# Fisheries and Oceans Canada

Information Requests

Final Environmental Impact Statement and Supporting Documents

## Mary River Iron Ore Project

Submitted to: Nunavut Impact Review Board March 30, 2012

NIRB File No.: 08MN053 DFO File No.: NU-07-0050

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## 1 ALTERNATIVES ASSESSMENT

### DFO IR # 1.1 Port Site Location Alternatives Assessment

**Section/Reference:** Volume 1 – Main Document, Section 3.2

**Preamble**: During review of the DEIS, DFO recommended (DFO Technical Comment #3.1) that the Proponent undertake a re-evaluation of the port options, particularly eastern Baffin locations such as Port 'F', taking care to apply the same criteria values as similar options elsewhere and considering the impacts on marine mammals. The Proponent committed to expand their alternative assessment on port options and address DFO's Technical Comments (Baffinland Commitment #4). During its compliance check of the FEIS, NIRB identified that a quantitative assessment method was not presented and all potential port sites were not evaluated fully by four factors, namely, technical feasibility, economic viability, environmental acceptability and social/community acceptance. The assessment was solely based on technical feasibility. NIRB recommended the Proponent provide a more solid assessment to justify its preferred alternative by applying the four criteria as identified. The Proponent responded that all four criteria were used for reaching their conclusions and that if an alternative was not considered technically or economically feasible it was eliminated from further assessment. This information is needed to evaluate whether the potential port locations have been adequately assessed on the basis of all four criteria.

**Request:**

- DFO requests that the Proponent provide the full details of the quantitative assessment conducted for all potential port sites, as requested by DFO during the review of the DEIS.

### DFO IR # 1.2 Port Site Location

**Section/Reference:** Volume 1 – Main Document, Section 3.3

**Preamble**: Within Foxe Basin, two potential port locations were examined by the Proponent: a location on the shore of Steensby Inlet and a location on the shore of Cape Jensen (Nuvuit). During the DEIS review, some Inuit proposed the port location be moved from Steensby Inlet to Nuvuit. Based on the Proponent's concerns about increased construction and operations costs associated with the Nuvuit site, they undertook a Cockburn Lake – Nuvuit Coastal Rail Link Feasibility study. The key findings of the report are summarized in the FEIS. A "cost-benefit" evaluation of whether the Steensby port site warrants preference over the Nuvuit port site requires some additional information.

**Request:**

- DFO requests information about (1) the savings in ship fuel over the life of the mine versus the longer rail route for the Nuvuit port location and (2) the marine environmental costs of each port location.

## 2 IMPACT ASSESSMENT APPROACHES

### DFO IR # 2.1 Quantitative Effects Assessment

**Section/Reference:** Volume 8 – Marine Environment, Section 1.5; NIRB Compliance Table Commitment #23, #91 and #142

**Preamble**: The Proponent committed to integrating the effects assessment quantitatively, where possible, by key indicators and including in the cumulative effects assessment. During their compliance review, NIRB reported this was done in Volume 8 Section 1.5 which focuses on marine VECs but this is applicable to all other VECs. The Proponent refers to Figure 10-8.2 in the EHS Management System (Volume 10, Section 8.0). However this figure is a flow chart of process only and does not mention cumulative effects. Although the Proponent seems to be suggesting that this will be addressed through development of their environmental monitoring plan, DFO disagrees with the Proponents suggested approach. In the cumulative effects analysis presented, the determination of overall significance of a residual environmental effect resulting from the Project was based on evaluation of a number of attributes and employing professional judgment. The qualitative analysis appears to be based on the assumption that if two or more impacts are each non-significant then when they are combined the collective impact remains non-significant. DFO is of the opinion that a qualitative analysis would provide a more thorough assessment of Project effects and greater confidence in the conclusions reached in the FEIS.

**Request:**

- DFO requests that the Proponent provide a quantitative assessment of cumulative effects.

### DFO IR # 2.2 Thresholds

**Section/Reference:** Volume 2 – Consultation, Regulatory Framework and Assessment Methodology, Section 3.8 and Tables 2-3.3 and 2-3.4; Volume 8 – Marine Environment, Section 1.5; NIRB Compliance Table Commitment #27

**Preamble**: The Proponent committed to review the selected thresholds and threshold levels for determination of magnitude of effects to ensure that they are appropriately selected and adequately described for the marine environment. Where possible they committed to providing quantitative descriptions. NIRB indicated compliance. This commitment was generated as a result of DFO Technical Comment 4.3.1 which identified that throughout the EIS, the proponent proposes the use of 10% as a threshold, however there was no supporting rationale/discussion or literature on the merit of this value.

**Request:**

- DFO requests the Proponent provide the rationale for their use of each threshold level with evidence that they are selected appropriately and described adequately as per the commitment.

**DFO IR # 2.3 Production Capacity**

**Section/Reference:** Volume 3 – Project Description, Section 6.3, Table 3-6.2; NIRB Compliance Table Commitment #2.

**Preamble**: The FEIS states that the Project infrastructure are designed for a capacity of 30 Mt/a of iron ore, and that no additional infrastructures would be required to exploit Deposits No. 2 and 3 and increase production from the minimum of 18Mt/a up to 30 Mt/a. While the FEIS assumes the minimum of 18Mt/a for assessing impacts of the project, BIM indicate they would accelerate the development of another deposit(s), *should there be a need to increase production*. The trigger for exploiting Deposits No. 2 and 3 is not presented but is obviously related to economic viability and financial profits, and likely in the planning of BIM over the short-term. BIM acknowledges that an increase in production rate would result in an increase in shipping frequency.

According to the data presented on round-trip duration and port limits for the size of ore-carriers (Table 3-6.2), it follows that they require 10-12 ore carriers to deliver the 18Mt/a of iron ore to Europe. Given the fixed trip duration and port limits, an increase in production to 30 Mt/a will necessarily result in an increase in the number of ships rather than in an increase in the number of trips per ship. In other words, while our current assessment suggests there will be approximately four icebreakers in the study area at any one time, for one ship to load iron ore every second day, the increase in production would result in near doubling the number of ships in the study area for one ship to load iron ore every day.

**Request:**

- DFO requests clarification on what production level (18 Mt/a or 30 Mt/a) the EIS is based on.
- DFO requests clarification as to whether the EIS has assessed the impacts of a 30 Mt/a production level on fish, marine mammals and their habitat, and if not, how the Proponent would envision any increase in production (beyond 18 Mt/a) being assessed for its potential impacts to fish, marine mammals and their habitat.

