Atlantic halibut	*Hippoglossus Hippoglossus*	~~Moderate~~ High	Year-Round
Atlantic wolffish[2]	*Anarchichas lupus*	Low	Year-Round
Deepwater redfish[2]	*Sebastes mentella*	~~Low~~ Low to Moderate	Year-Round
Haddock	*Melanogrammus aeglefinus*	Low	Year-Round
Hagfish	*Myxine glutinosa*	Moderate	Year-Round
Monkfish	*Lophius americanus*	~~Low~~ Low to Moderate	Year-Round
Pollock	*Pollachius virens*	Low	Year-Round
Red hake	*Urophycis chuss*	Low	Year-Round
Sand lance	*Ammodytes dubius*	Low	Year-Round
Silver hake	*Merluccius bilinearis*	~~Low~~ Moderate to High	Year-Round
Turbot – Greenland halibut	*Reinhardtius hippoglossoides*	Moderate to High	Year-Round
White hake[2]	Urophycis tenuis	Moderate	Year-Round
Witch flounder	*Glyptocephalus cynoglossus*	~~Low~~ Low to Moderate	Year-Round
Yellowtail founder	*Limanda ferruginea*	Low	Year-Round

Note:
[1]This is based on the analysis of habitat preferences during various life-history stages, distribution mapping, and catch data for each species within the Project Area.
[2]SAR or SOCC.

Sources: DFO 2009f, 2009g, 2009h, 2010b, 2013p, 2013q, 2013r, 2013s; Horseman and Shackell 2009; NOAA 2006, 2013h, 2013i, 2013j, 2013k

Table 5.2.6 Error! No text of specified style in document.**Pelagic Fish Species of Commercial, Recreational, or Aboriginal Value Potentially Occurring on the Scotian Shelf and Slope**

Common Name	Scientific Name	Potential for Occurrence in the Project Area[1]	Timing of Presence
Albacore tuna	*Thunnus alalunga*	Low	July to November
Alewife	*Alosa pseudolarengus and A. aestivalis*	Low	July to February
Atlantic herring	*Clupea harengus*	Low	Year-round
Atlantic mackerel	*Scomber scombrus*	Low	Winter – deep water on the Shelf Spring/Summer – Migrate to shallower coastal zones
American eel[2]	*Anguilla rostrate*	Low (Transient Species)	March to November
Bigeye tuna	*Thunnus obesus*	Low	July to November
Black dogfish	*Centroscyllium fabricii*	Low	Year-round
Bluefin tuna[2]	*Thunnus thynnus*	~~Low~~ Low to Moderate	June to October
Blue shark[2]	*Prionace glauca*	Moderate	June to October
Capelin	*Mallotus villosus*	Low	Year-round
Cusk[2]	*Brosme brosme*	Moderate	Year-round
Porbeagle shark[2]	*Lamna nasus*	Moderate	Year-round
Shortfin mako shark[2]	*Isurus oxyrinchus*	Moderate	July to October
Swordfish	*Xiphias gladius*	Moderate	July to October
White marlin	*Kajikia albida*	Moderate	July to October
Yellowfin tuna	*Thunnus albacares*	Low	July to October

Note:
[1]This is based on the analysis of habitat preferences during various life-history stages, distribution mapping, and catch data for each species within the Project Area.
[2]SAR or SOCC.

Sources: DFO 1997; GMRI 2014; FLMNH 2013a, 2013b; NOAA 2013a, 2013b, 2013c, 2013d, 2013f, 2013g.

Table 5.2.7 Invertebrate Species of Commercial, Recreational or Aboriginal Value Potentially Occurring on the Scotian Shelf and Slope

Common Name	Scientific Name	Potential for Occurrence in the Project Area[1]	Timing of Presence
American lobster	*Homarus americanus*	Low	Year-round
Clams (Atlantic Surf, Soft-shelled, quahaugs)	*Spisula solidissima*, *Mya areniaria*, *Mercenaria mercenaria.*	Low	Year-round
Green sea urchin	*Strongylocentrotus droebachiensis*	Low	Year-round
Jonah crab	*Cancer borealis*	Low	Year-round
Atlantic sea scallop	*Placopecten magellanicus*	Low	Year-round
Northern shrimp	*Pandalus borealis*	Low	October to April – Nearshore May to September-Offshore
Shortfin squid	*Illex illecebrosus*	High	April to November[2]
Snow crab	*Chionoecetes opilio*	~~Low~~ Moderate	Year-round

Note:
[1]This is based on the analysis of habitat preferences during various life-history stages, distribution mapping, and catch data for each species within the Project Area.
[2]This is based on theoretical / assumed spawning times.

Sources: Choi *et al.* 2012; DFO 2009g, 2009i, 2013m, 2013n, 2013q, 2013t; NOAA 2004.

Table 5.2.8 Fish Species of Special Status Potentially Occurring on the Scotian Shelf and Slope

Common Name	Scientific Name	SARA Schedule 1 Status	COSEWIC Designation[1]	Potential for Occurrence in the Project Area[2]	Timing of Presence
Acadian redfish (Atlantic population)	*Sebastes fasciatus*	Not Listed	Threatened	~~Low~~ Low to Moderate	Year-round
American eel	*Anguilla rostrata*	Not Listed	Threatened	Transient	November -Silver eel out migration from NS March to July - Larvae and glass eels on the Slope and Shelf
American plaice (Maritime population)	*Hippoglossus platessoides*	Not Listed	Threatened	Low	Year-round
Atlantic bluefin tuna	*Thunnus thynnus*	Not Listed	Endangered	~~Low~~ Low to Moderate	June to October
Atlantic cod (Laurentian South population)	*Gadus morhua*	Not Listed	Endangered	Low	Year-round
Atlantic cod (Southern population)		Not Listed	Endangered	Low	Winter – Deep water of Browns and LaHave Banks Summer- Southern Northeast Channel, shallow waters of Browns and LaHave Banks
Atlantic salmon (Outer Bay of Fundy population)	*Salmo salar*	Not Listed	Endangered	Transient	March to November
Atlantic salmon (Inner Bay of Fundy population)		Endangered	Endangered	Transient	March to November
Atlantic salmon (Eastern Cape Breton population)		Not Listed	Endangered	Transient	March to November

Table 5.2.8 Fish Species of Special Status Potentially Occurring on the Scotian Shelf and Slope

Common Name	Scientific Name	SARA Schedule 1 Status	COSEWIC Designation[1]	Potential for Occurrence in the Project Area[2]	Timing of Presence
Atlantic salmon (Nova Scotia Southern Upland population)		Not Listed	Endangered	Transient	March to November
Atlantic sturgeon (Maritimes population)	*Ancipenser oxyrinchus*	Not Listed	Threatened	Low	Year-round
Atlantic wolffish	*Anarhichas lupus*	Special Concern	Special Concern	Low	Year-round
Basking shark (Atlantic population)	*Cetorhinus maximus*	Not Listed	Special Concern	Low to Moderate	Year-round
Blue shark (Atlantic population)	*Priomace glauca*	Not Listed	Special Concern	Moderate ~~to High~~	June to October
Cusk	*Brosme brosme*	Not Listed	Endangered	~~Low to~~ Moderate	Year-round
Deepwater redfish (Northern population)	*Sebastes mentalla*	Not Listed	Threatened	~~Low~~ Low to Moderate	Year-round
Northern wolffish	*Anarhichas denticulatus*	Threatened	Threatened	Low	Year-round
Porbeagle shark	*Lamna nasus*	Not Listed	Endangered	~~High~~ Moderate	Year-round
Roughhead grenadier	*Macrourus berglax*	Not Listed	Special Concern	Moderate	Year-round
Roundnose grenadier	*Coryphaenoides rupestris*	Not Listed	Endangered	Moderate to High	Year-round
Shortfin mako	*Isurus oxyrinchus*	Not Listed	Threatened	Moderate	July to October
Smooth skate (Laurentian-Scotian population)	*Malacoraja senta*	Not Listed	Special Concern	Moderate	Year-round
Spiny dogfish (Atlantic population)	*Squalus acanthias*	Not Listed	Special Concern	~~High~~ Low	Year-round
Spotted wolffish	*Anarhichas minor*	Threatened	Threatened	Low	Year-round
Striped bass (Southern Gulf of St. Lawrence population)	*Morone saxatilis*	Not Listed	Special Concern	Low	June to October
Striped bass (Bay of Fundy population)		Not Listed	Endangered	Low	

Table 5.2.8 Fish Species of Special Status Potentially Occurring on the Scotian Shelf and Slope

Common Name	Scientific Name	SARA Schedule 1 Status	COSEWIC Designation[1]	Potential for Occurrence in the Project Area[2]	Timing of Presence
Thorny skate	*Amblyraja radiate*	Not Listed	Special Concern	Low to Moderate	Year-round
White shark	*Carcharodon Carcharias*	Endangered	Endangered	Low	June to November
White hake	*Urophycis tenuis*	Not Listed	Special	Moderate	Year-round

Note:
[1]Species of conservation concern (SOCC) listed as endangered, threatened, or of special concern by COSEWIC, but not listed in Schedule 1 of SARA.
[2]This is based on the analysis of habitat preferences during various life-history stages, distribution mapping, and catch data for each species within the Project Area.

Sources: BIO 2013a; Campana *et al.* 2013; COSWEIC 2006a, 2006b, 2007a, 2008a, 2009b, 2009c, 2010a, 2010b, 2010c, 2010d, 2011a, 2012a, 2012b, 2012c, 2012d, 2012e; DFO2013b, 2013e, 2013l, 2013j, 2013k; Horseman and Shackell 2009; Maguire and Lester 2012; NOAA2013e; SARA 2015

Table 5.2.9 Marine Mammals Known to Occur in the Vicinity of the Project Area

Common Name	Scientific Name	SARA Schedule 1 Status	COSEWIC Designation	Potential for Occurrence in the Project Area[1]	Timing of Presence
Mysticetes (Toothless or Baleen Whales)					
Blue whale (Atlantic population)	*Balaenoptera musculus*	Endangered	Endangered	Moderate	Summer to Fall
Fin whale (Atlantic Population)	*Balaenoptera physalus*	Special Concern	Special Concern	High	Year- round (highest concentrations in Summer)
Humpback whale (Western North Atlantic population)	*Megaptera novaeangliae*	Not Listed	Not at Risk	~~Low to~~ Moderate	Summer
Minke whale	*Balaenoptera acutorostrata*	Not Listed	Not at Risk	Moderate	Spring to Summer

Table 5.2.9 Marine Mammals Known to Occur in the Vicinity of the Project Area

Common Name	Scientific Name	SARA Schedule 1 Status	COSEWIC Designation	Potential for Occurrence in the Project Area[1]	Timing of Presence
North Atlantic right whale	*Eubalaena glacialis*	Endangered	Endangered	Low	Summer
Sei whale	*Balaenoptera borealis*	Not Listed	Not Listed	Low to Moderate	Summer to early Fall
Odontocetes (Toothed Whales)					
Atlantic spotted dolphin	*Stenella frontalis*	Not Listed	Not at Risk	Low	Summer
Atlantic white-sided dolphin	*Lagenorhynchus acutus*	Not Listed	Not at Risk	Moderate to High	Late Spring to late Fall
Bottlenose dolphin	*Tursiops truncates*	Not Listed	Not at Risk	~~Low~~ Moderate	Year-round
Harbour porpoise (Northwest Atlantic population)	*Phocoena phocoena*	Not Listed	Special Concern	Low	Summer to Fall
Killer whale	*Orcinus orca*	Not Listed	Special Concern	Low ~~to Moderate~~	Summer
Long-finned pilot whale	*Globicephala melas*	Not Listed	Not at Risk	High	Year-round
Northern bottlenose whale (Scotian Shelf Population)	*Hyperoodon ampullatus*	Endangered	Endangered	~~Low~~ High	Year-round
Pantropical spotted dolphin	*Stenella attenuata*	Not Listed	Not at Risk	Low	Summer
Risso's dolphin	*Grampus griseus*	Not Listed	Not at Risk	Moderate	Year-round
Sowerby's beaked whale	*Mesoplodon bidens*	Special Concern	Special Concern	Low	Year-round
Short-beaked common dolphin	*Delphinus delphis*	Not Listed	Not at Risk	High	Summer to Fall

Table 5.2.9 Marine Mammals Known to Occur in the Vicinity of the Project Area

Common Name	Scientific Name	SARA Schedule 1 Status	COSEWIC Designation	Potential for Occurrence in the Project Area[1]	Timing of Presence
Sperm whale	*Physeter macrocephalus*	Not Listed	Not at Risk	High	Summer
Striped dolphin	*Stenella coeruleoalba*	Not Listed	Not at Risk	Low	Summer to Fall
White-beaked dolphin	*Lagenorhynchis albiorostris*	Not Listed	Not at Risk	Low	Year-round
Phocids (Seals)					
Grey Seal	*Halichoerus grypus*	Not Listed	Not at Risk	High	Year-round
Harbour Seal	*Phoca vitulina*	Not Listed	Not at Risk	Moderate	Year-round
Harp Seal	*Pagophilus groenlandicus*	Not Listed	Not at Risk	Moderate	Winter to early Spring
Hooded Seal	*Cystophora cristata*	Not Listed	Not at Risk	Moderate	Winter to early Spring
Ringed Seal	*Pusa hispida*	Not Listed	Not at Risk	Low	Winter to early Spring

Note:
[1]This is based on the analysis of habitat preferences during various life-history stages, distribution mapping, and sightings data for each species within the Project Area.

Sources: Modified from Stantec 2014b and Stantec 2012a

Table 7.2.3 Fish Species at Risk and/or of Conservation Concern Potentially Occurring on the Scotian Shelf and Slope

Common Name	Scientific Name	SARA Schedule 1 Status	COSEWIC Designation[1]	Potential for Occurrence in the Project Area[2]	Timing of Presence
Acadian redfish (Atlantic population)	*Sebastes fasciatus*	Not Listed	Threatened	~~Low~~ Low to Moderate	Year-round
American eel	*Anguilla rostrata*	Not Listed	Threatened	Transient	November -Silver eel out migration from NS March to July - Larvae and glass eels on the Slope and Shelf
American plaice (Maritime population)	*Hippoglossus platessoides*	Not Listed	Threatened	Low	Year-round
Atlantic bluefin tuna	*Thunnus thynnus*	Not Listed	Endangered	~~High~~ Low to Moderate	June to October
Atlantic cod (Laurentian South population)	*Gadus morhua*	Not Listed	Endangered	Low	Year-round
Atlantic cod (Southern population)		Not Listed	Endangered	Low	Winter – Deep water of Browns and LaHave Banks Summer- Southern Northwest Channel, shallow waters of Browns and LaHave Banks
Atlantic salmon (Outer Bay of Fundy population)	*Salmo salar*	Not Listed	Endangered	Transient	March to November

Table 7.2.3 Fish Species at Risk and/or of Conservation Concern Potentially Occurring on the Scotian Shelf and Slope

Common Name	Scientific Name	SARA Schedule 1 Status	COSEWIC Designation[1]	Potential for Occurrence in the Project Area[2]	Timing of Presence
Atlantic salmon (Inner Bay of Fundy population)		Endangered	Endangered	Transient	March to November
Atlantic salmon (Eastern Cape Breton population)		Not Listed	Endangered	Transient	March to November
Atlantic salmon (Nova Scotia Southern Upland population)		Not Listed	Endangered	Transient	March to November
Atlantic sturgeon (Maritimes population)	*Ancipenser oxyrinchus*	Not Listed	Threatened	Low	Year-round
Atlantic wolffish	*Anarhichas lupus*	Special Concern	Special Concern	Low	Year-round
Basking shark (Atlantic population)	*Cetorhinus maximus*	Not Listed	Special Concern	Low to Moderate	Year-round
Blue shark (Atlantic population)	*Priomace glauca*	Not Listed	Special Concern	Moderate ~~to High~~	June to October
Cusk	*Brosme brosme*	Not Listed	Endangered	~~Low to~~ Moderate	Year-round
Deepwater redfish (Northern population)	*Sebastes mentalla*	Not Listed	Threatened	~~Low~~ Low to Moderate	Year-round
Northern wolffish	*Anarhichas denticulatus*	Threatened	Threatened	Low	Year-round
Porbeagle shark	*Lamna nasus*	Not Listed	Endangered	~~High~~ Moderate	Year-round
Roughhead grenadier	*Macrourus berglax*	Not Listed	Special Concern	Moderate	Year-round
Roundnose grenadier	*Coryphaenoides rupestris*	Not Listed	Endangered	Moderate to High	Year-round
Shortfin mako	*Isurus oxyrinchus*	Not Listed	Threatened	Moderate	July to October

Table 7.2.3 Fish Species at Risk and/or of Conservation Concern Potentially Occurring on the Scotian Shelf and Slope

Common Name	Scientific Name	SARA Schedule 1 Status	COSEWIC Designation[1]	Potential for Occurrence in the Project Area[2]	Timing of Presence
Smooth skate (Laurentian-Scotian population)	*Malacoraja senta*	Not Listed	Special Concern	Moderate	Year-round
Spiny dogfish (Atlantic population)	*Squalus acanthias*	Not Listed	Special Concern	~~High~~ Low	Year-round
Spotted wolffish	*Anarhichas minor*	Threatened	Threatened	Low	Year-round
Striped bass (Southern Gulf of St. Lawrence population)	*Morone saxatilis*	Not Listed	Special Concern	Low	June to October
Striped bass (Bay of Fundy population)		Not Listed	Endangered	Low	
Thorny skate	*Amblyraja radiate*	Not Listed	Special Concern	Low to Moderate	Year-round
White shark	*Carcharodon Carcharias*	Endangered	Endangered	Low	June to November
White hake	*Urophycis tenuis*	Not Listed	Special	Moderate	Year-round

Note:
[1]Species of conservation concern (SOCC) listed as endangered, threatened, or of special concern by COSEWIC and not listed on Schedule 1 of SARA.
[2]This is based on the analysis of habitat preferences during various life-history stages, distribution mapping, and catch data for each species within the Project Area.

Source: BIO 2013a; Campana *et al.* 2013; COSWEIC 2006a, 2006b, 2007a, 2008a, 2009b, 2009c, 2010a, 2010b, 2010c, 2010d, 2011b, 2012a, 2012b, 2012c, 2012d, 2012e, DFO 2013e, 2013l, 2013j, 2013k, 2013w; Horseman and Shackell 2009; Maguire and Lester 2012; NOAA2013e; SARA 2015

Table 7.2.4 Fish Species of Commercial, Recreational or Aboriginal Value Found in the RAA

Common Name	Scientific Name	Potential for Occurrence in the Project Area[1]	Timing of Presence
Groundfish Species			
Acadian redfish[2]	*Sebastes fasciatus*	~~Low~~ Low to Moderate	Year-Round
American plaice[2]	*Hippoglossoides platessoides*	Low	Year-Round
Atlantic cod[2]	*Gadus morhua*	Low	Year-Round
Atlantic halibut	*Hippoglossus hippoglossus*	~~Moderate~~ High	Year-Round
Deepwater redfish[2]	*Sebastes mentalla*	~~Low~~ Low to Moderate	Year-Round
Haddock	*Melanogrammus aeglefinus*	Low	Year-Round
Hagfish	*Myxine glutinosa*	Moderate	Year-Round
Monkfish	*Lophius americanus*	~~Low~~ Low to Moderate	Year-Round
Pollock	*Pollachius virens*	Low	Year-Round
Red hake	*Urophycis chuss*	Low	Year-Round
Sand lance	*Ammodytes dubius*	Low	Year-Round
Silver hake	*Merluccius bilinearis*	~~Low~~ Moderate to High	Year-Round
Turbot – Greenland flounder	*Reinhardtius hippoglossoides*	Moderate to High	Year-Round
White hake[2]	Urophycis tenuis	Moderate	Year-Round
Witch flounder	*Glyptocephalus cynoglossus*	~~Low~~ Low to Moderate	Year-Round
Yellowtail founder	*Limanda ferruginea*	Low	Year-Round
Pelagic Species			
Albacore tuna	*Thunnys alalunga*	Low	July to November
Alewife	*Alosa pseudolarengus and A. aestivalis*	Low	July to February
Atlantic herring	*Clupea harengus*	Low	Year-round
Atlantic mackerel	*Scomber scombrus*	Low	Winter – deep water on the Shelf Spring/Summer – Migrate to shallower coastal zones
Bigeye tuna	*Thunnus obesis*	Low	July to November
Black dogfish	*Centroscyllium fabricii*	Low	Year-round
Bluefin tuna[2]	*Thunnus thynnus*	~~Low~~ Low to Moderate	June to October
Blue shark[2]	*Prionace glauce*	Moderate	June to October

Table 7.2.4 Fish Species of Commercial, Recreational or Aboriginal Value Found in the RAA

Common Name	Scientific Name	Potential for Occurrence in the Project Area[1]	Timing of Presence
Capelin	*Mallotus villosus*	Low	Year-round
Porbeagle shark[2]	*Lamna nasus*	Moderate	Year-round
Shortfin mako shark[2]	*Leurus oxyringus*	Moderate	July to October
Swordfish	*Xiphias gladuis*	Moderate	July to October
White marlin	*Tetrapturus albidus*	Moderate	July to October
Yellowfin tuna	*Thunnus albacares*	Low	July to October
Invertebrates			
American lobster	*Homarus americanus*	Low	Year-round
Jonah crab	*Cancer borealis*	Low	Year-round
Atlantic sea scallop	*Placopecten magellanicus*	Low	Year-round
Clams (Atlantic Surf, Soft-shelled, quahaugs)	*Spisula solidissima, Mya areniaria, Mercenaria mercenaria.*	Low	Year-round
Green sea urchin	*Strongylocentrotus droebachiensis*	Low	Year-round
Northern shrimp	*Pandalus borealis*	Low	October - April – Nearshore May - September- Offshore
Shortfin squid	*Illex illecebrosus*	High	April – November[3]
Snow crab	*Chionoecetes opilio*	~~Low~~ Moderate	Year-round
Red crab	*Chaceon quinquedens*	Low	Year-round

Note:
[1] Based on the analysis of habitat preferences during various life-history stages, distribution mapping, and catch data for each species within the Project Area.
[2] Species at Risk or Species of Conservation Concern.
[3] Based on assumed spawning times.

A review of updated mapping (marine mammals) and literature on each species was conducted to confirm or update the potential of occurrence for each species. With respect to fish species, a few species were upgraded from “Low” to “Low to Moderate” including the Acadian redfish, deepwater redfish, monkfish, witch flounder, and bluefin tuna. Other fish species which have been upgraded include the cusk which have moved from “Low to Moderate” to “Moderate” as well as the Atlantic halibut and the silver hake, both of which have been upgraded from “Moderate” to “High”. Several fish species have been downgraded including the blue shark from "Moderate to High" to "Moderate", the porbeagle shark from "High" to "Moderate" and the spiny dogfish from "High" to "Low".

With respect to marine mammals, a review has led to three species being upgraded which include the humpback from "Low to Moderate" to "Moderate", bottlenose dolphin from "Low" to "Moderate" and the northern bottlenose whale from "Low" to "High". One marine mammal species has been downgraded, the killer whale, from "Low to Moderate" to "Low".

None of these updates result in change in the analysis of environmental effects, recommended mitigation or significance determination for Fish and Fish Habitat, Marine Mammals, and Commercial Fisheries (see Sections 7.2.8.2, 7.2.9, 7.3.2.8, 7.3.9, 7.6.2.8, and 7.6.9 of the EIS) as the EIS had assumed species presence and therefore potential interactions with the Project.

References:

BIO [Bedford Institute of Oceanography]. 2013a. Smooth Skate (Malacoraja senta). Bedford Institute of Oceanography-Research. Fisheries and Oceans Canada. Available from: http://www.bio.gc.ca/science/research-recherche/fisheries-pecheries/rays-raies/atlantic-atlantique/malacoraja-senta-eng.php.

Campana, S.E., Gibson, A.J.F., Fowler, M., Dorey, A., and Joyce, W. 2013. Population Dynamics of Northwest Atlantic porbeagle (Lamna nasus), with an Assessment of Status and Projections for Recovery. Fisheries and Oceans Canada. Can. Sci. Advis. Sec. Res. Doc. 2012/096. iv + 84pp.

Choi, J.S., Zisserson, B.M., and Cameron, B.J. 2012. Assessment of Scotian Shelf Snow Crab in 2011. DFO Can. Sci. Advis. Sec. Res. Doc. 2012/024. iv + 95 p.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2006a. COSEWIC Assessment and Status Report on the Blue Shark *Prionace glauca* (Atlantic and Pacific populations) in Canada. Committee on the Status of Endangered Wildelife in Canada. Ottawa. vii + 46pp. Available from: http://www/sararegostru/gc/ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2006b. COSEWIC Assessment and Status Report on the White Shark *Carcharodon carcharias* (Atlantic and Pacific populations) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 31pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2007a. COSEWIC Assessment and Status Report on the Roughhead Grenadier *Macrourus berglax* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 40pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2008a. COSEWIC Assessment and Status Report on the Roundnose Grenadier *Coryphaenoides rupestris* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 42pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2009b. COSEWIC Assessment and Status Report on the American Plaice *Hippoglossoides platessoides* (Maritime population, Newfoundland and Labrador population and Arctic population) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 74pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2009c. COSEWIC Assessment and Status Report on the Basking Shark *Ceorhinus maximus* (Atlantic population) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. Vii + 48 pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2010a. COSEWIC Assessment and Status Report on the Atlantic Salmon *Salmo salar* (Nunavik population, Labrador population, Northeast Newfoundland population, South Newfoundland population, Southwest Newfoundland population, Northwest Newfoundland population, Quebec Eastern North Shore population, Quebec Western North Shore population, Anticosti Island population, Inner St. Lawrence population, Lake Ontario population, Gaspé-Southern Gulf of St. Lawrence population, Eastern Cape Breton population, Nova Scotia Southern Upland population, Inner Bay of Fundy population, Outer Bay of Fundy population) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xlvii + 136pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2010b. COSEWIC Assessment and Status Report on the Spiny Dogfish *Squalus acanthias* (Atlantic population) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 50pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2010c. COSEWIC Assessment and Status Report on the Deepwater Redfish/ Acadian Redfish Complex *Sebates mentella* and *Sebates faciatus*, in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 80pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2010d. COSEWIC Assessment and Status Report on the Atlantic Cod *Gadus morhua* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 105pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2011a. COSEWIC Assessment and Status Report on the Atlantic Bluefin Tuna Thunnus thynnus in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xiii +30 pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2011b. COSEWIC Assessment and Status Report on the Atlantic Sturgeon *Acipenser oxyinchus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xiii +50pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2012a. COSEWIC Assessment and Status Report on the Thorny Skate *Amblyraja radiata* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. ix + 75pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2012b. COSEWIC Assessment and Status Report on the Atlantic Wolffish *Anarhichas lupus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. ix + 56pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2012c. COSEWIC Assessment and Status Report on the American Eel *Anguilla rostrata* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xii + 109pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2012d. COSEWIC Assessment and Status Report on the Northern Wolffish *Anarhichas denticulatus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 41pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2012e. COSEWIC Assessment and Status Report on the Spotted Wolffish *Anarhichas minor* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 44pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

DFO [Fisheries and Oceans Canada]. 1997. DFO Stock Status Report B3-06. Scotian Shelf Capelin. 3 pp.

DFO [Fisheries and Oceans Canada]. 2009f. Underwater World: Atlantic Halibut-Estuary and Gulf of St. Lawrence (Canadian East Coast). Available from: http://www.dfo-mpo.gc.ca/science/publications/uww-msm/articles/atlantichalibut-fletanatlantique-eng.html.

DFO [Fisheries and Oceans Canada]. 2009g. Proceedings of a Workshop on Canadian Science and Management Strategies for Atlantic Hagfish. DFO Can. Sci. Advis. Sec. Proceed. Ser. 2009/009. Available online : http://www.dfo-mpo.gc.ca/CSAS/Csas/Publications/Pro-CR/2009/2009_009_e.pdf.

DFO [Fisheries and Oceans Canada]. 2009h. Underwater World: Yellowtail Flounder, Western North Atlantic Ocean. Available from: http://www.dfo-mpo.gc.ca/science/publications/uww-msm/articles/yellowtailflounder-limandeaqueuejaune-eng.html.

DFO [Fisheries and Oceans Canada]. 2009i. Underwater World: Short-Finned Squid, North American Atlantic coast. Available from: http://www.dfo-mpo.gc.ca/Science/publications/uww-msm/articles/shortfinnedsquid-calmaranageoirescourtes-eng.html.

DFO [Fisheries and Oceans Canada]. 2010b. Recovery Strategy for the Northern Bottlenose Whale, Scotian Shelf population, in Atlantic Canadian Waters. *Species at Risk Act* Recovery Strategy Series. Fisheries and Oceans Canada. vi + 61p.

DFO [Fisheries and Oceans Canada]. 2013b. The Scotian Shelf in Context. In: State of the Scotian Shelf Report. MacLean, M., Breeze, H., Walmsley, J. and Corkum, J. (eds.). Can. Tech. Rep. Fish. Aquat. Sci. 3074: pp. 5-46.

DFO [Fisheries and Oceans Canada]. 2013e. Satellite Tagging Uncovers Surprising Birthing Ground of Porbeagle Sharks. Available from: http://www.dfo-mpo.gc.ca/science/publications/article/2011/01-24-11-eng.html.

DFO [Fisheries and Oceans Canada]. 2013i. Aquatic Species at Risk-American Plaice (Maritime population) Available from: http://www.dfo-mpo.gc.ca/species-especes/species-especes/american-plaice-plie-eng.htm.

DFO [Fisheries and Oceans Canada]. 2013j. Aquatic Species at Risk-American Eel. Available from: http://www.dfo-mpo.gc.ca/species-especes/species-especes/eel-anguille-eng.htm.

DFO [Fisheries and Oceans Canada]. 2013k. Aquatic Species at Risk-Acadian Redfish (Atlantic population). Available from: http://www.dfo-mpo.gc.ca/species-especes/species-especes/acadia-redfish-sebaste-acadie-eng.html#information.

DFO [Fisheries and Oceans Canada]. 2013l. Underwater World: White Hake (Western Atlantic Ocean population). Available from: http://www.dfo-mpo.gc.ca/science/publications/uww-msm/articles/whitehake-merlucheblanche-eng.html.

DFO [Fisheries and Oceans Canada]. 2013m. Underwater World: North American lobster (Northwest Atlantic population). Available from: http://www.dfo-mpo.gc.ca/science/publications/uww-msm/articles/americanlobster-homarddamerique-eng.html.

DFO [Fisheries and Oceans Canada]. 2013n. Managed Fisheries-Jonah Crab. Available from: http://www.bio.gc.ca/science/research-recherche/fisheries-pecheries/managed-gere/jonah-nordique-eng.php.

DFO [Fisheries and Oceans Canada]. 2013p. Facts on Canadian Fisheries: Haddock. Available from: http://www.dfo-mpo.gc.ca/fm-gp/sustainable-durable/fisheries-peches/haddock-aiglefin-eng.htm.

DFO [Fisheries and Oceans Canada]. 2013q. Underwater World: Sandlance. Available from: http://www.dfo-mpo.gc.ca/science/publications/uww-msm/articles/sandlance-lancon-eng.htm.

DFO [Fisheries and Oceans Canada]. 2013r. 2012 Assessment of 4VWX Silver Hake. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2013/018. Available from: http://www.dfo-mpo.gc.ca/csas-sccs/Publications/SAR-AS/2013/2013_018-eng.pdf.

DFO [Fisheries and Oceans Canada]. 2013s. Underwater World: The Witch Flounder. Available from: http://www.dfo-mpo.gc.ca/science/publications/uww-msm/articles/witchflounder-pliegrise-eng.htm.

DFO [Fisheries and Oceans Canada]. 2013t. Facts on Canadian Fisheries: Shrimp. Available from: http://www.dfo-mpo.gc.ca/fm-gp/sustainable-durable/fisheries-peches/shrimp-crevette-eng.htm.

DFO [Fisheries and Oceans Canada]. 2013w. 2011 Value of Atlantic Coast Commercial Landings, by Region. Preliminary data.

FLMNH [Florida Museum of Natural History]. 2013a. Education-Biological Profiles: Black Dogfish. Available from: http://www.flmnh.ufl.edu/fish/Gallery/Descript/Blackdogfish/blackdogfish.html.

FLMNH [Florida Museum of Natural History]. 2013b. Education-Biological Profiles: White Marlin. Available from:http://www.flmnh.ufl.edu/fish/Gallery/Descript/whitemarlin/whitemarlin.html.

GMRI [Gulf of Maine Research Institute]. 2014. Atlantic Herring-Biology. Available from: http://www.gma.org/herring/biology/default.asp

Horsman, T.L., and Shackell, N.L. 2009. Atlas of Important Habitat for Key Fish Species of the Scotian Shelf, Canada. DFO Can. Tech. Rep. Fish. Aquat. Sci. 2835 viii + 82pp. Available from: http://www.dfo-mpo.gc.ca/Library/337080.pdf.

Maguire, J.J., and Lester, B. 2012. Bluefin tuna (Thunnus thynnus) in Atlantic Canadian Waters: Biology, Status, Recovery Potential, and Measures for Mitigation. DFO Can. Sci. Advis. Sec. Res. Doc. 2012/002: vi + 28pp.

NOAA [National Oceanic and Atmospheric Administration]. 2004. NOAA Technical Memorandum NMFS-NE-191 Essential fish habitat source document: northern shortfin squid, Illex illecebrosus, life history and habitat characteristics. Vi + 45pp.

NOAA [National Oceanic and Atmospheric Administration]. 2006. Status of Fisheries Resources off the Northeastern US: Red Hake. Available from: http://www.nefsc.noaa.gov/sos/spsyn/pg/redhake/.

NOAA [National Oceanic and Atmospheric Administration]. 2013a. Fish Watch: North Atlantic Albacore tuna. Available from: http://www.fishwatch.gov/seafood_profiles/species/tuna/species_pages/atl_albacore_tuna.htm.

NOAA [National Oceanic and Atmospheric Administration]. 2013b. Fish Watch: Atlantic Herring. Available from:

http://www.fishwatch.gov/seafood_profiles/species/herring/species_pages/atl_herring.htm.

NOAA [National Oceanic and Atmospheric Administration]. 2013c. Fish Watch: Atlantic Mackerel. Available from: http://www.fishwatch.gov/seafood_profiles/species/mackerel/species_pages/atlantic_mackerel.htm.

NOAA [National Oceanic and Atmospheric Administration]. 2013d. Fish Watch: Atlantic Bigeye Tuna. Available from: http://www.fishwatch.gov/seafood_profiles/species/tuna/species_pages/atl_bigeye_tuna.htm.

NOAA [National Oceanic and Atmospheric Administration]. 2013e. Fish Watch: Western Atlantic Bluefin Tuna. Available from: http://www.fishwatch.gov/seafood_profiles/species/tuna/species_pages/atl_bluefin_tuna.htm.

NOAA [National Oceanic and Atmospheric Administration]. 2013f. Fish Watch: North Atlantic Swordfish. Available from: http://www.fishwatch.gov/seafood_profiles/species/swordfish/species_pages/north_atlantic_swordfish.htm.

NOAA [National Oceanic and Atmospheric Administration]. 2013g. Fish Watch: Atlantic Yellowfin Tuna. Available from: http://www.fishwatch.gov/seafood_profiles/species/tuna/species_pages/atl_yellowfin_tuna.htm.

NOAA [National Oceanic and Atmospheric Administration]. 2013h. Fish Watch: Haddock. Available from: http://www.fishwatch.gov/seafood_profiles/species/haddock/species_pages/haddock.htm.

NOAA [National Oceanic and Atmospheric Administration]. 2013i. Fish Watch: Monkfish. Available from: http://www.fishwatch.gov/seafood_profiles/species/haddock/species_pages/monkfish.htm.

NOAA [National Oceanic and Atmospheric Administration]. 2013j. Fish Watch: Atlantic Pollock. Available from: http://www.fishwatch.gov/seafood_profiles/species/pollock/species_pages/atlantic_pollock.htm.

NOAA [National Oceanic and Atmospheric Administration]. 2013k. Fish Watch: Greenland Turbot. Available from: http://www.fishwatch.gov/seafood_profiles/species/turbot/species_pages/greenland_turbot.htm.

SARA [Species at Risk Act]. 2015. Species at Risk Registry: Species Profile (Atlantic Salmon) Accessed at: https://www.registrelep-sararegistry.gc.ca/species/speciesDetails_e.cfm?sid=672 on October 20, 2015.

Stantec [Stantec Consulting Ltd.]. 2012a. Strategic Environmental Assessment for Offshore Petroleum Activities. Eastern Scotian Slope – Middle and Sable Island Banks (Phase 1A). v +204 pp.

Stantec [Stantec Consulting Ltd.]. 2014b. Strategic Environmental Assessment for Offshore Petroleum Exploration Activities. Western Scotian Slope (Phase 3B). Prepared for the Canada-Nova Scotia Offshore Petroleum Board, Halifax, NS. iv + 282 pp.

Information Request (IR) IR-024 (DFO-20)

Applicable CEAA 2012 effect(s): 5(1)(a)(i) Fish and Fish Habitat; 5(1)(a)(ii) Aquatic Species

EIS Guidelines Reference: Part 2, 6.3.1 Fish and fish habitat and 6.6.1 Effects of potential accidents or malfunctions

EIS Reference: 7.2.8.3 Characterization of Project Related Environmental Effects, p.7.39; 8.1.5.3 Characterization of Project Related Environmental Effects, p.8.99

Context and Rationale: The EIS states "The diversity and abundance of fish eggs and larvae in the project area and surrounding LAA, with the exception of the Haddock Box, is generally expected to be low." This information is not consistent with other statements in the document such as in section 8.5.1.3 where it is indicated "it should be emphasized that the majority of fish species on the Scotian Shelf and Slope spawn in a variety of large areas, over long time scales, and a spill is not predicted to encompass all of these areas or time scales within the RAA to such a degree that natural recruitment of juvenile organisms may not re-establish the population(s) to their original level within one generation."

Specific Question or Request: Provide updated text for section 7.2.8.3 that reflects the variety of spawning areas and presence of fish eggs and larvae along the Scotian Shelf and Slope outside of the Haddock Box. Update the effects assessment, as appropriate, or explain why no update is required.

Response: It has been noted that Sections 7.2.8.3 and 8.1.5.3 differ in the characterization of the diversity and abundance of fish eggs and larvae in the Project Area and the Local Assessment Area (LAA)/Regional Assessment Area (RAA). The text in Section 7.2.8.3 has been adjusted to correspond to Section 8.5.1.3. These changes can be found in track changes below.

Underwater sound emissions from a seismic source array such as that used in VSP may cause mortality of fish eggs, larvae or fry in very close proximity (*i.e.* <5 m) (Kostyuchenko 1973; Booman *et al.* 1996). Potential mortality associated with sound from the VSP source is not considered to have an effect on recruitment to fish populations (Dalen *et al.* 1996). Sound exposure guidelines for eggs and larvae by Popper *et al.* (2014) were established using dual-criteria similar to those established by the Hydroacoustic Working Group. The sound exposure guidelines suggest that potential mortality or injury to eggs and larvae from seismic sources may result from a cumulative SEL greater than 210 dB re 1 $\mu Pa^2 s$ or peak SPLs greater than 207 dB re 1 µPa. Using this dual criteria, potential injury to fish eggs and larvae may occur within 160 m of the source.

Shackell and Frank (2000) concluded that the Scotian Shelf supports an array of species larvae throughout the year, with abundance changes occurring with the seasons. Based on the likely wellsite locations within the Project Area (no Project well locations will be located within the Haddock Box) and predicted sound propagation, the low likelihood of marine fish eggs and larvae located within a few hundred metres of the sound source while VSP is occurring, and the temporary nature of VSP surveys (no more than one day per well), it is anticipated that the amount of eggs and larvae with the potential to be exposed to sound levels causing physical injury or mortality (even in consideration of proximity to the Haddock Box) would be negligible. Eggs and larvae are only present in the water column during certain periods as indicated in Section 5.2.5.2 of the EIS, thereby reducing temporal opportunities for potential interactions with Project activities and components. The distribution of these species' eggs or larvae extends well beyond the LAA to include most or all of the RAA. There are only a few species which spawn in a limited geographical area; these include the smooth skate and the sand lance. These species have the potential to spawn over many months or year round, as a result, the impacts from VSP surveys would not impact their entire spawning window. Saetre and Ona (1996) concluded that the mortality rates from exposure to a seismic sound source is insignificant as compared to natural mortality. This conclusion is consistent with findings reported in the Environmental Assessment of BP's Tangier 3D Seismic Survey (LGL 2014).

It is therefore expected that there will be no change to the effects assessment for the Change in Risk of Mortality or Physical Injury or the Change in Habitat Quality and Use presented in Table 7.2.6 (which has been updated in response to IR-022) and in Table 8.5.1.

References:

Booman, C., Dalen, J., Leivestad, H., Levsen, A., van der Meeren, T., and og Toklum, K. 1996. Effekter av luftkanonskyting på egg, larver og yngel. Undersøkelser ved Havforskningsinstituttet og Zoologisk Laboratorium, UiB. (Engelsk sammendrag og figurtekster). Havforskningsinstituttet, Bergen. *Fisken og Havet*, nr. 3 (1996). 83 s.

Dalen, J., Ona, E., Vold Soldal, A. and og Sætre, R. 1996. Seismiske undersøkeleser til havs: En vurdering av konsekvenser for fisk og fiskerier. Fisken og Havet, nr. 9 – 1996. 26 s.

Kostyuchenko, L.P. 1973. Effects of elastic waves generated in marine seismic prospecting on fish eggs in the Black Sea. Hydrobiol J 9:45–46.

LGL [LGL Limited]. 2014. Environmental Assessment of BP Exploration (Canada) Limited's Tangier 3-D Seismic Survey. BP Document No. NS-HS-REP-BP-B01-0001. March 2014.

Popper, A.N., Hawkins, A.D., Fay, R.R., Mann, D.A., Bartol, S., Carlson, T.J., Coombs, S., Ellison, W.T., Genrey, R.L., Halvorsen, M.B., Lokkeborg, S., Rogers, P.H., Southall, B.L., Zeddies, D.G., and Tavolga, W.N. 2014. Sound Exposure Guidelines for Fishes and Sea Turtles. A Technical Report prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI.

Sætre, R., and Ona, E. 1996. Seismiske undersøkelser og skader på fi skeegg og -larver; en vurdering av mulige effekter på bestandsnivå. Havforskningsinstituttet, Fisken og Havet nr. 8–1996. Seismic investigations and damage to fish eggs and larvae: an assessment of potential effects on the population level.

Shackell, N.L., and Frank, K.T. 2000. Larval fish diversity on the Scotian Shelf. Can. J. Fish. Aquat. Sci., 57: 1747-1760.

Information Request (IR) IR-025

Applicable CEAA 2012 effect(s): 5(1)(a)(i) fish and fish habitat

EIS Guidelines Reference: Part 2, 6.5 Significance of residual effects

EIS Reference: 7.2.5 Criteria for Characterizing Residual Environmental Effects and Determining Significance

Context and Rationale: The EIS states that "For the purposes of this effects assessment, a significant adverse residual environmental effect on Fish and Fish Habitat is defined as a project-related environmental effect that:

- causes a significant decline in abundance or change in distribution of fish populations within the RAA, such that natural recruitment may not re-establish the population(s) to its original level within one generation;
- jeopardizes the achievement of self-sustaining population objectives or recovery goals for listed species;
- results in permanent and irreversible loss of critical habitat as defined in a recovery plan or an action strategy; or
- results in serious harm to fish as defined by the *Fisheries Act* that is unauthorized, unmitigated, or not compensated through offsetting measures in accordance with DFO's *Fisheries Protection Policy Statement* (DFO 2013z)."

Additional information on the choice of thresholds is required.

Specific Question or Request: Provide a rationale to justify for the use of these significance thresholds for Fish and Fish Habitat proposed in the EIS, including information on why effects less than the threshold described would not be considered significant by the proponent.

Response: The criteria for established thresholds for determining the significance of residual adverse environmental effects is presented in Section 6.2.3.5 of the Environmental Impact Statement (EIS). As discussed in Section 6.2.3.5, criteria are defined using available information, scientific literature, applicable regulatory documents, environmental standards, guidelines or objectives where available and the professional judgement of the Environmental Assessment Study Team. The definition of significance is intended to cover a wide range of potential effects, with the thresholds establishing a level beyond which a residual environmental effect would be considered an unacceptable change by regulators and stakeholders. By definition, any change to the valued component that would not meet the threshold would be considered not significant.

The significance definition for Fish and Fish Habitat (Section 7.2.5 of the EIS) is primarily linked to statutory and policy requirements, including serious harm to fish as defined in the *Fisheries Act* (fourth bullet above) and loss of critical habitat through the *Species at Risk Act* (second and third bullets above). For secure species (first bullet above), population-based thresholds were applied using a qualitative approach based primarily on professional opinion supported by relevant scientific literature, where available (***e.g.***, effects of underwater noise on fish, or re-establishment of benthic populations).

Information Request (IR) IR-026

Applicable CEAA 2012 effect(s): 5(1)(a)(i); 5(1)(a)(ii); 5(1)(b)(i)

EIS Guidelines Reference: Part 2, 6.3.1 Fish and Fish Habitat; 6.3.3 Marine Mammals

EIS Reference: 7.2.8.2 Mitigation of Project-Related Environmental Effects, p. 7.36

Context and Rationale: VSP activities may adversely affect marine mammals. The EIS states in section 7.2.8.2 that measures to mitigate the effects of vertical seismic profiling include "BP will use the minimum amount of energy necessary to achieve operational objectives, reduce the energy at frequencies above those necessary for the purpose of the survey; and will reduce the proportion of energy that propagates horizontally." Typical energy levels are provided in Appendix D (Acoustic Modeling Report).

Specific Question or Request: What would be considered a reduced level? Above what frequency is energy considered unnecessary for the purpose of the survey? What techniques will be used to reduce the proportion of energy that propagates horizontally? How much reduction can be achieved? To what extent would these changes reduce potential effects on marine mammals?

Response: Section 4.1.1 of the Environmental Impact Statement (EIS) and Appendix D includes details of sound output characteristics for an example vertical seismic profiling (VSP) sound source configuration that has been used during BP activities in the Gulf of Mexico. The technical requirements for VSP sources will be reviewed and planned as part of BP's management processes for VSP operations, which includes consideration of survey objectives, survey and source configuration as well as health, safety and environment (HSE) aspects of conducting operations offshore.

A "reduced level" refers to energy at frequencies not above those necessary for the purpose of the survey. Figure 18 and Table 9 of Appendix D show that the source output sound levels for the example source array decrease significantly with increasing frequency. This characteristic is inherent to compressed air sources. The variation of horizontal source array output with angle from vertical is shown in Figure 19, whereby the horizontal footprint reduces significantly with increased frequency. Again this characteristic is inherent to the use of multiple compressed air sources together to form a source array.

The required frequency for the survey is dependent on geology and the depth of imaging target. The frequency bandwidth of VSP data is generally wider compared to surface seismic data. Typical bandwidth for marine seismic imaging purposes is up to several hundred hertz. Energy at higher frequencies is significantly lower than those at lower frequencies and attenuation of sound energy increases with frequency. Therefore propagation of higher frequency (10s kHz) sound is expected to be less than lower frequencies.

Source array design will be used to ensure geophysical objectives are achievable and the proportion of energy that propagates horizontally is reduced as much as is practically possible. The variation of horizontal source array output with angle from vertical is shown in Figure 19 in Appendix D.

Generally speaking, lower sound levels within a given frequency bandwidth of interest would result in reduced predicted distances to the various threshold values used in the assessment. It should be noted however that the various threshold levels are conservative, with any potential risk to marine life being reduced further by the implementation of existing mitigation and monitoring measures.

Information Request (IR) IR-027

Applicable CEAA 2012 effect(s): 5(1)(a)(i) fish and fish habitat

EIS Guidelines Reference: Part 2, 6.5 Significance of residual effects

EIS Reference: 7.3.5 Criteria for Characterizing Residual Environmental Effects and Determining Significance

Context and Rationale: The EIS states that "For the purposes of this effects assessment, a significant adverse residual environmental effect on Marine Mammals and Sea Turtles is defined as a project- related environmental effect that:

- causes a decline in abundance or change in distribution of marine mammal or sea turtle populations within the RAA, such that natural recruitment may not re-establish the population(s) to its original level within one generation;
- jeopardizes the achievement of self-sustaining population objectives or recovery goals for listed SARA species; or
- results in permanent and irreversible loss of critical habitat as defined in a recovery plan or an action strategy."

Additional information on the choice of thresholds is required.

Specific Question or Request: Provide a rationale to justify the selection of the significance thresholds for Marine Mammals and Sea Turtles proposed in the EIS, including information on why effects less than the threshold described would not be considered significant by the proponent.

Response: The criteria for established thresholds for determining the significance of residual adverse environmental effects is presented in Section 6.2.3.5 of the Environmental Impact Statement (EIS). As discussed in Section 6.2.3.5, criteria are defined using available information, scientific literature, applicable regulatory documents, environmental standards, guidelines or objectives where available and the professional judgement of the Environmental Assessment (EA) Study Team. The definition of significance is intended to cover a wide range of potential effects, with the thresholds establishing a level beyond which a residual environmental effect would be considered an unacceptable change by regulators and stakeholders. By definition, any change to the valued component that would not meet the threshold would be considered not significant.

The significance definition for Marine Mammals and Sea Turtles (Section 7.3.5 of the EIS) is primarily linked to statutory and policy instruments, including the *Species at Risk Act* (second and third bullets above). For secure species (first bullet above), population-based thresholds were applied using a qualitative approach based primarily on professional opinion supported by relevant scientific literature, where available (*e.g.*, effects of underwater noise on marine mammals).

Information Request (IR) IR-028 (DFO-07)

Applicable CEAA 2012 effect(s): 5(1)(a)(i) Fish and Fish Habitat; 5(1)(a)(ii) Aquatic Species

EIS Guidelines Reference: Part 2, 6.6.3 Cumulative effects assessment

EIS Reference: 7.3.3 Potential Environmental Effects, Pathways and Measureable Parameters; Table 7.3.1, p. 7.49

Context and Rationale: Behavioural effects are not included in the effects pathway table for marine mammals.

Specific Question or Request: Update the assessment of effects on marine mammals to explicitly include "changes in behaviour," such as masking (*i.e.* reduced ability to communicate).

Response: The assessment of effects on marine mammals includes an assessment of behavioural effects. Behavioural effects, including masking, have been extensively assessed in Section 7.3.8.3 (Characterization of Residual Project-Related Environmental Effects) under the Change in Habitat Quality and Use Potential Environmental Effect. The measurable parameter included in Table 7.3.1 is the extent (km from sound source) of underwater sound potentially affecting marine mammals and sea turtle behavior.

Information Request (IR) IR-029 (DFO-11)

Applicable CEAA 2012 effect(s): 5(1)(a)(i) Fish and Fish Habitat; 5(1)(a)(ii) Aquatic Species

EIS Guidelines Reference: Part 2, 6.3.3 Marine mammals and 6.3.6 Federal species at risk

EIS Reference: 2.8.5 Sound and Light Emissions, p.2.36

Context and Rationale: Sound generated by helicopters will carry underwater, and marine mammal disturbance reactions resulting from aircraft overflights have been documented.

Specific Question or Request: Update the effects assessment for marine mammals to explicitly consider sound produced from the regular helicopter activities, or explain why an update is not required.

Response: The effects assessment for marine mammals explicitly considers the effects of sound produced from regular helicopter activities. These findings can be found in Section 7.3.8.3. Sound levels created from helicopter overflights are not expected to reach thresholds to cause injury or mortality to marine mammals and sea turtles. The potential for helicopter transportation to result in a Change in Habitat Quality and Use for Marine Mammals and Sea Turtles is discussed in Section 7.3.8.

Information Request (IR) IR-030 (DFO-12)

Applicable CEAA 2012 effect(s): 5(1)(a)(i) Fish and Fish Habitat; 5(1)(a)(ii) Aquatic Species

EIS Guidelines Reference: Part 2, 6.1.5 Species at risk and species of conservation concern; 6.1.6 Marine mammals

EIS Reference: 5.2.6 Marine Mammals

Context and Rationale: Sightings data of marine mammals presented and used in this document only includes data up to 2013 and does not include all available sightings data prior to 2013.

Specific Question or Request: Provide updated sightings data for the Scotian Shelf and Slope region and figures that incorporate all relevant sources (*e.g.* NEFSC, DFO, seismic survey data, NARWC data). For example, the North Atlantic Right Whale Consortium database (http://www.narwc.org/index.php?mc=8&p=28) is a source of whale sightings data for the Scotian Shelf region and would provide additional information not included in the document. Update the effects analysis, as applicable.

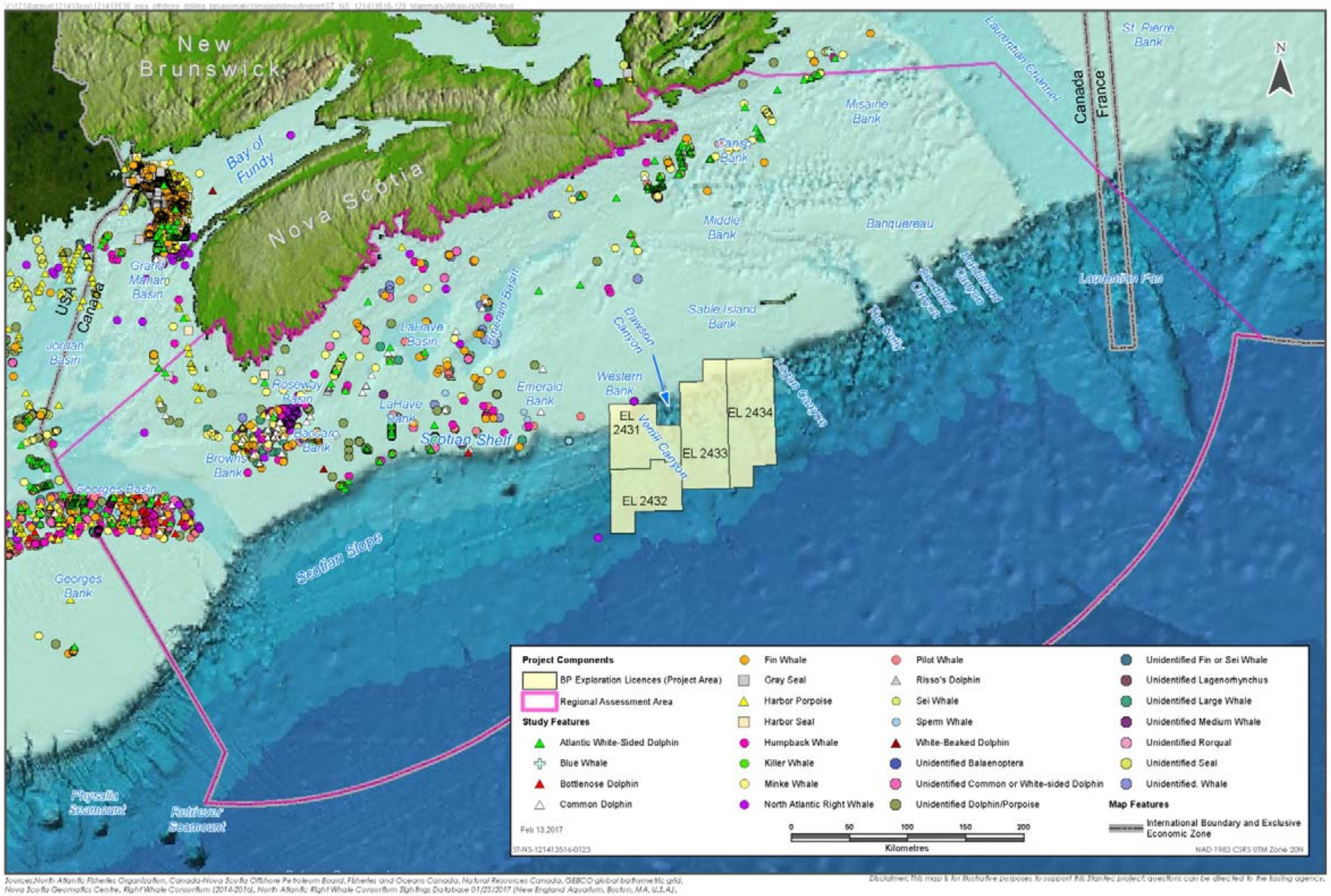
Response: Marine mammal sightings data shown on Environmental Impact Statement (EIS) Figures 5.2.14 (Total Mysticete Sightings), 5.2.15 (Total Odontocete Sightings), and 5.2.20 (Seal Sightings) present data from 1911 to 2013 made available to Stantec by Fisheries and Oceans Canada (DFO) at the time of EIS preparation. Marine mammal sightings from the 2013 Shelburne Basin Venture 3D Seismic Survey are displayed on Figure 5.2.1.6 and sightings from the 2014 Tangier 3D Seismic Survey are displayed on Figures 5.2.17 and 5.2.18.

Species-specific marine mammal mapping found in Appendix E includes data from Ocean Biogeographic Information System (OBIS) (2014), Global biodiversity indices from the Ocean Biogeographic Information System, Intergovernmental Oceanographic Commission of United Nations Education, Scientic and Cultural Organization (UNESCO). Web. http://www.iobis.org (consulted on 2014/07/22). This data set combines data from the following sources:

- A Biological Survey of the Waters of Woods Hole and Vicinity
- Aerial survey of upper trophic level predators on Platts Bank, Gulf of Maine
- Allied Finback Whale Catalogue
  Allied Humpback Whale Catalogue, 1976 - 2003
- Bay of Fundy Species List
- Bureau of Land Management (BLM) Cetacean and Turtle Assessment Program (CETAP) AIR, SHIP and OPP Sightings
- Canadian Wildlife Services – Environment Canada (CWS-EC) Eastern Canada Seabirds at Sea (ECSAS)
- Deep Panuke whale sightings 2003
- Fisheries and Oceans Canada (DFO) Maritimes Region Cetacean Sightings (OBIS), Canada)
- Duke Harbor Porpoise Tracking
- Gulf of Maine humpback whale satellite tagging project: 2011; 2012
- Harbor Porpoise Survey 1992 (AJ92-01)

- Historical distribution of whales shown by logbook records 1785-1913
- History of Marine Animal Populations (HMAP) Dataset 04: World Whaling
- New England Aquarium Harbor Porpoise Tracking
- National Oceanic and Atmospheric Administration (NOAA)
    - NOAA Northeast Fisheries Science Center (NEFSC) Aerial Circle-Back Abundance Survey 2004
    - NOAA NEFSC 1995 AJ9501 (Part I)
    - NOAA NEFSC 1995 AJ9501 (Part II)
    - NOAA NEFSC 1995 pe9502
    - NOAA NEFSC 1999 aj9902
    - NOAA NEFSC Aerial Survey - Experimental 2002
    - NOAA NEFSC Aerial Survey - Summer 1995
    - NOAA NEFSC Aerial Survey - Summer 1998
    - NOAA NEFSC Deepwater Marine Mammal 2002
    - NOAA NEFSC Harbor Porpoise 1991
    - NOAA NEFSC Marine Mammal Abundance Cruise 2004 Passive Acoustic Monitoring - Rainbow Click Detections
    - NOAA NEFSC Mid-Atlantic Marine Mammal Abundance Survey 2004
    - NOAA NEFSC Right Whale Aerial Survey
    - NOAA NEFSC Survey 1991
    - NOAA NEFSC Survey 1997
    - NOAA NEFSC Survey 1998 1
    - NOAA NEFSC Survey 1998 2
    - NOAA Southeast Fishery Science Center (SEFSC) Commercial Pelagic Observer Program (POP) Data
- Opportunistic marine mammal sightings from commercial whale watching vessels, Montauk, New York 1981-1994
- Programme Intégré de recherches sur les oiseaux pélagiques (PIROP) Northwest Atlantic 1965-1992
- Sargasso 2005 - cetacean sightings
  Sargasso sperm whales 2004
- United Kingdom (UK) Royal Navy Marine Mammal Observations
- The Years of the North Atlantic Humpback whale (YoNAH) Encounter

Collectively, these sources represent a considerable amount of data to help characterize the use of the Regional Assessment Area by marine mammals and assist in the prediction of effects and significance determination for this Project. In addition, the North Atlantic Right Whale Consortium (NARWC) database was consulted for more recent observations (2014-2015) to supplement existing data presented in the EIS. Figure 1 presents additional marine mammal sightings recorded in the NARWC database that were not presented in the EIS. Most of the new sightings are located outside the Project Area, on the Scotian Shelf; the exception is a North Atlantic right whale sighting at the edge of the Project Area, between Dawson and Verrill Canyons. The additional NARWC data does not change the analysis of effects, proposed mitigation and monitoring, or significance determinations presented in the EIS.



Source: North Atlantic Right Whale Consortium (2017).

Figure 1 Marine Mammal Sightings 2014-2016 from the North Atlantic Right Whale Consortium Database

References:

North Atlantic Right Whale Consortium. 2017. Right Whale Consortium Sightings Database (2014-2016). New England Aquarium, Boston, MA, U.S.A. Data provided by NARWC February 2017.

Information Request (IR) IR-031 (DFO-13)

Applicable CEAA 2012 effect(s): 5(1)(a)(i) Fish and Fish Habitat; 5(1)(a)(ii) Aquatic Species

EIS Guidelines Reference: Part 2, 6.1.5 Species at risk and species of conservation concern and 6.1.6 Marine mammals

EIS Reference: 5.2.6 Marine Mammals, p.5.121; Table 5.2.9, p.5.124; Table 5.2.10, p.5.125

Context and Rationale: Relatively little effort has been spent searching for marine mammals in the project area, thus reported sightings are sparse. The recent 2013 and 2014 seismic survey data from the area represent particularly important sources of information. Given northern bottlenose whales' affinity for deep water and that there are several northern bottlenose whale sightings near the project area, their potential for occurrence should be considered as "moderate". Risso's dolphins, Atlantic spotted dolphins and pantropial spotted dolphins were also reported during the 2014 seismic surveys indicating that these species also occur in the project area, yet they are not included in Table 5.2.9 or 5.2.10.

Specific Question or Request: Please update the potential for occurrence and species information. Update the effects assessment, as appropriate, or explain why no update is necessary.

Response: The status of the northern bottlenose whale has been upgraded from "Low" to "High" because there have been 10 sightings directly in the Project Area despite their small population (143 individuals). Tables 5.2.9 and 5.2.10 have been updated below to reflect this change and the addition of Risso's dolphin, Atlantic spotted dolphin, and pantropical spotted dolphin. Species descriptions for each of these marine mammals are included below. Additional changes have been made in Table 5.2.9 to reflect the response to IR-023.

Risso's Dolphin (Grampus griseus)

The Risso's dolphin are distributed worldwide in both tropical and temperate waters, and in the Northwest Atlantic they can be found from Florida to Eastern Newfoundland (NOAA 2016d). The species occupies a narrow niche, which is the steep upper continental slope where water depths usually exceed 300 m, where it predominantly feeds on squid. Other prey species include schooling fish species, krill, and other cephalopods (octopus and cuttlefish) (NOAA 2015c). The species can be found in groups of 5 to 50 animals.

The species becomes sexually mature when they reach a length of approximately 2.6 m, with breeding and calving occurring year-round. The gestation period for the Risso's dolphin is 13-14 months (NOAA 2015c). There is no information on stock structure for individuals in the western North Atlantic. Currently, the best estimate for abundance of the Risso's dolphin is 18,250 individuals (2012) (NOAA 2016d). There were 31 sightings of this species during the 2007 TNASS survey of the Scotian Shelf and Slope area (Lawson and Gosselin 2009).

Atlantic Spotted Dolphin (Stenella frontalis)

The Atlantic spotted dolphin can be found in warm temperate waters along the continental shelf of the Northwest Atlantic from the Gulf of Mexico to the waters off Cape Cod (NOAA

2015d). The species can be periodically found off the Scotian Shelf and Slope in warm water influenced by the Gulf Stream. They are typically found in water depths ranging from 20 to 250 m, but can be occasionally found in deeper waters (NOAA 2015d). The species is usually found in groups of fewer than 50 individuals, but have been found in groups of greater than 200. The Atlantic spotted dolphin feeds on a variety of small schooling fish, benthic invertebrates, and cephalopods, with groups often cooperating to hunt and feed on prey.

Atlantic spotted dolphins become sexually mature from 8 to 15 years of age with females giving birth to a single calf on average every three years. The best estimate for the population size of the species in the western North Atlantic is 44,715 individuals (2011)(NOAA 2014h). There were no sightings of the species during the 2009 TNASS survey of the Scotian Shelf and Slope Area (Lawson and Gosselin 2009).

Pantropical Spotted Dolphin (Stenella attenuata)

The pantropical spotted dolphin can be found in oceans of tropical and subtropical climates worldwide (NOAA 2015e). The species often occurs in large groups of several hundred to one thousand animals and can also be found schooling with other dolphin species. They are typically found inshore in the fall and winter months and move offshore in the spring. The species feeds primarily on mesopelagic fish and cephalopods (NOAA 2015e). The species matures at approximately 11 years of age and has a lifespan of 46 years. Total numbers of pantropical spotted dolphins of the U.S. or Canadian Atlantic coast are unknown. The most recent abundance estimate taken from June to August 2004 from Florida to the Bay of Fundy estimates the population at 4,439 individuals (NOAA 2007b). There were no sightings of the species during the 2009 TNASS survey of the Scotian Shelf and Slope Area (Lawson and Gosselin 2009).

Table 5.2.9 Marine Mammals Known to Occur in the Vicinity of the Project Area

Common Name	Scientific Name	SARA Schedule 1 Status	COSEWIC Designation	Potential for Occurrence in the Project Area[1]	Timing of Presence
Mysticetes (Toothless or Baleen Whales)					
Blue whale (Atlantic population)	*Balaenoptera musculus*	Endangered	Endangered	Moderate	Summer to Fall
Fin whale (Atlantic Population)	*Balaenoptera physalus*	Special Concern	Special Concern	High	Year- round (highest concentrations in Summer)
Humpback whale (Western North Atlantic population)	*Megaptera novaeangliae*	Not Listed	Not at Risk	~~Low to~~ Moderate	Summer
Minke whale	*Balaenoptera acutorostrata*	Not Listed	Not at Risk	Moderate	Spring to Summer
North Atlantic right whale	*Eubalaena glacialis*	Endangered	Endangered	Low	Summer
Sei whale	*Balaenoptera borealis*	Not Listed	Not Listed	Low to Moderate	Summer to early Fall
Odontocetes (Toothed Whales)					
Atlantic spotted dolphin	*Stenella frontalis*	Not Listed	Not at Risk	Low	Summer
Atlantic white-sided dolphin	*Lagenorhynchus acutus*	Not Listed	Not at Risk	Moderate to High	Late Spring to late Fall
Bottlenose dolphin	*Tursiops truncates*	Not Listed	Not at Risk	~~Low~~ Moderate	Year-round
Harbour porpoise (Northwest Atlantic population)	*Phocoena phocoena*	Not Listed	Special Concern	Low	Summer to Fall
Killer whale	*Orcinus orca*	Not Listed	Special Concern	Low ~~to Moderate~~	Summer
Long-finned pilot whale	*Globicephala melas*	Not Listed	Not at Risk	High	Year-round
Northern bottlenose whale (Scotian Shelf Population)	*Hyperoodon ampullatus*	Endangered	Endangered	~~Low~~ High	Year-round
Pantropical spotted dolphin	*Stenella attenuata*	Not Listed	Not at Risk	Low	Summer

Table 5.2.9 Marine Mammals Known to Occur in the Vicinity of the Project Area

Common Name	Scientific Name	SARA Schedule 1 Status	COSEWIC Designation	Potential for Occurrence in the Project Area[1]	Timing of Presence
Risso's dolphin	*Grampus griseus*	Not Listed	Not at Risk	Moderate	Year-round
Sowerby's beaked whale	*Mesoplodon bidens*	Special Concern	Special Concern	Low	Year-round
Short-beaked common dolphin	*Delphinus delphis*	Not Listed	Not at Risk	High	Summer to Fall
Sperm whale	*Physeter macrocephalus*	Not Listed	Not at Risk	High	Summer
Striped dolphin	*Stenella coeruleoalba*	Not Listed	Not at Risk	Low	Summer to Fall
White-beaked dolphin	*Lagenorhynchis albiorostris*	Not Listed	Not at Risk	Low	Year-round
Phocids (Seals)					
Grey Seal	*Halichoerus grypus*	Not Listed	Not at Risk	High	Year-round
Harbour Seal	*Phoca vitulina*	Not Listed	Not at Risk	Moderate	Year-round
Harp Seal	*Pagophilus groenlandicus*	Not Listed	Not at Risk	Moderate	Winter to early Spring
Hooded Seal	*Cystophora cristata*	Not Listed	Not at Risk	Moderate	Winter to early Spring
Ringed Seal	*Pusa hispida*	Not Listed	Not at Risk	Low	Winter to early Spring

Note:
[1]This is based on the analysis of habitat preferences during various life-history stages, distribution mapping, and sightings data for each species within the Project Area.

Sources: Modified from Stantec 2014b and Stantec 2012a

Table 5.2.10 Marine Mammal Presence on the Scotian Shelf and Slope

Common Name	Scientific Name	January	February	March	April	May	June	July	August	September	October	November	December
Mysticetes (Baleen Whales)													
Blue whale	*Balaenoptera musculus*					■	■	■	■	■	■	■	
Fin whale	*Balaenoptera physalus*	■	■	■	■	■	■	■	■	■	■	■	■
Humpback whale	*Megaptera novaeangliae*					■	■	■	■	■			
Minke whale	*Balaenoptera acutorostrata*			■	■	■	■	■	■	■			
North Atlantic right whale	*Eubalaena glacialis*					■	■	■	■	■			
Sei whale	*Balaenoptera borealis*					■	■	■	■	■	■		
Odontocetes (Toothed Whales)													
Atlantic spotted dolphin	*Stenella frontalis*							■	■	■			
Atlantic white-sided dolphin	*Lagenorhynchus acutus*						■	■	■	■	■	■	■
Bottlenose dolphin	*Tursiops truncates*	■	■	■	■	■	■	■	■	■	■	■	■
Harbour porpoise	*Phocoena phocoena*					■	■	■	■	■	■	■	
Killer whale	*Orcinus orca*					■	■	■	■	■			
Long-finned pilot whale	*Globicephala melas*	■	■	■	■	■	■	■	■	■	■	■	■
Northern bottlenose whale	*Hyperoodon ampullatus*	■	■	■	■	■	■	■	■	■	■	■	■
Pantropical spotted dolphin	*Stenella attenuata*							■	■	■			
Risso's dolphin	*Grampus griseus*	■	■	■	■	■	■	■	■	■	■	■	■
Sowerby's beaked whale	*Mesoplodon bidens*	■	■	■	■	■	■	■	■	■	■	■	■
Short-beaked common dolphin	*Delphinus delphis*					■	■	■	■	■	■	■	
Sperm whale	*Physeter macrocephalus*					■	■	■	■	■			
Striped dolphin	*Stenella coeruleoalba*					■	■	■	■	■	■	■	
White-beaked dolphin	*Lagenorhynchus albirostris*	■	■	■	■	■	■	■	■	■	■	■	■
Phocids (Seals)													
Grey Seal	*Halichoerus grypus*	■	■	■	■	■	■	■	■	■	■	■	■
Harbour Seal	*Phoca vitulina*	■	■	■	■	■	■	■	■	■	■	■	■
Harp Seal	*Pagophilus groenlandicus*	■	■	■									■
Hooded Seal	*Cystophora cristata*	■	■	■									■
Ringed Seal	*Pusa hispida*	■	■	■									■
■	Timing of Presence on the Scotian Shelf and Slope												

Source: Modified from Stantec 2014a

References:

Lawson. J.W., and Gosselin, J.-F. 2009. Distribution and preliminary abundance estimates for cetaceans seen during Canada's marine megafauna survey - A component of the 2007 TNASS. DFO Can. Sci. Advis. Sec. Res. Doc. 2009/031. vi + 28 p.

National Oceanic and Atmospheric Administration (NOAA). 2007. Pantropical Spotted Dolphin (*Stenella attenuata*): Western North Atlantic Stock. Available from: http://www.nmfs.noaa.gov/pr/pdfs/sars/ao2007dops-wn.pdf

National Oceanic and Atmospheric Administration (NOAA). 2014h. Atlantic Spotted Dolphin (*Stenella frontalis*): Western North Atlantic Stock. Available from: http://www.nmfs.noaa.gov/pr/sars/2013/ao2013_spotteddolphin-wna.pdf

National Oceanic and Atmospheric Administration (NOAA). 2015c. Risso's Dolphin (*Grampus griseus*). Available from: http://www.fisheries.noaa.gov/pr/species/mammals/dolphins/rissos-dolphin.html

National Oceanic and Atmospheric Administration (NOAA). 2015d. Atlantic Spotted Dolphin (*Stenella frontalis*). Available from: http://www.fisheries.noaa.gov/pr/species/mammals/dolphins/atlantic-spotted-dolphin.html

National Oceanic and Atmospheric Administration (NOAA). 2015e. Pantropical Spotted Dolphin (*Stenella attenuata*). Available from: http://www.fisheries.noaa.gov/pr/species/mammals/dolphins/pantropical-spotted-dolphin.html

National Oceanic and Atmospheric Administration (NOAA). 2016d. Risso's Dolphin (*Grampus griseus*): Western North Atlantic Stock. Available from: http://www.fisheries.noaa.gov/pr/sars/pdf/stocks/atlantic/2015/f2015_rissos.pdf

Stantec [Stantec Consulting Ltd.]. 2012a. Strategic Environmental Assessment for Offshore Petroleum Activities. Eastern Scotian Slope – Middle and sable Island Banks (Phase 1A). v +204 pp.

Stantec [Stantec Consulting Ltd.]. 2014b. Strategic Environmental Assessment for Offshore Petroleum Exploration Activities. Western Scotian Slope (Phase 3B). Prepared for the Canada-Nova Scotia Offshore Petroleum Board, Halifax, NS. iv + 282 pp.

Information Request (IR) IR-032 (DFO-16)

Applicable CEAA 2012 effect(s): 5(1)(a)(i) Fish and Fish Habitat; 5(1)(a)(ii) Aquatic Species **EIS Guidelines Reference:** Part 2, 6.1.5 Species at risk and species of conservation concern **EIS Reference:** 5.2.6.4 Species at Risk and Species of Conservation Concern p 5.141

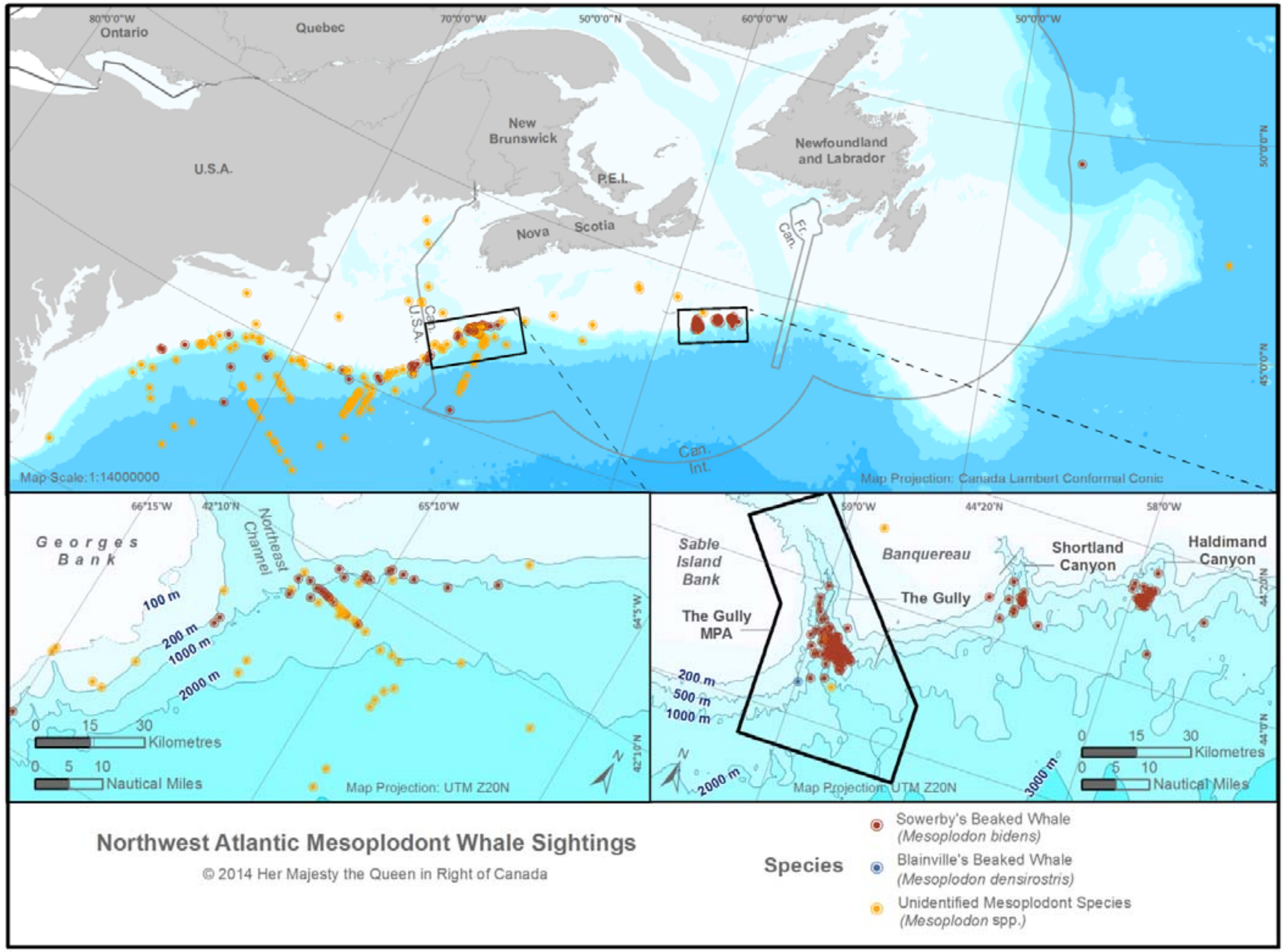
Context and Rationale: Sightings data of Sowerby's Beaked Whales presented in this document only includes data from 1998-2004. Updated and comprehensive sightings data for Sowerby's Beaked Whale on the Scotian Shelf and Slope region are available in DFOs Sowerby's Beaked Whale Management Plan and should be consulted.

Specific Question or Request: Summarize sighting data for the Sowerby's Beaked Whale on the Scotian Shelf and Slope region in DFOs Sowerby's Beaked Whale Management Plan. Update the effects assessment and proposed mitigation measures accordingly.

Response: DFO's Sowerby's Beaked Whale Management Plan (DFO 2016) has been consulted and the following is a summary regarding the species distribution on the Scotian Shelf and Slope.

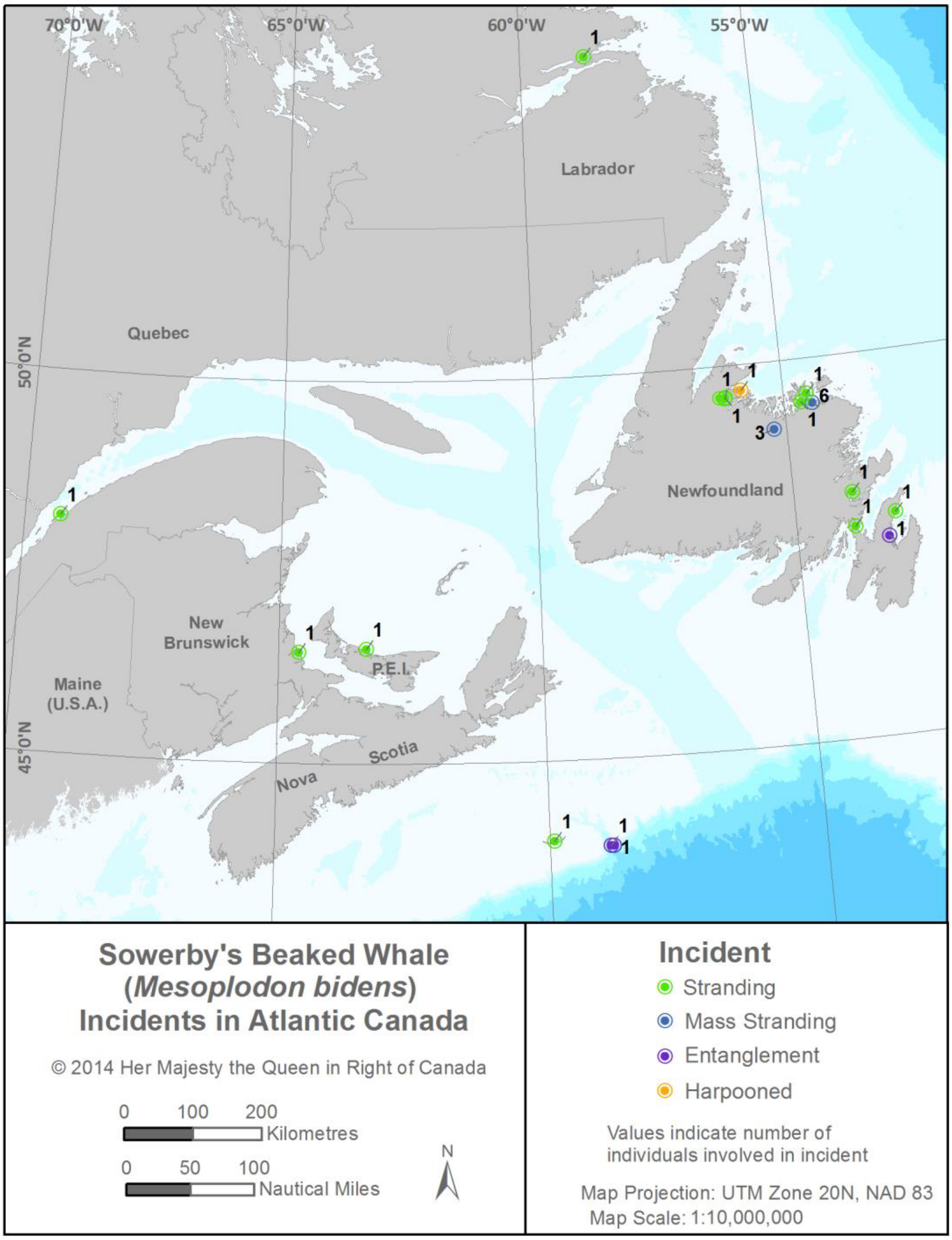
The Sowerby's beaked whale is found exclusively in the North Atlantic. In the western North Atlantic, the species can occur as far north as the Davis Strait, although it is most frequently observed off Newfoundland, Nova Scotia, and the Northeastern United States. In Canadian waters, the species occurs primarily along the continental slope off Nova Scotia and Newfoundland and Labrador in waters greater than 200 m in depth. There have been two recent strandings in the Gulf of St. Lawrence and one unconfirmed sighting in the Davis Strait, indicating that the species range may also include these regions. Sowerby's beaked whale sightings and incidents in Atlantic Canada can be seen in Figures 1 and 2 below.

There is currently no population estimate for the species in Canada. Survey effort has been limited and it is largely targeted towards incidental sightings in specific areas including the Gully, Shortland, and Haldimand canyons, where research has been conducted on the Northern Bottlenose whale since the 1980s. Over a 23-year study period (1988-2011), there has been an annual increase of 21% in incidental sightings of the Sowerby's beaked whale in the Gully, with the first reported sighting in 1994. The maximum potential increase due to population growth has been calculated at 4%. Other unknown factors may have contributed to the increasing observations.



Source: DFO 2016

Figure 1 Reported Sowerby's Beaked whale and other mesoplodont sightings in Atlantic Canada and the Northeastern U.S.



Source: DFO 2016

Figure 2 Distribution of reported Sowerby's beaked whale incidents in Atlantic Canada (1952 - 2013)

Based on this additional information, the effects assessment and proposed mitigations will remain unchanged. The species was initially identified to be potentially present in the Project Area, and these new sightings (which occur outside of the Project Area), will not change the effects assessment.

References:

DFO [Fisheries and Oceans Canada]. 2016. Management Plan for the Sowerby's Beaked Whale (*Mesoplodon bidens*) in Canada [Proposed]. *Species at Risk Act* Management Plan Series. Fisheries and Oceans Canada, Ottawa. iv + 48 pp.

Information Request (IR) IR-033 (DFO-17)

Applicable CEAA 2012 effect(s): 5(1)(a)(i) Fish and Fish Habitat; 5(1)(a)(ii) Aquatic Species

EIS Guidelines Reference: Part 2, 6.1.6 Marine mammals

EIS Reference: Figure 5.2.20 Seal Sightings on the Scotian Shelf and Slope, p.5.142

Context and Rationale: The DFO seal observations recorded on the Scotian Shelf and Slope mapped in Figure 5.2.20 are not an exhaustive map of all known sightings of seals in the region. Data from intensive seal surveys and tagging studies are not considered in this document.

Specific Question or Request: Summarize information available in the most up to date sightings data and indicate the source and limitations of the data. Update the effects assessment and proposed mitigation measures accordingly.

Response: Fisheries and Oceans Canada was contacted to obtain any outstanding seal observation data, including data from intensive seal surveys and tagging studies described above. This data is not publicly available, and therefore cannot be included in the Environmental Impact Statement (EIS)or information request response. A pup production survey was completed in 2016, although the results of this survey are not yet available. The observations recorded on the Scotian Shelf and Slope in Figure 5.2.20 of the EIS are therefore current until more recent observations are made available to the public. Despite not being able to present the 2016 data, we believe the level of information presented in the EIS is considered adequate to inform the analysis of effects for seals.

Information Request (IR) IR-034 (DFO-18)

Applicable CEAA 2012 effect(s): 5(1)(a)(i) Fish and Fish Habitat; 5(1)(a)(ii) Aquatic Species

EIS Guidelines Reference: Part 2, 6.1.7 Marine turtles

EIS Reference: Figure 5.2.21 Sea Turtle Sightings on the Scotian Shelf and Slope (1911-2013) p5.144

Context and Rationale: More sea turtles sightings have occurred in the region than are represented in the map. For example, Figure 2 in James *et. al.* (2006), shows 851 Leatherback sea turtle sightings off Nova Scotia recorded between 1998-2005. (James, M.C., Sherrill-Mix, S.A., Martin, K. and Myers, R.A. (2006) Canadian waters provide critical foraging habitat for leatherback sea turtles. Biol. Conserv. 133: 347-357.) The Canadian Sea Turtle Network is a good reference for sea turtle sightings.

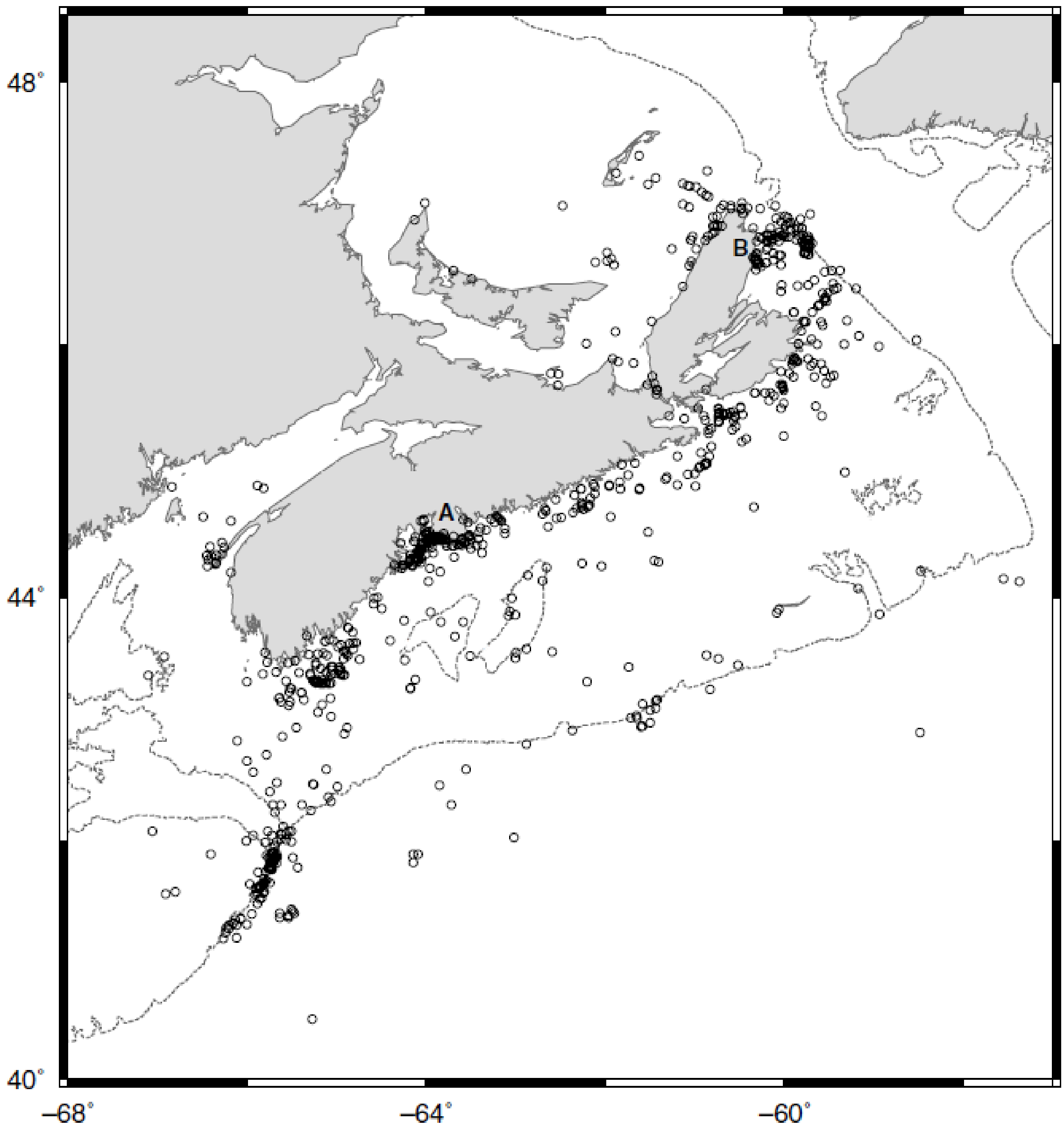
Specific Question or Request: Summarize the baseline information provided in the references cited above. Update the effects assessment and proposed mitigation measures accordingly.

Response: In the Northwest Atlantic, leatherback sea turtles can be found in the shelf and slope waters of the United States and Canada. Three years of aerial and shipboard surveys off the northeastern United States revealed 128 sightings with peak abundances occurring between late June and late September. These findings indicated a relatively low density of leatherbacks in the northeastern U.S (James *et al.* 2006).

To evaluate the importance of Canadian Atlantic habitat to leatherbacks, James *et al.* (2006), launched a formal program to promote the reporting of sightings of sea turtles by commercial fishermen and other mariners in 1998. From 1998 to 2005, fishermen and other mariners reported 851 geo-referenced sightings of free-swimming or entangled leatherbacks in Atlantic Canada. The sightings were principally reported from the Scotian Shelf (Figure 1), however smaller numbers of sightings were also reported from coastal Newfoundland and on the Scotian Slope (Figure 2). During Atlantic right whale aerial surveys in 1998 and 1999, 31 leatherbacks were sighted in 1998 and 11 were spotted in 1999. From 1998-2005, 120 leatherback interactions with Canadian pelagic longline fishing vessels were recorded by fisheries observers.

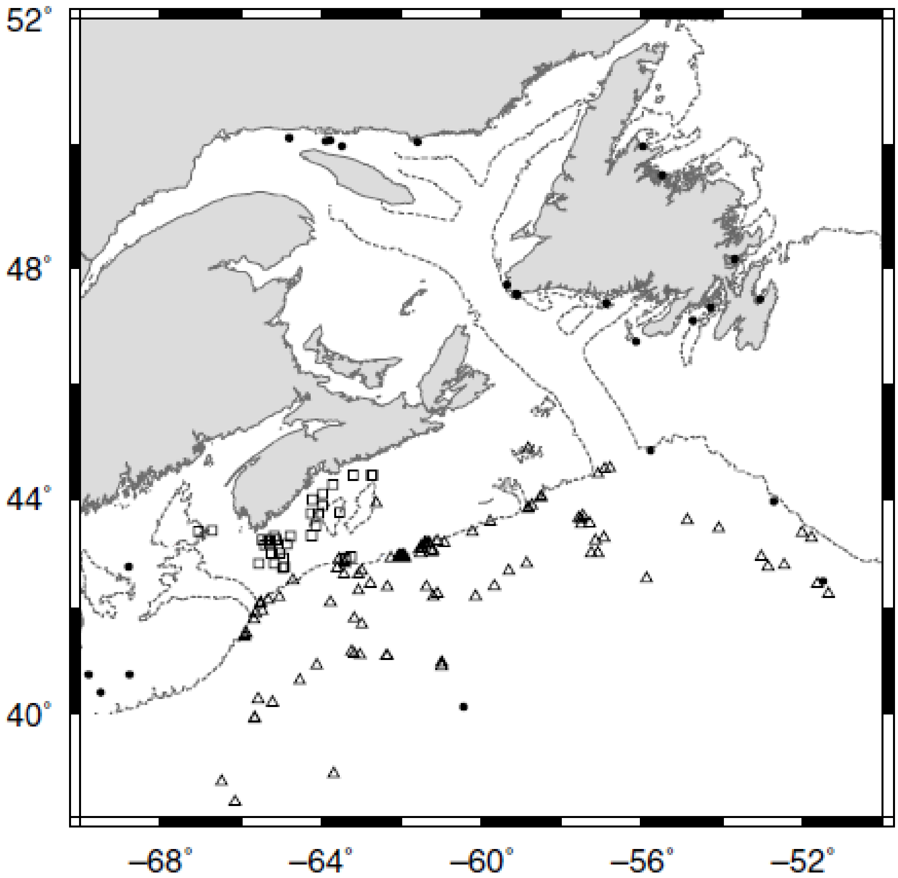
With respect to seasonality, the first reported sightings of the year typically occurred in June and usually corresponded to the waters in the vicinity of Georges Bank, with turtles not being regularly sighted until July. In July and August, turtles were reported along most of the Scotian Shelf. Sightings off Cape Breton, further to the north, increased in August and remained frequent until later into the season, as sightings decreased in more southern areas. No live turtles were reported from January to April. Satellite tagged turtles (nine) remained on the continental shelf and/or slope into the second week of September. Eight of these remained into the first week of October, with two remaining until November (Figure 3). The majority of turtles (80.2%) were reported on the continental shelf (waters inside the 200 m isobath) with depths ranging from 2 to 5,033 m.

It should be noted that the majority of these sightings were reported voluntarily through commercial fishermen. In most cases, fishers have limited opportunities to observe and record turtles during fishing operations. It is therefore expected that only a small proportion of mariners who observed turtles reported them. Thus, the sightings data likely underestimates the actual number of turtles observed in the region.



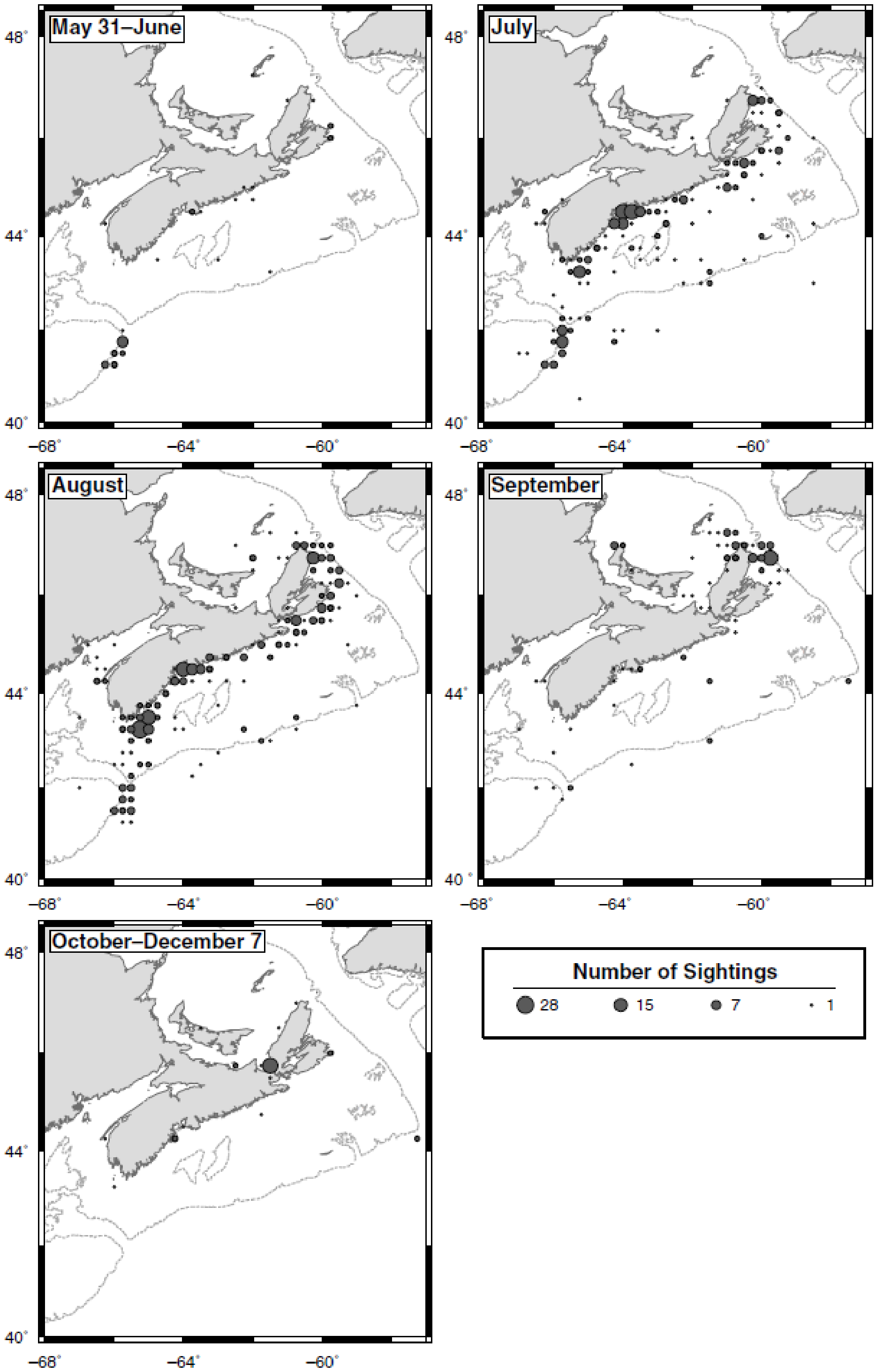
Source: James *et al.* 2006

Figure 1 Sightings of leatherback turtles off Nova Scotia (circles) voluntarily reported by fishers and other mariners (1998-2005)



Source: James *et al.* 2006

Figure 2 Additional records of leatherbacks in Canadian waters (1998 -2005)



Source: James *et al.* 2006

Figure 3 Sightings of leatherback turtles voluntarily reported off Nova Scotia by month (1998-2005)

Figures 5.2.21 to 5.2.23 present sightings data provided by DFO, Shell and BP for sea turtles within the Regional Assessment Area. Although James *et al.* (2006) provides additional data on presence of leatherback turtles, the species was initially identified with a "High" potential to be present in the Study Area. This new data does not infer a large increase in sightings within the Project Area compared to data already presented in the EIS. The effects assessment had assumed that the species would be present and potentially interacting with the Project. Therefore, the conclusions of the effects assessment and the associated mitigation remain unchanged.

