APPENDIX 9F

MARINE SPILL SENSITIVITY ASSESSMENT OF BAFFINLAND'S EARLY REVENUE PHASE (NEW)

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Marine Spill Sensitivity Assessment of the Baffinland's Early Revenue Phase, Mary River Iron Mine Project

prepared for

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SUMMARY

This assessment addresses potential impacts from an accidental spill of fuel from tankers serving the Baffinlands port at the head of Milne Inlet. This approach provides an overview of key spill issues for the Baffinlands Early Revenue Phase (ERP). An estimated two to three tankers per year would supply fuel to the port during the open water season for five years. Tankers will pass through Eclipse sound and then into Milne Inlet. The overall length of Eclipse Sound shipping route is 570 km and assuming that a worst-case spill would have a footprint of impact 15 km to each side of the proposed transit route, the total Area of Concern in excess of the 17,000 km^2; an estimated 601 km of shoreline fall within this Area of Concern.

The Environment Canada Arctic Environmental Sensitivity Atlas System (AESAS) was used to provide insight to potentially sensitive resources in the region. More detailed shoreline habitat mapping of Milne Inlet, based on classification of high-resolution videography and photography, was used to delineate sensitive coastal habitat in Milne Inlet.

There is potential risk to resources along the proposed shipping route and some resources are more sensitive than others For the purpose of this discussion, *sensitivity* is the ability to recover from spill effects and *risk* is defined as the probability of contact. Resources of special concern are those for which large aggregations of a significant proportion of the total population occur within a relatively small area – that is, a large proportion of the population could potentially come into contact with a spill. In some cases, these resources are also sensitive to spill affects (e.g., diving ducks).

There are some resources that are considered high sensitivity and high risk. An overall summary of risk and sensitivity is provided in Table 10. Resources of special concern include:

- **narwhal,** whose sensitivity to diesel spills is unknown but where large portions of the population aggregate in a relatively small area in Milne Inlet and eastern Eclipse Sound. Given the aggregations of narwhal that are known to occur in Milne Inlet, there is the potential for a significant portion of the population to come into contact with a spill.

- **marine birds** occur in large aggregations near the eastern entrance to Pond Inlet. Birds are known to be sensitive to spills and considered at high risk in the event of a spill due to large aggregations near the shipping route.

- **hunting activities** occur throughout the region of the shipping route. A spill and associated response operations could disrupt hunting activities such that a substantial portion of the open-water hunting season could be lost.

This assessment is made based on a number of assumptions (see Section 2.3) about potential spills and is restricted to an assessment of diesel spills only. Some mitigation techniques are mentioned in the text. However, these strategies are outlined only in concept and require further consideration within the project spill contingency plan. Some of the conceptual mitigation techniques (e.g., wildlife hazing) would require discussion/approval from regulatory agencies.

1.1 Scope of Sensitivity Assessment

This report provides an overview of potential sensitivity of resources to an open-water diesel spill near the proposed port at Milne Inlet and along the proposed shipping route (Figure 1) through Eclipse Sound (the "Northern Shipping Route"; 570 km long). The proposed Mary River Iron Mine project calls for diesel fuel to be shipped to Milne Port in the ERP during open-water season; fuel will be stored on shore to support year-round operations of the mine. While the potential for large marine diesel spill is considered unlikely, a spill is possible and worst-case spill scenarios are developed for both the port areas and for the shipping routes. The initial Environmental Assessment (EA) for the Approved Project included a sensitivity assessment; this version draws on that assessment but includes some higher resolution mapping for both Milne Inlet and Eclipse Sound.

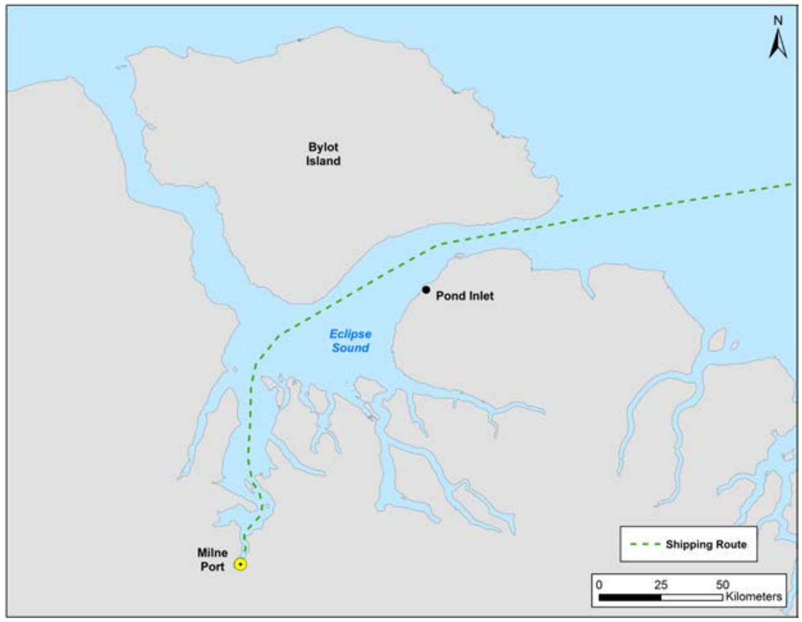

Figure 1 Proposed Northern Shipping route for the Mary River Iron Mine project.

The risk assessment that identified a 5 ML spill as a "credible, worst-case spill scenario" is identified in a separate document (AMEC 2010a, b). The spill scenarios are used as first approximation to evaluate potential contact with pelagic and coastal resources. While some of the aspects of a spill are known (product type, season of spill), the location of a potential spill could include any place along the proposed shipping route. As such, resources within a probable spill envelope are considered in this assessment.

There is shoreline sensitivity mapping information for the northern shipping route (Arctic Environmental Sensitivity Atlas System, AESAS; Environment Canada 2000).

The overall approach of this assessment is to identify the resources that may be present near the shipping route at the times when a spill could occur (i.e., open-water season). This involves mapping the resources and knowing something about the resources life cycle and seasonal use of habitats. Previous experiences of similar diesel spills provide some additional information on the potential extent and longevity of a spill before it dissipates. In the assessment of potential spill effects on resources, the concepts of ***sensitivity*** of a resource to a spill and the ***risk*** of contact with a spill are considered.

Sensitivity

For this assessment, we considered sensitivity as the ability of a resource to recover in the event of contact with a diesel spill. The ability to recover is a factor of: (a) the sensitivity of an individual to toxicity posed by a spill, (b) the percentage of a population that could potentially be affected by a spill and (c) the general health of the population (e.g., cumulative effect). For example, most species of seabirds are considered sensitive to a spill (contact with a spill is usually be lethal) but if their population is widely distributed then even though a number of individuals may be killed, the recovery potential is good and the resource is considered to have a low sensitivity to the spill scenarios. However, a seabird group that tends to aggregate, where a large part of population could be exposed to the spill, would be considered highly sensitive. There are some resources where the sensitivity to the spill toxicity is not known (e.g., narwhal). Because narwhal aggregate with a significant portion of their population in a small area, they would be considered *potentially* highly sensitive.

Risk

The use of the term "risk" in this assessment is to identify the likelihood of overlap between a resource and the spill. For the assessment, we assume that a spill has occurred (admittedly, a very low probability) and examine the likelihood of a resource to be contacted. In some cases, the resource is not present (e.g., juvenile arctic char out-migrate through estuaries during freshet when there is little chance of a spill) or is in very low densities (e.g., ringed seals) so the risk of contact is low.

2.1 Diesel Weathering

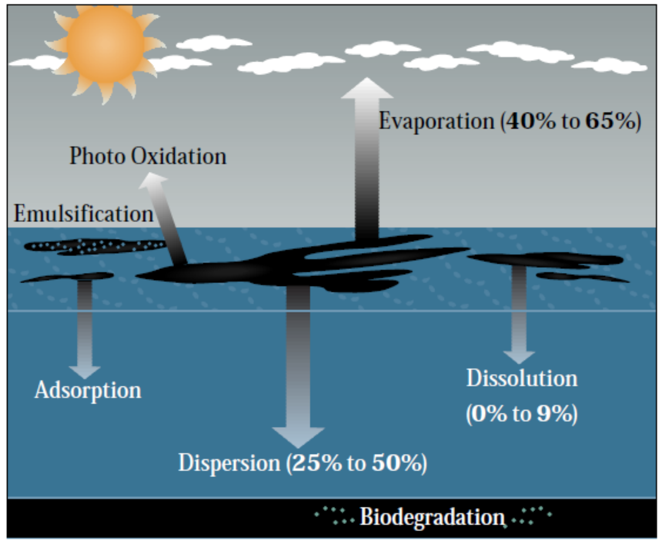

Figure 2. Weathering processes that affect diesel spills (from NOAA 2010a).

Diesel is a relatively volatile fuel and will weather rapidly when spilled on water. Diesel is classified as a low-viscosity, Group 2 fuel (Robertson *et al* 1997) and when spilled on water, rapidly spreads and thins (Fig. 2; NOAA 2010a). A spill weathering model that predicts the fate of spills based on fuel properties as well as environmental conditions such as water temperature, winds speed, etc. (NOAA 2010b) shows the weathering of diesel under conditions that are likely to similar to the proposed shipping routes (Fig. 3). The model shows that approximately 90% of the spilled fuel (“diesel, “Canadian”) is likely to be weathered within 96 hr of the spill initiation, where weathering includes evaporation into the atmosphere (~60% by volume) and dispersal into the water column (~ 30% by volume; Fig. 2, Fig. 3). The type of diesel used in the models is important as different diesels have different weathering properties, where “heavier” diesels show much lower evaporation rates and higher in-water dispersion rates (Fig. 4).

In most cases, the modeling indicates that the worst case diesel spill of 5 ML is likely to have a relatively short duration, in the order of days to weeks. Lighter diesel fuels, high winds and warmer water temperatures are all factors that would lead to shorter duration of the diesel slicks on the water surface. Depending on weather conditions at the time of the spill, the spill may contact shorelines, where continued weathering will take place.

As the fuel weathers, it becomes denser and more viscous. The most toxic components of a diesel fuel tend to evaporate rapidly during the early part of a spill (benzenes evaporate completely within 8-12 hr after the spill).

2.2 Port Spills

The proposed port location in Milne Inlet was assessed for spill potential in separate modeling efforts (AMEC 2010a, AMEC 2010b). A probability map for open-water spill potential in Milne Inlet is included in Figure 5. This map provides a summary of 900 model runs of the spill scenario using a variety of historical wind data to realistically emulate open-water wind conditions within Milne Inlet (AMEC 2010a). The modeling indicates 98 % of the slicks occur within a 2 km radius of the spill site. The modeling further indicates that most of the spills contact the shoreline and a some amount of the total spill is likely captured on nearby beaches,

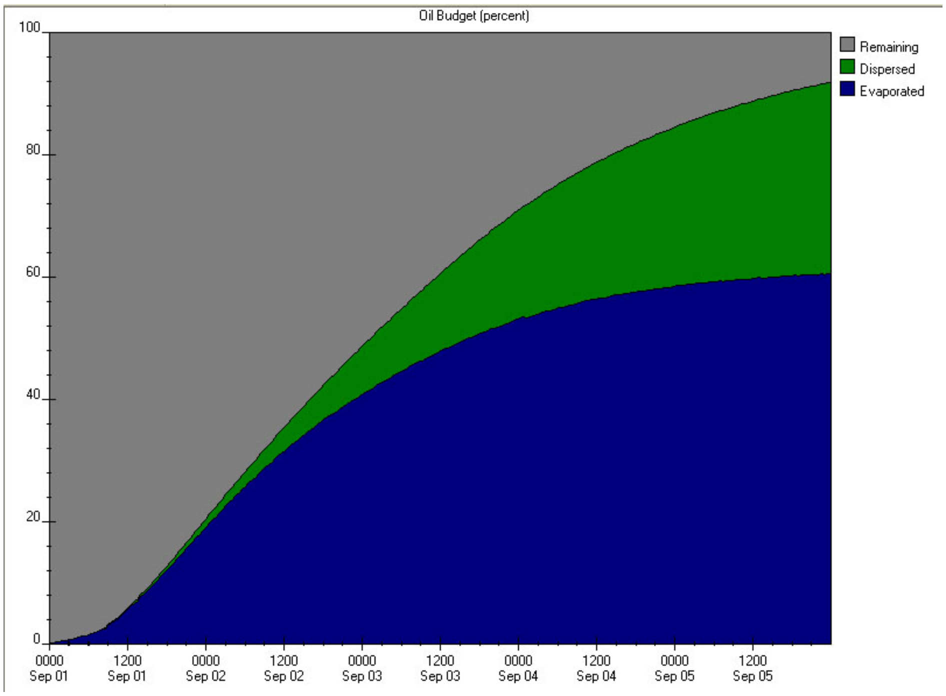

Figure 3. Weathering characteristics of a 5 ML (43,000 bbl) diesel spill in 2° C waters under moderate wind and wave conditions. “Canadian diesel” (see ADIOS2 model) is used as the spilled fuel.

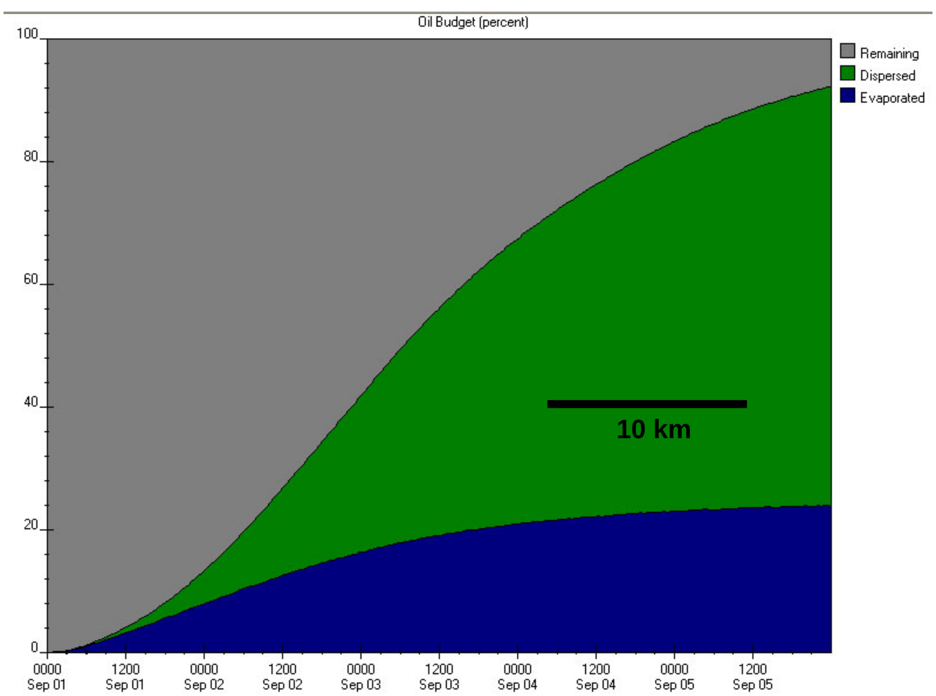

Figure 4. Weathering characteristics of a 5 ML (43,000 bbl) diesel spill in 2° C waters under moderate wind and wave conditions. “USA Southern” diesel (see ADIOS2 model) is used as the spilled fuel. Note the significantly lower evaporation rates and higher dispersion rate of this diesel type.

