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November 24, 2023

Catherine Ducey
Policy Analyst, Regional and Strategic Assessment
Impact Assessment Agency

Submitted by email: OffshoreWindNL-EolienneExtracotiereTNL@iaac-aeic.gc.ca

Subject: Request for Advice - Committee for the Regional Assessment of Offshore Wind Development in Newfoundland and Labrador

Dear Colleague,

The Impact Assessment Agency of Canada (the Agency) requested that Natural Resources Canada (NRCan) provide advice into the following:

- Existing regional Environmental Characteristics for both physical environment components;
- Relevant regional-scale mapping data as it relates to the existing environmental information;
- Advice and input regarding spatial and temporal trends for existing physical and biological component in relation to potential interactions with offshore wind development components and activities (e.g., installation and operation of wind turbines, subsea cables, and service vessels);
- Advice regarding general gaps in knowledge or understanding of areas within the Study Area, or future works being undertaken to help address these gaps; and
- Other information or advice that NRCan identifies as being relevant to the Committee's mandate as part of the overall goal and objectives of the Regional Assessment.

NRCan is submitting this response pursuant to section 23 of the *Impact Assessment Act*. Details of NRCan's response can be found below in the Advice Record for Regional Assessment of Offshore Wind Development in Newfoundland and Labrador.

NRCan looks forward to revisiting once more data or information becomes available. If you have any questions, comments, or concerns, please contact Natalie.Robinson@nrcan-rncan.gc.ca.

Sincerely,

Natalie Robinson
Impact Assessment Division
Office of the Chief Scientist

CC: Christina Clarke; Peter Unger

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Advice Record for Regional Assessment of Offshore Wind Development in Newfoundland and Labrador

Department/Agency	Natural Resources Canada
Lead Contact	Natalie Robinson
Email	Natalie.Robinson@NRCan-RNCan.gc.ca

1. Provision of Information on existing conditions

Physical / Oceanographic Conditions
• A general overview / summary of oceanographic conditions within the Study Area including: o Bedrock and surficial geology within the region, as it relates to offshore wind potential.

This information has generally been summarized in Eamer et al., 2020 - https://doi.org/10.4095/326514 where the bedrock, surficial geology, and seabed morphology have been described for each physiographic region of the RA area. In addition, key sources of more targeted information, data and maps are provided for each region. The GSC encourages the committee to download that material and let us know if they have any questions. Parts of that study were based on Shaw and Potter (2015), from which you may find more detailed information - https://doi.org/10.4095/293728

Regional data/map products to support the interpretations found therein are as follows:

- Bathymetry: gebco provides the best regional bathymetric product, updated yearly: https://www.gebco.net/data_and_products/gridded_bathymetry_data/ and high resolution (e.g., wind-farm scale) mapping data is available through a Canadian Hydrographic Service portal: https://data.chs-shc.ca/dashboard/map, although coverage is not across the RA area. An example of this coverage is shown below, where the high-resolution map data is represented by the bold colours from red to blue.