References:

James, M.C., Sherrill-Mix, S.A., Martin, K. and Myers, R.A. 2006. Canadian waters provide critical foraging habitat for leatherback sea turtles. Biol. Conserv. 133: 347-357.

Information Request (IR) IR-035 (DFO-19)

Applicable CEAA 2012 effect(s): 5(1)(a)(i) Fish and Fish Habitat; 5(1)(a)(ii) Aquatic Species

EIS Guidelines Reference: Part 2, 3.1 Project components; 6.2 Predicted Changes to the Physical Environment

EIS Reference: 7.1.1.2 Underwater Sound; 7.1.3 Vertical Seismic Profiling; Figure 7.1.1 Sound Transmission Pathways and Sources of Sound Associated with a Drillship or Semi-submersible Drilling Vessel, p.7.6

Context and Rationale: Information regarding generated sound is incomplete.

Specific Question or Request: Update the description of underwater sound to include sound generated by the acoustic positioning (p. 7.6) and sounds from VSP activities. Update the assessment of effects as appropriate.

Response: Section 7.1.1.2 (Underwater Sound), as referenced in the information request, relates explicitly to sounds generated by the mobile offshore drilling unit (MODU) (*i.e.*, this subsection falls within Section 7.1.1 – Presence and Operation of the MODU). As noted in the Environmental Impact Statement (EIS) (p.7.4), a description of underwater sound associated with other Project activities is discussed in later sections; sound generated by vertical seismic profiling (VSP) activities is described in Section 7.1.3 of the EIS. A discussion of associated potential environmental effects is included in Sections 7.2.8.3 (Fish and Fish Habitats), 7.3.8.3 (Marine Mammals and Sea Turtles), 7.4.8.3 (Migratory Birds), 7.5.8.3 (Special Areas), 7.6.8.3 (Commercial Fisheries) and 7.7.8.3 (Current Aboriginal Use of Lands and Resources for Traditional Purposes) of the EIS.

With respect to acoustic positioning, the MODU dynamic positioning system will use hydroacoustics to supplement the GPS signals. The acoustic signals occur between transducers mounted in the hull of the MODU and the transponders fixed on the seafloor. Typically, two hull-mounted transducers are used for redundancy in case one fails, and between four and six transponders are fitted on the seafloor. Depending on the model of transducers and the positioning setup used, frequencies generated by acoustic positioning transponders can vary between 18 kHz and 36 kHz (Austin *et al.* 2012). It is likely that the hydroacoustic system employed for the Project will be one of the Kongsberg High Precision Acoustic Positioning (HiPAP) systems (Kongsberg Maritime 2016), or something similar, operated in 'long-base-line' (LBL) mode to accommodate the water depths.

Manufacturer source level specifications for this type of system have been reported as 206 dB re 1μPa @ 1 m (Austin *et al.* 2012). Based on an empirical spreading loss equation (as obtained from field measurements; Warner and McCrodan 2011), transponder source levels of this magnitude have been modelled for operations of other E&P companies offshore Greenland, which show sound pressure levels to decrease to below 160 dB re 1μPa SPL at distances greater than 40 m (Austin *et al.* 2012). Potential for Change in Habitat Quality and Use as a result of the use of acoustic positioning systems is therefore predicted to have a potential adverse effect but low in magnitude, occur within the Local Assessment Area (LAA) more than once at irregular intervals, be short-term in duration, and reversible. Potential for a Change in Risk of Mortality or Physical Injury is considered unlikely to occur.

References:

Austin, M., G. Warner, and A. McCrodan. 2012. Underwater Sound Propagation Acoustics Technical Report: Maersk Oil Kalaallit Nunaat A/S 2012 3-D Seismic Program Block 9 (Tooq). Version 2.0. Technical report for Golder Associates A/S and Golder Associates Ltd. by JASCO Applied Sciences.

Kongsberg Maritime. 2016. HiPAP – High Precision Acoustic Positioning. Accessed March 6, 2017. Available at: https://www.km.kongsberg.com/ks/web/nokbg0397.nsf/AllWeb/D3F9B693E19302BBC12571B6003DD0AE/$file/HiPAP_Family_brochure_v3_lowres.pdf

Warner, G., and A. McCrodan. 2011. Underwater Sound Measurements. (Chapter 3) In: Hartin K.G., L.N. Bisson, S.A. Case, D.S. Ireland, and D. Hannay. (eds.) 2011. Marine mammal monitoring and mitigation during site clearance and geotechnical surveys by Statoil USA E&P Inc. in the Chukchi Sea, August–October 2011: 90-day report. LGL Rep. P1193. Rep. from LGL Alaska Research Associates Inc., LGL Ltd., and JASCO Research Ltd. for Statoil USA E&P Inc., Nat. Mar. Fish. Serv., and U.S. Fish and Wild. Serv. 202 pp, plus appendices.

Information Request (IR) IR-036 (DFO-21)

Applicable CEAA 2012 effect(s): 5(1)(a)(i) Fish and Fish Habitat; 5(1)(a)(ii) Aquatic Species

EIS Guidelines Reference: Part 2, 6.3.3 Marine mammals; 6.3.6 Federal species at risk

EIS Reference: 7.3.8.2 Mitigation of Project Related Environmental Effects, p.7.65

Context and Rationale: Present in the project area are deep-diving odontocete species that spend most of their time underwater, that may be quite difficult to detect when at the surface, and that can be acoustically detected as they regularly vocalize.

The use of passive acoustic monitoring (PAM) during good visibility conditions to increase the likelihood of detecting deep-diving cetaceans is recommended by DFO; however, concurrent visual and acoustic monitoring would increase the probability of detection for many species, including beaked whales which are difficult to visually detect. DFO also recommends concurrent visual and acoustic monitoring for all VSP surveys. In addition, to increase the probability to accommodate deeper, longer diving behaviour, a pre-ramp up watch period of 60 minutes in deep water areas where beaked and other deep diving whales may be present is recommended by DFO.

Specific Question or Request: Consider the recommendations identified above, and describe whether and how such recommendations would be included in the mitigation measures and follow-up programs proposed. If the proponent does not believe additional mitigation and follow-up recommended by DFO is required, provide rationale.

Response: BP will adopt the recommendations made by Fisheries and Oceans Canada (DFO). Concurrent visual and acoustic monitoring will be carried out during vertical seismic profile (VSP) surveys.

As committed to in the Environmental Impact Statement (EIS), marine mammal observers (MMOs) will be used to monitor and report on marine mammal and sea turtle sightings during VSP surveys. This will enable VSP shutdown or delay actions to be implemented if marine mammal or sea turtle species listed on Schedule 1 of the *Species at Risk Act* (SARA) (or any other baleen whales or sea turtles) are detected within the monitored exclusion zone.

BP will also adopt a ramp-up procedure (*i.e.*, gradually increasing seismic source elements over a period of approximately 30 minutes before the operating level is achieved) before any VSP activity begins. BP will adopt a pre-ramp up watch of 60 minutes whenever VSP activities are scheduled to occur in deep-water areas where beaked and other deep-diving whales may be present. This measure is recommended by DFO so that MMOs can enable VSP shutdown or delay actions if marine mammal or sea turtle species listed on Schedule 1 of SARA (or any other baleen whales or sea turtles) are detected within the monitored exclusion zone.

Passive acoustic monitoring (PAM) will be used throughout VSP surveys to detect vocalising marine mammals, concurrent to the MMOs' visual monitoring. The technical specifications and operational deployment configuration of the PAM system will be optimised within the bounds of operational and safety constraints to maximise the likelihood of detecting cetacean species anticipated in the area.

Information Request (IR) IR-037 (DFO-22)

Applicable CEAA 2012 effect(s): 5(1)(a)(i) Fish and Fish Habitat; 5(1)(a)(ii) Aquatic Species

EIS Guidelines Reference: Part 2, 6.3.3 Marine mammals; 6.3.6 Federal species at risk

EIS Reference: 7.3.8.2 Mitigation of Project Related Environmental Effects, p.7.66

Context and Rationale: Avoiding Critical Habitat and using shipping lanes during vessel transits is important mitigation. However, DFO has advised the Agency that additional measures could also be appropriate. For example, maintaining a watch for nearby marine mammals during vessel transits should be considered.

Specific Question or Request: Please advise whether additional mitigation measures, such as that suggested by DFO, have been considered and would be implemented. If not, provide rationale.

Response: Vessel crews on the platform supply vessels will carry out opportunistic visual monitoring during vessel transit. Any sightings will be recorded and will be reported to Fisheries and Oceans Canada (DFO) by email (XMARWhaleSightings@dfo-mpo.gc.ca) in line with DFO guidance (DFO n.d.). The vessel crews will be provided with training to aid identification and reporting requirements. Refer also to IR-036.

References:

DFO, n.d. Marine mammals and sea turtles at risk in the Maritimes Region. Available at: http://www.dfo-mpo.gc.ca/fm-gp/mammals-mammiferes/maritimes-eng.html

Information Request (IR) IR-038

Applicable CEAA 2012 effect(s): 5(1)(a)(ii)

EIS Guidelines Reference: Part 2, 6.3.2 Marine Plants

EIS Reference: 7.2 Fish and Fish Habitat

Context and Rationale: The EIS Guidelines (section 6.3.2) require the proponent to assess the environmental effects of the Project on marine plants from routine operations and accidents and malfunctions. As defined in the *Fisheries Act*, marine plants[3] includes all benthic and detached algae, marine flowering plants, brown algae, red algae, green algae, and phytoplankton.

The EIS (section 5.2.1.2) describes phytoplankton as the base of the marine food web, influencing production of all higher trophic levels in an ecosystem. The section provides a description of the annual phytoplankton blooms in the project area. However, further on, the EIS (Table 6.2.1) describes how marine plants are not located in the Project Area (given water depth) and routine project activities are not predicted to interact with marine plants which occur in the nearshore. As such, marine plants were not identified as a stand-alone valued component, but addressed within the fish and fish habitat valued component where applicable. In the absence of comprehensive benthic survey data and considering that water depths in the project area vary from 100 metres to 3000 metres (page 2.1), it is not clear that this can be categorically stated. Also, some marine plants (*e.g.* phytoplankton) are known to be present at or near the sea surface as described in the EIS (section 5.2.1.2).

The project pathways identified for effects on the valued component fish and fish habitat from routine operations (section 7.2.8.1) does not appear to address project pathways for effects on the marine plant phytoplankton, specifically, such as changes in water quality as a result of waste management. The description of residual effects (7.2.8.3) and conclusions regarding significance (7.2.9) do not address effects on the marine plant phytoplankton.

With regard to effects from accidents and malfunctions, the EIS (section 8.5.1.1) describes how an oil spill or well blowout incident could result in reduced productivity and growth for phytoplankton and a change in community composition. It is not clear what the duration and level of residual effects could be to phytoplankton from a well blowout incident, nor how the conclusions regarding significance of adverse effects address potential effects on phytoplankton.

Specific Question or Request: Provide an assessment of potential adverse effects from both routine operations and from accidents and malfunctions to phytoplankton. Include in the accidents and malfunctions assessment consideration as to the applicability of the effects thresholds in Table 8.4.7 to phytoplankton.

---

[3] The definition of environmental effects in section 5 of CEAA 2012 includes effects on aquatic species (sub-paragraph 5(1)(a)(ii)), as defined in subsection 2(1) of the *Species at Risk Act.* In the *Species at Risk Act*, aquatic species means a wildlife species that is a fish or a marine plant (as defined in section 47 of the *Fisheries Act).*

Response:

Potential Adverse Effects on Phytoplankton from Routine Operations

The discharge of drill muds and cuttings and other drilling and testing emissions is not predicted to interact with Fish and Fish Habitat with respect to marine plants, specifically phytoplankton. Discharges of synthetic-based mud (SBM) mud and cuttings will be managed in accordance with the Offshore Waste Treatment Guidelines (OWTG). SBM cuttings will only be discharged once the performance targets in OWTG of 6.9 g/100 g retained "synthetic on cuttings" on wet solids can be satisfied. The concentration of SBM on cuttings will be monitored on the mobile offshore drilling unit (MODU) for compliance with the OWTG. In accordance with OWTG, no excess or spent SBM will be discharged to the sea. Spent or excess SBM that cannot be re-used during drilling operations will be brought back to shore for disposal. Routine liquid discharges (cooling water, ballast water, bilge and deck water, grey/black water and small amounts of process water during well testing) will be in accordance with the OWTG, Transport Canada's *Ballast Water Control and Management Regulations* and/or MARPOL as applicable, which are designed to be protective of the marine environment and will not be at levels that would cause mortality or physical injury to fish species.

The various phytoplankton groups encompass a wide range of physiologies, resulting in a multitude of responses and tolerance to oil toxicants (Ozhan *et al.* 2014). In addition to the potential direct toxic effects from hydrocarbons, hydrocarbons, specifically crude oil, have some other effects that could also be potentially detrimental to phytoplankton. Slicks created by hydrocarbons have the potential to limit gas exchange through the air-sea interface and reduce light penetration into the water column by up to 90% (Ozhan *et al.* 2014). Overall, field and laboratory studies seem to show the influence of crude oil on phytoplankton as beneficial and/or detrimental, depending on in-water concentrations. In general concentrations of crude oil up to 1.0 mg/L (1,000 ppb) have been shown to potentially stimulate phytoplankton growth. Concentrations between 1.0 and 100 mg/L (1,000 to 100,000 ppb) have the potential to cause slight to severe growth inhibition, and concentrations greater than 100 mg/L (>100,000 ppb) result in severe or complete growth inhibition (Ozhan *et al.* 2014).

Drill cuttings associated with SBM use will be discharged via a caisson below the sea surface, potentially affecting water quality within a localized area as the discharges migrate through the water column. The discharge of cuttings has potential to result in small sheens to form under certain conditions (*i.e.*, calm winds and small waves) during routine operation, which has the potential to affect phytoplankton.

The potential for sheen formation as a result of the discharge of cuttings and SBM use is low because activity will be carried out in adherence to the OWTG and drill muds will be selected in accordance with the Offshore Chemical Selection Guidelines (OCSG). The SBM itself has a fraction of oil or synthetic oil as a component and the cuttings are cleaned and have only a very small fraction of the SBM adhered to them when discharged. The amount of SBM on cuttings would be in the single percentages of the total volume. Discharging the cuttings at depth further mitigates the potential for sheen formation. Furthermore, if the wind and wave conditions were such that a sheen formed in association with an SBM cuttings discharge for this Project, the sheen would be temporary and limited in size. In the event of sheen formation, in water concentrations of hydrocarbons are not expected to reach levels which are toxic to phytoplankton (>1,000 ppb), or reduce light penetration which would impact the growth of marine algae. As a result, routine waste management operations are not expected to to cause a Change in Risk of Mortality or Physical Injury or Change in Habitat Quality and Use in relation to phytoplankton.

Potential Adverse Effects on Phytoplankton from Accidents and Malfunctions

As noted above, phytoplankton display a multitude of responses and tolerances to oil toxicants (Ozhan *et al.* 2014). Although the factors which govern the toxicity of crude oil to phytoplankton are not well understood, the properties of the receiving water body seem to play a role, with temperature being one such factor. Crude oil contains many different compounds, some of which may cause distinct harm to phytoplankton; especially the water-soluble and volatile oil components (*i.e.*, saturates < C7, BTEX's and C-3-Benzenes). Short-term negative effects on phytoplankton (*e.g.*, growth inhibition) are typically observed in the presence of high concentrations of these compounds. However, studies have shown that when phytoplankton mortality occurred at high crude oil concentrations, there was no correlation between toxicity and exposure time (Ozhan *et al.* 2014). In general, concentrations of crude oil up to 1.0 mg/L (1,000 ppb) have been shown to potentially stimulate phytoplankton growth. Concentrations between 1.0 and 100 mg/L (1,000 to 100,000 ppb) have the potential to cause slight to severe growth inhibition, and concentrations greater than 100 mg/L (>100,000 ppb) result in severe or complete growth inhibition (Ozhan *et al.* 2014).

Remote sensing analyses suggests that the Macondo blowout stimulated phytoplankton growth (Ozhan *et al.* 2014). In August of 2010, a large area (>11,000 km^2) in the northeast Gulf of Mexico appeared to have very high concentrations of chlorophyll. Measures used to indicate chlorophyll presence were higher in August 2010 than during any August since 2002, even when there were higher river discharges in the area. These areas of increased chlorophyll coincided with oil locations inferred from satellite imagery and predicted circulation models. These results suggested that phytoplankton were stimulated by the spill.

Experiments have also been conducted on phytoplankton communities with Macondo oil and Corexit 9500A (oil dispersant) treatments (each alone and in combination) in addition to ultraviolet light exposure (to test for phototoxicity). Dispersed oil (oil and Corexit) produced the largest decrease in chlorophyll-*a* concentrations but also caused an increase in photosynthetic efficiency. However, none of the treatments significantly altered community structure following acute exposure (Ozhan *et al.* 2014).

In the event of a blowout scenario, there may be a temporary decline in the abundance of phytoplankton in the immediate area of the spill, where in-water concentrations of total hydrocarbons are elevated above 1,000 ppb or when light is limited to prevent photosynthesis from occurring. The study of potential impacts of crude oil on phytoplankton communities is a complicated process. Different crude oils do not impact phytoplankton in the same way. The weathering of crude oil can affect its toxicity, with the application of dispersants potentially making it more toxic (Ozhan *et al.* 2014). Toxicity can also vary with light and temperature. Some species may be more tolerant of crude oil under low concentrations, while others are more tolerant under high concentrations. Phytoplankton populations can change quickly on limited temporal and spatial scales, resulting in the fact that it can be difficult to predict how a community would respond to a blowout (Ozhan *et al.* 2014). In the event of a blowout, phytoplankton populations may increase or decrease depending on a variety of factors. Community composition may also shift in favour of those species thriving in the conditions present at the time of an incident. It is expected that these changes would be temporary in nature and that the population composition would return to natural conditions once the environment returned to a pre-spill state.

References:

Echols, B.S., A.J. Smith, P.R. Gardinali, and G.M. Rand. 2015. Acute aquatic toxicity studies of Gulf of Mexico water samples collected following the Deepwater Horizon incident (May 12, 2010 to December 11, 2010). Chemosphere 120 (2015): 131-137.

Ozhan, K., Parsons, M.L., and S. Bargu. 2014. How Were Phytoplankton Affected by the Deepwater Horizon Oil Spill? Bioscience 64:9.

Information Request (IR) IR-039 (ECCC-IR-05)

Applicable CEAA 2012 effect(s): 5(1)(a); 5(1)(b)(i)

EIS Guidelines Reference: Part 2, 3.1 Project Components ("In its EIS, the proponent will describe: helicopters, including routes, number and frequency of trips"); 6.4 Mitigation

EIS Reference: 2.4.5.2 Helicopter Traffic and Operations; 7.1.4.1 Helicopter Transportation; 7.4.8.2 Mitigation of Project-Related Environmental Effects; 7.4.8.3 Characterization of Residual Project-Related Environmental Effects; 7.5.8.2 Mitigation of Project-Related Environmental Effects; 13.2 Summary of Mitigation, Monitoring and Follow-up Commitments.

Context and Rationale: The text states that "…areas of high environmental sensitivity have been identified and will be avoided as the helicopter flight paths are determined by the helicopter operators."

Text in 7.1.4.1 states that "helicopters…..will fly at altitudes greater than 300 metres and at a lateral distance of 2 kilometres around active bird colonies <u>when possible</u> (underlining added). Helicopters will also avoid flying over Sable Island ("a 2-kilometre buffer will be recognized except…in the case of an emergency.") The same text appears in other locations (*e.g.* page 7.111).

Additional clarity is needed to better understand the potential for adverse effects arising from project- related helicopter traffic.

Specific Question or Request: Specify all areas of high environmental sensitivity that have been identified in relation to helicopter flight paths and describe the factors that influence helicopter operators' ability to avoid them. Describe the potential environmental effects associated with and anticipated frequency of situations where sensitive areas cannot be avoided.

Response: Helicopter operations will be run out of Halifax Stanfield International Airport (YHZ) but routes to the well locations from shore have not yet been finalized because well locations have not yet been confirmed. However, helicopters may be expected to follow a direct path between YHZ and the Project Area. Information on areas of importance to migratory birds is provided in Section 5.2.8.3, with additional areas of potential environmental sensitivity identified in Section 5.2.10 (Special Areas).

Figures 5.2.27 and 5.2.28 of the EIS present information on the location of seabird colonies and Important Birds Areas (IBAs) within the Regional Assessment Area (RAA) and have been updated in IR-056 to include national Migratory Bird Sanctuaries. No migratory bird sanctuaries along the coastline of mainland Nova Scotia are within likely paths of helicopter transport but several IBAs and multiple bird colonies are within potential flight paths. Information on the species composition and abundance of the individual colonies is available in Table 5.2.17 of the Environmental Impact Statement (EIS) and a summary of each of the IBAs within the RAA is provided in Table 5.2.18. Refer to IR-056 for more information (including mapping) on Migratory Bird Sanctuaries.

Low-level helicopter traffic has potential to adversely affect migratory birds at active nesting colonies if setbacks cannot be maintained. As discussed in Section 7.4.8.3 of the EIS, "aircraft passing over nesting colonies can cause birds to panic, leaving eggs and young-of-the-year unprotected from predators and inclement weather, and also result in the use of valuable energy reserves for defence instead of caring for their young". The anticipated frequency of situations where active bird colonies cannot be avoided may be characterized as "multiple irregular event", as defined in Section 6.2.5 of the EIS. These events could potentially occur if severe inclement weather or other unplanned events require helicopters to deviate from their anticipated flight path during the breeding season for colonial waterbirds.

As noted in Section 7.4.8.2 of the EIS, helicopters transiting to and from the mobile offshore drilling unit (MODU) will fly at altitudes greater than 300 m (with the exception of approach and landing activities) and at a lateral distance of 2 km around active colonies when possible. Helicopters will also avoid flying over Sable Island (a 2 km buffer will be recognized) except as needed in the case of an emergency.

The characterization of the residual environmental effects associated with supply and servicing operations (*i.e.*, as described in Section 7.4.8.3 of the EIS) remains unchanged in consideration of additional information on helicopter traffic in relation to sensitive bird habitat.

Additional areas of potential environmental sensitivity are identified in Section 5.2.10 (Special Areas) of the EIS. Figure 5.2.32 of the EIS indicates that two sponge conservation areas (*i.e.*, Emerald and Sambro Bank Sponge Conservation Areas) and an area identified as important for fisheries conservation (*i.e.*, Haddock Box) are within the potential path of helicopter traffic. Figure 5.2.33 of the EIS identifies four offshore Ecologically and Biologically Significant Areas (EBSA) that occur within potential helicopter flight paths: Emerald Basin and the Scotian Shelf, Emerald Western Sable Banks Complex, Sable Island Shoals, and the Scotian Slope. Helicopter traffic is unlikely to interact with sponge conservation areas, important areas for fisheries conservation, or offshore EBSAs in a way that would affect the biological or ecological integrity of these Special Areas.

Information Request (IR) IR-040 (ECCC-IR-07)

Applicable CEAA 2012 effect(s): 5(1)(a)(iii) Migratory Birds

EIS Guidelines Reference: Part 2, 6.3.5

EIS Reference: 7.4.8.2 Mitigation of Project-Related Environmental Effects; 7.4.8.3 Characterization of Residual Project-Related Environmental Effects; 10.2.1.1 Potential Residual Environmental Effects of Offshore Gas Development Projects in the RAA; 10.2.5.1 Change in Risk of Mortality or Physical Injury

Context and Rationale: In section 7.4.8.2, the EIS states that "Seabird monitoring conducted as part of the SOEP and Deep Panuke EEM programs has shown little to no effect of flaring on birds transiting to and from Sable Island or the Scotian Slope (CNSOPB 2011; McGregor Geoscience Limited 2012). In 2012, only a single stranding (Leach's Storm-petrel) was recorded during the Deep Panuke bird monitoring program, with the bird released unharmed (McGregor Geoscience Limited 2012)."

In Table 10.2.1, the EIS states that "Nocturnally migrating birds may be attracted and/or disoriented by artificial night lighting on the SOEP and Deep Panuke platforms, thereby increasing the risk of injury or mortality. However, EEM data for these projects indicate a very minor effect on migratory birds (ExxonMobil 2012, McGregor Geoscience Limited 2013)".

The Sable Island Offshore Energy Project (SOEP) Environmental Effects Monitoring (EEM) was not designed to test for an effect of flaring on birds, so cannot be used to provide evidence of an effect or lack thereof.

Environment and Climate Change Canada does not agree with the proponent that it is possible to come to conclusions regarding EEM data for SOEP and Deep Panuke, since the data on bird strandings were not collected systematically and therefore cannot be used to measure effects of lights and flares on birds. Instead, stranded bird data are collected and reported opportunistically for these projects. In the absence of a program where stranded birds are searched for systematically, and reporting of stranded birds is complete, a conclusion that effect of lighting on migratory birds is low should not be made.

The interactions between flaring and migratory birds is simply not known beyond what is being monitored on the platforms and does in fact pose potential risks (Fraser *et al.* 2016 and Ronconi *et al.* 2015). Furthermore, while Leach's Storm-Petrels may be one of the most numerous seabirds in the Northwest Atlantic, concern has been raised recently as to their status in Eastern Canada. Specifically, many of the largest colonies are showing substantial population declines (Wilhelm *et al.* 2015; CWS, unpublished data). In addition, recent studies are revealing that adult survival is low for Leach's Storm- Petrels at breeding colonies in both Nova Scotia and Newfoundland (Fife *et al.* 2015; A. Hedd, unpublished data) which is also alarming as Leach's Storm-Petrels have long life spans but low reproductive rates, resulting in slow population recoveries. Finally, recent studies tracking foraging patterns of Leach's Storm-Petrels from breeding colonies in Nova Scotia and Newfoundland are showing foraging areas overlapping with current oil and gas production areas (Hedd *et al.* in revision). Hence, to adequately assess and address environmental effects, Environment and Climate

Change Canada has advised that there is an urgent need for information on avian attraction and interaction with offshore platforms off Canada's east coast.

Specific Question or Request: In light of the comments above, discuss any changes to the information provided in the EIS regarding SOEP and Deep Panuke EEM data on bird strandings and mortality, describe how the information does or does not change the expected residual effects (direct and cumulative), and update the confidence with which conclusions are drawn, as appropriate (*e.g.* conclusions regarding residual cumulative change in risk of mortality or physical injury for migratory birds are made with "a high level of confidence" (section 10.2.5.1)).

Response: Although data were collected opportunistically during the SOEP and Deep Panuke EEM programs, results did not indicate a high degree of bird mortality caused by those projects. An EEM program was also recently conducted by Shell for the Cheshire well in the offshore area of Nova Scotia to verify the accuracy of EIS effects predictions on migratory birds. The methods and results of that program are summarized below to provide further context on the expected residual environmental effects to migratory birds from offshore lighting on the Scotian Shelf and Slope.

The Cheshire EEM program consisted of routine checks for stranded birds on the mobile offshore drilling unit (MODU) and offshore support vessels (OSVs) to document stranding events, injuries, and mortality of migratory birds (Shell 2017). Designated crew members received training and were tasked with undertaking daily walk-throughs to search all decks and easily-accessible open areas of their respective vessels for dead, stranded or injured birds. Monitoring occurred for the entirety of activity at Cheshire, from October 19, 2015 to September 21, 2016 (Shell 2017). All birds found on each vessel were documented and bird handling records were compiled regularly for each vessel by the Environmental/Regulatory onshore focal. Data was not collected on the effect of flaring on migratory birds since flaring did not occur during the drilling of the Cheshire well (Shell 2017).

A total of 86 birds were found stranded on the MODU or the OSVs during the Shell EEM program (19 October 2015 – 21 September 2016); 50 birds were dead or died in care, and 35 were alive and released (Shell 2017). One bird was found with grease/oil in its feathers and was sent to a rehabilitation facility in Dartmouth, Nova Scotia. Data indicated that bird strandings occurred year round but the majority were encountered between November 2015 and January 2016 (Shell 2017). Approximately 60% of the species records from November (13 of the 22 records) were of migrating landbirds; the majority of which were found dead. Conversely, the majority of records from January 2016 were of marine species (15 of the 18 records), particularly dovekies (*Alle alle*) and Leach's storm petrels (*Oceanodroma leucorhoa*). Although there were up to four OSVs supporting the well, the vast majority of strandings occurred on the MODU, with data indicating an average of 0.19 strandings/day on the MODU, or approximately one stranding every 5 days (Shell 2017). Based on the results of the EEM program, it was determined that while there were likely adverse environmental effects on migratory birds from of the project (*i.e.*, those demonstrated were likely to reflect the influence of artificial lighting on mortality risk), the environmental effects were not considered to result in thresholds that would indicate significant adverse effects. As such, the

Shelburne Basin Venture Exploration Drilling Project EIS predictions for no significant adverse environmental effects on marine birds for the Cheshire well were considered valid (Shell 2017).

It is acknowledged that that there is uncertainty regarding the effects of flaring in the offshore environment of the Scotian Shelf on migratory birds, and that there are concerns regarding the populations of some pelagic species such as Leach's storm-petrels. Despite limitations in the interpretation of EEM data collected to-date, available information sources do not indicate that effects to migratory birds because of routine operations would be beyond those characterized in Section 7.4.8.3 of the EIS. In particular, the effects of the presence and operation of the MODU on migratory birds are predicted to be adverse, low to moderate in magnitude (*i.e.*, measurable change but not posing a risk to population viability), restricted to the Project Area, continuous throughout the Project, medium-term in duration, and reversible. Additionally, in consideration of the recent findings from Shell (2017) and identified mitigation measures, the characterization of cumulative effects on migratory birds in Section 10.2.5 remains unchanged. However, because of a lack of data on the effects of flaring along the Scotian Shelf and concerns regarding the decline of some species within the area, the confidence associated with conclusions regarding the residual cumulative change of Project operations on a change in risk of mortality or physical injury or habitat quality and use are adjusted from "High" to "Moderate".

References:

Shell. 2017. Canadian Environmental Assessment Agency Closure Report for Cheshire L-97A Well. Shelburne Basin Venture Exploration Drilling Project.

Information Request (IR) IR-041

Applicable CEAA 2012 effect(s): 5(1)(a(iii)

EIS Guidelines Reference: Part 2, 6.3.5 Migratory Birds; 6.5 Mitigation

EIS Reference: 7.4.8.3 Characterization of Residual Project-Related Environmental Effects

Context and Rationale: The text box on page 7.95 includes the following statement: "In consideration of mitigation, including efforts to reduce flaring…." Likewise, it is stated on page 7.97 that "…mitigation measures to limit flaring….will reduce potential effects."

In the discussion of mitigation (7.4.8.2 Mitigation of Project-Related Environmental Effects), there is no mention of flaring or any measures to reduce it.

Specific Question or Request: Describe specific mitigation measures that are being proposed to reduce flaring, the expected effectiveness of those measures, and the residual effects of flaring.

Response: It is not currently anticipated that well test flaring will be carried out on the wells drilled in the first phase of exploratory drilling (*i.e.*, the first one to two wells of the Project). In the event of well success in the initial wells, a well test program will be developed and executed on subsequent wells drilled as part of the primary term of the license.

In the event that a well test is required and a well test program is developed, it will be subject to BP's process for well test planning which is designed to promote safe and efficient well test operations. A key requirement of these processes is the use of process safety design methods to ensure effective barriers are in place for the well test activity, and an internal approval process for any well test activity and any associated flaring. The internal approval process is designed to provide assurance that the minimum amount of flaring is carried out to complete the well test. Furthermore, specialist equipment and services will be contracted to carry out the activity. It is likely that the well test operation will be run using conventional drill stem test (DST) tooling, subsea safety systems and temporary surface flow equipment to manage and measure the well fluids, collect fluid samples and necessary data sets. Gases will be diverted to an open ended gas flare tip burner, and liquids to a high efficiency burner head. High combustion equipment will be used which will maximise complete combustion, thereby reducing the likelihood of black smoke in flaring activity and drop out of un-combusted liquids on to the sea surface. BP will also consider the use of a water curtain for heat suppression from the gas flare and oil burner.

In the event that well testing is required, BP will inform the Canada-Nova Scotia Offshore Petroleum Board (CNSOPB) of any plans for well test flaring as part of the Authorisation to Drill a Well (ADW) process. BP will report on any flaring activity to the CNSOPB.

Information about well flow testing is included in Section 2.4.3.3 of the Environmental Impact Statement (EIS). Information about residual effects from flaring through well test is included in Section 7, specifically 7.4.8.3 for effects on Migratory Birds.

Information Request (IR) IR-042 (ECCC-IR-06)

Applicable CEAA 2012 effect(s): 5(1)(a)(iii) Migratory Birds

EIS Guidelines Reference: Part 2, 6.4 Mitigation; 6.6.3 Cumulative effects assessment; 8.2 Monitoring

EIS Reference: 7.4.8.2 Mitigation of Project-Related Environmental Effects; 7.4.10 Follow-up and Monitoring; 10.2.5.1 Change in Risk of Mortality or Injury; 12.2 Follow-up and Monitoring; 13.2 Summary of Mitigation, Monitoring and Follow-up Commitments

Context and Rationale: In sections 7.4.8.2, 10.2.5.1 and 13.2, the EIS states that "Routine checks for stranded birds will be conducted…" on the MODU and PSVs, and that "…appropriate procedures for release will be implemented. If stranded birds are found during routine inspections, they will be handled using the protocol outlined in *The Leach's Storm Petrel: General Information and Handling Instructions* (Williams and Chardine 1999), including obtaining the associated permit from CWS. Activities will comply with the requirements for documenting and reporting any stranded birds (or mortalities) to CWS during the drilling program." The "Williams and Chardine protocol" is also mentioned in section 7.4.10. The carrying out of routine checks for stranded birds or bird mortality on the MODU and PSVs in mentioned in Table 12.2.1.

Williams and Chardine (1999) is specific to storm-petrels, and due to a better understanding of bird strandings at sea since 1999, ECCC now expects such protocols to be applicable for other species of seabirds and for other bird groups. It has advised that the proponent should develop a similar-type protocol for birds other than storm-petrels which may become stranded on vessels. ECCC has further advised that the proponent should be prepared to conduct systematic checks for stranded birds, rather than only checking birds found when conducting routine checks for facility operations.

ECCC has been preparing a protocol for handling stranded birds that expands on Williams and Chardine (1999) and that includes all bird groups. ECCC is prepared to provide its draft for use by the proponent upon request.

Specific Question or Request: Based on the advice from ECCC, advise whether a protocol for handling stranded birds that expands on Williams and Chardine (1999) and includes all bird groups would be developed. Clarify if the protocol would be based on ECCC's draft protocol, and whether ECCC would be consulted in its development. Clarify if and how this would be implemented as mitigation.

Response: The bird mortality monitoring program will consist of systematic checks for stranded birds on the mobile offshore drilling unit (MODU) as well as platform supply vessels (PSVs). Prior to implementation of the monitoring program, BP will develop a bird handling protocol in consultation with Environment and Climate Change Canada (ECCC) and in consideration of the latest available information (*e.g.*, ECCC's draft protocol) to provide guidance on the handling of dead and stranded birds that may be found during these systematic checks. Adherence to a protocol for proper handling and release of live stranded birds will reduce risk of mortality or physical injury to migratory birds.

Information Request (IR) IR-043 (ECCC-IR-03)

Applicable CEAA 2012 effect(s): 5(1)(a)(iii) Migratory Birds

EIS Guidelines Reference: Part 2, 6.1.4 Migratory birds and their habitat; 6.3.5 Migratory birds; 6.4 Mitigation; 6.6.1 Effects of potential accidents or malfunctions; 6.6.3 Cumulative effects; 8.2 Monitoring

EIS Reference: 5.2.8 Migratory Birds; 7.4 Migratory Birds; 8.5.3 Migratory Birds; 10.0 Cumulative Effects; Follow-up and Monitoring

Context and Rationale: Two species of Globally Endangered (IUCN Red List) seabirds, the Bermuda Petrel and Black-capped Petrel, both protected under the *Migratory Birds Convention Act*, have been observed in slope waters off Nova Scotia. Both species have very small global population sizes and restricted ranges, so are extremely vulnerable; however, neither species is mentioned in the EIS.

Specific Question or Request: Describe the use of the assessment area by migratory birds with IUCN Red List rarity ranks. Describe the potential effects of the Project on these species, including effects of accidents and cumulative effects, as well as measures to mitigate effects, and any follow-up monitoring proposed.

Response: The IUCN lists 44 species that are associated with marine habitats whose status in Canada is listed as either *native*, vagrant, or *uncertain* (*i.e.*, *introduced* species excluded); and that have been designated as *critically endangered*, *endangered*, *vulnerable*, or *near threatened* on the IUCN Red List of Threatened Species (2016). Of these, data from the Atlantic Canada Conservation Data Centre (AC CDC) indicates that 21 are known, or have potential, to occur in association with Nova Scotia (*i.e.*, species which are not assessed in Nova Scotia by the AC CDC were not considered likely to occur) (Table 1). Many of these species are generally restricted to coastal environments and are therefore unlikely to occur within the offshore environment. Seven of these seabirds have potential to occur in the Project Area. None of the IUCN-listed species that are occur on the Scotian Shelf and Slope are listed as *critically endangered*, but two *endangered* species occur: the Bermuda petrel (*Pterodroma cahow*) and the black-capped petrel (*Pterodroma hasitata*). Of the remaining species, four are considered *vulnerable* by the IUCN and 16 are designated *near threatened* (Table 1). Additional information on the use of the assessment area by these species is provided below.

The Bermuda petrel is known to nest on several small islands in the Bermuda archipelago but it spends most its adult life on the open seas ranging from the North Atlantic coastal United States and Canada to waters off western Europe, particularly the Azores (Madeiros *et al.* 2014). This species was historically abundant in Bermuda but its population declined drastically because of habitat modifications, predation by introduced species, and human hunting pressure. It was considered extinct for almost three centuries until reported during the first half of the 20th century (IUCN 2016). In 1951, 18 pairs were rediscovered breeding on suboptimal rocky islets off Bermuda, but habitat restoration and reintroduction efforts have helped to increase the population to approximately 100 breeding pairs (Madeiros *et al.* 2014). Although Canada is considered to be within the range of the Bermuda petrel, there is considerable uncertainty regarding its status within the region. The Bermuda petrel's presence in Canada is designated as "present - origin uncertain" by the IUCN (2016) and within Nova Scotia it has been assigned a ranking of *SU* by the AC CDC (2016a), indicating that it is considered "currently unrankable due to lack of information or due to substantially conflicting information about status or trends" (AC CDC 2016b). Although data indicates that the Bermuda petrel may forage in waters of the Scotian Shelf and Slope (Madeiros *et al.* 2014), ECSAS and PIROP data obtained for the Scotian Shelf (CWS 2015) do not include records for this species which suggests that it occurs infrequently and / or in low numbers within the Regional Assessment Area (RAA).

The CWS has indicated that black-capped petrel has been reported in slope waters off Nova Scotia (CWS 2015) but this species is not expected to regularly occur within the RAA. The breeding grounds for the black-capped petrel are restricted to the Caribbean and the Scotian Shelf and Slope is not within the primary foraging range for black-capped petrels, which includes waters in and adjacent to the Florida Current and the Gulf Stream between north Florida and southern Virginia (Simons *et al.* 2013; Hass *et al.* 2014). Although the IUCN does not indicate that Canada is within the range of this species (IUCN 2016), the black-capped petrel may be considered an accidental transient within the waters of Nova Scotia (AC CDC 2016a) and has potential to irregularly occur within the Project Area.

Other IUCN-listed seabirds that have potential to occur within the offshore Project Area include ivory gull (*Pagophila eburnea*), razorbill (*Alca torda*), Atlantic puffin (*Fratercula arctica*), sooty shearwater (*Puffinus griseus*), and Leach's storm-petrel (*Oceanodroma leucorhoa*). Ivory gull is a neritic seabird that is occasionally observed in coastal areas of Nova Scotia during winter months. This species is listed as *endangered* on Schedule 1 of the federal SARA and is discussed in Section 5.2.8.4 of the EIS. Razorbill, Atlantic puffin, and Leach's storm-petrel all breed in the area and are also present during migration or overwintering. Sooty shearwaters do not breed in the region but pass through waters of the Scotian Shelf from the sub-Antarctic during the summer months. Additional information on occurrence of these species in association with the Scotian Shelf and Slope is available in Section 5.2.8 of the EIS and associated appendices.

Five of the IUCN-listed species are waterfowl that may occur in coastal waters of the RAA (Table 1). One of these species, common eider (*Somateria mollissima*) breeds in the region and is present in association with coastal features throughout the year. Three other species are not known to breed in Nova Scotia but have secure non-breeding populations: long-tailed duck (*Clangula hyemalis*), horned grebe (*Podiceps auritus*), and black scoter (*Melanitta nigra*). Although the status of white-billed diver (*Gavia adamsii*) within the region is uncertain, this species may be expected to occur infrequently in coastal environments. Information on use of the RAA by waterfowl is provided in Section 5.2.8 of the EIS; additional discussion on horned grebe is provided in response to IR-044.

Ten of the IUCN-listed species are shorebirds that are known, or have potential, to occur along the shoreline of the RAA (Table 1). Of these species, the piping plover (*Charadrius melodus*) is the only one which breeds in Nova Scotia. Red knot (*Calidris canutus*) and semipalmated sandpiper (*Calidris pusilla*) do not breed in Nova Scotia but are known to regularly occur in coastal areas during their fall migration. Black-tailed godwit (*Limosa limosa*), bar-tailed godwit (*Limosa lapponica*), Eurasian curlew (*Numenius arquata*), curlew sandpiper (*Calidris ferruginea*), buff-breasted sandpiper (*Tryngites subruficollis*), and northern lapwing (*Vanellus vanellus*) do not regularly occur within the region but are occasionally observed in coastal environments as accidental transients. Although the status of red-necked stint (*Calidris ruficollis*) within the region is uncertain, this species may be expected to only occur infrequently in coastal environments. Piping plover, red knot, and buff-breasted sandpiper are also listed under the federal *Species at Risk Act* and / or have been assessed by Committee on the Status of Endangered Wildlife in Canada; additional information on these species is provided in Section 5.2.8.4 of the EIS and in response to IR-44.

Other species listed on the IUCN Red List of Threatened Species could potentially occur within the offshore environment and other areas of the RAA as vagrants, but are expected to occur in low frequency and abundance. As discussed in Section 5.2.8.1 of the EIS, Sable Island attracts an unusually large number of vagrant species compared to other offshore islands on the Atlantic coast, most likely because its isolation makes it a rare landfall habitat and because it is located along frequent storm tracks (McLaren 1981).

Effects on bird species listed under the IUCN Red List of Threatened Species (IUCN 2016) that are identified in the RAA, or are identified Species at Risk, are as described in Sections 7.4.8, 8.5.3, and 10.2.5 of the EIS. Effects to species that are considered accidental vagrants within the RAA are expected to be lower in magnitude than described for many other migratory birds in the EIS because vagrants are unlikely to occur in important abundances near the Project Area. Although there is uncertainty regarding use of the RAA by the Bermuda petrel, and its small global population may make it especially vulnerable to interactions with offshore activities, available information sources do not suggest that it is a regular occurrence in the area. Although the Bermuda petrel may pass through the RAA for foraging purposes, it does not breed in the area and predominantly forages in other areas of the Atlantic, particularly areas to the south of the Project and around the Azores (Madeiros *et al.* 2014). Similarly, because the breeding and primary foraging range for black-capped petrels are restricted to more southern locations (Simons *et al.* 2013; Hass *et al.* 2012), the Project is unlikely to interact with an important proportion of this specie's population. Based on these considerations, routine project activities and accidental events are unlikely to result in residual effects to these, or other IUCN-listed species, beyond those currently characterized in Sections 7.4.8, 8.5.3, and 10.2.5 of the EIS.

Table 1 Marine-Related Birds of the Scotian Shelf and Slope Listed under the IUCN Red List of Threatened Species[1]

Common Name	Scientific Name(ACCDC)	IUCN Assessment[2]	Canadian Status[2]	Potential to Occur in Project Area[3]	AC CDC S-Rank (Nova Scotia)
Pelagic Seabirds					
Razorbill	*Alca torda*	Near Threatened	Native	Likely	S2B,S4N
Atlantic Puffin	*Fratercula arctica*	Vulnerable	Native	Likely	S3B,S5N
Black-capped Petrel	*Pterodroma hasitata*	Endangered	na	Likely	SNA (accidental transient)
Bermuda Petrel	*Pterodroma cahow*	Endangered	Uncertain	Likely	SU (unknown status)
Sooty Shearwater	*Puffinus griseus*	Near Threatened	Uncertain	Likely	S5N
Leach's Storm-petrel	*Oceanodroma leucorhoa*	Vulnerable	Native	Likely	S3B,S5M
Neritic Seabirds					
Ivory Gull	*Pagophila eburnea*	Near Threatened	Native	Likely	SNA (accidental transient)
Waterfowl					
Common Eider	*Somateria mollissima*	Near Threatened	Native	Unlikely	S3S4
Long-tailed Duck	*Clangula hyemalis*	Vulnerable	Native	Unlikely	S5N
Horned Grebe	*Podiceps auritus*	Vulnerable	Native	Unlikely	S4N
White-billed Diver	*Gavia adamsii*	Near Threatened	Native	Unlikely	SNA (unconfirmed, unknown status)
Black Scoter	*Melanitta nigra*	Near Threatened	Native	Unlikely	S4N
Shorebirds					
Black-tailed Godwit	*Limosa limosa*	Near Threatened	Vagrant	Unlikely	SNA (accidental transient)
Bar-tailed Godwit	*Limosa lapponica*	Near Threatened	Native	Unlikely	SNA (accidental transient)
Eurasian Curlew	*Numenius arquata*	Near Threatened	Vagrant	Unlikely	SNA (accidental transient)
Red Knot	*Calidris canutus*	Near Threatened	Native	Unlikely	S2M
Semipalmated Sandpiper	*Calidris pusilla*	Near Threatened	Native	Unlikely	S3M
Red-necked Stint	*Calidris ruficollis*	Near Threatened	Vagrant	Unlikely	SNA (unconfirmed, unknown status)
Curlew Sandpiper	*Calidris ferruginea*	Near Threatened	Vagrant	Unlikely	SNA (accidental transient)

Table 1 Marine-Related Birds of the Scotian Shelf and Slope Listed under the IUCN Red List of Threatened Species[1]

Common Name	Scientific Name(ACCDC)	IUCN Assessment[2]	Canadian Status[2]	Potential to Occur in Project Area[3]	AC CDC S-Rank (Nova Scotia)
Buff-breasted Sandpiper	*Tryngites subruficollis*	Near Threatened	Native	Unlikely	SNA (accidental transient)
Piping Plover	*Charadrius melodus*	Near Threatened	Native	Unlikely	S1B
Northern Lapwing	*Vanellus vanellus*	Near Threatened	Vagrant	Unlikely	SNA (accidental transient)

[1]Includes species with *native*, *vagrant*, or *uncertain* status in Canada (*i.e.*, *introduced* species excluded) which have been designated as *critically endangered*, *endangered*, *vulnerable*, or *near threatened* on the IUCN Red List of Threatened Species (IUCN 2016). Of exception, the Black-capped Petrel was not identified by the IUCN as occuring in Canada but has been included

[2]From IUCN (2016)

[3] Spatial boundaries of the Project Area are shown in Figure 5.2.26; potential occurrence considers known spatial and temporal use of the waters near the Project Area; Unlikely: generally restricted to coastline and nearshore waters; Likely: regular occurrence in offshore waters and may be expected to occur in the Project Area during the breeding season (*i.e.*, for feeding), migration, and/or overwintering.

References:

AC CDC. 2016a. Species Ranks. Available at: http://accdc.com/en/ranks.html. Date updated: December 5, 2016. Accessed: January, 2017.

AC CDC. 2016b. Understanding Ranks. Available at: http://www.accdc.com/enNew/rank-definitions.html. Accessed: January, 2017.

CWS [Environment and Climate Change Canada's Canadian Wildlife Service]. 2015. Eastern Canada Seabirds at Sea (ECSAS) and Programme Intégré de recherches sur les oiseaux pélagiques (PIROP) data for the Scotia Shelf. Data obtained for the Project via email August 18, 2015.

Hass, T., J. Hyman, and B.X. Semmens. 2012. Climate change, heightened hurricane activity, and extinction risk for an endangered tropical seabird, the black-capped petrel *Pterodroma hasitata*. Mar Ecol Prog Ser 454:251-261. https://doi.org/10.3354/meps09723

IUCN [International Union for Conservation of Nature and Natural Resources]. 2016. The IUCN Red List of Threatened Species. Version 2016-3. <www.iucnredlist.org>. Downloaded on 17 January 2017.

Madeiros, J., B. Flood, and K. Zufelt. 2014. Conservation and At-sea Range of Bermuda Petrel. North American Birds 67.4 (2014): 546-57. Available at: http://www.scillypelagics.com/BEPE_X.pdf

McLaren, I.A.1981. The Birds of Sable Island. Nova Scotian Institute of Science, Halifax, N.S.

Simons, T.R.; D.S. Lee; and J.C. Haney. 2013. Diablotin *Pterodroma hasitata*: a biography of the endangered Black-capped Petrel. Marine Orthinology, 41: 1-43. Available at: https://pubs.er.usgs.gov/publication/70154814

Information Request (IR) IR-044 (ECCC-IR-04)

Applicable CEAA 2012 effect(s): 5(1)(a)(iii) Migratory Birds; SARA 79(2) Species at risk

EIS Guidelines Reference: Part 2, 6.1.5 Species at risk and species of conservation concern; 6.3.6 Federal species at risk; 6.4 Mitigation; 6.6.1 Effects of potential accidents or malfunctions; 6.6.3 Cumulative effects assessment; 8.2 Monitoring

EIS Reference: 6.0 Environmental Effects Assessment and Methods; 7.0 Environmental Effects Assessment; 8.0 Accidental Events; 10.0 Cumulative Effects; 12.2 Follow-up and Monitoring

Context and Rationale: Under sub-section 79(2) of the *Species at Risk Act* (SARA), the Agency must ensure that adverse effects on all listed species are identified. This includes species of special concern and the critical habitat of extirpated, endangered and threatened species. If the Project is carried out, the Agency must ensure that measures are taken to avoid or lessen those effects and to monitor them. These measures must:

- be consistent with best available information including any Recovery Strategy, Action Plan or Management Plan in a final or proposed version; and
- respect the terms and conditions of the SARA regarding protection of individuals, residences, and critical habitat of extirpated, endangered, or threatened species.

The Agency relies on information from the proponent to carry out these responsibilities.

For species which are not yet listed under SARA, but have been assessed and designated by COSEWIC, it is best practice to consider these species in EA as though they were listed under SARA.

ECCC has advised that Eastern Lilaeopsis (SARA-listed, Special Concern), Buff-breasted Sandpiper (COSEWIC, Special Concern), Bank Swallow (COSEWIC, Threatened), Sable Island Sweat Bee (COSEWIC, Threatened), and Eastern Baccharis (COSEWIC, Threatened) are not assessed in the EIS, but require consideration.

Specific Question or Request: Describe the use of the assessment area by Buff-breasted Sandpiper and Bank Swallow, and the presence in the assessment area of Eastern Lilaeopsis, Sable Island Sweat Bee, and Eastern Baccharis. Identify the potential effects of the Project on these species, including effects of accidents and cumulative effects, as well as measures to mitigate effects, and any follow-up monitoring proposed.

Response: Information on the presence and / or use of the assessment area by buff-breasted sandpiper (*Tryngites subruficollis*), bank swallow (*Riparia riparia*), horned grebe (Podiceps auritus cornutus), Sable Island sweat bee (*Lasioglossum sablense*), eastern lilaeopsis (*Lilaeopsis chinensis*), and eastern baccharis (*Baccharis halimifolia*) is provided in the following sections. The potential effects of the Project on these species is also outlined.

Horned Grebe

The horned grebe is a relatively small waterbird that occurs in coastal waters of the Scotian Shelf during winter. There are two known subspecies of the horned grebe; one (*P. a. auritus*) which breeds in Eurasia, and another (*P. a. cornutus*) which breeds in North America (COSEWIC 2009). The North American subspecies is designated as a species of special concern by COSEWIC, and includes both a western population that breeds from British Columbia to northwestern Ontario, and a small population on the Magdalen Islands. The total population is estimated to be between 200,000 and 500,000 individuals, with the Magdalen Islands population estimated at an average of 15 adults (COSEWIC 2009). Birds from both populations may overlap on the wintering grounds on the east coast of Canada, and data from Christmas Bird Counts suggests that approximately 47% of the western population winters on the east coast of North America (COSEWIC 2009). Although ECSAS and PIROP data obtained for the Project contain only one horned grebe record on the Scotia Shelf (*i.e.*, from March 31, 1988) it is known to be a fairly common transient in coastal waters off Nova Scotia and to be uncommonly observed in winter (Tufts 1986). It has been assigned a general status rank of secure within Nova Scotia and a ranking of S4N (AC CDC 2016a), indicating that the nonbreeding population is present and apparently secure (AC CDC 2016b).

Loss and degradation of wetlands to agriculture and development are considered the primary threats to the horned grebe. The small size of the Magdalen Islands population makes it especially vulnerable to demographic, environmental and genetic factors (COSEWIC 2009). The loss of wetlands, contaminant poisoning, incidental take during the waterfowl hunt, petroleum spills, recreational activities, commercial fisheries, adverse weather, and predation and competition with the pied-billed grebe (*Podilymbus podiceps*) are all considered threats to the Magdalen Islands population (Environment Canada 2013). Oil spills on the wintering grounds are considered a potential threat to horned grebe populations (COSEWIC 2009).

As identified in the recovery strategy for the Magdalen Islands Population (Environment Canada 2013), the five-year population and distribution objectives for the horned grebe are to "maintain and, as far as possible, increase the current horned grebe, Magdalen Islands population, size and distribution". The long-term objectives are to "increase the size and distribution of the population so that it occupies all sectors that it occupied prior to 2005." Recovery efforts have largely focused on the identification and protection of critical habitat for this species; which is considered sufficient for achieving short- and long-term population and distribution objectives (Environment Canada 2013). Critical habitat has been identified as "all potential nesting ponds and any pond where the species was observed feeding or is suspected of having nested between 1995 and 2011" and includes 52 ponds in the Magdalen Islands (Environment Canada 2013).

Buff-Breasted Sandpiper

The buff-breasted sandpiper breeds in tundra habitat of the Canadian Arctic but is known as an accidental transient within Nova Scotia (AC CDC 2016a) and has potential to irregularly occur along the coastline of the Regional Assessment Area (RAA) during migration. Although adult buff-breasted sandpipers migrate south to the wintering grounds through the interior of North American, juveniles often travel along the Atlantic and Pacific coasts. Migration north to the breeding grounds is concentrated through the central parts of the United States and Canada, with a large proportion of the population passing through the prairie provinces (COSEWIC 2012).

This buff-breasted sandpiper is designated as a species of special concern by COSEWIC and a recent global estimate of its population is 56,000 birds, with approximately 42,000 likely breeding in the Canadian Arctic (COSEWIC 2012). Its population has suffered severe declines because of hunting in the late 1800s and early 1900s; and by the 1920s it was on the brink of extinction. Its abundance increased following a ban on hunting in North America, but numbers remain much lower than historic levels. Although there is evidence for a population decline in recent decades, this species is difficult to monitor effectively and data necessary to estimate population trends are currently lacking (COSEWIC 2012).

Habitat loss, fragmentation and degradation are considered the primary threats to the buff-breasted sandpiper (COSEWIC 2012). Important breeding habitat overlaps with areas of mineral, coal, oil and gas development. Outside the breeding period it is primarily associated with grasslands, and loss and degradation of these habitats is a threat to both migrating and overwintering birds (COSEWIC 2012). The regular use of croplands by this species may expose it to agrochemicals and agricultural practices may decrease food habitat availability. The development of wind energy projects along the North American migratory route is also considered to have potential to adversely affect this species. Furthermore, climate change is expected to pose several threats to this species; including to juveniles migrating along the Atlantic coast where more frequent and intense storms could increase mortality (COSEWIC 2012).

Bank Swallow

Bank swallows may be expected to nest along the coastline and to forage over coastal environments of the RAA. They breed in all Canadian provinces and territories, except Nunavut, and primarily winter in South America. Bank swallows nest in a variety of natural and artificial sites with vertical banks; including riverbanks, lake and ocean bluffs, aggregate pits, road cuts, and stock piles of soil (COSEWIC 2013). Sand-silt substrates are preferred for excavating nest burrows and breeding sites tend to be somewhat ephemeral because of erosion (COSEWIC 2013). Nesting areas are often located near open habitats that are used for aerial foraging and large wetlands are used as communal nocturnal roost sites during post-breeding, migration, and wintering periods (COSEWIC 2013).

Bank swallows have experienced considerable long-term population declines and are designated as a threatened species by COSEWIC. Over the last 40 years the Canadian population has experienced a loss of approximately 98% (COSEWIC 2013). The reasons for declines are not well understood, but cumulative effects from several factors are considered likely. Threats that are contributing to the decline of this species include loss of breeding and foraging habitat, destruction of nests during aggregate excavation, collision with vehicles, effects of pesticide use on prey abundance, and climate change (COSEWIC 2013). Threats during migration and on the wintering grounds are largely unknown but may be important contributing factors (COSEWIC 2013). Within Nova Scotia, bank swallows are assigned a ranking of S2S3B by the AC CDC (2016a), indicating that it's breeding population may be considered imperiled to vulnerable as a result of restricted range, few populations, declines, or other factors (AC CDC 2016b).

Sable Island Sweat Bee

The Sable Island sweat bee is globally endemic to Sable Island, Nova Scotia, where it occurs as a single isolated population with a very small range (COSEWIC 2014). The species is a ground-nester and visits a variety of flowering plants for pollen and nectar. Approximately 13 km^2 of vegetated area on Sable Island provides foraging and nesting habitat for this species. Vegetated areas on Sable Island encompass a few distinct plant communities, the most abundant of which are marram-forb grasslands, sparse grass lands and heath (COSEWIC 2014). The size of the Sable Island sweat bee population is currently unknown but data indicate that it is the least commonly collected of four bee species that occur on the island (COSEWIC 2014).

The Sable Island sweat bee is designated as a threatened species by COSEWIC and its population is considered to have likely decreased over time because of loss of vegetation on Sable Island (COSEWIC 2014). Historical human influence may have reduced the abundance and diversity of flowering vegetation on the island. The potential for increased frequency and severity of storms, and sea level rise because of climate change are expected to be important factors influencing the quality and quantity of habitat for this species. Although current levels of human activity are minimal because of the island's isolated location and control of visitors, eco-tourism is considered a potential future threat to this species through the introduction of invasive plants or non-native bees (COSEWIC 2014).

Eastern Lilaeopsis

Eastern lilaeopsis is a small perennial herb that is associated with mud slopes in the intertidal zone along estuary shorelines and it has been designated as a species of special concern by COSEWIC (2004). Although it occurs along the Atlantic and Gulf coasts from Maine to Louisiana, its Canadian population is restricted to three estuaries along the southern shore in Nova Scotia (*i.e.*, the Medway, Tusket, and LaHave river estuaries), all of which occur within the RAA. Although this species only occupies a limited geographical area in Canada, it is abundant where present (COSEWIC 2004). The rarity of this species in Canada and its associated conservation status is not a result of human influence, but reflects it being at its northernmost edge of its range within the region (COSEWIC 2004).

No important declines in the Canadian population of eastern lilaeopsis have been documented over the past 15 years and this species does not appear to be subject to any imminent threats. However, future shoreline development or degradation is considered to have potential to destroy extant populations (COSEWIC 2004). Furthermore, sea level rise because of climate change has potential to act as a stressor to this species over the long term.

Eastern Baccharis

Eastern baccharis is shrub of the Atlantic Coastal Plain Flora that is designated as a *threatened* species by COSEWIC and occurs in coastal habitats (COSEWIC 2011) of the RAA. Although this species is present throughout much of eastern United States, as well as Cuba and the Bahamas, the Canadian populations is restricted to a 25 km stretch of coast in southwestern Nova Scotia. In other parts of its range it is found in a variety of moist or disturbed habitats, but its Nova Scotian population is restricted to the open margins of well-developed salt marshes within harbours or bays that provide protection from wind and waves. At these locations it occurs in or near the transition zone to coastal forest that are dominated by graminoids and shrubs (COSEWIC 2011).

Nova Scotia supports approximately 2,850 mature eastern baccharis plants distributed among three populations (*i.e.*, Tusket River Estuary, Surettes Island, and Morris and Roberts Islands), with an additional site (West Pubnico) having only one known individual (COSEWIC 2011). These populations are divided into nine subpopulations, two of which support approximately 88% of the Canadian population. Their dominance by large, mature individuals suggests that this species has a long-term occurrence in Nova Scotia (COSEWIC 2011). Population trends for this species are not documented but are considered stable, with impacts from only relatively small and localized developments having occurred. However, its coastal habitat is declining because of shoreline development and this is considered to be an active or imminent threat to some populations, and may be a future threat in others (COSEWIC 2011). The extent of occurrence of this species is expected to be largely climate controlled, and its presence along the southwestern coast of Nova Scotia reflects the moderating influence of oceanic currents in that zone (COSEWIC 2011). Climate change, including rising sea level and increasing and more frequent storm surges, are considered threats to eastern baccharis individuals and its habitat (COSEWIC 2011).

Potential Effects, Mitigation, and Follow-Up Monitoring for SOCC

Project residual environmental effects described in Sections 7.4.8.3, 8.5.33, and 10.2.5 of the EIS for migratory birds remain unchanged with further consideration of buff-breasted sandpiper, bank swallow, and horned grebe. Because of the coastal distribution of these species, they are unlikely to interact with routine Project operations in the offshore environment. Interactions during supply and servicing operations (including helicopter transportation and platform supply vessel (PSV) operations) are possible in nearshore waters but effects are not predicted to be different than those already described. A well blowout incident has potential to result in adverse changes to risk of mortality or physical injury and habitat quality and use for these species, and is considered to have potential to result in a significant effect to Migratory Birds. Similarly, although routine Project operations are not expected to interact with Sable Island sweat bee, eastern lilaeopsis, or eastern baccharis, these species and important habitat elements could be adversely affected by a well blowout incident.

No new mitigative measures or follow-up monitoring is proposed for these species beyond that already described in the EIS. Further discussion and characterization of the expected results of accidental events, particularly a well blowout incident, on Species at Risk is provided in response to IR-050.

References:

AC CDC. 2016a. Species Ranks. Available at: http://accdc.com/en/ranks.html. Date updated: December 5, 2016. Accessed: January, 2017.

AC CDC. 2016b. Understanding Ranks. Available at: http://www.accdc.com/enNew/rank-definitions.html. Accessed: January, 2017.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2004. COSEWIC assessment and update status report on the eastern lilaeopsis *Lilaeopsis chinensis* in Canada. Ottawa. vi + 18 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2009. COSEWIC assessment and status report on the Horned Grebe *Podiceps auritus*, Western population and Magdalen Islands population, in Canada. Ottawa. vii + 42 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2011. COSEWIC assessment and status report on the Eastern Baccharis *Baccharis halimifolia* in Canada. Ottawa. x + 31 pp. (www.registrelep-sararegistry.gc.ca/default_e.cfm).

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2012. COSEWIC assessment and status report on the Buff-breasted Sandpiper *Tryngites subruficollis* in Canada. Ottawa. x + 44 pp. (www.registrelep-sararegistry.gc.ca/default_e.cfm).

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2013. COSEWIC assessment and status report on the Bank Swallow *Riparia riparia* in Canada. Ottawa. ix + 48 pp. (www.registrelep-sararegistry.gc.ca/default_e.cfm).

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2014. COSEWIC assessment and status report on the Sable Island Sweat Bee *Lasioglossum sablense* in Canada. Ottawa. ix + 38 pp. (www.registrelep-sararegistry.gc.ca/default_e.cfm).

Environment Canada. 2013. Recovery Strategy for the Horned Grebe (*Podiceps auritus*), Magdalen Islands Population, in Canada, Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa. iv + 19 pp.

Tufts, R.W. 1986. Birds of Nova Scotia. Numbus Publishing Ltd. and the Nova Scotia Museum. Halifax, NS.

Information Request (IR) IR-045 (ECCC-IR-08)

Applicable CEAA 2012 effect(s): 5(1)(a)(iii) Migratory Birds

EIS Guidelines Reference: Part 2, 6.5 Significance of residual effects

EIS Reference: 7.4.5 Criteria for Characterizing Residual Environmental Effects and Determining Significance

Context and Rationale: The EIS states that "for the purposes of this effects assessment, a significant adverse residual environmental effect on Migratory Birds is defined as a project-related environmental effect that:

- causes a decline in abundance or change in distribution of migratory birds, within the RAA, such that natural recruitment may not re-establish the population(s) to its original level within one generation;
- jeopardized the achievement of self-sustaining population objectives or recovery goals for listed (SAR) species; or
- results in permanent and irreversible loss of critical habitat as defined in a recovery plan or an action strategy for a listed (SAR) species."

Additional information on the choice of thresholds is required.

Specific Question or Request: Provide a rationale for the use of these significance thresholds for Migratory Birds proposed in the EIS, including information on why effects less than the threshold described would not be considered significant by the proponent.

For the third bullet, clarify what is meant by "permanent and irreversible loss of critical habitat".

Describe how an effect that resulted in the abandonment or nesting failure of a migratory bird species at risk or seabird or waterbird colony would be considered in light of these significance thresholds.

Response: The criteria for established thresholds for determining the significance of residual adverse environmental effects is included in Section 6.2.3.5 of the Environmental Impact Statement (EIS). As discussed in Section 6.2.3.5, criteria are defined using available information, scientific literature, applicable regulatory documents, environmental standards, guidelines or objectives where available and the professional judgement of the Environmental Assessment (EA) Study Team. The definition of significance is intended to cover a wide range of potential effects, with the thresholds establishing a level beyond which a residual environmental effect would be considered an unacceptable change by regulators and stakeholders. By definition, any adverse change to the valued component (VC) that would not meet the threshold would be considered not significant.

The significance definition for Migratory Birds (Section 7.4.5 of the EIS) is primarily linked to statutory and policy requirements, including the *Species at Risk Act* (second and third bullets above). For secure species (first bullet above), population-based thresholds were applied using a qualitative approach based primarily on professional opinion supported by relevant scientific literature, where available (*e.g.*, effects of lighting to migratory birds, or re-establishment of nesting populations).

For the purpose of this environmental assessment, a "permanent and irreversible loss of critical habitat" refers to the disturbance of critical habitat itself and not to other factors that could prevent a listed species from occupying that habitat. However, it is recognized that abandonment of a colony by a species at risk could result in a significant effect, even if the Project does not result in permanent and irreversible loss of critical habitat itself. A change in the use of critical habitat, either temporarily or permanently, could result in a significant effect depending on the exact nature of the change. Therefore, the inclusion of the following criteria in the significance definition was intended to capture this type of effect: "jeopardizes the achievement of self-sustaining population objectives or recovery goals for listed (SAR) species". The abandonment of nesting habitat could also result in a decline in abundance or change in distribution of migratory birds, such that natural recruitment may not reestablish the population(s) to its original level within one generation, which is also captured in the existing definition of significance (first bullet).

Information Request (IR) IR-046 (ECCC-IR-09)

Applicable CEAA 2012 effect(s): 5(1)(a)(iii) Migratory Birds

EIS Guidelines Reference: Part 2, 6.5 Significance of residual effects

EIS Reference: 6.2.5 Assessment of Project-Related Environmental Effects; 7.4.8.3 Characterization of Residual Project-Related Environmental Effects; 7.4.9 Determination of Significance; 8.5.3.3 Characterization of Residual Project-Related Environmental Effects; 8.5.3.4 Determination of Significance; 8.5.4.3 Characterization of Residual Project-Related Environmental Effects; 8.5.4.4 Determination of Significance; 10.2.5.1 Change in Risk of Mortality or Injury; 10.2.5.3 Summary of Cumulative Environmental Effects on Migratory Birds

Context and Rationale: In Table 6.2.2, the EIS states that reversibility of residual environmental effects "Pertains to whether a measurable parameter or the VC can return to its existing condition after the project activity ceases". It then defines "Reversible" as "will recover to baseline conditions before or after project completion (well abandonment)."

Based on this definition, ECCC has advised that it is not clear how the proponent then comes to conclusions regarding reversibility of residual environmental effects and cumulative effects on birds and special areas.

The proponent states that the effects on migratory birds due to the presence and operation of the MODU, waste management, and supply and service operations would be reversible.

The proponent states that the effects on migratory birds and special areas of each of its modelled spill scenarios (*i.e.* 10-barrel diesel spill, 100-barrel diesel spill, PSV diesel spill, well blowout incident, SBM spill) would be reversible.

The proponent states that the cumulative effects on migratory birds due to a change in risk of mortality or physical injury would be reversible.

Seabirds have long life spans and low reproductive rates. For instance, Leach's Storm-Petrels may be one of the most numerous seabirds in the Northwest Atlantic; however, concern has been raised recently as to the species' status in Eastern Canada. Specifically, many of the largest colonies are showing substantial population declines (Wilhelm *et al.* 2015; CWS, unpublished data). In addition, recent studies are revealing that adult survival is low for Leach's Storm-Petrels at breeding colonies in both Nova Scotia and Newfoundland (Fife *et al.* 2015; A. Hedd, unpublished data) which is also alarming as Leach's Storm- Petrels have long life spans but low reproductive rates, resulting in slow population recoveries.

Globally Endangered (IUCN Red List) seabirds, the Bermuda Petrel and Black-capped Petrel, both protected under the *Migratory Birds Convention Act*, have been observed in slope waters off Nova Scotia. Both species have very small global population sizes and restricted ranges, so are extremely vulnerable.

Specific Question or Request: Clarify whether and how the conclusions described above considered the life history of seabirds. Explain how effects of spills on migratory birds, including bird species at risk and their critical habitat, and special areas, including important bird areas, would be reversible (*i.e.* would "recover to baseline conditions before or after project completion (well abandonment))".

Response: It is acknowledged that many seabirds have long life spans but low reproductive rates, and that these life history characteristics result in slow population recoveries. Furthermore, it is acknowledged that the populations of some seabird species (*e.g.*, Bermuda petrel and Leach's storm-petrel) may be especially vulnerable to interactions with the Project because of their low global abundance or because they are experiencing declines because of other factors. Although routine Project operations are unlikely to result in significant adverse effects to migratory birds or special areas, the potential for significant effects has been identified in the case of a well blowout incident. These determinations have been made in consideration of the life history of seabirds that have potential to interact with the Project, the presence of Species at Risk and their critical habitat, Important Bird Areas and other special areas.

Residual effects of the presence and operation of the mobile offshore drilling unit (MODU) (*i.e.*, particularly interactions caused by lighting and flaring) and accidental diesel spills have been identified in the EIS as likely to result in measurable changes to migratory birds that do not pose a risk to population viability (*i.e.*, an effect with a magnitude of Moderate). These effects are considered reversible but it is acknowledged that there is potential that recovery may not occur until after Project completion (well abandonment).

In the event of a worst-case well blowout incident, the Project is considered to have potential to result in measurable changes that could exceed the limits of natural variability and may affect long-term population viability (*i.e.*, an effect with a magnitude of High). Although unlikely to occur, irreversible Project residual effects to certain migratory bird populations could occur if an important proportion of its population were affected. In particular, the small size of the Bermuda petrel's global population makes it especially vulnerable to changes to risk of mortality or physical injury. However, available information sources suggest that a low proportion of the population of this species is likely to occur within the Regional Assessment Area at any given time because it predominantly forages in other areas of the Atlantic, particularly to the south of the Project Area and around the Azores (Madeiros *et al.* 2014). However, in consideration of the potential for a well blowout incident to result in effects that could affect the long term population viability of some migratory bird species, the reversibility of a well blowout incident on migratory birds and special areas, as characterized in Sections 8.5.3.4 and 8.5.4.4 is adjusted from "reversible" to "reversible – irreversible".

References:

Madeiros, J., B. Flood, and K. Zufelt. 2014. Conservation and At-sea Range of Bermuda Petrel. North American Birds 67.4 (2014): 546-57. Available at: http://www.scillypelagics.com/BEPE_X.pdf

Information Request (IR) IR-047 (ECCC-IR-10)

Applicable CEAA 2012 effect(s): 5(1)(a)(iii) Migratory Birds

EIS Guidelines Reference: Part 2, 6.6.1 Effects of potential accidents or malfunctions

EIS Reference: 8.5.3.1 Project Pathways for Effects

Context and Rationale: As stated in the subsection on effects of SBM spills, O'Hara and Morandin (2010) showed effects of sub-visible sheens on the microstructure of feathers of pelagic seabirds. ECCC has advised that this provides a plausible link between operational discharges of hydrocarbons and increased seabird mortality.

Specific Question or Request: Clarify if the results of O'Hara and Morandin (2010) were considered in the analysis of effects of hydrocarbons on migratory birds. If not, provide updated analysis as necessary.

Response: The results of O'Hara and Morandin (2010) were considered in the effects assessment of operational discharges of synthetic-based muds (SBM) on migratory birds in Section 7.4.8.3 of the Environmental Impact Statement (EIS), and for a SBM spill in Section 8.5.3.1. Additional discussion regarding the results of O'Hara and Morandin (2010) on the effects assessment is provided in the response to IR-017.

References:

O'Hara, P.D. and Morandin, L.A. 2010. Effects of sheens associated with offshore oil and gas development on the feather microstructure of pelagic seabirds. Marine Pollution Bulletin, 60: 672-278.

Information Request (IR) IR-048 (ECCC-IR-13)

Applicable CEAA 2012 effect(s): 5(1)(a)(iii) Migratory Birds

EIS Guidelines Reference: Part 2, 6.1.4 Migratory birds and their habitat

EIS Reference: 5.2.8.2 Seasonal Distribution of Migratory Birds in Association with the Scotian Shelf and Slope

Context and Rationale: The EIS states that "information on the distribution and abundance of marine birds in association with the Scotian Shelf and Slope was primarily obtained from the PIROP (Programme Intégré de recherches sur les oiseaux pélagiques) and ECSAS (Eastern Canada Seabirds at Sea) databases." Because the ECSAS program is ongoing, it is not clear what years were included in the data summary.

Note that Environment and Climate Change Canada's Canadian Wildlife Service (CWS) should be referenced as the source for these databases.

Specific Question or Request: Clarify the years encompassed in the data summary, and when the ECSAS data was accessed.

Response: The years encompassed in the ECSAS data summary are 2001 – 2015. Data was obtained from CWS via email on August 18, 2015.

Information Request (IR) IR-049

Applicable CEAA 2012 effect(s): 5(1)(a), 5(1)(b), 5(2)(a)

EIS Guidelines Reference: Part 2, 6.5 Significance of residual effects

EIS Reference: 7.5.5 Criteria for Characterizing Residual Environmental Effects and Determining Significance

Context and Rationale: The EIS states that "A significant adverse residual environmental effect on special areas is defined as a project-related environmental effect that:

- alters the valued habitat physically, chemically or biologically, in quality or extent, to such a degree that there is a decline in abundance lasting more than one generation of key species (for which the Special Area was designated) or a change in community structure, beyond which natural recruitment (reproduction and immigration from unaffected areas) would not sustain the population or community in the special area and would not return to its original level within one generation; or
- results in permanent and irreversible loss of critical habitat as defined in a recovery plan or an action strategy."

Additional information on the choice of thresholds is required.

Specific Question or Request: Provide a rationale for the use of these significance thresholds for special areas proposed in the EIS, including information on why effects less than the threshold described would not be considered significant by the proponent.

Response: The criteria for established thresholds for determining the significance of residual adverse environmental effects is included in Section 6.2.3.5 of the Environmental Impact Statement (EIS). As discussed in Section 6.2.3.5, criteria are defined using available information, scientific literature, applicable regulatory documents, environmental standards, guidelines or objectives where available and the professional judgement of the Environmental Assessment (EA) Study Team. The definition of significance is intended to cover a wide range of potential effects, with the thresholds establishing a level beyond which a residual environmental effect would be considered an unacceptable change by regulators and stakeholders. By definition, any change to the valued component (VC) that would not meet the threshold would be considered not significant.

The significance definition for Special Areas (Section 7.5.5 of the EIS) is primarily linked to the Fish and Fish Habitat, Marine Mammals and Sea Turtles, and Migratory Birds VCs, as Special Areas are often designated to protect species at risk and species of conservation concern. The definition takes into consideration statutory and policy requirements (*i.e.*, *Species at Risk Act*). For secure species (first bullet above), population- based thresholds were applied using a qualitative approach based primarily on professional opinion supported by relevant scientific literature, where available (*e.g.*, re-establishment of benthic environments).

Information Request (IR) IR-050

Applicable CEAA 2012 effect(s): 5(1); 79(2) - *Species at Risk Act*

EIS Guidelines Reference: Part 2, 6.3.6 Federal species at risk; 6.4 Mitigation

EIS Reference: Table 6.2.1 Selection of Valued Components

Context and Rationale: Effects on species at risk have been assessed by the proponent within other more general valued components. For example, effects on fish species at risk have been analyzed in the context of effects on fish in general, and likewise for marine mammals, sea turtles and migratory birds. There is no stand-alone section containing an analysis of species at risk.

The Agency is the responsible authority for the environmental assessment of the Project and therefore must identify the adverse effects of the Project on listed wildlife species and their critical habitat and, if the Project is carried out, and must ensure that measures are taken to avoid or lessen those effects and to monitor them. The measures must be consistent with any applicable recovery strategy and action plans. Furthermore, in recognition of the potential risks to COSEWIC species, the Agency requires the assessment of effects on these species as well, considering what adverse effects could occur and what measures could be taken to avoid or lessen effects.

Specific Question or Request: Provide a stand-alone assessment of effects on species at risk and species listed by COWESIC, drawing on information regarding these species included in the fish and fish habitat, marine mammals and sea turtles, and migratory birds valued component assessments. The analysis must:

- identify the adverse effects of the Project on species and their critical habitat;
- describe measures that would be taken to avoid or lessen effects; and
- describe measures to monitor effects, including whether adjustments would be made to mitigation measures, if needed.

The summary should clearly identify for which species there exist recovery strategies or action plans, including critical habitat and how these have been incorporated into the assessment. A summary table should also be provided, similar to what has been provide for valued components (*e.g.* Table 7.2.6).

Response: In order to reduce redundancy and improve efficiency of the Environmental Impact Statement (EIS), Species at Risk (SAR) and Species of Conservation Concern (SOCC) were not presented as a stand-alone valued component (VC) but instead were assessed under their respective biological VCs (Fish and Fish Habitat VC (Section 7.2), Marine Mammals and Sea Turtles VC (Section 7.3), and the Migratory Birds VC (Section 7.4)).

Table 1 summarizes the SAR/SOCC with potential to occur in the Regional Assessment Area (RAA) and notes whether a recovery strategy has been developed or critical habitat has been defined for the species. A summary of predicted effects, and proposed mitigation and monitoring for SAR and SOCC is presented below. For more information and context, please refer to the respective VCs in the EIS as referenced above.

Table 1 Species at Risk and/or of Conservation Concern Potentially Occurring on the Scotian Shelf and Slope

Common Name	Scientific Name	SARA Schedule 1 Status	COSEWIC Designation[1]	Recover Strategy or Action Plan	Critical Habitat in RAA	Potential for Occurrence in the Project Area[2]	Timing of Presence
Marine Fish Species							
Acadian redfish (Atlantic population)	*Sebastes fasciatus*	Not Listed	Threatened	No	No	Low	Year-round
American eel	*Anguilla rostrata*	Not Listed	Threatened	No	No	Transient	November -Silver eel out migration from NS March to July - Larvae and glass eels on the Slope and Shelf
American plaice (Maritime population)	*Hippoglossus platessoides*	Not Listed	Threatened	No	No	Low	Year-round
Atlantic bluefin tuna	*Thunnus thynnus*	Not Listed	Endangered	No	No	High	June to October
Atlantic cod (Laurentian South population)	*Gadus morhua*	Not Listed	Endangered	No	No	Low	Year-round
Atlantic cod (Southern population)		Not Listed	Endangered	No	No	Low	Winter – Deep water of Browns and LaHave Banks Summer- Southern Northwest Channel, shallow waters of Browns and LaHave Banks
Atlantic salmon (Outer Bay of Fundy population)	*Salmo salar*	Not Listed	Endangered	No	No	Transient	March to November
Atlantic salmon (Inner Bay of Fundy population)		Endangered	Endangered	Yes	No	Transient	March to November

Table 1 Species at Risk and/or of Conservation Concern Potentially Occurring on the Scotian Shelf and Slope

Common Name	Scientific Name	SARA Schedule 1 Status	COSEWIC Designation[1]	Recover Strategy or Action Plan	Critical Habitat in RAA	Potential for Occurrence in the Project Area[2]	Timing of Presence
Atlantic salmon (Eastern Cape Breton population)		Not Listed	Endangered	No	No	Transient	March to November
Atlantic salmon (Nova Scotia Southern Upland population)		Not Listed	Endangered	No	No	Transient	March to November
Atlantic sturgeon (Maritimes population)	*Ancipenser oxyrinchus*	Not Listed	Threatened	No	No	Low	Year-round
Atlantic wolffish	*Anarhichas lupus*	Special Concern	Special Concern	Yes	No	Low	Year-round
Basking shark (Atlantic population)	*Cetorhinus maximus*	Not Listed	Special Concern	No	No	Low to Moderate	Year-round
Blue shark (Atlantic population)	*Priomace glauca*	Not Listed	Special Concern	No	No	Moderate to High	June to October
Cusk	*Brosme brosme*	Not Listed	Endangered	No	No	Low to Moderate	Year-round
Deepwater redfish (Northern population)	*Sebastes mentalla*	Not Listed	Threatened	No	No	Low	Year-round
Northern wolffish	*Anarhichas denticulatus*	Threatened	Threatened	Yes	No	Low	Year-round
Porbeagle shark	*Lamna nasus*	Not Listed	Endangered	No	No	High	Year-round
Roughhead grenadier	*Macrourus berglax*	Not Listed	Special Concern	No	No	Moderate	Year-round
Roundnose grenadier	*Coryphaenoides rupestris*	Not Listed	Endangered	No	No	Moderate to High	Year-round
Shortfin mako	*Isurus oxyrinchus*	Not Listed	Threatened	No	No	Moderate	July to October
Smooth skate (Laurentian-Scotian population)	*Malacoraja senta*	Not Listed	Special Concern	No	No	Moderate	Year-round

Table 1 Species at Risk and/or of Conservation Concern Potentially Occurring on the Scotian Shelf and Slope

Common Name	Scientific Name	SARA Schedule 1 Status	COSEWIC Designation[1]	Recover Strategy or Action Plan	Critical Habitat in RAA	Potential for Occurrence in the Project Area[2]	Timing of Presence
Spiny dogfish (Atlantic population)	*Squalus acanthias*	Not Listed	Special Concern	No	No	High	Year-round
Spotted wolffish	*Anarhichas minor*	Threatened	Threatened	Yes	No	Low	Year-round
Striped bass (Southern Gulf of St. Lawrence population)	*Morone saxatilis*	Not Listed	Special Concern	No	No	Low	June to October
Striped bass (Bay of Fundy population)		Not Listed	Endangered	No	No	Low	
Thorny skate	*Amblyraja radiate*	Not Listed	Special Concern	No	No	Low to Moderate	Year-round
White shark	*Carcharodon Carcharias*	Endangered	Endangered	No	No	Low	June to November
White hake	*Urophycis tenuis*	Not Listed	Special	No	No	Moderate	Year-round
Winter Skate (Eastern Scotian Shelf population)	*Leucoraja ocellata*	Not Listed	Endangered	No	No	Moderate to High	Year-round
Marine Mammal Species							
Blue whale (Atlantic population)	*Balaenoptera musculus*	Endangered	Endangered	Yes	No	Moderate	Summer to Fall
Fin whale (Atlantic Population)	*Balaenoptera physalus*	Special Concern	Special Concern	Yes	No	High	Year- round (highest concentrations in Summer)
North Atlantic right whale	*Eubalaena glacialis*	Endangered	Endangered	Yes	Grand Manan and Roseway Basins	Low	Summer
Harbour porpoise (Northwest Atlantic population)	*Phocoena phocoena*	Not Listed	Special Concern	No	No	Low	Summer to Fall
Killer whale	*Orcinus orca*	Not Listed	Special Concern	No	No	Low to Moderate	Summer

Table 1 Species at Risk and/or of Conservation Concern Potentially Occurring on the Scotian Shelf and Slope

Common Name	Scientific Name	SARA Schedule 1 Status	COSEWIC Designation[1]	Recover Strategy or Action Plan	Critical Habitat in RAA	Potential for Occurrence in the Project Area[2]	Timing of Presence
Northern bottlenose whale (Scotian Shelf Population)	*Hyperoodon ampullatus*	Endangered	Endangered	Yes	Zone 1 of the Gully Marine Protected Area Haldimand and Shortland Canyon in water depths > 500 m.	Low	Year-round
Sowerby's beaked whale	*Mesoplodon bidens*	Special Concern	Special Concern	Yes	No	Low	Year-round
Sea Turtle Species							
Leatherback sea turtle	*Dermochelys coriacea*	Endangered	Endangered	Yes	No	High	April to December
Loggerhead sea turtle	*Caretta caretta*	Not Listed	Endangered	No	No	High	April to December
Migratory Bird Species							
Ivory Gull	*Pagophila eburnea*	Endangered	Endangered	Yes	No	Moderate to High	Winter
Roseate Tern	*Sterna dougallii*	Endangered	Endangered	Yes	Sable Island Bird Sanctuary Sable Island National Park Reserve Country Island The Brothers (North and South Border Islands)	High	May to September (breed June – July)

Table 1 Species at Risk and/or of Conservation Concern Potentially Occurring on the Scotian Shelf and Slope

Common Name	Scientific Name	SARA Schedule 1 Status	COSEWIC Designation[1]	Recover Strategy or Action Plan	Critical Habitat in RAA	Potential for Occurrence in the Project Area[2]	Timing of Presence
Bank Swallow	*Riparia riparia*	Not Listed	Threatened	Yes	No	Low	May to September (breed May to August)
Barrows Goldeneye	*Bucephala islandica*	Special Concern	Special Concern	Yes	No	Low	Winter
Buff-breasted Sandpiper	*Tryngites subruficollis*	Not Listed	Special Concern	Yes	No	Low	Spring and Fall
Harlequin Duck	*Histrionicus histrionicus*	Special Concern	Special Concern	Yes	No	Low	September to May
Horned Grebe	*Podiceps auritus*	Not Listed	Special Concern	Yes	No	Low	Winter
Piping Plover (*melodus* subspecies)	*Charadrius melodus melodus*	Endangered	Endangered	Yes	Refer to Recovery Strategy	Low	Late March to September (breeds May to July)
Red Knot (*rufa* ssp)	*Calidris canutus rufa*	Endangered	Endangered	Yes	No	Low	Spring and Fall
Peregrine Falcon (*anatum/tundrius* subspecies)	*Falco perengrinus anatum/tundrius*	Special Concern	Special Concern	Yes	No	Low	Year-round (breeds June – July)
Red-necked Phalarope	*Phalaropus lobatus*	Not Listed	Special Concern	No	No	High	Spring and Fall
Savannah Sparrow (*princeps* subspecies)	*Passerculus sandwichensis princeps*	Special Concern	Special Concern	Yes	No	Moderate	Year-round (breed May to August)

Note:
[1]Species of conservation concern (SOCC) listed as endangered, threatened, or of special concern by COSEWIC and not listed on Schedule 1 of SARA.
[2]This is based on the analysis of habitat preferences during various life-history stages, distribution mapping, and catch data for each species within the Project Area.

Source: BIO 2013a; BSC 2016; Campana *et al.* 2013; COSWEIC 2006a, 2006b, 2007a, 2008a, 2009b, 2009c, 2010a, 2010b, 2010c, 2010d, 2011b, 2012a, 2012b, 2012c, 2012d, 2012e, DFO 2013e, 2013l, 2013j, 2013k, 2013w; Horseman and Shackell 2009; Maguire and Lester 2012; NOAA2013e; SARA 2015, Tufts 1986

Potential Project-VC Interactions

Table 2 identifies the physical Project activities that can interact with SAR/SOCC to result in the identified environmental effects. These interactions are indicated by checkmarks and are discussed below in the context of effects pathways, mitigation, and residual effects. A justification is provided below for non-interactions where applicable.

Table 2 Potential Project-Environment Interactions and Effects on SAR/SOCC

Project Components and Physical Activities	Potential Environmental Effects	
	Change in Risk of Mortality or Physical Injury	Change in Habitat Quality and Use
Presence and Operation of MODU (including well drilling and testing operations and associated lights, safety [exclusion] zone and underwater sound)	✓	✓
Waste Management (including discharge of drill muds and cuttings and other drilling and testing emissions)	✓	✓
Vertical Seismic Profiling	✓	✓
Supply and Servicing Operations (including helicopter transportation and PSV operations)	✓	✓
Well Abandonment	-	✓
Note: ✓ = Potential interactions that might cause an effect. – = Interaction between the Project and the VC are not expected.		

<u>Waste Management</u>

Discharge of drill muds and cuttings as well as other routine discharges are not predicted to interact with Marine Mammals and Sea Turtles to cause a Change in Risk of Mortality or Physical Injury; these discharges will be in accordance with the Offshore Waste Treatment Guidelines (OWTG), which are designed to mitigate potential effects from discharges. Wastes that do not meet OWTG requirements will not be discharged to the ocean, but brought to shore for disposal. Discharges made in accordance with OWTG requirements will result in a temporary and localized reduction in water and sediment quality; however, they are highly unlikely to cause mortality or physical injury to marine mammals or sea turtles. Potential effects of these discharges on marine mammal and sea turtle food sources (*e.g.*, plankton, fish) as well as migratory birds are discussed in Section 7.3.8 in the context of Change in Habitat Quality and Use.

<u>Supply and Servicing Operations</u>

Helicopter transportation is not predicted to interact with marine fish, marine mammals or sea turtle SAR/SOCC to cause a Change in Risk of Mortality or Physical Injury. Helicopter transportation is not predicted to interact with marine fish SAR/SOCC to cause a Change in

Habitat Quality and Use due to a lack or very limited interaction with the marine environment (*i.e.*, very weak to no underwater sound transmission and no marine discharges).

The operation of the PSVs (including transit and transfer activities) is not predicted to interact with marine fish SAR/SOCC resulting in a Change in Risk of Mortality or Physical Injury because the underwater sound levels associated with PSV traffic is not expected to be at levels that would cause injury or mortality to marine fish species. Fish are anticipated to temporarily avoid the immediate areas subject to PSV traffic, thereby reducing the risk of fish mortality due to vessel strikes or contact with propeller blades. Change in Habitat Quality and Use for fish SAR/SOCC has been identified as having potential interactions with PSVs that might cause an environmental effect on SAR/SOCC and is therefore discussed later in this response.

<u>Well Abandonment</u>

All wells drilled in the drilling campaign will likely be permanently plugged and abandoned. Wells will be abandoned using a series of cement and mechanical plugs within the wellbore, and will have no interaction with SAR/SOCC outside of the wellsite. Whether the wellhead is removed or kept in place, well abandonment activities are not anticipated to produce underwater sound or discharges that would pose a risk of physical injury or mortality to fish or marine mammals. Well abandonment will occur underwater at sufficient depths to prevent interaction with migratory bird SAR/SOCC. Well abandonment activities are not anticipated to produce sound or discharges that would pose a risk of physical injury or mortality to marine mammals or sea turtles. Well abandonment activities are therefore not predicted to interact with SAR/SOCC resulting in a Change in Risk of Mortality or Physical Injury. Well abandonment may interact with marine fish, marine mammal, and sea turtle SAR/SOCC potentially resulting in a Change in Habitat Quality and Use; this effect is therefore discussed later in this response.

Change in Risk of Mortality or Physical Injury

A Change in Risk of Mortality or Physical Injury for individual marine fish, mammal, and turtle SAR/SOCC may result from underwater sound associated with the presence and operation of the mobile offshore drilling unit (MODU) and vertical seismic profiling (VSP). Drilling operations and station-keeping (*i.e.*, use of dynamic positioning thrusters) during MODU operations will generate underwater sound while the MODU is on station, affecting the quality of the underwater acoustic environment for fish species in the Project Area. VSP operation will also result in temporarily (no more than a day per well) increased sounds levels in the marine environment. Sound levels in very close proximity to the VSP sound array may result in physical injury or mortality from acute changes in pressure. Exposure to underwater sound of sufficient intensity may result in hearing loss, whether temporary or permanent (*i.e.*, TTS or PTS) (Richardson *et al.* 1995; Nowacek *et al.* 2007; Southall *et al.* 2007). There is also the potential for vessel collisions with marine mammals and sea turtles during PSV operations.

The presence and operation of the MODU and platform supply vessels (PSVs) has the greatest potential to result in Changes to Risk of Mortality or Physical Injury for bird SAR/SOCC because they are known to aggregate around drilling features as a result of night lighting, food, and other visual cues, potentially making them subject to increased risk of mortality due to physical impacts with structures, predation by other marine bird species, and incineration from flares (Wiese *et al.* 2001; Ronconi *et al.* 2015). In addition to direct (*e.g.*, collisions) and indirect interactions with the MODU and PSVs, the Project has potential to result in a Change in Risk of Mortality or Physical Injury of Migratory Birds through exposure to residual hydrocarbons associated with drill muds, cuttings, and other discharges and emissions through exposure to underwater sound caused by VSP operations and disturbance from and collisions with transiting helicopters.

Change in Habitat Quality and Use

A Change in Habitat Quality and Use for marine fish, mammal, sea turtle, and migratory bird SAR/SOCC may occur as a result of Project activities affecting the marine environment including the presence and operation of the MODU (light and sound emissions above and into the water column), waste management (discharge of drill muds and cuttings affecting water and sediment quality), VSP (underwater sound), supply and servicing operations (PSV and helicopter operations and underwater sound associated with vessel movement), and well abandonment (potential underwater sound associated with removal of wellhead infrastructure and/or a change in benthic habitat associated with leaving the wellhead in place).

Mitigation of Project-Related Environmental Effects

In consideration of the environmental effect pathways outlined above, the following mitigation measures and standard practices will be employed to reduce the potential environmental effects of the Project on SAR/SOCC.

Presence and Operation of MODU

- Refer to the presence and operation of MODU mitigation measures identified in the Fish and Fish Habitat VC (Section 7.2.8.2), Marine Mammals and Sea Turtles VC (Section 7.3.8.2), and Migratory Birds VC (Section 7.4.8.2).

Waste Management

- Refer to the waste management mitigation measures identified in the Fish and Fish Habitat VC (Section 7.2.8.2).

Vertical Seismic Profiling

- Refer to the vertical seismic profiling mitigation measures identified in the Fish and Fish Habitat VC (Section 7.2.8.2), Marine Mammals and Sea Turtles VC (Section 7.3.8.2), and Migratory Birds VC (Section 7.4.8.2).

Supply and Servicing Operations

- Refer to the supply and servicing mitigation measures identified in the Marine Mammals and Sea Turtles VC (Section 7.3.8.2), and Migratory Birds VC (Section 7.4.8.2).

Well Abandonment

- Refer to the presence and operation of MODU mitigation measures identified in the Fish and Fish Habitat VC (Section 7.2.8.2), and Marine Mammals and Sea Turtles VC (Section 7.3.8.2).

Characterization of Residual Project-Related Environmental Effects

Change in Risk of Mortality or Physical Injury

Presence and Operation of MODU

Underwater sound levels from the MODU were modelled to predict sound level propagation and inform the effects assessment (refer to Appendix D for the acoustic modelling report). Underwater sounds from the presence and operation of the MODU may result in a Change in Risk of Mortality or Physical Injury to SAR/SOCC in the Project Area if they are in and remain within close proximity of the operation. Although intended as criteria for the onset of effects of impulsive sounds (*e.g.*, pile driving, air guns), in terms of injuries to fish, the US Fisheries Hydroacoustic Working Group proposes the dual criteria of a peak sound pressure level of 206 dB re 1 μPa (peak) and cumulative sound exposure level (SEL) of 187 dB re 1 μPa^2s for fish 2 grams or heavier (Fisheries Hydroacoustic Working Group 2008). In consideration of this general criteria and the acoustic modelling conducted for the Project, physical injury effects to individual fish as a result of MODU operation would be very localized. It should also be noted that exposure at these levels would be transient as mobile fish would be expected to react behaviourally at lower thresholds, moving away from these sound levels before injury could occur.

The source levels for the MODU used in the acoustic modelling are 208.7 dB re 1 μPa @1m peak sound pressure level (SPL) (Zykov 2016), thus just slightly above the 206 dB re 1 μPa peak SPL threshold and therefore have potential to cause physical injury or mortality at very close range (*i.e.*, within 1 to 2 m) to individual fish (refer to Section 4.2.3.2 in Appendix D). While physical effects on small fish may occur if they are in the immediate vicinity of the MODU, mobile fish will likely be startled by vessel movement and activation of the thrusters and are predicted to avoid the area immediately around the thrusters before injury can occur. Aggregations of fish surrounding the thrusters are unlikely as a result of the turbulence generated by the thruster propellers.

The US Fisheries Hydroacoustic Working Group guidelines also suggest a second threshold criteria of 187 dB re 1 μPa cumulative SEL for fish 2 grams or heavier. Sound modelling of the MODU with PSV suggests a 24-hour cumulative SEL will decrease to below 190 dB re 1 μPa^2s beyond a maximum distance of 2 km (assuming maximum $R_{95\%}$ value across all seasons and sites). This predicted distance is based on ocean conditions during winter when sound propagation is greater (during summer this distance is reduced to 1 km). These maximum values are based on cumulative sound exposure levels over a period of 24 hours; within this period avoidance behaviour by fish is likely to result by increasing their distance from the source, and therefore an associated exposure to decreased cumulative SELs. Based on the motility of the fish species and their anticipated avoidance behaviour, the risk of mortality or injury from cumulative SELs is expected to be low. Studies by Popper *et al.* (2014) and

Normandeau Associates (2012) also indicate that the cumulative SEL criteria established by the Hydroacoustic Working Group may be lower than the actual level of effect for hearing in non-specialist fish. This is substantiated with results by Halvorsen *et al.* (2011a, b) and Casper *et al.* (2011) on hearing generalists.

Many fish SAR/SOCC are not likely to be found in the Project Area, and as a result, would likely not be within close proximity to the MODU. Those species which are likely to be found in the Project Area (*i.e.*, bluefin tuna, blue shark, porbeagle shark, roundnose grenadier,spiny dogfish, and winter skate) are all highly motile species and would likely avoid underwater sound prior to the levels which are required to cause injury or mortality. Of all the marine SAR/SOCC, the Atlantic salmon, Atlantic wolfish, northern wolffish, and spotted wolffish all have either recovery or action plans. The Atlantic salmon is not expected to be found in the Project Area and any time spent in the area would be transient in nature with the species migrating to either feeding or breeding grounds. The likelihood of Atlantic, northern, or spotted wolffish being found in the Project Area is low. The main anthropogenic threat to these species is mortality through ground fishing activities. The effects of seismic sound on wolffish has not been studied (Kulka *et al.* 2007). Furthermore, critical habitat for marine fish SAR/SOCC does not exist within the Project Area or Regional Assessment Area (RAA). Due to the fact that these species are not likely to be found in the Project Area, and the fact that they would likely display avoidance behaviour to underwater sound at lower levels than those at which injury or mortality may occur, physical harm associated with peak SPLs is unlikely to occur; therefore, any potential impact on fish SAR populations is highly unlikely.

