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Hebron

HEBRON PROJECT

Comprehensive Study Report: Response to Review Comments, Part 1

November 2010

ExxonMobil Chevron SUNCOR ENERGY Statoil nalcor energy

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1.0 INTRODUCTION

This Response Document has been prepared to address the review comments on the Hebron Project Comprehensive Study Report (CSR) provided to ExxonMobil Canada Properties (EMCP) by the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) on September 7, 2010. The Response Document is organized to closely reflect the order of the comments provided by the C-NLOPB. As previously agreed with the C-NLOPB, the responses to comments on Chapter 14 and those related to oil spill trajectory modelling are not included in this submission. A full response to those comments will be provided after additional oil spill trajectory modelling is completed. The following comments will be addressed in the Response to Review Comments Part 2:

- Comment 40: C-NLOPB 17
- Comment 85: C-NLOPB 28
- Comment 123: GF 25
- Comment 128: EC 48
- Section 14 Comments (Comments 141 to 167)
- Additional Deficiencies and Editorial Comments from Fisheries and Oceans Canada (179-DFO F6; 179-DFO G1; 179-DFO G2)
- Spill Trajectory Modelling Supporting Document for the Hebron Project (AMEC Earth & Environmental – April 2010)

The document is organized as follows:

- Section 1 provides an update to Project description activities
- Section 2 provides the Hebron Project teams responses to the "Specific Comments received from the C-NLOPB
- Section 3 provides the Hebron Project teams responses to government agency general comments (Environment Canada, Transport Canada and the Newfoundland and Labrador Department of Environment and Conservation [NLDEC])
- Section 4 provides the Hebron Project teams responses to additional deficiencies and editorial comments from Fisheries and Oceans Canada (DFO)
- Section 5 provides the Hebron Project teams responses to other general comments (from the Fish, Food and Allied Workers (FFAW) Union, the Alder Society and Health Canada)
- Section 6 provides the Hebron Project teams responses to supporting document comments (air emissions modelling)
- Section 7 provides the Hebron Project teams responses to Appendix A comments on sea ice and iceberg sections

2.0 UPDATED PROJECT DESCRIPTION

After the draft CSR was submitted to the C-NLOPB in June 2010, the Hebron engineering design teams continued to refine the project concept in preparation for start of Front End Engineering and Design (FEED). These further refinements fall within the scope of the original Project Description (Hebron Project, 2009) and the Scoping Document (C-NLOPB *et al.* 2009). These Project updates include:

- Nearshore
  - Bund wall construction options
  - Dredging activities
- Offshore
  - Produced water discharge volume
  - Power generators and air emissions modeling
  - Alternate offshore loading system

The following is an overview of these updates and includes any changes or updates required in the respective sections of the CSR.

Nearshore

The June 2010 CSR considered all marine-related project activities that are likely to occur at Bull Arm: the construction of the Hebron GBS in the re-established dry dock and at the deepwater site; the mating of the Topsides with the Gravity Base Structure (GBS); subsequent commissioning of the Topsides / Platform; and tow-out of the platform to the Hebron offshore location. While the CSR captures the general nature and environmental effects of these activities as they are within the Scope of the Project (C-NLOPB *et al.* 2009), the following updated planning information is provided to ensure all activities are captured in the environmental assessment.

1. Bund Wall / Drydock Alternatives

An alternate bund wall design is being considered by the Hebron Project Team which may eliminate or reduce underwater blasting and dredging during construction. The alternate design would see the outer limit of the bund wall move eastward within Great Mosquito Cove. The following table provides a comparison of the two options. Note that this information is preliminary and is provided as an estimate

Table 1 Comparison of Two Bund Wall Options

Feature	Option 1 – Original Hibernia Drydock Footprint[A]	Option 2 – Expanded Footprint[A]
Bund Wall Length (m)	253	365
Bund Wall (m^3)	280,000	425,000
Drydock Projected Area (m^2)	74,000	97,000
Ocean Disposal	Blasted rock associated with bund wall construction and at bund wall removal	Rock at bund wall removal
[A] All values are approximate		

Option 2 is an alternative approach to building the bund wall currently under consideration. With this approach, underwater blasting would be avoided as any required blasting would be done 'in the dry' once the dry dock had been de-watered. As well, with Option 2, the need for ocean disposal of blasted material would be reduced, as material from blasting operations could be stored and/or disposed of on-land. Ocean disposal of bund wall rock

would be required during the opening of the bund wall to move the GBS to the deepwater site.

Section 2.8.1 of the CSR will be updated to include the alternative bund wall / drydock design currently under consideration. In addition, applicable sections of the CSR will be updated (*i.e.*, Project activities tables and environmental assessment tables and associated text) to ensure the environmental effects analysis includes the bund wall-Option 2. With regard to the *Fisheries Act* Authorization for habitat alteration, disruption and destruction (HADD), all documentation required for the authorization and compensation plan, including the HADD strategy, will include both options.

2. Dredging Activities in Bull Arm

Dredging and ocean disposal of the dredged spoils is required in association with the partial removal of the bund wall and to ensure adequate depth for navigation and tow-out of the GBS to the deepwater site. Dredging of shallow areas near the Topsides pier identified by detailed bathymetry, may be required, depending on the vessels chartered for load-out of the Topsides. The CSR addresses dredging, ocean disposal, and any associated environmental effects in Sections 7.5.1, 8.5.1, 10.5.1, 11.4.2 and 11.5.2 of the CSR. The CSR outlines all mitigations to be employed during dredging, including *Fisheries Act* compensation.

It is anticipated that a single ocean disposal location will be used for all Project dredging operations. A candidate site for ocean disposal will be discussed with DFO, Environment Canada and Transport Canada. The selection of a preferred site will consider fish habitat characteristics as well as its ability to accommodate the estimated volume of material for disposal without affecting navigation. Based on current estimates, the site will likely be in water depths ranging from 40 to 45 m and may be located near the mouth of Great Mosquito Cove.

Offshore

1. Produced Water Discharge Volume

The June 2010 CSR addressed produced water discharges up to 43,500 m^3/day. However, since submission of the CSR in June 2010, additional information is available regarding potential subsea tieback activities and associated produced water volumes. It is now projected that the overall volume of produced water could increase to a discharge volume up to 56,000 m^3/day.

The produced water discharge model was re-run to account for the potential increase in discharge volume and to incorporate the 2009 metocean criteria report. The revised produced water modelling report (AMEC 2010) is included as a supporting reference to the Hebron CSR Response Document.

The CSR has been updated to incorporate the conclusions of the updated produced water discharge modelling report and any changes in the environmental effects predictions. The conclusions of the revised produced water modelling report show that for higher effluent discharge rates (56,000 m^3/d), the dilution factor of 300 is reached within a horizontal distance of 379 m in February under average current conditions, and within a distance of 676 m under low ambient current conditions. In August, the dilution factor of 300 is reached

at distances of 74 m under average current speeds and out to 352 m under low current speeds (AMEC 2010).

2. Power Generation and Air Emissions Modelling

Additional design cases considered for the Hebron Platform could require larger generators on the Platform (compared to the base design) to support increased power demands. The June 2010 CSR modelled air emissions for a 2500+ generator and did not account for fugitive emissions as estimates were unavailable.

The air emissions model has now been re-run to include the larger generators using generic vendor data and fugitive emissions estimates. The CSR will be updated to include the above changes to power generation (2500+ model to a G4 model) and any associated environmental predictions. The revised air emissions modelling report is included as a supporting reference to the Hebron CSR Response Document. In summary, the air emissions related to the first year of platform operation, cumulative first year of operation, peak operation and cumulative peak operation of the Hebron Platform would meet the National Ambient Air Quality (NAAQ) Objectives. The predicted air emissions during a flaring event would also meet the NAAQ Objectives for each time period modelled. The revised modelling does not change the previous assessment as presented in Section 6.6 of the CSR.

3. Alternate Offshore Loading System

The Hebron Project Team is currently examining options for offloading crude oil to tankers. The June 2010 CSR (Section 2.8.8) indicated that the Hebron Project anticipated using an Offshore Loading System (OLS) similar to that used by the Hibernia production operation. An alternate approach to this system is being examined by the Hebron Project Team. The information in Section 2.6.1 will be updated to include the following information (**new text is bolded**). In addition, where the offloading system is addressed in the environmental effects analysis, appropriate sections of the CSR will be updated to include the Direct Offloading alternate.

> The Hebron Project will include a system to offload crude oil onto ice-strengthened tankers for transfer to the Newfoundland Transshipment Terminal or directly to market. This system may be either an OLS, similar to the upgraded Hibernia system, or a **Direct Offloading system**.
>
> If a system similar to Hibernia's OLS is used, the Hebron OLS....During loading, the riser will be connected to the dynamically-positioned, bow-loading shuttle tanker.. (text from June 2010 CSR).
>
> **If the Direct Offloading option is selected, the system will likely consist of a hose reel integrated with the topsides, extending from the northeast side of the topsides structure, together with an approximately 340 m long, 508 mm (20") diameter marine hose with buoyancy elements. The hose will remain on the reel between offloadings and, during offloading, will be connected to a dynamically positioned, bow-loading shuttle tanker. During offloading, the tanker will maintain its position in a safe zone approximately 250 m from the GBS using its thrusters. The hose connecting the GBS storage tanks with the tanker storage tanks will take a "Lazy-W" configuration in the water (see**

Figures 1 and 2). The hose ends enter the water almost vertically and the intermediate hose sections float at approximately mid-water column height at an approximate water depth of 38 m. No subsea equipment is required for Direct Offloading.

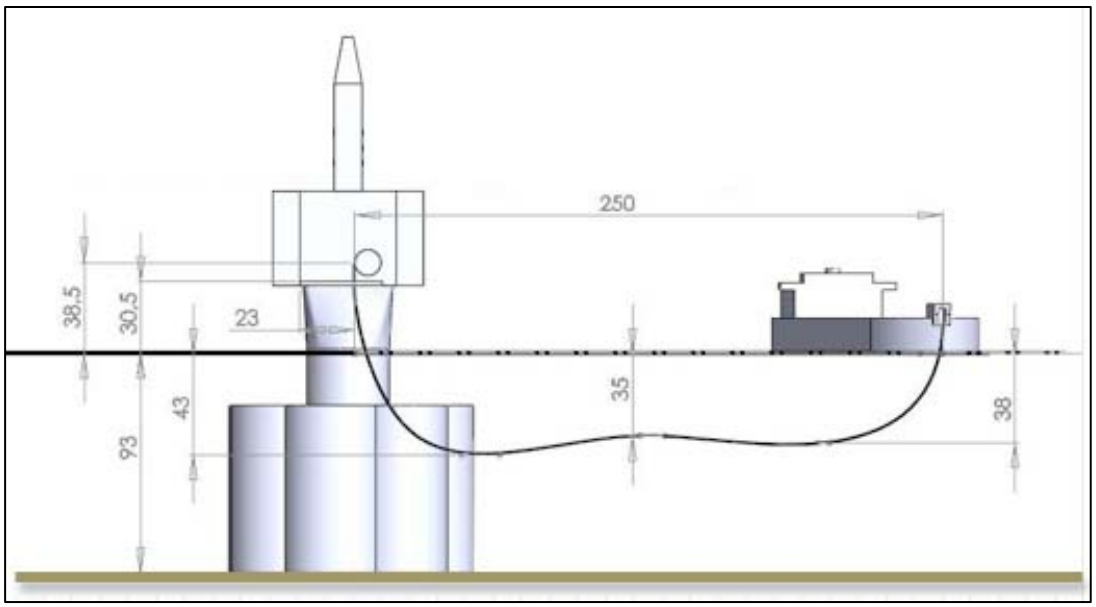


Figure 1 Configuration of Offloading Hose

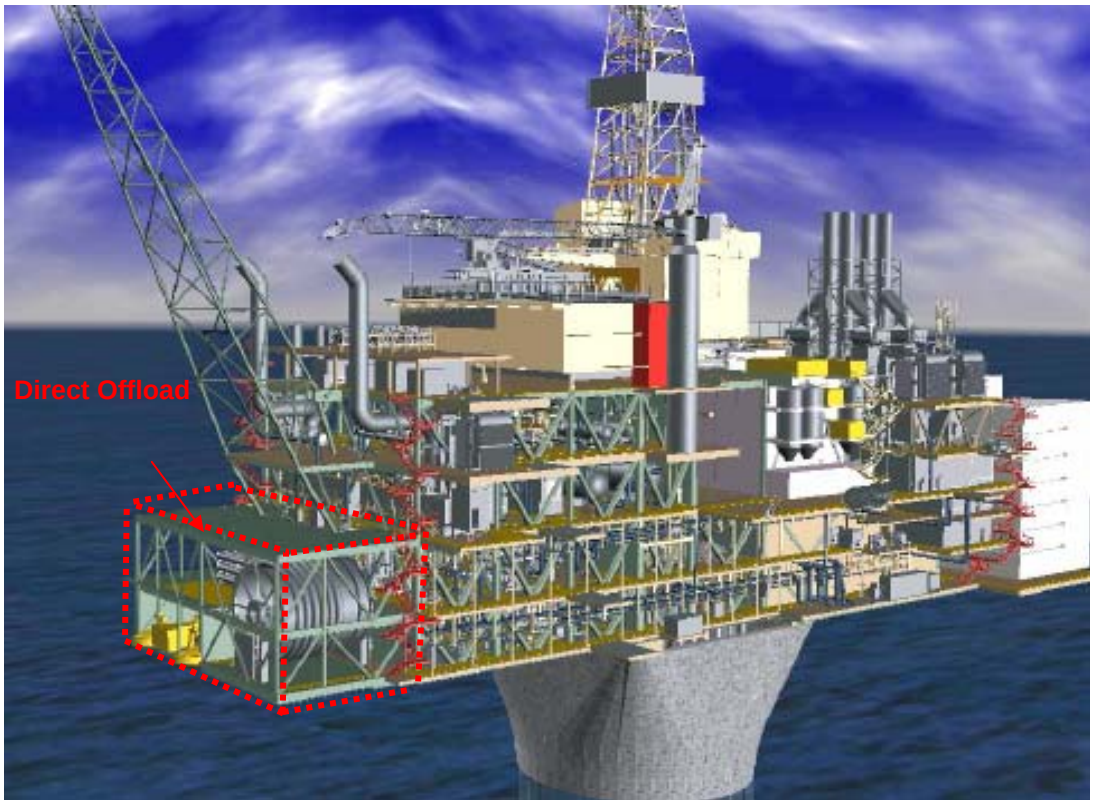


Figure 2 Platform Location of Direct Offloading Equipment

3.0 SPECIFIC COMMENTS

3.1 Response to Section 1 Comments

Comment 1: TC 1

1-TC 1	**EA Reference:**:	Section 1.3 Regulatory Context Page 1-4, First Paragraph
Preamble:	It is stated that "Transport Canada may issue an approval under paragraph 5(1)(a) of the *Navigable Waters Protection Act* (NWPA)".	
Request:	To reflect the March 2009 amendments to the NWPA, please change to "Transport Canada may issue an approval under **Part 1, Section 5 of the *Navigable Waters Protection Act***".	
Response:	Noted, thank you and sentence will be amended in text.	

Comment 2: C-NLOPB 1

2-C-NLOPB 1	**EA Reference:**:	Section 1.5 Scope of the Project Page 1-7
Preamble:	In the list of project components and potential future activities, "etc." has been used.	
Request:	The list of components and future activities that are included in the assessment should be identified in this section. The use of the term "etc." is not appropriate.	
Response:	Noted, "etc." will be removed from text and sentences with "etc." have been amended to include the full list of components or potential future activities.	

3.2 Response to Section 2 Comments

Comment 3: C-NLOPB 2

3-CNLOPB 2	**EA Reference:**:	Section 2.1 Project Need and Justification Page 2-1
Preamble:	The Hebron Project's contribution to sustainable economic development within the Province is described in detail in the Socio-economic Impact Statement and the Canada-Newfoundland and Labrador Benefits Plan for the Project.	
Request:	The Socio-economic Impact Statement has not been made available during the review of the CSR.	
Response:	The sentence "The Hebron Project's contribution to sustainable economic development....." was removed from the CSR as it was included as an information note.	

Comment 4: C-NLOPB 3

4-C-NLOPB 3	**EA Reference:**:	Section 2.6.4.1 Drilling Facilities Page 2-15
Preamble:	The CSR states that only non-aqueous fluid (NAF) based mud and cuttings will be re-injected and not water based cuttings. Section 21 of the OWTG states that each application for a Drilling Program Authorization or Production Operations Authorization should contain a description of specific pollution prevention measures that the operator plans to implement to reduce waste generation and discharge. Reinjection of water-based cutting would fit with reducing the amount of waste discharged from the facility.	
Request:	It should be justified why it is not possible to re-inject water-based cuttings in terms of reducing waste discharged.	
Response:	**The following text will be added to Section 2.6.4.1:** Water-based mud (WBM) cuttings are currently planned to be used on the first three hole sections of the Hebron wellbores. For the first hole section (conductor section), it is planned to return the WBM cuttings to the GBS shaft. Soil strengths immediately below the GBS base slab are anticipated to very weak and unable to sustain the additional hydrostatic load that would be introduced should the cuttings be returned to the Drilling Support Module (DSM) for re-injection. It is anticipated the DSM will be ±50 m above mean sea level. The returning fluid column would exert this equivalent hydrostatic head on the soils in the conductor hole section. Based on operational experience at Hibernia, it is anticipated this would result in significant fluid losses while drilling, subsequently creating a hole enlargement. This would pose potential risk to subsequent cementing operations of the conductor, overall well integrity and, potentially, stability of the soils beneath the base slab. Similarly, the second hole section (surface casing) is anticipated to encounter weak sands and soils. It is currently planned to return these cuttings to the lower levels of the Platform, where they will be routed to the shale chutes for overboard discharge. Attempting to route the returns to the higher elevation of the cuttings re-Injection system would introduce hydrostatic head that could also result in hole enlargement and risk to wellbore integrity. The third hole section (intermediate casing) will also be drilled with WBM systems. However, the geologic intervals to be penetrated typically return cuttings that tend to be tacky in texture and result in large masses, or clumps, of cuttings, that can best be defined as 'sticky'. These masses are not well suited to cuttings re-injection as they require large surface systems to dissolve the cuttings prior to routing to subsurface injection.	

	Finally, at the current Project stage, analysis has been performed to identify candidate subsurface zones for cuttings re-injection. Modelling is currently planned to be completed to ensure containment can be maintained for the non-aqueous fluid (NAF)-based mud drill cuttings and avoid out of zone fracture. Injection of large volumes of WBM cuttings potentially poses a risk for out-of-zone fracture and the subsequent loss of containment of NAF materials. Thus, the proposed plan of water-based discharge provides a balanced approach that minimizes overall risk of environmental damage.

Comment 5: C-NLOPB 4

5-C-NLOPB 4	**EA Reference:**:	Section 2.6.4.1 Drilling Facilities Page 2-15
Preamble:	Cuttings that are discharged inside the GBS	
Request:	The potential bacterial action and the potential need to treat should be addressed as well as the associated environmental effect of the treatment and deposit of cutting in the GBS.	
Response:	**The following text will be added to Section 2.6.4.1:** The growth of anaerobic bacteria and the resulting production of hydrogen sulfide could be potential health issues in addition to being corrosive to facilities. Anaerobic bacteria require very low or no oxygen in their environment in order to survive and grow. The GBS shaft for Hebron will be designed with a passive seawater circulation system using natural convection. Cold seawater will enter from the bottom of the shaft and warmer water will exit at the top of the shaft, with direct discharge to the ocean. The constant replenishment of fresh seawater (containing dissolved oxygen) will minimize the possibility for developing the anaerobic conditions suitable for growth of anaerobic bacteria, thereby minimizing the growth of anaerobic bacteria action in the GBS without the need for to add biocides. This circulation system design will account for drill cuttings that may be discharged at the shaft bottom.	

Comment 6: EC 1

6-EC 01	**EA Reference:**:	Section 2.6.4.2 Process Systems Page 2-15
Preamble:	In the March 2009 project description (Table 2.1-5, P. 2-23) the proponent mentioned investigating the use of pilotless flares. The CSR states that "fuel gas will be continuously used for flare pilots" and makes no mention of pilotless flares.	
Request:	What was the outcome of the investigation into the use of pilotless flares?	
Response:	The primary function of the flare system is to safely dispose of flammable gases during unplanned events. To achieve this function, maximizing ignition probability, flame stability and free movement of gas to the flare tip provides the highest level of safety. The Hebron Project evaluated pilotless flare technology and concluded the following. 1. Flare ignition by standard, continuous pilots is preferred: a) Gas-fired continuous pilots have minimal greenhouse gas (GHG) emissions impact. They are described in and recommended by proven industry standards (*e.g.*, API STD 537) as providing high ignition probability and flame stability, and the Operator has significant operating and design experience with gas-fired continuous pilots. b) Continuous, non-burning ignition devices such as the sparker and glow bar are described in, but not recommended by industry standards (*e.g.*, API STD 537), due to their inability to guarantee ignition and their inability to maintain a stable flame.	

	c) Discontinuous ignition devices such as the ballistic pellet are not recommended by industry standards (*e.g.*, API STD 537). Use of a discontinuous ignition device with an open flare increases GHG emissions, as the GHG contribution of methane (CH_4) is much higher than the GHG contribution from CH_4 combustion products (CO_2). 2. Gas disposal by an open flare stack and with no gas recovery is preferred: a) An open flare stack presents no obstructions to gas flow and is therefore the safest choice. b) Gas recovery systems require blockage (*e.g.*, valves) of the piloted flare such that gas is recovered without the introduction of air, which could create a flammable atmosphere inside the flare header or gas processing facilities. This blockage introduces the possibility that, when emergency disposal of gas is required, the flare header remains blocked, with potentially severe consequences to the platform. The emissions-reduction potential of gas recovery systems is minimal as only low-rate gas leakage can feasibly be recovered. The total quantity of low-rate gas leakage is very small compared to overall platform emissions (approximately 3 to 4 percent of total platform GHG emissions), and its recovery does not justify the potential reduction in platform safety caused by introduction of blockages in the flare header.

Comment 7: C-NLOPB 5

7-C-NLOPB 5	**EA Reference:**:	Section 2.6.4.2 Process Systems Page 2-16, Third Bullet
Preamble:	It is stated that produced water will be discharged in accordance with the OWTG 2002.	
Request:	The proponent should evaluate technology beyond the standard hydro cyclone separation to see if it is possible to achieve oil in water concentrations lower than those of the OWTG and if it is economically or technically feasible to implement.	
Response:	**Third bullet, page 2-16, Section 2.6.4.2. The following text will be added after the sentence: "Produced water will be discharged from a single point…depth."** Water treatment technology was evaluated, and Compact Flotation Units (CFUs) were identified as the most advanced proven water treatment technologies available on the market for offshore application. The Hebron produced water treatment system includes compact floatation units (CFUs) in addition to hydrocyclones operating in series. The heavy, API 20 Hebron crude is expected to be difficult to separate from produced water. Thus, both hydrocyclones and CFUs are expected to be necessary to meet OWTG 2002 guidelines.	

Comment 8: C-NLOPB 6

8-C-NLOPB 6	**EA Reference:**:	Section 2.6.4.2 Process Systems Page 2-16, Third Bullet
Preamble:	It is stated that the details regarding produced water re-injection feasibility will be addressed in the Development Plan. Produced water is the major waste discharged from oil and gas processing. Elimination of this waste stream removes, though re-injection, one of the greatest sources of effects the Hebron project will have on the environment.	
Request:	More detail should be provided as to the viability of re-injecting produced water. Also, initiating re-injection of produced water at the start of the project can reduce some of negative effects produced water may have on the reservoir.	

Response:	**The following text will be added to Section 2.x.x.x** (new subsection on Produced Water) **PRODUCED WATER MANAGEMENT** ***Introduction*** Produced water outfall from the Hebron Platform is estimated at up to 45,000 m^3/d. The Project Team is investigating the feasibility of injecting produced water into the reservoir for pressure maintenance. The overboard discharge of treated produced water is allowed by the Offshore Waste Treatment Guidelines (OWTG 2002), as well as the latest draft guidelines (OWTG 2010). ExxonMobil has completed its initial assessment of produced water re-injection (PWRI) and concluded there are unacceptable risks associated with initiating PWRI until factors associated with these risks are better known. Initial assessment indicates that PWRI into the producing formations for pressure maintenance purposes may be technically feasible, if technical risks can be reduced through further data acquisition and studies post start-up. ExxonMobil is committed to adopting PWRI once it is demonstrated that the risks and costs are manageable. Preliminary studies identified several potential risks to adopting PWRI: • Souring potential is up to 50 percent greater than with injecting sea water only due to temperature and the presence of volatile fatty acids (VFAs) • PWRI could result in greater than predicted increases in injection pressure (potentially beyond pressure limits) • Fracture containment could be compromised with increasing use of produced water • Scaling potential is increased when injecting produced water into the formation Confirming that these risks are manageable requires additional data that can only be obtained and analyzed post start-up and after several years of operation. For example, VFA content is highly variable across reservoirs and more produced water samples are required. Further, only a very small number of formation water samples are currently available – more are needed to draw firm conclusions. A dedicated produced water disposal reservoir was investigated and found not to be feasible. The cumulative volume of water produced in 30 years is approximately 366 million m^3 and a suitable reservoir could not be identified. In addition, over-pressuring of the disposal formation is a significant risk. ***Produced Water Management Strategy*** Hebron will initially operate with marine discharge of produced water at start-up. As more wells come on-line and production data and experience is gathered, further testing on rock properties and produced water / sea water / reservoir compatibility will be carried out as additional core samples and produced water become available. Hebron will switch to PWRI for routine operations, once testing and studies (post-start-up) demonstrate that the risk and impacts of PWRI are understood and acceptable. When PWRI is adopted, the facility will maintain flexibility for marine discharge during unplanned events (*e.g.*, equipment failure) or planned maintenance. In addition, it will be necessary to preserve the option to return to marine discharge if unexpected complications arise with PWRI (*e.g.*, loss of oil recovery, reservoir souring, scaling, plugging). In the base design, the water injection system is designed to inject at the predicted pressures required for PWRI. The Topsides facilities include space and connections for the future installation of the low pressure incremental equipment required to route produced water into the water injection system.

Produced Water Re-injection Feasibility Studies

Large volumes of seawater will be needed for pressure maintenance and the design team investigated if produced water could be used to satisfy a portion of those needs. Several risks arise when mixing produced water with seawater and injecting into a producing formation that need to be well understood before committing to produced water re-injection:

- Compatibility of seawater and produced water with each other and the reservoir
- Potential to "plug" the formation
- Potential for injection pressures to increase with produced water / seawater mix compared to seawater only injection
- Potential for bacterial contamination of the producing formation

The proceeding sections summarize the studies completed to date, and further work to be completed.

Injectivity

Water injectivity (the ability to inject water into the producing formation) can be impaired over time by injecting produced water with higher concentrations of suspended solids and even relatively low concentrations of oil-in-water. Both of these would increase the risk of plugging pore throats in the near-well region where the injected water first enters the formation. In turn, such plugging may accelerate the rate of fracture growth and extend fractures beyond desired boundaries, leading to a potential loss of conformance and thereby reduced effectiveness in supporting reservoir pressure.

Thermal effects of PWRI may also influence water injectivity since PWRI is likely to raise the injected water temperature (compared to seawater-only) and thus increase the fracture extension pressure, leading to a reduction in injectivity index.

An injectivity study was conducted to assess the required injection pressure to achieve fracture injection for all potential injection wells in Hebron and how the injection requirements may change PWRI versus seawater injection.

The injectivity study found that PWRI is technically feasible from an injectivity standpoint; however, there are several vulnerabilities that require additional operational data to confirm. A key area of risk is that fracture pressure will increase through time with PWRI, and increasing fracture pressures can lead to a greater risk for loss of fracture containment during injection.

Scaling

Both seawater and produced water are a complex solution of dissolved components (many types of “salts”). Upon mixing, the positive and negative ions in each must reach a new balance and sometimes they combine to form a solid that precipitates out of solution. Some of these chemical reactions take time to occur and precipitation can occur during injection process, as pressure and temperature changes take place. The rock fractures and pore spaces can then get plugged by these solids and hinder or prevent future injection.

The only way to obtain a clear answer on the compatibility of Hebron produced water with seawater from the Grand Banks is to mix the two waters in a laboratory study and observe what happens under different temperature and pressure conditions. Such a definitive study cannot be done as yet, since there are no production wells available to sample. The produced water at the Hebron platform will be a mix of produced water from several different reservoirs and, therefore, is not presently available for study.

However, the Project does have small samples of what is now “aged” water produced from individual reservoirs. These samples were obtained during production testing of individual wells from individual reservoirs in the late 1990s. These are now considered “aged” samples and, although ionic composition is the same, the potential

loss of volatile organics and possible changes in organic composition could alter ionic reactions when mixed with seawater. Using these samples, the Project has proceeded with a small-scale study to obtain a preliminary understanding regarding the compatibility of the two waters.

The results of this small-scale study suggest with low certainty that mixing produced water and seawater is possible. However, further investigation is required, using samples of Hebron produced water from actual production wells, to confirm and validate these preliminary compatibility test results.

Souring (bacterial contamination)

In the oil producing reservoir, bacteria are present. Hydrogen sulfides (H_2S) act as an energy source and VFAs are the nutrient source. An increase in growth of bacteria could result in a plugging of the formation, or souring of the reservoir. Levels of souring are dependent upon VFA concentration in formation water.

An initial study of Pool 1 (Ben Nevis reservoir) souring susceptibility was conducted in 2005, using a range of levels of souring nutrients (VFAs) in formation water. Pool 1 predictions indicate potential for significant total-wellstream mass of H_2S, and that the sulphide content forecast for mixed produced water / sea water injection is up to 50 percent higher than that for seawater-only injection.

PWRI is likely to increase the souring susceptibility of Pool 1 *vs*. sea water only injection, however, further studies are required to determine the effects and extent of souring from PWRI and if mitigations are available to control bacterial contamination, and prevent reservoir souring.

Disposal Reservoir

An evaluation was made to identify non-producing subsurface formations that could potentially serve as repositories for produced water. Ideally, such formations would be relatively thick and laterally continuous with high capacity for accepting a large volume of fluid, and would provide minimal potential for migration of injected fluid into other formations, or for entering subsurface faults that are conductive in character.

Screening of wireline well logs and mud logs revealed only one prospective non-producing formation that would merit quantitative analysis of its potential water storage capacity. A unit of porcelaneous mudstone (also known as the Tilton Member) exists in the Paleocene section approximately 300 m above the top of the Ben Nevis formation in the Hebron initial development area, and this unit was subjected to preliminary investigation as a possible storage compartment for Hebron produced water. Screening-level calculations were performed to estimate the thickness trend, average net-to-gross, average porosity and, subsequently, the net pore volume of this formation within the Hebron Unit boundary.

Results indicated that the porcelaneous mudstone unit is predicted to have far too little storage capacity to accept the forecasted volume of produced water over the life of the Hebron Project (an estimated 366 million m^3 plus additional produced water if future expansions are developed).

A screening assessment of the disposal equipment required on the Topsides was performed, and it was found that a produced water disposal system (in addition to the required water injection required for reservoir maintenance) would result in approximately 150,000 t of CO_2e being released into the atmosphere annually (4.5 million tonnes over 30 years).

The overall conclusion of the Project's evaluation is that disposal of produced water into a non-producing formation is not a feasible nor the preferred option.

Plan for Completing further Produced Water Re-injection Feasibility Assessment

In order to complete an assessment of PWRI and ensure all risks are understood, additional formation water samples are required. This can only be completed post

	start-up and analyses will include measuring produced water compositions for each distinct hydrocarbon resource and determining the degree of intra-reservoir variability in water compositions. Produced water from a few geographically-distributed wells is likely to provide the highest-confidence data. Further testing of produced water is required to confirm the scaling tendency/severity of sea water / produced water for both in-situ reservoir conditions and for operating conditions of wells / facilities. The concentration of VFA nutrients in produced water is needed for better forecasting of souring behaviour and additional measurements of variability will aid in characterizing the effects of mixed produced water / sea water. Further testing is also required on the reservoir rock properties, and some fresh core material will be acquired in select new wells to enable lab displacement measurements of mixed-produced water / sea water- waterflooding. ***Topsides Facilities*** The Hebron Topsides facilities include the best commercially proven water treatment technology and equipment for offshore applications. Heavy oil separation challenges warrant a robust produced water treatment system that includes hydrocyclones, CFUs, and degassing drum. In addition, Hebron will include Vessel Internal Electrostatic Coalsescer technology, which minimizes emulsion layer thickness and creates a better defined oil / water interface, helping to mitigate oil carry-under from separators to the produced water treating system. Pre-investment has been made in the water injections system to allow for PWRI to be initiated at a later date. Design elements include: • System designed to inject at predicted pressures required for PWRI • Inclusion of manifolds to blend produced water with sea water make-up, • Injection pump seals designed for the fine particles in produced water (a specialist application) • Include space and connections for the future installation of the low pressure incremental equipment required to route produced water into the water injection system (*i.e.*, low pressure booster pumps and filters) ***Summary*** ExxonMobil is committed to adopting PWRI for routine operations once it is demonstrated that the associated risks are acceptable. The Produced Water management strategy will be to operate with marine discharge of produced water at start-up using best commercially available and proven treatment technology. Hebron will switch to PWRI for routine operations, if testing and studies demonstrate that the risk and impacts of PWRI are understood and acceptable. The option will be preserved to return to marine discharge if unexpected complications arise with PWRI (*e.g.*, loss of oil recovery, reservoir souring, scaling, plugging). The Hebron water injection system will be designed to inject at predicted pressures required for PWRI, and include pre-investment for potential establishment of PWRI (space and connections for additional PWRI equipment). A post-start-up study and testing plan will be developed to address uncertainties.

Comment 9: C-NLOPB 7

9-C-NLOPB 7	**EA Reference:**:	Section 2.6.4.2 Process Systems Page 2-16, Third Bullet
Preamble:	The CSR states that the details regarding produced water re-injection feasibility will be addressed in the Development Plan. The Scoping Document clearly states that the "Means for reduction, reuse and recovery of wastes beyond those specified in regulations and guidelines, including an evaluation of the applicability of "best	

	available/practicable technology" (e.g., cuttings reinjection and produced water re-injection) to the project".
Request:	The CSR should include an evaluation of produced water re-injection.
Response:	Please refer to the response to Comment 8: C-NLOPB 6

Comment 10: C-NLOPB 8

10-C-NLOPB 8	**EA Reference:**:	Section 2.6.4.2 Process Systems Page 2-16, Fourth Bullet
Preamble:	The flare will dispose of associated gas from the low pressure separator when the low pressure compressor is down for maintenance. Flaring of low pressure gas tends to produce black smoke.	
Request:	The CSR should discuss flaring of low pressure gas in the air quality section and the mitigations that could be implemented to reduce or eliminate black smoke from flaring operations.	
Response:	**Section 2.6.4.2 will be revised as follows at the end of the fourth bullet ("Vent and flare system:"):** The Hebron flare system design is not yet complete. The flare system will implement a design that uses appropriate, available, proven technology to minimize smoke production.	

Comment 11: EC 2

11-EC 02	**EA Reference:**:	Section 2.6.4.2 Process Systems Page 2-17
Preamble:	Part of the process description identifies the venting of gases from near atmospheric systems. There is no description of the magnitude, composition or significance of these gases, either in this or the air quality section.	
Request:	The proponent is asked to comment on the composition, magnitude and significance of the gases being released through these vents.	
Response	**The following text will be added to Section 2.6.4.2:** Design definition of utility systems, such as atmospheric tanks, is not well developed at this conceptual engineering phase. Definition will increase as engineering progresses. However, the low pressure atmospheric tanks that will be vented generally contain low vapour pressure sources (*e.g.*, diesel, methanol) or non-hydrocarbon sources (*e.g.*, glycol, fresh water, drill water, potable water. Most venting will occur during tank transfers and tank breathing. Vented volumes are expected to be minimal.	

Comment 12: DFO 1

12-DFO 1	**EA Reference:**	2.8 Hebron Project: Construction and Installation
Preamble:	The CSR does not provide sufficient information regarding the spoils disposal area within the nearshore project area. Fish habitat information within the proposed spoils disposal area is required in order for DFO to determine if it is likely to result in a HADD.	
Request:	Provide information on the proposed spoils disposal area including, but not limited to, location and fish habitat information.	
Response:	The disposal area in Great Mosquito Cove is unknown at this time. Work is ongoing to identify an area that has the least potential for habitat disturbance and that can accommodate the volume of spoils to be disposed. Based on preliminary review of the bathymetry and fish habitat information for Great Mosquito Cove, a likely candidate area is located at approximately 40 to 45 m water depth on the south side of Great Mosquito Cove. EMCP will consult with DFO regarding the selection of the	

	spoils disposal area. In addition, Transport Canada requirements regarding navigability of water channels will be included in the selection process. A general description of the habitat for Great Mosquito Cove was provided in Section 7.3.1.2 (a HADD Strategy will be submitted in December 2010). **The following text will be incorporated into Section 7.3.1.2:** In Great Mosquito Cove, the bottom characteristics of the original Hibernia bund wall disposal zone between pre-disposal (1995) and post-disposal (2005) have been compared and documented (AMEC 2005). The survey showed that in the area of the bund wall disposal, there are mounds of sediment at depths between 20 to 40 m and that fish habitat had changed relatively little since the 1995 data. Surficial substrates were covered with fines, primarily clay, and very occasional cobble and boulders were visible with coralline algae (AMEC 2005). Slightly more epifauna were observed in 2005, compared to 1995. Kelp (*Agarum* sp. and *Laminaria* sp.) was abundant in some areas and scarce to absent in other areas (AMEC 2005). A more recent remotely operated vehicle (ROV) survey in August 2009 (Stantec 2010) revealed that fine material was a frequent surficial substrate observed in the cove, switching to gravel and cobble towards the outer section of the cove. The fine material was generally found in the central areas of the cove in deeper water, which is approximately 15 to 18 m in the inner area of the cove and 30 to 33 m in the middle area of the cove. The deepest areas in the outer cove reach a water depth of about 60 m, but on average is approximately 33 m. Benthic habitat with solid substrate was generally observed more towards the shore and which may be comprised of boulder and rubble and/or mixed with gravel and cobbles. Habitat with bedrock substrate was most common in the outer section of the cove towards the north shore and which covered approximately 15 percent of the seafloor. The benthic macroflora were relatively sparse overall and ranged in cover from approximately 2 to 11 percent of the seafloor (Stantec 2010). Sour weed (*Dictyosiphon* sp.) was the predominate species but which decreased towards the outside area of Great Mosquito Cove where it was observed in equal proportion with sea colander (*Agarum cribrosum*) and to some extent also the brown seaweed, *Laminaria longicruris*. The sessile benthic macrofauna observed in the ROV transects included sea urchins (*Stronglyocentrotus droebachiensis*), which were the most common, followed by seastars, sea anemones and scallops. Species diversity was more pronounced on hard substrate such as boulder, rubble, cobble and gravel. Winter flounder (*Pseudopleuronectes americanus*) and cunner (*Tautogolabrus adspersus*) were the principle fish encountered during the benthic habitat ROV survey in August 2009. The cunner was the most frequently observed fish and was equally observed among all types of substrate. Winter flounder were observed mostly on fine substrate, but were also observed on hard substrate towards the outer area of the cove. Atlantic wolffish, a federally listed Species at Risk (Schedule 1, special concern), was identified in Great Mosquito Cove during the ROV habitat surveys in August 2009. They were observed at a depth of approximately 35 m, in areas of 80 to 90 percent boulder habitat, which has been identified as potential spawning habitat (Barsukov 1959; Keats *et al.* 1985; Kulka *et al.* 2007).

Comment 13: DFO 2

13-DFO 2	**EA Reference:**	Section 2.8 Hebron Project: Construction and Installation Page 2-20
Preamble:	Tables 2-6 and 2-7 indicate that dredging may be required for the tow-out from the deepwater site to the offshore location. The potential requirement for this dredging is not addressed in the environmental effects assessment.	
Request:	Given there is a possibility that dredging may be required, it should be included in the environmental effects assessment.	

Response:	Environmental effects associated with all dredging activities, including those in Bull Arm or along the tow-out channel, can be found in the following sections of the CSR (June 2010): • Section 7.5.1.1, Nearshore, page 7-46 • Section 7.5.1.1, Future Activities, Construction, page 7-48 • Table 7-10, page 7-49 • Section 7.5.1.2, Nearshore, page 7-49 • Section 7.5.1.2, Suspended Sediment, second bullet, page 7-52 • Section 7.5.1.2, Offshore, Suspended Sediment, page 7-55 • Section 7.5.1.2, Noise, page 7-56 • Section 7.5.1.4, Nearshore, page 7-60 • Section 7.5.1.4, Offshore, pages 7-61 and 7-62 • Table 7-11, pages 7-63 and 7-65 • Section 7.5.5.2 (Offshore Cumulative Environmental Effects), page 7-86 • Section 8.5.1.1, Fishing Gear, page 8-50 • Section 8.5.1.1, Catchability, page 8-50 • Table 8-15, pages 8-57 and 8-58 • Table 9-10, pages 9-42, 9-43 and 9-44 • Section 10.5.1.1, Offshore, page 10-36 • Section 10.5.1.3, Nearshore, Dredging, pages 10-51 and 10-52 • Section 10.5.1.3, Offshore, Dredging, page 10-53 • Table 10-10, pages 10-63 and 10-65 • Section 11.4.2.1, Change in Habitat Quantity, Nearshore, page 11-40 • Section 11.4.2.1, Change in Habitat Quality, Nearshore, page 11-41 • Section 11.4.2.1, Change in Habitat Quality, Offshore, page 11-42 • Table 11-4, pages 11-47 and 11-48 • Section 11.5.2.1, Change in Habitat Use, Nearshore, page 11-70 • Section 11.5.2.1, Change in Habitat Use, Offshore, page 11-70 • Table 11-10, pages 11-73 and 11-75 Note that details regarding dredging, such as timing or anticipated volumes in the tow channel from the deepwater site to the offshore location are not provided in the CSR. It is uncertain at this time whether dredging would be required. The need to undertake dredging in this area will be determined prior to the scheduled tow-out window.

Comment 14: HC 1

14-HC 1	**EA Reference:**:	Section 2.8.1 Great Mosquito Cove: Drydock Construction Page 2-22, Table 2.5 – Potential Activities and Potential Discharges/Emissions/Wastes
Preamble:	Table 2.5 indicates that noise may be an issue during pre-construction and construction activities; however, noise with respect to nearby human receptors is not discussed further in the document. As such, Health Canada was unable to assess the potential noise impacts on nearby residents or other potentially sensitive human receptors during pre-construction and construction phases of the project on-land and in the nearshore.	
Request:	a) Please provide a discussion about the locations and proximity of all potential noise-sensitive human receptors relative to the project area, and the identification of areas	

	in which receptors could be considered to have a reasonable expectation of "peace and quiet" (i.e. "quiet rural areas"). The identification of sensitive receptors may include residences, daycares, school, hospitals, places of worship, nursing homes, and First Nations and Inuit communities. b) Please provide a discussion of the expected duration of construction activities. Note that Health Canada uses the *Alberta Energy and Utilities Board Noise Control Directive 038* (2007) for guidance on whether construction noise should be considered short-term with regard to the prediction of complaint levels. • If construction noise lasts for less than two months at receptors, it may be considered temporary, and community consultation is advised. • For construction noise at receptors with durations of less than one year (i.e. short-term), Health Canada advises that mitigation be proposed if the resulting levels are predicted to result in widespread complaints or a stronger community reaction, based on the U.S. EPA method (U.S. EPA 1974, Michaud et al. 2008). • For construction noise at receptors with durations of more than one year (i.e. long-term), for operational noise, and where noise levels are in the range of 45-75 dB at the nearest receptor, Health Canada advises that health impact endpoints be evaluated on the change in the percentage of the population (at a specific receptor location) who become highly annoyed (%HA). Health Canada suggests that mitigation be proposed if the predicted change in %HA at a specific receptor is greater than 6.5% between project and baseline noise environments, or when the baseline-plus-project-related noise is in excess of 75 dB. c) If health effects due to noise are predicted, Health Canada advises the identification of mitigation measures to limit noise, which typically include community consultation programs. In some situations where a specific type of mitigation is not technically or economically feasible, community consultation has achieved success in limiting the number of noise-related complaints. Noise References Alberta Energy and Utilities Board. 2007. Energy Resources Conservation Board - Directive 038: Noise Control. Revised edition. www.ercb.ca/docs/documents/directives/Directive038.pdf Michaud, D.S., Bly, S.H.P. and Keith, S.E. 2008. Using a change in percent highly annoyed with noise as a potential health effect measure for projects under the Canadian Environmental Assessment Act. Canadian Acoustics, 36(2):13-28. U.S. EPA. 1974. Office of Noise Abatement and Control. Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety. www.nonoise.org/library/levels74/levels74.htm
Response:	a) Airborne noise was considered in the scoping of the work but not specifically addressed in the environmental assessment. The reasoning for screening out the noise effects for the operational, offshore component remains valid, and is self evident; the separation of over a hundred kilometers from the nearest sensitive receptors. Considering the routine movements of supply vessels and relatively infrequent helicopter traffic, island effects of the project are nominal. Construction activities occur within Bull Arm, but were considered to have sufficient buffer distance that quantitative assessment was not conducted. The construction site in Bull Arm is over 4 km from the nearest residences of any type in Sunnyside to the north northwest, with screening occurring due to topography between the construction and the community. Receptors in the community of Arnold's Cove to the west southwest are over twice that distance and enjoy line-of-sight and vegetation screening. b) The overall scheduled construction will occur over a long-term period, as defined

	by Health Canada, but the sound levels will remain far below the lower threshold for community annoyance. A simulation with Cadna (a noise modeling software) shows that, even with an assumed 36 pieces of construction equipment distributed from supply boat height of 4 m to crane height of 50 m, all with sound power levels exceeding 100 dBA, levels at Sunnyside would not exceed about 20 dBA due to the assumed construction. There are no known residences or sensitive receptors closer to the centre of construction. c) The community will be informed about the project, and mechanisms will be in place to handle concerns or complaints from the public. A community liaison will be on site throughout construction.

Comment 15: EC 3

15-EC 03	**EA Reference:**	Section 2.8.2 Gravity Base Structure Construction at Drydock Page 2-22
Preamble:	Section 3.1.1 of the Scoping Document includes ocean disposal of berm material and potential disposals from dredging activities to facilitate GBS tow operations. The CSR document does not indicate that a disposal site has been selected to receive the material from the berm and the clearance dredging. Selection and assessment of a disposal site will be a requirement for a disposal at sea permit application. Delaying site selection until permit application could also have project scheduling implications.	
Request:	The proponents should indicate a potential disposal site location or locations in order to properly assess the associated environmental effects.	
Response:	Please Refer to Response for Comment 12-DFO 1	

Comment 16: DFO 3

16-DFO 3	**EA Reference:**	Section 2.8.3 Deepwater Site Construction Page 2-23
Preamble:	Section 2.8.3 states that "*It is anticipated that existing deepwater moorings will be used; however additional moorings may be required.*" There is no information provided on these moorings.	
Request:	a) Specify whether these moorings are located on land or in water. If located in water, provide a description of existing and new moorings, including but not limited to location, general design, construction method, mitigation measures to protect fish and fish habitat, etc. b) Given that the construction of new moorings is a possibility, it should be included in the environmental effects assessment.	
Response:	**The following text will be added to Section 2.8.3:** The requirement for additional moorings will be determined at the FEED stage. If additional moorings are required at the deepwater site, they may be constructed on land. The Environmental Protection Plan for Bull Arm includes mitigation measures for any land based construction. At the Topsides pier, temporary underwater moorings (or anchors) may be required to position the heavy lift vessel for Topsides tow-out. Details regarding the requirement for moorings, or the type of moorings that may be required are unknown at this time, as the Project is in the early stages of Project design. However, the Hebron HADD Strategy addresses all potential activities at Bull Arm, and any effects on fish habitat at this site, will be included in the fish habitat compensation plan, if warranted. Appropriate sections of the CSR will be updated (*i.e.*, Project activity tables) to include the possible temporary moorings at the Topsides pier.	

Comment 17: EC 4

17-EC 04	**EA Reference:**:	Section 2.9.2 Operational Support Page 2-30, Table 2-9
Preamble:	In the March 2009 project description (Tables 2.1-4 and 2.1-5) the potential use of a waste incinerator is mentioned. The CSR has numerous mentions of waste treatment, but does not provide any specifics. Air emissions from an incinerator are not mentioned in the CSR.	
Request:	Could the proponent confirm that an incinerator is no longer part of the project? If an incinerator is to be included in the project, the emissions should be identified and included in the analysis.	
Response:	An incinerator is no longer part of the proposed Project.	

Comment 18: C-NLOPB 9

18-C-NLOPB 9	**EA Reference:**:	Section 2.9.6.3 Geotechnical Surveys Page 2-36
Preamble:	These surveys assist in the positioning of wells, pipelines and production facilities.	
Request:	Some general information should be provided as to how these surveys are conducted.	
Response:	**The following description will be included in Section 2.9.6.3** Substrate properties often need to be characterized prior to installation of any equipment on the substrate (such as the Platform and flowlines). Geotechnical investigations primarily involve the physical collection of sediment samples, and may also include collection of geophysical data (*i.e.*, side-scan sonar), as described in Section X.X. Methods to collect sediment samples include drilled boreholes and grab samples. Boreholes are drilled at each of the potential site to an approximate depth of 30 m below seabed. Due to the shallow nature of most boreholes, they are usually entirely in soils (unconsolidated sands, silts, and clays) and will not penetrate hydrocarbon-bearing formations. Cuttings will be expelled at the seafloor. Approximately 1 m^3 cuttings is generally generated per borehole. The major concerns associated with drilling activities in the marine environment are siltation of the water column and mortality and/or change in habitat quality of marine species by smothering. Noise associated with drilling is also a potential concern for marine wildlife, particularly marine mammals. In addition, birds may be attracted to drilling platform lights.	

3.3 Response to Section 3 Comments

Comment 19: EC 5

<table>
<tr><td>19-EC 05</td><td>EA Reference::</td><td>Sections 3.1.1.1 Wind Climatology & 3.1.2.1 Waves
Pages 3-1 & 3-9</td></tr>
<tr><td>Preamble:</td><td colspan="2">The data sources in these sections for the nearshore were incompletely described (and in Oceans 1.1.1 and 1.1.3).</td></tr>
<tr><td>Request:</td><td colspan="2">a) For each data source, please give the lat/long, exposure, elevation (land station) or water depth (wave buoy), and years of coverage. This information in needed for interpretation of differences in measurements.
b) Are the names Bull Arm Oceans and Mosquito Cove used interchangeably when referring to the Oceans Ltd. Weather station (Bull Arm Oceans in tables, but Mosquito Cove in text and figures)?
c) Could an example of an extreme winter storm during the 1995-1997 interval, when there are local measurements available, be added to this section?</td></tr>
<tr><td>Response:</td><td colspan="2">a) The following table will be included in the CSR:
<table>
<tr><th>Source</th><th>Period</th><th>Location</th><th>Elevation (m)</th><th>Depth (m)</th></tr>
<tr><td>M12874</td><td>January 01, 1954 to December 31, 2005</td><td>47.70°N -53.80°W</td><td></td><td>140.89</td></tr>
<tr><td>Environment Canada Bull Arm</td><td>June 08, 1994 – May 28, 1997</td><td>47.82°N -53.90°W</td><td>13.7</td><td></td></tr>
<tr><td>Oceans Bull Arm (Wind)</td><td>January 26, 1995 to May 27, 1997</td><td>47.82°N -51.86°W</td><td>10.0</td><td></td></tr>
<tr><td>Oceans Bull Arm (Wave)</td><td>May 15, 1995 to January 31, 1996</td><td>47.82°N -51.86°W</td><td></td><td>155.00</td></tr>
<tr><td>Argentia, NL</td><td>January 01, 1953 to May 25, 1970</td><td>47.30°N -54.00°W</td><td>13.7</td><td></td></tr>
<tr><td></td><td>May 01, 1976 to October 31, 1986</td><td>47.30°N -54.00°W</td><td>15.5</td><td></td></tr>
<tr><td></td><td>January 01, 1987 to July 26, 2006</td><td>47.30°N -54.00°W</td><td>15.0</td><td></td></tr>
<tr><td>Arnold’s Cove, NL</td><td>July 01, 1971 to July 01, 1993</td><td>47.78°N -54.00°W</td><td>15.2</td><td></td></tr>
</table>
b) Bull Arm Oceans and Mosquito Cove both refer to the same weather station. The CSR will be updated to ensure consistency of terms.
c) The highest wind speed of 27.8 m/s recorded at Bull Arm occurred on February 14, 1995. During this event, a mid-latitude low pressure system tracked eastward across Newfoundland, and deepened rapidly as it moved over the cold North Atlantic ocean. During this same event, the Oceans Ltd. weather station reported wind speeds of 15.9 m/s. Unfortunately, the waverider buoy at Bull Arm was not reporting during this event.</td></tr>
</table>

Comment 20: EC 6

<table>
<tr><td>20-EC 06</td><td>EA Reference::</td><td>Section 3.1.1.3 Tropical Systems
Page 3-6</td></tr>
<tr><td>Preamble:</td><td colspan="2">The distance chosen to find tropical systems that passed near Bull Arm, listed in Table 3-4, should be expanded, so that the list would include Hurricane Michael, 20 October 2000. Michael brings the peak wind speed for October at the MSC50 data point near Bull Arm (Table 3-2), and Michael is given as an example of an extreme tropical storm in the Oceans report (1.1.2).</td></tr>
<tr><td>Request:</td><td colspan="2">a) Include Hurricane Michael in Table 3-4
b) There are contradictory sentences about the definition of the wind speeds in Table 3-4, in the text, 3.2.1.7, and in the Oceans report (1.1.6 and 1.29), that need to be corrected.</td></tr>
</table>

Response:	a) Table 3-4 and Figure 3-5 will be revised to include Hurricane Michael. b) **The following text in the CSR is the correct information:** Section 3.1.1.3: It must be noted that the values in Table 3-4 are the maximum 1-minute mean wind speeds occurring within the tropical system at the 10-m reference level as it passed. Section 3.2.1.7: It must be noted that the values in Table 3-29 are the maximum 1-minute mean wind speeds occurring within the tropical system at the 10-m reference level as it passed. **Therefore, the following text will be deleted from the text:** Section 3.1.1.3: Wind speed in Table 3-4 refers to the maximum sustained wind recorded during the life of the tropical hurricane and not the wind speed at the time it passed. Section 3.2.1.7: Wind speed in Table 3-29 refers to the maximum sustained wind recorded during the life of the tropical cyclone and not the wind speed at the time it passed.

Comment 21: EC 7

21-EC 07	**EA Reference:**:	Section 3.1.1.3 Tropical Systems and 3.1.2.2 Waves Pages 3-6 & 3-9
Preamble:	In 3.1.1.3, the description of peak measurements in Hurricane Luis, which made landfall near Argentia on 11 September 1995, includes the peak wind speed at the MSC50 grid point location, but not the peak wind and wave measurements from the local weather stations and buoy.	
Request:	Include the peak wind and wave measurements from the local weather stations and buoy.	
Response:	**The following will be added to Sections 3.1.1.3 and 3.1.2.2:** During this same event, the Oceans Ltd. weather station at Bull Arm only recorded wind speeds of 8.7 m/s. This may be the result of a number of factors, including local effects and distance of the site from the storm centre. Significant wave heights measured by the waverider buoy peak near 0.5 m shortly after the storm passed.	