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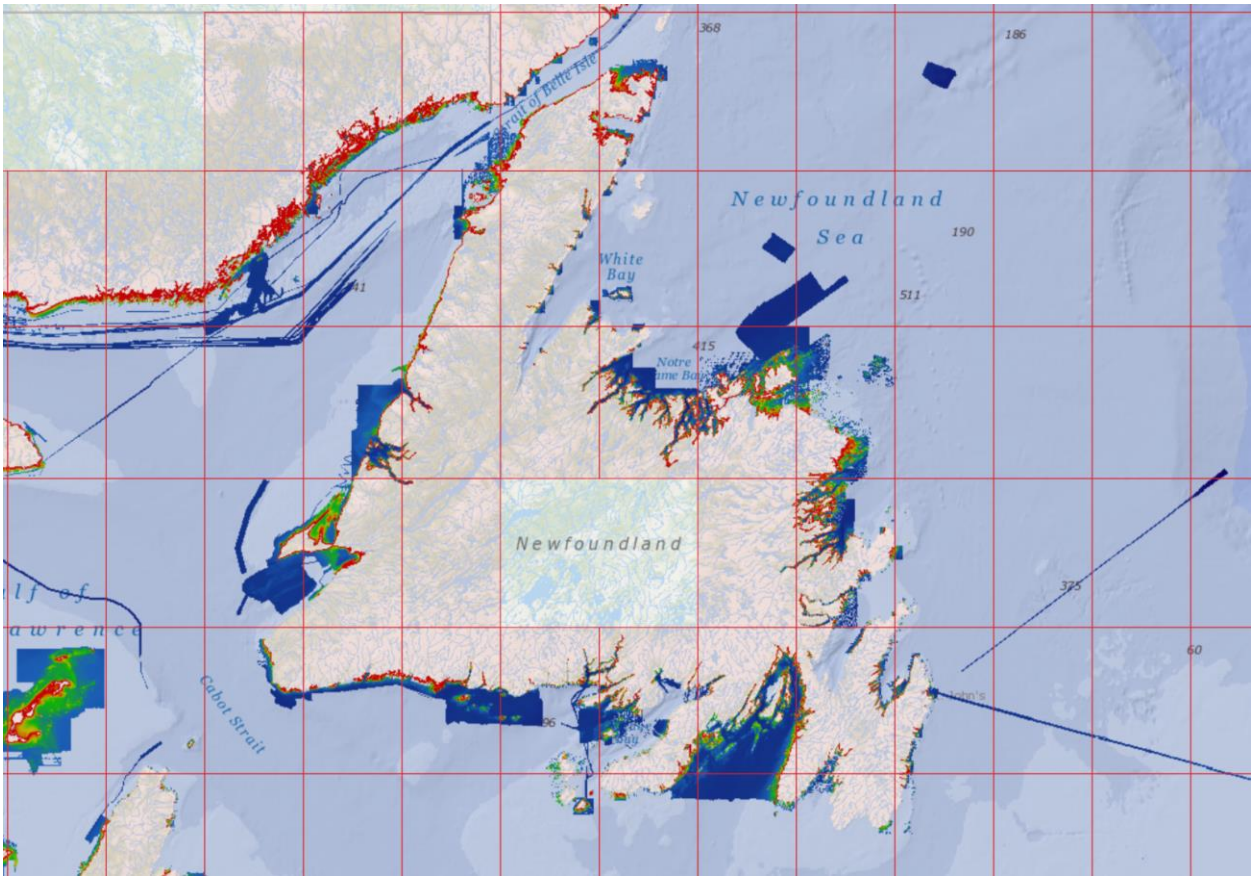

- Surficial geology: for Newfoundland there is an upcoming surficial geological compilation produced by Gordon Cameron (Gordon.cameron@nrcan-rncan.gc.ca) who may be able to provide the data pre-publication. Josenhans (2007) has assembled the most up-to-date regional products for the Gulf Coast into one atlas, including sediment thickness, surficial geology, and bedrock geology: https://doi.org/10.4095/222864 e.g., below is a surficial geology map included in the atlas:

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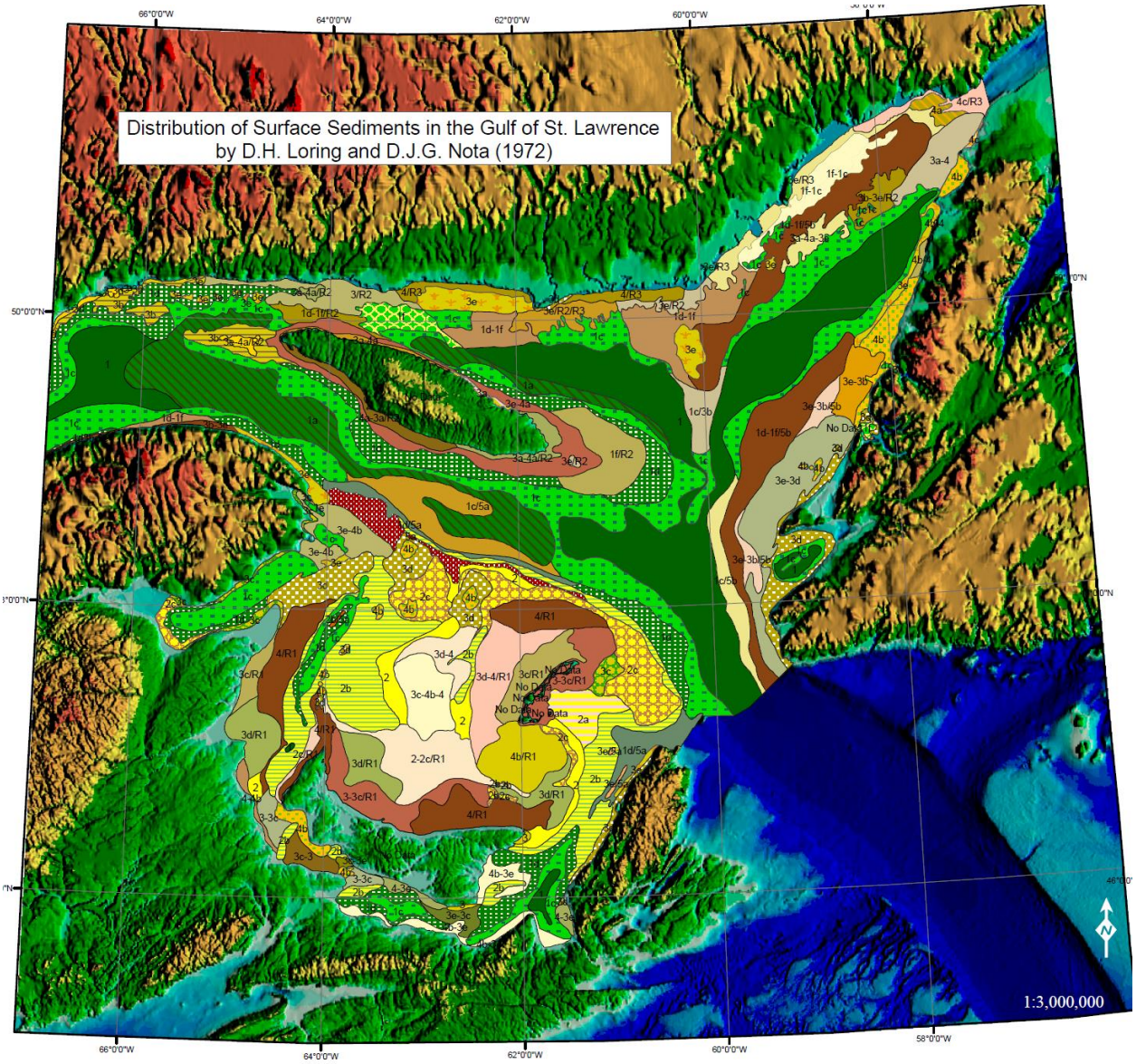
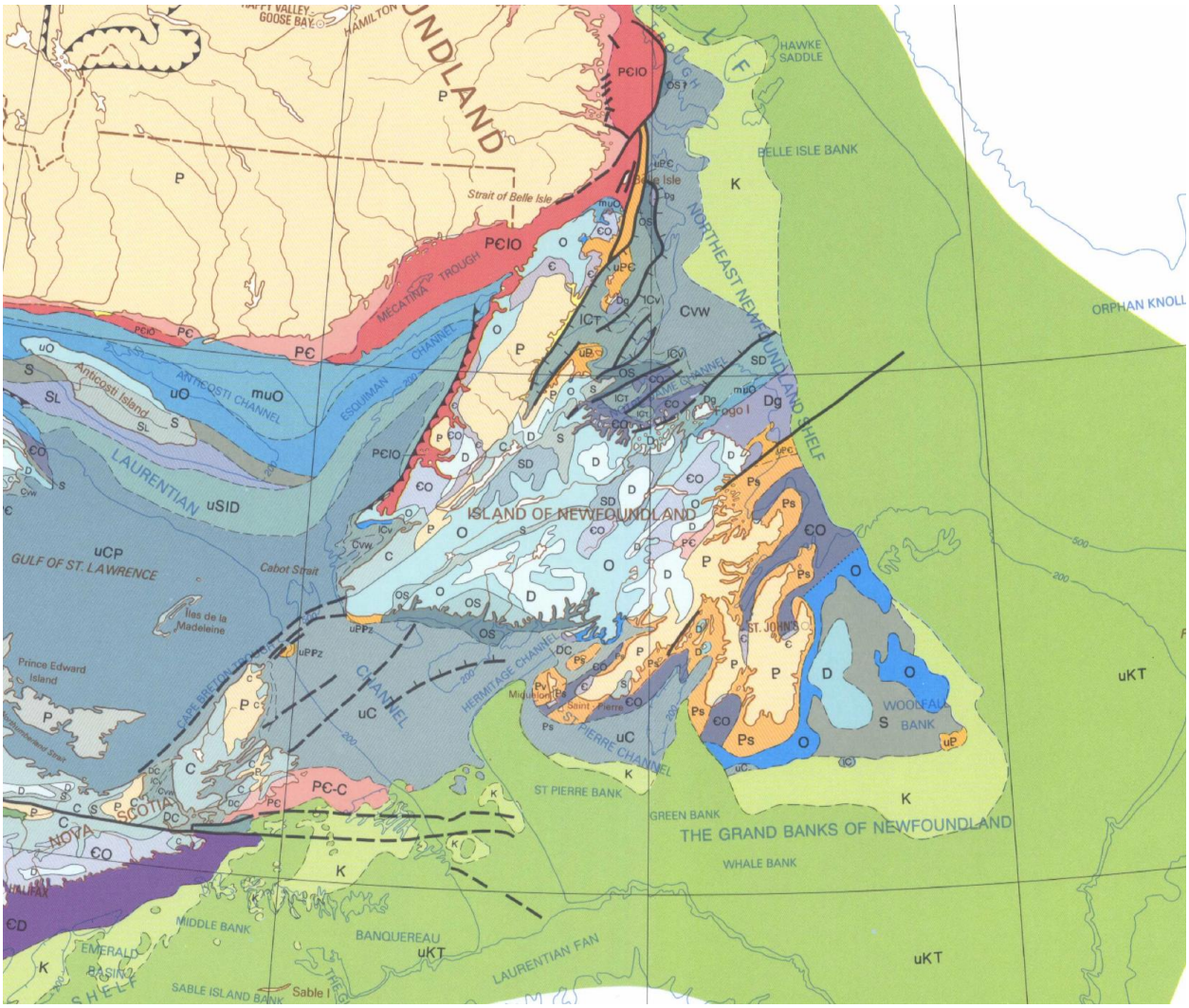