Underwater acoustic modelling (Zykov 2016) results for the operation of the MODU with PSV, suggest cumulative SELs over 24 hours will decrease to below threshold values associated with potential injury for cetaceans at distances between less than 100 m and 470 m from the operation (depending on species group and scenario), using both the Southall *et al.* (2007) and NOAA (2015b) criteria (Appendix D). Calculation of these values assumes that all the thrusters of the vessels (MODU and PSV as applicable) are performing at nominal output power (*i.e.*, the highest sustainable revolutions per minute [rpm]), and that the receiver (*i.e.*, marine mammal or sea turtle) is exposed to this level continuously over a 24-hour period. This scenario is precautionary and highly unlikely to manifest, as marine mammals are not expected to remain within 470 m of the MODU and PSV over the course of 24 hours. Peak SPLs based on both the Southall *et al.* (2007) and NOAA (2015b) criteria are predicted to decrease to below threshold values associated with potential auditory injury at distances beyond 10 m from the source. All values presented are maximum $R_{95\%}$ values across seasons and sites modelled.

Although responses of marine mammals to increased sound levels are highly variable and depend on several internal and external factors (NRC 2005), some studies have documented avoidance of intense sound sources by marine mammals (Stone and Tasker 2006; Moulton and Holst 2010), particularly if the marine mammals are exposed to multiple simultaneous sound sources (Richardson *et al.* 1995; Richardson and Wursig 1995). Based on the most conservative thresholds and modelled results, cumulative SEL over 24 hours, high-frequency cetaceans (*e.g.*, harbour porpoise) would have to remain within approximately

470 m of the MODU, and low- and mid-frequency cetaceans (including blue, fin, North Atlantic right, and northern bottlenose whales, Sowerby's beaked whale, and killer whale) would have to remain within 140 m of the MODU and PSV for sound levels to be greater than threshold level associated with potential auditory injury. These are not likely to be credible scenarios.

Critical Habitat Areas for two species of marine mammal SAR (North Atlantic right whale, and the northern bottlenose whale) exist within the RAA, but are distant enough from the Project Area that the presence and operation of the MODU should not cause injury or mortality. The marine mammal SAR species most likely to be found within the Project Area (blue and fin whales) would need to stay within 140 m of the MODU and PSV for sound levels to be greater than thresholds associated with injury, which is not a likely scenario. Furthermore, critical habitat for these species does not occur in the Project Area or RAA.

Less is known about the responses of sea turtles to underwater sound; studies to date have focused on seismic sound sources that are far more intense than the sounds emitted from drilling activities. It is assumed that similar to marine mammals, sea turtles will tend to avoid intense sources of sound, and therefore may not approach close enough to the MODU, or remain in the vicinity long enough to be exposed to sound levels capable of causing auditory injury.

Many migratory birds navigate by sight, and lights can be a visual cue (Wiese *et al.* 2001). Artificial lighting in the offshore and coastal environments regularly attract nocturnally-active seabirds and migrating land and water birds, sometimes in large numbers (Imber 1975; Montevecchi *et al.* 1999; Wiese *et al.* 2001; Gauthreaux and Belser 2006; Montevecchi 2006; Bruinzeel *et al.* 2009; Bruinzeel and van Belle 2010; Ronconi *et al.* 2015). Attraction to artificial lighting is widespread among procellariiform sea birds (*e.g.*, shearwaters and storm-petrels) because they feed on bioluminescent prey and are naturally attracted to light (Imber 1975). During migration, small songbirds are also commonly attracted to artificial lighting on offshore ships and installations (Gauthreaux and Belser 2006; Poot *et al.* 2008). Artificial lighting associated with the MODU and PSVs has potential to result in strandings, collisions, increased opportunities for predation, and exposure to other vessel-based threats.

Migratory birds that are attracted to offshore installations may experience mortality through direct collision with the MODU or may become disoriented by lights and become stranded. Short-duration flaring by the MODU during testing may attract migratory birds and result in increased mortality risk. In addition to incineration, seabirds have been observed to circle flares for days, eventually dying of starvation (Bourne 1979). However, studies have shown most bird mortality on offshore platforms or lighthouses to be related to collision injuries rather than energy reserve depletion (Bruinzeel and van Belle 2010).

A number of factors influence the potential severity of marine bird interactions with flares, including the time of year, location, height, light and cross-sectional areas of the obstacle and weather conditions (Weir 1976; Wiese *et al.* 2001). The extent of attraction from artificial lights on drilling vessels and flares can vary based on meteorological conditions (rain, visibility), season, age of the birds, the lunar phase, and light composition (*e.g.*, wavelength, intensity). Assuming a typical offshore platform scenario of 30 kW of artificial lighting, birds may be attracted from distances up to 5 km from the source (Poot *et al.* 2008). Bruinzeel and van Belle (2010) calculate that the threshold for disorientation ranges from 200 m (dense fog), 1,000 m (fog) 1,250 m (mist), 1,400 m light rain, and 1,650 m (heavy rain), with the most dramatic scenario being one with perfect ground visibility (*e.g.*, 10,000 m) with no celestial cues due to overhead clouds, where disorientation can occur up to 4,500 m from the illuminated platform. Mortality can also increase during migration when large numbers of birds fly relatively low as a result of unfavorable weather conditions (Wiese *et al.* 2001).

Migratory bird SAR/SOCC with moderate or high potential to be found within the Project Area include the roseate tern, ivory gull, red-necked phalarope, and the savannah sparrow. None of these species have critical habitat within the Project Area. Reference to the species Recovery and Action Plans list high impact threats to these species as climate change, air-borne pollutants, overwintering survival, predation during breeding, illegal shooting, and other anthropogenic activities on land. The presence and operation of the MODU is not predicted to increase or interact with these threats to these SAR/SOCC.

Waste Management

Although there are several types of discharges that migratory birds may interact with during drilling of the well and operation of the PSVs, these discharges will comply with the OWTG and in adherence to MARPOL, both of which have been established to protect the marine environment. As well, discharges and emissions are expected to be temporary, localized, non-toxic, and subject to high dilution in the open ocean.

Drill cuttings associated with synthetic-based muds (SBM) use will be discharged via a caisson below the sea surface, potentially affecting water quality within a localized area as the discharges migrate through the water column (refer to Appendix C of the EIS for drill waste dispersion modelling). The discharge of cuttings has potential to result in small sheens to form under certain conditions (*i.e.*, calm winds and small waves) during routine operation, which could affect migratory bird SAR/SOCC.

The potential for sheen formation as a result of the discharge of cuttings and SBM use is low because activity will be carried out in adherence to the OWTG and drill muds will be selected in accordance with the Offshore Chemical Selection Guidelines (OCSG). The SBM itself has a fraction of oil or synthetic oil as a component, and the cuttings are cleaned and have only a very small fraction of the SBM adhered to them when discharged. The amount of SBM on cuttings would be in the single percentages of the total volume (*I.e.*, <6.9% of oil on wet solids as per the OWTG). Discharging the cuttings at depth further mitigates the potential for sheen formation. Furthermore, if the wind and wave conditions were such that a sheen formed in association with an SBM cuttings discharge for this Project, the sheen would be temporary and limited in size, and only birds in the immediate area of the spill would likely be affected. While the risk of mortality for individual birds that came in contact with the sheen would be increased, the limited nature of this sheen and the likely number of birds affected would be low. WBM and cuttings released at the seafloor will not interact with surface waters such that migratory birds or their prey would be affected.

Deck drainage and bilge waters have potential to negatively affect marine bird health because of the presence of residual hydrocarbons. However, residual hydrocarbons in discharges are generally not associated with the formation of a slick and are therefore unlikely to have a measurable effect on migratory birds. Sea water used for cooling purposes aboard the MODU will be treated through an oil-water separator before being disposed of at sea. Discharges of sanitary and domestic waste may attract birds and/or prey to the MODU and PSVs, but food and sewage waste will be macerated to maximum particle size (6 mm) prior to disposal. This waste is expected to be quickly degraded by bacteria and other biological activity after release. However, even if discharges are non-toxic, gray water discharge will attract gulls and other species to the vicinity of the MODU and PSVs, which may slightly increase Risk of Mortality or Physical Injury of marine bird SAR/SOCC species, particularly if they interact with a flare or become stranded on the MODU. No food or sewage waste will be discharged within 3 nm of the coast consistent with MARPOL.

The roseate tern, ivory gull, red-necked phalarope, and savannah sparrow all have a moderate or high potential to be found within the Project Area. With the exception of red-necked phalarope, these species are not expected to spend a substantial portion of time on the water's surface. As a result, they are not likely to be impacted by residual hydrocarbons on the water's surface. Phalaropes spend considerable time foraging on the surface of the sea in areas where upwelling brings plankton to the surface and would have greater potential to interact with waste management practices. However, given the nature of the discharges, waste management practices are unlikely to cause measurable adverse effects to bird SAR/SOCC populations.

Vertical Seismic Profiling

Vertical seismic profiling is expected to generate the most intensive underwater sound associated with the Project, although it will be over a relatively short period of time (no more than one day per well). Acoustic modelling conducted for the Project (refer to Appendix D of the EIS) suggests the maximum sound source level of the VSP array will be 248 dB re 1 µPa @ 1 m peak SPL (broadside).

As discussed for the MODU operation, a threshold of 206 dB re 1 µPa peak and cumulative SELs of 187 dB re 1 $\mu Pa^2 s$ has been suggested as a threshold to avoid potential injury to fish species 2 grams or heavier (Fisheries Hydroacoustic Working Group 2008). The results of the acoustic modelling conducted for the Scotian Basin Exploration Drilling Project (Zykov 2016; Appendix H), predicted that sound levels will decrease to below 202 dB re 1 µPa peak SPL at distances greater than 140 m from the VSP source (at wellsite) during VSP surveys (maximum $R_{95\%}$ value across all seasons and sites). This suggests that injury or mortality to fish if they were present (caused by exposure to SPLs ≥ 206 dB re 1 µPa peak) would be restricted to less than 140 m from the VSP sound source.

The results of the modelling were also compared to the Fisheries Hydroacoustic Working Group (2008) cumulative SEL criteria. The modelled cumulative SEL for a 24-hour period was predicted to decrease to below 190 dB re 1 $\mu Pa^2 s$ at distances greater than 1.7 km from the VSP source (maximum $R_{95\%}$ value across all seasons and sites). As previously mentioned, application of this criteria is considered to be conservative as more recent studies indicate effects to hearing generalists could occur at sound levels greater than 187 dB re 1 μPa²s SEL.

Received sound levels are unlikely to result in physical effects to the majority of mobile fish SAR/SOCC due to the expectation that they would respond to avoid underwater sound at lower levels than those at which injury or mortality may occur. A ramp-up period for the VSP source will be initiated to further deter fish SAR/SOCC from the area, thereby reducing their risk of being exposed to harmful levels of sound.

Underwater sound emissions from a seismic source array such as that used in VSP may cause mortality of fish eggs, larvae or fry in very close proximity (*i.e.* <5 m) (Kostyuchenko 1973; Booman *et al.* 1996). Potential mortality associated with sound from the VSP source is not considered to have an effect on recruitment to fish populations (Dalen *et al.* 1996). Sound exposure guidelines for eggs and larvae by Popper *et al.* (2014) were established using dual-criteria similar to those established by the Hydroacoustic Working Group. The sound exposure guidelines suggest that potential mortality or injury to eggs and larvae from seismic sources may result from a cumulative SEL greater than 210 dB re 1 μPa²s or peak SPLs greater than 207 dB re 1 μPa. Using this dual criteria, potential injury to fish eggs and larvae may occur within 160 m of the source.

Shackell and Frank (2000) concluded that the Scotian Shelf supports an array of species larvae throughout the year, with abundance changes occurring with the seasons. Based on the likely wellsite locations within the Project Area and predicted sound propagation, the low likelihood of marine fish eggs and larvae located within a few hundred metres of the sound source while VSP is occurring, and the temporary nature of VSP surveys (no more than one day per well), it is anticipated that the amount of eggs and larvae with the potential to be exposed to sound levels causing physical injury or mortality would be negligible. Eggs and larvae are only present in the water column during certain periods, thereby reducing temporal opportunities for potential interactions with Project activities and components. The distribution of these species' eggs or larvae extends well beyond the LAA to include most or all of the RAA. Of the fish SAR/SOCC which have the potential to spawn in the Project Area (Acadian redfish, American plaice, Atlantic cod, cusk, deepwater redfish, roughhead grenadier, roundnose grenadier, thorny skate, and winter skate), none of these species are restricted to spawn in one location (*i.e.*, the Project Area). These species also have the potential to spawn over many months or year-round, and as a result, the impacts from VSP surveys would not affect their entire spawning window. Saetre and Ona (1996) concluded that the mortality rates from exposure to a seismic sound source is insignificant as compared to natural mortality. This conclusion is consistent with findings reported in the Environmental Assessment of BP's Tangier 3D Seismic Survey (LGL 2014).

There have been no documented cases of marine mammal or sea turtle mortality stemming from exposure to sound from exploration seismic surveys. However, it has been suggested that the typical monitoring programs implemented for mitigation purposes during offshore activities may not detect sub-lethal or longer-term effects that could have occurred (DFO 2004). Underwater sounds emitted during VSP operation are expected to be the most intense sounds generated by the Project and therefore may result in a Change in Risk of

Mortality or Physical Injury to Marine Mammals and Sea Turtles SAR/SOCC. For the purposes of acoustic modelling, a larger source array, the Schlumberger Dual Magnum 2,400 in^3 airgun, which has been used by BP in other geographic regions, was modelled as the VSP sound source for the Project at an assumed depth of 4.5 m (Appendix D of EIS). Literature values suggest that the energy level from a single VSP pulse is expected to produce a source level of 220 to 245 dB re 1 µPa @ 1 m, at frequencies of 5 to 300 Hz (Lee *et al.* 2011). Source level specifications for the airgun source array used in the acoustic modelling were 248 dB re 1 µPa @ 1 m (peak SPL) in the broadside firing direction (Appendix D).

Based on the results of underwater acoustic modelling (Zykov 2016) (Appendix D of the EIS), sound levels are expected to decrease to below peak SPL threshold values associated with potential permanent auditory injury (*i.e.*, 230 dB, 218 dB, and 202 dB re 1 µPa) at distances greater than 40 m for mid- and low-frequency cetaceans (including blue, fin, North Atlantic right, and northern bottlenose whales, Sowerby's beaked whale, and killer whale)(Southall *et al.* 2007 and NOAA 2015b), and >140 m for high-frequency cetaceans (harbour porpoise) (NOAA 2015b).

Sound levels (maximum $R_{95\%}$ values across all seasons and sites) are expected to be below cumulative SEL levels associated with permanent auditory injury (198 dB re 1 $µPa^2s$ for cetaceans and 186 dB re 1 $µPa^2s$ for pinnipeds) (Southall *et al.* 2007) beyond maximum distances of approximately 620 m, 240 m, and 170 m for low, mid and high-frequency cetacean hearing groups, respectively. Calculation of cumulative SEL values assumes that the VSP source array is activated 2,040 times in a 24-hour period during the VSP survey and that the receiver (*i.e.*, marine mammal or sea turtle) is exposed to this level continuously over this period. VSP surveys are expected to take up to one day at each well; therefore, based on the most conservative distance estimate considered, a marine mammal would have to remain within 620 m of the VSP sound source over the duration of the survey for cumulative sound levels to be greater than threshold values associated with potential auditory injury. This scenario is considered unlikely. Sound levels are expected to be below the NOAA 2015b cumulative SEL threshold levels for all cetacean hearing groups at shorter distances from the sound source than those predicted using the Southall *et al.* (2007) thresholds. For example, for low-frequency cetaceans (including fin and blue whales) and mid-frequency cetaceans (including the northern bottlenose whale, Sowerby's beaked whale, and killer whale) this distance is expected to be less than 240 m and 20 m, respectively, from the sound source (compared to 620 m and 240 m, Southall *et al.* [2007]). Likewise, peak SPLs are expected to decrease below the Southall *et al.* 2007 and NOAA 2005 thresholds for all cetacean hearing groups and pinnipeds at shorter distances from the sound source than those discussed above.

Although less is known about sound levels that may cause auditory injury to sea turtles, it is assumed that these values would not exceed those for cetaceans (LGL 2014). While they acknowledge that few data exist on the effects of seismic airguns on sea turtles, Popper *et al.* (2014) proposed guidelines for threshold levels capable of causing mortality and potential mortal injury from seismic airguns of 210 dB cumulative SEL and 207 dB peak SPL. These values are consistent with those proposed for fish species whose swim bladder is not involved in hearing (Popper *et al.* 2014). Based on acoustic modelling (Zykov 2016), sound levels from VSP operations are predicted to be below these levels at distances greater than approximately 160 m and 100 m respectively. It is also possible that sea turtles are highly protected from potential effects from impulsive sound by their rigid external anatomy (Popper *et al.* 2014). Thresholds for non-mortal injury of sea turtles have not been identified, but the relative risk has been described as 'high' in the 'near' field (*i.e.*, in the tens of metres from the source), and 'low' at both intermediate (*i.e.*, hundreds of metres) and far (*i.e.*, thousands of metres) distances (Popper *et al.* 2014).

Marine mammals and sea turtles SAR/SOCC are generally expected to temporarily avoid localized areas subject to sound from seismic sources (LGL 2014) and are therefore considered unlikely to approach (or remain) close enough to the VSP sound source to be exposed to sound levels capable of causing auditory injury. A number of mitigation measures will also be implemented to further reduce the effects to marine mammals and sea turtles from VSP operation.

There is a scarcity of data on the effects of underwater sound on marine birds and the few studies that have been done regarding seismic testing have observed little behavioural effect (Stemp 1985; Turnpenny and Nedwell 1994; Lacroix *et al.* 2003). For example, shearwaters have been observed with their heads underwater within 30 m of seismic vessels and no response was noted (Stemp 1985). Environmental observers found the same lack of response by guillemots, fulmars, and kittiwakes during seismic testing in the North Sea (Turnpenny and Nedwell 1994). A study of Long-tailed Ducks in the Beaufort Sea also found no effects from seismic testing (Lacroix *et al.* 2003).

Although birds are generally considered to have good hearing abilities, information on their underwater hearing abilities is largely lacking (Wiese *et al.* 2001; OSPAR 2009; Dooling and Therrien 2012). Taking into consideration changes in human hearing underwater and the protective effect against acoustic overexposure in birds from changes in middle ear pressure, it has been suggested that diving birds may not hear well underwater. It is also thought that the frequency for optimal hearing may shift below 2 to 4 kHz (Dooling and Therrien 2012). The migratory bird SAR expected to be found in the vicinity of the Project Area are not expected to spend a significant portion of time diving for prey. As a result, they are not likely to be impacted by sound emitted from VSP surveys.

Change in Habitat Quality and Use

Presence and Operation of MODU

Drilling operations as well as dynamic positioning activity of the MODU (*i.e.*, use of thrusters) will generate underwater sound, which may affect the quality of the underwater acoustic environment for marine fish, mammals, turtles, and birds. This activity could occur at any time of the year and would be continuous during the time it takes to drill each well (approximately 120 days per well).

As indicated above, predicting behavioural changes in fish is challenging given the variation in sound characteristics from different types of sources and interspecific differences in how sound is perceived by and may affect different species. Numerous studies have demonstrated avoidance behaviour (*e.g.*, diving, horizontal movements) of fish to approaching vessels, although reactions can vary depending on species, environmental conditions, and the physiological state of the fish (De Robertis and Handegard 2013). Behavioural responses of fish can also vary depending on the context (*e.g.*, the same fish may react differently when exposed to the same sound level while aggregated for spawning versus during foraging or feeding activities) (Hawkins and Popper 2014). Although underwater sound is believed to be the primary stimuli, other factors, including visual stimuli, may also influence behaviour.

During the initial period of drilling, avoidance of some fish species may occur, and startle responses may be elicited in close proximity to the sound source (*e.g.*, DP thrusters) at start-up (Mueller-Blenkle *et al.* 2008; Fewtrel and McCauley 2012). A general behavioral response was noted by McCauley *et al.* (2000a) at sound levels of 156 to 161 dB re 1μPa SPL RMS. Over the course of drilling, it is expected that fish will become habituated to the sound and avoidance and startle responses will cease (Chapman and Hawkins 1969; McCauley *et al.* 2000a, 2000b; Fewtrel and McCauley 2012). Acoustic modelling for the Project (Zykov 2016) predicts sound levels will decrease to below ≤ 150 dB re 1 μPa peak SPL greater than 0.4 km from the MODU and PSV (maximum $R_{95\%}$ value across all seasons and sites, Figure 29, Table 14 in Appendix D). Those fish SAR which are likely to be found in the Project Area (*i.e.*, bluefin tuna, blue shark, porbeagle shark, roundnose grenadier, spiny dogfish, and winter skate) are all highly motile species and would likely avoid underwater sound until habituation is achieved. These species are not confined to the habitat of the Project Area, and any avoidance or startle responses would not remove species from their only available habitat. All of these species (with the exception of the roundnose grenadier and the winter skate) spawn outside of the Project Area or the RAA and avoidance of the Project Area would not interfere with spawning activities. The roundnose grenadier and winter skate have the ability to spawn in multiple locations as well as during multiple temporal periods. As a result, any avoidance behaviour due to the operation of the MODU would not cause the species to miss their entire spawning window.

Lights from the MODU could potentially result in physiological stress in marine fish within the area of influence as artificial light is introduced to the water column. A common reaction of fish groups to the presence of artificial lighting is to school and move towards the light source. Sharp light contrasts created by over-water structures due to shading during the day and artificial lighting at night have the potential to alter the feeding, schooling, predator avoidance, and migratory behaviours of fish (Nightingale and Simenstad 2001; Hanson *et al.* 2003). Fish, especially juveniles and larvae, rely on visual cues for feeding. Shadows can create a light-dark interface, which may increase predation by ambush predators and increase starvation through limited feeding ability (NOAA 2008). The migratory behaviour of some species may favour deeper waters away from shaded areas during the day and lighted areas could affect migratory movements at night, contributing to increased risk of predation.

The operation of the MODU, and in particular, the dynamic positioning activity (*i.e.*, use of DP thrusters), will generate underwater sound, thereby affecting the quality of the underwater acoustic environment for marine mammals and sea turtle SAR/SOCC.

In the US, NOAA (n.d.) has used 120 dB re 1 µPa RMS SPL as a behavioural threshold value for marine mammals exposed to continuous sounds (*e.g.*, shipping and drilling). At received sound levels above this, marine mammals may exhibit a variety of behavioural responses. These may include, for example, changes in vocalizations and call length, diving rates, foraging or travelling patterns, breeding and/or migration routes, and in some cases of intense source levels, avoidance of the area of increased sound (refer to Section 7.3.6.2 of the EIS for additional information on potential behavioural effects of introduced underwater sound).

Based on the results of underwater acoustic modelling (Zykov 2016), sound levels are predicted to decrease to below 120 dB re 1 µPa RMS SPL at distances >150 km from the MODU during operations in winter (*i.e.*, when sound propagates furthest due to environment conditions). For the most conservative summer scenario (*i.e.*, drillship with PSV at Site A), the distance is predicted to be one-third of the winter distance, approximately 50 km. While onset of marine mammal behavioural responses to continuous sound may occur at SPLs of 120 dB re 1 µPa RMS (NOAA n.d.), the potential magnitude and ecological relevance of a response is expected to vary and depending on a number of factors, such as the intensity of underwater sound, degree of overlap in frequency between a sound and the marine mammal species' hearing sensitivity, as well as the animal's activity state at the time of exposure. More extreme behavioural responses (*e.g.*, long-term displacement from an area) may become generally more likely at received sound levels significantly higher than 120 dB re 1 µPa RMS SPL. Therefore, the distances over which such overt responses may occur will also be less than those predicted for the 120 dB re 1 µPa isopleth. Some species of marine mammals, such as fin and right whales, have been found to be less responsive to stationary sources of sound than moving sources (Watkins 1986).

The greatest potential for masking exists for marine mammals that produce and perceive sounds within the range of frequencies produced by vessels. Baleen whales vocalize primarily in the lower frequencies (7 Hz to 22 kHz) and are therefore likely to be the most susceptible species (Clark 1990; Erbe 2002) to potential masking associated with the increased ambient sound levels as a result of the MODU or PSV traffic, especially over greater distances. In contrast, odontocete communication frequency ranges from 2 to over 100 kHz (Au and Hastings 2008), which would only partially be overlapped by the low frequency range of drilling sounds (10 Hz to 10 kHz). This suggests that effects of masking may be of lesser concern than for baleen whales (blue, fin, North Atlantic right whale), though recent studies suggest odontocetes may still react to low levels of the high frequency components of vessel sound (*e.g.*, Dyndo *et al.* 2015; Veirs *et al.* 2016). Studies on North Atlantic right whales indicate that this species will adjust its vocalizations in the presence of vessel sound. Most species of baleen whales known to occur in the RAA are present primarily in the summer months; thus individuals that frequent the area are less likely to be present at the time of year when sound levels will extend to the greater distances due to the sound propagation characteristics in winter. Some species of toothed whale are present in the RAA year-round. Most of these species are mid-frequency cetaceans, and thus communicate at frequency ranges that only partially overlap with the low-frequency range of MODU operation sounds; however, at ranges less than 3 km, sound levels received from ships also extends to frequencies used by odontocetes (*i.e.*, 10 to 96 kHz; Veirs *et al.* 2016). The marine mammal SAR and SOCC that are most likely to be in the RAA during the winter months are fin whale (SAR Special Concern), northern bottlenose whale (SAR Endangered), and Sowerby's beaked whale (SAR Special Concern). During the winter months, when the strong surface channel propagates sound from the MODU and PSV over the greatest distances, sound levels above 120 dB re 1 µPa RMS SPL may extend to portions of northern bottlenose whale critical habitat: the Gully, Shortland Canyon, and Haldimand Canyon approximately 81 km, 139 km and 171 km respectively from the Project Area. Uncertainty around acoustic disturbances and the effect on species using the Gully remains in spite of numerous scientific reviews undertaken to address this issue (*e.g.*, Lawson *et al.* 2000; Lee *et al.* 2005) (see Section 7.5 – Special Areas). Furthermore, the potential extent of masking effects could be limited depending on the background sound levels already present in these areas. Critical habitat for the North Atlantic right whale exists within the RAA, although it is located over 250 km from the Project Area, and is outside the range of expected behavioural impacts due to sound emission from the presence and operation of the MODU.

At this time, there are no data on the effects of shipping sounds (or other continuous sources such as drilling or dynamic positioning) on sea turtles, and no numeric thresholds have been proposed for which to compare to acoustic modelling results (Popper *et al.* 2014). None of the two sea turtles SAR known to occur in the vicinity of the Project Area are expected to be present in February, when underwater sounds from MODU operations are expected to extend the furthest. Leatherback and loggerhead sea turtles may still be in the area in December. Studies have suggested that sea turtles (including the leatherback and loggerhead) have greatest hearing sensitivity to low-frequency sounds (Office of Naval Research 2002; Environment Australia 2003; Ketten and Bartol 2005). While there is a general lack of research or scientific data on the effects of sound on sea turtles or the relative importance of their acoustic environment, there is also little to suggest that they would be more sensitive to underwater sounds than marine mammals (Popper *et al.* 2014). The same categories of potential effects discussed above for marine mammals (*i.e.*, behavioural effects and communication masking) are generally expected to encompass the range of potential effects on sea turtles.

Underwater and atmospheric sound from the MODU may result in sensory disturbance to migratory birds, leading to behavioural responses such as temporary habitat avoidance or changes in activity state (*e.g.*, feeding, resting, or travelling). However, because the MODU will remain on-site at the drilling location during Project activities, the spatial extent of changes to habitat quality for migratory birds as a result of the presence and operation of the MODU would be minimal. Mitigation measures to limit flaring and exposure of migratory birds to artificial lighting will also reduce potential effects.

Waste Management

Waste and emission discharges with potential for toxicity effects to the marine environment are regulated for compliance under the OWTG. Discharges from the MODU will meet OWTG requirements, which are established to protect the marine environment. Discharges are expected to be temporary, non-bioaccumulating, non-toxic, and will be subject to high dilution in the open ocean; organic matter will be quickly dispersed and degraded by bacteria. If residual hydrocarbons are present in discharges (*e.g.*, deck drainage, bilge water) they would be at such low volumes and concentrations as they will comply with OWTG and MARPOL requirements.

There are several types of discharges during drilling of the well and from PSV operations that may interact with migratory bird habitat and use (Section 2.8 of the EIS). However, all of these discharges will be in compliance with the OWTG and in adherence to MARPOL. As well, discharges and emissions are expected to be temporary, localized, non-toxic, and subject to high dilution in the open ocean. Residual hydrocarbons in discharges are generally not associated with the formation of a slick and are therefore unlikely to have a measurable effect on the quality of migratory bird SAR/SOCC habitat.

The discharge of mud and cuttings could potentially result in a Change in Habitat Quality for Migratory Bird SAR/SOCC. However, WBM and cuttings released at the seafloor will not interact with surface waters such that migratory bird SAR or their prey would be affected. Furthermore, drill cuttings associated with SBM use will be treated in accordance with the OWTG prior to discharged via a caisson below the sea surface. Discharged drill cuttings will settle rapidly to the seabed and have a negligible interaction with migratory birds. Extremely small volumes and fine particle sizes of SBM adhered to treated drill cuttings will remain suspended in the upper water column, contributing to increased levels of TSS before dispersing (refer to Appendix C of the EIS for drill waste dispersion modelling). Temporary elevated TSS levels in the water column could result in temporary avoidance of a localized area of the Project Area by migratory bird SAR/SOCC during discharge of SBM cuttings at the surface.

As outlined in Section 7.4.8.2 of the EIS, seawater used for cooling purposes aboard the MODU will be treated through an oil-water separator before being disposed of at sea. Discharges of sanitary and domestic waste may attract birds and/or prey to the MODU and PSVs, but food and sewage waste will be macerated to maximum particle size (6 mm) prior to discharge. This waste is expected to be quickly degraded by bacteria and other biological activity after release.

Vertical Seismic Profiling

As noted above for a Change in Risk of Mortality or Physical Injury, this activity is expected to generate the most intense sounds associated with Project activities, with the energy level from a single VSP shot expected to have a frequency of 5 to 2,000 Hz and a SPL of 248 dB re 1 µPa @ 1 m (*i.e.*, at source) (Zykov 2016; Appendix D of the EIS). As noted above, thresholds for behavioural effects can vary depending on species. For marine fish species avoidance behaviour can potentially occur at sound levels of 151 dB re 1 µPa peak SPL (McCauley *et al.*

2000a). Acoustic modelling for the Project (Zykov 2016) predicts sound levels will decrease to below 160 dB re 1 µPa peak SPL at distances greater than 20 km from the VSP sound source (maximum $R_{95\%}$ value across all seasons and sites (Figure 45, Table 26 in Appendix D)). As a result, behavioural effects associated with VSP surveys will not affect critical habitat for fish SAR/SOCC in proximity to the Project. The duration of VSP surveys are not expected to last more than one day per well and as a result the potential impacts to habitat quality and use for marine fish SAR/SOCC is expected to be minimal.

Acoustic modelling conducted for the Project (Zykov 2016) predicts that sound from the VSP source will decrease to below 160 dB re 1 µPa RMS SPL (NOAA's interim threshold for sensory disturbance from an impulsive source) at distances greater than approximately 3.2 km from the sound source.

Mysticetes generally avoid active air source arrays, although the radius of avoidance can vary (Richardson *et al.*1995; Gordon *et al.* 2004). Numerous studies have been conducted and mysticetes exposed to strong pulses from air source arrays typically respond by avoiding the sound source, which can result in deviation from their normal migration route and/or disruption to feeding (Malme *et al.* 1984, 1985, 1988; Richardson *et al.* 1986, 1995; Ljungbald *et al.* 1988; McCauley *et al.* 1998, 2000a, 2000b; Miller *et al.* 1999, 2005; Gordon *et al.* 2004; Stone and Tasker 2006; Johnson *et al.* 2007; Nowacek *et al.* 2007; Weir 2008; Moulton and Holst 2010). Avoidance responses may occur at distances beyond the monitoring range of vessel-based observers and as a result, behavioural observations from vessels can be biased (LGL 2014).

Studies of migrating grey, bowhead, and humpback whales have shown that received SPLs of pulses in the 160 to 170 dB re 1 µPa RMS range elicit avoidance behaviour in a substantial number of animals exposed to the sound (Richardson *et al.* 1995). Migrating bowhead whales have shown avoidance behaviour to sound levels as low as 120 to 130 dB re 1 µPa RMS (over pulse duration) (Miller *et al.* 1999; Manly *et al.* 2007). At the same time, some mysticetes have shown limited response to sound from full-air source arrays with only localized avoidance and minor changes in behaviour (LGL 2014). Additionally, grey whales have continued to migrate annually along the west coast of North America regardless of seismic exploration or shipping traffic in the area (Malme *et al.* 1984; Richardson *et al.* 1995). As a result of these varying findings, it is not known to what extent impulsive sounds affect the distribution and habitat use of cetaceans. The overall trend seems to show that over the history of seismic surveys co-existing with mysticetes, brief exposure to pulsed sounds from a single seismic survey are not likely to result in prolonged disturbance (LGL 2014).

The overall response of odontocetes to seismic pulsed sound is variable (LGL 2014). Data suggest that some odontocete species such as belugas and harbour porpoises are more responsive to low-frequency sound than once thought (LGL 2014). Reactions at larger distances may occur when environmental sound propagation conditions are conducive to transmission of the higher-frequency components of the pulsed sound (DeRuiter *et al.* 2006; Tyack *et al.* 2006; Potter *et al.* 2007). There is a lack of specific data on responses of beaked whales to seismic surveys, but it is believed that they would exhibit strong avoidance patterns. Most beaked whales avoid approaching vessels in general (Würsig *et al.* 1998) and may also dive for extended periods of time when approached by a vessel (Kasuya 1986). As a result, it is likely that beaked whales would show avoidance to seismic vessels and activity, although this behaviour has not been specifically studied or documented to date.

For some odontocetes such as delphinids, data suggest that a sound level of >170 dB re 1 µPa RMS may result in avoidance behaviour (LGL 2014). Seismic operators and marine mammal observers on seismic vessels regularly observe dolphins and other small toothed whales in close proximity to operating air source arrays, but there is a general tendency for most delphinids to show some avoidance to operating seismic air source arrays (Stone and Tasker 2006; Weir 2008; Richardson *et al.* 2009; Moulton and Holst 2010). Harbour porpoises have been shown to exhibit behavioural responses to operating seismic air source arrays at levels <145 dB re 1 µPa RMS (Bain and Williams 2006). Lee *et al.* (2005) reported that northern bottlenose whales in the Gully were not displaced by received sound levels of 145 dB re 1 µPa RMS SPL generated by a seismic survey >20 km away that had been operating for a number of weeks. For VSP surveys, sound levels are expected to dissipate below 150 dB re 1 µPa RMS approximately >20 km from the source, and potential for exposure would be limited to a single day for each well.

Masking could potentially occur during VSP, although the sound emitted during the survey would be of very short duration (*i.e.*, one day), with periods of silence between pulses, resulting in a limited masking effect.

Studies to date indicate that seismic surveys can have short-term effects on sea turtles such as a change in hearing sensitivity and behavioural effects (*e.g.*, increased and erratic swimming behaviour; McCauley *et al.* 2000a), and physiological responses. Certain levels of exposure to low-frequency sound may cause temporary displacement from areas near the sound source and increased surfacing behaviour. This exposure could potentially lead to displacement from preferred foraging areas (Atlantic Leatherback Turtle Recovery Team 2006). Weir (2007) reported a decrease in the number of sea turtles (of several species) during periods when seismic sources were active, although sea turtles at the surface exhibited no obvious behavioural avoidance, and it is not possible to distinguish whether the decrease in numbers was in relation to the presence of the ship and towing equipment, or to the airgun sounds themselves. DeRuiter and Doukara (2012) also reported avoidance responses (diving behaviour) by loggerhead sea turtles at ranges of up to 839 m, in response to active seismic sources at estimated exposure levels between 175 and 191 dB re 1 µPa peak SPL. In studies of penned animals, McCauley *et al.* (2000a) reported behavioural responses (including surfacing and changes in swim patterns) in sea turtles exposed to received levels of 166 dB re 1 µPa RMS SPL, and Moein *et al.* (1995) (cited in Popper *et al.* 2014) reported avoidance of penned loggerhead turtles exposed to active airguns at source levels of 175 to 179 dB re 1 µPa at 1 m (though this behaviour occurred only upon first exposure). Sea turtle dive probability has been shown to decline with increasing minimum range to a seismic source array (DeRuiter and Doukara 2012).

No critical habitat for any species of sea turtle in the Atlantic Ocean has yet been defined under SARA; however, a draft Recovery Strategy for the Leatherback Sea Turtle Atlantic population identified three areas of critical habitat (DFO 2015o). The closest of these areas to the Project Area is located south and southeast of Georges Bank and extending to the southwest boundary of the Canadian EEZ on the southwestern Scotian Slope (DFO 2015o); this area is well beyond (more than 200 km) the extent over which behavioural responses to sound from VSP operation may be expected, and any potential disturbance effects in the near field would be short-lived.

Studies have failed to document a strong response of migratory birds to seismic testing (Stemp 1985; Turnpenny and Nedwell 1994; Lacroix *et al.* 2003). Many species of seabirds that may be present in the Project Area spend less than one minute underwater during a foraging dive, resulting in a short temporal overlap with VSP operations. There are no migratory bird SAR/SOCC that may be found within the Project Area which spend relatively high amounts of time underwater during forage dives and as a result impacts from VSP surveys are expected to be minimal.

Supply and Servicing Operations

Supply and servicing operations will increase vessel traffic within the Project Area and LAA (two to three PSVs making two to three round trips per week between the MODU and the supply base) and may therefore locally affect Fish Habitat Quality and Use around the PSV due to increased vessel sound. At an estimated sound source level of 188 dB re 1 µPa @ 1 m RMS SPL (Zykov 2016; Appendix D of the EIS), underwater sound associated with PSV traffic will introduce additional underwater sound to the acoustic environment, although given the relatively small increment in vessel traffic as a result of the Project, this increase will be very low. Reactions of fish to vessels can vary by species and can also be influenced by environmental conditions and physiological state of the fish at the time of the interaction (De Robertis and Handegard 2013). However, the likely reaction to vessel sound is either temporary displacement or avoidance of the area in which the disturbing sound level is occurring. Any change to habitat quality would represent a small increment over similar effects currently associated with existing high levels of marine traffic and shipping activity throughout the RAA.

Helicopter transportation has the potential to interact with marine mammals or sea turtles via sensory disturbance resulting from visual cues and helicopter sounds (while the animal is either at the surface or submerged). The most common response of cetaceans to aircraft sounds is diving; however, other reactions include breaching, short surfacing, and changes in behavioural state (Luksenburg and Parsons 2009). Cetaceans have shown varying degrees of sensitivity to aircraft sounds; this may depend on their activity and behavioural state at the time of exposure (*e.g.*, resting, socializing, foraging or travelling), with individuals in a resting state appearing to be the most sensitive to disturbance (Würsig *et al.* 1998; Luksenburg and Parsons 2009). In a study in the Beaufort Sea, observers recorded beluga and bowhead whale reactions to a Bell 212 helicopter, and reported that the majority of responses occurred when the helicopter was flying at altitudes less than 150 m, and at lateral distances of less than 250 m (Patenaude *et al.* 2002).

Helicopter overflights are not expected to travel over critical habitat for marine mammal SAR/SOCC. Any behavioural responses of cetaceans near the surface during a helicopter overflight are expected to be infrequent and temporary.

Underwater sound associated with PSV traffic (*i.e.*, during transiting and operations) has the potential to adversely affect the quality of the acoustic environment and therefore result in a Change in Habitat Quality and Use by marine mammal and sea turtle SAR/SOCC. The combined effects of underwater sound levels produced by the PSV while alongside the operating MODU are addressed above; however, PSVs will also produce sound during transit to and from the MODU. PSVs are predicted to have nominal operating source sound levels of 170 to 180 dB re 1 µPa @ 1 m RMS SPL (Hurley and Ellis 2004). Sound levels produced by PSVs are not expected to be high enough to cause direct physical harm; however, similar to any other vessels, they could result in changes to swimming, foraging, or vocal behaviours and contribute to masking, as previously discussed (Richardson *et al.* 1995; Clark *et al.* 2009; Nowacek *et al.* 2007; Sundermeyer *et al.* 2012; Tougaard *et al.* 2012; Parks *et al.* 2012). Studies have shown that at frequencies dominated by shipping sound (10 to 100 Hz), ambient spectral sound levels in the RAA are up to 40 dB re 1 µPa higher than sound levels generated by high winds (Walmsley and Theriault 2011). PSV traffic is expected to avoid critical habitat for marine mammal SAR species.

Migratory birds can react to low-level helicopter flights although their reactions are often temporary in nature. However, as outlined in Section 7.4.8.2, helicopters transiting to and from the MODU will fly at altitudes greater than 300 m and at a lateral distance of 2 km around active colonies when possible. Helicopters will also avoid flying over Sable Island (a 2-km buffer will be recognized) except as needed in the case of an emergency, as is the standard protocol for other oil and gas operators working offshore Nova Scotia (see Section 7.5 of the EIS). Although migratory birds near the MODU may be disturbed during take-off and landing, they are likely to become habituated to the activity.

The presence of an approaching PSV may alert birds and flush some species from the area. The potential for PSVs to disturb bird colonies will be minor as the only colonies in the vicinity of the travel routes are in Halifax Harbour, where nesting birds are currently habituated to relatively high shipping activity. PSVs will not come in close proximity to any critical habitat for marine birds (*i.e.*, piping plover or roseate tern), or IBAs. PSV activities are expected to be low compared to ongoing ship activity within the LAA; two or three PSVs will be required for the transport of materials and equipment to the MODU and will make between two to three round trips per week. One PSV must also be present on-site at all times as a standby vessel, as required by BP's operating standards and under the CNSOPB regulations. PSVs travelling from mainland Nova Scotia will follow established shipping lanes in proximity to shore and travel at approximately 22 km/hour (12 knots), except as needed in the case of an emergency.

Well Abandonment

Well abandonment is likely only to give rise to a localized disturbance, and therefore it is expected that fish would avoid the immediate area where the mechanical separation activities are taking place. Following abandonment of the drill site, it is anticipated that the wellhead (if left in place), will provide hard substrate suitable for recolonization by benthic communities.

The well abandonment program has not yet been finalized. If approval is sought and granted to keep the wellhead in place, benthic communities may begin to colonize the hard surface of the wellhead; however, this change in habitat is expected to have a negligible effect on marine mammal and sea turtle populations. If the wellhead is removed, it will be done via mechanical separation, which will also result in limited interaction with marine mammals and sea turtles. The mechanical separation of the wellhead from the seabed will not produce excess sound or discharge, but it is likely that this physical disturbance may result in marine mammals and sea turtles temporarily avoiding the immediate area around the wellhead during this activity (which may take 7 to 10 days per well).

Summary of Residual Effects

In summary, the Project may result in adverse effects that cause a Change in Risk of Mortality or Physical Injury and a Change in Habitat Quality and Use for SAR/SOCC. In consideration of the implementation of applicable mitigation measures, best practices, and adherence to industry standards (*e.g.*, compliance with OWTG, *Canadian Practice with Respect to the Mitigation of Sound in the Marine Environment*), the residual effect of a Change in Risk of Mortality or Physical Injury for various Project components and activities is considered to be negligible to moderate in magnitude. Residual project environmental effects for a Change in Risk of Mortality or Physical Injury will be restricted primarily to the Project Area but could extend into parts of the LAA during VSP surveys, PSV operations, and helicopter transportation. The duration of effects will vary from short-term events (*i.e.*, no more than one day per well for VSP) to long-term, continuous or regular events such as the presence and operation of the MODU and waste management. These environmental effects may occur within a disturbed ecological and socio-economic context (associated with ongoing harvesting of fish species and underwater sound and waste discharge associated with marine shipping in the RAA). Similarly, changes to Habitat Quality and Use for SAR/SOCC are predicted to be negligible to low in magnitude, occur within the Project Area or parts of the LAA, be short to long-term in duration, be reversible at the completion of the Project, and occur within a relatively undisturbed ecological and socio-economic context. No permanent alteration to, or destruction of, SAR/SOCC habitat (including designated critical habitat) is predicted to occur as a result of Project activities.

Table 4 summarizes the environmental effects assessment and prediction of residual environmental effects resulting from those interactions between the Project and Species at Risk that were identified in Table 2.

Table 4 Summary of Project Residual Environmental Effects on SAR/SOCC

Residual Effect	Residual Environmental Effects Characterization						
	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Socio-economic Context
Change in Risk of Mortality or Physical Injury							
Presence and Operation of MODU (including well drilling and testing operations and associated lights, safety [exclusion] zone and underwater sound)	A	L-M	PA	MT	C	R	D
Waste Management (including discharge of drill muds and cuttings and other drilling and testing emissions)	A	L	PA	LT	R	R	D
Vertical Seismic Profiling	A	L	LAA	ST	IR	R	D
Change in Habitat Quality and Use							
Presence and Operation of MODU (including well drilling and testing operations and associated lights, safety [exclusion] zone and underwater sounds)	A	L	LAA	MT	C	R	D
Waste Management (including discharge of drill muds and cuttings and other drilling and testing emissions)	A	L	PA	LT	R	R	D
Vertical Seismic Profiling	A	L	LAA	ST	IR	R	D
Supply and Servicing Operations (including helicopter transportation and PSV operations)	A	L	LAA	MT	R	R	D
Well Abandonment	A	L	PA	ST	IR	R	D

KEY:
See Table 7.2.2 for detailed definitions
N/A: Not Applicable

Direction:
P: Positive
A: Adverse
N: Neutral

Magnitude:
N: Negligible
L: Low
M: Moderate
H: High

Geographic Extent:
PA: Project Area
LAA: Local Assessment Area
RAA: Regional Assessment Area

Duration:
ST: Short-term
MT: Medium-term
LT: Long-term

Frequency:
S: Single event
IR: Irregular event
R: Regular event
C: Continuous

Reversibility:
R: Reversible
I: Irreversible

Ecological/Socio-Economic Context:
D: Disturbed
U: Undisturbed

With the application of proposed mitigation and environmental protection measures, the residual environmental effects of a Change in Risk of Mortality of Physical Injury and Change in Habitat Quality on SAR/SOCC from Project activities and components are predicted to be not significant. This conclusion has been determined with a moderate to high level of confidence based on a good understanding of the general effects of exploration drilling and VSP operation on marine fish, mammal, sea turtle, and migratory bird SAR/SOCC and the effectiveness of mitigation measures proposed. Taking a conservative approach, the confidence level has been reduced to moderate in some cases to account for the lack of research around appropriate effects thresholds for continuous sounds on marine fish species. There is also scientific uncertainty of potential effects of introduced underwater sound on sea turtles and marine mammals (particularly with respect to species-specific behavioural effects). There are also inherent uncertainties in the acoustic model, as well as scientific disagreement about the appropriateness of the various thresholds. There is, however a reasonable understanding of the general effects of exploration drilling and VSP operation on marine mammals and the effectiveness of mitigation measures. The greatest risk to migratory bird SAR/SOCC from routine Project activities and components was identified as a potential Change in Risk of Mortality or Physical Injury as a result of the presence of the MODU and the transiting PSVs.

Follow-up and Monitoring

BP will assess in consultation with the appropriate authorities the potential for undertaking an acoustic monitoring program during the drilling program to collect field measurements of underwater sound in order to verify predicted underwater sound levels. The objectives of such a program will be identified in collaboration with DFO and the CNSOPB and in consideration of lessons learned from the underwater sound monitoring program to be undertaken by Shell as part of the Shelburne Basin Venture Exploration Drilling Project in 2016.

MMOs will be employed to monitor and report on sightings of marine mammals and sea turtles during VSP surveys. Monitoring will include visual observations and the use of passive acoustic monitoring (PAM) instruments to inform decisions related to mitigation actions required during VSP operations when baleen whales, sea turtles, or any marine mammal listed on Schedule 1 of SARA are detected within a minimum 650 m predetermined exclusion zone.

MMO duties will include watching for and identifying marine mammals and sea turtles; recording their numbers, distances and behaviour relative to the VSP survey; initiating mitigation measures when appropriate (*e.g.*, shutdown); and reporting results. Following the program, copies of the marine mammal and sea turtle observer reports will be provided to DFO and the CNSOPB.

PAM will be used to supplement visual surveys. The technical specifications and operational deployment configuration of the PAM system will be optimized within the bounds of operational and safety constraints in order to maximize the likelihood of detecting cetacean species anticipated to be in the area.

Following the program, recorded PAM data will be provided to DFO so that this information can be used to help inform understanding of marine mammals in the area.

More information on marine mammal and sea turtle follow-up and monitoring programs is provided in IR-083 and IR-085.

BP will also consult with DFO regarding relevant findings from the 2014 CSAS review that examined mitigation and monitoring measures for seismic survey activities in and near habitat for cetacean species at risk (DFO 2015a).

In the event that a vessel collision with a marine mammal or sea turtle occurs, BP will contact the Marine Animal Response Society or the Canadian Coast Guard to relay incident information.

Monitoring will also include routine checks for stranded birds on the MODU and PSVs (refer to IR-042.

Accidental Events

Section 8.4 and Appendix H of the EIS present the spill behavior modelling for worst credible case spill scenarios. Effects of accidental events on biological VCs are presented in Section 8.5.1 (Fish and Fish Habitat), 8.5.2 (Marine Mammals and Sea Turtles), and 8.5.3 (Migratory Birds).

Modelling results indicate that diesel spills from the MODU or PSV are not likely to result in biological effects on fish SAR/SOCC over a large area (refer to Section 8.4.10 or Appendix H). With respect to a Change in Habitat Quality and Use, the majority of diesel from a spill from either the MODU or PSV will evaporate and disperse within the first three days following the release (refer to Appendix H). This will create a temporary and reversible degradation in habitat quality. Depending on the location and extent of the spill, nearshore spawning and nursery areas could potentially be affected. There has not been any critical habitat identified in the RAA for fish SAR/SOCC and any impacts from a diesel spill are expected to be minimal. With respect to a Change in Risk of Mortality or Physical Injury, although there is a risk of sub-lethal and lethal effects to larval and juvenile fish species present in the mixed surface layer of the water column, these residual effects will likely be restricted to a localized area. The potential for these effects would also be temporary and reversible.

Marine mammals and sea turtles are not considered to be at high risk from a diesel spill, due to the fact that it is probable that only a small proportion of a species population would be within the area affected by the spill, which is expected to be limited in size. In addition, it is predicted that marine mammals would exhibit avoidance behavior in areas of harmful hydrocarbon concentrations, thereby limiting exposure.

For migratory bird SAR/SOCC the maximum exposure time for oil on the surface with a thickness greater than 0.04 μm is one day. As a result, this will create a temporary and reversible degradation in habitat quality. Depending on the location and extent of the spill, it could directly and indirectly reduce the amount of habitat available to migrating birds at sea. In the event of a vessel spill in the nearshore area, there is the potential for shoreline to be affected by a diesel spill. These effects would be short-term in duration. A batch spill of diesel is not expected to create permanent or irreversible changes to Habitat Quality and Use. With respect to Change in Risk of Mortality or Physical Injury for Migratory Birds, the accidental release of diesel fuel has the potential to affect migratory bird SAR/SOCC through direct contact, although it is predicted that the number of birds affected would be limited due to the short time and small area where the diesel would be on the water's surface.

In the event of a blowout scenario, greater concentrations of total hydrocarbons in spilled oil and present in the surface mixed layer following an incident during winter conditions, may be expected to result in higher mortalities and sub-lethal effects on fish eggs, larvae and juveniles. There is likely to be greater concentrations of dissolved hydrocarbons dissolved in the mixed surface layer during the winter due increases in wind and wave events during the winter season and leading to greater mixing of oil in the surface layer. In the unlikely event that dissolved hydrocarbons are transported towards inshore waters, residual effects on fish may extend to lethal and sub-lethal effects on the eggs, larvae and juveniles of demersal species and other fish species including those in spawning and nursing areas. The majority of adult finfish will be able to avoid exposure via temporary migration. In the event that the spill encompasses areas where fish eggs or larvae are located, lethal and sub-lethal effects could occur. It should be emphasized that the majority of fish SAR/SOCC species on the Scotian Shelf and Slope spawn in a variety of large areas and over long temporal periods. A spill, therefore, is not predicted to encompass all of these areas or time scales within the RAA to such a degree that natural recruitment of juvenile organisms may not re-establish the population(s) to their original level within one generation.

Stochastic modelling predicts the average probability of surface oiling (exceeding a thickness of 0.04 µm) reaching the Gully marine protected area (MPA) (designated critical habitat for the northern bottlenose whale) to be approximately 61% during the summer season (worst-case credible scenario) (May to October). The maximum exposure time for surface oil exceeding the 0.04 µm threshold in the Gully is 4 to 7 days. The maximum time-averaged thickness of surface oil predicted in the Gully MPA may reach more than 200 µm; however, the average time-averaged thickness is predicted to be less than 50 µm. Therefore there is potential for adverse environmental effects on species (including Sowerby's beaked whale, blue whale, North Atlantic right whale, killer whale, fin whale, and harbor porpoise) present in this area in the unlikely event of a well blowout incident. These effects could include physiological effects associated with direct oiling or ingestion of prey as described in 8.5.2.1 and/or indirect effects associated with a change in behaviour (including habitat use). Furthermore, Stochastic modelling predicts the average probability of surface oiling (exceeding a thickness of 0.04 µm) reaching the Roseway Basin (designated critical habitat for the North Atlantic right whale) to be approximately 20% during the winter season (worst-case credible scenario for the Roseway Basin) (November to April). A Change in Risk of Mortality or Physical Injury as well as a Change in Habitat Quality and Use for Marine Mammals and Sea Turtles SAR/SOCC is predicted to occur as a result of a well blowout scenario.

There are eight marine-related bird SAR/SOCC that occur within the RAA for the Project: ivory gull, piping plover, red-necked phalarope, buff-breasted sandpiper, roseate tern, red knot, Harlequin duck, and Barrow's goldeneye. Of these, red-necked phalarope, ivory gull and roseate tern are the most likely to occur within the Project Area. Roseate Tern is a diving species known to breed on Sable Island, which based on modelling results, would be susceptible to shoreline and surface oiling as a result of an unmitigated blowout incident. Although a landbird, savannah sparrow (princeps subspecies) breeds almost exclusively on Sable Island and the habitat of this species could be potentially influenced by an oil spill. Deterministic modelling results predicts that surface oiling from an unmitigated blowout could exceed a surface thickness threshold of 10 μm over a total area of 91,778 km^2.

With respect to a Change in Habitat Quality and Use for Migratory Birds, hydrocarbon spills are not likely to permanently alter the quality of marine bird habitat. Prey availability may be reduced or migratory birds may avoid affected habitat. However, spill cleanup and natural weathering processes are likely to result in the eventual recovery of such habitat. As indicated on Figures 8.4.11 to 8.4.14, there are several coastline areas that could potentially be exposed to shoreline oiling above the 1.0 g/m^2 threshold. For both Site 1 and Site 2 (both winter and summer seasons), Sable Island could be expected to result in heavy oiling (>10 mm thickness of emulsified oil on the shoreline). Stochastic modelling results for Site 2 (summer season) show more extensive shoreline oiling ranging from a stain/film (0.1 to 0.001 mm) to heavy oiling (>10 mm) in some locations along the Nova Scotia mainland coastline. As indicated in Section 5.2.8.3, there are several seabird colonies and IBAs along the coast (including small coastal islands) which potentially could be affected by a well blowout incident. The average minimum timeframe required for oil to potentially reach these areas at a threshold of 1 μm (minimum approximately 30 days for mainland Nova Scotia) would allow for response measures and containment equipment to be placed in advance to avoid or mitigate adverse effects.

There is potential for a SBM spill to result in a surface sheen, which in turn could potentially cause a Change in Risk of Mortality or Physical Injury for seabird SAR/SOCC present in the immediate area. If the wind and wave conditions were such that a sheen formed, it would be temporary and limited in size, such that only birds in the immediate area of the spill would likely be affected. Furthermore, given the low surface oil thickness required to result in a sheen (0.04 μm), it is expected that effects would be minor and unlikely to result in seabird mortality.

References:

Atlantic Leatherback Turtle Recovery Team. 2006. Recovery Strategy for Leatherback Turtle (Dermochelys coriacea) in Atlantic Canada. Species at Risk Act Recovery Strategy Series. Fisheries and Oceans Canada, Ottawa, vi + 45pp.

Au, W.W.L., and Hastings, M.C. 2008. Principles of marine bioacoustics. Spring Science, LCC.

Bain, D.E., and Williams, R. 2006. Long-range effects of airgun noise on marine mammals: responses as a function of received sound level and distance. Paper SC/58/E35 presented to the IWC Scient. Commit., IWC Annu. Meet., 1-13 June, St. Kitts.

BIO [Bedford Institute of Oceanography]. 2013a. Smooth Skate (Malacoraja senta). Bedford Institute of Oceanography-Research. Fisheries and Oceans Canada. Available from: http://www.bio.gc.ca/science/research-recherche/fisheries-pecheries/rays-raies/atlantic-atlantique/malacoraja-senta-eng.php.

Booman, C., Dalen, J., Leivestad, H., Levsen, A., van der Meeren, T., and og Toklum, K. 1996. Effekter av luftkanonskyting på egg, larver og yngel. Undersøkelser ved Havforskningsinstituttet og Zoologisk Laboratorium, UiB. (Engelsk sammendrag og figurtekster). Havforskningsinstituttet, Bergen. *Fisken og Havet*, nr. 3 (1996). 83 s.

Bourne, W.R.P. 1979. Birds and gas flares. Mar. Pollut. Bull., 10: 124-125.

Bruinzeel, L.W., van Belle, J., and Davids, L. 2009. The Impact of Conventional Illumination of Offshore Platforms in the North Sea on Migratory Bird Populations. A&W-rapport 1227. Altenburg & Wymenga Ecologisch Onderzoek, Feanwalden.

Bruinzeel, L.W., and van Belle, J. 2010. Additional Research on the Impact of Conventional Illumination of Offshore Platforms in the North Sea on Migratory Bird Populations. A&W-rapport 1439. Altenburg & Wymenga Ecologisch Onderzoek, Feanwalden.

BSC (Bird Studies Canada). 2016. Second Atlas of Breeding Birds of the Maritime Provinces. Breeding dates. Available at: http://www.mba-aom.ca/downloads/breedingdates.pdf. Accessed February 2017.

Campana, S.E., Gibson, A.J.F., Fowler, M., Dorey, A., and Joyce, W. 2013. Population Dynamics of Northwest Atlantic porbeagle (Lamna nasus), with an Assessment of Status and Projections for Recovery. Fisheries and Oceans Canada. Can. Sci. Advis. Sec. Res. Doc. 2012/096. iv + 84pp.

Casper, B.M., Matthews, F.M., Halvorsen, M.B., Carlson, T.J., and Popper, A.N. 2011. Recovery from exposure to pile driving signals by Chinook salmon. J. Acoust. Soc. Am. 129(4): 2436.

Chapman, C.J., and Hawkins, A.D. 1969. The Importance of Sound in Fish Behaviour in Relation to Capture by Trawls. FAO Fish. Rep. 62: 717-729.

Clark, C.W. 1990. Acoustic behavior of mysticete whales. In: Thomas, J., and Kastelein, R., (eds.). Sensory Abilities of Cetaceans. Plenum Press. pp. 571-583.

Clark, C.W., Ellison, W.T., Southall, B.L., Hatch, L., Van Parijs, S.M., Frankel, A., and Ponirakis, D. 2009. Acoustic masking in marine ecosystems: intuitions, analysis, and implication. Mar. Ecol. Prog. Ser. 395: 201-222. Available from: http://dx.doi.org/10.3354/meps08402.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2006a. COSEWIC Assessment and Status Report on the Blue Shark *Prionace glauca* (Atlantic and Pacific populations) in Canada. Committee on the Status of Endangered Wildelife in Canada. Ottawa. vii + 46pp. Available from: http://www/sararegostru/gc/ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2006b. COSEWIC Assessment and Status Report on the White Shark *Carcharodon carcharias* (Atlantic and Pacific populations) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 31pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2007a. COSEWIC Assessment and Status Report on the Roughhead Grenadier *Macrourus berglax* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 40pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2008a. COSEWIC Assessment and Status Report on the Roundnose Grenadier *Coryphaenoides rupestris* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 42pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2009b. COSEWIC Assessment and Status Report on the American Plaice *Hippoglossoides platessoides* (Maritime population, Newfoundland and Labrador population and Arctic population) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 74pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2009c. COSEWIC Assessment and Status Report on the Basking Shark *Ceorhinus maximus* (Atlantic population) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. Vii + 48 pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2010a. COSEWIC Assessment and Status Report on the Atlantic Salmon *Salmo salar* (Nunavik population, Labrador population, Northeast Newfoundland population, South Newfoundland population, Southwest Newfoundland population, Northwest Newfoundland population, Quebec Eastern North Shore population, Quebec Western North Shore population, Anticosti Island population, Inner St. Lawrence population, Lake Ontario population, Gaspé-Southern Gulf of St. Lawrence population, Eastern Cape Breton population, Nova Scotia Southern Upland population, Inner Bay of Fundy population, Outer Bay of Fundy population) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xlvii + 136pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2010b. COSEWIC Assessment and Status Report on the Spiny Dogfish *Squalus acanthias* (Atlantic population) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 50pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2010c. COSEWIC Assessment and Status Report on the Deepwater Redfish/ Acadian Redfish Complex *Sebates mentella* and *Sebates faciatus*, in Canada. Committee on the Status of

Endangered Wildlife in Canada. Ottawa. x + 80pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2010d. COSEWIC Assessment and Status Report on the Atlantic Cod *Gadus morhua* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 105pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2011b. COSEWIC Assessment and Status Report on the Atlantic Sturgeon *Acipenser oxyinchus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xiii +50pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2012a. COSEWIC Assessment and Status Report on the Thorny Skate *Amblyraja radiata* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. ix + 75pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2012b. COSEWIC Assessment and Status Report on the Atlantic Wolffish *Anarhichas lupus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. ix + 56pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2012c. COSEWIC Assessment and Status Report on the American Eel *Anguilla rostrata* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xii + 109pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2012d. COSEWIC Assessment and Status Report on the Northern Wolffish *Anarhichas denticulatus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 41pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2012e. COSEWIC Assessment and Status Report on the Spotted Wolffish *Anarhichas minor* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 44pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

Dalen, J., Ona, E., Vold Soldal, A. and og Sætre, R. 1996. Seismiske undersøkeleser til havs: En vurdering av konsekvenser for fisk og fiskerier. Fisken og Havet, nr. 9 – 1996. 26 s.

De Robertis, A., and Handegard, N.O. 2013. Fish avoidance of research vessels and the efficacy of noise-reduced vessels: A review. ICES J. Mar. Sci/J. Conseil. 70(1): 34-45.

DeRuiter, S.L. and Doukara, K.L., 2012. Loggerhead turtles dive in response to airgun sound exposure. Endangered Species Research, 16(1), pp.55-63.

DeRuiter, S.L., Tyack, P.L., Lin, Y.-T., Newhall, A.E., Lynch, J.F., and Miller, P.J.O. 2006. Modeling acoustic propagation of airgun array pulses recorded on tagged sperm whales (Physeter macrocephalus). J. Acoust. Soc. Am., 120(6): 4100-4114.

DFO [Fisheries and Oceans Canada]. 2004. Review of Scientific Information on Impacts of Seismic Sound on Fish, Invertebrates, Marine Turtles and Marine Mammals. Habitat Status Report 2004/002, September 2004.

DFO [Fisheries and Oceans Canada]. 2013e. Satellite Tagging Uncovers Surprising Birthing Ground of Porbeagle Sharks. Available from: http://www.dfo-mpo.gc.ca/science/publications/article/2011/01-24-11-eng.html.

DFO [Fisheries and Oceans Canada]. 2013i. Aquatic Species at Risk-American Plaice (Maritime population) Available from: http://www.dfo-mpo.gc.ca/species-especes/species-especes/american-plaice-plie-eng.htm.

DFO [Fisheries and Oceans Canada]. 2013j. Aquatic Species at Risk-American Eel. Available from: http://www.dfo-mpo.gc.ca/species-especes/species-especes/eel-anguille-eng.htm.

DFO [Fisheries and Oceans Canada]. 2013k. Aquatic Species at Risk-Acadian Redfish (Atlantic population). Available from: http://www.dfo-mpo.gc.ca/species-especes/species-especes/acadia-redfish-sebaste-acadie-eng.html#information.

DFO [Fisheries and Oceans Canada]. 2013w. 2011 Value of Atlantic Coast Commercial Landings, by Region. Preliminary data.

DFO [Fisheries and Oceans Canada]. 2015a. Review of Mitigation and Monitoring Measures for Seismic Survey Activities in and near the Habitat of Cetacean Species at Risk. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2015/005.

DFO [Fisheries and Oceans Canada]. 2015o. Recovery Strategy for the Leatherback Sea Turtle (Dermochelys coriacea) in Atlantic Canada [Draft]. Species at Risk Act Recovery Strategy Series. Fisheries and Oceans Canada Ottawa. vii + 48 pp.

Dooling, R.J., and Therrien, S.A. 2012. Hearing in birds: what changes from air to water. In: Popper, A.N., and Hawkins, A. (eds.). The Effects of Noise on Aquatic Life: Advances in Experimental Medicine and Biology. Vol. 730, pp. 77-82.

Dyndo, M., Wiśniewska, D.M., Rojano-Doñate, L. and Madsen, P.T. 2015. Harbour porpoises react to low levels of high frequency vessel noise. Scientific reports, 5.

Environment Australia. 2003. Recovery Plan for Marine Turtles in Australia. Prepared by the Marine Species Section Approvals and Wildlife Division, Environment Australia in consultation with the Marine Turtle Recovery Team Canberra (cited 7 March 2011). Available from: www.environment.gov.au/coasts/publications/turtle-recovery/index.html.

Erbe, C. 2002. Underwater noise of whale-watching boats and potential effects on killer whales (Orcinus orca), based on an acoustic impact model. Mar. Mamm. Sci., 18(2): 394-418.

Fewtrell, J.L., and McCauley, R.D. 2012. Impact of air gun noise on the behaviour of marine fish and squid. Mar. Pollut. Bull., 64(5): 984-993.

Fisheries Hydroacoustic Working Group. 2008. Agreement in Principle for Interim Criteria for Injury to Fish from Pile Driving Activities. Memorandum. Available from: http://www.wsdot.wa.gov/NR/rdonlyres/4019ED62-B403-489C-AF05-5F4713D663C9/0/BA_InterimCriteriaAgree.pdf.

Gauthreaux, Jr., S.A., and Belser, C.G. 2006. Effects of artificial night lighting on migrating birds. In: Rich, C., and Longcore, T. (eds.). Ecological Consequences of Artificial Night Lighting. Island Press, Washington, D.C. pp. 67-93.

Gordon, J., Gillespie, D., Potter, J., Frantzis, A., Simmonds, M.P., Swift, R., and Thompson, D. 2004. A review of the effects of seismic surveys on marine mammals. Mar. Tech. Soc. J., 37(4): 16-34.

Halvorsen, M.B., Woodley, C.M., Casper, B.M., Carlson, T.J., and Popper, A.N. 2011a. Derivation of a response severity index model for physiological quantification of fish response to impulsive sound. J. Acoust. Soc. Am. 129(4):2435.

Halvorsen, M.B., Casper, B.M., Woodley, C.M., Carlson, T.J., and Popper, A.N. 2011b. Predicting and mitigating hydroacoustic impacts on fish from pile installations. National Cooperative Highway Research Program Transportation Research Board of The National Academies, (in press).

Hawkins, A.D. and Popper, A.N. 2014. Assessing the impact of underwater sounds on fishes and other forms of marine life. Acoustics Today. Spring 2014.

Horsman, T.L., and Shackell, N.L. 2009. Atlas of Important Habitat for Key Fish Species of the Scotian Shelf, Canada. DFO Can. Tech. Rep. Fish. Aquat. Sci. 2835 viii + 82pp. Available from: http://www.dfo-mpo.gc.ca/Library/337080.pdf.

Hurley, G., and Ellis, J. 2004. Environmental Effects of Exploratory Drilling in Offshore Canada: Environmental Effects Monitoring Data and Literature Review-Final Report. Prepared for the Canadian Environmental Assessment Agency-Regulatory Advisory Committee. 61pp. + App.

Imber, M. 1975. Behavior of petrels in relation to the moon and artificial lights. Notornis, 22: 302-306.

Johnson, S.R., Richardson, W.J., Yazvenko, S.B., Blokhin, S.A., Gailey, G., Jenkerson, M.R., Meier, S.K., Melton, H.R., Newcomer, M.W., Perlov, A.S., *et al.* 2007. A western gray whale mitigation and monitoring program for a 3D seismic survey, Sakhalin Island, Russia. Environ. Monit. Assess., 134(1-3): 1-19.

Kasuya, T. 1986. Distribution and behavior of Baird's beaked whales off the Pacific coast of Japan. Sci. Rep. Whales Res. Inst., 37: 61-83.

Ketten, D.R., and Bartol, M. 2005. Functional Measures of Sea Turtle Hearing. Woods Hole Oceanographic Institution: ONR Award No: N00014-02-1-0510.

Kostyuchenko, L.P. 1973. Effects of elastic waves generated in marine seismic prospecting on fish eggs in the Black Sea. Hydrobiol J 9:45–46.

Kulka, D., C. Hood and J. Huntington. 2007. Recovery Strategy for Northern Wolffish (Anarhichas denticulatus) and Spotted Wolffish (Anarhichas minor), and Management Plan for Atlantic Wolffish (Anarhichas lupus) in Canada [Proposed]. Fisheries and Oceans Canada: Newfoundland and Labrador Region. St. John's, NL. x + 103 pp.

Lacroix, D.L., Lancot, R.B., Reed, J.A., and McDonald, T.L. 2003. Effect of underwater seismic surveys on molting male long-tailed ducks in the Beaufort Sea, Alaska. Can. J. Zool., 81: 1862-1875.

Lawson, J.W., Davis, R.A., Richardson, W.J., and Malme, C.I. 2000. Assessment of noise issues relevant to key cetacean species (northern bottlenose and sperm whales) in the Sable Gully Area of Interest. Prepared for Oceans Act Coordination Office, Maritimes Region, Department of Fisheries and Oceans Canada.

Lee, K., Bain, H., and Hurley, G.V. (eds.). 2005. Acoustic Monitoring and Marine Mammal Surveys in the Gully and Outer Scotian Shelf before and during Active Seismic Programs. Environmental Studies Research Funds Report No. 151.

Lee, K., Armsworthy, S.L., Cobanli, S.E., Cochrane, N.A., Cranford, P.J., Drozdowski, A., Hamoutene, D., Hannah, C.G., Kennedy, E., King, T., *et al.* 2011. Consideration of the Potential Impacts on the Marine Environment Associated with Offshore Petroleum Exploration and Development Activities. DFO. Can. Sci. Advis. Sec. Res. Doc. 2011/060: xii + 134pp.

LGL [LGL Limited]. 2014. Environmental Assessment of BP Exploration (Canada) Limited's Tangier 3-D Seismic Survey. BP Document No. NS-HS-REP-BP-B01-0001. March 2014.

Ljungblad, D.K., Würsig, B., Swartz, S.L., and Keene, J.M. 1988. Observations on the behavioral responses of bowhead whales (Balaena mysticetus) to active geophysical vessels in the Alaskan Beaufort Sea. Arctic, 41(3): 183-194.

Luksenburg, J.A., and Parsons, E.C.M. 2009. The effects of aircraft on cetaceans: implications for aerial whalewatching. International Whaling Commission, SC/61/WW2. 10pp. Available from: http://www.researchgate.net/publication/228409420_The_effects_of_aircraft_on_cetaceans_implications_for_aerial_whalewatching/file/9fcfd50b0a3b9d8a7a.pdf.

Maguire, J.J., and Lester, B. 2012. Bluefin tuna (Thunnus thynnus) in Atlantic Canadian Waters: Biology, Status, Recovery Potential, and Measures for Mitigation. DFO Can. Sci. Advis. Sec. Res. Doc. 2012/002: vi + 28pp.

Malme, C.I., Miles, P.R., Clark, C.W., Tyack, P., and Bird, J.E. 1984. Investigations of the Potential Effects of Underwater Noise from Petroleum Industry Activities on Migrating Gray Whale Behavior / Phase II: January 1984 Migration. BBN Report 5586 from Bolt Beranek & Newman Inc., Cambridge, MA, for US Minerals Management Service, Anchorage, AK. Various pages.

Malme, C.I., Miles, P.R., Tyack, P., Clark, C.W., and Bird, J.E. 1985. Investigation of the Potential Effects of Underwater Noise from Petroleum Industry Activities on Feeding Humpback Whale Behavior. BBN Report 5851 from BBN Labs Inc., Cambridge, MA, for US Minerals Management Service, Anchorage, AK. OCS Study MMS 85-0019.

Malme, C.I., Wursig, B., Bird, J.E., and Tyack, P. 1988. Observations of feeding gray whale responses to controlled industrial noise exposure. In: Sackinger, W.M., and Jeffries, M.O. (eds.). Port and Ocean Engineering Under Arctic Conditions. Volumn II. University of Alaska, Fairbanks, AK, Geophys. Inst. 131pp: 55-73.

Manly, B.F.J., Moulton, V.D., Elliott, R.E., Miller, G.W., and Richardson, W.J. 2007. Analysis of Covariance of Fall Migrations of Bowhead Whales in Relation to Human Activities and Environmental Factors, Alaskan Beaufort Sea: Phase I, 1996-1998. LGL Rep. TA2799-2; OCS Study MMS 2005-033. Rep. from LGL Limited, King City, Ont., and WEST Inc., Cheyenne, WY, for U.S. Minerals Manage. Serv., Herndon, VA, and Anchorage, AK. 128pp.

McCauley, R.D., Jenner, M.-N., Jenner, C., McCabe, K.A., Murdoch, J. 1998. The response of humpback whales (Megaptera novaeangliae) to offshore seismic survey noise: preliminary results of observations about a working seismic vessel and experimental exposures. Australian Petroleum Producers and Exploration Association. APPEA J.

McCauley, R.D., Fewtrell, J., Duncan, A.J., Jenner, C., Jenner, M.-N., Penrose, J.D., Prince, R.I.T., Adhitya, A. Murdoch, J., and McCabe, K. 2000a. Marine Seismic Surveys: Analysis of Airgun Signals and Effects of Air Gun Exposure on Humpback Whales, Sea Turtles, Fishes and Squid. Report prepared by the Centre for Marine Science and Technology (Report R99-15), Curtin University, Perth, WA, for Australian Petroleum Production Association, Sydney, NSW.

McCauley, R.D., Fewtrell, J., Duncan, A.J., Jenner, C., Jenner, M.-N., Penrose, J.D., Prince, R.I.T., Adhitya, A., Murdoch, J., and McCabe, K. 2000b. Marine seismic surveys-A study of environmental implications. Australian Petroleum Producers and Exploration Association. APPEA J., 40: 692-706.

Miller, G.W., Elliott, R.E., Koski, W.R., Moulton, V.D., Richardson, W.J. 1999. Whales. In: Richardson, W.J., editor. Marine mammal and acoustical monitoring of western geophysical's open-water seismic program in the Alaskan Beaufort Sea, 1998. LGL Rep. TA2230-3. Rep. from LGL Limited, King City, Ont., and Greeneridge Sciences Inc., Santa Barbara, CA, for Western Geophysical, Houston, TX, and Nat. Mar. Fish. Serv., Anchorage, AK, and Silver Spring, MD. 390 pp: 5-1 to 5-109.

Miller, G.W., Moulton, V.D., Davis, R.A., Holst, M., Millman, P., MacGillivray, A., and Hannay, D. 2005. Monitoring seismic effects on marine mammals-Southeastern Beaufort Sea, 2001-2002. In: Armsworthy, S.L., Cranford, P.J., Lee, K. (eds.). Offshore Oil and Gas Environmental Effects Monitoring: Approaches and Technologies. Battelle Press, Columbus, OH. 631 pp: 511-542.

Moein, S.E., Musick, J.A., Keinath, J.A. *et al.* (1995) Evaluation of seismic sources for repelling sea turtles from hopper dredges. In: Hales LZ (ed) Sea turtle research program: summary report. Prepared for US Army Engineer Division, South Atlantic, Atlanta, GA, and US Naval Submarine Base, Kings Bay, GA. Technical Report CERC-95, 90, p 75–78.

Montevecchi, W.A., Wiese, F.K., Davoren, G.K., Diamond, A.W., Huettmann, F., and Linke, J. 1999. Seabird Attraction to Offshore Platforms and Seabird Monitoring From Offshore Support Vessels and Other Ships: Literature Review and Monitoring Designs. Prepared for the Canadian Association of Petroleum Producers. 56pp.

Montevecchi, W.A. 2006. Influences of artificial light on marine birds. In: Rich, C., Longcore, T. (eds.). Ecological Consequences of Artificial Night Lighting. Island Press, Washington, D.C. 478 pp: 94-113.

Moulton, V.D., and Holst, M. 2010. Effects of Seismic Survey Sound on Cetaceans in the Northwest Atlantic. ESRF Rep.182.

Müeller-Blenkle, C., Jones, E., Reid, D., Lüdemann, K., Kafemann, R., and Elepfandt, A. 2008. Reactions of cod (Gadus morhua) to low frequency sound resembling offshore wind turbine noise emissions. Bioacoustics, 17: 207-209.

NOAA [National Marine Fisheries Service]. n.d. Marine Mammals: Interim Sound Threshold Guidance (webpage). National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce. http://www.westcoast.fisheries.noaa.gov/protected_species/marine_mammals/threshold_guidance.html.

NOAA [National Oceanic and Atmospheric Administration]. 2008. Impacts to Marine Fisheries Habitat from Nonfishing Activities in the Northeastern United States. Northeast Regional Office Gloucester, Massachusetts NOAA Technical Memorandum NMFS-NE-209.

NOAA [National Oceanic and Atmospheric Administration]. 2013e. Fish Watch: Western Atlantic Bluefin Tuna. Available from: http://www.fishwatch.gov/seafood_profiles/species/tuna/species_pages/atl_bluefin_tuna.htm.

NOAA [National Oceanic and Atmospheric Administration]. 2015b. Draft Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing: Underwater Acoustic Threshold Levels for Onset of Permanent and Temporary Threshold Shifts. In: National Oceanic and Atmospheric Administration and U.S. Department of Commerce. Revised version for Second Public Comment Period. 180 pp. http://www.nmfs.noaa.gov/pr/acoustics/draft%20acoustic%20guidance%20July%202015.pdf.

Normandeau Associates Inc. 2012. Effects of Noise on Fish, Fisheries, and Invertebrates in the U.S. Atlantic and Arctic from Energy Industry Sound-Generating Activities. A Workshop

Report for the U.S. Dept. of the Interior, Bureau of Ocean Energy Management. Contract # M11PC00031. 72 pp. plus Appendices.

Nowacek, D.P., Thorne, L.H., Johnston, D.W., and Tyack, P.L. 2007. Responses of cetaceans to anthropogenic noise. Mammal Rev., 37: 81-115.

NRC [National Research Council]. 2005. Marine mammals populations and ocean noise: determining when noise causes biologically significant effects. The National Academies Press, Washington, DC.

Office of Naval Research. 2002. Ocean Life: Green Sea Turtle-Current Research, Science and Technology Focus, Oceanography. Available from: http://www.onr.navy.mil/focus/ocean/life/turtle4.htm.

OSPAR [OSPAR Commission]. 2009. Overview of the Impacts of Anthropogenic Underwater Sound in the Marine Environment. Publication number 441/2009. 134pp. Available from: http://qsr2010.ospar.org/media/assessments/p00441_Noise_background_document.pdf.

Parks, S.E., Johnson, M.P., Nowacek, D.P., Tyack, P.L. 2012. Changes in Vocal Behavior of North Atlantic Right Whales in Increased Noise. In: Popper, A.N., Hawkins, A. editors. The Effects of Noise on Aquatic Life, Springer, pp. 317-320.

Patenaude, N.J., Richardson, W.J., Smultea, M.A., Koski, W.R., Miller, G.W., Wuersig, B. and Greene, C.R. Jr. 2002. Aircraft sound and disturbance to bowhead and beluga whales during spring migration in the Alaskan Beaufort Sea. Marine Mammal Science, 18, 309–355.

Poot, H., Ens, B.J., de Vries, H., Donners, M.A.H., Wernand, M.R., and Marquenie, J.M. 2008. Green light for nocturnally migrating birds. Ecol. Soc., 13(2): 47. Available from: http://www.ecologyandsociety.org/vol13/iss2/art47/.

Popper, A.N., Hawkins, A.D., Fay, R.R., Mann, D.A., Bartol, S., Carlson, T.J., Coombs, S., Ellison, W.T., Genrey, R.L., Halvorsen, M.B., Lokkeborg, S., Rogers, P.H., Southall, B.L., Zeddies, D.G., and Tavolga, W.N. 2014. Sound Exposure Guidelines for Fishes and Sea Turtles. A Technical Report prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI.

Potter, J.R., Thillet, M., Douglas, C., Chitre, M.A., Doborzynski, Z., and Seekings, P.J. 2007. Visual and passive acoustic marine mammal observations and high-frequency seismic source characteristics recorded during a seismic survey. IEEE J. Oceanic Eng., 32(2): 469-483.

Richardson, W.J., Wursig, B. 1995. Influences of man-made noise and other human actions on cetacean behaviour. Mar. Freshw. Behav. Physiol., 29: 183–209.

Richardson, W.J., Würsig, B., and Greene, C.R. 1986. Reactions of bowhead whales, Balaena mysticetus, to seismic exploration in the Canadian Beaufort Sea. J. Acoust. Soc. Am., 79(4): 1117-1128.

Richardson, W.J., Greene, Jr., C.R., Malme, C.I., and Thomson, D.H. 1995. Marine mammals and noise. Academic Press, San Diego, California. 576 pp: 631-700.

Richardson, W.J., Holst, M., Koski, W.R., Cummings, M. 2009. Responses of cetaceans to large-source seismic surveys by Lamont-Doherty Earth Observatory. In: Abstr. 18th Bienn. Conf. Biol. Mar. Mamm., Québec, Oct. 2009. 306 pp: 213.

Ronconi, R.A., Allard, K.A., and Taylor, P.D. 2015. Bird interactions with offshore oil and gas platforms: review of impacts and monitoring techniques. Journal of Environmental Management; 147: 34-45.

Sætre, R., and Ona, E. 1996. Seismiske undersøkelser og skader på fi skeegg og -larver; en vurdering av mulige effekter på bestandsnivå. Havforskningsinstituttet, Fisken og Havet nr. 8–1996. Seismic investigations and damage to fish eggs and larvae: an assessment of potential effects on the population level.

SARA [Species at Risk Act]. 2015. Species at Risk Registry: Species Profile (Atlantic Salmon) Accessed at: https://www.registrelep-sararegistry.gc.ca/species/speciesDetails_e.cfm?sid=672 on October 20, 2015.

Shackell, N.L., and Frank, K.T. 2000. Larval fish diversity on the Scotian Shelf. Can. J. Fish. Aquat. Sci., 57: 1747-1760.

Southall, B.L., Bowles, A.E., Ellison, W.T., Finneran, J.J., Gentry, R.L., Greene, Jr., C.R., Lastal, D., Ketten, D.R., Miller, J.H., and Nachitgall, P.E. 2007. Special Issue: marine mammal noise exposure criteria: initial scientific recommendations. Aquat. Mammals, 33(4): 411-521.

Stemp, R. 1985. Observations on the effects of seismic exploration on seabirds. In: Greene, G.D., Engelhardt, F.R., and Paterson, R.J. (eds.). Proceeding Workshop on Effects of Explosives Use in the Marine Environment, January, 1985, Halifax, NS. Canadian Oil and Gas Lands Administration, Environmental Protection Branch, Ottawa, ON. Technical Report No. 5; pp. 217-233.

Stone, C.J., and Tasker, M.L. 2006. The effects of seismic airguns on cetaceans in UK waters. J. Cetac. Res. Manage., 8(3): 255-263.

Sundermeyer, J.K., Lucke, K., Dahne, M., Gallus, A., Krugel, K., and Siebert, U. 2012. Effects of underwater explosions on presence and habitat use of harbor porpoises in the German Baltic Sea. In: Popper, A.N., Hawkins, A., editors. Effects of Noise on Aquatic Life. Vol. 730, 289-291.

Tougaard, J., Kyhn, L.A., Amundin, M., Wennerberg, D., and Bordin, C. 2012. Behavioral reactions of harbor porpoises to pile-driving noise. In: Popper, A.N., Hawkins, A., editors. The Effects of Noise on Aquatic Life. Vol. 730, 277-280.

Turnpenny, A.W.H., and Nedwell, J.R. 1994. The Effects on Marine Fish, Diving Mammals and Birds of Underwater Sounds Generated by Seismic Surveys. Report by Fawley Aquatic Research Laboratory Ltd. (FCR 089/94) for U.K. Offshore Operators Association (UKOAA).

Tyack, P.L., Johnson, M.P., Madsen, P.T., Miller, P.J., and Lynch, J. 2006. Biological significance of acoustic impacts on marine mammals: examples using an acoustic recording tag to define acoustic exposure of sperm whales, Physeter catodon, exposed to airgun sounds in controlled exposure experiments. Eos, Trans. Am. Geophys. Union 87(36), Joint Assembly Suppl., Abstract OS42A-02. 23-26 May, Baltimore, MD.

Tufts, R.W. 1986. Birds of Nova Scotia. Third Edition. Nimbus Publishing Limited and The Nova Scotia Museum. Halifax, Nova Scotia. 478 pp.

Veirs, S., Veirs, V., and Wood, J.D. 2016. Ship noise extends to frequencies used for echolocation by endangered killer whales. PeerJ, 4:e1657.

Walmsley, D., and Theriault, J. 2011. State of the Scotian Shelf Report: Ocean Noise. Atlantic Coastal Zone Information Steering Committee [ACZISC]. 25 pp. Available from: http://coinatlantic.ca/docs/ocean-noise.pdf.

Watkins, W. A. 1986. Whale reactions to human activities in Cape Cod waters. Marine Mammal Science, 2, 251-262.

Weir, C.R. 1976. Annotated bibliography of bird kills at man-made obstacles: a review of the state-of-the-art and solutions. Can. Wildl. Serv., Ont. Reg., Ottawa. 85 pp.

Weir, C.R. 2007.Observations of marine turtles in relation to seismic airgun sound off Angola.Mar. Turt. Newsl., 116 (2007), pp. 17–20

Weir, C.R. 2008. Overt responses of humpback whales (Megaptera novaeangliae), sperm whales (Physeter macrocephalus), and Atlantic spotted dolphins (Stenella frontalis) to seismic exploration off Angola. Aquat. Mamm., 34(1): 71-83.

Wiese, F.K., Montevecchi, W.A., Davoren, G.K., Huettmann, F., Diamond, A.W., and Linke, J. 2001. Seabirds at risk around offshore oil platforms in the Northwest Atlantic. Mar. Pollut. Bull., 42: 1285-1290.

Würsig, B., Lynn, S.K., Jefferson, T.A., and Mullin, K.D. 1998. Behaviour of cetaceans in the northern Gulf of Mexico relative to survey ships and aircraft. Aquat. Mamm. 24(1):41-50.

Zykov, M.M. 2016. Modelling Underwater Sound Associated with Scotian Basin Exploration Drilling Project: Acoustic Modelling Report. JASCO Document 01112, Version 2.0. Technical report by JASCO Applied Sciences for Stantec Consulting Ltd. February 2010.

Information Request (IR) IR-051 (DFO-10)

Applicable CEAA 2012 effect(s): 5(1)(a)(i) Fish and Fish Habitat; 5(1)(a)(ii) Aquatic Species

EIS Guidelines Reference: Part 2, 6.4 Mitigation

EIS Reference: 5.2.6.4 Species at Risk and Species of Conservation Concern, p.5.140

Context and Rationale: DFO has noted that habitat in the project area is important to the Northern Bottlenose Whale. Specifically, DFO has advised with increasing confidence that Logan Canyon on the east side of the project area is important to Northern Bottlenose Whales.

Specific Question or Request: Taking into consideration the advice from DFO, describe whether additional mitigation measures for the Bottlenose Whale should be applied in Logan Canyon. Update the effects assessment as appropriate.

Response: BP has committed to carrying out a suite of measures to facilitate the detection of marine mammals during vertical seismic profile (VSP) surveys irrespective of the well locations in the Project Area. Therefore these commitments will be applied if a wellsite falls in or near Logan's Canyon (*i.e.*, in a location where effects from the Project could have a potential interaction with any potential marine mammals in Logan's Canyon.

BP will carry out concurrent visual and passive acoustic monitoring (PAM) during VSP surveys. This commitment for concurrent monitoring represents enhanced mitigation beyond the Statement of Canadian Practice with Respect to the Mitigation of Seismic Sound in the Marine Environment (DFO 2007).

Marine mammal observers (MMOs) will be used to monitor and report on marine mammal and sea turtle sightings during VSP surveys. This will enable VSP shutdown or delay actions to be implemented if marine mammal or sea turtle species listed on Schedule 1 of *Species at Risk Act* (SARA) (or any other baleen whales or sea turtles) are detected within the monitored exclusion zone.

Furthermore, BP will adopt a ramp-up procedure (*i.e.*, gradually increasing seismic source elements over a period of approximately 30 minutes before the operating level is achieved) before any VSP activity begins. BP will also adopt a pre-ramp up watch of 60 minutes whenever VSP activities are scheduled to occur in deep-water areas where beaked and other deep-diving whales may be present. This measure is recommended by Fisheries and Oceans Canada (DFO) so that MMOs can enable shutdown or delay actions if marine mammal or sea turtle species listed on Schedule 1 of SARA (or any other baleen whales or sea turtles) are detected within the monitored exclusion zone.

Additionally, PAM will be used throughout the VSP surveys to detect vocalising marine mammals, concurrent to the MMOs' visual monitoring. The technical specifications and operational deployment configuration of the PAM system will be optimised within the bounds of operational and safety constraints to maximise the likelihood of detecting cetacean species anticipated in the area.

The EIS assumed potential presence of northern bottlenose whales in the Project Area, Local Assessment Area and Regional Assessment Area and therefore assessed potential effects of the Project on this species (refer also to the response provided for IR-050). Although BP has committed to additional mitigation measures, the conclusions of the EIS (no significant adverse residual effects as a result of routine Project activities) remain unchanged.

References:

DFO [Fisheries and Oceans Canada]. 2007. Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment. http://www.dfo-mpo.gc.ca/oceans/management-gestion/integratedmanagement-gestionintegree/seismic-sismique/statement-enonce-eng.asp.

Information Request (IR) IR-052

Applicable CEAA 2012 effect(s): 5(1)(c), 5(2)(b)

EIS Guidelines Reference: Part 2, 6.5 Significance of residual effects

EIS Reference: 7.5.5 Criteria for Characterizing Residual Environmental Effects and Determining Significance

Context and Rationale: The EIS states that "For the purposes of this effects assessment, a significant adverse residual environmental effect on Commercial Fisheries is defined as a project-related environmental effect that results in one or more of the following outcomes:

- local fishers being displaced or unable to use substantial portions of the areas currently fished for all or most of a fishing season;
- local fishers experiencing a change in the availability of fisheries resources (*e.g.* fish mortality and/or dispersion of stocks) such that resources cannot continue to be used at current levels within the RAA for more than one fishing season; or
- unmitigated damage to fishing gear."

Additional information on the choice of thresholds is required.

Specific Question or Request: Provide a rationale for the use of these significance thresholds for Commercial Fisheries proposed in the EIS, including information on why effects less than the threshold described would not be considered significant by the proponent.

Response: The criteria for established thresholds for determining the significance of residual adverse environmental effects are included in Section 6.2.3.5 of the Environmental Impact Statement (EIS). As discussed in Section 6.2.3.5, criteria are defined using available information, scientific literature, applicable regulatory documents, environmental standards, guidelines or objectives where available and the professional judgment of the Environmental Assessment (EA) Study Team. The definition of significance is VC-specific and is intended to cover a wide range of potential effects, with the thresholds establishing a level beyond which a residual environmental effect would be considered an unacceptable change by regulators and stakeholders. By definition, any change to the valued component (VC) that would not meet the threshold would be considered not significant.

This significance definition for Commercial Fisheries is linked to the Canada-Nova Scotia Offshore Petroleum Board (CNSOPB) Compensation Guidelines Respecting Damages Relating to Offshore Petroleum Activity (C-NLOPB and CNSOPB 2002) (third bullet above) and acknowledges that a change in availability of resources or displacement for more than one fishing season may cause substantial economic hardship to commercial fishers (first and second bullet above).

References:

C-NLOPB [Canada-Newfoundland and Labrador Offshore Petroleum Board] and CNSOPB [Canada-Nova Scotia Offshore Petroleum Board]. 2002. Compensation Guidelines

Respecting Damages Relating to Offshore Petroleum Activity. Available from: http://www.cnsopb.ns.ca/pdfs/CompGuidelines.pdf

Information Request (IR) IR-053

Applicable CEAA 2012 effect(s): 5(1)(a)(i); 5(1)(a)(ii)

EIS Guidelines Reference: Part 2, 6.3.9 Commercial Fisheries

EIS Reference: Table 3.4.1 Summary of Key Issues Raised During Public Stakeholder Engagement, p. 3.12

Context and Rationale: The response to concerns raised about possible effects on the fishing industry includes the statement that "For the most part, effects on the fishery will be limited to a 500-metre safety (exclusion) zone from the MODU….."

Specific Question or Request: Explain why the qualifier "for the most part" was used. Are there effects that may extend beyond the safety zone?

Response: The reference noted above was included in the Summary of Key Issues Raised During Public Stakeholder Engagement table (Table 3.4.1). The intent of the table is to provide a high-level overview of the stakeholder comments and response. Additional detail regarding the potential effects on commercial fisheries is provided in Section 7.6 of the Environmental Impact Statement (EIS). As noted in Section 7.6.8.3 and 7.2.8.3 of the EIS, vertical seismic profiling (VSP) activity has the potential to cause startle and alarm responses of marine fish at distances greater than 20 km from the VSP sound source. This has the potential to cause behavioural changes in fisheries species, thereby potentially indirectly affecting the availability of fisheries resources. However, potential effects from VSP operations are typically of short duration, normally taking no more than a day per well and expected to be low. Effects on fisheries as a result of behavioral changes in fish associated with the VSP activity would therefore be low.

Information Request (IR) IR-054

Applicable CEAA 2012 effect(s): 5(1)(b)(i); 5(1)(c); 5(2)(a)

EIS Guidelines Reference: Part 2, 6.3.9 Commercial Fisheries - "The proponent is to assess the environmental effects of the Project from routine operations and accidents and malfunctions on…

…commercial fisheries, including…..effects from subsea infrastructure that could be left in place (*e.g.* wellheads) following abandonment".

EIS Reference: 2.4.4 Well Abandonment; Table 3.4.1, page 3.17; page 7.42 Well Abandonment; 2.4.4 Well Abandonment; 7.5.8.3 Characterization of Residual Project-Related Environmental Effects

Context and Rationale: The EIS (page 7.115) states "….all wells drilled as part of the Project will be abandoned." This implies that there is no possibility that a well could be suspended for later re-entry. Furthermore, the EIS states (section 2.4.4) "It is possible that subsea infrastructure could be removed….

Alternatively, approval may be sought to leave the wellhead in place." The EIS (page 7.43) states that

"following abandonment of the drill site, it is anticipated that the wellhead (if left in place), will provide hard substrate suitable for recolonization by benthic communities." In Table 3.4.1 it is stated that "inspection and monitoring of abandoned wellheads will be conducted according to CNSOPB requirements."

It is unclear what subsea infrastructure would remain after decommissioning, and how that could affect commercial fisheries.

Specific Question or Request: Confirm whether or not all wells will be abandoned (and not suspended) at the end of drilling or testing operations and whether or not abandoned wells are monitored. Describe potential effects on commercial fisheries (*e.g.* risk of fishing gear damage). Clarify what would be the worst-case scenario for effects of sub-sea infrastructure (*e.g.* all seven wells drilled, and then abandoned with wellheads left in place) and discuss whether or not this would change the analysis of potential effects on commercial fisheries. Provide updated analysis of effects on commercial fishing, as necessary.

Response: BP's aim is to permanently plug and abandon all wells in line with BP practices and Canada-Nova Scotia Offshore Petroleum Board (CNSOPB) requirements at the end of the drilling and testing program. Information about the proposed well abandonment program options is included in Section 2.4.4 of the Environmental Impact Statement (EIS). The final abandonment program has not yet been defined. Irrespective of the details of the abandonment program, all abandoned wells will have cement plugs placed at defined intervals within the wellbore as well as at the surface.

It is likely that approval will be sought to leave the wellhead in place however it is possible that subsea infrastructure will be removed. In the event that the approval is sought to leave the wellhead in situ, the only infrastructure that will be left on the seafloor is a wellhead which would be approximately 5 to 12 feet in height and take up a permanent footprint of less than 1m^2. The largest outside dimension on the wellhead is the extension joint which is 36" in diameter. All other subsea infrastructure, including the blowout preventer (BOP) will be removed. The BOP will only be removed once the cement plugs are put in place. Final details about the well abandonment program will be confirmed to the CNSOPB as planning continues.

Section 7 of the EIS discusses the potential effects of well abandonment. In light of the fact that the final well abandonment program has not been finalized, both abandonment cases were considered throughout the assessment (*i.e.* removal of subsea infrastructure and leaving the wellhead in situ) to take account of the potential environmental effects associated with both cases.

In Section 7.6.8.3 of the EIS, a discussion is provided about the potential effects of well abandonment on commercial fisheries. If the wellhead is left in situ, it is acknowledged that there could potentially be an interaction with commercial fishing activity in the Project Area as there could be a change in fish habitat. This could occur because the wellhead, a relatively small structure, will remain above the seabed thereby providing a hard substrate suitable for recolonization by benthic communities. However, the interaction is expected to be very limited because of the deep water depths in the Project Area and anticipated localized nature of effects around the wellsite. It is concluded that the Change in Availability of Fisheries Resources as a result of well abandonment is predicted to be adverse, low in magnitude and localized to within the Project Area. Effects are expected more than once over the lifetime of the Project, but at irregular intervals. Any disruption from physical activities associated with well abandonment is likely to be short term in duration. It is likely that Project effects associated with well abandonment will be reversible because the substrate will recolonize.