Comment 22: EC 8

22-EC 08	**EA Reference:**:	3.1.2.2 Waves and 3.1.3 Wind and Wave Extremes Pages 3-9 & 3-22
Preamble:	The analysis uses MSC50 wave hindcast data for a grid point location that is adjacent to land, for one of its primary sources of wave data.	
Request:	a) The text should indicate that caution is needed in using this data given limits of the model resolution and the proximity to land. This caution should also be noted in the Oceans and AMEC reports. b) Clarity would be improved if important information on extremes, results of a 1992 extremal wave analysis for Bull Arm, were moved from 3.1.2.2 to section 3.1.3, Wind and Wave Extremes, 3.1.3.2 Waves. The analysis method should be described briefly, to allow comparison with the extremal analysis method used in this CSR.	
Response:	a) **The following text will be added to the end of paragraph 1.** Caution should be taken with respect to this grid point however due to it's proximity to land and the resolution of the MSC50 model. b) The section on page 3-14 of the June 2010 CSR titled "Additional Waves Estimates" (including Table 3-7) will be moved from Section 3.1.2.2 to the end of Section 3.1.3.2. The 1992 extremal analysis for Bull Arm was performed by Noble Denton and as such, it is inappropriate to comment on the analysis method.	

Comment 23: EC 9

23-EC 09	**EA Reference:**:	3.1.3 Wind and Wave Extremes, 3.1.3.1 Wind Page 3-22
Preamble:	This subsection gives extremal analysis results based on the MSC50 grid point data and adjusted to 10 minute and 1 minute sustained winds at 10 m.	
Request:	Given the height of the planned structure, and the increase of wind speed with height, it could also be useful for design to give equivalent estimates of the wind speed at a height relevant for the structure topsides.	
Response:	See response to Comment 26: EC 12.	

Comment 24: EC 10

24-EC 10	**EA Reference:**:	Section 3.1.4 Sea Ice and Icebergs (nearshore) Section 3.2.3 Sea Ice and Icebergs (offshore) Section 13.3.6 Effects of the Environment on the Project: Sea Ice and Icebergs (nearshore) Section 13.4.6 Effects of the Environment on the Project: Sea Ice and Icebergs (offshore)
Preamble:	Errors and inconsistencies are noted throughout the text.	
Request:	Revise the text, figures and charts in accordance with the guidance provided in Appendix A – Environment Canada.	
Response:	Noted. Responses to comments in Appendix A are provided in Appendix A.	

Comment 25: EC 11

25-EC 11	**EA Reference:**:	3.2.1.2 Wind Climatology Page 3-32
Preamble:	This section presents the monthly mean and maximum wind speed statistics for both the MSC50 grid point and several offshore platforms presented separately, and gives the platform anemometer heights, all useful information.	
Request:	a) To improve the utility of Table 3-23, maximum wind speeds, it would be appropriate to adjust the MSC50 values from a one-hour mean maximum to an expected 10-minute mean maximum, to make them more comparable to the maximum 10-minute sustained winds reported by the platforms (as is done in the section on Wind Extremes). This would also be appropriate for the MSC50 maximum wind speeds in Subsection 3.1.1.1, Table 3-2, for the nearshore, to compare with the maximum reported 10-minute means from the weather stations. b) The offshore platforms listed in Table 3-23 include Glomar Grand Banks and GSF Grand Banks. Positions and periods of coverage are given in the Oceans Report, Table 1-8. Please confirm whether these two periods were from the same platform, with different names at different times, and if those records could be combined.	
Response:	a) Maximum wind speeds from the MSC50 dataset were converted from 1-hour maximum to 10-minute maximums, as indicated on page 3-33 (first paragraph) of the June 2010 CSR. **The following text will be added to the CSR as the second paragraph on page 3-33:** Winds speeds from MSC50 data set are 1-hour averages while the MANMAR data sets are 10-minute average winds. For consistency, wind speeds from the MSC50 data set have been adjusted to 10-minute maximum wind speeds. b) These two periods were for the same platform, under different names.	

Comment 26: EC 12

26-EC 12	**EA Reference:**:	3.2.1.2 Wind Climatology and 3.2.2.6 Wind and Wave Extremes Pages 3-32 & 3-56
Preamble:	When using winds from different sources, it is advisable to adjust winds for height, in order to reduce (although not eliminate) uncertainty when interpreting the data.	
Request:	Given the large height differences involved between platform anemometers and 10 m, and the presence of both unstable (winter) and stable (spring and summer) conditions, it would be advisable to use a surface layer model that accounts for atmospheric stability, to adjust from one height to another (e.g. Cardone et al. 2004 and Bourassa et al. 1999, with software at: http://www.coaps.fsu.edu/~bourassa/BVW_html/bvw_docs.shtml). References: Bourassa, M.A., D.G. Vincent, W.L. Wood. 1999. A flux parameterization including the effects of capillary waves and sea state. *J. Atmos. Sci.*, **56**, 1123-1139. Cardone V.J., A.T. Cox, E.L. Harris, E.A. Orelup, M.J. Parsons and H.C. Graber. 2004. Impact of QuikSCAT Surface Marine Winds on Wave Hindcasting. *8th International Workshop on Wave Forecasting and Hindcasting*, *Oahu, Hawaii, November 14-19, 2004.* [http://www.waveworkshop.org/]	
Response:	The MSC50 dataset compiled by Environment Canada, under contract to Oceanweather, is the most comprehensive wind dataset available. When performing this analysis, Oceanweather validated their models using Canadian Marine Environmental Data Service (MEDS) data, which incorporated wind and wave measurements from all platforms on the Grand Banks. This validation showed excellent agreement with the modelled MSC50 data with a bias of 0.04 and Scatter Index of 0.10 for wind speeds. In addition, a quantile-quantile comparison of wind speed show excellent agreement from the 1st to the 99th percentiles and the extreme storms represented by the 99.1 to 99.9 percentiles (Swail *et al.* 2006). In addition, Swail *et al.* (2006) concluded "*the wind and wave data are considered to be sufficiently high quality to be used in the analysis of long return period statistics, and other engineering applications.*" Given the extensive research and the accuracy of the results with the MSC50 dataset, adjustment of platform wind speeds from anemometer height to 10 m is not necessary. Anemometer wind speeds are provided as is, to give representation of wind speeds at levels which would be of concern to the design of GBS.	

Comment 27: EC 13

27-EC 13	**EA Reference:**:	3.2.1.7 Tropical Systems Page 3-41
Preamble:	In this section, Table 3-29 gives the strongest winds associated with tropical systems at the time they pass closest to the offshore project area.	
Request:	a) It would be useful to give an example of a severe event when platform wind and wave measurements are available. b) The table indicates the winds are in m/s, however it appears the values are in knots. Also, the table caption refers to a different (incorrect) location than the text. c) The text (and also the Oceans report, 1.2.9) attributes the increase in Atlantic hurricane activity since 1995 to naturally occurring cycles in the tropical multi-decadal signal that typically last 20 to 30 years, referencing Bell and Chelliah (2006). This could give the impression that the increase would be expected to reverse. However, the paper by Bell and Chelliah did not describe the tropical multi-decadal mode or signal as a naturally occurring cycle, and it did describe notable differences between the earlier and the current period of higher activity. d) It should be noted that about one half of N Atlantic tropical cyclones transition to extratropical midlatitude storms, and about half of those reintensify (Hart and Evans	

	2001). This is important because the area of damaging winds and waves increases substantially. Reference: Hart and Evans, 2001: A Climatology of the extratropical transition of Atlantic tropical cyclones. Journal of Climate, 14: 546-564.
Response:	a) **The following text will be added to Section 3.2.1.7 of the CSR:** More recently, in 2006, Category 1 hurricane Florence began undergoing extratropical transition on September 13, 2006 near 40.5°N 57.9°W (about 420 nm south-southwest of Cape Race, Newfoundland. The system then tracked northeast, passing near Cape Race late on September 13, 2006, then across the Northern Grand Banks September 14, 2006. As this system passed, winds speeds of 23.1 m/s was recorded by the Cape Race weather station and 37.6 and 28.3 m/s were recorded by the Hibernia and Henry Goodrich platforms, respectively. b) **Wind speeds are in knots. Values will be adjusted.** Caption: **Table 3-29 Tropical Systems Passing within 370 km of 46.5°N 48.5°W, 1950 to 2009** Also, Table 3-29 will be updated to account for storms passing within 370 km of the site to correspond with the table (Table 3-4) for the Nearshore Project Area. Figure 3-23 will also be updated. c) **Text in Section 3.2.1.7 will be replaced with the following:** There has been a significant increase in the number of hurricanes that have developed within the Atlantic Basin within the last 15 years. This increase in activity has been attributed to the tropical multi-decadal signal (Bell and Chelliah 2006). As a result of the increase in tropical activity in the Atlantic Basin, there has also been an increase in tropical storms or their remnants entering the Canadian Hurricane Centre Response zone and, consequently, a slight increase in the number of tropical storms entering the Grand Banks (Figure 3-23). It should be noted that the unusually high number of tropical storms in 2005 may be skewing the results for the 2005 to 2008 season. The average number of storms for the three year period of 2006 to 2008 is only 14.7, as opposed to 18.5 storms for the four-year period of 2005 to 2008. d) **The following paragraph will be inserted in the CSR:** A significant number of tropical cyclones which move into the midlatitudes transition into extratropical cyclones. On average, 46 percent of tropical cyclones which formed in the Atlantic transition into extratropical cyclones. During this transformation, the system loses tropical characteristics and becomes more extratropical in nature resulting in an increase in the area which produces large waves, gale to hurricane force winds and intense rainfall. The likelihood that a tropical cyclone will transition increases toward the second half of the tropical season, with October having the highest probability of transition. In the Atlantic, extratropical transition occurs at lower altitudes in the early and late hurricane season and at higher latitudes during the peak of the season (Hart and Evans 2001). Reference: Hart, R.E. and J.L. Evans, 2001: A Climatology of the extratropical transition of Atlantic tropical cyclones. Journal of Climate, 14: 546-564.

Comment 28: EC 14

28-EC 14	**EA Reference:**:	Section 3.2.2.1 Waves and 3.2.2.6 Wind and Wave Extremes Pages 3-46 & 3-56
Preamble:	This section benefits from the addition of analyses based on the past 10 years of measurements in this area, as well as from the MSC50 climatology.	
Request:	a) It would be valuable to include some comparison to statistics derived for the earlier relatively continuous observation period on the Northern Grand Banks, from 1979 to	

	1988 measurements. b) This section (or supporting documents) would be more complete with a brief description of the each of instruments, methods of measuring waves, and methods of calculating significant wave height and wave period, when these differ among the different data sources. As well, this should include any significant changes over time in these details which might affect the wave climatology, such as described in the Oceans report for the Hibernia wave data sampling interval. c) As with the nearshore section, this section contains a description of the metocean extreme wave conditions developed by the ExxonMobil Upstream Research Company that would be more appropriately located in 3.2.2.6, Wind and Wave Extremes. There is a statement (also in the AMEC report) that the significant wave height values were first calibrated to Hibernia measurements. Please explain this. d) The monthly statistics for both Terra Nova (1999 to 2007, Tables 3-34 and 3-35) and White Rose (2003 to 2007, Table 3-36), seem to be based on incomplete data. The monthly means would be higher if the complete datasets were used. The reference for the Terra Nova dataset is DFO 2009b (in the AMEC report as DFO2009c), file WEL411, which does not cover the entire period indicated. There are additional DFO files for Terra Nova during this period (as well as more recent years, now up to 2009). Similarly, for White Rose, the data source is given as AMEC but the DFO file for White Rose for the same period, 2003-2007, seems to include more observations. The full available datasets should be used in the analysis, or there should be some explanation of why some data are excluded. e) What is the reason for using a different method of calculating the peak wave period for the Triaxys wave buoy than used by DFO, and why this is not the same as used for the Terra Nova buoy (Table 3-36 for White Rose notes that the peak wave period, Tp5, is calculated by the Read method)? f) While this does not affect the CSR, please note that the list of wave sources in the Oceans report, Table 1.9, includes invalid dates for buoy 44153. Valid dates for the project area are October 1997 to March 1998 only, not starting in 1994 as indicated. This will affect the values in the Wave Climatology Table 1.12. The error arises due to the DFO wave archive structure, and past use of the same identifier for short term buoys moored in different locations.
Response:	a) Statistics for the Hibernia 1980 to 1988 nine year wave time-series (Dal-Santo 1986; McClintock 1993) are provided in tables in response to Comment 28: EC 14 (b). This is a long data set that itself was compiled from different Grand Banks wave measurement programs and should be representative of those 'earlier' times. Otherwise, in terms of other 1979 to 1988 measurements, the comparison would involve bringing together, in some systematic fashion in order to produce meaningful information, all sorts of measurement program data for various locations and durations, and would take a greater additional effort. This effort, at the time, was what was accomplished with the Hibernia time-series. b) **A brief introduction / orientation for the reader on chronology of Grand Banks wave measurements will be added to Section 3.X.X.X. Updated text, tables and figures will be provided beginning with the last paragraph following Table 3-33, as follows:** - Physical monitoring data from offshore production activities on the Jeanne d'Arc Basin have been collected for more than 10 years. There are presently three oil-producing fields in the North Atlantic: Hibernia; Terra Nova; and White Rose (*e.g.*, Table 3-X (or Figure 3-25)). Water depths range from approximately 85 m at Hibernia to 95 m at Terra Nova to 120 m at White Rose. The Hebron Field is located in the Jeanne d'Arc Basin, approximately 9 km north of Terra Nova and approximately 35 km southeast of Hibernia. Numerous exploration drilling programs and associated oceanographic

monitoring programs at these and other Grand Banks locations have also been completed from the late 1970s through to the present. Table 3-X presents a summary of selected sources available for comparison of Grand Banks wave conditions. A series of Hs and Tp monthly and annual, and annual Hs *vs* Tp bivariate statistics for these sources are presented in to Tables 3-Y to 3-Z.

- A comparison of the MSC50 hindcast with these measurements is presented in Table 3-X, where mean and 95 percent upper limit (estimated, assuming a normal distribution, as mean +1.96 x standard deviation) are shown.
- This is clearly not a complete list, nor exhaustive analysis or comparison; however, it focuses on providing a continuous record from the 1980s, together with record of the most recent measurements available from Hibernia, Terra Nova and White Rose. The history also shows the various wave instruments employed.

Table 3-X Grand Banks Selected Wave Measurement Sources

Site	Instrument	Time Period	Description
Hibernia	Waverider buoy	1980-1988	Assembled from Waverider buoy measurements from drill sites near Hibernia. Waveriders are sea surface-following accelerometer buoys (twice integrated the measurements yield sea surface elevation, hence wave height). Gap filling was accomplished with a wind/wave correlation model, and (for 1985 to 1988 which saw substantially lower drilling activity) an operational wave hindcast model (McClintock 1993).
Hibernia	MIROS surface radar system	1998-1999	"The Hibernia platform-mounted MIROS Wave Radar system monitors sea state and surface currents. MIROS makes use of active microwave remote sensing techniques to collect sea state (waves and currents) information from the ocean surface. MIROS operates in C-band. The frequency of operation is 5.8 GHz and the corresponding wavelength is 5.17 cm. The sea surface is illuminated by the radar antenna pointing almost horizontally, with a grazing angle of some 10 degrees. MIROS scans a 180 degree swath of ocean extending some 100 metres out from the platform" (AMEC 2003)
Terra Nova	Waverider buoy	1999-2009	Datawell Waverider buoy as noted above for earlier Grand Banks exploration drilling.
White Rose	TRIAXYS directional wave buoy	2003-2007	Similar and acceptable wave measurement as per Waverider: has three accelerometers, three rate gyros. Benefits include directional wave information and rugged buoy design as a practical benefit.

Notes:
Hm0, significant wave height, is estimated from the spectral moment, m0
Tp, peak period, is defined as $1/f_p$ where f_p is the frequency at which the wave spectrum has its maximum value
These parameters correspond to VCAR, Characteristic significant wave height, and VTPK, wave spectrum peak period, as reported by DFO (2010b)
The reader interested in details of these and other particular wave instrumentation and/or data measurements should consult the appropriate data repositories (*e.g.*, DFO 2010a) and end-of-well or annual oceanographic data reports (*e.g.*, from Operator or C-NLOPB library).

Table 3-X Monthly and Annual Significant Wave Height and Peak Period Statistics at Hibernia for January 1980 to December 1988, and January 1998 to December 1999

Month	Significant Wave Height (m)			Peak Wave Period (s)		
	Min	Mean	Max	Min	Mean	Max
Jan	0.5	4.0	13.7	3.3	11.0	18.2
Feb	0.0	3.1	11.4	2.0	10.3	22.7
Mar	0.1	2.8	9.1	3.0	10.4	21.5
Apr	0.7	2.8	9.4	3.3	11.1	23.0
May	0.1	2.1	6.4	3.3	9.6	23.1
Jun	0.5	1.8	5.2	3.3	8.9	23.0
Jul	0.1	1.6	6.4	3.4	8.5	22.6
Aug	0.1	1.7	5.8	3.3	8.7	22.9
Sep	0.0	2.5	9.9	2.0	10.2	23.1
Oct	0.1	3.2	13.0	3.3	10.4	21.8
Nov	0.4	3.3	11.5	3.8	10.3	21.4
Dec	0.1	3.8	13.8	3.3	10.8	21.7
Year	0.0	2.7	13.8	2.0	10.0	23.1

Source:
1980-1988 (McClintock 1993)
1998-1999 (DFO 2010a; Hibernia WEL IDs: 407 (MIROS))
Note: Data sampled at 3 hour intervals during 1980 to 1988, and at 20 minute intervals during 1998 to 1999.

Table 3-X Annual Significant Wave Height vs. Peak Wave Period at Hibernia for January 1980 to December 1988, and January 1998 to December 1999

Peak Period (s)	Significant Wave Height (m)							
	0-2	2-4	4-6	6-8	8-10	10-15	Total	% Total
2-4	189	215	1	0	0	0	405	0.6
4-6	2,076	853	17	3	3	0	2,952	4.0
6-8	5,392	4,927	371	18	5	2	10,715	14.5
8-10	10,129	9,345	2,643	209	14	9	22,349	30.2
10-12	5,505	12,723	3,663	735	121	33	22,780	30.8
12-14	1,761	5,143	1,777	498	191	47	9,417	12.7
14-16	717	1,948	834	138	71	7	3,715	5.0
16+	512	720	125	20	0	5	1,382	1.9
Total	26,281	35,874	9,431	1,621	405	103	73,715	99.6
% Exceed	35.5	48.5	12.7	2.2	0.6	0.1	99.6	0

Source:
1980-1988 (McClintock 1993)
1998-1999 (DFO 2010a Hibernia WEL IDs: 407 (MIROS))
Note: Data sampled at 3 hour intervals during 1980 to 1988, and at 20 mininute intervals during 1998 to 1999.

Table 3-X Monthly and Annual Significant Wave Height and Peak Period Statistics at Terra Nova for July 1999 to September 2009

Month	Significant Wave Height (m)			Peak Wave Period (s)		
	Min	Mean	Max	Min	Mean	Max
Jan	1.5	4.0	12.5	4.6	10.0	18.2
Feb	1.0	3.8	14.6	4.2	9.8	16.7
Mar	0.8	3.3	9.4	4.4	9.6	16.7
Apr	0.6	2.6	7.1	3.7	9.3	14.3
May	0.6	2.2	6.3	2.9	8.5	14.3
Jun	0.6	1.8	6.5	3.0	7.9	14.3
Jul	0.6	1.5	4.1	3.2	7.8	14.3
Aug	0.5	1.8	8.0	3.2	8.0	25.0
Sep	0.7	2.3	10.4	2.8	9.0	18.2
Oct	0.8	3.0	10.4	3.9	9.7	18.2
Nov	1.0	3.0	10.2	4.0	9.6	18.2
Dec	1.2	3.8	11.7	4.2	9.8	14.3
Year	0.5	2.7	14.6	2.8	9.1	25.0

Source: DFO (2010a)
Terra Nova WEL IDs: 411 (G-90), 426 (F-88), 436 (G-90), 437 (L-98), 438 (C-69), 439 (F-100), 448 (FPSO)
Note: Data sampled at 20 minute intervals until February 2000, and subsequently at 30 minute intervals.
Data gaps include parts of September-October 2002; January-April 2004.

Table 3-X Annual Significant Wave Height vs. Peak Wave Period at Terra Nova for July 1999 to September 2009

Peak Period (s)	Significant Wave Height (m)							
	0-2	2-4	4-6	6-8	8-10	10-15	Total	% Total
2-4	144	0	0	0	0	0	144	0.1
4-6	6,408	1,946	1	0	0	0	8,355	5.0
6-8	23,999	16,389	972	7	0	0	41,367	24.7
8-10	18,866	27,159	5,439	377	9	0	51,849	30.9
10-12	9,315	31,157	12,115	2,364	415	30	55,396	33.0
12-14	799	4,110	2,414	470	124	46	7,963	4.7
14-16	337	1,193	801	285	64	6	2,686	1.6
16+	3	54	10	7	3	0	77	0.1
Total	59,871	82,008	21,751	3,510	615	82	167,837	100
% Exceed	35.7	48.9	13.0	2.1	0.4	0.1	100	0

Source: DFO (2010a)
Terra Nova WEL IDs: 411 (G-90), 426 (F-88), 436 (G-90), 437 (L-98), 438 (C-69), 439 (F-100), 448 (FPSO)

Table 3-X Monthly and Annual Significant Wave Height and Peak Wave Period Statistics at White Rose for October 2003 to August 2007

Month	Significant Wave Height (m)			Peak Wave Period (s)		
	Min	Mean	Max	Min	Mean	Max
Jan	1.5	4.2	11.2	5.6	11.4	16.7
Feb	1.4	3.5	9.4	5.0	11.0	16.7
Mar	1.2	3.5	10.0	5.0	11.6	16.7
Apr	0.8	2.6	7.1	4.6	10.5	16.7
May	0.6	2.2	5.9	3.5	9.7	16.7
Jun	0.7	1.8	6.8	3.2	8.6	16.7
Jul	0.6	1.4	3.5	3.3	8.3	16.7
Aug	0.7	1.8	7.5	3.5	8.9	16.7
Sep	0.7	2.4	10.2	4.4	10.3	16.7
Oct	0.9	3.0	12.2	4.8	11.1	16.7
Nov	1.1	3.2	11.2	4.8	11.4	16.7
Dec	1.4	3.4	11.1	4.8	10.7	16.7
Year	0.6	2.7	12.2	3.2	10.2	16.7

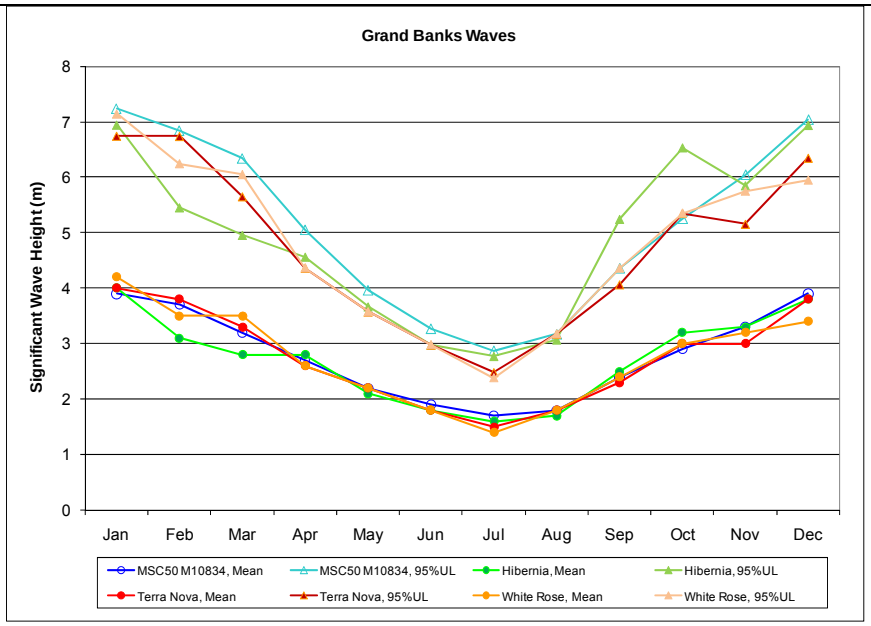
Source: DFO (2010b)

Note: Data sampled at 30 minute intervals. Data gaps include parts of February-May 2004; August-September 2004; February 2006; January-February 2007;

Table 3-X Annual Significant Wave Height vs. Peak Wave Period at White Rose for October 2003 to August 2007

Peak Period (s)	Significant Wave Height (m)							
	0-2	2-4	4-6	6-8	8-10	10-15	Total	% Total
2-4	32	0	0	0	0	0	32	0.1
4-6	1,366	212	0	0	0	0	1,578	3.1
6-8	4,656	2,689	51	0	0	0	7,396	14.4
8-10	6,161	5,101	499	8	0	0	11,769	23.0
10-12	4,379	10,420	2,379	314	13	0	17,505	34.1
12-14	873	4,400	1,748	395	95	3	7,514	14.7
14-16	325	2,290	1,267	291	79	19	4,271	8.3
16+	100	333	381	160	56	10	1,040	2.0
Total	17,892	25,445	6,325	1,168	243	32	51,105	99.7
% Exceed	34.9	49.6	12.3	2.3	0.5	0.1	99.7	0

Source: DFO (2010b)



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Figure 3-X Significant Wave Height Comparison: MSC50 Grid Point M6010834 Hindcast, and Hibernia, Terra Nova, and White Rose, Measurements.

References added to the CSR:

- AMEC. 2003. Hibernia Platform 2002 Environmental Report Volume I Oceanographic Report. AMEC Earth & Environmental report prepared for Hibernia Management and Development Company Ltd., St. John's, NL.
- McClintock, J. 1993. Time-Series Extension and Wave Persistence Analysis of a Continuous Hibernia Wind and Wave Time-Series. Seaconsult Report prepared for Hibernia Management and Development Company Ltd., St. John's, NL.
- Dal-Santo, R. 1986. Development of a Continuous Five-Year Time-Series of Winds, Waves and Currents at Hibernia. Seaconsult Report prepared for Mobil Oil Canada Ltd.
- Internet Sites
- DFO (Fisheries and Oceans Canada, Integrated Science Data Management (ISDM)). 2010a. Waves: Search For Wave Data Available On-line. URL (user may search by data ID, e.g., WEL, or with a map at URL): http://www.meds-sdmm.dfo-mpo.gc.ca/isdm-gdsi/waves-vagues/search-recherche/index-eng.asp
- DFO (Fisheries and Oceans Canada, Integrated Science Data Management (ISDM)). 2010b. Waves: CSV Format Description. URL: http://www.meds-sdmm.dfo-mpo.gc.ca/isdm-gdsi/waves-vagues/formats/csv-eng.htm

c) Regarding "…significant wave height values were first calibrated to Hibernia measurements…" URC scaled the MSC50 values based on an analysis they did with Hibernia wave measurements. The following is from (ExxonMobil Upstream Research Company 2009):

"**Extreme Wave Criteria**: The hindcast wave data have been previously calibrated based on measurements at Hibernia from 1999 through 2005 (Berek and Wang 2009). The following calibrationi s used:

$H_{s,calibrated} = 1.0507 * H_{s,hindcast} - 0.4793$

Where H_s is the significant wave height. The calibration leads to a reduced operational criteria and increased extreme criteria."

d) A new version of the Waves section is provided (at end of Table 3-X). Also, please note that:

- an updated data set for Terra Nova has been compiled for the period 1999 to 2009, now including seven WEL sets.
- no additional White Rose waves were found beyond 2003 to 2007 in WEL449. As the Comment seems to suggest there are additional data post-August 2007, we request that if there are any, please identify.
- Hibernia has been added to the Operator record. In addition to the 1980 to 1988 record, there is also WEL407 for Hibernia production 1998 and 1999 (other Hibernia platform data do not appear to be online).

e) This question is resolved with inclusion of statistics based on DFO 2010, where Tp is peak period, defined as $1/f_p$ where f_p is the frequency at which the wave spectrum has its maximum value; however, the description provided below is for possible general interest:

- T_{p5}, peak period as computed by the Read method and is available for TRIAXYS wave buoy (used at White Rose, 2003-2007). The Read Peak Period is reported by the TRIAXYS as part of its analysis because it can remove ambiguities caused by seas with multi-modal peak periods. The Read Peak Period (T_{p5}), is determined from calculating the average frequency (f_{p5}) as follows:
- $T_{p5} = 1/f_{p5}$
- where
- $$f_{p5} = \sum_i f_i (S_i / S_{\max})^5 \Big/ \sum_i (S_i / S_{\max})^5$$
- and the summations are for the low frequency to the high frequency bands;
- f_i is the frequency in band i ;
- S_i is the spectrum estimate at frequency i ; and
- $S_{\max}$ is the maximum spectrum estimate or energy of peak frequency.
- T_{p5} has less statistical variability than the peak period (T_p) because it is based on spectral moments. For the White Rose deployment, AMEC found T_{p5} yielded a consistently smoother estimate of peak period.
- Note: Section number 3.2.2.1 is used twice, for "Bathymetry" and "Waves".

f) An analysis of the valid dates above show that the data is only valid for the month of November. The remainder of the data has been either flagged as erroneous or occurs is below 1.0 m indicating the possibility of ice present. Therefore, wave observations from buoy 44153 have been removed from the tables. The new tables are provided below:

Table 3-X Locations of Wave Observations

Location	Latitude	Longitude	Period
Terra Nova	46.4°N	48.4°W	July 13, 1999 - March 31, 2007
Ocean Ranger	46.5°N	48.4°W	December 04, 1980 – February 09, 1982
Hibernia	46.7°N	48.7°W	January 01, 1998 - December 08, 2004
Hibernia	46.7°N	48.7°W	January 01, 2004 - December 31, 2008

Table 3-X Combined Significant Wave Height Statistics (m) for the MSC50 Data Set

Month	MSC50 Grid Point 10632	Terra Nova	Hibernia (1998-2004)	Hibernia (2005-2008)	*Ocean Ranger*
January	3.9	4.1	4.0	3.9	5.2
February	3.7	3.9	3.7	3.4	4.4
March	3.2	3.4	3.6	3.1	4.7
April	2.7	2.6	2.8	2.3	3.7
May	2.2	2.2	2.3	1.8	1.7
June	1.9	1.8	2.0	1.8	1.5
July	1.7	1.5	1.6	1.6	1.8
August	1.8	1.7	1.9	1.8	1.8
September	2.4	2.3	2.3	2.4	3.8
October	2.9	3.0	2.6	3.2	3.0
November	3.3	3.2	3.2	2.9	4.8
December	3.9	3.7	3.8	3.6	4.6

Comment 29: C-NLOPB 10

29-C-NLOPB 10	**EA Reference:**	Section 3.2.2.6 Page 3-56
Preamble:		
Request:	The description of the February 11, 2003 storm should include the wave conditions, for completeness.	
Response:	**The following text will be deleted:** Rapidly deepening storm systems, known as weather bombs, frequently cross the Grand Banks. These storm systems typically develop in the warm waters of Cape Hatteras and move northeast across the Grand Banks. On February 11, 2003, wind speeds at Grid Point M10632 peaked at 29.9 m/s. Wind speeds of 49.4 and 52.5 m/s from the southwest were recorded by the Hibernia and the Henry Goodrich anemometers, respectively, as this system passed. During this storm, a low pressure developing off Cape Hatteras on February 10, rapidly deepened to 949 mb as it tracked northeast across the Avalon Peninsula around 18 GMT on February 11. **And the following text will be added:** Rapidly deepening storm systems, known as weather bombs, frequently cross the Grand Banks. These storm systems typically develop in the warm waters of Cape Hatteras and move northeast across the Grand Banks. On February 11, 2003, wind speeds at Grid Point M10632 peaked at 29.9 m/s, while wave heights peaked four to five hours later at 13.6 m. Wind speeds of 49.4 and 52.5 m/s from the southwest were recorded by the Hibernia and the Henry Goodrich anemometers, respectively, as this system passed. During this same event, wave heights of 14.66 m were recorded over a 20-minute interval by a waverider buoy in the area. During this storm, a low pressure developing off Cape Hatteras on February 10, rapidly deepened to 949 mb as it tracked northeast across the Avalon Peninsula around 18 GMT on February 11.	

Comment 30: C-NLOPB 11

30-C-NLOPB 11	**EA Reference:**	Section 3.2.2.6 Page 3-62
Preamble:	In the "Extreme Value Estimates…" section it is stated that the 100-year extreme Hs "corresponds with a Hs of 14.66 m recorded . . . on February 11, 2003".	
Request:	It should be explained how two unequal Hs values correspond, or the statement should be amended.	
Response:	**The following text will be deleted:** The annual 100-year extreme Hs was 15.1 m at Grid Point M10632. This Hs corresponds with an Hs of 14.66 m recorded over a 20-minute interval by a waverider buoy in the area on February 11, 2003. **And replaced with the following text:** The annual 50-year extreme Hs was 14.4 m at Grid Point M10632, while the annual 100-year extreme was 15.1 m. An Hs of 14.66 m recorded over a 20-minute interval by a waverider buoy in the area on February 11, 2003, lies somewhere between these extreme estimates.	

Comment 31: C-NLOPB 12

31-C-NLOPB 12	**EA Reference:**	Section 3.2.3.6 Page 3-76 ff.
Preamble:		
Request:	Given the variation in iceberg occurrence, the CSR should explicitly indicate what portion of the iceberg occurrence data will be used in generating design information for the platform, and give a rationale for this selection.	
Response:	**The first paragraph in Section 3.2.3.6 ends with ".....sighted in the 1° grid containing the Hebron platform location has been 31." The following text will be added after this sentence.** Although the IIP database of icebergs drifting south of 48°N extends from 1900 to the present, significant changes in technology have improved the quality of the data over time. In particular, in 1983, the IIP began using Side Looking Airborne Radar (SLAR) for iceberg detection and the system was further enhanced in 1993 with the addition of Forward Looking Airborne Radar (FLAR). The iceberg design basis for Hebron is based on data from the 1984 to 2008 period.	

Comment 32: C-NLOPB 13

32-C-NLOPB 13	**EA Reference:**:	Section 3.2.3.6 Icebergs Page 3-76
Preamble:		
Request:	What is the design iceberg?	
Response:	**The following text will be included in Section 3.2.3.6:** The iceberg load for the Hebron GBS is calculated with a probabilistic simulation and, as such, there is no single "design iceberg". The design load is calculated from an energy approach in which the kinetic energy of the impacting iceberg is arrested by the work done in crushing the ice against the GBS. The key parameters that affect the load are the iceberg's mass, velocity, strength and local shape in the impact zone. These parameters are all described by statistical distributions, which allow for a wide range of possible scenarios that may lead to the design load. Based on this approach, the 10,000 year overall horizontal iceberg load on the pre-FEED GBS geometry is 517MN, and can, for example, be caused by a 3.13 million tonne iceberg with 250 m waterline length and drifting at a 0.72 m/s velocity. This load will be updated during FEED and detailed design when the GBS geometry is finalized.	

Comment 33: C-NLOPB 14

33-C-NLOPB 14	**EA Reference:**	Section 3.2.5 Page 3-89, Paragraph 2
Preamble:	The paragraph begins "An average of 400 icebergs per year (albeit highly variable) reach the latitude of the Grand Banks (Sonnichsen and King 2005)." The statement, even with qualifiers, is inconsistent with the discussion of iceberg occurrence numbers in Section 3.2.2.6.	
Request:	The inconsistency should be resolved.	
Response:	**Paragraph 2 in Section 3.2.5 will be revised as follows:** Between 0 and 2,202 icebergs reach the Grand Banks each year as recorded by Provincial Aerospace Limited and the International Ice Patrol. Bathymetric sheltering limits the number that can cross the banktop region, and enter the Hebron region. Sidescan sonar and multibeam bathymetry data from the bank top display frequent linear ice scour (or furrows) from grounded icebergs. In addition, icebergs calving or rolling, or remaining in one location for an extended period, can produce large semicircular pits (Lewis and Blasco 1990; Parrott *et al.* 1990). Scours mapped (with sidescan sonar) within the Hebron Project Area are indicated in Figure 3-46. Some of those evident are infilled with sand, and are likely old (although establishing absolute age of ice scour features is a challenge).	

Comment 34: C-NLOPB 15

34-C-NLOPB 15	**EA Reference:**	Section 3.2.6 Page 3-91 – 3-93
Preamble:	The Climate Change section entirely omits any considerations of ice and iceberg coverage.	
Request:	The Climate Change section should include a discussion, to the degree feasible, of implications of climate change upon occurrence of sea ice and icebergs at/near the project area.	
Response:	**The following text will be added to Section 3.2.6:** Since the early 2000s, the number of observed icebergs has increased in the North Atlantic Ocean (Rudkin *et al.* 2005). This may be a result of increased sea and air temperatures, but may also be a product of improved technologies for observing glacial sources. Should sea and air temperatures increase north of the Grand Banks, the number of icebergs entering the project area would likely increase initially due to increased calving of glaciers and ice islands. The size and presence of the icebergs would eventually decrease due to melt as the bergs drifted into the warmer waters. Similarly, the number of bergs could decrease as the lack of pack ice that helps carry and sustain the bergs on the Grand Banks would decrease, providing no insulation for the icebergs in the warmer waters. Whether this effect would be cyclical or permanent, or if it will transpire at all, remains to be seen. There is currently no reliable way of predicting the future occurrence and movement of sea ice and icebergs.	

Comment 35: EC 15

35-EC 15	**EA Reference:**:	3.2.6 Climate Change, 3.2.6.2 Waves Pages 3-91 & 3-92
Preamble:	The reference for Swail et al. (2006), mentioned in Section 3.2.6 is incorrect.	
Request:	Please give the correct reference for Swail et al. (2006).	
Response:	**This citation and reference should be:** Wang *et al.* (2004) Wang, X.L., F.W. Zwiers and V.R. Swail. 2004. North Atlantic Ocean wave climate change scenarios for the twenty-first century. Journal of Climate, 17: 2368-2383	

Comment 36: EC 16

36-EC 16	**EA Reference:**:	Section 3.2.6 – Climate Change Page 3-91
Preamble:	While the proponent provides references and comments on storm activity and waves, there is little or no comment on extreme events related to increased storm activity such as heavy precipitation events. The proponent is using the length of the Construction and Operational Phase to discount the impact of 100-year extreme events. Even if the event has a return period of 100 years, that doesn't mean it couldn't happen next year.	
Request:	The proponent is asked to review current literature and incorporate extreme event values (particularly precipitation events) in their consideration of operations during both the onshore and offshore periods.	
Response:	Section 3 provides an overview of extreme events, including 100-year events, for the Nearshore Study Area and the Offshore Study Area. Section 13, Effects of the Environment on the Project, also discusses the potential environmental effects of extreme events, including tides, water levels and storm surges on the drydock and indicates that these extreme events will be considered in the design and operation of activities at Bull Arm. The Operator has not discounted the potential effect of 100-year extreme events, as is implied in the preamble. Furthermore, an environmental assessment is done at the conceptual level of project design. An evaluation of extreme design loads on the Hebron Platform, including those caused by potentially elevated precipitation rates and other documented metocean conditions will be conducted during the next stage of design, which is known as "Front End Engineering Design" or FEED. The contracts for both the gravity based structure FEED and the topsides FEED have only recently been awarded and are just now getting underway.	

Comment 37: EC 17

36-EC 17	**EA Reference:**:	Section 3.2.6.1 Sea Level Rise (Climate Change) Page 3-91
Preamble:	Section 5.3.1 of the Scoping Document states that the EA will consider the influence that noted environmental changes and hazards may have on the project. Sea Level rise information noted in the study has been superseded by newer work. More current research and recent indications note the rate of Greeenland & Antarctic land ice melt is occurring at a faster rate than previously predicted. Current research querying this increased melt rate indicate that by the year 2100, SLR could be as high as 1-2 metres, for example, *Rahmstorf et al. 2009.*	
Request:	The proponents should apply more recent research regarding sea level rise projections. Proponents can see latest research in article at this website: http://www.nature.com/climate/2010/1004/pdf/climate.2010.29.pdf	

	Consideration of any adjustments to rig specifications and operations due to increases Sea Level Rise projections should be taken into account during the design stage of the project.
Response:	**The last paragraph of Section 3.2.6.1 will be replaced with the following paragraphs:** More recently, Vermeer and Rahmstorf (2009) used a semi-empirical model to estimate sea level rise over the next century based on emission scenarios from the 2007 IPCC assessment. They derived a relationship between historical global temperature and sea-level rise, and used this to obtain revised sea-level projections. This semi-empirical method implicitly accounts for the effects of the recent rapid glacial melt, and differs from physical, more explicit methods, that generally have much greater complexity but are limited because physical processes like glacial melt are still not fully understood. According to Rahmstorf (2010), these new results have found wide recognition in the scientific community. Scientists are generally cautious about predictions of sea-level change, in part because ice sheet dynamics are complex and not well understood. In addition, some studies indicate that inter-annual variability in sea level could be due in part to long-term atmospheric states like the North Atlantic Oscillation. From the studies referenced above, estimates of the rise globally over the next 100 years due to global warming alone are from 5 cm to as much as 190 cm. However, over the time period of 2010 to 2050, the expected total rise has a central estimate of 45 cm and an upper limit of about 70 cm (based on a rate of 1.7 cm per year as per Vermeer and Rahmstorf (2009)). The basis of design for calculating loads due to increased water depth from sea level rise and wave motion are accounted for in the safety factors used to determine minimum deck height and wave crest heights. An evaluation of design loads on the Hebron Platform due to the metocean environment will be conducted during the next stage of design (FEED) and will account for metocean uncertainties. **The following references will be added:** Cazenave, A., K. Dominh, S. Guinehut, E. Berthier, W. Llovel, G. Ramillien, M. Ablain, G. Larnicol. 2008. Sea-level Budget over 2003-2008: A Reevaluation from GRACE Space Gravimetry Satellite Altimetry, and Argo. Global Planetary Change 65: 83-88. Available at URL: http://etienne.berthier.free.fr/download/Cazenave_et_al_GPC_2009.pdf Rahmstorf, S. 2010. A new view on sea level rise. *Nature*, 4: 44-45. Available at URL: http://www.nature.com/climate/2010/1004/pdf/climate.2010.29.pdf Vermeer, M. and S. Rahmstorf. 2009. Global sea level linked to global temperature. Proceedings of the National Academy of Science. USA 106, 21527-21532. Available at URL: http://www.pnas.org/content/early/2009/12/04/ 0907765106.full.pdf+html

Comment 38: EC 18

38-EC 18	**EA Reference:**:	Section 3.2.6.4 Summary (Climate Change) Page 3-93.
Preamble:	The proponent deems all the information it referenced as "inconclusive" when describing the potential impact of climate change on the project. Such a statement reflects the proponents' lack of desire to incorporate information in non-traditional ways into their project planning. Recent approaches, taken by professional groups such as Engineers Canada, are focusing on risk management techniques to incorporate ranges of projections effectively into design decisions.	
Request:	The proponent is asked to consider incorporating current climate change projections for extreme events, high waves and storm surge (on top of sea level rise) into both phases of this project by utilizing risk management techniques.	

Response:	The term "inconclusive" was used to describe the high degree of variability in projections of future metocean conditions and its possible effect on the Grand Banks. The Operator does not deem all climate change information as inconclusive, as is implied in the preamble. **The following text will be added to Section 3.2.6.4** **Climate Change** Climate is naturally variable and can change over a range of time scales. Short-term meteorological variations are largely a consequence of the passage of synoptic scale weather systems: low pressure systems, high pressure systems, troughs and ridges. Energetics of these features varies seasonally in accordance with the changes in the strength of the mean tropical-polar temperature gradient. Long-term changes occur in response to small and large-scale changes of atmospheric circulation patterns. In the past, changes in Northern Hemisphere atmospheric circulation patterns were mainly the result of changes in the North Atlantic Oscillation. While the North Atlantic Oscillation still has an effect on climate patterns, there is a general consensus amongst the scientific community that greenhouse gas emissions have played a significant role in the climate during the last 50 years. However, the high degree of naturally experienced climate variation makes the identification of trends that are a direct result of climate change uncertain (Environment Canada 1997). As the Operator, ExxonMobil does use risk management methods throughout the various aspects of its business, including facility design. The basis of design for calculating loads due to increased water depth from sea level rise and wave motion are accounted for in the safety factors used to determine minimum deck height and wave crest heights. An evaluation of design loads on the Hebron Platform, due to the metocean environment and associated uncertainties, will be conducted during FEED, and further refined during detailed design. **The following will be added to the references:** Environment Canada. 1997: *The Canada Country Study: Climate Impacts and Adaptation, Atlantic Canada Summary*. IPPC (Intergovernmental Panel on Climate Change). 2001. *Climate Change 2001: The Scientific Basis*. IPCC Third Assessment Report, Cambridge university Press, Cambridge UK.

3.4 Response to Section 4 Comments

Comment 39: C-NLOPB 16

39-C-NLOPB 16	**EA Reference:**:	Section 4.1 Types of Environmental Effects Page 4-1
Preamble:	The social and economic benefits of the Project are analyzed in the Socio-economic Impact Statement (SEIS)/Sustainable Development Report, submitted in support of the Hebron Project Development Application.	
Request:	The reference to the SEIS is inappropriate without its inclusion. This SEIS has not been made available and the Development application has not been submitted.	
Response:	Noted. The sentence will be removed.	

Comment 41: C-NLOPB 18

41-C-NLOPB 18	**EA Reference:**:	Section 4.3.7 Step 7 – Cumulative Environmental Effects Page 4-17
Preamble:	Cumulative effects assessment must include a consideration of environmental effects that are likely to result from the proposed project in combination with other projects or activities that have been or will be carried out.	
Request:	The nearshore Study Area is the same as that for Hibernia, however, the residual impact of the Hibernia project is not mentioned.	
Response:	**The following paragraph will be added to Section 4.3.7** Results of the marine environmental effects monitoring (EEM) program conducted at Bull Arm from August 1991 to November 1997 indicated that the construction activities associated with the Hibernia GBS did not affect the marine environment beyond acceptable levels (*i.e.*, none of the null hypotheses developed for the marine EEM program were rejected) (LGL 1998). **The following reference will be added:** LGL Limited. 1998. *The Hibernia GBS Platform Construction Site Marine Environmental Effects Monitoring Program August 1991 – November 1997*. Prepared for Hibernia Management and Development Company Ltd., St. John's, NL. xiv + 110 pp.	

Comment 42: C-NLOPB 19

42-C-NLOPB 19	**EA Reference:**:	Section 4.3.7 Step 7 – Cumulative Environmental Effects Page 4-18 and 4-19, Table 4-4
Preamble:	Information in this table is dated (e.g. Offshore Oil Exploration Activities – there are three seismic programs proposed for offshore Labrador, not one)	
Request:	Table 4-4 should be reviewed and revised to incorporate the most recent information...	
Response:	Table 4-4 will be revised to reflect the most recent information (as of September 30, 2010)	

3.5 Response to Section 6 Comments

Comment 43: C-NLOPB 20

43-C-NLOPB 20	**EA Reference:**:	Section 6 Air Quality Page 6-1
Preamble:	Air quality is discussed in terms of the effects on local air quality. What is not discussed are the emissions from equipment and the federal government objectives to reduce emissions of Critical air contaminates, including greenhouse gases, from equipment.	
Request:	The CSR should address facility emissions in relation to the federal government's objectives and how they will be achieved. The CSR should address the use of ozone depleting substances (e.g. halocarbons) and why it would not be possible to use alternative substances. Mitigation to prevent the release of these substances should also be identified.	
Response:	Emission estimates of critical air contaminants from equipment are addressed and provided in Tables 6.9 and 6.20 and for greenhouse gas emissions in Tables 6.10, 6.16 and 6.17. The estimated emissions from the platform, and the ambient air quality in the region, meet the NAAQ objectives. The Hebron Project is in the conceptual stage of design. It is understood that the federal government is reviewing industrial emissions criteria. EMCP is a participant in the Base Level Industrial Emissions Equipments / Requirements (BLIERs) initiative, where performance levels for certain CACs may be implemented. EMCP expects to use non-halocarbon fire suppressants such as water / water mist and breathable, inert-gas based systems such as Inergen or FM 200. EMCP will endeavor to use non-ozone depleting substances where appropriate and proven technologies are available.	

Comment 44: HC 3

44-HC 3	**EA Reference:**:	Section 6 Air Quality Page 6-1 Air Emissions and Dispersion Modelling Study for the Hebron Project
Preamble:	In a review of National Pollutant Release Inventory (NPRI) for the Hibernia offshore platform, several polycyclic aromatic hydrocarbons (including acenaphthene, acenapthylene, fluorene, naphthalene, and pyrene), n-hexane, benzene, toluene, ethylbenzene and xylenes were reported to have been released to air in 2008 (Environment Canada, 2009). These substances were not specifically modeled in the Air Emissions and Dispersion Modelling Study[2] and it is unclear whether they were implicitly included as part of the total volatile organic compound (VOC) releases or whether they were not assessed. Air Reference: Environment Canada. 2009. National Pollutant Release Inventory, 2008 data. Hibernia (NPRI ID: 6096). http://www.ec.gc.ca/pdb/websol/querysite/facility_substance_summary_e.cfm?opt_npri_id= 0000006096&opt_report_year=2008	
Request:	Please indicate whether or not these substances were included in the modeling assessment. If they were not, please provide a rationale as to why they were excluded, as several of these substances can act as respiratory irritants, and at least one (i.e., benzene) may be carcinogenic to humans via the inhalation route of exposure.	
Response:	Individual VOCs were not modelled in this study only total VOCs. The Project is in the early stages of design, and the level of detail required to undertake individual VOC emissions is not available. Therefore, the emission factors for total VOCs were	

	acquired from the US EPA AP-42, Section 3.1 Stationary Gas Turbines. Once the platform is operational, EMCP will report per National Pollutant Release Inventory, on VOCs and other releases, as required by legislation.

Comment 45: HC 2

45-HC 2	**EA Reference:**:	Section 6.1.1 Environmental Assessment Boundaries - Spatial Page 6-1
Preamble:	re: Air Quality – On-land and Nearshore *Please note that Health Canada does not verify air quality modelling results and assumes that correct and accepted and/or validated methods were used. Health Canada relies on the expertise of Environment Canada for the review of air quality modelling results and the provision of related advice. If errors and/or gaps in the modelling are noted by Environment Canada, it is suggested that revisions be made to address them as indicated by Environment Canada. If the revised results differ from the originally submitted results, it is advised that the report be resubmitted to Health Canada for review.* Section 6.1.1 (Environmental Assessment Boundaries – Spatial) – The report states that "*professional experience indicates that the environmental effects of emissions in construction would disperse to within the range of normal background levels at this distance* [at the nearest residences]". The locations of the nearest residences and/or other potentially sensitive human receptors are not identified in the report.	
Request:	Please provide the locations and proximity of the nearest potentially sensitive human receptors in order for Health Canada to assess the potential for human health effects associated with air emissions as a result of construction activities on-land and in the nearshore.	
Response:	**Please refer to response to Comment 15: HC 1** The nearest community of Sunnyside is located over 4 km to the north northwest, and the community of Arnolds Cove over twice that distance to the west southweSt. As the project is committed to providing a safe work environment for the workers, it was assessed that the effects in Sunnyside, the nearest location of residences, would be well within acceptable levels. The CSR concluded that the environmental effects on air quality will be not significant.	

Comment 46: EC 22

46-EC 22	**EA Reference:**:	Section 6.1.3 Administrative Page 6-4, Table 6-2 Dispersion Modelling Study, Table 2-1
Preamble:	There is a blank box in the column listing pollutants in Table 6-2. This should be sulphur dioxide as correctly noted in the Modelling Study. The table gives the impression that the averaging times given for both PM2.5 and ozone are applicable to both the Canada-wide Standards and the NL Ambient Air Quality Standards. They are only applicable to the Canada-wide Standards. The NL standard averaging times are 24 hours for PM2.5, and 8 hours for ozone as presented in the table. There is also a 1 hour ozone standard of 160 ug/m^3.	
Request:	This table should be corrected	
Response:	Table 6-2 will be corrected.	

Comment 47: EC 25

47-EC 25	**EA Reference:**:	Section 6.1.3 Administrative Page 6-4 Section 6.4.1 Change in Ambient Air Quality Page 6-16
Preamble:	The proponent describes the "tolerable", "acceptable", and "desirable" categories of the National Ambient Air Quality Objectives but does not identify which of these categories will be used in the determination of exceedances.	
Request:	The proponent is asked to identify in the text that the modelling results (as identified in the tables further on) are the maximum "acceptable" objectives.	
Response:	**The following text will be added to the CSR:** The modelling results were being compared to the maximum "acceptable" National Ambient Air Quality Objectives in order to determine potential exceedances.	

Comment 48: EC 23

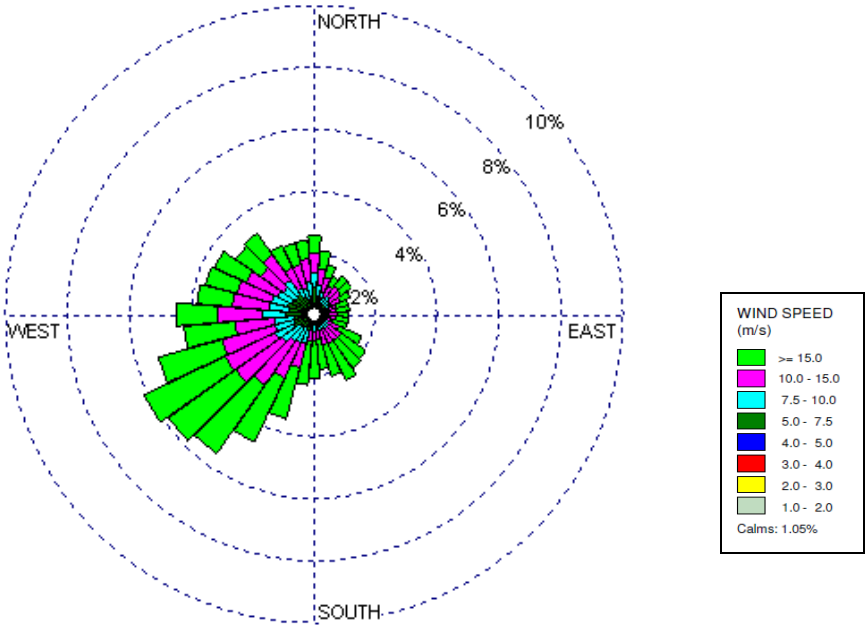
48-EC 23	**EA Reference:**:	Section 6.2.1.1 Air Quality Page 6-6, Table 6-3
Preamble:	It is not clear what the numbers in Table 6-3 represent. i.e. Are they the highest concentration for each time period over a year or longer, or some other metric (percentile, 4th highest).	
Request:	The proponent is asked to confirm exactly what the values in the table represent and the time frame from which the data was selected.	
Response:	The data represented in Table 6-3 were based on information available at that time. Since the CSR was completed and reviewed, more recent ambient air quality monitoring data was published by the NLDEC in June 2010, titled "2009 Ambient Air Monitoring Report". **These data have been summarized in Table 6-X (based on maximum annual values) and will be included in the CSR:**	

Table 6-X: Ambient Air Quality in and Surrounding the Nearshore Affected Area (Maximum Annual Values for 2009)

Pollutants ($\mu g/m^3$)	Time Frame (Max. Values)	Arnold's Cove	Come by Chance	Sunnyside
SO_2	1-hour	137.5	203.8	192.6
	24-hour	19.9	64.6	49.9
$PM_{2.5}$	24-hour	15.5	16.6	17.5
PM_{10}	24-hour	-	-	22.3
NO_x	-	NA	NA	NA

Comment 49: EC 19

49-EC 19	**EA Reference:**:	Section 6.2.2 Offshore Page 6-7
Preamble:	Indication given in the introductory paragraph that each platform would be downwind of each other less than 15 percent of the time.	
Request:	The proponent is asked to provide a reference or to substantiate this statement.	
Response:	The statement is an introductory one, based on observations of wind direction distributions for many stations where it can be observed that the prevailing wind direction is usually not as pronounced as is implied, although the prevailing quadrant may be dominant. The horizontal angular size of an elevated point source plume is about 10 degrees; it can be narrower, as in very stable conditions, when the plume generally remains elevated at distance, or it can be broader in strongly mixed conditions. To be more accurate, it is acknowledged that the solid angle of the plume also changes with distance due to a number of factors including wind shear, but the	

	comment was not made at that level of detail. Given that the plume is of the order of 10 degrees, the question becomes how often a wind occurs with a direction that is within 10 degrees of an upwind/downwind pairing of source and receptor. If the wind direction were to be completely random, a specific 10 degree sector would occur with a frequency, f = (10/360)X100 percent = 2.8 percent. In any given location, the wind direction is not random, but shows a distribution that results from the overlay of local topography or surface temperatures, synoptic scale weather systems, and global circulation. For the wind dataset used in this assessment, the wind direction frequency distribution, or wind rose, is as follows, plotted according to 10 degree direction segments. No segment has a frequency greater than 10%, in agreement with the introductory statement. 

