

*Risk Assessment for Marine Spills
in Canadian Waters*

Phase 2, Part B: Spills of Oil Select HNS
North of the 60th Parallel North

Overall Return Period (years)
1,000 m to 9,999.9 m³ Fuel Oil Spill
in Canadian Waters

0 150 300 600 km

May 2014

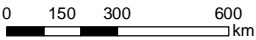
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Map 4.12

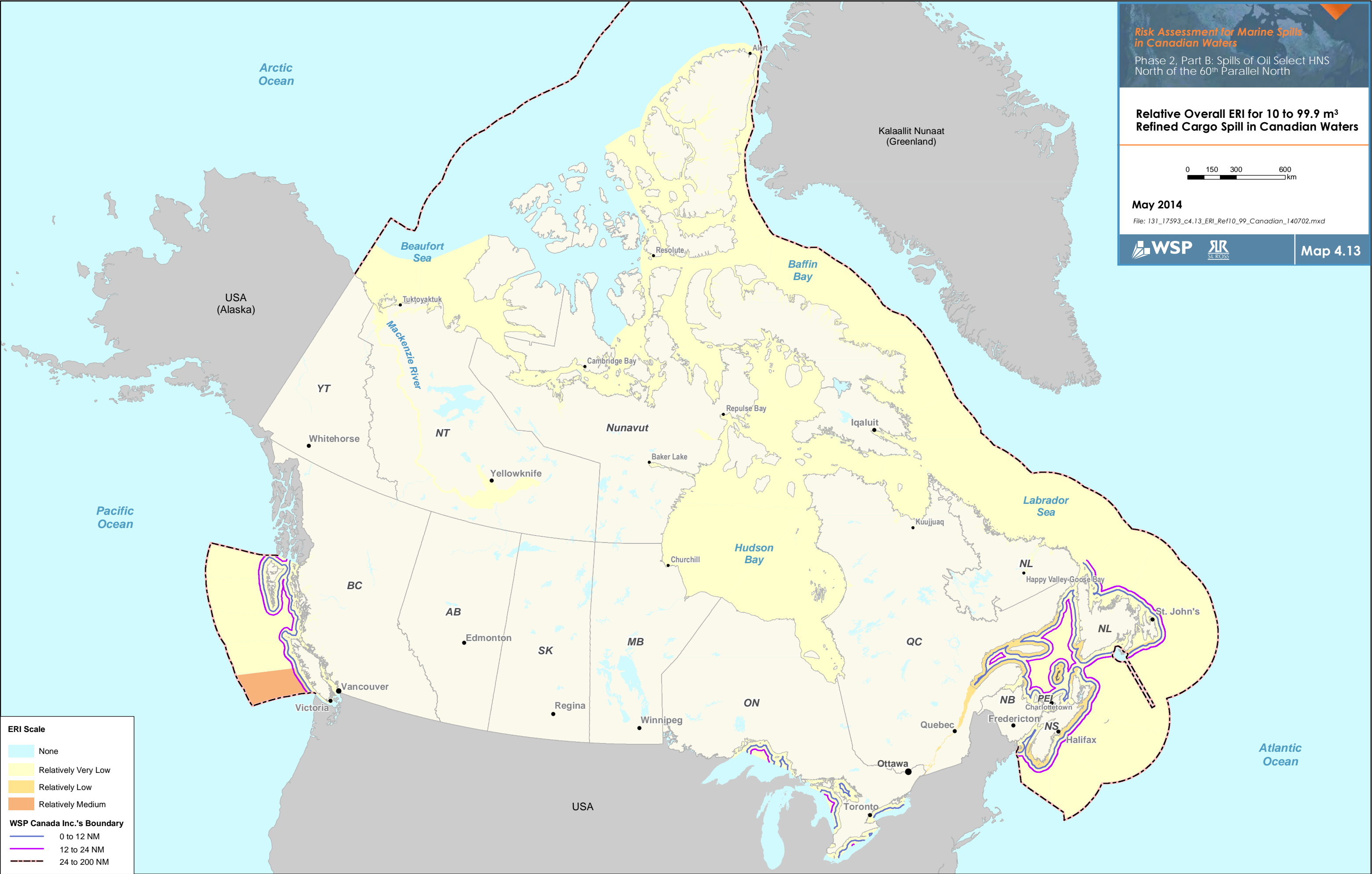


Relative Overall ERI for 10 to 99.9 m³
Refined Cargo Spill in Canadian Waters



May 2014

File: 131_17593_c4.13_ERI_Ref10_99_Canadian_140702.mxd



ERI Scale

- None
- Relatively Very Low
- Relatively Low
- Relatively Medium

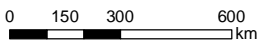
WSP Canada Inc.'s Boundary

- 0 to 12 NM
- 12 to 24 NM
- 24 to 200 NM

Risk Assessment for Marine Spills
in Canadian Waters

Phase 2, Part B: Spills of Oil Select HNS
North of the 60th Parallel North

Relative Overall ERI for 100 to 999.9 m³
Refined Cargo Spill in Canadian Waters



May 2014

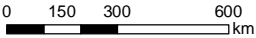
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Map 4.14



Relative Overall ERI for 1,000 to
9,999.9 m³ Refined Cargo Spill
in Canadian Waters