## 3 SHIPPING ROUTE ASSESSMENT

**DFO IR # 3.1 Shipping Routes - Potential Route Deviations**

**Section/Reference:** Volume 8 – Marine Environment, Section 1.2.1, Figure 8-1.2, Section 2.2, Section 5.5.6, Figure 8-5.2; Volume 10 – Environmental Health and Safety Management Appendix 10D-10; NIRB Compliance Table Commitment #36, #82 and #142

**Preamble**: The Proponent committed to describing potential route deviations (and their relative effects) in the final EIS. During its compliance check of the FEIS, NIRB identified that Volume 8, Section 1.2.1 described the adjustment made to shipping route in the DEIS however this does not describe potential route deviations. This item does not appear to be addressed in the FEIS. The Proponent indicated that the shipping track identified is 1 km wide and that it avoids sensitive habitats in Foxe Basin and any actual deviations in the shipping track will remain within this 1 km band.

**Request:**

- DFO requests the Proponent describe the circumstances under which a route deviation outside the designated shipping route would occur (e.g. safety reasons), potential locations this is more likely to occur along the shipping route and the relative effects of a route deviation on the marine mammals and their habitat.
- DFO requests that the Proponent provide the updated bathymetric data including that which was used to alter the ship route entering Steensby Inlet (Figure 8-1.2).
- DFO requests the Proponent indicate why the designated route is 1 km wide when the FEIS identifies it as being 1.5 km wide (Volume 8, Section 2.2).
- DFO requests clarification of whether the shipping route will remain the same 1.5 km

**DFO IR # 3.2 Ship densities and passing points**

**Section/Reference:** Volume 8 – Marine Environment, Sections 5.5.6 Figure 8-5.2; NIRB Compliance Table Commitment #82 and #96

**Preamble:** The proponent was requested to quantify ship densities and identify places where vessels will pass each other. In the FEIS the proponent provided technical data on the ship densities and passing locations. The proponent states in the narrative (Volume 8 p. 153) that in winter there will be five carriers in the RSA: two vessels at the dock and three outgoing at 621, 931 and 1243 km. However Table 8-5.2 and Figure 8-5.2 indicate winter cross-overs at 310, 621, 931, and 1243 km. Since, by definition a cross-over requires two ships, it appears a maximum of 10 ore carriers will be present in the RSA in winter. Similarly there must be six, not three in the summer because there will be two crossing at 1243 km another two crossing at 621 km in addition to the two at the dock as shown in Figure 8-5.2.

**Request:**

- DFO requests the Proponent clarify the maximum number of ore carriers to be present in the RSA simultaneously under normal summer and winter operation scenarios.
- DFO requests the Proponent identify where additional ore carriers will hove to (move to) should there be unplanned delays in the ‘conveyor of ships’ of 24, 48 and 72 h.
- DFO requests the Proponent provide their acoustic analysis of the RSA at maximum ship density (presumed to be 10 in winter/6 in summer) that considers nodes of noise propagation at times of ship overlap. A contour map of decibels might be useful.
- Since winter separation between passing nodes (pairs of ships) is in the order of 300 km maximum and marine mammals can hear the ships 250 km away, DFO requests the Proponent clearly state the minimum noise level associated with the two ships approaching each other and moving away from each other.
- DFO requests the Proponent describe the width where ships pass each other along the ship route (Volume 8, Figure 8-5.2).

**DFO IR # 3.3 Shipping during winter (ice-covered season)**

**Section/References:** Volume 3 – Project Description, Appendix 3G, Appendix D

**Preamble**: The Proponent held an ice management workshop in June 2011 to discuss ice management methods and equipment needed for, together with compatible dock designs necessary for the successful execution of, year-round port operations in Steensby Inlet. A summary of the workshop discussions and conclusions is presented in Appendix D of Volume 3, Appendix 3G. During the discussion of “Next steps”, near the end of the meeting, participants noted the importance of arranging a test voyage to Steensby Inlet port in order to determine if a large vessel – be it an ore carrier or an ice breaker – can handle the winter ice conditions in Hudson Strait and Foxe Basin en route to/from the port. Participants were unanimous in their view that a trial voyage was needed. They said “the winter ice conditions in the Hudson Strait – will be the ultimate test", and they “Will face all sorts of surprises in the Hudson Strait". They also said “People don’t know how we can go forward without making this voyage – have to figure out [how] to make it happen so the project can go forward – need information for a baseline". Almost all (17 of 19) said that the vessel should be a bulk carrier although most felt that an ice breaker would suffice for the trial. Participants indicated that the best month for the trial voyage would be April. However, DFO notes that ice conditions in Hudson Strait can vary significantly on a daily basis thus a single transit may not provide an adequate baseline. The feasibility of the Steensby port location and shipping route through Foxe Basin and Hudson Strait depends on the feasibility of year-round shipping. If the test reveals that shipping is limited in any way, this puts into question the Alternate Ports Assessment and the validity of the FEIS.

**Request:**

- DFO requests the Proponent provide details on how and when the test voyage(s) will be conducted to determine if it is feasible for a large vessel to transit Hudson Strait and Foxe Basin during the periods of maximum ice cover.
- DFO requests the Proponent provide the results of the test voyage(s).
- DFO requests the Proponent explain how the results will impact the Project

## 4 ASSESSMENT BOUNDARIES

**DFO IR # 4.1 Davis Strait and northern Labrador Sea**

**Section/References:** Volume 8 – Marine Environment, Section 5.15; NIRB Compliance Table Commitment #25

**Preamble**: At the Technical Hearings in Iqaluit, the question was raised about the potential effects of the project on marine mammals in Davis Strait and the northern Labrador Sea.The Proponent committed to providing an overview consideration of effects extending into Davis Strait and northern Labrador Sea regarding marine mammals and birds based on the zone of influence of the vessels and the receiving environment. This area is known to harbor feeding aggregations of species such as the northern bottlenose and sperm whales, and hooded seals (particularly females in the late summer and early fall). For the hooded seals in particular, the shipping track will pass directly through this important feeding area, and thus there could be detrimental effects from underwater noise from the distant ships. However Volume 8 Section 5.15

does not include in-water impacts on hooded seals or mention whelping harp seals in Davis Strait. This section dismisses effects on marine mammals as it is "'only additional to what they encounter already" indicating that this should be considered in the cumulative effects assessment.

**Request:**

- DFO requests the Proponent provide their discussion of the interactions between, and impacts of, the proposed shipping and feeding hooded seals and whelping harp seals in Davis Strait and northern Labrador Sea.
- DFO requests the Proponent provide their discussion of impacts of shipping in Davis Strait and northern Labrador Sea for the cumulative effects assessment.
- DFO requests the Proponent provide details of their monitoring programme that investigates the distribution of species such as hooded and harp seals and northern bottlenose whales and whether potential impacts are occuring.