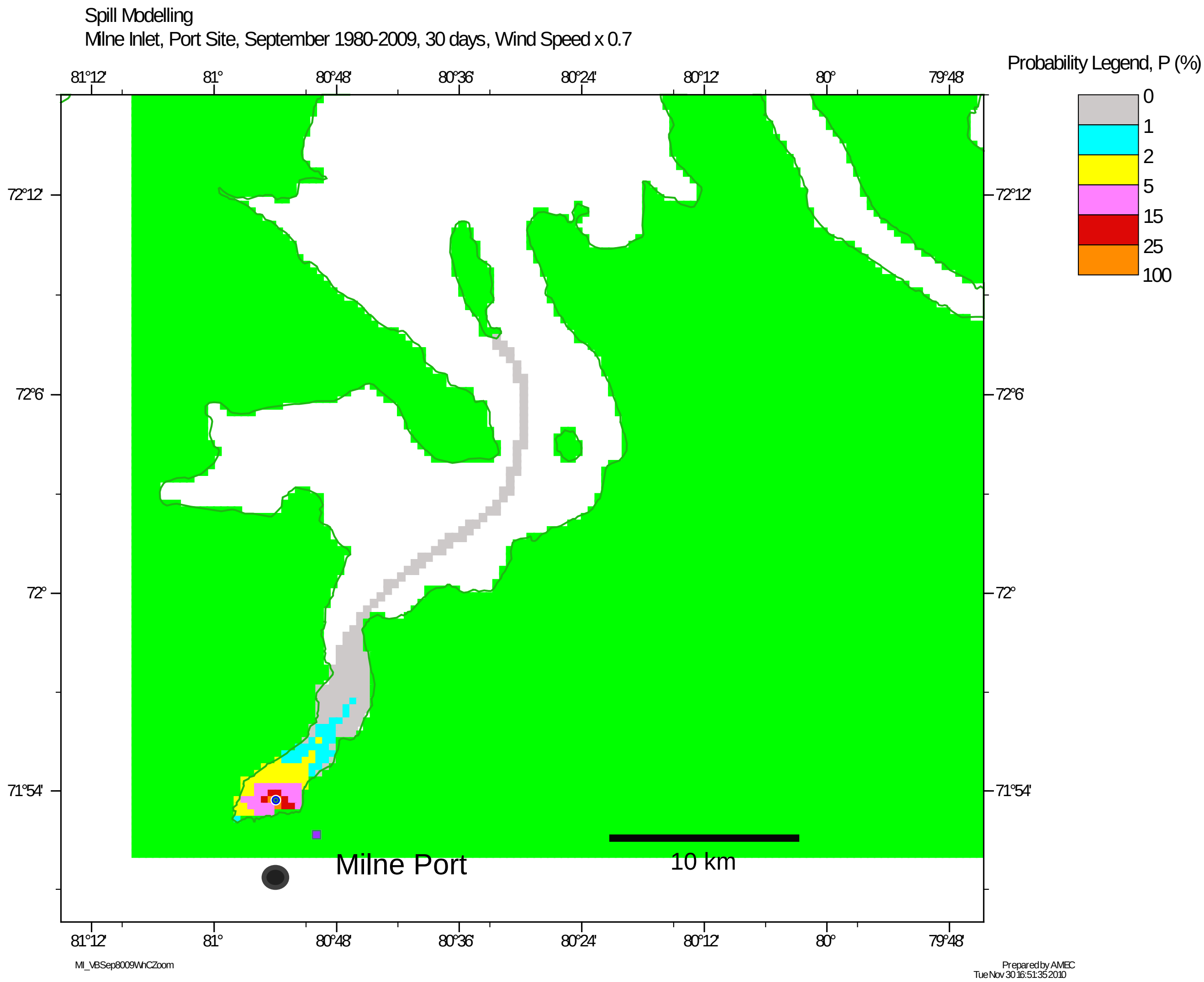

Figure 5. Probability envelopes from 30 years of wind data (900 individual trajectories using long term wind data for the Milne Inlet area). The yellow coloring indicates the 98% probability envelope (that is, 98% of the modeled spills are within this envelope – a maximum of <2 km from the spill site (from AMEC 2010a).

assuming no mitigation takes place. Of the 900 model runs, only two resulted in shoreline contact within Koluktoo Bay (AMEC 2010a). The modeling indicates a total of <15km of shoreline are contained within the 98% probability envelope

2.3 Shipping Route Spills

The proposed northern shipping route is an estimated 570 km between Baffin Bay and the Milne Port (Fig. 1). No site specific spill models along the shipping routes have been run. There are a very large number of potential spill scenarios that could be run along the proposed shipping route to accommodate differing coastlines, tidal current regimes and localized wind climates. In particular, the spill location is unknown and tidal currents outside of the port areas are poorly understood so forecasting becomes very hypothetical. Using the results from the more detailed modeling for the Steensby Inlet spill modeling (AMEC 2010a), a 'generic spill' with a 15 km spill radius is assumed for the shipping route. That is, a swath of 15 km each side of the proposed shipping route (Fig. 7) is assumed to contain 98% of the possible trajectories for an open-water diesel spill. The assumed swath width is based on review of the Steensby Inlet probability plots and provides a first order approximation of possible worst-case spill extents, recognizing that tidal currents and wind regimes may differ in other regions. This swath is used to identify potential resources at risk from an accidental, worst-case spill.

Typical slick sizes (>1 micron thickness) for such a spill are 18 km^2 after one day, 35 km^2 after two days, 50 km^2 after three days and 70 km^2 after four days (John McClintock, AMEC Earth and Environmental, pers. com. 2010). If slicks encounter a shoreline, some fuel will adhere to intertidal sediments, particularly in the upper intertidal zone, where longer substrate drying times occur. Because diesel is non-viscous, there is potential for penetration into intertidal sediments. On the other hand, diesel spills are typically very thin, so the overall volumetric loading to a shoreline is low, limiting the amount of penetration that could occur. In the port spill modeling (AMEC 2010a, AMEC 2010b), the total shoreline contacted by sheens is less than 15 km. For the shipping route spill assessment it is assumed that *a few tens of kilometers of shoreline oiling could occur in worst-case scenarios where shorelines are within 15 km of the shipping route.*

In summary, the key elements of our spill scenario assessment assume the following spill features:

- a worst case spill of 5 ML of diesel (assume ADIOS2 "diesel [Canada]" fuel type NOAA 2010b).
- the spill occurs near the centre of the proposed shipping lane.
- it is highly probable that the spill will be largely confined to a 15 km swath on each side of the shipping lane.
- slick areas are in the order of 18 km^2 after one day and 70 km^2 after seven days.
- shorelines within 15 km of the shipping lane may be contacted by the spill; if they are contacted, it is likely that worst-case contact would be a few tens of kilometers (not 100s of kilometers).
- in general, diesel slicks are thin (~1-10 microns) so that should shoreline contact occur, loading levels are low.
- shorelines outside of 15 km from the shipping lanes are unlikely to be contacted.
- a spill would be most toxic, shortly after the spill, before significant weathering has taken place; locations more distant from the centre of the shipping lane would experience lower toxicity levels.
- spill scenarios assume no mitigation; in some locations, particularly near the port sites, there is good potential for mitigation.
- diesel persistence is relatively short – generally a matter of days and at worst case one to two weeks.

One of the assumptions of this assessment is that spills are likely to originate along the proposed shipping routes. However, one of the causes of spills is navigational error where the vessel deviates from it planned track. This assessment does not considered the potential deviation of ships from the planned route and such deviations will increase the areas of concern.

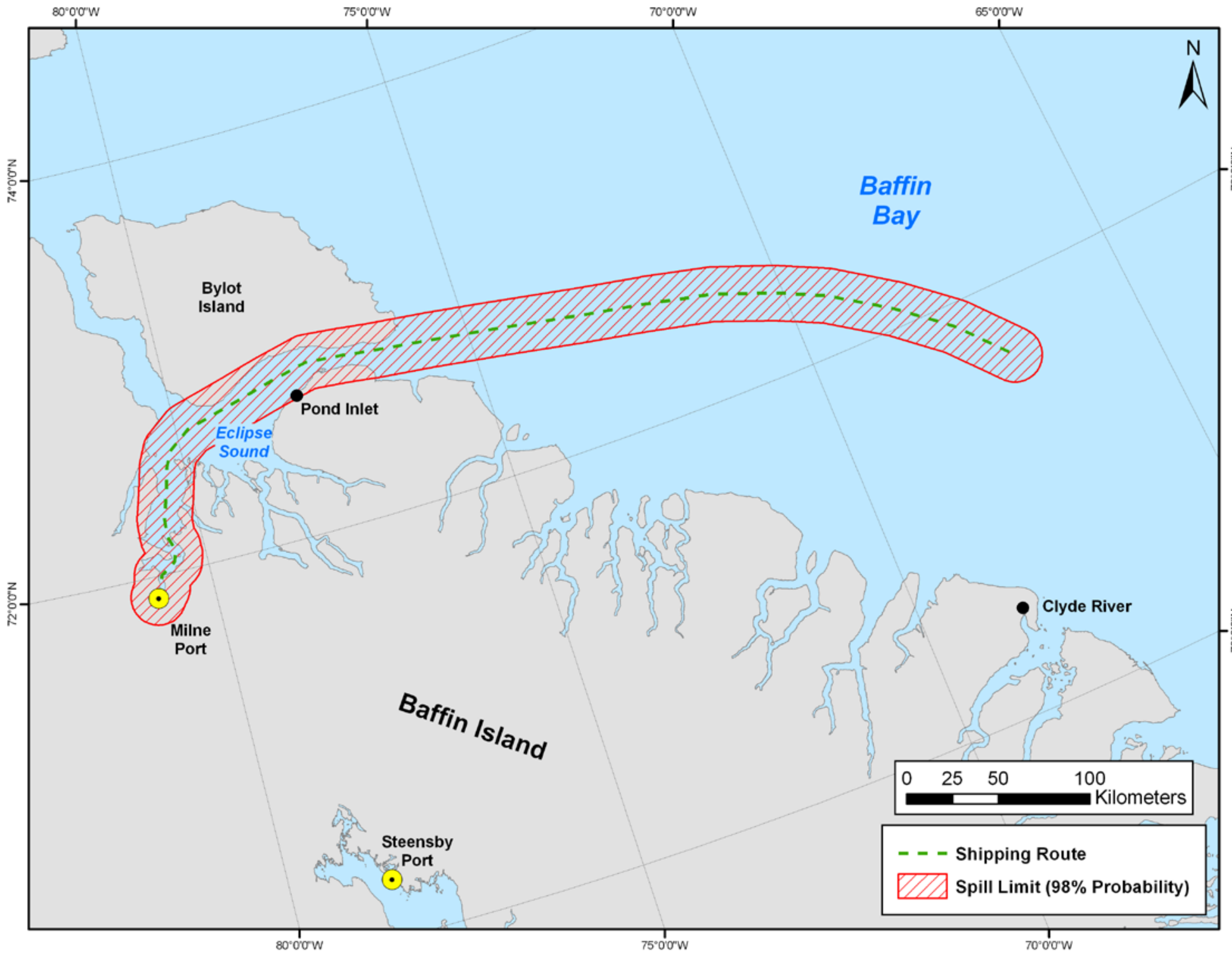

Figure 6. Approximate proposed northern shipping route with a 30km swath (15 km to each side of the proposed route), which nominally encompasses the 98% probability envelope for spills. Note that specific spill trajectory models have not been run along the proposed route.

3.1 Overview of Resources at Risk

There are approximately 570 km of proposed shipping route to Milne Port and assuming a 30 km swath for the spill probability envelope, there are approximately 18,000 km^2 at risk along the Northern Route. Some shoreline falls within the 30 km swath, – 600 km of shoreline on the Northern Route.

Resources at risk include: coastal habitat, marine mammals, coastal and marine birds, marine fish and lower trophic resources (e.g., plankton, invertebrates). In addition, there are some human-use activities that could be impacted by an open water spill. An environmental atlas for use in spill planning and response has been assembled for the Northern Route (Environment Canada 2000).

3.2 Coastal Habitat at Risk

Coastal Vegetation

There are two special biotic habitats that could be impacted by a spill: *salt marsh* (Fig. 9, 10) and the attached macro algae *Fucus* (Fig. 11). Salt marshes occur in the upper intertidal zone and *Fucus* seaweed is more common in the lower intertidal zone.

Figure 7. Salt marsh in the upper intertidal zone near Steensby Port

Figure 8. Detail of upper intertidal salt marsh showing extensive grazing of plants, high water table and iron oxidation.

Figure 9. The macro algae *Fucus* in the lower intertidal zone.

Salt Marsh

Johnston and Pepper (2009) used Morrison's (1997) habitat classification to stratify sampling in their investigation of breeding birds and habitat associations on Prince Charles and Air Force Islands. The salt marsh habitat category is described as having > 50% vegetation cover, with dominant species as salt-tolerant grass, (*Puccinellia*), bear sedge (*Carex ursina*), and salt marsh starwort (*Stellaria humifusa*). Substrate moisture was described as 'saturated' (Fig. 10).

The zonation of salt marsh plant community on Bray Island, in northeast Foxe Basin, is described by Dansereau (1953), as having 'large expanses' of the salt grass *Puccinellia phryganodes*, dominating the upper intertidal marsh, in particular in sheltered bays and coves. At the upper edge of the salt marsh, colonies of *Cochlearia groenlandica* and *Stellaria humifusa* occur. Dansereau (1953) also describes the only rooted vascular plants found on sandy beach habitats, as occasional occurrence of oysterleaf (*Mertensia maritima*) in shallow depressions in the sand.

Sub-arctic salt marshes in southern Hudson Bay are heavily used as breeding and feeding grounds by lesser snow geese and Canada geese (Cargill and Jeffries 1984). The researchers describe the salt marsh assemblages as 'dominated by *Puccinellia phryganodes* and *Carex subspathacea'*. Although somewhat south of the Foxe Basin and Hudson Strait shorelines, the description of the dominance of the salt marsh by these same species as are characterize the salt marsh assemblages further north shows that it's likely that coastal salt marshes throughout the whole region are dominated by the same species of *Puccinellia* and *Carex*.

The species richness of Arctic and sub-Arctic salt marshes is described as 'low' compared to temperate marshes (Perillo *et al* 2009) and the common species that have circumpolar distribution is the grass, *Puccinellia phryganodes.* Individuals are extremely resilient to harsh environments and can withstand months of frozen ice conditions. The sedge *Carex subspathacea* is also widespread circumpolar species which tends to occur in more brackish water areas than does the *Puccinellia.* Several other salt marsh species are listed by Perillo *et al* (2009) from south Hudson Bay surveys.