May 2014

File: 131_17593_c4.15_ERI_Ref1000more_Canadian_140702.mxd



Map 4.15



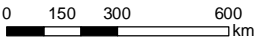
ERI Scale

- None
- Relatively Very Low
- Relatively Low

WSP Canada Inc.'s Boundary

- 0 to 12 NM
- 12 to 24 NM
- 24 to 200 NM

Relative Overall ERI for 10 to 99.9 m³
Fuel Oil Spill in Canadian Waters

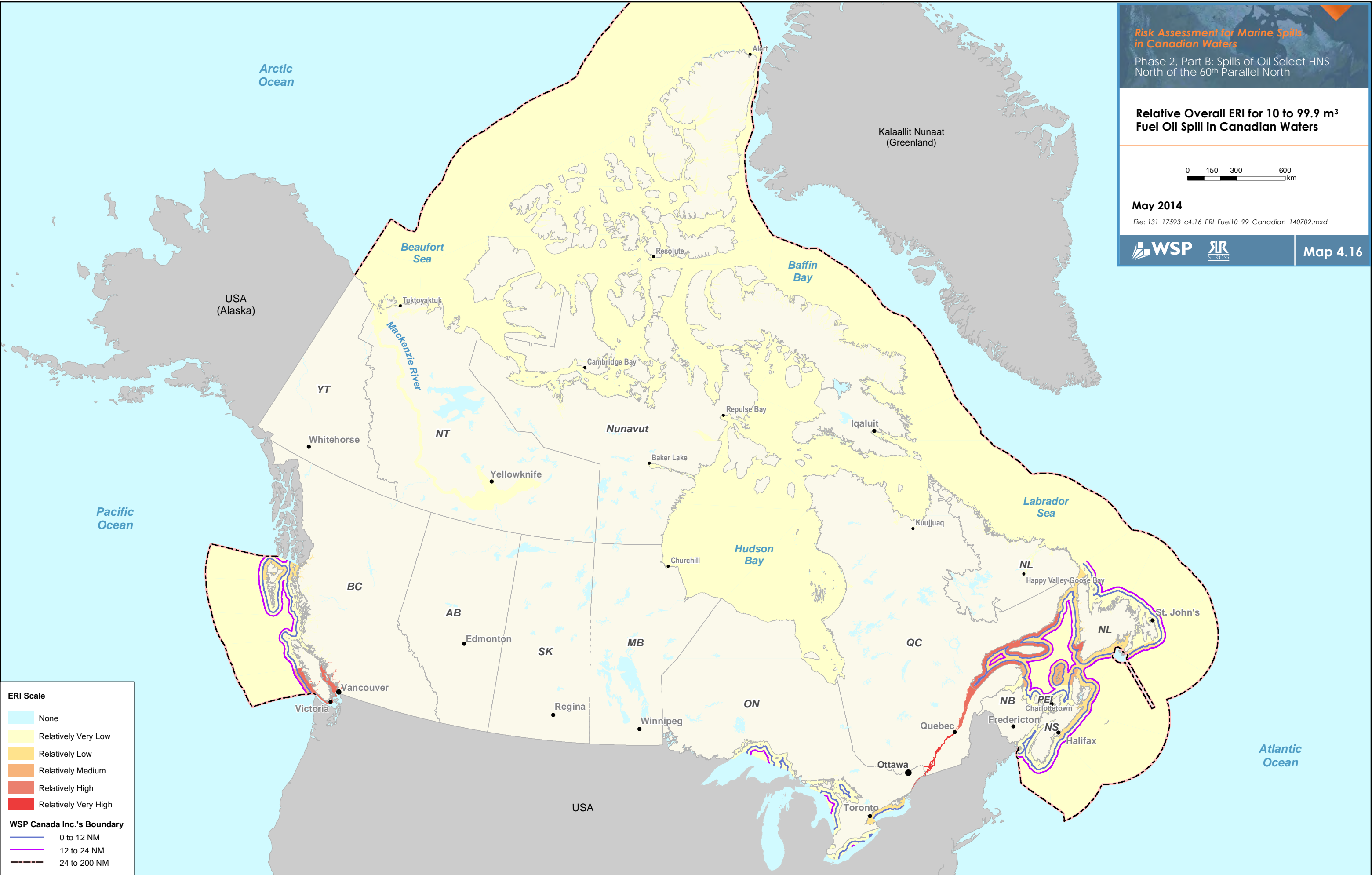


May 2014

File: 131_17593_c4.16_ERI_Fuel10_99_Canadian_140702.mxd



Map 4.16



ERI Scale

- None
- Relatively Very Low
- Relatively Low
- Relatively Medium
- Relatively High
- Relatively Very High

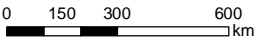
WSP Canada Inc.'s Boundary

- 0 to 12 NM
- 12 to 24 NM
- 24 to 200 NM

Risk Assessment for Marine Spills
in Canadian Waters

Phase 2, Part B: Spills of Oil Select HNS
North of the 60th Parallel North

Relative Overall ERI for 100 to 999.9 m³
Fuel Oil Spill in Canadian Waters



May 2014

File: 131_17593_c4.17_ERI_Fuel100_999_Canadian_140702.mxd



Map 4.17



ERI Scale

None

Relatively Very Low

Relatively Low

Relatively Medium

Relatively High

Relatively Very High

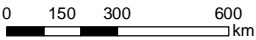
WSP Canada Inc.'s Boundary

0 to 12 NM

12 to 24 NM

24 to 200 NM

Relative Overall ERI for
1,000 m to 9,999.9 m³ Fuel Oil Spill
in Canadian Waters



May 2014

File: I31_17593_c4.18_ERI_Fuel1000more_Canadian_I40702.mxd



Map 4.18



ERI Scale

- None
- Relatively Very Low
- Relatively Low

WSP Canada Inc.'s Boundary

- 0 to 12 NM
- 12 to 24 NM
- 24 to 200 NM

4.7 Select HNS Results

Based on the select HNS extracted from the TC commodity database, three substances were moved in bulk during the last 10 years in the Canadian Arctic.

Bulk lead concentrate was only moved in 2002 in three shipments, for a total of 52,524 t. The low frequency of movements combined with the low volumes limits the calculation of a risk value for inorganic HNS.

Bulk fertilizers were moved in 2007-2008 only in three shipments for a total volume of 17,220 t. For the same reasons as mentioned above, these results are not sufficient to provide an estimate of risk for organic HNS.

Bulk naphthalene was shipped every year from 2002 to 2005 with a total of 37 shipments (total volume of 712.2 t.). The volume per shipment was low (less than 20 t) for most of the shipments with the exception of a volume of 471 t in 2002. Based on these results, no risk estimate was calculated for HNS petroleum products.

Based on these results, the risk of spills for select HNS moved in bulk is currently negligible in the Canadian Arctic.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

This study examines the potential frequency of spills in Canadian waters located north of the 60th parallel north and the potential consequences associated with these spills. The combination of these two indicators produces an overall spill risk for 18 sub-sectors across the Canadian Arctic.

Based on volumes of oil products being transported in the Arctic between 2002 and 2012, a risk estimate was produced for fuel oil as well as for refined cargo products. No crude oil is currently transported in the Arctic.

Based on volumes of select HNS transported in bulk in the Arctic, only three substances (fertilizers, lead concentrate and naphthalene) were transported between 2002 and 2012. The low total volume of HNS transported in bulk in the Arctic does not allow for a risk estimate to be produced for HNS spills in the Arctic. Based on current HNS volumes, the risk of HNS spills in the Arctic is negligible.

The method applied for this risk assessment is based on a database developed in a GIS framework, which allows updating with future data on volumes and transits. For example, this feature would be useful to take into account the impact of future projects, such as the ones presented in Appendix 2.

Overall, a great variation in relative spill was observed across the Arctic for both fuel oil and refined cargo products. The range of variation includes relatively very low risk values, mostly observed in western and northern Arctic sub-sectors to relatively high and relatively very high risk values observed in eastern and southern Arctic sub-sectors. Relative risk values are the highest for the fuel oil compared to refined cargo products and this maximum value is observed for the 100 to 999.9 m³ spill size.

The highest risk values are observed in the Labrador Sea as well as in the corridor connecting the Labrador Sea to James Bay and Baffin Bay (Table 5.1). These high risk values stem from the higher volumes and traffic in these sub-sectors.

Tables 5.2 and 5.3 identify the top 10 sub-sectors with the highest risk of spills for refined and fuel oil respectively. It is important to note that ERI values were lower (relatively very low/low risk) for the refined cargo products compared to fuel oil.

Table 5.1 Highest Refined Cargo and Fuel ERI Ranked Sub-Sectors in Arctic Coast Sector.

Rank	Sector	Sub-Sector	Area	Product	Spill Size
1	8	c	Labrador Sea	Fuel	100 to 999.9 m ³
2	7	b	Hudson Strait	Fuel	100 to 999.9 m ³
3	7	a	Hudson Strait	Fuel	100 to 999.9 m ³
4	8	c	Labrador Sea	Refined Cargo	≥1,000 m ³
5	8	c	Labrador Sea	Fuel	10 to 99.9 m ³
6	8	b	Baffin Bay	Fuel	100 to 999.9 m ³
7	6	a	Hudson Bay	Fuel	100 to 999.9 m ³
8	8	a	Canadian Archipelago (Lancaster Sound/Gulf of Boothia)	Fuel	100 to 999.9 m ³
9	7	b	Hudson Strait	Refined Cargo	≥1,000 m ³
10	7	a	Hudson Strait	Refined Cargo	≥1,000 m ³

Table 5.2 Highest Refined Cargo ERI Ranked Sub-Sectors in Arctic Coast Sector.

Rank	Sector	Sub-Sector	Area	Spill Size
1	8	c	Labrador Sea	≥1,000 m ³
2	7	b	Hudson Strait	≥1,000 m ³
3	7	a	Hudson Strait	≥1,000 m ³
4	6	a	Hudson Bay	≥1,000 m ³
5	8	c	Labrador Sea	100 to 999.9 m ³
6	6	c	Hudson Bay/James Bay	≥1,000 m ³
7	7	b	Hudson Strait	100 to 999.9 m ³
8	6	b	Hudson Bay	≥1,000 m ³
9	8	c	Labrador Sea	10 to 99.9 m ³
10	7	a	Hudson Strait	100 to 999.9 m ³

Table 5.3 Highest Fuel Oil ERI Ranked Sub-Sectors in Arctic Coast Sector.