## DFO IR # 4.2 Extending boundaries for zone of influence

**Section/References:** Volume 8 – Marine Environment, Section 5.14; NIRB Compliance Table Commitment #26 and #67

**Preamble**: During the Technical Hearings, there was a request to consider the predicted effects of the Project beyond the RSA. The Proponent committed to reviewing the range of interactions of shipping activities with marine mammals including those that could affect marine mammals to the west of Hudson Strait and to providing the rationale for not extending boundaries of zone of influence. Further, the Proponent was to include a discussion of the interactions along the shipping route including between ships and migrating marine mammals within Hudson Strait. NIRB indicated compliance. However, DFO doesn't agree that the Proponent has adequately addressed this commitment, as the conclusions reached are not fully supported by the analysis provided (see DFO IR#11). The FEIS predicts no serious project effects on marine mammals within the RSA, therefore they conclude it is not likely there will be any residual indirect effects from the Project in areas beyond the RSA. However, it may be premature to dismiss indirect effects on marine mammals in areas beyond the RSA before a quantitative assessment has been conducted.

While its is not expected that direct project effects would extend beyond the RSA, it is possible that effects within the RSA might have indirect effects in areas beyond the RSA, and that such effects might occur in Hudson Bay or in Davis Strait. In a worst-case scenario, if bowhead mothers and calves are displaced from the ice-covered habitat to more open water areas of Hudson Bay or Davis Strait they might be at greater risk of predation from killer whales, or ship strike, or pursuit by human whalers. In this Section the Proponent argues that a non-serious project effect on marine mammals within the RSA will necessarily mean there will be non-serious residual indirect effects from the project beyond the RSA. Given that the Proponent and expert reviewers do not yet know the occurrence and magnitude of such marine mammal displacements, it is all the more imperative that an adequate monitoring and mitigation plan is well-designed and can provide clear-cut data to support interpretation.

**Request:**

- DFO requests the Proponent meet NIRB Compliance Table Commitment #26, once the quantitative effects assessment has been conducted (see DFO IR#2.1 – Quantitative Effects Assessment).
- DFO requests the Proponent describe how the monitoring plans are sufficiently sensitive to allow detection of changes in marine mammal mortality and distribution patterns, in response to the Project, such that displacements to non-project areas can be detected.
- In the case of species at risk (i.e., beluga, bowhead whales, narwhals, and walruses), DFO requests the monitoring programme be updated to investigate sources of mortality (e.g., through tooth rakes marks in the case of interactions with killer whales) within and outside the project area be provided.

## 5 PROJECT ENVIRONMENT AND IMPACT ASSESSMENT

### 5.1 Freshwater Fish and Fish Habitat

**DFO IR # 5.1 Fish Passage Determination Matrix – Swimming Performance**

**Section/Reference:** Volume 7 - Freshwater Environment (page 239) & Volume 10 – Appendix 10D-7A Determination of Harmful Alteration, Disruption or Destruction (HADD) of Freshwater Fish Habitat

**Preamble:** Using the published (Peake 2008) and regional information, the velocity threshold for unimpeded juvenile passage was assumed to be 0.4 m/sec, and velocity thresholds for partial and total fish passage impediment were assumed to be 2.5 m/sec and 3.0 m/sec, respectively. The culvert length threshold for unimpeded fish passage was assumed to be 60 m. For culverts longer than 60 m, partial or total fish passage impediment was assumed, depending on flow velocities and an assumption of some effect of culvert darkness. These assumptions were based on velocity data which was collected between 2008 and 2009 at culverts along the Tote Road.

**Table 7-4.10 Fish Passage Determination Matrix for Railway and Access Road Culvert Crossings of Streams with Juvenile Arctic Char**

| Culvert Length (m) | Culvert Flow Velocity (m/sec) per barrel Average Flow Conditions | | | | | | |
|---|---|---|---|---|---|---|---|
| | < 0.4 | < 1.0 | < 1.5 | < 2.0 | < 2.5 | < 3.0 | > 3.0 |
| < 40 | Y | Y | Y | Y | P | P | N |
| 40 - 60 | Y | Y | P | P | P | N | N |
| 60 - 80 | P | P | P | P | N | N | N |
| > 80 | P | P | N | N | N | N | N |

Y = fish passage not impeded
P = partial impediment to fish passage possible or likely
N = impediment to fish passage likely

The water velocity design criteria shown in Table 6-3 are from the California Transportation Fish Crossing Design Guide. For adult non-anadromous salmonids the recommended maximum average water velocity is 1.2 m/s for culverts 18 m or less in

length and 0.61m/s for culverts 60-90 m in length. For juvenile salmonids the maximum average velocity is 0.3 m/s.

**Table 6-3. Maximum average water velocity for various culvert lengths.**

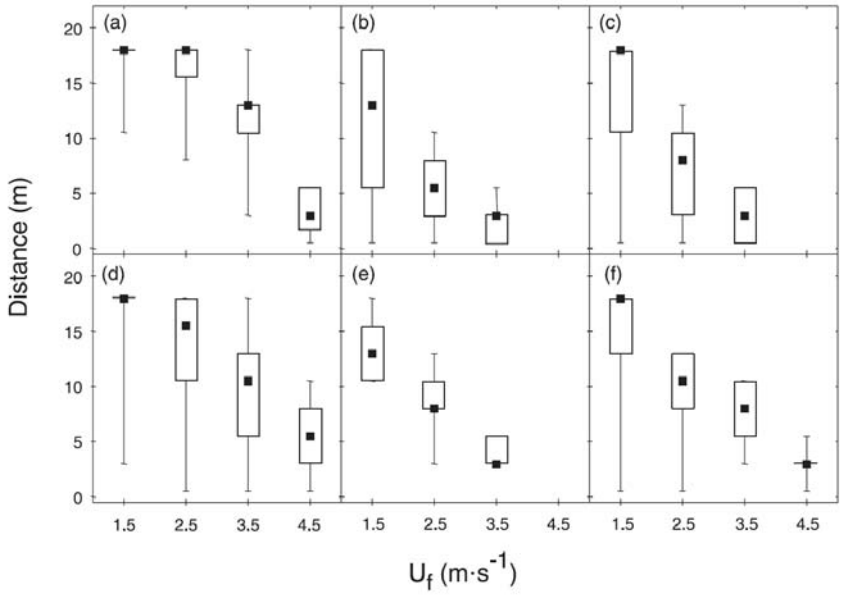
| Species/Life Stage | Maximum Average Water Velocity (ft/s) | | | | |
|---|---|---|---|---|---|
| | Culvert Length (ft) | | | | |
| | <60 | 60 -100 | 100 -200 | 200 -300 | >300 |
| Adult Anadromous Salmonids | 6 | 5 | 4 | 3 | 2 |
| Adult Non-Anadromous Salmonids | 4 | 4 | 3 | 2 | 2 |
| Juvenile Salmonids | 1 | 1 | 1 | 1 | 1 |
| Native Non-Salmonids | Species specific swimming, performance data is required for the use of the hydraulic design option for non-salmonids. Hydraulic design is not allowed for these species without this data. | | | | |
| Non-Native Species | | | | | |