Salt marshes are generally regarded as sensitive to spills because of their oleophillic nature (oil tend to stick to organic substrates) and because they almost always occur in low-energy environments where natural recovery rates are low (Hayes *et al* 1992/2001; Hoff 1995; Owens and Sergy 2004; Peterson *et al* 2002). Plants may suffer direct mortality from oiling or lower growth rates from oil retained in associated peat substrates.

Mitigation is problematic as salt marshes are very sensitive to trampling (Hoff 1995). Natural recovery is usually the preferred response option supplemented by spot sorbent and flushing treatments where appropriate (EPPR 1998).

Macroalagae

Fucus seaweed is common along the coast of Eclipse Sound. *Fucus* occurs both within the intertidal zone (Fig. 11) and in the subtidal (CORI 2008b; 2008c, Wilce 1997). The ecological significance of *Fucus* for these regions is uncertain, although it does represent primary productivity and it is widely distributed.

Intertidal zone fucus would be vulnerable to fuel contact during low tides. The effects of diesel spill on *Fucus* is not well known, although Ganning and Billing (1974) suggested that *Fucus vesiculosus* is resistant to exposure from light fuel oil, based on laboratory experiments. Studies of crude oil spills on *Fucus* indicate complete recovery may require more than seven years, although most re-colonization occurs within two to three years (Fukuyama *et al* 1998; Driskell et al 2001). In 1980 experimental studies near Cape Hatt (NE Milne Inlet), crude oil releases did not produce any measureable effect on the biomass of subtidal *Fucus* (Cross *et al* 1987).

It is likely that *Fucus* would experience both mortality and damage as a result of contact with a diesel spill. However, given that *Fucus* is widely distributed both alongshore and within the subtidal and that potential spill impacts are for limited extents of shorelines (tens or kilometers or less), it is likely that recovery would be substantial within one generation.

3.3 Coastal Habitat in the Eclipse Sound Region

The proposed shipping route for tankers is through Eclipse Sound and then into Milne Inlet (Fig. 1). The route length is approximately 570 km. There are approximately 1,690 km of shoreline (Table 1) immediately adjacent to the shipping route. The initial EA submission reviewed potential issues of diesel spill associated with tanker deliveries and considered a 30 km swath of potential impact from an accidental spill.

Table 1 Shoreline Extent

Subregion	Shoreline Length (km)
Milne Inlet	547
Eclipse Sound	1,145
TOTAL:	**1,692**

Resources at risk include: coastal habitat, marine mammals, coastal and marine birds, marine fish and lower trophic resources (e.g., plankton, invertebrates). In addition, there are some human-use activities that could be impacted by an open water spill. An environmental atlas for use in spill planning and response (AESAS) has been assembled for the northern route (Environment Canada 2000) and these data were used to give a regional picture of potential spill sensitivities.

Regional Coastal Habitat Types

The Environment Canada AESAS Atlas shows general shore types in the region (Table 2 and Fig. 12). These shore types were mapped from an interpretation of vertical air photos so only capture the most general coastal morphologies; substrate types are inferred from the morphology (Environment Canada 2000).

Table 2 AESAS Shore Types for the Region

AESAS Shore Type	Milne Inlet (km)	Eclipse Sound (km)	Region (km)	% Occurrence
Bedrock Cliffs/Talus	349	871	1,220	72%
Bedrock Platforms	37	25	62	4%
Beaches	148	190	338	20%
Barrier Beaches, Spit with Lagoons		58	58	3%
Embayments with Tidal Flats/Beaches/ Tundra	12	0	12	1%
Glacier Ice		2	2	0%
Totals:	*547*	*1,145*	*1,692*	*100%*

Open-water is limited to approximately three months of the year but during open-water wave fetch can exceed 100 km in the main portion of Eclipse Sound; exposures associated with these open fetches would be characterized as *semi-exposed* (Fig. 13). The many bays and inlet surrounding the Sound have much more limited fetch windows and would be characterized as *semi-protected* and *protected*.

Significance to Spills

In terms of sensitivity to heavy oil spills, the two primary concerns would be (a) low-energy shores where hydraulic wave energy levels are low so persistence of stranded oil is likely to be lengthy and (b) highly permeable, coarse substrates where permeability allows penetration into the sediments, contributing to lengthy persistence. The more energetic shorelines generally have higher permeability, and lower energy shores have lower permeability.

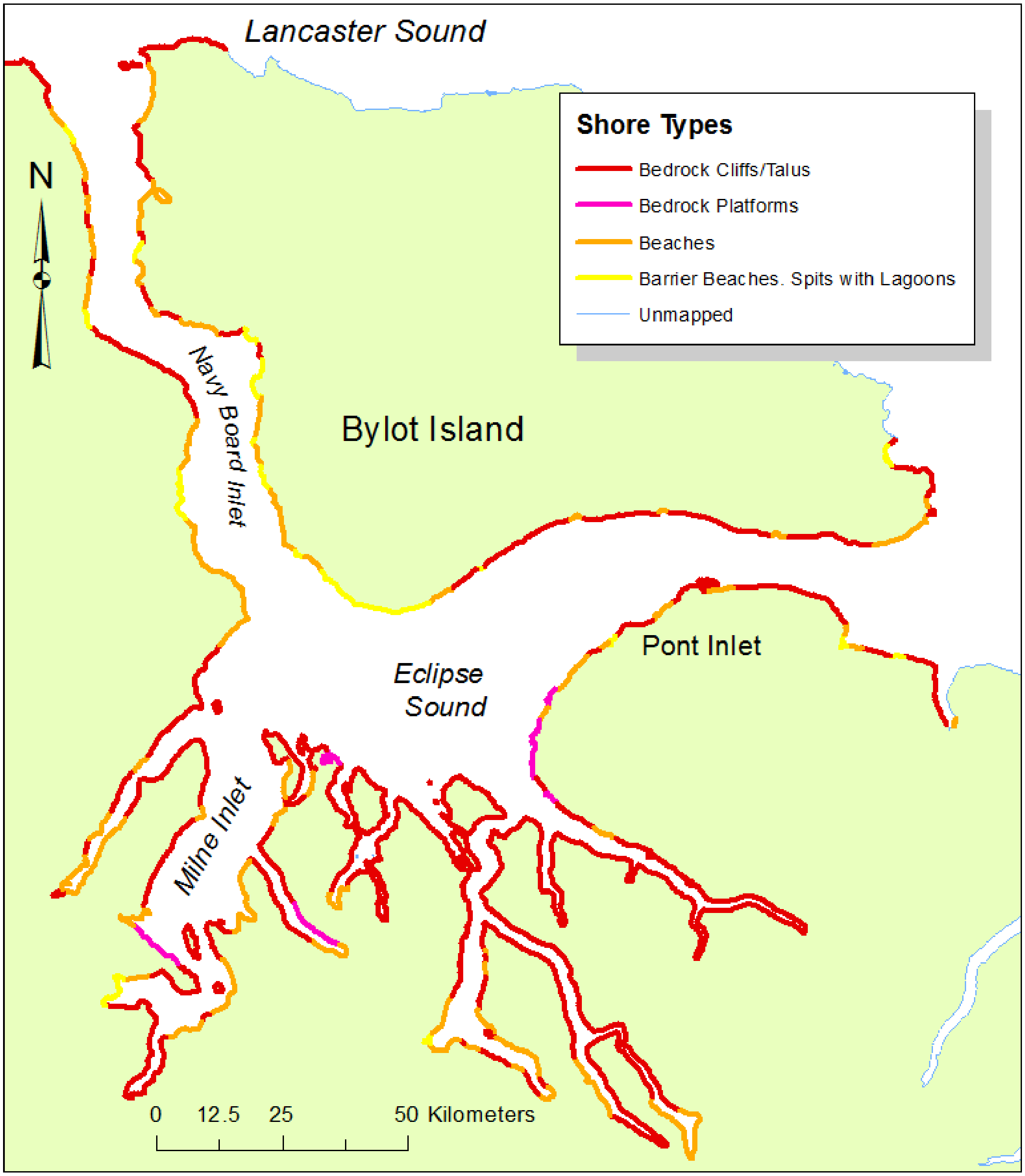

Figure 10. Shore types mapped in AESAS for the proposed shipping route. The region is dominated by cliff/talus and beaches, which are most likely either pebble/cobble or sand & gravel.

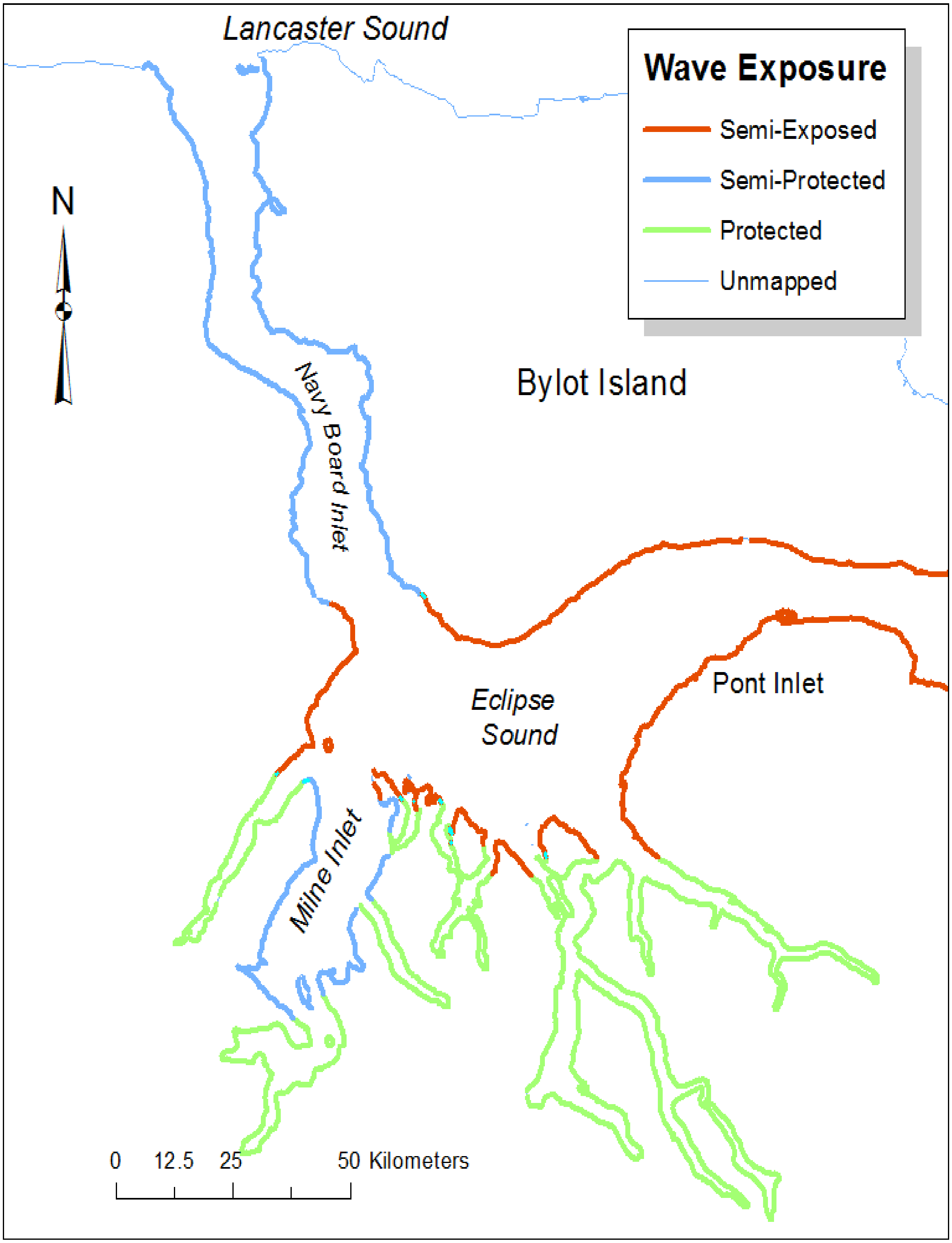

Figure 11. Open-water wave exposure categories, based on wave fetch windows.

The most likely scenario for a diesel spill is that the spill would be substantially weathered by the time it reached the shore. Should slicks reach the shoreline, they will have limited penetration on *bedrock* surfaces; persistence is in the order of days is likely. Where fuel strands on *sand matrix beaches*, penetration would likely be limited to a few centimeters from the surface. Depending on the time of stranding fuel could be removed during a single storm event or persist for weeks until some higher energy storm occurs. Should a spill strand just prior to freeze-up, some residual fuel could persist into the following open-water season. *Talus shorelines* could have boulder beaches and associated high permeability with corresponding higher retention; residual fuel could persist for months. *Tidal flats* are rare in the region (Fig. 14) but are the locations where salt marshes are most likely to be found. Retention can be higher in salt marshes due to the oleophilic nature of the grasses and peats and low energy associated with this habitat. Residual fuel might persist for months.

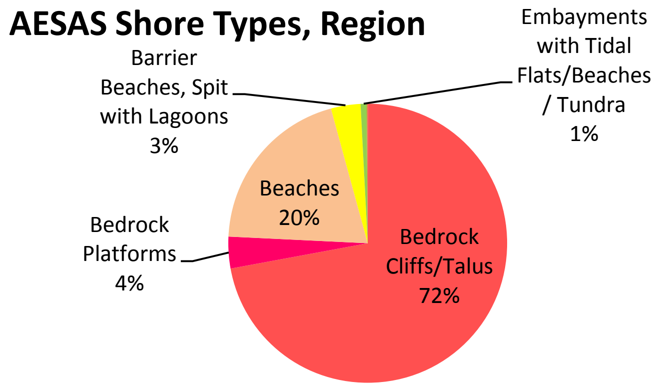

Figure 12. Occurrence of shore types in Eclipse Sound

Milne Inlet

The Milne Inlet shoreline is potentially at higher risk for diesel or Jet A spills because there will be ship-to-shore fueling operations and because there are large, on-shore fuel tanks. High resolution coastal imagery, collected during the open-water season of 2007, was used to refine potential sensitivities to spills. The imagery was reviewed to systematically characterize coastal habitats, shoreline marshes and intertidal vegetation. Shoreline camps were also visible on the imagery, and occupied camps, unoccupied camps and tent rings were systematically cataloged to provide an indication of high human use locations.

Milne Inlet Coastal Habitats

A total of 384 km of shoreline were inventoried. The Environment Canada (EC) shore types (Owens and Sergy 2000, 2004) were used as the basis for the classification of shoreline habitats. The EC shoreline types are summarized in Table 3; not all the EC shore types occur in Milne Inlet. In addition to the EC shore types, locations with intertidal marsh and algae were documented.