Comment 50: EC 26

50-EC 26	**EA Reference:**:	Section 6.3.2 Offshore Page 6-11 Section 6.5.1.2 Greenhouse Gas Emissions Page 6-18, Table 6-9
Preamble:	P. 6-11 states that natural gas use will release greater quantities of NOx than diesel and confirms this in Table 6-9 referencing the US EPA. AP-42, the US EPA's Compilation of Air Emission Factors, however, lists NOx emissions from the use of distillate fuel in turbines as being greater than that of natural gas.	
Request:	The proponent is asked to confirm these emissions estimates and the reference.	
Response:	Based on similar fuel usage, this is correct, that natural gas will release smaller quantities of NO_x, than diesel. The values that are presented in Table 6-9 for power generation on diesel vs. power generation on natural gas are based on actual fuel usage for the Project during the first year of operation (diesel) and peak operation (natural gas). The amount of fuel burnt during peak operation is estimated to be greater than that during the first year of operation and therefore a greater quantity of NO_x emissions are being reported.	

Comment 51: EC 27

51-EC 27	**EA Reference:**:	Section 6.3.2 Offshore Page 6-11 Section 6.5.1.2 Change in ambient Air Quality Page 6-19, Table 6-10
Preamble:	P. 6-11 states that natural gas use will release lower quantities of CO_2 than diesel use, however, Table 6-10 lists the CO_2 emissions from natural gas as being far greater than from the use of diesel fuel.	
Request:	The discrepancy between the text and the table should be addressed.	
Response:	The text stated on page 6-11 is correct; generally natural gas use will release lower quantities of CO_2 than diesel use in terms of stationary gas turbines operating at similar rates and fuel usage. However, the data presented in Table 6-10 are based on two different operating scenarios, power generation during the first year of operation (diesel) and power generation during peak operation (natural gas). Refer to the response to Comment 50: EC-26 above, as well.	

Comment 52: C-NLOPB 21

52-C-NLOPB 21	**EA Reference:**:	Section 6 Air Quality Pages 6-11 and 6-12
Preamble:	Fugitive emissions are described as originating from back up or standby generators, loading of fuel, etc. Not all of the mentioned sources fit the National Pollution Inventories definition of fugitive emissions. Fugitive emissions, as define by NPRI, are air pollution derived from human activities that do not emanate from a particular point, such as an exhaust pipe or stack. They are releases to air that are not released through confined process streams. Roadway dust and volatile organic compounds (VOCs) from refinery valves are examples of fugitive emissions. These releases include fugitive equipment leaks from valves, pump seals, flanges, compressors, sampling connections, open-ended lines, etc., evaporative losses from surface impoundments and spills, releases from building ventilation systems, and any other fugitive or non-point air emissions from land treatment, mine tailings, storage piles, etc.	
Request:	The CSR should be reviewed in terms of what has been stated as being fugitive emissions in relation to the standard definition.	
Response:	Fugitive emissions sources include facility flanges, valves and occur during connect / disconnect of hydrocarbon loading lines. The text in the CSR has been modified to reflect this definition. The number of flanges / valves have been modelled to provide an estimate of fugitive emissions. Refer to response to Comment 53: C-NLOPB 22.	

Comment 53: C-NLOPB 22

53-C-NLOPB 22	**EA Reference:**:	Section 6.3.2.2 Operations/Maintenance Page 6-12
Preamble:	It is concluded that minor amounts of TSP and VOC emissions will be emitted during various routine maintenance activities, including welding, machine oils and cleaning solvents. There will also be some fugitive emissions of VOCs and CACs from the loading and unloading of fuels and products, from storage tanks, and backup-generators. It has been stated that these emissions will be limited in quantity and therefore were not assessed further in the CSR. The CSR has not quantified fugitive emissions nor has it defined what is meant by limited in quantity.	
Request:	The conclusion reached in the CSR should be supported through references or calculations to show that such emissions are limited and, in relation to the federal clean air agenda, not significant. Management practices for fugitive emissions should be considered. CAPP's guidance for possible mitigative measures that could be applied should be considered.	

Response:	Conceptual level work to date has been based on using the CAPP Guidelines for estimating emissions due to fugitive sources (*e.g.*, valves, flanges, compressor seals, sampling connections, open-ended lines, PRVs). Fugitive emissions are calculated by combining factors and number of fittings. For Hebron, fugitive methane releases are estimated to be 1,346 tonnes/yr of CH_4 (or 28,266 tonnes/yr of CO_2e) using this method. Fugitive emissions of non-CH_4 VOCs were estimated by similar methodology, and maximum ground level concentrations during peak operation were predicted to be 2.94 mg/m^3. These estimated emissions fall within range of those reported in 2008 by the existing platforms (Hibernia – 1,664 tonnes/yr CH_4, White Rose – 1,430 tonnes/yr CH_4, Terra Nova – 1,489 tonnes/yr CH_4) under the NPRI and GHG Reporting systems. As well, once the Hebron Platform is operational, all emissions will be reported under both the NPRI and GHG Reporting systems. Fugitive emissions will also be managed consistent with the CAPP guidelines, Best Management Practice for Fugitive Emissions.

Comment 54: C-NLOPB 23

54-C-NLOPB 23	**EA Reference:**:	Section 6.3.2.2 Operations/Maintenance Page 6-12
Preamble:	It is stated that during operation of the Platform there will be times when excess gas will be flared, for example, during well testing.	
Request:	What is the need to flare gas during well testing? What is the technical impediment to processing gas from well testing with that of production?	
Response:	**The following text:** "During operation of the Platform, there will be times when excess gas will be flared, for example, during well testing and during upset conditions, …" **will be amended to read as follows:** "During operation of the Platform, there will be times when excess gas will be flared, for example, during well cleanup and unloading after initial completion of a well, during upset conditions, and during background flaring.	

Comment 55: EC 24

55-EC 24	**EA Reference:**:	Section 6.3.2.1 Offshore Construction/Installation Pages 6-11 and 6-13 Air Emissions and Dispersion Modelling Study, Page 15, Table 6-2.
Preamble:	Pages 6-11 and 6-13 states that emissions other than those presented (i.e. loading and unloading) would be limited in quantity and are therefore not further assessed. However, Table 6-2 in the Dispersion Modelling Study uses values that for Hebron that are much smaller than those of the other three platforms. In the case of VOCs, this difference is in orders of magnitude.	
Request:	The proponent is asked to confirm whether these differences are real, and if so to describe the changes in technology that would allow the emissions from Hebron to be so much less than those from the other facilities. If these emissions differences are not real (i.e., there are sources included in the estimates for the other operations that are not included in those for Hebron) then these other sources should be identified and included in the analysis.	
Response:	The June 2010 CSR provided emission estimates for the Hebron Project based on the operation of stationary combustion equipment, and did not include VOC fugitive emission estimates. Therefore, the values reported appeared to be much lower than other operations. Air emission estimates were updated to include fugitive emissions (see Stantec October 2010). The revised air emission estimates, which are based on	

	conceptual level work, shows that the VOC emissions are within the range of the existing platforms.

Comment 56: C-NLOPB 24

56-C-NLOPB 24	**EA Reference:**:	Section 6.3.3 Summary Page 6-14, Table 6-8
Preamble:	Table 6-8 does not appear to list all of the major activities. For example, power generation and gas compression are not listed.	
Request:	The table should be revisited and revised to include all the activities that may occur.	
Response:	Table 6-8 will be updated.	

Comment 57: EC 28

57-EC 28	**EA Reference:**:	Section 6.5.1.1 Change in Ambient Air Quality Page 6-18 Dispersion Modelling Study, Page 7
Preamble:	The CSR notes that the sulphur concentration in the diesel fuel would be very low, and the Modelling Study lists this number as limited to 500 ppm by federal regulation. Technically, the Sulphur in Diesel Regulations apply to on and off road mobile engines that may not cover the generators (pending further design details) used in this project. As well, the limit is scheduled to be reduced to 15 ppm, possibly before the project is underway.	
Request:	The proponent is asked to confirm that the sulphur concentration limit identified in the federal regulation represents the maximum limit that will be actually used in the project. If this is not the case, the proponent should specify the maximum sulphur limit that will actually be used, and if significant, carry out the appropriate analysis.	
Response:	Standard commercially-available diesel or marine diesel fuel will be used throughout the commissioning and operation of the proposed Hebron Platform. The pending change in diesel fuel standards will result in limits of 15 mg/kg being in effect during the commissioning of the Project, representing a convergence of the limits in effect at the present time for on-road, off-road and marine diesel fuels.	

Comment 58: EC 31

58-EC 31	**EA Reference:**:	Section 6.5.2.1 Change in Ambient Air Quality Page 6-27, Table 6-15 Page 6-43, Table 6-25
Preamble:	The 1 hour maximum GLC for NOx is exactly the same in both the peak operation and cumulative scenarios. For most of the other pollutants, the cumulative GLCs are greater than those for peak operation. The dispersion modelling report does not give us access to the peak operation contours to better assess the likelihood (while recognizing that this is feasible) of these numbers being identical.	
Request:	The proponent is asked to confirm that these numbers are actually identical and not a transcription error.	
Response:	The maximum predicted 1-hour GLC at the maximum predicted grid receptor for NO_x was exactly the same for both the peak operation model run and the peak operation cumulative effect run. When additional sources in a new emission configuration do not alter the maximum concentration, it reflects the fact that the impacts of the added sources are not at the same location because of stack height and other release parameters.	

Comment 59: EC 29

59-EC 29	**EA Reference:**:	Section 6.5.3 Offshore Decommissioning and Abandonment Page 6-32, Table 6-18
Preamble:	The CSR states in table 6-18, and throughout the document that it will investigate the use of efficient/reduced emission technology and incorporate it where appropriate. The scoping requires a description of the potential means of reduction. Emission reductions can also be achieved through practices (i.e., leak detection and repair) as well as technologies and these should be identified as well.	
Request:	The proponent should commit to reporting on the results of their investigations in order to meet the requirements of the scoping document and allow the reviewers to evaluate the application of best industry practices.	
Response:	The largest potential to reduce emissions, particularly GHGs, comes from energy efficiency. Power generation is the largest source of GHGs on the platform. The Hebron facility includes several energy efficient technologies: • 'Aero-derivative' type gas turbines will be used for power generation • Waste Heat Recovery Units (WHRUs) will be installed on the main power generators. This equipment has heat exchangers to capture energy from the hot turbine exhausts and use the energy for the process heating systems on board • Insulation will be applied to process piping, reducing heat loss and thus energy required to heat process streams. • Cross-stream heat exchangers will be installed to use the heat from the stabilized oil for warming process streams rather than burning additional gas for heating. These cross-stream exchangers also cool the stabilized crude, thus reducing the cooling medium circulation, seawater lift and their associated electrical and fuel demand. • Mechanical Variable Speed Drives (VSDs) will be installed on the water injection pumps (the largest single energy user). VSDs allow for pump power demand to be tailored to pumping requirements, compared to a conventional fixed speed pump. This is the only Grand Banks application of this technology. The Hebron flare system will be purged with nitrogen gas, which reduces 'background' flaring volumes and hence GHG and Criteria Air Contaminant (CAC) emissions, versus other flare systems that use fuel gas to keep the flare header purged. Fuel gas will used for flare purge when the nitrogen system is unavailable. ExxonMobil adopts industry Best Practices in regards to leaks and emissions and is committed to No Spills. Leak detection is executed using a rigorous maintenance and inspection campaign. The Operator employs FIMS (Facilities Integrity Management System), which incorporates proactive procedures to identify and remediate leaks. This includes a corrosion monitoring program to identify components that need closer monitoring, preventative maintenance or remediation before any leakage could occur. A flange management system will be put in place and carried through engineering, procurement, construction, commissioning and the operating life of the facility. Flanges are the primary source of fugitive emissions leaks. The flange management system recognizes this and implements proactive management of flanges to ensure utmost quality control, alignment, fitting and monitoring over the life of the facility. Gas detectors are located around the facility to detect any leakage of gas. Assessment of other leak detection technologies will occur as the design matures.	

Comment 60: EC 20

60-EC 20	**EA Reference:**:	Section 6.5.4.1 Change in Air Quality Page 6-35; Table 6-20
Preamble:	Air dispersion Modelling Emission Rates are indicated in the table header without an indication of units.	
Request:	The proponent is asked to provide units for this table.	
Response:	Table 6-20 will be updated to include the units of the emission rates.	

Comment 61: EC 30

61-EC 30	**EA Reference:**:	Section 6.5.4.1 Change in Air Quality Page 6-34; Table 6-22 Page 6-38
Preamble:	P. 6-34 alludes to the potential of an explosion or fire but states that the emissions would be marginally small, and does not provide any information on the frequency, magnitude, extent or duration of such an incident. The only analysis of an emergency event/upset conditions provided is for a relatively straightforward emergency flaring procedure.	
Request:	The proponent is asked to revisit the possibility of a catastrophic event and carry out an appropriate analysis of the possible frequency, magnitude, extent and duration.	
Response:	For air emissions, “upset conditions” are defined as process upsets that result in the routing of hydrocarbon to the flare. Emission estimates from upset conditions are provided in Section 6.5.4.1 of the CSR. These estimates are based on the operating experience of similar ExxonMobil-operated facilities.	

Comment 62: EC 21

62-EC 21	**EA Reference:**:	Section 6.5.5.2 Offshore Page 6-45, Table 6.26
Preamble:	Total of the four platform’s CH_4 CO_2eq is greater than the provincial total after the inclusion of Hebron.	
Request:	The proponent is asked to reconcile this difference.	
Response:	The data currently represented in Table 6-26 are correct. The provincial total presented is a total for the Province of Newfoundland and Labrador and is based on the current GHG emission sources as reported to the Environment Canada GHG Reporting Program for the 2008 reporting year. It does not include the estimated GHG emissions from the operation of the proposed Hebron platform, but it does include the emissions of other, non-oil / gas project sources not shown in the table. The table is not a full balance sheet, and the provincial total is not the simple sum of the previous rows in the table. Once the estimated emissions of GHGs related to the operation of the proposed Hebron Platform are added to those reported for the other existing platforms the sum will increase accordingly.	

Comment 63: EC 32

63-EC 32	**EA Reference:**:	Section 6.7 Follow-up and Monitoring Page 6-47
Preamble:	The proponent has only stated its intent to report its emissions, while the scoping document clearly states that the methods for validating and monitoring emissions methods should be included. While the difficulties of carrying out ambient monitoring in this location are understood, there should be some description of the methodologies that will be used to estimate or measure emissions once the project is underway. Given the variation in emissions between this project and the others in the area, it is important that this be undertaken.	

Request:	The proponent is asked to describe the methodology that will be used to validate the emissions
Response:	As stated in the response to comment 55-EC 24, the air emission estimates that were reported in the 2010 CSR did not account for VOC fugitive emissions. The revised air emission estimates show that the air emissions from the Hebron Project are similar to existing offshore installations. **The following text will be added to Section 6.7:** Emission estimates are based on vendor specifications and EPA guidance. The values estimated will be validated against vendor guaranteed emissions performance data, which can only be obtained once the equipment is purchased. Once in operations, the Hebron Project will be required to report annually to the NPRI, and will do so using industry standard reporting procedures (*i.e.*, CAPP guidance on NPRI reporting; CAPP 2007-0009). This will also serve to validate the emission estimates used in the CSR.

3.6 Response to Section 7 Comments

Comment 64: DFO 4

64-DFO 4	**EA Reference:**	7.3 Existing Conditions Page 7-3
Preamble:	The information provided on existing fish habitat in the nearshore area is not sufficient with regards to the CSR scoping requirements. A more detailed description of fish habitat is required for the Bull Arm project area. Page 7-4 indicates that *"…an extensive fish and fish habitat survey of Great Mosquito Cove was conducted for the Hebron Project in August 2009.*" However, none of this information appears in the CSR as the descriptions are based on earlier studies. Also, the information provided on fish species and their life history characteristics is not discussed in relation to the habitat present within the nearshore project area.	
Request:	a) Provide the August 2009 fish habitat survey of Great Mosquito Cove. b) Rather than providing general overviews of the life history characteristics of the species present, it should be linked to the habitat present within the nearshore project area itself.	
Response:	a) The August 2009 Fish Habitat Survey of Great Mosquito Cove will be provided to DFO b) *In addition, information contained within the Hebron Project Marine Habitat Survey, Great Mosquito Cove, Trinity Bay – Location of Hebron GBS Construction (EMCP 2009) and Fish Habitat Assessment in Great Mosquito Cove, Trinity Bay: An Overview of Available Fish Habitat and Resources in the Vicinity of the GBS Construction Site Location (LeDrew, Fudge and Associates 1990), will be incorporated in Section 7.3.1.2 after the last paragraph. Information from Section 7.3.1.4 will be incorporated into the expanded Section 7.3.1.2 and as such, Section 7.3.1.4 is removed. The first two paragraphs of Section 7.3.1.5 have been incorporated as appropriate in this section and are removed from Section 7.3.1.5. This information ties species to habitat found within the nearshore of Great Mosquito Cove. The overview of the life history of the species is provided after Section 7.3.1.2 for completeness and consistency.* Based on information collected for the Hebron Project Marine Habitat Survey, Great Mosquito Cove, Trinity Bay – Location of Hebron GBS Construction (EMCP 2009), revealed that fine material was a frequent surficial substrate observed in the cove, switching to gravel and cobble towards the outer section of the cove (see attached figure (new Figure 7-X)). The fine material was generally found in the central areas of the cove in deeper water, which is approximately 50 to 60 m in the inner area of the cove and 100 to 110 m in the middle area of the cove. The deepest areas in the outer cove reach a water depth of about 200 m, but on average is approximately 110 m Benthic habitat with solid substrate was generally observed more towards the shore and which may be comprised of boulder and rubble and/or mixed with gravel and cobbles. Habitat with bedrock substrate was most common in the outer section of the cove towards the north shore and which covered approximately 15 percent of the seafloor. A fish habitat assessment conducted in Great Mosquito Cove in November 1989 (LeDrew, Fudge and Associates 1990) noted that there were three fish habitats type identified by SCUBA surveys and one from camera photographs (based on Moyle and Cech 1982) within Great Mosquito Cove: nearshore rocky bottom; nearshore soft bottom; kelp beds; and deep-water rocky bottom. Three fish habitat types were identified in Great Mosquito Cove during marine baseline surveys (Mobil Oil 1990a). The communities were described as: • A shallow water (≤10 m depth), rocky bottom community dominated by polychaetes (fringed worms (*Dodecaceria concharum*) and paddle worms (*Eulalia viridis*)), chiton (*Tonicella rubra*), gastropods (limpets (*Acmaea testudinalis*) and	

Puncturella noachina), aeolidoid nudibranchs, and echinoderms (green sea urchin (*Strongylocentrotus droebachiensis*), daisy brittle star (*Ophiopholus aculeata*) and boreal sea star (*Asterias vulgaris*))

- A nearshore midwater (10 to 12 m depth) community characteristic of mixed substrates and dominated by nematodes, polychaetes (scale worms (*Pholoe minuta*), *Microphthalmus sczelkowii* and *Harmothoe imbricate*) and thread worms (*Mediomastus ambizeta* and *Lumbrineris* sp.)), cockles (*Cerastoderma pinnulatum*), harpacticoid copepods (*Laophonte horrid*, *Ectinosoma* sp., and *Arthropsyllus serratus*), unidentified cytherid ostracods, cumacean (*Diastylis rathkei*), and gammarid amphipods (*Orchomenella minuta* and *Corophiium bonelli*)
- A deepwater (>40 m depth) community characterized by a silty substrate and dominated by polychaetes (*Gyptis vittata*, *Prionospio steenstrupi*, *Aglaopphamus neotenus*, *Cossura longocirrata*, syllid species and unattached serpulids), pelecypods (*Crenella glandula* and *Thyasira gouldi*), cytherid ostracods, and cumacean (*Leucon* sp.)

The nearshore rocky habitat (or shallow water rocky bottom community as described in Mobil Oil 1990a) was described as comprised of shallow waters generally less than 10 m in depth with steep slopes of loosely associated boulder and gravel with bedrock outcrops. This habitat type was found bordering the north and south shoreline of great Mosquito Cove (LeDrew, Fudge and Associates 1990). The 2009 fish habitat survey concurred with this assessment having found benthic habitat with solid substrate was generally observed more towards the shore, which may be comprised of boulder and rubble and/or mixed with gravel and cobbles. Bedrock substrate was most common in the Outer Area of the cove towards the north shore, which covered approximately 15 percent of the seafloor (EMCP 2009). The shoreline in Great Mosquito Cove is primarily comprised of hard substrate, the majority of which is anthropogenic (fill, concrete dock, and rip rap shoreline units) in the Inner and Middle Areas of the cove (EMCP 2009). Bedrock cliffs are dominant and mainly present along the north shore of the cove. The width of the shore and intertidal zone is relatively narrow because of the steep ramping of the shoreline and generally ranges from 2 to 5 m. The predominant macroflora observed along the shoreline is rockweed when present in the intertidal zone; with periwinkles the most common macrofauna observed along the shoreline followed by sea urchins, mussels and anemones (EMCP 2009).

Nearshore rocky habitats in Trinity Bay are typically covered with kelp and coralline algae. Mussels, periwinkles (*Littorina* spp.), whelks (*Colus* spp.), urchins, brittle stars, hermit crabs (*Pagurus* spp.), rock crabs and sea stars are the most common macro-invertebrate species. Vegetation decreases with increasing depth, but patches of kelp and filamentous algae occur. The most common macro-invertebrates nearshore are sea urchins, sand dollars (*Echinarachnius parma*) and rock crabs.

Coralline algae play an important role in nearshore ecology as habitat for invertebrates, as a food source for a variety of gastropods (Mandeveldt *et al.* 2006) and by limiting the re-colonization of kelp species that have been harvested by urchins (Bulleri *et al.* 2002; Bulleri and Benedetti-Cecchi 2006). The attraction of invertebrates to coralline algae beds results in the attraction of fish to feed in these areas. There has been little study of the role of coralline algae as fish habitat in the western North Atlantic.

In nearshore rocky habitats, the common finfish species are gunnels (*Pholis nebulosa*), shannies (*Ulavaria subbifurcata*) and cunners (*Tautogolabrus adspersus*). American lobsters (*Homarus americanus*) are commercially fished from these habitats.

The nearshore soft bottom habitat (most likely corresponds to the deepwater community described in Mobil Oil 1990a) observed in Great Mosquito Cove in 1989 (LeDrew, Fudge and Associates 1990) was described as level bottomed, barren with gravel, sand and silt substrate at depths greater than 10 metres. It was noted that this

habitat was relatively featureless with scattered small patches of kelp and included observations of sculpins and winter founder. The 2009 fish habitat survey found that cunner and winter flounder were the principle fish encountered during the benthic habitat survey (EMCP 2009) and were equally observed among all types of substrate. Winter flounder were observed mostly on fine substrate in the Inner and Middle Areas of the cove, but were also observed on hard substrate in the Outer Area of the cove.

At water depths beyond 10 m on soft substrates, winter flounder (*Pseudopleuronectes americanus*) and various sculpin species are common; sea scallops occur in patches. Commercial fisheries in these habitats may include capelin (*Mallotus villosus*), herring (*Clupea harengus*), mackerel (*Scomber scombrus*), winter flounder, lumpfish (*Cyclopterus lumpus*) and lobster.

The kelp beds noted in LeDrew, Fudge and Associates (1990) was described as level-bottom dense kelp stands at depth greater than 10 m. They noted the areal extent of the kelp stands in great Mosquito Cove is unknown. The 2009 fish habitat survey noted that benthic macroflora were relatively sparse covering 2, 11 and 9 percent of the seafloor in the Inner, Middle, and Outer Areas of Great Mosquito Cove (EMCP 2009). Sea colander accounted for 39 percent of the macroflora in the Middle Area and was the dominant species at 66 percent in the Outer Area. *Laminaria longicruris* was mainly observed in the Middle Area of the cove and comprised 22 percent of the macroflora present in this area (EMCP 2009).

In addition to macroflora species that can be considered to be associated with “kelp beds”, sour weed was the predominate species and comprised 98 percent of the macroflora in the Inner Area of the cove and was commonly observed on fine material, but also less common on hard substrate. The percentage of sour weed in the Middle and Outer Areas of the cove was 39 and 33 percent, respectively.

Based on information from deep-sea camera photographs and grab samples (LeDrew, Fudge and Associates 1990), the fourth bottom type described is for a deep water rocky bottom at depths greater than 15 m. They noted that the extent of this habitat is unknown.

The fish habitat survey conducted in 2009 noted that sessile benthic macrofauna observed in Great Mosquito Cove included sea urchins, which were the most common macrofauna, followed by starfish, sea anemones and scallops, and were generally observed on hard substrate, but were also observed on fine substrate. Species diversity was more pronounced on hard substrate such as boulder, rubble, cobble and gravel (EMCP 2009). Much of the substrate associated with the above species would fall into the deep water rocky bottom or the deeper depths of the nearshore rocky bottom habitat.

Sea scallop (*Placopecten magellanicus*) and blue mussel (*Mytilus edulis*) beds have been recorded for the inner portions of Bull Arm (Osborne and Roberts 1983). An October 1989 survey of shellfish habitat in Great Mosquito Cove revealed no large beds of blue mussels (Newfoundland Geosciences Limited 1990). Adult sea scallops occurred sporadically in Great Mosquito Cove, but were more common along the southern shoreline.

In Bull Arm, the following species of finfish are commonly found and commercially fished (DFO Coastal Resource Inventory website, accessed October 2009): cod (*Gadus morhua*), capelin, herring and mackerel. Greenland halibut (*Reinhardardtius hippoglossoides*) may be present in deeper water (200 to 300 m) outside Bull Arm. Other species include wolffish, eelpout (*Lycodes* sp.), lumpfish, skate (*Raja* sp.) and cunners. Great Mosquito Cove and “The Brood” in Bellevue are locally known as a spawning ground for herring and is commonly used for commercial harvest of herring and mackerel (see Section 8).

Of particular interest and note is that the Atlantic wolffish, a federally listed Species at Risk (Schedule 1, special concern), was identified in Great Mosquito Cove to the south of the Outer Area during the ROV habitat surveys in August 2009. They were

	observed at a water depth of approximately 35 m, in 80 to 90 percent boulder habitat, which has been identified as potential spawning habitat (Barsukov 1959; Keats *et al.* 1985; Kulka *et al.* 2007). References: Barsukov, V.V. 1959, The Wolffish (Anarhichadidae). Zoologicheskogo Institute Akademii Nauk USSR Fauna:Fishes, 5(5):173 pp. [Translated for Smithsonian Institution and National Science Foundation, Washington, DC, by Indian National Scientific Documentation, New Delhi, 1972] Keats, D.W., G.R. South and D.H. Steele. 1985. Reproduction and egg guarding by Atlantic wolffish (*Anarhichas lupus*: Anarhichidae) and ocean pout (*Macrozoarces americanus*: Zoarcidae) in Newfoundland waters. *Canadian Journal of Zoology*, 63: 2565-2568. Kelly, J., R. Power, L. Noble, J. Meade, K. Reid, S. Kuehnemund, C. Varley, C. Grant, M. Roberge, E. Lee, and M. Teasdale. 2009. *A System for Characterizing and Quantifying Coastal Marine Habitat in Newfoundland and Labrador*. Draft report prepared by Fisheries and Oceans Canada. Kulka, D.W., 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.

Comment 65: DFO 5

65-DFO 5	**EA Reference:**	7.3.1.5 Fish and Shellfish Page 7-7
Preamble:	Section 5.3.2.3 request the CSR describe the distribution/abundance of species in the study area. It is likely that American Plaice and Yellowtail Flounder would be found in the Nearshore Project Area.	
Request:	Confirm whether American Plaice or Yellowtail Flounder exist in the Nearshore Project Area.	
Response:	A review of the data contained within the Hibernia GBS Platform Construction Site Marine Environmental Effects Monitoring Program August 1991 to November 1997 (Christian and Buchanan 1998), Fish Habitat Assessment in Great Mosquito Cove, Trinity Bay: An Overview of Available Fish Habitat and Resources in the Vicinity of the GBS Construction Site Location (LeDrew, Fudge and Associates 1990), Hebron Project Marine Habitat Survey, Great Mosquito Cove, Trinity Bay – Location of Hebron GBS Construction (EMCP 2009) and Commercial Fisheries data for 3Lb (2004 to 2008) did not indicate the presence of American plaice or yellowtail in the Nearshore Project Area.	

Comment 66: DFO 6

66-DFO 6	**EA Reference:**	7.3.1.5 Fish and Shellfish Page 7-14
Preamble:	Section 5.3.2.3 request the CSR describe the distribution/abundance of species in the study area.	
Request:	This section should be revised as there are a number of inaccuracies and discrepancies, including: • Snow Crab occur in all major bays surrounding the island and also off Labrador, not just "*...from Fortune Bay to White Bay*" as indicated in the text. • The 170-380 m estimate is likely one taken from a reference for the Gulf of St. Lawrence. In Newfoundland and the Eastern Scotia Shelf, Snow Crab are captured at greater depths along the slope edges, 20-2000 m is a common	

	estimate. • Although a statement is made that, "*The distribution of small crabs is not well documented…*", the distribution of small crabs is described in any of the most recent Canadian Science Advisory Secretariat (CSAS) Research Documents produced by DFO NL Region. • Contrary to the text provided, females carry fertilized eggs for 1-2 years, which is likely influenced by temperature (Sainte-Marie 1993; Moriyasu and Lanteigne 1998; Comeau et al. 1999). Sainte-Marie, B. 1993. Reproductive cycle and fecundity of primiparous and multiparous female snow crab, *Chionoecetes opilio*, in the Northwest Gulf of St. Lawrence. Can. J. Fish. Aquat. Sci. 50(10): 2147-2156. Moriyasu, M. and Lanteigne, C. 1998. Embryo development and reproductive cycle in the snow crab, *Chionoecetes opilio* (Crustacea: Majidae), in the southern Gulf of St. Lawrence, Canada. Can. J. Zool. 76(11): 2040-2048. Comeau, M., Starr, M., Conan, G.Y., Robichaud, G. and Therriault, J-C. 1999. Fecundity and duration of egg incubation for multiparous female snow crabs (*Chionoecetes opilio*) in the fjord of Bonne Bay, Newfoundland. Can. J. Fish. Aquat. Sci. 56(6): 1088-1095.
Response:	**Based on the comments above, Section 5.3.2.3 will be revised as follows:** In the nearshore environment, snow crabs are common in the estuary and the Gulf of St. Lawrence, around Cape Breton Island and in all major bays surrounding Newfoundland and Labrador. Snow Crabs feed on fish, clams, polychaete worms, brittlestars, shrimp, snow craps and other crustaceans (DFO 2008). Snow crabs live most commonly on muddy or sand-mud bottoms at temperatures ranging from -0.5°C to 4.5°C at depths 20 m to 2,000 m along slope edges off Newfoundland and the Eastern Scotia Shelf (Dawe and Colbourne 2002; Fisheries Resources Conservation Council (FRCC) 2005; DFO 2005b). The distribution of small crabs is not well documented but they are occasionally found with adults, or on gravelly bottom to mud bottom, usually in deeper waters as they reach maturity. Mating is thought to occur at the end of the winter or in the spring. Females carry the fertilized eggs for 1 to 2 years, which is likely influenced by temperature (Sainte-Marie 1993; Moriyasu and Lanteigne 1998; Comeau *et al.* 1999). References: Comeau, M., M. Starr, G.Y. Conan, G. Robichaud and J.-C. Therriault. 1999. Fecundity and duration of egg incubation for multiparous female snow crabs (*Chionoecetes opilio*) in the fjord of Bonne Bay, Newfoundland. *Canadian Journal of Fisheries and Aquatic Sciences*, 56(6): 1088-1095. Dawe, E.G., and E.B. Colbourne. 2002. Distribution and demography of snow crab (*Chionoecetes opilio*) males on the Newfoundland and Labrador Shelf. Pp. 577–594. In: A.J. Paul, E.G. Dawe, R. Elner, G.S. Jamieson, G.H. Kruse, R.S. Otto, B. Sainte-Marie, T.C. Shirley and D. Woodby (eds.). *Crabs in Cold Water Regions: Biology, Management, and Economics*, Proceedings of the 19th Lowell Wakefield Symposium, Ed. University of Alaska Sea Grant AK-SG-02-01, Fairbanks, AK. 866 pp. DFO (Fisheries and Oceans Canada). 2009. Assessment of Newfoundland and Labrador snow crab. *Canadian Science Advisory Secretariat Research Document*, 2009/045. Available at URL: http://www.dfo-mpo.gc.ca/csas-sccs/publications/sar-as/2009/2009_045-eng.htm. FRCC (Fisheries Resources Conservation Council). 2005. *Fisheries Resource Conversation Council. Strategic Conservation Framework for Atlantic Snow Crab*. Report to the Minister of Fisheries of Oceans. FRCC.05.R1 Moriyasu, M. and C. Lanteigne. 1998. Embryo development and reproductive cycle in the snow crab, *Chionoecetes opilio* (Crustacea: Majidae), in the southern Gulf of St.

	Lawrence, Canada. *Canadian Journal of Zoology*, 76(11): 2040-2048. Sainte-Marie, B. 1993. Reproductive cycle and fecundity of primiparous and multiparous female snow crab, *Chionoecetes opilio*, in the Northwest Gulf of St. Lawrence. *Canadian Journal of Fisheries and Aquatic Sciences*, 50(10): 2147-2156.

Comment 67: C-NLOPB 25

67-C-NLOPB 25	**EA Reference:**	Section 7.3.2.2 Page 7-17 and elsewhere
Preamble:	The description of substrate conditions in the Offshore Project Area relies heavily upon the references Chevron (2002) and Chevron (2003). They should be made available for examination/review as required.	
Request:	Submit Chevron (2002) and Chevron (2003).	
Response:	The reports have been submitted to the C-NLOPB.	

Comment 68: EC 34

68-EC 34	**EA Reference:**:	Section 7.3.2.2 Habitat Page 7-17, Paragraph 3.
Preamble:	At Section 7.3.2.2, Page 7-17, paragraph 3, the text states "Eight of the twenty sediment samples taken throughout the Hebron Project Area were declared toxic using the Microtox™ test. None were declared toxic by the amphipod survival test. The Microtox™ test is known to be hyper-sensitive in substrates with less than 20 percent fines, which is the case in the Hebron Project Area (Chevron 2003)."	
Request:	(1) The text should state what is the criterion being used to judge a sediment sample being declared toxic. (2) Suggested text based on limitations of the test, the text should read something like "The Microtox™ test is known to be sensitive in substrates with more than 20 percent fines". This is based on information contained in Environment Canada Report EPS 1/RM/42 which could be referenced. (3) The proponent should reword and clarify the meaning of the last sentence.	
Response:	**The text will be modified to read as:** The Microtox™ test is known to be sensitive in substrates with more than 20 percent fines (Environment Canada 2002), which may be the case in the Hebron Project Area (Chevron 2003). None of the sediment samples were declared toxic by the amphipod survival test. **The following reference will be added:** Environment Canada. 2002. Environment Canada Report EPS 1/RM/142.	

Comment 69: DFO 7

69-DFO 7	**EA Reference:**	7.3.2.5 Fish and Shellfish Page 7-26
Preamble:	Section 5.3.2.3 request that the CSR describe the distribution/abundance of species in the study area.	
Request:	Although American Plaice is noted as the fourth most abundantly caught species during the Hebron biological survey, there is no species description provided. It is noted, however, that a description of this species is included in Section 11.3.1.2, which should be cross-referenced here. This section states that, "*Historically, the most abundant species in the area, and over the entire Grand Banks, were Atlantic cod and American plaice. However, in more recent years, these species have become uncommon on the northern portion of the Grand Banks.*" This statement is not accurate for American Plaice. While there are	

	fewer plaice in NAFO Div. 3L than were present in the 1980s, this species is still not uncommon. For example, in Figure 7.5, plaice is the fourth most common species encountered by catch and in Table 7-7 it is ranked third by weight landed. Please revise accordingly.
Response:	**The text will be revised as follows:** American plaice have been assessed as a species at risk (Threatened) by COSEWIC and are discussed in Section 11.3.1.2. Cross-reference to this section will be included in the introductory paragraph in Section 7.3.2.5. Fish species most likely to occur within the Offshore Project Area are those historically widespread over the Grand Banks. These species are yellowtail flounder, American plaice (described in Section 11.3.1.2), Atlantic cod (described in Section 11.3.1.1) and thorny skate. In more recent years, these species have been concentrated on the southern part of the Grand Banks. Monkfish (*Lophius americanus*), white hake, Atlantic halibut, haddock and pollock (*Pollachius virens*) are mostly found in the warm waters of the Southwest Slope, whereas roundnose (*Coryphaenoides rupestris*) and roughhead (*Macrourus berglax*) grenadiers (both described in Section 11.3.1.6), Greenland halibut and redfish are commonly found in deeper water on the slope of the Grand Banks. Common epibenthic species in deeper areas include pink shrimp (*Pandalus borealis*), snow crab (*Chinocetes opilio*), witch flounder and redfish. The following paragraph will be revised: In general, the Offshore Project Area does not support a higher biomass of demersal fish relative to other areas of the Grand Banks (Kulka *et al.* 2003). Historically, the most abundant species in the area, and over the entire Grand Banks, were Atlantic cod and American plaice. In more recent years, Atlantic cod have become uncommon on the northern portion of the Grand Banks (NAFO 3L); however, while there are fewer American plaice than were present in the 1980s, this species is still not uncommon. Commercial fishing effort on the Grand Banks is currently focused on shellfish species, such as snow crab and shrimp.

Comment 70: DFO 8

70-DFO 8	**EA Reference:**	7.3.2.5 Fish and Shellfish Page 7-28, Table 7-7
Preamble:	Section 5.3.2.3 request that the CSR describe the distribution/abundance of species in the study area.	
Request:	Information in Table 7-7 appears to be incorrect. Table 7-7 indicates that Yellowtail Flounder were not caught in the Study Area in 2007, however, distribution plots from 2007 (from the most recent assessments) depict Yellowtail Flounder throughout the Study Area at depths less than 93 m on the bank. Table 7-8 also contradicts Table 7-7 as values are reported for Yellowtail Flounder in 2007. Furthermore, values for American Plaice also seem low. The table indicates landed weight but should be revised to be weight caught as this information is from DFO research vessel surveys and not fishery related. Also the figures in the table need re-examination. For example, the table suggests there was 2,439,298 kg of Redfish caught in the in 2007 survey, which would be equivalent to 2, 439 metric tons (an incredibly high value for this fishery). Values for some of the other species are suspect as well. Perhaps there was some error in reading the data from DFO species catch weight. Please review this information.	
Response:	The table will be updated and text will be revised to reflect information in this table. Yellowtail flounder was captured in 2007 in both the Project and Study Areas. The Landed Weight will be revised to Weight Caught as suggested. All the information was reviewed and there were 2/19 values in the 2007 Study Area for redfish that accounted for 85 percent of the total weight caught (a value of 680,000 and 1,404,183). It is possible that there is an error with these two numbers. Removing these two values	

from the data set resulted in percentage catch for redfish of 28.5 (2007) as compared to 30.2 (2008). The table will be revised based on the removal of the two outlier values. American plaice values were correct for the dataset examined.

Table 7-7 Species/Groups with Highest Catch Weights during DFO Research Vessel Surveys in the Hebron Offshore Project and Study Areas between 2007 and 2008 (Fish and Invertebrates)

Year	Offshore Project Area				Hebron Offshore Study Area			
	2007		2008		2007		2008	
Gear	Campelen 1800 Shrimp Trawl- Lined				Campelen 1800 Shrimp Trawl- Lined			
Total Weight Landed (kg)	142,650		24,672		1,246,944		966,930	
	Caught Weight (kg)	Percent of total (%)	Caught Weight (kg)	Percent of total (%)	Caught Weight (kg)	Percent of total (%)	Caught Weight (kg)	Percent of total (%)
Sand lance	125,963	88.3	1,984	8	100,683	8.07	96,805	10.01
Shrimp	1,958	1.4	980	4	361,865	29.02	152,784	15.80
American plaice	6,768	4.7	5,650	22.9	34,147	2.74	34,880	3.61
Snow crab	1,125	0.8	9,349	37.9	1,838	0.15	3,164	0.33
Unspecified invertebrate	2,658	1.9	NA	-	13,799	1.11	NA	-
Capelin	1,614	1.1	2,517	10.2	9,717	0.78	160,071	16.55
Sea urchin	1,218	0.9	364	1.5	1,094	0.09	4,896	0.51
Mailed sculpin	1,097	0.8	555	2.2	16,677	1.34	5,512	0.57
Toad crab	216	0.2	21	0.1	283	0.02	91	0.01
Comb- jelly	NA	-	2,520	10.2	255	0.02	2	< 0.01
Thorny skate	NA	-	400	1.6	80,340	6.44	146,340	15.13
Brittle star	NA	-	332	1.3	480	0.04	1,482	0.15
Deepwater redfish	NA	-	NA	-	355,115 [a]	28.48	291,632	30.16
Sea sponge	NA	-	NA	-	92,911	7.45	8,805	0.91
Greenland shark	NA	-	NA	-	100,000	8.02	NA	-
Roughhead grenadier	NA	-	NA	-	46,485	3.73	34,239	3.54
Greenland halibut	NA	-	NA	-	30,750	2.47	16,191	1.67
Yellowtail flounder	33	< 0.1	NA	-	505	0.04	10,036	1.04
Note [A]: 2 of 19 catch values for redfish were removed from data calculations as they were extreme outliers.								

Comment 71: DFO 9

71-DFO 9	**EA Reference:**	7.3.2.5 Fish and Shellfish Page 7-30
Preamble:	Section 5.3.2.3 request that the CSR describe the distribution/abundance of species in the study area.	
Request:	This section states that, "*Halibut population estimates declined for many years, but a slight increasing trend has been observed more recently (Kulka et al. 2003).*" This information and reference is not considered "recent". More recent information exists which should be incorporated into the CSR.	
Response:	Based on the comments provided above, Section 7.3.2.5 will be revised as follows: Halibut population estimates declined for many years, **but industry / DFO surveys have more recently demonstrated relative population stability (Trzcinski *et al.* 2009).** Reference: Trzcinski, M.K., S.L. Armsworthy, S. Wilson, R.K. Mohn, M. Fowler and S.E. Campana. 2009. Atlantic halibut on the Scotian Shelf and Southern Grand Banks (NAFO Divisions 3NOPs4VWX5Zc) – Industry/DFO longline survey and tagging tesults to 2008. *Canadian Science Advisory Secretariat Research Document*, 2009/026.	

Comment 72: DFO 10

72-DFO 10	**EA Reference:**	7.3.2.5 Fish and Shellfish Page 7-31
Preamble:	Section 5.3.2.3 request that the CSR describe the distribution/abundance of species in the study area.	
Request:	This section should be revised as there are a number of inaccuracies and discrepancies, including: a) Although it states that, "*Snow crab are relatively sedentary and are not known to undergo seasonal or spawning migrations,*" it has been known for quite some time that Snow Crab undergo seasonal breeding migrations throughout the Gulf of St. Lawrence and Newfoundland (Ennis et al. 1988). b) Contrary to the statement, "*The spatial distribution of snow crab appears to be a function of their age, physical habitat and time of the year,*" the spatial distribution of Snow Crab may have nothing to do with age as we cannot age them. They also terminally molt at different sizes/ages, which introduces further uncertainty to the statement. c) Contrary to the statement, "*Recently-settled juveniles (<30 mm, carapace width) prefer a mud substrate…*" most appear to settle on shallow hard substrates (i.e., atop banks). Therefore, the following statement, "*Given the low percentage of fines in the substrate within the Offshore Project Area, it is not considered juvenile snow crab habitat*" is also incorrect. d) The exploitable biomass of Snow Crab in NAFO Div. 3L has changed drastically since the DFO (2005b) report referenced here. Since assessments of this species are carried out annually, it would be more appropriate to reference the most recent, 2010 DFO Science Advisory Report, which indicates that the exploitable biomass of Snow Crab is now increasing. Ennis, G.P., R.G. Hooper and D.M. Taylor. 1988. Changes in size composition of male crabs (*Chionoecetes opilio*) participating in the annual breeding migration in Bonne Bay, Newfoundland. *Canadian Science Advisory Secretariat Research Document*, 88(2): 14 pp.	
Response:	**a) and b) text in Section 7.3.2.5 in reference to Snow Crab will be revised as follows:**	

	Snow crabs are relatively sedentary and are known to undergo seasonal breeding migrations throughout the Gulf of St. Lawrence and Newfoundland (Ennis et. al 1988). The spatial distribution of snow crab appears to be a function of physical habitat and time of year.... c) **The following statement will be removed:** *Given the low percentage of fines in the substrate within the Offshore Project Area, it is not considered juvenile snow crab habitat.* d) **Paragraph 5 on Page 7-31 will be revised as follows:** *The exploitable biomass of snow crab (Dawe et al. 2010) in NAFO Division 3L (northern half of the Grand Banks) are uncertain with the exploitable biomass declining sharply in post-season trawls (3L Offshore). The 3L Offshore exploitable biomass has remained low in the trap survey but has since increased in the trawl surveys since 2006 (Dawe et al. 2010). The exploitable biomass in 3L Inshore has recently increased. The pre-recruit index has recently increased since 2006 with the 2008 index the highest since 1996 for 3L Offshore with recruitment prospects uncertain for 3L inshore (Dawe et al. 2010). The snow crab fishery occurs almost exclusively in water depths greater than 100 m (see Section 8.2.6.1).* **The following references will be added:** Dawe, E., D. Mullowney, D. Stansbury, E. Hynick, P. Veitch, J. Drew, E. Colbourne, P. O'Keefe, D. Fiander, K. Skanes, R. Stead, D. Maddock-Parsons, P. Higdon, T. Paddle, B. Noseworthy and S. Kelland. 2010. An assessment of Newfoundland and Labrador snow crab (*Chionoecetes opilio*) in 2008. *DFO Canadian Science Advisory Secretariat Research Document*, 2010/016: iv + 183 pp. Ennis, G.P., R.G. Hooper and D.M. Taylor. 1988. Changes in size composition of male crabs (*Chionoecetes opilio*) participating in the annual breeding migration in Bonne Bay, Newfoundland. *Canadian Science Advisory Secretariat Research Document*, 88(2): 14 pp.

Comment 73: DFO 11

73-DFO 11	**EA Reference:**	Section 7.3.2.5 Fish and Shellfish Page 7-31
Preamble:	Section 5.3.2.3 request the CSR describe the distribution/abundance of species in the study area.	
Request:	This section states that, "*The most recent measure of the population of Greenland halibut on, and in the vicinity of the Grand Banks, indicates the exploitable biomass is currently at the lowest recorded level (Healey and Mahe 2005).*" The reference is an assessment of Greenland Halibut based on an age-based population model for the subarea 2 + Division 3KLMNO stock area, not just "*on, and in the vicinity of the Grand Banks*". It should also be noted that as the assessment of this resource occurs annually, a 2005 reference is quite dated. Information from more recent studies should be incorporated into the CSR.	
Response:	**The text will be revised as follows:** *The most recent assessment of Greenland halibut using the age-based population model for the subarea 2+ division 3KLMNO Stock Area, indicates the exploitable biomass has shown decreases over 2008-2010, as weaker year classes have recruited to the biomass (Healey et al. 2010).* **The following reference will be added:** Healey, B.P., J.C. Mahe and M.J. Morgan. 2010. An assessment of Greenland halibut (*Reinhardtius hippoglossoides*) in NAFO Subarea 2 and Divisions 3KLMNO. *NAFO Science Council Research Document*, 10/40: 108 pp.	

Comment 74: DFO 12

74-DFO 12	**EA Reference:**	7.4.1 Nearshore Page 7-42
Preamble:	Section 7.4.1 outlines nearshore project activities that could potentially interact directly or indirectly with marine fish and fish habitat. This list of activities does not include upgrades to the terminal at Back Cove, which will be used for vessel docking during crew transport. During a recent visit to the Bull Arm site, DFO was informed that upgrades to the terminal would be required, which could result in a narrowing of the mouth of a stream which empties at the site.	
Request:	a) Provide details on the upgrades required at the Back Cove terminal. b) Proposed upgrades to the terminal should be included in the environmental effects assessment.	
Response:	a) The pier in Back Cove, which is the site of the ferry terminal to transport workers to the GBS in deep water site, will require upgrading. The details regarding the upgrades are unknown at this time, but likely will include a temporary replacement of the pier. Back Cove is included in the DFO HADD strategy, and, where impacts to fish habitat are identified in relation to construction activities, they will be included in the Fish Habitat Compensation Plan for Bull Arm. As more information becomes available during FEED, EMCP will consult with DFO regarding construction activities. Design changes or mitigations will be considered to reduce potential impacts to the stream. Currently proposed upgrades are within the tidal zone of the stream outflow. Section 2.8.3 will be updated indicating potential upgrades to Back Cove / Ferry Terminal site; Table 2-6 will include this as an activity. b) The list of activities in Section 7.4.1 will be updated to include upgrades to the ferry terminal in Back Cove. Appropriate subsections of Section 7.5.1 regarding environmental effects assessment will be updated to reflect the ferry dock upgrades.	

Comment 75: DFO 13

75-DFO 13	**EA Reference:**	7.5 Environmental Effects Analysis and Mitigation Page 7-46
Preamble:	Although the potential environmental effects listed within the tables in this section are fairly comprehensive, some effects have not been adequately described within the text. Thus, it is important that there is sufficient discussion within the text to support the claims made within the tables.	
Request:	Provide a more detailed explanation of environmental effects.	
Response:	**Additional information will be incorporated into the text under contamination (Pg 7-56). Section will be revised to incorporate information from the Terra Nova EEM programs as the Terra Nova environmental footprint has the greatest potential to overlap with that of the Hebron Project.** As summarized in Section 7.3.3.2, there are indications of previous drilling activities in the surficial sediments of the Offshore Project Area. Several metals were found to have concentrations above the median for the Offshore Project Area (Chevron 2003). The areal and temporal extent of discharged drill wastes (as measured by barium and total petroleum hydrocarbon (TPH) concentrations in sediments) tend to be related to differences in the number of wells and associated volume of discharges, mud types, current speed and direction, water depth and/or sediment mobility at the drilling location (Hurley and Ellis 2004). Hurley and Ellis (2004) also concluded that changes in the diversity and abundance of benthic organisms were detected within 1,000 m of drill sites, most commonly within the 50 to 500 m range of drill sites. The results were consistent for both literature (international) review case studies and for east coast	

	offshore petroleum project EEM data. This scale of effects apply to wells discharging SBM or WBM and for multiple or single wells drilled at the same site. Beyond the bottom area covered by the cuttings pile, benthic communities generally returned to baseline conditions within one year after cessation of drilling discharges." The Terra Nova EEM program has conducted a baseline characterization in 1997 and has conducted six operational EEM programs to date. A review of the first five operational EEM programs for Terra Nova conducted in 2000, 2001, 2002, 2004 and 2006 found that total petroleum hydrocarbons were detected at 35 (2000) to 52 (2002) of the 53 stations (Petro-Canada 2001, 2002, 2003, 2005, 2007). Elevated hydrocarbon levels were detected above 4 mg/kg within 2 km (2000, 2002) to 3.5 km (2002) from the various Terra Nova drill centres. The maximum $>C_{10}$-C_{21} levels were 13.3 mg/kg at station 750 m from Northwest (NW) drill centre (2000); 28.6 near Northeast (NE) drill centre (2001); 925 mg/kg at 150 m from Far East (FE) drill centre (2002); 6.550 mg/kg at 150 m from FE drill centre (2004); and 980 mg/kg at 150 m from FE drill centre (2006). Barium levels at Terra Nova were slightly elevated compared to baseline conditions in 2000 with a maximum barium level of 230 mg/kg at 250 m from Southwest (SW) drill centre and the median barium level of 130 mg/kg (Petro-Canada 2001). Barium levels in 2001 (Petro-Canada 2002) were comparable to baseline conditions (1997 levels). Elevated barium levels were observed within 1 to 2 km of drill centres for 2002, 2004 and 2006 (Petro-Canada 2003, 2005, 2007). During these years the maximum barium concentrations were observed at 150 km from far east drill centre and were 2,200, 2,100 and 16,000 mg/kg respectively (Petro-Canada 2003, 2005, 2007). The Petro-Canada baseline amphipod survival had 1 of 54 samples that was considered to be toxic (Petro-Canada 1997). There were no toxic amphipod results for 2000, 2001 and 2002. In 2004 and 2006 (Petro-Canada 2005; 2007) amphipod survival had a toxic response within 150 m from the FE drill centre (station 30FE). In 2006 (Petro-Canada 2007), in addition to the toxic response within 150 m from the FE drill centre, there were two other toxic amphipod survival responses located at 1.08 and 1.28 kms from a drill centre (W14). The hydrocarbon levels ($>C_{10}$-C_{21}) for the within 150 m from the FE drill centre (station 30FE) were 6,550 mg/kg in 2004 and 925 mg/kg in 2006. The benthic community structure in 1997 at Terra Nova was dominated by polychaetes, with good abundances of amphipods, bivalves, gastropods, echinoderms and anthrozoa and a similar relationship was observed in 2000 (Petro-Canada 1998, 2001). Potential enrichment of polychaetes (primarily of spionidae family) was observed from 2001 through 2006 (Petro-Canada 2002, 2003, 2005, 2007). An inhibitory response on abundance and richness was observed within 150 m from FE drill centre (30 FE station) in 2002, 2004 with an inhibitory response in richness observed in 2006 for the 30FE station (Petro-Canada 2003, 2005, 2007). Inhibitory responses on amphipods were observed within 150 m from FE drill centre (30 FE station) in 2004 and 2006 (Petro-Canada 2005, 2007). The highest levels of barium, lead, manganese and strontium within the Offshore Project Area were found less than 750 m southeast of an abandoned oil well. These metals in other samples from the Offshore Project Area were well within the range from baseline and Year One of EEM programs at Terra Nova (Chevron 2003). Low-level fuel and lube range hydrocarbons were detected in 16 and 11 of 20 samples, respectively, during the sediment quality survey at Hebron (Chevron 2003). The median concentration of fuel range hydrocarbons was 0.81 mg/kg, while the median for lube range hydrocarbons was 0.75 mg/kg. Hydrocarbon concentrations were below 2 mg/kg in all samples. PAHs were not detected above an estimated quantification limits (EQL) of 0.05 mg/kg in any sediment samples from Hebron. These are not concentrations that are expected to cause hydrocarbon or barium contamination should they become suspended in the water column during offshore construction

	activities. Hebron plans to re-inject SBMs for drilling completed from the GBS and only release SBMs associated with satellite wells drilling from MODU in potential future well developments. The EEM programs from Hibernia have demonstrated that reinjection of SBMs reduces the contaminant footprint associated with the release of SBMs. Hibernia commenced cuttings reinjection in March 2001, with greater than 95 percent cuttings reinjection achieved by second quarter 2002. Since the installation of the cuttings reinjection systems, hydrocarbon and barium concentrations around the Hibernia platform have returned to near baseline conditions for most contaminants beyond 250 m from the platform.