Rank	Sector	Sub-Sector	Area	Spill Size
1	8	c	Labrador Sea	100 to 999.9 m ³
2	7	b	Hudson Strait	100 to 999.9 m ³
3	7	a	Hudson Strait	100 to 999.9 m ³
4	8	c	Labrador Sea	10 to 99.9 m ³
5	8	b	Baffin Bay	100 to 999.9 m ³
6	6	a	Hudson Bay	100 to 999.9 m ³
7	8	a	Canadian Archipelago (Lancaster Sound/Gulf of Boothia)	100 to 999.9 m ³
8	7	b	Hudson Strait	10 to 99.9 m ³
9	6	b	Hudson Bay	100 to 999.9 m ³
10	7	a	Hudson Strait	10 to 99.9 m ³

5.2 Recommendations

5.2.1 Enhancement of Future Risk Assessments

Several elements could be considered to improve the level of details of variables applied to generate the risk values. Risk estimates could be refined by addressing some of the limitations identified earlier in this report. In addition, the following issues were identified while analyzing the data and if resolve, would improve current risk estimates:

- MPIRS, the database on pollution incidents maintained by CCG, should be examined for potential improvements related to the comprehensiveness and quality of recorded data.
- The AIS data allows identifying the exact number of transits as well as their locations. Matching vessel codes from the AIS database and the TC commodity database would allow considering the exact trajectory of specific cargo. This approach should be considered for the Arctic as well as for other regions of Canada.
- The consequence analysis was performed assuming that countermeasures were not employed or were ineffective. In future risk assessments, consideration could be given to including the effects of spill countermeasures, which could vary with oil type, spill size, and location with regard to remoteness, weather variability and other factors.
- The collection of environmental data is improving with time. Ensuring that all regions have the same level of detail would allow for better comparisons. Data from freshwater environments differed from that obtained in the marine sectors. A refined regional risk assessment should consider freshwater ecosystems separate from the marine environment. The development of databases in a GIS format should facilitate the production of reviewed risk values.
- The current analysis is based on yearly estimates of spill frequencies. The estimate could be refined by taking into account the length of the shipping season within each sub-sector and therefore consider seasonal variation influencing risk estimates.
- For the PSI:
 - Data on the evolution of coastal areas facing climate change impacts would be beneficial, in particular since the developed metric was based on ice cover.

- For the BRI, the following elements could be considered:
 - Incorporating all protected marine areas identified under various jurisdictions.
 - Incorporating EBSA layers or equivalent layers with similar biological content. In this context, the risk analysis for the freshwater environments (MacKenzie River, Great Slave Lakes) should be considered as a separate analysis due to the discrepancies in the type of available data. Incorporating the coverage of species at risk.
- For the HRI, a revised risk assessment would benefit from:
 - Incorporating information on provincial and municipal conservation/protected areas.
 - Incorporating information on commercial fisheries.
 - Incorporating information on archaeological sites and cultural heritage sites.

6. REFERENCES

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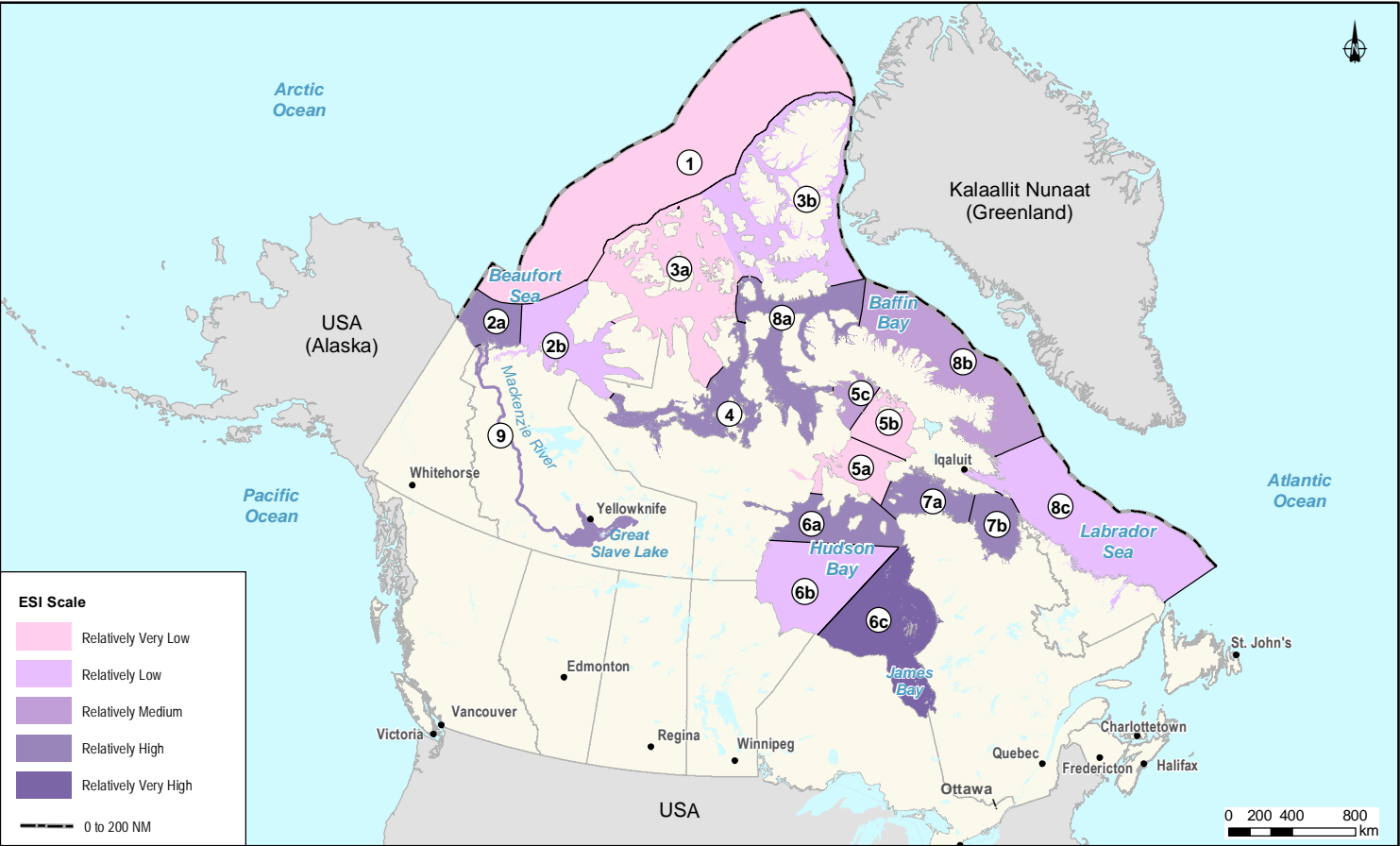
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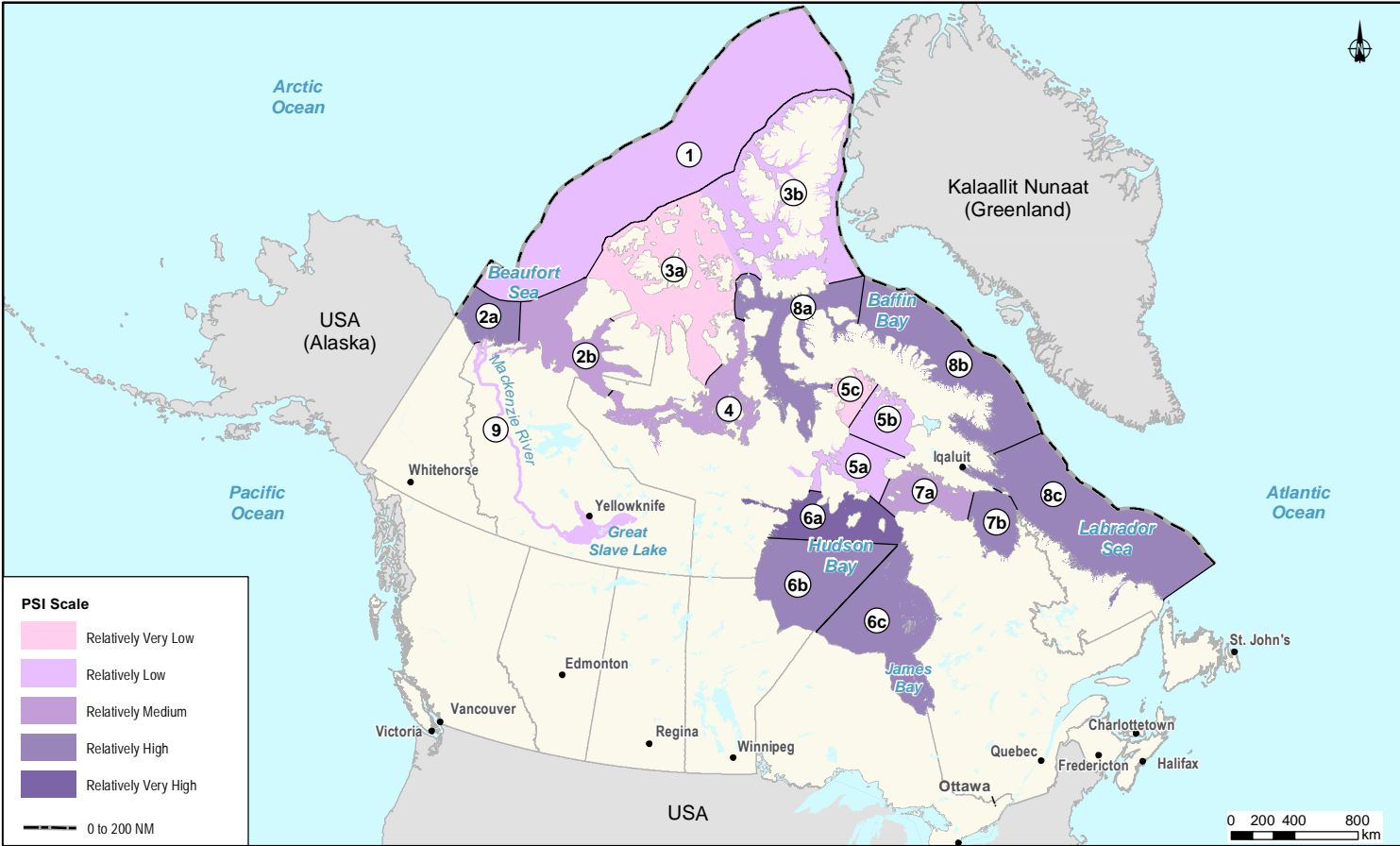
APPENDIX 1