Haro et al (2004) measure the swimming distance against a series of water velocities for six (adult) migratory fish species using an open channel. Results for the test are summarized in Fig. 4, and show the median and 95 percentile swim distances were 10 m and 15 m or less, respectively for the water velocity of 2.5 m/s for 4 of the 6 species (alewife, blueback herring, walleye and white sucker).

Passage estimates summarized in Table 7-4-10 show partial impediment to fish passage for juvenile Arctic char for water velocities of 2.5 m/s and culvert lengths of 40 m or less which is significantly higher than the measurements from Haro.

A more realistic estimate of performance for juvenile Arctic char would be to reduce the culvert lengths in Table 7-4.10 by half for corresponding culvert flow velocities, with <40 m becoming < 20 m , 40-60 becoming 20-30 m etc.

**Fig. 4.** Maximum distance of ascent ($D_{max}$) by species and nominal water velocity ($U_f$). (*a*) American shad; (*b*) alewife; (*c*) blueback herring; (*d*) striped bass; (*e*) walleye; (*f*) white sucker. Data are presented as median (■), 25–75 percentiles (boxes), and 5–95 percentiles (whiskers). Note that actual water velocities deviated from nominal velocities. Smaller species (alewife, blueback herring, and walleye) were not run against the 4.5 m·s$^{-1}$ condition. Data are truncated to 18 m for consistency.



**Request:**

- Using the recommended swimming distance correction (reduce distance by half) for Table 7-4.10, please provide an update on how this change will affect the fish passage and HADD assessments.
- DFO requests that the proponent provide the methodology used for the collection of the flow data at culverts along the Tote Road; the flow data which was collected and how the average flows for each culvert were calculated.

References:

Caltrans, 2007. Fish Passage Design for Road Crossings: An Engineering Document Providing Fish Passage Design Guidance for Caltrans Projects. California Department of Transportation, Sacramento, CA.

Haro, A., T. Castro-Santos, J. Noreika, and M. Odeh 2004. Swimming performance of upstream migrant fishes in open-channel flow: a new approach to predicting passage through velocity barriers Can. J. Fish. Aquat. Sci. 61, 1590-1601.

### 5.2 Marine Wildlife and Marine Habitat

**DFO IR # 5.2.1 Additional Oceanographic Data Collected to Support Detailed Design**

**Section/Reference:** Volume 8 – Marine Environment, Appendices 8A-1 & 8D-2; NIRB Compliance Table Commitment #14

**Preamble**: The Proponent committed to providing additional oceanographic data as required to support detailed design, and to consider issues of ice roughness, converging wakes and effects on coastal areas, including walrus haulout sites. During their compliance review, however, NIRB reported that while there had been some marine mammal data incorporated into Appendix 8D-2, no additional oceanographic data had incorporated into the FEIS. While the Proponent indicated they had included some 2010 oceanographic data, DFO did not note any new oceanographic information apparent in Appendix 8A-1. Wake effect information related to wave heights, shoreline types and erosion was presented in Appendix 8D-2 but wake effects on marine mammals were not provided. It is not possible to assess the predicted effects of ship wakes on marine mammals without having the requested information.

**Request:**

- DFO requests an evaluation of wake effects on marine mammals, particularly on hauled out walruses and seals (on ice and land).

**DFO IR # 5.2.2 Impacts to Fish and Fish Habitat**

**Section/Reference:** Volume 8 – Marine Environment, Section 4.5.2.1, Table 8-4.8; NIRB Compliance Table Commitment #18

**Preamble:** The FEIS states that there will be no significant adverse residual impacts on fish habitat at Milne Port and Steensby Port. Barge and ship traffic has the potential to affect the feeding zones used by Arctic Char through changes to the food web from impacts to the benthic community from routine disturbance of the sediment as well as the disruption of other species which use the feeding zones. According to Table 8-4.8 vessel noise is expected to cause negative habitat alterations at the port site during all phases of the project and negative alterations from ballast water are also expected during the operational phase.

**Request:**

- DFO requests an explanation for and reconciliation of the inconsistencies between the written statement and Table 8-4.8.
- DFO requests the Proponent provide details about the expected frequency and duration of periods of high activity that will create underwater noise. Given these estimates, describe the effects on fishes and other marine organisms.
- DFO requests the Proponent provide support for the conclusion that underwater noise will affect pelagic fishes within only small portions of each LSA.

**DFO IR # 5.2.3 Habitat loss impacts on marine benthic and fin fish species**

**Section/Reference:** Volume 8 – Marine Environment, Section 4.5.2.1; Section 4.6.2, Tables 8-4.15 and 8-4.16; NIRB compliance table commitment #19

**Preamble**: The Proponent committed to including within the marine habitat quantification a discussion of a marine benthic species and a marine fin fish species in addition to a discussion of Arctic char in the adult feeding stage. This information is needed to evaluate the affects assessment for *Mya truncata* and *Boreogadus saida.*

**Request:**

- DFO requests an effects assessment summary table for each of the marine benthic species and marine fish species for both port sites as was provided for Arctic Char (Table 8-4.15, 8-4.16).

**DFO IR # 5.2.4 Food Chain**

**Section/Reference:** Wave Action: Volume 8 – Marine Environment, Appendix 8D-2, Sedimentation: Volume 8, Section 3.4, Chronic Spills: Volume 10 Appendix 10D-13, Appendix 3 (Tables 2, 4, 5) and Appendix 8 (Table 1); NIRB Compliance Table Commitment #28

**Preamble**: The Proponent committed to examining marine species from a food chain perspective and incorporating within the discussion a consideration of effects related to chronic spills, wave action, and sedimentation. NIRB has indicated compliance. Although

the FEIS includes information on wave action (Volume 8, Appendix 8D-2), propeller wash (Volume 8, Section 3.4), Chronic Spills impacting birds (Volume 6, Section 4.3) and Monitoring plans for biophysical environmental effects (Volume 10, Appendix 10D-13) the Proponent has not fully addressed this commitment, in that the intention was to asses impacts to the food chain in relation to the three stressors. Further, the monitoring information provided is insufficient to indicate how these interactions will be addressed in the monitoring phase of the project.