Comment 76: DFO 16

76-DFO 16	**EA Reference:**	7.5 Environmental Effects Analysis and Mitigation Page 7-46
Preamble:	In Table 7-11 the use of "*bubble curtains, if required*" and "*Compliance with terms of Section 32 Fisheries Act Authorization (if required)*" are listed as mitigations during removal of the bund wall and disposal (dredging/ocean disposal). These mitigations are typically associated with in-water blasting, however, the CSR does not specify that in-water blasting will be used for bund wall removal and disposal.	
Request:	Provide clarification on whether in-water blasting will be required for removal of the bund wall.	
Response:	In-water blasting will not be required to remove the bund wall to flood the dry dock. The bund wall will be dredged for removal. Mitigations that may be employed, which are not listed in the table, would be siltation control measures. Table 7.11 will be updated to include sedimentation control measures for bund wall removal.	

Comment 77: DFO 17

77-DFO 17	**EA Reference:**	7.5 Environmental Effects Analysis and Mitigation Page 7-62
Preamble:	Table 7-11 lists installation of temporary moorings at the offshore project location as a project activity, however, there is no other information on these temporary moorings within the CSR.	
Request:	Provide details on the nature of these moorings.	
Response:	It is very early in the design to determine if temporary mooring will be required for the installation of the Hebron Platform at its offshore location. If temporary moorings are required, up to four lines (two in one direction, (*e.g.*, south), and one to each side (*e.g.*, east and west) will be installed prior to the arrival of the Platform. During the final Platform installation phase, these lines would be connected to the bow of towing tugs and when system is tightened up, the final positioning will be achieved by use of the tugs winches. The mooring lines may consist of a conventional drag embedded anchor (10 to 15 tonnes), short piece of chain and approximately 400 m of 64 mm steel wire rope buoyed at the surface. The anchors will be set approximately 1,000 m away from the final Platform location. It is assumed that the lines will be installed a couple of weeks prior to the final platform installation and removed immediately after completion of platform installation. Both installation and retrieval may be done by one or two towing tugs using conventional anchor handling methods.	

Comment 78: DFO 14

78-DFO 14	**EA Reference:**	7.5.1.1 Change in Habitat Quantity Page 7-49
Preamble:	The last paragraph of this section states that, "*In accordance with the DFO policy of no net loss of fish habitat, a habitat compensation program will be developed in conjunction with DFO as a mitigation measure for the net loss of fish habitat resulting from nearshore and offshore Hebron Project activities.*" Although DFO acknowledges the proponent's commitment to the development and implementation of a fish habitat compensation program, a fish habitat compensation strategy is required as part of this CSR.	
Request:	Provide a Fish Habitat Compensation Strategy	
Response	The Fish Habitat Compensation Strategy will be submitted in December 2010.	

Comment 79: EC 36

79-EC 36	**EA Reference:**:	Section 7.5.1.2 Change in Habitat Quality Page 7 - 52 last line to Page 7 - 53, line 3.
Preamble:	a) At Section 7.5.1.2, sub section on Nearshore, sub-sub section on Contamination, starting on Page 7 - 52 last line the text states "During the EEM program, iron and manganese were the only elements recorded above the Maximum Allowable Effects Levels, the concentration level in sediments above which the frequency of associated biological effects are unacceptable." b) At Section 7.5.1.2, sub section on Offshore, sub-sub section on Contamination, on Page 7-56, the text states "Given that the metals concentrations reported are total concentrations, there is little risk that the metals will become highly bioavailable to filter feeding organisms should the sediments become suspended during offshore construction activities.".	
Request:	a) For point # 1 above, please provide a reference for these Maximum Allowable Effects Levels, it is not clear what guidelines are being used for comparison with measured metal levels, or which organization has produced these guidelines. b) For point # 2 above, it is recommended that the proponent compare metal levels against CCME interim marine sediment quality guidelines provided in CCME (1999) as a more rigorous way to predict whether adverse biological effects are likely or not. Reference: Canadian Council of Ministers of the Environment (CCME). 1999. *Canadian Environmental Quality Guidelines*. Canadian Council of Ministers of the Environment, Winnipeg.	
Response:	a) The Maximum Allowable Effects Levels (MAELs) that were used during the Hibernia GBS Construction Site Marine EEM programs (Christian and Buchanan 1998) were based on a variety of sources and regulations of the related time period. MAELs developed for Mussel and Sediments were based on the Canadian Fish Health Inspection / Food and Drug Regulations, FAO (1983), *Canadian Environmental Protection Act Ocean Dumping Regulations* (1988), Canadian Marine Environmental Quality Guidelines (1992), and the Environment Canada's Interim Sediment Quality Guidelines (ISQGs) (1995). MAELs for Mixed Function Oxygenase activity were developed based on recommendations from Dr. J. Payne. b) A review of section 7.3.2.2 found that the metal concentration for sediment samples collected at the Hebron site (Chevron 2003) were not above the ISQGs and Probable Effects Levels (PELs) as listed in the CCME interim marine sediment quality guidelines provided in CCME (1999). The sediment chemistry results below ISQGs and PELs at Hebron are consistent with the results of the Hibernia EEM program (HMDC 2007) and as such no adverse biological effects are expected from the chemicals listed in CCME interim marine sediment quality guidelines. Barium, the metal with the highest levels and which is associated with drill muds and cuttings has no published ISQG or PEL at	

	this time. **The following reference will be added:** CCME (Canadian Council of Ministers of the Environment). 1999. Canadian Environmental Quality Guidelines. Canadian Council of Ministers of the Environment, Winnipeg, MB.

Comment 80: DFO 15

80-DFO 15	**EA Reference:**	7.5.1.4 Potential Mortality (Nearshore) Page 7-60
Preamble:	Dewatering of the drydock will result in fish mortality, which is not included in the environmental effects assessment. During dewatering it is likely that fish will be stranded within the drydock area. Prior to dewatering, fish should be removed from the isolated drydock area and be relocated to a predetermined location within the nearby marine environment.	
Request:	a) Provide details of a fish recovery and relocation program. b) Fish mortality should be included as a potential environmental effect within the environmental effects assessment (text and tables). c) Make reference to the fish recovery and relocation program in the applicable mitigations column in Table 7-11.	
Response:	a) An environmental Protection Plan for Bull Arm is under development. The Plan will include a fish recovery and relocation program. The CSR will reference the EPP, specifically the relocation program as a mitigation for potential effects on fish for the dewatering of the dry dock. b) **Section 7.5.1.1 will include the following new text:** During the dewatering of the dry dock, a fish recovery and relocation program which will be included as part of the Environment Protection Plan (in progress) will be initiated. The goal of the program is to remove fish which would be stranded as a result of the dry dock dewatering and relocate them to the nearby marine environment. It is acknowledged that while every reasonable effort will be made to recover and relocate the stranded fish, a certain degree of fish mortality may occur. Note: during the construction of the Hibernia GBS, fish were not present within the drydock when it was dewatered. c) Table 7-11 updated to include the mitigation strategy Fish Recovery and Relocation Program	

Comment 81: EC 35

81-EC 35	**EA Reference:**:	Section 7.5.1.4 Potential Mortality Page 7-62, Table 7-11 – Environmental Effects Assessment: Construction and Installation
Preamble:	The selection of a suitable disposal site is an important aspect of effects mitigation. Another area of concern is raised by the presence of construction debris found during the 2005 survey of the berm disposal site.	
Request:	Proper disposal site selection should be included in Table 7-11 in association with these activities: 1) Dredging of Bund Wall and Possibly Sections of Tow-out Route; and, 2) removal of Bund Wall and Disposal. Removal of construction debris should be added to the list of mitigations in Table 7-11 under the activity “Removal of Bund Wall and Disposal”. <u>Typos</u> Table 2-2: Page 2-1 Well Treatment Fluids – under Attributes “fluids” is misspelled. Pages 10-60 and 10-61: Reference is made to Sections 10.5.1.5 and 10.5.1.6. The last section numbered in this sequence of Section 10 is 10.5.1.4.	

	References Page 18-2. The citation is incorrect for AMEC Earth and Environmental Limited (2005a). The study was prepared for Environment Canada.
Response	Table 7 will be revised to include new activities. The suggested edits / typo corrections will be made to the text.

Comment 82: EC 37

82-EC 37	**EA Reference:**:	Project Overview, and Section 7.5.2.2 Change in Habitat Quality Page 7-67
Preamble:	In the Project Overview the text states "and synthetic-based mud will be re-injected into the formation." This is better than regulated practice (NEB Offshore Waste Treatment Guidelines), and ExxonMobil Canada Properties should receive recognition and encouragement for this pollution prevention measure. However, this is not mentioned in Section 7.5.2.2 (starting on page 7-67), nor in Table 7.12 (starting on page 7-72). but should be discussed at these locations. Re-injection of SBM drill cuttings is feasible and important, as stated in Section 7.5.5.2 at page 7-84, paragraph 3, quoted here in full "At Hibernia, partial re-injection of SBM drill cuttings commenced in March 2000; full re-injection capacity began in September 2002. In the 2002 EEM field study, a substantial reduction in hydrocarbon concentrations in sediment was already observed."	
Request:	Section 5.3.4.1, bullet 3 of the Scoping Document clearly states that the EA will consider discharges and emissions including "means for reduction re-use and recovery of wastes beyond those specified in regulations and guidelines". Re-injection of synthetic-based mud cuttings needs to be discussed in section 7.5.2.2.	
Response:	**The second paragraph of Drilling Discharges Page 7-68 (Section 7.5.2.2) will be revised as follows:** SBM cutting reinjection will be undertaken for Platform drilling as a means of waste reduction. SBM cutting reinjection is not technically feasible for MODU drilling and SBMs will be discharged overboard after treatment in accordance with the OWTG. These estimates are based on preliminary analyses which will be updated during FEED and detailed engineering phases. Thicknesses of at least 1 cm are generally confined to within about 50 to 60 m of the GBS. These cuttings near the GBS are almost exclusively the fast-settling pebbles and sand (a very small percentage of the fines will drift for a time and ultimately settle near the GBS) whereas at distances greater than about 50 to 200 m, the deposits will be exclusively fines (see AMEC 2010a).	

Comment 83: C-NLOPB 26

83-C-NLOPB 26	**EA Reference:**	Section 7.5.2.2 Page 7-70. final paragraph
Preamble:	The paragraph begins "All liquid discharges will adhere to the OWTG discharge limits and are subject to an Offshore Chemical Management System screening." OCMS screening typically is applied to chemicals/substances that are planned for use by an operator, most commonly as either drilling fluid or process chemical ingredients. It has not generally been used to characterize whole discharges (e.g., black or grey water, cooling water).	
Request:	The statement should be reconsidered and modified as necessary.	
Response:	**The Statement will be revised to read as:** All liquid wastes discharges from the Hebron Project drilling and production operations will be discharged in accordance with the OWTG.	

Comment 84: C-NLOPB 27

84-C-NLOPB 27	**EA Reference:**	Section 7.5.2.4 Page 7-72, paragraph 2
Preamble:	The paragraph states that "Due to a larger average size and discharge rate, SBM cuttings stay closer to the well site and do not disperse as widely as WBMs and cuttings."	
Request:	The statement should be referenced, and re-evaluated to determine whether it likely is consistent with the fate of SBM cuttings treated and discharged consistent with the 2002 Offshore Waste Treatment Guidelines (e.g., from a "cuttings dryer").	
Response:	A reference associated with the statement would be CAPP (2001). **The following additional information is provided for further clarification of the above statement:** SBM cuttings do not tend to disperse like WBM cuttings do unless the fluid retention values are below 5 percent (CAPP 2001). Due to the fact that SBM related particles are not water miscible, they tend to aggregate, resulting in rapid fall velocities (CAPP 2001). Due to the rapid fall velocity, SBMs tend to fall through the water column faster, be deposited in smaller areas, and to accumulate in higher concentrations near the discharge point than would WBM cuttings (CAPP 2001). Fine suspended solids associated with WBMs are not trapped in agglomerations like fines associated with SBMs (CAPP 2001). This allows these WBMs fines to disperse in the marine environment and travel farther than fines in SBMs before contacting the seabed (CAPP 2001). The discharge of SBMs cuttings will be in accordance with the OWTG (2002).	

3.7 Response to Section 8 Comments

Comment 86: HC 4

86-HC 4	**EA Reference:**:	Section 8 Commercial Fisheries Page 8-1
Preamble:	Re: Recreational Fisheries The Scoping Document indicates that traditional, existing and potential commercial, recreational and subsistence fishing will be described. Scoping Document Table of Concordance indicates that this has been addressed in Section 8.3 of the Comprehensive Study. There was no discussion about traditional, recreational or subsistence fisheries in this section. Health Canada provides advice with respect to the ingestion of contaminated 'country foods', also known as traditional foods, which includes those foods trapped, fished, hunted, harvested or grown for subsistence or medicinal purposes, or obtained from recreational activities such as sport fishing and/or game hunting. Country foods do not include foods produced in commercial operations (*e.g.*, large farms, greenhouses).	
Request:	Please provide a discussion about traditional, recreational and subsistence fisheries in the nearshore and offshore areas and whether or not they may be adversely impacted as a result of project activities.	
Response:	**The following text will be added to Section 8:** **Nearshore** **Recreational and Subsistence Fisheries**. Nearshore Project Area fish harvesters and other local area industry experts stated that, other than the annual food fishery for cod, there are no other known or known potential recreational or subsistence fisheries in the Nearshore Project Area. This cod fishery has been limited to a few days a year, as determined by DFO and this is not expected to change during the life of the nearshore project components. **The following text will be added to Section 8:** **Offshore** **Recreational and Subsistence Fisheries**. There has been no subsistence or recreational fisheries in the Offshore Project Area. **The following text will be added to Sections 18.1 and 18.2:** **18.1 Personal Communications** Len Knight, Area Chief, Resource Management, Fisheries and Oceans Canada, Eastern Newfoundland Larry Yetman, Resource Management Officer, Fisheries and Oceans Canada, Fisheries and Aquaculture Management Branch Derwin Temple, Nearshore Project Area Fisher, Sunnyside Clayton Warren, Nearshore Project Area Fisher, Chapel Arm Robyn Saunders, Petroleum Industry Liaison Keith Sullivan, Biologist / Market Analyst Bob Warren, Nalcor Fisheries Liaison Consultant, Chance Cove 18.2 References Brodie, W. 2005. A description of the autumn multispecies surveys in SA2 + Divisions 3KLMNO from 1995 – 2004. NAFO Science Council Research Document, 05/8. DFO (Fisheries and Oceans Canada). 2009. Fishing for Data: The Multi-Species Survey. Available at URL: http://www.dfo-mpo.gc.ca/science/Publications/article/2008/02-07-2008-eng.htm.	

	Husky Energy. 2010. Commercial Fisheries Risk Assessment for White Rose Field Area Assets.

Comment 87: DFO 19

87-DFO 19	**EA Reference:**	Section 8 – Commercial Fisheries Page 8-1
Preamble:	Scoping document requires CSR to provide a description of fisheries in Study Areas (including traditional, existing and potential commercial, recreational and subsistence). However, this section only identifies traditional and existing key species fisheries of significant value in the study areas.	
Request:	a) Study report to include potential commercial, recreational and subsistence fisheries. b) If not included, explain why.	
Response:	**The following text will be added to Section 8:** **Nearshore** ***Potential Commercial Fisheries***. The greatest potential for commercial fisheries in the future is a return of groundfish harvesting to levels approaching those of the past (for example, in the late 1980s cod harvesting in Trinity Bay (*i.e.*, Unit Area 3Lb) was an average of 7,774 tonnes a year (1986 to 1990), compared to the recent average (2004 to 2008) of 303 tonnes. However, a return of these quotas to such levels, or any significant increase in quota, is not likely during the timeframe of the nearshore project activities. In terms of other future commercial species, the FFAW marketing analyst was not aware of any new species with the potential to develop into a commercially harvested fishery. He noted that currently known species such as sea cucumber and whelk might be harvested in Trinity Bay in future. The Union's O&G Co-ordinator was not aware of any DFO or industry research designed to identify future commercially harvested species, and noted that the FFAW has not undertaken any research of this nature. DFO's Area Chief, Resource Management - Eastern Newfoundland, was not aware of any new potential species in the area that might qualify as an "emerging" commercial species, though, as noted above, whelk is one possibility for an increase in Trinity Bay. It was noted that billfish (also called Atlantic saury) are known to inhabit nearshore coastal areas and there have been incidental catches of this species in capelin and herring traps in Trinity Bay, and other inshore areas. Similarly, the Resource Management Officer of DFO's Fisheries and Aquaculture Management Branch was not aware of any emerging species or any fishery with the potential to be developed on a commercial basis. Nearshore Project Area fish harvesters and community-based industry experts were also contacted. The Newfoundland and Labrador Energy Corporation (Nalcor) Fisheries Consultant (formerly a full-time Project Area fisher) did not know of any underutilized species in the area other than whelk and sea urchins. Some Project Area fishers hold whelk licences but this species has not yet been fished extensively. Sea urchins have been harvested in the past but not for the last several years due to unfavourable market conditions and low prices. He noted that one Project Area fisher has been harvesting eels in the fall for the past few years. The Chair of the Sunnyside Fisher Committee notes that there are some signs of whelk, sea cucumbers and billfish in the areas in which he fishes, but none of these species are of commercial interest at the present. The Chair of the Norman's Cove – Chapel Arm Fisher Committee notes that, in the past, whelk have been harvested in parts of Trinity Bay, mostly in water depths greater than 100 fathoms (approx. 200 m). He notes that some of Project Area fishers hold whelk licences but so far this species has not been fished to any significant extent because fishers have not had to pursue this fishery in order to make their annual fishing income. Billfish have been fished in	

	the past using traps, but price and market conditions were not sufficient to sustain this effort and it did not "take off". In the past, kelp laden with herring roe has been harvested after the annual herring spawn on grounds near Long Cove and Bellevue. Another species – known locally as "sea cats" – was harvested some years ago. This species was apparently harvested for research purposes because it was said to contain a chemical similar to antifreeze. **The following text will be added to Section 8:** **Offshore** ***Potential Commercial Fisheries***. As with the Nearshore Project Area, the most likely new future fishery – from the perspective of current harvesting – is a return of groundfish harvesting, particularly cod and American plaice, though when this might happen is not known. DFO managers consulted noted that plaice stocks still have a long way to go before they were at a level where they could be harvested on a commercial basis. For other potential future fisheries there is very little information available. DFO conducts annual stratified random multi-species trawl surveys during the spring and autumn in the Newfoundland and Labrador Region (Brodie 2005; DFO 2009). One of the main objectives of these surveys is to determine the distribution and abundance of various groundfish and shellfish species. A recent study dealing with the potential effects of various types of fishing gears on sub-sea installations (Husky Energy 2010) identified an abundance of sand lance in the 3Lt region. These findings, based on an analysis of DFO research survey data from 2002 to 2008, might indicate some future commercial potential for this species. The same study indicated the presence of eelpout which, given the relatively large individual body sizes of this species, might make it attractive to commercial harvesters at some point in the future. Commenting on the potential for the commercial exploitation of eelpout, DFO managers agreed that this might be a possibility in the long term, but pointed out that other sources of marine protein would likely be explored before this species was used. Please refer to response to Comment 86: HC 4 for discussion on recreational fisheries.

Comment 88: DFO 20

88-DFO 20	**EA Reference:**	Section 8 – Commercial Fisheries Page 8-1
Preamble:	Scoping document requires CSR to detail traditional historical fishing activity – abundance data for certain species in this area, prior to the severe decline of many fish species (e.g., an overview of survey results and fishing patterns in the survey areas for the last 20 years). While there is some landings and value data presented as well as harvesting locations, theses are limited to the last 3-6 years.	
Request:	Please provide an overview of survey results and fishing patterns in the survey areas for the last 20 years	
Response:	**The following will be added before existing Section 8.1.3.4 (the section s following have been renumbered accordingly), within the nearshore fisheries section.** **8.1.3.4 Historical Overview of Regional Fisheries (Trinity Bay)** The fisheries in Trinity Bay have changed significantly since the mid to late 1980s, as the following graph (Figure 8-X) shows. This is largely the result of the collapse of several commercially important groundfish species stocks in the early 1990s and the subsequent declaration of a harvesting moratorium in 1992, virtually ending the directed fisheries for cod and some other species in most waters off Newfoundland and Labrador. From 1990 to its low point in 1996, the Trinity Bay (Unit Area 3Lb) cod harvest fell from 11,475 tonnes to under 75 tonnes, a drop of more than 99 percent.	

Similar relative levels of decline occurred in the Trinity Bay greysole flounder and turbot fisheries.

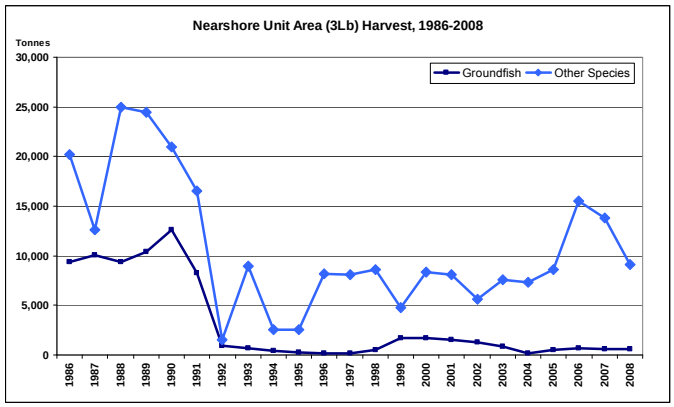


Figure 8-X Nearshore Unit Area (3Lb) Harvest, 1986 to 2008

The virtual disappearance of groundfish fisheries generated an increasing interest in and reliance on other species, mainly snow crab in this area. Between 1990 and its high point in 1995, the snow crab harvest in Trinity Bay increased by more than 200 percent, from 535 tonnes to 1,635 tonnes. Squid, capelin, herring and mackerel have continued to be the other principal fisheries (in terms of quantity) through this period, though landings have varied considerably from year to year depending on markets and resource availability.

Landings for individual species of significance in Trinity Bay for the 20-year period from 1989 to 2008 are illustrated in Figures 8-X to 8-X.

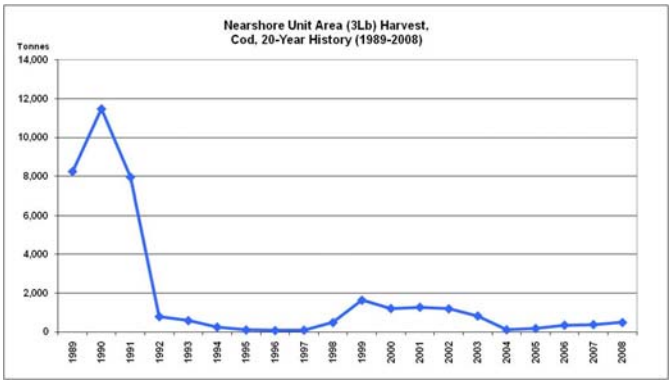


Figure 8-X Nearshore Unit Area (3Lb) Harvest, Cod, 20-year History (1989 to 2008)

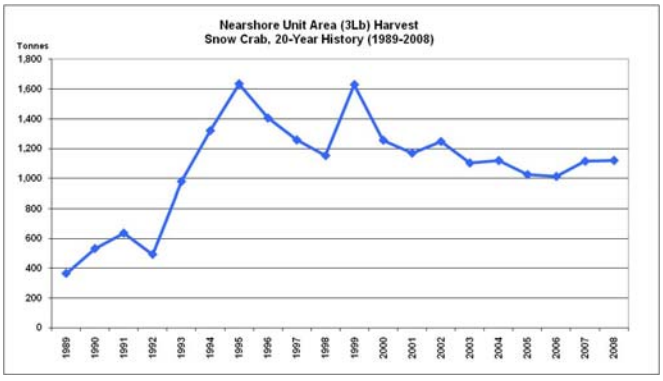


Figure 8-X Nearshore Unit Area (3Lb) Harvest, Snow Crab, 20-year History (1989 to 2008)

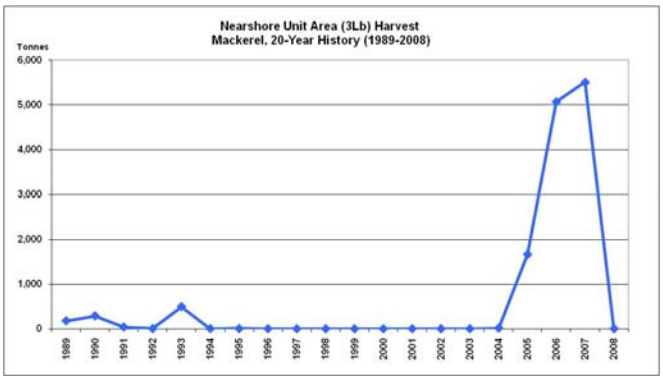


Figure 8-X Nearshore Unit Area (3Lb) Harvest, Mackerel, 20-year History (1989 to 2008)

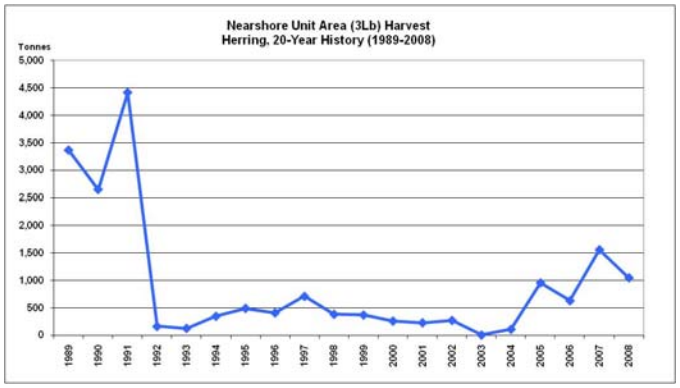


Figure 8-X Nearshore Unit Area (3Lb) Harvest, Herring, 20-year History (1989 to 2008)

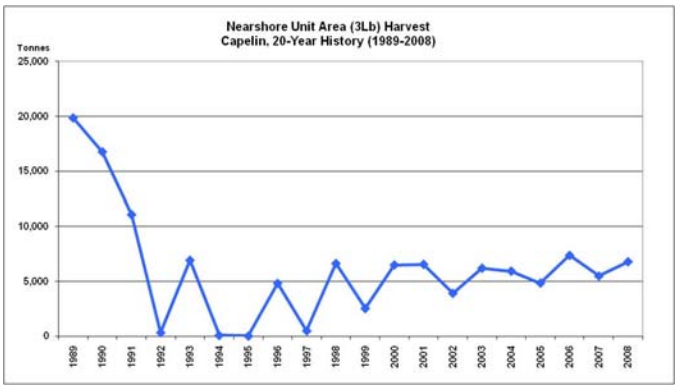


Figure 8-X Nearshore Unit Area (3Lb) Harvest, Capelin, 20-year History (1989 to 2008)

Comment 89: DFO 21

89-DFO 21	**EA Reference:**	Section 8 – Commercial Fisheries Page 8-1
Preamble:	Scoping document requires CSR to demonstrate consideration of underutilized species that may be found in the study area as determined by analyses of past DFO research surveys and Industry GEAC survey data, with emphasis on those species being considered for future potential fishers, and species under moratoria. This is not	

	evident in the CSR.
Request:	Demonstrate consideration of underutilized species that may be found in the study areas as determined by analyses of past DFO research surveys and Industry GEAC survey data, with emphasis on those species being considered for future potential fishers, and species under moratoria.
Response:	DFO trawl surveys are included in response to Comment 87: DFO 19.

Comment 90: DFO 22

90-DFO 22	**EA Reference:**	Section 8 – Commercial Fisheries Page 8-1
Preamble:	Scoping document requires CSR to detail program(s) for compensation of affected parties, including fisheries interests, for accidental damage resulting from project activities. While a Fisheries Compensation Plan will be established, it only states that the plan will be developed based on existing practice and industry-based guidance.	
Request:	a) Identify what the plan will compensate and to whom. That is, who would be an "affected party" and if the plan will include compensation for accidental damage or other negative effect resulting from project activities. b) Although the plan is not yet developed, a summary of "existing practice" and industry-based guidance should be included.	
Response:	EMCP is in the early stages of developing a Bull Arm fisheries agreement, which will be similar to the agreement in place during the construction of the Hibernia GBS. Elements of the Agreement may include communication protocols, vessel traffic management procedures and compensation to fishers directly affected by Project Activities during the construction of the GBS. Compensation for any accidental releases at Bull Arm will be captured in the oil spill response plan, which is under development. Project Area fishers sustaining gear or vessel damage as a result of contact with Project Activities will be compensated for any such demonstrated economic loss where it is directly attributable to Project activities. The principles and procedures for calculating and paying Project-related gear and vessel damage claims will be similar to those contained in existing programs such as those used by operators involved in offshore exploration activities (*e.g.*, seismic surveys). For accidental events in the offshore area, a compensation plan will adhere to the Compensation Guidelines Respecting Damages Relating to Offshore Petroleum Activity (C-NLOPB and CNSOPB, 2002) and CAPP guidance "Canadian East Coast Offshore Operators Non-attributable Fisheries Damage Compensation Program" (2007). With respect to the offshore: In addition, under the Atlantic Accord Acts, Section 160, "actual loss or damage" is defined as including "loss of income, including future income, and, with respect to any aboriginal peoples of Canada, includes loss of hunting, fishing and gathering opportunities." Section 162 states that claims can be made for "all actual loss or damage incurred by any person as a result of the spill or the authorized discharge, emission or escape of petroleum" as well as for actual loss or damage and all such costs or expenses resulting from the escape of debris.	

Comment 91: DFO 18

91-DFO 18	**EA Reference:**	Section 8.4.2 Potential Interactions (and Impact Pathways) Table 8-14 Potential Project-related Interactions with Commercial Fisheries Page 8-45
Preamble:	Section 5.3.3.3 requests that the environmental effects of the project fisheries be discussed. Section 8.4.1.1 indicates that fishers are concerned about effects of construction-related noise and light on fish behaviour in the nearshore however, lighting is not indicated as having a potential effect in Table 8-14 or included in Section 8.5 Environmental Effects Analysis and Mitigation.	
Request:	Please revise Table 8.14 and Section 8.5 to include the potential for lighting to affect fisheries.	
Response:	The effects of construction-related noise and light on fish behaviour in the nearshore are described in the Fish and Fish Habitat Section, Section 7.5.1.3 (and is included in Table 7-9)	

Comment 92: DFO 23

92-DFO 23	**EA Reference**	Section 8.5.1.1 Nearshore (Mitigations) Page 8-51
Preamble:	Section 5.3.3.2 of the scoping document request that the means by which adverse effects upon marine use may be mitigated through design or operation procedures. List below are operational regulations and procedures regarding the movement of vessel traffic inshore and offshore.	
Request:	This section should be revised to include the following mitigations: • All vessel traffic to be made aware of the provisions of the Eastern Canada Traffic Zone Regulations (ECAREG) and inshore High Level Traffic Zone practices and procedures. • All parties provide Canadian Coast Guard with required information for issuance of Notices to Shipping and Notices to Mariners in a timely manner. • Private floating and fixed Aids to Navigation be established in Trinity Bay approaches to Bull Arm. See below The following Aids to Navigation are recommended by Superintendent, Aids to Navigation, NL Region. 1. Floating aid identified as Bowers Ledge (TBU) North Cardinal Buoy with RACON. 2. Floating aid identified as Temples Knob (TB2) Starboard Hand Light Buoy 3. Floating Aid identified as Stanton Point (TB4) Starboard Hand Light Buoy 4. Floating Aid identified as The Hoof Port Hand Buoy 5. Fixed Aid – a sector light recommended at Ram Head. Item 4, The Hoof port hand buoy is already in place as a private AtoN. A tower is also in place to accommodate a sector light, item 5. Coast Guard would place, maintain and retrieve Aids on a cost-recovery basis from the project proponent.	
Response:	Advice noted; the Project will be looking at all vessel traffic and navigation aids requirements, related to both floating and fixed aids to navigation, as recommended by the Superintendent, Aids to Navigation.	

Comment 93: DFO 24

93-DFO 24	**EA Reference::**	Section 8.5.1.2 Offshore, Mitigations Page 8-53
Preamble:	Clarification of procedures is required regarding – Notice to shipping, Not mariners, Notice to Fish Harvesters.	
Request:	Please revise this section accordingly. Canadian Coast Guard will issue Notices to Shipping based on waterway conditions, exploration activities, or other short term operations. Notices to Mariners are written notices, usually based on a broadcast Notice to Shipping and also promulgated by the Canadian Coast Guard dealing with situations over three (3) weeks in duration. Notices to Shipping are broadcast by MF radio and Navtex and by VHF on the Continuous Marine Broadcast (CMB) while they are in force. Notices to Mariners are promulgated by written copy on a monthly basis. Notices to Fish Harvesters are promulgated by DFO Resource Management Branch. They are also broadcast by Coast Guard MCTS Centres on MF and on the CMB for a period of 24 hours. DFO also sends Notices to Fish Harvesters to CBC Radio for inclusion on the Fisheries Broadcast.	
Response:	**Point 2 in Section 8.5.1.2 2 will be revised as follows:** Relevant information about marine operations outside Safety Zones will also be publicized, when appropriate, using established communications mechanisms, such as the Notices to Shipping (Continuous Marine Broadcast and NavTex) and CBC Radio's (Newfoundland and Labrador) Fisheries Broadcast.	

Comment 94: C-NLOPB 29

94-C-NLOPB 29	**EA Reference:**	Section 8.5.3.1 Page 8-56, paragraph 2
Preamble:	The paragraph describes the difficulty in predicting, and possibly in quantifying, effects of an oil spill upon seafood market perceptions.	
Request:	The CSR should consider and describe whether any mitigation of, or response to, actual or potential market perception effects can be envisaged at the contingency planning stage.	
Response:	The Hebron Project is at the early stages of project development. Separate contingency plans will be developed for Bull Arm and offshore operations. Effective responses to mitigate market perceptions (publicizing the results of testing fish flesh for hydrocarbon presence or establishing taste panels to determine organoleptic effects) require that they be tailored to the specific circumstances of any actual spill and should consider such factors as the size and duration of the spill, the areas affected, the species affected, the time of year and clean-up or rehabilitation methods, as well as the type and characteristics of the markets (local or international, competing products). These factors will be considered in the development of the oil spill response plan for Bull Arm and the Offshore area.	

3.8 Response to Section 9 Comments

Comment 95: EC 38

95-EC 38	**EA Reference:**:	Section 9.3.2.1 Data Sources and Survey Effort for Marine Birds in the Study Area Page 9-6
Preamble:	The following comments pertain to the clarity of the text for the above mentioned section and page of the CSR. Changes to text should be made as appropriate:	
Request:	It is not clear where the data come from and which data were used for the summaries that follow. The text should indicate that PIROP data were collected from 1984-1992, and ECSAS data from 2006-2009. Page 9-6 states "*Systematic marine bird observations (Tasker surveys; Tasker et al. 1984) were conducted on the northern Grand Banks and the adjacent Orphan Basin from 2004 to 2008.*". – CWS surveys were also systematic and also used the Tasker method. As currently written, it sounds as though this method is unique to these surveys. The text should be changed to clarify this. Page 9-6 also states "*Tasker surveys provide marine bird data as densities (numbers per km2). The offshore research and seismic-related cruises on which Tasker surveys and other marine bird observations were conducted are listed in Table 9-3. The geographic distribution of Tasker surveys in and around the Offshore Study Area is illustrated in Figure 9-4*." – to call these the Tasker surveys is misleading, as the other sources of data also come from survey methodology based on Tasker. Please remove "Tasker" from this description.	
Response:	On page 9-6, the change below will be made to indicate that the data shown in Figure 9-3 of the CSR includes PIROP data derived from seabird abundance maps, more specifically Figures 3.3, 3.7, 3.11, and 3.25 in Locke et al. (1994). Locke et al. (1994) does not include the specific years of data used to derive the seabird abundance maps so we cannot confirm the reviewer's comment that PIROP data were collected from 1984 to 1992. Figure 9-3 correctly indicates that the data shown are from Locke et al. (1994). Also, the change noted below clearly indicates that the ECSAS data include collected during 2006 to 2009 and that the systematic surveys were based on the Tasker method. "Tasker" was included in the description of the surveys conducted during seismic, CSEM, and research cruises to distinguish it from the PIROP survey type which provided estimates of number of birds per linear km vs. number of birds per square km. Rather than remove Tasker from the description on page 9-6, the changes made below acknowledge that the ECSAS data are also based on the Tasker method and allows for derivation of density estimates. **The following paragraph from draft CSR (page 9-6):** "Most of the information available up to 2000 was collected by the CWS through PIROP (Programme intégré de recherches sur les oiseaux pélagiques). Those data have been published for 1969 to 1983 (Brown 1986), and up to the early 1990s (Lock *et al.* 1994). In 2006, the CWS resumed surveying marine bird abundance and distribution and those recent data have become available (CWS 2009). The PIROP survey coverage within and around the Offshore Study Area is presented in Figure 9-3. PIROP marine bird data are of birds per linear kilometre. New survey protocols have been developed by CWS which permit the derivation of density estimates (Wilhelm *et al. in prep*.)." **Will be replaced with:** "Most of the information available up to 2000 was collected by the CWS through PIROP (Programme intégré de recherches sur les oiseaux pélagiques). Those data have been published for 1969 to 1983 (Brown 1986), and up to the early 1990s (Lock *et al.* 1994). The PIROP survey coverage within and around the Offshore Study Area	

	is presented in Figure 9-3, which is derived from maps in Lock et al. (1994). PIROP marine bird data are of birds per linear kilometre. In 2006, the CWS resumed surveying marine birds and those recent data have become available for the years 2006-2009 (CWS 2009). New survey protocols (see Wilhelm *et al.* in prep.) based on the Tasker survey method (Tasker *et al.* 1984) were used to collect these recent data, which allow for the derivation of density estimates.

Comment 96: EC 39

96-EC 39	**EA Reference:**:	Section 9.3.2.1 Data Sources and Survey Effort for Marine Birds in the Study Area Page 9-8, Table 9-3
Preamble:	Not clear from previous text section 9.3.2.1 which data this table is summarizing.	
Request:	Recommend adding a sentence in the Table heading to indicate sources of the data.	
Response:	Sources of data are included as footnotes to Table 9-3 (Sources: Lang and Moulton (2004, 2008); Moulton *et al.* (2005b, 2006b); Lang *et al.* (2006); Lang (2007); Abgrall *et al.* (2008a, 2008b, in prep.)).	

Comment 97: GF 7

97-GF 7	**EA Reference:**:	Section 9.3.2.2 General patterns of Marine Bird Occurrence in the Offshore Study Area Page 9-9
Preamble:	"*but generally in lower densities than on the shelf and slope; the deeper waters away from the shelf and slope are typically less productive*."	
Request:	Provide a reference for the sentence.	
Response:	**The following sentence will be deleted as it offers very little to the reader in the CSR contex**t: "However, a similar mix of species is expected to occur there, but generally in lower densities than on the shelf and slope; the deeper waters away from the shelf and slope are typically less productive."	

Comment 98: EC 40

98-EC 40	**EA Reference:**:	Section 9.3.2.2 General Patterns of Marine Bird Occurrence in the Offshore Study Area Page 9-10 and Table 9-4
Preamble:	The species and general monthly abundance expected on the Continental Shelf and slope waters of the Offshore Study Area are listed in Table 9-4.	
Request:	Sources of data listed at end of table do not cite CWS 2009, although was discussed in Section 9.3.2.1 as a data source. This source should be added. Murres are not scarce to uncommon on the Grand Banks according to CWS 2009. The survey results reported in CWS 2009 conducted from 2006-2009 indicate relatively high densities of murres year-round in the study area. The data show murres as common on the shelf during the non-breeding season, less common (but not scarce) during the breeding season. Brown 1986 also indicates relatively high densities for murres (*Uria spp*) in the study area during the non-breeding season (1-10 birds/km). Lock et al. 1994 also indicates relatively high densities of vulnerable species (Auks) in the study area. The densities of murres reported in the table should be changed as indicated.	
Response:	**CWS (2009) will be added as a data source at the end of Table 9-4.** The presentation of seabird data in CWS (2009) does not permit a species-level assessment of relative abundance of murres, given that Common Murres and Thick-billed Murres are combined and Razorbill are grouped together with Atlantic Puffin,	

	Black Guillemot and Unidentified Alcids. Although murres occur in low densities relative to species like Greater Shearwaters, it is agreed that the relative abundance status of Common and Thick-billed Murres should be increased and the following changes will be made to Table 9-4: • Common Murre and Thick-billed Murre will be combined into one group called Murre spp. • Murre spp. will be assigned "U-C" status for January, February, March, April, September, October, November and December; "S-U" status for May, June, July, and August • No changes are required for Razorbills

Comment 99: EC 41

99-EC 41	**EA Reference:**:	Section 9.3.2.4 Species Profiles Page 9-16, Table 9-6
Preamble:	There is an error in the number presented for Average Density of All Species from 5-8 November (458.7 is too high).	
Request:	Please correct the number.	
Response:	458.7 will be changed to 32.8.	

Comment 100: GF 8

100-GF 8	**EA Reference:**:	Section 9.3.2.4 Species Profiles Page 9-22
Preamble:	"*That number is low compared to the numbers of Leach's Storm Petrels seen from ships in the same area, and may have been a result of the tall height of observers off the water and the lack of persistent use of binoculars for scanning. Storm-Petrels are difficult to see because they are dark and fly very low over the water*."	
Request:	Should reference Ballie et al. 2005.	
Response:	Baillie *et al.* 2005 will be added as the reference for these sentences.	

Comment 101: EC 42

101-EC 42	**EA Reference:**:	Section 9.3.2.4 Species Profiles Page 9-23 Pomarine Jaeger, Parasitic Jaeger and Long-tailed Jaeger
Preamble:	This section states: "…Like skuas, they are kleptoparasites, preying chiefly on Black-legged Kittiwakes and Arctic Terns."	
Request:	The above sentence is misleading, however because they do not prey chiefly on kittiwakes and terns, but rather steal the prey of the kittiwakes and terns. Please rewrite this sentence.	
Response:	**The following change will be made:** Sentence from draft CSR (page 9-23): "Like skuas, they are kleptoparasites, preying chiefly on Black-legged Kittiwakes and Arctic Terns." Change to: "Like skuas, they are kleptoparasites, primarily targeting the prey of Black-legged Kittiwakes and Arctic Terns."	

Comment 102: GF 9

102-GF 9	**EA Reference:**:	Sections 9.4.1.1, 9.4.1.2, 9.4.1.3 Page 9-28
Preamble:	"*Lighting at night throughout the Project may attract marine birds, particularly the Leach's Storm-Petrel, which may strike vessels or platform infrastructure leading to injury, strandings, and mortality*."	
Request:	Table 9-9, should identify mortality as source of effect from lighting as birds that hit structures can die (thus, infrastructure and lighting must both have mortality, not just infrastructure)**.**	
Response:	As described in the CSR text, under certain conditions lights may attract some species of birds that then collide with the structures to suffer stranding or mortality. These events are not restricted to the offshore oil and gas industry but in general apply to most lighted structures on both land and sea. This issue has not been extensively studied in Newfoundland and Labrador waters with the possible exception of the bird standings' data collected on offshore seismic vessels. Based on these data, Leaches Storm-petrel is, by far, the most commonly involved species. Because this species spends most of its time in offshore waters, it is likely that most strandings involving this species would occur offshore. Table 9-9 will be amended to include potential mortality from lighting. As described in the CSR, EMCP will have a bird release program. Lighting is required for safety of personnel and safe navigation. The Project will evaluate use of shielding and deflectors with directional lighting to minimize attraction by lighting, and may incorporate such features where safety of operations and navigation are not affected. Appropriate sections / text / tables of CSR will be updated to include this as a mitigation.	

Comment 103: C-NLOPB 30

103-C-NLOPB 30	**EA Reference:**	Section 9.4.2.4 Page 9-29
Preamble:	The paragraph states "An oil spill, although unlikely, could potentially occur. . ."	
Request:	The reference to a spill being "unlikely" should be referenced or qualified or both.	
Response:	The sentence will be revised as follows: An oil spill, although unlikely (See Section 14.1.4 for a summary of blowout and spill frequencies), could potentially occur during the construction, operation and maintenance, and/or decommissioning phases of the Project.	

Comment 104: EC 43

104-EC 43	**EA Reference:**:	Section 9.5.1.2 Change in Habitat Quality Page 9-34 Lighting
Preamble:	There is very little information on the conditions favourable to bird strandings. More information of this type would be beneficial to our understanding of this phenomenon. CWS would like to see a commitment, not only to standardized searches and releases, but also to data collection regarding the meteorological and operational conditions experienced at the time of strandings.	
Request:	Data regarding meteorological and operational conditions (*e.g.*, lighting, flares) should be collected and submitted to CWS along with all reports of strandings.	
Response:	ExxonMobil Canada East, as part of its bird stranding and release program for Hebron, will adhere to the reporting requirements of the Bird Handling and Release Permit, as outlined in the "Report of "Live" Migratory Seabirds Salvaged Under The Authority of a Federal Migratory Bird Permit" form.	

Comment 105: GF 10

105-GF 10	**EA Reference:**:	Section 9.5.1.2 Change in Habitat Quality, Offshore Lighting Page 9-36
Preamble:		
Request:	Habitat quality can also be degraded for birds attracted to lights may be exposed to increased risk of predation by gulls.	
Response:	Attraction to light and predation are more behavioural issues as opposed to habitat ones. Gulls do not normally feed at night (B. Mactavish, LGL, pers. comm.). If predation does occur, it is predicted to be relatively limited in scale, especially with a bird rescue program as mitigation, and captured within the CSR's prediction of mortality due to attraction to lights.	

Comment 106: C-NLOPB 31

106-C-NLOPB 31	**EA Reference:**:	Section 9.5.1.2 Change in Habitat Quality, Offshore Lighting Page 9-36
Preamble:	"*Young-of the-year birds appear to be more susceptible to light attraction than are adults, but the extent of Storm-Petrel susceptibility is unclear*."	
Request:	Please provide the reference for this statement. Has the attraction issues associated with lighting and possible spectral mitigations been considered. Some relevant studies are: Marquenie, J., M. Donners, H. Pool, W. Steckel and B. de Wit. 2008 *Adapting the Spectral; Composition of Artificial Light To Safeguard the Environment*, as cited from Petroleum and Chemical Industry Conference Europe – Electrical and Instrumentation Applications. 2008 Poot, H., B.J. Ens, H. de Vries, M.A.H. Donners, M.R. Wernand and J.M. Marquenic. 2008. *Green Light for Nocturnally Migrating Birds* as published in Ecology and Society 13(2):47 available at http://www.ecologyandsociety.org/vol13/iss2/art47/.	
Response:	**The sentence indicated in preamble will be replaced with the following:** "The largest Leach's Storm-petrel stranding events that have been recorded from seismic vessels in and near the Study Area have occurred at the time of year when the young have recently fledged (T. Lang, Biologist, LGL Limited, pers. comm., September 2010), but the extent of Storm-Petrel susceptibility is unclear. " The effects of lighting on birds was assessed and judged to be not significant. The references provided above and indeed which occur elsewhere, have focused primarily on passerines, which do not migrate through the Hebron Offshore Study Area. Regardless, there is potential for seabirds, particularly Leach's Storm-petrels, to be attracted to offshore lighting from the production installation as well as attending vessels. EMCP will investigate various lighting options as suggested in Comment 102-GF-9.	

Comment 107: GF 12

107-GF 12	**EA Reference:**:	Section 9.5.1.2 Change in Habitat Quality, Offshore Lighting Page 9-36
Preamble:	"*Other marine bird species, as well as migrating land birds, are also known to be attracted to lights on offshore oil and gas platforms at night, especially during foggy or overcast conditions. Birds could potentially injure themselves by flying into structures on the platform (Avery et al. 1978).*"	
Request:	Given that Dovekies are one of the most abundant species in the area at certain times of year, this discussion should be expanded to consider evidence from ships in Alaska of closely related Alcids flooding onto boats from lighting levels far lower than that of a platform (Dick and Donaldson 1978, Condor 80:235-236;) and specifically consider dovekies. Further, because Dovekies are highly vulnerable to oil pollution, a two-tiered effect should be considered here: birds attracted to the platform are more likely to experience oil pollution from discharges.	
Response:	While Dovekies were observed one time to circle the lighted Hibernia platform for hours (in Wiese *et al.* (2001)), EMCP is not aware of any large scale strandings or mortalities related to such events on the Grand Banks. There have been reports in other regions of mass strandings involving related species. For example, Dick and Donaldson (1978) interviewed the crew of an Alaskan crab fishing boat that experienced a mass collision with Crested Auklets (*Aethia cristatella*), a related species. It was estimated that about 1.5 tons of birds collided and landed on the brightly lit boat. The birds appeared to be disoriented by the bright overhead work deck lights although they only ran into the lower running lights because the birds were all flying close to the water. Poot et al. (2008) suggested using "bird friendly" green lights (as developed by Phillips) on offshore platforms in the North Sea to reduce or eliminate the disorientation to nocturnally migrating birds caused by white and red lights. However, it should be noted that the North Sea is not at all analogous to the Grand Banks in terms of numbers and types of species, distance to nearest land, and bird migration pathways. Routine platform discharges are not expected to produce sheens. Nonetheless, there has been a number of small petroleum spills on the Grand Banks (see Section 14 of the CSR). O'Hara and Morandin (2010a) demonstrated that it only requires a small amount of oil (*e.g.*, 10 ml) to affect the feather structure of Common Murre and Dovekie. Such modifications to feather structure cause a loss of insulation, which in turn can result in mortality in the cold Northwest Atlantic environment. **The following references will be added:** Dick, M.H. and W. Donaldson. 1978. Fishing vessel endangered by Crested Auklet landings. *Condor*, 80: 235-236. O'Hara, P.D. and L.A. Morandin. 2010a. Effects of sheens associated with offshore oil and gas development on the feather microstructure of pelagic seabirds. *Marine Pollution Bulletin*, 60: 672-278. Poot, H., B.J. Ens, H. de Vries, M.A.H. Donners, M.R. Wernand, and J.M. Marquenic. 2008. Green light for nocturnally migrating birds. *Ecology and Society*, 13(2): 47 available at http://www.ecologyandsociety.org/vol13/iss2/art47/.	

Comment 108: GF 13

108-GF 13	**EA Reference:**:	Section 9.5.1.2 Change in Habitat Quality, Offshore Lighting Page 9-36
Preamble:	"*Foggy nights seem to attract more birds, and Leach's Storm-Petrels are more common in the Offshore Study Area during late summer to early fall***."**	
Request:	Given that data exist for: 1) the number of foggy nights the project will experience; 2) density of lesp in study area; and 3) past salvage information, a model should be developed to provide estimates of the number of birds which may be salvaged during the lifetime of the project (separate models for both development and production). Further, it should be noted that the salvage protocol and the past findings of the numbers of birds represents an underestimate of the number of birds effected by lighting as the salvage protocol only works for birds that hit and fall on the platform; it does not address birds that fall into the water.	
Response:	As described in the CSR, EMCP will have a bird stranding and release program. There are likely insufficient data and too many variables regarding this issue to produce a worthwhile model to determine the number of birds that may be salvaged. As noted above (see response to Comment 102-GF 9), local bird stranding data have been collected by marine mammal and seabird observers on seismic vessels that typically operate within a window of May to October. The numbers of stranding have been highly variable from a few birds to hundreds of storm-petrels. Some ships may have increased mortalities caused more from oily and or hidden crevices where stranded birds seek shelter and are not discovered in time to release alive, as opposed to simple attraction to light (T. Lang, Biologist, LGL Limited, pers. comm., September 2010). Most stranded petrels are released alive using CWS protocols.	

Comment 109: GF 14

109-GF 14	**EA Reference:**:	Section 9.5.1.2 Change in Habitat Quality, Offshore Lighting Page 9-37
Preamble:	"*EMCP will develop protocols for regular searches of birds that may become stranded on all vessels and facilities. Recovered birds will be released in accordance with standard protocols (Williams and Chardine 1999; Husky Energy 2008)."*	
Request:	Given that a new platform is being built, why not instead be at the forefront of new lighting technologies, which may reduce the need to recover birds? Such as shielding lights, changing light signature pattern, not having lights projected outwards (See Poot et al 2008, Ecology and Society 13:47; Baccetti, N., Sposimo, P. & Giannini, F. 2005. Avocetta 29: 89-91; Rodriguez and Rodriguez 2009 Ibis 151:299). Workers should be required to cover their windows at night to reduce light pollution and all non-safety lights should be shielded wherever possible.	
Response:	Refer to Comment 102-GF-9 for additional information regarding environmental effects of lighting on seabirds.	

Comment 110: GF 15

110-GF 15	**EA Reference:**:	Section 9.5.1.4 Potential Mortality Page 9-41
Preamble:	"*The only routine Project construction/installation activity that is predicted to potentially result in mortality of marine birds is blasting in the nearshore*."	
Request:	Given that birds may hit infrastructure due to lighting or experience predation due to attraction to the platform during installation, can experience mortality, this sentence is incorrect. (Table 9-10 notes potential mortality, therefore appropriate mitigation measures to PREVENT attraction and mortality should be required).	

Response:	**The sentence in the preamble will be removed from the CSR.** The sentence in the preamble will be modified to remove "The only" and replace with "One" in the CSR. **The following sentence will be added immediately after the revised introductory sentence:** Collision with infrastructure is another potential source of mortality. This issue is mostly relevant to offshore operations and is discussed in Section 9.5.2."