Environmental Sensitivity Index Results

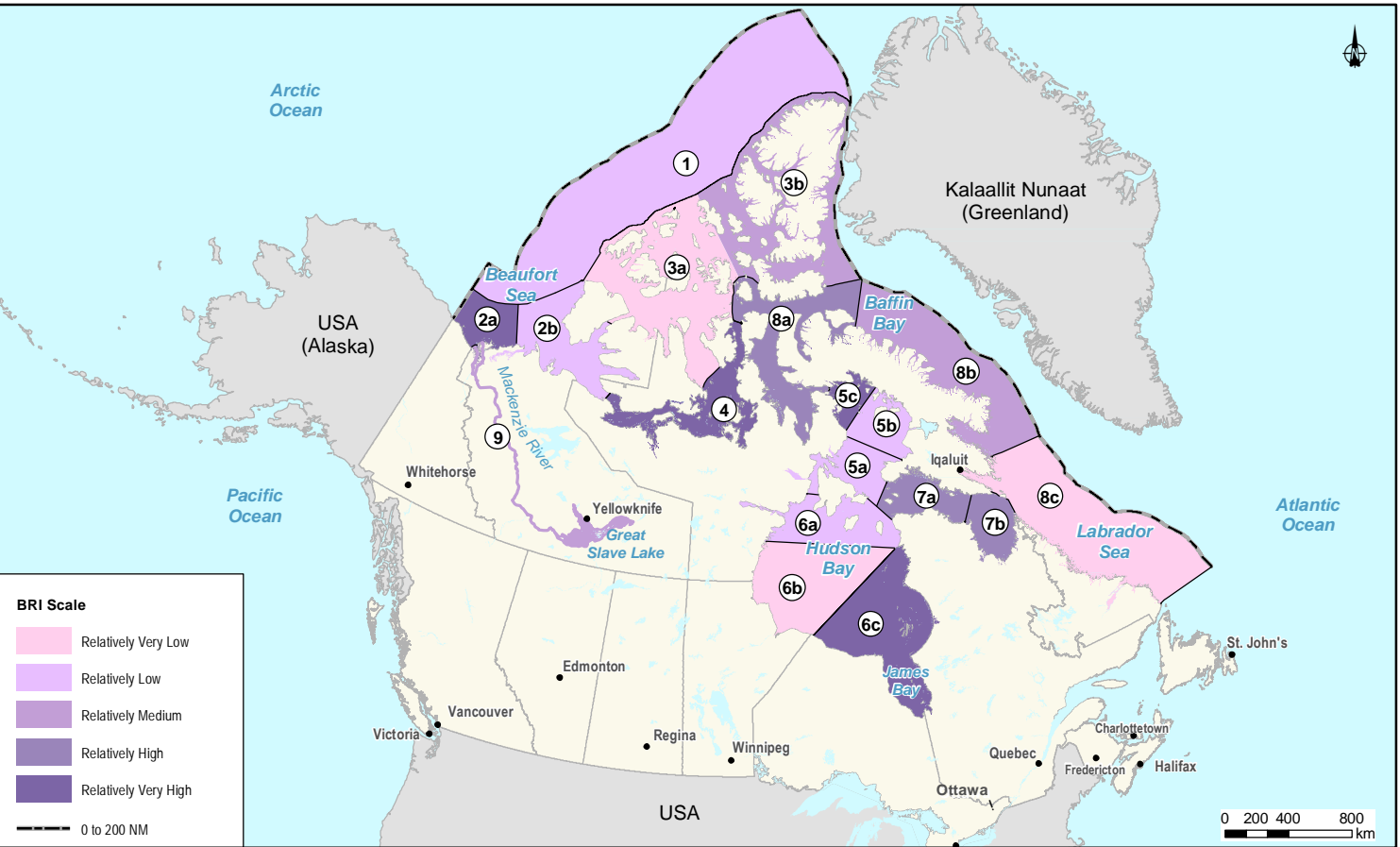
a) Environmental Sensitivity Index (ESI)