**Request:**

- DFO requests that the Proponent clearly indicate how chronic spills, wave action, and sedimentation will impact the marine food chain within the LSA including along the shipping route during both the open-water and ice-covered seasons.

**DFO IR # 5.2.5 Substrate alteration - due to prop wash**

**Section/Reference:** Volume 8 – Marine Environment, Section 4.5.2.1; NIRB Compliance Table Commitment #28

**Preamble:** Prolonged and frequent exposure of the seabed to prop wash is expected to create substantial scour pits and to remove finer sediments, leaving behind a substrate dominated by cobbles and boulders. Ore carriers are expected to affect relatively consistent areas within prescribed courses, but tugs will affect more widespread habitats. Downslope movement of sediments is expected to occur until the sites reach “equilibrium” states. An equilibrium state would mean that inputs of sediments to affected areas were occurring at the same rate as removals by prop wash, and presumably some fine sediments would still be present in affected areas. However, it is not clear whether the expectation is that all of the finer sediments will be removed and only cobbles and boulders are left behind.

The Proponent estimated the total area that is expected to be affected by prop wash at each site was estimated. These estimates included areas around the ore and freight docks, where sediment mobilization is expected to occur. However, these estimates do not include areas where the mobilized sediments are expected to re-settle. The current estimate is that less than 0.1% of the coastal habitat will be affected by prop wash-driven sediment movement, but this percentage does not fully account for the effects of sediment movement. This information is needed to evaluate the effects assessment for fish habitat in the marine environment.

**Request:**

- DFO requests the Proponent explain where are the mobilized sediments expected to be re-deposited, the total affected area and the rate of sediment deposition in the affected areas.

## 5.3 Ballast Water

### DFO IR # 5.3.1 Model for Ballast Water Dispersal

**Section/Reference:** Volume 8 – Marine Environment, Appendix 8B-1; NIRB Compliance Table Commitment #20

**Preamble**: The Proponent committed to developing a model for ballast water dispersal. NIRB's compliance table indicates this information was provided but DFO's review of Appendix 8B-1 in the DEIS and FEIS is they are identical. It is not possible to accurately evaluate project effects of ballast water on the marine environment in Steensby Inlet without information on the anticipated fates and movements of ballast water.

**Request:**

- DFO requests the Proponent provide a new comprehensive model of the fates, including accumulation, and movements of ballast water in three dimensions.

### DFO IR # 5.3.2 Selection, Assessment and Regulatory Approval of Ballast Water Treatment Options and Risk Assessment for Introductions

**Section/Reference:** Volume 9 – Cumulative Effects and other assessments, Section 1.4.4.3; Volume 10 – Environmental Health and Safety Management, Appendix 10D-10, Section 4.2 and Appendices 5 and 6; Volume 8 – Marine Environment, Section 3.5.2.3 and 3.5.3.3; NIRB Compliance Table Commitment #21, #92 and #103

**Preamble**: The Proponent committed to providing information about the selection, assessment and regulatory approval of ballast water treatment options. The FEIS presents the typical combination of techniques used for Ballast Water Treatment, not the specific system that will be used for the project, thus it is not possible to evaluate whether it will be effective at treating ballast water that will be discharged into Steensby Inlet. The FEIS also does not assess whether accumulating ballast water discharges would significantly increase the potential for species introductions given that ballast water treatment or ballast water exchange are not 100% effective. Appendix 5 (within Appendix 10D-10) allows for exemptions under Regulation A-4 but the ground for exemptions under this Regulation are not provided.

**Request:**

- DFO requests the Proponent provide their rationale for the ballast water treatment they will use (i.e., what factors would be considered in making their decision to choose any one option) to ensure that the most effective and appropriate ballast water treatment in used.
- DFO requests the Proponent provide a risk assessment to assess whether accumulating ballast water discharges would significantly increase the potential for species introductions.
- DFO requests the Proponent provide information about the grounds for which an exemption under Regulation A-4 might occur.
- DFO requests the Proponent identify which volume is being referred to for Section 4.2 and Appendices 5 and 6

**DFO IR # 5.3.3 Selection, Assessment and Regulatory Approval of Ballast Water Treatment Options**

**Section/Reference:** Volume 9 – Cumulative Effects and other assessments, Table 9-1.4; Volume 8 – Marine Environment, Appendix 8-B1; NIRB Compliance Table Commitment #22

**Preamble**: The Proponent committed to including increased ballast water releases in the cumulative effects assessment. The FEIS mentions ballast water releases in the cumulative effects table (9-1.4) without discussion. An effluent dispersion modelling that predicts the formation of a near-bottom, clockwise rotating "ballastwater eddy" was provided in Volume 8, Appendix 8-B1 Ballast Water Discharge at Steensby Inlet. However, the cumulative effects of long-term discharge of ballast water through the life of the project was not discussed, and therefore DFO is unable to assess the long-term effects of ballast water accumulation in Steensby Inlet on the marine ecosystem.

**Request:**

- DFO requests that the cumulative effects of long-term discharge of ballast water through the life of the project be more fully discussed. In particular, discuss how the accumulation of ballast water will affect the eddy and how will this impact the marine ecosystem?

## 5.4 Marine Mammals

**DFO IR # 5.4.1 Effects assessment of bearded seals**

**Section/Reference:** Volume 8 – Marine Environment, Section 5.12.2.5; NIRB Compliance Table Commitment #16

**Preamble:** IR DFO-03e (Marine Animal VEC – Bearded Seals) reported that vessel speed in areas of pack ice would be "5.5-7.7 km/h" while the FEIS reports it would be "approximately 13 km/h".

**Request:**

- DFO requests the proponent identify the correct vessel speed and confirm which speed was used for the analysis provided.

**DFO IR # 5.4.2 Basking seal surveys**

**Section/Reference:** Volume 8 – Marine Environment, Appendix 8A-2 and Table 4.1; NIRB Compliance Table Commitment #51

**Preamble**: The threshold levels for measuring Project effects on ringed seals depend on having a population estimate in Steensby Inlet, the LSA or RSA. It may be possible to get a population estimate for northeast Foxe Basin/Steensby Inlet from past surveys flown provided details of corrections (missed seals, diving seals, and seals not on ice) are provided and uncertainty in estimates documented. Thus information about

sensitivity of the density estimates to correction factors used is essential. The Proponent committed to providing more detail on the sensitivity of the density estimates to the correction factors used, as well as the basking seal surveys, including the date, time of day, weather and sea ice conditions experienced. During its compliance check of the FEIS, NIRB indicated compliance although it appears there are no new data provided in the FEIS. The information included is the same as that in the DEIS.