Information Request (IR) IR-055 (DFO-03)

Applicable CEAA 2012 effect(s): 5(1)(a)(i) Fish and Fish Habitat; 5(1)(a)(ii) Aquatic Species

EIS Guidelines Reference: Part 2, 6.1.8 Special areas

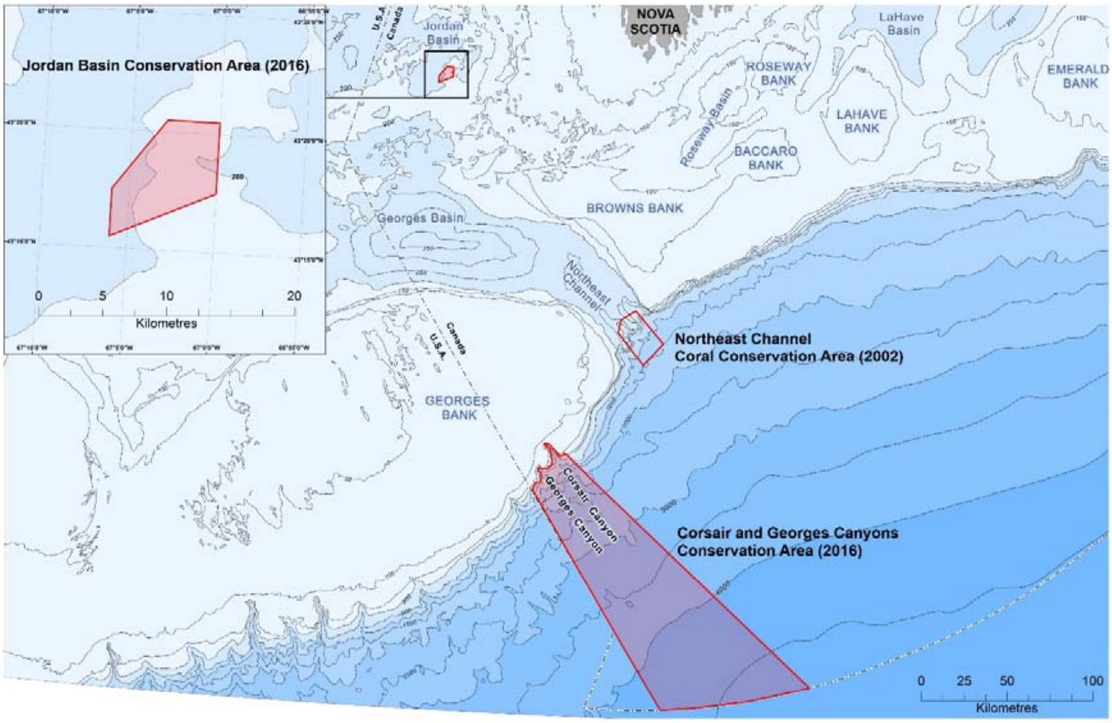
EIS Reference: 5.2.10 Special Areas, p. 5.207

Context and Rationale: Special areas within an approximate 300-kilometre radius are described in the EIS but do not include two new areas that were recently established. Under federal objectives, additional protected areas such as fishery closure areas, Critical Habitat, Marine Protected Areas or related Areas of Interest may be identified during the life of the Project. Two new Sensitive Benthic Areas, the Corsair and Georges Canyons Conservation Area (9106 square kilometres) and the Jordan Basin Conservation Area (49 square kilometres), have recently been established and are closed to bottom contact fishing. These coral communities qualify for protection under DFO's *Policy for Managing the Impact of Fishing on Sensitive Benthic Areas*. DFO has advised that there will likely be other special areas identified over the life of the Project.

Specific Question or Request: Assess potential effects of the Project on Corsair and Georges Canyons Conservation Area and the Jordan Basin Conservation Area and describe any measures that would be implemented to mitigate these effects. Should new special areas be identified during the lifetime of the Project, describe how potential effects of the Project on these areas would be considered and mitigated, as appropriate.

Response: Two new Sensitive Benthic Areas were designated for protection in December 2016 under DFO's *Policy for Managing the Impact of Fishing on Sensitive Benthic Areas*: Corsair and Georges Canyons Conservation Area (south of Georges Bank) and Jordan Basin Conservation Area (100 km west of Yarmouth). Under the Sensitive Benthic Area Policy, both of these areas are now closed to bottom-contact fishing and DFO is committed to work with other regulators and ocean users to minimize bottom disturbances in these areas (DFO 2017).

Given the distance from the Project Area (approximately 320 km southwest for Corsair and Georges Canyons Conservation Area and approximately 440 km northwest for Jordan Basin Conservation Area [Jordan Basin is outside the Regional Assessment Area]) (refer to Figure 1 below), Project activities will not interact with these special areas and associated benthic communities.



Source: DFO (2017)

Figure 1 Location of Corsair and Georges Canyons and Jordan Basin Conservation Areas

BP recognizes that additional special areas could be identified over the life of the Project. As part of the Operation Authorization application required by the Canada-Nova Scotia Offshore Petroleum Board (CNSOPB), BP will prepare an Environmental Protection Plan (EPP) which will make note of environmental sensitivities (including special areas), required mitigation and other environmental commitments associated with the Project. Furthermore, BP is required to obtain an Approval to Drill a Well (ADW) from the CNSOPB for each well drilled for the Project. During each ADW process, BP is committed to reviewing the EPP with the CNSOPB to determine if additional special areas have been identified since the EPP was filed and if additional mitigation measures are necessary.

References:

DFO [Fisheries and Oceans Canada]. 2017. Backgrounder: Closures to protect Sensitive Benthic Areas: Corsair/Georges Canyons and Eastern Jordan Basin. Available online at: http://www.dfo-mpo.gc.ca/oceans/publications/backgrounder-fiche/index-eng.html. January 23, 2017.

Information Request (IR) IR-056 (ECCC-IR-12)

Applicable CEAA 2012 effect(s): 5(1)(a)(iii) Migratory Birds

EIS Guidelines Reference: Part 2, 6.1.8 Special areas

EIS Reference: 5.2.8.3 Areas of Significance to Migratory Birds

Context and Rationale: The EIS guidelines require that the EIS describes special areas, including Migratory Bird Sanctuaries, "at the project site and within areas that could be affected by routine operations or accidents and malfunctions", as well as describe the distances between the edge of the project and special areas, and provide the rationale for the designation of the area as "special".

While Sable Island Migratory Bird Sanctuary is mentioned, other Migratory Bird Sanctuaries that may be affected in the event of accidents or malfunctions are not included in the EIS.

Specific Question or Request: Describe all Migratory Bird Sanctuary that could be affected by the Project, and the potential associated effects.

Response: There are five national migratory bird sanctuaries within the Regional Assessment Area (RAA): Sable Island, Port Joli, Port Hebert, Haley Lake, and Sable River (Figures 1 and 2). The Sable Island Migratory Bird Sanctuary encompasses the entirety of Sable Island, located in offshore Nova Scotia, and is also considered an Important Bird Area (IBA). The other four sanctuaries are located in close proximity to each other in southwestern Nova Scotia and are within the boundaries of the South Shore (Port Joli Sector) IBA. These were primarily created for the protection of the Canada goose (*Branta canadensis*) but their borders have changed several times as a result of hunting interests (IBA 2017). All of the national migratory bird sanctuaries within the RAA are coastal except for Haley Lake. Information on size, habitat types, and bird species supported by the migratory bird sanctuaries within the RAA is provided in Table 1. In addition to these designated areas, Environment and Climate Change Canada is considering Country Island as a potential migratory bird sanctuary (IBA 2017).

Table 1 Migratory Bird Sanctuaries within the RAA[1]

Migratory Bird Sanctuary	Area (ha)	Main Habitat Types	Key Bird Species	SARA Listed Species
Port Joli	280	Shallow estuary and intertidal flats (80%), salt marsh (5%), mixed second-growth forest (15%)	Canada Goose, American Black Duck, American Green-winged Teal, Northern Pintail, Common Goldeneye, Bufflehead, Greater Scaup, scoters and mergansers	None

Table 1 Migratory Bird Sanctuaries within the RAA[1]

Migratory Bird Sanctuary	Area (ha)	Main Habitat Types	Key Bird Species	SARA Listed Species
Port Hebert	350	Shallow coastal water (89%), channels and deeper areas (10%), wooded island (1%)	Canada Goose, American Black Duck, Green-winged Teal, Northern Pintail, Common Goldeneye, Bufflehead, scoters, mergansers and Greater Scaup	None
Haley Lake	100	Open water (99.5%), rocky ledges (0.5%)	American Black Duck, Canada Goose and Great Blue Heron	None
Sable River	260	Open estuarine water (90%), rocky and wooded islands (1%), salt marshes (9%)	Canada Goose, American Black Duck and American Green-winged Teal	None
Sable Island	2350	Overwash (terminal) sand spits (18%), beach (23%), consolidated sand dunes (54%), saltwater lake (5%)	Savannah Sparrow Ipswich subspecies, Great Black-backed Gull, Herring Gull, Semipalmated Plover, American Black Duck, Red-breasted Merganser, Arctic Tern, Common Tern, Roseate Tern, Blue-winged Teal, Spotted Sandpiper and Least Sandpiper	Savannah Sparrow Ipswich subspecies

[1]Information from Environment Canada 2016

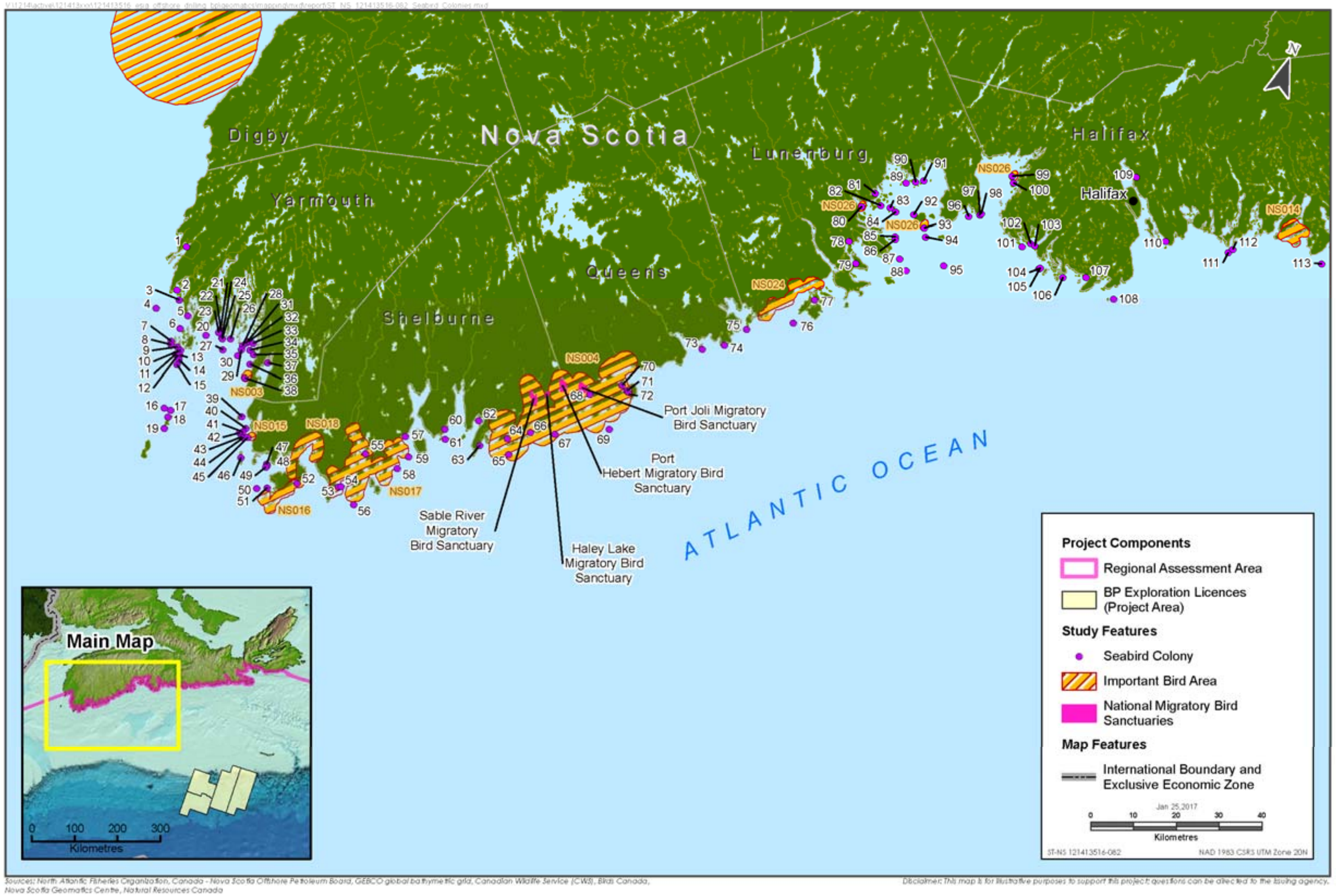


Figure 1 Important Bird Areas, Seabird Colonies and Migratory Bird Sanctuaries (Map 1 of 2)

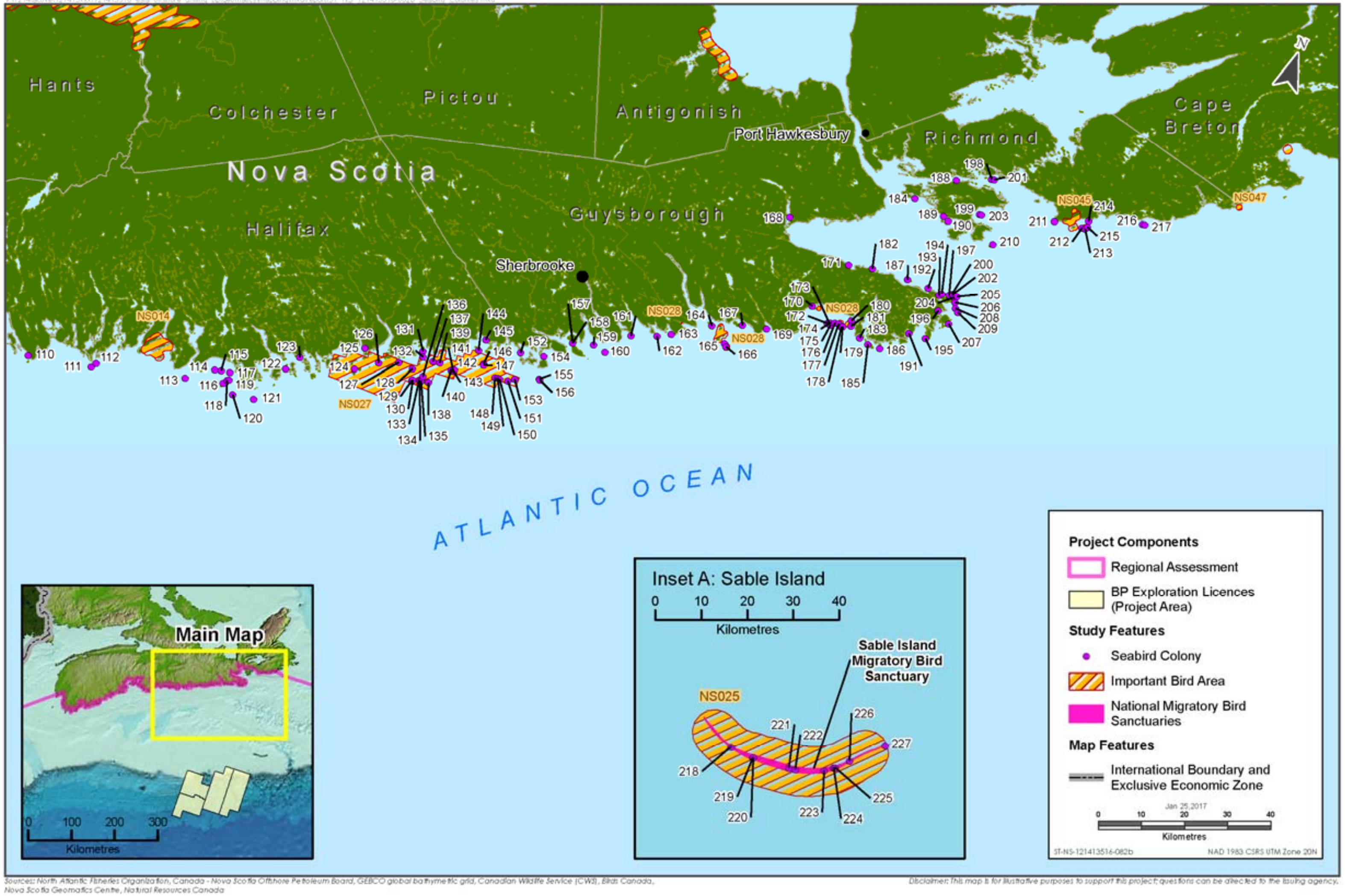


Figure 2 Important Bird Areas, Seabird Colonies and Migratory Bird Sanctuaries (Map 2 of 2)

Routine Project operations are not expected to interact with migratory bird sanctuaries, with the potential exception of unforeseen helicopter traffic during periods of severe inclement weather or other unplanned events (*i.e.*, as discussed in response to IR-039), but a well blowout incident could effect coastal migratory bird sanctuaries. As discussed in Section 8.5.3.3 and presented in Figures 8.4.11 to 8.4.14 of the Environmental Impact Statement (EIS), there are several coastline areas that could potentially be exposed to shoreline oiling above 1 μm oil thickness; including Sable Island and parts of southwestern Nova Scotia. Coastal migratory bird sanctuaries in these areas could potentially be affected by a well blowout incident. The average minimum timeframe required for oil to potentially reach coastal areas of mainland Nova Scotia at a threshold of 1 μm is approximately 30 days, which would allow for response measures and containment equipment to be placed in advance to avoid or mitigate adverse effects. However, response measures are considered to have potential to result in disruption of nesting birds and reproductive failure. The average minimum arrival time for shoreline emulsion mass exceeding 1 μm at Sable Island is 5 days, which would greatly reduce the opportunity for implementation of response measures to avoid or mitigate adverse effects on birds. Additional information on potential effects of a well blowout incident on migratory birds is discussed in Section 8.5.3.3 of the EIS. The characterization of the residual environmental effects are unchanged in consideration of additional information on the description of Migratory Bird Sanctuaries within the RAA.

References:

Environment Canada. 2016. Migratory Bird Sanctuaries. Website: https://www.ec.gc.ca/ap-pa/default.asp?lang=En&n=35D97114-1#_sanc3. Accessed January 2017.

IBA Canada. 2017. Important Bird Areas. Website: http://www.ibacanada.ca/. Accessed January 2017.

Information Request (IR) IR-057

Applicable CEAA 2012 effect(s): 5(2)(a); 5(2)(b)(i)

EIS Guidelines Reference: Part 2, Cumulative effects assessment

EIS Reference: 10.2.7.1 Change in Availability of Fisheries Resources

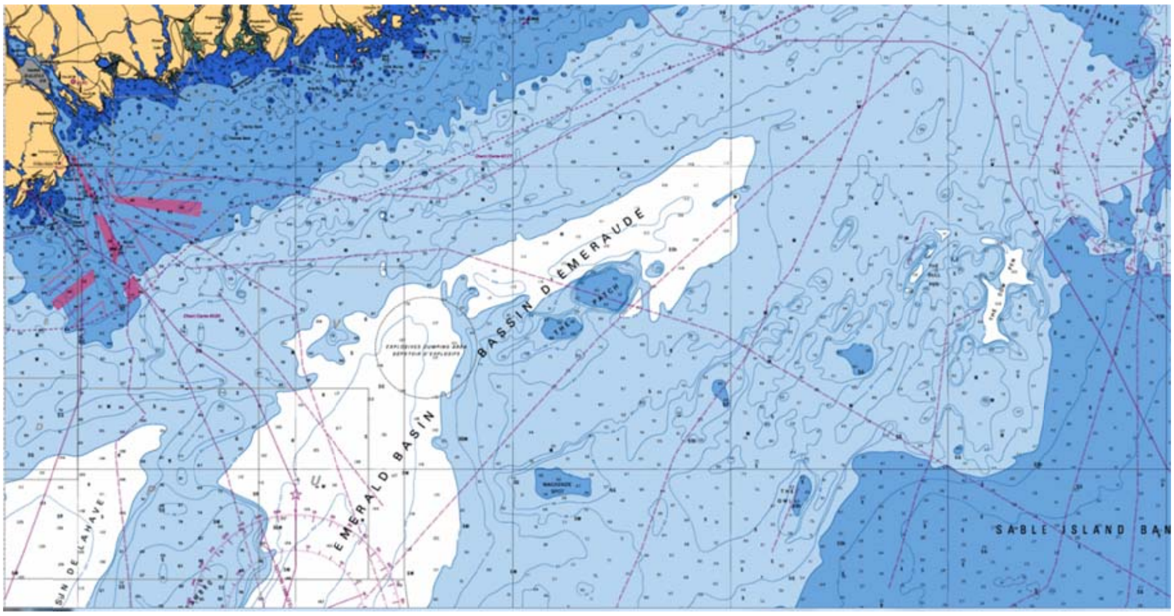
Context and Rationale: When considering the cumulative effects on commercial fisheries, the EIS (section 10.2.7.1) describes how platform supply vessels (PSVs) will use existing shipping routes when travelling between the MODU and the supply base in Halifax Harbour, and how the project supply vessels are a minor component of the total marine traffic in the RAA. Although it is clear that the PSVs will make two or three round trips per week between the MODU and the supply base, it is not clear how much traffic there is currently in the shipping routes and in the LAA.

Specific Question or Request: Generally estimate the quantity of marine traffic currently using the shipping routes and marine areas in the LAA, further refining the description of the PSVs as a minor contribution.

Provide a map or maps showing relevant existing shipping routes in the project area, indicating which ones will be used by project vessels. Explain if and how these routes are regulated.

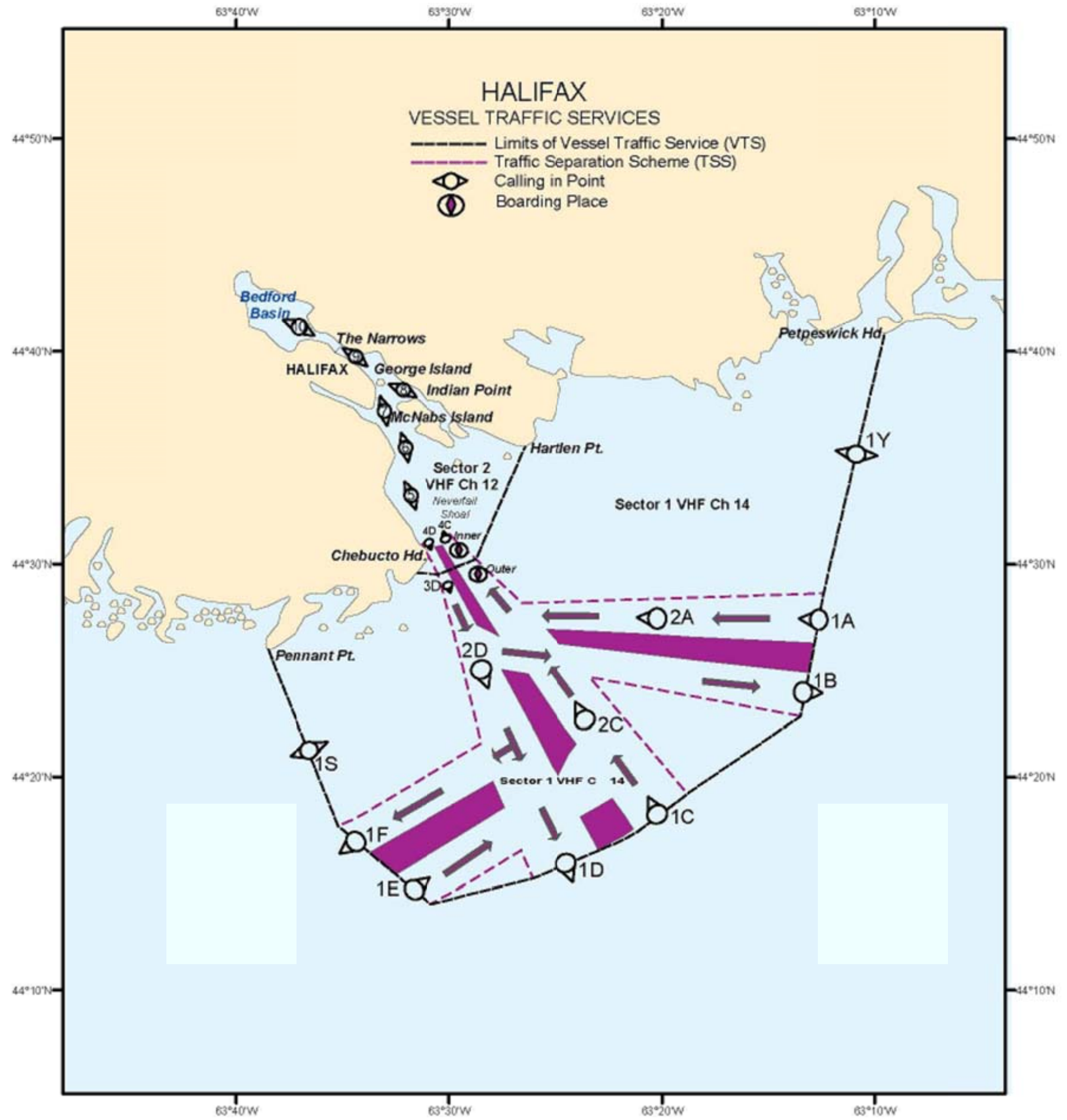
Response: As indicated in Section 5.3.4.3 (Marine Traffic), shipping traffic volumes offshore Nova Scotia are in the range of 44,263 vessels per year (Pelot and Wootton 2004). The Port of Halifax alone handles 1,500 vessels per year (HPA 2017). The Project is located in an area lacking a designated shipping corridor. Figure 1 below presents the shipping lanes charted by the Canadian Hydrographic Services (Chart 8007), which shows shipping lanes (depicted as magenta polygons) are primarily charted for the approaches to Halifax Harbour and not to/from the Project Area. Vessels entering shipping channels (including platform supply vessels to be contracted by BP) have to call into Halifax Harbour and Approaches Vessel Traffic Services (Halifax MCTS) at control call-in points along the shipping channel and in the harbour as shown on Figure 2.

Outside of these shipping channels, it is assumed that platform supply vessels (PSVs) will travel in the most economical route (direct line) to and from the Project Area. It is expected that up to three PSVs will be used to support the project, and that the PSVs will make two to three trips per week. A PSV will remain on standby at the mobile offshore drilling unit (MODU) at all times. It is therefore expected that there will be up to three PSVs travelling between the wellsite and the supply base at any one time. Three round trips per week equates to six one-way trips between the Project Area and Halifax Harbour for three PSVs. Over the course of a year this equates to 936 trips over the Scotian Slope and Shelf area (6 trips/week x 52 weeks x 3 PSVs). Assuming there are 44,263 vessel trips per year in the region, the addition of PSV traffic equates to 2.1% of total traffic estimated to currently use the area. An increase of 2.1% attributed to PSV traffic would be considered a minor component of the total marine traffic in the Regional Assessment Area (RAA). Figure 5.3.4 of the EIS shows shipping traffic density.



Source: CHS 1988

Figure 1 CHS Chart 8007 Showing Shipping Lanes within the Approach to Halifax Harbour



Source: DFO 2016

Figure 2 Vessel Traffic Services – Halifax Harbour

References:

CHS [Canadian Hydrographic Service]. 1988. Halifax to Sable Island including Emerald Bank and Sable Island Bank. Offshore areas surveyed by the Canadian Hydrographic Service. 1980-83. Chart 8007.

DFO [Fisheries and Oceans Canada]. 2016. Radio Aids to Marine Navigation -Atlantic, St. Lawrence, Great Lakes, Lake Winnipeg, and Arctic. Part 3 Vessel Traffic Services.

Halifax Port Authority (HPA). 2017. Port of Halifax – About the Port. Available at: http://portofhalifax.ca/about-us/

Pelot, R. and D. Wooton. 2004. Merchant Traffic through Eastern Canadian Waters: Canadian Port of Call versus Transient Shipping Traffic. Maritime Activity and Risk Investigation Network. MARIN Report #2004-09.

Information Request (IR) IR-058

Applicable CEAA 2012 effect(s): 5(1)(a)(i) Fish and Fish Habitat

EIS Guidelines Reference: 6.6.3 Cumulative effects assessment

EIS Reference: 10.2.4 Assessment of Cumulative Environmental Effects on Marine Mammals and Sea Turtles; 10.2.6 Assessment of Cumulative Environmental Effects on Special Areas

Context and Rationale: Further information is required to support the assessment of cumulative effects on marine mammals due to underwater noise.

To describe the environmental effects of mortality or injury from underwater sound on marine mammals, the EIS (section 10.2.4.1) refers to the cumulative effects assessment for underwater sound for fish. To describe the environmental effects on habitat quality and use from underwater sound on marine mammals, the EIS (section 10.2.4.2) describes how in the winter the underwater noise from the MODU could exceed the behaviour threshold for continuous noise at distances of up to 150 kilometres, and that this noise could interact cumulatively with noise from other projects and activities. The EIS (section 10.2.6.1) also describes how the frequency of the noise from the Project only partially overlaps with the range of hearing frequencies for northern bottlenose whale (and other odontocetes), suggesting effects of masking from the Project may be of lesser concern when compared to baleen whales, but may still cause a reaction.

However, there does not seem to be an analysis of the effects of noise on the different types of marine mammals (*e.g.* mysticites, odontecetes), including species at risk, that could occur in the area that would be affected by the Project, or information about the underwater noise injury thresholds most appropriate for those species, the areas over which those thresholds may be exceeded, for how long, and the importance of the timing of any such exceedances.

Specific Question or Request: Please augment the assessment of cumulative effects of underwater noise to marine mammals by considering:

- the marine mammal types expected to occur in the area to be affected by the Project, including species at risk;
- estimations of the cumulative underwater noise, considering how different noise sources may act additively;
- estimations of the frequency (Hz) of that noise, comparison with the hearing ranges of marine mammals expected in the area to be affected by the Project;
- the underwater noise injury, behaviour change, and masking thresholds for those mammals, where available;
- the areas over which those thresholds may be exceeded including any critical habitats and migratory routes;
- for how long those thresholds may be exceeded;

- the importance of the timing of any such exceedances relative to marine mammal and turtle use of affected areas;
- the availability of suitable alternative habitat; and
- mitigation measures that could reduce the cumulative effect.

Response: An analysis of the potential effects of Project-related sound on the different types of marine mammals (*e.g.*, mysticetes, odontocetes), including species at risk, that could occur in the area that would be affected by the Project is presented in Sections 5.2.6 (Existing Environment – Marine Mammals) and 7.3 (Environmental Effects Assessment – Marine Mammals and Sea Turtles) and was supported and informed by the quantitative Project-specific underwater sound modelling presented in Appendix D. This analysis took into consideration, and presents information about, the underwater sound injury thresholds that are most appropriate for those species, the areas over which those thresholds may be exceeded, anticipated durations, and the importance of the timing of any such exceedances.

The information provided in the aforementioned sections is equally relevant to the consideration of, and was used to inform the assessment of, cumulative effects. For example, the marine mammal types expected to occur in the area to be affected by the Project, including species at risk (*i.e.*, the information requested in bullet point 1 above) is presented in detail in Section 5.2.6 and was therefore not repeated in Sections 10.2.4 or 10.2.6. There is not expected to be any material differences in this information whether considered for the purposes of assessing residual or cumulative effects.

A thorough quantitative analysis of Project-related sound was undertaken, including estimates of sound frequency (Hz), comparison with hearing ranges of marine mammals, consideration of available injury and behavioural change thresholds, and predicted spatial and temporal extents of potential exposure (including potential for overlap with special areas and important timing periods) (refer to Appendix D and Section 7.3). However, the technical specifications and parameters required to undertake this scale of quantitative modelling analysis at the singular project level are prohibitive of a realistic predictive model at a regional scale. As such, BP elected to undertake a qualitative assessment of the potential cumulative effects related to increases in underwater sound. The operation of the Project mobile offshore drilling unit (MODU) and platform supply vessels (PSVs) will represent only a small incremental increase over existing levels of marine traffic and activity in the Regional Assessment Area and will therefore only cause a small increase in the cumulative effects of underwater noise on marine mammals and sea turtles. The application of proposed Project-related mitigation and environmental protection measures is expected to reduce residual cumulative environmental effects on marine mammals and sea turtles.

Information Request (IR) IR-059 (CNSOPB-4)

Applicable CEAA 2012 effect(s): All

EIS Guidelines Reference: Part 2, 6.6.3 Cumulative effects assessment

EIS Reference: 10 Cumulative Effects

Context and Rationale: Consideration of the decommissioning of the Sable Offshore Energy Project (SOEP) in the cumulative effects section of the EIS is limited. The EIS states that the effects of decommissioning will be similar to those generated by current production activities; however, the activities and equipment associated with plugging and abandoning of wells is more like exploratory drilling. Furthermore, plugging and abandonment activities may overlap temporally with continued operation of the SOEP and the Project.

Specific Question or Request: Update the cumulative environmental effects analysis to consider SOEP decommissioning activities in light of the above comments.

Response: Information about SOEP and its proximity to the Project Area is included in Section 5.3.4.1 of the Environmental Impact Statement (EIS).

Information on the decommissioning plans for the SOEP are very limited therefore the assessment of cumulative effects associated with the decommissioning of the oil and gas development projects (*e.g.*, SOEP project, Deep Panuke project) are fairly general.

The residual environmental effects of routine exploratory drilling Project activities and components on Fish and Fish Habitat, Marine Mammals and Sea Turtles, Migratory Birds, Special Areas, Commercial Fisheries, and Current Aboriginal Use of Lands, Resources for Traditional Purposes, and Species at Risk are predicted to be not significant. If decommissioning activities are more similar to exploratory drilling, their predicted effects and standard mitigation would be similar to those effects predicted for the Project and there would be little spatial overlap of effects (temporal overlap is currently unknown). The assessment of cumulative effects of the Project with offshore gas development projects remains valid and conclusions on the significance of effects (*i.e.*, not significant), are unchanged from the EIS.

Information Request (IR) IR-060 (DFO-06)

Applicable CEAA 2012 effect(s): 5(1)(a)(i) Fish and Fish Habitat; 5(1)(a)(ii) Aquatic Species

EIS Guidelines Reference: Part 2, 6.5 Significance of residual effects; 6.6.1 Effects of potential accidents and malfunctions

EIS Reference: 8.5.1.1 Project Pathways for Effects; 8.1.5.3 Characterization of Project Related Environmental Effects, p.8.99; 11.4 Summary, p.11.14; 8.5.1.4 Determination of Significance

Context and Rationale: DFO has advised the Agency that there are many unknown or poorly understood variables in assessing effects on fish and fish habitat from a spill event, including exact drilling location, species impacted, trajectory of oil, *etc.* There are also a number of species at risk that are known to occur in the area; for some species, the death of one individual could cause a population level effect.

Specific Question or Request: In light of advice from DFO, reconsider the assessment of effects on fish and fish habitat from a blowout, taking into consideration proximity of the Haddock Box and other spawning areas in the RAA and the adverse impacts of major releases on fish eggs and larvae.

Response: The assessment of accidental events including a potential blowout incident relied extensively on spill modelling conducted for the Project, under which no tactical response methods were applied as mitigation measures. Furthermore, for the blowout incident scenarios, the flow rates used were the worst case credible discharge for each well site.

In the unlikely event of a spill, BP would implement multiple preventative and response barriers to manage risk of incidents occurring and mitigate potential consequences. As noted in Section 8.3, the Project will operate under an Incident Management Plan (IMP) which will include a number of specific contingency plans for responding to specific emergency events, including potential spill or well control events. The IMP and supporting specific contingency plans, such as a Spill Response Plan (SRP), will be submitted to the Canada-Nova Scotia Offshore Petroleum Board (CNSOPB) prior to the start of any drilling activity as part of the Operations Authorization (OA) process. The SRP will clarify tactical response methods and procedures and strategies for safely responding to different spill scenarios. Tactical response methods that would be considered following a spill incident include, but are not limited to: offshore containment and recovery; surveillance and tracking; dispersant application; in-situ burning; shoreline protection; shoreline clean up; and oiled wildlife response. Refer to Section 8.3 of the EIS for details on incident management and spill response.

In the unlikely event of a blowout incident, mitigation would be implemented which would reduce the extent of the potential affected area compared to the unmitigated scenarios depicted in Section 8.2 of the Environmental Impact Statement (EIS).

The majority of spawning areas for fish species in the Regional Assessment Area (RAA) occur on the Scotian Shelf, with the eggs and larvae of some species being found along the Scotian Slope and Shelf Break (refer to Section 5.2.1.4 and Table 5.2.3 of the EIS). In the unlikely event of a large blowout incident, the area affected by a spill will not encompass all the spawning locations or timing windows for any one species. Furthermore, the area of the spill exceeding the 58 ppb total hydrocarbon threshold, potentially impacting fish eggs and larvae, will be much smaller than the total area of a spill (refer to Figures 8.4.7 to 8.4.10). Most fish species on the Scotian Shelf and Slope spawn in multiple locations and within multiple temporal windows within the RAA, with the exception of a few species. There are a few species which tend to spawn in a limited geographic area. These species include the smooth skate and sand lance. However, these species have the potential to spawn over many months or the entire year and with mitigation (*e.g.*, containment and/or recovery), their spawning window would not be completely affected by a blowout incident. Most species including species at risk (SAR), spawn in multiple locations within the RAA or over long time scales, and with only a portion of the RAA having the potential to be affected in the unlikely event of a major blowout incident, it is not likely that an entire year class would be lost from the effects of oil on early life stages of fish species.

The Haddock Box is an important nursery area for the protection of juvenile haddock, with adult haddock congregating in the area to spawn. In the event of an unmitigated blowout incident, there is the potential for hydrocarbons to migrate into this sensitive area. Stochastic modelling indicates that there is a 40 to 60% probability that water column oiling exceeding the 58 ppb total hydrocarbon threshold could occur within areas of the Haddock Box. With the implementation of mitigation, these probabilities would be reduced. Furthermore, haddock are known to spawn in areas other than the Haddock Box (refer to Table 5.2.3 of the EIS and Horsman and Shackell 2009). The spawning window for the species also occurs over many months. As a result, and in the unlikely event of a major blowout incident, it is not likely that an entire year class of haddock would be lost, even if a portion of the Haddock Box was affected by a spill.

The notion that the death of one individual could cause a population level effect seems inconclusive or highly extrapolated with respect to affecting current population levels of fish SAR. The Change in Risk of Mortality or Physical Injury and the Change in Habitat Quality and Use for many, if not all, marine fish SAR have the potential to be adversely impacted through groundfishing practices and being caught as by-catch in nets, yet these practices still occur today over a wide area. If the death of a single SAR individual was thought to cause the loss of a population, these practices should have ceased, which is not the case.

Based on the information above, the information contained in the EIS, and the significance criteria, the predicted residual adverse environmental effects from a blowout incident on Fish and Fish Habitat would not be significant. There is the potential for oil, particularly dispersed oil, to have an impact on larvae and juvenile fish species in the area of a major spill. However, these effects will be limited spatially and temporally and are not expected to lead to population level effects. Furthermore, a blowout incident would not be expected to result in the permanent alteration or irreversible loss of critical habitat as defined in a recovery plan or action strategy. IR-061 and IR-069 further discuss the residual environmental effects from a blowout scenario on Fish and Fish Habitat.

References:

Horsman, T.L. and Shackell, N.L. 2009. Atlas of important habitat for key fish species of the Scotian Shelf, Canada. Can. Tech. Rep. Fish. Aquat. Sci. 2835: vii +82p.

Information Request (IR) IR-061

Applicable CEAA 2012 effect(s): 5(1)(a)(i) Fish and Fish Habitat; 5(1)(a)(ii) Aquatic Species

EIS Guidelines Reference: Part 2, 6.5 Significance of residual effects; 6.6.1 Effects of potential accidents and malfunctions

EIS Reference: 8.5.1.1 Project Pathways for Effects; 8.1.5.3 Characterization of Project Related Environmental Effects, p.8.99; 11.4 Summary, p.11.14; 8.5.1.4 Determination of Significance

Context and Rationale: The EIS describes the potential effect of a well blowout incident on fish and fish habitat as a moderate magnitude effect (sections 8.5.1.3, 8.5.1.4). A moderate magnitude effect is defined (Table 7.2.2) as a measurable change in marine species populations that does not pose a risk to population viability. The residual effect is described as not significant (section 8.5.1.4) as it does not exceed the proponent's significance thresholds:

- an effect that cases a significant decline in abundance or change in distribution of fish populations with the RAA, such that natural recruitment may not re-establish the population(s) to its original level within one generation.
- an effect that results in permanent and irreversible loss of critical habitat as defined in a recovery plan or an action strategy.

The EIS does not consider the residual effects of an accidental event in relation to the third significance threshold identified by the proponent: an effect that jeopardizes the achievement of self-sustaining population objectives or recovery goals for listed species.

Specific Question or Request: For fish and fish habitat, marine mammals and turtles, including species at risk and species of conservation concern, describe the magnitude and significance of residual environmental effects of a blowout, taking into consideration population viabilities and whether such events may or may not jeopardize the achievement of a self-sustaining population objectives or recovery goals.

Response: As presented in Table 8.5.2, the Environmental Impact Statement (EIS) describes the potential effect of a well blowout incident on marine mammals and turtles, including species at risk (SAR), as High in magnitude and causing a significant adverse residual environmental effect. However, this significant effect is not likely to occur given the extremely low probability of a blowout incident occurring. A medium level of confidence is assigned to this significance determination based on the conservatism of the spill modelling and the uncertainty of interaction with breeding seals or SAR depending on the timing of a spill of that magnitude.

As described in IR-060 and in the EIS, the environmental effects of a blowout on Fish and Fish Habitat would not be expected to cause a significant adverse effect. There is potential for a blowout to have a negative impact on the eggs and larvae of marine fish in areas of the water column where the concentration of total hydrocarbons (THC) exceed the 58 ppb threshold level for effects near the blowout. This area would likely be much smaller than the total area for the presence of THC because of the spill. Furthermore, most fish species within the Regional Assessment Area (RAA) (including SAR) have the potential to spawn in multiple locations and over multiple time periods throughout the year. As a result, the effects from a spill would not be expected to negatively impact the entire year class of any species to the level where it would not re-establish its population to original levels within one year or result in the permanent or irreversible loss of critical habitat as defined in a recovery or action plan. Furthermore, the achievement of self-sustainable population objectives or recovery goals would not be expected to be impeded due to the limited area of potential acute and chronic lethality exposure as compared to the potential areas inhabited by marine fish SAR.

The magnitude of residual environmental effects will remain at Moderate due to the fact that there is the potential for effects on populations and habitat quality and/or quantity, although long-term population viability would not be expected to be affected. The impacts of oil and dispersed oil on marine fish and fish habitat are further explored in the EIS and in response to IR-073. The duration of the residual effects has been increased to "Long-term" due to implications in considering the potential effects of a blowout on benthic communities as discussed in IR-069. The changes can be seen in tracked changes below.

Table 1 Summary of Residual Project-Related Environmental Effects on Fish and Fish Habitat – Accidental Events (Updates to Table 8.5.1 of the EIS)

Residual Effect	Residual Environmental Effects Characterization						
	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Socio-economic Context
Change in Risk of Mortality or Physical Injury/Change in Habitat Quality and Use							
10 bbl Diesel Spill	A	L	LAA	ST	S	R	U
100 bbl Diesel Spill	A	M	RAA	ST	S	R	U
PSV Diesel Spill	A	M	RAA	ST-MT	S	R	U
Well Blowout Incident	A	M	RAA*	~~ST-MT~~ LT	S	R	U
SBM Spill	A	L	LAA	ST	S	R	U

KEY:
See Table 7.2.2 for detailed definitions
N/A: Not Applicable
Direction:
P: Positive
A: Adverse
N: Neutral
Magnitude:
N: Negligible
L: Low
M: Moderate
H: High

Geographic Extent:
PA: Project Area
LAA: Local Assessment Area
RAA: Regional Assessment Area; in certain scenarios, effects may extend beyond the RAA as indicated by an "*".
Duration:
ST: Short-term
MT: Medium-term
LT: Long-term

Frequency:
S: Single event
IR: Irregular event
R: Regular event
C: Continuous
Reversibility:
R: Reversible
I: Irreversible
Ecological/Socio-Economic Context:
D: Disturbed
U: Undisturbed

Information Request (IR) IR-062 (CNSOPB-5)

Applicable CEAA 2012 effect(s): All

EIS Guidelines Reference: Part 2, 6.6.1 Effects of potential accidents or malfunctions

EIS Reference: Table 8.4.2 Modelled Scenarios; 8.5 Environmental Effects Assessment

Context and Rationale: Table 8.4.2 of the EIS notes that the modelled flow rate of oil released to the marine environment during the blowout scenarios would decline over the duration of the 30-day release. There was no rationale provided for the declining flow rate in either the main EIS document or the corresponding technical report included as Appendix H. Although the decline is not necessarily significant, please provide a rationale for the decline, particularly given that the EIS states that the flow rates used were the worst-case credible discharge (section 8.5).

Specific Question or Request: Provide rationale for using a declining flow rate in the modelling of the two blowout scenarios, or update the analysis to reflect how using a constant flow rate would alter spill modelling results.

Response: As part of the scenario identification and planning for oil spill modelling, BP identified the worst case credible discharge (WCCD) that could occur as part of the Project. Information about the scenarios that were considered is provided in Section 8.4.3 of the Environmental Impact Statement (EIS). Scenarios were modelled to represent both a low probability large scale event (*i.e.*, a subsea blowout incident) and an instantaneous, small scale spill scenario (*i.e.*, a surface release of diesel). The scenarios were modelled at two potential drilling locations in the exploration licences (ELs) to evaluate the potential impact of water depth and proximity to sensitive receptors in and around the ELs. For all scenarios, the models were run without mitigation until the amount of oil in the system fell below the effects thresholds for surface oiling and in water concentration.

For the subsea blowout incident, the WCCD for a blowout incident at two separate locations was calculated using a suite of modelling tools. The WCCD for each location was calculated using the nodal analysis tool Prosper™ (version 11.5) software by Petroleum Experts Ltd. As part of the WCCD calculations, the model inputs were selected based on a balance of "most likely" and conservative assumptions about how the well would behave. Assumptions about the well design and blowout mechanism were selected on a conservative basis. For example, it was assumed that two reservoirs would be exposed during a blowout incident and that there would be unconstrained flow to the mudline with no drill pipe in the hold during discharge. Information about rock and fluid properties for the target sands such as permeability, temperature, porosity and initial reservoir pressures were derived from the sparse analogous offset well data in or near the Scotian Basin and were selected on a "most likely" basis.

Reservoirs have a tendency to decline over time. Consequently, the potential for a decline rate was considered as part of the assessment of most likely rock and fluid properties. Typically, as the reservoir pressure drops, expansion of the oil and its dissolved gas provides most of the reservoir's drive energy and additional energy is obtained from the expansion of the rock and its associated water. The wells in the Scotian Basin were modeled using MBAL, a material balance software package. For the Scotian Basin wells WCCD, it was assumed that there would be no active aquifer maintaining pressure, or that any aquifer would not have an impact within the timeframe of a potential blowout incident. This was assumed because analog wells showed low permeability in the reservoirs. In light of these analogues, it was assumed that permeability will decrease with depth. In the shallowest reservoir it was assumed that the permeability would be 100mD and would be 50mD in the deeper reservoir. Taking account of the low reservoir permeability, it was assumed that there would be no aquifer impact on the reservoir which would help to maintain pressure. The MBAL model takes fluid expansion into account, so reservoir energy was reflected in the profile as the well produces but aquifer impact was considered to be negligible.

The decline rates observed at the two well locations were minor as shown in the Figure below (from Appendix H of the EIS – Oil Spill Trajectory Modelling, Figure 3.3).

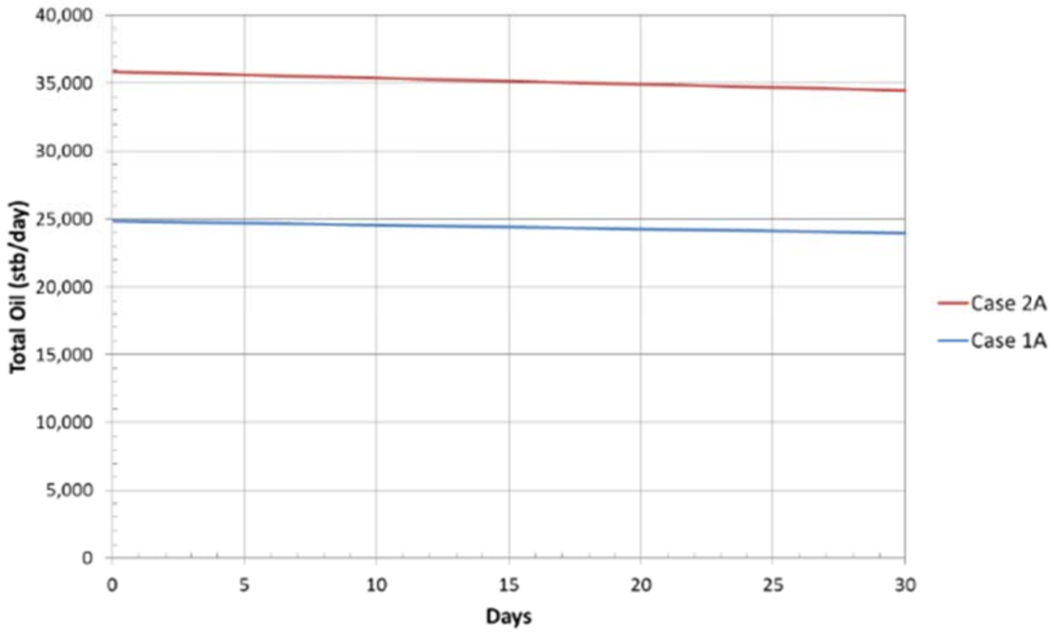


Figure 1 **Steady state uncontrolled discharge rates for the NS-1 subsea well blowout scenarios over the 30 days estimated to cap and contain the well (Figure 3.3 in Appendix H of the EIS**

Information Request (IR) IR-063 (ECCC-IR-19)

Applicable CEAA 2012 effect(s): 5(1)(a)(i) Fish and Fish Habitat; 5(1)(a)(ii) Aquatic Species; 5(1)(a)(iii) Migratory Birds; 5(1)(b) Federal Lands or Transboundary

EIS Guidelines Reference: Part 2, 6.6 Other effects to consider; 6.6.1 Effects of potential accidents or malfunctions

EIS Reference: 8.0 Accidental Events; 8.3.1 Incident Management Plan and Spill Response Plan; 8.3.3 Response Strategies

Context and Rationale: The *Canadian Environmental Assessment Act, 2012* requires that all designated projects consider "the environmental effects of the designated project, including the environmental effects of malfunctions or accidents that may occur in connection with the designated project" (subsection 19(1)(a)). ECCC's Environmental Emergencies Program assists EA reviews by providing preparedness and response planning advice in relation to federal interests under the *Canadian Environmental Protection Act* (CEPA 1999), the pollution prevention provisions of the *Fisheries Act*, and the *Migratory Birds Convention Act* 1994 (MBCA). Questions, comments and recommendations are developed with a view to optimizing Emergency Response and Spill Contingency Plans for plausible accidents and malfunctions to help ensure that preparedness planning abilities and response capabilities are commensurate with the project's environmental risks. Preparedness for environmental emergencies (including spills) is a critical pre-requisite to rapid and effective response to an incident.

The EIS Guidelines state: "the EIS will describe the safeguards that have been established to protect against such occurrences and the contingency and emergency response procedures in place if such events do occur." The Guidelines also state that: "based on the results of the spill modelling and analysis in the EIS, an emergency response plan for spills (small and large) and blowouts will be required. At a minimum, an outline of the emergency response plan along with key commitments is required in the EIS."

Section 8.0 of the EIS, however, provides: "details about environmental management measures which will be put in place will be submitted in the Environmental Protection Plan (EPP). The Safety Plan, Incident Management Plan (IMP), Spill Response Plan (SRP) and EPP will be submitted to the CNSOPB as part of the Operations Authorization (OA) process." Section 8.3.1 also provides: "the Project will operate under an IMP to define the response to incidents. The IMP will be a comprehensive document including practices and procedures for responding to an emergency event. The IMP will include, or reference, a number of specific contingency plans for responding to specific emergency events, including potential spill or well control events. The IMP and supporting specific contingency plans, such as the SRP will be aligned with applicable regulations, industry practice and BP standards and will include response scenarios, strategies and capabilities. These plans will be submitted to the CNSOPB prior to the start of any drilling activity as part of the OA process."

Section 8.3.3 of the EIS states: "the IMP and SRP will include information about well control response strategies to set out measures to stop the flow of oil, and spill response tactics to manage any released oil." It is understood that the IMP and the SRP will also include a description of the proponent's Incident Command System (ICS) structure as well as management details respecting recovered oil spill response waste.

Although the IMP, SRP and EPP may not yet be fully developed, outlines of the IMP, SRP, and EPP, as well as an accounting of key commitments, is required to inform the effects assessment.

Specific Question or Request: Provide outlines of each of the IMP, SRP, and EPP and an accounting of key commitments, including those related to incident prevention, emergency preparedness, mitigation, and follow-up. Include the following, as applicable:

- a commitment for a quantitative hazard identification and risk assessment that would address the full range of hazards;
- a commitment to account for plausible worst-case spill scenarios in plans and to include place- holders for detailed spill response strategies for each accident and malfunction type;
- plans to identify and consider contributing and complicating factors such as weather conditions and sea states;
- a commitment to identify other site-specific conditions and sensitivities (*e.g.* special areas);
- a commitment to identify oil spill response equipment, their locations, including resource mobilization procedures and estimated response times;
- a commitment to include subsea well head blowout counter measures such as the utilization of a capping stack, the drilling of a relief well and the use of dispersants, including their respective probabilities of success;
- a commitment to develop an oil spill response waste management plan and consider associated handling capacities;
- a commitment to identify oil spill response personnel, their roles and responsibilities, including response training and exercise regimes;
- a commitment to identify mutual aid agreements with other operators;
- a commitment to identify and describe the Incident Command System (ICS) structure including alignment with federal and provincial level regulators; and
- a commitment to identify reporting procedures to regulators and alerting procedures for affected stakeholders.

Response: BP is required to submit environmental protection and emergency response plans to the Canada-Nova Scotia Offshore Petroleum Board (CNSOPB) as part of the Drilling Operations Authorization (OA) approval process. The Drilling and Production Guidelines (C-NLOPB and CNSOPB 2011) provide additional information on the specific requirements for these plans. The commitments requested in the IR are standard items for inclusion in these plans which are currently under development and will be submitted to, and reviewed by, the CNSOPB.

A summary and outline of the Incident Management Plan (IMP), Spill Response Plan (SRP), Source Control Contingency Plan (SCCP) and Environmental Protection Plan (EPP) has been provided below.

- **Incident Management Plan (IMP)**

  The Project will operate under an IMP to define the response to incidents. The IMP will be a comprehensive document including practices and procedures for responding to an emergency event.

  The IMP will describe the overarching response measures to respond to an emergency event, irrespective of the size, complexity or type of incident. Specifically, it will define the response organization and roles and responsibilities, and will include notification and reporting procedures. It will be designed to ensure an efficient and timely response. The IMP will be compiled on the basis of a hazard identification and risk assessment process to support the identification of the full range of potential hazards.

  The Project will have an overarching IMP which will be the umbrella document to the plans that form the Project's emergency response documentation. The IMP will provide details of BPs onshore response support to the incident site and will also be linked to the site specific MODU Emergency Response Plan (ERP), which will itself cover the following potential hazards:

  - Fire and explosion
  - Uncontrolled well flow
  - Ship collision
  - Adverse weather
  - H_2S
  - Helicopter ditching within the safety (exclusion) zone, or on deck
  - Hydrocarbon spills to the water.

  All the response plans that will be put in place for the Project will be developed following the appropriate hazard identification and risk assessment that will address the full range of hazards.

  As part of the development of the IMP and supporting documents, the availability and applicability of other operator's response resources/support within the region will be identified and mutual aid agreements will be incorporated into the plan as appropriate.

The IMP will describe the Incident Command System (ICS) structure and will detail alignment with federal and provincial level regulators as per the structure in place with the CNSOPB.

The IMP will identify reporting procedures to regulators and alerting procedures for affected stakeholders.

- **Spill Response Plan (SRP)**

The SRP will satisfy BP's planning requirements and will be designed to fulfil all of the information required as part of the OA process. The SRP will include a risk assessment and detailed description of how BP's preventative measures reduce the likelihood of spills occurring. It will also include response information for a variety of potential spill scenarios, the response organization structure, roles and responsibilities, and the procedures for notification and reporting.

The SRP will describe the location, mobilization and deployment of equipment and personnel and will include information about how to monitor and predict spill movement to facilitate an effective response. Information about environmental and socio-economic sensitivities and potentially affected Indigenous groups and stakeholders will also be included in the plan.

The SRP will identify oil spill response personnel, their roles and responsibilities, including response training and exercise programs. It will identify and document oil spill equipment, staff, their locations including resource mobilization procedures and estimated response times. It will define the notification, activation and mobilization procedures to be followed if an unintended release occurs.

The SRP will account for plausible worst-case spill scenarios and will detail spill response strategies for each potential incident.

The development of the SRP will take into account contributing factors (*e.g.*, weather conditions and sea states) and will also identify other site specific conditions and sensitivities as applicable.

BP will include tactical response measures within the SRP to clarify procedures and strategies for safely responding to different spill scenarios. The plan will include information how a sampling and monitoring program will be established if necessary. Specific tactical response planning that will be included in the SRP includes: surface dispersant application; offshore mechanical containment and recovery; oil spill waste management (including handling capabilities); in-situ burning; shoreline clean up and shoreline protection. The SRP will be supplemented by a project specific net environmental benefits analysis (NEBA), also referred to as a spill impact mitigation assessment (SIMA) and will also include a section/plan on Wildlife Response.

Source Control Contingency Plan (SCCP)

The SCCP constitutes several specific documents to create an overarching contingency plan. The SCCP is intended to provide specific details on how to respond to a major spill event, such as a blowout incident.

The plans that constitute the SCCP Plan are:

- Relief Well Contingency Plan
- Capping Procedure
- Subsea Dispersant Plan

Where practicable, each constituent plan will include a description about their respective probabilities of success.

- **Environment Protection Plan (EPP)**

  The EPP will serve as a tool to communicate Project requirements and commitments for environmental management and protection to Project personnel, regulatory agencies and stakeholders. It will apply to both BP staff and contractors.

  The EPP will be a project specific document that will identify the applicable environmental management processes and procedures from BP standard practices and any regulatory requirements and commitments (including commitments and conditions developed during the environmental assessment and approval process). It will also provide detail about how BP global requirements will be used in local procedures and practices.

  The EPP will identify roles and responsibilities for personnel, monitoring requirements, reporting and notification procedures to regulators and stakeholders. As noted in IR-055, the EPP will become the mechanism for capturing post-EIS updates on environmental sensitivities and required mitigation.

References:

C-NLOPB (Canada-Newfoundland and Labrador Offshore Petroleum Board) and CNSOPB (Canada-Nova Scotia Offshore Petroleum Board. 2011. Drilling and Production Guidelines. Available from: http://www.cnsopb.ns.ca/pdfs/DrillingandProduction_Guidelines_Mar312011.pdf

Information Request (IR) IR-064

Applicable CEAA 2012 effect(s): All

EIS Guidelines Reference: Part 2, 6.6.1 Effects of potential accidents or malfunctions

EIS Reference: 8.0 Accidental Events

Context and Rationale: It is not clear whether and how federal experts would be involved in developing and implementing emergency preparedness and response plans.

Specific Question or Request: Describe if, when, and under what circumstances the proponent may consult with experts in Environment and Climate Change Canada (including the Canada Wildlife Service), Fisheries and Oceans Canada, Transport Canada, and Health Canada in developing and implementing emergency preparedness and response plans, including both prior to and during an incident. Describe the subject areas where expertise from these departments would be sought.

Response: BP is required to submit environmental protection and emergency response plans to the Canada-Nova Scotia Offshore Petroleum Board (CNSOPB) as part of the Drilling Operations Authorization (OA) approval process. BP will liaise in the first instance with the CNSOPB as the primary regulatory agency in the development and implementation of the Safety Plan, Incident Management Plan and Spill Response Plan. The CNSOPB has established memoranda of understanding (MOUs) with various federal departments to facilitate access to expert technical advice from these departments as necessary. The CNSOPB will identify the need for inclusion of experts from other federal departments including prior to and during an incident. An example of this may be the request of experts from Environment and Climate Change Canada's Environmental Emergency Program to provide expert review and advice on a spill response plan.

Information Request (IR) IR-065

Applicable CEAA 2012 effect(s): 5(1)(a); 5(1)(b)(i); 5(1)(c); 5(2)(a); 5(2)(b)

EIS Guidelines Reference: Part 2, 6.6.1 Effects of potential accidents or malfunctions

EIS Reference: Table 1.5.2 Summary of Key Relevant Federal Legislation

Context and Rationale: Table 1.5.2 provides a summary of key relevant federal legislation. The final row of the table discusses the use of spill-treating agents in the context of the proposed *Regulations Establishing a List of Spill-treating Agents*, and indicates that "upon the coming into force of the Regulations, the CNSOPB will be able to authorize the use of one or more of the spill-treating agent products listed in the proposed Regulations <u>under the conditions described above</u> to respond to an oil spill" (underlining added). However, it is unclear where those conditions are described.

Specific Question or Request: Describe the conditions under which the spill-treating agents specified in the proposed regulations might be used.

Response: The conditions referred to in Table 1.5.2 of the Environmental Impact Statement (EIS) that will determine whether dispersants may be used are listed in the Regulations Establishing a List of Spill-treating Agents (*Canada Oil and Gas Operations Act*). In line with the regulations acceptable conditions in which dispersants (also referred to as spill treating agents) may be considered for use include:

- the spill-treating agent (STA) is listed in regulations made by the Minister of the Environment;
- the use of the STA is included in the operator's contingency plan;
- in response to a spill, the relevant offshore board's Chief Conservation Officer determines that its use is likely to achieve a net environmental benefit in the particular circumstances of the spill and approves the use of the STA;
- the STA is used in accordance with conditions set out in regulations that will developed within the next five years and any other conditions stipulated by the Chief Conservation Officer at the time of the spill; and
- the Minister of the Environment is consulted at the time of a spill by the Chief Conservation Officer within the five-year transition period during which STA conditions of use regulations will be developed.

A net environmental benefit analysis (NEBA), also referred to as a spill impact mitigation assessment (SIMA) will be conducted for the Project which will consider the use of STAs (dispersants). The suitability for dispersant application will be considered on a site specific and incident specific basis.

Further information about dispersant planning and application is presented in Section 8.3.3.3 of the EIS and includes some information about when dispersant use may be considered.

Information Request (IR) IR-066 (DFO-26)

Applicable CEAA 2012 effect(s): 5(1)(a)(i) Fish and Fish Habitat; 5(1)(a)(ii) Aquatic Species

EIS Guidelines Reference: Part 2, 6.6.1 Effects of potential accidents or malfunctions

EIS Reference: 8.4 Spill Fate and Behaviour, p.8.44; Appendix H Oil Spill Trajectory Modelling

Context and Rationale: Subsea oil release fate and behaviour may be influenced by chemical dispersants.

Specific Question or Request: Taking into consideration the spill fate and behaviour modelling results described in the EIS (section 8.4), discuss how the potential use of dispersants may change how far oil may travel from a blowout location, how oil would move in the water column, or could affect shorelines.

If dispersants were employed to mitigate a subsea spill, discuss how these might influence the fate and behaviour of the subsea oil. Discuss if there are past examples of when dispersants have been used to mitigate a subsea spill and how these examples would be used in the analysis.

Response: The spill trajectory modelling work conducted in support of the Environmental Impact Statement (EIS) was carried out on a worst case credible basis. All modelled scenarios were run unmitigated, with the assumption that no oil spill tactical response methods were deployed to capture, divert or disperse oil.

A summary of oil spill tactical response methods that will be considered for use as part of the Project is included in Section 8.3.3.3 of the EIS and includes the use of:

- Surveillance and tracking
- Offshore containment and recovery
- Dispersant application (surface application and subsea injection)
- In-situ burning
- Shoreline protection
- Shoreline clean-up
- Oiled wildlife response

BP will carry out a net environmental benefit analysis (NEBA), also referred to as a spill impact mitigation assessment (SIMA) to assess the benefits/effects associated with different spill response strategies, including dispersant application.

Commercial dispersant products are a combination of solvents and surfactants which can be sprayed on the sea surface or injected directly close to the wellhead in the event of a subsea release. Dispersants enhance the natural processes that occur when oil is spilled into the sea surface or into the sea at depth. The mixing energy of wave action and currents will naturally promote the breakdown of an oil mass into smaller droplets. Dispersants accelerate that process: they are used to increase the portion of oil that will be dispersed as small buoyant oil droplets are rapidly diluted into the water column by currents and wave action.

In general, dispersants will change the fates of oil. As explained in Section 8.3.3.3 of the EIS, dispersants do not reduce the total volume of oil in the environment; however, they increase the surface area of oil exposed to the environment, which helps to accelerate oil biodegradation, and typically reduce the extent of surface and onshore oiling. Once dispersants have been applied to an oil slick at the sea surface, dispersed oil dilutes rapidly into the water column and eventually, dispersed oil droplets degrade into naturally occurring substances. In the event dispersants are directly injected at the well head, the majority of oil is rapidly diluted into the water column limiting the amount of oil able to create an oil slick at the sea surface. The extent to which this could occur is dependent on conditions (*e.g.*, wind, waves and currents) at the time of the spill and dispersant application; the type of oil being treated; and the method of dispersant application. An oil's chemical composition, weathering state and viscosity and the water salinity and temperature are all factors that can affect dispersant efficiency.

The NEBA/SIMA will provide detailed information about the extent to which dispersants may influence the fate of oil. It will be used to compare how ecological, social, economic resources are affected by the various spill prevention, planning and response actions. It is expected that dispersants will reduce the extent of surface oiling and oil slicks which may reduce the risk to marine birds and marine mammals, and sensitive receptors in the nearshore and around the shoreline if oil strands on beaches. Subsea dispersant injection also reduces the amount of volatile organic compounds (VOCs) emissions, thereby reducing the potential exposure of spill responders working at the surface and in the near shore environment. However, the application of dispersants would likely increase the exposure of receptors within the water column to small droplets of oil. The NEBA will compare the ability of sensitive receptors in the water column to recover from the increased exposure to dispersed oil to the effects of floating oil exposure on seabirds, marine mammals and ecological and social receptors in the nearshore and shoreline.

The goals of subsea dispersant injection (SSDI) into a deep water oil and gas blowout are to increase effectiveness of dispersant treatment over that achievable at the water surface and to reduce the amount of dispersant product required to treat a certain oil amount; decrease the volume of oil that surfaces; reduce human and wildlife exposure to VOCs; disperse the oil over a large water volume at depth; enhance biodegradation; and reduce surface, near-shore and shoreline exposure to floating and surface-water entrained/dissolved oil. Potential trade-offs include increased water column and benthic resource exposures to oil at depth.

SSDI was used for the first time in response to the Deepwater Horizon incident in 2010. Information about the Deepwater Horizon incident is included in Section 8.3.4 of the EIS.

The NEBA/SIMA will take account of findings and observations from the subsea dispersant used in the Deepwater Horizon incident.

Information Request (IR) IR-067

Applicable CEAA 2012 effect(s): 5(1)(a); 5(1)(b)(i); 5(1)(c); 5(2)(a); 5(2)(b)

EIS Guidelines Reference: Part 2, 6.6.1 Effects of potential accidents or malfunctions

EIS Reference: 8.1.3.2 Dropped Objects

Context and Rationale: The section on potential accidental risk scenarios describes the marine riser-loss incident at Shell's Cheshire L-97 well site, stating that no drilling fluid was released during the incident. A report by the Canada-Nova Scotia Offshore Petroleum Board states that BOP control fluid was released (http://www.cnsopb.ns.ca/sites/default/files/pdfs/droppedriserreportsummary.pdf).

It is not clear that the potential spill scenarios described in 8.2 included the possibility of a marine riser-loss and associated effects.

Specific Question or Request: Comment on the probability for a marine riser-loss as part of the Project and assess the potential for associated environmental effects (*e.g.* release of BOP control fluid).

Response: Drilling fluid refers to the drilling muds used to drill the well. Blowout preventer (BOP) fluids are used to control the BOP. No well fluids or drilling fluids (*i.e.* synthetic based mud) were released as part of the Cheshire L-97 incident.

Section 8.2.2 of the Environmental Impact Statement (EIS) describes potential bulk spills which could occur as part of the Project.

Bulk spills, which can occur on the mobile offshore drilling unit (MODU) or platform supply vessels (PSVs), involve the accidental release of different types of hydrocarbons, including diesel, aviation fuel, and drilling fluids such as synthetic-based muds (SBM). The bulk spill category includes a number of small to medium size releases from a variety of potential incidents.

Bulk spill incidents described in Section 8.2.2 include:

- A tank rupture as a result of a vessel collision;
- A riser unlatching as a result of a loss of position through dynamic positioning (DP) failure or bad weather before which fluids are removed.;
- A hose or tank failure during bunkering operations on the PSV or MODU.

Information about a riser unlatching is included in Section 8.1.3.2 of the EIS.

The riser used in drilling will circulate drilling fluid and cuttings between the MODU and the wellbore. The riser will be designed to withstand the meteorological and oceanographic (metocean) conditions likely to be encountered in the area. In the event of approaching extreme weather, the riser may be unlatched to prevent damaging the MODU, the BOP or the riser, and to avoid risk of uncontrolled loss of cuttings or fluid. The riser would be emptied as part of the unlatching process. Procedures will be in place to reduce the risk of an unintentional unlatching (refer to Section 8.1.3.2 for a discussion of dropped objects and the recent riser incident during the Shelburne Basin Venture Exploration Drilling Project where no drilling fluid loss occurred).

As indicated in response provided for IR-019, it is estimated that approximately 50 bbls of BOP fluid would be released if/when the riser unlatches. BOP fluid is primarily comprised of freshwater (approximately 95%) but also contains glycol based antifreeze and soluble lubricants with corrosion inhibitors.

All liquid discharges from the MODU and PSVs were considered as part of the impact assessment, including BOP fluids. Section 7.1.2 gives an overview of the potential interactions of routine liquid waste discharges with the environment. This is explored in further detail in Section 7.2.8.1, for fish and fish habitat and Section 7.3.7 for marine mammals. BOP fluids and other discharges from the subsea control equipment will be managed according to the Offshore Waste Treatment Guidelines (OWTG) and the Offshore Chemical Selection Guidelines (OCSG).

A 3,604 bbl release of SBM was assessed in the EIS as a credible worst case scenario due to a marine riser loss (refer to Sections 8.4 and 8.5). Given the composition of BOP fluid and adherence to the OWTG and OCSG, it is predicted that environmental effects associated with BOP fluid loss as a result of a marine riser loss would be of lower magnitude and significance than that predicted as a result of an SBM release (*i.e.*, not significant).

Information Request (IR) IR-068

Applicable CEAA 2012 effect(s): All

EIS Guidelines Reference: Part 2, 6.6.1 Effects of potential accidents or malfunctions

EIS Reference: 8.2.3 Well Blowout Incident

Context and Rationale: This section, on page 8.18, discusses the Uniacke G-72 incident that occurred in the Nova Scotia offshore in 1984. However, there was also a subsurface blowout that occurred at Mobil's West Venture N-91 exploratory gas well in April 1985. The Agency understands that the N-91 incident did not lead to the release of any hydrocarbons to the marine or atmospheric environment because it was contained underground, but it nonetheless provides historical context.

Specific Question or Request: Comment on the possibility of an incident similar to the April 1985 subsurface blowout that occurred at Mobil's West Venture N-91 exploratory gas well occurring during the Project and the likelihood of it leading to a spill or other release.

Response: Two loss of well control incidents have been reported to occur in offshore Nova Scotia.

The first, the Uniacke G-72 incident occurred on February 22, 1984. The loss of well control at Uniacke G-72 resulted in a blowout incident. It occurred at a gas well that was being drilled 150 nautical miles from Halifax by the semisubmersible drilling vessel, Vinland, under contract to Shell Canada Resources. The initial flow rate of gas and condensate was estimated to be approximately 300 barrels per day. The incident lasted for 10 days and approximately 1,500 barrels of gas condensate was released in total. Approximately 1.11 to 1.83 million m^3/day of natural gas was released. The well was declared static 10 days after the initial release after a team of specialists boarded the Vinland and pumped mud down the choke line (Gill *et al.* 1985).

The second loss of well control occurred in 1985 at N-91, a Mobil exploratory gas well in West Venture at a water depth of 38 m. The blowout preventer (BOP) was activated at the N-91 incident and no fluids or hydrocarbons were released as a result of the loss of well control. Instead hydrocarbons were contained within the subsurface formations. The loss of well control arose as a consequence of a casing failure in the wellbore that allowed natural gas to escape from one subsurface formation to another. No hydrocarbons escaped from the wellbore into the ocean or atmosphere however a relief well was drilled to kill the well (Angus and Mitchell 2010).

The BOP was successfully deployed in the N-91 incident to prevent any loss of hydrocarbons. As part of the project, BP will use BOPs that comply with American Petroleum Institute (API) standards, specifically API Standard 53 (Blowout Prevention Systems for Drilling Wells). In light of their critically important role to the safety of the crew, the rig and the wellbore itself, BOPs are inspected, tested and refurbished at regular intervals.

Furthermore, as explained in Section 8.2.3 of the Environmental Impact Statement (EIS), a number of controls and mitigation measures will be used as part of the Project to minimize the possibility of a loss of well control from arising and in the unlikely event that a loss of well control incident occurs, to manage any potential consequences.

There have been a number of industry advancements in the field of well control in the time since the Uniacke G-72 and West Venture N-91 which have reduced the likelihood of a blowout incident from occurring. Many of the barriers that have been described in Section 8.2.3 of the EIS take account of these advancements. BP will adopt these, as well as lessons learned from Deepwater Horizon, as part of the Project. These advancements and lessons learned include, but are not limited to:

- enhanced industry and BP training and competency assessments for individuals and crews with accountability for well control and other well operations;
- additional shear rams on the BOP - BP uses three shear rams on the BOP. In addition, there are two variable pipe rams;
- regular system and pressure testing of the BOP;
- third-party verification of BOP testing and maintenance;
- onshore remote monitoring to support well operations.

References:

Angus, W. D. and Mitchell, G. 2010. Facts do not justify banning Canada's current offshore drilling operations: A senate review in the wake of BP's Deepwater Horizon Incident. Eighth report of the Standing Senate Committee on Energy, the Environment and Natural Resources.

Gill, S. D., Bonke, C. A., and Carter, J. 1985. Management of the Uniacke G-72 Incident. International Oil Spill Conference Proceedings 1985 (1): 311-313.

Information Request (IR) IR-069

Applicable CEAA 2012 effect(s): 5(1)

EIS Guidelines Reference: Part 2, 6.6.1 Effects of potential accidents or malfunctions

EIS Reference: 8.4.7.2 Oil Fate Results, Figures showing dispersed and dissolved oil concentration in water column.

Context and Rationale: The EIS (section 8.4.6) identifies thresholds that were used in describing the extent of surface oil (0.04 micrometers), shoreline oil (1.0 grams per square metre), and water column oil (58 parts per billion) effects from a potential well blowout scenario. The in-water oil concentration threshold was chosen drawing on studies of the "no observed effect threshold" for acute exposure developed by the Norwegian Oil Industry Association. It is not clear the 58 parts-per-billion threshold is relevant to species that could be affected by the Project off the coast of Nova Scotia, or how it relates to potential chronic effects following a well blowout scenario. Table 8.4.7 refers to this threshold as "In-Water Concentration (dissolved and entrained, top 100 metres);" it is not clear if the modelling results reflect exceedances of 58 parts per billion only in the top 100 metres or throughout the water column.

The EIS (section 8.4.8) also provides the outputs of deterministic modelling work done to estimate the mass balance distribution of oil following a well blowout scenario, and how the oil would change phases over time (*e.g.* more evaporates, biodegrades, lands as sediment with time; less on surface or dispersed with time). Although potential effects from surface oil, water column oil, and shoreline are discussed, it is not clear what the potential effects would be to benthic communities in areas potentially affected by a well blowout.

Specific Question or Request: Discuss how the 58 parts per billion in-water concentration threshold developed in Norway is relevant in assessing potential effects on fish in the areas potentially affected by a well blowout. Discuss how this threshold relates to potential chronic effects. Explain how the threshold does or does not apply for only the top 100 metres of the water column, and whether potential effects throughout the water column have been illustrated in the figures provided.

Provide an assessment of the potential effects on benthic communities – the extent, magnitude, timing, frequency, duration, and reversibility of the effect.

Response:

Threshold applicability

Under OSPAR Recommendation 2012/5 for a risk-based approach to the Management of Produced Water Discharges from Offshore Installations, a harmonised, structured procedure has been developed (OSPAR 12/22/1 Annex 19 of OSPAR Agreement 2012/7) which follows the principles of environmental risk assessment already in use in Europe (ECHA – Technical Guidance documents) and the United States (EPA guidance on risk assessment). As part of the risk assessment approach, a series of Predicted No Effect Concentrations (PNECs) for a range of naturally occurring substances typically found in produced waters have been identified (OSPAR Agreement 2014/5). The selection of the PNECs was based on the following prioritisation:

1. Environmental Quality Standards (EQS) derived under the Water Framework Directive (WFD) established for Priority Substances
2. Reliable PNECs derived from European Union (EU) Risk Assessment Reports (RARs).
3. Reliable PNECs or EQS from publicly available literature sources.

The PNEC for dispersed oil in produced water identified in OSPAR Agreement 2014/5 is 70.5 ppb.

Scholten *et al.* (1993) calculated the PNEC for dispersed oil in produced water as 40.4 ppb THC from no observed effect concentrations (NOECs) obtained in chronic exposure experiments. This is a general effect level designed to ensure protection of 95% of all aquatic organisms worldwide by making use of an appropriate assessment factor (EC 2003).

Nilsen *et al.* (2006) extracted a lethal effect level (LC5) of 58 ppb THC for dispersed oil. This effect level is extracted from a species sensitivity distribution (SSD) based on a dataset compiled by the National Research Council of the National Academies (2005). The SSD contains 24 different LC50 data points obtained in laboratory experiments where various marine organisms have been exposed to crude oil with added dispersant. All data used for the SSD rely on measured rather than nominal exposure concentrations. The SSD has a median value of 650 ppb, thus considered a representative LC50 for marine organisms exposed to dispersed oil. The concentration representing a lethal dose level to 5% of all marine organisms (193 ppb in the SSD) is considered representative of a sensitive species and used to construct a parallel slope (SD 0.32) with a median value 193 ppb THC. The 5% effect level in this parallel effect curve (58 ppb THC) is then considered a representative LC5 for water column organisms including fish eggs and larvae. The principle for how the effect level was identified is shown in Figure 1.

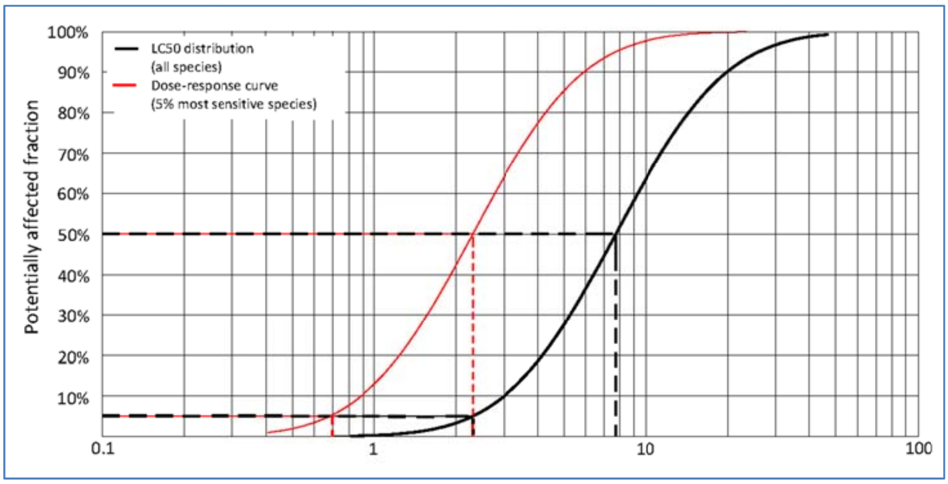


Figure 1 **Principle sketch showing how the LC5 effect level of dispersed oil was defined for water column organisms (Nilsen *et al.* 2006)**

Smit *et al.* (2009) calculated an EC5 for growth, reproduction and survival of marine organisms of 70.5 ppb THC based on laboratory experiments performed at IRIS (Norway). The dataset included organisms representing five different phyla (fish, crustaceans, polychaets, echinoderms and molluscs).

Vikebø *et al.* (2013) simulated the impact on cod larvae from a major oil spill originating from various locations outside the Norwegian coast, and coinciding with the spawning season of Arctic cod (*Gadus morhua*). In this study, effect levels are expressed as total PAH concentrations (TPAH) rather than total hydrocarbon (THC) or dispersed oil concentrations; 1 ppb total PAHs was set as the lethal effect level, and 0.1 ppb total PAHs as the sublethal. Table 1 shows measured PAH contents in four oil types produced on the Norwegian continental shelf (NCS) and with densities ranging from 0.793 to 0.914 kg/L; Kristin, Oseberg Øst, Norne and Svale. Based on these representative oil types, the effect limits used by Vikebø *et al.* correspond to a THC concentration 92 to 200 ppb for lethal effects, and 9 to 20 ppb THC for sublethal effects. As a rule of thumb, light oils (represented by Kristin condensate) have a higher PAH content than heavy oils (represented by Svale oil), although Table 1 shows that there is no direct relationship between densities and PAH contents.

Table 1 Total PAH content in representative oil types produced on the NCS

Oil type	Density (kg/L)	Total PAHs (wt %)	Reference
Kristin condensate	0.793	1.09	SINTEF (2006)
Oseberg Øst	0.842	0.56	SINTEF (2012)
Norne blend	0.868	0.74	SINTEF (2010)
Svale	0.914	0.50	SINTEF (2010)

TPAH effect levels used by Vikebø *et al.* (2013) are largely based upon documentation from both laboratory studies and field observations following the Exxon Valdez incident, demonstrating that the embryonic and larval stages of fish are particularly sensitive to PAHs (*e.g.*, Carls and Meador 2009). In weathered oils, the toxicity is primarily explained by the concentration of PAHs (Neff *et al.* 2000).

In a risk assessment of the impact on early life stages of Arctic cod and Norwegian spring-spawning herring (*Clupea harengus*) following an acute oil spill outside Lofoten, DNV and SINTEF (2010) calculated a lethal effect level (LC5) of 0.74 ppb TPAH, based on a dose/response curve with SD 0.32 (with SD 0.2, the effect level was calculated to 1.19 ppb TPAH). The effect level was based on a literature study and exposure experiments with Balder oil performed by SINTEF on first-feeding cod larvae. In Balder oil (density 0.863 kg/L, TPAH content 0.67 wt.%) 0.74 ppb TPAH corresponds to a THC concentration of 110 ppb (DNV and SINTEF 2010).

Table 2 presents a summary of proposed lethal effect levels of petroleum hydrocarbons cited above.

Table 2 Extract of THC effect levels proposed in the literature

Effect level (ppb THC)	Comment (calculation method)	Reference
40.4	PNEC $_{water}$ (chronic NOEC/assessment factor)	Scholten *et al.* (1993)
58	LC5 for growth, development and mortality in marine organisms (SSD)	Nilsen *et al.* (2006)
70.5	EC5 for growth, development and mortality in marine organisms (SSD)	Smit *et al.* (2009)
≈92-200 (depending on PAH content)	Lethal effect level (LC5?) in early life stages of fish (Literature/estimate)	Vikebø *et al.* (2013)
110 ppb	LC5 for early life stages in fish calculated for Balder oil from effect level 0.74 ppb TPAH (Literature/experiments)	DNV and SINTEF (2010)

The effect level (LC5) employed in the modelling was 58 ppb THC used to calculate impact (lethal effects) in fish eggs and larvae according to Nilsen *et al.* 2006. Alternative effect levels listed in Table 2 are in the range 40.4 to 200 ppb THC. One reason for using this effect level is that it is on the conservative side and based on THC rather than TPAH, which is easier to implement in an oil spill model. However, the main reason for using this effect level is that it is not just a “threshold” but also accompanied with a dose-response curve with defined slope (SD 0.32).

Explain how the threshold does or does not apply for only the top 100 metres of the water column, and whether potential effects throughout the water column have been illustrated in the figures provided.

The 58 ppb threshold applies throughout the water column. However, there is a 10 million cell limit on the number of grid cells that can be used to describe the water column within OSCAR, the software used for spill modelling. Therefore, the justification for limiting the depth of the water column modelling grid in stochastic modelling is to ensure that the spatial extent and resolution of grid cells describing the water column is not sacrificed by using up grid cells to cover regions in the lower water column where oil is not present. Oil is less dense than water, therefore the majority of the oil released during the blowout rises to the sea surface and spends most of the time either as an oil slick/film on the surface or becomes broken up into oil droplets by wave action and re-entrained into the upper water column.

As the oil rises within a few hours to the surface, the radial extent that the plume and oil droplets move away from the release location is relatively small compared to the lateral transport of oil once it arrives at the surface. Sections 6.2.1 and 6.2.2 of Appendix H of the EIS provide the results of near-field deterministic simulation over the first two days of NS-1 subsea blowouts at Sites 1 and 2 respectively with the water column grid in the vertical (extending all the way to the sea-floor - 100 layers in each case).

Due to the high turbulence at the release point, oil and gas released from the seabed rise as droplets and bubbles along with a substantial quantity of entrained water as a multiphase plume. The size of oil droplets does not substantially affect the transport of the mixture of plume fluid. Hence, the phases are initially clustered together and then move as an integral mixture governed by plume buoyancy forces. The terminal level for plume dynamics (TLPD) is the level where the plume dynamics is not important any more. Dissolution of gas and the lighter oil components may occur as the plume rises. Figures 6.31 and 6.41 illustrate a lateral extrusion of dissolved hydrocarbon components away from the plume below the TLDP.

Above the TLPD the oil droplet size distribution becomes important, as smaller droplets move slower towards the surface compared to larger droplets. Cross currents move droplets laterally, thus the droplets can spread in all directions. The OSCAR simulation results suggest that the TLPD occurs at about 1,955 m below sea-level at Site 1 and 2,370 m at Site 2 and is reached within 10 minutes of oil being released at the seabed. Figures 6.32 and 6.42 illustrate that it will take the largest oil droplets (8.8 mm) another 5 to 6 hours to rise to the surface, with 50% having arrived after 10 to 12 hours.

The figures show that the central core of the plume does not extend more than 5 to 15 km radially away from the release locations.

Provide an assessment of the potential effects on benthic communities – the extent, magnitude, timing, frequency, duration, and reversibility of the effect.

In the event of a blowout scenario, a portion of the oil released from the wellhead will eventually become entrained in the sediment after some time has elapsed. Figures 6.34 and 6.44 of Appendix H present the mass balance time development and distribution for oil for well sites 1 and 2 for the worst case, maximum shoreline oiling, summer scenario. In each of these scenarios, approximately 10% of the released oil becomes entrained in sediment after a modelling period of 120 days because of weathered oil that sinks and becomes incorporated into the sediment.

Following oil spills or blowouts, large scale lethality has been observed when high quantities of oil reach the benthic environment (Lee *et al.* 2015). Oil that has mixed with sediments can persist for long durations (*e.g.*, 30 years after the Arrow spill in Nova Scotia). Benthic community structure has the potential to change with sensitive species giving way to opportunistic species that can flourish in the presence of hydrocarbons. The persistence of hydrocarbons in sediments for long durations is due to the slow biodegradation that occurs under anoxic conditions characteristic of benthic environments (Lee *et al.* 2015). Organisms in constant contact with contaminated sediments are at higher risk for adverse effects such as impaired feeding, growth, development, and recruitment.

In waters in which vegetation occurs, marine algae may experience decreased reproduction, bleaching and mortality if exposed to oil (Lee *et al.* 2015). Benthic organisms that rely on this vegetation would be inherently affected. Benthic species also have the potential to be subject to hypoxia in the event where there is a high biochemical oxygen demand (BOD) of sediments due to organic enrichment from an oil spill.

There are several chronic and sublethal effects which could occur due to sediment oiling in the event of a well blow-out incident. One potential effect is for fish to become more sensitive to disease in the presence of oil. The cumulative mortality of juvenile flounder increased with an eight-week exposure to sediments contaminated with Hibernia crude oil (100 to 2,200 μg/g)(Lee *et al.* 2015). As the oil-in-sediment concentrations were increased, the susceptibility to mortality of the flounder infected with a parasite increased as compared to control individuals. Furthermore, benthic fish species are particularly susceptible to an increased prevalence of cancer following exposure to carcinogenic and mutagenic PAHs, typical of pyrogenic PAHs found in oil. To date, there have been no long-term studies of the prevalence of cancer in benthic fish chronically exposed to spilled oil.

In consideration of the potential effects of a blowout on benthic communities and the potential for spilled oil to remain in the sediment for long durations, the duration of the Project-Related Environmental Effects on Fish and Fish Habitat from a Well Blowout Incident has been upgraded to Long-Term from Short-Term to Medium-Term. The extent, magnitude, timing, frequency, and reversibility of the effect remain unchanged. See below for associated changes.

Table 3 Summary of Residual Project-Related Environmental Effects on Fish and Fish Habitat – Accidental Events (Updates to Table 8.5.1 of the EIS)

Residual Effect	Residual Environmental Effects Characterization						
	Direction	**Magnitude**	**Geographic Extent**	**Duration**	**Frequency**	**Reversibility**	**Ecological and Socio-economic Context**
Change in Risk of Mortality or Physical Injury/Change in Habitat Quality and Use							
10 bbl Diesel Spill	A	L	LAA	ST	S	R	U
100 bbl Diesel Spill	A	M	RAA	ST	S	R	U
PSV Diesel Spill	A	M	RAA	ST-MT	S	R	U
Well Blowout Incident	A	M	RAA*	~~ST-MT~~LT	S	R	U
SBM Spill	A	L	LAA	ST	S	R	U

KEY:
See Table 7.2.2 for detailed definitions

N/A: Not Applicable
Direction:
P: Positive
A: Adverse
N: Neutral
Magnitude:
N: Negligible
L: Low
M: Moderate
H: High

Geographic Extent:
PA: Project Area
LAA: Local Assessment Area
RAA: Regional Assessment Area; in certain scenarios, effects may extend beyond the RAA as indicated by an "*".
Duration:
ST: Short-term
MT: Medium-term
LT: Long-term

Frequency:
S: Single event
IR: Irregular event
R: Regular event
C: Continuous
Reversibility:
R: Reversible
I: Irreversible
Ecological/Socio-Economic Context:
D: Disturbed
U: Undisturbed

The response to IR-060 and IR-61 further discusses the assessment of Fish and Fish Habitat in relation to a blowout scenario.

References:

Carls M.G. and Meador, J.P. 2009. A perspective on the toxicity of petrogenic PAHs to developing fish embryos related to environmental chemistry. Human and Ecological Risk Assessment 15:1084–98.

DNV and SINTEF. 2010. Petroleumsvirksomhet. Oppdatering av faglig grunnlag for forvaltningsplanen for Barentshavet og områdene utenfor Lofoten (HFB). Konsekvenser av akutt utslipp for fisk. Appendix 2: Effektgrenser for torsk og sild. DNV report no. 2010-0527.

EC. 2003. Technical Guidance Document on risk assessment in support of Commission Directive 93/67/EEC on risk assessment for new notified substances and Commission Regulation (EC) No 1488/94 on risk assessment for existing substances and Directive 98/8/EC of the European parliament and of the council concerning the placing of biocidal products on the market. Part II – Environmental Risk Assessment

Lee, K., Boufadel, M., Chen, B., Foght, J., Hodson, P., Swanson, S., Venosa, A. 2015. Expert Panel Report on the Behavior and Environmental Impacts of Crude Oil Released into Aqueous Environments. Royal Society of Canada, Ottawa, ON.

National Research Council of the National Academies. 2005. Oil Spill Dispersants - Efficacy and Effects. The National Academic Press. Washington DC. ISBN 978-0-309-09562-4 (http://www.nap.edu/catalog/11283/oil-spill-dispersants-efficacy-and-effects).

Neff, J.M., McKelvie, S., and Ayers, Jr., R.C. 2000. Environmental Impacts of Synthetic Based Drilling Fluids. OCS Study MMS 2000-64. US Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Program, New Orleans, LA. 118pp.

Nilsen H., Greiff Johnsen H., Nordtug T., Johansen Ø. 2006. Threshold values and exposure to risk functions for oil components in the water column to be used for risk assessment of acute discharges (EIF Acute). Statoil Report

OSPAR Recommendation 2012/5 for a risk-based approach to the management of produced water discharges from offshore installations.

OSPAR 12/22/1 Annex 19 of OSPAR Agreement 2012/7, OSPAR Guidelines in support of Recommendation 2012/5 for a Risk-based Approach to the Management of Produced Water Discharges from Offshore Installations.

OSPAR Agreement 2014/5, Establishment of a list of Predicted No Effect Concentrations (PNECs) for naturally occurring substances in produced water.

Scholten M.C.T., Schobben, H.P.M., Karman, C.C., Jak R.G., van het Groenewoud. 1993. De berekening van het maximaal toelaatbare risico-niveau van olie componenten in water en sediment. TNO report R93/87.

Smit, M.G.D., Bechmann, R.K., Hendriks, A.J., Skadsheim, A, Larsen, B.K., Baussant, T., Sanni, S. 2009. Relating effect levels to whole-organism effects using species sensitivity distributions: A pilot study for marine species exposed to oil. Environmental Toxicology and Chemistry 28(5):1104-9.

Vikebø, F.B., Rønningen, P., Lien, V.S., Meier, S., Reed, M., Ådlandsvik, B., Kristiansen, T. 2013. Spatio-temporal overlap of oil spills and early life stages of fish. ICES Journal of Marine Science, October 14, 2013, doi: 10.1093/icesjms/fst131.

Information Request (IR) IR-070

Applicable CEAA 2012 effect(s): 5(1)

EIS Guidelines Reference: Part 2, 6.6.1 Effects of potential accidents or malfunctions

EIS Reference: Figures 8.4.17 and 8.4.19

Context and Rationale: These figures are difficult to understand. Many of the dots showing shoreline oiling are located in the ocean, far from shore.

Specific Question or Request: Provide text to explain Figures 8.4.17 and 8.4.19 (*e.g.* why dots showing shoreline oiling are located in the ocean, far from shore) and/or provide revised or additional figures, as appropriate.

Response: Figures 8.4.17 and 8.4.19 in the Environmental Impact Statement (EIS) show both surface thickness and shoreline oiling following a deterministic run of a well blowout incident.

The figures have been updated to show the shoreline oiling only in each case.

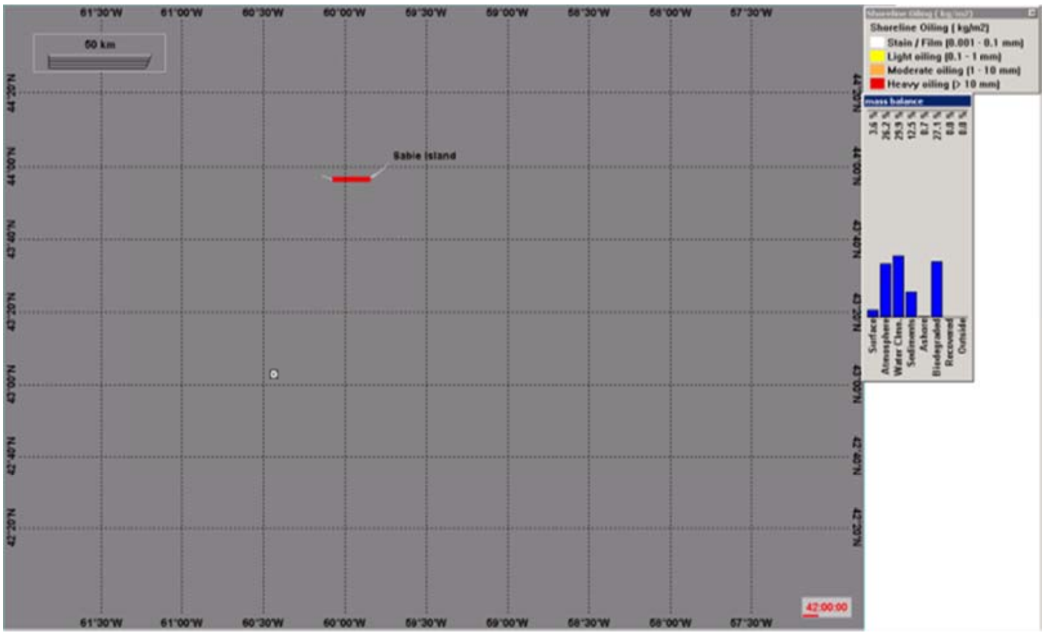


Figure 1 **(Updated Figure 8.4.17 of the EIS) Site 1 summer (June 19 2006, 23:00) deterministic model output showing a snapshot of shoreline oiling on day 42 after the release for a worst credible case (*i.e.*, unmitigated), 30-day continuous 24,890 bpd blowout incident.**

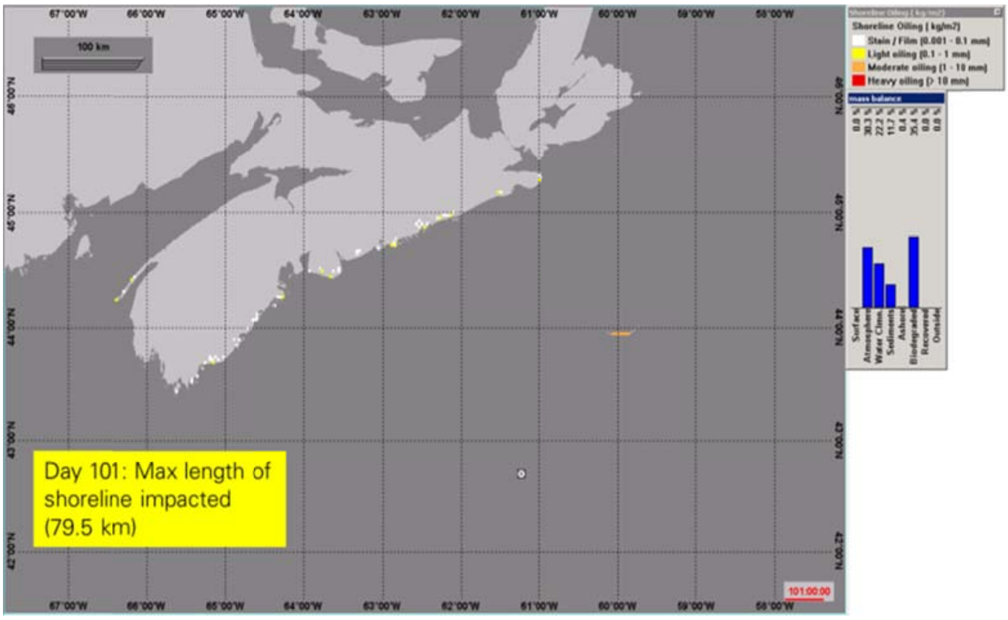


Figure 2 **(Updated Figure 8.4.19 of the EIS) Site 2 summer (June 24 2008, 03:00) deterministic model output showing a snapshot of shoreline oiling on day 101 after the release for a worst credible case (*i.e.*, unmitigated), 30-day continuous 35,914 bpd blowout incident.**

Information Request (IR) IR-071

Applicable CEAA 2012 effect(s): 5(1)

EIS Guidelines Reference: Part 2, 6.6.1 Effects of potential accidents or malfunctions

EIS Reference: 8.4.10 SBM spill

Context and Rationale: It is noted here that the synthetic-based mud (SBM) dispersion modeling that was done for the Shelburne Basin Venture Exploration Drilling Project is "considered valid to inform the assessment for the Project." Therefore, project-specific dispersion modeling was not conducted.