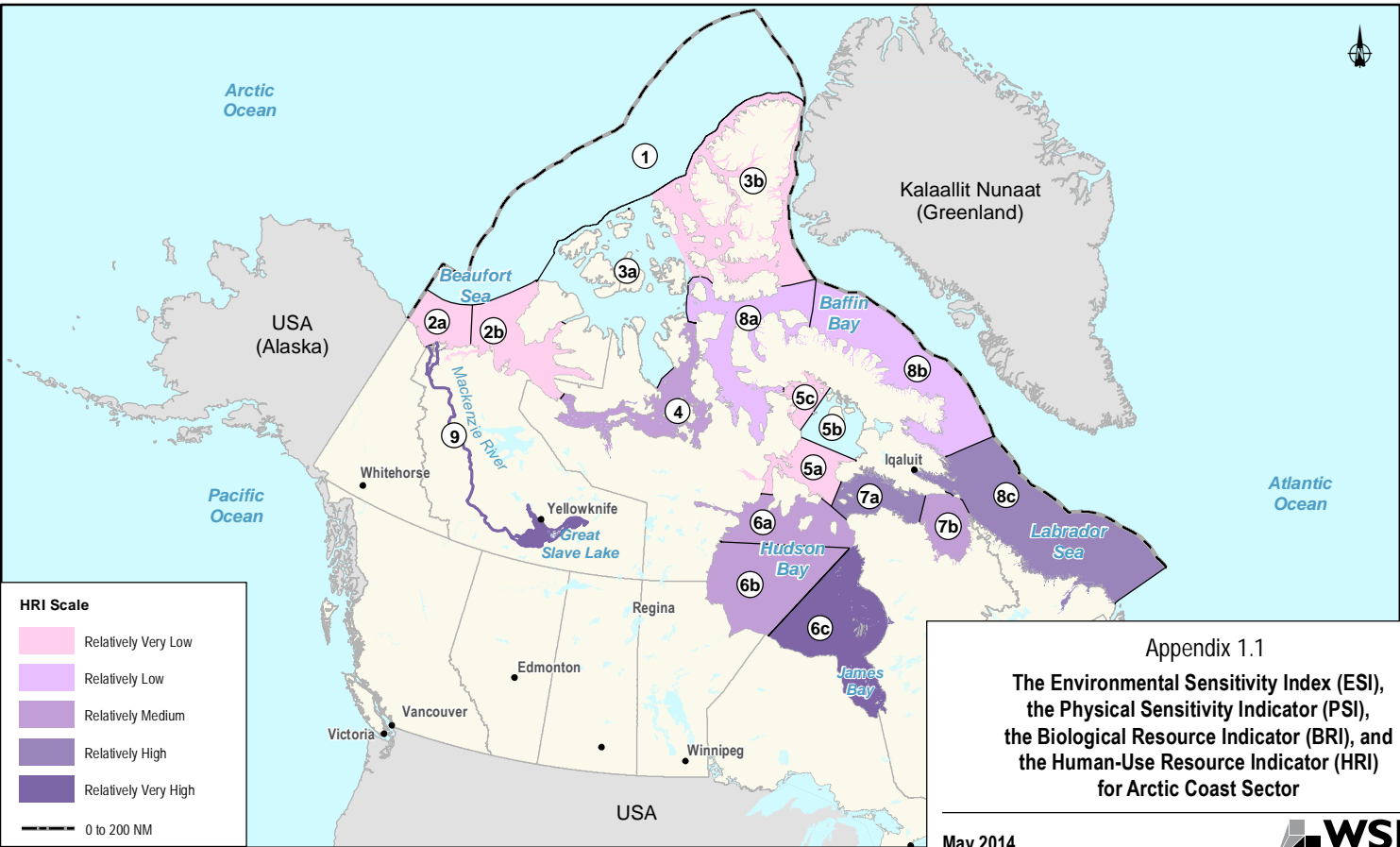
b) Physical Sensitivity Indicator (PSI)



c) Biological Resource Indicator (BRI)



d) Human-Use Resource Indicator (HRI)



Appendix 1.1
The Environmental Sensitivity Index (ESI),
the Physical Sensitivity Indicator (PSI),
the Biological Resource Indicator (BRI), and
the Human-Use Resource Indicator (HRI)
for Arctic Coast Sector

May 2014



APPENDIX 2

Future Projects

APPENDIX 2 Future Projects

In the risk assessment for oil spills south of the 60th parallel (WSP, 2014a), the potential effect of future projects on the overall and relative risk per sub-sector was estimated in a qualitative manner. Similarly, the following is a brief description of potential developments in the Canadian Arctic that could change the risk profile. Unlike the south, the potential projects in the Arctic do not involve large shipments of crude oil that can be defined with precision, which would allow a comparison to be made against existing volumes as a spill frequency indicator. Potential projects in the Arctic may involve significant volumes of fuel shipments and significant vessel transits during both the development and the operational phases. However, both fuel volumes and vessel transits, which are used as indicators of spill frequency, cannot be estimated with any sense of precision, making a quantitative comparison of risk, future versus present, even more difficult.

Transport Canada commissioned a study on future trends in Arctic shipping activity (STX, 2014). The study examined the potential change in marine activity in five main areas: community resupply, commercial fisheries, oil and gas, mining and mineral extraction, and tourism. The results provide forecasts according to “low” likelihood, “most likely”, and “high” scenarios for the period from baseline to year 2020. Their key findings are summarized as follow:

- Community Resupply: increases in shipping are likely to be only incremental, based on likely trends in population growth and community needs. In general, traffic is scheduled well in advance, and follows the same routes each season.
- Commercial Fisheries: growth in fisheries traffic is likely to be constrained by fishing quota limits, which are currently being met with the existing fleet; any changes are likely to be incremental.
- Oil and Gas Sector: although there are known oil reserves in the Beaufort Sea, present and near-term activity is expected to be low. The most likely near-term scenario would be for a small number of seismic survey vessels and traffic related to pre-engineering and environmental baseline documentation.
- Mining and Minerals Extraction Sector: current traffic in this sector is mostly related to the Raglan mine, of which the operators reportedly hope to increase production by 50% in the coming years. Of numerous proposed new mines, the Baffinland Mary River iron ore mine, near Pond Inlet, is closest to production and could lead to export trips alone on the order of 50 transits/year. Initial production is anticipated in 2014, with first shipments of ore in the summer of 2015.
- Tourism Sector: activity in this sector is limited and expected to remain so due to Canadian government requirements and regulations.

Overall, the report concluded that traffic in the Arctic is reasonably predictable, and generally limited by the challenging logistics of Arctic operations. By 2020, the study suggests modest growth in the community supply sector, little to no growth in the fisheries, oil and gas, and tourism sector, and significant growth in the mining sector, depending on the successful initiation of production at the Mary River site.

In addition to the conclusions of the STX report, Internet searches of company websites and trade journals indicate additional potential developments in the oil and gas and mining sectors.

Two companies have announced plans to drill a total of two exploratory wells in the Beaufort Sea in the next decade, and one operator is in the preliminary stages of proposal to produce oil from a Beaufort Sea well, possibly within the next decade. Although the spill risks associated with exploration and production are outside the mandate of this study, both exploration and production could involve substantial volumes of fuel and some marine traffic. In the case of production, the most likely alternative for delivering initial production would be tanker transport through the Bering Strait to markets in Asia (or, less likely, through the Northwest Passage to markets in eastern North America or Europe). An additional component of interest is exploration activity off west Greenland: three exploration wells were drilled in the summer of 2010 but there has been no further activity. Given the distance from Canada of the well locations, and the prevailing wind and current regime, there would be considerable time before such spills would threaten Canadian waters and coastlines.

There are also numerous proposed mining developments, some of which have gained some level of regulatory approval but are contingent on market conditions prior to development:

- Baffinland – Mary River Project;
- Meliadine Gold Project;
- Phase II Hope Bay Belt Project;
- Izok Corridor Project;
- Kiggavik Uranium Mine Project;
- Avalon Rare Metals;
- MGM Energy Corp;
- Sabina Gold Mine – Black River Project;
- Bathurst Inlet Port Project.