Comment 111: GF 16

111-GF 16	**EA Reference:**:	Section 9.5.2.2 Change in Habitat Quality - Flaring Page 9-45
Preamble:	"*As in the case of lighting (described above), EMCP will develop protocols for regular searches of birds that may become stranded on all vessels and facilities. Recovered birds will be released in accordance with standard protocols (Williams and Chardine 1999; Husky Energy 2008). Stranded bird reports will be provided to the CWS*."	
Request:	In previous offshore oil and gas EAs in this region, other mitigation strategies have been noted on how to reduce the effects of flaring on marine birds. For example, Husky Oil Ltd (2001) noted they would attempt to "*schedule routine maintenance shutdowns to coincide with the time of maximum Storm-petrel local abundance…"* (pg 15). Assuming that shutdowns mean less chance of flaring, this mitigation should be required. Given that the Hibernia project exceeded their flaring quotas (e.g., C-NOPB 1999 Annual Report), the Hebron project needs to provide evidence that they will make every attempt to minimize flaring and provide details as to how this will be achieved. Further, there should be an analysis of past flaring for all production projects in the C-NLOPB's jurisdiction, the amount that they flared, when (seasonally) the flaring occurred and whether the flaring occurred at low lighting. A model should be developed to provide estimates of seabird mortality based on these data in conjunction with known seabird (lesp and dove) estimates.	
Response:	With regard to flaring, the primary function of the flare system is to safely dispose of flammable gases during emergency events. The timing of emergency events is not at the discretion of the operator. **The following text will be added to Section 9.5.2.2**: During steady-state operations, it is estimated that the Hebron facility will have reduced flare emissions compared with existing operations. Flaring during platform start-up and early year operations will be greater than steady-state operations. Flare operating practices will be developed for the Operations Authorization and a flaring allowance established in consultation with the C-NLOPB. With regards to effects of flaring on seabirds, Section 9.5.2.2 describes potential impacts from flaring on seabirds.	

Comment 112: GF 17

112-GF 17	**EA Reference:**:	Section 9.5.2.4 Potential Mortality Page 9-47
Preamble:	"*As described above, the Leach's Storm-Petrel is the most likely marine bird species to be affected*…"	
Request:	This sentence should include Dovekies as an additional species also affected by gas flaring at night.	
Response:	There is little to no evidence to indicate that Dovekies vs. other seabird species are susceptible to mortality from flaring. Leach's Storm-petrels are known to regularly strand on vessels and hence, may be particularly attracted to lights from the flare. However, flares are quite noisy and this noise may deter birds. Also, the height of the	

	flare (approximately 98 to 108 m above sea level) is much higher than the altitude that Leach's Storm-petrels (and Dovekies) typically fly (B. Mactavish, LGL, pers. comm.). **The following sentence will be added to page 9-47:** "It is unknown which seabird species, if any, are susceptible to mortality from flaring."

Comment 113: GF 18

113-GF 18	**EA Reference:**:	Section 9.5.2.4 Potential Mortality Page 9-47
Preamble:	*There is currently no known mitigation for this potential effect, but flaring is expected to have minimal impact on marine birds over the duration of the Project*."	
Request:	See Comment 16 above regarding mitigation for flaring.	
Response:	See response to Comment 111: GF 16.	

Comment 114: GF 19

114-GF 19	**EA Reference:**:	Section 9.5.2.4 Potential Mortality Page 9-48
Preamble:	"*The Environmental Studies Research Find (ESRF) has commissioned a study on the effects of sheens on marine birds that has not yet been published*."	
Request:	This should not be used as an excuse for not including data collected by operators on the frequency, size and persistence of oil sheens in the C-NLOPB's jurisdiction. At the very least EMCP should be required to present data from Hibernia. Without these data, a worst case scenario must be assumed. Without these data, it is not possible for the public to draw its own conclusions about the potential effects of oil sheens associated with the project and to assess whether the EA is correct in its assessment of the effect. With regards to sheens, a published paper, resulting from ESRF funding mentioned above was released in April 2010, prior to the release of the CSR, and should be discussed: O'Hara and Morandin 2010. Effects of sheens associated with offshore oil and gas development on the feather microstructure of pelagic seabirds. Marine Pollution Bulletin 60: 672-278. General: in the White Rose Project CSR, an assessment of the level of certainty of the residual effect of the prediction and the likelihood of the effect occurring were provided for each predicted effect (I see EMCP has this step for overall). Why was this not done for this project? These are important steps as they provide the public with a rating of whether the prediction is a best guess, or whether the prediction is relatively certain. General: Despite the definition of a significant residual environmental effect changing from the number individuals in the area (see Husky Oil Ltd 2001) potentially effected to populations, and improved information on marine bird abundance in the study area, there are still no species specific models provided in areas where the impact could be assessed. This continues to be an on-going weakness for oil and gas production EAs.	
Response:	The above referenced ESRF project was published as a journal article (O'Hara and Morandin 2010a) and as an ESRF report (O'Hara and Morandin 2010b). These publications were not available at the time of preparing the June 2010 CSR. This laboratory study by O'Hara and Morandin demonstrated that it only requires a small amount of oil (*e.g.*, 10 ml) to affect the feather structure of Common Murre and Dovekie. Such modifications to feather structure cause a loss of insulation which in turn can result in mortality in the cold NW Atlantic environment. The CSR concluded that, aside from accidental events (e.g., oil spills) (see Section 14.1.3), sheens are unlikely to occur from routine Project operations. The level of certainty was determined for predicted residual environmental effects for each Project phase (Construction and Installation, Operation and Maintenance,	

	Decommissioning and Abandonment, Accidental Events, Cumulative Effects). This is consistent with guidance provided by the CEA Agency (CEA Agency 1994) and represents a comprehensive level of certainty for each effect that occurs within that Project phase. A reasonable model of the number of seabirds that could suffer mortality from a major oil spill is impossible to determine with any accuracy or precision because of the numerous variables involved and the difficulty in confirming any such model. In the event of a spill, EMCP will implement a bird monitoring and recovery program. **The following reference will be added:** CEA Agency (Canadian Environmental Assessment Agency). 1994. *A Reference Guide for the Canadian Environmental Assessment Act: Determining Whether a Project is Likely to Cause Significant Adverse Environmental Effects*. Prepared by the Federal Environmental Assessment Review Office. O'Hara, P.D. and L.A. Morandin. 2010a. Effects of sheens associated with offshore oil and gas development on the feather microstructure of pelagic seabirds. *Marine Pollution Bulletin*, 60: 672-278. O'Hara, P.D. and L.A. Morandin. 2010b. Effects of Sheens Associated with Offshore Oil and Gas Development on the Feather Microstructure of Pelagic Seabirds. Environmental Studies Research Funds Related Studies.

Comment 115: EC 45

115-EC 45	**EA Reference:**:	Section 9.5.2.4 Potential Mortality Page 9-48
Preamble:	The ESRF study on the effects of sheens on marine birds has been published.	
Request:	The information from the results of this study should be included in the CSR	
Response:	See response to Comment 114-GF 19.	

Comment 116: GF 20

116-GF 20	**EA Reference:**:	Section 9.5.4.3 Potential Mortality Page 9-53
Preamble:	"*In June 1979, an oil spill occurred from the Ixtoc I off Texas*…"	
Request:	Ixtoc was not a spill, it was a blowout (and it was off Mexico, not Texas). This is an important distinction.	
Response:	**Sentence revised in CSR as follows:** "In June 1979, an oil blowout occurred from the *Ixtoc 1* in the Gulf of Mexico off Mexico."	

Comment 117: GF 21

117-GF 21	**EA Reference:**:	Section 9.5.4.3 Potential Mortality Page 9-53
Preamble:	"*Birds living in coldwater environments, such as the Study Area, are most likely to succumb to hypothermia (Hartung 1995)."*	
Request:	**Wiese and Ryan 2003 should be cited here as well.**	
Response:	**The sentence will be revised as follows:** Birds living in coldwater environments, such as the Study Area, are most likely to succumb to hypothermia (Hartung 1995; Wiese and Ryan 2003).	

Comment 118: GF 22

118-GF 22	**EA Reference:**:	Section 9.5.4.3 Potential Mortality Page 9-54
Preamble:	"*Oiled birds that are cleaned and released might not have high survival rates*."	
Request:	This section needs to be updated. There has been much discussion in the seabird community on this issue, particularly in the past 3 months. Michael H. Ziccardi is the director of the Oiled Wildlife Care Network at the Wildlife Health Center at UC Davis, is quoted as saying "Even in the best of circumstances, many oil-affected animals will die in the rehabilitation center. However, due to the evolution of professional oiled rehabilitation organizations over the past 30 years, survival is much higher than in the paSt. For spills that my organization, the Oiled Wildlife Care Network, manages for California, we successfully release, on average, 50 to 75 percent of the live animals collected." http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2010/06/23/EDFM1E32SQ.DTL#ixzz0rgxFIdJA Thus, Dr. Ziccardi is suggesting that the situation may not be as dire as we think when it comes to cleaning birds.	
Response:	EMCP agrees that advances have been made over the last 20 years in the survival rates of birds cleaned under laboratory conditions. Nonetheless, survival rates of 50 to 75 percent have not been proven on a large scale for Newfoundland and Labrador waters. Thus, EMCP stands by the original statement.	

Comment 119: EC 47

119-EC 47	**EA Reference:**:	Section 9.5.4.3 – Potential Mortality – Offshore Page 9-56
Preamble:	The fourth paragraph on page 9-56 states "It appears that direct, long-term sublethal toxic effects on marine birds are unlikely." Research has shown that oil components are eliminated relatively quickly from the internal tissues of birds. However, recent research has clearly demonstrated delayed toxic effects on the immune and endocrine systems and on reproductive behaviour and success of birds after brief exposure to oil.	
Request:	(a) The proponents should better describe the duration of sublethal toxic effects of oil exposure on the immune and endocrine systems and on reproductive behaviour and success of birds.	
Response:	It is unclear what literature the reviewer is referencing. EMCP predicts that regulated releases from routine discharges will not produce measureable effects on immune, endocrine or reproductive systems of seabirds. An accidental event such as a large oil spill, although unlikely to occur, could produce both lethal and sublethal effects as predicted in the CSR and could result in a significant effect on seabirds (see Subsection 9.5.4 for a detailed discussion of the effects of oil on seabirds).	

Comment 120: GF 23

120-GF 23	**EA Reference:**:	Section 9.5.4.3 – Potential Mortality – Offshore Page 9-57
Preamble:	Given that the EA discusses the lack of relationship between the quantity of oil spilled and the resulting mortality of seabirds in past oil spills, there should be a paragraph which discusses small spills known to originate from all production platforms in the C-NLOPB's jurisdiction, the frequency of these spills *and* follow-up on them especially regarding persistence & size. Information should be provided on whether attempts were made to contain/clean up small spills from platforms and how the impacts of these small spills on seabirds were assessed and by whom (i.e., CWS or operator). If data on estimated mortality associated with small spills were not obtained, it should be discussed why this was not possible.	

Request:	At the very least, EMCP should provide these data from the Hibernia Project. If these data are not presented, it should be stated why they are not presented. Further, there should be a citation on the impact of chronic oil pollution on seabird populations (Piatt et al. 1990. Effects of oil pollution on marine bird populations. In Effects of oil on wildlife, Research, Rehabilitation and general concerns. Proceedings from: The Oil Symposium, Herndon, Virginia, Oct 16-18 1990).
Response:	The effects of chronic pollution on marine birds are discussed in the Sections 9.5.5.1 and 9.5.5.2 of the CSR. In addition, the frequency of spills associated with offshore oil and gas operations on the Grand Banks is addressed in Section 14.1.3. **The following sentence will be added at the end of the second paragraph on page 9-57**: Some researchers suggest that chronic oil pollution, acting in combination with other mortality factors, may affect seabirds at the population level (Piatt *et al.* 1990)

Comment 121: GF 24

121-GF 24	**EA Reference:**:	Section 9.5.4.3 – Potential Mortality – Offshore Page 9-58
Preamble:	"*Mitigation for accidental hydrocarbon spills will consist of following the protocols detailed in the spill response plan. The oil spill response plan is under development. Depending on the nature and tiered response required, mitigations include the provision for spill response equipment and the rescue and rehabilitation of oiled marine birds*."	
Request:	Spill Response plans should be a public document, which is included in the EA process prior to permitting the Hebron project. Further, spill response plans should include detailed information as to HOW the impact of all oil spills > 1 bbl will determine the impacts of seabirds in the spill area. These plans should be based on prior experience in the area and describe successes and failures at attempts to clean and contain spills.	
Response:	The Hebron Project is at the early stages of project design. Sections 14.4 and 14.5 describe the elements of the Hebron oil spill response plan (OSRP), but the plan itself is still being developed. The purpose of the OSRP is to describe response measures to be implemented in the event of a spill. The level of response required is dependent on the size of the spill event. In developing the OSPR, the plan will consider experience from other operators in the NL offshore, and will include provisions for monitoring and rehabilitation of oiled marine birds. The plan is submitted to the C-NLOPB for approval. The CSR addresses the environmental effects of spills on marine birds in Section 9.5.4.	

Comment 122: C-NLOPB 32

122-C-NLOPB 32	**EA Reference:**	Section 9.5.4.3 Page 9-58, paragraph 3
Preamble:		
Request:	While the detailed oil spill response plan required for the offshore portion of the Project likely will not be formally submitted for some time, greater detail than that presented in the cited paragraph should be available, and provided, in the CSR.	
Response:	EMCP acknowledges that the offshore oil spill response plan is under development; however, Section 14.6 of the CSR provides an outline of the oil spill response plan. **The following text will be at the end of the following sentence "…plan is under development":** "…however, Section 14.6 provides an outline of the proposed spill response plan for offshore operations. Depending on the nature.…"	

Comment 124: C-NLOPB 33

124-C-NLOPB 33	**EA Reference:**	Section 9.5.5.2 Page 9-61, final paragraph
Preamble:	The paragraph states "However, condensate from a deepwater blowout may be considerably reduced when it reaches the surface, and the wind and wave conditions typical of the Grand Banks will further aid in the dispersal of condensate."	
Request:	The relevance of condensate to the paragraph's discussion of oil blowout effects is unclear. This should be clarified or the statement removed.	
Response:	"condensate" will be replaced with "petroleum hydrocarbons" in this paragraph.	

Comment 125: C-NLOPB 34

125-C-NLOPB 34	**EA Reference:**	Section 9.5.7 Page 9-63
Preamble:		
Request:	a) The follow-up / monitoring discussion is weak and over-generalized. At the very least, monitoring of marine birds following an oil spill should be described or referenced, as it is elsewhere in the CSR document. The potential for marine bird observation programs associated with the Project to lessen uncertainty respecting potential spill effects, and potential effects of light/flare attraction, should be discussed further. b) It should be explained whether the marine bird observation program described in paragraph 3 for the MODU program also will be in place during the production platform's operation.	
Response:	a) The Hebron Project is at the conceptual design stage. Environmental effects monitoring programs, for the nearshore and offshore components of the project, are at the very early stages of development. Section 15 of the CSR outlines a proposed process to develop the EEM program. The EEM will be developed in consultation with stakeholders, including the public, regulatory agencies and scientific community. While it is stated in Section 9 that effects monitoring is not planned for marine birds, this statement reflects the conclusions reached in the CSR and refers only to routine operations. The final EEM design may include marine bird monitoring, however, that will be determined as the EEM design process progresses. With regards to an oil spill EEM program, an EEM program specific to spill events will be developed as part of the oil spill response plan. The spill EEM program will include monitoring of marine birds. As described in Section 14, spill response is typically classified according the level of effort required. Each level or tier will have specific response requirements and, depending on the level, specific environmental effects monitoring requirements. **The following text will be added to Section 9.5.7:** EEM programs, for the nearshore and offshore components of the Project, are at the very early stages of development. Chapter 15 of the CSR outlines a proposed process to develop the EEM program. Based on the environmental effects assessment for marine birds, a marine bird EEM component is not contemplated at this stage. The EEM will be developed in consultation with stakeholders, including the public, regulatory agencies and scientific community. The final EEM design may include marine bird monitoring; however, that will be determined as the EEM design process progresses. In the event of a spill, and depending on the nature and size of the spill, marine bird monitoring will be implemented. The details regarding monitoring requirements and protocols will be outlined in the oil spill response plan and will be determined in consultation with the C-NLOPB and Environment Canada. b) EMCP supports initiatives such as the recent ESRF marine bird observation	

	program and will investigate the development of a marine bird observation program from Hebron Project supply vessels, where space is available. MODU drilling programs typically engage a weather observer on staff to undertake dedicated marine bird and marine mammal observations. This position is not currently envisaged for the Hebron Platform, as all weather observations will be automated.

Comment 126: GF 26

126-GF 26	**EA Reference:**:	Section 9.5.7 Follow-up and Monitoring Page 9-63
Preamble:	"*A specific EEM program to verify the accuracy of assessment predictions and the efficacy of mitigation measures is not planned for Marine Birds*."	
Request:	a) This is unacceptable given that birds are a VEC and the most vulnerable to oil (and light) pollution. The EEM should at the very least include a verification of the accuracy of the assessment predictions for accidental spills. Further, EMCP should be required to contribute to the knowledge base on the effects of light and flares as they pertain to attraction. An automated radar system (such as "Merlin" Bird radar; see also Zaugg et al. 2008, Journal of the Royal Society Interface, 5:1041-1053; Hüppop et al. 2006 Ibis 148) should be required as part of the construction of the platform. b) General – the primary stakeholder, ExxonMobil is also the lead operator for the Hibernia Project. When members of the public, including NGOs who participated in EA reviews for Hibernia requested important information on oil spill pollutant data ExxonMobil choose not to disclose this information (Fraser, G.S. and J. Ellis 2008. Reply from Gail Fraser and Joanne Ellis to a letter from CNSLOPB. *Journal of Environmental Assessment Policy and Management.* 10 (4): 483). I request a statement from the EMCP that they have a commitment to disclosure, particularly around oil pollutant data.	
Response:	a) EMCP will include marine bird monitoring as part of its spill environmental effects monitoring program. See Response to Comment 125 C-NLOPB 34 for additional information. See earlier Response to Comment 109: GF 14 and Response to Comment 111: GF 16 regarding use of directional lighting. b) With regard to the disclosure of oil spill data, EMCP is required to report all spills from its operations to the C-NLOPB. This data is reported to the C-NLOPB, as per the *Guideline for the Reporting and Investigation of Incidents* (C-NLOPB and CNSOPB 2009). The C-NLOPB publishes hydrocarbon spill data on its website.	

Comment 127: EC 44

127-EC 44	**EA Reference:**:	Section 9.5.4.3 Potential Mortality Page 9-58, Table 9-13
Preamble:	The numbers in the table need to be updated.	
Request:	Please make the following changes: Wadham Islands Arctic and Common Terns 184^{L} Funk Island: Northern Gannet 9987^{L} Black-legged Kittiwake 100^{N} * Cape Freels and Cabot Island Arctic and Common Terns Common Murre 10000^{L} Baccalieu Island:	

	Northern Gannet 2254[L] Black-legged Kittiwake 6456[L] Common Murre 1697[L] Thick-billed Murre216[L] Razorbill 352[L] Corbin Island: Herring Gull 50[L] The corresponding totals at the bottom of the table need to be changed as well. *** N reference to be added:** Nettleship, D.N. 1980. A guide to the major seabird colonies of eastern Canada, CWS, Dartmouth.
Response:	As confirmed with Environment Canada, the table referenced above should be Table 9-5 on page 9-13. Changes, which are mostly updated data from CWS (unpubl. data), will be made to the table.

Comment 129: EC 46

129-EC 46	**EA Reference:**	Section 9.5.7 Follow-up and Monitoring Page 9-63
Preamble:	The predictions of the CSR (i.e., that light attraction will be not significant) cannot be verified without a follow-up program. CWS is aware that there are no marine bird components in existing EEMs for drilling operations, but it would be valuable for marine bird monitoring to be incorporated into the EEM.	
Request:	Include seabird monitoring in the EEM.	
Response:	See response to Comment 125: C-NLOPB 34.	

3.9 Response to Section 10 Comments

Comment 130: DFO 25

130-DFO 25	**EA Reference:**	10.3.1.2 Fisheries and Oceans Canada Cetacean Sightings Database, Page 10-10
Preamble:	Section 5.3.2.4 request the CSR describe the distribution/abundance of species utilizing the study area.	
Request:	Lawson and Gosselin 2009 should also be referenced in this section as it includes effort measures and density estimates in a stratum that borders the western edge of the operational study area. 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. Canadian Science Advisory Secretariat Research Document. 28p + vi.	
Response:	**Section 10.3.1.2 will be updated as follows:** Lawson and Gosselin (2009) provide preliminary abundance estimates of three mysticete and four small odontocete species based on aerial survey data collected off the south and northeast coasts of Newfoundland. It is difficult to comment on the distribution and relative abundance of cetacean species near the Hebron Study Area vs. adjacent areas given the nature of the report. Overall densities (uncorrected for availability and perception biases) off the south coast of Newfoundland (0.002 cetacean sightings/km^2) were much higher than those (0.0005 cetacean sightings/km^2) off the northeast coast (Table 3 in Lawson and Gosselin (2003)). The south coast survey stratum is adjacent to the western portion of the offshore Hebron Study Area. Overall, preliminary abundance estimates (uncorrected) for cetaceans off the south and northeast coasts of Newfoundland including 95 percent confidence intervals in parentheses are as follows: • Humpback whale 1,427 (952 to 2,140) • Minke whale 1,315 (855 to 2,046) • Fin whale 890 (551 to 1,435) • White-beaked dolphin 1,842 (1,188 to 2,854) • White-sided dolphin 1,507 (968 to 2,347) • Common dolphin 576 (314 to 1,056) • Harbour porpoise 1,195 (639 to 2,235)	

Comment 131: DFO 26

131-DFO 26	**EA Reference:**	Section 10.5 Environmental Effects Analysis and Mitigation Page 10-47
Preamble:	Section 5.3.3.1 of the scoping document requests that the proponent discuss the means by which potentially significant effect may be mitigated through design and/or operational procedures. Section 10.5.1.2 of the CSR describes the environmental effects of surveys, in particular seismic surveys, on habitat quality for marine mammals and sea turtles. While this section does make reference to the *Statement of Canadian Practice with Respect to the Mitigation of Sound in the Marine Environment* (SOCP) it accurate only provides a limited discussion of associated mitigations.	

	For example, the SOCP states that monitoring should be carried out by a qualified Marine Mammal Observer, not a "*dedicated environmental observer*" as specified in the text on Page 10-47 of the CSR. Please be advised that the SOCP specifies the mitigation requirements that must be met during the planning and conduct of marine seismic surveys, in order to minimize impacts on life in the oceans. These requirements are set out as minimum standards, which will apply in all non-ice covered marine waters in Canada
Request:	Provide all mitigation measures as stipulated in the SOCP that will be implemented to minimize any adverse effects on fish, marine mammals and sea turtles.
Response:	As noted on page 10-47 of the CSR "…mitigation measures will follow those outlined in the *Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment* (C-NLOPB 2008)." The Operator is committed to implementing these mitigations, and has committed as such in the CSR. While the CSR lists only a few of the mitigations from the *Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment*, the intent is that all applicable mitigations be implemented. The CSR makes reference to numerous guidelines, regulations and operating practices throughout the report in reference to applicable mitigation measures for project activities. Examples from these references are provided for discussion purposes, and are not meant to be exclusionary. During seismic programs, program specific mitigations will be developed, and will include all applicable mitigations listed in the "Geophysical, Geological, Environmental and Geotechnical Program Guidelines" (C-NLOPB 2008), including those listed in the *Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment*. . **The following text will be modified:** As indicated in the C-NLOPB *Geophysical, Geological, Environmental and Geotechnical Program Guidelines* (C-NLOPB 2008), mitigation measures will follow those outlined in the *Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment* (C-NLOPB 2008), but not limited to: • Ramp-up of the airgun array over a minimum of 20 minutes • Monitoring by a trained marine mammal observer • Delay of ramp-up if any marine mammal or sea turtle is sighted within the 500 m safety zone • Shutdown of the airgun array when a Schedule 1 endangered or threatened marine mammal or sea turtle is sighted within the 500 m safety zone

Comment 132: C-NLOPB 35

132-C-NLOPB 35	**EA Reference:**	Section 10.5.4.3 Page 10-75 – 10-76
Preamble:		
Request:	The applicability to the Hebron Project of the references to "condensate" is unclear and should be clarified.	
Response:	"Gas / oil condensate" and "condensate or oil" will be replaced with "petroleum hydrocarbons" in this section.	

3.10 Response to Section 11 Comments

Comment 133: DFO 27

133-DFO 27	**EA Reference:**	Section 11.1.3 – Administrative Page 11-3
Preamble:	There are several errors in the text about SARA that need to be addressed.	
Request:	a) The purpose of SARA as stated is not entirely correct. Replace text "management of other species to prevent from becoming at risk" with "manage species of special concern to prevent them from becoming endangered or threatened. b) There is reference made to Schedules 2 and 3 of SARA. Note that there are no species left to be reassessed on Schedule 2 and many of the Schedule 3 species have also been re-assessed. c) Section 32 of SARA as worded in this section is incorrect – it does not include critical habitat. Section 32 prohibits the killing, harming harassing, capturing, taking, etc. of an extirpated, endangered or threatened species. Section 33 deals specifically with damage and destruction of residences and Section 58 deals with the destruction of critical habitat. The text should be revised accordingly. d) The 3rd paragraph lists existing recovery strategies/mgmt plans. The Recovery Strategy for North Atlantic Right Whale should also be included.	
Response:	a) Although the existing statement in the CSR is consistent with statements published on the *SARA* registry website, **the text in Section 11.1.3 will be revised as follows** to address the reviewer's comment: The objective of *SARA* is to prevent Canadian indigenous species, subspecies and distinct populations of wildlife from becoming extirpated or extinct, to provide for the recovery of endangered or threatened species, and to manage species of special concern to prevent them from becoming endangered or threatened. b) As indicated in Table 11-2, there are Schedule 2 and Schedule 3 species that may be present in the Study Area. The Harbour Porpoise and Sowerby's Beaked Whale remain on Schedule 2 and Schedule 3, respectively and have not been assessed since 2006. The statement in the CSR remains valid. c) **Section 11.1.3 will be revised to accurately reflect the relevant sections of SARA as noted. The new text reads as follows:** Section 32 of *SARA* prohibits the killing, harming, harassing, capturing or taking of an individual of a wildlife species that is listed as extirpated, endangered, or threatened. Section 33 prohibits the damage or destruction of the residence of an endangered, threatened or extirpated species. Section 58 prohibits the destruction of critical habitat of any listed endangered or threatened species, or of any extirpated species for which a recovery strategy has been recommended. *SARA* defines critical habitat as the habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified in the species' critical habitat in the recovery strategy or in an action plan for the species. d) The CSR will be edited to include the North Atlantic right whale to the list of species with recovery strategies**.**	

Comment 134: DFO 28

134-DFO 28	**EA Reference:**	Section 11.3 - Existing Conditions Page 11-5
Preamble:	There are several items that need to be addressed or revised in Table 11.2.	
Request:	a) For American Plaice it should be noted that it is the Newfoundland and Labrador population being referred to.	

	b) It is not necessary to refer to the COSEWIC status of species which are listed on Schedule 1 of SARA. c) Earlier in the document (Table 7-2), it mentions that redfish may occur. Since Table 11.2 includes species assessed by COSEWIC, then it should be updated to include Deepwater and/or Acadian Redfish (as applicable) as both these species have been recently assessed by COSEWIC. For Deepwater Redfish, the Gulf of St. Lawrence/Laurentian Channel population was assessed as endangered and the Northern population was assessed as threatened. For Acadian Redfish, the Atlantic population was assessed as threatened and the Bonne Bay population was assessed as special concern. d) Earlier in the document (Section 10.3.3) it mentions that Loggerhead Sea Turtle may occur. This species was recently assessed by COSEWIC as endangered. Table 11.2 should be updated to include this.
Response:	a) Table 11-2 will be revised to reference the Newfoundland and Labrador population for American Plaice. b) Comment noted; however, for consistency in presentation, this text shall remain in spite of its redundancy. c) Table 11-2 will be updated to include the relevant populations of Deepwater Redfish and Acadian Redfish as noted (they are assessed and managed as one population but the Study Area would have Acadian redfish (Atlantic population) and deepwater redfish (northern population)) and text will be added in Section 11.3.1. d) Loggerhead Sea Turtle will be added to Table 11.2 and text will be added in Section 11.3.2.

Comment 135: DFO 29

135-DFO 29	**EA Reference:**	Section 11.3.1.1 – Atlantic Cod Page 11-6
Preamble:	Cod was recently re-assessed by COSEWIC and the information in this section needs up-dating.	
Request:	Revise text to indicate that the Laurentian North population is now assessed as endangered, not threatened.	
Response:	Text in Section 11.3.1.1 will be revised to show update in COSEWIC status as of April 2010.	

Comment 136: DFO 30

136-DFO 30	**EA Reference:**	Section 11.3.1.3 – American eel Section 11.3.1.6 – Grenadier Section 11.3.1.8 – Blue shark Section 11.3.1.11 – White shark Section 11.3.2.4 – Killer whale Section 11.3.2.5 – Harbour porpoise
Preamble:	The same comment applies to all of the above sections. The wording used to describe COSEWIC assessments is inaccurate.	
Request:	COSEWIC does not “list” species. Where the document indicates that a species is “listed by COSEWIC” the wording should be changed to indicate that a species is “assessed by COSEWIC as…”	
Response:	Text will be revised throughout to Section 11.3 as requested.	

Comment 137: DFO 31

137-DFO 31	**EA Reference**	Section 11.3.2. – Marine Mammals and Sea Turtle Species at Risk, Page 11-25
Preamble:	The recovery strategies published for marine mammals and sea turtles are listed in this section.	
Request:	It should be noted that there is also a recovery strategy published for the North Atlantic Right Whale.	
Response:	**Section 11.3.2 will be revised to reference the recovery strategy for the North Atlantic Right Whale (Brown et al. 2009).** **The following reference will be added:** Brown, M.W., D. Fenton, K. Smedbol, C. Merriman, K. Robichaud-Leblanc and J.D. Conway. 2009. *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. vi + 66 pp.	

3.11 Response to Section 12 Comments

Comment 138: DFO 32

138-DFO 32	**EA Reference:**	Section 12.4.1 Near shore (Project-Valued Ecosystem Component Interactions), Page 12-13
Preamble:	The scoping document requires the CSR to discuss the environmental effects of the project on sensitive areas. The first paragraph in this section states that, "*These potential effects are fully considered and assessed in the respective VECs (i.e., Marine Fish and Fish Habitat, Marine Birds)*", which implies a complete assessment of all relevant species that may be affected by the development. However, this may not be the case. There are several large (>1000 m^2) productive eelgrass meadows within a 20 km radius of the Bull Arm site. The head of Bull Arm itself is particularly productive, through the presence of eelgrass nursery meadows, pebble-cobble areas, and extensive kelp and algae species, all of which provide cover for a variety of ground fish species, particularly juveniles of several prominent marine commercial species.	
Request:	Please revise this section to include the species to be affected by the impacts on these sensitive areas.	
Response:	The fish species that are likely to be present in the eelgrass include juvenile and adult cunner, juvenile lumpfish, juvenile lobster and pelagic juvenile Atlantic cod and herring spawn in eelgrass. The environmental assessment of accidental events on marine fish species in the nearshore includes a discussion applicable to most species and is detailed in the Marine Fish VEC in Section 7.5.4. In addition, it is acknowledged that the environmental effect from an accidental event on the habitats is rated as significant.	

Comment 139: DFO 33

139-DFO 33	**EA Reference:**	Section 12.4.1 Near shore (Project-Valued Ecosystem Component Interactions) p. 12-13
Preamble:	The last paragraph on this page states that, "*There is potential for eelgrass beds to be physically affected by an accidental oil spill in the near shore environment during construction, which could result in a change in habitat quality and mortality of individual plants.*" This statement understates a more serious concern, which would be the disruption or destruction of a significant portion of an entire eelgrass meadow. This should also be addressed in Table 12-2 and the environmental effects analysis.	
Request:	Please revise this section to include the impact an entire eelgrass meadow. IN additional please revise the Section 12.4.3 Summary to reflect these changes.	
Response:	According to the literature (Den Hartog and Jacobs 1980; Jewett and Dean 1997; Dean *et al.* 1998), it is unlikely that the entire meadow will be destroyed; it suggests recovery of the eelgrass within two to three years. The environmental effect was not understated as is has been predicted that such an environmental effect could be significant. **The sentence will be revised to the following:** There is potential for eelgrass beds to be physically affected by an accidental oil spill in the near shore environment during construction, which could result in a potential widespread die-off of individual plants.	

3.12 Response to Section 13 Comments

Comment 140: C-NLOPB 36

140-C-NLOPB 36	**EA Reference:**:	Section 13.4.6 Sea Ice and Icebergs Page 13-7
Preamble:		
Request:	What is the duration of the data set that sea ice is based on.	
Response:	The duration of the data is 1983 to 2008 inclusive (CIS Ice Charts). **The text in Section 13.4.6 will be revised as follows:** The Hebron location has experienced sea ice incursions at a rate of one in every four years, with a peak of 14 percent probability centred on two periods, the first in the last week of February and the second on the first week of April. The duration of the incursions vary from a low of one week to a high of seven weeks. Of the 11 years that ice was present, the average duration was three weeks. These statistics are based on Environment Canada CIS's Sea Ice Charts (1983 to 2008). The number of icebergs drifting south of 48°N each year has varied from a low of zero in 1966 and 2006 to a high of 2,202 in 1984, with the average over the last 20 years (using 1989 to 2008 PAL data) ranging between 725 to 752 icebergs. Of these, only a small proportion has passed through the Offshore Project Area. Over the last 10 years, the average annual number of icebergs sighted in the Hebron Offshore Project Area has been 31. The majority (73 percent) of the icebergs south of 48°N fall within the small to medium categories.	

3.13 Response to Section 15 Comments

Comment 168: TC 2

168-TC 2	**EA Reference:**:	Section 15.3 Other Required Programs Page 15-7, Paragraph 2
Preamble:		
Request:	A bullet should be added detailing that compliance monitoring will be required for any approvals issued under the NWPA. The Bullet should state: "**Compliance monitoring to ensure that the *Navigable Waters Protection Act* Conditions of Approval are implemented as outlined by Navigable Waters Protection Program of Transport Canada**".	
Response:	**Section 15.3 of the CSR will be revised to include the following bullet:** • Compliance monitoring to ensure that the *Navigable Waters Protection Act* Conditions of Approval are implemented as outlined by Navigable Waters Protection Program of Transport Canada	

3.14 Response to Section 17 Comments

Comment 169: C-NLOPB 56

169-C-NLOPB 56	**EA Reference:**:	Section 17.2.2 Summary of Proposed Mitigation Measures Page 17-3, Table 17-2 Offshore Construction and Installation
Preamble:	The bullets list some of the mitigation outlined in the Geophysical, Geological, Environmental and Geotechnical Program Guidelines.	
Request:	For completeness, the following mitigation should be added: "Adherence to the Geophysical, Geological, Environmental and Geotechnical Program Guidelines".	
Response:	The section on Offshore Construction and Installation, Table 17-2 in Section 17.2.2 of the CSR, does include the above suggested mitigation, as the last bullet of mitigations listed for the following VECs: • Fish and Fish Habitat • Marine Birds • Marine Mammals and Sea Turtles • Species at Risk (Marine Fish, Marine Mammals and Sea Turtles, and Marine Birds)	

Comment 170: TC 3

170-TC 3	**EA Reference:**:	Section 17.2.2 Summary of Proposed Mitigation Measures Page 17-3, Table 17-2, Third Column
Preamble:	Section 5 of the CSR indicates that public concerns were raised related to increase vessel traffic and the potential for floating debris at the near shore construction site. The NWPA protects the public's right to safe navigation. Given these public concerns, a mitigation bullet should be added to the Commercial Fisheries VEC regarding the NWPA.	
Request:	Mitigation should state: "**Compliance with *Navigable Waters Protection Act* – Conditions of Approval**".	
Response:	**The section on Offshore Construction and Installation, Table 17-2 in Section 17.2.2 of the CSR, will be revised to include the following bullet in the mitigations listed for Commercial Fisheries:** • Compliance with *Navigable Waters Protection Act* – Conditions of Approval	

Comment 171: C-NLOPB 57

171-C-NLOPB 57	**EA Reference:**:	Section 17.2.2 Summary of Proposed Mitigation Measures Page 17-4, Table 17-2 Potential Future Construction Activities
Preamble:	The bullets list some of the mitigation outlined in the Geophysical, Geological, Environmental and Geotechnical Program Guidelines.	
Request:	For completeness, the following mitigation should be added: "Adherence to the Geophysical, Geological, Environmental and Geotechnical Program Guidelines".	
Response:	**The section on Offshore Construction and Installation, Table 17-2 in Section 17.2.2 of the CSR, will be revised to include the following bullet in the mitigations listed for Fish and Fish Habitat, Marine Birds, Marine Mammals and**	

	Sea Turtles and Species at Risk (Marine Fish, Marine Mammals and Sea Turtles) • Adherence to the *Geophysical, Geological, Environmental and Geotechnical Program Guidelines*

Comment 172: TC 4

172-TC 4	**EA Reference:**:	Section 17.2.2 Summary of Proposed Mitigation Measures Page 17-5, Table 17-2, Fourth Column
Preamble:	Mitigation states; "Adherence with all standard navigation procedures, Coast Guard requirements and navigation systems."	
Request:	Given Transport Canada has responsibility for the *Canada Shipping Act* and the *Navigable Waters Protection Act*, TC suggest re-wording to: "Adherence with all standard navigation procedures, **Transport Canada requirements**, Coast Guard requirement and navigation systems".	
Response:	**The section on Accidental Events, Table 17-2 in Section 17.2.2 of the CSR, will be revised to include the following bullet in the mitigations listed for all VECs** • Adherence with all standard navigation procedures, Transport Canada requirements, Coast Guard Requirements and navigation systems	

4.0 GOVERNMENT AGENCY GENERAL COMMENTS

4.1 Response to Environment Canada General Comments

173-EC	**Section 13.3.2** - There is a comment that *"site specific weather and oceanographic data are typically collected as part of the physical environment monitoring program, which will enhance the physical database for the area*"…This does not appear to be a firm commitment to actually perform the monitoring and to provide the data to appropriate bodies such as Environment Canada. Please review the wording and revise as appropriate.
Response:	EMCP and the Project will adhere to the Operator requirements concerning the observing, forecasting and reporting of physical environmental data (*i.e.*, wind, waves, current, ice) as presented in the Physical Environmental Guidelines (NEB, C-NLOPB and C-NSOPB 2008).
174-EC	**Section 13.3.4** - In reference to storm surges, there is a mention of extreme water level being 1.52 metres above mean water level. Should this not be above highest astronomical tide, which would be significantly higher.
Response:	No. As presented in Section 3.1.2.5, the Mean Water Level (MWL) for the Marex (1992) analysis is 2.24 m below the GULL benchmark and 0.96 m above CHS chart datum (Marex 1992). We acknowledge the text (taken Section 3.1.2.5) is not as clear as it could be in this section. Instead, **the second paragraph of Section 13.3.4 will be replaced as follows:** An estimate of 100-year maximum water level is +1.52 m above Mean Water Level (MWL) (Marex 1992). This includes the standard deviation of the MWL, the dominant (M2 and S2) tide, the 50-year storm surge and the standard deviation of the 50-year surge. A 100-year minimum water level of -1.20 m below MWL is similarly estimated. A more conservative estimate of extreme maximum water level would be +1.68 m above MWL taken as the sum of highest astronomical tide (HAT) (0.80 m above MWL) and the 100-year positive surge amplitude (0.88 m above MWL). Similarly, a more conservative estimate of extreme minimum water level would be -1.45 m below MWL taken as the sum of lowest astronomical tide (LAT) (-0.91 m below MWL) and the 100-year negative surge amplitude (-0.54 m below MWL) (Marex 1992).
175-EC	**Section 13.4.2** – In the discussion about the wave climate, there is a paragraph which describes when sea states would be below Beaufort Force thresholds. Have the winds speeds been looked at in terms of Beaufort wind categories and then the typical sea states that are associated with those wind speeds applied. This would not take into account any swell and therefore could be rather misleading.
Response:	As noted in the Section 13.4.2 text, Beaufort Force (BF) sea state threshold conditions were analyzed. The analysis mentioned was of the nine-year Hibernia wind, wave, and current (for 5 year) time-series, where waves include swell. BF was assigned based on Hs, with the following mapping as a function of probable maximum height of waves:

Hs (m)	Beaufort Force Scale
<1.0	3
≥1.0 and ≤1.5	4
>1.5 and ≤0.5	□
>2.5 and ≤4.0	6
>4.0 and ≤5.5	7
>5.5 and ≤7.5	8
>7.5 and ≤10.0	□
>10.0 and ≤1□.5	10
>12.5 and ≤16.0	11
>16	□□

	The persistence analysis was then completed on the new BF variable. **Last paragraph, p. 13-5, will be edited as follows:** …seas *(including swell)* will persist below …

4.2 Response to Transport Canada General Comments

176-TC 5	1) In accordance with the *Navigable Waters Protection Act*, the proponent is required to submit an Application (s) for Project Review, complete with scaled drawings, for any new, repaired, altered, or rebuilt in-water works located at the near shore site. Complete applications are to be forwarded to: Navigable Waters Protection Program Transport Canada – Marine Safety P.O. Box 1300 St. John's, NL A1C 6H8 Tel: (709) 772-2284 2) The CSR indicates the proponent is aware of the various regulations under the *Canada Shipping Act* that apply to the project. The proponent, or any of the proponent's contractors, are encouraged to contact Transport Canada – Marine Safety at (709) 772-5166 should they have any questions regarding the *Canada Shipping Act*. 3) Throughout the CSR, the proponent indicates they will prepare a Vessel Traffic Management Plan to help mitigate interactions with project vessels and commercial fishing vessels. Transport Canada – Marine Safety would like an opportunity to review the proposed Vessel Traffic Management Plan. A copy of the plan can be forwarded to: Compliance and Enforcement Transport Canada – Marine Safety John Cabot Building, 10 Barter's Hill P.O. Box 1300 St. John's, NL A1C 6H8 Tel: (709) 772-5166
Response:	Thank you for the contact information. EMCP will consult with Transport Canada on all aspects of the Project that fall within Transport Canada's authority.

4.3 Response to Newfoundland and Labrador Department of Environment and Conservation General Comments

177-NLDEC 1	The following comments relate to the regulatory mandate of ENVC and the Pollution Prevention Division, Waste Management Section.
	• Operations in the near shore and marine environment will be regulated by the Canada-Newfoundland and Labrador Offshore Petroleum Board and the Federal Government.
	• As stated in the report, land-based activities in Bull Arm will comply with provincial legislation. The Department of Environment and Conservation (ENVC) requires an Environmental Protection Plan for the Bull Arm site. ENVC looks forward to assessing this plan as well as the following supporting documentation. The following documents were referenced in the Comprehensive Study Report.
	  • Waste Management Plan
	  • Oil Spill Response Plan
	  • Community Liaison Plan

	• While the EPP and other documents will require more detailed assessment, it is noted that the Bull Arm Fabrication Site was used for similar construction purposes in the past. Therefore, the environmental footprint of the Hebron Project is not expected to be significant from a near shore / land-based perspective. • It is encouraged that an oil spill response plan considers waste management issues and coastal zone impacts. • The near shore spill-modelling scenario refers to a diesel spill between 500 – 5000 gallons. It is agreed that the majority of modelling scenarios would result in spilled diesel remaining in the Bull Arm area. Diesel is a light end hydrocarbon and it is agreeable that impacts would be localized in nature. • The maximum impact that would result from an accidental event would be a spill of crude oil that reaches the coastline. Even in the offshore, a major spill of crude could eventually reach shorelines of NL. Once oil contaminates the shoreline, the magnitude of impacts and volumes of oily waste are significantly increased.
Response:	Thank you for the information on ENVC's mandate and responsibilities. EMCP will consult with ENVC on all aspects of the Project that fall within ENVC's authority. An Environmental Protection Plan for the Bull Arm site will be submitted to the NLDEC.
178-NLDEC 3	The following comments relate to the regulatory mandate of ENVC and the Water Resources Division. The approvals and permits that WRMD would issue for this project are mainly related to the site infrastructure and construction of the dry dock. At this stage there has been limited information provided in this document to outline the site infrastructure requirements for this project. In addition, this may be the responsibility of Nalcor as they are the owners of the site. The following is a general list of permits/approvals which may be required by WRMD for site infrastructure and construction of the dry dock: The proponent will require approval from this Division under Section 39 of the *Water Resources Act* for the proposed development within Protected Water Supply Areas. Contact: Manager, Surface Water Section (709) 729-2535 The proponent must obtain a permit under Sections 36 & 37 of the *Water Resources Act* prior to the start of construction. Contact: Manager, Surface Water Section (709) 729-2535 The proponent must apply for a non-domestic drilled well permit under Section 58 of the *Water Resources Act* for the proposed drilled well(s) Contact: Manager, Groundwater Section (709) 729-2939. The proponent must obtain a Water Use License from this Division for the non-domestic use of water. Contact: Manager, Water Rights Section (709) 729-4795 The proponent will require approval from this Division under Section 48 of the *Water Resources Act* before starting construction activities within 15 metres of any water body (including wetlands). Construction activities include all stream crossings, drainage works, fording and any other work such as landscaping, clearing or cutting of any natural vegetation within 15 metres of a body of water. Contact: Manager, Water Investigations Section (709) 729-5713 Any effluent or runoff leaving the site will be required to conform to the requirements of the *Environmental Control Water and Sewage Regulations*, 2003.
Response:	Thank you for the contact information. EMCP will consult with ENVC's Water Resources Division on all aspects of the Project that fall within the Water Resources Division's authority.

5.0 ADDITIONAL DEFICIENCIES AND EDITORIAL COMMENTS FROM FISHERIES AND OCEANS CANADA

179-DFO	A) **4.0 Effects Assessment Methods** A1) 4.3.1 Step 1 – Scoping Issues and Selecting Valued Ecosystem Components; Page 4-4 Under the Fish and Fish Habitat section, the first bullet should read "*Provisions of the Fisheries Act pertaining to the* ***harmful alteration, disruption or destruction*** *of fish habitat…*"
	Response: The bullet in the CSR will be revised at noted.
	A2) 4.3.3 Step 3 – Definition of Significance; Page 4-10 Fish and Fish Habitat The definition of a significant adverse environmental effect is somewhat confusing. This definition should be revised to the following "…would be one that results in a residual effect (i.e., harmful alteration, disruption or destruction of fish habitat) that is so large and/or the fish and fish habitat is of such importance that it cannot be adequately compensated for." This definition should also be revised in **Section 7.2 Definition of Significance p. 7-3, par. 2**
	Response: The suggested definition appears to address fish habitat only. However, the definition of "significant effect" for Fish and Fish Habitat considers two separate but related definitions for this VEC. It is necessary (and standard practice) to consider both Fish and Fish Habitat to adequately assess the Project effects to the VEC. The definition for a significant effect to fish is population-based, as are the definitions for the other biological VECs, and the definition for a significant effect to habitat is based on the no net habitat loss policy.
	B) 7.0 Fish and Fish Habitat B1) Some fish species descriptions are absent from this section, but appear in later sections of the document, most specifically the Species at Risk section. These species should at least be cross-referenced here, so the reader can locate the information easily.
	Response: Cross-references have been added in Section 7 where species description appears in CSR.
	B2) It should be noted throughout the assessment of fish and fish habitat that stocks are interrelated (i.e., have a connection with other areas), although knowing exactly what this connection is may be uncertain. It is also important to recognize that surveys are simply snapshots in time as fish tend to continually move in and out of areas.
	Response: The following statement will be added to Section 7.3 Existing Conditions: While reviewing information on fish and fish habitat, it is important to note that stock assessment surveys are snapshots in time and space since fish tend to continually move in and out of certain areas.
	B3) 7.3.1.5 Fish and Shellfish; Page 7-10 (Greenland Halibut) This section states that, "*Although Greenland halibut can be found in small numbers at depths of less than 100 m, most of them are caught near the sea bottom at depths of between 200 to 600 m. In the southern part of the range; however, they go as deep as 1,500 m*". This statement is not entirely accurate as, "*Greenland Halibut can be found at depths ranging from less than 100 m to deeper than 1,500 m*" and although they are predominantly considered a deepwater fish, they are generally found at all depths.

	Response: Based on the comments provided, the text will be modified as follows: Although Greenland halibut can be found at depths of less than 100 m, most of them are caught near the sea bottom at depths of between 200 to 600 m. In the southern part of the range they can be found at depths of 1,500 m.
	B4) 7.3.2 Offshore; Page 7-16 The second paragraph in this section states that, "*DFO RV data from 3Lt have also been reviewed along with relevant fish and fish habitat primary literature for the Hebron Offshore Study Area.*" In order to provide an accurate depiction of the species composition and abundance in the **Offshore Study Area**, surveys within other subdivisions of 3L and 3N, which fall within the Study Area should also be included. Depending on the findings, the assessment of impacts on fisheries may need to be revisited accordingly.
	Response: DFO RV data have been requested for 3N to compliment the 3L data that were reviewed for the Hebron Offshore Area. However, in absence of these data, a review of a recent Environmental Assessment completed for a similar study area (Christian 2008) was undertaken to ensure the assessment of the effects on fisheries was covered. The review of this document provided similar findings as are presented in this CSR and no changes are expected to be required with respect to the assessment of the effect on fisheries with the inclusion of 3N data.
	B5) Page 7-19; Table 7-2 should include American Plaice.
	Response: As suggested, American Plaice will be added to Table 7-2: **Fish Species**: American Plaice **Spawning Period**: April to June **Spawning Location**: Throughout the Grand Banks; most intensive in Northern Grand Banks **Timing of Pelagic Eggs/Larvae**: American plaice eggs float near the surface and hatch within 11 to 14 days at temperatures of 3.9°C. Larvae are concentrated near the thermocline at approximately 20 m until they reach a length of approximately 25 mm, the average length for settlement). Larvae, therefore, may settle to substrate far removed from where the eggs were fertilized. However, plaice larvae are retained on the eastern edge of the Grand Banks by the Labrador Current. References: Scott, W.B. and M.G. Scott. 1988. *Atlantic Fishes of Canada*. *Canadian Bulletin of Fishery and Aquatic Sciences*, 219: 731 pp. Frank, K.T., J.W. Loder, J.E. Carscadden, W.C. Leggett and C.T. Taggart.1992. Larval flatfish distributions and drift on the southern Grand Bank. *Canadian Journal of Fisheries and Aquatic Sciences*, 49: 467-483. Morgan, M.J. 2001. Time and location of spawning of American plaice in NAFO Divisions 3LNO. *Journal of Northwest Atlantic Fishery Scienc*e, 29: 41-49. Ollerhead, L.M.N., M.J. Morgan, D.A. Scruton and B. Marrie. 2004. Mapping spawning times and locations for 10 commercially important fish species found on the Grand Banks of Newfoundland. *Canadian Technical Report of Fisheries and Aquatic Sciences*, 2522: iv + 45 pp.
	B6) 7.3.2.3 Plankton; Page 7-18 The last paragraph in this section states that ichthyoplankton may include jellyfish and squid. This is incorrect as "*ichthyoplankton*" refers to fish eggs and larvae. While jellyfish and squid may have been found during ichthyoplankton surveys, they are not considered ichthyoplankton.

	Response: Jellyfish and squid have been removed from the list to avoid confusion.
	B7 7.3.2.4 Benthos Although the CSR mentions the numbers of trawls reporting a particular coral species, it would be beneficial to present this number in the context of the total number of trawls taken.
	Response: The following text will be added to Section 7.3.2.4: During this period (2003 to 2008), there were 83 trawls conducted, with 64 of these trawls recording data on the corals species ranging from 0 to 132 corals per trawl. Six of the sixty-four had the number of corals species caught per trawl greater than three.
	B8) Page 7-20 This section refers to, "…*short-lived polychaetes, amphipods and cumaceans*". Please provide supporting reference(s).
	Response: The following reference will be added: Kenchington, E.L.R., J. Prena, K. Gilkinson, D.C. Gordon, K. MacIsaac, C. Bourbonnais, P. Schwinghamer, T.W. Rowell, D.L. McKeown and W.P. Vass. 2001. Effects of experimental otter trawling on the macrofauna of a sandy bottom ecosystem on the Grand Banks of Newfoundland. *Canadian Journal of Fisheries and Aquatic Sciences*, 58: 1043-1057.
	B9) 7.3.2.5 Fish and Shellfish More recent references than Methven 1999 exist on the diet of ground fish in the area. Since there has been a regime shift on the Newfoundland shelf over time, the most up to date information should be incorporated into the CSR. Information on the biology of a species, including feeding habits, can be found in the most recent CSAS or NAFO documents for that species.
	Response: Additional research has been conducted for supplementary information on the biology of species discussed in the CSR, focusing on feeding habits. However, there does not appear to be an abundance of updated references that provide additional data that conflicts with what has been reported previously. The CSR will be updated as relevant, including reference of Link *et al.* (2002) to update information on diet of yellowtail flounder and witch flounder. Reference: Link, J.S., K. Bolles and G.C. Milliken. 2002. The Feeding ecology of flatfish in the Northwest Atlantic. *Journal of the Northwest Atlantic Fisheries Science*, 30: 1-17.
	B10) Page 7-29 The second paragraph on this page states that, "*There are several other species that are so infrequent, there is little chance of an interaction with the Project.*" It is important to note that just because a species is infrequent, does not mean it is unimportant or does not need to be considered. In fact, the opposite may be true, particularly for some rare species and/or structural species such as corals and sponges. In addition, although plaice are no longer concentrated in Div. 3L (but are increasing slightly in the area), it does not mean they are infrequent. Notably, habitat in the area is very important to the recovery of American Plaice.
	Response: Noted. Paragraph will be revised to read: The environmental effects of the Hebron Project are assessed for the principal fish species that occur within the Hebron Offshore Study Area. Some of the species considered in this assessment are less common than others in the Offshore Study Area for various reasons (*e.g.*, fluctuations in abundance, differences in habitat preference). Species at risk, such as American plaice, are specifically addressed in Section 11.3.1.

	B11) Page 7-32 (Greenland Halibut) The caption for Figure 7-6 references Yellowtail Flounder when it should in fact be Greenland Halibut.
	Response: The caption for Figure 7-6 will be updated to Greenland Halibut.
	B12) Page 7-33 (Greenland Halibut) The first paragraph on this page states that, "*Spawning occurs during the winter in the Davis Strait….*" This information should be checked against more recent references, as it may prove the statement to be inaccurate.
	Response: The CSR will be updated as follows: Spawning occurs from December to April in the north and August in the south with some evidence of year round spawning (Morgan *et al.* 2003). Morgan, M.J., W.R. Bowering, A.C. Gundersen, A. Hoines, B. Morin, O. Smirnov and E. Hjorleiffson. 2003. A comparison of the maturation of Greenland halibut (*Reinhardtius hippoglossoides*) from populations throughout the North Atlantic. *Journal of the Northwest Atlantic Fisheries Science*, 31: 99-112.
	B13) Page 7-33 (Yellowtail Flounder) Although it states that, "*Historically, their distribution has included the northern portion of the Grand Banks (Walsh et al. 2000) and, therefore may occur within the Offshore Project Area*", according to recent NAFO documents the distribution of Yellowtail Flounder, since their population increase in 2000, has been returning to its historical pattern and a greater proportion of the stock is found in Div. 3L.
	Response: The CSR will be updated as follows: Historically, their distribution has included the northern portion of the Grand Banks (Walsh *et al.* 2000); however, a more recent study shows increases in biomass in Division 3L which is thought to be the result of an extension of the range of yellowtail flounder with increasing stock size (Walsh *et al.* 2006). **The following reference will be added:** Walsh, S.J., M.F. Veitch, W.B. Brodie and E. Colbourne. 2006. Distribution and Abundance of Yellowtail Flounder (*Limanda ferruginea*) on the Grand Bank, NAFO Divisions 3LNO from Canadian bottom trawl survey estimates from 1984-2006. *Northwest Atlantic Fisheries Organization Scientific Council Research Document*, 06/41: 50 pp.
	B14) Page 7-40 (Redfish) It is likely that Figure 7-11 is inaccurate as Redfish are more common than indicated according to recent NAFO documents.
	Response: Acknowledged. A review of recent publications did not result in more recent figures. These figures illustrate the point that redfish distribution within the Hebron area is patchy and variable.
	B15) 7.4 Project-Valued Ecosystem Component Interactions; Page 7-41 In the interactions summary categories a "*Change in Habitat Quantity*" is noted as, "*Project activities that may result in physical alteration of fish habitat, and may be declared a HADD of fish habitat by DFO and require a Section 35(2) Fisheries Act Authorization.*" This should be revised to read "*Project activities that may result in **the harmful alteration, disruption or destruction of fish habitat**, and may be declared a HADD of fish habitat by DFO and require a Section 35(2) Fisheries Act Authorization.*"
	Response: The interaction summary definition for "Change in Habitat Quantity" will be revised as follows: Project activities may result in the harmful, alteration, disruption or destruction of fish habitat, and may be declared a HADD of fish habitat by DFO and require a Section 35(2) *Fisheries Act* Authorization.