**Request:**

- DFO requests the Proponent address this commitment. If there are new data that were included, provide detailed locations where it can be found in the FEIS.

### 5.5 Shipping Noise

**DFO IR # 5.5.1 Noise exposure levels for seals and walruses**

**Section/Reference:** Volume 8 – Marine Environment, Section 5.6.2; NIRB Compliance Table Commitment #79

**Preamble**: The Proponent was asked to consider more precautionary noise exposure levels for ringed seals and walruses, and update the assessment accordingly (e.g., for ringed seals consider disturbance to occur at 70 dB rather than 80 dB received level). Further, a precautionary approach would be to assume a similar 70 dB disturbance criteria for walrus (instead of the 100 dB used by the Proponent in the FEIS).

**Request:**

- DFO requests the Proponent present a formal consideration of the interaction between the proposed activities and ringed seals and walrus using the more conservative 70 dB disturbance criteria.

**DFO IR # 5.5.2 Appropriate thresholds for monitoring noise-related impacts**

**Section/Reference:** Volume 8 – Marine Environment, Section 5.6.2; NIRB Compliance Table Commitment #80

**Preamble**: The Proponent was asked to consider more life-stage specific noise exposure criteria for ringed seals and walruses – such as calving or nursing animals - and update the assessment accordingly. Such information may be available in the literature with regards to whether ringed seals and walruses are more sensitive to anthropogenic sounds during these life stages.

**Request:**

- DFO requests the Proponent present a formal consideration of the interaction between the proposed activities and ringed seals and walrus using disturbance threshold that could be more appropriate for more sensitive life stages (e.g., calving and nursing).

**DFO IR # 5.5.3 Assessment of noise impacts**

**Section/Reference:** Volume 8 – Marine Environment, Sections 5.5.6, 5.5.7; NIRB Compliance Table Commitment #81

**Preamble**: The Proponent was asked to consider a comprehensive assessment of noise impacts using a 250 km radius on each side of the proposed shipping route (i.e., expand the LSA). In the FEIS this was not done as the Proponent argues that "mere detection of distant ship noise should not be considered a disturbance to a mammal receptor. Any potential negative effects from the shipping will occur at much closer distances from the ships." In fact, marine mammal behavioural responses to anthropogenic sounds have been documented at great distances and at received levels not much above ambient. Further, at these distances there will be multiple sound sources detectable as carriers pass each other and/or are spaced along the shipping route. Sound modeling will become more difficult with far-field propagation considerations that might cause unexpected noise "hotspots" such as subsea permafrost and variations in bathymetry and bottom composition.

**Request:**

- DFO requests the Proponent provide their consideration of the interaction between the proposed shipping activities using the larger 250 km potential acoustic field.
- In collecting baseline data and for further monitoring, DFO requests the Proponent use high quality measurements of the received sound levels using log-duration recorders and stations at a variety of distances from the sound sources. These will be important to understanding the potential impacts of shipping noise.
- The Proponent dismissed the Booth (2010) approach to modelling potential effects of multiple sound sources on the basis that Temporary Threshold Shift and Permanent Threshold Shift thresholds would be difficult to estimate for the species of concern here. DFO requests the Proponent provide further consideration of the utility of analysing signal summation and interactions arising from multiple sound sources.

**DFO IR # 5.5.4 Sound modelling sites and sound measurements**

**Section/Reference:** Volume 8 – Marine Environment, Sections 5.5.1, 5.6.5, 5.7.5, 5.8.5, 5.10.5; NIRB Compliance Table Commitment #93 and #94

**Preamble**: The Proponent provided a rationale for the sound modeling site in the Hudson Strait, and their modeling of sound propagation. While this site might provide the most direct sound path to several other areas, DFO still recommends that the Proponent conduct further sound modeling in areas with different oceanographic and hydrographic characteristics. In addition to sound modelling, obtaining field sound measurements are critical especially since the Proponent has indicated some uncertainty exists in the acoustic modelling results.

**Request:**

- DFO requests the Proponent describe how further sound modeling will be conducted in areas with different oceanographic and hydrographic characteristics as opposed to relying on just the one site chosen.

- DFO requests the Proponent describe how field sound measurements (shipping/icebreaking sound measurements) will be conducted in multiple locations before and after construction and shipping begins.

**DFO IR # 5.5.5 Modelling of overlapping sound fields**

**Section/Reference:** Volume 8 – Marine Environment, Sections 5.5.6 and Appendix 8C-4; NIRB Compliance Table Commitment #83 and #95

**Preamble**: The Proponent was requested to undertake modelling of potentially overlapping sound fields from the noisier sound sources, and where there is not overlap in space, make an effort to determine what the temporal lag might be between such overlaps (e.g., for moving sound sources like the ore carriers and tugs). In the FEIS the Proponent provided technical reasons for assuming a worst-case 3 dB increase in received sound levels from two incoherent sound sources.

In the FEIS, when noise was examined from two passing ships the proponent used 1 km separation (equivalent to a 1 km wide point source). However, according to FedNav the required minimum separation between ships should be 1 nautical mile (nm) (1.85 km). While separation is to be at least 1 nm, the tracks in the pack ice may necessitate wider separation as the winter progresses and ice rubble builds up.

**Request:**

- DFO requests the Proponent clarify what the sound output would be from an ore carrier moving at 14 knots instead of 7 knots.
- DFO requests the Proponent provide their plan to conduct field sound measurements in locations where there are overlapping shipping sound sources and zones where cumulative noise would be mitigated due to biophysical features.
- DFO requests the Proponent add wider ship separations (2 and 2.5 km wide point sources) to the current analysis of passing ships.

**DFO IR # 5.5.6 Cumulative effects of chronic disturbance**

**Section/Reference:** Volume 8 – Marine Environment, Sections 5.6.3.2, 5.7.3.2, 5.8.3.2, 5.9.3.2, 5.10.3.2, 5.11.3.2, 5.12.3.2; NIRB Compliance Table Commitment #85

**Preamble**: The Proponent was asked to discuss the cumulative effects of chronic disturbance on the distribution of marine mammal VECs. In the FEIS the Proponent has not added significant new discussion or information to address this issue, as they assume that their mitigation and monitoring strategies will prevent such cumulative effects.

**Request:**

- DFO requests the Proponent clearly state how mitigation and monitoring will detect (if it occurs) and alleviate potential cumulative disturbance (noise, wave action, etc) impacts resulting in displacements of marine mammal VECs. For example, if displacement of walrus occurs, what will be the fate of these animals? Will this

change in distribution result in impacts for walrus in other areas where displaced newcomers arrive?