Of the projects listed above, only the Baffinland Mary River project is close to fruition. Iron ore extraction is expected to begin in the summer of 2014 with first shipments in the open water season of 2015. Total known reserves are 365 million tonnes. Initial plans were for up to 18 million tonnes of ore extraction and transport per year, and included a 150-km railroad to be built from Mary River south to Steensby Port, at the north end of Foxe Basin. Once the railway was operational, ore would be transported from the mine site and shipped from Steensby Port. Shipping of iron ore will occur year-round using vessels with ice-breaking capabilities. A scaled-down plan emerged in 2013, with ore trucked to Milne Inlet and transported only in the open –water season. Plans are for up to 3.5-million tonnes of ore per year, using ships that carry between 70,000 and 90,000 tonnes. They expect to use about 55 ships during the open water season, in addition to ships carrying sealift supplies and fuel. The life of the mine is expected to be more than 20 years for the first deposit; there are nine iron ore deposits overall.

For the purposes of estimating changes to the spill frequency and consequent risk, the projected number of transits can be compared with the existing values. (Note that the total Baffinland-related transits, based on 55 shipments of ore, would be 110, reflecting both the inbound and outbound journeys of the ship.) The Labrador Sea subsector (Eastern Arctic 3) presently has significant transit numbers, so the increase related to Baffinland is minor, 14%. For the two Baffin Bay subsectors, Eastern Arctic 1 and 2, the increase is substantial, 150% and 93% respectively. Should the planned railway option be implemented, subsectors in Foxe Basin and Hudson Strait would be affected: these areas presently have little marine activity so the increases would be substantial, approximately 10 times the present levels in Foxe Basin 2 and 3, seven times present levels in Foxe Basin 1, and 60 to 75% increase in Hudson Strait 1 and 2. Eastern Arctic 3 would still have a 14% with the rail option, but Eastern Arctic 1 and 2 would remain at present levels.

Looking at the Arctic as a whole, the Baffinland transits will increase the overall transit numbers by approximately 7%. More significantly would be the re-apportioning of spill frequency and associated risk of fuel spills to the subsectors noted above. With the “non-railway” option, the transit levels in Eastern Arctic 1 and 2 would increase significantly, to levels comparable to present-day Hudson Strait 1 and 2. With the railway option, transit numbers in Hudson Strait 1 and 2 would almost double (note that these two sub-sectors are presently the most transited), and the levels in the three Foxe Basin sub-sectors would increase to the levels presently experienced in Hudson Strait. The increased levels in transits would similarly result in a comparably increased level of risk of spills of oil transported as fuel.

As noted previously, defining the spill risks associated with development activities and ongoing operations is difficult. As an example of the logistics and potential spill risk involved in these ventures, the Hope Bay project involved a sealift, in 2010, of 20,000 t of cargo and $22 \times 10^3 \text{ m}^3$ diesel fuel. The fuel amount alone is equivalent to that shipped annually to the largest-volume ports in the Arctic.

APPENDIX 3

Ship-source Pollution Prevention in Canadian Arctic Waters

APPENDIX 3 Ship-source Pollution Prevention in Canadian Arctic Waters

In order to safeguard the Arctic marine environment, there are a number of ship-source spill prevention measures in place which have a direct correlation with the low frequency of large oil spills in Canadian Arctic waters. The following are some of the measures that contribute to ship-source oil spill prevention in the Canadian Arctic.

A3.1 Legislative and Regulatory Requirements

There are a number of legislative and regulatory requirements to which ship operators and owners are compelled to adhere, whose aim is to prevent pollution in Canadian Arctic waters. These include the *Arctic Waters Pollution Prevention Act* and its regulations, the *Canada Shipping Act, 2001*, *Charts and Nautical Publications Regulations, 1995*, and *Navigation Safety Regulations made pursuant to the Canada Shipping Act, 2001*.

In particular, under the *Arctic Waters Pollution Prevention Act* (AWPPA), the Arctic waters are deemed as an area of “zero discharge”. Except as permitted by the Regulations under exception circumstances, this legislation specifically states that “no person or ship shall deposit or permit the deposit of waste of any type in the Arctic waters”. Offenses and punishments are outlined in the Act. Federal Pollution Prevention Officers may enforce the Act by exercising powers under certain circumstances, which allow them to: board and inspect ships; redirect ships; order a ship’s location be provided; and order a ship to take part in clean-up or control activities of waste from the ship.

Under the AWPPA, measures are provided via the *Arctic Shipping Pollution Prevention Regulations* (ASPPR) to prevent ship-source pollution in Canadian Arctic waters. The measures included construction and operational elements of navigating in the Arctic, including the requirement for ice navigators. These measures will be further described.

A3.2 Northern Canada Vessel Traffic Services (NORDREG)

The Northern Canada Vessel Traffic Services Zone Regulations detail the requirements for vessels to report information before entering, during operations within and upon departing Canada’s northern waters. Such information includes information about the vessel itself, intended routes and pollutant cargoes and defects. The Regulations apply to the Northern Canada Vessel Traffic Services Zone, which, as established within the Regulations, includes the waters north of the 60th parallel north, as well as in the southern part of Hudson Bay and Ungava Bay. Vessels to which the NORDREG Regulations might apply report to NORDREG Canada, which then assesses their information and provides recommended vessel routes and ice conditions. The Regulations seek to ensure that the most effective services are available, thereby enhancing the safety of vessels, crew and passengers, and safeguarding the Arctic marine environment.

A3.3 Marine Communication and Traffic Services (MCTS).

Within the Canadian Coast Guard (CCG), MCTS provides several preventive measures to reduce the risks of incidents leading to marine pollution:

- Regulating vessel traffic movements for marine risk reduction:
 - Providing traffic and waterway information via VHF radio;
 - Providing recommendations and directions, including the delivery of clearances, and under certain conditions, restricting traffic movement;
 - Implementing actions necessary to ensure safe and orderly flow of marine traffic; and,
 - Providing specialized surveillance for conservation and environmental protection in support of government agencies such as Environment Canada, the Royal Canadian Mounted Police (RCMP), and Agriculture Canada.
- Broadcast of Safety Information: Broadcasting marine safety information such as weather bulletins, ice information and notices to shipping concerning dangers to navigation by means of NAVTEX, Continuous Marine Broadcast and other electronic systems.

A3.4 Icebreaking and Ice Advisory Services

To support safe, economical and efficient marine navigation in Canadian Arctic waters, the CCG provides ice breaking and ice advisory services primarily for the needs of commercial shipping. During the Arctic shipping season between June and November, CCG deploys up to six icebreakers to assist beset vessels in ice; open tracks through shore-fast ice and escort ships in ice-covered waters. The icebreakers also provide support to scientific endeavors of federal departments (e.g., mapping and hydrographic charting). In addition, CCG provides recommended ice routes, ice charts, ice advisories, bulletins, briefings and advice to support safe navigation around difficult areas of ice. This information is obtained through ice reconnaissance and liaison with the Canadian Ice Service. Icebreaking and ice advisory services are obtained via CCG's Ice Operations Centres, and are further enhanced through CCG's monitoring of vessel routes, as reported via NORDREG.

A3.5 Aids to Navigation

Publicly available Global Positioning Systems (GPS) tend to have limited range and reliability in Canadian Arctic waters so mariners must rely on CCG's aids to navigation to facilitate safe, economical and efficient marine navigation. CCG deploys a limited number of aids to navigation (145 fixed aids and 26 floating) in Canadian Arctic waters to help reduce the risks of grounding and collision, and the potential resultant environmental pollution. Types of aids to navigation include: visual aids (shore lights, buoys – mostly in the south section), day beacons and, radar aids (racons and reflectors).