Table 3 Environment Canada Shore Types (after Owens and Sergy 2000, 2004)

No	Environment Canada Type	Description
		Non-Permeable
1	Bedrock	Primarily bedrock surface but may contain boulder and cobble veneer but <25% cover
2	Man-Made Solid Structures	Concrete or steel wharfs usually
		Permeable
3	Sand Beaches	Usually <50 wide; ~5° slope; estimated sand content>75%
4	Sand & Gravel Beaches	Sand matrix with pebble, cobble, boulder; sand content >25% and <75%; typically show across-shore variation with sand in the lower intertidal and ravel in the upper intertidal.
5	Pebble-Cobble Beaches	Well-sorted, pebble cobble; Sand content <25%; on low energy shorelines (max fetch <10 km) subsurface is likely to be sand.
6	Boulder Beaches	Also includes rip-rap shoreline; on low energy shorelines (max fetch <10 km) subsurface is likely to be sand.
7	Mud Tidal Flats	Mud surface usually has a shine to the surface
8	Sand Tidal Flats	Usually >50m wide; <5°; estimated sand content >75%
9	Salt Marshes	Organic substrate
10	Peat Shoreline	Often associated with tundra cliffs; no mineral soil evident
11	Inundated, Low-Lying Tundra	Very low lying tundra areas where tundra vegetation or polygons may be seen under the water; thaw lakes common
12	Tundra Cliffs	Almost no beach (intertidal <2m wide); unconsolidated except by permafrost; often show associated Ice slumps

A total of 1,768 units were delineated with an average length of 220 m. The distribution of shore types is shown in Figure 15 and summarized in Table 4. Three shore types comprise the vast majority of the Milne Inlet shoreline (Fig. 16): *impermeable bedrock* (15%), *boulder beaches* (11%), and *sand & gravel beaches* (70%).

Table 4 EC Shore Types, Milne Inlet

Environment Canada Shore Type	Length		Occurrence (%)
	m	(km)	
Bedrock	57,080	57.1	15%
Man-Made Solid Structures	47	0.0	0%
Sand Beaches	3,520	3.5	1%
Sand & Gravel Beaches	270,634	270.6	70
Pebble-Cobble Beaches	70	0.1	0%
Boulder Beaches	41,275	41.3	11%
Sand Tidal Flats	11,258	11.3	3%
Totals:	***384,334***	***384.3***	***100%***

The EC shore types were developed to provide a measure of spill retention in the event of a spill. In general, shore types that are most permeable will retain more oil once the spill reaches a shoreline. With the shore types that are mapped in Milne Inlet, bedrock and man-made, solid structures are considered *impermeable* and would retain little oil in the event of a stranding. Boulder and pebble-cobble beaches are considered *highly permeable,* and light oils, such as diesel, could permeate significantly into the substrate. Beaches or flats with a sand-mud matrix (common in low energy shorelines) will have limited penetration, typically a few centimeters below the surface.

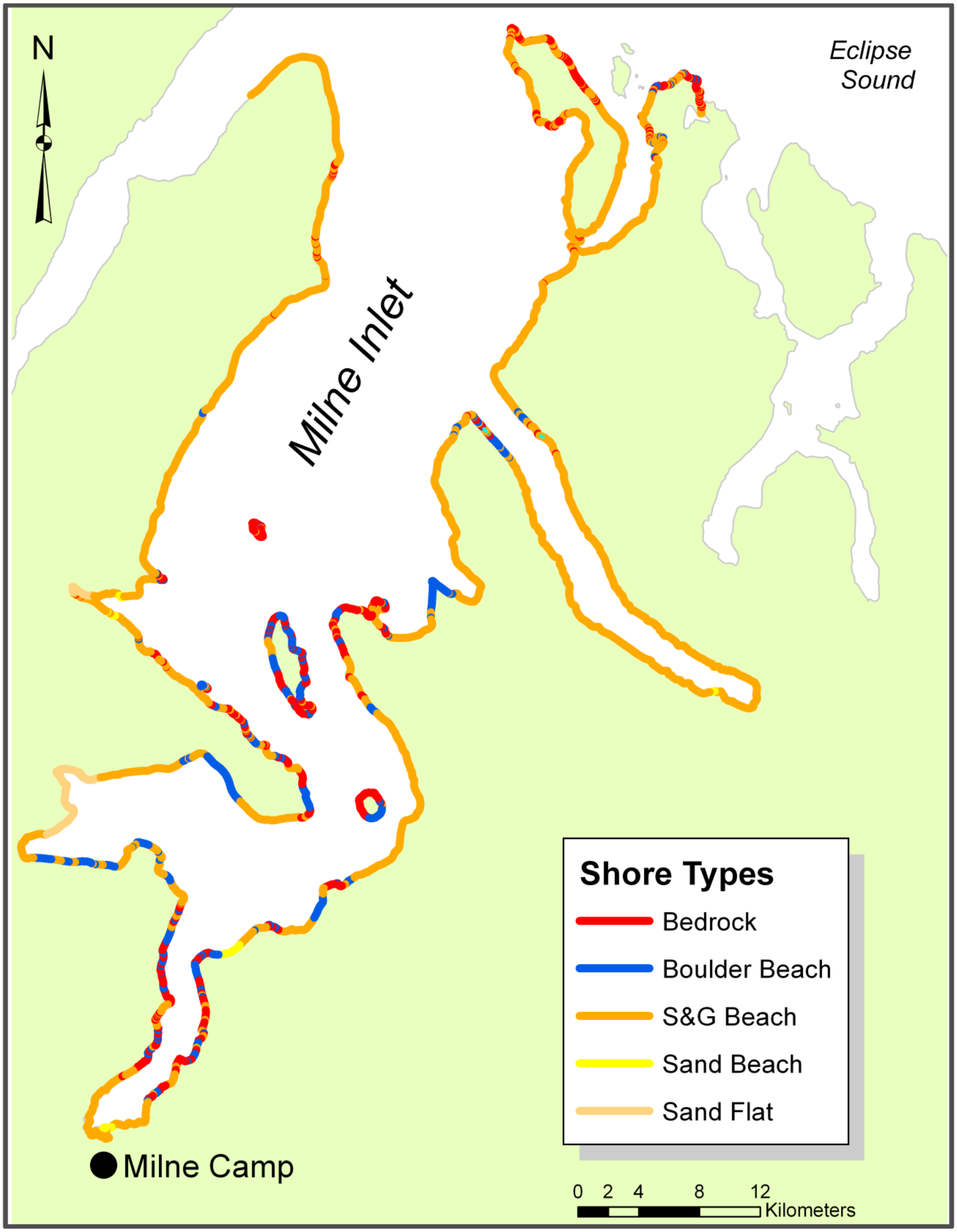

Figure 13. Occurrence of EC shore types in Milne Inlet. A total of 1,768 units were delineated

Wave energy is another factor affecting the persistence of stranded oil, where hydraulic wave energy can break up and disperse stranded oil. Higher energy shorelines have shorter persistence than lower energy shorelines. Most of Milne Inlet would be considered *semi-protected* (maximum wave fetches of 10 – 50 km) or *protected* (wave fetches <10 km; see Fig. 13). In addition, there are only three months of open-water when waves can be generated. As such, Milne Inlet would be considered a low-wave exposure environment.

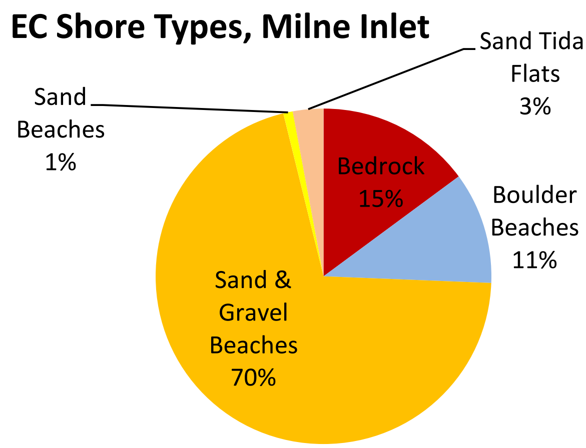

Figure 14. Occurrence of EC shore types

Spill Implications for Coastal Habitats in Milne Inlet

Diesel is considered non-persistent oil when spilled on water. Most of a diesel spill evaporates or is dispersed within the water column. Previous modeling suggests that most of a spill would be evaporated or dispersed within 96 hr (Fig. 3). The two most common shore types, sand & gravel beaches and bedrock shorelines, are not conducive to significant penetration; the sand and mud component of sand and gravel shorelines is likely to limit penetration of diesel. **As a result it is unlikely that large volumes of diesel would be incorporated into shorelines.** Boulder beaches are highly permeable, allowing spilled diesel to penetrate and be retained for longer periods of time. However, most of these boulder beaches are associated with steep, active talus shorelines.

Persistence of stranded diesel would be expected to be short on bedrock shore (days to weeks) and slightly longer on sand & gravel beaches (weeks to months), depending on the frequency of energetic storm events which could remove all of the stranded diesel in a single tide. Boulder beaches would likely retain some residual fuel for weeks to months.

Shoreline Biota in Milne Inlet

There is little intertidal biota on the shores of Milne Inlet but two vegetative assemblages that were mapped are: *intertidal marshes* and *intertidal algae*. Marshes exist in the upper intertidal zone and supra-tidal zones (subject to occasional inundation). In the Milne Inlet mapping area, 5.9 km of marsh were mapped, accounting for 2% of the shoreline (Figure 17). Ground observations in the region indicate that these marshes are heavily grazed by geese and ducks (Fig. 9, 10). Marshes are sensitive to spills because spills tend to stick to the organic substrates of the plants and peat, and as a result persistence is longer, even for diesel spills. Diesel stranded in marshes might be expected to persist for years due to: (1) the oleophilic vegetation and peat, (2) the short open-water season with its associated low hydraulic wave action, (3) relatively infrequent inundation and (4) cold winters when weathering is expected to be naturally slow. Marshes are very sensitive to disturbance from cleanup as oil can be pushed into the substrate if walked on (Hoff 1995).

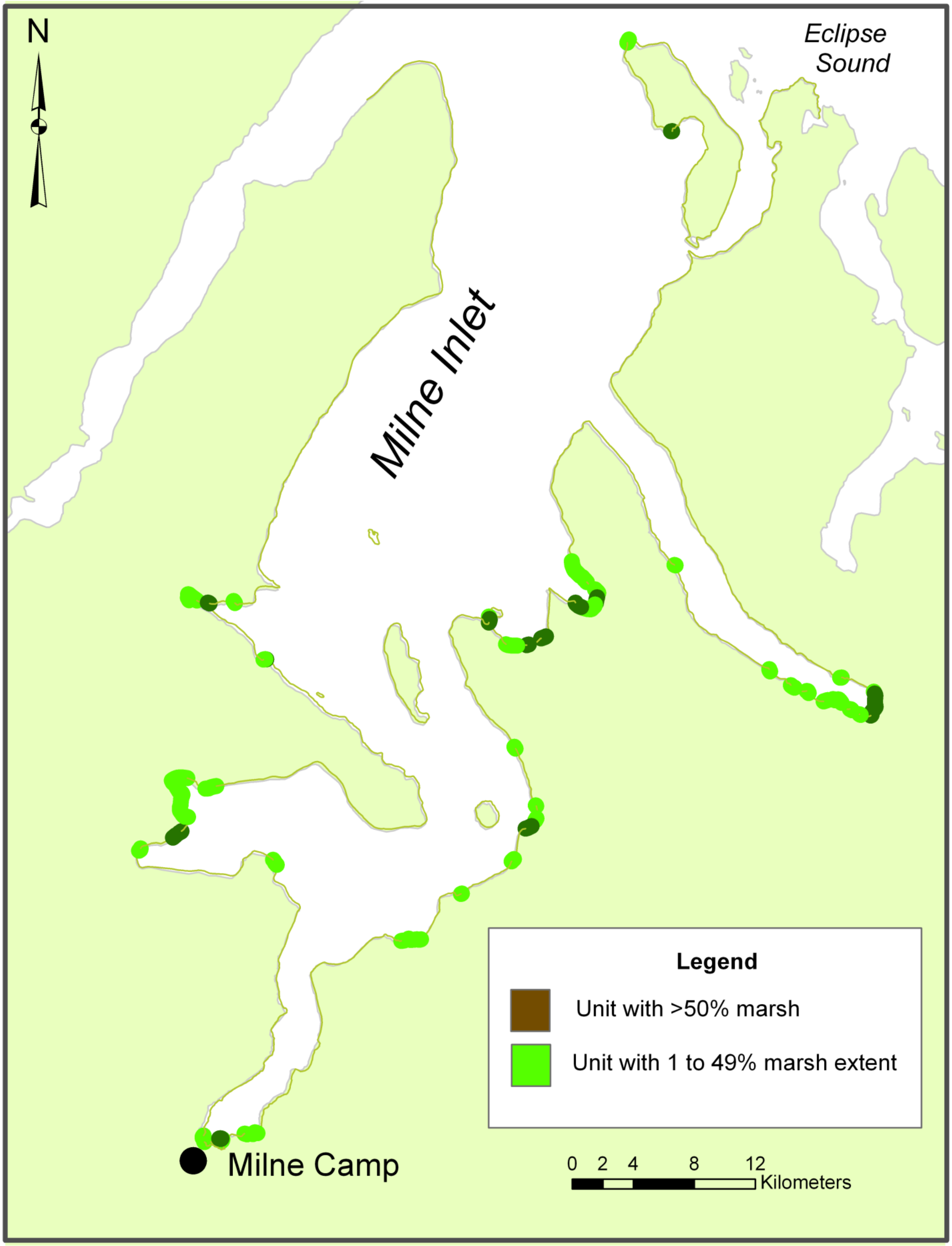

Figure 15. Distribution of marshes within Milne Inlet. About 2% of the shoreline contains marsh.

Marshes are of limited extent (2% of the shoreline) and concentrated in a few areas (Fig. 17). A spill contingency plan can identify these marshes along with specific protection strategies (e.g., Geographic Response Strategies or GRS) so that the effect of spills on this sensitive resource can be substantially mitigated.

Intertidal algae was also observed along the shoreline of Milne Inlet. Most of the algae that was observed were *Fucus sp* although some filamentous green and brown algae was also observed. Algae were mapped in the lower intertidal zone along 27.6 km (7%) of the shoreline (Fig. 18) and would be contacted in event of a spill in Milne Inlet.

Provided that the spill was short term in nature, it appears likely that a diesel spill would have both lethal and sub-lethal effects on intertidal algae. Most intertidal algae is in the lower intertidal, mitigating the potential for lengthy contact (*Fucus* will be submerged each tidal cycle for as much as six hours).Subtidal *Fucus* would be considerably less affected.

3.4 Marine Mammals at Risk

Eclipse Sound

Table 5 summarizes marine mammal occurrence from the Arctic Environmental Sensitivity Atlas System (AESAS; Environment Canada 2000) relative to spill scenarios for the proposed northern shipping route.