## 6 ACCIDENTS AND MALFUNCTIONS - FUEL SPILLS ( OIL AND DIESEL)

### DFO IR # 6.1 Pathways of effects for Marine Mammals

**Section/Reference:** Volume 9 – Cumulative Effects and other assessments, Section 3.8; NIRB Compliance Table Commitment #65

**Preamble**: The Proponent committed to including a discussion of possible additional pathways from oil spills in their assessment including damage to ocular surfaces and interferences with olfactory cues (e.g., mother-young bonds); ingestion or inhalation pathways and sub-lethal effects to seals including reproductive failures. During its compliance check of the FEIS, NIRB indicated compliance but also indicated that very limited information was included relating to effects on ocular and olfactory cues and mother-pup pairs. The Proponent responded that the information they provided was adequate for an effects assessment. DFO disagrees, and notes that Section 3.8.7.2 where impacts on marine mammals are described doesn't include sufficient discussion of all pathways of effects.

**Request:**

- DFO requests the Proponent provide their assessment of the potential for damage to ocular surfaces and interference with olfactory cues, ingestion or inhalation pathways and sub-lethal effects to seals including reproductive failures, resulting from spilled oil. .

### DFO IR # 6.2 Risk of shipping accidents and diesel spills

**Section/Reference:** Volume 9 – Cumulative Effects and other assessments, Sections 3.6.2, 3.6.4, 3.8.3, 3.8.7 and 3.9; NIRB Compliance Table Commitment #89

**Preamble**: DFO considered that the risk of shipping accidents and diesel spills was not adequately evaluated and discussed in the DEIS. There is available literature on the frequency of maritime accidents, thus DFO recommended a more quantitative risk assessment. The Proponent did provide more information on this topic in the FEIS. However they restricted their comparisons of shipping accidents to Canadian waters. Shipping has increased in recent years in Canadian Arctic waters but, it is still relatively limited. Additional relevant information could also be obtained from other polar regions. DFO was also concerned with the evaluation and discussion of fuel spills. The Proponent has provided more information but has limited their discussion of the impacts to that of a large diesel spill by a tanker in open water, and concluded that its effects would be short lived due to the volatility of the diesel fuel. Volatility is affected by temperature and wind; winter conditions need to be considered.

**Request:**

- DFO requests the Proponent consider shipping accidents beyond Canadian waters especially in other Arctic areas, for their fuel spill risk assessment.

- DFO requests the Proponent provide an assessment of the risks and potential impacts of a fuel spill under winter conditions for at least three main points along the southern shipping route due to the different features present in northeastern Foxe Basin, southeastern Foxe Basin and Hudson Strait. The conditions in these areas vary greatly in time and space and pose extreme conditions for shipping. These conditions (strong and reversing tidal currents, jumbled ice) must be considered when the Proponent examines the fate of an oil spill in winter and the intermixing of oil and ice.
- DFO requests the Proponent clearly identify their criteria to asses "level of confidence" and "certainty" for their risk assessments (e.g., Table 9-3.9).

## 7 ENVIRONMENTAL MANAGEMENT SYSTEMS

### 7.1 Freshwater Environment

**DFO IR # 7.1.1 Fish Passage Monitoring at Watercourse Crossings.**

**Section/Reference**: Volume 10D-7D; BIM commitment #256

**Preamble**: Commitment 256 from the NIRB technical review stated that "A monitoring program will be developed to determine if the mitigation measures installed are functioning as intended, including a contingency plan if it is found that fish passage was not maintained as predicted." It is noted in volume 10D-7D that "Aquatic Effects Monitoring and Adaptive Management Plans will be developed to monitor ongoing effects on the Project on the Aquatic Environment and adaptively manage those effects through the construction, operation and closure phases of the project. However fish passage monitoring has not been incorporated in to the Environmental Monitoring and Mitigation Plans or the Biophysical Environmental Effects Monitoring Framework.

**Request:**

- DFO requests the proponent provide a Fish Passage Monitoring Plan to determine if the mitigation measures installed at the watercourse crossings along the railway and access road are functioning as intended. This should also include a contingency plan if monitoring shows that fish passage was not maintained as predicted.

**DFO IR # 7.1.2 Fish Habitat Compensation Plan for the Freshwater Environment**

**Section /Reference**: Volume 10, Appendix 10D-7D Fish Habitat Compensation Plan for the Freshwater Environment

**Preamble**: The Proponent has provided a Conceptual Fish Habitat Compensation Plan for the Freshwater Environment. However the Proponent's Fish Habitat Compensation Plan does not include an analysis of potential compensation options against DFO's hierarchy of preferences as outlined in Fisheries and Oceans Canada's Policy for the Management of Fish Habitat (1986).

**Request:**

- Provide an analysis of potential compensation options, taking into consideration the hierarchy of preferences outlined in Fisheries and Oceans Canada's Policy for the Management of Fish Habitat (1986). The analysis should include feasibility of various options and supporting rationale for dismissal prior to proceeding to the next compensation approach in the hierarchy, if necessary.

**DFO IR # 7.1.3 Determination of Harmful Alteration, Disruption or Destruction (HADD) of Freshwater Fish Habitat**

**Section/Reference:** Volume 10, Appendix 10D-7A – Determination of Harmful Alteration, Disruption or Destruction (HADD) of Freshwater Fish Habitat.

**Preamble:** The project interactions in the Freshwater Environment which were included in the determination and quantification of Project related impacts to fish and fish habitat included; footprints of water intakes and other infrastructure, footprints of railway and road bridges and culverts, water withdrawal, dust and sedimentation and stream diversions.

The installation of bridges and culverts often involves the realignment of the watercourse to reduce the culvert skew angle and reduce the length of the culvert. DFO noted that during the review of the Predevelopment Works Proposal (September 2011) all 3 culvert installations along the access road to the air strip had channel realignments associated with them. If channel realignments are required at railway or access road culverts and bridges then this may result in an increased risk of negative impacts to fish and fish habitat.

**Request**

- DFO requests that the Proponent confirm whether there will be channel realignments associated with culvert and bridge installations along the railway or the access road.
- If channel realignments are required DFO requests that the proponent describe the mitigation measures which will be incorporated into the newly realigned channel to ensure stability and mitigate negative impacts to fish and fish habitat.