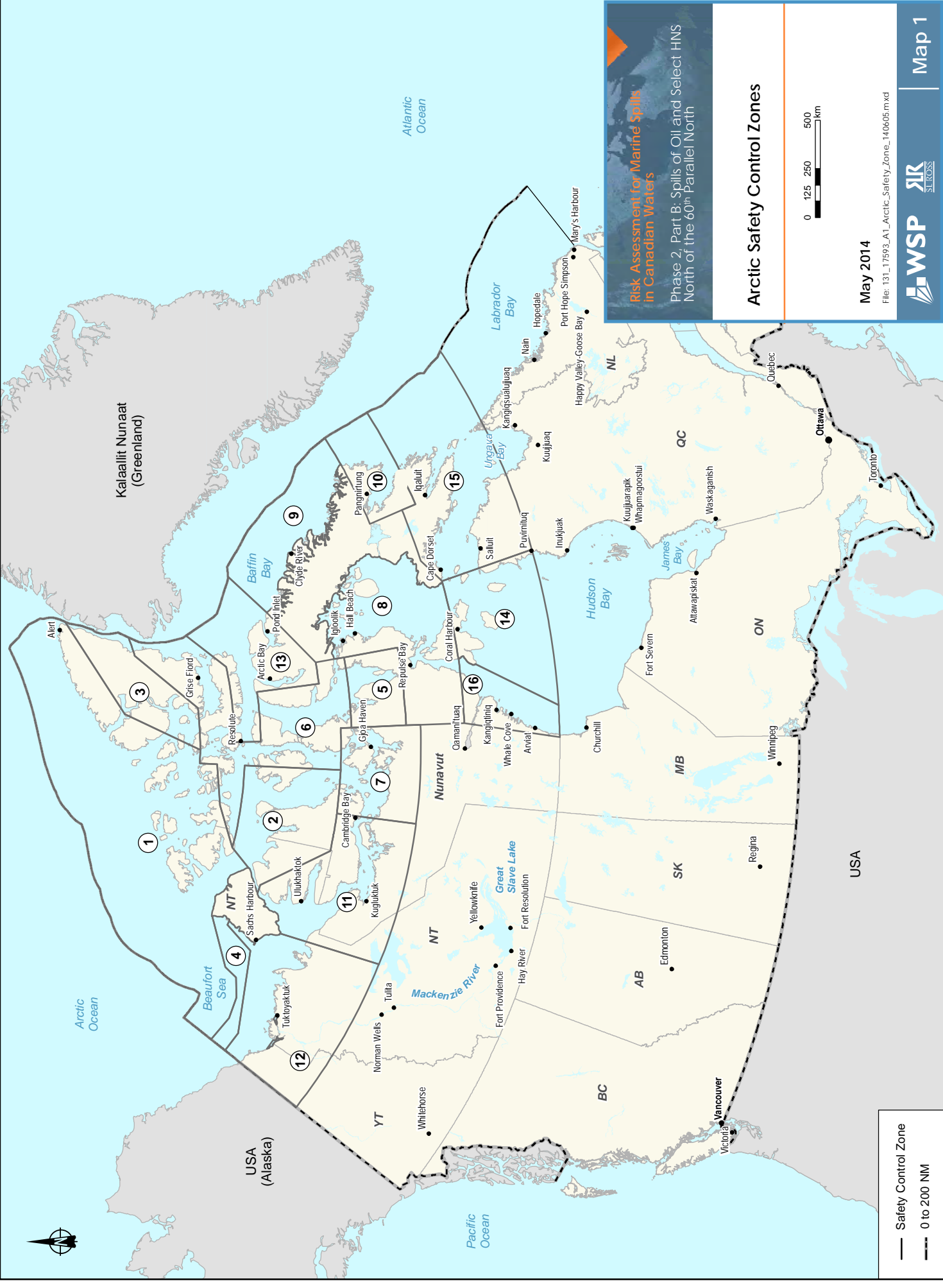
A3.6 Charting

Under the *Canada Shipping Act, 2001* and the *Charts and Nautical Publications Regulations, 1995*, all vessels in Canadian waters are required to carry and use nautical charts and related publications. The Canadian Hydrographic Services (CHS) seeks to have the main traffic areas in the Arctic well-charted. CHS provides charts for vessels of all types. In addition, the Arctic Voyage Planning Guide is a digital planning tool, to assist mariners considering navigating in Canada's Northern waters.

A3.7 Zone/Date and Arctic Ice Regime Shipping Systems

Canada has two systems to promote safe navigation of ships in Arctic waters. These systems are applicable to ships carrying more than 453 cubic meters of oil. The Zone/Date system classifies 16 Shipping Safety Control Zones of increasing ice condition severity, based on historical data of the probable ice conditions in a zone at a given time of year. For each Shipping Safety Control Zone, opening and closing dates for navigation are established for nine Arctic classes of ships and five ship types (Baltic ice classes or no ice strengthening). This system restricts ships operations to periods during which the ice conditions for a given zone may be expected to be within their capability. See Map 1 representing Transport Canada Safety Control Zones.

Although the Zone/Date system is simple to use and is beneficial for voyage planning, it does not offer flexibility with respect to actual ice conditions. In years where the ice is actually greater or less than the annual average, the period during which operations are permitted in a zone does not change. In such cases, the more dynamic Arctic Ice Regime Shipping System, which uses actual ice conditions, provides greater flexibility. It is used anytime a ship is navigating a Shipping Safety Control Zone outside the approved dates provided a qualified ice navigator is on board. The Arctic Ice Regime Shipping System requires calculation of an Ice Numeral based on actual ice conditions and factors related to the strength of the vessel. The key to the calculation is the assessment of ice conditions - concentration, thickness, age, state of decay, and roughness – by an experienced ice navigator. This assessment is combined with the vessel's ice multipliers (based on the vessel's degree of ice-strengthening) in a specified formula to produce an 'Ice Numeral'. A negative Ice Numeral indicates that the ice conditions exceed the vessel's capabilities for that particular ice regime or ice conditions. A positive ice numeral, on the other hand, indicates that a vessel may operate within a particular ice regime.



A3.8 Ice Navigators

Under certain circumstances, ships are required to have a qualified ice navigator on board. An Ice Navigator is required:

- on tankers (when carrying oil as cargo) when in a Shipping Safety Control Zone;
- when any ship, over 100 gross tons is navigating outside the Type E dates from Zone / Date Table; and
- while using the Arctic Ice Regime Shipping System.

Beyond these requirements, having an experienced person guiding the ship when there is the potential for encountering sea ice is always recommended. It is the ship owner's responsibility to ensure that qualified persons are on board for the intended voyage.

The role of the ice navigator is to evaluate whether the ship is capable of handling the planned route, based on the ice regime (i.e., ice conditions). If the Master or another officer meets the qualification, he or she can act as an ice navigator; otherwise an additional qualified person will be required to provide advice to the Master.

A3.9 Aerial Surveillance

Transport Canada conducts aerial surveillance, through its National Aerial Surveillance Program (NASP), over all Canadian waters to detect ship-source pollution. Transport Canada owns and operates a specialized DASH 7 aircraft in the Arctic during the Arctic-shipping season, with state of the art remote sensing equipment. The NASP observes, analyzes, records and reports marine pollution (e.g., ballast water or oil discharges). This works as an effective deterrent for oil discharges. Evidence gathered by the crew of the NASP has led to successful prosecutions of polluters over the years. See Map 2 representing density of recent NASP pollution surveillance efforts in the Arctic.

In addition, the NASP also monitors sea ice conditions in the Arctic, in partnership with Environment Canada, to ensure vessels can safely navigate in the Arctic. See Map 3 representing density of recent NASP ice surveillance efforts in the Arctic.