The AESAS (Environment Canada 2000) data indicate there is potential overlap of the spill scenarios and known occurrences of marine mammals along the proposed northern shipping route, including narwhal, bowheads, beluga, walrus, ring seals, harbor seals, bearded seals and harp seals (Fig. 19-26). Of particular concern would be the presence of large portions of the total narwhal population in western Eclipse Sound and Milne Inlet (Richard *et al* 2010). While the potential effects of a diesel spill on narwhal are unknown. The effects of oil spills on marine mammals are difficult to predict (Salazar 2003) and defining petroleum toxicity in marine mammals as a result of oil spills has not been conclusive (Engelhardt 1983; Short 2000). For example, it has been suggested that there is no conclusive evidence that there are acute or chronic effects on cetaceans from hydrocarbon contamination associated with oil spills (Short 2000). Engelhardt (1983) identified that the susceptibility of marine mammals to petroleum toxicity is not general, and that species-specific responses occur although correlation and inferences often are required to predict effects. Furthermore, numerous causal relationships between oil spills and marine mammal mortalities have been suggested by post-spill investigations and studies, but these claims have often been debated and/or considered unsubstantiated (Short 2000; Engelhardt 1983) (e.g., AB killer whale pod mortalities and *Exxon Valdez* spill).

Milne Inlet Port Area

Milne Inlet is an important summering location of narwhal (Fig. 19) and is also used by other marine mammals (Fig. 20-26). The frequency of use in the proposed port area is unknown. The risk of contact by a spill in Milne Inlet is considered *high*.

In the event of a diesel spill in the port area of Milne Inlet, there is some potential for mitigation as there are support vessels that could assist in the deployment of hazing devices. Narwhal or bowhead could be temporarily displaced from a spill area by using acoustical devices, although a hazing plan, appropriate equipment and regulatory approval would be required prior to such a program.

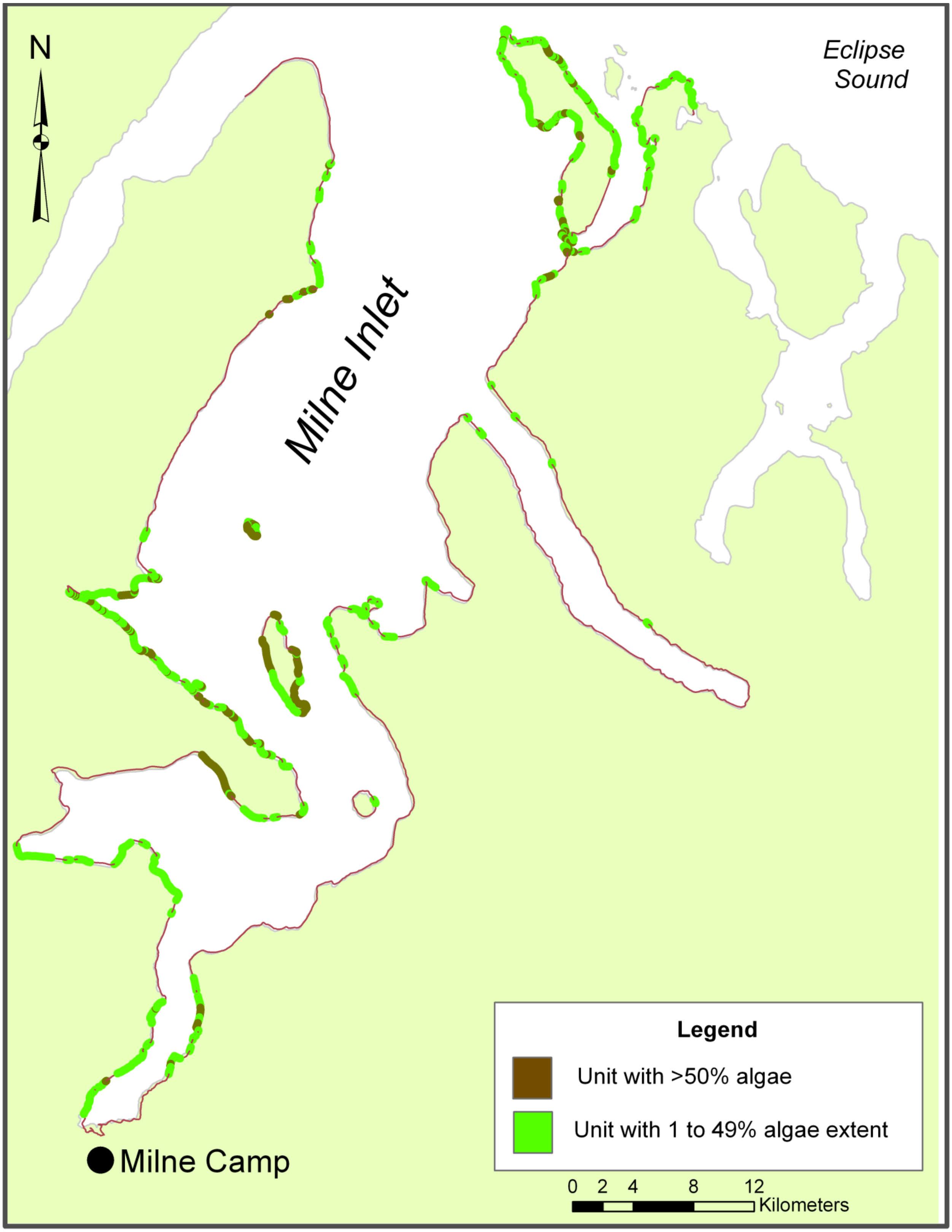

Figure 16. The observed distribution of intertidal algae within Milne Inlet.

Table 5. Summary of Marine Mammal Concerns from AESAS (Environment . Canada 2000)

Location	Marine Mammal Concerns	Months	Reference
Milne Inlet	Milne Inlet, Tremblay Sound, and Koluktoo Bay are a major summering ground for narwhals	Jul, Aug, Sep	AESAS Na88, Na89 Finley and Gibb 1982 Koski and Davis 1979 Mansfield *et al* 1975 Silverman 1979
	Bowhead whales frequent Eclipse Sound and Milne Inlet	Jul, Aug, Sep	AESAS Bh89 Davis and Koski 1980
SW Bylot Is (Eclipse Snd)	Eclipse Sound is a major summering area of narwhal	Jul, Aug, Sep	AESAS Na87 Finley and Gibb 1982 Koski and Davis 1979 Mansfield *et al* 1975 Silverman 1979
	A significant number of bowhead whales occupy Eclipse Sound in the summer	Jul, Aug, Sep	AESAS Bh89 Davis and Koski 1980
SE Bylot Is (NE Pond In.)	During early summer, large numbers of narwhals move through shore leads in Pond Inlet toward their traditional summering grounds in Eclipse Sound. Narwhals return eastward through Pond Inlet in late September and early October	Jul, Sep, Oct	AESAS Na97 Finley and Gibb 1982 Koski and Davis 1979 Mansfield *et al* 1975 Silverman 1979
	A major migration route for harp seals	Jul, Sep	AESAS: Hs103, Hs104 Greendale and Brousseau-Greendale 1976 Johnson *et al* 1976 Koski and Davis 1979
Pond Inlet (S. Pond In.)	During early summer, large numbers of narwhals move through shore leads in Pond Inlet toward their traditional summering grounds in Eclipse Sound. Narwhals return eastward through Pond Inlet in late September and early October	Jul, Sep, Oct	AESAS Na94 Finley and Gibb 1982 Koski and Davis 1979 Mansfield *et al* 1975 Silverman 1979
SE Pond Inlet (C. Liverpool, C. Fanshawe)	A major migration route for narwhals during their spring (May-July) and fall (September) migrations (31, 35, 41).	May, June, Jul, Sep	AESAS Na103-Na 105 Greendale and Brousseau-Greendale 1976 James Dobbin 1982 Koski and Davis 1979
	A major migration route for bowheads during their spring and fall migrations	May, June, Jul, Sep	AESAS Na103-Na 105 Greendale and Brousseau-Greendale 1976 James Dobbin 1982 Koski and Davis 1979
	A major migration route for harp seals	Jul, Sep	AESAS: Hs103, Hs104 Greendale and Brousseau-Greendale 1976 Johnson *et al* 1976 Koski and Davis 1979

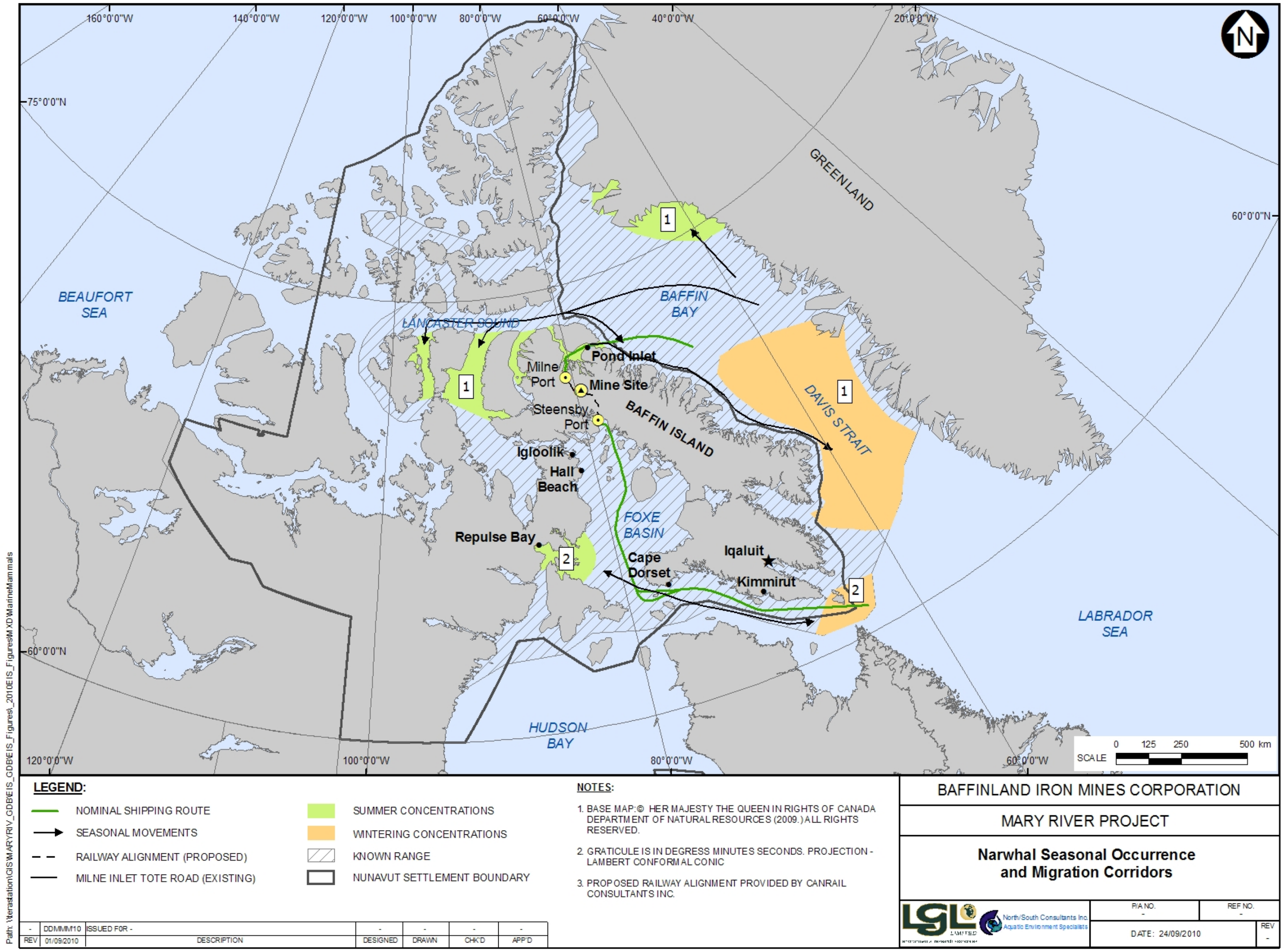

Figure 17. Distribution of narwhal.

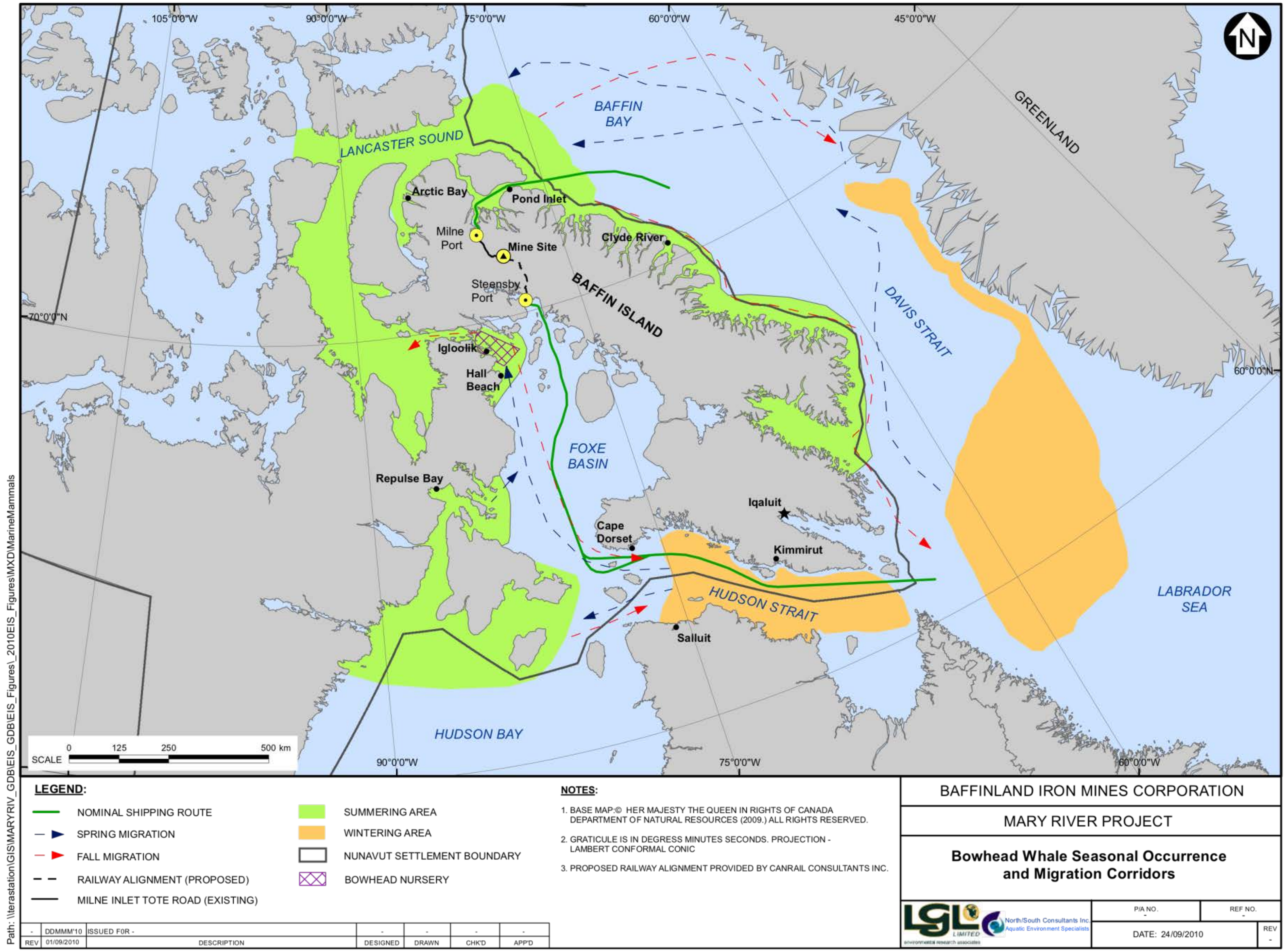

Figure 18. Distribution of bowhead whales.