Specific Question or Request: Provide further rationale that the modelling of an SBM full riser spill done for the Shelburne project is an adequate proxy for the Scotian Basin project, considering similarities or differences in site morphologies, prevailing ocean current speeds and directions in both locations, and similarities or differences in the type of SBM modelled and the SBM likely to be used for the Scotian Basin project.

Response: The SBM full riser spill scenario modelled for the Shelburne Basin Exploration Drilling Project was used as an example to inform the assessment of the Project based on the proximity of the project to the Scotian Basin Exploration Drilling Project Site, and similarities in water depth, benthic habitat, and prevailing current speeds and directions between the two sites. Although BP has not yet selected a drilling fluids contractor and has not yet confirmed the fluids basis of design or the type of SBM that may be used, it is likely that the mud type will be similar to that used by Shell in the SBM modelling exercise for the Shelburne Basin Exploration Drilling Project. Table 1 below shows the constituents used in the Shelburne Basin Exploration Drilling Project SBM modelling.

Table 1 Composition of SBM used for modelling the SBM spill scenarios for the Shelburne Basin Venture Exploration Drilling Project (RPS ASA 2014)

Product	Function	Concentration
S/W Ratio		75/25
VG-Plus	Viscosifier	1.5 ppb
VG-Supreme	Viscosifier	0.8 ppb
Lime	Alkalinity Control	3 ppb
Suremul	Emulsifier	7 ppb
Surewet	Wetting Agent	2 ppb
Ecotrol RD	Fluid Loss Control Agent	0.5 ppb
Calcium Chloride (% by wt)		20-25
Rheflat	Rheological Modifier	0.5-2 ppb
Rhethik	Rheological Modifier	0.5 ppb
M-I Wate (4.1SG Barite)	Weighting Agent	As required

The benthic habitat in both the Shelburne and Scotian basins are generally barren and devoid of visible epifaunal organisms. The substrate in both locations are generally made up of Holocene silt and clay, which are slowly deposited over the area. Isolated patches of gravel can be found but are rare. Brittle stars and burrowing anenomies are the most common species found in the Project locations.

Three major currents influence the movement of water for both of the Project locations which are the Nova Scotia Current, the Shelf Break Current (an extension of the Labrador Current), and the Gulf Stream. An overview of ocean currents relevant to both the Shelburne and Scotian Basins can be found in Section 5.1.3.2 of the EIS.

Modelling conducted for the Shelburne Basin Venture Exploration Drilling Project was conducted in water depths of 1,770 and 2,550 m. At each of the discharge modelling sites, daily HYCOM currents were obtained by interpolating the values from the nearest model grid points. Surface currents in the region are generally of moderate speed in the range of 20-30 cm/s, although currents in excess of 60 cm/s occur 5% of the time. The current intensity decreases rapidly with depth, with average speeds dropping to approximately 10 cm/s by 400 m of depth. Currents near the seabed of each site are extremely weak with speeds of 4-5 cm/s. At the sea surface in the Shelburne Basin, currents were directionally variable, becoming strongly oriented towards the west and southwest at depth. For an in depth look at currents used in the Shelburne Basin SBM full riser spill scenario please refer to RPS ASA 2014 (Appendix C in Stantec 2014).

The Scotian Basin Oil Spill Trajectory Modelling was carried out at two sites, one in 2,104 m of water and one in 2,652 m of water. HYCOM current models were also relied on for these two sites. Similarly to the Shelburne Basin modelling, currents in the area of the Scotian Basin Project were in the order of magnitude of 20-30 cm/s at the surface, decreasing to the < 5 cm/s near the seabed. Surface currents in the Scotian basin were also highly variable with respect to direction. For an in depth description of currents in the Project Area used in the Scotian Basin Oil Spill Trajectory Modelling please refer to the Fate and Effects Oil Spill Trajectory Modelling Report for Scotian Basin Exploration Drilling Project (Appendix H).

The SBM used for the Scotian Basin Drilling Project is expected to be similar with respect to chemical parameters as the fluid used in the Shelburne basin Project. This coupled with the fact that the sites for each Project are similar with respect to benthic habitat, water depth, current speeds and current directionality provides rationale that the modelling of an SBM full riser spill done for the Shelburne Project is an adequate proxy for the Scotian Basin Project.

References:

RPS ASA. 2014. Sediment Dispersion Modelling in Support of the Shelburne Basin Venture Exploration Drilling Program. February 2014.

Stantec [Stantec Consulting Ltd.]. 2014. Shelburne Basin Venture Exploration Drilling Project Environmental Impact Statement. Prepared for Shell Canada Limited. June 2014.

Information Request (IR) IR-072

Applicable CEAA 2012 effect(s): All

EIS Guidelines Reference: Part 2, 6.6.1 Effects of potential accidents or malfunctions

EIS Reference: 8.3.3.3 Oil Spill Tactical Response Methods

Context and Rationale: The EIS Guidelines (6.6.1) require that the environmental effects from emergency response burns should be considered in the assessment of effects from potential oil spills and blowouts.

In the EIS (section 8.3.3.3), the controlled in-situ burning of oil on the water surface is identified as a possible response to an oil spill. The proponent commits to not do in-situ burning without prior regulatory approval. However, the environmental effects described do not include the effects from potential burning.

Specific Question or Request: If in-situ burns of oil on the water surface is under consideration as a possible response to an oil spill, then describe the potential for associated environmental effects on valued components. Clarify how potential residual environmental effects are considered in the overall characterization of residual effects (magnitude, duration, timing, reversibility, *etc.*) and significance determinations.

Response: In situ burning is mentioned in Section 8.3.3.3 of the Environmental Impact Statement (EIS) as a potential oil spill tactical response method which will be considered following a spill incident. Information about response methods which can be used in the event of a spill will be contained in the Spill Response Plan (SRP). A toolkit of different tactical response methods will be available to be used depending on the specific conditions of a spill event. The effectiveness of different spill response methods will depend on specific environmental conditions and on the nature of the spilled material.

One tactical response method that will be considered as part of the tactical response method toolkit is controlled in situ burning (ISB). ISB will not be used by BP without prior regulatory approval.

ISB can be used to quickly and efficiently reduce the volume of oil on the water surface that could otherwise reach shorelines and nearshore sensitive receptors. ISB can only take place when oil has been contained within fire resistant booms and when meteorological conditions are suitable (*i.e.* calm seas and light winds). Typically, the oil is contained within a boom and ignited using a hand-held igniter or an igniter suspended from a helicopter. The burn will continue only as long as the oil is thick enough—usually about 1/10 of an inch or 2 to 3 millimeters.

Under favourable conditions ISB is a fast, efficient, and relatively simple way of removing spilled oil from the water. Furthermore, it greatly reduces the need for storage and disposal of the collected oil and the waste it generates.

A net environmental benefit analysis (NEBA), also referred to as a spill impact mitigation assessment (SIMA) will be conducted for the Project and will consider potential effects of various spill response tactics including but not limited to, in situ burning.

The EIS did not consider the application of any tactical response methods in the oil spill modelling as it was based on an unmitigated worst credible case discharge. The residual effects of in-situ burning were therefore not considered as part of the assessment. There are some environmental considerations associated with in-situ burning which will be evaluated when determining which spill response methods will be deployed including:

- **Atmospheric emissions**

  Studies of the emissions from in-situ burning have shown fairly consistent results. About 85 to 95% of the burned oil becomes carbon dioxide and water, 5 to 15% of the oil is not burned efficiently and is converted to particulates, mostly soot, and the remaining 1-3%, is comprised of nitrogen dioxide, sulphur dioxide, carbon monoxide, polynuclear aromatic hydrocarbons (PAH), ketones, aldehydes, and other combustion by-products (Ferek *et al.* 1997). The burning of oil on water seems to be similar to burning the oil in a furnace or a car, with the exception that the burn is oxygen-starved and not very efficient, so that it generates black soot particulates that absorb sunlight and create black smoke.

- **Burn residue**

  Generally, the composition of burn residue is similar to that of the original oil. Burn residues generally have less volatile hydrocarbons, and are more viscous and denser than unburned oil.

  Burn residues may either float or sink. For example, in a controlled test burn during the Exxon Valdez spill, an estimated 15,000 to 30,000 gallons of Prudhoe Bay crude oil were burned. Following this burn, about 300 gallons of "stiff, taffy-like burn residue that could be picked up easily" remained on the sea surface (Allen 1990). However, during the 1991 Haven tanker incident near Genoa, Italy, the remaining burn residues sank. Reliable estimates of the amount of oil actually burned were not possible, but the tanker was laden with 141,000 tons of Iranian heavy crude, and very little remained in the wreck after the incident. Several 1991 surveys confirmed that there was sunken oil offshore and along the coast (Moller 1992). In some other cases, the residues stay afloat while warm, but sink as they cool. In a series of test burns in Prudhoe Bay, Alaska using Alaska North Slope crude, it was found that, as the residues cooled, some of it sank (Buist 1995). The sunken residues formed a brittle solid, while the residues that stayed afloat were semi-solid tar. It seems, therefore, that prompt collection of the residues can at least in some cases prevent the residues from sinking.

- **Direct temperature effect**

  Burning oil on the surface of the water could lead to a temporary, localized increase in temperature which could adversely affect organisms at or near the interface between oil and water.

Observations during large-scale burns using towed containment boom did not indicate a temperature impact on surface waters. Thermocouple probes in the water during a Newfoundland test burn showed no increase in water temperatures during the burn (Fingas *et al.* 1994). It appears that the burning layer may not remain over a given water surface long enough to change the temperature because the ambient temperature seawater is continually being supplied below the oil layer as the boom is towed.

- **Water-column toxicity**

  Environment Canada coordinated a series of studies to determine whether in-situ burning caused water-column toxicity beyond that attributable to allowing the slick to remain on the surface of the water. While these studies centered on the Newfoundland in-situ burn field trials conducted in August 1993, they also included laboratory tests to investigate potential effects in a more controlled environment (Daykin *et al.*1994). Results from the laboratory and field studies indicated that, although toxicity increased in water samples collected beneath oil burning on water, this increase was generally no greater than that caused by the presence of an unburned oil slick on water. Chemical analyses performed along with the biological tests reflected low hydrocarbon levels in the water samples.

- **Effect on surface microlayer**

  The surface of the water represents a unique ecological niche called the "surface microlayer," which has been the subject of many recent biological and chemical studies. The microlayer, often considered to be the upper millimeter or less of the water surface, is habitat for many sensitive life stages of marine organisms, including eggs and larval stages of fish and crustaceans, and reproductive stages of other plants and animals. It is known that cod, sole, flounder, hake, anchovy, crab, and lobster have egg or larval stages that develop in this layer. There is little doubt that in-situ burning would kill the organism in the area of the burn. However, when considering the small area affected by in-situ burning, the rare nature of this event, and the rapid renewal of the surface microlayer from adjacent areas, the long-term biomass loss is negligent (Shigenaka and Barnea 1993).

References:

Allen, A.A. 1990. Contained controlled burning of spilled oil during the Exxon Valdez oil spill. In Proceedings of the Thirteenth Arctic and Marine Oil Spill Program Technical Seminar, June 6-8, 1990, Edmonton, Alberta, pp. 305- 313.

Buist, I.A. 1995. Demulsifiers and modified heli-torch fuels to enhance in-situ burning of emulsion. Final Report, Ottawa: S.L. Ross Environmental Research.

Daykin, M., G. Sergy, D. Aurand, G. Shigenaka, Z. Wang, and A. Tang. 1994. Aquatic toxicity resulting from in-situ burning of oil-on-water. In Proceedings of the Seventeenth Arctic and Marine Oil Spill Program Technical Seminar, Vancouver B.C. pp. 1165-1193.

Ferek, R. A. Allen, and J.H. Kucklick. 1997. Air quality considerations involving in-situ burning. Scottsdale: Marine Preservation Association. 29 pp

Fingas, M.F., F. Ackerman, K. Li, P. Lambert, Z. Wang, M.C. Bissonnette, P.R. Campagna, P. Boileau, N. Laroche, P. Jokuti, R. Nelson, R.D. Turpin, M.J. Trespalacios, G. Halley, J. Belanger, J. Pare, N. Vanderkooy, E.J. Tennyson, D. Aurand, and R. Hiltabrand. 1994. The Newfoundland offshore burn experiment-NOBE, preliminary results of emission measurement. In Proceedings of the Seventeenth Arctic and Marine Oil Spill Program Technical Seminar, Environment Canada, Vancouver B.C., pp. 1099-1163

Moller, T.H. 1992. Recent experience of oil sinking. In Proceedings of the Fifteenth Arctic and Marine Oil Spill Program Technical Seminar, June 10-12, 1992, Edmonton, Alberta, pp. 11-14.

Shigenaka, G. and N. Barnea. 1993. Questions about in-situ burning as an open-water oil spill response technique. 1993. HAZMAT Report 93-3. Seattle: Hazardous Material Response and Assessment Division, NOAA.

Information Request (IR) IR-073

Applicable CEAA 2012 effect(s): All

EIS Guidelines Reference: Part 2, 6.4 Mitigation

EIS Reference: 8.3.3.3 Oil Spill Tactical Response Methods; 8.5.3 Migratory Birds

Context and Rationale: The EIS Guidelines (section 6.4) require that where mitigation measures are proposed with which there is little experience, or for which there is some question as to their effectiveness, the potential risks and effects on the environment should those measures not be effective be clearly and concisely described, and the extent to which the measure would help mitigate environmental effects be identified.

The EIS (section 8.3.3.3) describes the recent (2016) listing under the *Canada Oil and Gas Operations Act* of several dispersants as acceptable for use in Canada's offshore. The EIS further describes how authorization for the use of dispersants as part of emergency response measures is currently being reviewed by the Canada-Nova Scotia Offshore Petroleum Board as part of the Accords Acts. As part of the requirements for a Spill Response Plan for the Board, the proponent will undertake a Net Environmental Benefits Analysis (NEBA) that includes consideration of the use of dispersants.

With regard to migratory birds, the EIS (section 8.5.3.1) describes how the effects of oil-dispersant mixtures may be similar to or more harmful than untreated oil considering effects on thermoregulation and buoyancy. With regard to fish and fish habitat, the EIS (section 8.3.3.3) describes how the use of dispersants could result in a temporary, localized increase in risk of adverse environmental effects on invertebrates and plankton in the water column in the vicinity of the application, with the effect of concern being toxicity. Section 8.5.3.1 of the EIS describes how the use of dispersants could cause a short term increase in exposure to dispersed oil to organisms in the water column, such as corals and shellfish. However, it is not clear what the potential adverse effects would be to fish other than general toxicity.

Specific Question or Request: With the exception of migratory birds, describe more fully the potential adverse environmental effects from the use of dispersants on VCs. Consider acute and chronic toxicity, bioaccumulation through the food chain, and the duration of the toxic effect. Consider the Royal Society of Canada's report "Behaviour and Environmental Impacts of Crude Oil Released into Aqueous Environments," in the effects analysis, as applicable.

Response: The use and effects of dispersants have been examined and discussed in Section 8.3.3.3 of the EIS. BP will undertake a net environmental benefit analysis (NEBA), also referred to as a spill impact mitigation assessment (SIMA) as part of the preparation of the Spill Response Plan to evaluate the benefits associated with different spill response tactics including dispersant application. In a NEBA/SIMA framework, potential biophysical and socio-economic risks would be weighed against risks of not dispersing surface and subsurface oil including the risk to marine life associated with surface slicks and shoreline (*e.g.*, Sable Island) contamination. The NEBA/SIMA will analyze the trade-off between the toxic effects of the dispersed oil in the water column relative to advantages of removing floating oil from the sea surface and preventing environmental effects on sensitive shorelines. This analysis will take into account Fish and Fish Habitat, Marine Mammals and Sea Turtles, Migratory Birds, Special Areas, Commercial Fisheries, and Current Aboriginal Use of Lands and Resources for Traditional Purposes. Short- and long-term aquatic toxicity effects, bioaccumulation through the food chain, and the duration of any toxic effects will be addressed in the NEBA/SIMA. The Royal Society of Canada's review "Behaviour and Environmental Impacts of Crude Oil Released into Aqueous Environments" (Lee *et al.* 2015), amongst other literature and research (including Deepwater Horizon work) will be used to guide examination of these topics.

The EIS focused on environmental effects of unmitigated spills (including worst-case credible discharge [WCCD]). Environmental impact considerations associated with the use of dispersants will be evaluated when determining which spill response methods will be deployed; a summary of the effects of dispersant use is provided below.

In the event of an oil spill, fish, birds, mammals, sea turtles, and shoreline habitats can be exposed from: a) physical effects of smothering and oiling from oil slicks on the sea surface; b) emission of volatile oil components into the air; and c) readily water-soluble and volatile oil components into the water column (Lee *et al.* 2015). The purpose of treating spilled oil with an approved dispersant product, such as Corexit 9500A, is to reduce the amount of oil reaching, or floating on, the water's surface; reducing health risks to surface species including seabirds, marine mammals, and sea turtles, which also need clean air to breathe; and reducing oiling of sensitive shoreline habitats (Lee et al. 2015). Application of dispersants reduces the size of oil droplets, resulting in the dilution and dispersion of these droplets into the water column by wave action/currents and hence making the oil bioavailable for microbial oil biodegradation, and increasing the rate of natural environmental processes that remove oil from the water as a direct result of volatilization, oxidation, biodegradation, hydrolysis, evaporation, and several other biological and physical mechanisms (Fingas 2011).

The U.S. Coast Guard, with support from a variety of other federal and state agencies including National Oceanic and Atmospheric Administration (NOAA), US Fish and Wildlife Service, and the Texas General Land Office, has sponsored several Ecological Risk Assessment workshops in the Gulf of Mexico and Caribbean that considered the impacts and ecosystem recovery rates from various oil spill response options at hypothetical open water spills. In each of these workshops, participants evaluated dispersant use along with other oil spill response strategies and found that dispersants were effective in protecting many nearshore and shoreline resources, and also offered some benefit to animals that utilize open ocean surface waters (such as birds and marine mammals) because of the ability of dispersants to quickly remove oil from the surface of the water. Similar conclusions are expected for subsea dispersant use since most undispersed oil will reach the sea surface over large areas making it difficult to recover and creating environmental impact scenarios consistent with or exceeding those of surface spills.

Treatments of spilled oil with dispersants can temporarily increase exposure of small subsurface marine organisms (which can't quickly swim away) to small oil droplets which remain in the water column due to natural turbulent mixing. With respect to surface application of dispersants, concentrations of dispersed oil components can potentially increase (generally within the top 10 m of the upper water column) to acutely toxic levels to sensitive life stages of small fish and invertebrates - especially their larvae and eggs (embryos). Although the intent of dispersion of the oil is to rapidly reduce the formation of oil slicks floating on the sea surface and to dilute oil concentrations in the water column, the dispersed oil can therefore sometimes reach toxic concentrations for short time periods for those very sensitive life stages of organisms that are part of the nekton (endpoint is mortality).

Corexit 9500A, the primary dispersant used during the Deepwater Horizon incident (DWH) spill response effort, meets the rigid U.S. Environmental Protection Agency (USEPA) criteria established for the U.S. National Oil and Hazardous Substances Pollution Contingency Plan (NCP) listing, as well as subsequent testing conducted by USEPA laboratories to validate test results obtained during the listing process (US EPA 1995, 2017). Environment Canada (2016) testing further confirmed low toxicity of Corexit 9500A to marine organisms and approved its use in Canada's offshore. Corexit 9500A, among other dispersant products, is composed of surfactant components similar to those used in common household products, and their toxicity to aquatic species when they are free in solution is low. Word *et al.* (2014) put dispersant toxicity in context by commissioning two independent accredited labs to conduct parallel studies that compared the acute toxicity of Corexit 9500A to common household cleaning agents. These studies revealed that the commercially available dispersant products are less toxic than crude oil or oil mixed with dispersants. The review by the Royal Society of Canada also states that dispersant products themselves do not cause synergistic toxicity, nor increase the solubility of toxic constituents of the oil but rather increase the concentration of small oil droplets to which organisms are exposed to (Lee *et al.* 2015). A paired model and mesocosm study examining *Gadus morhua* larval response to dispersant water soluble fraction (WSF) treatments versus WSF + oil droplet treatments concluded no additional toxicity effects were attributable to the oil droplet component (Nordtug *et al.* 2011).

Bioaccumulation occurs in the food web when a substance in the tissue of a food item is at a higher concentration than the concentration in the organism's surrounding environment such that the substance is persistent and accumulates from the consumer's diet faster than it is lost due to excretion or metabolism (Lee *et al.* 2015). Invertebrates do not metabolize or excrete petroleum products quickly, and as a result can contribute to the dietary exposure of predators feeding on them. However, petroleum hydrocarbons typically do not biomagnify in food webs. This is likely due to the fact that most hydrocarbons can be readily metabolized by vertebrates including fish, birds, and mammals, and bioaccumulation is not thought of as an issue for these species (Lee *et al.* 2015). Monitoring by federal and state agencies for PAHs and the dispersant components in >8,000 seafood specimens (whole fish or groups of individual small shellfish) collected in federal waters of the Gulf in response to the 2010 Deepwater Horizon oil spill concluded concentrations were below the limits of quantitation or, when detected, were at least two orders of magnitude lower than the US Food and Drug Administration human level of concern for each compound (Ylitalo *et al.* 2011). There have also been numerous studies which demonstrate that turtles can bioaccumulate persistent organic pollutants and develop dose-dependent deformities. However, evidence for similar effects due to petroleum hydrocarbons, particularly PAHs, on turtles is less evident (Lee *et al.* 2015).

Fish are typically at risk from acute oil exposure in a 24- to 48-hour period following an oil spill. As a result of this, mortality to fish – mainly early life stages (larvae, eggs if present if a spill happens during spawning season) are typically brief and localized due to the loss of the acutely toxic water-soluble low molecular weight aromatic components of oil due to dilution and weathering (Lee *et al.* 2015). The primary toxicity concern regarding dispersant use is therefore the acute (short-term) exposure of water column organisms to potentially toxic concentrations of these lower molecular weight compounds. Additional concerns include the potential sub-lethal effects from the persistent components that remain bioavailable in the different environmental matrices. But those mortalities to fish larvae or eggs wouldn't be expected to produce effects at population- or community-levels (*e.g.* population of fish stocks). The magnitude of potential effects would also depend on the habitat where local species spawn or have nurseries and the time of the year.

Although acute mortality to early life stages of fish could be extensive in the event of a well blowout directly in the area of a continuous oil release and dispersants use would likely increase the chance of fish species to come into contact with oil, any substantial impact on fish populations is not expected. When dynamic, rapidly decreasing concentrations of dispersed oil are present, short-term exposures above laboratory derived toxicity thresholds are usually limited in duration, and occur only in the upper layers of the water column for treated surface slicks. For sub-sea injection of dispersants at well control incidents, concentrations exceeding mortality thresholds are limited to areas near the dispersant injection site. This was supported by the DWH studies which showed that Macondo oils (fresh source and field-collected weathered oil), along with oil-dispersant mixtures demonstrated a range of adverse effects from acute mortality (Almeda *et al.* 2013; Echols *et al.* 2016a, b) to sub-lethal chronic effects such as cardiac toxicity (Brette *et al.* 2014; Incardona *et al.* 2014), mutagenicity (Paul *et al.* 2013), and developmental deformities (Barron 2012; Incardona *et al.* 2013; Dubansky *et al.* 2013). However, sub-lethal chronic effect studies on fish in general, have not been based on standardized procedures and often fail to demonstrate reproducibility. The use of widely accepted standardized aquatic toxicity test procedures typically used by regulatory authorities for making decisions on safety assessment provides greater assurance of data quality and the repeatability of results for complex mixtures, such as oil. At the time Lee *et al.* (2015) was prepared, no information on chronic exposures and toxicological effects based on standard aquatic toxicity test procedures existed in the literature for DWH oils and other crude oil in general. In general, such chronic toxicity information on crude oils and associated polycyclic aromatic hydrocarbons (PAHs) is limited (Lee *et al.* 2015). This Royal Society of Canada review therefore suggested that additional research is needed to determine "critical exposure periods for impacts on the reproductive biology of sexually maturing fish" and that "models of chronic toxicity must be developed from results of chronic toxicity tests and not from acute toxicity tests via application factors" (Lee *et al.* 2015). Echols *et al.* (2016b) therefore studied the chronic toxicity of source and field-collected Macondo oil(s) using standardized aquatic toxicity tests with two standard test species (mysids and inland silversides). The mysid shrimp and inland silverside were chosen because they can be tested as whole organisms (rather than cellular and subcellular responses commonly termed "biomarker" tests) and they are the most widely used marine standard and are the recommended test species under USEPA guidance for Whole-Effluent Toxicity testing (USEPA 2002). Additionally, in a recent review of available toxicity information for the calculation of species sensitivity distributions (SSDs) for petroleum products and oil dispersant exposures, it was reported that the largest toxicity database available for aquatic toxicity of PAHs exists for mysids and inland silversides (Bejarano and Barron 2014). Echols *et al.* (2016b) showed that survival and growth of mysid shrimp exposed to weathered oils did not differ from that of test controls. In contrast, survival and growth of fish declined relative to that of test controls at loading rates of 1 g/L for weathered oils. Based on the concentration of total polycyclic aromatic hydrocarbons ($TPAH_{42}$), no observed effect concentrations (NOEC) were lower for fish survival (5-8 μg/L) and growth (<2 to<8 μg/L) in chronic exposures to different weathered oils as compared with mysids (4.75–17.9 μg/L). Average TPAH concentrations in full strength WAFs followed the weathering trend, with 165 μg/L for fresh source oil, as compared to 18 to 5 μg/L for weathered oil and studied chronic toxicity test exposures represent the highest concentrations of total PAHs that were rarely observed in water column samples collected in the GOM during the release and post release periods of the DWH incident (Boehm *et al.*, 2016).

Marine mammals are susceptible to floating oil due to the fact they need to surface at regular intervals to breathe; as a result, dispersing oil may be beneficial for mammals by reducing the probability of contacting concentrated floating oil. The dispersion of oil, however, may expose swimming or feeding mammals to skin or fur contamination, the consumption of contaminated plankton, and potentially the clogging of baleen (Lee *et al.* 2015). Hydrocarbons consumed by marine mammals through contaminated diets can be metabolized and excreted, although Engelhardt (1983) hypothesized hydrocarbons might be stored in blubber and other fat deposits. These stored hydrocarbons have the potential to be released into circulation during periods of physiological stress (low prey availability, migration, or lactation). These circulating hydrocarbons may be bioavailable and toxic to the fetus or newborns (Engelhardt 1983).

Several mesocosm and open ocean field trial experiments have demonstrated that the rates of mixing and dilution in open waters that are three nautical miles or more offshore and are 10 meters in depth or greater are sufficient to minimize the potential toxic effects of oil dispersed at the surface. At these depths and distances from shore, net environmental benefit analysis/spill impact mitigation assessment demonstrates that transient aquatic toxicological impacts in the water column are much less than the risks to birds, mammals, and coastal and shoreline communities by allowing oil slicks to persist on the water surface and eventually become stranded on the shoreline (Lewis and Aurand, 1997). The net environmental benefits of subsea dispersant injection could be more pronounced since the depths and distance from shore are likely to be greater for Nova Scotia.

Laboratory studies on embryos and larvae of corals exposed to dispersed oil caused greater toxicity than to oil alone (Lee *et al.* 2015), direct contact with oil may also cause mortality and/or sublethal effects (*i.e.* reduced growth or reproduction) to adult corals (depending on the concentration and exposure duration to toxic components). However, it is not expected that dispersant application has a potential for implications to corals since dispersed oil only poses elevated exposures to organisms in the immediate area of application and not the coral habitats. Research and experience has also shown that those exposures are rapidly mitigated by the effects of dilution and microbial degradation of the dispersed oil. While corals can exist in the deep-water environment at this site, they will likely be present in sporadic aggregations or mounds at the seafloor. Past OSCAR modelling suggested that the deep-water dispersed oil will be localized to the area of the wellhead (one to several kilometres) and the vertical modelling results indicated that risks to corals are low based on the predictions of low water column concentrations in the deeper and colder waters at the sea bottom. It should be noted, however, that the use of dispersants to manage the discharge of oil from the wellhead during the Deepwater Horizon oil spill demonstrated that deep-water organisms in waters 1,300 m in depth are at risk for exposure to chemically-dispersed oil.

References:

Almeda R, Wambaugh Z, Wang Z, Hyatt C, Liu Z, Buskey EJ. 2013. Interactions between zooplankton and crude oil: toxic effects and bioaccumulation of polycyclic aromatic hydrocarbons. PLoS ONE 8: e67212.

Bejarano, A.C. and M.G. Barron. 2014. Development and practical application of petroleum and dispersant interspecies correlation models for aquatic species. Environ. Sci. Technol. 48: 4564−4572.

Barron, M.G. 2012. Ecological impacts of the Deepwater Horizon oil spill: Implications for immunotoxicity. Toxicol Pathol 40: 315-320

Boehm P.D., Murray K.J., Cook, L.L. 2016. Distribution and attenuation of polycyclic aromatic hydrocarbons in Gulf of Mexico seawater from the Deepwater Horizon Oil Accident. Env. Sci. Tech. 50:584–592.

Brette F., Machado B., Cros C., Incardona J.P., Scholz N.L., Block B.A.. 2014. Crude oil impairs cardiac: excitation-contraction coupling in fish. Science 343: 772–776.

Dubansky B, Whitehead A, Miller J, Rice CD, Galvez F. 2013. Multitissue molecular, genomic, and developmental effects of the Deepwater Horizon oil spill on resident Gulf killifish (*Fundulus grandis*). Environ. Sci. Technol. 47: 5074–5082.

Echols B.S., Smith A., Gardinali P., Rand G. 2016a. An evaluation of select test variables potentially affecting acute oil toxicity. Arch Env Contam Tox 70: 392–405.

Echols, B.S., A.J. Smith, P.R. Gardinali, G.M. Rand. 2016b Chronic Toxicity of Unweathered and Weathered Macondo Oils to Mysid Shrimp (*Americamysis bahia*) and Inland Silversides (*Menidia beryllina*). Arch Environ Contam Toxicol (DOI 10.1007/s00244-016-0280-x).

Engelhardt, R.F. 1983. Petroleum effects on marine mammals. Aquatic Toxicology 4: 199-217.

Environment Canada. 2016. Regulations Establishing a List of Spill-treating Agents (Canada Oil and Gas Operations Act). http://www.gazette.gc.ca/rp-pr/p2/2016/2016-06-15/html/sor-dors108-eng.php#footnoteRef.53232. Accessed 20 Mar 2017.

Fingas, M. 2011. Oil spill science and technology: prevention, response, and cleanup (Gulf Professional Publishing, Burlington MA, 2011), 1192 pp.

Incardona J.P., Swarts T.L., Edmunds R.C., Linbo T.L., Aquilina-Beck A., Sloan C.A., Scholz N.L. 2013. Exxon Valdez to Deepwater Horizon: comparable toxicity of both crude oils to fish early life stages. Aqua Toxicol 142: 303–316.

Incardona, J. P., Gardner, L. D., Linbo, T. L., Brown, T. L., Esbaugh, A. J., Mager, E. M., Stieglitz, J. D., French, B. L., Labenia, J. S., Laetz, C. A., Tagal, M., Sloan, C. A., Elizur, A., Benetti, D. D., Grosell, M., Block, B. A., Scholz, N. L. 2014. Deepwater Horizon crude oil impacts the developing hearts of large predatory pelagic fish. Proc. Natl. Acad. Sci. U. S. A., No. 10.1073/pnas.1320950111

Lee, K., Boufadel, M., Chen, B., Foght, J., Hodson, P., Swanson, S., Venosa, A. 2015. Expert Panel Report on the Behavior and Environmental Impacts of Crude Oil Released into Aqueous Environments. Royal Society of Canada, Ottawa, ON.

Lewis, A. and D. Aurand. 1997. Overview and Background. International Oil Spill Conference Proceedings: January 1997, Vol. 1997, No. TR4, pp. 13-25.

Nordtug, T., Olsen, A.J., Altin, D., Overrein, I., Storoy, W., Hansen, B.H., De Laender, F. 2011. Oil droplets do not affect assimilation and survival probability of first feeding larvae of North-East Arctic cod. Sci. Total Environ. 412: 148–153.

Paul, J. H., Hollander, D., Coble, P., Daly, K. L., Murasko, S., English, D., Basson, J., Delaney, J., McDaniel, L., Kovach, C. W. 2013. Toxicity and mutagenicity of Gulf of Mexico waters during and after the Deepwater Horizon oil spill. Environmental Science and Technology 47: 9651-9659

US EPA (United States Environmental Protection Agency). 1995. COREXIT® EC9500A Technical Product Bulletin #D-4 USEPA, OEM Regulations Implementation Division Original Listing Date: April 13, 1994. Revised Listing Date: December 18, 1995. Available from: https://www.epa.gov/emergency-response/corexitr-ec9500a

US EPA (United States Environmental Protection Agency). 2002. Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms Fifth Edition EPA-821-R-02-012. Washington, DC: US Environmental Protection Agency.

US EPA (United States Environmental Protection Agency). 2017. National Contingency Plan (NCP) Product Schedule (Products Available for Use on Oil Spills). Available from: https://www.epa.gov/emergency-response/ncp-product-schedule-products-available-use-oil-spills

Word, J. Q., Clark, J. R., Word, L. S. 2014. Comparison of the acute toxicity of Corexit 9500 and household cleaning products. Hum. Ecol. Risk Assess 21: 707−725.

Ylitalo, G. M., Krahn, M. M., Dickhoff, W. W., Stein, J. E., Walker, C. C., Lassitter, C. L., Garrett, E. S., Desfosse, L. L., Mitchell, K. M., Noble, B. T., Wilson, S., Beck, N. B., Benner, R. A., Koufopoulos, P. N., and Dickey, R. W. (2012). Federal seafood safety response to the Deepwater Horizon oil spill. Proceedings of the National Academy of Sciences 109(50): 20274-20279

Information Request (IR) IR-074

Applicable CEAA 2012 effect(s): All

EIS Guidelines Reference: Part 2, 6.6.1 Effects of potential accidents or malfunctions

EIS Reference: 8.0 Accidental Events

Context and Rationale: The EIS Guidelines (6.6.1) require the assessment of potential worst-case oil spill scenarios, including when species at risk and high concentrations of fish are present, including a discussion on water depth and its effect on blow-out rate and spill trajectory modelling assumptions. The EIS Guidelines indicate that where well locations have not yet been identified, points of origin selected for spill trajectory models should be conservative (*e.g.*, selecting a potential location within the proposed drilling area that is closest to a sensitive feature or that could result in greatest effects).

The EIS (section 8.4.3) describes how two tentative locations for potential well blowout modelling scenarios were selected based on preliminary seismic data processing and interpretation; both locations represent viable drilling prospects. They are located in different water depths (2104 metres and 2652 metres) and at varying distances from sensitive receptors (105 kilometres and 170 kilometres from Sable Island). However, it is not clear that the modelling using these two locations adequately describes the possible range of effects from a well blowout from drilling anywhere in the ELs. The EIS describes the water depths in the ELs as ranging from 100 - 3000+ metres (section 2.2), the closest distance to Sable Island is 48 kilometres (section 5.2.10), and 153 hectares of one of the ELs overlaps with the Haddock Box (Table 5.2.20).

Specific Question or Request: Explain whether the modelling locations included in the EIS are considered conservative with respect to the potential for associated environmental effects, as required by the EIS Guidelines. Describe whether the potential effects of spills on VCs could vary from predications in the EIS through consideration of other sites where drilling could occur, including: the most shallow and deepest parts of the ELs, areas immediately adjacent to the Haddock box; and the closest location to Sable Island. Provide a rationale to support to effects assessment and determinations of significance included in the EIS, or update the effects assessment accordingly.

Response: As stated in the Environmental Impact Statement (EIS), well locations are not yet known. For modelling purposes, a number of potential prospects were selected on the basis of preliminary seismic data processing and interpretation. The well locations represent viable drilling prospects and are located at different water depths and proximity to sensitive receptors to satisfy the EIS Guidelines.

In Section 6.6.1 of the EIS Guidelines, it is stated that "Where well locations have not yet been identified, points of origin selected for spill trajectory models should be conservative (*e.g.*, selecting a potential location within the proposed drilling area that is closest to a sensitive feature or that could result in greatest effects)." Furthermore, in the same section of the guidelines it is requested that "A discussion on water depth and its effect on blow-out rate and spill trajectory modelling assumptions must be provided."

The potential well locations that were identified included the shallowest and deepest locations in the prospect area closest to Sable Island (Site 1 and Site 3 respectively), and Site 2 represents the most likely first well location.

The spill trajectory modelling carried out for the project considers how oil moves through the water column and on the surface following a release of hydrocarbon. It was identified that potential effects could therefore be realized on the shorelines closest to the Project Area, as well as through the water column. The most sensitive receptor, and closest shoreline to the exploration licences (ELs) that was identified is Sable Island. BP therefore carried out spill trajectory modelling at two locations to assess the potential effects on Sable Island and other identified sensitivities in and around the ELs. Site 2 was used in order to best represent any potential effects from the most likely well location. In keeping with the EIS guidelines, the well location closest to Sable Island (Site 1) was also selected as a conservative point of origin. Site 1 and Site 2 are in different water depths and therefore it was possible to demonstrate the potential effects of water depth on the spill trajectory modelling.

The EIS assessed worst credible case spill scenarios assuming an unmitigated spill and interaction with sensitive receptors and special areas including the Haddock Box and Sable Island. Given the relative proximity of these special areas to the Project Area (0 km for Haddock Box and 48 km for Sable Island) and the conservatism of the effects assessment no changes would be expected in terms of effects prediction, mitigation or significance determination as a result of changing modelling locations within the Project Area.

Information Request (IR) IR-075 (ECCC-IR-20)

Applicable CEAA 2012 effect(s): 5(1)(a)(i) Fish and Fish Habitat; 5(1)(a)(ii) Aquatic Species; 5(1)(a)(iii) Migratory Birds; 5(1)(b) Federal Lands or Transboundary

EIS Guidelines Reference: Part 2, 3.2 Project activities; 6.1.1 Atmospheric environment and climate; 6.6.2 Effects of the environment on the Project

EIS Reference: 8.0 Accidental Events; 8.1.3.4 Loss of Well Control during Well Construction and Well Testing

Context and Rationale: Section 8.1.3.4 of the EIS states: "the crew on the rig will be supported with an additional level of monitoring for well control situations from BP's monitoring center in Houston."

The EIS also indicates that: "agreed shut in procedures define what the rig crew must do in the event of a "kick" (*i.e.*, a sudden influx of formation fluids in the wellbore)." However, no standard operating procedures or incident threshold triggers have been provided to define or govern shut in escalation procedures.

ECCC has advised that it is unclear whether or not the monitoring team in Houston would have the ability to take operational control and/or over-ride drill rig control in the event a catastrophic incident is encountered on the rig.

Specific Question or Request: Advise whether the monitoring team in Houston would have the ability to control drilling and testing operations remotely. Explain whether set standard operating procedures or incident threshold triggers exist for the "agreed shut in procedures" or whether these procedures are decided by drilling crews based on their well control training certification.

Response: Sections 8.1.2, 8.1.3.4 and 8.2.3 of the Environmental Impact Statement (EIS) provide information about the remote monitoring centre in Houston which will be used to support the crew on the mobile offshore drilling unit (MODU) drilling activities in the Scotian Basin.

The role of the monitoring team in Houston will be to provide assistance to the crews by monitoring well pressures. The monitoring centre will maintain close communication with nominated representatives on the MODU throughout the drilling program. The monitoring team in Houston will not have the ability to take operational control in the event of an incident. Operational control will always be maintained on the MODU. As explained in Section 8.1.3.4, the drilling crew will follow agreed shut in procedures, such as a well control contingency plan during a loss of well control event. If required the monitoring team in Houston will continue to provide information to crews on the MODU during a loss of well control incident.

As explained in Section 8.1.3.4 of the EIS, a number of barriers will be used during the drilling program to minimize the likelihood of a loss of well control incident from arising and also to minimize the likelihood of potential consequences of a loss of well control event arising.

Information Request (IR) IR-076 (DFO-25)

Applicable CEAA 2012 effect(s): 5(1)(a)(i) Fish and Fish Habitat; 5(1)(a)(ii) Aquatic Species

EIS Guidelines Reference: Part 2, 6.6.1 Effects of potential accidents or malfunctions

EIS Reference: 8.4.8 Deterministic Modelling Results, p.8.78; Figure 8.4.16

Context and Rationale: In Figure 8.4.16, the mass balance resulting from an unmitigated blowout shows that a portion of the oil is expected to be contained in the sediments. However, the explanation of the mass balance on p. 8.75 does not provide information on these sediment impacts.

Specific Question or Request: Discuss whether nearshore or offshore sediments would be impacted in the case of an unmitigated blowout, the processes that would transfer oil from the surface and water column to sediments, and oil-sediment interactions as well as flocculation and oiled marine snow.

Response: As seen in Section 8, Figure 8.4.16 is a mass balance figure which shows the expected fates of oil from a deterministic run of a 24,890 bpd 30-day continuous blowout incident. It shows evaporated oil, surface oiling (over 0.04 µm threshold), oil naturally dispersed in the water column (over 58 ppb threshold), biodegraded oil and oil that has been entrained in sediment, and stranded oil on the shoreline.

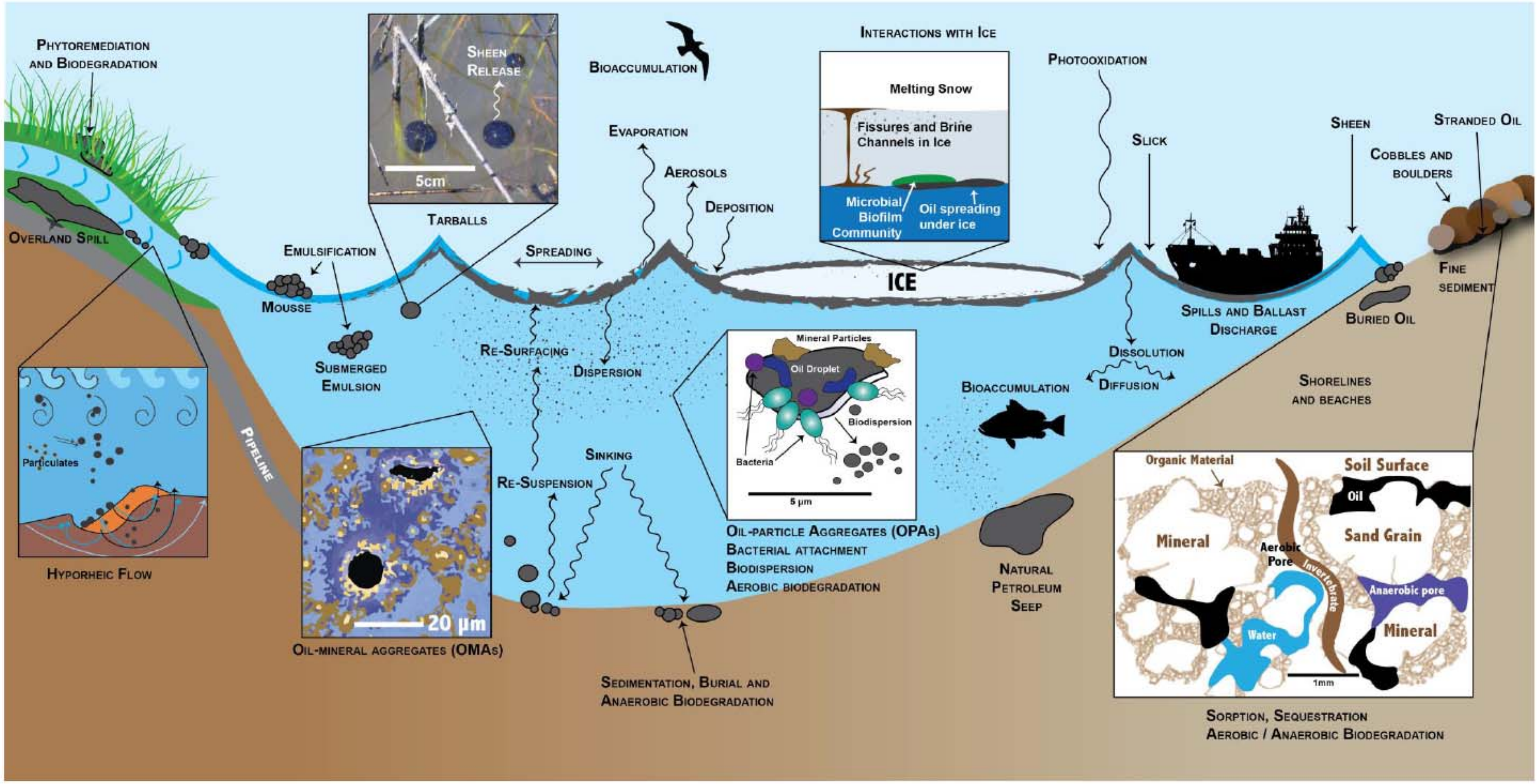
The mass balance shows that some oil becomes entrained in the sediment. This is calculated in the model once an oil droplet passes into a cell identified as a sediment cell. Sediment cells are generated in the model using the bathymetry data and so it is only considered to occur once oil falls onto the seafloor. Sedimentation may occur both in the nearshore and offshore environments; however, it is likely to be largely concentrated in the near-shore as water depths become shallower. It can be seen in Figure 8.4.16 that sedimentation first occurs at the same time as shoreline stranding. Shoreline stranding for the deterministic run is largely limited to Sable Island, as shown in Figure 8.4.17. Sable Island is a sandbank and is surrounded by shallow waters and so it is considered likely that sedimentation may occur around Sable Island. Some sedimentation may also occur in the offshore environment.

Very few oils naturally sink in the marine environment as oil is less dense than water. However, as explained above, when oil approaches shorelines, sedimentation may occur. When oil on the water surface or in the water column comes into contact with sediment suspended in the water column, the oil and sediment may bind together which in turn increases the density of the oil droplet, thereby causing it to sink. Sediment binding is particularly common in shallow waters where the concentration of suspended sediment through the water column is generally higher than in offshore environments. Sedimentation can also occur as oil naturally weathers. As weathering occurs, the lighter compounds in the oil evaporate and the oil density increases making it less buoyant and more likely to sink if it becomes attached to more dense sediment or organic particles. The weathering process and how oil can interact with different sediment types is described below.

Interactions of both biological and non-biological processes lead to different fates of oil spilled into the aquatic environment. These different fates can be viewed in Figure 1 below. Weathering processes occur at different rates, with different onset times, resulting in progressive changes in oil composition and behaviour after a spill. In general, the weathering process involves spreading and mixing, evaporation, dissolution, dispersion, emulsification, photo oxidation, biodegradation, and sedimentation (Lee *et al.* 2015).

The first process to occur after a blowout will be the spreading of oil on the waters surface. Oil accumulated at the water surface can be spread by wind, currents, and tides, which are the three main forces acting to spread a spill (Lee *et al.* 2015). Environmentally, evaporation is the most important weathering process during the early stages of an oil spill. Evaporation is responsible for the removal of a large fraction of the oil including the more acutely toxic, lower molecular weight components. The major factors influencing the rate of evaporation include the composition and physical properties of the oil, wave action, wind velocity, and water temperature. Evaporation leaves behind the heavier components of the oil, which may sink to the ocean floor and eventually end up in sediment.

The competing force against evaporation is dissolution, under which petroleum products are diluted into the water column from the underside of the slick (Lee *et al.* 2015). Both evaporation and dissolution reduce the potential acute toxicity of the residual oil, while potentially increasing the chronic toxicity by increasing the concentration of alkyl PAHs in the remaining oil. The relative importance of dissolution increases in deep sea spills such as a blowout, where the long travel time for oil droplets to travel through the water column increases the opportunity for small molecules to dissolve rather than evaporate after reaching the sea surface (Lee *et al.* 2015).



Source: Lee *et al.* 2015.

Figure 1 Overview of Processes affecting the fate and behaviour of oil spilled in freshwater and marine environments

The natural dispersion of oil in the water column occurs when the mechanical action and turbulence of waves detaches oil droplets from the slick and forces them into the water column. Furthermore, turbulent flow through subsea blowouts also has the potential to create dispersion of oil into the water column. Depending on the droplet size, depth, and energy of the forcing, the oil may remain dispersed or may resurface. Emulsification can follow dispersion when the incorporation of small droplets of oil into the water column leads to an emulsification of the two liquids (Lee *et al.* 2015). Emulsifications are usually very viscous and more persistent than the original oil, forming a mousse. This oil entrained in the mousse resists dispersion with chemicals and biodegradation. Emulsions typically move from floating on the surface to being submerged in the water column, making physical recovery efforts more difficult. Emulsions may eventually separate back into oil and water through natural processes including weathering, oxidation, and/or freeze-thaw action.

There are multiple processes which have the potential to alter oil density to influence submergence, sinking, and sedimentation, which include: increased density due to evaporation and/or dissolution, emulsification, and interactions with particles in the water column (Lee *et al.* 2015). In addition to evaporation, other environmental processes such as photooxidation can affect oil buoyancy. As water temperature decreases with water depth, oil density increases, potentially causing it to remain submerged or sink. The interaction of oil with non-oil particulates changes the properties of the aggregates, causing normally buoyant oil to sink. Oil-Mineral Aggregates (OMAs) can form when oil interacts with inorganic materials, such as clay (Lee *et al.* 2015). Oil-particle aggregates (OPAs) collectively encompass OMAs as well as oil associated with organic materials, such as detritus and microbial cells. OPAs can have neutral buoyancy, or may sink and become entrained in the sediments. If they become entrained in sediments, they could potentially become entrained in anaerobic conditions where biodegradation is slower.

An example of OPAs forming after a blowout occurred after the Deepwater Horizon (DWH) spill. The DWH spill may have stimulated the production of marine snow in the region following the event (Ozhan *et al.* 2014). Studies were conducted to determine the possible causes for the large marine snow formation event observed in contaminated surface waters in the Gulf of Mexico after the oil spill. Experimental results indicated that the marine snow was formed by mucus produced by oil-degrading bacteria coupled with the coagulation of oil compounds and suspended particulate matter, as well as phytoplankton and oil droplets (Ozhan *et al.* 2014). The increased marine snow production could enhance the benthic flux of oil and particulate organic matter to the benthic region, possibly influencing the degradation process of oil and leading to benthic hypoxia.

In the event that oil interacts with sediment, it can have differing fates depending on the substrate type or environment in which it is situated. In the event that oil sinks to the benthic zone, and is buried by additional sediment, the oil may be protected from remobilization, with biodegradation rates being limited if oxygen or nutrients cannot be replenished (Lee *et al.* 2015). This is typical for mudflats and the deep ocean, where oil buried in sediments may remain virtually unchanged for long periods. Oil that remains on the surface or submerged in the water column has the potential to reach the shoreline and adhere to sand, cobble, bedrock, as well as man made structures like piers and jetties. Light oils have the potential to penetrate into beach sediments due to low viscosity, where it will have reduced exposure to weathering. Viscous heavy oils and/or heavily weathered oils are less likely to penetrate deep into the intertidal sediments, but have the potential to be forced to depth due to wave action on high-energy beaches (Lee *et al.* 2015). Weathered oil that is thrown above the tidal zone will continue to physically and chemically weather and can form an asphalt like substance.

The behaviour of oil on sand and gravel shorelines depends on the properties of the shoreline, including the porosity of the substrate, the morphology of the shoreline, and the energy of the waves impacting the shoreline (Lee *et al.* 2015). The interaction of oil with fine particles on the shoreline creates OMAs which are easily dispersed by tidal action and currents. These OMAs enhance the availability of oil for biodegradation.

Higher wave impacted areas enhance the physical removal and weathering process of spilled oil. Wave impacted rocky shores recovery from oil within months, whereas areas such as marshes can act as a petroleum sink for many years (Lee *et al.* 2015). On coarse-grained shorelines including cobble and sandy beaches, oil can penetrate deeper and remain longer due to the fact that it is trapped below the limit of wave action. Fine grained areas such as silt and clay, prevent the oil from penetrating as deep. Conversely, oil is more easily removed from coarse-grained sediments via the flushing of water.

Estuarine shorelines are complex, and as a result, the disposition and weathering of spilled oil in this type of environment would be site-specific and difficult to predict (Lee *et al.* 2015).

As indicated in Section 8 of the EIS, fish that spawn or occur in nearshore intertidal and subtidal zones and in shallow reef zones are at higher risk of exposure where there is shoreline oiling or contamination of sediments, thereby potentially increasing the risk for chronic exposure (Yender *et al.* 2002; Lee *et al.* 2015). Benthic invertebrates have a moderate to high risk of exposure, depending on their mobility and use of contaminated sediments (Yender *et al.* 2002; Lee *et al.* 2015). The duration of these effects will be based upon a number of factors including the state of the oil impacting the sediment (*i.e.*, how weathered is it) and the type of substrate impacted.

As indicated on Figures 8.4.11 to 8.4.14, there are several coastline areas that could potentially be exposed to shoreline oiling above the 1.0 g/m^2 threshold. For both Site 1 and Site 2 (both winter and summer seasons), Sable Island could be expected to result in heavy oiling (>10 mm thickness of emulsified oil on the shoreline). Stochastic modelling results for Site 2 (summer season) show more extensive shoreline oiling ranging from a stain/film (0.1 to 0.001 mm) to heavy oiling (>10 mm) in some locations along the coastline of mainland Nova Scotia . As indicated in Section 5.2.8.3, there are several seabird colonies and IBAs along the coast (including small coastal islands) which potentially could be affected by a well blowout incident. The average minimum timeframe required for oil to potentially reach these areas at a threshold of 1 µm (minimum approximately 30 days for mainland Nova Scotia) would allow for response measures and containment equipment to be placed in advance to avoid or mitigate adverse effects. Response measures could result in disruption of nesting birds and reproductive failure. The average minimum arrival time for shoreline emulsion mass exceeding 1 μm at Sable Island would be 5 days (Site 1, summer), which would reduce the opportunity for implementation of response measures to avoid or mitigate adverse effects on birds nesting there.

A threshold of 100 μm is used as an exposure index for mortality of shorebirds on the shore, therefore this would provide additional response time to intervene prior to shoreline emulsion reaching levels predicted to result in shorebird mortality.

References:

Lee, K., Boufadel, M., Chen, B., Foght, J., Hodson, P., Swanson, S., Venosa, A. 2015. Expert Panel Report on the Behavior and Environmental Impacts of Crude Oil Released into Aqueous Environments. Royal Society of Canada, Ottawa, ON.

Ozhan, K., M.L., Parsons, and S., Bargu. 2014. How Were Phytoplankton Affected by the Deepwater Horizon Oil Spill. BioScience 64:9.

Yender, R.J., Michel, J., and Lord, C. 2002. Managing Seafood Safety after an Oil Spill. Seattle Hazardous Materials Response Division, Office of Response and Restoration, National Oceanic and Atmospheric Administration. 72 pp.

Information Request (IR) IR-077 (ECCC-IR-15)

Applicable CEAA 2012 effect(s): section 5 generally

EIS Guidelines Reference: Part 2, 3.2 Project activities; 6.1.1 Atmospheric environment and climate;

6.6.2 Effects of the environment on the Project

EIS Reference: 5.1.2.3 Wind Climate

Context and Rationale: The EIS states "This wave hindcast includes the effects of shallow water physics, sea ice information, large-scale weather patterns, as well as storm track information, and predicts hourly wind and wave conditions at 0.1 degree grid points for the entire northwest Atlantic."

ECCC advised the Agency that the MSC50 grid has a 0.1 degree resolution covering the Maritimes (including the proposed project area) as well as waters offshore of Newfoundland. This limited 0.1 grid, however, is nested inside a coarser 0.5 degree grid that covers the remaining Northwest Atlantic basin (http://oceanweather.net/MSC50WaveAtlas/).

Specific Question or Request: In light of the comments from ECCC above, describe if there are any change to the assessment of environmental effects.

Response: The MSC50 wind and wave hindcast data Grid Point 3551 used for the Environmental Impact Statement (EIS) is located within the Project Area. Comparison of the MSC50 data with the data collected by DFO and Environment Canada from four nearby buoys and data collected by five nearby drilling rigs and exploration wells indicate that the MSC50 grid point selected for the wind and wave data are representative of the Project Area.

Based on the above analysis, the MSC50 data used for the assessment of environmental effects represents the wind and wave conditions in the Project Area. Therefore, no changes are anticipated to the assessment of environmental effects.

Information Request (IR) IR-078 (ECCC-IR-16 and ECCC-IR-17)

Applicable CEAA 2012 effect(s): section 5 generally

EIS Guidelines Reference: Part 2, 3.2 Project activities; 6.1.1 Atmospheric environment and climate;

6.6.2 Effects of the environment on the Project

EIS Reference: 9.1.2 Extreme Weather Conditions

Context and Rationale: Section 9.1.2 of the EIS includes a description of the annual average wind speed range for the project area, "Average wind speeds on the Scotian Shelf range from 4.9 metres per second to 8.8 metres per second (17.5 kilometres to 31.5 kilometres per hour) in September and January, respectively." The proponent references the *Strategic Environmental Assessment for the Eastern Half of Scotian Slope and Laurentian Fan* for the values; however, the proposed project study area is located west of the SEA study area. Based on the wind statistics provided in section 5 of the EIS (Tables 5.1.4, 5.1.5 and 5.1.6) the upper range of the mean wind speed of 8.8 metres per second for January appears to be understated. For example, the 10-minute average wind speed is 11.3 metres per second at the MSC50 grid point 3551 and 9.6 metres per second for the East Scotian Slope buoy (C44137) for January.

The EIS describes the average daily forecast winds used for the 2006-2010 period for the NS-1 and NS-2 well locations combined. The following description is given for the maximum daily wind speeds, "However, maximum wind speeds were much higher, with a maximum daily average wind speed of 19.5 metres per second (38 knots) in the summer and 25.5 metres per second (57 knots) in the winter".

These values are too high to represent a daily average maximum wind speed. The values presented are more representative of a monthly maximum wind speed similar to those shown in Figure 5.1.6 for the MSC50 grid point and nearby moored buoys.

Specific Question or Request: In light of the comments from ECCC above, explain how the annual range of average wind speeds and upper range of the mean wind speed were determined. Revise the calculations for the average daily maximum winds for Summer and Winter and clarify what these winds represent. Describe any change to the assessment of effects arising from the ECCC comments.

Response: The source of the wind data for the referenced report is from the Environment Canada Climate Normals for Sable Island. The climate normal data are average values for the period 1971 to 2010. The wind speed 4.9 m/s (17.5 km/h) is for the month of August not for the month of January as indicated in the Environmental Impact Statement (EIS). Environment Canada wind data for Sable Island is hourly average data. The MSC50 hourly average wind data range from 6.1 m/s for August to 11.0 m/s for January and are comparable with the Sable Island wind speed. The difference is due to the length and period of data averaging (MSC50: 1954 – 2013; and EC Sable Island: 1971-2000).

The description given to the maximum daily wind speeds should be revised as follows:

"However, maximum wind speeds were much higher, with a maximum hourly average wind speed of 19.5 metres per second (38 knots) in the summer and 25.4 metres per second (57 knots) in the winter".

The above statement was quoted in the Oil Spill Trajectory Modelling Report (Appendix H). The Oil Spill Trajectory Modelling used the wind data from the National Centers for Environmental Prediction (NCEP) Climate Forecast System Reanalysis (CFSR). In the Oil Spill Trajectory Modelling Report, the summer period is defined as May to October and the winter period is defined as November to April. Table 1 below compares average wind speed and maximum hourly average wind speed for MSC50 and CFSR data for summer and winter periods. Average wind speed was calculated by averaging all hourly wind speeds over a period (*i.e.*, summer and winter). Maximum hourly average wind speed was calculated as follows:

- Select maximum hourly wind speed for each month over the period of records; and
- Average the selected maximum hourly wind speed for summer and winter months.

Table 1 Average Wind Speed and maximum hourly average wind speed for MSC50 and CFSR

Period	Average Wind Speed (m/s)		Maximum Hourly Average Wind Speed (m/s)	
	MSC50[1]	CFSR[2]	MSC50	CFSR
Summer	6.8	7.3	25.7	19.5
Winter	10.2	9.9	27.4	25.4
[1] Period of data: 1954 to 2013; [2] Period of record: 2006 to 2010				

MSC50 and CFSR data compare very well, except for the maximum hourly average wind speed for summer.

Based on the above analysis and relatively small differences, there is no change to the assessment of environmental effects.

Information Request (IR) IR-079 (ECCC-IR-18)

Applicable CEAA 2012 effect(s): 19(1)(h) section 5 generally

EIS Guidelines Reference: Part 2, 3.2 Project activities; 6.1.1 Atmospheric environment and climate;

6.6.2 Effects of the environment on the Project

EIS Reference: Appendix 2

Context and Rationale: Figure A2.7 is a time series of maximum and daily average wave heights for Sites 1 and 2 during the period 2006-10 as calculated by OSCAR. The maximum daily wave height values as plotted do not reflect the wave conditions that occurred during this time period. When comparing the values of wave height in Figure A2.7 against the MSC50 hindcast and the ECCC moored buoy data (C44137), for the same time period, there were a considerable number of high wave events not captured by the plot. For example, the MSC50 data for grid point 3551 has roughly 1300 hourly values where the significant wave heights ranged between 6 to 12 metres and at the East Scotian Slope buoy (C44137) about 940 hourly observations were recorded of significant wave heights ranging between 6 to 14 metres. In Figure A2.7, there are no daily wave heights exceeding 4.5 metres during the same five- year period.

Specific Question or Request: Explain why Figure A2.7 shows no maximum significant wave heights exceeding 5 metres for the period 2006-2010 when both MSC50 and buoy observations within or near the project area show a large number of hourly significant wave heights exceeding 6 metres during the same time period. Describe any change to the assessment of effects arising from the ECCC comments.

Response: Wave dynamics are computed through the Oil Spill Contingency and Response (OSCAR) model as a function of wind and ocean characteristics. Within OSCAR, Equations 2 and 3 (illustrated below) are used to compute wave height (H) and period (T) as functions of wind speed (U), water depth (d), fetch (F), and gravitational acceleration (g). These equations are taken from the U.S. Army Corps of Engineers Shore Protection Manual (1984).

$$\frac{gH}{U_A^2} = 0.283 \tanh\left[0.530\left(\frac{gd}{U_A^2}\right)^{3/4}\right]\tanh\left\{\frac{0.00565\left(\frac{gF}{U_A^2}\right)^{1/2}}{\tanh\left[0.530\left(\frac{gd}{U_A^2}\right)^{3/4}\right]}\right\} \qquad 2$$

$$\frac{gT}{U_A} = 7.54 \tanh\left[0.833\left(\frac{gd}{U_A^2}\right)^{3/8}\right]\tanh\left\{\frac{0.0379\left(\frac{gF}{U_A^2}\right)^{1/3}}{\tanh\left[0.833\left(\frac{gd}{U_A^2}\right)^{3/8}\right]}\right\} \qquad 3$$

Hindcast wind data (in BP's simulations derived from National Centre for Atmospheric Research (NCAR) / National Centre for Environmental Protection (NCEP) Climate Forecast System Reanalysis (CFSR)) and local water depth and fetch are computed internally in the model from the grid data. At an open grid boundary, a fetch of 100 km (*i.e.*, virtually non-limiting) is assumed.

Wave height and period are computed at 6-hourly intervals and stored on a rectangular grid matching that used to define land and water. On startup, a set of four fetch grids is computed and stored, one grid for each major compass point. (A direction variance of ± 45° is used to select the appropriate fetch grid). At each change in the wind speed or direction, a new pair of wave height and period grids is calculated. This procedure allows for variations in wave height due to changes in fetch, such that "shadows" downwind of islands are achieved. However, the approach does not include wave shoaling, diffraction, reflection, or wave-current interactions, which may explain the differences mentioned between modelled and observed ECCC moored buoy wave height data.

The wave dynamics in the OSCAR model may have been underestimated relative to the ECCC moored buoys data and therefore the modelled output can be considered conservative. Waves and turbulence at the sea surface can cause some or all of a slick to break up into fragments and droplets of varying sizes. Natural dispersion occurs more rapidly when sea conditions are rough. It is therefore expected that the oil spill modelling shown in the EIS can be considered as conservative with respect to physical dispersion and mixing effects (*i.e.*, the modelled output will show surface oiling extending further from the point of release, and more shoreline oiling than might be expected if sea conditions were rougher because of increased wave dynamics.

References:

U.S. Army Corps of Engineers.1984. Shore Protection Manual. Coastal Engineering Research Center, Vicksburg, Missippi. 2 vols.

Information Request (IR) IR-080 (ECCC-IR-24)

Applicable CEAA 2012 effect(s): 5(1)(a)(i) Fish and Fish Habitat; 5(1)(a)(ii) Aquatic Species; 5(1)(a)(iii) Migratory Birds; 5(1)(b) Federal Lands or Transboundary

EIS Guidelines Reference: Part 2, 6.1.2 Marine environment

EIS Reference: 9.0 Effects of the Environment on the Project; 9.1.5 Seismic Events and Tsunamis

Context and Rationale: The EIS Guideline state: "The EIS will take into account how local conditions and natural hazards, such as severe and/or extreme weather conditions and external events could adversely affect the Project and how this in turn could result in impacts to the environment (*e.g.* extreme environmental conditions result in malfunctions and accidental events). These events will be considered in different probability patterns (*i.e.* 5-year event vs. 100-year event)."

A threshold magnitude for a damaging *vs*. non-damaging seismic event has not been provided, nor have probability patterns been provided for damaging seismic events and tsunamis.

Specific Question or Request: Provide a threshold magnitude for a damaging seismic event, including the associated probability pattern.

Discuss potential impacts that 'damaging' seismic activity could have on both actively drilled wells and on the integrity of abandoned wells that have been plugged or otherwise suspended.

Response: ISO 19901-2 (ISO 2004) requires structures located in seismically active areas to be designed for the ultimate limit state (ULS). The ULS requirements are intended to provide a structure which is adequately sized for strength and stiffness such that no significant structural damage occurs for a level of earthquake ground motion with an adequately low likelihood of being exceeded during the design service life of the structure. The seismic ULS design event is the extreme level earthquake (ELE). The structure shall be designed such that an ELE event will cause little or no damage. Shutdown of production operations is tolerable and the structure should be inspected subsequent to an ELE occurrence. ELE return period depends on the exposure level and the expected intensity of seismic events, and the type of structure.

Potential impact of an earthquake loading is considered both during drilling phase (short-term) and after plugging and abandonment (long-term). For both situations, an ELE event corresponding to L2 Exposure Level and a target annual probability, P_f, of equal to 1 xE-3 (1/1,000) is viewed appropriate for the top-tensioned riser system and the floating rig presently considered for delivery of BP well(s) offshore Nova Scotia. ISO 19901-2 (ISO 2004) provides two alternative procedures for seismic design of structures: a simplified method and a detailed method. The former involves spectral acceleration (S_a) analysis for earthquake force demand. Based on the seismic maps (ISO 2004), offshore Nova Scotia is classified as seismic Zone 1 with $S_{a,map}$ (1.0 s oscillator period) of ranging between 0.03g and 0.10 g. Based on the geophysical data collected over the blocks, the upper 30 m of seabed at the wellsites considered can be classed as either D (soft to firm soil) or E (stiff to very stiff soil) –

Table 5 (ISO 2004). The spectral accelerations derived based on ISO 19901-2 (ISO 2004) procedures for the Project Area (Exploration Licences) are presented in the following figure.

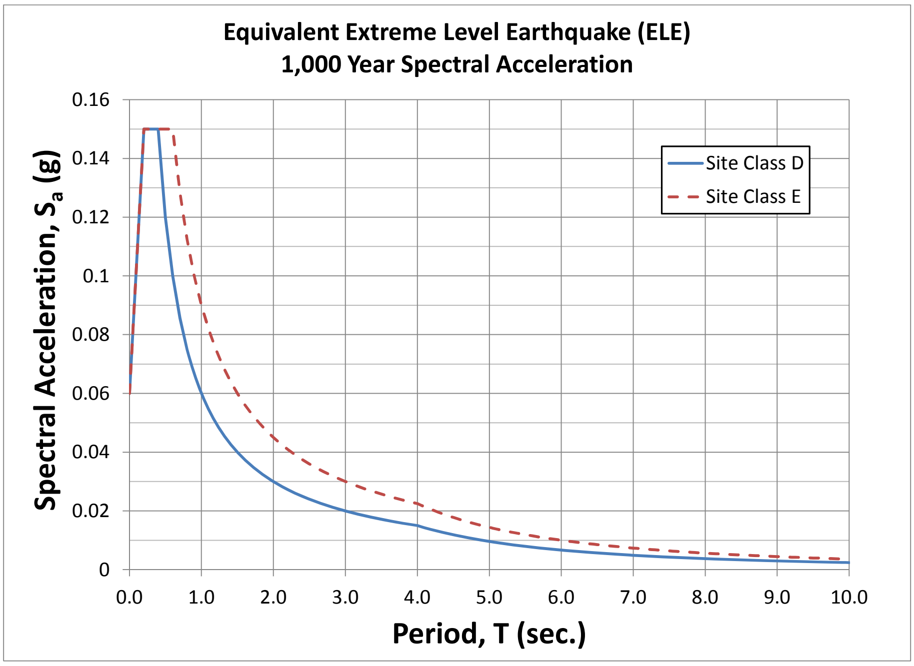


Figure 1 **Spectral Acceleration for the Project Area**

BP is presently considering drilling the wells using a 6th generation semi-submersible rig with 5 rams blowout preventer (BOP) stack. The natural period for such a BOP stack (riser-well system) typically ranges between 4.5 and 7 seconds depending on the seabed stiffness. The spectral accelerations corresponding to this range of natural periods is below 0.02 g (see Figure 1). Such level of ELE loading produces stresses and deformations that are within the allowable design limits of the well system (*i.e.*, elastic range) and therefore the riser-well system is expected to perform satisfactorily during drilling operation should an ELE event occur. This is supported by a study carried out by Brown *et al.* (2003) who assessed risks arising from Zone 1 and Zone 2 earthquake design loads on subsea structures (including well systems) as a conservative upper bound for subsea structures installed in the Gulf of Mexico. They conducted both simplified and detailed earthquake analyses. Furthermore, the assessment presented above is fully aligned with the approach outlined in ISO 19905-1 (ISO 2016) for ELE screening level check required for jack-up rigs (manned units). According to ISO 19905-1, if a jack-up rig in Zone 1 passes the ULS strength and stiffness check at the ELE screening level load (a 1,000 earthquake response spectrum) there is no requirement for conducting additional earthquake assessment to obtain thresholds. The ISO19905-1 for a jack-up rig is considered to present a more stringent ELE assessment screening level than for a floating drilling rig (*i.e.*, a semisubmersible or drillship), consequently the assessment is considered conservative.

Once plugged and abandoned, there will be no BOP stack on the wellhead. During an ELE event, the well system will be moving with the ground. The tophole well(s) trajectory will be optimally selected not to cross any active faults. Further, the cement will cap and isolate the deep hydrocarbon bearing strata from the upper strata. Therefore, integrity of the plugged and abandoned wells is not expected to be compromised during an ELE event.

References:

Brown, L.A., Bracci, J.M., Hueste, M.B., and Murff, J.D. 2003. Assessment of Seismic Risk for Subsea Production Systems in the Gulf of Mexico, Final Project Report Prepared for the Minerals Management Service Report OTRC Library Number: 12/03A136, Project Number 422, Offshore Technology Research Center, Austin, Texas.

ISO 2004. Petroleum and natural gas industries — Specific requirements for offshore structures — Part 2: Seismic design procedures and criteria (19901-2:2004).

ISO 2016. Petroleum and natural gas industries — Site-specific assessment of mobile offshore units (19905-1:2016).

Information Request (IR) IR-081 (ECCC-IR-25)

Applicable CEAA 2012 effect(s): 5(1)(a)(i) Fish and Fish Habitat; 5(1)(a)(ii) Aquatic Species; 5(1)(a)(iii) Migratory Birds; 5(1)(b) Federal Lands or Transboundary

EIS Guidelines Reference: Part 2, 6.6.2 Effects of the environment on the Project

EIS Reference: 9.1.6 Sediment and Seafloor Instability and Other Geohazards

Context and Rationale: Section 9.1.6 of the EIS states: "Sediment scour, liquefaction of sediments from seismic events, and slope failure on the seafloor are geohazards that could adversely affect exploration drilling activities (Stantec 2014b). Canyons in and around the project area (*e.g.* Dawson and Verril Canyons) represent possible areas of slope instability as they create steep banks, and provide avenues for sediment transport between the Shelf and the Slope into the deep ocean (Stantec 2013a). Section 9.1.6 also states that "Avoidance of geohazards associated with sediment and seafloor instability is critical to the success of drilling programs and to reduce the risk of accidental events."

The probabilities of the various risks, what effect would they have, and how the hazards described would be managed are not clear.

Specific Question or Request: More fully describe possible effects of sediment scour, liquefaction of sediments from seismic events, and slope failure on the integrity of abandoned wells that have been plugged and where the wellheads have not been removed, as well as how potential risks are mitigated.

Response: As explained in Section 5.2.2.2, BP will select wellsite locations to avoid areas of known geohazards. However, in the event that a seismic event or slope failure does give rise to sediment scour or liquefaction of sediments, it is expected that the integrity of any BP abandoned wells in the area will be maintained.

Well abandonment is explained in Section 2.4.4 of the Environmental Impact Statement (EIS). As part of the abandonment program, cement plugs will be inserted at a number of points within the wellbore. Each hydrocarbon potential flow zone is required to have at least two lateral barriers installed for permanent abandonment. It is possible that subsea infrastructure may be removed, or that approval will be sought to leave the wellhead in place. Irrespective of what subsea infrastructure is left in place, the cement plugs will isolate the well, and therefore the barriers to potential flow zones will not rely on the wellhead system to prevent flow to surface or seabed.

In the case of a worst credible seabed failure (*e.g.*, ≥300m sediment thickness below mudline) the extreme case would be that the wellhead, conductor and any other casing strings brought to seafloor may be broken off. In this scenario the failure would still not be expected to disturb any deep set lateral barriers. Such a failure would therefore present a negligible risk to the environment from any abandoned wells.

Information Request (IR) IR-082

Applicable CEAA 2012 effect(s): 5(1)(a)(i)

EIS Guidelines Reference: Part 2, 6.3.1 Fish and fish habitat; 8 Follow-up and Monitoring Programs

EIS Reference: 7.2.10 Follow-up and Monitoring, p. 7.45

Context and Rationale: The proponent indicates that it "will conduct a visual survey (using an ROV) of the seafloor during and after drilling activities to assess the extent of sediment dispersion" (underlining added). DFO has requested that it be provided with copies of the reports prepared for the sediment survey to assess the extent of sediment dispersion when they are provided to the CNSOPB.

Specific Question or Request: Provide further information of proposed monitoring, including: at what point(s) during drilling activities a visual survey would be conducted; how long it would take; how results would be recorded, analyzed and reported; and to whom results would be reported. Describe the procedure and any limitations, such as maximum range of the ROV from the drilling site, compared to predicted extent of dispersion.

Clarify what the reference to monitoring "after drilling activities" means, *e.g.* immediately after, before the drilling unit leaves the drilling location, or at a later time?

Response: Refer to responses provided for IR-016 and IR-021 for information on the pre-drill survey. This survey will provide baseline data to support visual surveys to be conducted during the drilling program.

It is anticipated that a remotely operated vehicle (ROV) survey will be conducted after the riserless section when cuttings are discharged directly at the seafloor before riser drilling ("post-riserless survey"). A final seabed survey ("post-drilling survey") will be carried out once drilling is complete and the well has been plugged and abandoned but most likely before the MODU leaves the wellsite. As per the pre-drill ROV survey, the survey design will capture video footage over an area with a 500-metre radius in an eight leg pattern in 45 degree increments as shown in Figure 1 below.

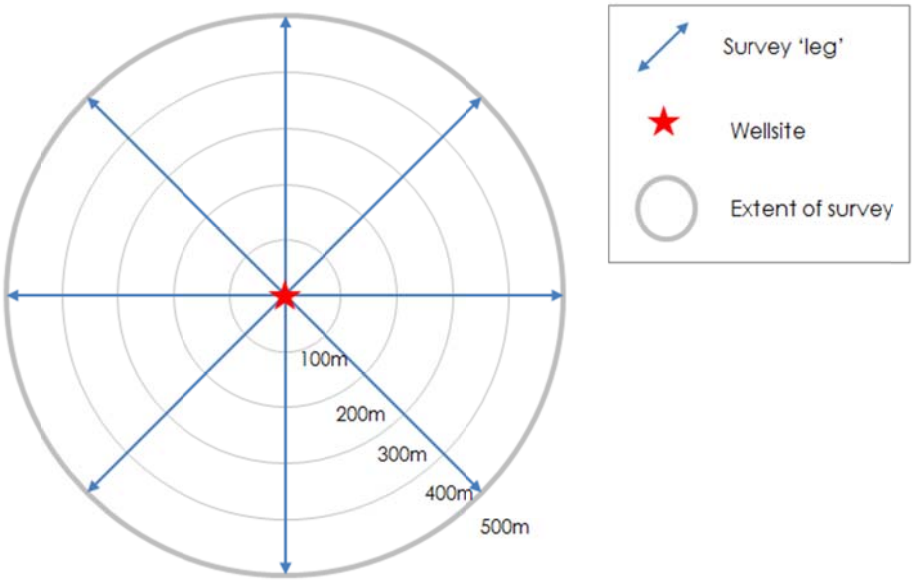


Figure 1 Proposed Survey Design for ROV Surveys

Video footage of the "post-riserless drilling" survey and the "post-drilling survey" will be reviewed to conduct a visual assessment of the drill waste dispersion. Section 7.1.2 of the EIS discusses the drill waste dispersion modelling that was conducted in support of the Project. Two representative locations at different water depths were selected, and dispersion modelling was conducted at each to identify the potential extent of deposition from the wellsite. The predicted extent of benthic smothering from the wellsites that were modelled is up to 116m from the wellsite, using a threshold of 9.6mm (Neff *et al.* 2004). This is the maximum range based on deterministic modelling for a wellsite in 2,790 metres water depth. It is possible that the extent of benthic smothering may be greater than the 116m radius identified in the discharge modelling as local metocean conditions at the time of discharge may be different than those used in the deterministic modelling work, however it is considered very likely that this cuttings exceeding a 9.6mm threshold will fall well within the 500 m range captured as part of the seabed survey.

A report on the ROV surveys conducted to verify drill waste dispersion modelling results (containing pre-drill, during drilling (post-riserless), and post-drilling results) will be submitted to the CNSOPB within 90 days of well abandonment.

References:

Neff, J.M., Kjeilen-Eilersten, G., Trannum, H., Jak, R., Smit, M., and Durell, G. 2004. Literature Report on Burial: Derivation of PNEC as Component in the MEMW Model Tool. ERMS Report No. 9B. AM 2004/024. 25pp.

Information Request (IR) IR-083

Applicable CEAA 2012 effect(s): 5(1)(a)(i)

EIS Guidelines Reference: Part 2, 6.3.3 Marine mammals; 8 Follow-up and Monitoring Programs

EIS Reference: 7.3.10 Follow-up and Monitoring, p. 7.80

Context and Rationale: The EIS states that "in the event that a vessel collision with a marine mammal or sea turtle occurs, BP will contact the Marine Animal Response Society or the Canadian Coast Guard to relay incident information."

Specific Question or Request: Provide additional information about the roles and mandates of the Animal Response Society and Canadian Coast Guard for marine mammal or sea turtle collisions. Explain what procedures are in place for notifications of other organizations such as DFO in case of a vessel collision with a marine mammal or sea turtle. Explain what types of responses could be expected and who would undertake them. As part of a follow-up program, explain how this information would be used to verify effects predictions or test mitigation effectiveness.

Response: Section 7.3.8.3 discusses the potential for collisions between marine mammals and sea turtles with platform supply vessels.

As a mitigation measure (mitigation measure #52 in Table 13.2.1), the Environmental Impact Statement (EIS) states that in the event of a vessel collision with a marine mammal or sea turtle, BP will contact the Marine Animal Response Society or the Canadian Coast Guard to relay incident information.

The Project Area falls within the Canadian Maritime Region. In line with guidance from the Fisheries and Oceans Canada (DFO) for a collision in the Maritime Region, in the first instance, BP will report the collision to the Marine Animal Response Society (1-866-567-6277). BP will also immediately follow up with a notification to the Coast Guard and DFO via the Canadian Coast Guard Regional Operations Centre (1-800-565-1633 or 902-426-9750 (Halifax)).

The Marine Animal Response Society is the organization nominated by DFO to respond to a report of an injured, distressed or entangled marine animal (Refer to DFO's website for marine mammals and sea turtles at risk in the Maritimes Region for various sighting and response scenarios and appropriate contact information: http://www.dfo-mpo.gc.ca/fm-gp/mammals-mammiferes/maritimes-eng.html).The Marine Animal Response Society is an organization which is dedicated to the conservation of marine animals, such as cetaceans, pinnipeds, sea turtles and sharks. The Society works in cooperation with industry, federal agencies, other non-governmental organizations and local communities to document all incidents of live and dead marine mammals in Nova Scotia. They aim to assist all live cetaceans in distress by deciding the best course of action based on careful assessment (MARS 2017).

BP would also notify the Coast Guard because an injured marine mammal may cause a navigational hazard. The Coast Guard would be informed by BP that the Marine Animal

Response Society had been notified. Finally, BP would also contact DFO to report an incident with a SARA-species. DFO would be informed about other notifications that had been provided to the Marine Animal Response Society and Coast Guard. It is expected that the Marine Animal Response Society will take primacy in responding to a marine animal in distress, and that the Coast Guard and DFO would liaise with them to manage any risks to navigational safety to marine users and provide support in the response.

BP will maintain records following a collision wherever practicable. If the animal involved in the incident stays near the surface, the vessel crew will keep the animal in sight where possible and will maintain information to pass to the Marine Animal Response Society, including but not limited to:

- Date, time, and location (lat./long.) of animal
- Type of animal (species if possible)
- Description of key body parts, including colour, any tags or unique markings
- Estimated length of the animal
- Description and location of injuries and/or gear (type, colour)
- If the animal is alive, description of the behavior: Is it struggling to surface; free swimming or anchored; and which direction is the animal headed?
- If the animal is dead, the body condition (*e.g.* decomposed, bloated, or white)
- Where possible, photographs and video of the animal

The Marine Animal Response Society will launch a response taking into consideration the nature of the incident and the condition of the animal. The response that will be exercised by the Marine Animal Response Society is dependent on local conditions and the species involved. The Marine Animal Response Society would help to stabilize the animal and to minimise stress. There are no rehabilitation facilities in the Maritime Provinces for marine mammals so options for responding to an injured marine mammal may be limited. Examples of response strategies for live cetaceans which have become stranded are listed on the Marine Animal Response Society website and include re-floating, euthanasia or monitoring the animal while it dies naturally.

The Project Environmental Protection Plan to be submitted to the Canada-Nova Scotia Offshore Petroleum Board (CNSOPB) as part of the Drilling Operation Authorization process will include procedures for notification as noted above.

References:

DFO [Fisheries and Oceans Canada). 2017. Marine mammals and sea turtles at risk in the Maritimes Region. Available online at: http://www.dfo-mpo.gc.ca/fm-gp/mammals-mammiferes/maritimes-eng.html.

MARS [Marine Animal Response Society]. 2017. Available online at: http://marineanimals.ca/site.

Information Request (IR) IR-084

Applicable CEAA 2012 effect(s):

EIS Guidelines Reference: Part 2, 8 Follow-up and Monitoring Programs

EIS Reference: 12.2 Follow-up and Monitoring

Context and Rationale: On page 12.4, it is stated that the proponent would submit a Well Termination Report (within 30 days of well termination date). Well termination is not described as a project activity in section 2.4.

Specific Question or Request: Explain the term "well termination." How does it relate to well abandonment? What would the Well Termination report include? Who would have access to this report, would it be publicly available?

Response: Well termination is another term for permanently plugging or temporarily abandoning a well. Wells will be permanently plugged and abandoned following the drilling and testing campaign for each well. BP has referred to the activity as well abandonment throughout the EIS, however the Canada-Nova Scotia Offshore Petroleum Board (CNSOPB) reporting process refers to well termination. They are the same activity.

Well abandonment (*i.e.*, termination) is regulated by the CNSOPB as part of the Operations Authorization process. As described in the Drilling and Production Guidelines (C-NLOPB and CNSOPB 2011), the CNSOPB must approve the well termination program prior to terminating any well and a well termination record is submitted to the CNSOPB within 30 days after well abandonment (termination). The CNSOPB will maintain the well termination report as part of their records.

Information about the activity authorizations is included on the CNSOPB website (http://www.cnsopb.ns.ca/offshore-activity/activity-authorizations). This website also includes the template for the well termination record that will be completed following the abandonment program (http://www.cnsopb.ns.ca/OP_forms/wellterminationrecord.pdf).

As part of the well termination record, BP will notify the CNSOPB of some well specific details, such as the well location and water depth. It will also include information about the casing and cementing program adopted while drilling and the abandonment (termination) program, such as details of the plugs which will be inserted into the wellbore.

References:

C-NLOPB (Canada-Newfoundland and Labrador Offshore Petroleum Board) and CNSOPB (Canada-Nova Scotia Offshore Petroleum Board. 2011. Drilling and Production Guidelines. Available from: http://www.cnsopb.ns.ca/pdfs/DrillingandProduction_Guidelines_Mar312011.pdf

Information Request (IR) IR-085 (DFO-01)

Applicable CEAA 2012 effect(s): 5(1)(a)(i) Fish and Fish Habitat; 5(1)(a)(ii) Aquatic Species

EIS Guidelines Reference: Part 2, 6.3.1 Fish and fish habitat; 8.1 Follow-up Program

EIS Reference: 7.2.8.2 Mitigation of Project-Related Environmental Effects; 7.3.8.2 Mitigation of Project-Related Environmental Effects; 12.2 Follow-up and Monitoring

Context and Rationale: Additional information on follow-up program elements pertaining to underwater noise is required.

The EIS Guidelines (section 8.1) require that a preliminary follow-up program be included in the EIS, in particular for areas where scientific uncertainty exists in the prediction of effects. For fish and fish habitat specifically, the EIS Guidelines (6.3.1) require that the EIS describe how acoustic monitoring data would be collected during and after drilling operations and how this would be used to verify effects predictions. The EIS Guidelines (section 8.1) require the follow-up program include the parameters to be measured, intervention mechanisms to be used in the event that an unexpected deterioration of the environment is observed, accessibility of the data for the general population, opportunities for participation by Aboriginal groups and interested stakeholders, and involvement of and communication with local and regional organizations in the design, implementation and evaluation of follow-up results.

The EIS (sections 7.2.8.2 and 7.3.8.2) describes a number of mitigation measures to reduce the potential environmental effect of the Project on fish and fish habitat, and on marine mammals and turtles.

The EIS (section 12.2) proposes an Acoustic Monitoring Program, where the proponent would assess the potential for undertaking an acoustic monitoring program during the first phase of the drilling program to collect field measurements to verify predicted underwater sound levels. The objectives of such a program would be identified in collaboration with DFO and the CNSOPB and in consideration of lessons learned from the underwater sound monitoring program that will be undertaken for the Shelburne Basin Venture Exploration Drilling Project. From the information provided in the EIS, it is not clear when this monitoring program would be carried out (*i.e.* during and after drilling). It is also not clear whether the monitoring is intended to monitor effects on species at risk and how this would be achieved.

The EIS (section 12.2) also proposes a Marine Mammal and Sea Turtle Monitoring Program, which would monitor and report on sightings of marine mammals and sea turtles during vertical seismic profiling (VSP) surveys. Resulting information would be used to delay or shutdown VSP operations when baleen whales, sea turtles, or SARA-listed species are detected within 650 metres. Additional information on this follow-up program is needed to satisfy the requirements of EIS Guidelines (*e.g.*, if and how the proponent would involve and communicate with local and regional organizations in the design, implementation, and evaluation of follow-up results).

Specific Question or Request: Provide additional information on proposed follow-up to satisfy information requirements set out in section 8 of the EIS Guidelines, as applicable.

Response:

Acoustic Monitoring Follow-up Program

BP will implement an acoustic monitoring follow-up program during the first phase of the drilling program (*i.e.*, during the drilling of the first one or two wells). This follow-up program will be designed to monitor sound levels and frequency characteristics of sound generated from the mobile offshore drilling unit (MODU) at various distances away from the MODU.

The sound study will aim to measure sound levels to verify the inputs and outcomes of the acoustic modelling study carried out as part of the EIS (Appendix D to the EIS).

In the absence of measurement data being available from previous studies, conducted in a similar offshore setting, either by BP or other operators, the acoustic study may also aim to assess/verify source sound levels generated by the MODU operations.

The results of this study will be compared to the acoustic modelling results and expectations.

The deployment of the acoustic monitoring equipment will depend on weather and sea state conditions. Redeployed recorders will collect acoustic data over a period of time. The data collection period, data sampling configuration and technical specifications of the recording equipment will be selected in order to maximise the potential to collect data related to marine mammal vocalisation as well as sound from the MODU facility.

BP will finalize the scope of the acoustic study following discussions with the CNSOPB to identify potential additional objectives in consideration of lessons learned from the underwater sound monitoring program that was undertaken for the Shelburne Basin Venture Exploration Drilling Project.

Recorders will be deployed at varying distances from the MODU in a configuration that will optimise the recording capability to provide an overview of the sound levels generated by the MODU over its daily operating cycle.

BP will submit an acoustic monitoring plan, detailing the specifics of this follow-up program, to the CNSOPB at least 30 days prior to the commencement of the drilling program. The data captured as part of the program will be analysed and a summary report of results, including results of propagation loss modelling, will be submitted to the CNSOPB following completion of the field program and modelling. The CNSOPB will determine the method and extent of distribution of results.

Marine Mammal and Sea Turtle Monitoring Program

To reduce potential adverse environmental effects, a marine mammal and sea turtle monitoring program will be implemented during the VSP survey for each well. A marine mammal and sea turtle monitoring plan detailing the specifics of this program will be submitted to the CNSOPB for review at least 30 days prior to the commencement of the first VSP survey. BP will use experienced and trained marine mammal observers (MMOs) including a passive acoustic monitoring (PAM) operator to collect visual and acoustic data concurrently during the surveys. The marine mammal and sea turtle sightings data captured as part of the program will be analysed and a summary report of results will be submitted to the CNSOPB following completion of the field program. The CNSOPB will make this report available on its website. A high-level overview of the nature and intent of the monitoring program is provided below.

As indicated in the response to IR-36, use of experienced and trained MMOs will enable shutdown or delay actions to be implemented if a marine mammal or sea turtle species listed on Schedule 1 of SARA (or any other baleen whales or sea turtles) are detected within the monitored exclusion zone. BP will also adopt a soft-start or ramp-up procedure (*i.e.*, gradually increasing seismic source elements over a period of approximately 30 minutes before the operating level is achieved) before any VSP activity begins, and a pre-ramp-up watch of 60 minutes whenever VSP activities are scheduled to occur in areas where beaked and other deep-diving whales may be present. The technical specifications and operational deployment configuration of the PAM system will be optimised within the bounds of operational and safety constraints to maximise the likelihood of detecting cetacean species anticipated in the area.

Information Request (IR) IR-086 (MNNB-39)

Applicable CEAA 2012 effect(s)[4]: All

EIS Guidelines Reference: Part 2, Section 5.0 Aboriginal Engagement and Concerns and Section 3.3.2 Valued components to be examined

EIS Reference: 4.1 Aboriginal Engagement Objectives; 4.4 Aboriginal Engagement Activities; 4.5 Questions and Comments Raised During Aboriginal Engagement; 6.0 Environmental Effects Assessment Scope and Methods

Context and Rationale: According to the *Guidelines for the Preparation of an Environmental Impact Statement* (the Guidelines), interested groups, including Indigenous communities, may recommend VCs. If a VC suggested by an Indigenous group is not included in the EIS, the proponent must explain why it was excluded (Guidelines, Part 2, Section 5.0, page 15). In addition, the Guidelines state that "the EIS will identify those VCs, processes, and interactions that either were identified to be of concern during any workshops or meetings held by the proponent or that the proponent considers likely to be affected by the Project. In doing so, the EIS will indicate to whom these concerns are important and the reasons why, including environmental, Aboriginal, social, economic, recreational, and aesthetic considerations. If comments are received on a component that has not been included as a VC, these comments will be summarized." (Guidelines, Part 2, Section 3.3.2, page 4).

The MNNB noted that the EIS discusses how, in part, VCs were identified in the course of examining issues raised by Indigenous peoples, directing readers to Section 4 and Appendix B of the EIS for more information (EIS, Section 6.2.2, page 6.7). However, the MNNB noted that Section 4 does not clearly show which questions and comments resulted in identifying VCs subsequently examined in the EIS.

Specific Question or Request: Identify which VCs, if any, were included as a result of concerns raised by Indigenous peoples, when concerns or recommendations were raised to the proponent, and why they were described as important. If recommended VCs were not included in the EIS, explain why.

Response: Section 4 of the Environmental Impact Statement (EIS) discusses ongoing and proposed engagement with Indigenous[5] organizations that may have an interest in the Project. Engagement undertaken since the submission of the EIS is provided in Table 1 below. As detailed in Section 4.5, questions and comments raised during Indigenous engagement, including comments submitted to the Canadian Environmental Assessment (CEA) Agency during the comment periods for the Project Description and Draft Environmental Impact Statement (EIS) Guidelines under *Canadian Environmental Assessment Act* (CEAA), 2012, were considered during the preparation of this EIS. A summary of key concerns and how they have been addressed is provided in Table 4.5.1 of the EIS. Comments received during engagement with the Indigenous communities to date (March 2017) have not identified any

[4] See legend at end of document for a description of applicable environmental effects
[5] 'Indigenous' is synonymous with 'Aboriginal'

Valued Components (VCs) in addition to the VCs described in the Project Description submitted for review and comment on August 19, 2015. Concerns raised by Indigenous communities have been incorporated into the seven VCs selected during the Project scoping process (see Section 6 of the EIS and separately in Information Request (IR) IR-050 Species at Risk). For example, concern was raised that a spill could affect migration, spawning and/or feeding grounds of species of significance to Mi'kmaq culture including American eel, Atlantic sturgeon, Bluefin tuna, herring and gaspereau, whales, and migratory birds. Potential effects of a spill are assessed in Section 8.5 of the EIS for Fish and Fish Habitat, Marine Mammals and Sea Turtles, Migratory Birds, and Current Aboriginal Use of Lands and Resources for Traditional Purposes. These VCs encompass potential effects to the aforementioned species. The following engagement activities have taken place since the submission of the EIS.