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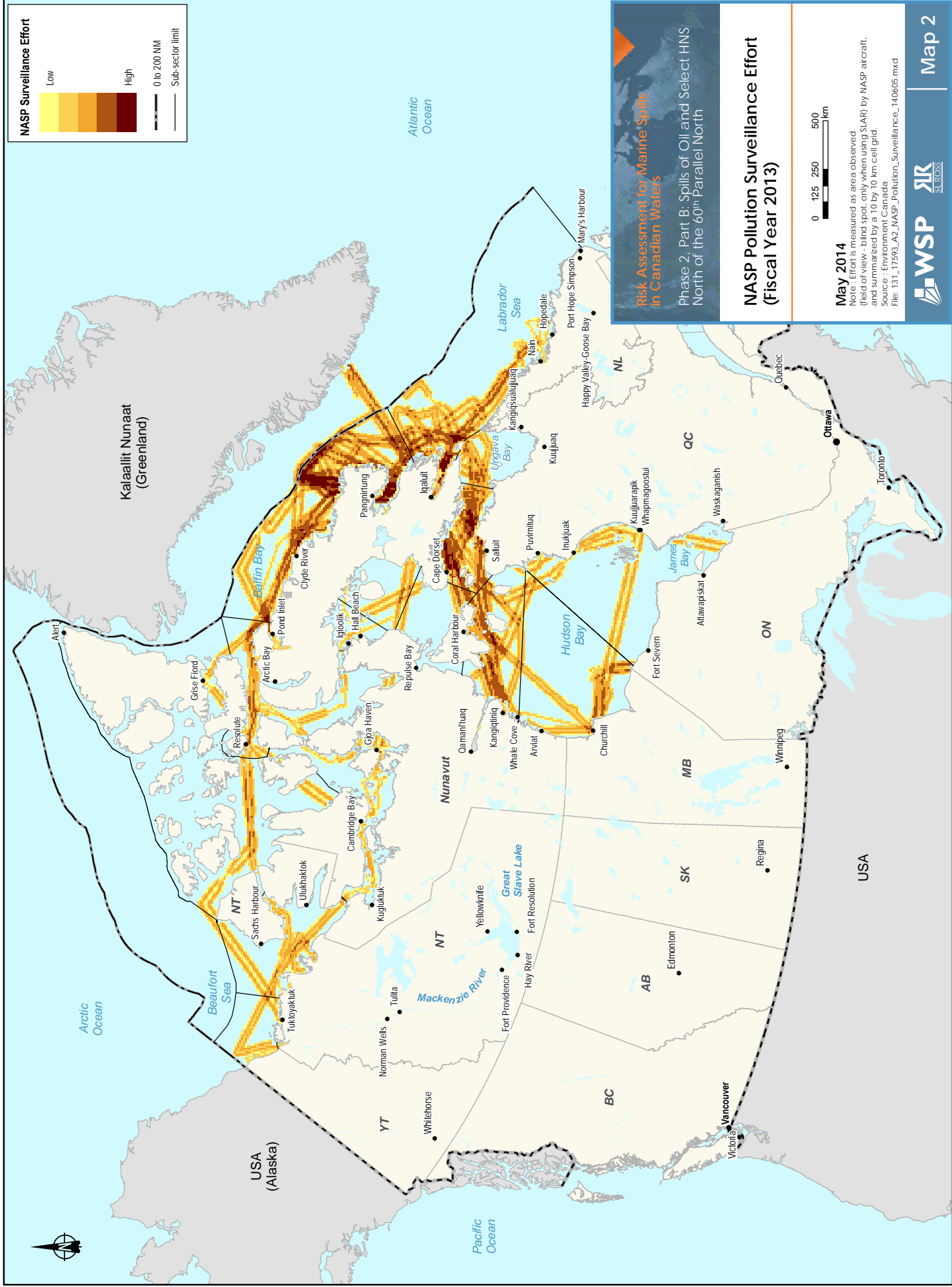
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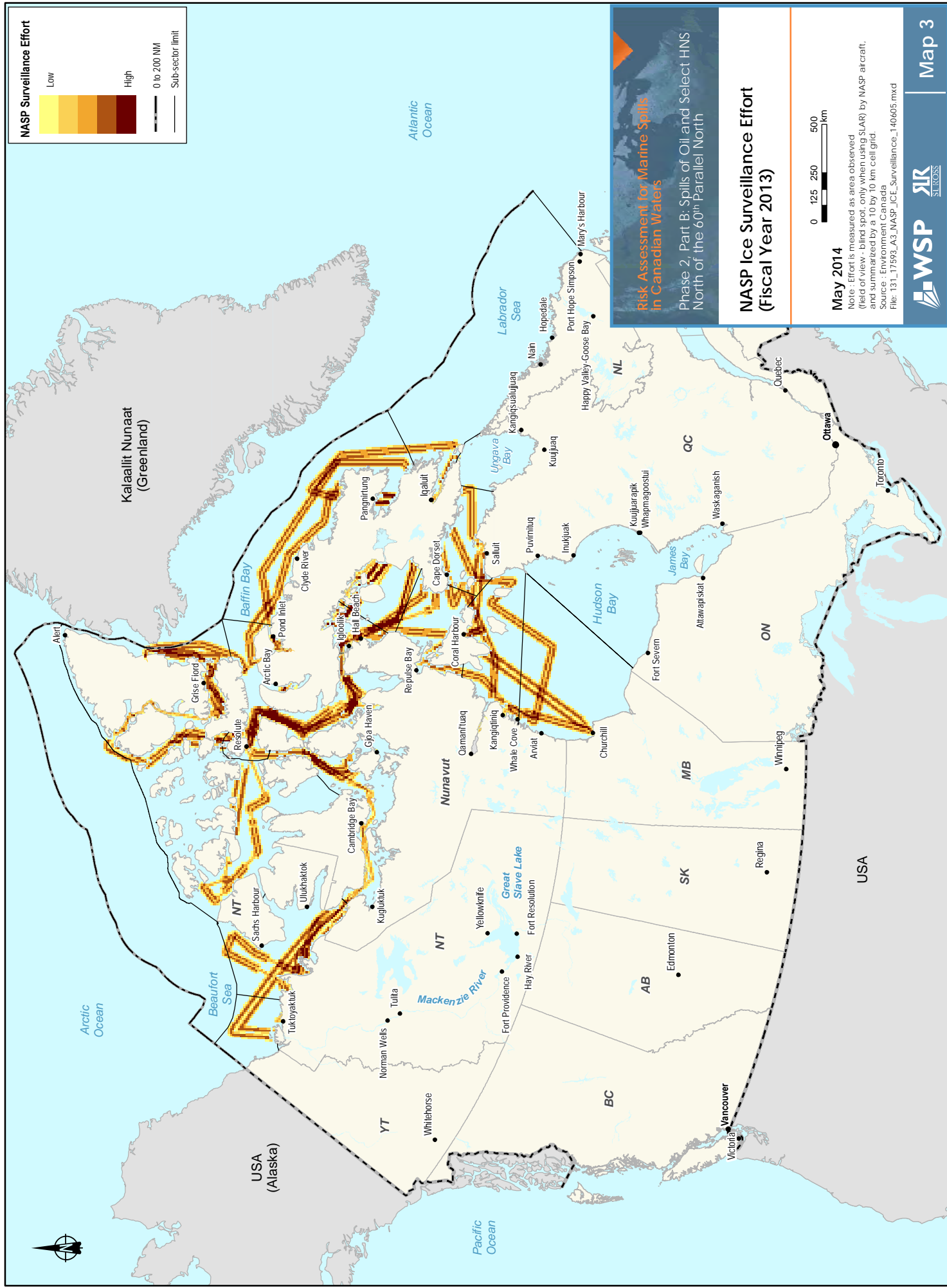
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