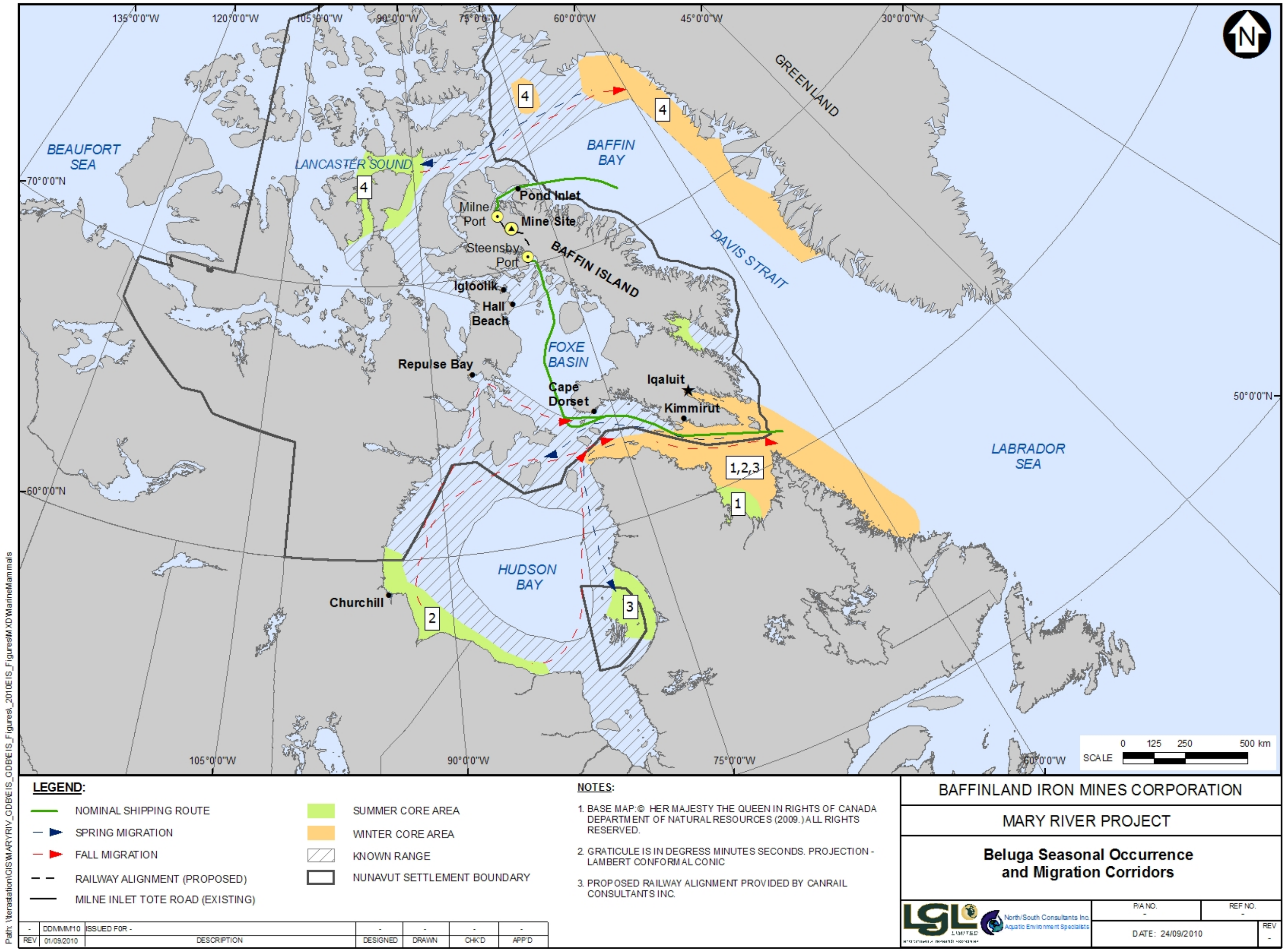

Figure 19. Distribution of belugas.

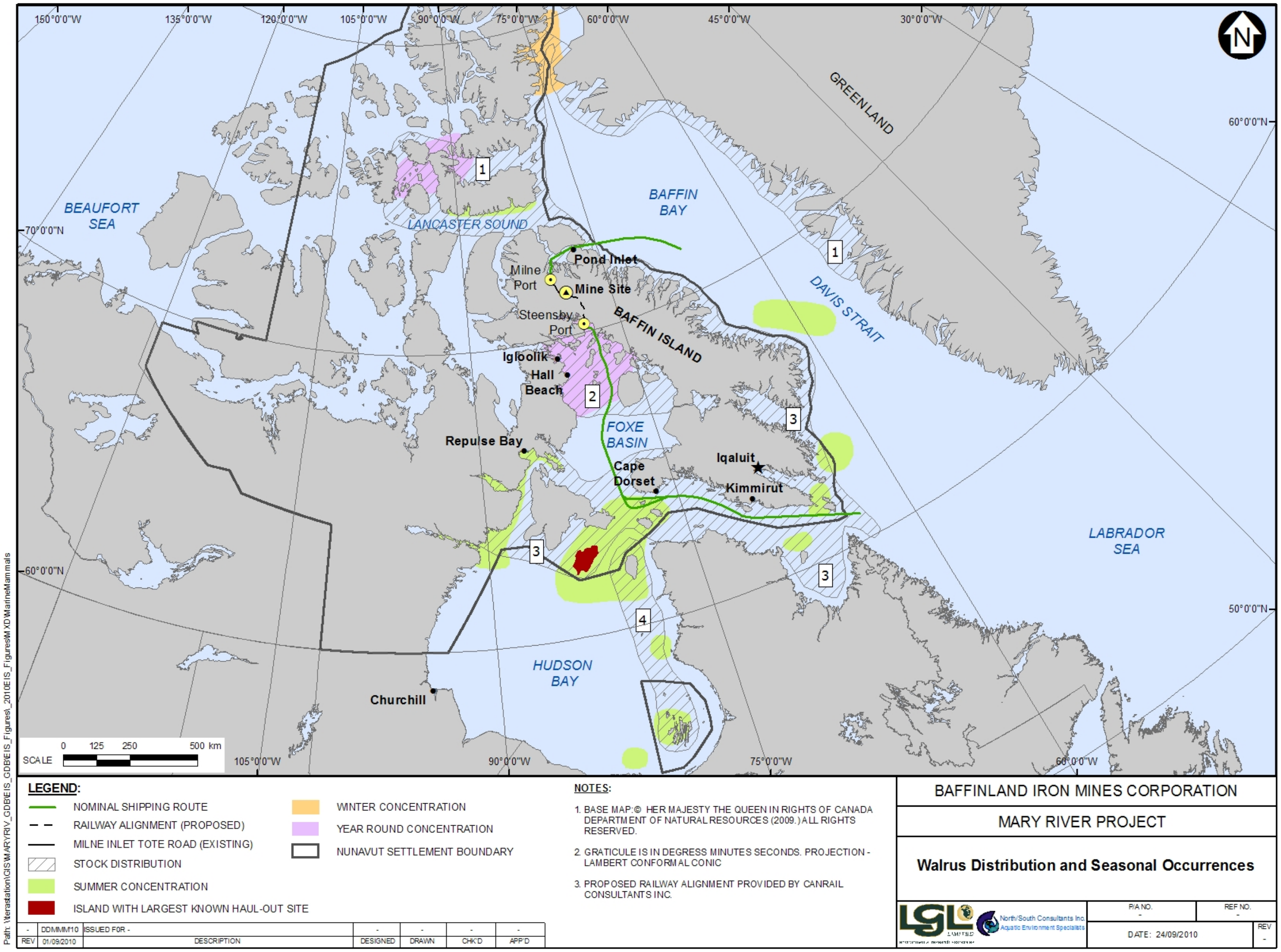

Figure 20. Distribution of walrus.

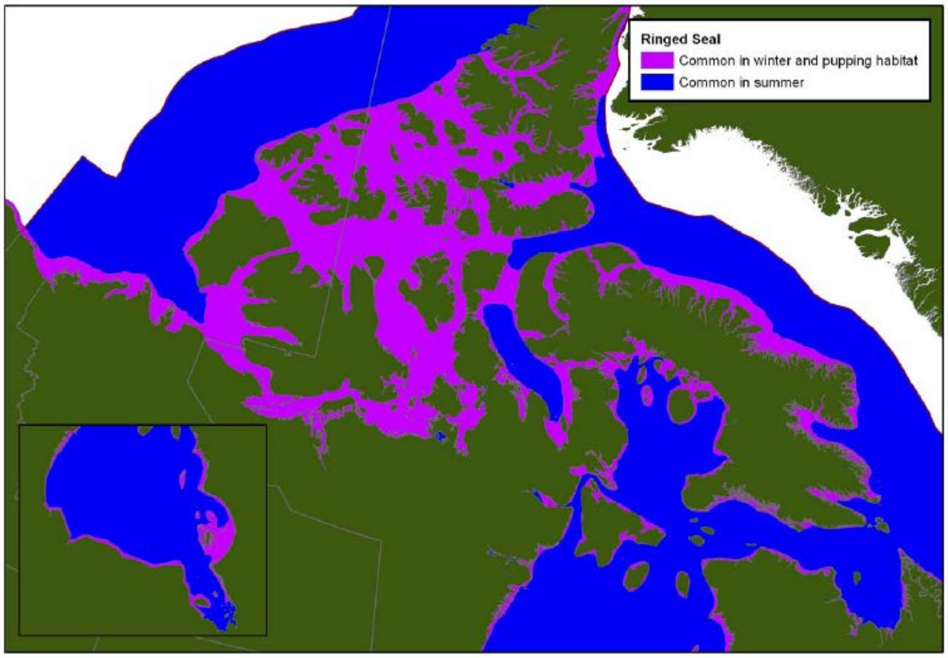

Figure 21. Occurrence of ringed seals in Foxe Basin and Hudson Strait (from Stephenson and Hartwig 2010).

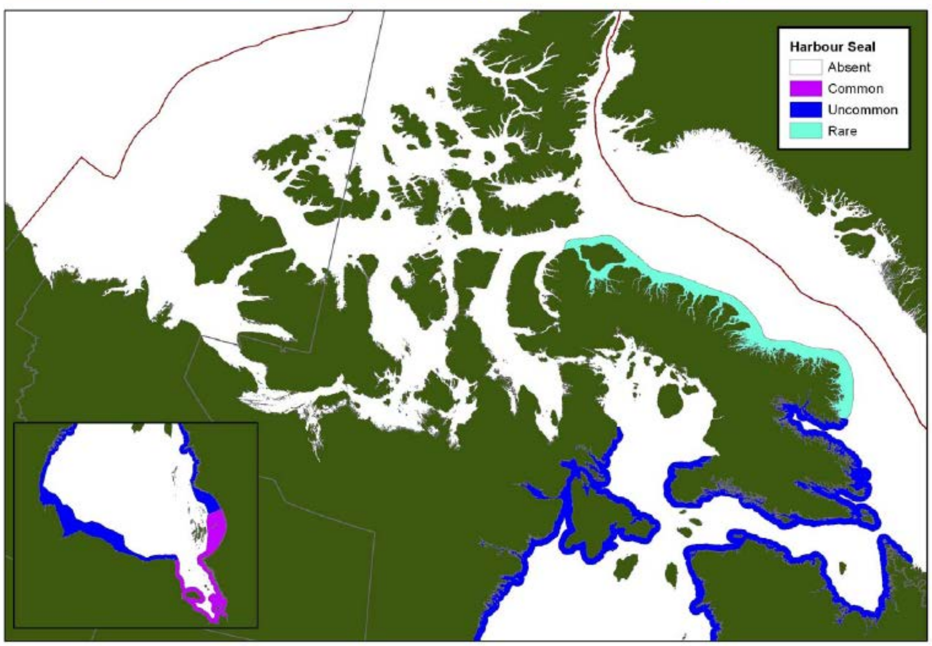

Figure 22. Occurrence of harbour seals in Foxe Basin and Hudson Strait (from Stephenson and Hartwig 2010).

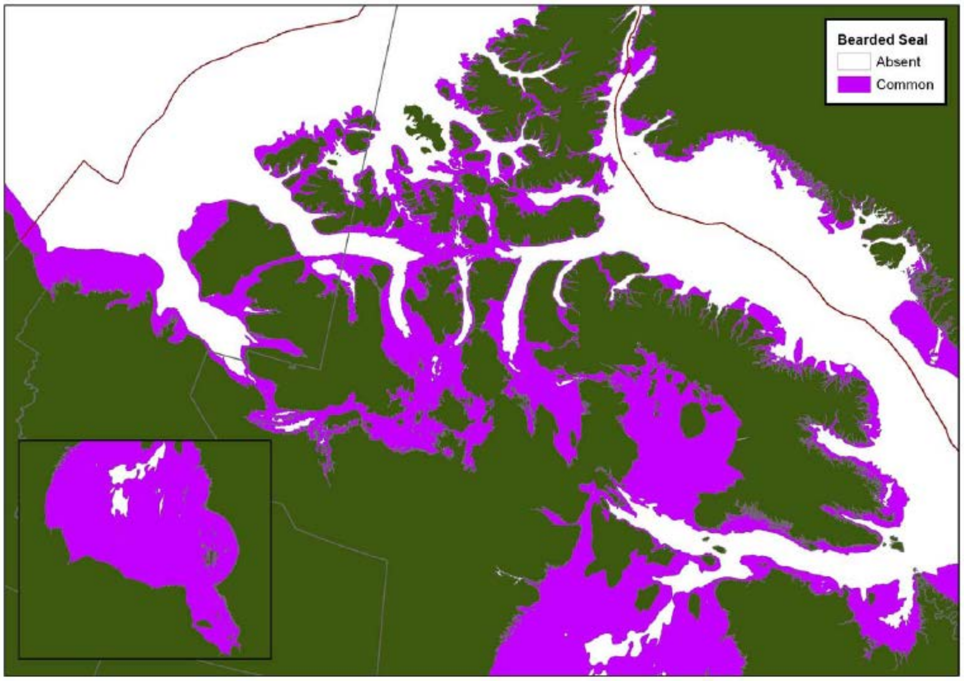

Figure 23. Occurrence of bearded seals in Foxe Basin and Hudson Strait (from Stephenson and Hartwig 2010).