Table 1 Summary of Aboriginal Engagement Conducted for the Project (as of March 2017)

Stakeholder Group	Communication Date	Communication Summary	Communication Method
Abegweit First Nation	Oct 12, 2016	Introduction and opportunity to discuss BP's project in Nova Scotia.	Email
	Nov 03, 2016	Letter of non-objection received from Mi'kmaq Confederacy of Prince Edward Island. This includes Abegweit First Nation (FN) and Lennox Island FN.	Email
	Nov 03, 2016	To introduce and discuss the project further with Chief Francis.	Email
	Feb 07, 2017	Provide update on Scotian Basin Exploration Project, attached BP's latest newsletter and an update on the status of our Environmental Impact Statement.	
Fort Folly FN	Nov 09, 2016	Follow-up information regarding recent acceptance of BP's EIS by Canadian Environmental Assessment Agency (CEA Agency) re: the Scotian Basin Exploration Drilling Project. Offer to provide more information about BP and the commitment to undertake a safe and environmentally responsible project in the Nova Scotia offshore.	Email
	Feb 07, 2017	Provide update on Scotian Basin Exploration Project, attached BP's latest newsletter and an update on the status of our Environmental Impact Statement.	Email
Kingsclear NF	Nov 09, 2016	Follow-up information regarding recent acceptance of BP's EIS by CEA Agency re: the Scotian Basin Exploration Drilling Project. Offer to provide more information about BP and the commitment to undertake a safe and environmentally responsible project in the Nova Scotia offshore.	Email
	Nov 10, 2016	Response from Chief Atwin, Kingsclear FN, regarding BP's email re acceptance of	Email

Table 1 Summary of Aboriginal Engagement Conducted for the Project (as of March 2017)

Stakeholder Group	Communication Date	Communication Summary	Communication Method
		BP's EIS.	
	Feb 07, 2017	Provide update on Scotian Basin Exploration Project, attached BP's latest newsletter and an update on the status of our Environmental Impact Statement.	Email
Lennox Island First Nation	Oct 12, 2016	Introduction and update on BP's Nova Scotia project.	Email
	Nov 03, 2016	Letter of non-objection received from Mi'kmaq Confederacy of Prince Edward Island	Email
	Feb 07, 2017	Provide update on Scotian Basin Exploration Project, attached BP's latest newsletter and an update on the status of our Environmental Impact Statement.	Email
Madawaska FN - Maliseet Nation	Nov 10, 2016	Follow-up information regarding recent acceptance of BP's EIS by CEA Agency re: the Scotian Basin Exploration Drilling Project. Offer to provide more information about BP and the commitment to undertake a safe and environmentally responsible project in the Nova Scotia offshore.	Email
	Feb 07, 2017	Provide update on Scotian Basin Exploration Project, attached BP's latest newsletter and an update on the status of our Environmental Impact Statement.	Email
Mi'kmaq Kwilmu'kq Maw-Klusuaqn Negotiation Office (KMKNO)	Oct 12, 2016	Meeting with the Benefits Committee to better establish working relationship between leadership of KMK and BP.	In-Person/Face-to-Face
	Nov 03, 2016	• BP Technical session - This session is a continuation and provides opportunity to have a conversation around previous discussion points. • Update on regulatory process • Prevention and prevention management • Exploratory drilling • Fisheries Study • Fishery Health Covered a several themes and included: • Development in the region • Location of exploration well • Community concerned • Risk management • Potential damage caused by exploration activity can cause	In-Person/Face-to-Face

Table 1 Summary of Aboriginal Engagement Conducted for the Project (as of March 2017)

Stakeholder Group	Communication Date	Communication Summary	Communication Method
		damage • Potential damages sustained • Differences between Pre and Post Deepwater Horizon incident? • Capping stack availability and vessel availability. • Activity may potentially impact the fisheries and marketing of Nova Scotia seafood. Managing Deepwater Drilling Risks - managing risks to minimize potential incidents as well as health of the fishery in Gulf of Mexico Fishery study provided by BP Potential to affect fisheries / livelihood for Nova Scotia First Nations	
	Nov 09, 2016	Follow-up information regarding recent acceptance of BP's EIS by CEA Agency re: the Scotian Basin Exploration Drilling Project and offer to provide more information about BP and the commitment to undertaking a safe and environmentally responsible project in the Nova Scotia offshore.	Email
	Jan 19, 2017	Meeting to discuss defining a relationship between BP and KMKNO.	In-Person/Face-to-Face
	Jan 19, 2017	Meeting to discuss relationship management, including management of further meetings, leadership roles, and communication plan.	In-Person/Face-to-Face
	Feb 07, 2017	Provide update on Scotian Basin Exploration Project, attached BP's latest newsletter and an update on the status of our Environmental Impact Statement.	Email
	Mar 1, 2017	Update meeting to address questions and plan for information session on well containment, spill response, well abandonment and fishery communication plan	In person/Face-to-face
Mi'gmawe'l Tplu'taqnn Incorporated (MTI)	Nov 29, 2016	Response to request from MTI for copy of Appendix B (TUS) from the EIS.	Email
	Jan 12, 2017	Requesting introductory phone conversation as the new Energy and Mines Coordinator for Mi'gmawe'l Tplu'taqnn Inc.	Email
	Jan 24, 2017	Update on BP activities as well as discussion on the CEAA process and participation in the EIS review. The	Phone Call meeting

Table 1 Summary of Aboriginal Engagement Conducted for the Project (as of March 2017)

Stakeholder Group	Communication Date	Communication Summary	Communication Method
		meeting revolved around: • CEAA process and participation • Update on BP activities within the CEAA assessment process • Fisheries study scope • Clarification of effects and mitigation on migratory and endangered species and spill monitoring	
	Jan 25, 2017	MTI requesting a face-to-face meeting with BP including technical staff regarding project.	Email
	Feb 07, 2017	Provide update on Scotian Basin Exploration Project, attached BP's latest newsletter and an update on the status of our Environmental Impact Statement.	Email
Mi'kmaq Confederacy of PEI	Nov 15, 2016	Acknowledging letter sent by MC PEI to CEA Agency re: their interest in BP's Scotian Basin Exploration Project and to continue to include MCPEI to share information on the Project.	Email
	Feb 07, 2017	Provide update on Scotian Basin Exploration Project, attached BP's latest newsletter and an update on the status of our Environmental Impact Statement.	Email
Millbrook First Nation	Oct 20, 2016	Introduction and information/update on Scotian Basin Exploration Project.	Email
	Nov 10, 2016	Direction on planning information meeting and election of new chief.	Email
	Nov 17, 2016	Follow-up information regarding recent acceptance of BP's EIS by CEA Agency regarding the Scotian Basin Exploration Drilling Project and offer to provide more information about BP and the commitment to undertaking a safe and environmentally responsible project in the Nova Scotia offshore.	Email
	Feb 07, 2017	Provide update on Scotian Basin Exploration Project, attached BP's latest newsletter and an update on the status of our Environmental Impact Statement.	Email
Native Council of Nova Scotia (NCNS)	Jan 19, 2017	Meeting to continue to build on relationship and discuss potential economic opportunities.	In-Person/Face-to-Face
	Nov 17, 2016	Follow-up information regarding recent acceptance of BP's EIS by CEA Agency regarding the Scotian Basin Exploration Drilling Project. Offer to provide more information about BP and the commitment to undertake a safe and environmentally responsible project in the	Email

Table 1 Summary of Aboriginal Engagement Conducted for the Project (as of March 2017)

Stakeholder Group	Communication Date	Communication Summary	Communication Method
		Nova Scotia offshore.	
	Feb 07, 2017	Provide update on Scotian Basin Exploration Project, attached BP's latest newsletter and an update on the status of our Environmental Impact Statement.	Email
Oromocto FN - Maliseet Nation	Nov 09, 2016	Follow-up information regarding recent acceptance of BP's EIS by CEA Agency regarding the Scotian Basin Exploration Drilling Project. Offer to provide more information about BP and the commitment to undertake a safe and environmentally responsible project in the Nova Scotia offshore.	Email
	Feb 07, 2017	Provide update on Scotian Basin Exploration Project, attached BP's latest newsletter and an update on the status of our Environmental Impact Statement.	Email
Sipekne'katik FN	Nov 09, 2016	Follow-up information regarding recent acceptance of BP's EIS by CEA Agency regarding the Scotian Basin Exploration Drilling Project. Offer to provide more information about BP and the commitment to undertake a safe and environmentally responsible project in the Nova Scotia offshore.	Email
	Nov 10, 2016	Notification from Sipekne'katik FN to BP of new chief and will forward possible meeting dates soon.	Email
	Jan 05, 2017	Requesting information on attendance at a rescheduled meeting from December 2016 to January 18, 2017 meeting.	Email
	Feb 07, 2017	Provide update on Scotian Basin Exploration Project, attached BP's latest newsletter and an update on the status of our Environmental Impact Statement.	Email
	Feb 24, 2017	Meeting to provide Project information and update and discussion of next steps.	In-Person/Face-to-Face
St. Mary's FN	Nov 09, 2016	Follow-up information regarding recent acceptance of BP's EIS by CEA Agency regarding the Scotian Basin Exploration Drilling Project Offer to provide more information about BP and the commitment to undertake a safe and environmentally responsible project in the Nova Scotia offshore.	Email
	Feb 07, 2017	Provide update on Scotian Basin Exploration Project, attached BP's latest newsletter and an update on the status	Email

Table 1 Summary of Aboriginal Engagement Conducted for the Project (as of March 2017)

Stakeholder Group	Communication Date	Communication Summary	Communication Method
		of our Environmental Impact Statement.	
Tobique FN - Maliseet Nation	Nov 09, 2016	Follow-up information regarding recent acceptance of BP's EIS by CEA Agency regarding the Scotian Basin Exploration Drilling Project. Offer to provide more information about BP and the commitment to undertaking a safe and environmentally responsible project in the Nova Scotia offshore.	Email
	Feb 07, 2017	Provide update on Scotian Basin Exploration Project, attached BP's latest newsletter and an update on the status of our Environmental Impact Statement.	Email
Woodstock FN - Maliseet Nation	Nov 09, 2016	Follow-up information regarding recent acceptance of BP's EIS by CEA Agency regarding the Scotian Basin Exploration Drilling Project. Offer to provide more information about BP and the commitment to undertake a safe and environmentally responsible project in the Nova Scotia offshore.	Email
	Feb 07, 2017	Provide update on Scotian Basin Exploration Project, attached BP's latest newsletter and an update on the status of our Environmental Impact Statement.	Email

Information Request (IR) IR-087 (MNNB-40)

Applicable CEAA 2012 effect(s): All

EIS Guidelines Reference: Part 1, Section 4.2 Study Strategy and Methodology

EIS Reference: 4.1 Aboriginal Engagement Objectives; 4.4 Aboriginal Engagement Activities; 4.5 Questions and Comments Raised During Aboriginal Engagement; 6.2.2 Selection of Valued Components; 7.2.2, 7.3.2, 7.4.2, 7.5.2, 7.6.2, 7.7.2; 6.2.3.2 The Influence of Engagement on the Assessment

Context and Rationale: The Guidelines direct the proponent to show the methods it used to assess project-related effects on valued components and to "incorporate into the EIS the community and Aboriginal traditional knowledge to which it has access or that is acquired through Aboriginal and public engagement activities."

The EIS documents engagement activities that were conducted by the proponent in developing its EIS. The MNNB has commented that demonstrations of effective integration of traditional knowledge in the EIS are vague. For example, the EIS states that the identification of special areas was "based on a compilation of scientific expert opinion and traditional knowledge that was solicited through efforts to support integrated ecosystem-based management efforts on the Scotian Shelf (Doherty and Horsman 2007)" (EIS, Section 5.2.10, page 5.207; Table 5.2.20, page 5.210). However, the cited reference does not appear to include any traditional knowledge. This leaves the role of traditional knowledge in the EIS unclear to the MNNB.

Section 7 assesses the potential effect of the Project on species occurring in the area of the Project. Each subsection includes a paragraph titled "The Influence of Engagement on the Assessment." Section 7.2.2 (page 7.19) of the EIS (influence of engagement on assessment of fish and fish habitat) states that: "Key issues raised during stakeholder and Aboriginal engagement for the Project to date include general concerns related to potential Project effects (and cumulative effects) on the marine environment including fish species at risk, commercial fish species, and/or fish species that have been identified as having significance to Mi'kmaq and/or Wolastoqiyik (Maliseet) culture. Questions and concerns were raised with respect to effects of routine discharges and spills on fish populations and migration, feeding, and spawning activities that could be occurring in the affected area". There is a similar section for each VC, modified as appropriate to the specific VC, but none discuss the influence of traditional knowledge. The phrase "traditional knowledge" is used only a few times in the entire EIS. The Agency notes that only Woodstock and St. Mary's First Nation fishery directors were interviewed as part of BP's consultation effort, and that the other four New Brunswick Maliseet communities were not consulted.

Specific Question or Request: Clarify what traditional knowledge was incorporated in the EIS, how it was obtained (*e.g.* from what community), and how it was incorporated into the analysis. Provide specific examples from the EIS.

Response: Traditional knowledge was obtained through Aboriginal engagement, the commissioning of a Traditional Use Study (TUS), and data provided by Fisheries and Oceans

Canada (DFO). BP has been conducting ongoing engagement with the Mi'kmaq of Nova Scotia since October 2013 when BP was planning the Tangier 3D Seismic Survey Project. Since then, their engagement program has expanded in recognition of a potentially larger regional area of influence associated with the exploration drilling program and has included engagement of Mi'kmaq and Wolastoqiyik (Maliseet) in New Brunswick in addition to the Mi'kmaq of Nova Scotia. BP has also engaged with the First Nations in Prince Edward Island (PEI). Engagement has included face to face meetings, provision of information packages and phone calls and emails. As detailed in Table 4.4.1 of the Environmental Impact Statement (EIS), First Nation communities and organizations engaged as of October 2016 include:

- Kwilmu'kq Maw-Klusuaqn Negotiation Office (KMKNO)
- Whycocomagh (affiliated with KMKNO)
- Wagmatcook (affiliated with KMKNO)
- Membertou (affiliated with KMKNO)
- Eskasoni (affiliated with KMKNO)
- Chapel Island (Potlotek) (affiliated with KMKNO)
- Pictou Landing (affiliated with KMKNO)
- Acadia (affiliated with KMKNO)
- Paq'tnkek (affiliated with KMKNO)
- Bear River (affiliated with KMKNO)
- Annapolis Valley (affiliated with KMKNO)
- Glooscap (affiliated with KMKNO)
- Millbrook
- Sipekne'katik
- Native Council of Nova Scotia (NCNS)/Netukulimkewe'l Commission
- Mi'gmawe'l Tplu'taqnn Incorporated (MTI) (formerly Assembly of First Nation Chiefs of New Brunswick)
- Fort Folly - (affiliated with MTI)
- Eel River Bar (Ugpi'ganjig) - (affiliated with MTI)
- Burnt Church (Esgenoopetitj) - (affiliated with MTI)
- Indian Island (L'nui Menikuk) - (affiliated with MTI)
- Pabineau (Oinpegitjoig) - (affiliated with MTI)
- Bouctouche (Tjipogtotjg) - (affiliated with MTI)
- St. Mary's
- Woodstock
- Kingsclear
- Madawaska
- Oromocto
- Tobique
- Abegweit
- Lennox Island

In an effort to better understand traditional use of marine areas and resources by Aboriginal peoples and potential effects on Aboriginal and Treaty rights, Membertou Geomatics Solutions (MGS) and Unama'ki Institute of Natural Resources (UINR) were commissioned to undertake a TUS. Based on knowledge of fishing interests obtained from DFO and through consultation with the Canadian Environmental Assessment (CEA) Agency, the TUS targeted interviews with the Native Council of Nova Scotia (NCNS), all 13 First Nation Bands in Nova Scotia, and Fort Folly, St. Mary's, and Woodstock First Nations in New Brunswick. Interviews with fisheries managers, captains and fishers, along with a literature review and review of DFO licensing information were used to help characterize communal commercial and/or food, social or ceremonial (FSC) fisheries that may occur in the Regional Assessment Area (RAA). Organizations that were interested in participating in the TUS are represented in the study results. The TUS was not intended to be an exhaustive inventory of Indigenous resource use occurring in the Regional Assessment Area (RAA) but provides a representative characterization of potential interactions with the Project. Sipekne'katik (Indian Brook) First Nation declined to participate in the TUS. As of April 2016, Annapolis Valley First Nation and Bear River First Nation had not been included in the TUS for EIS submission.

Traditional knowledge obtained through the TUS and Indigenous engagement was incorporated into each valued component (VC) and particularly the Current Aboriginal Use of Lands and Resources for Traditional Purposes VC. Species and sensitive areas identified as having importance to Mi'kmaq and/or Wolastoqiyik (Maliseet) culture were included in the effects assessment from routine Project activities (Section 7 of the EIS), accidental events (Section 8 of the EIS), and cumulative effects (Section 10 of the EIS). For example, concerns were raised by Aboriginal organizations about potential adverse effects from planned Project activities or accidental events on fish identified as being traditionally or commercially significant to the Mi'kmaq and/or Wolastoqiyik (Maliseet) including American eel, Atlantic sturgeon, bluefin tuna, swordfish, herring, gaspereau (alewife), lobster, crab and shrimp. These species, along with other species identified as being important to Indigenous communities, were therefore included in the description of the existing environment (Section 5 of the EIS) and considered in the effects assessment (Section 7 of the EIS).

BP continues to engage with and inform Indigenous groups in Nova Scotia, New Brunswick, and PEI about the Project to better understand their interests and concerns associated with the Project. BP is also developing a Fisheries Communication Plan which will provide a framework for ongoing engagement with Indigenous and non-Indigenous fisheries organizations during the Project (before, during and at the conclusion of drilling operations). This will also provide more opportunities for groups to share traditional knowledge with BP while they are proceeding with Project planning.

Information Request (IR) IR-088 (MNNB-43)

Applicable CEAA 2012 effect(s): 5(1)(c)

EIS Guidelines Reference: Part 1, Section 4.2 Study Strategy and Methodology

EIS Reference: 4.1 Aboriginal Engagement Objectives; 4.4 Aboriginal Engagement Activities; 4.5 Questions and Comments Raised During Aboriginal Engagement; 7.2.2, 7.3.2, 7.4.2, 7.5.2, 7.6.2, 7.7.2 The Influence of Engagement on the Assessment

Context and Rationale: The Guidelines direct the proponent to "provide Aboriginal groups the opportunity to review and provide comments on the information used for describing and assessing effects on Aboriginal peoples. Where there are discrepancies in the views of the proponent and Aboriginal groups on the information to be used in the EIS, the EIS will document these discrepancies and the rationale for the proponent's selection of information" (Guidelines, Section 4.2, page 6). There is no indication in the EIS that Aboriginal groups reviewed the EIS prior to its submission to the Agency (EIS, Table 4.4.1, pages 4.13-19).

Specific Question or Request:

a) Clarify the extent to which Indigenous groups were given an opportunity to review and provide comments on the information used for describing and assessing effects on Indigenous peoples prior to submission of the EIS. If so, describe when and how this occurred.

b) Provide the results of any pre-submission Indigenous reviews, including the discussion of potential discrepancies as required in the Guidelines.

Response: Prior to the submission of the Environmental Impact Statement (EIS), BP gathered data and information for describing and assessing effects on Indigenous peoples from a number of sources. This is explained in Section 5.3.6 of the EIS.

As part of data gathering, BP commissioned Membertou Geomatics Solutions (MGS), and the Unama'ki Institute of Natural Resources (UINR) to conduct a Traditional Use Study (TUS) to obtain information from Indigenous fisheries in and around the Project Area. The TUS scope included a background review of commercial licenses and FSC agreements, and interviews with elders, fishers, and fisheries managers from a representative subset of First Nations in Nova Scotia and New Brunswick, and the Native Council of Nova Scotia. The TUS includes information on target species, general fishing areas, and fishing seasons, along with any additional information pertaining to fish or sensitive areas.

BP also gathered information from the Fisheries and Oceans Canada (DFO), including licensing information for food, social and ceremonial (FSC) fisheries and commercial fisheries which may overlap with the areas considered as part of the EIS, including the Project Area and Regional Assessment Area (RAA).

Further to the information included in the TUS, BP also gathered information from Indigenous communities through ongoing engagement efforts. As described in Section 4 of the EIS, BP's engagement with the Mi'kmaq of Nova Scotia began in October 2013 when BP was planning the Tangier 3D Seismic Survey Project. Since then, their engagement program has expanded in recognition of a potentially larger regional area of influence associated with the exploration drilling program and has included engagement of Mi'kmaq and Wolastoqiyik (Maliseet) in New Brunswick in addition to the Mi'kmaq of Nova Scotia. BP has also commenced engagement with the First Nations in Prince Edward Island (PEI). Engagement has included face to face meetings, provision of information packages and phone calls and emails.

In addition to input received through BP's engagement initiatives, opportunity for input has been made through the public participation opportunities under CEAA, 2012, including the Project Description (20-day public comment period starting August 19, 2015) and draft EIS Guidelines (30-day public comment period starting September 16, 2015), which have been posted on the CEA Agency's Registry website for the Project. A summary of key concerns raised prior to the submission of the EIS and how they have been addressed is provided in Table 4.5.1 of the EIS.

Questions or discrepancies raised following the submission of the EIS are addressed on an individual basis through the information response process. Concerns noted are similar to those included in Table 4.5.1, with the addition of more specific concerns including questions around well abandonment, effects of dispersants, effects on species at risk, follow-up and monitoring requirements, and learnings from Deepwater Horizon.

Information Request (IR) IR-089 (NCNS-01)

Applicable CEAA 2012 effect(s): 5(1)(a)(i) fish and fish habitat

EIS Guidelines Reference: Part 2, Sections 6.3.1 Fish and Fish Habitat

EIS Reference: 7.2 Fish and Fish Habitat; 7.2.10 Follow-up and Monitoring

Context and Rationale: Section 7.2.10 of the EIS states that "BP will assess in consultation with the appropriate authorities the potential for undertaking an acoustic monitoring program during the drilling program to collect field measurements of underwater sound in order to verify predicted underwater sound levels. The objectives of such a program will be identified in collaboration with DFO and the CNSOPB and in consideration of lessons learned from the underwater sound monitoring program to be undertaken by Shell as part of the Shelburne Basin Venture Exploration Drilling Project in 2016."

Specific Question or Request: Further to IR 085, which requests additional information about the proposed follow-up program, does the proponent intend to make the results of the acoustic monitoring program publicly available?

Response: BP will submit the results of the acoustic monitoring program to the Canada-Nova Scotia Offshore Petroleum Board (CNSOPB). The CNSOPB will determine the method and extent of distribution of results.

Information Request (IR) IR-090 (NCNS-02 and NCNS-03)

Applicable CEAA 2012 effect(s): 5(1)(a)(i)

EIS Guidelines Reference: Part 2, Section 3.2 Project Activities

EIS Reference: 2.4.4 Well Abandonment; 7.1.5 Well Abandonment

Context and Rationale: Section 7.1.5 of the EIS states that "The final well abandonment program has not yet been finalized; however these details will be confirmed to the CNSOPB as planning for the Project continues" and that "approval may be sought to leave the wellhead in place."

Specific Question or Request:

a) State whether the proponent intends to share the well abandonment program (plan) with the Native Council of Nova Scotia or others for comment during its development, prior to CNSOPB approval.

b) Provide the criteria that the proponent would apply in assessing whether or not to abandon a wellhead in place.

Response: BP's aim is to permanently plug and abandon all wells in line with BP practices and CNSOPB requirements at the end of the drilling and testing program. The final abandonment program has not yet been defined; however, BP confirms that all abandoned wells will have cement plugs placed at defined intervals within the wellbore as well as at the surface. Information about the proposed well abandonment program options is included in Section 2.4.4 of the EIS. Further information has also been provided in the response to information request IR-054.

The decision on the final well abandonment program for each well will depend on local conditions at each wellsite, most significantly water depth. In deep water (*i.e.*, over 1,500 m water depth), it is more likely that approval will be sought to leave the wellhead in place; however, it is it is possible that subsea infrastructure will be removed.

In the event that the approval is sought to leave the wellhead in situ, the infrastructure that may be left on the seafloor is a wellhead which would be approximately 5 to 12 feet in height and take up a permanent footprint of less than 1 m^2. Other subsea infrastructure, including the blowout preventer (BOP) may be removed. The BOP will be removed once the cement plugs are put in place.

Final details about the well abandonment program will be confirmed to the CNSOPB as planning continues; however, BP will discuss well abandonment options with Indigenous communities as part of ongoing consultation and engagement efforts.

Information Request (IR) IR-091 (MTI-13)

Applicable CEAA 2012 effect(s): 5(1)(c); 5(1)(a)(i) fish and fish habitat

EIS Guidelines Reference: Part 2, Sections 6.3.1 Fish and Fish Habitat and 6.1.5 Species at Risk and Species of Conservation Concern

EIS Reference: 7.2 Fish and Fish Habitat

Context and Rationale: MTI noted that there is a no specific assessment of Project operations on Winter Skate. Winter Skate is a species of conservation concern for MTI. The Gulf of St. Lawrence and Eastern Scotian Shelf-Newfoundland winter skate populations have been assessed by COSEWIC as Endangered The 2015 COSEWIC assessment and status report states that "fishers have noted females extruding complete cases only in the late summer-early autumn west of Sable Island, suggesting that this may be a spawning area". MTI suggested that the region around Sable Island may be the only known successful winter skate spawning grounds left within the Scotian region. Although the EIS provides spawning and hatching periods for the winter skate (Table 5.2.3), the proponent has not assessed the potential effects of Project operations on this species.

Specific Question or Request: Assess the potential effects of the Project specifically on winter skate, including the potential effects of underwater sound from the Project on the behaviour, distribution, and movement of winter skate, taking into consideration potential effects on eggs and larvae. Also ensure that the Eastern Scotian Shelf-Newfoundland population, individuals of which may be present within the RAA, is considered in the stand-alone species-at risk analysis that was requested in IR 050.

Response: The potential effects of the Project on winter skate (Eastern Scotian Shelf – Newfoundland population) have been assessed in the Species at Risk (SAR) valued component (VC), which can be viewed in the response to IR-050. The 2015 COSWEIC assessment outlines that fishers have anecdotally noted females extruding cases in the late summer- early fall west of Sable Island. The report, however, does not indicate that this is the only spawning area, but that it may be a spawning area. The species can be found over Emerald, Western, Sable Island, Banquereau, Middle, and Missaine Banks (Horsman and Shackell 2009), and there is currently no indication that Sable Island Bank is the only spawning area. There is currently a lack of mature female winter skate on the Eastern Scotian Shelf to fully determine their reproductive cycles in the area (DFO 2016).

References:

COSEWIC. 2015. COSEWIC assessment and status report on the Winter Skate Leucoraja ocellata, Gulf of St. Lawrence population, Eastern Scotian Shelf - Newfoundland population and Western Scotian Shelf - Georges Bank population in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xviii + 46 pp. (www.registrelep-sararegistry.gc.ca/default_e.cfm).

DFO (Fisheries and Oceans Canada). 2016. Skates and Rays: Skate Research. Available from: http://www.dfo-mpo.gc.ca/species-especes/skates/research/index-eng.html#conservation

Horsman, T.L. and Shackell, N.L. 2009. Atlas of important habitat for key fish species on the Scotian Shelf, Canada. Can. Tech. Rep. Fish. Aquat. Sci. 2835: viii+ 82p.

Information Request (IR) IR-092 (MTI-08)

Applicable CEAA 2012 effect(s): 5(1)(a)(i) fish and fish habitat

EIS Guidelines Reference: Part 2, Sections 6.1.5 Species at Risk and Species of Conservation Concern and 6.1.6 Marine Mammals

EIS Reference: Section 7.3.8.3 Characterization of Residual Project-Related Environmental Effects, pg. 7.67

Context and Rationale: MTI has expressed concern that there is no specific assessment of individual whale species, in particular the endangered North Atlantic Right Whale, a culturally-significant species to MTI. Critical habitat for the Right Whale has been identified in Roseway Basin on the Scotian Shelf within the RAA. The sound generated by the MODU will be continuous throughout the drilling program. There will also be sound from vessel traffic associated with MODU operations. Underwater sound may interfere with the ability of North Atlantic Right Whales and other whale species to navigate and communicate. The Proponent has stated that the effects of MODU operations on marine mammals are predicted to be not significant.

Specific Question or Request: Further to the general assessment of effects on marine mammals and IR- 050 (species at risk), discuss the potential effects of MODU operation and vessel traffic specifically on the behaviour, distribution and movement of North Atlantic Right Whales.

Response: The potential effects of the Project on marine mammals, specifically the North Atlantic right whale have been assessed in Section 7.3 of the Environmental Impact Statement (EIS) (Marine Mammals and Sea Turtles Valued Component [VC]) as well as in the response to IR-050 (Species at Risk VC). These VCs have specifically addressed the effects of mobile offshore drilling unit (MODU) operation and vessel traffic on marine mammals and the North Atlantic right whale. Furthermore, effects of the Project on Special Areas, including the Roseway Basin, have also been assessed in Section 7.5 of the EIS (Special Areas VC).

Information Request (IR) IR-093 (MNNB-08)

Applicable CEAA 2012 effect(s): 5(1)(a)(i) fish and fish habitat

EIS Guidelines Reference: Part 2, Sections 6.1.6 Marine Mammals, 6.1.7 Marine Turtles, and 8.2 Monitoring

EIS Reference: 7.3.3 Marine Mammals & Sea Turtles

Context and Rationale: The EIS states that the "Project could also result in changes in availability, distribution, or quality of prey items and habitat for marine mammals and sea turtles as a result of underwater sound or operation discharges (refer to Section 7.2 for an assessment of effects on prey species)" (pg. 7.48). The MNNB acknowledged that fish are important prey for many marine mammal species and that effects on fish are assessed in Section 7.2. The MNNB noted that some species, such as the North Atlantic Right Whale, forage on zooplankton (*e.g.* copepods). While the proponent provided a high level discussion of the zooplankton community in the region, no baseline data on the distribution of zooplankton inside the PA was provided.

Specific Question or Request: Discuss how the Project could affect the distribution, abundance or quality of zooplankton in the LAA, including during regular operations and as a result of accidents and malfunctions. Discuss how such changes could affect marine mammals and sea turtles that rely on this food source, with specific consideration of potential effects on species at risk.

Response: A baseline description of zooplankton on the Scotian Shelf and Slope is included in Section 5.2.1.3 of the Environmental Impact Statement (EIS).

Zooplankton is an important food source for a variety of species, including some marine mammals and sea turtles. Several marine species-at-risk (SAR) depend on zooplankton as a food source, including the blue whale (*Balaenoptera musculus*), fin whale (*Balaenoptera physalus*), North Atlantic right whale (*Eubalaena glacialis)*, and the leatherback (*Dermochelys coriacea)* and loggerhead (*Caretta caretta)* sea turtles. If the availability of zooplankton did decrease, it could potentially result in decreased food availability for these species. However, this effect would likely occur in a localized area and be of short term due to the high fecundity and short generation time of zooplankton, and ability of these species to move where food sources are greater.

Possible effects on zooplankton are discussed in the Fish and Fish Habitat Valued Component (VC) (Section 7.2). Project effects on zooplankton in the Project Area are expected to be limited during routine operations and where underwater sound associated with the presence and operation of the mobile offshore drilling unit (MODU) as well as from vertical seismic profiling (VSP) would most likely interact with zooplankton species in the Project Area. Effects from waste discharges, including drilling waste discharges, which will be released in accordance with the Offshore Waste Treatment Guidelines, are expected to have negligible effects on zooplankton (refer to Sections 7.12 and 7.2 of the EIS).

Of most relevance for effects on zooplankton would be effects from accidental spills. As discussed in Section 8.5.1 of the EIS, zooplankton has been shown to be sensitive to hydrocarbons. Effects of hydrocarbons on zooplankton include increased mortality, decreased feeding, and decreased reproduction (Suchanek 1993; Seuront 2011). Zooplankton with the ability to sense and avoid spills (*e.g.*, copepods) can reduce contact and mortality risk (Seuront 2010). At sub-lethal levels, hydrocarbons accumulated in zooplankton after a spill can be depurated within days of moving to clean water (Trudel *et al.* 1985). Recovery of zooplankton communities are likely to occur soon after a spill due to their short generation time, high fecundity, and the ability of some zooplankton to actively avoid spill sites (Seuront 2011).

Significant adverse residual environmental effects from routine Project activities or accidental events are not predicted to occur for Fish and Fish Habitat (including zooplankton). While some adverse effects may occur resulting in physical injury or mortality for zooplankton, these effects are not predicted to be on a scale that would affect predator species, including species at risk that could be foraging in the area.

References:

Seuront L. 2010. Zooplankton avoidance as a response to point sources of hydrocarbon contaminated water. Mar Fresh Res 61: 263–270.

Seuront L. 2011. Hydrocarbon contamination decreases mating success in a marine planktonic copepod. *PLoS ONE*, 6(10): e26283

Suchanek, T.H. 1993. Oil impacts on marine invertebrate populations and communities. *Integrative and Comparative Biology*, 33(6): 510-523.

Trudel, K. 1985. Zooplankton. In: Duval, W.S., editor. A Review of the Biological Fate and Effects of Oil in Cold Marine Environments. Report by ESL Ltd., SL Ross Environmental Research Ltd. and Arctic Laboratories Ltd. For Environment Canada, Edmonton, AB. 242 pp.

Information Request (IR) IR-094 (MNNB-09)

Applicable CEAA 2012 effect(s): 5(1)(a)(i) fish and fish habitat

EIS Guidelines Reference: Part 2, Sections 6.1.6 Marine Mammals and 6.1.7 Marine Turtles

EIS Reference: 7.3 Marine Mammals and Sea Turtles

Context and Rationale: The MNNB noted that while extensive discussion was provided about marine mammals and underwater sounds in Section 7.3, as well as information on the drilling noise expected, there is no direct comparison between expected frequencies of the drilling noise (Hz) and overlap with marine mammal hearing ranges for the potentially-affected species. The assessment would be aided by a table or figure that displays the hearing range (Hertz) and tolerance (decibels) for marine mammals in comparison to expected drilling sound frequencies and levels, as well as noise from other Project activities. The EIS provides a table of hearing thresholds by functional hearing range (*e.g.* low-frequency cetaceans – Table 7.3.4) and lists mammals and sea turtles known to occur near the PA (Tables 5.2.9 and 5.2.12, respectively), but does not indicate which species are in which hearing range.

Specific Question or Request: Further to IR 058 (cumulative effects of noise), provide a table directly comparing marine mammal and sea turtle hearing ranges and tolerances to the expected sound frequencies and levels expected to be directly emitted by the Project.

Response: Information about the functional hearing ranges of marine mammals is included in Section 7.3.6.2 of the Environmental Impact Statement (EIS); however, greater species-specific detail is provided for marine mammals and sea turtles below.

Table 1 presents hearing ranges for marine mammal and sea turtle species likely to be found in the Regional Assessment Area and compares these ranges to frequencies of sound sources associated with Project activities. Given the wide range of frequencies expected from Project activities and the wide hearing ranges for most species in Table 1, most of the underwater sound generated by the Project is expected to be audible to various species. Refer to Appendix D and Section 7.3 of the EIS for information on predicted sound levels (which vary depending on the source, scenario, and acoustic metric considered) and general thresholds for behavioural or physical effects on marine mammals and sea turtles.

Table 1 Marine Mammal and Sea Turtle Hearing Ranges and Overlap with Expected Frequency Ranges of Project Activities

Marine Mammal and Sea Turtle Hearing Ranges				Expected Frequencies for Project Activities		
Common Name	**Scientific Name**	**Functional Hearing Group[1,2]**	**Functional Hearing Range of Species[1,2]**	**Dominant Frequency Range of Vessel Noise[3]**	**Dominant Frequency Range of Drilling[4]**	**Dominant Frequency Range of Vertical Seismic Profiling[4,5]**
Mysticetes (Toothless or Baleen Whales)						
Blue whale (Atlantic population)	*Balaenoptera musculus*	Low-frequency	7 - 35,000 Hz	10 – 10,000 Hz	10 – 10,000 Hz	10 – 25250 Hz
Fin whale (Atlantic Population)	*Balaenoptera physalus*					
Humpback whale (Western North Atlantic population)	*Megaptera novaeangliae*					
Minke whale	*Balaenoptera acutorostrata*					
North Atlantic right whale	*Eubalaena glacialis*					
Sei whale	*Balaenoptera borealis*					
Odontocetes (Toothed Whales)						
Atlantic spotted dolphin	*Stenella frontalis*	Mid-frequency	150 - 160,000 Hz	10 – 10,000 Hz	10 – 10,000 Hz	10 – 250 Hz
Atlantic white-sided dolphin	*Lagenorhynchus acutus*					
Bottlenose dolphin	*Tursiops truncatus*					
Killer whale	*Orcinus orca*					
Long-finned pilot whale	*Globicephala melas*					
Northern bottlenose whale (Scotian Shelf Population)	*Hyperoodon ampullatus*					
Pantropical spotted dolphin	*Stenella attenuata*					
Risso's dolphin	*Grampus griseus*					
Sowerby's beaked whale	*Mesoplodon bidens*					
Short-beaked common dolphin	*Delphinus delphis*					

Table 1 Marine Mammal and Sea Turtle Hearing Ranges and Overlap with Expected Frequency Ranges of Project Activities

Marine Mammal and Sea Turtle Hearing Ranges				Expected Frequencies for Project Activities		
Common Name	**Scientific Name**	**Functional Hearing Group[1,2]**	**Functional Hearing Range of Species[1,2]**	**Dominant Frequency Range of Vessel Noise[3]**	**Dominant Frequency Range of Drilling[4]**	**Dominant Frequency Range of Vertical Seismic Profiling[4,5]**
Sperm whale	*Physeter macrocephalus*					
Striped dolphin	*Stenella coeruleoalba*	Mid-frequency	150 - 160,000 Hz	10 – 10,000 Hz	10 – 10,000 Hz	10 – 250 Hz
White-beaked dolphin	*Lagenorhynchus albirostris*					
Harbour porpoise (Northwest Atlantic population)	*Phocoena phocoena*	High-frequency	200 - 180,000 Hz	10 – 10,000 Hz	10 – 10,000 Hz	10 – 250 Hz
Phocids (Seals)						
Grey Seal	*Halichoerus grypus*	Phocid Pinnipeds	50 - 86,000 Hz	10 – 10,000 Hz	10 – 10,000 Hz	10 – 250 Hz
Harbour Seal	*Phoca vitulina*					
Harp Seal	*Pagophilus groenlandicus*					
Hooded Seal	*Cystophora cristata*					
Ringed Seal	*Pusa hispida*					
Sea Turtles						
Leatherback sea turtle	*Dermochelys coriacea*	Sea Turtles	100 – 900 Hz	10 – 10,000 Hz	10 – 10,000 Hz	10 – 250 Hz
Loggerhead sea turtle	*Caretta caretta*					
Kemp's ridley sea turtle	*Lepidochelys kempii*					
Green sea turtle	*Chelonia mydas*					

Table 1 Marine Mammal and Sea Turtle Hearing Ranges and Overlap with Expected Frequency Ranges of Project Activities

Marine Mammal and Sea Turtle Hearing Ranges				Expected Frequencies for Project Activities		
Common Name	Scientific Name	Functional Hearing Group[1,2]	Functional Hearing Range of Species[1,2]	Dominant Frequency Range of Vessel Noise[3]	Dominant Frequency Range of Drilling[4]	Dominant Frequency Range of Vertical Seismic Profiling[4,5]

Note:
[1] Source of marine mammal functional hearing groups and frequency ranges: A combination of Southall *et al.*(2007) and National Marine Fisheries Service (2016) so as to provide the broadest expected range.
[2] Source of sea turtles' generalized hearing range: Office of Naval Research (2002); Environment Australia (2003); Ketten and Bartol (2005).
[3] Source: Leggat *et al.* (1981)
[4] Source: Walmsley and Theriault (2011), OSPAR (2009)
[5] Source: Zykov 2016

References:

Environment Australia. 2003. Recovery Plan for Marine Turtles in Australia. Prepared by the Marine Species Section Approvals and Wildlife Division, Environment Australia in consultation with the Marine Turtle Recovery Team Canberra (cited 7 March 2011). Available from: www.environment.gov.au/coasts/publications/turtle-recovery/index.html.

Ketten, D.R., and Bartol, M. 2005. Functional Measures of Sea Turtle Hearing. Woods Hole Oceanographic Institution: ONR Award No: N00014-02-1-0510.

Leggat, L.J., H.M. Merklinger, and J.L. Kennedy. 1981. LNG Carrier Underwater Noise Study for Baffin Bay. Defence Research Establishment Atlantic, Dartmouth, Nova Scotia. 32 pp.

National Marine Fisheries Service. 2016. Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing: Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts. U.S. Dept. of Commer., NOAA. NOAA Technical Memorandum NMFS-OPR-55, 178 p.

OSPAR [OSPAR Commission]. 2009. Overview of the Impacts of Anthropogenic Underwater Sound in the Marine Environment. Publication number 441/2009. 134pp. Available from: http://qsr2010.ospar.org/media/assessments/p00441_Noise_background_document.pdf

Office of Naval Research. 2002. Ocean Life: Green Sea Turtle-Current Research, Science and Technology Focus, Oceanography. Available from: http://www.onr.navy.mil/focus/ocean/life/turtle4.htm.

Southall, B.L., A.E. Bowles, W.T. Ellison, J.J. Finneran, R.L. Gentry, C.R. Greene, Jr., D. Kastak, D.R. Ketten, J.H. Miller, *et al.* 2007. Marine mammal noise exposure criteria: Initial scientific recommendations. Aquatic Mammals 33(4): 411-521.

Walmsley, D., and Theriault, J. 2011. State of the Scotian Shelf Report: Ocean Noise. Atlantic Coastal Zone Information Steering Committee [ACZISC]. 25 pp. Available from: http://coinatlantic.ca/docs/ocean-noise.pdf.

Zykov, M.M. 2016. Modelling Underwater Sound Associated with Scotian Basin Exploration Drilling Project: Acoustic Modelling Report. JASCO Document 01112, Version 2.0. Technical report by JASCO Applied Sciences for Stantec Consulting Ltd. February 2010.

Information Request (IR) IR-095 (MNNB-10)

Applicable CEAA 2012 effect(s): 5(1)(a)(i) fish and fish habitat

EIS Guidelines Reference: Part 2, Sections 6.1.6 Marine Mammals, 6.1.7 Marine Turtles, and 6.6.3 Cumulative effects assessment

EIS Reference: Section 7.3.8.3 Characterization of Residual Project-Related Environmental Effects, pg. 7.67

Context and Rationale: The MNNB noted that "there have been no documented cases of marine mammal or sea turtle mortality stemming from exposure to sound from exploration seismic surveys. However, it has been suggested that the typical monitoring programs implemented for mitigation purposes during offshore activities may not detect sub-lethal or longer-term effects that could have occurred (DFO 2004)" (pg. 7.67). The MNNB asked if and how the proponent plans to monitor for assessing potential sub-lethal or longer-term effects of seismic (VSP) or drilling activities in the marine environment. While the EIS assesses potential sub-lethal effects such as behavioural changes or effects on habitat quality, there does not appear to be any discussion of longer-term effects, such as could be linked to behavioural or habitat changes.

Specific Question or Request: Assess the potential for VSP and drilling activities to cause longer-term effects on marine mammals and sea turtles. Further to IR-085 (follow-up program), indicate whether the proponent intends to include monitoring for longer-term effects in its follow-up program and provide an associated rationale.

Response: Extensive research has been undertaken to explore the effects of underwater sound from the offshore oil and gas industry. The E&P Sound & Marine Life Joint Industry Programme (JIP) supports research to help improve the understanding of the effect of sound on marine life generated by offshore exploration and production activities. Using case studies of areas known to host offshore expoloration and production activities, cetacean stocks have been reviewed to ascertain potential population level effects attributed to these activities (e.g., Thomsen et al. 2008; LGL Ltd. 2009). These studies have highlighted the uncertainty and gaps in understanding of the distribution and abundance of cetaceans in particular areas and effects of sound exposure on populations. It is recognized that additional research is required to improve interpretations of the effects of anthropogenic activities on cetaceans although this proves even more challenging at the scale of an individual exploration project.

The assessment or monitoring of potential sub-lethal or longer-term effects within the marine environment is challenging to attribute to specific project impacts particularly where other anthropogenic activities can occur, thereby contributing to cumulative effects. It would not be technically or economically feasible to undertake field investigations where it would require not only the identification of potential marine mammal exposure to vertical seismic profiling (VSP) and drilling activities (and to what degree), but also a means by which to track and assess the long-term fate of those individuals exposed.

Since monitoring for potential sub-lethal or longer-term effects is considered impracticable particularly at the project-level, marine scientists and environmental assessment practitioners rely on the understanding of marine mammal physiology (often based on acoustic experiments in captive settings) to predict potential for injury. Based on current scientific understanding of sound levels capable of causing permanent auditory injury (*i.e.*, a long-term but sub-lethal effect) and the results of underwater acoustic modelling conducted for the Project, sound levels are expected to decrease to below peak sound pressure level injury threshold values at distances greater than 40 m for mid- and low-frequency cetaceans and pinnipeds, and greater than >140 m for high-frequency cetaceans (Zykov 2016) (Section 7.3.8 and Appendix D of the EIS). As determined in the Environmental Impact Statement (EIS), the change in risk of mortality or physical injury as a result of VSP operation or drilling activities is predicted to be low in magnitude, restricted to the Project Area, and reversible. Therefore, no long-term monitoring or follow-up program is planned. Refer to IR-085 for more information on the proposed acoustic monitoring program and marine mammal and sea turtle monitoring program.

References:

LGL Limited. 2009. Cetacean stock assessment in relation to exploration and production industry sound. Prepared for Joint Industry Programme. 30 September 2009. Available at: http://gisserver.intertek.com/JIP/DMS/ProjectReports/Cat3/JIP-Proj3.3.3_CetaceanStockAssessment_2009.pdf

Thomsen, F. S.R. McCully, L. Weiss, D. Wood, K. Warr, M, Kirby, L. Kell and R. Law. 2008. Cetacean stock assessment in relation to exploration and production industry sound: current knowledge and data needs. 07-11 Schedule 01. Submitted E&P Sound and Marine Life Programme – International Association of Oil and Gas Producers. 4 July 2008. Available at: http://gisserver.intertek.com/JIP/DMS/ProjectReports/Cat3/JIP-Proj3.3.2_CetaceanStockAssessment_2008.pdf

Zykov, M.M. 2016. Modelling Underwater Sound Associated with Scotian Basin Exploration Drilling Project: Acoustic Modelling Report. JASCO Document 01112, Version 2.0. Technical report by JASCO Applied Sciences for Stantec Consulting Ltd.

Information Request (IR) IR-096 (MNNB-11)

Applicable CEAA 2012 effect(s): 5(1)(a)(i) fish and fish habitat

EIS Guidelines Reference: Part 2, Sections 6.1.6 Marine Mammals, 6.1.7 Marine Turtles and 6.4 Mitigation

EIS Reference: Section 7.3.9 Determination of Significance, pg. 7.79

Context and Rationale: The EIS states that "MMOs will be employed to monitor and report on sightings of marine mammals and sea turtles during VSP surveys (see Section 7.3.8.2). Monitoring will include visual observations and the use of PAM (passive acoustic monitoring) to inform decisions related to mitigation actions required during VSP operations when baleen whales, sea turtles, or any marine mammal listed on Schedule 1 of SARA are detected within a minimum 650 m predetermined exclusion zone" (pg. 7.79). The EIS also states that "MMO duties will include watching for and identifying marine mammals and sea turtles; recording their numbers, distances and behaviour relative to the VSP survey; initiating mitigation measures when appropriate (*e.g.* shutdown); and reporting results. Following the program, copies of the marine mammal and sea turtle observer reports will be provided to DFO and the CNSOPB" (pg. 7.79).

It is unclear to the MNNB from these descriptions how the proponent plans to determine that the 650- metre exclusion zone is effective.

Specific Question or Request: Describe the anticipated effectiveness of visual observations and the use of PAM to detect marine mammals and turtles that may be in the area and could potentially be affected by underwater sound from the Project. Describe whether and how the observations of marine mammals and turtles could lead to the implementation of additional mitigation measures such as a shut-down; provide examples.

Response: The combined use of visual monitoring and passive acoustic monitoring (PAM) of marine mammals during seismic survey operations and vertical seismic profiling (VSP) activity is considered to be an industry-standard best management practice and is applied in Canada, the United States, and numerous other countries around the world to mitigate potential adverse effects.

Historically marine mammal monitoring is conducted offshore using visual monitoring by personnel. The effectiveness of visual monitoring is primarily limited by the availability of marine species at the sea surface in combination with sea state, weather and light conditions. PAM offers an additional monitoring capability that can to some extent address the limitations of visual monitoring alone. However PAM also has a number of limitations, such as the reliance on a marine species vocalising and detection range in the presence of background sound.

It is widely recognised that no single monitoring technology or method is able to detect all animals all of the time. Therefore, by combining the use of the two monitoring capabilities, the likelihood of detecting a marine mammal will be increased.

In the event that a marine mammal or sea turtle species listed on Schedule 1 of SARA (or any other baleen whale or sea turtle) is detected (either visually or acoustically) within the exclusion zone, the Marine Mammal Observer (MMO) will order a shut-down of the source array (during VSP operations) or a delay of start-up (should the array not yet be active). VSP activity will be planned and conducted in keeping with measures outlined in the Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment (SOCP; DFO 2007).

The use of visual monitoring and PAM during VSP activities is just one of several measures that will be implemented by the Project to mitigate potential effects on marine mammals as far as reasonably practicable. Mitigation measures are not implemented in isolation and therefore it is important to consider the effectiveness of the overall package of mitigation measures rather than the effectiveness of a single measure.

References:

DFO [Fisheries and Oceans Canada]. 2007. Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment. http://www.dfo-mpo.gc.ca/oceans/management-gestion/integratedmanagement-gestionintegree/seismic-sismique/statement-enonce-eng.asp.

Information Request (IR) IR-097 (MNNB-15, MNNB-26)

Applicable CEAA 2012 effect(s): 5(1)(a)(iii) migratory birds

EIS Guidelines Reference: Part 2, Sections 6.1.4 Migratory Birds and their Habitat and 6.3.5 Migratory Birds

EIS Reference: 5.2.8 Migratory Birds; Table 5.2.13 Marine Birds of the Scotian shelf and slope, p. 5.154; 7.4 Migratory Birds

Context and Rationale: MNNB noted that Table 5.2.13 in the EIS leaves out several seabird species occurrences that have been documented near the PA, which is (or is close to) the seabirds' prime ocean habitat. The MNNB stated that seabirds that have been documented to occur in or near the RAA but omitted from Table 7.4.3 include Bermuda, Black-capped, Fea's Petrels, Barolo, Audubon's and Yelkouan Shearwaters, White-faced Storm-Petrel, Band-rumped Storm-Petrel, and European Storm-Petrel. Zino's Petrel and Scopoli's Shearwater may also occur. These include species that, although not COSEWIC- assessed or SARA-listed, are considered globally-rare or endangered (BirdLife International, 2016). Those species, when in Canada, are protected by the *Migratory Birds Convention Act*. The MNNB expressed concern about effects on globally-rare species that are difficult to detect, compared to more common species. The MNNB noted that fast-flying seabirds, among the most vulnerable to fatal light attraction of any bird group (Brooke 2004, Rodríguez and Rodríguez 2009, Rodríguez *et al.* 2012, Rodríguez *et al.* 2014), occur off Nova Scotia in small numbers, but the few individuals that use the area are crucially significant to these species' populations because their world population size is so low.

MNNB has advised that the following species have ranges (either maximal or core) that overlap with the Nova Scotia offshore shelf or slope areas or have been observed in these waters:

- Bermuda Petrel (*Pterodroma cahow*)
- Black-capped Petrel (*Pterodroma hasitata*)
- Fea's Petrel (*Pterodroma feae*)
- Zino's Petrel (*Pterodroma madeira*)
- Yelkouan Shearwater (*Puffinus yelkouan*)
- Barolo Shearwater (*Puffinus baroli*)
- Audubon's Shearwater (*Puffinus lherminieri*)
- White-faced Storm-Petrel (*Pelagodroma marina*)
- Band-rumped Storm-Petrel (*Oceanodroma castro*)
- European Storm-Petrel (*Hydrobates pelagicus*)

In addition, MNNB advised that Cory's Shearwater (*Calonectris diomedea borealis*) (included in Table 5.2.13 of the EIS) has been reclassified into two taxa: Scopoli's Shearwater (*Calonectris diomedea*) and Cory's Shearwater (*Calonectris borealis*) (BirdLife International 2016) and that either of these species may occur in the study area. The status of Scopoli's Shearwater on the Nova Scotian continental slope is relatively unknown, but it has been recently recorded over the slope and deep water off the northeastern United States in similar habitat (Howell 2012).

MNNB has advised that there is suitable habitat for the following pelagic seabird species in the RAA: Fea's Petrel, Zino's Petrel, White-faced Storm-Petrel, Band-rumped Storm-Petrel, European Storm- Petrel, Barolo Shearwater, Cory's Shearwater and Audubon's Shearwater.

Specific Question or Request:

a) Further to the assessment of effects on migratory birds in the EIS, and IR 043, which requests information for the Bermuda Petrel and Black-capped petrel, provide background information (*i.e.* seasonal distributions and important biological attributes), as appropriate, and assess potential project effects to each of the following species: Fea's Petrel, Zino's Petrel, White-faced Storm-Petrel, Band-rumped Storm-Petrel, European Storm-Petrel, Barolo Shearwater, Cory's Shearwater and Audubon's Shearwater. The level of analysis for each additional species should be similar to that provided in the EIS for Peregrine Falcon, Piping Plover and Savannah Sparrow. The assessment should review the vulnerability of each of the petrel species to fatal light and flare attraction.

b) Lee (2000) references the development of gas or oil fields off the coast of South Carolina as a grave threat to the remaining Black-capped Petrels at sea. Discuss the relevance of Lee (2000) to the assessment of effects of the Project.

Response: The lists of species provided in Tables 5.2.13 and 7.4.3 of the Environmental Impact Statement (EIS) are not meant to be exhaustive of all taxa that are known or have potential to occur within the offshore environment and as outlined in the EIS, exclude "rare transients / vagrants, except for Species at Risk which are known to occasionally occur." Species at Risk (SAR) are defined in the EIS as species "listed under Schedule 1 of the federal *Species at Risk Act* (SARA) as *endangered*, *threatened*, or of *special concern*; or listed under the Nova Scotia *Endangered Species Act* (NS ESA) as *endangered*, *threatened*, or *vulnerable*". Additional Species of Conservation Concern (SOCC) are defined as "those that are listed as *endangered*, *threatened*, or of *special concern* by COSEWIC, but not yet listed in Schedule 1 of SARA". Background information (*e.g.*, seasonal distributions and important biological attributes) for SAR and SOCC are provided in Section 5.2.8.4 of the EIS. Species that are on the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species (IUCN 2016) are not included in the definition of SAR or SOCC, and requirements to report on these species have not been outlined in the Environmental Impact Statement guidelines for the Project.

It is acknowledged that Fea's petrel (*Pterodroma feae*), Zino's petrel (*Pterodroma madeira*), Audubon's shearwater (*Puffinus lherminieri*), Barolo shearwater (*Puffinus baroli*), Yelkouan shearwater (*Puffinus yelkouan*), white-faced storm-petrel (*Pelagodroma marina*), European storm-petrel (*Hydrobates pelagicus*) and band-rumped storm-petrel (*Oceanodroma castro*) have potential to occur within the Regional Assessment Area (RAA). However, information from the IUCN (2016) indicate that the range for these species is primarily outside of Canadian waters and most may be considered accidental transients to the region (AC CDC

2016), although the status of white-faced storm-petrel in Canada is currently considered *present - origin uncertain* (Table 1). The aforementioned species are likely to occasionally occur within the RAA and Eastern Canada Seabirds at Sea (ECSAS) and Programme Intégré de Recherches sur les Oiseaux Pélagiques (PIROP) data obtained for the Project confirm that some have been recorded in the waters of the Scotian Shelf and Slope, with records of Audubon's shearwater being most common (Table 1). In contrast, Cory's shearwater is known to regularly occur in waters of the Scotian Shelf and Slope (Table 1). This species breeds in the northern hemisphere in association with the Azores, Madeira, Berlangas Archipelago, and Canary Islands and most birds migrate into the Atlantic in late summer and autumn (Brooke 2004). ECSAS and PIROP data indicate that Cory's shearwater has been recorded in the region from late spring into fall, and are most commonly observed in August.

Because of their nocturnal habits, petrels and other Procellariiform seabirds are generally considered vulnerable to artificial lighting (Imber 1975; Huntingdon *et al.* 1996; Le Corre *et al.* 2002; Rodríguez and Rodríguez 2009). For example, black-capped petrels (*Pterodroma hasitata*) are known to be attracted to bright lights and are therefore considered susceptible to collisions with lighted ships and platforms (Simons *et al.* 2013). While it is acknowledged that offshore development may pose a threat to the remaining population of black-capped petrels, this threat is likely to be more substantial in southern localities, such as off the coast of South Carolina, than near the Project. In particular, the Scotian Shelf and Slope is not within the primary foraging range for black-capped petrels, which includes waters in and adjacent to the Florida Current and the Gulf Stream between north Florida and southern Virginia (Simons *et al.* 2013; Hass *et al.* 2014). Although black-capped petrels may occasional occur in waters of the Scotian Shelf and Slope, available information sources do not indicate that they regularly occur in important abundances in the area.

Information on the global status of the aforementioned species, as determined by the IUCN (2016), is available in Table 1 and in response to IR-043. The global status of Barolo shearwater and Fea's petrel have not yet been assessed for the IUCN Red List (IUCN 2016) and the status of Audubon's Shearwater, band-rumped storm-petrel, Cory's shearwater, European storm-petrel, and white-faced storm-petrel is considered of *least concern* (Table 1). The global status of the Yelkouan shearwater and Zino's petrel have been evaluated as *vulnerable* and *endangered* by the IUCN, respectively (Table 1). In consideration of the EIS Guidelines for the Project and the likely occurrence of the aforementioned species within the RAA, detailed background information (*e.g.*, seasonal distributions and important biological attributes) is not provided for species except those identified as SAR or SOCC.

References:

Brooke, M. 2004. Albatrosses and petrels across the world. Oxford University Press, Oxford.

Hass, T.; J. Hyman, and B.X. Semmens. 2012. Climate change, heightened hurricane activity, and extinction risk for an endangered tropical seabird, the black-capped petrel *Pterodroma hasitata*. Mar Ecol Prog Ser 454:251-261. https://doi.org/10.3354/meps09723

Huntington, C. E., R. G. Butler and R. A. Mauck. 1996. Leach's Storm-petrel, *Oceanodroma leucorhoa*. Pages 1-32 in A. Poole and F. Gill (eds.), The Birds of North America, No. 233. The Birds of North America, Inc., Philadelphia, PA.

Imber, M. 1975. Behavior of petrels in relation to the moon and artificial lights. Notornis, 22: 302-306.

IUCN (International Union for Conservation of Nature and Natural Resources). 2016. The IUCN Red List of Threatened Species. Version 2016-3. <www.iucnredlist.org>. Accessed February 2017.

Le Corre, M., Ollivier, A., Ribes, S.B., and Jouventin, P. 2002. Light-induced mortality of petrels : a 4 year study from Réunion Island (Indian Ocean). Biological Conservation, 95:93-102 *et al.* 2002.

Rodríguez, A., and Rodríguez, B. 2009. Attraction of petrels to artificial lights in the Canary Islands: effects of the moon phase and age class. Ibis, 151:299-310.

Simons, T.R.; D.S. Lee; and J.C. Haney. 2013. Diablotin *Pterodroma hasitata*: a biography of the endangered Black-capped Petrel. Marine Orthinology, 41: 1-43. Available at: https://pubs.er.usgs.gov/publication/70154814

Table 1 ECSAS and PIROP records for species of interest on the Scotian Shelf and Slope

Common Name	Scientific Name	IUCN Assessment[1]	Canadian Status[1]	AC CDC S-Rank (Nova Scotia)	ECSAS and PIROP	
					# Records	# Individuals
Fea's Petrel	*Pterodroma feae*	na	na	SNA (accidental transient)	0	0
Zino's Petrel	*Pterodroma madeira*	Endangered	N/A	na	0	0
Cory's Shearwater	*Calonectris borealis*	Least Concern	Native	na	1037	2980
Audubon's Shearwater	*Puffinus lherminieri*	Least Concern	N/A	SNA (accidental transient)	44	81
Barolo Shearwater	*Puffinus baroli*	na	na	SNA (accidental transient)	0	0
Yelkouan Shearwater	*Puffinus yelkouan*	Vulnerable	N/A	na	2	2
White-faced Storm-petrel	*Pelagodroma marina*	Least Concern	Present - origin uncertain	SNA (accidental transient)	3	11
European Storm-petrel	*Hydrobates pelagicus*	Least Concern	N/A	SNA (accidental transient)	0	0
Band-rumped Storm-petrel	*Oceanodroma castro*	Least Concern	N/A	SNA (accidental transient)	2	2

[1]From IUCN (2016), na = not assessed; N/A = not applicable (*i.e.*, not considered within Canadian range)

Information Request (IR) IR-098 (MNNB-17)

Applicable CEAA 2012 effect(s): 5(1)(a)(iii) migratory birds

EIS Guidelines Reference: Part 2, Section 6.1.4 Migratory Birds and their Habitat

EIS Reference: 5.2.8 Migratory Birds

Context and Rationale: The MNNB noted that during the monitoring program undertaken for the Tangier 3D Seismic Survey, "vessel crews encountered 19 stranded birds and 26 dead birds. The stranded birds consisted of 18 Storm-Petrels and one Magnolia Warbler. The majority of deceased birds were passerines (RPS 2014)" (EIS, Section 5.2.8.1, pg. 5.158). The MNNB noted that the number of birds that survived stranding and the species composition of the dead birds provide context for understanding the nature and potential magnitude of effects on migratory birds.

Specific Question or Request: Review the results of the monitoring program from the Tangier 3D Seismic Survey and discuss the relevance of the results to the Project. Specifically, and to the extent known:

a) indicate if the occurrence of stranded and dead birds is associated with nocturnal attraction to lights. If not, indicate potential alternative cause;
b) describe what was done with the stranded birds;
c) provide the post-encounter survival rate of the stranded birds and explain how it was determined; and
d) provide the species composition of the dead birds.
e) Describe how the above-noted information affects the assessment of effects of the Project on migratory birds.

Response: During the monitoring program for the Tangier 3D Seismic Survey, stranded birds were recovered and released using the handling methods devised by Williams and Chardine (1999), whereas dead birds were disposed of at sea through incineration (RPS Energy Canada 2014). Stranded birds were released after a recovery period during which they were held in a box and allowed to dry (if found wet) and settle after being handled. Stranded storm petrels were released during darkness. Data indicate that of the 19 live birds that were found stranded, 18 were released. One warbler died during the recovery period; all other stranded birds were storm-petrels and were released. The overall post-encounter survival rate was approximately 95% between capture and release. Of the dead birds encountered, 62% were passerines and 38% were storm-petrels (Table 1). Although the Wildlife Observation Report for the BP Tangier 3D Wide Azimuth Towed Streamer (WATS) Seismic Survey did not provide information on whether the occurrence of stranded and dead birds was associated with nocturnal attraction to lights or other causes (and information on the timing of the bird strandings or deaths was not provided), surveys were preferentially conducted at night to target birds that may be attracted to light and the species composition of the birds encountered (*e.g.*, storm-petrels and nocturnal migrants) suggest that lighting was likely an important influence. The above-noted information does not influence the characterization of environmental effects of the Project on migratory birds beyond those already outlined in the Environmental Impact Statement (EIS).

Table 1 Stranded and Dead Birds Found During Vessel Searches - BP Tangier 3D WATS Seismic Survey

Species	Number Stranded and Released	Number Found Deceased
Leach's Storm Petrel	11	3
Wilson's Storm Petrel	3	4
Unidentified Storm Petrel	4	3
Barn Swallow	0	1
Black-billed Cuckoo	0	1
Lesser Goldfinch	0	1
White-eyed Vireo	0	1
Savannah Sparrow	0	2
Unidentified Sparrow	0	2
Black and White Warbler	0	1
Chestnut Warbler	0	1
Magnolia Warbler[2]	1	0
Yellow Warbler	0	1
Yellow-rumped Warbler	0	1
Unidentified Warbler	0	2
Unidentified Passerine	0	2
Total	19	26

[1] Adopted from RPS Energy Canada (2014)
[2] Found alive, but died during the recovery period and was therefore not released

References:

RPS Energy Canada. 2014. Wildlife Observation Report. BP Tangier 3D WATS Seismic Survey. Halifax, Nova Scotia.

Williams, U., and Chardine, J. 1999. The Leach's Storm Petrel: General Information and Handling Instructions. 4 pp. Available from: http://www.cnlopb.nl.ca/pdfs/mkiseislab/mki_app_h.pdf.

Information Request (IR) IR-099 (MNNB-34)

Applicable CEAA 2012 effect(s): 5(1)(a)(iii) migratory birds

EIS Guidelines Reference: Part 2, Sections 6.3.5 Migratory Birds, 6.4 Mitigation and 6.6.3 Cumulative Effects Assessment

EIS Reference: 10.2.5 Assessment of Cumulative Environmental Effects on Migratory Birds, 10.2.5.1 Change in Risk of Mortality or Physical Injury, p. 10.39

Context and Rationale: The EIS states that "routine checks for stranded birds on the MODU and PSVs and appropriate procedures for release (*i.e.* the protocol outlined in *The Leach's Storm Petrel: General Information and Handling Instructions* (Williams and Chardine, 1999)) will be implemented to mitigate the environmental effects of Project-related artificial night lighting and flaring on birds" (EIS, Section 10.2.5, p 10.41). The MNNB has noted that there is no evidence presented to support that birds captured and released in accordance with the protocol survive.

Specific Question or Request: Further to IR 098 which asks about general survival rates of stranded birds, indicate if there is literature or data available about survival rates of stranded storm-petrels released specifically in accordance with the Williams and Chardine protocol (or ECCC's expanded protocol as discussed in IR 042). Provide a summary of information found and discuss any implications for the prediction of effects from the Project.

Response: A literature review did not identify information sources detailing the post-release survival rates of stranded storm-petrels released in accordance with the Williams and Chardine (1999) or Environment Canada's (2015 draft) protocols. However, available data indicate that the mortality rate for the time between the capture and release of storm-petrels (*i.e.*, which includes a recovery / stabilization phase) is low. For example, all of the 18 stranded storm-petrels encountered during the Tangier 3D Seismic Survey were successfully released (RPS Energy Canada 2014), as were all 16 storm-petrels captured as part of the Cheshire Environmental Effects Monitoring (EEM) program (Shell 2017). Data collected as part of a pelagic seabird monitoring program at offshore oil and gas sites on the Grand Banks between 1997 and 2002 indicated that 74% of stranded birds were released and 3% died, but the fate of 23% was not known because of insufficient data entry (Baillie *et al.* 2005). This information is not considered to have implications for the characterization of predicted residual effects beyond those currently described for migratory birds in Sections 7.4.8 and 10.2.5 of the Environmental Impact Statement (EIS).

References:

Environment Canada. 2015. Best practices for stranded birds encountered offshore Atlantic Canada. Draft 2 – April 17 2015. Available from: http://www.cnlopb.ca/pdfs/mg3/strandbird.pdf.

RPS Energy Canada. 2014. Wildlife Observation Report. BP Tangier 3D WATS Seismic Survey. Halifax, Nova Scotia. Get reference

Shell. 2017. Canadian Environmental Assessment Agency Closure Report for Cheshire L-97A Well. Shelburne Basin Venture Exploration Drilling Project.

Williams, U., and Chardine, J. 1999. The Leach's Storm Petrel: General Information and Handling Instructions. 4 pp. Available from: http://www.cnlopb.nl.ca/pdfs/mkiseislab/mki_app_h.pdf.

Information Request (IR) IR-100 (MNNB-18)

Applicable CEAA 2012 effect(s): 5(1)(a)(iii) migratory birds

EIS Guidelines Reference: Part 2, Section 6.1.4 Migratory Birds and their Habitat

EIS Reference: 5.2.8 Migratory Birds, p. 5.160

Context and Rationale: The MNNB is aware that the Nova Scotia continental shelf area has been subjected to extensive ship-based seismic surveys and these vessels normally carry observers on board to conduct marine bird surveys. The EIS states that "most of the surveys were conducted from either oil industry supply ships or DFO research/fishery patrol vessels with a small number of surveys conducted from ferries, cargo vessels, seismic ships or sailboats" (Section 5.2.8.1, p. 5.160). The MNNB stated that it considers marine bird survey information from seismic ships to be important baseline information because few other survey vessels have covered the remote Nova Scotia continental slope area.

Specific Question or Request: Review seabird survey data from seismic ships from the Nova Scotia continental slope as relevant to the assessment of effects of this Project, including observations of seabirds (such as Bermuda and Black-capped Petrels) that were made by Mike Force (2014) and Bruce Mactavish (2003). Describe how resulting information affects the assessment of effects of the Project on migratory birds.

Response: Eastern Canada Seabirds at Sea (ECSAS) data contains information collected by marine observers on offshore vessels inclusive of seismic ships (Gjerdrum *et. al.* 2012), and was obtained for the Project to support the description of baseline conditions and the characterization of potential residual environmental effects. However, because data received in support of the Project did not include the vessel type, information specific to seismic ship surveys is not available without further request to the Canadian Wildlife Service (CWS). The statements made in the Environmental Impact Statement (EIS) regarding the vessel type (*i.e.*, as quoted in the Context and Rationale for IR-100) refer to a 3.5-year offshore seabird monitoring program conducted by Fifield *et al.* (2009) and do not necessarily represent the inclusion of observations from seismic surveys for the larger ECSAS program.

It is acknowledged that there have been observations of marine birds collected from seismic ships that are not integrated into ECSAS and Programme Intégré de Recherches sur les Oiseaux Pélagiques (PIROP) datasets obtained for the Project; including those relayed to MNNB through personal communication. However, because ECSAS and PIROP datasets are considered to represent the largest data sets available for information on offshore observations of seabirds in association with the Scotian Shelf and Slope, they have been relied upon to support the characterization of baseline conditions and determination of likely residual effects in the EIS. Although it is acknowledged that additional observations of species of interest may exist from seismic ships, such records are not expected to result in changes to the assessment of effects of the Project on migratory birds. Additional information on the occurrence of the Bermuda petrel (*Pterodroma cahow*) and the Black-capped petrel (*Pterodroma hasitata*) in relation to the Project is available in response to IR-043 and information on other accidental transients is provided in response to IR-097.

References:

Fifield, D.A., Lewis, K.P., Gjerdrum, C., Robertson, G.J., and Wells, R. 2009. Offshore seabird monitoring program. Environ. Stud. Res. Funds Rep. No. 183: v + 68pp. + App.

Gjerdrum, C., D.A. Fifield, and S.I. Wilhelm. 2012. Eastern Canada Seabirds at Sea (ECSAS) standardized protocol for pelagic seabird surveys from moving and stationary platforms. Canadian Wildlife Service Technical Report Series No. 515. Atlantic Region. vi + 37 pp.

Information Request (IR) IR-101 (MNNB-19)

Applicable CEAA 2012 effect(s): 5(1)(a)(iii) migratory birds

EIS Guidelines Reference: Part 2, Section 6.1.4 Migratory Birds and their Habitat

EIS Reference: 5.2.8 Migratory Birds, p. 5.166

Context and Rationale: The EIS states that "shearwaters are common summer and fall visitors on the Scotian Shelf and Slope but spend the winter months in the southern hemisphere, where they breed" (EIS, Section 5.2.8.1, p. 5.166). The MNNB has noted that among the shearwater species mentioned, only Great and Sooty Shearwaters spend the winter months breeding in the southern hemisphere (Brooke 2004). Cory's Shearwaters breed in the Mediterranean (Scopoli's) and in the Azores, Madeira and Canary Islands (Cory's) in the northern hemisphere (Brooke 2004).

The MNNB advised that Manx Shearwaters breed only in the northern hemisphere in summer (mostly British Isles, also in Newfoundland, approximately 280 nautical miles (520 kilometres) northeast of the RAA (Roule 2010) and winter (non-breeding) in the South Atlantic (Brooke 2004). Audubon's Shearwaters breed only in the northern hemisphere in summer (Caribbean, extirpated from Bermuda) and do not migrate to the South Atlantic (Brooke 2004).

Specific Question or Request: Discuss whether this new breeding-location information would influence the conclusions about potential effects on migratory birds. Provide an update to the assessment of effects, as appropriate.

Response: Although it is acknowledged that there are shearwater species that breed in the northern hemisphere that are known to occur in the Scotian Shelf and Slope, the vast majority of those in the region breed in the southern hemisphere. In particular, approximately 97% of the shearwater observations that were identified to species within the Eastern Canada Seabirds at Sea (ECSAS) and Programme Intégré de Recherches sur les Oiseaux Pélagiques (PIROP) datasets obtained for the Project are great or sooty shearwaters (*Puffinus gravis* and *P. griseus*). However, in consideration of the presence of shearwater species that breed in both the southern and northern hemispheres, text in Section 5.2.8.1 of the Environmental Impact Statement (EIS) should be modified to read:

"PIROP and ECSAS data indicate that shearwaters are particularly abundant in offshore waters in summer and fall and widely distributed along the Scotian Shelf and Slope (Figure 11 in Appendix F). Although encountered less frequently during spring, they may occur throughout much of the area at this time of year, with larger concentrations often occurring near the edge of the shelf (Figure 11 in Appendix F). Great Shearwater account for the majority of shearwater observations in the PIROP and ECSAS databases, although Sooty Shearwaters are also relatively abundant. Both of these species spend the winter months in the southern hemisphere where they breed. Other species of shearwater that have been observed on the Scotian Shelf and Slope include Cory's Shearwater (*Calonectris borealis*), Manx Shearwater (*Puffinus puffinus*), Audubon's Shearwater (*P. lherminieri*), and Yelkouan Shearwater (*P. yelkouan*), all of which breed in the northern hemisphere."

This information is not considered to alter the characterization of residual environmental effects of the Project on migratory birds, as outlined in the EIS.

Information Request (IR) IR-102 (MNNB-25)

Applicable CEAA 2012 effect(s): 5(1)(a)(iii) migratory birds

EIS Guidelines Reference: Part 2, Section 6.3.5 Migratory Birds

EIS Reference: Section 7.4.3 Potential Environmental Effects, Pathways and Measurable Parameters, p. 544; 7.4.5 Criteria for Characterizing Residual Environmental Effects and Determining Significance, p. 7.86

Context and Rationale: The EIS states that "the RAA is restricted to the 200 nautical mile limit of Canada's Exclusive Economic Zone (EEZ), including offshore marine waters of the Scotian Shelf and Slope within Canadian jurisdiction" (Section 7.4.3, p. 7.82). The MNNB noted that while migratory birds do not breed in the PA, their ranges include extensive parts of continental North America and the North and South Atlantic Oceans. Seabirds, in particular, are wide-ranging species whose breeding populations are based on remote islands and coastlines scattered across the Atlantic, Arctic and Antarctic Oceans. The MNNB has noted that the spatial area boundaries described in the EIS are political and likely do not reflect ecological boundaries.

The MNNB expressed concern that the definition of significant adverse residual effect used by the proponent, particularly that "natural recruitment may not re-establish the population(s) to its original level within one generation" (EIS, Section 7.4.5, p. 7.86) is not relevant to migratory birds occurring inside the RAA that breed outside the RAA. The limitation of effects assessment for migratory birds to the RAA therefore almost by definition omits attention to most potential effects on migratory birds, because the Project is sited on the open ocean and migratory birds do not breed on the sea surface. Due to density dependent factors, harmful effects on seabird populations might not measurably change abundance in the RAA (Lewis *et al.* 2001).

Specific Question or Request: Further to IR 004 that requests the rationale for the spatial scopes used in the cumulative effects assessments, discuss how adjusting the spatial scope for migratory birds based on an ecological perspective that takes into account their full ranges and breeding locations could influence the analysis of cumulative effects on migratory birds. If it could affect conclusions, provide additional effects analysis.

Response: The spatial boundaries for the assessment of migratory birds are established based on the potential extent of Project-related effects. Whereas routine project operations are limited to the Local Assessment Area (LAA), the Regional Assessment Area (RAA) provides regional context, used to account for effects from other physical activities potentially overlapping with Project effects (*i.e.*, cumulative effects), and was drawn to accommodate the relatively large area that could be affected in the unlikely event of a substantial spill (*e.g.*, well blowout). It is acknowledged that the range of many migratory birds extend beyond the RAA and there is potential for individuals of these species to be affected by the combined residual environmental effects of the Project and effects from other stressors within and beyond the RAA. However, in many cases, these "external" stressors are reflected in species' status and population descriptions and effects of other projects and activities (*e.g.*, fishing, shipping, oil and gas activities) within the RAA would also resemble those from stressors outside the RAA. The use of political boundaries in the definition of the RAA also suggests an area within which BP and Canada could reasonably influence environmental management of species, and for which there is greater certainty around effects predictions and mitigative solutions.

Adjusting the spatial scope for migratory birds based on an ecological perspective that "takes into account their full ranges and breeding locations" would be impractical because the diversity of species and the extent of their ranges would necessitate a RAA that is global in nature. Adopting an RAA that is global in nature would act to weaken the characterization of residual effects for magnitude and may dilute the ability of the EIS to identify a significant adverse residual environmental effect (*i.e.*, since a larger area would be used to provide context for the evaluation of Project effects). The definition of a significant adverse residual effect is not specific to species that breed within the RAA, but refers to the populations of all migratory birds that may be influenced by Project activities independent of where they breed.

Information Request (IR) IR-103 (MNNB-28)

Applicable CEAA 2012 effect(s): 5(1)(a)(iii) migratory birds

EIS Guidelines Reference: Part 2, Sections 6.3.5 Migratory Birds and 6.4 Mitigation

EIS Reference: 7.4.8.2 Mitigation of Project-Related Environmental Effects, p. 7.92-7.93

Context and Rationale: The EIS states that "lighting will be reduced to the extent that worker safety and safe operations is not compromised. Reduction of light may include avoiding use of unnecessary lighting, shading, and directing lights towards the deck" (Section 7.4.8.2 p. 7.92-7.93). The MNNB expressed concern that without specific detailed information concerning what (and when) unnecessary lighting will be extinguished, exact dimensions and descriptions of shades for light fixtures, and exact dimensions and descriptions of light fixtures in relation to directing light radiation towards the deck, is it very difficult to assess the effectiveness of this general mitigation measure. The MNNB also noted that blackout curtains or blinds on all portholes and windows are not mentioned as a mitigation measure for light attraction, even though this would appear to be helpful.

Specific Question or Request: Although it is not possible to provide exact lighting specifications until a MODU has been selected, the environmental assessment can assess the range of potential alternatives under consideration. In order to better understand potential effects of lights on migratory birds and related mitigation, the following information is required:

a) Further to IR 018, which discuss alternatives that could reduce bird attraction to flares and lights, provide information, with examples, on whether there is unnecessary lighting as part of the Project that would be extinguished (*e.g.* blackout curtains or blinds on portholes); and

b) Explain what measures would be implemented to direct light radiation inward towards work areas and limit light emanating from the MODU that could attract migratory birds. If specific information is not available, describe any industry best practices that would be followed.

Response: BP will contract a mobile offshore drilling unit (MODU) to support Project-related exploration drilling activities. The MODU will be owned and operated by a third party. Procurement activity for the MODU is in progress and the selection of the MODU has not been confirmed. Information on whether there is unnecessary lighting that would be extinguished or whether there are measures that would be implemented to direct light radiation inward towards work areas and limit light emanating from the MODU, is not currently available. BP has been advised that the use of blackout curtains or blinds on portholes is not considered standard practice and is unlikely to be adopted on the MODU. Information on industry best practices for reducing lights on MODUs is not currently available but efforts will be made to reduce lighting to the extent that worker safety and safe operations is not compromised.

Information Request (IR) IR-104 (MNNB-29)

Applicable CEAA 2012 effect(s): 5(1)(a)(iii) migratory birds

EIS Guidelines Reference: Part 2, Sections 6.3.5 Migratory Birds

EIS Reference: 7.4.8.3 Characterization of Residual Project-Related Environmental Effects, Change in Risk of Mortality or Physical Injury, Presence and Operation of the MODU, p. 7.93

Context and Rationale: The MNNB has advised that the summary of seabird species vulnerable to light attraction on p.7.93 omits a variety of seabirds known to be light-attracted. For example, the MNNB stated that Pterodroma spp. petrels have been found to be vulnerable to fatal light attraction at fishing vessels in the southern ocean (Thompson 2013) and to fixed lighting on shore (Telfer *et al.* 1987, Le Corre *et al.* 2002, Rodríguez and Rodríguez 2009, Rodríguez *et al.* 2012, Rodríguez *et al.* 2014). Bermuda Petrel in particular was noted as vulnerable to light attraction by Beebe (1935). Band-rumped Storm- petrels in Hawaii were victims of light attraction (Telfer *et al.* 1987). Dovekies (Wiese *et al.* 2001) and other small auks (Dick and Donaldson 1978) and common eiders (Merkel and Johansen 2011) are known to be vulnerable to light attraction to vessels at sea and lighthouses. Merkel and Johansen (2011) also noted Thick-billed Murres, Black Guillemots and Long-tailed Ducks as victims of light-induced nocturnal bird strikes on vessels in Greenland. Wiese *et al.* (2001) described reports of large numbers of Dovekies being attracted to lights at offshore oil platforms in Newfoundland and recommended a long-term systematic investigation.

Specific Question or Request: Further to IR 043, which requests further information about effects on Bermuda and Black-capped Petrel, consider the potential occurrence of- and light attraction from the Project in relation to the other above-listed species. Update the effects assessment, proposed mitigation and conclusions of significance of potential effects on migratory birds, as applicable.

Response: Section 7.4.8 of the Environmental Impact Statement (EIS) provides an overview of seabird vulnerability to light attraction and is not intended to be a complete review of known interactions and vulnerability of all individual seabird species to light sources. Although the discussion on bird vulnerability to lighting in the EIS is general, specific reference is made to storm-petrels since these, along with nocturnal migrants, are most at risk of attraction to offshore lighting (Environment Canada 2015). In particular, Leach's storm-petrel (*Oceanodroma leucorhoa*) is considered the most common species to interact with offshore activities on the Scotian Shelf and Slope (Environment Canada 2015; Shell 2017). Additional information on vulnerability of storm-petrels and other Procellariiform seabirds to offshore lighting is available in the response to IR-097. It is acknowledged that additional species have potential to be affected by Project lighting, including those referenced in the Context and Rationale for IR-104 (*i.e.*, Pterodroma spp. petrels, common eiders, long-tailed ducks, thick-billed murres, black guillemots, dovekies and other small auks). The characterization of the residual environmental effects, proposed mitigation, and the determination of significance associated with the presence and operation of the MODU (*i.e.*, as described in Section 7.4.8 of the EIS) takes into account the likely interaction between Project lighting and all migratory birds and remains unchanged with further consideration of the potential occurrence and attraction of the aforementioned species.

References:

Environment Canada. 2015. Best practices for stranded birds encountered offshore Atlantic Canada. Draft 2 – April 17 2015. Available from: http://www.cnlopb.ca/pdfs/mg3/strandbird.pdf.

Shell. 2017. Canadian Environmental Assessment Agency Closure Report for Cheshire L-97A Well. Shelburne Basin Venture Exploration Drilling Project.

Information Request (IR) IR-105 (MNNB-30 and MNNB-31)

Applicable CEAA 2012 effect(s): 5(1)(a)(iii) migratory birds

EIS Guidelines Reference: Part 2, Sections 6.3.5 Migratory Birds and 6.4 Mitigation

EIS Reference: Section 7.4.8.3 Characterization of Residual Project-Related Environmental Effects, p. 7.95

Context and Rationale: The effect of flaring and lights on birds is stated in the EIS to be reversible. The EIS states: "in consideration of mitigation, including efforts to reduce flaring and exposure to artificial lighting, the Change in Risk of Mortality or Physical Injury as a result of the presence and operation of the MODU is predicted to be adverse, low to moderate in magnitude, restricted to the PA, continuous throughout the Project, medium-term in duration, and reversible" (EIS, Section 7.4.8.3, p. 7.95).

The EIS also states that "With the application of proposed mitigation and environmental protection measures, the residual environmental effect on migratory birds during routine Project activities is predicted to be not significant. This conclusion has been determined with a high level of confidence based on an understanding of the general effects of routine exploration drilling and the effectiveness of mitigation measures. The greatest risk to migratory birds from routine Project activities and components was identified as a potential Change in Risk of Mortality or Physical Injury as a result of the presence of the MODU and the transiting PSVs (see Table 7.4.5)" (EIS, Section 7.4.9 Determination of Significance, p. 7.101).

The MNNB has advised the Agency that in its view, the conclusion of no significant environmental effect on bird populations from light attraction is not well-supported. The MNNB noted that gadfly petrels' populations are especially vulnerable to fatal light attraction (*e.g.*, Reed *et al.* 1985, Le Corre *et al.* 2002), indicating an extreme level of concern about the project's potential effects on this species. As long-lived seabirds, the MNNB advises that these (and other seabird species mentioned in the EIS) are 'survival-species' vulnerable to any human-caused adult mortality (Saether and Bakke 2000) and project-induced fatalities could have serious consequences for their populations.

Specific Question or Request: Further to IR 041, which requests information about specific mitigation measures proposed to reduce effects of flaring, and IR 103 which requests further information about reducing light emissions from the MODU, describe if and how those measures have been shown to be effective in mitigating effects of lights on seabirds. Provide a rationale to support the prediction in the EIS that effects of flaring on birds are reversible. Support the response with peer reviewed literature or data, or indicate that no literature is available.

Response: A rationale to support the prediction that Project effects of flaring is reversible is provided in Section 7.4.8.3 of the Environmental Impact Statement (EIS). Although it is acknowledged that flaring has the potential to cause adverse effects to migratory birds, flaring activities associated with the Project will be short term in duration and intermittent in frequency. In addition to mitigation measures outlined in Section 7.4.8.2 of the EIS, BP commonly uses water curtains where flaring is required in offshore drilling operations around the world. Although no literature has been identified that addresses the effectiveness of the use of water curtains for reducing potential interactions with seabirds, they are expected to deter birds from the general vicinity of the flare because they will be positioned around the flare. Refer to the response provided for IR-018 for more information on flaring and water curtain use.

Because specific methods or industry best practices have not currently been identified to reduce light emissions from the Project, information on how those measures have been shown to be effective in mitigating effects to seabirds cannot be provided. However, refer to response to IR-040 for bird stranding and mortality data collected during exploration drilling at Shell's Cheshire well of the Shelburne Basin Venture Exploration Drilling Project.

Information Request (IR) IR-106 (MNNB-32)

Applicable CEAA 2012 effect(s): 5(1)(a)(iii) migratory birds

EIS Guidelines Reference: Part 2, Sections 6.3.5 Migratory Birds and 6.4 Mitigation

EIS Reference: 7.4.10 Follow-up and Monitoring, p. 7.101

Context and Rationale: The MNNB has advised that the following storm-petrels are known to occur in the RAA: Leach's Storm-Petrel, Wilson's Storm-Petrel, Band-rumped Storm-Petrel, European Storm- Petrel and White-faced Storm-Petrel (Endangered, BirdLife International 2016). While none of these species are SARA-listed or COSEWIC-assessed, they are migratory birds protected under the *Migratory Birds Convention A*ct when in Canada and some of these species are identified globally as at risk (BirdLife International 2016). Three, including the globally-endangered White-faced Storm-Petrel, are not mentioned for crew education (*e.g.* "To differentiate between Wilson's Storm-Petrel (*Oceanites oceanicus*) and Leach's Storm-Petrel, photographs depicting their differences will be provided to crew members trained to check for and handle stranded birds" (EIS, Section 7.4.10, p. 7.101). The MNNB has also noted that other petrels that are vulnerable to light attraction and are known to occur in the RAA are not mentioned for crew education. These are: Bermuda, Black-capped, Fea and Zino' s Petrels. The MNNB is concerned that if crew members are not familiar with all possible storm-petrel and petrel species expected at the platforms (or if a protocol for collecting, freezing and passing all dead birds to experts for identification is not implemented), follow-up and monitoring of project environmental effects will not be rigorous or sufficient, especially for globally-endangered bird species.

Specific Question or Request:

a) Provide a rationale for why the list of storm-petrels (and other petrels) slated for crew member education should be limited to two common species (Leach's and Wilson's Storm-Petrels), or update the list as appropriate.

b) Explain how less-common petrel species would be identified during monitoring. Advise whether potential corpses would be collected for identification by experts.

c) In the event that an individual of a bird species listed in Schedule I of SARA, or assessed by COSEWIC as endangered or threatened, is found dead on the platforms, describe what additional mitigation, if any, would be undertaken to prevent further mortality.

Response: As part of the Environmental Effects Monitoring (EEM) program for the Project, BP will develop bird handling guidelines in consultation with the Canadian Wildlife Service (CWS) and provide these to personnel onboard the mobile offshore drilling unit (MODU) and platform supply vessels (PSVs). These guidelines will include instructions on how to manage and document the capture, handling, transport, and release of live and dead birds that may be encountered during the Project. Reference material (*i.e.*, bird field guides / reference photos) will be provided to help differentiate between species that have potential to be encountered, including Leach's storm-petrel (*Oceanodroma leucorhoa*), Wilson's storm-petrel (*Oceanites oceanicus*), band-rumped storm-petrel (*Oceanodroma castro*), European storm-petrel (*Hydrobates pelagicus*), white-faced storm-petrel (*Pelagodroma marina*), Bermuda petrel (*Pterodroma cahow*), black-capped petrel (*Pterodroma hasitata*), Fea's petrel (*Pterodroma feae*), and Zino's petrel (*Pterodroma madeira*).Where species cannot be identified by offshore crew members, photos of injured and dead birds will be sent to BP's environmental / regulatory onshore representative for proper identification and/or discussions with the CWS. In the event that a designated Species at Risk (SAR) is encountered during Project operations, that information will be relayed to the CWS within 24 hours of identification and guidance may be sought for the disposal of the individual; the specimen will be sent to CWS if requested. Although no additional mitigation is currently identified to prevent further mortality of SAR (*i.e.*, in the event of an incident involving a SAR), measures may be identified in consultation with CWS at that time if required.

Information Request (IR) IR-107 (MNNB-33)

Applicable CEAA 2012 effect(s): 5(1)(a)(iii) migratory birds

EIS Guidelines Reference: Part 2, Sections 6.3.5 Migratory Birds and 6.6.1 Effects of Potential Accidents or Malfunctions

EIS Reference: 8.5 Environmental Effects Assessment; 8.5.3.1 Project Pathways for Effects, Effects of Hydrocarbons on Migratory Birds, p. 8.114

Context and Rationale: The MNNB noted that two estimates of seabird mortality resulting from 'operational oil spills' are provided, one from 1991 and one from 1984. The MNNB further noted the EIS statement that "to help provide additional context, it is estimated that approximately 21,000 birds die annually from operational spills on the Atlantic coast of Canada, and 72,000 in all of Canada (Thomson *et al.* 1991). Clark (1984) estimated that 150,000 to 450,000 birds die annually in the North Sea and North Atlantic from oil pollution from all natural and anthropogenic sources" (EIS, Section 8.5.3.1, p 8.116). The MNNB questioned whether the estimates provided in the EIS remain relevant, given their age (25 years and 32 years, respectively).

Specific Question or Request: Advise whether there are more current estimates of seabird mortality from operational oil spills available that are relevant to the area potentially affected by the Project. If so, provide these estimates or describe efforts to locate them. Where additional estimates are found, describe whether they support or alter the assessment of effects on migratory birds included in the EIS. Update the effects assessment and impact predictions accordingly.

Response: Wiese (2002) estimated that approximately 300,000 seabirds die annually in Atlantic Canada as a result of illegal discharges of oil from ships. However, a more recent estimate of the effects of illegal discharges of oil from ships on murres (*Uria* spp.) and dovekie (*Alle alle*) were of approximately 315,000 annual mortalities between 1998 and 2000 in southeastern Newfoundland alone (Wiese and Robertson 2004). As indicated by Wiese (2002) and references therein, long-term sustained mortality rates caused by chronic oil pollution have a similar or greater effect on seabird populations than occasional large spills. However, data indicate that the oiling rate of beached birds on the Scotian Shelf and Slope (*i.e.*, as evidenced by monitoring on Sable Island from 1993-2009, as well as during the 1970s and 1980s) are declining, ranging from a high of 69.9% in 1996 to 1.4% in 2009 (Lucas *et al.* 2012). During seabird monitoring conducted from 1998 to 2007 for the Sable Offshore Energy Project, only one sample was identified where mortality was associated with substances considered typical of offshore gas activities (CNSOPB 2009).

Estimates of seabird mortality as a result of operational oil spills from the offshore oil and gas sector, or chronic oil pollution, do not change the effects assessment for accidental effects in Section 8.5.3, for which a significant residual adverse environmental effect of a blowout incident, large batch spill, or vessel spill is predicted.

References:

CNSOPB [Canadian Nova Scotia Offshore Petroleum Board]. 2011. A Synopsis of Nova Scotia's Offshore Oil and Gas Environmental Effects Monitoring Programs: Summary Report. Available from: http://www.cnsopb.ns.ca/pdfs/EEM_Summary_Report.pdf.

Lucas, Z., Horn, A., and Freedman, B. 2012. Beached bird surveys on Sable Island, Nova Scotia, 1993 to 2009, show a decline in the incidence of oiling. Proceedings of the Nova Scotian Institute of Science., 47: 91-129.

Wiese, F. 2002. Seabirds and Atlantic Canada's ship-source oil pollution: impacts, trends, and solutions. Report prepared for the World Wildlife Fund Canada. Available at: http://awsassets.wwf.ca/downloads/wwf_northwestatlantic

Wiese, F. and G. Robertson. 2004. Assessing Seabird Mortality from Chronic Oil Discharges at Sea. Journal of Wildlife Management 68(3):627-638.

Information Request (IR) IR-108 (MNNB-36)

Applicable CEAA 2012 effect(s): 5(1)(a)(iii) migratory birds

EIS Guidelines Reference: Part 2, Sections 6.3.5 Migratory Birds and 8 Follow-up and Monitoring Programs

EIS Reference: Section 12.2 Follow-up and Monitoring, Table 12.2.1 Summary of Follow-up and Monitoring Programs for the Scotian Basin Exploration Drilling Project (p. 12.3)

Context and Rationale: The EIS states that the proponent will "carry out routine checks for stranded birds or bird mortality on the MODU and PSVs and compliance with the requirements for documenting and reporting any stranded birds (or bird mortalities) to the CWS during the drilling program. If a species at risk is found alive (stranded) or dead on the MODU or PSV, a report will be sent to CWS within 24 hours of identification. Reporting of live migratory seabirds captured and released will be recorded in accordance with a Migratory Bird Permit issued by CWS. A bird monitoring report will be submitted to the CNSOPB within 90 days of well abandonment" (EIS, Section 12.2, p 12.3).

The MNNB has noted that globally-endangered bird species occur in the RAA and that it is unclear if bird species at risk other than those currently considered in the EIS (*e.g.* Section 5.2.8.4), such as species at risk on the International Union for Conservation of Nature (IUCN) Red List (BirdLife International 2016), would be included in this follow-up program. The MNNB also remarked that the results of a 'routine check' are most useful when the detection efficiency is known for both stranded and dead seabirds.

Specific Question or Request:

a) Clarify if globally-endangered or otherwise-at-risk seabirds (*i.e.* from the IUCN Red List, BirdLife International 2016) would be included in the stranded-birds monitoring and reporting procedures outlined in the EIS.

b) Predict what proportion of seabirds that are stranded or die on the platform are expected to be detected via routine checks? What is the expected detection efficiency of the proposed routine check method?

Response: BP will develop bird handling guidelines in consultation with the Canadian Wildlife Service (CWS) and provide these to personnel onboard the mobile offshore drilling unit (MODU) as well as platform supply vessels (PSVs), with instructions on how to manage and document the capture, handling, transport, and release of live and dead birds that may be encountered during the Project. Reference material (*i.e.*, bird field guides / reference photos) will be provided to help differentiate between species that have potential to be encountered. Where species cannot be identified by offshore crew members, photos of injured and dead birds will be sent to BPs environmental / regulatory onshore representative for proper identification and/or discussions with the CWS.

Although specific reporting requirements have been identified for Species at Risk (*e.g.*, CWS will be contacted within 24 hours of identification [refer to response provided for IR-106]), monitoring and reporting will address all stranded and dead birds encountered on the MODU and PSVs, including those identified on the IUCN Red List of Threatened Species (IUCN 2016).

A literature search did not identify any references that document the detection rate of routine checks for stranded or dead seabirds on offshore vessels and it is unknown how many birds are killed but not recovered on offshore oil and gas facilities (Ronconi *et al.* 2015). However, given the relatively small surface area of the MODU and PSVs and the awareness training of the crews, the detection efficiency is expected to be very high.

References:

IUCN (International Union for Conservation of Nature and Natural Resources). 2016. The IUCN Red List of Threatened Species. Version 2016-3. <www.iucnredlist.org>. Downloaded February 2017.

Ronconi, R.A., Allard, K.A., and Taylor, P.D. 2015. Bird interactions with offshore oil and gas platforms: review of impacts and monitoring techniques. Journal of Environmental Management; 147: 34-45.

Information Request (IR) IR-109 (MNNB-37)

Applicable CEAA 2012 effect(s): 5(1)(a)(iii) migratory birds

EIS Guidelines Reference: Part 2, Sections 6.1.4 Migratory Birds and their Habitat and 6.3.5 Migratory Birds

EIS Reference: Figure 5.2.26; Appendix F Migratory Birds Distribution

Context and Rationale: The PA lies mostly beyond the shelf break over 100 nautical miles from land - an area with minimal seabird survey coverage in spring and summer (EIS, Figure 5.2.26). The MNNB commented that most of the area has never been transited by a seabird-survey vessel and it appears to have been transited by only eight cruises at all times of year.

Specific Question or Request:

a) Clarify if expected seabird diversity and abundance in the PA is inferred from seabird surveys that have been conducted specifically within that area, or from surveys over the entire RAA; and

b) Discuss the level of uncertainty associated with inferring seabird diversity and abundance in the PA based on the extent of current surveys. Discuss the extent to which additional surveys or additional data reviewed for IR 100 would reduce that uncertainty or could alter effects predictions.

Response: Although survey data indicate that the densities of seabirds in the offshore environment vary within the region (Lock *et al.* 1994; Fifield *et al.* 2009), those within the Project Area are expected to reflect those in the surrounding areas of the Scotian Shelf and Slope. Inferences regarding the likely occurrence and relative abundances of seabirds within the Project Area are based on surveys within and adjacent to the Project Area (although the diversity and abundances of some species would be greater in proximity to Sable Island), and Eastern Canada Seabirds at Sea (ECSAS) and Programme Intégré de Recherches sur les Oiseaux Pélagiques (PIROP) within the larger Regional Assessment Area (RAA) was referenced for this purpose. Although Figures 1 to 15 in Appendix F of the Environmental Impact Statement (EIS) provide information on the relative abundances of seabirds within the RAA, the only data on seabird densities presented in the EIS is in Table 5.2.15, which is adopted from Fifield *et al.* (2009) and provides data for three ocean regions within Atlantic Canada (*i.e.*, including the Scotian Shelf – Gulf of Maine region, in which the Project is located). Although it is acknowledged that seabird survey coverage within the Project Area is limited (particularly during winter months), Figure 5.2.26 indicates that it has been transited more than is referenced in the Context and Rationale for this IR (*i.e.*, data indicate that it has been transited approximately ten times during each of the spring, summer, and fall seasons, and several times in winter).

ECSAS and PIROP datasets are considered to represent the largest data sets available for information on offshore observations of seabirds in association with the Scotian Shelf and Slope and have therefore been relied upon to support the characterization of baseline conditions and determination of likely residual effects in the EIS. However, it is acknowledged that these data sources are not comprehensive of all known information on seabirds within and adjacent to the Project Area and for this reason additional information sources have also been considered. For example, although ECSAS and PIROP data do not contain any records for the federally endangered ivory gull (*Pagophila eburnea*), this species has been identified as potentially present within the Project Area because other information on its general distribution indicates its potential presence near the Project Area. In consideration of limitations in the current understanding of seabird diversity and abundance in the offshore environment, it is acknowledged that a greater level of survey coverage would result in increased certainty regarding the potential effects of the Project on migratory birds. However, additional data on seabird occurrences are not anticipated to result in important changes to the characterization of residual environmental effects of the Project on migratory birds outlined in the EIS.

References:

Fifield, D.A., Lewis, K.P., Gjerdrum, C., Robertson, G.J., and Wells, R. 2009. Offshore seabird monitoring program. Environ. Stud. Res. Funds Rep. No. 183: v + 68pp. + App.

Lock, A.R., Brown, R.G.B., and Gerriets, S.H. 1994. Gazetteer of Marine Birds in Atlantic Canada. An Atlas of Seabird Vulnerability to Oil Pollution. Canadian Wildlife Service, Environmental Conservation Branch, Environment Canada, Atlantic Region. 137 pp.

Information Request (IR) IR-110 (MNNB-38)

Applicable CEAA 2012 effect(s): 5(1)(a)(iii) migratory birds

EIS Guidelines Reference: Part 2, Sections 6.1.4 Migratory Birds and their Habitat and 6.3.5 Migratory Birds

EIS Reference: Appendix F Migratory Birds Figure 13 Petrels (p. 13)

Context and Rationale: Figure 13 of Appendix F in the EIS is captioned 'Petrels.' The MNNB noted that petrels (Northern Fulmar, gadfly petrels Pterodroma spp., *etc.*) are in the family Procellariidae along with the shearwaters (Puffinus spp.) (Brooke 2004). Storm-petrels (Hydrobatidae) include Wilson's and Leach's Storm-Petrels, *etc.* (Brooke 2004).

Specific Question or Request: Clarify if Figure 13 of Appendix F includes the distribution of petrels or storm-petrels (different bird families). If it does not, indicate where the distribution of storm-petrels (Hydrobatidae) is shown, or provide a new figure.

Response: Figure 13 in Appendix F of the Environmental Impact Statement (EIS) provides information on the relative abundance of storm-petrels (*i.e.*, family Hydrobatidae) on the Scotian Shelf and Slope. Information on the distribution of northern fulmar (*Fulmarus glacialis*) and shearwaters are presented in Figures 8 and 11 of Appendix F, respectively.

Information Request (IR) IR-111 (MTI-10)

Applicable CEAA 2012 effect(s): 5(1)(a)(iii) migratory birds

EIS Guidelines Reference: Part 2, Sections 6.1.4 Migratory Birds and their Habitat, 6.3.5 Migratory Birds and 6.4 Mitigation

EIS Reference: 7.4 Migratory Birds

Context and Rationale: MTI advised the Agency that, while concerns associated with light attraction are likely the main issue for migratory birds, it is concerned that underwater and atmospheric sound from the MODU may result in sensory disturbance to migratory birds, leading to behavioural responses such as temporary habitat avoidance or changes in activity state (*e.g.* feeding, resting, or travelling). The EIS stated that the effects of atmospheric sound are reversible and did not propose related mitigation.

Specific Question or Request: Discuss potential effects of underwater and atmospheric noise on migratory birds, including potential behavioural change such as habitat avoidance. Consider migratory bird routes and timing, and if there are particular periods when these birds could be more vulnerable and effects potentially more pronounced. Describe mitigation to address these effects, if appropriate.

Response: Information on the potential effects of noise to migratory birds is discussed in Section 7.4.8.3 of the Environmental Impact Statement (EIS) with respect to vertical seismic profiling (VSP), which is expected to result in the most intense sounds generated by the Project. Sound generated from the mobile offshore drilling unit (MODU) as a result of the positioning system and drilling activities will be of a more continuous but less intense nature than from VSP activities. It is acknowledged that underwater and atmospheric noise generated by the MODU could potentially result in habitat avoidance by migratory birds but a literature review did not identify specific information on these effects. However, because seabirds are known to occur in higher concentrations around offshore production platforms, including for roosting sites and foraging opportunities (see Wiese *et al.* 2001; Ronconi *et al.* 2015 and references therein), noise levels associated with the MODU are not expected to be an important deterrent.