	B16) Page 7-42 With regards to a "*Change in Habitat Quality*" it should be noted that this could be considered a harmful alteration or disruption of fish habitat and may be declared a HADD of fish habitat by DFO and require a Section 35(2) *Fisheries Act* Authorization.
	Response: The interaction summary definition for "Change in Habitat Quality" will be revised as follows: Project activities may result in the harmful, alteration, disruption or destruction of fish habitat, and may be declared a HADD of fish habitat by DFO and require a Section 35(2) *Fisheries Act* Authorization.
	B17) Table 7-9 There are numerous instances where a change in habitat quality has been noted for a particular activity, however, DFO is of the opinion that no change in habitat quality will occur. Below is a list of these activities. This table, as well as other tables within this section should be updated to remove this environmental effect or a justification should be provided as to why the effect should remain. -Operation of vessels/vessel traffic -Lighting -Tow-out of GBS to Bull Arm deepwater site -GBS ballasting and de-ballasting (seawater only) -Complete GBS construction and mate topside at Bull Arm deepwater site -Hook-up and commissioning of Topsides -Various surveys -Platform tow-out to deepwater site. -Hook-up and commissioning of Hebron platform -Hook-up, production testing and commissioning of excavated drill centres -Presence of structures Since Table 7-11 noted that OLS installation and testing could result in potential fish mortality, then Table 7.9 should be updated to reflect this information as well. Since Table 7-12 indicates that the potential future operational activity of geophysical/seismic surveys could result in potential fish mortality, then Table 7.9 should be updated to reflect this information as well.
	Response: Tables 7-9, 7-11 and 7-12 in the CSR will be revised as per the reviewer's comments. Payne *et al.* (2008) concluded that seismic-related fish mortality is possible only in shallow, confined embayments.
	B18) 7.5.1.1 Change in Habitat Quantity (Construction and Installation); Page 7-47 The fist paragraph on this page states that, "*The footprint of the bund wall, the area of the dry-dock, the area to be dredged and the footprint of any at-sea disposal will be quantified and detailed within the Habitat Compensation Strategy report for the Hebron Project*." While this level of detail is not required in a Fish Habitat Compensation Strategy, a separate document detailing the HADD quantification should be submitted to DFO.
	Response: Noted. A fish habitat Compensation Strategy will be submitted and will provide an overview of the expected habitat alteration, disruption or destruction of fish habitat. Details regarding the quantification of fish habitat will be provided to DFO as part of the information requirements for the *Fisheries Act* authorization.
	B19) The second paragraph on this page states that, "*The bund wall footprint and the area to be drained for the dry-dock in Great Mosquito Cove may temporarily affect to a small degree, the quantity of available habitat for fish and shellfish for an estimated 24 months.*" While it is true that this change in habitat quantity will be temporary, it is

	important to note that construction of the bund wall and dry-dock dewatering may still constitute a HADD of fish habitat.
	Response: Noted.
	B20) 7.5.1.2 Change in Habitat Quality (Construction and Installation); Page 7-52 Two of the mitigation measures being considered to reduce sediment loading during construction are, "*Investigate the use of washed rock or in-water sediment control measures for fill material in the construction of the bund wall*" and "*Investigate technologies to reduce sedimentation during dredging operations*" There should be a commitment to implement, not investigate, these standard mitigations, which are commonly recommended by DFO for the protection of fish and fish habitat. Similar statements are made throughout the text and tables within this document. These statements should also be revised accordingly.
	Response: Sediment control measures are standard mitigations to implement for in-water work; however, the efficacy of some of these standard measures may not be understood for such an undertaking in Great Mosquito Cove. EMCP will implement proven sediment control measures. The statement in the CSR is meant that different measures will be investigated, and a proven method will be implemented.
	B21) Table 7-11 Although the following comments were made regarding information contained within Table 7-11 on page 7-62, they also pertain to the text portion of Section 7 and Table 7-9 on page 7-44. **Near shore Project Activities:** • **Presence of Safety Zone** The duration for presence of safety zone is noted as a "*2*" (1-12 months), it should in fact be a "*3*" (13-36 months) to correspond to the life of the project at the Bull Arm site. • **Dewater Dry-dock/Prep of Dry-dock Area** The text on page 7-47 states that, "*The bund wall footprint and the area to be drained for the dry-dock in Great Mosquito Cove may temporarily affect to a small degree, the quantity of available habitat for fish and shellfish for an estimated 24 months.*" However, Table 7-11 does not include habitat quantity as a potential environmental effect. It also rates the duration as "*2*" (1-12 months) when according to the text on page 7-47 it should clearly be rated as "*3*" (13-36 months). In addition, compliance to the Section 35(2) *Fisheries Act* Authorization and Fish Habitat Compensation should be included as mitigations. The environmental effects of dewatering the dry-dock should also include fish mortality. • **Concrete Production (Floating Batch Plant)** "*Concrete wash water containment and testing to meet applicable regulations*" is included as an applicable mitigation in the text on page 7-53. This should be added to Table 7-11. • **Dredging of Bund Wall and Possibly Sections of Tow-Out Route (May Require At-Sea Disposal)** Compliance to the Section 35(2) *Fisheries Act* Authorization and Fish Habitat Compensation should be included as mitigations for at-sea disposal. Section 7.4.1 (page 7-42) indicates that there may be possible blasting along sections of the GBS tow-out route to the deepwater site, however, there are no mitigations indicated in this table to offset the effects of in-water blasting. The mitigations section should be updated as applicable (i.e., bubble curtains, compliance with Section 32 *Fisheries Act* Authorization, if applicable, etc.).

- **Removal of Bund Wall and Disposal (Dredging/Ocean Disposal)**

"*Implementation of in-water sediment control measures*" should be cited as a mitigation.

- **GBS Ballasting and De-Ballasting (Seawater Only)**

The environmental effects of GBS ballasting and de-ballasting (seawater only) should include habitat use.

Offshore Construction/Installation:

- **OLS Installation and Testing**

The OLS installation is considered a permanent structure and as such the duration rating should be "*5*" (> 72 months). Compliance to the Section 35(2) *Fisheries Act* Authorization should be included as a mitigation.

- **Concrete Mattress Pads/Rock Dumping Over the OLS Offloading Lines**

As noted in Table 7-9, the environmental effects of placement of concrete mattress pads/rock dumping over the OLS offloading lines could result in potential fish mortality and change in habitat quality. These effects should be added to this table.

The concrete mattress pads/rock dumping over the OLS offloading lines are considered permanent structures and as such the duration rating should be "*5*" (> 72 months). Compliance to the Section 35(2) *Fisheries Act* Authorization should be included as a mitigation.

- **Platform Tow-Out/Offshore Installation**

The environmental effects of offshore installation should also include potential fish mortality and change in habitat quality.

The offshore installation is considered a permanent structure and as such the duration rating should be "*5*" (> 72 months). Compliance to the Section 35(2) *Fisheries Act* Authorization should be included as a mitigation.

- **Placement of Rock Scour Protection on the Seafloor Around Final Hebron Platform Location**

The environmental effects of placement of rock scour protection on the seafloor around the final Hebron platform location should also include potential fish mortality.

The placement of rock scour on the seafloor around the final Hebron platform location is considered a permanent structure and as such the duration rating should be "*5*" (> 72 months). Compliance to the Section 35(2) *Fisheries Act* Authorization and Fish Habitat Compensation should be included as mitigations.

Potential Future Construction Activities:

- **Installation of Pipeline(s)/Flow line(s) and Testing from Excavated Drill Centre(s) to Platform Plus Concrete Mattresses, Rock Cover, or Other Flow lines Insulation**

Installation of pipeline(s)/flow line(s) and testing from excavated drill centre(s) to platform plus concrete mattresses, rock cover, or other flow lines insulation are considered permanent and as such the duration rating should be "*5*" (> 72 months). Compliance to the Section 35(2) *Fisheries Act* Authorization should be included as a mitigation.

Response: The requested edits have been made to Table 7-11 to improve consistency with the text. Note that there is no blasting associated with dredging along the tow-out channel. Section 7.4.1 (and throughout the CSR as necessary) will be revised to reflect this.

B22) Page 7-61

The third paragraph states that, "*These studies indicate that dredging causes an initial reduction in the abundance, species diversity, and biomass of the benthic community and that substantial progress towards full restoration of the fauna and sediments can be*

	expected within a period of approximately two to four years following cessation (Kenny et al. 1998; Sardá et al. 2000; Van Dalfsen et al. 2000)." It should be noted that although this statement may be true for polychaetes etc., it is not the case for long-lived species such as corals.
	Response: It is recognized that long-lived species such as corals, while unlikely to be present in the dredged area, may take longer to recover; the CSR text will be updated to reflect this.
	B23) Page 7-62 In the third paragraph it states that, "*The risk of mortality to sessile invertebrates from dredging will be reduced by having dredging contained to the smallest area possible and restricting dredge spoils disposal to a designated disposal area.*" The proponent should note that the disposal area should be determined though consultations with Federal Authorities, including DFO, to ensure the best location is chosen in order to minimize any adverse effects on fish and fish habitat.
	Response: Comment acknowledged. EMCP will consult with DFO regarding the location of the disposal area.
	B24) Table 7-12 Although the following comments were made regarding information contained within Table 7-12 on page 7-72, they also pertain to the text portion of Section 7 and Table 7-9 on page 7-44. • **Presence of Structures** The change in habitat quantity with regards to the presence of structures has already been considered in the environmental effects assessment for construction and installation (Table 7-11) and therefore does not need to be taken into consideration again under operations and maintenance. **Potential Future Operational Activities:** • **Presence of Structures** The change in habitat quantity with regards to the presence of structures is factored into the environmental effects assessment under construction and installation (Table 7-11) and therefore does not need to be taken into consideration again here.
	Response: Tables 7-9 will be updated in the CSR
	B25) Table 7-13 • **Removal of the Hebron Platform and OLS Loading Points** As noted in Table 7-9, the environmental effects of removal of the platform and OLS loading points could also result in potential mortality. These effects should be added to this table. • **Surveys (Geophysical, Geological, Geotechnical Environmental, ROV, diving, etc.)** As noted in Tables 7-9 and 7-11, these activities would not result in potential fish mortality. This table should be updated to reflect the same information.
	Response: Table 7-13 will be updated in the CSR.
	B26) 7.5.4.1 Change in Habitat Quantity (Accidents, Malfunctions and Unplanned Events); Page 7-77 The first paragraph in this section states that, *"In the offshore, a spill of crude oil would dissipate through evaporation as well, but would have the potential to form tar balls and sink to the sea floor. In any case, the quantity of fish habitat affected by a spill would be negligible.*" Please provide a reference which supports this prediction (i.e. formation and impact of tar balls).

	Response: Sentence will be reworded to read: In the offshore, a spill of crude oil would dissipate through a variety of different process including evaporation as well would have the potential to form tar balls (Iliffe and Knap 1979; Ramamurthy 1991; NRC 2003). Tar balls may be transported long distances from source and concentrating in convergence zones or shorelines (NRC 2003). The actual fate of the tar balls will be dependent upon their specific gravities, which are influenced by the amount of sediment and other extraneous materials incorporated into the tar balls. Tar balls and the PAHs associated with them have low bioavailability (Gustafsson *et al.* 1997; Baumard *et al.* 1999). The quantity of fish habitat that may be affected by an unplanned event would be examined as part of an environmental effects monitoring program in the event of an unplanned event. **The following references will be added:** Baumard, P., H. Budzinski, P. Garrigues, T. Burgeot, X. Michel and J. Bellocq. 1999. Polycyclic aromatic hydrocarbon (PAH) burden of mussels (*Mytilus* sp.) in different marine environments in relation with sediment PAH contamination, and bioavailabiliy. *Marine Environmental Research*, 47: 415-439. Gustafsson, Ö., F. Haghseta, C. Chan, J. MacFarlane and P.M. Gschwend. 1997. Quantification of the dilute sedimentary soot phase: implications for PAH speciation and bioavailability. *Environmental Science and Technology*, 31: 203-209. Iliffe, T.M. and A.H. Knap. 1979. The fate of stranded pelagic tar on Bermuda beaches. *Marine Pollution Bulletin*, 10: 203-205. NRC (National Research Council). 2003. *Oil in the Sea III: Inputs, Fates, and Effects*. Committee on Oil in the Sea: Inputs, Fates, and Effects, Ocean Studies Board and Marine Board, Divisions of Earth and Life Studies and Transportation Research Board. National Academies Press. Washington, DC. 265 pp. Ramamurthy, V.D. 1991. Effects of oil pollution on bio-ecology and fisheries on certain enclosed coastal regions of the Arabian Sea. *Marine Pollution Bulletin*, 23: 239-245.
	C) 8. Commercial Fisheries C1) 8.1.3 Administrative; Page 8-1 This section gives the impression that NAFO divisions and unit areas are defined by DFO, which is not the case. Suggest revising this section.
	Response: **The text in Section 8.1.3 will be revised as follows:** Administrative boundaries for commercial fisheries are determined by DFO, which manages the fisheries resources in the area and is primarily responsible for scientific surveys within the area. These boundaries generally follow Northwest Atlantic Fisheries Organization (NAFO) Division and Unit Areas.
	C2) 8.3.2 Offshore Fisheries; Page 8-14 Figure 8-5 NAFO unit area 3Na is mislabels as 3Lb
	Response: Corrected Figure 8-5 is provided as follows:

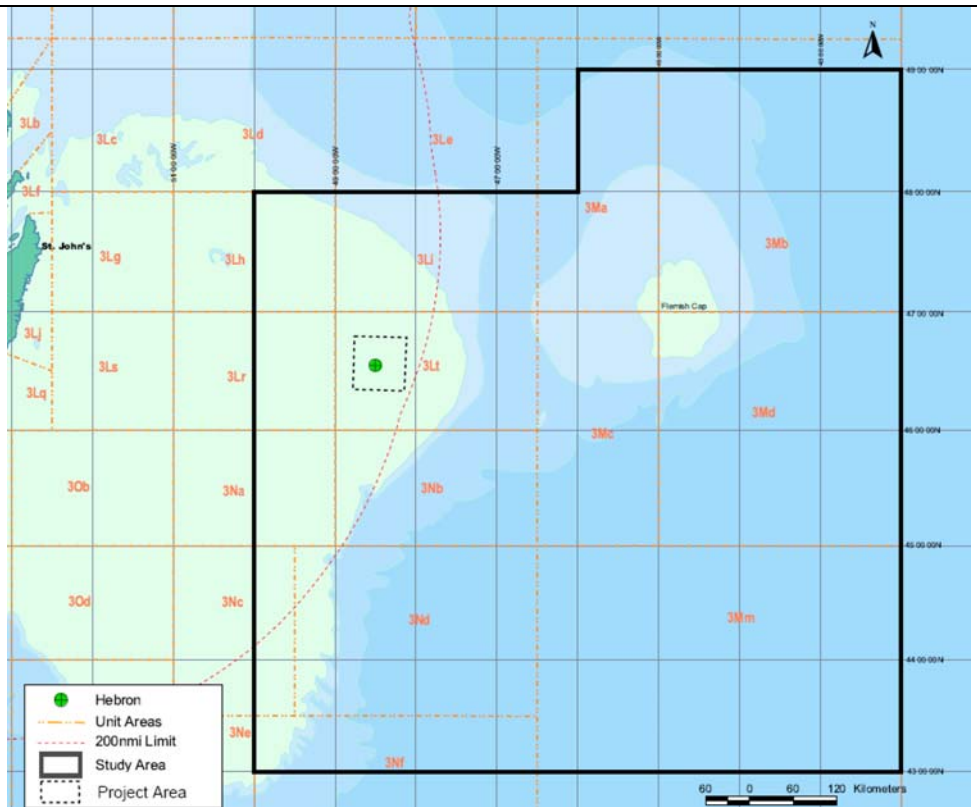


Figure 8-5 Offshore Study Area, Project Area and Other Zones

C3) 8.3.2.2 – Historical Overview of Regional Fisheries; Page 8-16

a) Please revise Committee on the Status of Wildlife in Canada to Committee on the Status of Endangered Wildlife in Canada.

b) This section states that "…COSEWIC listed the Atlantic Cod (Newfoundland and Labrador Population as an endangered species." Please be advised that COSEWIC assessed Atlantic Cod as endangered in 2003. Please revise accordingly.

Response:

a) Text will be corrected to Committee on the Status of Endangered Wildlife in Canada.

b) Text will be changed to "…COSEWIC assessed the Atlantic Cod (Newfoundland and Labrador Population) as an endangered species …"

C4) 8.5.1.2 Offshore (Access to Fishing Grounds); Page 8-52

The lack of harvest activity within the proposed offshore safety zone over the last two decades is a function of a significant decline in the abundance of ground fish. In the event of an increase in the abundance of ground fish, reduced access to these fishing grounds may have economic impacts for ground fish licence holders.

Response: Acknowledged. However, it should also be noted that even in the years before the moratorium, Unit Area 3Lt was one of the least productive / harvested of all the Division 3L fishing areas (though geographically one of the largest) accounting for just 1.7 percent of the harvest by quantity in those years (see Table 8-X).

Table 8-X Pre-Moratorium Landings in Unit Area 3L

3L Unit Area	Tonnes (1984-1990 average)	% of total
3Lc	2,691	1.5%
3Lt	3,057	1.7%
3Lg	3,221	1.8%
3Le	3,308	1.9%
3Li	4,494	2.5%
3Lh	5,774	3.3%
3Ls	9,265	5.2%
3Lq	12,091	6.8%
3Lj	15,799	8.9%
3Ld	19,209	10.8%
3La	20,098	11.3%
3Lf	23,302	13.1%
3Lr	25,839	14.6%
3Lb	29,294	16.5%
3L Total	177,442	100.0%

D) 10.0 Marine Mammals and Sea Turtles

D1) 10.3.1.1 Recent Marine Mammal Monitoring in the Jeanne d'Arc Basin, Page 10-8

The last paragraph on this page states that, "There were no confirmed identifications of sperm whales…" However, DFO and others have made many sightings of sperm whales on the Grand Banks, including some in very shallow near shore waters, so the low number of these animals should be considered "unexpected". In addition, the most common cetacean sighted in association with offshore trawling operations in recent years are sperm whales. Thus, sperm whales are attracted to fishing operations on the Grand banks and may approach other vessels as a result.

Response: The text as written is accurate in that it is specifically referring to sightings made during seismic monitoring programs on the Jeanne d'Arc Basin. There were no sperm whale sightings made during these monitoring programs. However, it is recognized in Section 10.3.1.2 that sperm whales have been recorded and are included in DFO's cetacean database. Given that effort is not accounted for in the DFO database, it is difficult to comment on the relative abundance of a given species (*i.e.*, sperm whale) in the Offshore Study Area, particularly relative to water depth.

The following sentence:

"This was not unexpected given that the seismic programs occurred in relatively shallow shelf waters."

is replaced with:

"Perhaps with the exception of sperm whales, this was not unexpected given that the seismic programs occurred in relatively shallow shelf waters."

D2) 10.3.2.2 Toothed Whales (Odontocetes) (Northern Bottlenose Whale), Page 10-20

It should be noted that there have been several northern bottlenose whale standings recently in coastal waters, including one in Terra Nova. It is likely these whales were chasing near shore squid.

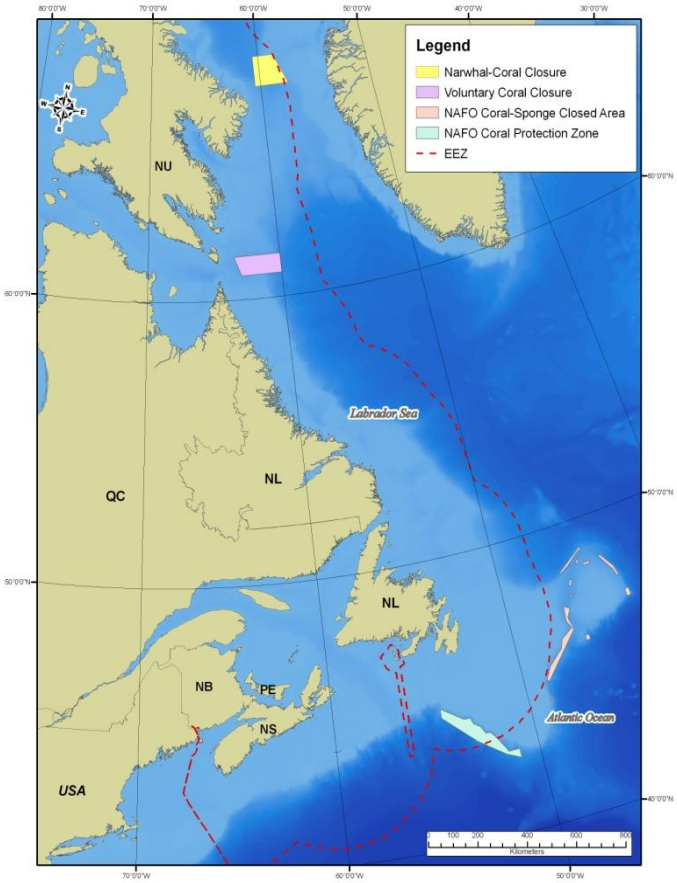
Response: The following paragraph from the CSR (page 10-20):

Northern bottlenose whales have occasionally been observed in coastal eastern Newfoundland, although most records are based on carcasses that have washed ashore. Lien (1994) reported that northern bottlenose whales were entrapped in inshore fishing gear on two occasions from 1979 to 1990, and Sergeant *et al.* (1970) described a

	single northern bottlenose whale taken at the South Dildo, Trinity Bay, whaling station in July 1953. Apparently a second whale, associated with the one captured, remained free-swimming in the southern part of Trinity Bay for at least three additional days (Sergeant and Fisher 1957). There were no sightings of northern bottlenose whales reported in the DFO cetacean sightings database in the Nearshore Study Area (Table 10-6). Thus, it appears possible, but quite unlikely, that northern bottlenose whales will occur in the Nearshore Study Area. **Will be replaced with:** Northern bottlenose whales have occasionally been observed in coastal eastern Newfoundland, although most records are based on carcasses that have washed ashore. Lien (1994) reported that northern bottlenose whales were entrapped in inshore fishing gear on two occasions from 1979 to 1990, and Sergeant *et al.* (1970) described a single northern bottlenose whale taken at the South Dildo, Trinity Bay, whaling station in July 1953. Apparently a second whale, associated with the one captured, remained free-swimming in the southern part of Trinity Bay for at least three additional days (Sergeant and Fisher 1957). Recently, northern bottlenose whales have stranded in Bonavista Bay (2004) and the south coast of Newfoundland (2005) and it is suspected that the whales were pursuing nearshore squid (J. Lawson, pers. comm., October, 2010). There were no sightings of northern bottlenose whales reported in the DFO cetacean sightings database in the Nearshore Study Area (Table 10-6). It appears possible that northern bottlenose whales may occur in the Nearshore Study Area but sightings would be considered rare.
	E) 11.0 Species at Risk E1) Since project activities will be occurring over a long time period (e.g. near shore construction up to 2016, offshore construction to 2017 and onwards) it is possible that during this timeframe more species could be added to Schedule 1 of SARA, new Recovery Strategies, Management Plans or Action Plans could be posted for listed species, critical habitat could be identified, COSEWIC will have assessed new species, etc. Many things could change that may affect a species status and the requirements for it under SARA. This will need to be taken into consideration by the proponent.
	Response: The CSR includes COSEWIC-assessed species in the environmental effects analysis for Species at Risk. If species that were listed by COSEWIC become a *SARA*-listed species during the life of the Project, environmental effects have been assessed. EMCP will monitor the status of Species at Risk on a regular basis.
	E2) 11.3.1.2 American Plaice; Page 11-10 Although the second paragraph states that, "*Females in spawning condition may be found throughout the Grand Banks (Morgan 2001), indicating the lack of a specific spawning ground",* the last paragraph states that, "*The Southeast Shoal and Tail of the Banks EBSA, proposed by DFO, is known as a spawning and nursery area for plaice."* The former statement is more accurate, as recent data has shown that it is unlikely that the Southeast Shoal is the only spawning ground for American Plaice, although they do spawn there. It is also possible that it is not a nursery area as previously thought, however, despite this the area still contains important habitat for American Plaice.
	Response: The second paragraph remains unedited; the last paragraph on page 11-10 will be revised to read as follows: The Southeast Shoal and Tail of the Banks EBSA, proposed by DFO, contains important habitat for American plaice.
	F) 12.0 Sensitive of Special Areas; Page 12-3 F1) Figure 12-2 shows "Sponge/Coral Area" but does not note if this is an area where they are found, if these are VMEs (that is what is suggested in paragraph 3 on page 12-1 but not made clear), or closed areas. A map of NAFO Coral and Sponge closed areas and the NAFO Coral Protection zone exists. This data could be used to update Table 12-2. This may be less ambiguous than using "sponge/coral area". See

attached map.

Also the green area, southwest of the Flemish Cap, is the Beothuk Knoll as indicated by the map's legend. However, the Orphan Knoll also appears as a green area north of the Flemish Cap, but is not included within the map's legend.



Response: Figure 12-2 will be revised to provide clarity as per the above comment.

F2) 12.1.2 Administrative; Page 12-5

The following changes should be made.

- Line 15 Some EBSAs **are** – change to – Some EBSAs **may be**

- Line 16…other EBSAs **are** – change to - ..other EBSAs **may be**

- Line 17….management implications **of the identification of** these…change to...management implications **for** these

Response: These editorial changes will be made in the CSR.

F3) 12.3.2 Offshore; Page 12-8

Please change where it says EBSAs **are** to EBSAs **may be** in lines 12 and 13

Response: This editorial change will be made in the CSR.

F4) 12.5 Environmental Effects Analysis and Mitigation

This section notes that an oil spill in the Bull Arm area could adversely affect some capelin beaches or eelgrass habitat. However, relatively low levels of oil retained in inter-tidal or shallow sub-tidal sediments could potentially affect a variety of species. For instance, studies in the United States and Canada have noted that sub-lethal effects can be produced in flounder species chronically exposed to very low levels (≤ 3 ppm) of sedimentary PAH. This generalization would also hold true in the Offshore Project Area.

	Response: Section 12.5.1.1 (Nearshore, Eelgrass Beds), Page 12-18, the end of the first paragraph will be revised to include the following: While most components are likely to recover within several years following a spill, some taxa such as Amphipoda and some families of Polychaeta, may take longer to return. In addition, relatively low levels of oil retained in intertidal or shallow subtidal sediments could potentially affect a variety of species. Payne *et al.* (1988, in Hurley and Ellis 2004) conducted laboratory experiments that exposed male winter flounder to sediments contaminated with a range of Venezuelan crude oil concentrations for approximately four months and observed sub-lethal effects from sediment containing aromatic hydrocarbons as low as 1 ppm. The conclusion that the potential environmental effect of an accidental fuel spill on eel grass beds (and capelin beaches) will be significant remains unchanged.
	F5) 12.5.1.1 Near shore (Accidents, Malfunctions and Unplanned Events); Page 12-16 (Eelgrass Beds) a) The references, Fingas (2001) and Wright (2002) do not appear to be first-hand accounts, but rather reviews or information taken from technical manuals. Since neither appears to be the source studies, the references have not been cited appropriately. Please check these references and revise as appropriate. b) It should be noted that the recovery time of eelgrass is likely to depend at least partly upon the extent and duration of the exposure. Research on eelgrass disturbance and recovery in Newfoundland coastal waters suggests that eelgrass may recover from disturbance (i.e., physical removal) in 2-3 years (Laurel et al 2003 MEPS; Warren et al. in press JEMBE). However, in both of the above referenced studies, underground rhizomes remained intact after the disturbance, therefore only the removal of the above-substrate biomass (shoots and blades) was investigated. The recovery of eelgrass meadows would take much longer if any spill resulted in appreciable mortality of the underground rhizomes in affected eelgrass beds, perhaps as much as a decade or more based on studies of eelgrass expansion in Newfoundland coastal waters (Warren et al. in press), but certainly longer than 2-3 years as referenced in the CSR. Laurel, B.J., Gregory, R.S. and Brown, J.A. 2003. Settlement and distribution of Age-0 juvenile cod, *Gadus morhua* and *G. ogac*, following a large-scale habitat manipulation. Mar. Ecol. Prog. Ser. 262: 241-252. b) The fourth paragraph states that, "*The average density of eelgrass shoots and flowering shoots were 24 percent and 62 percent lower at oiled sites than at reference sites in 1990; however, no differences between oiled and reference sites were observed with respect to eelgrass biomass, seed density, seed germination or the incidence of normal mitosis in seedlings, and there were no signs of elimination of eelgrass beds*". This sentence is contradictory and should be revised.
	Response: a) M. Fingas is the author of Fingas (2001) and other than indicating that the information is in Section 13 ("Effects of Oil Spills on the Environment"), this is the source material. N. Wright's discussion paper (Wright 2002) is an abridged version of a larger discussion paper written in October 2001 for the Canadian Wildlife Service, but is still considered a source document for the information as presented in the CSR. b) **The text will be revised to include the following:** Research on eelgrass disturbance and recovery in Newfoundland coastal waters suggests that eelgrass may recover from disturbance (i.e., physical removal) in two to three years (Laurel *et al.* 2003); however, only the removal of the above-substrate biomass (shoots and blades) was investigated, as underground rhizomes remained intact after the disturbance. The recovery of eelgrass meadows could take much longer if any spill resulted in appreciable mortality of the underground rhizomes in affected eelgrass beds.

	The following reference will be included in Section 18.2: Laurel, B.J., R.S. Gregory and J.A. Brown. 2003. Settlement and distribution of Age-0 juvenile cod, *Gadus morhua* and *G. ogac*, following a large-scale habitat manipulation. *Marine Ecology Progress Series*, 262: 241-252. Note that the conclusion that the potential environmental effect of an accidental fuel spill on eel grass beds indicates the beds will recover, but will, nonetheless, be significant remains unchanged. c) This is the information provided in the source material (Dean *et al.* 1998). **The text will be revised as follows:** Dean *et al.* (1998) compared populations of eelgrass at oiled versus reference sites between 1990 and 1995 following the *Exxon Valdez* spill. Injury to eelgrass beds in heavily oiled bays appeared to be slight and did not persist for more than a year after the spill. Populations recovered from possible injuries by 1991 and there were no differences in shoot or flowering shoot densities between oiled and reference sites in 1990 or subsequent years. Note that the conclusion that the potential environmental effect of an accidental fuel spill on eel grass beds (and capelin beaches) will be significant remains unchanged.
	H) 15.0 Follow-Up and Monitoring H1) 15.1.1 Proposed Offshore Environmental Effects Monitoring Program; Page 15-3 The second last paragraph in this section states that, "*A fish habitat compensation monitoring survey is conducted following completion of the compensation works to verify the amount and productivity of habitat created*." While this is correct, it should also be noted that compensation monitoring to determine the continued functioning of the habitat will need to be carried out for a period of time and at intervals agreed upon by DFO and the proponent. Timelines for monitoring will be included in the Fish Habitat Compensation Plan, which will be included as a condition of the Section 35(2) *Fisheries Act* Authorization. Please revise accordingly
	Response: Section 15.1.1 of the CSR text will be revised as follows: In addition to the operational EEM program, EMCP is committed to a fish habitat compensation monitoring program. The details regarding fish habitat compensation monitoring will be determined in consultation with DFO.
	H2) 15.2.1 Near shore Environmental Compliance Monitoring; Page 15-5 Section 32 of the *Fisheries Act,* which prohibits the destruction of fish by any means other than fishing should also be included in the list of regulatory instruments as it may be applicable in relation to in-water blasting, if required.
	Response: Section 15.2.1 of the CSR will be revised to include the following bullet: • Section 32 of the federal *Fisheries Act*, which prohibits the destruction of fish by any means other than fishing
	H3) 15.2.2 Offshore Environmental Compliance Monitoring; Page 15-6 As an Authorization for Works or Undertakings Affecting Fish Habitat will also be issued under the *Fisheries Act* for project components occurring at the offshore project area, a reference to this Authorization should be made in this section as well
	Response: Section 15.2.2 of the CSR will be revised to include the following: An Authorization for Works or Undertakings Affecting Fish Habitat will also be issued under the *Fisheries Act* for Project components occurring at the Offshore Project Area.
	H4) 15.3 Other Required Programs; Page 15-7 The third bullet can be removed as the information contained within the fifth bullet is more comprehensive. With regards to the fifth bullet, while this information is correct, it should also be noted that compensation monitoring to determine the continued functioning of the habitat will need to be carried out for a period of time and at intervals

	agreed upon by DFO and the proponent. Timelines for monitoring will be included in the Fish Habitat Compensation Plan, which will be included as a condition of the Section 35(2) *Fisheries Act* Authorization.
	Response: Section 15.3 of the CSR will be revised to delete the following bullet: • *Fisheries Act* habitat compensation monitoring requirements **In addition, this bullet will be revised as follows**: • Project activities affecting fish habitat evaluated as part of the fish habitat compensation program. All fish habitat compensation measures will be monitored to ensure no net loss of productive capacity in fish habitat. A fish habitat compensation monitoring survey is conducted following completion of the compensation works to verify the amount and productivity of habitat created. In addition, compensation monitoring to determine the continued functioning of the habitat will be conducted for a period of time and at intervals agreed upon by DFO and EMCP. The timelines for monitoring will be included in the Fish Habitat Compensation Plan, which will be provided as a condition of Section 35(2) of the *Fisheries Act*
	I) 17.0 Summary and Conclusions I1) 17.2.2 Summary of Proposed Mitigation Measures; Table 17-2 Mitigations relating to fish and fish habitat for 1) offshore construction and installation and 2) potential future construction activities should include adherence to the Section 35(2) *Fisheries Act* Authorization and completion of associated fish habitat compensation and related monitoring.
	Response: The section on Offshore Construction and Installation, Table 17-2 in Section 17.2.2 of the CSR, will be revised to include the following bullet in the mitigations listed for Fish and Fish Habitat • Adherence the Section 35(2) *Fisheries Act* Authorization and completion of associated fish habitat compensation and related monitoring **The section on Potential Future Construction Activities, Table 17-2 in Section 17.2.2 of the CSR, will be revised to include the following bullet in the mitigations listed for Fish and Fish Habitat** • Adherence the Section 35(2) *Fisheries Act* Authorization and completion of associated fish habitat compensation and related monitoring

6.0 OTHER GENERAL COMMENTS

6.1 Response to Fish, Food and Allied Workers Union Comments

180-FFAW	Fundamentally, the overall project will impact fish harvesters both in Trinity Bay and the offshore. The nearshore component of the project will result in some loss of fishing grounds to harvesters in Trinity Bay. It needs to be noted that accessing alternate fishing grounds can be problematic when considering the traditional nature of the fishery in Newfoundland. Harvesters fish where their forefathers fished, particularly lobster grounds. Fishing alternate grounds generally means that they are infringing on another harvester's "territory". As well, commercial species are not distributed equally in bays and coves. Therefore, the impacts of project-related activities in the next few years will have an impact on many harvesters in Trinity Bay, that is, not just those in the communities adjacent to construction activities. All Trinity Bay harvesters will be subjected to increased risk of gear/vessel loss and damage, accidental spills, as well as reduced safety on the water, access to fishing grounds, and catch rates as a result of this project. As well, similar impacts will be faced by offshore harvesters with quotas to fish in NAFO Division 3L as offshore development begins.
Response:	Effects of Project activities on commercial fisheries are addressed in Section 8. EMCP understands the concerns fishers, and will continue to consult with fishers throughout the Project. A Project fisheries agreement for Bull Arm will be developed in consultation with Bull Arm and adjacent area fishers.
181-FFAW	Section 18.1, page 18-1. The correct title for Saunders, R. is Petroleum Industry Liaison.
Response:	Noted. **Section 18.1 of the CSR will be revised as follows:** Saunders, R. Petroleum Industry Liaison, Food, Fish and Allied Workers Union, St. John's, NL.
182-FFAW 1	Establishing a Fisheries Liaison Committee with adequate fish harvester representation will be key in the coming months to enable appropriate consultation with affected harvesters as the project proceeds (Section 8.5.1.1). Involving harvesters in the development of an Environmental Effects Monitoring program prior to the start of construction at the site will also provide opportunity for collaboration (Section 15.1.1).
Response:	Acknowledged. This is the plan for the Fisheries Liaison Committee. EMCP will design EEM Programs (both inshore and offshore) that will include input from leading experts in EEM programs, regulators and other affected stakeholders.
183-FFAW 2	Construction of the proposed Gravity Based Structure in Trinity Bay will have an impact on the environment in the bay and more specifically fish habitat. Concerns from fish harvesters have been duly noted in the report (Section 5.3.1.2) with respect to dredging, blasting, debris, discharges, dumping, accidental spills, construction related noise and lighting. It needs to be reiterated however that construction activity will also impact catchability, and therefore profitability, for fish harvesters.
Response:	This potential is acknowledged in the document, in Sections 8.4.1 and 8.4.2, as well as in the environmental effects assessment discussions in Section 8.5.
184-FFAW 3	It should be noted that lobster catches have been on the increase in Trinity Bay (Lobster Fishing Area 6) over the past number of years (Section 8.3.1.6). Harvesters attribute increased catches to the conservation measures, such as v-notching, that they have been involved with since the mid-1990s. DFO statistical information up to 2009 has been based on buyer slips (lobster sales to buyers). A mandatory logbook was introduced for the 2010 lobster season, which will provide a more accurate representation of actual lobster catches in the ensuing years.
Response:	Noted.

185-FFAW 4	The future fisheries (Section 8.4.1.2) section was nominal in the study report. Snow crab (Section 8.3.2.7) harvesters have been prospecting in recent years and have explored many new areas as the resource seemed to be moving further inshore. In 2010, harvesters are also reporting fishing in shallower depths for crab. Furthermore, the 2010 Science Advisory Report (in press) states a recent increase in the exploitable biomass of the 3LNO stock as well as increased recruitment that is expected to increase further over the next two to three years. As mentioned in the report, any DFO changes to quota area allocation boundaries would also impact fishing activity within the Jeanne d'Arc Basin of the Grand Banks. Lost harvesting grounds from the offshore component of this development could be more significant in the coming years (Section 5.3.2.2). The operator should consult with the fishing industry on a regular basis to keep up to date with snow crab fishing trends.
Response:	Noted. This will be done through the various Project consultation / liaison mechanisms.
186-FFAW 5	Also with respect to future fisheries (Section 8.3.2.7), information presented at RAP meetings in 2009 and 2010 indicated that there are increasing signs of cod (Section 8.3.2.3) in the offshore with scope for more recovery. The 2010 Assessment of Northern (2J3KL) Cod (Science Advisory Report) noted that the annual DFO trawl surveys indicated an eight fold increase in the spawning stock biomass from 2004 to 2008. A commercial fishery for Atlantic cod on the Flemish Cap (an adjacent, NAFO-regulated stock) opened in 2010. The resumption of offshore groundfish fisheries would significantly alter fishing patterns and activities within the Jean d'Arc Basin of the Grand Banks and have an impact on fishing enterprises. Again, the fishing industry should be regularly consulted to keep apprised of fishing trends.
Response:	Noted. EMCP will consult with fishers as the Project progresses.
187-FFAW 6	The establishment of a Safety Zone (Section 8.5.1.1) at the Great Mosquito Cove site, and later at the deepwater site in the bay will result in a loss of fishing grounds to harvesters in Trinity Bay. This is significant for inshore harvesters in Trinity Bay as previously discussed.
Response:	Noted. As stated in Section 8.5.1.1, Project construction activities will affect access to some fishing grounds during certain activities. The Project Fisheries Agreement, which will be developed in consultation with fishers, will address these issues.
188-FFAW 7	While the designation of a traffic lane for project related vessels in Trinity Bay and the associated proposed provisions such as communication protocols and speed reductions in designated areas are essential mitigation measures to reduce interference with harvesting activities (Section 8.5.1.1) it should be noted that crab (pots) and cod (gillnets) are fished in deeper water, likely where the proposed Designated Traffic Lane will be re-established in Trinity Bay. Project-related vessels that enter the bay should be aware that there may be fishing ongoing in the Traffic Lane. Similarly, there is also the possibility for gear conflicts.
Response:	Acknowledged and noted. Communication protocols and a vessel traffic management plan will be established and will include measures to ensure all users are aware of all activities that may be occurring in Bull Arm, and the traffic lane.
189-FFAW 8	The FFAW and its members are very concerned about the potential of aquatic invasive species, such as green crab, infesting our bays and coastal waters. The additional vessel traffic associated with the construction of the Gravity Based Structure in Trinity Bay may potentially lead to the introduction of unwanted aquatic invasive species. The green crab species that has become resident in areas of Placentia Bay for example has destroyed eel grass beds and competes with native crab and lobster species for food. The potential for the introduction of aquatic invasive species in the area was not mentioned at all in the Hebron Study Comprehensive Study Report document. The FFAW strongly encourages the company to consider and detail the mitigation strategies that the contracting marine vessel companies will need to follow to prevent the introduction of aquatic invasive species in Trinity Bay. Furthermore, the FFAW calls

	upon the various regulatory bodies to be very stringent regarding any ballast water exchange plans proposed by the company and ensure vessels follow proper ballast water management practices. As well, aquatic invasive species should be incorporated into the nearshore Environmental Effects Monitoring program.
Response:	Marine vessels are regulated through the MARPOL Convention and the *Canada Shipping Act*. EMCP is in the early stages of developing the Bull Arm EEM design; however, it will be designed in consultation with regulatory agencies, the scientific community and key stakeholders, including the fishing industry.

6.2 Response to Alder Comments

190-Alder 1	The draft *Comprehensive Study Report (CSR) for the Hebron Development Project* breaks the Project Environment down in to near shore (construction) and offshore (operations) environments. The Near shore Study Area is where the platform will be constructed and the Offshore Study Area is where the platform will be installed for the purpose of bringing oil to the surface and storing it within the fixed structure. We find the scope of the project deficient in not including in the Project Environment the area pertaining to the transportation of the product from the production platform to the Newfoundland Transshipment Facility or to market. For example, Table 2-9 includes the offloading of produced crude as an anticipated activity but it does not include the "transportation of produced crude". We request that this omission be corrected. We do not find the coverage of this issue provided by 2.9.5 adequate.
Response:	As stated in Section 2.9.5, the Hebron Project will ship the crude oil either direct to market, or to the Newfoundland Transshipment Terminal, using the fleet tankers currently in use for the Grand Banks offshore oil and gas operations. The Newfoundland Transshipment Terminal underwent environmental and regulatory reviews and more recently, Transport Canada undertook an in-depth risk assessment regarding tanker traffic in Placentia Bay.
191-Alder 2	Shore base support is vague on what areas other than St. John's are to be used. We request that any use of other areas such as Bay Bulls must be noted specifically and assessed as part of the project. Bay Bulls is of particular interest due to its proximity to the Witless Bay Ecological Reserve. We request that all onshore sites anticipated to be used by the Hebron Project must be identified and included in the scope of the project's environmental assessment.
Response:	The Hebron Project is at the early stages of Project design. Details regarding the level of services required by the Project have not been determined. Supplies, services, and associated vendor sites will be selected through procurement processes and is premature to speculate on possible sites where activities may occur.
192-Alder 3	While the draft CSR states that, no new tankers will be added to the fleet of those presently servicing the offshore area near Hebron it must be assumed that the frequency of tanker traffic may increase. We request more detailed presentation of information on this traffic and a separate assessment of the cumulative risk of tanker accidents in Placentia Bay that may accrue from the addition of the Hebron Project.
Response:	See Response to Comment 191-Alder 1. The Hebron Project is at the conceptual stage of engineering. Hebron production operations will not commence until 2017. By that time, it is projected that existing offshore production operations will be in declining production, based on existing forecasts. Therefore, the frequency of tanker traffic is not expected to increase.
193-Alder 4	We request that when using statistics to summarize data, which are not normally distributed that the use of means be replaced by the use of medians and whenever possible plots of raw data distributions are presented rather than only data summaries. For example, Figure 3-39 which depicts "average number of icebergs" is not useful in

	providing a true impression of the likely number of icebergs one might encounter.
Response:	Generally summary statistics used provide an indication of the central tendency (whether this is a mean or a median) and the range of values typically observed. While it may be appropriate to present the median statistic when data observations or sample size is small, the mean parametric statistic is more appropriate for a measure of central tendency for the parameter when a larger number of observations are involved (*e.g.*, >50). When sample sizes are >50, the central limit theorem states that the observations will approximate a normal distribution around a mean value. In the case of large metocean data sets, such as for wind strength and significant wave height for example, including the data for iceberg observations as depicted in Figure 3-39, descriptive statistics of mean, standard deviation, minimum and maximum values are therefore more appropriate.
194-Alder 5	With respect to marine birds, the draft CSR concludes that "*While there is no known mitigation, flaring is expected to have minimal effect on marine bird populations over the duration of the Project.* We are not convinced of the validity of this conclusion. We request that a detailed presentation of new research on this subject be required before the CSR is finalized including in the final CSR a detailed discussion of the evidence for the above conclusion.
Response:	The CSR addresses potential effects from flaring on marine birds in Sections 9.5.2.2 and 9.5.2.4. In addition, further information is provided in response to Comments 111-GF 16 and 112-GF 17.
195-Alder 6	We also request that the study of the feasibility of the reinjection of Produced Water be required to be included in the final CSR.
Response:	See response to Comment 8-C-NLOPB 6.
196-Alder 7	We request that the section of the final CSR addressing the "need for the project" include a discussion of the project in the context of green house gas emissions and Canada's energy policy and energy needs i.e. define the project as an "energy project" rather than simply an oil project. Alternatives to the project should include a review of the assumption that there is a need to increase the supply of fossil fuels at this time.
Response:	Energy policy is developed by federal and provincial governments. The Province of Newfoundland and Labrador's energy policy is outlined in the "Newfoundland and Labrador Energy Plan" and is available on the Government of Newfoundland and Labrador website (http://www.nr.gov.nl.ca/energyplan/EnergyReport.pdf). With respect to greenhouse gas emissions, these are addressed in Sections 6.2.1.2, 6.2.2.2, 6.5.1.2, 6.5.4.2 and 6.6.2 of the CSR.

6.3 Response to Health Canada Comments

197-HC	Health Canada has recently produced a document entitled "*Useful Information for Environmental Assessments*" (attached separately) which outlines information that would be beneficial to include in environmental assessment documents when Health Canada's advice is requested.
Response:	Thank you for the information.

7.0 SUPPORTING DOCUMENT COMMENTS

7.1 Air Emissions and Dispersion Modelling Study (Stantec – June 2010)

198-EC 33	**EA Reference:**:	Dispersion Modelling Study Page 15, Table 6.2
Preamble:	The modelling scenarios are not adequately labelled in the second row of table 6.2. We believe they match, from left to right, the 5 scenarios described on P. 11.	
Request:	Please confirm the modelling scenarios in Table 6.2.	
Response:	Table 6.2 will be updated.	

	General Comments
199-NLDEC 2	• A) The use of AERMOD versus CALPUFF. CALPUFF is more suited for modeling of long-range transport and has been proven to work very well in the near field and near shore environments. AERMOD is supposed to be good out to 50 kilometers, but given the size of the domain (100 km x 65 km), AERMOD is stretching the limits of acceptability. It has been found that CALPUFF is the more accurate of the two models. • B) The surface meteorological data is taken from both Hibernia and St. John's by incorporating a "linear interpolation". The use of such a method would result in inaccuracies in model outputs. It implies that not all the hourly data required for input into AERMET is available. Please clarify if all the parameters needed to run AERMET are available from Hibernia (ceiling height and cloud cover in particular)? If not, how are they accounted for in the model description? Given these uncertainties, a recommended approach is to use output from a meteorological model such as NAM or GEM as the input into the dispersion model. • C) There is a possible error in the document. The model describes receptors, which are located at the same location as the emission sources (e.g., Hibernia, Terra Nova and White Rose). Please clarify how this arrangement can provide accurate data or if this is an editing error. • D) The NO2 / NO / NOx reduction methods were discussed but it never said which option was used. Please provide the option chosen so that modeling results can be put into perspective. • E) It is mentioned that the BPIP program was used to calculate effects of building downwash for "particulate sources". Does this mean that the downwash was not considered for gaseous emissions? In addition, BPIP is very sensitive to how inputs are entered. With the limited information provided, it cannot be determined whether BPIP will run accurately. • F) For particulate, only TSP was considered in the model. There is no mention of PM2.5, which is a primary particulate fraction of concern. There is minimal supporting information provided to validate the conclusions. The results indicate concentrations close to the provincial limits. It should be noted that if emissions exceed 50% of provincial limits, that the province could take action to request more detailed information or engage in monitoring of air emissions.
Response:	• A) It is agreed that CALPUFF is the better of the two models for *long-range issues* but the issue here is not one of long-range impacts, as the concentrations of Project emissions are too low to be of concern at the distances where a transition from AERMOD to CALPUFF would be advisable. Turbines, proposed for use on the Platform, are used for electrical power generation within urban areas across Canada, for example, at Dartmouth and Toronto airports. Setting the domain at the limits used was done because the other projects represent the nearest fixed receptors, and to be in alignment with other component studies. An extensive comparison of

	CALPUFF, AERMOD and ISC3 models on gas turbine exhausts was undertaken and the results presented at the Guideline for Air Quality Models Conference in 2003 (presentation and animated simulations available upon request). This work confirmed the suggestion that CALPUFF is the better model in the far field, but also showed that AERMOD is a useful, and cost-effective tool in the near to medium range. It is recommended for like situations by the US EPA, and it was agreed in discussion with Environment Canada to be suitable for this application. • B) The interpolation involved the estimation of the in-between observations of the three-hour surface observations at Hibernia. This was done by vector time interpolation of the wind; that is, the wind was decomposed into easting and northing components, each of which were interpolated for the intervening hours, and then recombined for a wind with the correctly oriented direction. Interpolation of weather model data to the site was considered; it was rejected in this case in favour of the actual observations that became available, albeit with some compromise. • C) The study did not attempt to assess the contribution of each platform to itself, therefore the receptor coordinates were not designed to accurately locate the air intakes, for example, and the design was not sufficiently advanced to provide locations for the intakes on the Hebron structure. At the separation distances between projects, the difference between the concentrations at the coordinates used and the actual air intakes for the platforms will be not significant. • D) The modelling for this Project has been done using a worst-case analysis. This can mean an assumption of complete conversion of NO to NO_2, despite the fact that it may overestimate by an order of magnitude; however, in situations where such an approach shows an apparent exceedance, it is necessary to conduct a more realistic appraisal of the conversion rate. Unfortunately, offshore locations have limited ambient ozone data and it is therefore considered appropriate to use a conservative conversion rate that will approximate worst-case conditions, at least within the relative near-field where maximum concentrations are predicted. A conversion rate of 25 percent is adequately protective of the environment, and have used that in this assessment to account for the 10 percent of NO_x emitted as NO_2, plus a conservative additional 15 percent converted in the relative near field. • E) The BPIP program was applied for all pollutants, not just particulate matter. A typographical error appears to have changed “particular” to “particulate”. The study team is very familiar with the application of BPIP, but in this Project, as is often the case, the engineering design proceeds while the environmental assessment is being prepared. This is one of the best uses of an environmental assessment process, as the design adapts to reduce impacts. Accordingly, the air quality assessment, including BPIP, has been redone to address the design of the physical structure, and other changes that may arise due to load changes or equipment sizing. As standard practice, senior reviewers within the air quality group review all approaches and calculations are considered. The remodelling as of September 28, 2010, is in final data summary, and all model inputs have been through quality checks. Revised model inputs are primarily the turbine emissions, stack sizes and platform geometry. The results indicate compliance with all applicable standards. • F) $PM_{2.5}$ is becoming of more immediate concern, but emission factors are rarely available, and, 24 hour levels are regulated at 25 $\mu g/m^3$ by Newfoundland and Labrador, and the Canada Wide Standard is 30 $\mu g/m^3$. The emission factor for Total Suspended Particulate Matter includes the $PM_{2.5}$ fraction. Comparison of the model results with the criteria indicates compliance with both.

8.0 APPENDIX A COMMENTS ON SEA ICE AND ICEBERG SECTIONS

8.1 Response to Comments on Sea Ice and Iceberg Sections

3 PHYSICAL ENVIRONMENT SETTING

3.1 Near shore Environment (Bull Arm Area)

3.1.4 Sea Ice and Icebergs

Comment A-1: *Para 1, sentence 1*: change "cyclical" to "variable".

Response: The sentence will be revised as follows:

Much like the offshore areas, pack ice presence in Trinity Bay from year to year is variable, based on a review of the weekly CIS charts from 1983 to 2008 inclusive.

Comment A-2: *Para 1, sentence 2*: Poor wording. Also, the type of ice most likely to be encountered should be specified: up until the middle of March mostly new ice (0-10cm) and grey ice (10-15cm) can be anticipated, however from mid-March to mid-May if any ice is in the vicinity it will likely be first-year ice (which can range from 30 cm to greater than 1.2 m). **Suggest the sentence be changed to "**On average, pack ice is present in Trinity Bay every 1-in-3 years or 33% of the time, in the form of new or grey ice (<15cm) prior to mid-March and in the form of first-year ice from mid-March to mid-May (>30cm).**"**

Response: The sentence will be edited as follows:

On average, pack ice is present in Trinity Bay every 1-in-3 years, or 33 percent of the time, in the form of new or grey ice (10 to 15 cm) prior to mid-March and in the form of first-year ice from mid-March to mid-May (>30 cm).

Comment A-3: *Figure 3-13*: **Inconsistencies/Errors in quoted Source** … in paragraph 1 of 3.1.4, you mention that ice charts from 1983-2008 were reviewed. For Figure 3-13, however, you quote the source as "Canadian Ice Service 2001", which would refer to the "Canadian Ice Service Sea Ice Climatic Atlas: East Coast of Canada 1971-2000". Further down, for Figure 3-14, you quote the source as "Canadian Ice Service weekly composite ice charts". … After reviewing the data in your graphs (Figures 3-13 and 3-14), it appears that you used the Ice Atlas data from 1971-2000 and not the 25-year 1983-2008 chart data that you mention in the text. **This needs to be corrected in the text and in the Sources listed under the Figures.**

Response: The Section will be revised as follows:

3.1.4 Sea Ice and Icebergs

Much like the offshore areas, pack ice presence in Trinity Bay from year to year is cyclical, based on a review of Environment Canada's Sea Ice Climatic Atlas (2001). Trinity Bay has pack ice in one form or another present on a ratio of 1-in-3 years.