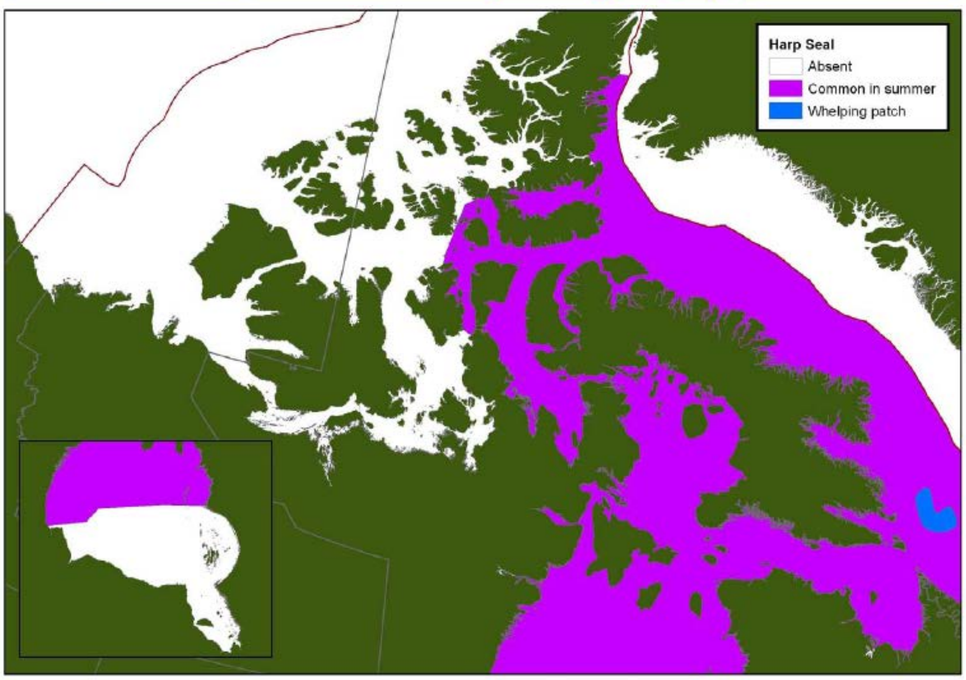

Figure 24. Occurrence of harp seals in Foxe Basin and Hudson Strait (from Stephenson and Hartwig 2010).

3.5 Marine Birds at Risk

Eclipse Sound

The Arctic Environmental Sensitivity Atlas System (AESAS; Environment Canada 2000). shows a number concerns for bird sensitivities within the northern shipping route areas of concern (Table 6). Pond Inlet and Eclipse Sound shorelines are important summering and important feeding areas. Mallory and Fontaine (2004) note that "*effectively, more than 1% of the Canadian population could be almost anywhere in these regions on any given day depending on ice conditions and the distribution of prey species"* (this statement applies to loons, swans, geese, sea ducks, gulls, alcids, terns).

In the event of a spill during open-water season, there is the potential for both shoreline and on-the-water contact with marine birds. Should a worst-case, open water diesel spill occur, marine birds are considered at *high* risk of contact, especially in eastern areas of Pond Inlet (Table 6).

Milne Inlet Port Area

The Milne Port area is not identified as a significant bird area in comparison to other areas of the proposed northern shipping route.

The port area is likely to have resources for spill response that may not be feasible for use along other areas of the shipping route. These resources are likely to include support vessels, booms and bird hazing equipment. Small vessels could be used to deploy protection booms at estuaries to minimize potential contamination of salt marshes, which are a habitat that is heavily used by snow geese during their migrations. The addition use of bird hazing equipment, such as propane cannons can be used to reduce the potential of bird-spill interaction, especially in estuary areas. Given the potentially short duration of s spill, bird hazing equipment would need to be stationed with the port response equipment to permit rapid deployment.

3.6 Marine Fish at Risk

Eclipse Sound

Char are ubiquitous in larger streams within the region. Especially important areas are identified by AESAS (Env. Can. 2000) and are summarized in Table 7.

The greatest concern should a spill occur is potential stranding of oil within estuaries where the elevated fuel concentrations in the water column could cause injury or damage to migrating fish, especially juvenile fish. However, the outmigration of juveniles and over-wintering adult fish typically occurs during freshet (May, June; Evans *et al* 2002), a season when fuel delivery or spills will not occur. In-migration of adult fish occurs in mid-August to mid-September, with peak runs occurring near the last week of August in the Steensby Inlet area (Evans *et al* 2000). While adult fish are typically less sensitive to hydrocarbon effects, aggregations of char in estuarine areas near the river mouth would be a concern.

Because of the volatile nature of the diesel fuel and weathering rapid, it is unlikely that effects would extend to more than one season within the estuary channels.

Milne Inlet Port Area

There are several estuaries with arctic char runs in the Milne port area that could be exposed to a fuel spill. It is important that these be identified in the spill contingency plan for protection priority as salt marsh occurs more commonly in these systems. There are likely to be more response capabilities near the ports site, including support vessels and booms, so that countermeasures near the port could be quite effective in the event of an open-water diesel spill.

Table 6 Summary of Marine Bird Concerns from AESAS (Env. Can 2000)

Location	Marine Bird Concerns	Months	Reference
SW Bylot Is	thousands of long-tailed ducks	Aug, Sep	AESAS: SD98,99 Mclaren and Renaud 1979
	hundreds of greater snow geese	July, Aug	AESAS: Ge99 Mclaren and Renaud 1979
	large numbers of glacous gulls and smaller numbers of arctic terns	Aug, Sep	AESAS: Gu98, Gu99 Mclaren and Renaud 1979
SE Bylot Is	Bylot Island Migratory Bird Sanctuary;		AESAS: R96
	About 50,000 thick-billed murres and 6,000 black-legged kittiwakes nest in a colony at Cape Graham Moore (IBP site; IBA)	May to Aug	AESAS: A1Gu107 Mclaren and Renaud 1979 McLaren 1980
	Thousands of eiders, some long-tailed ducks	May to Aug	AESAS: SD107 McLaren 1980
Pond Inlet	hundreds of fulmars use the coast east of Pond Inlet Village and feed in offshore tide rips	Aug to Sep	AESAS Fu93, Fu94 McLaren and Renaud 1979
	Ivory gulls, glacous gulls and kittiwakes use the coast east of the Pond Inlet Village	Sep to Oct	AESAS: Gu93,94 McLaren and Renaud 1979 Renaud and McLaren 1980
	During September, thousands of oldsquaws and some eiders occur in Guys Bight, east of Pond Inlet Village	Sep	AESAS: SD95 Johnson *et al* 1976 McLaren and Renaud 1979
SE Pond Inlet	thousands of fulmars occur along the fast ice edge	Jun to Jul	AESAS: Fu 103, Fu104 McLaren and Renaud 1979 McLaren 1980
	thousands (~50/km^2) of kittiwakes concentrated along the fast ice	Jun to Sep	AESAS: Gu103, Gu104 McLaren and Renaud 1979
	flocks of 100+ terns occur along the coast of Bathurst Bay, the site of a nesting colony	Aug	AESAS: Gu104 McLaren and Renaud 1979
	thousands of murres utilize the coast from Cape Hay to Cape Byam Martin	May to Jul	AESAS Al103,Al104, Al105 McLaren and Renaud 1979
	thousands eiders and some flocks of oldsquaws occur along the Cape Fanshawe shoreline	May to Aug	AESAS: SD 103, SD104, SD105 McLaren and Renaud 1979 McLaren 1980

Table 7 Summary of Key Marine Fish Concerns from AESAS

Location	Marine Fish Concerns	Months	Reference
Milne Inlet	The Robertson and Tugaat Rivers are important to anadromous char; char are likely to occur in other smaller rivers	Jul to Sep	AESAS: CH89 LGL 1983 Stewart and MacDonald 1981
Navy Board Inlet, Eclipse Sound	Anadromous Arctic char are known to feed and migrate through the Mala River and Alpha River areas	Jul to Sep	AESAS CH87, Ch88 LGL 1983 Stewart and MacDonald 1981
Tay Sound, southern Pond Inlet	Anadromous Arctic char are known to feed within and migrate through Tay Sound and Paquet Bay during the open water season. They are also known to occur in the vicinity of Salmon River and Erik Harbour	Jul to Sep	AESAS: CH93, CH94 LGL 1983

3.7 Human Use Activities at Risk

Human Use of Eclipse Sound

Resource harvesting sites are common throughout the region during the open water season (Table 8); 44 seasonal hunting camps are identified in AESAS but there are likely dozens of other unidentified sites that are routinely used in the region. An open-water spill could disrupt resource harvesting activities (e.g., gill netting; narwhal hunting). The combination of spills and associated cleanup activities would extend for weeks so there is the potential for a substantial portion of the open-water hunting season to be locally disrupted.

There are 27 archaeological sites identified in AESAS within the areas of concerns along the proposed shipping route, although it is probable that there are actually hundreds of unidentified sites in this area. It is unlikely that a spill would directly impact the archaeological sites, which are above the high-water line. The greatest risk to archaeological sites is associated with cleanup operations when large numbers of people could be involved with a response and cleanup operations. Standard Shoreline Cleanup Advisory Team (SCAT) protocols typically require archaeological surveys *prior* to any cleanup operations (Sergy and Owens 2004) and should sites be identified, qualified site monitors are required as part of the response plan.

Human Use of Milne Inlet

As indicated in AESAS Atlas, Milne Inlet is regarded as highly sensitive for human-use activities. As part of the shoreline classification, camps (active or inactive) and tent rings were cataloged for each of the mapped shore units. During the one day survey in August 2007, a total of 39 camps were seen of which 20 (51%) were occupied at the time of the survey (Fig. 27).

Tent rings were quite obvious in the high resolution imagery and the occurrence of tent rings in each unit was noted. A total of 184 tent rings were observed in the immediate backshore (Fig. 28). The camp and tent ring distributions indicate the entire extent of Milne Inlet are utilized for subsistence activities.

Table 8 Summary of Human Use Concerns from AESAS (Env. Can 2000)

Location	Human Use Concerns	Months	Reference
SW Bylot Is	Sirmilik National Park Bylot Island Migratory Bird Sanctuary Many archaeological sites	May – Sep	AESAS R98
	Seals and narwhal harvested along coast; numerous camps; naturalist sightseeing and recreation for Pond Inlet resident	May - Oct	AESAS R99
SE Bylot Is	Sirmilik National Park Bylot Island Migratory Bird Sanctuary National Historic Site (Button Pt) Important recreational and naturalist area Many archaeological sites	May – Sep	AESAS R96, R97, R98
	Seasonal hunting camps for seals, fishing, narwhal, geese, ducks and polar bears Numerous hunting camps	May – Sep	AESAS R96, R97, R98
Pond Inlet	Sirmilik National Park (Oliver Sound) Community of Pond Inlet Many archaeological sites	May - Sep	AESAS R91-R92
	Seasonal hunting camps for seals, narwhal, geese, ducks and polar bears Numerous hunting camps	May - Sep	AESAS R91-94; R98
SE Pond Inlet	Bylot Is Bird Sanctuary	May – Oct	AESAS R103 - R105
	Seasonal hunting camps for polar bears and seals	May - June	AESAS R104 – R105
Milne Inlet	Many archaeological sites	May – Sep	AESAS R88 – R90
	Numerous seasonal hunting camps for seal, narwhal, ducks and caribou. Seasonal fishing camps	May – Sep	AESAS R88 - R90

Small spills of diesel are likely to be substantially contained near the spill location by on-site response equipment. But larger spills that escape the initial containment have the potential to disrupt subsistence harvesting activities. This includes the avoidance of spills areas by hunters, the avoidance of spill areas by animals, tainting of animals, and lethal/sub-lethal effects that reduce species abundances.

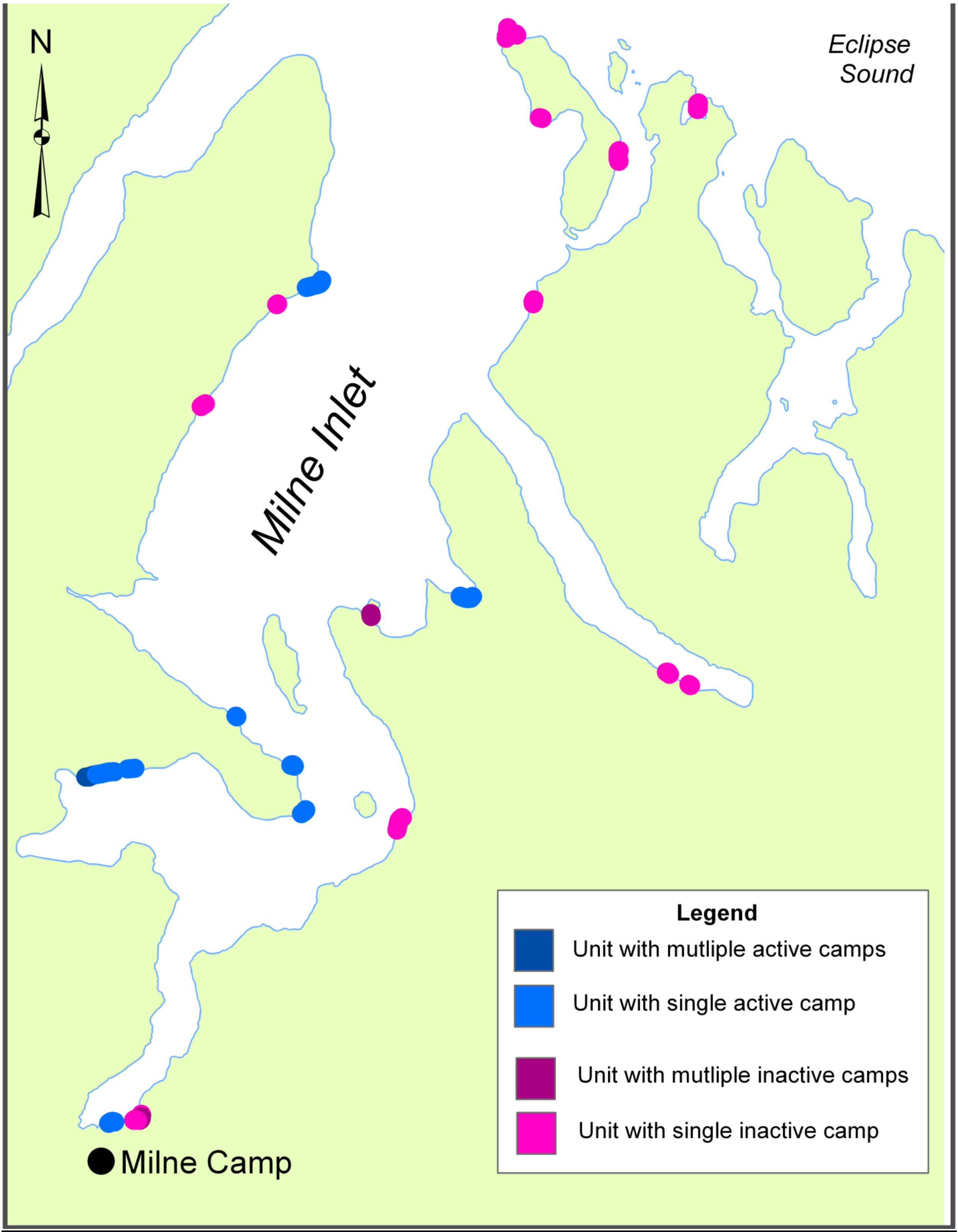

Figure 25. Location of camps inventoried within Milne inlet. There were a total of 39 camps, of which 20 were occupied on the day of the survey.