Information on the seasonal distributions and relative abundances of seabirds in proximity to the Project Area is presented in Section 5.2.8.22 of the EIS and in Appendix F and may be used to infer when they are most vulnerable to exposure to noise generated by Project activities. For example, because auks are generally most abundant on the Scotian Shelf and Slope during spring and winter they may be considered most likely to interact with sound generated by Project activities during those times.

The characterization of residual effects, mitigation and significance determination presented in the EIS remains unchanged.

References:

Ronconi, R.A., Allard, K.A., and Taylor, P.D. 2015. Bird interactions with offshore oil and gas platforms: review of impacts and monitoring techniques. Journal of Environmental Management; 147: 34-45.

Wiese, F.K., Montevecchi, W.A., Davoren, G.K., Huettmann, F., Diamond, A.W., and Linke, J. 2001. Seabirds at risk around offshore oil platforms in the Northwest Atlantic. Mar. Pollut. Bull., 42: 1285-1290.

Information Request (IR) IR-112 (SPANS-02)

Applicable CEAA 2012 effect(s): 5(1)(c)(i) and (iii); 5(2)(b)

EIS Guidelines Reference: Part 2, Section 6.3.9 Commercial Fisheries, and 6.4 Mitigation

EIS Reference: 7.6 Commercial Fisheries

Context and Rationale: If fishing gear is lost or damaged, the EIS indicates that the *Compensation Guidelines Respecting Damages Relating to Offshore Petroleum Activity* put in place by the CNSOPB in 2002 can handle claims. The Seafood Producers Association of Nova Scotia (SPANS) has advised the Agency that it has concerns about whether those guidelines would effectively compensate the fishing industry for losses that are caused by project-induced changes in the environment. Indigenous groups expressed similar concern.

Specific Question or Request: Describe how the proponent would manage claims for loss of, or damage to, fishing gear that are alleged to have been be caused by project-induced changes in the environment.

Response: Project related damage to fishing gear, if any, will be compensated in accordance with the Compensation Guidelines with Respect to Damages Relating to Offshore Petroleum Activity (C-NLOPB and CNSOPB 2002.)

The objective of the Compensation Guidelines is to provide assurance to fishermen and other affected parties that, in the event they suffer actual loss or damage arising from a spill or debris, or incur expenses in taking any remedial action in relation to a spill, all of which can be attributable to an offshore petroleum operator, they will receive both fair and rapid compensation. It also includes a process to provide compensation where damage has occurred as a result of offshore activities but cannot be attributed to a specific operator.

The compensation claims process shown in the figure below will be applied by the Project.

Where damage is attributable to BP, claims in the first instance should be directed to BP. Upon receipt of a claim, BP will review the eligibility of the claim against the Compensation Guidelines and will conduct an investigation to evaluate the basis for the claim and determine an appropriate course of action, including compensation if appropriate. Each claim will be considered on a case by case basis and BP will seek advice from third party experts if required. BP will investigate individual claims thoroughly and will seek to resolve claims as promptly as possible.

In the event that the claimant and BP are unable to settle a claim, the claimant will be encouraged to refer the claim to the CNSOBP for settlement through the Board process. Upon receipt of a claim, the CNOSPB will verify that: the claimant has already approached BP for compensation; the claimant has provided BP with all the necessary information and documentation; and that sufficient time has elapsed to enable the claim to be properly assessed by BP. Following this verification process, the CNSOPB will attempt to achieve a mutually satisfactory agreement between the two parties. In the event that a resolution cannot be reached, the CNSOPB will review the claim for the purposes of settlement.

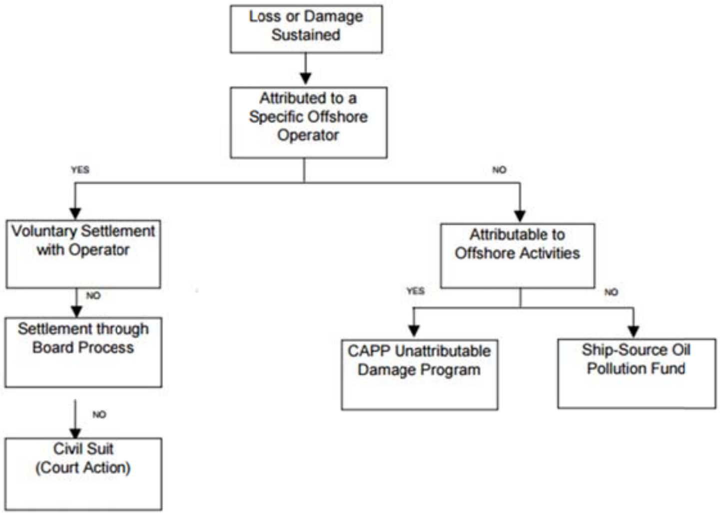


Figure 1 Compensation Claims Process

References:

C-NLOPB and CNSOPB. 2002. Compensation Guidelines Respecting Damages Relating to Offshore Petroleum Activity. Available from: http://www.cnsopb.ns.ca/pdfs/CompGuidelines.pdf

Information Request (IR) IR-113 (SPANS-03)

Applicable CEAA 2012 effect(s): 5(1)(c)(i) and (iii); 5(2)(b)

EIS Guidelines Reference: Part 2, Sections 6.3.9 Commercial Fisheries, 6.4 Mitigation and 6.6.1 Effects of potential accidents or malfunctions

EIS Reference: 7.6 Commercial Fisheries; 8.0 Accidental Events; Appendix H: Oil Spill Trajectory Modelling

Context and Rationale: The EIS shows, in virtually all the stochastic modelling dealing with a worst-case blowout scenario, the potential for oil to reach highly utilized fishing banks along the Scotian Shelf. In the event of such a scenario, SPANS is concerned about effects on commercial fishing enterprises in both the short term (due to exclusion) as well as in the longer term (*e.g.* adverse effects on fish stocks and the habitat they rely upon, market loss due to product tainting or fears thereof). SPANS is particularly concerned that oil on Georges Bank could be detrimental to the life cycles of the many fisheries resources resident there. Although Georges Bank is identified as a one of a number of special areas considered in the EIS, it is largely discussed more generally along with the other areas. The proponent's stochastic worst-case modeling estimates an up-to-30-percent chance of surface oiling thicker than 0.04 micrometres (the threshold for producing sheen) reaching George's Bank 30 to 42 days after a blowout.

Specific Question or Request: Describe more fully the potential effects of a worst-case spill scenario specifically on Georges Bank, including how these effects could affect commercial fishing on Georges Bank in the short-term and the long-term.

Response: While the stochastic model output for a 30-day continuous blowout incident in summer at Site 1 estimates up to a 30% chance of surface oiling thicker than 0.04 μm reaching George's Bank 30 to 42 days after a blowout incident, there is a very low probability (average probability of 0.48%; see Table A5.6 in Appendix H) that in water oiling exceeding a total hydrocarbon (THC) concentration of 58 ppb would reach the area. Surface oiling would have a short-term effect on commercial fisheries in the area due to the likely exclusion of fishing in areas where a sheen is detected (*e.g.*, surface oil exceeds 0.04 μm). Other than creating an temporary exclusion zone in the area where surface oil exceeds 0.04 μm, surface oiling will not impact fish species with respect to an increase in mortality, by causing acute or chronic toxicity to fish species in the area. In the event of an accidental event, including a blowout scenario, BP will implement several mitigation procedures in relation to commercial fisheries which can be viewed in Section 8.5.5.2 of the Environmental Impact Statement (EIS). The issue of tainting is examined in Section 8.5.5.1 of the EIS.

Water column oiling where in-water THC concentration exceeds 58 ppb has the potential to cause acute and chronic toxicity effects on fish species, specifically juvenile larval stages. As described in IR-060, IR-061, and in the EIS, the environmental effects of a blowout on Fish and Fish Habitat are not expected to cause a significant adverse effect. There is the potential for a blowout to have a negative impact on the eggs and larvae of marine fish in areas of the water column where the concentration of THC exceeds the 58 ppb threshold level for effects near the blowout. Furthermore, most fish species within the Regional Assessment Area (including Species at Risk [SAR]) have the potential to spawn in multiple locations and over multiple time periods throughout the year. As a result, the effects from a spill are not expected to negatively impact the entire year class of any species to the level where it would not re-establish its population to original levels within one year or result in the permanent or irreversible loss of critical habitat as defined in a recovery or action plan. In addition, the achievement of self-sustainable population objectives or recovery goals are not expected to be impeded due to the limited area of potential acute and chronic lethality exposure as compared to the potential areas inhabited by marine fish SAR. IR-069 and IR-073 further explore the effects of in-water oiling on fish species on the Scotian Shelf and Slope with regards to benthic communities as well as the application of dispersants.

In consideration of the above information and the fact that there is a <1% to 1% probability of in water THC levels exceeding 58 ppb on Georges Bank, it is unlikely that an accidental event would cause significant long-term effects to commercial fish species or their fishery in the area.

Information Request (IR) IR-114 (MTI-40, MTI-41, MTI-46, MNNB-41, MNNB 46, MNNB-47)

Applicable CEAA 2012 effect(s): 5(1)(c)

EIS Guidelines Reference: Part 2, Sections 5.1 Aboriginal Groups to Engage & Engagement Activities, 6.1.3 Fish and Fish Habitat (baseline), 6.1.9 Aboriginal Peoples, 6.3.1 Fish and Fish Habitat (effects), 6.3.7 Aboriginal Peoples and 6.6.1 Effects of Potential Accidents or Malfunctions

EIS Reference: Appendix B (Traditional Use Study); 7.6 Commercial Fisheries; 7.7 Current Aboriginal Use of Lands and Resources for Traditional Purposes; 8.0 Accidental Events; Appendix I (Aboriginal Fishing Licences Information)

Context and Rationale: The Traditional Use Study (TUS) in Appendix B of the EIS was based on input provided by ten participating Mi'kmaq and Maliseet communities and the Native Council of Nova Scotia, and provides aggregated baseline information and assessment for:

- the Mi'kmaq of Nova Scotia, based on information provided by the communities of Acadia, Eskasoni, Pictou Landing, Glooscap, Membertou, Potlotek (Chapel Island) and Paq'tnkek;
- the Mi'gmaq and Wolastoqiyik (Maliseet) of New Brunswick, based on information provided by the New Brunswick Mi'gmaq community of Fort Folly and the New Brunswick Maliseet communities of St. Mary's and Woodstock; and
- the Native Council of Nova Scotia.

For these communities, the TUS includes aggregate information about species fished by TUS participants, times of year and whether those species occur in the PA, the LAA or RAA and therefore may be fished there. Appendix I of the EIS provides a list of licences held in the Gulf and Scotia-Fundy (Maritimes) DFO regions by Indigenous communities (both TUS participants and non-participants).

Appendix I shows for which Northwest Atlantic Fisheries Organization (NAFO) fishing areas the licences are held, and species that may be fished with those licences. Appendix I also provides an overview of FSC fishing licencing data by location and Aboriginal organization.

Both the MNNB and the MTI expressed concern to the Agency about the completeness of the TUS and whether it adequately captures potential effects on their current use of lands and resources for traditional purposes and related effects on their communities' economies. The MNNB is concerned that there is not enough information provided in the EIS and TUS about their fishing activities to be able to fully understand the potential economic effects of a spill or other incident.

MTI expressed concern, from a socio-economic perspective, about an overall lack of information regarding New Brunswick Mi'gmaq First Nations with respect to assessing project-induced effects on MTI members and their Indigenous fishery. MTI is also concerned that effects on Indigenous lands and resource use were only assessed on an aggregated basis, and expressed the view that effects on Indigenous traditional use need to be assessed and reported on an individual community basis and not on an aggregated basis. MTI noted that while there may be common elements to the activities, resources, and locations where individual Indigenous communities use lands and resources for traditional purposes, each community may be differently affected relative to the location of a proposed project. MTI noted that there are no maps in the EIS or TUS illustrating where fishing or other resource-based activities take place for New Brunswick Mi'gmaq First Nations, other than for Fort Folly. MTI recommended that the proponent re-engage and coordinate with MTI to acquire a more meaningful representative subset that more accurately reflects the full spectrum of the activities taking place by (multiple) New Brunswick Mi'gmaq First Nations, including fishing.

Based on the description of the NAFO fishing area provided in Appendix I, the Agency finds it difficult to discern whether communities that did not participate in TUS may fish in the PA, the LAA, or the RA, based on species occurrence in those areas, and therefore could be affected by the Project.

The Agency noted the TUS conclusion that landings, value and employment generated information was unavailable at the community level for TUS participants, but that, regardless, the TUS states that revenue generated from commercial fishing activities is an important contribution to the overall economy of Mi'kmaq communities. The TUS does not comment on the importance of commercial fishing revenue to the Maliseet.

To enable a better understanding of the full scope of potential effects of the Project on current use and socio-economic conditions, the Agency needs to know the full scope of communities that could be affected by the Project, at the community level and the relative importance of potentially-affected activities to these communities. This baseline information is necessary for the assessment of potential effects on current use for traditional purposes and socio-economic conditions, for example in the event of a large spill or blowout.

Specific Question or Request: For each of the communities listed below, augment the information provided in the EIS to include the following:

- information similar to that provided in sections 5.2 (Commercial Fisheries) and 5.3 (Food, Social and Ceremonial Fisheries) and 5.4 (Summary of Interviews Completed) of the TUS;
- summary tables of species fished, seasons of harvest, occurrence in the PA, LAA and RAA (*e.g.* similar to Table 7 of the TUS);
- a summary of fishing activity in each of the PA, LAA and RAA (similar to sections 5.4.1, 5.4.2 and 5.4.3 of the TUS).
- maps showing the locations where fishing activity is practiced for each of the groupings, similar to those provided in the TUS Appendices.
- a description of the relative importance of fishing activity to the socio-economic conditions of communities in that grouping; provide a quantitative description where feasible.

The communities are:

- Nova Scotia Mi'kmaq communities of Millbrook, Sipekne'katik, Annapolis Valley, Bear River, Wagmatcook and We'koqmaq (Waycobah);
- New Brunswick Mi'gmaq communities of Bouctouche, Eel River Bar Esgenoôpetitj, Indian Island and Pabineau (Gulf Region);
- New Brunswick Maliseet communities of Kingsclear, Oromocto and Tobique;
- Prince Edward Island Mi'kmaq communities of Abegweit and Lennox Island; and
- The Newfoundland and Labrador community of Miawpukek.

This information can be provided in an updated TUS or as a stand-alone document. If included in an updated TUS, clearly indicate where in the updated TUS the information can be found. Where individual communities are unavailable or decline to provide information, please describe efforts to engage these groups and include relevant information in your response to this request.

In light of the information available (both in original EIS and new information arising from this information request), update the assessment of potential adverse effects of the Project on both current use of lands and resources for traditional purposes as well as on socio-economic conditions for the communities listed above. Include in the assessment adverse effects on fishing that may be caused by project-induced changes in the environment, including those due to accidents and malfunctions.

Response: The characterization of Indigenous fisheries (both communal commercial and food, social and ceremonial (FSC) for the Environmental Impact Statement (EIS) was based on licencing data obtained from Fisheries and Oceans Canada (DFO) and information obtained during interviews conducted during the Traditional Use Study (TUS).

TUS participation was guided based on the EIS Guidelines and subsequent discussions with the Canadian Environmental Assessment Agency (CEA Agency) as well as knowledge of fishing interests obtained from DFO. Although the TUS did not target all First Nations in the Maritimes and Gulf Regions, it did target those organizations which have historically been more actively fishing in the Regional Assessment Area (RAA). BP has not limited Indigenous engagement to those organizations included in the TUS (refer to response provided for IR-086 for an update of Indigenous engagement since September 2016).

All 13 Nova Scotia First Nations and the Native Council of Nova Scotia were invited to participate in the TUS. First Nations interested in participating were included in the TUS, specifically Acadia First Nation; Glooscap First Nation; Membertou First Nation; Millbrook First Nation; Waycobah First Nation; Wagmatcook First Nation; Paq'tnkek (Afton) First Nation; Potlokek First Nation; Eskasoni First Nation, and Pictou Landing First Nation.

BP also invited a number of First Nation communities from New Brunswick to participate in the TUS based on information obtained from DFO and the CEA Agency. First Nations from New Brunswick that were included in the TUS include First Folly First Nation; St Marys First Nation and Woodstock First Nation. All First Nation communities (including Eel River Bar (Ugpi'ganjig), Burnt Church (Esgenoopetitj), Indian Island (L'nui Menikuk), Pabineau (Oinpegitjoig), and

Bouctouche (Tjipogtotjg), Abegweit and Lennox Island) which potentially have an interaction with the Project Area were considered as part of the effects assessment as baseline data was obtained from a number of different sources.

It is important to note, that data collected during the TUS is presented in an aggregated format to protect privacy of information provided during the interviews. This is standard practice in the delivery of TUS reports. Likewise, although licencing data was obtained from DFO on a licence holder level, landings data is not accessible at this level for privacy reasons. A separate socio-economic impact assessment for each Indigenous organization as listed above is not feasible (due to the unavailability of community-specific landings data) or required (given the conservative approach used for the assessment) to assess the potential environmental effects of the Project. Reasonable worst case assumptions have been made upon which to base a prediction of the significance of environmental effects and commitments for mitigation and emergency response (*e.g.*, in the event of a large spill). This approach is considered standard and reasonable and conservative (*i.e.*, likely to overstate adverse effects) to address any uncertainties with respect to potential adverse effects.

Based on the data collected, BP has conservatively assumed that any Indigenous organization that has a licence to fish in the RAA could be exercising that right at any time of year and theoretically could potentially interact with the Project. Tables 5.3.8 and 5.3.9 of the EIS show where Indigenous organizations are potentially conducting commercial fishing and the species that are being fished. FSC fishing by Nova Scotia organizations occurs primarily in the nearshore or on the Scotian Shelf, outside of the Project Area but potentially within the LAA and RAA. FSC fishing by New Brunswick and Prince Edward Island (PEI) occurs outside the RAA. BP has also conservatively assumed that although an organization may not be currently exercising their right to conduct FSC fishing, they could choose to do so in the future. For example, because of the widespread nature of the worst-case, unmitigated blowout incident, a significant effect is conservatively predicted for Current Aboriginal Use of Lands and Resources for Traditional Purposes in the highly unlikely event of this scenario. This prediction would apply to any Indigenous fisheries using the affected areas at the time, as would the emergency response measures.

BP continues to engage with Indigenous groups in Nova Scotia, New Brunswick, and PEI to inform them of the Project and to better understand their interests and concerns associated with the Project. BP is also developing a Fisheries Communication Plan which will provide a framework for ongoing engagement with Indigenous and non-Indigenous fisheries organizations during the Project (before, during and at the conclusion of drilling operations).

In the unlikely event of a spill, as indicated in Section 8.5.6 of the EIS, there could potentially be damage to gear and/or implementation of fisheries closures which could potentially result in adverse environmental (including socio-economic) effects on Indigenous fisheries and associated communities. The Fisheries Communication Plan will include incident notification procedures to provide fishers with the opportunity to haul out gear from affecting areas, reducing potential for fouling of gear. Compensation for damage to gear will be in accordance with the Compensation Guidelines Respecting Damages Relating to Offshore

Petroleum Activity (C-NLOPB and CNSOPB 2002). In the unlikely event of a spill, specific monitoring and follow-up programs may also be required.

Information Request (IR) IR-115 (MTI-01)

Applicable CEAA 2012 effect(s): 5(1)(c); 5(1)(a)(i)

EIS Guidelines Reference: Part 2, Sections 6.3.1 Fish and Fish Habitat and Section 6.3.3 Marine Mammals

EIS Reference: 7.2 Fish and Fish Habitat; 7.3 Marine Mammals and Sea Turtles)

Context and Rationale: MTI has raised a concern that there is limited assessment of the specific effects of underwater sound on behaviour or migration of fish and marine mammals in close proximity to fixed developments over the course of all drilling programs. In the EIS, underwater sound levels from the MODU were modelled to predict sound level propagation and to aid the effects assessment. The MODU will generate underwater sounds as a result of the dynamic positioning (DP) system and drilling activities. The DP system will employ thrusters to keep the MODU on location. These thrusters will generate underwater sound through vibration, and through the creation of low pressure points and bubbles known as cavitation; this is the primary mechanism for sounds produced by propellers and thrusters under higher speeds and loads (Leggat *et al.* 1981). Underwater sound will also be generated by drilling activities through mechanical vibration of the MODU and associated machinery located on the vessel. During drilling, the drill string and bit will also emit sound into the marine environment. The EIS recognizes that this noise will have an impact on marine life, but the specifics of the impact are vague.

MTI recognizes that establishing a single sound-exposure criterion for marine fish to predict physical or behavioural changes is challenging, given the variation in sound characteristics from different types of sound sources and differences in how sound affects different species. The EIS applied general criteria for the acoustic modelling conducted for the Project, and suggested that, due to the transient nature of fish, physical injury effects on individual fish due to sound from MODU operation would be localized.

However, there is limited assessment of the specific effects of sound from multiple wells on the behaviour or migration patterns of specific fish and marine mammal species that are important to Mi'gmaq communities and their Indigenous fishery. Based on known physiology of these species and their ability to detect sound at certain distances, MTI has asked whether they will be significantly displaced by continuous sound emissions from all MODU operations.

Specific Question or Request: Although the EIS assesses effects on fish and fish habitat as a whole, assess the effects of underwater sound, from the drilling of multiple wells, considering thresholds for individual MTI culturally-significant or fished species to understand the effects on individuals and population behaviour and migration patterns. Species should include American Eel, Atlantic Sturgeon, Atlantic Bluefin Tuna, Herring and Gaspereau.

Response: Section 7.2.8 of the Environmental Impact Statement (EIS) assesses Project-related environmental effects in which the effects of underwater sound on marine fish species, including American eel, Atlantic sturgeon, Atlantic bluefin tuna, herring, and gaspereau (alewife). This assessment assumes the worst-case scenario where drilling is ongoing 24 hours a day, 365 days a year. It is estimated that each well will take approximately 120 days to drill.

The final schedule has not yet been confirmed which is why it has been assumed that drilling could occur throughout the year. As indicated above and in Section 7.2.8, predicting behavioural changes in fish is challenging given the variation in sound characteristics from different types of sources and interspecific differences in how sound is perceived by and may affect the different fish species. A general behavioral response was noted by McCauley *et al.* (2000) at sound levels of 156 to 161 dB re 1μPa sound pressure level (SPL) root mean square (RMS). Acoustic modelling for the Project (Zykov 2016) predicts sound levels will decrease to below ≤ 150 dB re 1 μPa peak SPL greater than 0.4 km from the mobile offshore drilling unit (MODU) and platform supply vessel (PSV) (maximum R95% value across all seasons and sites, Figure 29, Table 14 in Appendix D of the EIS). As a result, it is expected that the species listed above could have the potential to avoid an area extending 400 m in all directions around the MODU during drilling. This equates to an area of avoidance equalling 0.5 km^2. When comparing this area to the total area of the Regional Assessment Area (RAA), the area which migrating fish may avoid is relatively small and not likely to cause long-term population behaviour or migration behaviour impacts.

Furthermore, most of the species above are rarely found within the Project Area (Atlantic sturgeon, herring, and gaspereau). These three species either spawn in freshwater streams, estuaries, nearshore coastal zones, or areas >150 km from the Project Area (refer to Section 5 of the EIS for life history characteristics of these species). Although these species have the potential to be found in the Project Area, they are not likely to be present. In addition, none of these species are migrating into the RAA from southern waters, thus any avoidance behaviour displayed due to operation of the MODU would not impede the passage of fish from southern waters into the Scotian Basin.

Of the species which are more likely to be found within the Project Area (American eel and bluefin tuna), it is not expected that a localized (0.5 km^2) potential area of avoidance would significantly impact their behaviour during migration through a relatively wider corridor in kilometres. The American eel is a transient species, with adult eels travelling south to the Sargasso Sea to spawn, and with juvenile glass eels migrating back through the Scotian Slope and Shelf to return to freshwater streams and rivers to spend their adult lives feeding and growing. It is possible that eels migrating from southern waters would attempt to avoid a small area around the MODU during drilling operations, although it is not expected this small area will interfere with migration, such that the species at a population level distributed over a much wider geographic area would be impacted.

For the bluefin tuna, this species migrates north in the summer months to feed in the productive waters of the Scotian Shelf and Slope and could potentially be found within the Project Area. Any localized avoidance in the area of the MODU would not impede the ability of bluefin tuna to feed in the RAA or migrate south to the Gulf of Mexico for reproductive purposes.

The sound levels created by the MODU during drilling activities could potentially cause fish species to avoid the area encompassing 0.5 km^2. This potential localized avoidance of such an area would not affect individual or population behaviour and/or migration patterns.

Therefore, continuous sound emissions from the MODU are not expected to result in any significant displacement.

References:

McCauley, R.D., Fewtrell, J., Duncan, A.J., Jenner, C., Jenner, M.-N., Penrose, J.D., Prince, R.I.T., Adhitya, A. Murdoch, J., and McCabe, K. 2000. Marine Seismic Surveys: Analysis of Airgun Signals and Effects of Air Gun Exposure on Humpback Whales, Sea Turtles, Fishes and Squid. Report prepared by the Centre for Marine Science and Technology (Report R99-15), Curtin University, Perth, WA, for Australian Petroleum Production Association, Sydney, NSW.

Zykov, M.M. 2016. Modelling Underwater Sound Associated with Scotian Basin Exploration Drilling Project: Acoustic Modelling Report. JASCO Document 01112, Version 2.0. Technical report by JASCO Applied Sciences for Stantec Consulting Ltd. February 2010.

Information Request (IR) IR-116 (MTI-02)

Applicable CEAA 2012 effect(s): 5(1)(a)(i) fish and fish habitat; 5(1)(c)(i) and (iii)

EIS Guidelines Reference: Part 2, Sections 6.3.1 Fish and Fish Habitat and 6.3.7 Aboriginal Peoples

EIS Reference: 7.2 Fish and Fish Habitat; 7.7 Current Aboriginal Use of Lands and Resources for Traditional Purposes

Context and Rationale: There is no analysis of the potential effects from underwater sound, waste disposal and spills on the migration and development of juvenile American Eel specifically. MTI has advised that American Eel has been a source of sustenance for the Mi'gmaq and is deeply integrated into the culture as a species with great spiritual significance. The species has been assessed as "threatened" by COSEWIC.

MTI advised that the entire population of juvenile American Eel destined for Atlantic Canadian rivers float through the Scotian Basin, in which area the Project would occur, and around Cape Breton before making their way into the Northumberland Strait. During this migration, they undergo a metamorphosis into the next life stage known as glass eel. This transformation occurs beyond the edge of the continental shelf, and close to the PA (COSEWIC, 2012). During this highly-sensitive life stage, eels are vulnerable to environmental change. MTI noted that although the EIS acknowledges that American Eel are found within the RAA, there is no analysis of the potential effects underwater sound, waste disposal and spills from the Project could have on the migration and development of juvenile American Eel, and how that could in turn affect the ability of the Mi'gmaq to practice traditional use of this resource.

Specific Question or Request: Assess the potential effects of the Project on American Eel, considering various life stages and all potential effects pathways (except underwater sound, which is addressed in IR 115). Discuss how project effects could act cumulatively with effects of other projects. Describe how changes in the environment due to the Project could affect Indigenous peoples' ability to practice traditional use of this resource.

Response: The life history and population status of American eel (*Anguilla rostrate*) are presented in Section 5.2.5.4 and Table 5.2.8 in the Environmental Impact Statement (EIS). Section 7.2 of the EIS assesses Project-related environmental effects on fish and fish habitat. The effects on American eel vary based on life stage, and seasonality. This species is present on the Scotian Shelf and Slope as a silver eel in November during migration from Nova Scotia, and as larvae and glass eels from March to July. The American eel is a transient species, with adult eels travelling south to the Sargasso Sea to spawn, and juvenile glass eels migrating back through the Scotian Slope and Shelf to return to freshwater streams and rivers to spend their adult lives feeding and growing. It is possible that eels migrating from southern waters would attempt to avoid a small area around the mobile offshore drilling unit (MODU) during drilling operations; based on underwater sound, this area is estimated to be approximately 0.5 km^2. This level of avoidance is not expected to interfere with migration in a way that would cause population level impacts.

Waste management activities from the MODU and platform supply vessels (PSVs) have the potential to impact habitat quality and use for American eels. These activities include operational discharges and emissions from the MODU and PSVs, as described in Section 7.2.8 of the EIS. All offshore waste discharges and emissions associated with the Project will be managed in accordance with relevant regulations, including the *Offshore Waste Treatment Guidelines* (OWTG) and the *International Convention for the Prevention of Pollution from Ships* (MARPOL). Waste discharges not meeting guideline requirements will not be discharged to the ocean and will be brought to shore for disposal. Discharges are expected to be temporary, non-bioaccumulating, non-toxic, and will be subject to high dilution in the open ocean; organic matter will be quickly dispersed and degraded by bacteria. If residual hydrocarbons are present in discharges (*e.g.*, deck drainage, bilge water), they would be at such low volumes and concentrations and in compliance with OWTG and MARPOL requirements. As such, it is not anticipated that operational discharges, emissions, and disposal of waste will affect American eels in a way that would affect the species at a population level.

Accidental events could impact American eels. Potential accidental event scenarios, responses, and effects are outlined in Section 8. A spill event would increase the area in which the Project would interact with fish and fish habitat. In general, motile species have lower exposure risk because they are highly mobile and able to avoid oiled areas (Irwin 1997; Law *et al.* 1997). Larval and juvenile pelagic and benthic fish species are at a greater risk of exposure as they are often less mobile than adults (Yender *et al.* 2002) and have shown higher sensitivity to lower concentrations of hydrocarbons since they may not have yet developed detoxification systems allowing them to metabolize hydrocarbons (Rice 1985; Carls *et al.* 1999; Incardona *et al.* 2013; Lee *et al.* 2015). For this reason, larvae and glass eels are more at risk to the effects of accidental events.

Project effects could act cumulatively with the effects of other projects to further impact American eels. Cumulative effects are described in detail in Section 10 of the EIS, and an assessment of cumulative environmental effects on fish and fish habitat is presented in Section 10.2.3. Other projects that overlap temporally and spatially with the Project include other offshore gas development and petroleum exploration projects, commercial fisheries, and other ocean users, including shipping, scientific and military activities. Cumulative effects that may impact American eels include an increase of waste discharges and increased exposure to underwater sound. These effects may result in eel mortality or injury, or in changes to the quality of the habitat used by eels. However, these cumulative effects would be limited to eels that might migrate through the relatively small area in the vicinity of the MODU, or to underwater sound from PSVs when eels pass close to this source. The cumulative effects of the Project activities would be limited to the Project Area offshore and not interact with the nearshore migration of eels returning to or leaving freshwater environments for life cycle purposes. With the application of proposed mitigation and environmental protection measures, the residual environmental effects of a Change in Risk of Mortality of Physical Injury and Change in Habitat Quality on Fish and Fish Habitat from Project activities and components are predicted to be not significant.

Given that the effects of Project activities are not expected to impact American eels at a population level, the Project is not anticipated to significantly impact the ability of Indigenous communities to practice traditional use of this species.

References:

Carls, M.G., Rice, S.D., and Hose, J.E. 1999. Sensitivity of fish embryos to weathered crude oil: Part 1. Low-level exposure during incubation causes malformations, genetic damage, and mortality in larval Pacific herring (*Clupea pallasi*). Environ. Toxicol. Chem. 18: 481-493.

Incardona, J.P., Swartsa, T.L., Edmundsa, R.C., Linboa, T.L., Aquilina-Becka, A., Sloana, C.A., Gardnerb, L.D., Blockb, B.A., and Scholza, N.L. 2013. Exxon Valdez to Deepwater Horizon: Comparable toxicity of both crude oils to fish early life stages. Aquatic Toxicology 142– 143 (2013) 303– 316.

Irwin, R.J. 1997. Environmental Contaminants Encyclopedia Crude Oil Entry. National Park Service, Water Resources Divisions, Water Operations Branch, CO.

Law, R., Kelly, C., Graham, K., Woodhead, R., Dyrynda, P., and Dyrynda, E. 1997. Hydrocarbons and PAH in Fish and Shellfish from Southwest Wales following the *Sea Empress* Oil Spill in 199. Available from: http://ioscproceedings.org/doi/pdf/10.7901/2169-3358-1997-1-205.

Lee, K., Boufadel, M., Chen, B., Foght, J., Hodson, P., Swanson, S., Venosa, A. 2015. Expert Panel Report on the Behavior and Environmental Impacts of Crude Oil Released into Aqueous Environments. Royal Society of Canada, Ottawa, ON.

Rice, S.D. 1985. Effects of oil on fish. In: Engelhardt, F.R. (ed.). Petroleum Effects in the Arctic Environment, Elsevier Science Publishing Co., NY. xxiv + 282 pp: 157-182.

Yender, R.J., Michel, J., and Lord, C. 2002. Managing Seafood Safety after an Oil Spill. Seattle Hazardous Materials Response Division, Office of Response and Restoration, National Oceanic and Atmospheric Administration. 72 pp.

Information Request (IR) IR-117 (MTI-03)

Applicable CEAA 2012 effect(s): 5(1)(c)(i) and (iii); 5(1)(a)(i)

EIS Guidelines Reference: Part 2, Sections 6.3.1 Fish and Fish Habitat and 6.3.7 Aboriginal Peoples

EIS Reference: 7.2 Fish and Fish Habitat; 7.7 Current Aboriginal Use of Lands and Resources for Traditional Purposes

Context and Rationale: MTI expressed concern about potential effects on sturgeon habitat during project operations. Atlantic Sturgeon has been assessed as "threatened" by COSWEWIC and is an important species to the Mi'gmaq that can be found throughout the coastal waters of the Maritimes and on the Scotian Shelf, generally concentrated in water depths less than 50 metres. MTI advised that adults migrate into estuaries and rivers in the autumn between August and October or in the spring between May and June prior to reproduction, and that adult Atlantic Sturgeon often overwinter in deep channels and pools in rivers and estuaries downstream of spawning sites. Adults and large juveniles move both inwards and seawards in response to season and salinity. They can be found in the Bay of Fundy, along the coast of Nova Scotia, and offshore as far as Banquereau and Sable Island Banks.

Sturgeon prey on benthic organisms such as polychaetes (worms), shrimp, amphipods, isopods, gastropods and small fish (sand lance) (COSEWIC, 2011). MTI noted that the EIS addresses the potential for oil spills to affect sturgeon habitat, but there is no analysis of the potential effects of project operations on sturgeon habitat, specifically within the corridor to be used by platform supply vessels (PSVs) to and from the MODU. MTI has expressed concern that increased vessel traffic, waste disposal, potential reduction in sediment and water quality, and underwater sound in shallower waters may affect benthic habitat for sturgeon prey species, disrupting overall sturgeon food supply and habitat.

Specific Question or Request: Further to the general assessment of effects on fish and fish habitat that was presented in the EIS, assess the potential effects of the Project specifically on Atlantic Sturgeon habitat within the LAA, particularly in water depths of 50 metres or less. Consider potential effects of increased vessel traffic on benthic invertebrates and their habitat in which Atlantic Sturgeon feed.

Describe how potential changes in the environment due to the Project could affect Indigenous peoples' ability to practice traditional use of this resource.

Response: The life history and Maritimes population status of Atlantic sturgeon (*Acipenser oxyrinchus*) are characterized in Section 5.2.5.4 and Table 5.2.8 of the Environmental Impact Statement (EIS). Threats identified to affect Atlantic sturgeon populations include overexploitation from commercial fishing, dams, and contaminants, or from habitat loss and/or degradation, with commercial fishing identified as the most significant factor causing historical population declines (COSEWIC 2011). The potential effects on Atlantic sturgeon and their habitat from Project activities are related to marine discharges and noise from the operation of the mobile offshore drilling unit (MODU) and the platform supply vessels (PSVs) travelling to and from the MODU. These emissions from the MODU occur in deep water which is not anticipated to be sturgeon habitat, whereas transiting PSVs travel in water depths < 50 m in the Local Assessment Area (LAA) with the potential to affect sturgeon habitat. As stated in Section 7.7.8 of the EIS, two to three PSVs will be required for re-supply to the drilling vessel making two to three round trips per week between the MODU and the supply base. PSVs will use existing shipping routes when travelling in potential Atlantic sturgeon habitat in the LAA between the MODU and the supply base in Halifax Harbour, where applicable, and will adhere to standard navigation procedures, thereby reducing potential effects on the habitat and conflicts with Indigenous fisheries. Potential environmental effects on fish attributable to PSV traffic and operations in the LAA would also represent only a small incremental increase over similar effects currently associated with existing higher levels of marine traffic and shipping activity throughout the Regional Assessment Area (RAA).

Waste and emission discharges from the MODU with the potential for toxicity effects on the marine environment are regulated for compliance under the *Offshore Waste Treatment Guidelines* (OWTG) and the *International Convention for the Prevention of Pollution from Ships* (MARPOL). Waste discharges not meeting guideline requirements will not be discharged to the ocean and will be brought to shore for disposal. Discharges are expected to be temporary, non-bioaccumulating, non-toxic, and will be subject to high dilution in the open ocean; organic matter will be quickly dispersed and degraded by bacteria. If residual hydrocarbons are present in discharges (*e.g.*, deck drainage, bilge water), they would be at low volumes and concentrations and in compliance with OWTG and MARPOL requirements. As such, it is not anticipated that operational discharges, emissions, and disposal of waste will affect Atlantic sturgeon or occur in their habitat (i.e., < 50 m water depth) in a way that would affect the species at a population level. Discharges from PSVs will meet MARPOL requirements, which are established to protect the marine environment, and are expected to be temporary and will be subject to high dilution in the LAA. Results of environmental effects monitoring programs undertaken for various drilling programs in Atlantic Canada (Hurley and Ellis 2004) concluded that there are negligible effects on fish health and fish habitat from these activities; therefore, the availability of traditional fisheries resources, including the benthic prey items of the Atlantic sturgeon, are not expected to be affected by discharges from the Project, including PSV traffic between the MODU and the supply base.

PSV traffic will potentially increase underwater sound in the area in which PSV are transiting. This increased sound has the potential to affect the food sources of Atlantic sturgeon in the LAA. The effects of noise on marine fish species is provided in Section 7.2 of the EIS. A general behavioral response was noted by McCauley *et al.* (2000) at sound levels of 156 to 161 dB re 1µPa SPL RMS. Acoustic modelling for the Project (Zykov 2016) predicts sound levels will decrease to below ≤ 150 dB re 1 µPa peak SPL greater than 0.4 km from the MODU and PSV (maximum R95% value across all seasons and sites, Figure 29, Table 14 in Appendix D of the EIS). The effects of the PSV alone were not modelled but it is assumed these distances would be smaller in the absence of noise generated by the MODU. In regard to sand lance which is a prey fish species of Atlantic sturgeon in shallower water and several kilometers away from the MODU, this species will bury itself in the substrate in-between feeding periods and generally during the day (DFO 2015), but has the potential to be exposed to sound levels from PSVs transiting on the Scotian Shelf and in the LAA. However, the sound levels at the seabed potentially affecting this species from transiting PSVs would be reduced compared to potential effects on other species present near the surface water or in the water column.

Most of the available information on the acoustic abilities of marine invertebrates pertains to crustaceans, particularly lobsters, crabs, and shrimp (LGL 2014). An overview of the physiological, pathological, and behavioural effects is provided in Appendix G by LGL (2014). Any of the effects noted by LGL occurred under extreme noise levels produced by air guns, which would greatly exceed the sound produced by PSVs. Sound levels created by the PSVs are not expected to adversely affect invertebrates to the degree noted by LGL (2014).

When PSVs are transiting, they are constantly moving and as a result the environmental effects of their presence would be very temporary in both space and time. The availability of traditional fisheries resources, including the Atlantic sturgeon and the prey they rely on, are not expected to be affected by the transiting of PSV traffic between the MODU and the supply base.

References:

COSEWIC. 2011. COSEWIC assessment and status report on the Atlantic Sturgeon *Acipenser oxyrinchus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xiii + 49 pp. www.sararegistry.gc.ca/status/status_e.cfm).

DFO [Fisheries and Oceans Canada]. 2015. Underwater World: Sandlance. Available from: http://www.dfo-mpo.gc.ca/science/publications/uww-msm/project-eng.html?id=33 Accessed September 2015. Accessed September 2015.

Hurley, G., and Ellis, J. 2004. Environmental Effects of Exploratory Drilling in Offshore Canada: Environmental Effects Monitoring Data and Literature Review-Final Report. Prepared for the Canadian Environmental Assessment Agency-Regulatory Advisory Committee. 61pp. + App.

LGL Limited. 2014. Environmental assessment of BP Exploration (Canada) Ltd.' Tangier 3-D Seismic Survey. BP Document NS-HS-REP-BP-01-000 and LGL Rep. SA1222. Rep. by LGL Limited, Mahone Bay, NS and St. John's, NL for BP Exploration Canada Limited, Calgary, AB. 177 p + appendices.

McCauley, R.D., Fewtrell, J., Duncan, A.J., Jenner, C., Jenner, M.-N., Penrose, J.D., Prince, R.I.T., Adhitya, A. Murdoch, J., and McCabe, K. 2000a. Marine Seismic Surveys: Analysis of Airgun Signals and Effects of Air Gun Exposure on Humpback Whales, Sea Turtles, Fishes and Squid. Report prepared by the Centre for Marine Science and Technology (Report R99-15), Curtin University, Perth, WA, for Australian Petroleum Production Association, Sydney, NSW.

Zykov, M.M. 2016. Modelling Underwater Sound Associated with Scotian Basin Exploration Drilling Project: Acoustic Modelling Report. JASCO Document 01112, Version 2.0. Technical report by JASCO Applied Sciences for Stantec Consulting Ltd. February 2010.

Information Request (IR) IR-118 (MTI-04)

Applicable CEAA 2012 effect(s): 5(1)(a)(i) fish and fish habitat; 5(1)(c)(i) and (iii)

EIS Guidelines Reference: Part 2, Sections 6.3.1 Fish and Fish Habitat and 6.3.7 Aboriginal Peoples

EIS Reference: 7.2 Fish and Fish Habitat; 7.7 Current Aboriginal Use of Lands and Resources for Traditional Purposes

Context and Rationale: MTI expressed concern that there is limited information on how the underwater sound from operations and increased vessel traffic may affect salmon migration and movement. Atlantic Salmon, an important species for MTI, make long oceanic migrations from May to November from their over wintering at-sea locations to their native freshwater streams (COSEWIC 2010a). As stated in the EIS, there are 4 distinct populations that may occur in the vicinity of the PA:

- Outer Bay of Fundy Population (assessed by COSEWIC as Endangered);
- Inner Bay of Fundy Population (listed in SARA Schedule 1 as Endangered);
- Eastern Cape Breton Population (assessed by COSEWIC as Endangered); and
- Nova Scotia Southern Upland Population (assessed by COSEWIC as Endangered).

The EIS states that all populations, except for the Inner Bay of Fundy Population, are expected to occur within the PA but will be transient in nature, but does not assess how underwater sound from operations and increased vessel traffic may affect Atlantic Salmon migration and movement throughout the RAA.

Specific Question or Request: Further to the assessment of effects on fish and fish habitat in the EIS assess the potential effects of underwater noise from operations and vessel traffic specifically on migration and movement of the three Atlantic Salmon populations expected to occur in the PA. Describe how potential changes in the environment due to the Project could affect Indigenous peoples' ability to practice traditional use of this resource.

Response: The effects of underwater sound from on Fish and Fish Habitat are considered in Section 7.2.8 of the Environmental Impact Statement (EIS). This effects assessment assumed the worst-case scenario where drilling is ongoing 24 hours a day, 365 days a year. Furthermore, a detailed discussion of the effects of operational sound from the Project on marine fish species and marine fish behaviour including migration patterns is included in the response to IR-115.

The effects assessment and conclusions provided in IR-115 are consistent with those expected for populations of Atlantic salmon expected to be found within the Project Area, Local Assessment Area (LAA), and/or Regional Assessment Area (RAA).

Details on Atlantic salmon migration are provided in Section 5.2.5.4 of the EIS and in the response to IR-127. An area of avoidance is expected to potentially occur during Project operation in a radius extending out 400 m from the mobile offshore drilling unit (MODU) with the presence of a vessel nearby and based on the acoustic modelling for the Project

(Zykov 2016). It can be expected that this distance would be less for platform supply vessels (PSVs) transiting to and from the MODU through the LAA. Atlantic salmon have the potential to migrate to feeding areas off Labrador and Greenland through a wide area over the Scotian Shelf (refer to IR-127). As a result, a potential avoidance area of 0.5 km^2 surrounding the PSV during transiting and the MODU during operations is a very small portion of the Atlantic salmon migratory routes in comparison to the relatively larger area available for Atlantic salmon migration. Atlantic salmon belonging to any of the three populations likely to be present in the LAA or RAA are not expected to be impeded due to the limited area of potential migration route affected by underwater noise from the Project compared to the potential areas which could be used by Atlantic salmon. As a result, the Project is not expected to affect Indigenous peoples' ability to practice traditional use of this resource.

References:

Zykov, M.M. 2016. Modelling Underwater Sound Associated with Scotian Basin Exploration Drilling Project: Acoustic Modelling Report. JASCO Document 01112, Version 2.0. Technical report by JASCO Applied Sciences for Stantec Consulting Ltd. February 2010.

Information Request (IR) IR-119 (MTI-05)

Applicable CEAA 2012 effect(s): 5(1)(a)(i) fish and fish habitat; 5(1)(c)(i) and (iii)

EIS Guidelines Reference: Part 2, Sections 6.3.1 Fish and Fish Habitat and 6.3.7 Aboriginal Peoples

EIS Reference: 7.2 Fish and Fish Habitat; 7.7 Current Aboriginal Use of Lands and Resources for Traditional Purposes

Context and Rationale: MTI is concerned about the effect of underwater sound on the movement of Atlantic Herring, a culturally-important species for the Mi'gmaq and an important commercial fishery in the PA. Once profuse along the Atlantic Coast, herring spawning areas are now relatively scarce. Coastal spawning areas include areas off southwest Nova Scotia as well as in the Bay of Fundy and off Grand Manan Island.

Specific Question or Request: Assess the potential effects of underwater sound from the Project specifically on Atlantic Herring, including potential effects on movement of Atlantic Herring populations throughout the RAA, taking into account applicable sound thresholds of Atlantic Herring. Describe if and how this assessment of Atlantic Herring alters the assessment of effects on Indigenous peoples in the EIS, including potential effects on the Indigenous fishery or other traditional uses of this resource.

Response: Section 7.2.8 of the Environmental Impact Statement (EIS) assesses Project-related environmental effects in which the effects of underwater sound on marine fish species including the Atlantic herring have been assessed, as well as in the response to IR-115. This assessment assumes the worst-case scenario where drilling is ongoing 24 hours a day, 365 days a year. As indicated in Section 7.2.8, predicting behavioural changes in fish is challenging given the variation in sound characteristics from different types of sources and interspecific differences in how sound is perceived by and may affect the different fish species. A general behavioral response was noted by McCauley *et al.* (2000) at sound levels of 156 to 161 dB re 1µPa SPL RMS. Acoustic modelling for the Project (Zykov 2016) predicts sound levels will decrease to below ≤ 150 dB re 1 µPa peak SPL greater than 0.4 km from the mobile offshore drilling unit (MODU) with a platform supply vessel (PSV) (maximum R95% value across all seasons and sites, Figure 29, Table 14 in Appendix D of the EIS). As a result, Atlantic herring may avoid an area extending 400 m in all directions around the MODU during drilling. This equates to an area of avoidance equalling 0.5 km^2. When comparing this area to the total area of the Regional Assessment Area (RAA) where herring may be present, the area which migrating herring may avoid is relatively small and not likely to cause long-term population behaviour or migration behaviour impacts.

Furthermore, Atlantic herring are rarely found within the Project Area. This species migrates to spawning grounds in both coastal waters and offshore in areas of Georges Bank, or areas >150 km from the Project Area (refer to Section 5.2.5.2 of the EIS for life history characteristics of this species). Although Atlantic herring have the potential to be found in the Project Area, they are not likely to be present. Should Atlantic herring be found within the Project Area, it is not expected that a localized (0.5 km^2) area of avoidance would adversely affect their behaviour during migration through a relatively wider corridor (*i.e.*, kilometres). The sound levels created by the MODU during drilling activities could potentially cause herring to avoid the area encompassing 0.5 km^2. Localized avoidance of such an area would not likely affect individual or population behaviour and/or migration patterns. Therefore, continuous sound emissions from the MODU are not expected to result in any substantive displacement.

As stated in Section 7.7.8 of the EIS, two to three PSVs will be required for re-supply to the drilling vessel making two to three round trips per week between the MODU and the supply base in the Local Assessment Area (LAA). PSVs will use existing shipping routes when travelling in or near potential Atlantic herring spawning areas or migration routes in the LAA and between the MODU and the supply base in Halifax Harbour, where applicable. Transiting PSVs will adhere to standard navigation procedures, thereby reducing potential effects on Atlantic herring and conflicts with Indigenous fisheries. Potential effects on herring attributable to underwater sound from PSV traffic and operations in the LAA would also represent only a small incremental increase over similar effects currently associated with existing higher levels of marine traffic and shipping activity throughout the Regional Assessment Area (RAA).

PSV traffic may increase underwater sound in the area in which PSV are transiting. This increased sound has the potential to affect migration or spawning of Atlantic herring in the LAA. The effects of noise on marine fish species and predicted sound levels from the MODU and PSV in the Project Area is provided above and in Section 7.2 of the EIS. The effects of sound from the PSV alone were not modelled, but it is assumed the distances would be smaller in the absence of noise generated by the MODU.

When PSVs are transiting, they are constantly moving and as a result the environmental effects of their presence and underwater sound generated in the coastal zone would be very temporary in both space and time. The availability of the traditional herring fisheries resource is not expected to be affected by the transiting of PSV traffic between the MODU and the supply base.

Given that the potential effects of underwater sound from Project activities are not expected to affect Atlantic herring at a population level or their spawning areas and migration behaviour, the Project is not anticipated to adversely affect the Indigenous fishery or other traditional uses of this resource.

References:

McCauley, R.D., Fewtrell, J., Duncan, A.J., Jenner, C., Jenner, M.-N., Penrose, J.D., Prince, R.I.T., Adhitya, A. Murdoch, J., and McCabe, K. 2000. Marine Seismic Surveys: Analysis of Airgun Signals and Effects of Air Gun Exposure on Humpback Whales, Sea Turtles, Fishes and Squid. Report prepared by the Centre for Marine Science and Technology (Report R99-15), Curtin University, Perth, WA, for Australian Petroleum Production Association, Sydney, NSW.

Zykov, M.M. 2016. Modelling Underwater Sound Associated with Scotian Basin Exploration Drilling Project: Acoustic Modelling Report. JASCO Document 01112, Version 2.0. Technical report by JASCO Applied Sciences for Stantec Consulting Ltd. February 2010.

Information Request (IR) IR-120 (MNNB-05)

Applicable CEAA 2012 effect(s): 5(1)(a)(i) Fish and Fish Habitat; 5(1)(a)(ii) Aquatic Species; 5(1)(c) Effect of a change in the environment on Aboriginal peoples

EIS Guidelines Reference: Part 2, Section 6.3.1 Fish and Fish Habitat and Section 6.6.1 Effects of Potential Accidents or Malfunctions

EIS Reference: EIS Section 5.2.5 Marine Fish pp. 5.110-5.111; Section 8.5.5 Commercial Fisheries pp. 8.136; Appendix G, Fig. 18, pp 18

Context and Rationale: MNNB advised the Agency that Atlantic Bluefin Tuna is an important species for which fisheries are located primarily inshore and within shallower water along the Scotian Shelf, with landings of other tuna species predominantly located further offshore beyond the Scotian Slope. There were landings reported for all tuna species from along the edge of the Scotian Shelf. The MNNB acknowledged that, given the relatively low landings reported from the PA, direct effects from the Project appear likely be minimal, but nonetheless expressed concern that tuna may avoid the PA during drilling operations. Concern was also expressed that a major accident affecting the LAA or RAA could cause fish to avoid the area, and possible bioaccumulation of contaminants in fish. Oil and dispersants are most toxic to larval fish, and adult tuna are very mobile, so while the effects of even a major spill would probably be less severe for tuna than for resident and spawning fish, the MNNB noted that Bluefin Tuna populations are declining and show high inter-connectivity. MNNB is concerned that a major spill or blowout scenario could have unforeseen severe consequences to this species meta- population (Block *et al.* 2001) and noted that migration patterns and ecology are also not fully understood, complicating the understanding of adverse effects from a major spill or blowout (Richardson *et al.* 2016).

Specific Question or Request:

a) Assess the potential effects of the Project specifically on Atlantic Bluefin Tuna, including the potential for them to avoid the PA during normal operations or to avoid spill-affected areas.

b) Consider the potential for bioaccumulation of contaminants in Atlantic Bluefin Tuna as a result of a spill or response measure (*e.g.* dispersants). Describe if and how this assessment of Bluefin Tuna alters the assessment of effects on Indigenous peoples in the EIS, including potential effects on the Indigenous fishery or other traditional uses of this resource.

c) Indicate whether the proponent would review future Atlantic Bluefin Tuna migration research and update Environmental Management and Monitoring Plans within an adaptive management context for protection of this species, if applicable.

Response:

a) Although the western Atlantic population of the bluefin tuna was previously considered to only spawn in the Gulf of Mexico, recent research indicates that it also spawns in the Slope Sea (Richardson *et al.* 2016), which is an area of open ocean south of New

England and east of the mid-Atlantic states of the United States (US) with its northeastern boundary impinging near the Project Area. The larvae and embryos of this species may therefore occur in the vicinity of the Project. In consideration of recent research on the spawning and migration patterns of bluefin tuna, text on page 5.110 in Section 5.2.5.4 of the Environmental Impact Statement (EIS) is updated below to read:

"Atlantic bluefin … have a life expectancy up to 20 years. Although the western Atlantic stock was previously considered to reach maturity at about nine years of age and to only spawn in the Gulf of Mexico, recent research indicates that it also spawns on the Slope Sea starting at approximately 5 years of age (Richardson *et al.* 2016). Bluefin tuna larvae have been confirmed in the Slope Sea between the Gulf Stream and northeast United States continental shelf; but the northeastern section of the Slope Sea (*i.e.*, that located off Nova Scotia and in the vicinity to the Project Area) was not sampled for larvae (Richardson *et al.* 2016). Spawning for the eastern stock of bluefin tuna starts at age 4 in the Mediterranean Sea."

The effects of the Project on marine fish and fish habitat, including bluefin tuna, have been assessed in Sections 7.2 and 8.5.1 of the EIS. Although chronic effects of hydrocarbons on juvenile and spawning adult bluefin tuna are not well understood (Hazen *et al.* 2016), the exposure of adult finfish (including bluefin tuna) may be reduced through temporary migration away from affected areas in the event of a blowout incident. However, acute oil exposure has been predicted to cause defects in heart development which may result in mortality of bluefin eggs and larvae (Incardona *et al.* 2014). Exposure to oil at the concentrations used in Incardona's lab tests, is likely to be limited, based on modelling results described below and the anticipated lower risk for exposure and oil concentrations in the area of the Slope Sea.

Stochastic oil release modelling was undertaken for unmitigated blowout incidents at two potential well locations based on worst-case credible discharges (WCCD). Modelling was conducted for both summer and winter season spill scenarios. Applying the 58 ppb total hydrocarbon (THC) threshold for effects to fish (an in-water concentration of dissolved and entrained oil in the top 100 m), these levels are most likely to be encountered on the Scotian Slope, with 7 to 11% average probability of these levels occurring in the Haddock Box and 9 to 13% average probability of these levels reaching the Emerald, Western, and Sable Banks on the Scotian Shelf (refer to Figures 8.4.7 to 8.4.10 of the EIS). This threshold was calculated due to the potential acute lethality effects on larval and juvenile fish at 58 ppb THC. These levels are not likely to cause acutely toxic effects to adult fish such as bluefin tuna, which have the potential to be present in the RAA. Additional information pertaining to the 58 ppb THC threshold for effects on fish is provided in IR-069.

The oil release models indicate that the minimum time for in-water oil concentrations >58 ppb to arrive at the maximum distance from the well is between 50 and 75 days (illustrated in Figure 8.4.10 of the EIS, Site 2 summer season). As noted in Section 8.3.3 of the EIS, well intervention response strategies could be implemented within a matter of days for direct BOP intervention and the well could be capped between 13 and 25 days, thereby decreasing the spatial extent of a spill. These mitigation assumptions were not factored into the model to demonstrate the worst-case credible scenario of an unmitigated blowout incident. Exposure time to oil concentrations above 58 ppb is also contingent on spill response time. For the unmitigated scenario (Site 2 summer season), the predicted duration of exposure to in-water concentrations for oil >58 ppb around the wellsite is greater than 30 days, while in-water exposure time of one day or less may be expected at the outer extent of the predicted threshold exceedance area (Figure 8.4.10 of the EIS).

The effects of an accidental event including a blowout incident have been further assessed in response to IR-060, 061, 069, and 073. Based on the information above, the information in each of the aforementioned IR responses, and the information contained in the EIS, the predicted residual adverse environmental effects from a blowout incident on Fish and Fish Habitat including bluefin tuna would not be significant.

b) As noted in the response to IR-073, the biomagnification of petroleum hydrocarbons typically does not occur in food webs. This is due to the fact that vertebrates, including bluefin tuna, can readily metabolize petroleum hydrocarbons and as a result, biomagnification of these substances is not an issue for these species. Therefore, in the event that bluefin tuna are exposed to hydrocarbons via respiration, direct contact, or through diet, these hydrocarbons will be metabolized and generally will not pose a risk through bioaccumulation. In the event of a spill, surface oiling would have a short-term effect on commercial and traditional fisheries due to the exclusion of fishing in areas where oil exceeds a thickness of 0.04 μm. Indigenous and traditional uses of this resource would be closed until the surface oil has been dispersed or has biodegraded below the 0.04 μm threshold which is anticipated to occur in the short term.

c) The effects assessment in the EIS was carried out on bluefin tuna likely to be present in the Project Area, Local Assessment Area (LAA) and Regional Assessment Area (RAA) and the potential for impacts from routine operations of the Project and accidental events. The predicted residual adverse environmental effects from routine operations and accidental events on Fish and Fish Habitat including bluefin tuna have been considered to be not significant. As a result, follow-up and monitoring programs are not necessary including the requirement to review future Atlantic bluefin tuna migration research. However, it is acknowledged that recent research indicates that the migration patterns of the Atlantic bluefin tuna are more complicated than previously considered. The western Atlantic stock has a differential spawning migration pattern, with larger individuals spawning in the Gulf of Mexico and smaller individuals spawning in the Slope Sea (Richardson *et al.* 2016). Furthermore, contrary to the prevailing view that individuals exhibit complete spawning-site fidelity, recent research has shown that they may occupy both the Slope Sea and Mediterranean Sea in separate years (Richardson *et al.* 2016).

References:

Incardona, JP, L.D. Gardner, T.L. Linbo, T.L. Brown, A.J. Esbaugh, E.M. Mager, J.D. Stieglitz, B. L. French, J.S. Labenia, C.A. Laetz, M. Tagal, C.A. Sloan, A. Elizur, D.D. Benetti, M. Grosell, B.A. Block, and N.L. Scholz. 2014. Deepwater Horizon crude oil impacts the developing hearts of large predatory pelagic fish. Proceedings of the National Academy of Sciences. 111 no. 15.

Hazen E. L., A.B. Carlisle, S.G. Wilson, J.E. Ganong, M.R. Castleton, R.J. Schallert, M.J.W. Stokesbury, S.J. Bograd, and B.A. Block. 2016. Quantifying overlap between the Deepwater Horizon oil spill and predicted bluefin tuna spawning habitat in the Gulf of Mexico. Scientific Reports 6. Available at: http://www.nature.com/articles/srep33824

Richardson D.E., Marancik, K.E., Guyon, J.R., Lutcavage M.E., Galuardi, B., Lam, C.H., Walsh, H.J., Wildes, S., Yates, D.A., and Hare, J.A. (2016). Discovery of spawning ground reveals diverse migration strategies in Atlantic Bluefin tuna (*Thunnus thynnus*). Proceedings of the National Academy of Sciences 113: 3299-3304.

Information Request (IR) IR-121 (MTI-11, MTI-12)

Applicable CEAA 2012 effect(s): 5(1)(a)(i) fish and fish habitat; 5(1)(c)(i) and (iii)

EIS Guidelines Reference: Part 2, Section 6.3.1 Fish and Fish Habitat

EIS Reference: 7.2 Fish and Fish Habitat

Context and Rationale: MTI has commented to the Agency that more assessment of effects on benthic habitat from the release of drilling mud is required. The EIS describes the environmental effects of releasing drilling waste and mud disposal as mostly restricted to smothering of sessile or slow moving individuals and sedimentation. These effects are said to be negligible and reversible; MTI commented that the extent of the effects from loss or destruction of benthic habitat, and not just individuals in that habitat, is not adequately assessed. MTI is concerned about long-term effects and recommended that a reclamation plan be developed.

MTI has also expressed concern about the limited mitigation planned for the effects of waste disposal to fish and fisheries. The combined effects of discharge of drill muds and cuttings with sedimentation and localized changes in water quality are stated to interact with fisheries species within a localized area, thereby potentially affecting availability of fisheries resources or causing a change in traditional use for Indigenous fisheries. Limited mitigation is proposed in the EIS regarding the reversal of degraded sediment quality and water quality from discharge of drilling materials.

Specific Question or Request:

a) Describe proposed benthic habitat rehabilitation following well abandonment, or provide a rationale for why this is not proposed.

b) Identify if there are technically and economically-feasible measures that could reduce the benthic area affected by the drilling waste.

c) Discuss the potential for long-term effects from water and sediment quality degradation as a result of waste disposal on various life functions and migratory routes of important commercial fisheries species and the associated potential for effects on Indigenous traditional use.

Response:

a) A benthic habitat rehabilitation program following well abandonment is not required because benthic communities are expected to recover within one to four years post-drilling (refer to Section 7.2 of the Environmental Impact Statement (EIS)). The recovery of the benthic community post exploratory drilling is discussed in the response to IR-069.

   However, BP will conduct a visual (using a remote operated vehicle (ROV) survey of the seafloor to assess the extent of sediment dispersion during and after drilling to verify drilling waste dispersion modelling predictions which will provide additional information on the effects on the benthic habitat. Information about the proposed survey is included in Table 12.2.1 of the EIS.

b) There are currently no known technically or economically feasible measures which could reduce the benthic area affected by the drilling waste. However, the installation of the riser, after the riserless drilling of initial hole sections and installation of the wellhead, provides a conduit to carry drill waste back to the mobile offshore drilling unit (MODU) where it can be treated prior to discharge at sea in accordance with the Offshore Waste Treatment Guidelines (OWTG).

c) It is predicted that the benthic community will recover within one to four years after completion of drilling activities (refer to Section 7.2.8 of the EIS). Therefore, there are no predicted long-term effects on sediment quality degradation due to the disposal of drilling waste.

As stated in Section 7.2.8 of the EIS, the discharge of drill muds and cuttings could give rise to a change in sediment quality within a localized area, which may be altered in terms of nutrient enrichment and oxygen depletion that could potentially result in changes in the composition of the benthic macrofauna community. However, few fish species are expected to inhabit potential well locations within the Project Area given the depths at which the drilling operations will take place. BP will conduct an imagery-based seabed survey in the vicinity of wellsites to ground-truth the findings of the Geohazard Baseline Review (GBR) (refer to response provided for IR-021 for details on the pre-drill benthic survey). This includes confirming the absence of sensitive environmental features, such as habitat-forming corals or species at risk. The survey will be carried out prior to drilling. In the event that any habitat forming coral aggregations, epifauna species at risk, or epifauna that cannot be identified are observed the survey team will alert the project team and the CNSOPB will be notified immediately to discuss an appropriate course of action. This may involve further investigation and/or selecting an alternative wellsite, if it is feasible to do so.

Waste and emission discharges with the potential for toxicity effects on the marine environment are regulated for compliance under the Offshore Waste Treatment Guidelines (OWTG). Discharges from the MODU will meet OWTG requirements, which are established to protect the marine environment.

Discharges from the MODU are expected to be temporary, non-bio-accumulating, and non-toxic, and will be subject to high dilution in the open ocean; organic matter will be quickly dispersed and degraded by bacteria. If residual hydrocarbons are present in discharges (*e.g.*, deck drainage, bilge water), they would be at such low volumes and concentrations and in compliance with OWTG and MARPOL requirements. Results of environmental effects monitoring programs undertaken for various drilling programs in Atlantic Canada (Hurley and Ellis 2004) concluded that there are negligible effects on fish health and fish habitat from these activities; therefore, the availability of traditional fisheries resources are not expected to be affected by discharges from the Project including the discharge of drilling wastes. As a result, long-term effects to water and sediment quality as a result of waste discharges are not anticipated. Therefore, long term-effects leading to impacts on the various life functions or migratory routes of important commercial or traditional fisheries species targeted by Indigenous people are not predicted to occur.

References:

Hurley, G., and Ellis, J. 2004. Environmental Effects of Exploratory Drilling in Offshore Canada: Environmental Effects Monitoring Data and Literature Review-Final Report. Prepared for the Canadian Environmental Assessment Agency-Regulatory Advisory Committee. 61pp. + App.

Information Request (IR) IR-122 (MNNB-44)

Applicable CEAA 2012 effect(s): 5(1)(c)

EIS Guidelines Reference: Part 2, Section 6.1.9 Aboriginal Peoples; Part 2, Section 6.3.7 Aboriginal Peoples

EIS Reference: 5.3.6 Aboriginal Fisheries; 6.2.2 Selection of Valued Components; 7.7 Current Aboriginal Use of Lands and Resources for Traditional Purposes

Context and Rationale: MNNB has advised the Agency that the EIS does not address the nature and vulnerability of local economies or reliance on "country foods", taking into consideration the potential for effects of the Project (*e.g.* potential contamination).

The EIS discusses the commercial and FSC fisheries in some detail (EIS, Section 5.3.6.2, page 5.262; Traditional Use Study), but says nothing about the extent to which Indigenous communities rely on "country food." Socio-economic effects arising from a change in the environment must be considered in a federal environmental assessment, and are mentioned in the Guidelines, but the proponent has explicitly excluded socio-economic conditions as VCs (EIS, Table 6.2.1, p. 6.17). Thus, it is not possible to predict the effects of any degree of environmental change on the local or regional economies of Indigenous communities associated with effects on country food.

Specific Question or Request:

a) Provide a discussion of First Nations' reliance on country food and how this could be affected by the Project, or explain why it is not discussed in the EIS. This can either be included in an updated TUS or provided as a separate response. If included in the TUS, clearly indicate where in the document it has been addressed.

b) Discuss how changes in the environment that may be caused by the Project, particularly due to accidents or malfunctions such as a blowout, could affect the health of Indigenous peoples, including secondary socio-economic aspects as described above.

Response:

a) Foods obtained through harvesting, are known as "country foods" and are described in the Traditional Use Study (TUS) (Appendix B of the EIS). The only country foods that would be harvested within the Regional Assessment Area (RAA) of the proposed Project has been considered as part of food, social, and ceremonial (FSC) fishing. In particular, historic and current FSC harvesting is described in Section 5 of the TUS and Section 5.3.6.2 of the EIS. Traditional knowledge gained through the environmental assessment identified FSC fishing as the only harvesting activity occurring in the assessment area. Tables 7 and 8 of the TUS identify fish, invertebrate, and mammal species traditionally harvested by the Mi'kmaq of Nova Scotia for FSC purposes. The Mi'kmaq of Nova Scotia currently reported harvesting five fish species and three invertebrate species within the RAA and one invertebrate species in the Local Assessment Area (LAA). The Native Council of Nova Scotia (NCNS) currently report harvesting five fish species in the LAA and 16 fish species within the RAA (Table 9 in the TUS), as well as six invertebrate species in the RAA (Tables 10 in the TUS). Only one species (lobster) was identified as a species harvested for FSC needs by the New Brunswick bands which participated in the TUS. However, this fishing area occurs in the Bay of Fundy.

TUS interviewees did not report any FSC fishing activity within the Project Area. However, the TUS and the EIS acknowledge that this does not imply that FSC fisheries are not occurring in the Project Area or that the Project Area may not be accessed for future FSC fisheries needs and reliance. The assessment was therefore based on a precautionary approach and the assumption that FSC fishing has potential to occur anywhere in the Project Area, LAA, and RAA. Using this approach, it was determined that with the implementation of the mitigation measures proposed in the EIS, effects from Project activities would not be significant on FSC fishing activity and therefore would not affect First Nations' reliance on country food from Project activities. Potential effects from routine Project activities is also anticipated to be temporary and localized and is not likely to have a substantial effect on Indigenous fishing activities and availability of fisheries resources. The LAA does not include any unique fishing grounds or concentrated fishing effort that occurs exclusively within the LAA; similar alternative sites are readily available within the immediate area.

b) Accidental events (*e.g.*, spills), although unlikely to occur, could result in contamination of fish species commonly harvested for human consumption for FSC purposes. Results of spill modelling demonstrate that the geographic extent of an unmitigated spill will most likely be limited within the RAA. It is important to note that many of the areas delineated through the modelling have low probabilities of occurrence and that results are based on an unmitigated release (*i.e.*, without the application of tactical spill response methods such as those included in Section 8.3.3.3 of the EIS). In an actual incident, spill response measures would reduce the magnitude and duration of the spill thereby limiting the geographic extent and magnitude of potential environmental effects. Fisheries closures would be imposed in areas where a visible sheen of oil is present (*i.e.*, where surface oil is thicker than 0.04μm), thereby preventing human exposure to contaminated food sources. Similarly, the imposition of an exclusion zone around the affected area(s) would prevent human contact with spilled oil. Adverse effects on the health of Indigenous peoples are not predicted to occur as a result of the Project. However, if a conservative approach is adopted, and consideration is given to the potential temporary closure of areas to commercial and/or FSC fishing activities in the event of a blowout incident and potential economic effects linked to potential loss of access, the EIS has predicted a potential significant adverse residual effect on the Current Aboriginal Use of Lands and Resources for Traditional Purposes. This is explained in greater detail in Section 8.5.6 of the EIS.

Information Request (IR) IR-123 (MTI-43)

Applicable CEAA 2012 effect(s): 5(1)(c)

EIS Guidelines Reference: Part 1, Section 3.3.2 Valued Components to be Examined; Part 2, Sections 5 Aboriginal Engagement and Concerns, 6.1.9 Aboriginal Peoples and 6.3.7 Aboriginal Peoples

EIS Reference: Various – see context

Context and Rationale: MTI commented to the Agency that there was a lack of information presented in the EIS pertaining to contemporary resource-based livelihood (*e.g.* eco-tourism and other recreational activities). This may include eco-tourism or other recreational operations. These socio-economic components are described in general as they occur off the southeastern shores of Nova Scotia, however not with respect to other areas in, or in proximity to, the RAA that may have implications for New Brunswick Mi'gmaq First Nations.

Specific Question or Request: Considering the comments above, discuss the Project's potential effects on socio-economic conditions (including eco-tourism and recreation) of the New Brunswick Mi'gmaq First Nations (as represented by MTI).

Response: Eco-tourism and recreation does not occur in the Project Area, and routine Project activities are not predicted to interact with these activities which may be occurring within the Regional Assessment Area (RAA), closer to shore. Platform supply vessels (PSVs) will use existing shipping routes and are not expected to interfere with nearshore recreational activities.

Results of spill modelling conducted in support of the Environmental Impact Statement (EIS) demonstrate that the geographic extent of an unmitigated spill will most likely be limited within the RAA. It is possible, however, that some unmitigated blowout spill scenarios could result in some oil extending beyond the boundaries of the RAA. Recreational activity (including eco-tourism) in the nearshore waters of Nova Scotia has potential to be affected by accidental events associated with the Project; however, stochastic modelling of oil spilled from blowout incident scenarios indicates a low probability (0 to10%) for shoreline oiling along the Nova Scotia coastline, with most predicted contact locations being less than 1%. It is important to note that many of the areas delineated through the modelling have low probabilities of occurrence and that results are based on an unmitigated release (*i.e.*, without the application of tactical spill response methods, such as those described in Section 8.3.3.3 of the EIS). In an actual incident, spill response measures would reduce the magnitude and duration of the spill thereby limiting the geographic extent and magnitude of potential environmental effects. Adverse residual environmental effects of the Project on socio-economic conditions (including eco-tourism and recreation) of the New Brunswick Mi'gmaq First Nations are not predicted to occur as a result of the Project.

Information Request (IR) IR-124 (MTI-44)

Applicable CEAA 2012 effect(s): 5(1)(c)(i) and (iii)

EIS Guidelines Reference: Part 2, 6.1.9 Aboriginal Peoples and 6.3.7 Aboriginal Peoples

EIS Reference: 5.3 Socio-Economic Environment; 7.7 Current Aboriginal Use of Lands and Resources for Traditional Purposes

Context and Rationale: The MNNB notes that the assessment of effects on Indigenous peoples focuses on "Current Aboriginal Use of Lands and Resources for Traditional Purposes". MTI has advised the Agency that this valued component focus is too narrow and does not adequately reflect the values of Mi'gmaq First Nations in New Brunswick. Of interest and value is not only "current use" but linkages between past, current and future use of the lands and resources through a seven-generation approach to sustainability that aligns with Mi'gmaq environmental management practices and stewardship for Indigenous fishery and fisheries species harvested offshore or nearshore, particularly migratory species.

Specific Question or Request: Explain if and how the analysis of the significance of potential adverse environmental effects on current Indigenous use of lands and resources for traditional purposes includes consideration of elements of the Mi'gmaq seven-generation approach to sustainability.

Response: BP acknowledges the importance of the elements of the Mi'gmaq seven-generation approach to sustainability. A complementary approach to determining adverse residual effects from Project activities was used for the assessment. For example, as discussed in Section 7.2.5 of the Environmental Impact Statement (EIS), thresholds established to define a significant adverse residual environment effect on Fish and Fish Habitat included one that causes a significant decline in abundance or change in distribution of fish populations within the Regional Assessment Area (RAA), such that natural recruitment may not re-establish the population(s) to its original level within one generation as well as one that jeopardizes the achievement of self-sustaining population objectives or recovery goals for listed species. Similarly to elements of the Mi'gmag seven generation approach to sustainability, the characterization of residual effects also considers the duration (period of time required until the measurable parameter of the Valued Component (VC) returns to its existing condition) and reversibility (whether a measurable parameter or the VC can return to its existing condition after the project activity ceases). Other pertinent past, current and future use timescales of change have been identified in the EIS, where applicable, such as population trends for various marine species and variation in fishing catch rates, where this information is known. Given the aforementioned, and the short-term nature of the proposed Project, the Project is not predicted to affect the sustainability of Indigenous fishery and fisheries species harvested offshore or nearshore or migratory species.

Information Request (IR) IR-125 (MTI-45)

Applicable CEAA 2012 effect(s): 5 (1)(c)(i))

EIS Guidelines Reference: 6.3.11 Human Environment

EIS Reference: 6.2.2 Selection of Valued Components s

Context and Rationale: MTI has expressed concern to the Agency that the RAA does not extend far enough west and northwest, into the Gulf of Maine and Bay of Fundy, to fully understand the potential effects on Aboriginal ocean resource use and the Indigenous fishery under normal project conditions as well as accidental event (spill) scenarios.

Specific Question or Request: Further to providing the rationale for the spatial scope of the cumulative effects assessment for each valued component (IR 004), discuss whether extending the spatial scope of the RAA to encompass Aboriginal ocean resource use and the Indigenous fishery in the Gulf of Maine and Bay of Fundy could change the analysis of potential effects on Aboriginal culture, health and socio- economic conditions and current use of lands and resources for traditional purposes.

Response: Residual effects from routine Project activities are predicted to be limited to the Local Assessment Area (LAA) and therefore are not expected to affect Aboriginal ocean resource use and the Indigenous fishery in the Gulf of Maine and Bay of Fundy. A summary of environmental effects from routine activities can be found in Section 13.3 of the EIS.

As explained in Section 6.2.3.4 of the Environmental Impact Statement (EIS), the Regional Assessment Area (RAA) was defined as the area within which residual environmental effects from Project activities and components may interact cumulatively with the residual effects of other past, present and future physical activities. The RAA is significantly larger than the Project Area and LAA, and consequently it also is used to consider areas which could be impacted by a larger scale accidental event, such as a blowout incident.

Results of the spill trajectory modelling carried out for the Project demonstrate that the geographic extent of an unmitigated spill will most likely be limited within the RAA. The worst-case credible discharge that was considered as part of the spill trajectory modelling includes an unmitigated, (*i.e.*, without the application of tactical spill response methods) 30 day, continuous blowout spill scenario. The spill trajectory modelling identifies surface oiling, in water oil concentrations and shoreline oiling. While the stochastic model output of the predicted probability of sea surface oiling (exceeding the 0.04 μm thickness threshold) demonstrates a potentially large affected area, it is important to note that many of the areas delineated through the spill modelling have very low probabilities of occurrence and that results are based on an unmitigated release. In an actual incident, spill response measures would be applied to reduce the magnitude and duration of the spill thereby limiting the geographic extent and magnitude of potential environmental effects. It is therefore predicted that in the unlikely event of an accidental spill (including a well blowout), the Project will not result in adverse residual effects on Indigenous ocean resource use and the Indigenous fishery in the Gulf of Maine and Bay of Fundy.

Information Request (IR) IR-126

Applicable CEAA 2012 effect(s): 5(1)(c)(iii)

EIS Guidelines Reference:

EIS Reference: 7.7.8.2 Mitigation of Project-Related Environmental Effects

Context and Rationale: The proponent commits to developing and implementing a Fisheries Communication Plan for Indigenous fisheries representatives that will facilitate coordinated communication around routine Project activities and components as well as accidental events.

Specific Question or Request: Describe the objective of the Fisheries Communication Plan and how the proponent intends to work with Indigenous groups whose current use (*i.e.* fishing) may be affected by the Project to ensure their input is received and considered throughout the Project.

Response: As part of the EIS, BP has assessed the effects of the Project on Fish and Fish Habitat, Commercial Fisheries and the Current Use of Lands and Resources for Traditional Purposes. Mitigation measures have been proposed to reduce or eliminate adverse environmental effects. A summary of the mitigation measures are included in Section 13.2 of the EIS.

One of the mitigation measures states that "BP will continue to engage with commercial and Aboriginal fishers to share Project details as applicable and facilitate coordination of information sharing. A Fisheries Communication Plan will be used to facilitate coordinated communication with fishers." The Fisheries Communication Plan will be developed in advance of drilling activity and will be used to provide a framework for communications between BP and the commercial and Indigenous fishing communities.

As part of the Fisheries Communication Plan and in advance of activity, BP will develop a contact list of fishery managers to support communication during operations. Communication will address possible interaction with Indigenous groups whose current use may be affected and allow for ongoing dialogue during offshore activities.

As part of the Fisheries Communication Plan, BP will clarify Project plans for platform supply vessel (PSV) traffic and wellsite locations, including the location of a safety (exclusion) zone which will be placed around the mobile offshore drilling unit (MODU).

Fisheries Liaison Officers (FLO) will be appointed by BP as part of the Project to coordinate communication between BP and Indigenous and commercial fisheries. In addition to BP's ongoing engagement program with stakeholders in and around Nova Scotia, the FLOs will communicate Project plans and will conduct reporting on behalf of BP which will be shared with Indigenous and non-Indigenous groups. FLO reporting will include offshore activity, fishing vessel activity, date, vessel registration, and other pertinent information throughout operations.

BP has conducted engagement activity to date with Indigenous and commercial fisheries. This will continue as Project planning continues and during Project activities.

Information Request (IR) IR-127 (MNNB-01)

Applicable CEAA 2012 effect(s): 5(1)(a)(i) Fish and Fish Habitat; 5(1)(a)(ii) Aquatic Species; 5(1)(c) Effect of a change in the environment on Indigenous peoples

EIS Guidelines Reference: Part 2, Section 6.6.1 Effects of Potential Accidents or Malfunctions

EIS Reference: 5.2.5 Marine Fish pp. 5.111-5.112; 8.5.1 Fish and Fish Habitat pp. 8.92

Context and Rationale: The MNNB noted that Atlantic Salmon is an important species for the food social and ceremonial (FSC) fishery for Indigenous groups, particularly the MNNB. Maliseet communities do not have FSC allocations for salmon as the stocks are too low on the Saint John River, where the Atlantic Salmon fishery has been closed since 1996. The MMNB has advised that any future effects on Atlantic Salmon with the potential to further deplete the stocks are of great concern, as they are culturally important and have been part of the Maliseet diet since time immemorial.

The MNNB noted that Atlantic Salmon migrate through the LAA and the RAA and may migrate through the PA, and that several populations of Atlantic Salmon have been assessed as Endangered or Threatened by COSEWIC, or are SARA- listed, with high marine mortality being a key reason for their status. The Endangered (COSEWIC) Outer Bay of Fundy population is also known by the MNNB to migrate through the LAA and RAA, and likely the PA. Although the EIS assesses effects on fish and fish habitat collectively, and lists Atlantic Salmon as a species occurring in the area, potential adverse effects from Project activities and accidents specifically on Atlantic Salmon are not described.

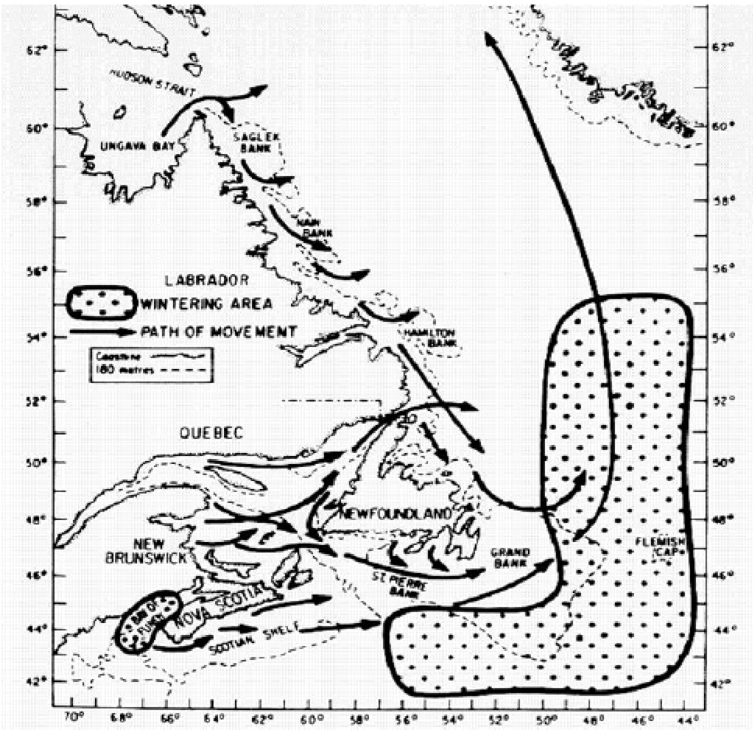
Specific Question or Request:

a) Provide information on how the different accident scenarios (including scale, temporal and spatial issues) could affect, specifically, migratory and transient species that depend on the LAA and RAA as migratory routes between breeding and feeding areas, with particular focus on Atlantic Salmon.

b) Provide information on how any subsequent changes to fish migratory behaviour due to a spill incident could affect Indigenous fishing, particularly for FSC purposes.

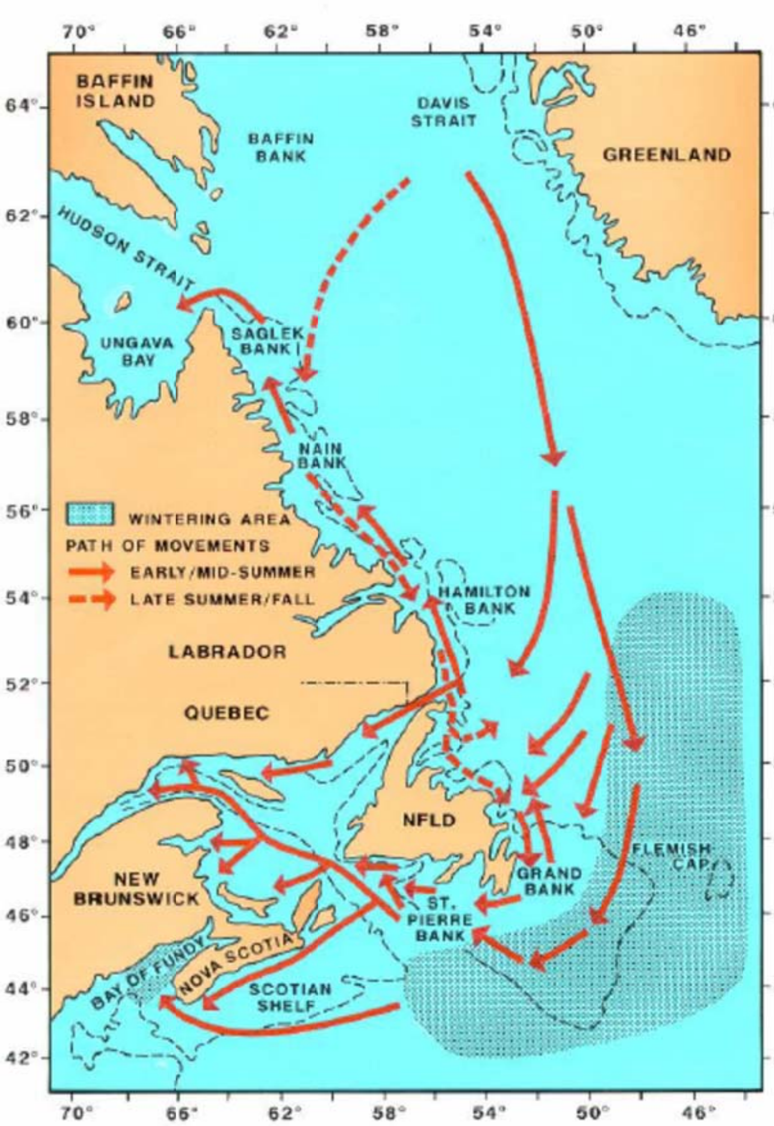
Response:

a) Atlantic salmon possess the innate ability to return to their natal rivers and streams to spawn, after completing ocean-scale migrations. Collectively over their entire range in North America, adult Atlantic salmon return to rivers from feeding and staging areas, near Labrador and Greenland, between May and November (COSEWIC 2010). Young salmon (parr) rear in fluvial and lacustrine habitats for 2 to 8 years prior to undergoing behavioural and physiological transformations and migrate to sea as smolt (COSEWIC 2010). The migration patterns of adult and smolt Atlantic salmon is provided in Figures 1 and 2 below (Reddin 2006).



Source: Reddin (2006)

Figure 1 Movement of Atlantic post-smolts away from natal rivers into the Northwest Atlantic



Source: Reddin (2006)

Figure 2 Migration of Atlantic salmon from the Labrador Sea and Western Greenland to Natal Rivers

In the unlikely event of a blowout incident, mitigation measures such as the spill tactical response methods described in Section 8.3.3.3 of the Environmental Impact Statement (EIS) would be implemented which would reduce the extent of the potential affected area compared to the unmitigated scenarios depicted in Section 8.2 of the EIS.

As part of the stochastic spill trajectory modelling for a potential blowout incident, a total of 210 individual oil releases were modelled from both spill Sites 1 and 2 in the Project Area. Each individual scenario was run for the initial 30 day release period, and an additional 90 days to show the fate and trajectory of oil after the well had been capped (*i.e.*, for 120 days in total). This approach allowed the spill scenarios to be evaluated to the point where either the oil had reached a negligible amount or the shoreline was reached as per the EIS Guidelines.

Seasonal summaries of stochastic analyses of potential surface oiling (Figures 8.4.3 to 8.4.6 of the EIS) and water column dispersed and dissolved oil concentrations (Figures 8.4.7 to 8.4.10 of the EIS) illustrate the locations of potential oil contamination in Canadian waters surrounding Nova Scotia and Newfoundland, United States (US) waters to the east of New England, and international waters south of Canada for Sites 1 and 2.

The oiling footprint locations provided in the stochastic modelling outputs are not the expected extent of oiling from a single release of oil. The locations of the oiling footprints represent the potential areas in which oil could travel following a 30-day unmitigated release. The modelling results predict that the majority of oil will remain in offshore waters with a <20% probability that surface oil exceeding the 0.04 μm (Bonn Agreement Oil Appearance Code (BAOAC) "Sheen") will enter nearshore waters of Nova Scotia for both the summer and winter scenarios. In the event that surface oil was to enter the nearshore area of Nova Scotia, it would take a minimum of between 30 to 50 days to arrive.

Both adult and smolt Atlantic salmon migrate using coastal and offshore waters found in the Regional Assessment Area (RAA), swimming at depths which fall predominantly in the surface waters (0 to 5 m). A study conducted by Godfey *et al.* (2014) found that kelts (salmon which have spawned) migrating away from natal rivers through fjords and estuaries were found to use the 0 to 5 m water depth range 94 to 99% of the time. When these fish reached the open ocean, they were found to inhabit this depth range 60 to 90% of the time. It was also found that adult salmon returning to their natal rivers are in the 0 to 5 m water depth range on average 67 to 81% of the time. As a result, these findings suggest that an accidental event leading to surface oiling could have the potential to interfere with Atlantic salmon migration from salmon avoiding oiled areas.

As indicated above, most oil is predicted to remain offshore, which could have the potential to temporarily impede or alter the migration of some Atlantic salmon, although it is believed that only a proportion of the population might be affected and an entire year class would not be affected to a degree which could result in the permanent or irreversible loss of critical habitat as defined in a recovery or action plan. Furthermore, the achievement of self-sustainable population objectives or recovery goals for Atlantic salmon are not expected to be impeded due to the limited area of potential migration route impacted compared to the potential areas which could be used by Atlantic salmon.

b) Given that the stochastic spill trajectory modelling predicts that the majority of oil would remain offshore, only a portion of the Atlantic salmon migratory routes are predicted to be potentially impacted. Nearshore and freshwater areas are not expected to be greatly affected and, as a result, Indigenous fishing is not expected to be impacted.

References:

COSEWIC. 2010. COSEWIC assessment and status report on the Atlantic Salmon Salmo salar (Nunavik population, Labrador population, Northeast Newfoundland population, South Newfoundland population, Southwest Newfoundland population, Northwest Newfoundland population, Quebec Eastern North Shore population, Quebec Western North Shore population, Anticosti Island population, Inner St. Lawrence population, Lake Ontario population, Gaspé-Southern Gulf of St. Lawrence population, Eastern Cape Breton population, Nova Scotia Southern Upland population, Inner Bay of Fundy population, Outer Bay of Fundy population) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xlvii + 136 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

Godfrey, J.D., D.C. Stewart, S.J. Middlemas, and J.D. Armstrong. 2015. Depth use and migratory behaviour of homing Atlantic salmon (*Salmo salar*) in Scottish coastal waters. ICES J Mar Sci 72(2): 568-575.

Reddin, D.G. 2006. Perspectives on the marine ecology of Atlantic salmon (*Salmo salar*) in the Northwest Atlantic. DFO Canadian Science Advisory Secretariat Research Documents. 2006/018.

Information Request (IR) IR-128 (MNNB-02)

Applicable CEAA 2012 effect(s): All

EIS Guidelines Reference: Part 2, Section 6.6.1 Effects of Potential Accidents or Malfunctions

EIS Reference: EIS Section 8.3.3.3 Oil Spill Tactical Response Methods

Context and Rationale: The MNNB noted that one of the proposed mitigation strategies for controlling a spill is the use of dispersants, pursuant to a Net Environmental Benefit Analysis (NEBA) being performed. The primary benefits of dispersant use are stated to be that they remove hydrocarbons from the water surface where they may harm seabirds and other wildlife, and they can be rapidly deployed over wide areas. The EIS provides a discussion on the benefits of dispersant use and suggests that risks are minimal.

The MNNB has noted that several recent studies on the effects of the Deepwater Horizon oil spill suggest that common dispersants used in spill scenarios make hydrocarbons more bioavailable, and have suggested links to health risks in humans and aquatic animals. Links between dispersant use and deformities, bioaccumulation, as well as direct mortality of aquatic life have been identified and are the subject of active research (*e.g.* Almeda et al 2013; Barron 2012; Goodbody *et al.* 2013; Paul *et al.* 2013; Rico-Martinez *et al.* 2013). Furthermore, the MNNB is concerned that dispersants may prolong exposure to hydrocarbons as the dispersed hydrocarbons become suspended in the water column or fall to the sediment on the sea floor and interfere with the ability of bacteria to degrade hydrocarbons (Hamdan and Fulmer, 2011; Kujawinski *et al.* 2011).

Specific Question or Request: Further to IR 073 that requests a more complete description of potential adverse effects of dispersant use on VCs and IR 066 that asks how dispersant use would affect fate of spilled oil:

a) provide a list of dispersants that may be used, along with any reported evidence of the observed environmental effects associated with their use;

b) provide the parameters that would be considered in the NEBA, including potential environmental effects on aquatic organisms due to both oil and dispersants; and

c) based on current science, including from the Deepwater Horizon oil spill, provide an analysis of how the potential effects of dispersant use on aquatic organisms could in turn affect FSC, commercial, and recreational fisheries.

Response:

a) A specific list of dispersants has not yet been determined for this Project. In May 2016, Regulations Establishing a List of Spill-treating Agents under the *Canada Oil and Gas Operations Act* came into force, listing spill-treating agents (dispersants) Corexit© EC9500A and Corexit© EC9580A as acceptable for use in Canada's offshore. Commercial dispersant products are in general a combination of solvents and surfactants. Dispersants enhance the natural processes that occur when oil is spilled into the sea surface or into the sea at depth. The use and effects of dispersants have been examined and discussed in Section 8.3.3.3 of the EIS and in IR-073 (including potential from the use of Corexit).

b) BP will undertake a net environmental benefit analysis (NEBA), also referred to as a spill impact mitigation assessment (SIMA) as part of the preparation of the Spill Response Plan to evaluate the benefits associated with different spill response tactics including dispersants. Operational considerations in evaluating the role of various spill response strategies (including use of dispersants) will consider: the feasibility of the response technique in prevailing conditions; capability of the response technique to significantly affect the outcome; and the availability of equipment and personnel to deploy the response technique. In a NEBA/SIMA framework, potential biophysical and socio-economic risks would be weighed against risks of not dispersing surface and subsurface oil including the risk to marine life associated with surface slicks and shoreline (*e.g.*, Sable Island) contamination. The NEBA/SIMA will analyze the trade-off between toxic effects of the dispersed oil in the water column relative to advantages of removing floating oil from the sea surface and preventing environmental effects on sensitive shorelines. The potential for short- and long-term aquatic toxicity effects, or bioaccumulation through the food chain, and the duration of any such effects will be addressed in the NEBA/SIMA. The Royal Society of Canada's review "Behaviour and Environmental Impacts of Crude Oi Released into Aqueous Environments" (Lee *et al*. 2015), amongst other literature and research (including Deepwater Horizon work) will be used to guide examination of these topics.

c) Potential effects on aquatic species from the use of dispersants is discussed in IR-073. From a socio-economic perspective, although studies indicate that dispersants have relatively low toxicity to fish species, dispersant use may increase public concern over seafood safety, thereby potentially prolonging effects on commercial and Aboriginal fisheries (HDR Inc. 2015). Seafood species collected during the Deepwater Horizon spill detected dioctylsulfosuccinate sodium salt which is a highly water-soluble component of dispersants and other consumer products, in only 4 of 299 tissue samples and determined that it was unlikely to pose a risk to aquatic receptors due to low tissue concentrations, low bioaccumulation and rapid depuration (Tjeerdema *et al*. 2013).

   In the event of a spill, a fishery closure may be imposed to prevent gear from being contaminated and to protect or reassure seafood consumers. Closures typically remain in place until: an area is free of oil and oil sheen on the surface; there is low risk of future exposure based on predicted trajectory modelling; and seafood has passed sensory sampling (smell and taste) for oil exposure (taint) and chemical analysis for oil concentration (toxicity) (National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling 2011). The implementation of a fishery closure during an oil spill would prevent localized or area-specific harvesting of fish, and potentially alleviate concerns about marketing of tainted product. Additional testing to confirm the safety of seafood harvested after such a spill would reduce the potential for long term impacts to fishers.

To address concerns about the potential effect of oil and dispersants on seafood in the Deepwater Horizon incident, in June 2010, the National Oceanic Atmospheric Administration (NOAA) and the US Food and Drug Administration (FDA), in consultation with United States Environmental Protection Agency (US EPA) and State agencies, agreed to an extensive sampling and testing procedure. Areas once closed to fishing were reopened only when all seafood sampled in the area passed both the established sensory and chemical testing.

While initial testing was focused on oil, in October 2010 the FDA and NOAA created a new test that could detect traces of dispersant constituents in fish tissue. (US FDA 2010). Every sample tested was well below FDA levels of concern, with 99 percent of the samples showing no detectable residue.

None of the seafood tested by the FDA, NOAA and the Gulf states exceeded the FDA's human health thresholds. Since May 2010, the FDA, NOAA and the Gulf states tested more than 10,000 finfish and shellfish specimens. Levels of PAHs in seafood consistently tested 100 to 1,000 times lower than FDA safety thresholds.

References:

HDR Inc. 2015. Net Environmental Benefit Analysis in Support of the Shelburne Basin Venture Exploration Drilling Project. June 2015.

Lee, K., Boufadel, M., Chen, B., Foght, J., Hodson, P., Swanson, S., Venosa, A. 2015. Expert Panel Report on the Behavior and Environmental Impacts of Crude Oil Released into Aqueous Environments. Royal Society of Canada, Ottawa, ON.

Tjeerdema, R., A.C. Bejarano and S. Edge. 2013. Biological Effects of Dispersants and Dispersed Oil on Surface and Deep Ocean Species. From the Oil Spill Dispersant-related Research Workshop, hosted by the Center for Spills in the Environment. March 12-13, 2013. Baton Rouge, LA.

US FDA (United States Food and Drug Administration). 2010. NOAA and FDA Announce Chemical Test for Dispersant in Gulf Seafood; All Samples Test Within Safety Threshold. October 29, 2010. Web. 6 Mar. 2015. Available from: http://blogs.fda.gov/fdavoice/?tag=gulf-seafood

US FDA (United States Food and Drug Administration). 2012. "Gulf Seafood is Safe to Eat after Oil Spill,". January 11, 2012. Web. 6 Mar. 2015. Available from: http://blogs.fda.gov/fdavoice/?tag=gulf-seafood

Information Request (IR) IR-129 *(intentionally left blank)*

Information Request (IR) IR-130 (MNNB-04)

Applicable CEAA 2012 effect(s): 5(1)(a)(i) Fish and Fish Habitat; 5(1)(a)(ii) Aquatic Species; 5(1)(c) Effect of a change in the environment on Indigenous peoples

EIS Guidelines Reference: Part 2, Section 6.6.1 Effects of Potential Accidents or Malfunctions

EIS Reference: BP Scotian Basin Exploration Drilling Project EIS Section 8.5.5 Commercial Fisheries pp. 8.136

Context and Rationale: MNNB has advised that, in addition to fish mortality, diminished fish reproduction, and loss of fish habitat, one of the long-term consequences of the Deepwater Horizon oil spill was a decrease in consumer confidence in seafood from the Gulf of Mexico. The MNNB stated that a majority of consumers perceived that fish and shellfish from the Gulf of Mexico were unsafe to eat even three years after the event, even though studies showed that this seafood had low toxicity (McKendree *et al.* 2013). The MNNB is concerned that a large oil spill from the Project could have severe economic consequences to Indigenous recreational, FSC and commercial fisheries and associated industries.