**7.2 Marine Environment**

**DFO IR # 7.2 Dredging**

**Section:** Volume 10 Appendix 10D-7B

**Preamble**: Dredging is proposed in the area of the freight dock and the ore dock to facilitate docking and ship manoeuvring. The methodology for the dredging has not been provided and it is uncertain how the dredged sediments will be disposed of. The proponent has not indicated where the sediments will be side cast of if they will be disposed of at sea. The disposal of dredged materials in Foxe Basin may also result in the Harmful Alternation, Disruption or Destruction of Fish Habitat (HADD).

**Request:**

- DFO requests the Proponent provide the methodology for the proposed dredging at the freight dock and the ore dock. This should include mitigation measures which will be implemented to reduce the negative impacts to fish and marine mammals and identify the location where the dredged sediments will be disposed.
- DFO requests the Proponent provide the fish habitat assessment of the proposed dredging location and the disposal site to determine if the dredging and disposal of dredgate will result in a HADD of fish habitat.

## 7.3 Adaptive Management

### DFO IR # 7.3 Adaptive Management

**Section/Reference:** Volume 10 Section 1.6.7, Section 11.0, Volume 10 Appendix 10D-10 Section 8.1.4; NIRB Compliance Table Committment #30

**Preamble**: The Proponent committed to applying adaptive management to address unforeseen risks. For foreseeable risks, every effort will be made to identify ahead of time, and apply appropriate mitigation and monitoring measures. The adaptive management approach is described in general terms.

**Request:**

- DFO requests that the Proponent indicate how they will respond if threshold values described in the EIS are exceeded.
- DFO requests that the Proponent indicate how they will adjust their shipping route and/or timing if they find that ship traffic negatively impacts marine mammals (e.g., walrus) in Foxe Basin or Hudson Strait.

## 7.4 Shipping and Marine Mammals Management Plan

### DFO IR # 7.4.1 Baseline monitoring

**Section/Reference:** Volume 10, Appendix 10D-13; NIRB Compliance Table Commitment #66

**Preamble**: Baseline studies are important not only to assess and qualify the components of ecosystems that might be impacted by the Project, but also to disentangle natural vs project-related variation in the system. Documenting effects such as those related to shipping traffic on marine mammal distribution and habitat use is particularly challenging scientifically given the natural variability of environmental characteristics and the myriad of factors intrinsic to species and that might affect behaviour. This is exacerbated here by the ongoing changes in Arctic climate and thus, the expected changes in ice and other oceanographic conditions. In this context, it is particularly crucial to develop scientifically sound protocols that have enough power to insure changes smaller than those that are extraordinary in magnitude will be detectable.

The Proponent has committed to conduct field studies to acquire baseline information on some of the VECs. DFO had recommended approaches (e.g., acoustic monitoring and

double-platform approaches to aerial surveys) to ensure scientifically sound monitoring. At the request of NIRB and DFO, BIM has provided some information about approaches that would be adopted to monitor effects on VECs and effectiveness of mitigation measures. However, DFO has concerns respecting adequacy of the methods proposed in some cases (e.g., monitoring of effects of shipping on marine mammal behaviour and habitat use), the lack of details about the sampling regime prior to and during project development and operation, the adequacy of the proposed methods to detect changes, and the need for much greater scientific rigour in data analysis.

**Request**:

- DFO reiterates its request for additional marine baseline data, and strongly recommends that detailed protocols both for data acquisition and data analysis, including sampling regime and methods, be developed and provided for each important VEC and issue of concern, such as marine mammals versus shipping. The demonstration that the proposed approaches have sufficient statistical power to detect less-than-extraordinary biologically significant effects should also be made.
- Given the uncertainty about impacts of this project on several of the VECs, DFO strongly feels that there is a need to demonstrate that potential effects related to the proposed Project can be documented adequately, and be mitigated to reduce their potential for significant. This is in contrast with the current approach, where BIM provided only a general outline of their approach and proposed to develop and implement detailed protocols once Project approval is granted. DFO is particularly concerned that the proponent has not proposed mitigation for effects related to shipping and marine mammal habitat use if monitoring indicates they are potentially significant.

**DFO IR # 7.4.2 Monitoring of Marine Environment and Resources**

**Section/Reference:** Volume 8 – Marine Environment, Section 6.2, Volume 10, Appendix 10D-10, Sections 4.2.2, 4.2.3 and 4.5.1.3; Appendix 10D-12; 10D-13, Appendices 3 and 4; NIRB Compliance Table Commitments 30, 43, 52, 63, 68, 69, 102

**Preamble**: Monitoring and mitigation are crucial components of an EIS, particularly in the Arctic where there are substantial environmental knowledge gaps and the impacts of development on this scale are largely unknown. The significant rate of large vessel movement (e.g., more than 200 transits to and from Steensby Port each year) in the study area will cause substantial changes in the ice structures along the vessel track, and will likely change the distribution of marine mammals relative to their undisturbed states prior to the mine operation (especially given that many Project sounds will be detectable even out to hundreds of kilometres). Effects of shipping traffic on marine mammal distribution and habitat use was identified as a major concern during consultations with Inuit communities.

A protocol for 'marine mammal monitoring' was added to the FEIS. However, there is still no clear evidence presented in the FEIS to assure the proposed methods will allow detection of less than catastrophic and biologically highly significant changes in the environment and biota in response to Project activities. It is also not clear how the proposed protocol will allow the detection of changes in marine mammal distribution and use of the habitat, or effects beyond those that are very short term, and which occur at

short distances from the ships. The FEIS needs to bring greater clarity as to how and when the proposed monitoring and mitigation procedures would be updated if results warrant a change. Specifically, the FEIS proposes to 'review the collected data' (App. 10D-10, p. 39), but does not provide clear evidence that the proposed review will be made using adequate tools to determine whether the threshold of 'significant changes in behavioural patterns of marine mammals along shipping route' (Table 10-7.2) has been reached. There is also still concern that some of the thresholds have not been rationalized.

**Request:**

- DFO requests the Proponent demonstrate that the monitoring plans are sufficiently sensitive to allow detection of incremental or cumulative changes in the environment (e.g., reductions in marine mammal abundance or distribution, changes in species composition or important habitat features such as prey, ice conditions and accessibility to predators such as killer whales) in response to the Project.
- In the context of the proposed adaptive management, DFO requests the Proponent describe the mitigation measures that would be implemented in the event that a significant change in marine mammal distribution, species composition, or habitat use is detected.
- For each of the main VECs to be monitored, DFO requests the Proponent provide the following information with sufficient details to allow it to be evaluated for effectiveness: an outline of monitoring, including detailed protocols, schedule for data collection, main objectives, adequacy (power) of the proposed schedule and sampling scheme with regard to the specific objectives; how this will be verified; trigger for adaptive management; and alternate mitigation measures