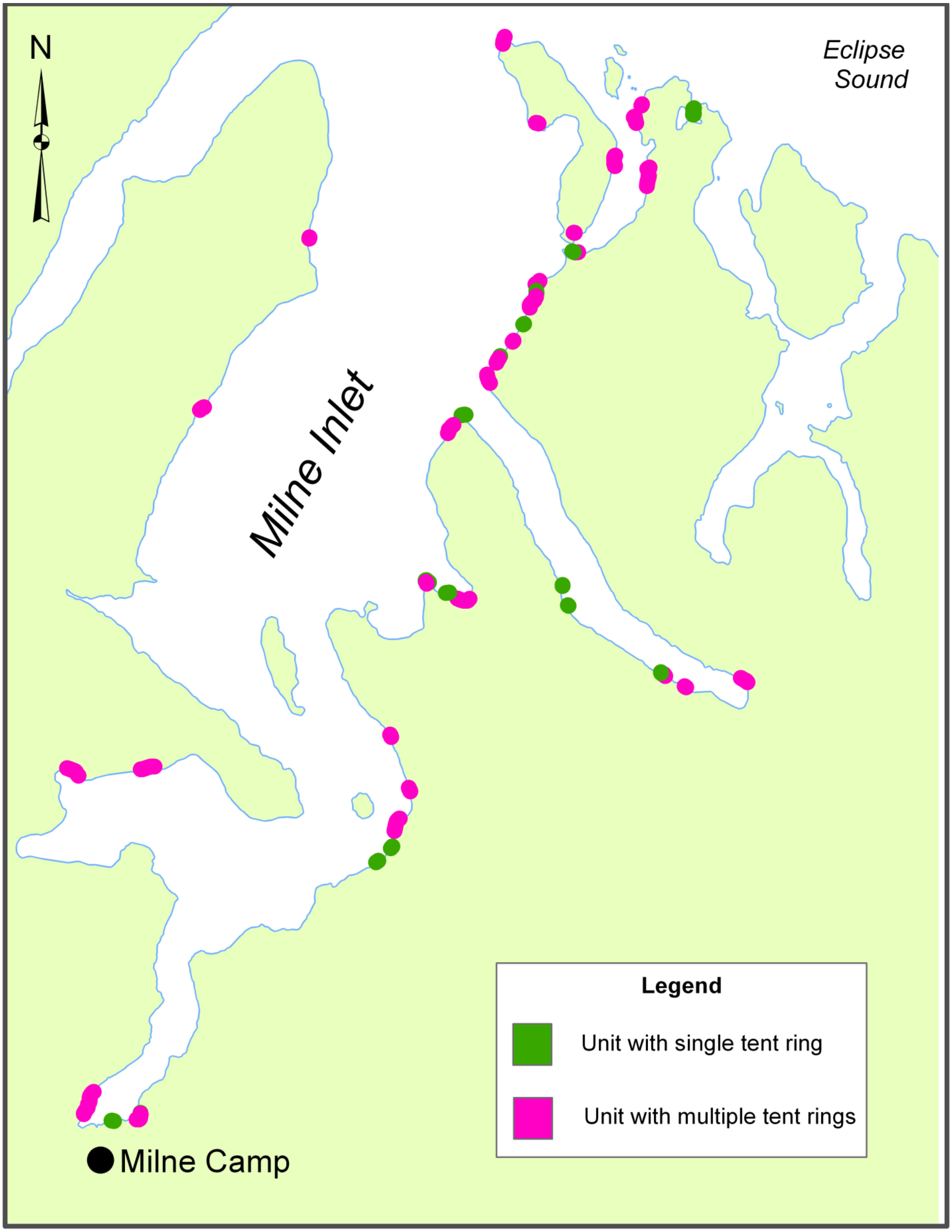

Figure 26. Location of tent rings within Milne Inlet. A total of 184 tent rings were inventoried.

3.8 Aggregate Sensitivity in Eclipse Sound and Milne Inlet

There are approximately 1,700 km of shoreline within the proposed northern shipping route *area of concern.* Aggregate sensitivity values of this region were extracted from the Arctic Environmental Sensitivity Atlas System (AESAS; Environment Canada 2000). These data combine sensitivity related to oil persistence, wildlife sensitivity, subsistence harvesting activities and cultural significance (e.g., national parks) into a single sensitivity value for each section of shoreline (Environment Canada 2000). The synthesized sensitivity values are summarized in Figure 27 (note that the AESAS sensitivity assessments were based on the assumption of a heavier fuel spills, e.g., crude oil or bunker oil, and are not directly relevant to the open-water diesel spill consider in this assessment).

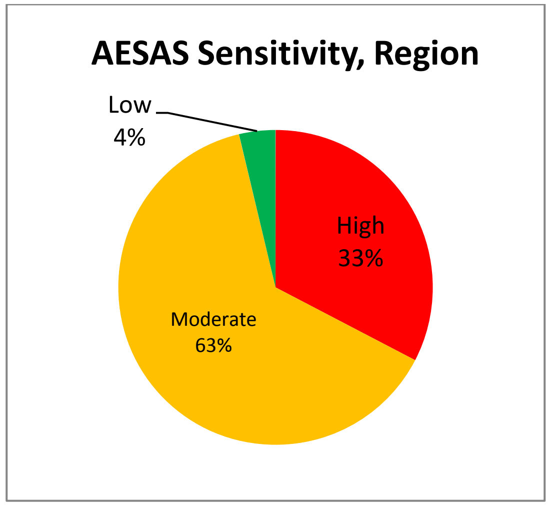

Figure 27. Occurrence of sensitivities in Eclipse Sound

The AESAS data do not include intertidal biota, but mapping of the Milne Inlet portion of the northern shipping route (CORI 2008a) indicates that salt marsh is rare (est. 4 % of shoreline) and *Fucus* seaweed is common (est. 7% of shoreline). It is likely that these estimates are relevant to remainder of the proposed route.

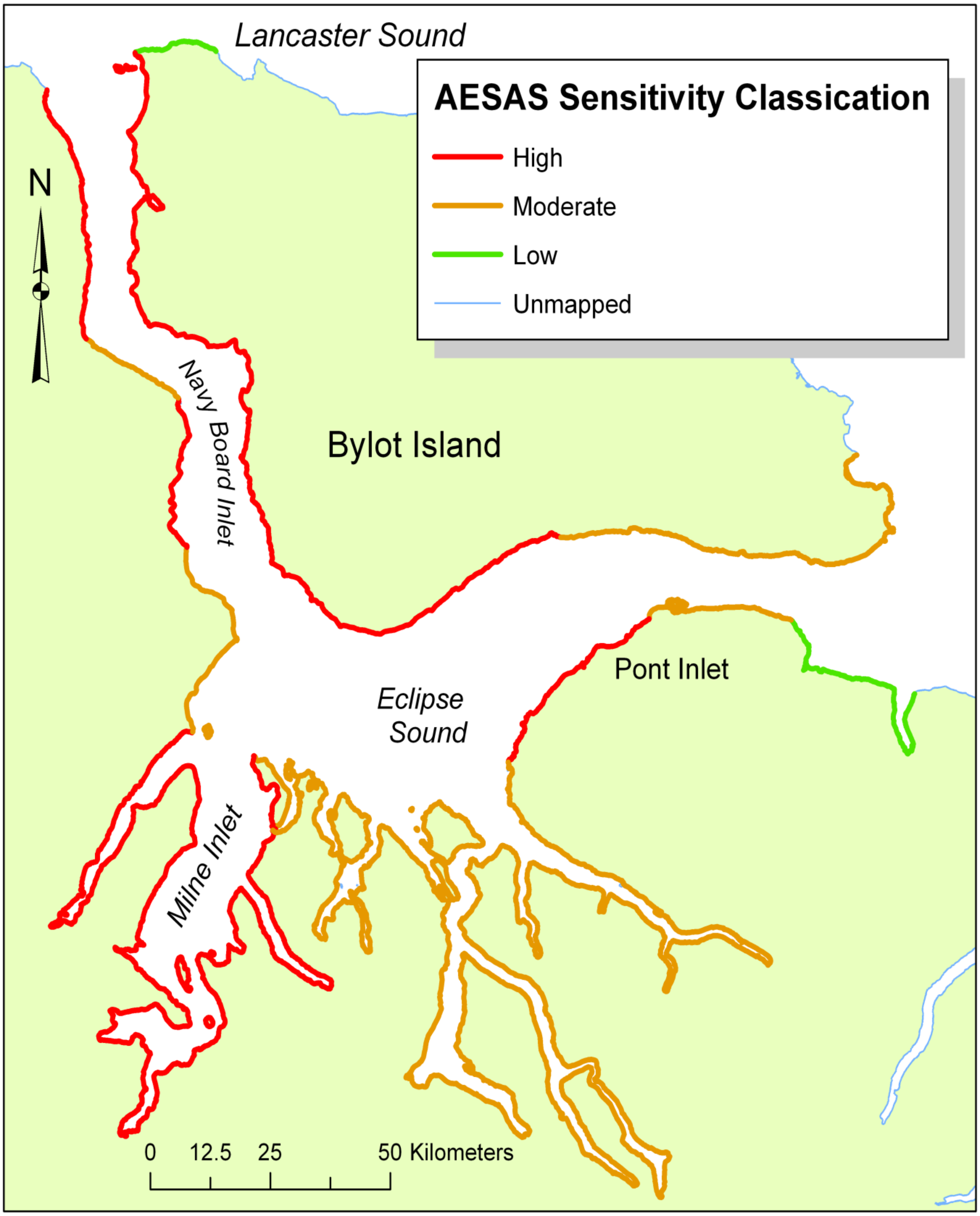

Figure 28. Shoreline sensitivity of AESAS based on physical impact (e.g., oil retention), wildlife impacts and cultural sensitivities to an oil spill.

4.1 Scope of Sensitivity Assessment

The overall scope of this assessment is large in that the overall length of Eclipse Sound shipping route is 570 km and the total area of concern in excess of the 17,000 km^2 (Table 9). The proposed shipping route is covered by the Environment Canada AESAS spill response atlas.

Table 9 Shipping Route Attributes

Attribute	Northern Route
Route Length	570 km
Area of Concern (w 15 km buffer)	17,100 km^2
Shoreline within Area of Concern	601 km

4.2 Overview of Sensitivity and Risk

We summarize the sensitivity and risk for the resources and activities that occur along the proposed shipping route. This approach provides an overview of key spill issues for the Baffinlands ERP. For the purpose of this discussion, *sensitivity* is the ability to recover from spill effects and *risk* is defined as the probability of contact. (inset below). Resources of special concern are those for which large aggregations of a significant proportion of the total population occur within a relatively small area – that is, a large proportion of the population could potentially come into contact with a spill. In some cases, these resources are also sensitive to spill affects (e.g., diving ducks).

> **Sensitivity** – the ability of a habitat, resource or activity to recover from the effects of a diesel spill on water. Resources that are likely to require more than one generation or in some cases more than one year to recover are considered *highly* sensitive. Resources that are likely to experience short-term, non lethal effects are considered to have a *low* sensitivity.
>
> **Risk** – risk considers the probability of resource interaction with the spill. Risk considers the proximity of resources or activities to the potential spill source, in this case the shipping route. Risk also considers timing of shipping and timing of resource events (e.g., migration corridors).

The compilation of sensitivity and risk is included in Table 10. There are some resources that are considered high sensitivity and high risk. These resources of special concern include:

- **narwhal,** whose sensitivity to diesel spills is unknown but where large portions of the population aggregate in a relatively small area in Milne Inlet and eastern Eclipse Sound.

- **marine birds** near the eastern entrance to Pond Inlet. Birds are known to be sensitive to spills and considered at high risk in the event of a spill due to large aggregations near the shipping route.

- **hunting activities** that take place throughout the region of the shipping route and where response operations could disrupt hunting activities such that a substantial portion of the open-water hunting season could be lost.

Table 10 Summary of Sensitivity and Risk[1] Associated with the Northern Shipping Route

Resource	Sensitivity	Risk
Coastal Habitat	In general, shores contact by diesel will recover within days to weeks so a *low* sensitivity. The exception is salt marsh, where fuel may persist for weeks to months (*moderate* sensitivity)	Within Milne Inlet, the risk from a worst-case spill is *high* as it is highly probable that fuel will reach shorelines. Risk is considered *moderate* for Eclipse Sound and Pond Inlet as some shore within 15 km buffer zone.
Marine Mammals	Sensitivity of narwhal to a diesel spills is uncertain. However, because a large part of population could be contacted any effect could be long term so considered *high* sensitivity	Risk of contact between a worst-case spill and narwhal is considered *high* as a large portion of total population summers in Milne Inlet
	Sensitivity of bowheads to a diesel spill is uncertain. However, because bowheads are widely distributed impacts at a population level considered *low.*	Risk from a worst case spill is considered *low* as only a limited number of bowheads likely exposed to a spill (10x10km max)
Marine Birds	Most marine birds will be killed by contact with diesel spills and are considered *highly* sensitive to spills.	Risk of spill contact will vary by species, season and location. Eastern Pond Inlet is considered an area of special concerns as large aggregations occur. The risk of contact along much of the northern route is *high*.
Marine Fish	The estuarine portion of fish habitat is most sensitive but considered *low* for out-migration (during freshet) and *moderate* for in-migration when adult fish aggregate near estuary.	risk considered *low* because out-migration (May, June) and in-migration (mid-Aug to mid Sep) are offset from possible fuel spill periods (mid Sep)
Hunting Activities	Spill duration is short but response operations could occur over longer period of time – an entire hunting season could be effected so sensitivity considered *high*.	Within Milne Inlet, risk is considered *high* that a worst-case spill would disrupt hunting activities. In Eclipse Sound and Pond Inlet a spill is likely to disrupt some hunting activities so a *moderate* risk.

Notes: [1] *Risk* in this table refers to the probability of contact *assuming* a worst-case spill has occurred. Worst-case spills are considered very low probability of events.

4.3 Limitations of Assessment

This assessment is made based on a number of assumptions (see list in Section 2.3) about potential spills and is restricted to an assessment of diesel spills only.

Some mitigation techniques are mentioned in the text. However, these strategies are outlined only in concept and require further consideration within the project spill contingency plan. We do not provide any specific recommendation about mitigation. Some of the conceptual techniques that are identified (e.g., wildlife hazing) will require discussion and approval from regulatory agencies.

AMEC Earth and Environmental 2010a. Milne Inlet spill trajectory modeling for the Mary River Project. Contract Report (draft) by AMEC Earth and Environmental, St. John's, NF to Baffinlands Iron Mine Corporation, Toronto, ON. 80p.

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