Specific Question or Request: Based on the modelled accident scenarios in the EIS, estimate possible economic effects on Indigenous peoples both from recreational and Indigenous fisheries closures that could result from a spill, and from to reduced consumer confidence in seafood from the affected area. In conducting this analysis, consider research or other information from the Deepwater Horizon oil spill, such as *Environmental effects of the Deepwater Horizon oil spill: A review* (Beyer et al 2016) and *Louisiana residents' self-reported lack of information following the Deepwater Horizon oil spill: Effects on seafood consumption and risk perception* (Simon-Friedt et al 2016).

Response: Potential effects on Current Aboriginal Land and Resource Use for Traditional Purposes (including recreational and Indigenous fisheries is provided in Section 8.5.6 of the Environmental Impact Statement (EIS). As discussed in IR-114, the data collected during the Traditional Use Study is presented in an aggregated format to protect privacy of information provided during the interviews. Likewise, although licencing data were obtained from DFO on a licence holder level, landings data is not accessible at this level for privacy reasons. An economic impact assessment is therefore not feasible (due to the unavailability of licencing data) or required (given the conservative approach used for the assessment) to assess the potential environmental effects of an accidental event. Credible worst case assumptions have been made upon which to base a prediction of the significance of environmental effects and commitments for mitigation and emergency response (*e.g.*, in the event of a large spill). For example, because of the widespread nature of the worst-case, unmitigated blowout incident, a significant effect is conservatively predicted for Current Aboriginal Use of Lands and Resources for Traditional Purposes for this scenario. The likelihood of this significant effect occurring is considered low, given the potential for a blowout incident to occur and given the response measures that would be in place to mitigate potential effects. In addition, while a blowout incident could potentially affect nearshore fishing and resource use along the coastline, the likelihood of oil reaching the coast is very low and the time required for oil to reach the shore would give BP and operators time to implement mitigation against oiling of cultivation gear. Residual effects related to tainting is discussed in Section 8.5.5.3 of the EIS and recognizes that market perceptions of poor product quality (*e.g.*, tainting might persist thereby prolonging effects for fishers, although these effects may be reduced by collecting test data to demonstrate that the seafood has a normal appearance, taste and smell, and has no detectable level of contaminants, or levels that are far below any threshold of concern, and are therefore safe for consumption.

Information Request (IR) IR-131 (MNNB-06)

Applicable CEAA 2012 effect(s): 5(1)(a)(i) Fish and Fish Habitat; 5(1)(a)(ii) Aquatic Species; 5(1)(c) Effect of a change in the environment on Indigenous peoples

EIS Guidelines Reference: Part 2, Section 6.6.1 Effects of Potential Accidents or Malfunctions

EIS Reference: EIS, Section 5.2.5 Marine Fish pp. 5.100; Section 8.5.5 Commercial Fisheries pp. 8.136; Appendix G, Fig. 21, pp 21

Context and Rationale: The MNNB noted that Swordfish landings are heavily concentrated along the edge of the Scotian Shelf, but there are also consistent landings throughout the Scotian Shelf, including in the PA. Because most landings occur outside of the PA, the MNNB acknowledged that direct effects from the Project are likely to be relatively low, although Swordfish may avoid the PA during project operations. A major accident affecting the LAA or RAA could cause Swordfish avoiding the area, and possible bioaccumulation of contaminants. The MNNR submission stated that oil and dispersants are most toxic to larval fish, which are not present in the RAA, and the adults are very mobile, so while the MNNB acknowledge that even a major spill may not cause population-level effects, the migration patterns of Swordfish are not well understood (Abascal *et al.* 2015, Neilson *et al.* 2014, Schirripa *et al.* 2016), and thus the potential effects on this species are difficult to ascertain.

Specific Question or Request:

a) Assess the potential short and long-term effects of potential spills and remediation efforts (*e.g.* use of dispersants) on Swordfish, including potential effects on the health and sustainability of the species and consider potential for effects on human health (*i.e.* bioaccumulation). Describe if this assessment of effects on Swordfish alters the assessment of effects on Aboriginal peoples, including potential effects on the Indigenous fishery or other traditional use of this resource.

b) Indicate whether the proponent would review future Swordfish migration research and update Environmental Management and Monitoring Plans within an adaptive management context for protection of this species, if applicable.

Response:

a) The effects of the Project on marine fish and fish habitat, including swordfish, have been assessed in Sections 7.2 and 8.5.1 of the EIS. In the event of a spill event, adult finfish including swordfish will likely avoid exposure through temporary migration from affected areas.

Stochastic and deterministic spill trajectory modelling was undertaken for a continuous, 30-day, unmitigated (*i.e.*, without the application of tactical spill response methods) blowout incident at two potential well locations within the Project Area. Modelling was conducted for both summer and winter season spill scenarios. Applying the 58 ppb total hydrocarbon (THC) threshold for effects to fish (an in-water concentration of dissolved and entrained oil in the top 100 m), these levels are most likely to be encountered on the

Scotian Slope, with 7 to 11% average probability of these levels occurring in the Haddock Box and 9 to 13% average probability of these levels reaching the Emerald, Western, and Sable Banks on the Scotian Shelf (refer to Figures 8.4.7 to 8.4.10 of the EIS). This threshold was calculated due to the potential acute lethality effects on larval and juvenile fish at 58 ppb THC. These levels are not likely to cause acutely toxic effects to adult fish such as swordfish which have the potential to be present in the Regional Assessment Area (RAA). Additional information pertaining to the 58 ppb THC threshold for effects on fish is provided in the response provided for IR-069.

The oil release models indicate that the minimum time for in-water oil concentrations >58 ppb to arrive at the maximum distance from the well is between 50 and 75 days (illustrated in Figure 8.4.10 of the EIS, Site 2 summer season). As noted in Section 8.3.3 of the EIS, well intervention response strategies could be implemented within a matter of days for blowout preventer (BOP) intervention and the well could be capped between 13 and 25 days, thereby decreasing the spatial extent of a spill. These mitigation assumptions were not factored into the model to demonstrate the worst-case credible scenario of an unmitigated blowout incident. Exposure time to oil concentrations above 58 ppb is also contingent on spill response time. For the unmitigated scenario (Site 2 summer season), the predicted duration of exposure to in-water concentrations of oil >58 ppb around the wellsite is greater than 30 days, while in-water exposure time of one day or less may be expected at the outer extent of the predicted threshold exceedance area (Figure 8.4.10 of the EIS).

As noted in the response to IR-073, the biomagnification of petroleum hydrocarbons typically does not occur in food webs. This is due to the fact that vertebrates, including swordfish, can readily metabolize petroleum hydrocarbons and as a result, biomagnification of these substances is not an issue for these species. Therefore, in the event that swordfish are exposed to hydrocarbons via respiration, direct contact, or through diet, these hydrocarbons will be metabolized and generally will not pose a risk through bioaccumulation.

In the event of a spill, surface oiling would have a short-term effect on commercial and food, social and ceremonial (FSC) fisheries due to the exclusion of fishing in areas where oil exceeds a thickness of 0.04 μm (a visible sheen). Affected areas would be closed to commercial and Indigenous fishing to prevent human contact with spilled oil and consumption of potentially contaminated food sources. Closures typically remain in place until: an area is free of oil and oil sheen on the surface; there is low risk of future exposure based on predicted trajectory modelling; and seafood has passed sensory sampling (smell and taste) for oil exposure (taint) and chemical analysis for oil concentration (toxicity). In recognition of potential socio-economic effects of a large spill (*e.g.*, 100 bbl diesel spill) or blowout incident on Indigenous use of water and resources (primarily as a result of fisheries exclusion), a conservative approach has been taken in the EIS and a significant adverse environmental effect has been predicted (refer to Section 8.5.6.4).

The effects of an accidental event including a blowout incident have been further assessed in response to IR-060, 061, 069, and 073. Based on the information above, the information in each of the aforementioned IR responses, the fact that the species spawns outside of the RAA and the information contained in the EIS, the predicted residual adverse environmental effects from a blowout incident on swordfish would not be significant.

b) The effects assessment against the Fish and Fish Habitat Valued Component (VC) in the EIS includes swordfish likely to be present in the Project Area, LAA and RAA and evaluates the potential for impacts from routine operations of the Project and accidental events. The predicted residual adverse environmental effects from routine operations and accidental events on Fish and Fish Habitat including swordfish are predicted to be not significant. As a result and given the medium to high level of confidence in the prediction, follow-up and monitoring programs, including the requirement to review future swordfish migration research are not viewed as necessary.

Information Request (IR) IR-132 (MNNB-07)

Applicable CEAA 2012 effect(s): 5(1)(a)(i) Fish and Fish Habitat; 5(1)(a)(ii) Aquatic Species; 5(1)(c) Effect of a change in the environment on Indigenous peoples

EIS Guidelines Reference: Part 2, Section 6.6.1 Effects of Potential Accidents or Malfunctions

EIS Reference: EIS Section 5.2.5 Marine Fish pp. 5.95; Section 8.5.5 Commercial Fisheries pp. 8.136; EIS Appendix G, Fig. 15, pp 15

Context and Rationale: The MNNB is concerned about the Silver Hake, a commercially harvested species. The MNNB has identified that Silver Hake spawn in the RAA, and is thus concerned that the species may be at greater risk than pelagic and transitory species. MNNB is concerned that a major spill or blow-out could have local and regional effects on adults and pelagic larvae.

Specific Question or Request: Assess the potential short and long-term effects of potential spills and remediation efforts (*e.g.* use of dispersants) on Silver Hake, including the health and sustainability of the population and potential human health (*i.e.* bioaccumulation) effects. Describe if and how these potential effects would alter any assessment of effects on Aboriginal peoples, including potential effects on the Indigenous fishery or other traditional use of this resource.

Response: The effects of an accidental event (including a blowout incident) on Fish and Fish Habitat have been considered in Section 8.5.1 of the Environmental Impact Statement (EIS). Further to the information in the EIS, additional assessment on the effects of accidental events on Fish and Fish Habitats has been carried out in response to IR-060, 061, 069, and 073.

Based on the information contained in these IR responses, and the information contained in the EIS, the predicted residual adverse environmental effects from a blowout incident or other accidental events on silver hake would not be significant.

As noted in the response to IR-073, the biomagnification of petroleum hydrocarbons typically does not occur in food webs. This is due to the fact that vertebrates, including silver hake, can readily metabolize petroleum hydrocarbons and as a result, biomagnification of these substances is not an issue for these species. Therefore, in the event that silver hake are exposed to hydrocarbons via respiration, direct contact, or through diet, these hydrocarbons will be metabolized and generally will not pose a risk through bioaccumulation.

In the event of a spill, surface oiling would have a short-term effect on commercial and food, social and ceremonial (FSC) fisheries due to the exclusion of fishing in areas where oil exceeds a thickness of 0.04 µm (a visible sheen). Affected areas would be closed to commercial and Indigenous fishing to prevent human contact with spilled oil and consumption of potentially contaminated food sources. Closures typically remain in place until: an area is free of oil and oil sheen on the surface; there is low risk of future exposure based on predicted trajectory modelling; and seafood has passed sensory sampling (smell and taste) for oil exposure (taint) and chemical analysis for oil concentration (toxicity). In recognition of potential socio-economic effects of a large spill (*e.g.*, 100 bbl diesel spill) or blowout incident on Indigenous use of water and resources (primarily as a result of fisheries exclusion), a conservative approach has been taken in the EIS and a significant adverse environmental effect has been predicted (refer to Section 8.5.6.4).

Information Request (IR) IR-133 (MTI-14)

Applicable CEAA 2012 effect(s): All

EIS Guidelines Reference: Part 2, Section 6.6.1 Effects of Potential Accidents or Malfunctions

EIS Reference: 8.3 Emergency Response and Spill Management

Context and Rationale: MTI has noted that, in line with standard practices, the proponent will submit various plans at a later date as part of the CNSOPB's authorization process, including an Incident Management Plan, a Spill Response Plan, an Environmental Protection Plan, and a Safety Plan. Thus, MTI is not able to evaluate the adequacy of these documents at this time.

Specific Question or Request: Further to IR 063, which requests outlines of the Incident Management Plan, Spill Response Plan, Environmental Protection Plan, and Safety Plan, along with key commitments, state whether the proponent intends to provide MTI or other groups with an opportunity to review or provide input to these plans before they are finalized.

Response: BP is committed to ongoing engagement with Aboriginal groups and interested stakeholders throughout the life of the Project. BP is required to submit environmental protection and emergency response plans to the Canada-Nova Scotia Offshore Petroleum Board (CNSOPB) as part of the Drilling Operations Authorization (OA) approval process. The Incident Management Plan, Spill Response Plan, Environmental Protection Plan, and Safety Plan are currently under development and would be discussed only at a high level during engagement. Relevant information and feedback received during Aboriginal and stakeholder engagement would be incorporated as applicable. These plans will be submitted to, and reviewed by, the CNSOPB as part of the Drilling Operations Approval process. The CNSOPB will determine the extent of distribution of these plans once they are finalized.

Information Request (IR) IR-134 (MTI-15)

Applicable CEAA 2012 effect(s): All

EIS Guidelines Reference: Part 2, Section 6.6.1 Effects of Potential Accidents or Malfunctions

EIS Reference: 8.1 Potential Accidental Events; 8.1.3.1 Offshore Vessel Collision; 8.2 Potential Spill Scenarios

Context and Rationale: The EIS notes that an offshore vessel collision could result in an oil spill. The MTI noted that no probability is provided for the likelihood of such a collision and the consequent likelihood of a resulting spill.

Specific Question or Request: Estimate the probability of an offshore vessel collision and the likelihood of a spill should a collision occur, based on past incidence of such events and considering project-specific characteristics.

Response: As evidenced by the record of spills to the sea maintained by the Canada-Nova Scotia Offshore Petroleum Board (CNSOPB) (http://www.cnsopb.ns.ca/environment/incident-reporting), spills from vessels associated with offshore petroleum exploration and production are very uncommon. In the last ten years, there has been one vessel spill (excluding installations and mobile offshore drilling unit [MODUs]) recorded associated with offshore petroleum exploration and production. On June 28, 2013 there was a small spill (0.75 litres) of hydraulic oil from the M/V Cook which was commissioned for Shell's seismic exploration program in the Shelburne Basin (CNSOPB 2014). However, this spill was not the result of a vessel collision incident. There have been no platform supply vessel (PSV) collisions that have resulted in a spill in the Nova Scotia offshore.

As indicated in the response to IR-057, it is expected that up to three platform supply vessels (PSVs) will be used to support the project, and that the PSVs will make two to three trips per week. PSVs will use existing shipping lanes for the approaches to Halifax Harbour and will contact Halifax Harbour and Approaches Vessel Traffic Services (Halifax Marine Communications and Traffic Services) at control call-in points along the shipping channel and in the harbour. PSVs will use weather forecasting tools and radar to plan operations to avoid or prepare for extreme weather events. Navigation and communication equipment and the implementation of vessel operator procedures will also help to reduce the risk of collision.

The probability of an offshore vessel collision and the likelihood of a spill should a collision occur are both extremely low given the safety measures and regulatory oversight that are in place for marine navigation to prevent these incidents and the relatively low volume of PSV traffic for the Project.

References:

CNSOPB (Canada-Nova Scotia Offshore Petroleum Board). 2014. Spills to the Sea April 1, 2013 – March 13, 2014. http://www.cnsopb.ns.ca/environment/incident-reporting.

Information Request (IR) IR-135 (MTI-15)

Applicable CEAA 2012 effect(s): All

EIS Guidelines Reference: Part 2, Section 6.6.1 Effects of Potential Accidents or Malfunctions

EIS Reference: 8.1 Potential Accidental Events; 8.2 Potential Spill Scenarios

Context and Rationale: MTI is concerned that the probability of a spill is greater now that wells are being drilled in deeper water. The EIS stated that the probability of a blowout incident is 3.1×10^{-4} per well drilled (or 2×10^{-3} if seven wells are drilled; data from 1980 to 2004). It also stated that there are more controls in place now compared to the time period of the data upon which the probability estimates are based. MTI is concerned that, that despite the relatively low probability of occurrence, the risk may be understated, given the potential severity of environmental effects of a blowout. Further, the 1980 to 2004 time period does not include the Deepwater Horizon oil spill that occurred in 2010.

Specific Question or Request: Provide a discussion of how project-specific characteristics may affect the likelihood of a well blowout. State whether the wells that would be drilled as part of the Project would be in water depths greater than those typically drilled over the time period used to develop the probability of a blowout (1980 to 2004). State whether wells in deeper waters pose a greater risk of blowouts.

Response: As stated in Section 2.1 of the Environmental Impact Statement (EIS), water depths across the exploration licenses (ELs) range from 100 m to more than 3,000 m.

BP and others in industry have safely explored for oil and gas from deepwater reservoirs in water depths to approximately 3,100 m water depth. BP uses advanced technology to help safely and responsibly overcome engineering challenges and runs tailored training programs to develop the right capability in the drilling teams.

Industry well control incident databases are normally updated annually. Reports analyzing the blowout data are prepared using the latest available data and consequently there are variable reports of blowout probability as the underlying data set evolves on a year to year basis.

In addition to the information provided in the EIS about blowout probability over the 1980-2004 data range, other reports based on industry databases up to 2015 (which would include more recent well incidents as well as wells drilled in water depths up to 3,100 m) do not indicate that there is significant variance in the probability of a blowout occurring as a function of water depth (ERC 2014; Holand 2016). In a blowout database with data up to 2011, there were no reported blowouts from the 42 exploratory wells drilled in water depths over 2,500 metres (ERC 2014).

BP's risk management approach, including assessment of risk and implementation of barriers, applies to well operations in all water depths.

A number of factors are considered to determine the risks associated with a particular drilling program. BP has assessed the risks that may be encountered during the Project. The risks that could occur in deep-water drilling are consistent with those presented in Section 8.1.3 of the EIS.

Risks have been identified that could lead to a well blowout incident. Detailed information about the risk of a loss of well control and the associated barriers are included in Section 8.1.3.4 of the EIS. Some examples of these risks include an improperly designed well or operations plan, encountering shallow gas, or experiencing an influx of hydrocarbons into the well bore. Other regional specific examples of these risks include a potential collision with an offshore vessel and extreme weather events.

As part of the risk assessment process, BP has identified the barriers that will be in place to mitigate the identified risks. BP will implement a verification and assurance program to test the strength and performance of the barriers during the Project.

BP has worked, along with others in industry to further enhance the performance of the barriers used in deep-water drilling risk prevention and management. These enhancements incorporate lessons learned as a result of the Deepwater Horizon incident and response in 2010 as well as other industry events. Examples of enhancements, including updates to procedures, process and equipment, and personnel competence and training programs are discussed in Section 8.1.2 and Table 8.3.2 of the EIS.

The risk of a loss of well control should be mitigated in the first instance with primary well control measures, such as predicting and monitoring the formation pressure and controlling the density of drilling fluid accordingly. Drilling and geological properties are monitored during drilling operations and the drilling fluid density is adjusted accordingly to maintain an overbalance of pressure against the formation, which keeps the wellbore stable. All drilling activity is carried out in line with a well operations program which includes measures to prevent loss of well control.

BP uses its global wells engineering practices which embed standardization and consistent implementation of well design and planning. These technical practices include current industry standards and are designed to encompass the full range of wells that may be drilled by BP, including deep-water wells. BP has updated and enhanced its engineering technical practices to incorporate learnings from the Deepwater Horizon incident. For example, BP’s Zonal Isolation Practice has been updated and clarified with respect to requirements for cement barrier installation and verification.

BP works with experienced, qualified drilling contractors and uses assurance practices, such as the rig intake process to confirm that the equipment is fit for purpose and satisfies applicable standards. Procedures are used to define ways of working, such as bridging documents and verification and assurance programs provide BP with confirmation that contactors are delivering against their operating management systems.

The mobile offshore drilling unit (MODU) will also be equipped with secondary well control equipment. Secondary well control equipment (e.g., a blowout preventer [BOP]) enables an emergency shut-down that would allow the well to be shut in. BP’s Well Control Practice specifies that all dynamically positioned rigs be equipped with subsea blowout preventers (BOPs) that have two blind shear rams and a casing shear ram, and BOPs require independent certification and verification. Additional information about enhancements that have been made to BOP technology and BP's Well Control Practice is included in Table 8.3.2 of the EIS.

Furthermore, BP will use advanced technological capability to monitor conditions in the wells. BP's global real-time monitoring centre in Houston will monitor wells drilled as part of the Project to provide an additional level of support including help to predict, prevent and, if needed, respond to potential well control situations. Communication will be maintained between the real-time monitoring centre and the MODU and the rig crew will take action as required.

BP will use equipment and technology (e.g., the MODU) which is designed to drill in the water depths in the exploration licenses (ELs). Also, only highly trained and competent personnel will be authorized to supervise operations. BP has a number of programs in place to assure that personnel undergo consistent and structured competency training and assessment for well control. Well control for deep water operations is practiced on simulators in scenario-based enhanced crew competency development programs. Agreed procedures will define what the rig crew must do in the event of a kick.

References:

ERC [Environmental Research Consulting]. 2014. Analysis of Potential Blowouts and Spills from Offshore Wells and Activities: Perspectives on Shelburn Basin Venture Exploration Drilling Project (2014 Jan 17). Prepared by Etkin, D.S. for Shell Canada Limited, Stantec Consulting Ltd., TPS RSA.

Holand, P. 2016. Blowout and Well Release Characteristics and Frequences, 2015. SINTEF Report F27447. SINTEF Technology and Society. Trondheim, Norway. 93p

Information Request (IR) IR-136 (MTI-18)

Applicable CEAA 2012 effect(s): All

EIS Guidelines Reference: Part 2, Section 6.6.1 Effects of Potential Accidents or Malfunctions

EIS Reference: 8.1 Potential Accidental Events; 8.2 Potential Spill Scenarios

Context and Rationale: Two oil volumes were modelled to represent a bulk spill of diesel from the MODU: 10 barrels and 100 barrels. MTI has advised that the 100-barrel volume used to represent the higher end of the range, in MTI's view, is too low. Figure 8.2.3 shows that 18 percent of spills from U.S. offshore platforms were of volumes between 100 and 999 barrels for the years 1968 to 2012.

Specific Question or Request: Provide a rationale for why a 100-barrel spill size was used for the spill modelling. Discuss how the results of that modelling would differ for a 1,000-barrel spill, and how that would affect the resulting effects to VCs.

Response: As indicated in Section 8.4 of the Environmental Impact Statement (EIS), the spill volumes modelled included 10 barrels (bbl) to represent a hose failure (*i.e.*, an operational and maintenance spill) and 100 bbl to represent a tank failure (*i.e.*, a bulk spill). Spills in this range represented the majority of spills from platforms in the United States (1968-2012) totalling 77.87% of all spills. These volumes were modelled because they are the most realistic spills to occur during operations.

A bulk spill of 1,000 bbl of diesel would have similar effects to biological resources at a slightly larger spatial scale. With respect to a Change in Risk of Mortality or Physical Injury, although there is a risk of mortality of phytoplankton and zooplankton (food sources), and sub-lethal and lethal effects to larval and juvenile fish species present in the mixed surface layer of the water column, these residual effects will likely be restricted to a localized area, albeit slightly larger than for a 100 bbl spill. The potential for these effects would also be temporary and reversible. Adult fish species in surface waters will largely be unaffected due to avoidance mechanisms; demersal (bottom dwelling) species are unlikely to be exposed to harmful concentrations of dissolved total hydrocarbons. Residual effects following a nearshore diesel spill from the platform supply vessel (PSV) could include localized mortality and sub-lethal effects to fish eggs, larvae and juveniles.

Information Request (IR) IR-137 (MTI-21, MTI-22)

Applicable CEAA 2012 effect(s): All

EIS Guidelines Reference: Part 2, Section 6.6.1 Effects of Potential Accidents or Malfunctions

EIS Reference: 8.3 Emergency Response and Spill Management

Context and Rationale: In the event of a spill, the EIS states that booming and skimming may be employed to limit the spread of oil and to partially recover the oil, but does not provide further detail. In particular, the EIS does not discuss how much equipment is available for spill response, whether or not it is enough to respond adequately to a large spill, or equipment locations and estimated deployment times. Without this information, MTI is unable to determine the extent to which booming and skimming may serve as useful mitigation measures.

Specific Question or Request: Describe, to the extent known:

- where spill response equipment would be stored,
- whether there would be enough equipment (*e.g.* number and capacity of skimmers, length of boom, deployment vessels, *etc.*) to respond effectively to a large spill or blowout,
- plans to get spill response equipment to the spill site, and
- the estimated time to get equipment to an oiled shoreline.

The response should consider the predicted time for oil to reach shorelines (*e.g.* 3.8 days to Sable Island for one blowout scenario).

Response: Emergency response and spill management is discussed in Section 8.3 of the Environmental Impact Statement (EIS).

In advance of the drilling program, BP will write an incident management plan (IMP), which will include a spill response plan (SRP). BP will include tactical response measures within the SRP to clarify procedures and strategies for safely responding to different spill scenarios. The plan will also include information about how oiled wildlife and recovered oil waste would be managed, and how a sampling and monitoring program would be established if necessary. The SRP, including specific details for response arrangements, such as the equipment that will be available for use by BP and where it is stored, will be submitted to the Canada-Nova Scotia Petroleum Board (CNSOPB) for approval prior to the start of drilling activity as part of the Operations Authorisation (OA) process.

As part of project planning and spill preparedness process, BP has considered a range of spill scenarios that could occur as part of the Project, including the worst case credible discharge from a potential well blowout incident. This has been done to define the type of spill response methods that may be required as part of the Project.

Additionally, as part of spill response and preparedness arrangements, BP will conduct a net environmental benefit analysis (NEBA), also referred to as a spill impact mitigation assessment

(SIMA) to evaluate the effectiveness and feasibility of certain spill response methods and to consider potential environmental effects associated with spill response methods. Final details about the NEBA/SIMA will be confirmed to the CNSOPB as planning continues.

For each of the selected response scenarios, a spill response strategy will be developed. The strategies, informed by the NEBA/SIMA results, outline the full suite of response tactics that would be employed for each scenario, including quantities, locations and times of deployment, from surveillance through waste management. BP will then make arrangements to secure the availability of the required capabilities – equipment, supplies and personnel - such that the response strategies can be implemented within the planned timeframes.

BP would seek to mobilize response equipment as efficiently as possible following a spill event. Depending on the specific nature of the incident, equipment may be mobilized using platform supply vessels (PSVs), helicopters, or vessels of opportunity. The mobilization will consider: environmental conditions, such as visibility and metocean conditions; safety criteria; and potential interactions with environmental and social sensitive receptors, such as fisheries, shorelines and special areas. Mobilization strategies will be considered as part of the NEBA/SIMA.

BP will adopt a tiered response for spill response and preparedness in line with industry guidelines. As such, BP will have access to a range of resources and tactics that can be mobilized and demobilized, and implemented efficiently and appropriately in order to be able to respond to a range of spill events. The selection of the appropriate response tactics and equipment would be determined by the specific nature of the incident and the environmental conditions at the time of the incident. Spill response tactics that will be considered for use by BP include, but are not limited to: surveillance and tracking, offshore containment and recovery, dispersant application, in-situ burning, shoreline protection, shoreline clean-up, oiled wildlife recovery and waste management. The spill response plan will contain information about the oil spill response tactics listed above. A toolkit of the different response tactics will be available to be used depending on the specific conditions of a spill event. The effectiveness of some of the tactics used would be defined by local conditions at the time of an event.

BP plans to maintain access to spill response equipment to respond to a range of potential scenarios. For example, some localized equipment, such as sorbent material will be maintained on the mobile offshore drilling unit (MODU) and PSVs to respond to small operational spills that may occur on the individual vessels. Furthermore, BP will have access to a stockpile of equipment such as booms and skimmers at a nominated location in, or near Halifax. Contracting arrangements for spill equipment have not yet been finalized and so the specific location cannot yet be confirmed. However equipment will be stored in a location that would allow rapid mobilization to a spill location. Additionally, BP will identify support organisations and agencies that can provide resources to support a spill response effort. Different organisations and resources are in place within the region, and may be mobilized to support a response depending on the extent and scale of a spill. BP also has access to Oil Spill Response Limited (OSRL), which is an international, industry owned organization that provides resources and expertise for oil spill response and clean up. BP is a member of OSRL and as such is able to access and use specialist equipment, call on and deploy specialist incident management experts and technical advisors. OSRL's expertise and resources are strategically located across the world to facilitate effective and efficient response to oil spill incidents. In the event of a spill incident, BP would be able to access response resources, including personnel, equipment and supplies locally on the MODU and PSVs and from the stockpile in a Halifax area location, and from the industry stockpiles held in strategic locations globally to ensure that sufficient resources are available to respond to any spill event.

The time it would take to mobilize equipment to a nominated location, including a shoreline, would be determined by local conditions, such as weather conditions. BP would use the results of spill trajectory modelling and the NEBA/SIMA to help inform and prioritise response strategies.

Information Request (IR) IR-138 (MTI-23)

Applicable CEAA 2012 effect(s): All

EIS Guidelines Reference: Part 2, Section 6.6.1 Effects of Potential Accidents or Malfunctions

EIS Reference: Various – See context

Context and Rationale: The EIS says that the proponent has addressed all 26 recommendations from its internal investigation of the Deepwater Horizon oil spill (as documented in the Bly Report; Table 8.3.3). MTI noted that it is not clear how the Bly Report recommendations relate to recommendations made by independent commissions, such as the Deepwater Horizon Study Group formed by members of the Center for Catastrophic Risk Management Deepwater Horizon Study Group (2011) and the National Academy of Engineering and the National Research Council (Marine Board 2012). Some of those recommendations may help reduce either the probability of a blowout, or its consequences.

Specific Question or Request: Explain the extent to which the proponent's procedures for accidents and malfunctions for the Project have been updated to address recommendations from independent commissions, including those named above.

Response: A number of investigations and commissions were established following the Deepwater Horizon incident.

BP conducted an internal investigation, which culminated in the Bly Report. The BP investigation involved a team of over 50 internal and external specialists from a variety of fields, including safety, operations, subsea, drilling, well control, cementing, well flow dynamic modelling, BOP systems, and process hazard analysis.

Additionally, a number of reports were compiled by governmental agencies and academic institutions external to BP, including the Presidential Commission, the United States Coast Guard, the Bureau of Ocean Energy Management (Regulation and Enforcement), and the National Academy of Engineering/National Research Council.

Each official investigation released to date reinforces the Bly Report's core conclusion that the incident was a complex accident with multiple causes.

The recommendations made in the Bly Report were primarily targeted at BP and were designed to strengthen BP's operational practices. Information about the recommendations can be found in Section 8.3.5 and 8.3.6 of the Environmental Impact Statement. In addition to meeting the recommendations that came out of the Bly Report, BP entered into administrative agreements with the United States Federal Government which includes safety and operations, ethics and compliance and corporate governance requirements which are consistent with findings and recommendations of other official reports.

BP's primary area of focus has been on the Bly Report as this report set out a specific set of recommendations for BP's drilling operating practices and management systems, and contractor and service provider oversight and assurance practices. BP has implemented all of the recommendations made in the Bly Report. Furthermore, taking into account learnings and recommendations from the Deepwater Horizon incident and other industry incidents, BP continues to work with industry counterparts to advance capabilities in deep water drilling risk management and incident prevention.

Information Request (IR) IR-139 (MTI-26)

Applicable CEAA 2012 effect(s): All

EIS Guidelines Reference: Part 2, Section 6.6.1 Effects of Potential Accidents or Malfunctions

EIS Reference: 8.4 Spill Fate and Behaviour; Appendix H Oil Spill Trajectory Modelling

Context and Rationale: MTI has asked what assumptions were used to develop the assumed flow rates of a well blowout for the purpose of oil spill modeling (24,890 barrels per day and 35,914 barrels per day). The flow rate determines the volume of oil released and is therefore a key assumption in oil spill modelling.

Specific Question or Request: Further to IR 062, which requests clarification of why a declining flow rate was used, state the assumptions used to generate the estimated flow rates for oil spill modelling and how they were verified as being appropriate. For context, discuss how the model flow rates compare to flow rates experienced during the Deepwater Horizon oil spill and explain any differences.

Response: As part of the scenario identification and planning for oil spill modelling, BP identified the worst-case credible discharge (WCCD) that could occur as part of the Project. Information about the scenarios that were considered is provided in Section 8.4.3 of the Environmental Impact Statement (EIS). Scenarios were modelled to represent both a low probability large scale event (*i.e.*, a subsea blowout incident) and an instantaneous, small scale spill scenario (*i.e.*, a surface release of diesel). The scenarios were modelled at two potential drilling locations in the exploration licences (ELs) to evaluate the potential impact of water depth and proximity to sensitive receptors in and around the ELs. For all scenarios, the models were run unmitigated (*i.e.*, without any oil spill tactical response methods) until the amount of oil in the system fell below the effects thresholds for surface oiling and in water concentration.

For the subsea blowout incident, the WCCD at two separate locations was calculated using a suite of modelling tools. The WCCD for each location was calculated using the nodal analysis tool Prosper™ (version 11.5) software by Petroleum Experts Ltd. As part of the WCCD calculations, the model inputs were selected based on a balance of "most likely" and conservative assumptions about how the well would behave. Assumptions about the well design and blowout mechanism were selected on a conservative basis. For example, it was assumed that two reservoirs would be exposed during a blowout incident and that there would be unconstrained flow to the mudline with no drill pipe in the hole during discharge. Information about rock and fluid properties for the target sands such as permeability, temperature, porosity and initial reservoir pressures were derived from the sparse analogous offset well data in or near the Scotian Basin and were selected on a "most likely" basis.

The flowrate is specific to the geological conditions (*e.g.*, reservoir thickness, porosity and permeability) at each location. It can be observed that there is a difference in flowrate between the two well locations within the Scotian Basin. A comparison to the flowrate from the Deepwater Horizon incident is not warranted given the differences in geological conditions in the two basins, well design, and other factors. The flowrates that were calculated for the two wellsite locations in the Scotian Basin were submitted to the Canada-Nova Scotia Offshore Petroleum Board (CNSOPB) for review and validation prior to conducting the modelling work.

Information Request (IR) IR-140 (MTI-27)

Applicable CEAA 2012 effect(s): All

EIS Guidelines Reference: Part 2, Section 6.6.1 Effects of Potential Accidents or Malfunctions

EIS Reference: 8.4 Spill Fate and Behaviour; Appendix H Oil Spill Trajectory Modelling

Context and Rationale: The spill model scenarios assume a release duration of 30 days, a time period that is slightly more conservative than the upper limit of 25 days assumed for the time to cap the well. Oil flowed from the Deepwater Horizon (Macondo) well for 87 days, considerably longer than the 30-day assumption used by the proponent. MTI understands that during the Deepwater Horizon oil spill, multiple capping attempts were required, and a relief well was ultimately needed to stop the flow of oil. The proponent assumes that a relief well could be drilled in 165 days, but this estimate is not used in the spill model scenarios.

Specific Question or Request: Clarify for how many days oil flowed from the well after the Deepwater Horizon oil spill. Explain how 30 days of flow was chosen as the worst-case oil spill scenario for the Project in light of that duration. Re-run the oil spill model using a more conservative approach taking into consideration the Deepwater Horizon oil spill, or provide a rationale of why this is not warranted.

Response: Information about the assumptions used for the spill scenarios is included in Section 8.4.3 of the Environmental Impact Statement (EIS). BP modelled two subsea blowout scenarios at two different locations within the exploration licenses (ELs). In line with the precautionary principle, BP selected the worst-case credible discharge for each scenario. The flowrate for each well was different to account for local differences in geological conditions. All modelled scenarios were run unmitigated, (*i.e.*, without the application of any oil spill tactical response methods), and it was assumed that flow would be stopped by the application of a capping stack. For modelling purposes, BP assumed a release duration of 30 days. Oil was released from the Macondo well as part of the Deepwater Horizon incident for 87 days.

Only one attempt was made at capping the well as part of the Deepwater Horizon incident, and it was successful. The well was then killed by pumping cement down the well through the BOP. The relief well played no role in stopping the flow of oil from the well. Once the relief well was completed, it only confirmed the well had already been killed.

BP has assumed a release duration of 30 days for the modelling work conducted for the Project. This reflects enhanced industry capabilities and availability of well intervention response resources since the Deepwater Horizon incident. Taking into account learnings and recommendations from the Deepwater Horizon incident and other industry incidents, BP has worked with industry counterparts to advance deep water drilling risk management, prevention and response capabilities. A detailed discussion of improvements which have been made since the Deepwater Horizon incident are included in Section 8.1.2 of the EIS, and a discussion of lessons learned from the Deepwater Horizon incident is included in Table 8.3.2.

For instance, a significant area where improvements have been made is in the field of well control and intervention capability. For example, BP's Well Control Practice specifies that all dynamically positioned rigs be equipped with subsea blowout preventers (BOPs) that have two blind shear rams and a casing shear ram. Requirements for independent certification and verification of BOPs have also been introduced as explained in Table 8.3.2 of the EIS. In addition, BP has worked with industry counterparts to enhance industry standards and BOP system reliability.

BP's first response to a blowout incident will be to attempt direct intervention measures to close the original BOP. Direct intervention would be achieved using specialist equipment and a remote operated vehicle which would be deployed from a platform supply vessel (PSV) or the mobile offshore drilling unit (MODU) to provide hydraulic power to the BOP in order to close the rams directly. The BOP will be equipped with multiple shear rams to provide additional options to close the BOP. A BOP intervention response is likely to be completed within a matter of days, significantly less than the 30 days modelled as part of the analysis.

As well as the BOP intervention strategy, BP would immediately commence the mobilization of the primary capping stack from Stavanger in the event of a blowout incident. Capping stacks are now available in a number of strategic locations around the world. This was not the case at the time of the Deepwater Horizon incident. Detailed analysis has been carried out to identify the time it would take to mobilize a capping stack to the well location if required to respond to a well blowout incident. The capping stack would be mobilized by vessel to Nova Scotia after preparation and testing in Stavanger. The transit and sailing times to Nova Scotia will be determined by metocean conditions which are likely to differ between summer and winter. The analysis is provided in Section 8.3.3.2 of the EIS, specifically in Figure 8.3.4. Allowing for uncertainties in metocean conditions and the implications for transit time, port calls and inspections and complexities in installations, BP estimates that a well could be capped between 13 and 25 days following an incident.

Well intervention response resources are available now that were not available at the time of the Deepwater Horizon incident and consequently, the 30 day release period modelled as part of the Scotian Basin EIS release is considered conservative. It is therefore not considered necessary to rerun the oil spill model for a longer period.

Information Request (IR) IR-141 (MTI-28)

Applicable CEAA 2012 effect(s): All

EIS Guidelines Reference: Part 2, Section 6.6.1 Effects of Potential Accidents or Malfunctions

EIS Reference: 8.4 Spill Fate and Behaviour; Appendix H Oil Spill Trajectory Modelling

Context and Rationale: The oil spill model used meteorological and oceanographic data from January 2006 to December 2010. MTI expressed concern that this period may not be long enough to reflect extreme weather events.

Specific Question or Request: Provide justification that the use of the 2006 to 2010 data set accurately reflects extreme weather events. Discuss whether using data for a longer time period could substantially affect model results. If yes, re-run the model or, alternatively, explain why this would not change the assessment of effects.

Response: BP typically uses a hind-cast metocean data set spanning five years when conducting spill trajectory modelling. Using a multi-year data set increases the likelihood of capturing representative weather events and patterns within a region.

As part of the planning for the Scotian Basin and preparation for the spill trajectory modelling, BP commissioned an independent, assurance review of potential metocean models to use in modelling work to support the Scotian Basin Environmental Impact Statement (EIS). The review compared hind-cast data of two potential metocean models to published data and buoy data to identify which model provided a better representation of the expected conditions in the Scotian Basin. The assurance work was designed to take account of the metocean features at the regional and sub-regional and locally along the Scotian Shelf. The metocean data set and parameters selected for the modelling work took account of the assurance work and are summarised in in Section 8.4.5 of the EIS.

BP carried out stochastic and deterministic modelling for a number of spill scenarios. In the stochastic modelling of the potential subsea blowout incident releases, a total of 210 individual, 30-day unmitigated (*i.e.*, without the application of tactical spill response methods) releases were modelled for 120 day periods for both Sites 1 and 2. The stochastic simulations were carried out to reflect the potential differences in season (*i.e.*, summer and winter). Simulations were run at varying start times within each 6 month season such that the predicted transport and oil weathering for each simulation is subjected to a range of prevailing wind and current conditions representative of the seasons.

The five year data set captures representative data and has been validated by an independent, assurance review conducted for the Project. While it is possible that some extreme weather events have not been fully captured in the metocean data set, it is important to note that extreme weather is typically associated with larger waves and greater turbulence at the sea surface which can cause some or all of a slick to break up into fragments and droplets of varying sizes. Natural dispersion occurs more rapidly when sea conditions are rough. Extreme weather events would therefore reduce the extent of surface oiling and shoreline oiling because of increased wave dynamics.

In summary, it is unlikely that using data for a longer period of time would substantially impact model results as the current data set contains a representative range of metocean conditions that could be encountered within the Scotian Basin, as validated in the independent assurance review. In the event that extreme weather events are encountered which have not been reflected in the model output, these are likely to give rise to more rapid natural dispersion and mixing and therefore the results presented as part of the modelling output could be considered conservative.

Information Request (IR) IR-142 (MTI-29 and MTI-30)

Applicable CEAA 2012 effect(s): All

EIS Guidelines Reference: Part 2, Section 6.6.1 Effects of Potential Accidents or Malfunctions

EIS Reference: 8.4 Spill Fate and Behaviour; Appendix H Oil Spill Trajectory Modelling

Context and Rationale: For the oil spill modelling, properties of the crude oil were predicted and then matched to the best fit in the Hydrocarbon Processing Industry (HPI) database (1987). The best fit was found to be Sture Blend. Oil weathering data and other oil properties were also derived from the HPI (1987). Please clarify whether this database has been updated since 1987. MTI noted that considerable research has been conducted on oil weathering since 1987. If oil is encountered during the Project, it may have different properties than the Sture Blend.

Specific Question or Request: Explain the sensitivity of the oil model to differences in various oil properties, such as weathering, pour point, viscosity, and specific gravity. Explain how the proponent ensured that the most appropriate oil weathering properties were input to the model.

Response: BP carried out spill trajectory modelling using SINTEF's Oil Spill Contingency and Response (OSCAR) model. OSCAR employs surface spreading, advection, entrainment, emulsification, and volatilization algorithms to determine transport and fate at the surface. In the water column, horizontal and vertical advection and dispersion of entrained and dissolved hydrocarbons are simulated by random walk procedures. Vertical turbulence is a function of wind speed (wave height) and depth; horizontal turbulence is a function of the age of a pollutant 'cloud'. Pollutants near the sea surface may evaporate to the atmosphere. Partitioning between particulate-adsorbed and dissolved states is calculated based on linear equilibrium theory. The contaminant fraction that is adsorbed to suspended particulate matter settles with the particles. Contaminants at the bottom are mixed into the underlying sediments, and may dissolve back into the water. Degradation in water and sediments is represented as a first order decay process. The algorithms used to simulate these processes controlling physical fates of substances are described in Aamo *et al.* (1993) and Reed *et al.* (1995). For spilled oil, processes such as advection, spreading, entrainment and vertical mixing in the water column are not directly dependent on oil composition, although all tend to be linked through macro-characteristics such as viscosity and density. Other processes, such as evaporation, dissolution, and degradation are directly dependent on oil composition.

For the oil spill modelling, the estimated fluid properties of the crude oil (density, viscosity, pour point, wax and asphaltene content) were matched to the properties of oils in the OSCAR oil database to identify the best oil analogue fit through multi-variance analysis. The OSCAR oil database contains both oils for which only crude oil assay data is available, but also oils for which complete weathering information is available. In the former case, model estimates of oil weathering are less reliable than for oil for which oil weathering studies have been carried out. However, the Sture Blend oil analogue which was selected as the best fit for this modelling had been previously subjected to a full oil weathering study according to the methods developed by SINTEF therefore the reliability of oil spill weathering predictions should be much greater than if an oil with only crude oil assay data had been selected.

The OSCAR oil database is maintained with up to date information. BP confirms that the database has been updated since 1987.

References:

Aamo, O.M., Reed, M., Daling, P.S. And Johansen, 0. 1993: A Laboratory-Based Weathering Model: PC Version for Coupling to Transport Models. Proceedings of the 1993 Arctic and Marine Oil Spill Program (AMOP) Technical Seminar pp.617-626.

Reed, M., O. M. Aamo, and P. S. Daling. 1995. OSCAR, a model system for quantitative analysis of oil spill response strategies. Proceedings 1995 AMOP Seminar, Edmonton, Alberta, Canada. p. 815 - 835.

Information Request (IR) IR-143 (MTI-32)

Applicable CEAA 2012 effect(s): All

EIS Guidelines Reference: Part 2, Section 6.6.1 Effects of Potential Accidents or Malfunctions

EIS Reference: 8.4 Spill Fate and Behaviour; Appendix H Oil Spill Trajectory Modelling

Context and Rationale: MTI advised that the 58 ppb TPH threshold used to estimate adverse effects on biological resources in the water column is not specific to oil type and is therefore not a credible threshold. In MTI's view, this threshold also does not adequately account for the significantly greater toxicity of diesel as compared to crude oil. The 100-barrel deterministic diesel batch spill scenario indicates that 336 square kilometres would have water column TPH concentrations exceeding 1 ppb. MTI is concerned that, depending on the biological effects threshold used, contamination of an area this large could result in significant mortality to water column resources and cause long-term effects on marine life.

Specific Question or Request: Further to IR 069, indicate if the 58 ppb effects threshold is applicable to diesel. If not, provide an appropriate effects threshold for diesel and conduct additional analysis, if required, to determine the areas where the threshold would be exceeded. Describe how this could affect predictions of environmental effects from diesel spills.

Response: The toxicity of oil is dependent on the relative proportion of components in the oil and how long they remain in the environment. Diesel contains a high proportion of volatiles and semi-volatiles components that readily evaporate or disperse and biodegrade rapidly. Only a minor fraction of the diesel fuel oil would be considered persistent or non-volatile. Modelling showed that the maximum total in water dissolved oil concentrations at any time during the simulations varied between 1 – 10 ppb and were < 1 ppb within 36 to 48 hours of any release. Thus, even if a threshold of 1 ppb total PAHs was set as the lethal effect level, the area of potential impact would be minor and no more than that shown in Figures 7.11 and Figure 7.12 (Appendix H) of the EIS (Environmental Impact Statement).

Information Request (IR) IR-144 (MTI-33)

Applicable CEAA 2012 effect(s): All

EIS Guidelines Reference: Part 2, Section 6.6.1 Effects of Potential Accidents or Malfunctions

EIS Reference: 8.5 Environmental Effects Assessment

Context and Rationale: For a well blowout, the maximum predicted oiling on the shoreline of the Sable Island National Park Reserve is 669 tonnes of oil along 79.5 kilometres of shoreline. MTI has expressed concern about the effects of this oiling and noted that for isolated areas such as Sable Island, recruitment of flora and fauna may be limited, which may limit recovery time.

Specific Question or Request: Provide a discussion of expected recovery time of potentially-oiled shoreline resources on Sable Island in the event of the worst case scenario described above. Cite current literature as appropriate.

Response: As noted in Appendix H of the Environmental Impact Statement (EIS), the results of stochastic modelling carried out for the Project indicates that there is a possibility of some shoreline oiling following a 30 day continuous unmitigated (*i.e.*, without the application of tactical spill response methods) blowout. A blowout incident was modelled at two different locations within the Project Area. The results indicate that 56% of the modelled runs resulted in <1 tonne of oil reaching the shoreline for site 1 in winter, and 67% of the runs indicated the same results for site 2 during the winter. Similarly during the summer, 31% of the modelled runs from site 1 resulted in <1 tonne of shoreline oiling, and 36% of the runs indicated the same results for site 2. The maximum amount of oil reaching the shoreline of Sable Island is 666 tonnes from both sites 1 and 2 during the summer months. A maximum amount of 255 tonnes and 220 tonnes is predicted to reach the Sable Island shoreline during the winter for sites 1 and 2, respectively. The earliest potential arrival time for oil on the shoreline from site 1 occurs during the summer after 3.8 days. At site 2, the earliest arrival time also occurs during the summer after 6.6 days. For site 1 the peak timing of oil accumulation on the shoreline occurs between 20 to 50 days post-blowout and 35 to 100 days for site 2.

It should be noted that these numbers represent a worst case credible discharge for an unmitigated spill. In the actual event of an incident, tactical spill response measures would be implemented which would reduce adverse effects from those predicted by the modelling and presented in the EIS.

In an unmitigated scenario (*i.e.*, without the application of any tactical response methods), shoreline oil would be left in place to weather naturally. The behaviour of oil on sand and gravel shorelines depends on the properties of the shoreline, including the porosity of the substrate, the morphology of the shoreline, and the energy of the waves impacting the shoreline (Lee *et al.* 2015). The interaction of oil with fine particles on the shoreline creates oil-mineral aggregates (OMAs) which are easily dispersed by waves, tidal action and currents. These OMAs enhance the availability of oil for biodegradation.

Higher wave impacted areas enhance the physical removal and weathering process of spilled oil. Wave impacted rocky shores recover from oil within months, whereas areas such as marshes can act as a petroleum sink for many years (Lee *et al.* 2015). On coarse-grained shorelines including cobble and sandy beaches, oil can penetrate deeper and remain longer due to the fact that it is trapped below the limit of wave action. Fine-grained areas such as silt and clay prevent the oil from penetrating as deep. Conversely, oil is more easily removed from coarse-grained sediments via the flushing of water. An in-depth discussion on nearshore and offshore sediment oiling is provided in the response to IR-076.

In the unlikely event that all of the primary and secondary well control measures fail to control a loss of well control event, and a blowout incident occurs, BP will have plans in place to launch multiple simultaneous response strategies to stop the flow of hydrocarbons. These response activities are outlined in Section 8.3 of the EIS.

In the event that spilled oil approaches shorelines in and around Nova Scotia, a shoreline protection program and shoreline response program will be deployed. Detailed information about shoreline protection and clean-up is provided in Section 8.3.3.3 of the EIS.

Furthermore, oiled wildlife response may be required for fauna encountered at sea and on the shorelines of islands and the mainland. Where it is required, BP will draw upon the expertise and equipment of specialist contractors to support the oiled wildlife response effort. Oiled wildlife response typically is based on a three tier approach:

1. Primary response: surveillance to determine the location and extent of wildlife injuries and death; and deflecting oil away from areas of high sensitivity where practicable.
2. Secondary response: deterring fauna from affected or potentially affected areas; and pre-emptive capture and exclusion activities.
3. Tertiary response: capture and stabilization of oiled wildlife (using boats, or on the shoreline); transport to treatment facilities and treatment of affected fauna.

References:

Lee, K., Boufadel, M., Chen, B., Foght, J., Hodson, P., Swanson, S., Venosa, A. 2015. Expert Panel Report on the Behavior and Environmental Impacts of Crude Oil Released into Aqueous Environments. Royal Society of Canada, Ottawa, ON.

Information Request (IR) IR-145 (MTI-34)

Applicable CEAA 2012 effect(s): All

EIS Guidelines Reference: Part 2, Section 6.6.1 Effects of Potential Accidents or Malfunctions

EIS Reference: 8.5 Environmental Effects Assessment

Context and Rationale: MTI is concerned that the toxicity of SBM to marine fauna may not have been adequately considered in the context of the SBM spill scenario. The evaluation of effects focuses on smothering (as well as a cursory consideration of turbidity).

Specific Question or Request: Describe the possible toxic effects of SBM on marine fauna. Discuss the degradation properties of SBM in the context of the effects on benthic habitat, which were predicted in the EIS to be “temporary” and “reversible”.

Response: Section 7.1.2.1 of the Environmental Impact Statement (EIS) discusses toxicity of synthetic based mud (SBM) on marine fauna. However, as noted therein, field studies have demonstrated limited effects associated with toxicity of drill waste discharges, with adverse effects more likely to result from smothering (see Hurley and Ellis 2004; Neff *et al.* 2004; Neff 2010).

As discussed in Section 8.4.10 of the EIS, SBM spill modelling conducted by RPS ASA (2014) for the Shelburne Venture Exploration Drilling Project predicted that due to the relatively small release volumes and fine particle sizes associated with SBM, a surface spill of SBM would not contribute to mass accumulation on the seabed. Most of the suspended sediment released from the MODU was predicted to remain within the uppermost 10 to 20 m of the water column. In all modelled SBM spill scenarios, the water column was predicted to return to ambient conditions (<1 mg/L) within 30 hours of the release (RPS ASA 2014, Appendix C in Stantec 2014).

Although the specific type of SBM to be used by BP for this Project is not currently known, it is likely to be similar to that used in the modelling for the Shelburne Venture Exploration Drilling Project. The SBM would be selected in accordance with the Offshore Chemical Selection Guidelines (NEB *et al.* 2010) which promotes the selection of lower toxicity chemicals wherever practicable. Given the relatively low toxicity of SBM and the limited spatial and temporal extent of effects in the water column and seafloor, effects on marine fauna, including marine benthic fauna as a result of a spill are predicted to be temporary and reversible as noted in the EIS.

References:

Hurley, G., and Ellis, J. 2004. Environmental Effects of Exploratory Drilling in Offshore Canada: Environmental Effects Monitoring Data and Literature Review-Final Report. Prepared for the Canadian Environmental Assessment Agency-Regulatory Advisory Committee. 61pp. + App.

NEB [National Energy Board], C-NLOPB [Canadian Newfoundland and Labrador Offshore Petroleum Board], and CNSOPB [Canada-Nova Scotia Offshore Petroleum Board].

2010. Offshore Waste Treatment Guidelines. Available from: http://www.C-NLOPB.nl.ca/pdfs/guidelines/owtg1012e.pdf

Neff, J.M. 2010. Fates and Effects of Water Based Drilling Muds and Cuttings in Cold-Water Environments. Prepared for Shell Exploration and Production Company, Houston, Texas, x + 287pp.

Neff, J.M., Kjeilen-Eilersten, G., Trannum, H., Jak, R., Smit, M., and Durell, G. 2004. Literature Report on Burial: Derivation of PNEC as Component in the MEMW Model Tool. ERMS Report No. 9B. AM 2004/024. 25pp.

Stantec [Stantec Consulting Ltd]. 2014. Shelburne Basin Venture Exploration Drilling Project Environmental Impact Statement. Prepared for Shell Canada Limited.

Information Request (IR) IR-146 (MTI-35)

Applicable CEAA 2012 effect(s): All

EIS Guidelines Reference: Part 2, Section 6.6.1 Effects of Potential Accidents or Malfunctions

EIS Reference: 8.5 Environmental Effects Assessment

Context and Rationale: MTI observed that references are not provided for many statements in the EIS regarding anticipated effects of a spill on marine and coastal life, making it difficult to verify the accuracy of the statements. Examples include the statement that zooplankton may be able to avoid exposure to oil, but those which cannot, will depurate (p. 8.99), as well as the statement that the fish community is likely to re-establish itself within one generation following a blow-out (p. 8.99).

Specific Question or Request: Indicate whether the examples stated above are supported by scientific research, or are based on professional judgement.

Response:

The examples stated above in this IR are supported by scientific research and/or professional opinion. The appropriate references for each statement in question are provided below.

For example, "Zooplankton communities may be able to avoid exposure" (page 8.99). This statement is based on a study on copepod swimming behaviour in relation to point-source contamination (Seuront 2010). This study concluded that the two species of calanoid copepods that were investigated (*Eurytemora affinis* and *Temora longicornis*) both showed avoidance behaviour of contaminated patches, regardless of the size or concentration.

Another statement from Section 8.5.1 of the Environmental Impact Statement (EIS), "*Zooplankton which cannot avoid exposure and experience sub-lethal effects will depurate once the spill has subsided due to mitigation (e.g., containment and/or recovery) and natural weathering processes".*

This statement is also based on scientific research. Trudel (1985) reported that at sub-lethal levels, hydrocarbons accumulated in zooplankton after a spill can be depurated within days of moving to clean water (page 8.99).

Regarding the statement, that *"the majority of fish species on the Scotian Shelf and Slope spawn in a variety of large areas, over long time scales, <u>and a spill is not predicted to encompass all of these areas or time scales within the Regional Assessment Area (RAA) to such a degree that natural recruitment of juvenile organisms may not re-establish the population(s) to their original level within one generation"</u>* (page 8.99), this statement is qualitative and the re-establishment of populations over a timeframe of one generation is used as part of the threshold for the determination of significance. If the impact affects a considerable proportion of the population in space or time such that the population cannot be re-established after one generation, then the effect of the impact on the population could be significant. In the case noted for this IR: 1) a spill is not likely to affect most of any one population; and 2) many of the populations that could be affected by a spill (*e.g.*, through mortality) live within areas on the Scotian Shelf and Slope that are considered highly productive (DFO 2014).

References:

DFO [Fisheries and Oceans Canada]. 2014. Offshore ecologically and biologically significant areas in the Scotian shelf bioregion. Canadian Science Advisory Secretariat. Science Advisory Report 2014/041. http://www.dfo-mpo.gc.ca/csas-sccs/publications/sar-as/2014/2014_041-eng.pdf

Seuront, L. 2010. Zooplankton avoidance behabiour as a response to point sources of hydrocarbon-contaminated water. Marine and Freshwater Research, 61(3), 263-270. http://dx.doi.org/10.1071/MF09055

Trudel, K. 1985. Zooplankton. In: Duval, W.S., editor. A Review of the Biological Fate and Effects of Oil in Cold Marine Environments. Report by ESL Ltd., SL Ross Environmental Research Ltd. and Arctic Laboratories Ltd. For Environment Canada, Edmonton, AB. 242 pp

Information Request (IR) IR-147 (MTI-36)

Applicable CEAA 2012 effect(s): All

EIS Guidelines Reference: Part 2, Section 6.6.1 Effects of Potential Accidents or Malfunctions

EIS Reference: 8.5 Environmental Effects Assessment

Context and Rationale: MTI has expressed concern that the anticipated effects of a well blowout may be underestimated in the EIS. Many studies were conducted following the Deepwater Horizon oil spill to assess effects on biological resources, including studies conducted by the Deepwater Horizon natural resource trustees for the natural resource damage assessment (NRDA; in many cases, in cooperation with the proponent) that are summarized in the Programmatic Damage Assessment and Restoration Plan (PDARP) and Programmatic Environmental Impact Statement (PEIS) (Deepwater Horizon Trustees, 2016).

Specific Question or Request: In conjunction with IR 137 (which focuses recommendations that arose from the Deepwater Horizon oil spill), comment on whether and if so, how, the findings of biological effects from that incident, including those presented in the PDARP, were taken into account in determining the anticipated Project effects.

Response: The assessment of accidental events relied extensively on spill modelling conducted for the Project and was based on the worst-case credible discharge for each scenario, including: marine diesel spills from the mobile offshore drilling unit (MODU) and platform supply vessel (PSV); continuous 30-day well blowout incidents (733,000 to 1,056,000 bbl over a 30-day period); and instantaneous spill of synthetic-based mud (SBM) from the MODU (both surface and subsea releases). Further, conservative thresholds were used for oil in-water concentration, surface oil thickness and shoreline mass to assess the results from oil spill modelling and the potential effects in the assessment. These thresholds were based on peer-reviewed scientific studies and are given in Table 8.4.7 of the Environmental Impact Statement (EIS) along with the thresholds used for the effects assessment of accidental events from an oil spill.

With respect to biological effects, the EIS relied on published reports, including those synthesized in the Royal Society of Canada's report "Behaviour and Environmental Impacts of Crude Oil Released into Aqueous Environments" (Lee *et al.* 2015) in determining the anticipated Project effects. Lee *et al.* (2015) paid particular attention to recent studies related to the NRDA following the Deepwater Horizon incident. For the effects assessment, environmental effects pathways were identified and discussed, with reference to Deepwater Horizon study results, if applicable. VC-specific mitigation was included where appropriate with specific focus on emergency response and spill management; however, spill modelling results were also incorporated for unmitigated events to increase the conservatism of the effects assessment.

In addition to the summaries by Lee *et al.* (2015), studies specific to assessing effects from Deepwater Horizon incident were cited in the EIS for all VCs. These studies included: phytoplankton (Gilde and Pinckney 2012); zooplankton (ASM 2011); juvenile fish (Fodrie and Heck 2011); commercial fisheries (National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling 2011; Xia *et al.* 2012); marine mammals (NOAA 2010, 2014a; Ackleh *et al*., 2012; William *et al.* 2011); sea turtles (NOAA 2010, 2014a, 2014b, 2014c); and seabirds (Belanger *et al.* 2010; Haney *et al.* 2014).

As part of spill response and preparedness arrangements, BP will conduct a net environmental benefit analysis (NEBA), also referred to as a spill impact mitigation assessment (SIMA) to evaluate the effectiveness and feasibility of certain spill response methods and to consider potential environmental effects associated with spill response methods. Final details about the NEBA/SIMA will be confirmed to the Canada-Nova Scotia Offshore Petroleum Board (CNSOPB) as planning continues. For each of the selected response scenarios, a spill response strategy will be developed. The strategies, informed by the NEBA/SIMA results, outline the full suite of response tactics that would be employed for each scenario, including quantities, locations and times of deployment, from surveillance through waste management. BP will then make arrangements to secure the availability of the required capabilities – equipment, supplies and personnel - such that the response strategies can be implemented within the planned timeframes.

References:

Ackleh, A.S., Loup, G.E., Loup, J.W., Ma, B., Newcomb, J.J., Pal, N., Sidorovskaia, N.A., and Tiemann, C. 2012. Assessing the Deepwater Horizon oil spill impact on marine mammal population through acoustics: endangered sperm whales. J. Acoust. Soc. Am., 131: 2306-2314.

ASM [American Society for Microbiology]. 2011. A Report from the American Academy of Microbiology: Microbes and Oil Spills, FAQ. 16pp.

Belanger, M., Tan, L., Askin, N., and Wittnich, C. 2010. Chronological effects of the Deepwater Horizon Gulf of Mexico oil spill on regional seabird casualties. J. Mar. Anim. Ecol., 3: 10-14.

Fodrie, F.J., and Heck, Jr., K.L. 2011. Response of coastal fishes to the Gulf of Mexico oil disaster. PLoS ONE, 6(7): e21609. doi: 10.1371/journal.pone.0021609.

Gilde, K., and Pinckney, J.L. 2012. Sublethal effects of crude oil on the community structure of estuarine phytoplankton. Estuar. Coast., 35(3): 853-861.

Haney, J.C., Geiger, H.J., Short, J.W. 2014. Bird mortality from the Deepwater Horizon oil spill. II. Carcass sampling and exposure probability in the coastal Gulf of Mexico. Mar Ecol Prog Ser 513:239-252. Available from: http://www.int-res.com/articles/meps_oa/m513p239.pdf.

Lee, K., Boufadel, M., Chen, B., Foght, J., Hodson, P., Swanson, S., Venosa, A. 2015. Expert Panel Report on the Behavior and Environmental Impacts of Crude Oil Released into Aqueous Environments. Royal Society of Canada, Ottawa, ON.

National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling. 2011. Rebuilding an Appetite for Gulf Seafood after Deepwater Horizon. Staff Working

Paper No. 16. Available from: http://permanent.access.gpo.gov/gpo8569/Rebuilding%20an%20Appetite%20for%20Gulf%20Seafood%20after%20Deepwater%20Horizon_0.pdf

NOAA [National Oceanic and Atmospheric Administration]. 2010. Deepwater Horizon Response Consolidated Fish and Wildlife Collection Report. 2010 Nov 2: Operational Period 196. Available from: http://www.restorethegulf.gov/sites/default/files/documents/pdf/Consolidated%20Wildlife%20Table%20110210.pdf.

NOAA [National Oceanic and Atmospheric Administration NOAA]. 2014a. Historical Hurricane Tracks. Available from: http://www.csc.noaa.gov/hurricanes/#.

NOAA [National Oceanic and Atmospheric Administration]. 2014b. Long-finned Pilot Whale (Glovicephala melas). Office of Protected Resources. Updated June 26, 2014. Available from: http://www.nmfs.noaa.gov/pr/species/mammals/cetaceans/pilotwhale_longfinned.htm.

NOAA [National Oceanic and Atmospheric Administration]. 2014d. NOAA Fisheries Office of Protected Resources: Bottlenose Dolphin (Tursiops truncatus). Available from: http://www.nmfs.noaa.gov/pr/species/mammals/cetaceans/bottlenosedolphin.htm.

William, R. Gero, S., Bejder, L., Calambokidis, J., Kraus, S.D., Lusseau, D., Read, A.J., and Robbins, J. 2011. Underestimating the damage: interpreting cetacean carcass recoveries in the context of the Deepwater Horizon/BP incident. Conservation Letters Vol. 4(3):228-233.

Xia, K., Hagood, G., Childers, C., Atkins, J., Rogers, B., Ware, L., Ambrust, K., Jewell, J., Diaz, D., Gatian, N., *et al.* 2012. Polycyclic aromatic hydrocarbons (PAHs) in Mississippi seafood from areas affected by the Deepwater Horizon oil spill. Environ. Sci. Technol., 46(10): 5310-5318.

Information Request (IR) IR-148 (MTI-37)

Applicable CEAA 2012 effect(s): 5(1)(a)(i) fish and fish habitat

EIS Guidelines Reference: Part 2, Section 6.6.1 Effects of Potential Accidents or Malfunctions

EIS Reference: 8.5 Environmental Effects Assessment

Context and Rationale: In the event of a well blowout, the magnitude of adverse effects on fish and fish habitat is characterized as moderate. The natural resource damage assessment for the Deepwater Horizon oil spill estimated that trillions of planktonic invertebrates and larval fish were killed in offshore waters alone (Deepwater Horizon Trustees, 2016, p. 4-202). While fish and invertebrate populations were expected to recover, MTI considers this to be a high-magnitude effect and has expressed concern about a possible similar scale of injury from a well blowout during the Project.

Specific Question or Request: Further to IR 061, which discusses significance criteria ratings for blowout scenarios, comment on whether information from the Deepwater Horizon PDARP-PEIS was considered in evaluating the magnitude of potential effects of the Project on fish and fish habitat.

Response: The characterization of residual environmental effects of a well blowout incident on fish and fish habitat was informed by information on the effects of the Deepwater Horizon (DWH) oil spill but relied extensively on worst-case spill modelling conducted specifically for the Project. Spill modelling for the Project assumed that no tactical response methods were applied as mitigation measures and used the worst case credible discharge for each wellsite for flow rates. However, in the unlikely event of a blowout incident, mitigation would be implemented which would reduce the extent of the potential affected area compared to the unmitigated scenarios depicted in Section 8.2 of the Environmental Impact Statement (EIS).

In the unlikely event of a spill, BP would implement multiple preventative and response barriers to manage risk of incidents occurring and mitigate potential consequences. As noted in Section 8.3, the Project will operate under an Incident Management Plan (IMP) which will include a number of specific contingency plans for responding to specific emergency events, including potential spill or well control events. The IMP and supporting specific contingency plans, such as a Spill Response Plan (SRP), will be submitted to the Canada-Nova Scotia Offshore Petroleum Board (CNSOPB) prior to the start of any drilling activity as part of the Operations Authorization (OA) process. The SRP will clarify tactical response methods and procedures and strategies for safely responding to different spill scenarios. Tactical response methods that would be considered following a spill incident include, but are not limited to: offshore containment and recovery; surveillance and tracking; dispersant application; in-situ burning; shoreline protection; shoreline clean up; and oiled wildlife response. Refer to Section 8.3 of the EIS for details on incident management and spill response.

The majority of spawning areas for fish species in the Regional Assessment Area (RAA) occur on the Scotian Shelf, with the eggs and larvae of some species being found along the Scotian

Slope and Shelf Break (refer to Section 5.2.1.4 and Table 5.2.3 of the EIS). In the unlikely event of a large blowout incident, the area affected by a spill will not encompass all the spawning locations or timing windows for any one species. Furthermore, the area of the spill exceeding the 58 ppb total hydrocarbon threshold, potentially affecting fish eggs and larvae, will be much smaller than the total area of a spill (refer to Figures 8.4.7 to 8.4.10). Most fish species on the Scotian Shelf and Slope spawn in multiple locations and within multiple temporal windows within the RAA, with the exception of a few species. There are a few species which tend to spawn in a limited geographic area, such as smooth skate and sand lance. However, these species have the potential to spawn over many months or the entire year and with mitigation (*e.g.*, containment and/or recovery), their spawning window would not be completely affected by a blowout incident. Most species including species at risk (SAR), spawn in multiple locations within the RAA or over long time scales, and with only a portion of the RAA having the potential to be affected in the unlikely event of a major blowout incident, it is not likely that an entire year class would be lost from the effects of oil on early life stages of fish species.

In summary, although there is the potential for oil, particularly dispersed oil, to have an effect on larvae and juvenile fish species in the area of a major spill, these effects will be limited spatially and temporally and are not expected to lead to population level effects. Effects from a spill are not expected to negatively affect the entire year class of any species to the level where it would not re-establish its population to original levels within one year. As such, the magnitude of potential effects of the Project on fish and fish habitat remains as Moderate because although measurable changes are expected, these are not anticipated to pose a risk to long-term population viability. Further information to support this rationale is provided in the EIS and in response to IR-060, IR-061, IR-069, IR-073, and IR-147.

Information Request (IR) IR-149 (MTI-38)

Applicable CEAA 2012 effect(s): 5(1)(a)(i) fish and fish habitat

EIS Guidelines Reference: Part 2, Section 6.6.1 Effects of Potential Accidents or Malfunctions

EIS Reference: 8.5 Environmental Effects Assessment

Context and Rationale: MTI has expressed concern that potential effects on cetaceans from a well blowout may be underestimated. Natural resource trustees for the Deepwater Horizon oil spill found that bottlenose dolphins suffered a loss of 30,347 lost cetacean years due to the spill. Without active restoration, the population was estimated to take 39 years to recover (Deepwater Horizon Trustees, 2016, p. 4-618).

Specific Question or Request: Further to IR 061 and IR 148, which also discuss significance criteria ratings for blowout scenarios, indicate if the discussion of anticipated effects of a well blowout on cetaceans considered the Deepwater Horizon NRDA finding referenced above. Reconcile the "short- term to medium-term" duration rating for effects of a large-scale blowout on marine mammals and sea turtles (Table 8.5.2) with the above-reported results and update the effects prediction, if appropriate.

Response: The discussion of anticipated effects of a well blowout on cetaceans considered the results of studies following the Deepwater Horizon spill but did not specifically reference the aforementioned NRDA report. Although the Unusual Mortality Event (UME) of cetaceans in the northern Gulf of Mexico from 2010 to 2014 has been attributed in part, by some to the Deepwater Horizon oil spill, the role of a *Brucella* bacterial outbreak and other factors on the UME is currently unknown and being investigated (NOAA 2016). No link between the UME of cetaceans in the northern Gulf of Mexico from 2010 to 2014 and the Deepwater Horizon oil spill has been established.

As presented in Table 8.5.2 in the Environmental Impact Statement (EIS), the potential residual effect of a well blowout incident on marine mammals and turtles, specifically for species at risk (SAR) and seals inhabiting Sable Island, is characterized as High in magnitude and considered to have potential to result in a significant adverse residual environmental effect. The duration of these residual effects has been increased to medium to long-term with further consideration of the life history characteristics of these species and the potential of a well blowout incident to influence population levels beyond the lifespan of the Project (the changes are illustrated in the table below). However, for other marine mammals and sea turtles (*e.g*., cetaceans and sea turtles that are not SAR), the magnitude and direction of a well blowout incident is anticipated to be lower (*i.e*., Short-term to Medium-term) than described in Table 8.5.2 because the number of individuals likely to be present in an area of oiling at the time of a spill is unlikely to represent a high proportion of any population.

Table 8.5.2 Summary of Residual Project-Related Environmental Effects on Marine Mammals and Sea Turtles – Accidental Events

Residual Effect	Residual Environmental Effects Characterization						
	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Socio-economic Context
Change in Risk of Mortality or Physical Injury/Change in Habitat Quality and Use							
10 bbl Diesel Spill	A	L	LAA	ST	S	R	U
100 bbl Diesel Spill	A	M	LAA	ST	S	R	U
PSV Diesel Spill	A	M	LAA	ST-MT	S	R	U
Well Blowout Incident	A	H	RAA*	~~ST-MT~~ MT-LT	S	R	U
SBM Spill	A	L	LAA	ST	S	R	U

KEY:
See Table 7.2.2 for detailed definitions
N/A: Not Applicable
Direction:
P: Positive
A: Adverse
N: Neutral
Magnitude:
N: Negligible
L: Low
M: Moderate
H: High

Geographic Extent:
PA: Project Area
LAA: Local Assessment Area
RAA: Regional Assessment Area; in certain scenarios, effects may extend beyond the RAA as indicated by an "*".
Duration:
ST: Short-term
MT: Medium-term
LT: Long-term

Frequency:
S: Single event
IR: Irregular event
R: Regular event
C: Continuous
Reversibility:
R: Reversible
I: Irreversible
Ecological/Socio-Economic Context:
D: Disturbed
U: Undisturbed

References:

NOAA [National Oceanic and Atmospheric Administration]. 2016. Cetacean Unusual Mortality Event in Northern Gulf of Mexico (2010-2014): CLOSED. Website: http://www.nmfs.noaa.gov/pr/health/mmume/cetacean_gulfofmexico.htm [accessed March, 2017].

Information Request (IR) IR-150 (MTI-39)

Applicable CEAA 2012 effect(s): 5(1)(a)(i) fish and fish habitat

EIS Guidelines Reference: Part 2, Section 6.6.1 Effects of Potential Accidents or Malfunctions

EIS Reference: 8.5 Environmental Effects Assessment

Context and Rationale: Effects of a well blowout on the sponge and coral conservation areas are estimated to be minimal because the oil would mostly be limited to the surface and mixed layer of the water column. MTI commented that deep sea corals were reported to have been adversely affected by the Deepwater Horizon oil spill (PDARP).

Specific Question or Request: Explain whether the effects of the Deepwater Horizon oil spill on deep sea corals were considered in the assessment of effects of a large-scale blowout on sponge and coral conservation areas and provide specific references of the studies that were considered in the EIS. If effects on sponges and corals from the Project are expected to be minimal, explain how that determination was reached in light of the similarities or differences between a project blowout and the Deepwater Horizon oil spill.

Response: The description of effects of a well blowout from the Project on sponges and deep-water corals in the Environmental Impact Statement (EIS) did not specifically reference studies on the effects of the Deepwater Horizon (DWH) oil spill on deep-sea corals. However, a summary of the potential effects of a large-scale blowout incident on corals is provided below and considered in the following discussion of effects on sponge and coral conservation areas.

White *et al.* (2012) examined deep-water coral communities at 11 sites several months after the DWH well was capped. None of the known coral sites located more than 20 km from the Macondo Well exhibited any changes that could be attributed to effects from the spill. Evidence of recently damaged and deceased corals was found at one site located 11 km to the southwest of the well and beneath the path of a previously documented plume. Floc deposited on the corals at this location was associated with the Macondo Well through biomarker analyses (White *et al.* 2012). Coral colonies at this site showed widespread signs of stress, including varying degrees of tissue loss, sclerite enlargement, excess mucous production, bleached commensal ophiuroids, and covering by floc (White *et al.* 2012). Of the corals examined at this particular site, 46% showed evidence of effects on more than half of the colony, and nearly a quarter showed effects to more than 90% of the colony. Follow-up surveys over a 17-month period indicated that the median level of obvious visual impact to the corals decreased substantially with time, but the authors of that study acknowledged that additional deterioration of the corals could occur because of the onset of hydroid colonization and the potential for effects that were not visually obvious (Hsing *et al.* 2013).

Research indicates that oil dispersants can be toxic to coral larvae (Goodbody-Gringley *et al.* 2013; Lee *et al.* 2015) and it has been recommended that they not be used near coral reefs (ITOPF 2014; Lee *et al.* 2015). However, because corals on the Atlantic coast of Canada inhabit relatively deep and cold waters, dispersion of surface oil is considered less likely to result in exposure to petroleum hydrocarbons than in other areas (Lee *et al.* 2015). Nonetheless, the use of dispersants to manage the discharge of oil from the wellhead during the DWH oil spill demonstrated that benthic organisms in depths of up to 1,300 m are at risk of exposure to chemically-dispersed oil (White *et al.* 2012; Lee *et al.* 2015).

Although studies indicate that the DWH spill had measurable effects to deep-sea corals, potential effects of a well blowout from the Project are expected to be minimal on these organisms. While corals can exist in the deep-water environment near the Project Area, they are likely present as sparse individual colonies on the seafloor, as observed in previous benthic surveys (JWEL 2003) within exploration licence (EL) areas overlapping and adjacent to the ELs and the Project Area. The Oil Spill Contingency and Response (OSCAR) modelling results suggest that the deep-water dispersed oil will be localized to the area of the wellhead (one to several kilometres) and the vertical modelling results indicated that risks to corals are low based on the predictions of low water column concentrations in the deeper and colder waters at the sea bottom. The Gully MPA is located 71 km from the Project Area, the Emerald and Sambro Bank Sponge Conservation Areas are located over 100 km from the Project Area, and the Lophelia and Northeast Channel Coral Conservation Areas are located more than 200 km from the Project Area. Although sponge and coral conservation areas are present in the Regional Assessment Area these are located at sufficient distances from the Project Area such that a well blowout is unlikely to result in adverse effects on the benthic communities in these areas.

References:

Goodbody-Gringley G., D.L. Wetzel, D. Gillon, E. Pulster, A. Miller, and K.B. Ritchie. 2013. Toxicity of Deepwater Horizon Source Oil and the Chemical Dispersant, CorexitH 9500, to Coral Larvae. PLoS ONE 8(1): e45574. doi:10.1371/journal.pone.0045574

Hsing P-Y, B. Fu, E.A. Larcom, S.P. Berlet, T.M. Shank, A.F. Govindarajan, *et al.* Evidence of lasting impact of the Deepwater Horizon oil spill on a deep Gulf of Mexico coral community. Elem Sci Anth. 2013;1:12. DOI: http://doi.org/10.12952/journal.elementa.000012

ITOPF [International Tanker Owners Pollution Federation Limited]. 2014. Effects of oil pollution on the marine environment. Technical Information Paper No. 13. Available from: http://www.itopf.com/fileadmin/data/Documents/TIPS%20TAPS/TIP13EffectsofOilPollutionontheMarineEnvironment.pdf

JWEL [Jacques Whitford Environment Limited]. 2003. Shell Canada Limited Characterization of Benthic Habitat Exploration Licenses 2381 and 2382. Iii + 53pp.

Lee, K., Boufadel, M., Chen, B., Foght, J., Hodson, P., Swanson, S., Venosa, A. 2015. Expert Panel Report on the Behavior and Environmental Impacts of Crude Oil Released into Aqueous Environments. Royal Society of Canada, Ottawa, ON.

White H.K., P-Y. Hsing, W. Cho, T.M. Shank, E.E. Cordes, *et al.* 2012. Impact of the Deepwater Horizon oil spill on a deep- water coral community in the Gulf of Mexico. Proc Natl Acad Sci 109:20303–20308. doi:10.1073/pnas.1118029109

Information Request (IR) IR-151 (SPANS-01)

Applicable CEAA 2012 effect(s):

EIS Guidelines Reference:

EIS Reference: †

Context and Rationale: SPANS has advised the Agency that it is aware of work that is taking place to develop and integrate the Net Environmental Benefits Analysis (NEBA) model into the accidental spill response toolkit of oil and gas exploratory drilling proponents including for the Project. SPANS has commented to the Agency that the NEBA development initiative, along with its implication for approval of dispersants, should be the subject of further follow up and consultation with all stakeholders.

Specific Question or Request: Describe if and how the proponent intends to involve stakeholders, including commercial fishers (Indigenous and non-Indigenous), in the development of the NEBA for this Project.

Response: BP will conduct a net environmental benefit analysis (NEBA), also referred to as a spill impact mitigation assessment (SIMA) as part of the spill response planning process. BP will undertake the NEBA/SIMA as part of the Offshore Authorization (OA) process to evaluate the risks and benefits of different spill response tactics, including dispersant application.

Final details about the NEBA/SIMA will be confirmed to the Canada-Nova Scotia Offshore Petroleum Board (CNSOPB) as planning continues; however, BP will discuss the NEBA/SIMA along with other aspects of spill response planning with stakeholders, including commercial and Indigenous fisheries as part of ongoing consultation and engagement efforts.

Information Request (IR) IR-152 (SFN-02)

Applicable CEAA 2012 effect(s): All

EIS Guidelines Reference: 6.6.1 Effects of potential accidents or malfunctions

EIS Reference: EIS Summary, Section 2.5.3 Emergency Response and Spill Management, page 13

Context and Rationale: The EIS states that "BP will work with a number of local and federal government bodies in the event of an oil spill. These government bodies would be notified of a spill event, engaged to support response efforts and provide regulatory oversight as required." The proponent of another recent exploration drilling project in Nova Scotia conducted an emergency response planning exercise in order to prepare for a well-coordinated response in the event of an environmental emergency.

Specific Question or Request: Indicate whether an emergency response exercise is planned to be carried out before the Scotian Basin drilling program is started and, if not, why. If an exercise is planned, indicate what agencies would be involved in the exercise and whether the fishing community or Indigenous peoples would be invited to participate, as participants or observers, and if so, which communities or groups.

Response: BP will conduct an emergency response drill prior to the commencement of drilling activities. The emergency response drill will be designed to test the incident management plan (IMP) and spill response plan (SRP) which will have been submitted to the Canada-Nova Scotia Offshore Petroleum Board (CNSOPB) as part of the Operations Authorization (OA) process. Information about the IMP and SRP, including the plan to conduct an emergency response drill, is included in Section 8.3.1 of the (Environmental Impact Statement) EIS.

BP will design and execute the emergency response drill in collaboration with the CNSOPB. Other regulatory agencies may be engaged to participate depending on the final agreed scope of the drill. As part of the development and execution of any emergency response drill, BP and the CNSOPB will identify which additional agencies or communities will be required to participate or review the drill, and BP will work with those nominated agencies or communities as mandated by CNSOPB.

Information Request (IR) IR-153 (ECCC-21, SFN-03, MTI-19)

Applicable CEAA 2012 effect(s): All

EIS Guidelines Reference: 6.4

EIS Reference: 8.3.3.2

Context and Rationale: The EIS Guidelines (section 6.4) require the EIS to indicate what other technically and economically feasible mitigation measures were considered, and explain why they were rejected. Trade-offs between cost savings and effectiveness of various forms of mitigation are to be justified.

Section 8.3.3.2 of the proponent's EIS states that: "BP has contributed to the provision of industry capping stacks, and along with other operators in industry, continues to refine and enhance the deployment of capping stacks being developed today." "For Scotian Basin wells, BP's current primary plan is to access the capping stack stored in Stavanger, Norway…". "While it is preferred that the cap is transported directly to the well site on-board a vessel with suitable deployment capabilities, it may become necessary to make an intermediate port call in St. John's (Newfoundland and Labrador) or Halifax. If this were to become necessary, the required customs clearances, functional checks, cargo transfers, *etc.* could add several days to the overall transit time." "Allowing for these uncertainties, BP estimates that a well could be capped between 13 and 25 days after an incident."

It is not clear if other means were considered for getting a capping stack to the scene of a blowout more quickly. The Agency has also heard concerns about this from Indigenous groups (*e.g.* MTI, Nova Scotia Mi'kmaq). MTI recommended that a capping stack be located in Eastern Canada.

Specific Question or Request:

a) Discuss the economic and technical feasibility of options for decreasing capping stack response times, taking into consideration: the potential to use other capping stacks (*e.g.* from organizations other than the Oil Spill Response Limited organization or private companies), establishing a capping stack facility in eastern Canada, or having a capping stack available on a vessel for rapid deployment.

b) The EIS states that it may become necessary to make an intermediate port call in St. John's or Halifax - explain if steps could be taken in advance to avoid a time-consuming port call in the event that a capping stack is required.

c) Clarify the assumptions used to develop the estimate that a well could be capped between 13 and 25 days after an incident and what allowances have been made for weather conditions such as extreme weather events or typical yearly storms. Discuss if weather could delay arrival beyond the estimated 19-day maximum transportation time? Describe any other circumstances (*e.g.* damaged wellhead or BOP) that could impede installation of a capping stack. Estimate the probability that capping stack installation could not be achieved within the 30 days used to model blowout fate and effects.

Response: Information about well control response strategies, including capping and containment, is included in Section 8.3.3 of the Environmental Impact Statement (EIS).

In the event that all of the primary well control measures fail and an uncontrolled well event occurs, BP would launch a suite of response measures as soon as practicable and safe to do so. Many of these measures would be launched simultaneously to provide a comprehensive response and to provide a multiple levels of contingency. An overview of the typical sequence of event for well control and response are shown in Figure 8.3.2 of the EIS.

One of the key response activities that will be launched is the deployment of a capping stack. If a blowout incident were to occur, BP would immediately commence the mobilization of the primary capping stack from Stavanger. BP has evaluated a number of options to define its approach for capping stack preparedness and deployment. For instance, BP considered capping equipment that could be provided by a number of different organizations, and the feasibility of equipment stored in different locations, domestically or internationally. BP also considered different mobilization methods for capping equipment to define whether the capping stack would be deployed by air or sea.

Information about capping stacks is included in Section 8.3.3.2 of the EIS. BP, along with other industry operators, has contributed to the provision of industry capping stacks. Capping equipment is specialized equipment and requires unique expertize for equipment preparation and maintenance. Capping stacks are stored in central locations around the world, and are maintained so they can be ready for immediate use and onward transportation by sea and/or air in the event of an incident.

BP has carried out detailed analysis of capping stack mobilization timing which is included in Figure 8.3.4 of the EIS.

a) Capping Stack Mobilization Time

As indicated in Section 8.3.3.2 of the EIS, the primary well intervention response that would be carried out in response to a blowout incident is direct intervention of the blowout preventer (BOP). Direct intervention involves the use of specialist equipment to close in the original BOP. The BOP will be equipped with multiple shear rams to provide additional options to close the BOP. BP will maintain equipment and capability that can carry out direct external intervention on the BOP within the Nova Scotia region. A BOP intervention response is estimated to take between two and five days. BP would exhaust all options for direct BOP intervention before resorting to capping stack deployment. Nevertheless, as indicated above, BP would mobilize the capping stack as soon as practicable after a blowout incident to provide additional contingency.

Furthermore, as explained in Section 8.3.3.2 of the EIS, a number of preparatory measures must be completed at the wellsite prior to capping stack installation. For example, whilst BOP intervention activities are ongoing, a site survey will be carried out to assess the extent of debris on the seafloor. Large debris on the seafloor could impede access for response equipment and would have to be cleared using subsea cranes and remotely operated vehicles (ROVs) equipped with debris removal tools. The site survey and debris clearance activities are critical for establishing a safe working environment above the wellsite for working in the area. Another preparatory measure that must be carried out prior to installation is the preparation and testing of the capping stack. Based on the specific nature of the blowout incident, it may be necessary to carry out engineering analysis and technical review prior to the installation of the capping stack.

Depending on site specific conditions and the specific nature of the blowout incident, the site survey, debris clearance and gaining access to the well could take several days, potentially a similar period of time as mobilizing a capping stack from a central location. BP will carry out the necessary engineering analysis, technical review, debris clearance and site preparation during the transit of the capping stack so that cap installation can begin upon arrival at the well location.

BP will optimize mobilization time as far as practicable as part of well planning activities. For example, BP will compile vessel loading plans so that the mobilization of the capping stack can take place as quickly as possible in Stavanger. BP will charter air transport for personnel to the site location. BP will conduct preliminary engineering analysis for capping stack installation, however the specific details will be contingent on the specific nature of the blowout incident.

In summary, a number of critical steps are required prior to capping stack installation to establish a safe working area above the wellsite and to analyze the specific nature of the blowout incident to maximize the likelihood of a safe and effective capping stack installation. While having a cap either available in country, available on a vessel for rapid deployment, or mobilized using alternative means such as air freight may allow the capping stack into country more quickly, there is a low likelihood that it would reduce the total mobilization and installation duration.

b) Port Call

The capping stack mobilization analysis presented in Section 8.3.3.2 states that there is a possibility that an intermediate port call may be required during capping stack transit from Stavanger to the well location. BP's preferred option is to sail directly from Stavanger to the well location, however an intermediate stop may be necessary to complete additional testing on land as a contingency if there are any concerns about capping stack integrity.

To reduce the probability of a port call before deployment, the capping stack will be pressure and function tested at the quayside in Stavanger as part of the mobilization. This will identify underlying issues with the capping stack. Furthermore, as stated previously, capping stacks stored in the central locations around the world are subject to regular maintenance and testing by specialist personnel to ensure that they are always ready to deploy.

The capping stack would be loaded on to the vessel in line with a pre-agreed loading plan and secured to minimize the probability of encountering any issues during transit.

An intermediate port call in St John's or Halifax would only be required as a contingency if there were unforeseen issues encountered during mobilization or installation.

c) Capping Stack Mobilization Assumptions

The assumptions for the response time are explained in Section 8.3.3.2 of the EIS and are illustrated in Figure 8.3.4.

It is assumed that the response would include the deployment of the primary capping stack from Stavanger using an installation vessel from the North Sea.

The response times summarized in the EIS account for 3.75 days for incident notification, vessel sourcing, pre-mobilisation testing and sea fastening. The remaining time is the transit time from Stavanger to the incident site and installation.

Sailing times are dependent on vessel cruising speeds which are in turn dependent on weather conditions. Consequently, different sailing times have been estimated for summer and winter. Extreme weather events are not included in the model due to the unpredictable nature of the events and inability to forecast if these events would occur at this point in time.

Transit times for the capping stack installation vessel have been probabilistically modeled for 300 different weather scenarios with a result of 8.25 days for summer weather conditions and 15.25 for winter. It is preferred that the vessel will be transported directly to the wellsite location for direct installation, however it may become necessary to make a contingency intermediate port call in St John's or Halifax. If this were to occur, the required customs clearances, functional checks and cargo transfers could add several days to the overall transit time.

The final set of assumptions that have been made are related to the actual installation of the capping stack at the well location. Precise durations are specific to local conditions at the wellsite. A straightforward installation and closure under good conditions could be completed in 24 hours once the capping stack is at the well location, however a more complicated installation with weather related downtime could take longer.

Issues that could impede capping stack installation include excessive wellhead inclination or damage to the primary sealing areas of the BOP. These issues could require additional measures to be taken to access suitable sealing surfaces which may require additional time. The probabilities of such events impeding installation of a capping stack cannot be calculated due to the lack of data. The only application of a capping stack has been the Deepwater Horizon Incident.

In the event that the capping stack cannot be successfully deployed, relief well plans will be in place to intercept and control the hydrocarbon flow in the event well control cannot be re-established. Information about relief well drilling preparedness is included in Section 8.3.3.2 of the EIS.

However, it is important to note that BP, along with industry counterparts, has worked to improve the reliability of primary and secondary well control measures to prevent a blowout incident from occurring in the first instance, and to develop improved well preparedness and response measures to respond to a blowout incident in the event that it does occur. BP will activate a suite of response measures in response to a blowout incident to provide multiple layers of contingency including well intervention measures such as those described in this IR and in Section 8.3.3.2 of the EIS including direct BOP intervention, mobilization and installation of a capping stack and drilling of a relief well if required. Furthermore, additional spill response options including containment and recovery of oil will be deployed as required.

Information Request (IR) IR-154 (MNNB-45, MNNB-49, MTI-47, MTI-49)

Applicable CEAA 2012 effect(s): 5(2)(b)

EIS Guidelines Reference: Part 2, Section 8 Follow-up and Monitoring Programs

EIS Reference: Section 7.6 Commercial Fisheries; Section 7.7 Current Aboriginal Use of Lands and Resources for Traditional Purposes; Section 12.0 Environmental Management and Monitoring

Context and Rationale: The EIS Guidelines require the proponent to set out a follow-up program for "as long as required for the environment to regain its equilibrium and to evaluate the effectiveness of the mitigation measures." Among other things, the follow-up program provides an "opportunity for the proponent to take advantage of the participation of Aboriginal groups…during the implementation of the program" (EIS Guidelines, Section 8.1, pages 32-33).

In the EIS, the proponent has not proposed follow-up and monitoring for the Project's potential effects on Indigenous current use of lands and resources for traditional purposes: "Given the high level of confidence around a prediction of no significant adverse environmental effects on Current Aboriginal Use of Lands and Resources for Traditional Purposes, and the implementation of standard mitigation, no follow-up and monitoring is proposed to be implemented for routine Project activities" (EIS, Section 7.7.10, page 7.145). Similarly, no follow-up monitoring is proposed for Commercial Fisheries, including Indigenous fisheries (EIS, section 7.6.10, page 7.131).

MTI has also expressed concern to the Agency that consultation or Indigenous knowledge study protocols for New Brunswick Mi'gmaq First Nations were not used to support the EIS and baseline information may therefore be incomplete. The EIS refers to the *Proponent's Guide: The Role of Proponents in Crown Consultation with the Mi'kmaq of Nova Scotia* (NSOAA 2012) and the *Mi'kmaq Ecological Knowledge Study Protocol* (Assembly of Nova Scotia Mi'kmaq Chiefs 2007)" and states that there is an absence of such protocols in New Brunswick. MTI advised the Agency that it made the proponent aware of the *New Brunswick Mi'gmaq Indigenous Knowledge Study Process Guide* and that not having used that Guide, in MTI's view, has affected scoping, consultation, and studies needed to determine effects on Mi'gmaq of New Brunswick First Nations that fished in the past, currently fish, and have interests in fishing and other resource based socio-economic activities (*e.g.* guiding; eco-tourism; other business operations) within or in proximity to the RAA. MTI expressed the view that this could increase the uncertainty of the analysis in the EIS. MTI stated that it finds it unacceptable that no follow up or monitoring is to be implemented for potential effects on Indigenous fishery and other current Indigenous use of lands and resources for traditional purposes. Similarly, the MNNB stated that predictions and mitigation success need to be confirmed and adjusted as needed through a follow-up program with regular meetings to verify EIS predictions and, depending on the findings, adjust mitigation measures accordingly.

Specific Question or Request: Further to IR 085, which requests additional information about the follow-up program, and in conjunction with IR 114 that seeks baseline information about Indigenous fishing activity, provide information regarding a potential follow-up program to monitor effects on the current use of lands and resources for traditional purposes and on Indigenous commercial fisheries. Either describe a proposed follow-up program or provide additional rationale as to why it is not deemed necessary.

In providing a response, consider:

- effects on both the current use of lands and resources for traditional purposes and Indigenous commercial fisheries;
- how inclusion of the guidance in the *New Brunswick Mi'gmaq Indigenous Knowledge Study Process Guide* could affect the potential effects described in the EIS, and the certainty of that assessment;
- if and how Indigenous groups would be consulted about the effects of the Project on the current use of lands and resources for traditional purposes, and on Indigenous commercial fisheries, for all project phases through a follow-up program, or other mechanisms. For example, would the proponent be willing to work collaboratively with First Nations to create a follow-up program, including meeting regularly with captains to verify EIS predictions and, depending on the findings, adjust mitigation measures accordingly?; and
- how the accuracy of predictions would be monitored with respect to potential effects on the current use of lands and resources for traditional purposes and Indigenous commercial fisheries, as a result of a change in the environment caused by the Project.

Also clarify how a qualitative assessment would be used to measure changes in catch rates, as is stated in the EIS (Table 7.7.1). Discuss the extent to which reported fish landings or other quantitative data could be used to measure changes in catch rates.

Response: As noted above, a high level of confidence around prediction of no significant adverse environmental effects was determined for Current Aboriginal Use of Lands and Resources for Traditional Purposes given the effects of routine exploration drilling activities and effectiveness of mitigation measures are well-understood. Residual effects on this Valued Component (VC) are predicted to be: low in magnitude for all routine Project activities, occur within the Local Assessment Area (LAA), be of short to medium-term in duration, and be reversible. Therefore, follow-up and monitoring was not proposed for potential effects on routine activities. In the unlikely event of a spill, however, specific monitoring (*e.g.*, environmental effects monitoring) and follow-up programs may be required and will be developed in consultation with applicable regulatory agencies.

In addition, with respect to routine operations, BP is responsible for reporting to the Canada-Nova Scotia Offshore Petroleum Board (CNSOPB) in accordance with the *Drilling and Production Regulations and Data Acquisition and Reporting Regulations*. The Drilling and Production Guidelines (C-NLOPB and CNSOPB 2011) and Data Acquisition and Reporting Guidelines (CNSOPB 2011) describe the extensive testing, measurement, monitoring and reporting requirements to be conducted during an exploratory well drilling program (see Section 12.2 of the Environmental Impact Statement (EIS) for details on follow-up and monitoring programs).

The *New Brunswick Mi'gmaq Indigenous Knowledge Study Process Guide* (Mi'qmaq Sagamaq Mawiomi 2016) provides guidance on the collection and use of Indigenous knowledge in a similar manner as the Nova Scotia Mi'kmaq Ecological Knowledge Study Protocol (Assembly of Nova Scotia Chiefs, n.d.) which was used to develop the Traditional Use Study for the EIS. The application of the Nova Scotia guide for the Project was a reasonable approach given the location of the Project and the similarities between the two guides. The application of the New Brunswick guide would therefore not be expected to change the effects assessment presented in the EIS.

Although licencing data was obtained from the Fisheries and Oceans Canada (DFO) on a licence holder level, landings data is not accessible at this level for privacy reasons. Reported fish landings or other quantitative data therefore would not be available to measure changes in catch rates on a community basis if in fact a monitoring program was implemented. Credible worst case assumptions have been made upon which to base a prediction of the significance of environmental effects and commitments for mitigation and emergency response (*e.g.*, in the event of a large spill). This approach is considered standard and reasonable and conservative (*i.e.*, likely to overstate adverse effects) to address any uncertainties with respect to potential adverse effects. Using this approach, it was predicted with high level of confidence based on a good understanding of the general effects on commercial species inhabiting the LAA and the effectiveness of the mitigation measures, that the residual environmental effects of a Change in Traditional Use from Project activities and components are not significant.

BP continues to engage with Indigenous groups in Nova Scotia, New Brunswick, and Prince Edward Island (PEI) to inform them of the Project and to better understand their interests and concerns associated with the Project. BP is also developing a Fisheries Communication Plan which will provide a framework for ongoing engagement with Indigenous and non-Indigenous fisheries organizations during the Project (before, during and at the conclusion of drilling operations).

References:

Assembly of Nova Scotia Mi'kmaq Chiefs. No date. Mi'kmaq Ecological Knowledge Study Protocol 2nd Edition. Available online at: http://mikmaqrights.com/wp-content/uploads/2014/01/MEKS-Protocol-Second-Edition.pdf

C-NLOPB [Canadian-Newfoundland and Labrador Offshore Petroleum Board] and CNSOPB [Canada-Nova Scotia Offshore Petroleum Board]. 2011. Drilling and Production Guidelines. Available from: http://www.cnlopb.ca/pdfs/guidelines/drill_prod_guide.pdf.

CNSOPB [Canadian Nova Scotia Offshore Petroleum Board]. 2011. Data Acquisition and Reporting Guidelines. Available from:

http://www.cnsopb.ns.ca/sites/default/files/pdfs/Data_Acquisition_and_Reporting_Guidelines_Oct2011.pdf.

Mi'qmaq Sagamaq Mawiomi. 2016. New Brunswick Mi'gmaq Indigenous Knowledge Study (NBMIKS) Process Guide. Available online at: http://eareview-examenee.ca/wp-content/uploads/uploaded_files/final-nbmks-guide-adopted-msm-february-10-2016.pdf