The frequency of presence of sea ice in Trinity Bay by week is shown in Figure 3-13. For this analysis, the frequency of sea ice in the mouth (most seaward point) of the bay and at the bottom (most landward point) of the bay over a 25-year period was reviewed.

The source beneath Figure 3-13 will be revised as follows:

Source: Environment Canada Sea Ice Climatic Atlas (2001)

Comment A-4: Also, the reference to the East Coast Sea Ice Atlas is not listed in your references at the end of the CSR. The reference to the Atlas needs to be added.

Response: The reference list in Section 18.2 will be revised as follows:

Environment Canada Canadian Ice Service. 2001. *Sea Ice Climatic Atlas: East Coast Canada, 1971-2000.* Ottawa, ON.

Comment A-5: The only thing listed in the references is: "Canadian Ice Service, 2009. *Ice Archive. Latest, Past & Future Ice Conditions – East Coast.* Available at URL:

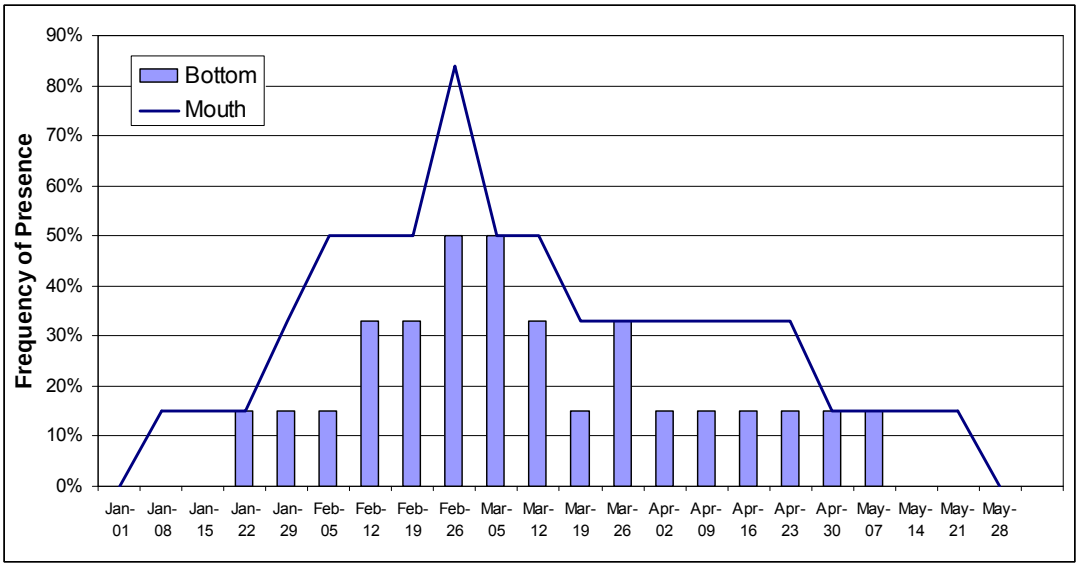
http://ice-glaces.ec.gc.ca/App/WsvPageDsp.cfm?Lang=eng&lnid=35&ScndLvl=no&ID=11889".

Note that CIS recently launched a new set of web pages, and referenced links may or may not work – all should be re-checked.

Response: Link to CIS Ice Archive, which is only CIS link cited, has been checked. This link is still functional and points to the correct address.

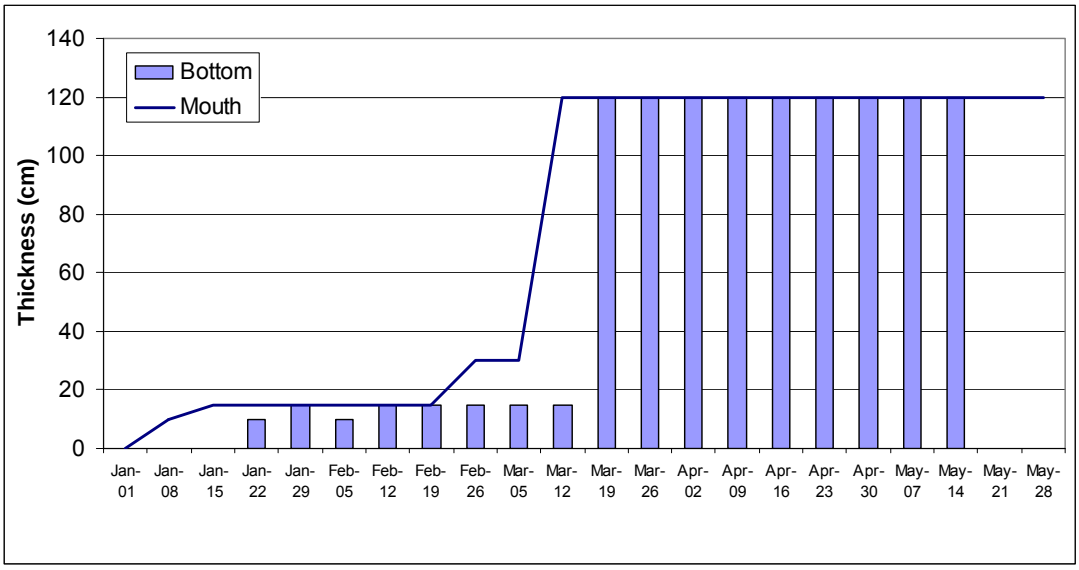
Comment A-6: **Also, on both Figures 3-13 and 3-14, the data for the week of Feb 19 was erroneously skipped and replaced with that for the week of Feb 26. As a result, all weeks after Feb 19 contain the data for the following week and the whole time series is out by one week. These graphs need to be corrected / re-done.

Response: The revised figures will be provided in the CSR as follows:



Source: Canadian Ice Service 2001

Figure 3-13 Frequency Presence of Sea Ice in Trinity Bay



Source: Canadian Ice Service 2001

Figure 3-14 Derived Sea Ice Thickness at the Mouth and Bottom of Trinity Bay

3.1.4.1 Ice Type

Comment A-7: *Para 1, sentence 2*: Add the underlined for clarification … As a result, the analysis uses the upper limit for the standard thickness-ranges of the ice types present to derive sea ice thickness.

Response: The sentence will be revised as follows:

As a result, the analysis uses the upper limit for the standard thickness-ranges of the ice types present to derive sea ice thickness.

Comment A-8: *Para 2*: **Several items are not clear here**. In the paragraph above, you say that you use the upper limit to derive the ice thickness in Figure 3-14. Then in Figure 3-14, you actually use the lower limit (70cm) for the first year ice range that you describe (70-120cm).

Note that there are different categories of first year ice (FYI) thickness (thin FYI = 30-70cm; medium FYI = 70-120cm; thick FYI > 120cm). In the text you are talking about medium FYI but neglect to mention this. However, since the Atlas (from which the graph data was derived) does not distinguish between FYI categories, categories should not be mentioned here. **All of section 3.1.4.1 as well as the data in Figure 3-14 (as described here and for the source error and missing week as described above) needs to be checked, re-plotted and the paragraph re-worded and clarified.**

Response: The figures are now using the Upper Limit (see Response to Comment A-6).

The following text will be inserted into Section 3.1.4.1

There are few quantifiable data on the exact thickness of the sea ice in Trinity Bay. As a result, the analysis uses the upper limit for the standard ice types to derive sea ice thickness. As with the offshore area, most sea ice that occurs within the bay is formed off southern Labrador and drifts south to enter the bay around the mid-March timeframe.

The derived sea ice thickness is shown in Figure 3-14 in centimetres (when ice is present) in Trinity Bay by week. This analysis includes the sea ice at the mouth and bottom of the bay over the same 25-year period.

3.1.4.2 Iceberg Conditions in Trinity Bay

Comment A-9: *Para 1, sentence 3*: **Typo** … According to Figure 3-15, the maximum number of icebergs (129) was sighted in **1997, not in 1979**. This typo needs to be corrected.

Response: The sentence will be revised as follows:

The maximum number of icebergs sighted in one year over the period of study was 129 in 1997, while the mean annual number for Trinity Bay is 32. In the area of Trinity Bay, the number of icebergs detected from year to year may be an underestimation of what is actually present as the Trinity Bay region does not lie on a primary route for aerial ice reconnaissance.

3.1.4.3 Iceberg Distribution by Year

Comment A-10: In the references, the PAL Iceberg Sighting Database is listed as spanning the years 1989 to 2008. Why is the data in Figure 3-15 only plotted from 1992 to 2007? Is the data from the earlier years not used because it is considered unreliable? Or is it because these years contained no data for Trinity Bay? Either way, it needs to be stated why the full range of years available in the database was not considered.

Response: The following text will be included in Section 3.1.4.3

Considerable fluctuations in the yearly iceberg distribution are evident in the PAL data. However, the same is true when considering any one-degree block off Canada's East Coast. The yearly iceberg distribution is shown in Figure 3-15, based on the PAL sighting database. Data from 1992 through to 2007 were used because data in the Trinity Bay region was variable as it does not lie on a regular flight route for iceberg surveillance. Data prior to 1992 are not well-documented and are not as of solid quality as those data logged from 1992 onwards.

3.1.4.4 Iceberg Distribution by Month

Comment A-11: Again, if the PAL database spans 1989-2008, why were only the years 1992-2007 considered in figure 3-16?

Response: Please refer to the response to Comment A-10.

3.1.4.5 Iceberg Size Distribution

Comment A-12: Table 3-20: Source … the most recent version of MANICE is dated 2005. This should be corrected in the Source and in the references at the end.

Response: Table 3-20 will be revised as follows:

Table 3-20 Iceberg Size

Category	Height (m)	Length (m)	Approx. Mass (T)
Very Large	>75	>200	<10 Million
Large	45 to 75	120 to 200	2 to 10 Million
Medium	15 to 45	60 to 120	100,000 to <2 Million
Small	5 to 15	15 to 60	100,000
Bergy Bit	1.0 to 5	5 to 15	10,000
Growler	<1.0	<5	1,000
Source: Meteorological Service of Canada Canadian Ice Service MANICE (2005)			

The list of references in Section 18.2 will be revised as follows:

Meteorological Service of Canada Canadian Ice Service. MANICE: Manual of Standard Procedures for Observing and Reporting Ice Conditions. Ottawa, Ontario: Meteorological Service of Canada, 2005.

3.2 Offshore

3.2.3 Sea Ice and Icebergs

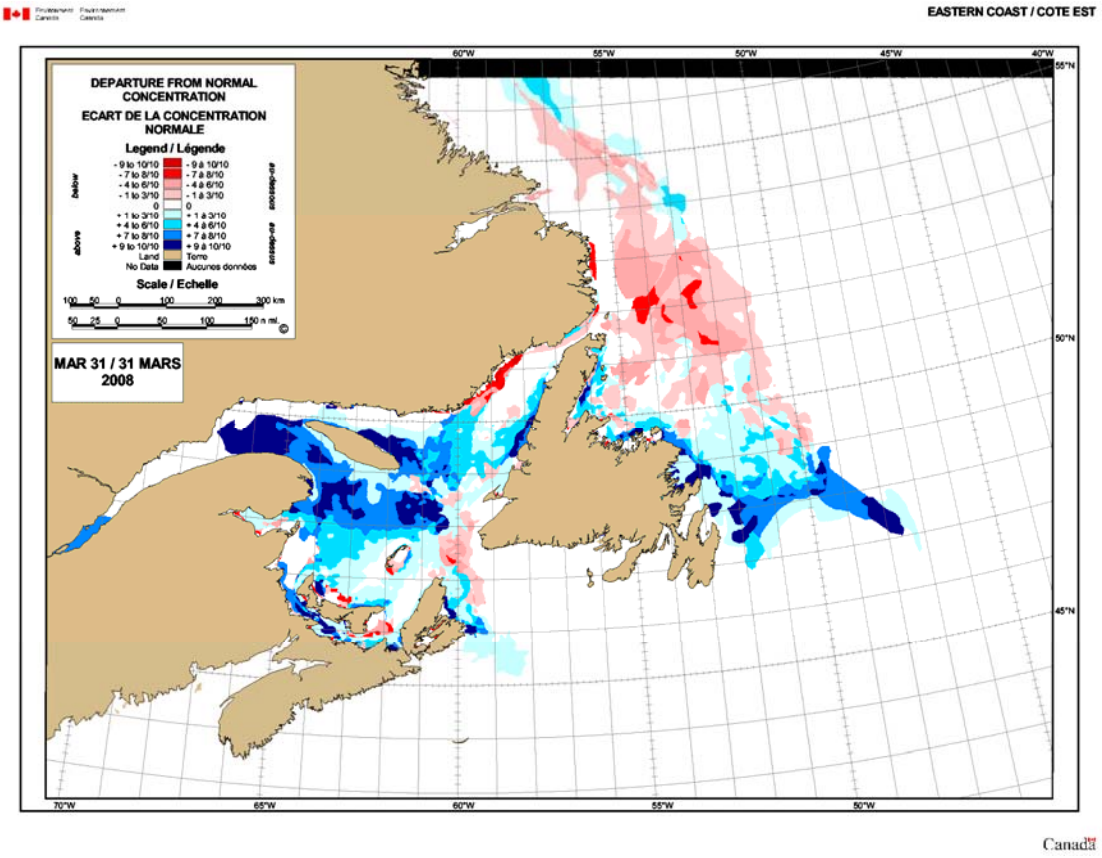
Comment A-13: The three paragraphs in this section are well written. However, the information presented in the second paragraph fails to emphasize that sea ice can also be a significant threat to platform operations in some years, and not only because it can mask icebergs (which pose the more common hazard). This is in spite of the fact that in the Hebron area sea ice, when present, is generally "loosely packed", "pressure-free", "with small floes" and "in the advanced stages of deterioration". For example, in April 2008, the White Rose oil platform was evacuated because of higher-than normal sea ice concentrations in the vicinity. The following article (see link below) about the incident contains many errors (e.g. it confuses sea ice floes and icebergs), but nevertheless records the fact that the platform was evacuated and production shut down because of encroaching sea ice in 2008:

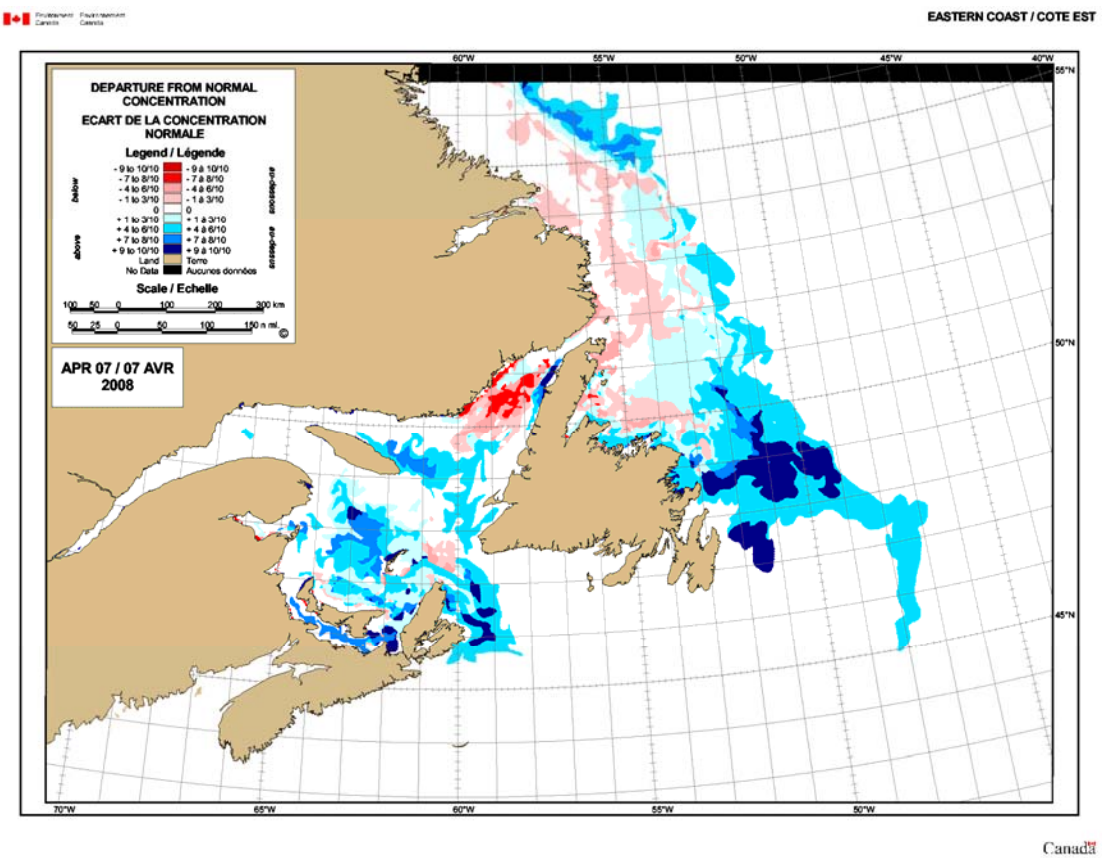
http://www.canada.com/calgaryherald/news/calgarybusiness/story.html?id=663b91ce-7090-4de1-9647-6948a5f10ef0.

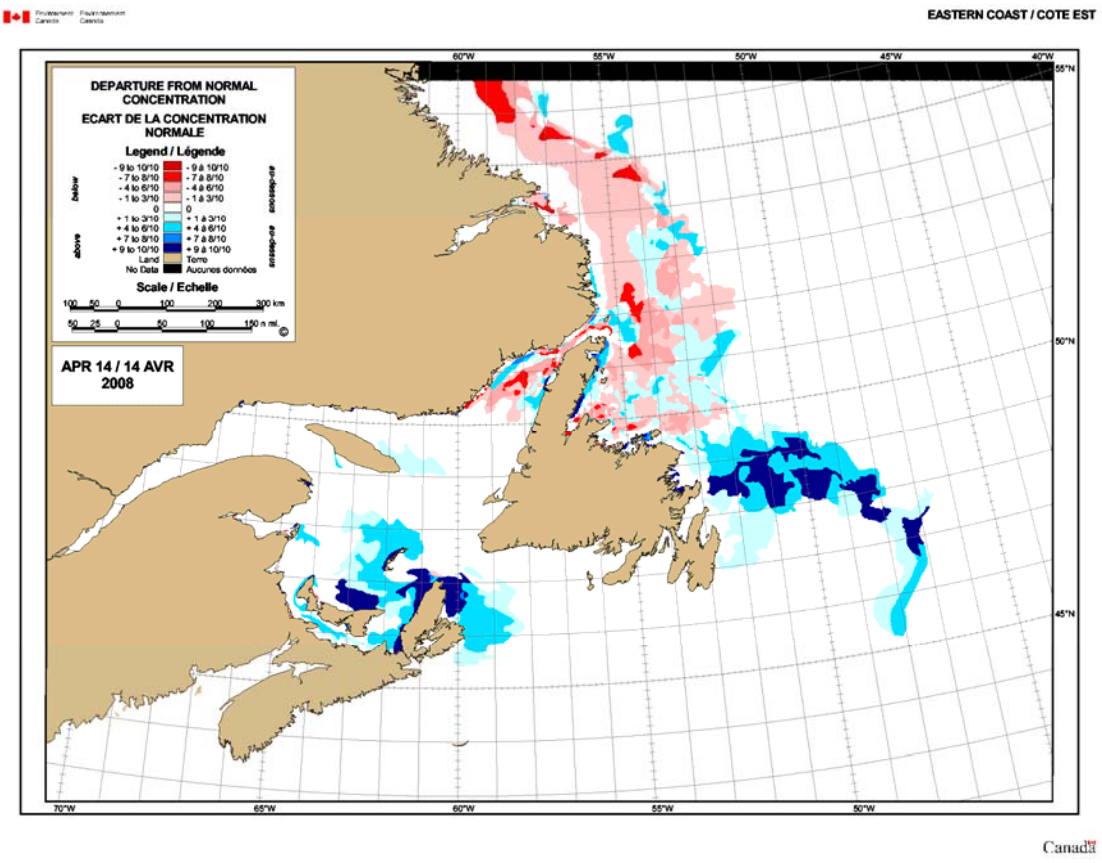
Response: The text will be revised as follows:

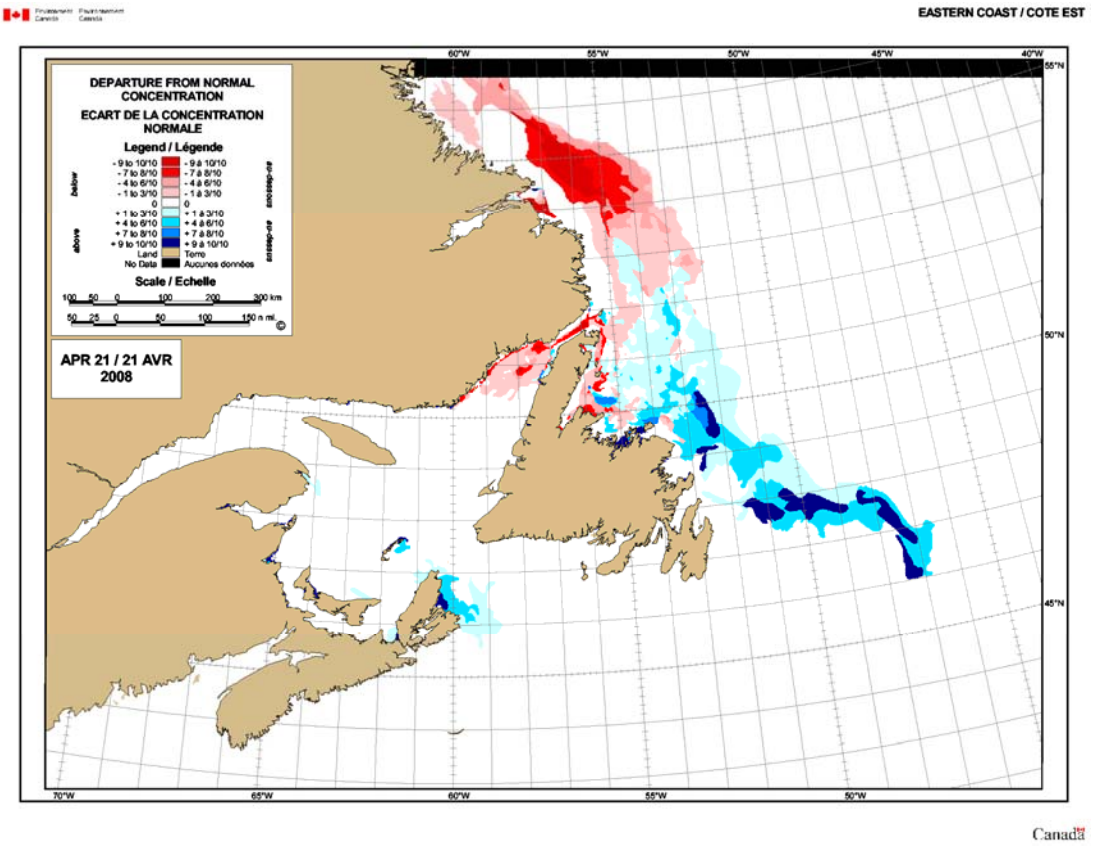
The Hebron Offshore Project Area is located on the eastern slope of the Continental Shelf, making it susceptible to seasonal incursions of ice. Two different forms of floating ice - sea ice and icebergs - are present in this marine environment. Sea ice is produced when the ocean's surface layer freezes. In the Hebron Project Area, sea ice is loosely packed and pressure-free. Floes are small and generally in advanced stages of deterioration permitting easy vessel movement. Despite this, sea ice can interfere with iceberg detection and management operations, and can force a facility to reduce operations if the quantity of pack ice near the facility exceeds the amounts in which evacuation equipment can be safely deployed and used. Sea ice is also known to carry embedded icebergs, and should these bergs start free drifting near a facility, implications may follow. Icebergs are freshwater ice made from snow compacted in a glacier. When the leading edge of a glacier reaches the sea, slabs of ice fall from it creating icebergs. Grand Banks icebergs originate primarily from the glaciers of West Greenland. Ice management efforts focus on icebergs as they can pose a hazard to offshore production facilities.

Comment A-14: Below is the series of departure-from-normal concentration sea ice charts showing the encroaching sea ice in the White Rose area over the period spanning end-of-March through April 2008:


EASTERN COAST / COTE EST
DEPARTURE FROM NORMAL CONCENTRATION
ECART DE LA CONCENTRATION NORMALE
Legend / Légende
Scale / Echelle
MAR 31 / 31 MARS 2008
Canada


EASTERN COAST / COTE EST
DEPARTURE FROM NORMAL CONCENTRATION
ECART DE LA CONCENTRATION NORMALE
Legend / Légende
Scale / Echelle
APR 07 / 07 AVR 2008
Canada


EASTERN COAST / COTE EST
DEPARTURE FROM NORMAL CONCENTRATION
ECART DE LA CONCENTRATION NORMALE
Legend / Légende
- 9 to 10/10
- 7 to 8/10
- 4 to 6/10
- 1 to 3/10
0
+ 1 to 3/10
+ 4 to 6/10
+ 7 to 8/10
+ 9 to 10/10
Land
No Data
- 9 à 10/10
- 7 à 8/10
- 4 à 6/10
- 1 à 3/10
0
+ 1 à 3/10
+ 4 à 6/10
+ 7 à 8/10
+ 9 à 10/10
Terre
Aucunes données
below
above
en dessous
en dessus
Scale / Echelle
APR 14 / 14 AVR 2008
60°W
55°W
50°W
45°W
40°W
55°N
50°N
45°N
70°W
65°W
60°W
55°W
50°W
Canada


EASTERN COAST / COTE EST
DEPARTURE FROM NORMAL CONCENTRATION
ECART DE LA CONCENTRATION NORMALE
Legend / Légende
- 9 to 10/10
- 7 to 8/10
- 4 to 6/10
- 1 to 3/10
0
+ 1 to 3/10
+ 4 to 6/10
+ 7 to 8/10
+ 9 to 10/10
Land
No Data
- 9 à 10/10
- 7 à 8/10
- 4 à 6/10
- 1 à 3/10
0
+ 1 à 3/10
+ 4 à 6/10
+ 7 à 8/10
+ 9 à 10/10
Terre
Aucunes données
below
above
en dessous
en dessus
Scale / Echelle
APR 21 / 21 AVR 2008
60°W
55°W
50°W
45°W
40°W
55°N
50°N
45°N
70°W
65°W
60°W
55°W
50°W
Canada

Response: The CSR will be revised to include the departure from normal charts.

Comment A-15: It is our understanding that, while the sea ice itself does not pose a direct serious hazard to the platform, concentrations greater than six tenths (>6/10) prevent the safe launch of emergency escape life-raft pods from the platform chutes into the water below. If there is the possibility that life rafts cannot be launched, preventing escape from the platform in the case of an emergency, then operations need to be shut down and personnel evacuated. **This should be verified and confirmed with those who coordinated the White Rose evacuation in 2008**.

Response: Operations practice is to reduce operational risk as ice conditions worsen. A matrix and ice response plan will be developed for the Hebron Project, including actions such as reducing staffing and discontinuing higher risk operations.

3.2.3.1 Sea Ice

Formation, Growth and Thickness

Comment A-16: *Para 1, sentence 2*: In this sentence you mention "young" ice, but this is not defined in Table 3.50. Young ice comprises Grey and Grey-white ice and ranges from 10 to 30 cm in thickness.

Response: The sentence will be revised as follows:

Almost all of the ice occurring near Hebron Platform location is either young (Grey and Grey-white ice between 10 and 30 cm in thickness) or first year ice between 30 and 100 cm thickness.

Comment A-17: *Table 3.50*: **Several corrections are required to this table, since MANICE is cited as the reference**. 1) In MANICE, new ice is defined as having a thickness **<10cm**, not 10cm; 2) The term "White Ice" is not an official MANICE term – the term "**First-Year**" ice should be used [White ice is a type of thin First-Year Ice as per MANICE (2005) page 1-3]; 3) The thickness range of first year ice given in MANICE is any ice that is **>30cm**, and not 30-200cm [White ice can be 30 – 70 cm thick as per MANICE (2005) page 1-3; first stage white ice is 30 – 50 cm thick while second stage white ice is 50 – 70 cm thick]; 4) The descriptions in the Age column are not exactly correct. The phrases "Early season first year" and "Mid-season first year" ice are misleading as these ice types can develop throughout the season at the fringes of and between floes within the main ice pack. Removing the "Age" column and changing the header of column 1 from "Description" to "Stage of Development" is suggested, in keeping with the term used in MANICE; and 5) the latest version of MANICE is dated 2005.

Response: Table 3-50 will be revised as follows:

Table 3-50 Characterization of Sea Ice by Type, Thickness and Age

Stage of Development	Thickness (cm)	Age (General Guideline)
New Ice	<10	Earliest stage of development
Young (Grey) Ice	10 to 15	First year; generally early season
Young (Grey-White) Ice	15 to 30	First year; generally mid-season
Young (White) Ice	30 to 70	First year
Old Ice	--	Second and multi-year ice
Source: Meteorological Service of Canada Canadian Ice Service MANICE (2005)		

Spatial Distribution

Comment A-18: *Para 2, sentences 2, 3, and 4*: **The interpretation presented in this paragraph is not exactly correct and is written in a confusing way.** For example, on the charts, the exact 50% presence of sea ice line (equivalent to the median ice extent) lies between the blue and green areas on the charts, and is not represented by the blue area as indicated in sentence 3. Also, in sentence 2, the black area is discussed and then it goes on to say that this indicates, "in all months the region was ice-free in at least one year". Because the Hebron area (indicated by a star on the charts) is not specifically referred to in sentence 2, it makes it sound like the black area is still the region being discussed. This could be very confusing to someone who is not used to looking at

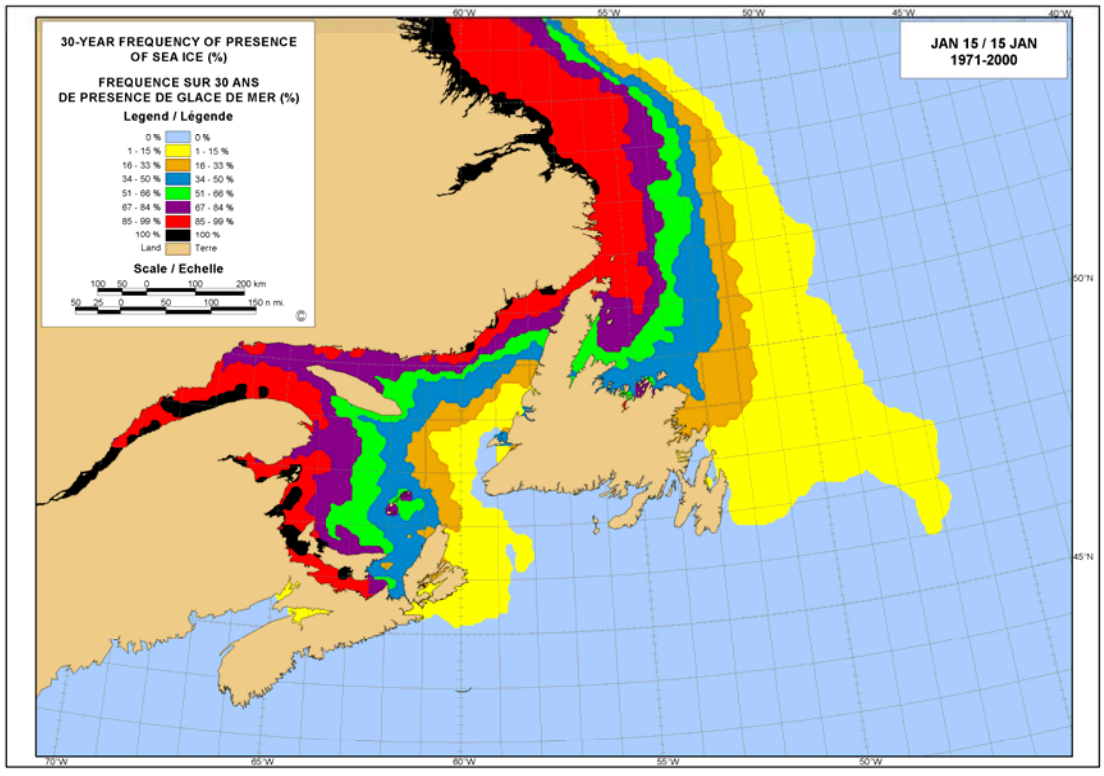
these charts. If mentioning the black area at all, it should be referred to as the area where ice is present 100% of the time but which is significantly north of the drilling site.

Suggest replacing Para 2, sentences 1-4 with: "The maximum mid-month ice extents for January through May, southeast of Newfoundland, are indicated by the yellow areas in Figures 3-29 to 3-33. These maximum extents are composites of the most advanced ice edges recorded over the 1971-2000 period. The Hebron platform location, indicated by a star on Figures 3-29 to 3-33, lies within the limit of the maximum recorded ice extent during the months of February, March and April. However, based on 1971-2000 data and as is indicated by the colours on the charts, the probability that this location will lie within the maximum limit is 1-15% in February and April, and 16-33% in March."

Response: Paragraph 2, sentences 1 to 4, will be replaced with the following:

The maximum mid-month ice extents for January through May, southeast of Newfoundland, are indicated by the yellow areas in Figures 3-29 to 3-33. These maximum extents are composites of the most advanced ice edges recorded over the 1971 to 2000 period. The Hebron Platform location, indicated by a star on Figures 3-29 to 3-33, lies within the limit of the maximum recorded ice extent during the months of February, March and April. However, based on 1971 to 2000 data and as is indicated by the colours on the charts, the probability that this location will lie within the maximum limit is 1 to 15 percent in February and April, and 16 to 33 percent in March."

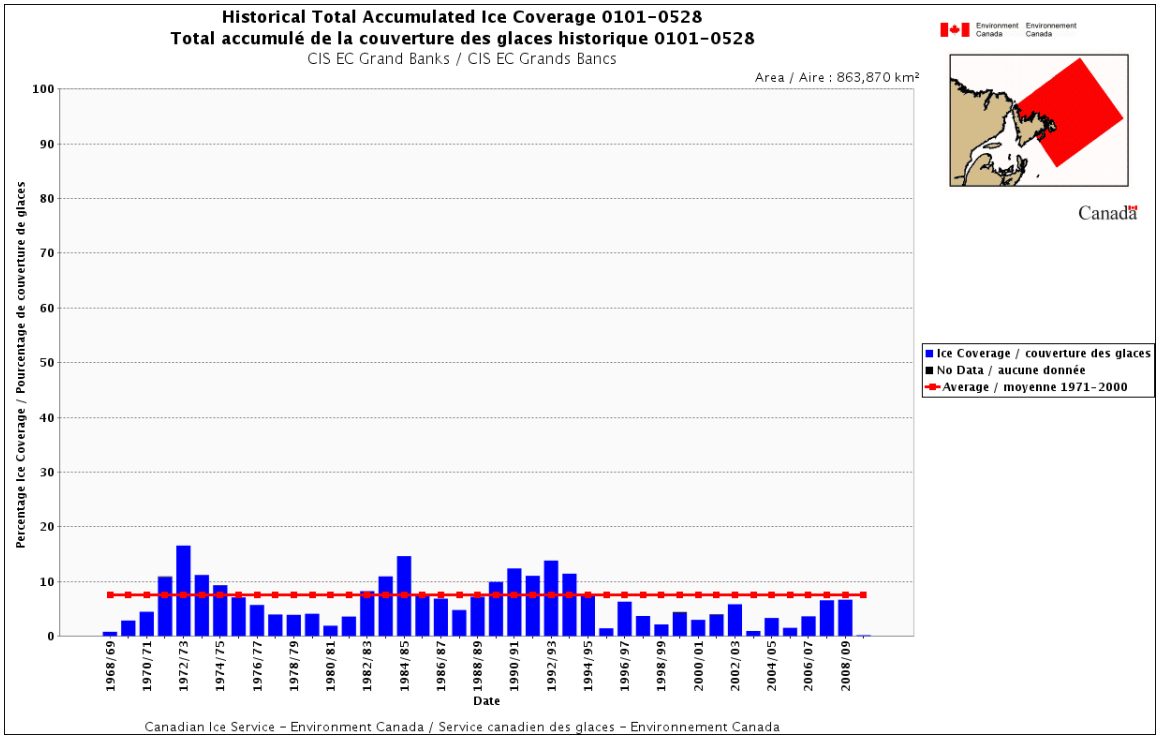
Comment A-19: *Figure 3-29*: This is not the "mid-month" chart for January. The charts for all the other months are for close to the 15th of that month, and in the text it says the included charts are for "mid-month", so why not use the January 15th chart (below) as opposed to the January 8th chart (used in the study)? Replace Figure 3-29 with:



Canada

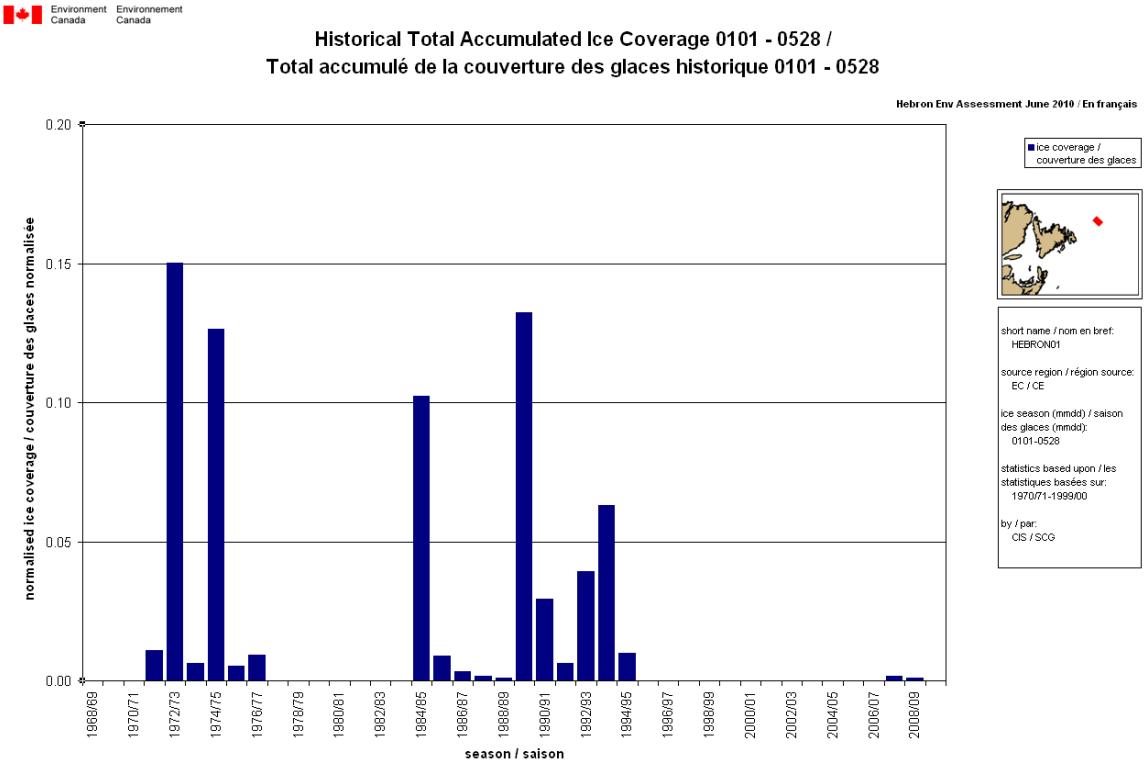
Response: Figure 3-29 will be replaced with above chart.

Comment A-20: *Figure 3-34*: Why was this graph produced for the entire east coast and not specifically for the Grand Banks area (which is an option with CIS's online Ice Graph tool). Additionally, as indicated by the ice charts shown in Figures 3-29 to 3-33, the ice season for this area usually begins in January and ends in May, so why choose a period from mid-November to mid-July to average over? **It would be better if this time series were replaced with one specific to the Grand Banks and representing the average for the January to May period (see below)**:



Response: Figure 3-34 will be replaced with the above and the text will be revised to reflect that it provides information specifically for the Grand Banks area.

Comment A-21: CIS also has the capability of generating such ice graphs for areas not included in the web tool, if requested. It might also be good to include the following ice graph, tailored specifically to the Hebron Platform area. This graph also emphasizes that, based on 1969-2010 data, ice is only present in the area in approximately 19 years out of every 42 years (or in ~45% of the years). Based on 1971-2000 data, ice was present in that area in 57% of the years. The springs of 2008 and 2009 represented the first time ice was seen in that area within the last 15 years. (Note that the ice graph below shows an "Accumulated Ice Coverage" for the entire January to May period. Naturally, the "frequency of presence of sea ice" for the January to May period is higher than that for any individual month as shown in Figures 3-29 to 3-33).



The above ice graph also makes a nice progression between the larger Grand Banks area (Figure 3-34) and the area within a 15km radius of the platform (Figure 3-35).

Response: The above figure will be added to the CSR (new Figure 3-X).

Comment A-22: *Figure 3-35:* In the text and in the caption, it says that this data is for within **15 km** of the platform location, but in the title of the top graph of Figure 3-35 it says within **28 km** of the platform. **Either the title or the Figure caption and text need to be corrected**.

Response: The figure caption will be revised as follows:

Figure 3-X: Weekly Incursions of Sea Ice Within 28 km of Hebron Platform Location

Comment A-23: Also, in the table for Figure 3-35 it is not clear what the values within the grey boxes represent. If they represent the average concentration of ice within 28 km of the Hebron platform, then the column containing the Mean Concentration in the table contains errors. For example, for year 1991, values of 1, 9 and 4 are indicated. The mean value should then be 4.67, but the corresponding Mean concentration given in column 7 is "9". On the other hand, if the values in the grey boxes represent "occurrence of ice within the 28km radius" as indicated in the column header, how can a value of 9 be obtained for a 7-day period? **The values in the table in Figure 3-35 need to be clearly defined and re-checked for errors**.

Response: Figure 3-35 will be revised as follows:

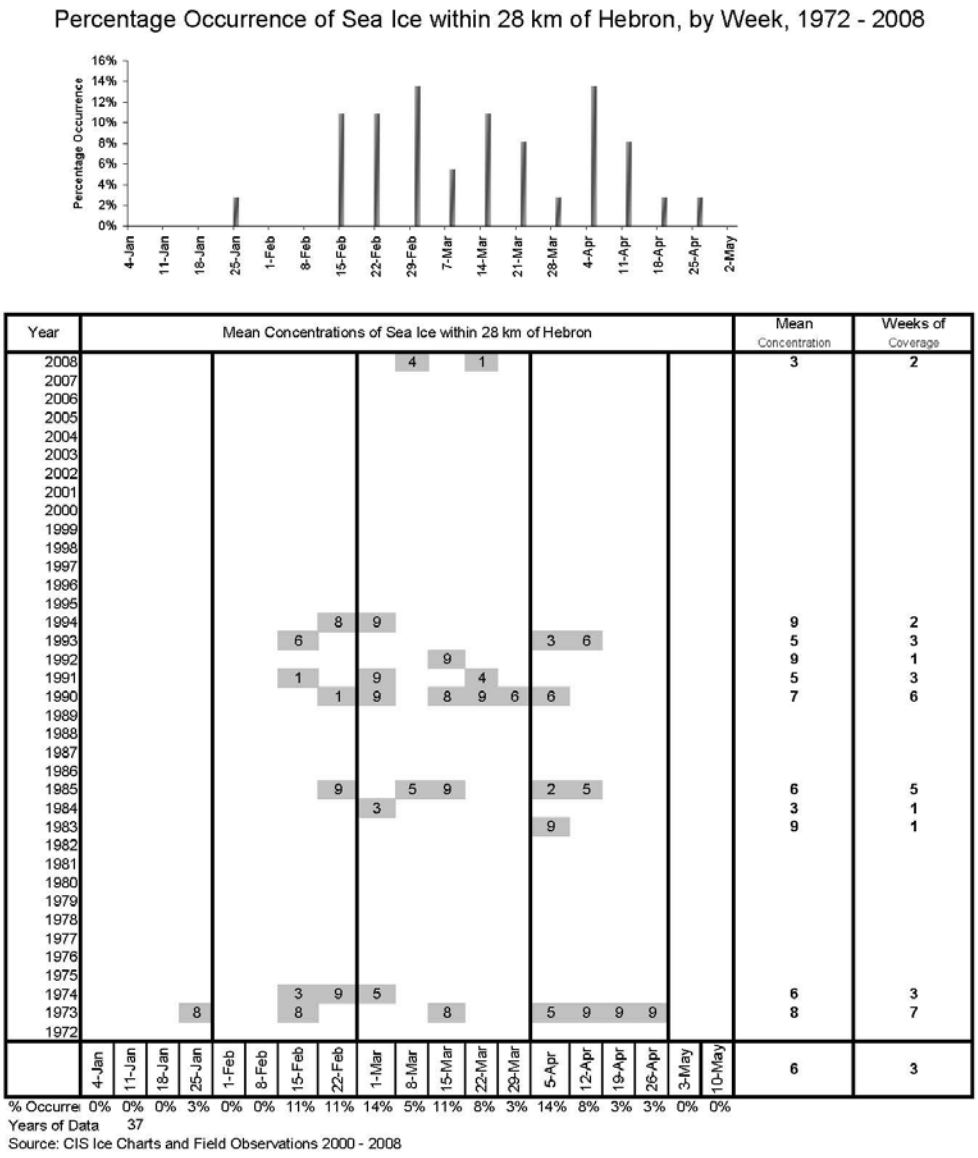


Figure 3-35 Weekly Incursions of Sea Ice within 28 km of Hebron Platform Location

Comment A-24: *Spatial Distribution section, para 4*: This paragraph is organized in a confusing way. **Please make the following edits**: "The time frame of the annual ice incursions within 15 km of the Hebron Platform location, based on data from 1972 to 2008, is shown in Figure 3-35. These data show the onset (roughly between 1983 and 1994) of a period of greater incursions which was then followed by a period of no pack ice incursions (from 1997 to 2007). The data also show that ice incursions are centred broadly in mid-March."

Response: The text will be revised as follows:

The time frame of the annual ice incursions within 28 km of the Hebron Platform location, based on data from 1972 to 2008, is shown in Figure 3-35. These data show the onset (approximately between 1983 and 1994) of a period of greater incursions which was then followed by a period of no pack ice incursions (from 1997 to 2007). The data also show that ice incursions are centred broadly in mid-March.

Comment A-25: *Spatial Distribution section, last para*: Again, the sentences in this paragraph are written in a very confusing way. For example, sentence 1 begins with rates in terms of years but then jumps to weekly periods with no logical transition from one phrase to the next. **Please edit this paragraph as follows**: "The Hebron Platform location experienced sea ice incursions in 11 of the 37 years examined in Figure 3-35. This is equivalent to a rate of one in every three to four years. Weekly probabilities, which peak at 14 percent, show two maxima: the first in the last week of February; and the second on the first week of April. The duration of the incursions vary from a minimum of one week to a maximum of seven weeks. Of the 11 years that ice was present, the average duration was three weeks."

Response: The text will be revised as follows:

The Hebron Platform location experienced sea ice incursions in 11 of the 37 years examined in Figure 3-35. This is equivalent to a rate of one in every three to four years. Weekly probabilities, which peak at 14 percent, show two maxima: the first in the last week of February; and the second on the first week of April. The duration of the incursions vary from a minimum of one week to a maximum of seven weeks. Of the 11 years that ice was present, the average duration was three weeks.

3.2.3.2 Sea Ice Movement

Comment A-26: *Para 1, sentence 1*: Make clearer … Suggest simplifying sentence 1 to: "Although the Hebron Platform location lies near the extreme southern limit of the regional ice pack, it is affected by the ice tongue that is formed by the loose pack ice being swept around the Grand Banks by the offshore branch of the Labrador Current".

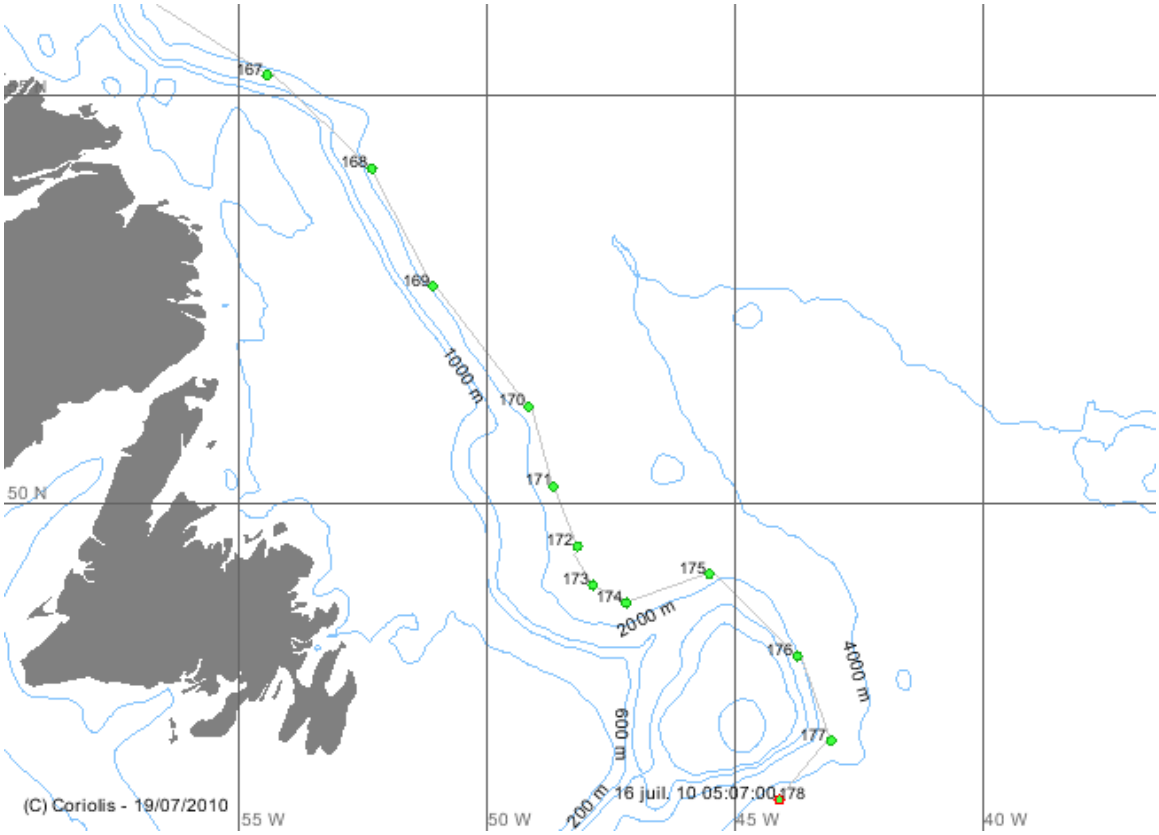
Response: The text will be revised as follows:

Although the Hebron Platform location lies near the extreme southern limit of the regional ice pack, it is affected by the ice tongue that is formed by the loose pack ice being swept around the Grand Banks by the offshore branch of the Labrador Current.

Comment A-27: *Para 2 and Figure 3-36*: **Inconsistent reference**. In the text it says the study was conducted over the period 1984-87 by Seaconsult Ltd. (1988), but in the figure itself it says "Data: February through April 1985" and references "Fissel et al. (1985)".

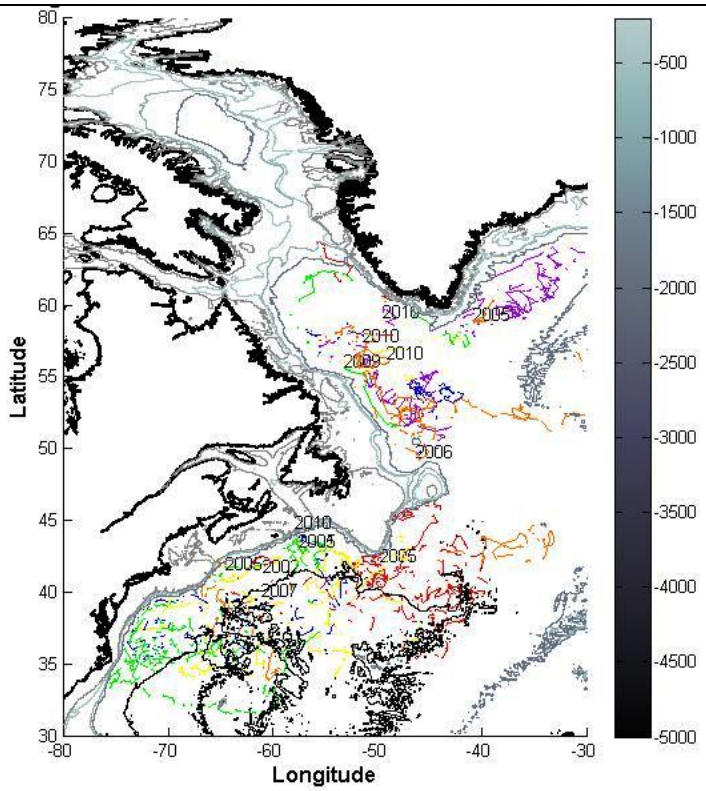
Additional comment: the drift speed and direction study was conducted over a very limited period of 4 years (1984-87). Many factors can influence ice drift, including some that may not have been observed during this 4-year study. A new study should be conducted using new ARGO float data, freely available here: http://www.argodatamgt.org/Access-to-data/Argo-data-selection .

For example, the drift track of ARGO float 6900190, released in 2005 south of Iceland, could be followed down the east coast and along the slope of the Grand Banks in 2010 (green dots on figure below) over the period March 28 (float cycle 167) through July 16 (float cycle 178).



Response: The following text will be added to Section 3.2.3.2

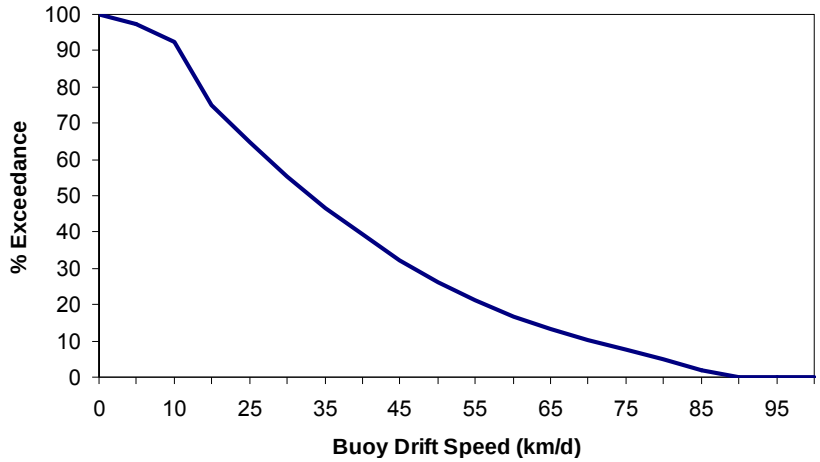
A verification study was carried out by Provincial Airlines Environmental Services Division with 18 Argo drifters from the years 2002 to 2010 in the North Atlantic Ocean, as obtained from the Integrated Science Data Management (ISDM) department of DFO. The spaghetti plot in Figure 3-X illustrates the tracks of these drifters. Each drift track is denoted by a different color line, with the year number indicating the point at which the drifter started transmitting data. Breaks in the lines indicate gaps in the data of five or more days, which may be a result of transmission errors or filtering of the data for quality control.



Source: ISDM 2010

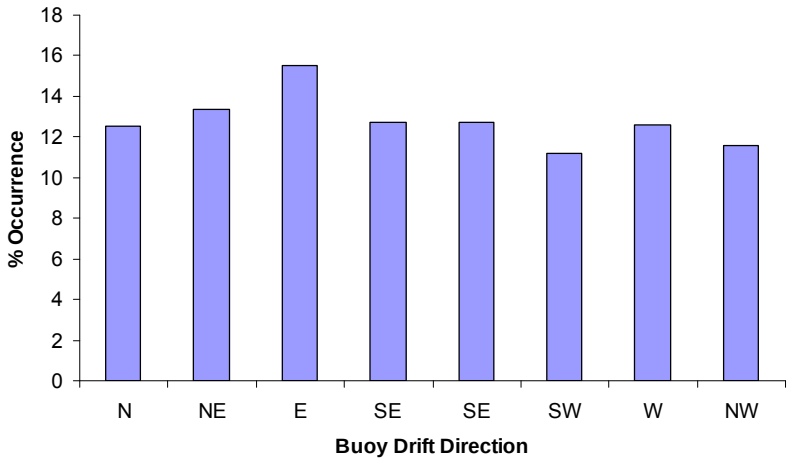
Figure 3-X Tracks of Argo Drifter, 2002 to 2010

Analysis of these tracks determined that similar drift speeds were encountered in the study by Fissel *et al.* (1985). The drift speed (Figure 3-X) was observed to be marginally higher overall, but this may be attributed to the fact that the 2002 to 2010 data were collected year-round while the 1985 study focussed on just one season (spring 1985). Similarly, there was no predominant direction of drift (Figure 3-X) in the PAL study, but the Fissel *et al.* (1985) study found that southeast drift was most common. This may be a result of both seasonal drift and geographic distribution of the drifters under study. The PAL study was widely distributed across the North Atlantic and undoubtedly captured less of the Labrador Current flow that Fissel *et al.* (1985) was focussed on, leading to the observation of multi-directional drift.



Source: ISDM 2010

Figure 3-X Buoy Drift Speed



Source: ISDM 2010

Figure 3-X Buoy Drift

The following reference will be added to Section 18.2:

ISDM (Integrated Science Data Management). 2010. Argo Canadian Tracked Data, 2002 - 2010. Available at URL: http://www.meds-sdmm.dfo-mpo.gc.ca/isdm-gdsi/argo/canada/data-donne-eng.html

3.2.3.3 Concentrations

Comment A-28" *Para 1*: The statements made in this paragraph do not agree with CIS median ice concentration charts. It appears that the statements were derived from the "Frequency of Presence of Sea ice" charts shown in Figures 3-29 to 3-33, and that "frequency of presence of sea ice" has been confused with "mean sea ice concentrations". **This needs to be corrected.** Also, it is not clear how the information in this paragraph, which purports to describe the seasonal variation in sea ice concentrations over the Grand Banks, relates to Figure 3-37 (whose data is not divided into monthly periods) as indicated in the last sentence. This needs to be amended.

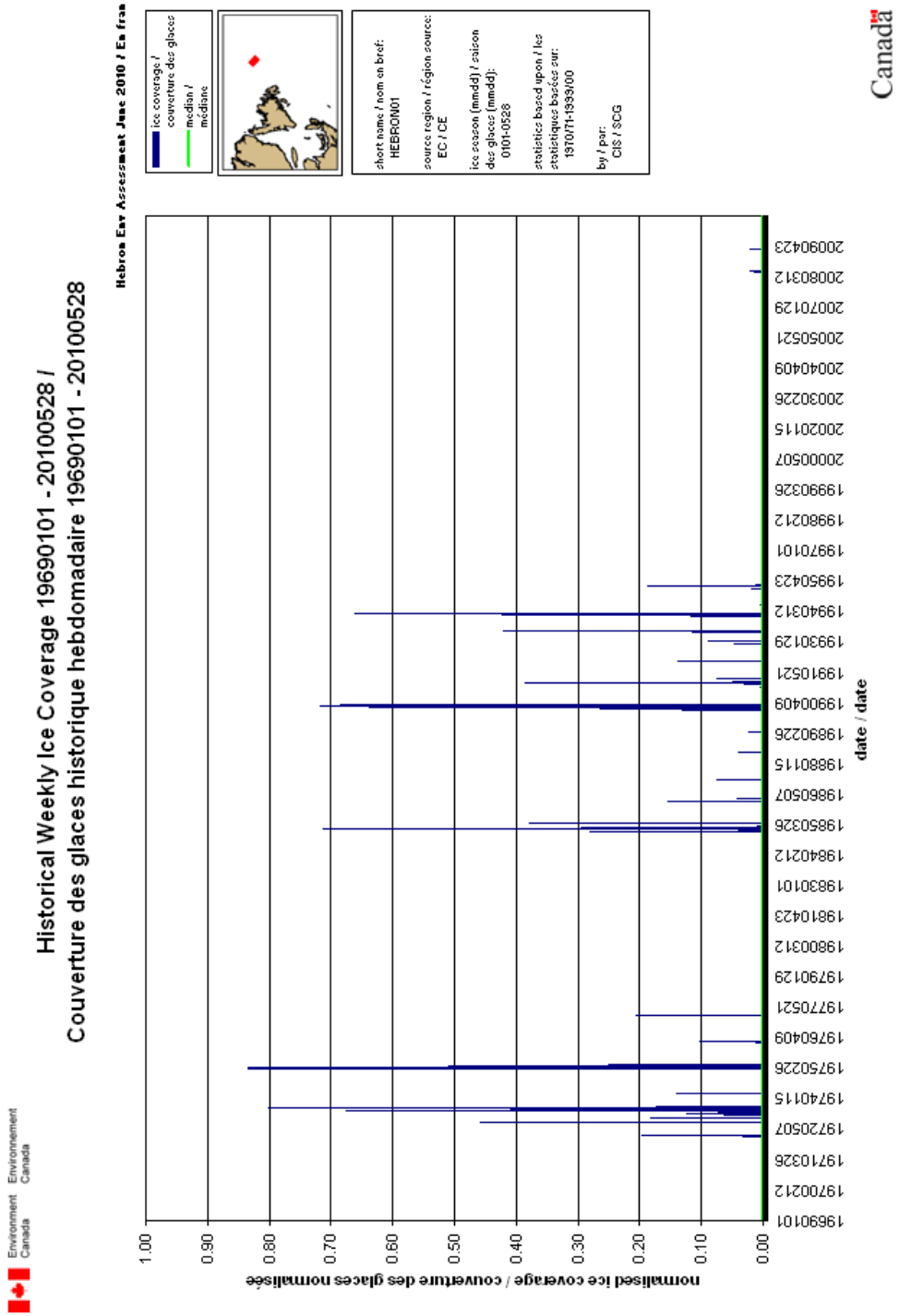
Response: The text will be revised as follows:

Frequency of presence of sea ice concentrations for the Grand Banks south of 49°N are fairly consistent at approximately 6/10ths coverage. Ice concentrations of greater than 5/10ths are evident by early February and continue through to mid-April, after which they slowly decrease to 2/10ths coverage as per Figure 3-37.

Comment A-29: *Figure 3-37 and Para 2*: √√ **Pie chart values were checked and are OK.** A spot-check was performed on several years during the 1979-2008 period during which ice was present in the Hebron area, using the CIS archived regional chart data. In 1985, ice affected the Hebron area between Feb03 and Apr07. Charts were produced every 3 days during this period, for a total of 17 charts. Ice concentrations greater than or equal to 8/10 affected Hebron on 8 (or 47%) of these charts and ice concentrations less than 8/10 affected Hebron on 9 (or 53%) of the charts. These numbers agree with the values presented in the pie chart, where concentrations of greater than or equal to 8/10s were determined to affect the area 46% of the time (during years when ice was present) and concentrations less that 8/10s were determined to affect the area 54% of the time. For 1993, ice affected the Hebron area on 3-4 charts from Feb08 to Apr19, and none of the charts indicated 8/10 or greater ice concentrations. Therefore, in this year, the proportions of 8/10 or more versus less than 8/10 is 0% and 100%. For 1994, a time when charts were done every week, ice affected the Hebron area from Feb14 to Mar07 (4 charts). Ice concentrations of 8/10 or greater impacted the Hebron area on ~3 of the charts, changing the proportions to 75% and 25%. For the 3 spot-check years, the average % of time with ice concentrations of 8/10 or greater is 40%, close

enough to the pie-chart percentages given the limited number of years checked. The mean overall concentration, based on the data in the pie chart is ~7/10 as indicated.

****Another way to show the information above would be to include the following Ice Graph**, which shows weekly ice coverages for the Hebron-specific area (although the coverages average less than the concentrations in the pie chart in Figure 3-37 because the area considered is >15km radius. The area on the Ice Graph covers a 1°×1° or 111km N-S × 76.5km E-W box).



Response: The above figure will be included in the CSR.

3.2.3.4 Floe Size

Comment A-30: *Sentences 2 and 3, immediately under the bullets*: Poorly written and unclear. **Rephrase as**: "In Newfoundland waters, floe sizes tend to decrease from north to south and from west to east, towards the outer margins of the ice pack. Enhanced melt and disintegration of the ice floes occurs at the outer ice pack margins as a result of larger amplitude waves (not damped by the ice pack proper) and warmer sea surface temperatures."

Response: The text will be edited as follows:

In Newfoundland waters, floe sizes tend to decrease from north to south and from west to east, towards the outer margins of the ice pack. Enhanced melt and disintegration of the ice floes occurs at the outer ice pack margins as a result of larger amplitude waves (not damped by the ice pack proper) and warmer sea surface temperatures.

Comment A-31: *Para 4, sentence 1*: It should be noted in the text that the Atmospheric Environment Service (AES) is now the Meteorological Service of Canada (MSC) and that the Canadian Ice Service (CIS) is a branch of the MSC.

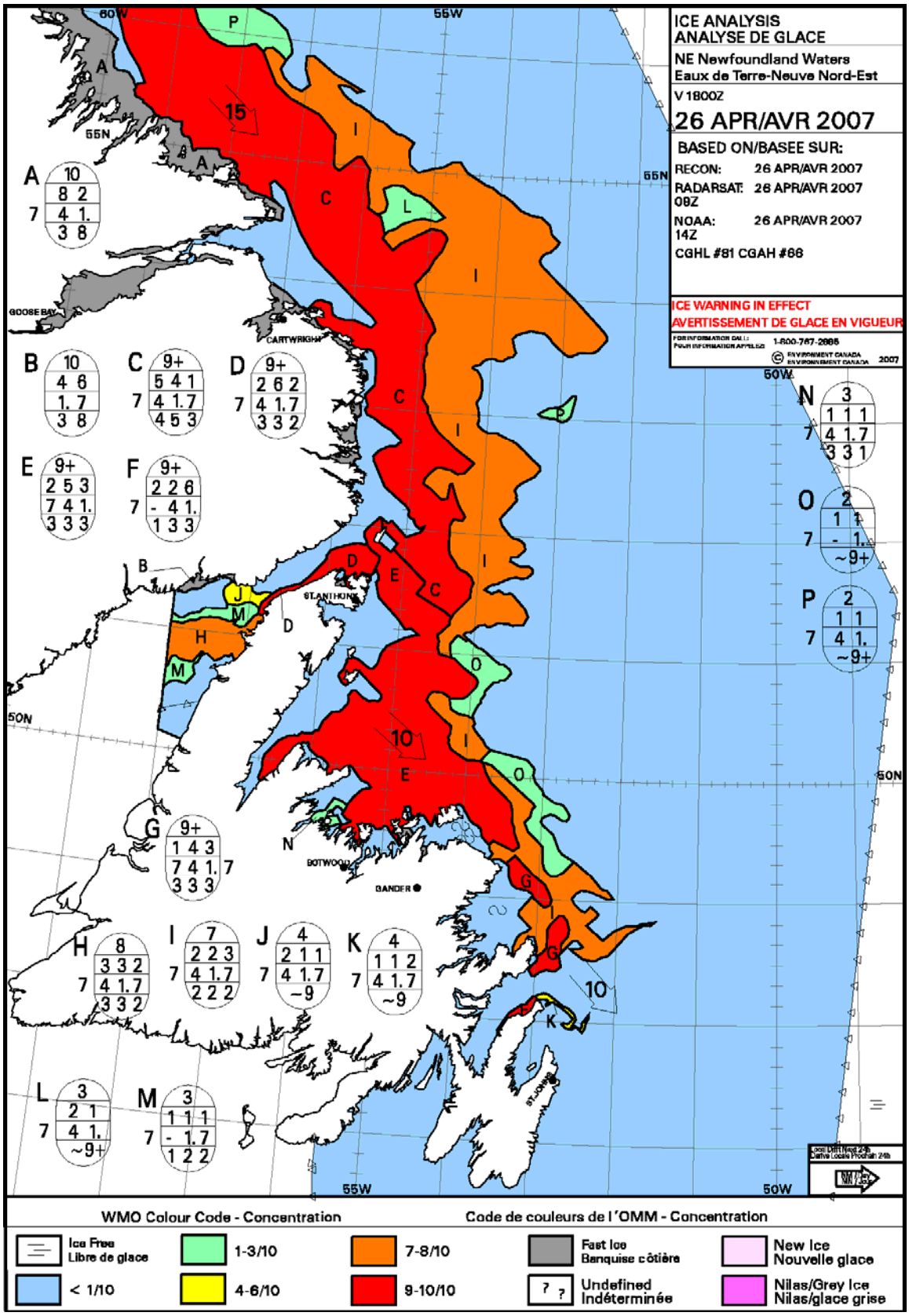
Response: The text will be revised as follows:

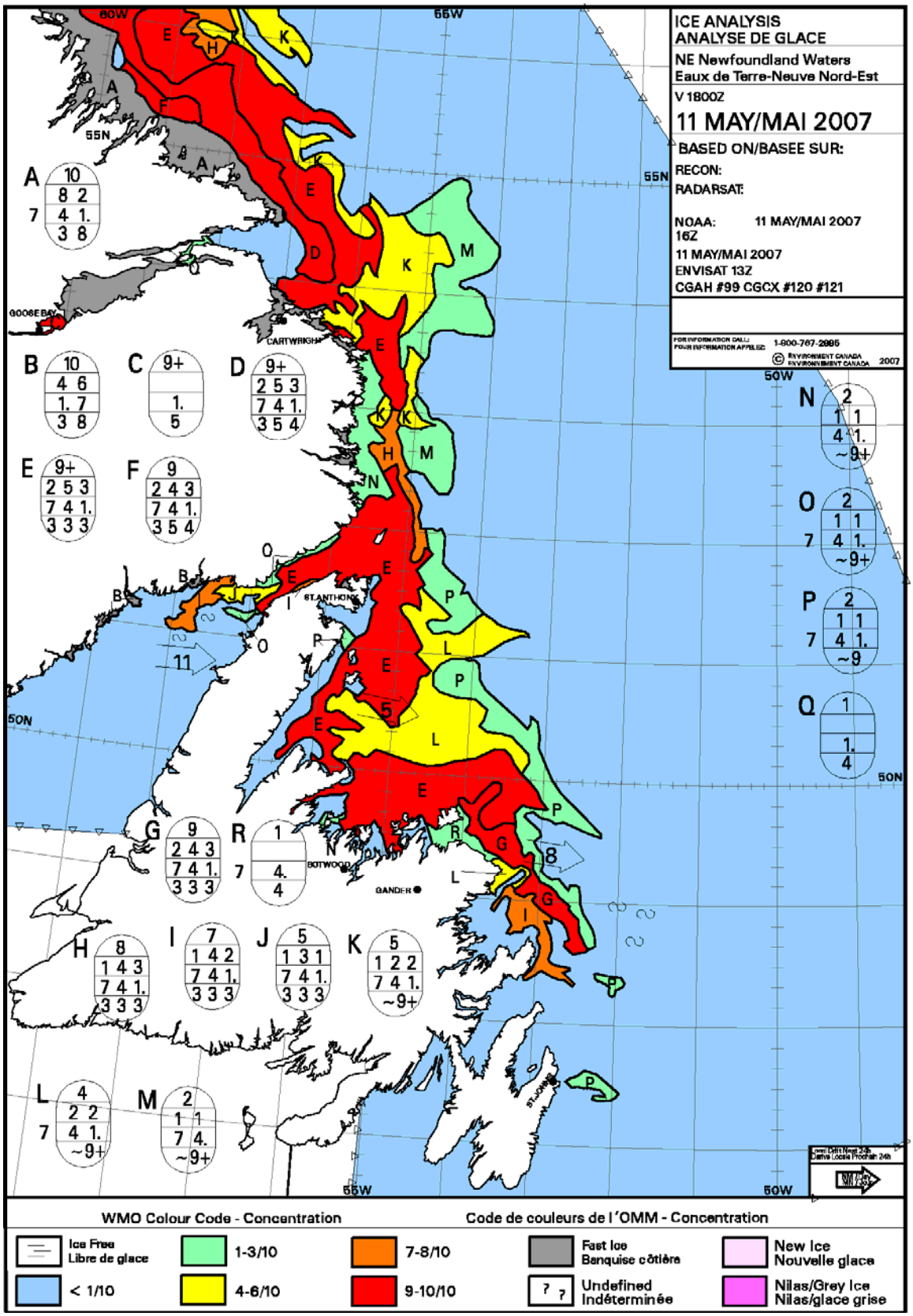
Atmospheric Environment Service (AES), now called the Meteorological Service of Canada (MSC) supports a branch called the CIS who compiles composite ice chart data. For 1964 to 1987, these charts indicate that, within 50 km of the Hebron Platform location, floes larger than 100 m are present only 10 percent of the time.

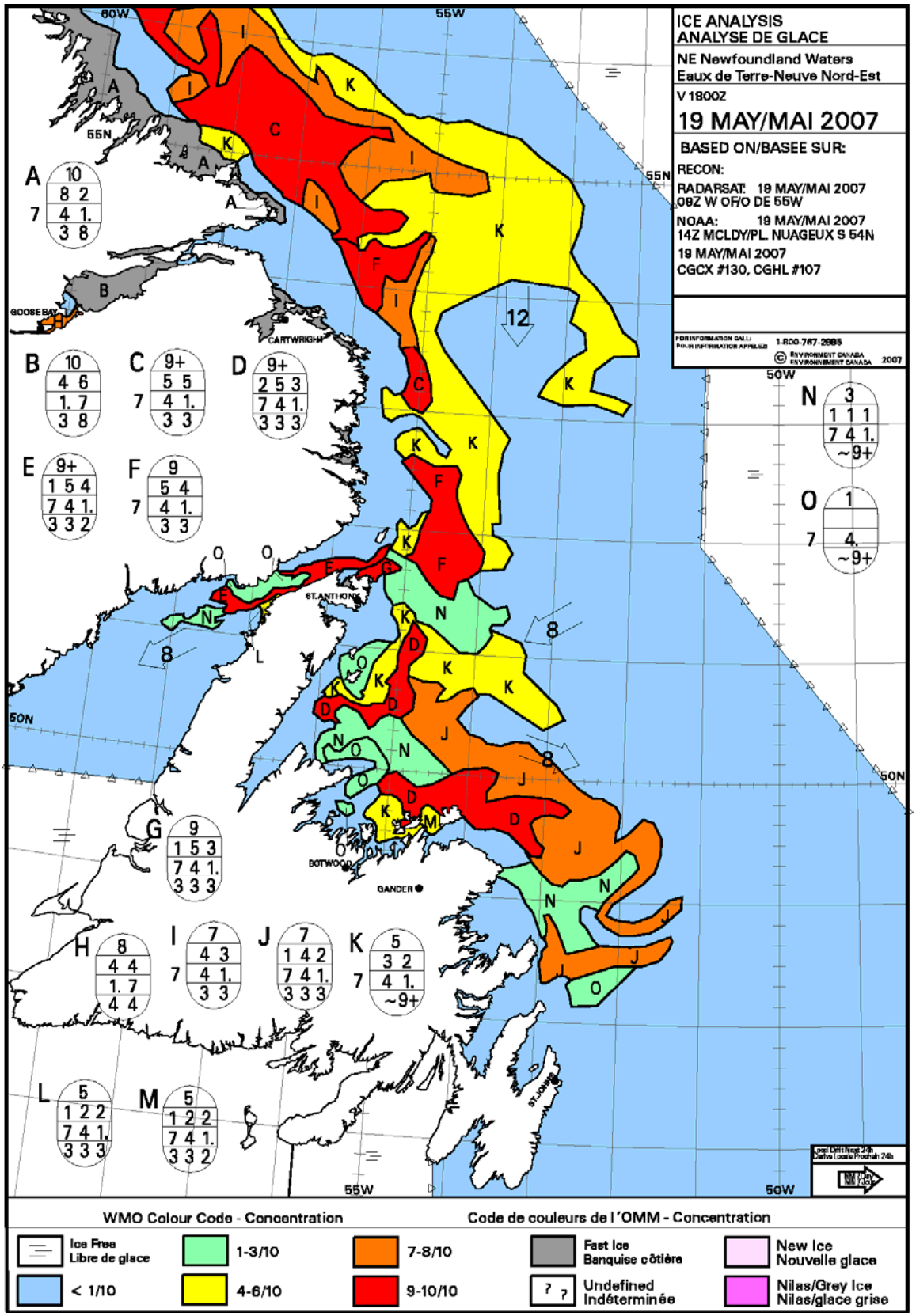
3.2.3.5 Thickness and Deformation

Comment A-32: General comment: Most of this section is devoted to a review of high ice thicknesses in the Grand Banks area as a result of ridging and deformation. Only a brief mention is made of thick ice floes drifting into the area from northern waters. In recent years, such as 2007 and 2010, Nares Strait has not always been consolidating in the winter as per normal, and as a result greater than normal amounts of thick, multi-year ice have been observed drifting south from the Arctic Ocean into Baffin Bay, down along the Labrador Coast and into Newfoundland waters. In spring 2007, pockets of 4/10 concentration of thick, old ice were observed by Coast Guard ships in some areas around Newfoundland.

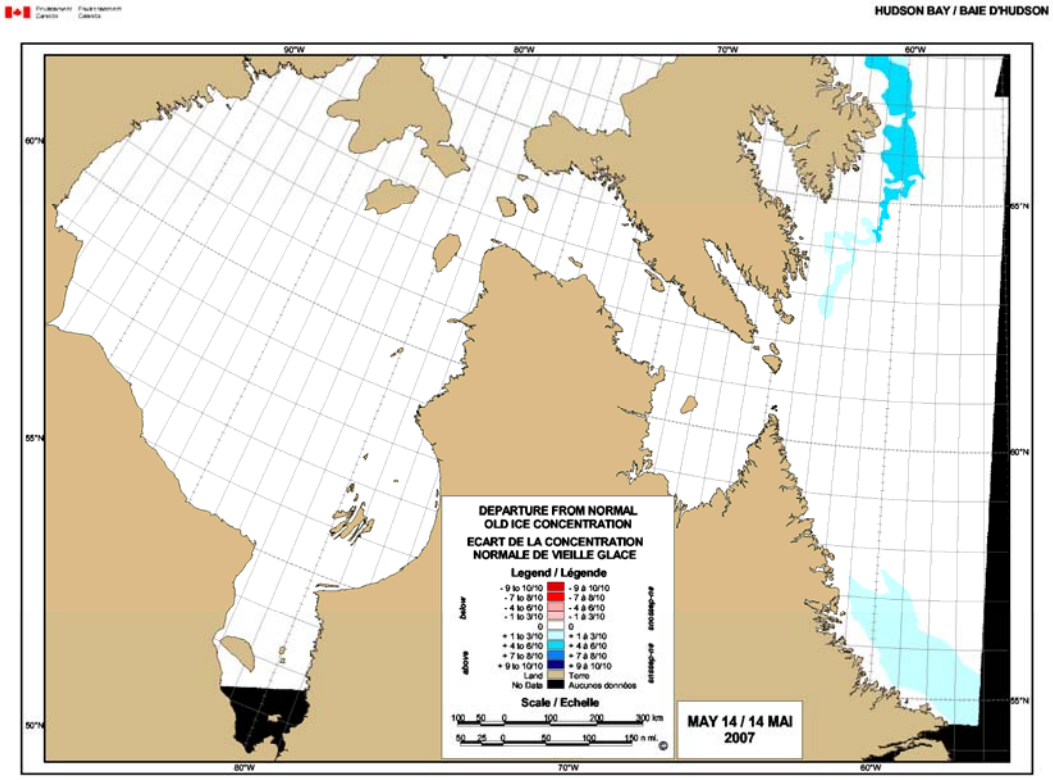
The sequence of daily ice charts below indicate a large area of 2/10 thick, old ice drifting south of 50°N at the end of April, 2007.

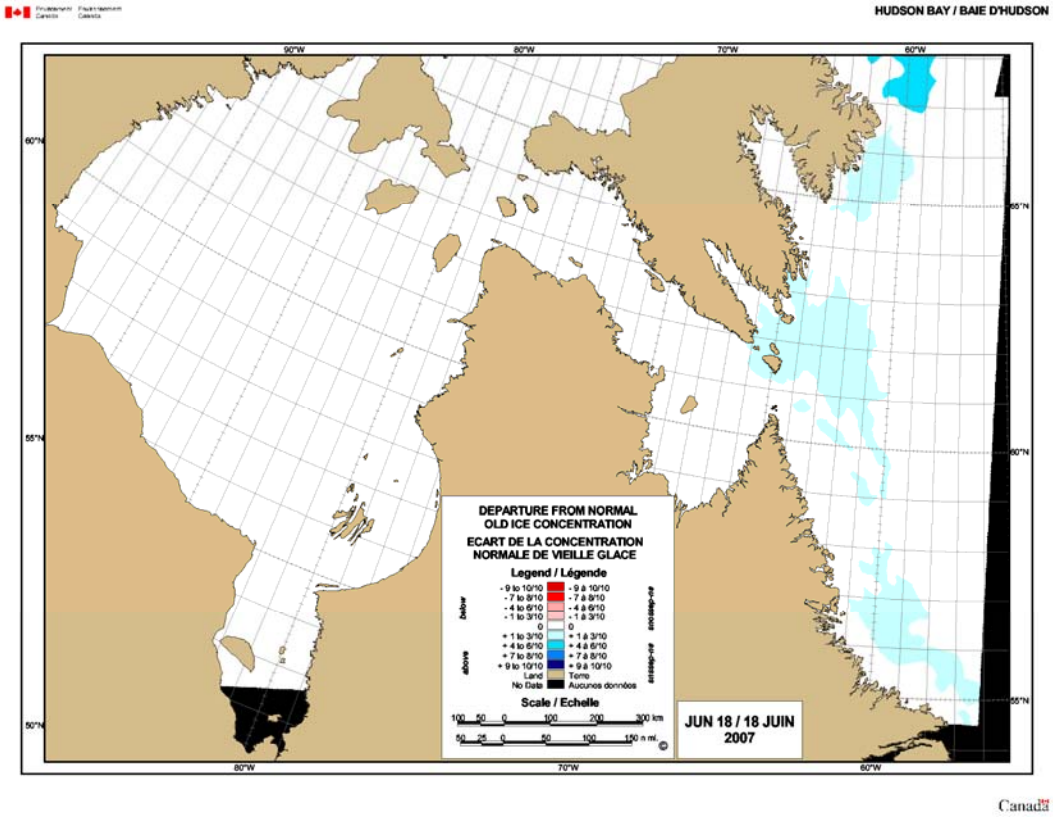

ICE ANALYSIS
ANALYSE DE GLACE
NE Newfoundland Waters
Eaux de Terre-Neuve Nord-Est
V 1800Z
26 APR/AVR 2007
BASED ON/BASEE SUR:
RECON: 26 APR/AVR 2007
RADARSAT 08Z: 26 APR/AVR 2007
NOAA 14Z: 26 APR/AVR 2007
CGHL #81 CGAH #66
ICE WARNING IN EFFECT
AVERTISSEMENT DE GLACE EN VIGUEUR
1-800-767-2885
© ENVIRONMENT CANADA ENVIRONNEMENT CANADA 2007
60W
55W
50W
55N
50N
GOOSE BAY
CARTWRIGHT
ST. ANTHONY
BOTWOOD
GANDER
WMO Colour Code - Concentration
Code de couleurs de l'OMM - Concentration
Ice Free
Libre de glace
< 1/10
1-3/10
4-6/10
7-8/10
9-10/10
Fast Ice
Banquise côtière
Undefined
Indéterminée
New Ice
Nouvelle glace
Nilas/Grey Ice
Nilas/glace grise


ICE ANALYSIS
ANALYSE DE GLACE
NE Newfoundland Waters
Eaux de Terre-Neuve Nord-Est
V 1800Z
11 MAY/MAI 2007
BASED ON/BASEE SUR:
RECON:
RADARSAT:
NOAA: 11 MAY/MAI 2007
16Z
11 MAY/MAI 2007
ENVISAT 13Z
CGAH #99 CGCX #120 #121
FOR INFORMATION CALL:
POUR INFORMATION APPELEZ: 1-800-767-2995
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GOOSE BAY
CARTWRIGHT
ST. ANTHONY
BOTWOOD
GANDER
ST. JOHN'S
WMO Colour Code - Concentration
Code de couleurs de l'OMM - Concentration
Ice Free
Libre de glace
< 1/10
1-3/10
4-6/10
7-8/10
9-10/10
Fast Ice
Banquise côtière
Undefined
Indéterminée
New Ice
Nouvelle glace
Nilas/Grey Ice
Nilas/glace grise


ICE ANALYSIS
ANALYSE DE GLACE
NE Newfoundland Waters
Eaux de Terre-Neuve Nord-Est
V 1800Z
19 MAY/MAI 2007
BASED ON/BASEE SUR:
RECON:
RADARSAT: 19 MAY/MAI 2007
09Z W OF/O DE 55W
NOAA: 19 MAY/MAI 2007
14Z MCLDY/PL NUAGEUX S 54N
19 MAY/MAI 2007
CGCX #130, CGHL #107
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© ENVIRONMENT CANADA
ENVIRONNEMENT CANADA 2007
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CARTWRIGHT
ST ANTHONY
BOTWOOD
GANDER
WMO Colour Code - Concentration
Code de couleurs de l'OMM - Concentration
Ice Free
Libre de glace
< 1/10
1-3/10
4-6/10
7-8/10
9-10/10
Fast Ice
Banquise côtière
Undefined
Indéterminée
New Ice
Nouvelle glace
Nilas/Grey Ice
Nilas/glace grise

See also the departure from normal concentration of old ice charts for 2007 below. Unfortunately, these are not produced for Newfoundland waters.





It may be worth adding a line or two to this section indicating that in some years thick multi-year ice floes originating from the Arctic Ocean can drift southwards into Newfoundland waters. Because of their thickness and low-salinity (which makes the ice nearly as hard as glacier-derived ice), these ice floes can pose a significant danger to ships in the area – similar to the risks posed by icebergs. These ice floes are slow to melt because of their thickness and may or may not reach the Hebron area. Once individual multi-year floes are left behind by the main (melting and retreating first-year) pack as they drift south, they would be indistinguishable from bergy bits or growlers. Multi-year ice floes could also occasionally impact the ice conditions at the entrance to Trinity Bay (previous section of this study).

Response: **The text will be revised as follows:**

Ridge thicknesses for the Grand Banks have also been estimated from data gathered off southern Labrador during February and early March and extrapolated to the Grand Banks (Seaconsult Ltd. 1988). These estimates indicate that ridges or rubble fields with sails as large as 3.5 m could form on the Grand Banks (Bradford 1972; NORDCO Ltd. 1977). However, these estimates are offset by the fact that the farther south the ice deformations occur, the faster the rafted and upturned floes, as well as the thin binding ice between the floes, will melt. As the melting occurs, structural fragility and ice porosity increase. This reduces the operational hazards of any ridge or rubble field fragments surviving to well below those associated with smaller pieces of old or glacial ice.

In some years, thick multi-year ice floes originating from the Arctic Ocean can drift southwards into Newfoundland waters. Because of their thickness and low-salinity (which makes the ice nearly as hard as glacier-derived ice), these ice floes can pose considerable danger to ships in the area – similar to the risks posed by icebergs. These ice floes are slow to melt because of their thickness and may or may not reach the Hebron area. Once individual multi-year floes are left behind by the main (melting and retreating first-year) pack as they drift south, they would be indistinguishable from bergy bits or growlers. Multi-year ice floes could also occasionally impact the ice conditions at the entrance to Trinity Bay.

3.2.3.6 Icebergs

Comment A-33: *Para 2, general comment*: The text mentions that data up to 2008 was considered, but the PERD Iceberg Sighting Database is updated annually … data up to 2009 and perhaps even 2010 are available on the NRC website:

http://www.nrc-cnrc.gc.ca/eng/ibp/chc/reports/ice-engineering.html

PERD Iceberg Sighting Database: 2010

Iceberg_Sighting_10.pdf
PERD_Iceberg_Sighting_Database_10.mdb
PERD_Iceberg_Sighting_DatabaseXP_10.mdb
BMT Fleet Technology, Kanata, ON, Canada, 2010

Comprehensive Iceberg Management Database 2010
Iceberg_Management_10.pdf
PERD_Iceberg_Management_Database_10.zip
PAL Environmental Services, St. John's, NL, Canada, 2010

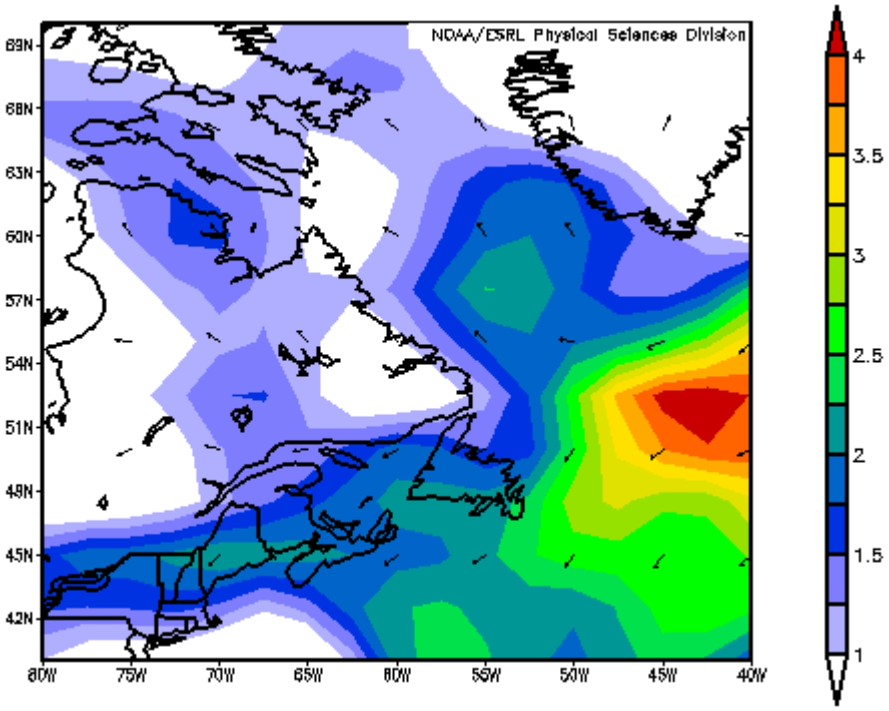
Grand Banks Iceberg Management
GB_Iceberg_Manage_Overview_07.pdf
AMEC and others
PERD/CHC Report 20-84, St. John's, NL, Canada, 2007.

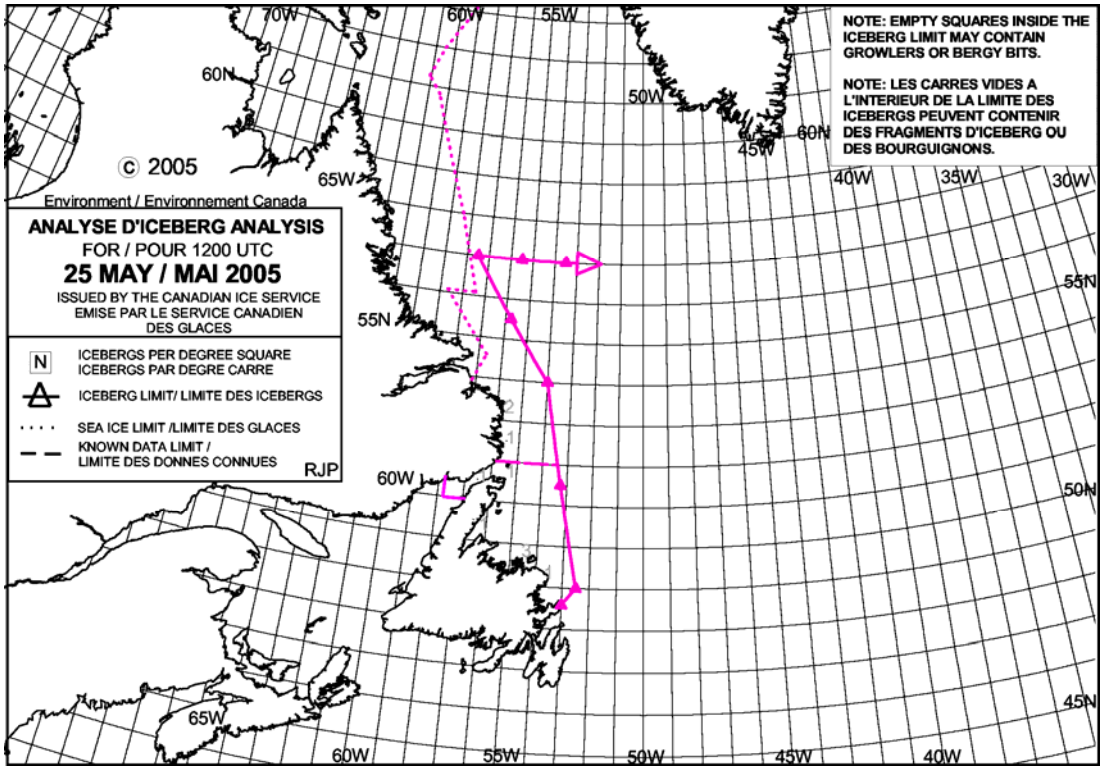
Response: Thank you for the information. However, as the text notes that these numbers are from the PAL / IIP Databases.

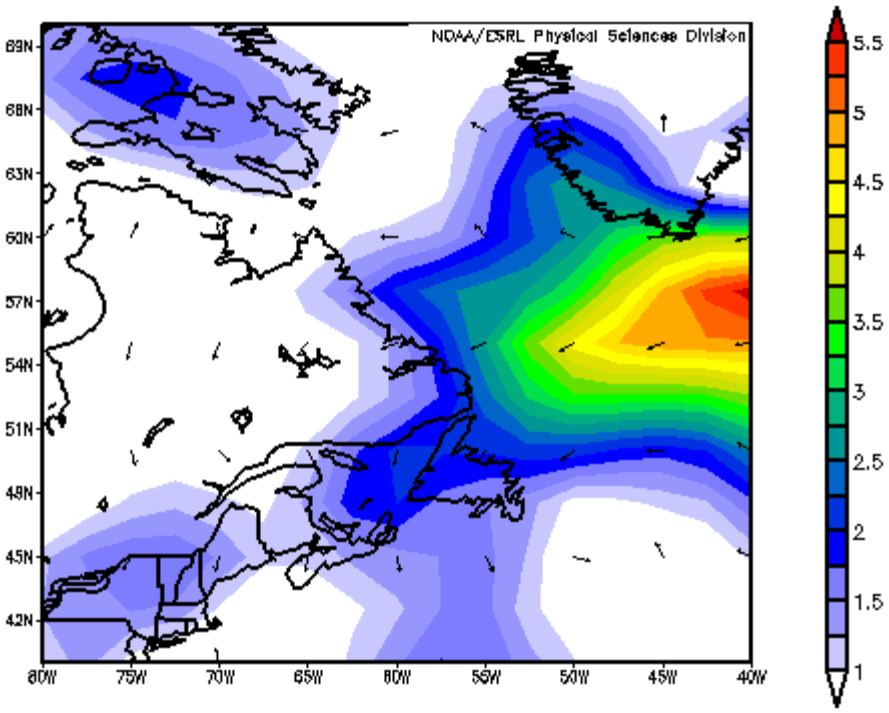
Comment A-34: Variations in Local and Regional Iceberg Numbers

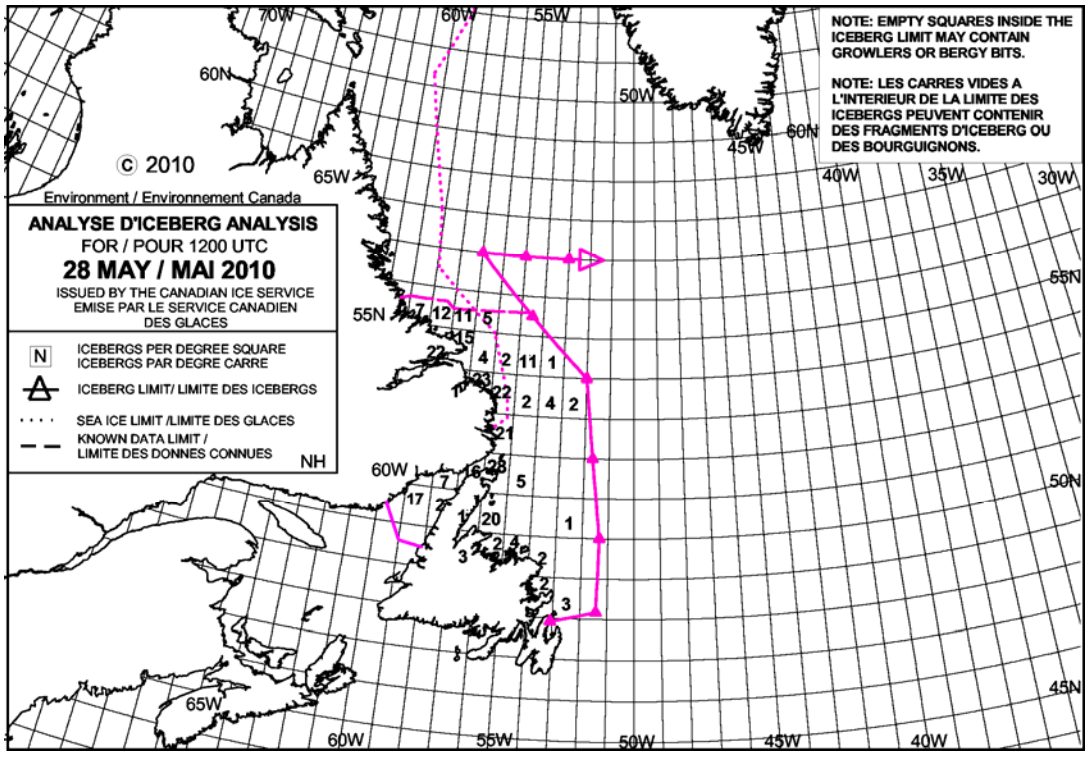
Para 1, sentence 4: "These low numbers were attributed to a combination of very light sea ice coverage and higher than normal water temperatures on the Grand Banks" … Note that the low

numbers in years such as 2005 were primarily the result of prolonged periods of onshore easterly winds during the spring months, which drove the bergs onto the Labrador Coast where they grounded. As a result, they were not free to drift south into Newfoundland waters. See the vector wind anomaly plots below for Mar-May (wind speeds in m/s), created from NCEP reanalysis data on the ESRL website: http://www.esrl.noaa.gov/psd/data/composites/day/ along with the CIS the daily iceberg charts from May of the years 2005 and 2010.









Response: The two figures will be included in the CSR. Paragraph 1, sentence 4 will be revised as follows:

These low numbers were attributed to a combination of higher than normal water temperatures on the Grand Banks, very light sea ice coverage and prolonged periods of onshore easterly winds during the spring months, which drove the bergs onto the Labrador Coast where they grounded. As a result, ice was not free to drift south into Newfoundland waters. This trend for light iceberg distribution…

Comment A-35: *Para 5, sentence 1*: **Typo** … The sentence should read: "Variations in the timing of iceberg influxes reflect annual differences in southward ice ***drift rates,*** iceberg drift rates and wind fields".

Response: The text will be revised as follows:

Variations in the timing of iceberg influxes reflect annual differences in southward ice drift rates, iceberg drift rates and wind fields.

Comment A-37: *Para 6, sentence 1*: "It should be noted that very low (less than 12) to iceberg-free conditions appear over 6 percent of the 118-year record and 15 percent when looking at only the past 20-years" … **specify over what area**: just in the vicinity of the Hebron platform or over the entire area south of 48N?

Response: The text will be revised as follows:

It should be noted that very low (less than 12) to iceberg-free conditions appear over 6 percent of the 118-year record and 15 percent when looking at only the past 20-years south of 48°N. Sightings within the same region over the past two ice seasons (2008-2009) have returned to the levels seen in the early 1990s.

Drift

Comment A-38: *Para 2, general comment*: Although the study (Figure 3-40) indicates that less than 20% of icebergs have a speed >45 km/day, **it should be stressed in the text that even though they are few these fast-moving bergs can be problematic to a fixed platform**. Size and speed both figure in the damage that can result from a berg impact and it could be difficult for ships to manage **such fast moving bergs.**

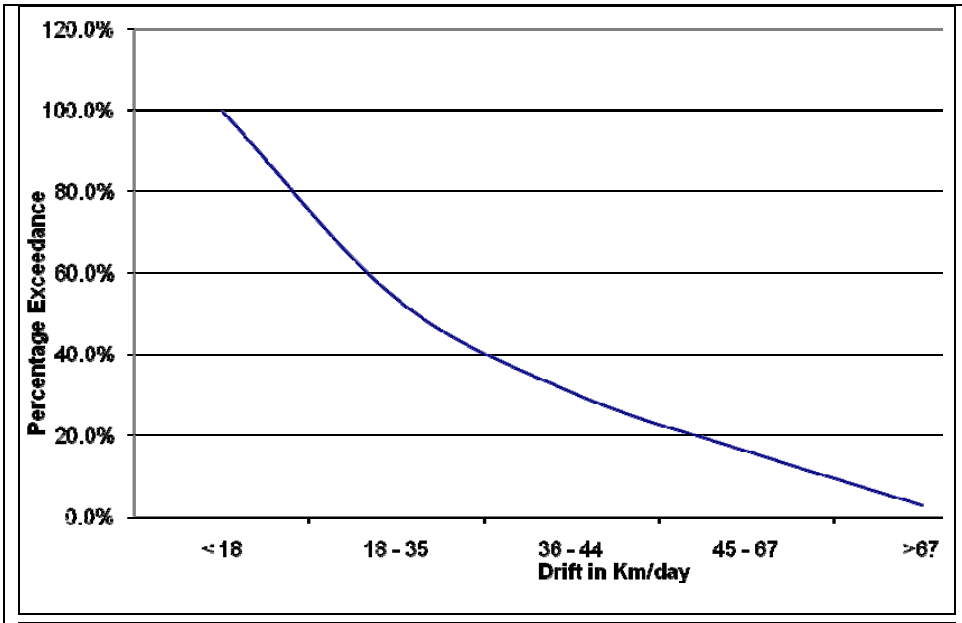
Response: The text will be revised as follows:

Iceberg speeds and drift directions on the Grand Banks (Figure 3-40) as measured over one- to three-hour time intervals in the years 2000 to 2008 (Provincial Aerospace Limited 2008), are qualitatively similar to mean sea ice velocity fields. Approximately 65 percent of the measured speeds were less than 30 km/day and most with a southerly component, with southeast drift being the most prevalent at 19.5 percent. Though there are few fast-moving bergs, these can still be problematic to a fixed platform as size and speed are both major factors in the impacts an iceberg can have, and management of such bergs may be more difficult.

Comment A-39: *Figure 3-40*: **Errors** …

1) The figure caption indicates that this figure shows data about both speed and direction. The text in paragraph 2 also refers the reader to Figure 3-40 for information on both of these factors. Yet the x-axes of both graphs shown in Figure 3-40 are identically labeled "Drift in km/day" and the ticks have speed values. Based on the similar Figure for ice drift (Figure 3-36) I suspect this is an error which needs to be corrected. **The second bar graph is supposed to show direction as opposed to speed, and its x-axis labels need to be corrected.**

Response: The figure will be edited as follows:



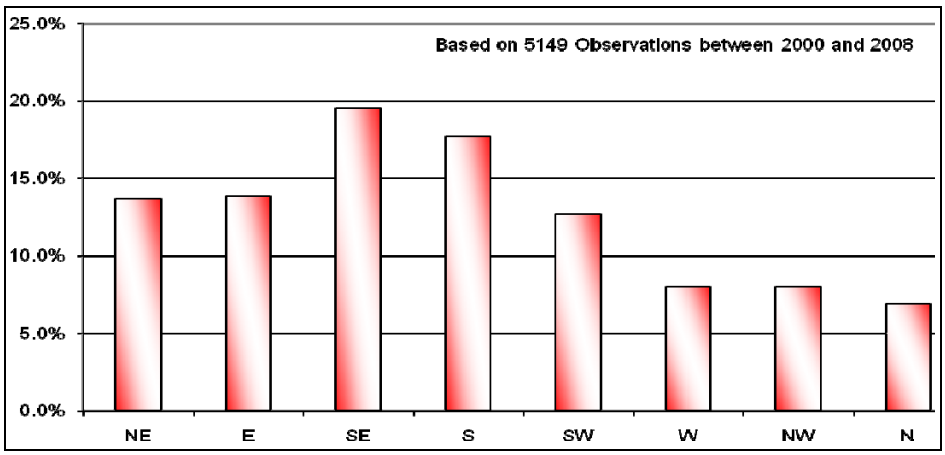


Figure 3-40 Speed Exceedance and Velocity Direction Distributions

2) The symbols > and < respectively denote "greater than" and "less than". They should not be used to show a range of values. On the x-axis of the speed graph, "18>35", "36>44", and "45>67" should be replaced with "18-35", "36-44", and "45-67".

Response: Information will be corrected in Figure in Response to Comment A-39-1)

Size Distributions

Comment A-40: *Para 1, sentence 1*: **Table 3-37, defining iceberg size categories, is referred to but is missing from the document**. This table needs to be added to the document.

Response: The CSR will be revised as follows:

Cross-reference will indicate Table 3-20.

Comment A-41: *Figure 3-41*: Source … Instead of citing the source reference here, the range of years considered is given. **The proper source reference needs to be added**.

Response: The following source will be added to Figure 3-41:

Source: PAL (2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008)

The following references will be added to Section 18.2:

PAL (Provincial Aerospace Limited Environmental Services). 2000. *The 2000 Ice Season Report for the Grand Banks of Newfoundland.* St. John's, Newfoundland and Labrador: The Grand Banks Joint Operators.

PAL (Provincial Aerospace Limited Environmental Services). 2001. *The 2001 Ice Season Report for the Grand Banks of Newfoundland.* St. John's, Newfoundland and Labrador: The Grand Banks Joint Operators.

PAL (Provincial Aerospace Limited Environmental Services). 2002. *The 2002 Ice Season Report for the Grand Banks of Newfoundland.* St. John's, Newfoundland and Labrador: The Grand Banks Joint Operators.

PAL (Provincial Aerospace Limited Environmental Services). 2003. *The 2003 Ice Season Report for the Grand Banks of Newfoundland.* St. John's, Newfoundland and Labrador: The Grand Banks Joint Operators.

PAL (Provincial Aerospace Limited Environmental Services). 2004. *The 2004 Ice Season Report for the Grand Banks of Newfoundland.* St. John's, Newfoundland and Labrador: The Grand Banks Joint Operators.

PAL (Provincial Aerospace Limited Environmental Services). 2005. *The 2005 Ice Season Report for the Grand Banks of Newfoundland.* St. John's, Newfoundland and Labrador: The Grand Banks Joint Operators.

PAL (Provincial Aerospace Limited Environmental Services). 2006. *The 2006 Ice Season Report for the Grand Banks of Newfoundland.* St. John's, Newfoundland and Labrador: The Grand Banks Joint Operators.

PAL (Provincial Aerospace Limited Environmental Services). 2007. *The 2007 Ice Season Report for the Grand Banks of Newfoundland.* St. John's, Newfoundland and Labrador: The Grand Banks Joint Operators.

13 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

13.3 Nearshore Potential Marine Effects

13.3.6 Sea Ice and Icebergs

Comment A-42: *Para 1, sentence 1*: **replace the word "cyclical" (which incorrectly implies extremely regular cycles), with "variable".**

Response: The text will be revised as follows:

Pack ice presence in Trinity Bay from year to year is variable, based on a review of the weekly CIS charts from 1983 to 2008, inclusive.

Comment A-43: *Para 1, last sentence*: **Error … First year ice is ice that is >30cm thick, NOT ice that ranges from 70 to 120cm thick.** First-year ice that ranges between 70 and 120 cm is termed "medium first-year ice". First-year ice that is 30-70cm thick is "thin first-year ice". First year ice that is >120cm thick is "thick first-year ice". But these-subtypes are not defined or referred to in the text. So the definition ">30cm" should be used here.

Response: The text will be revised as follows (as per Table 3-10):

From mid-March through to early May, the bay experiences first year ice, which can range in thickness from 10 to 70 cm.

Comment A-44: *Para 2, sentences 1 and 2*: **These sentences are speculation and the conclusions based on these speculations should be presented as tentative, not definite. Rephrase these sentences as**: "The Trinity Bay region does not lie on a primary aerial ice reconnaissance route; the low numbers of icebergs sighted each year, therefore, may be related to the low number of flights over that area. If this is true, the number of icebergs in the Trinity Bay area may be under-detected and under-reported."

Response: The text will be revised as follows:

The Trinity Bay region does not lie on a primary aerial ice reconnaissance route; the low numbers of icebergs sighted each year, therefore, may be related to the low number of flights over that area. If this is true, the number of icebergs in the Trinity Bay area may be under-detected and under-reported.

Comment A-45: Para 3: State where this "Ice Management Plan" plan can be found, if it already exists: either gives a page reference (if it is contained in this study) or a document reference. If it does not yet exist, state that it is under development.

Response: The ice management plan will be developed and submitted to the C-NLOPB as part of the Operations Authorization. The statement on the Ice Management Plan will be modified to state:

The ice management plan, which will be developed for offshore operations, will outline requirements for monitoring and managing sea ice conditions for the Hebron Platform.

13.4 Offshore Potential Marine Effects

13.4.6 Sea Ice and Icebergs

Comment A-46: *Para 1, sentence 1*: This sentence is written in a confusing way and is somewhat misleading. Stating that ice incursions occur in 1 out of every 4 years in the Hebron area is misleading. As seen in the Ice Graph for the Hebron area included on page 9 of this comment file, the incursions tend to occur in clusters or groups of years. **For clarity, rephrase this sentence as**: "The Hebron location experienced sea ice incursions in approximately 25% of the years spanning 1972 to 2008. These incursions are bi-modal and have peak probabilities centered on two periods: the first peak in the last week of February and the second in the first week of April."

Response: The text will be revised as follows:

The Hebron location experienced sea ice incursions in approximately 25 percent of the years spanning 1972 to 2008. These incursions are bi-modal and have peak probabilities centered on two periods: the first peak in the last week of February and the second in the first week of April.