- Bedrock geology: for areas outside the Gulf (covered above), the most up-to-date bedrock geology map product that the GSC is aware of is Fader et al. 1989 - https://doi.org/10.4095/127347 - noting that this includes major faults as well, relevant for the discussion of earthquakes.



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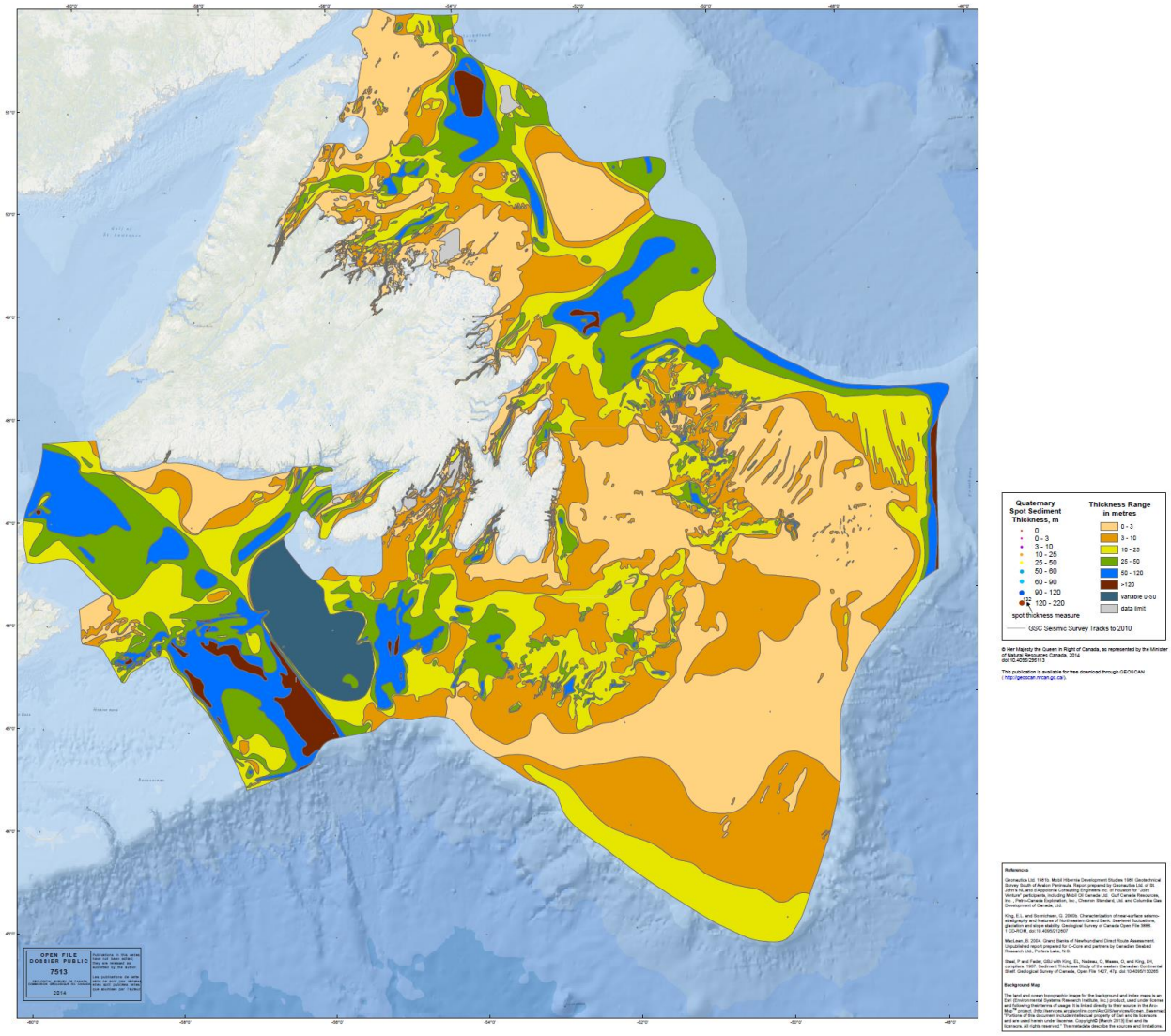
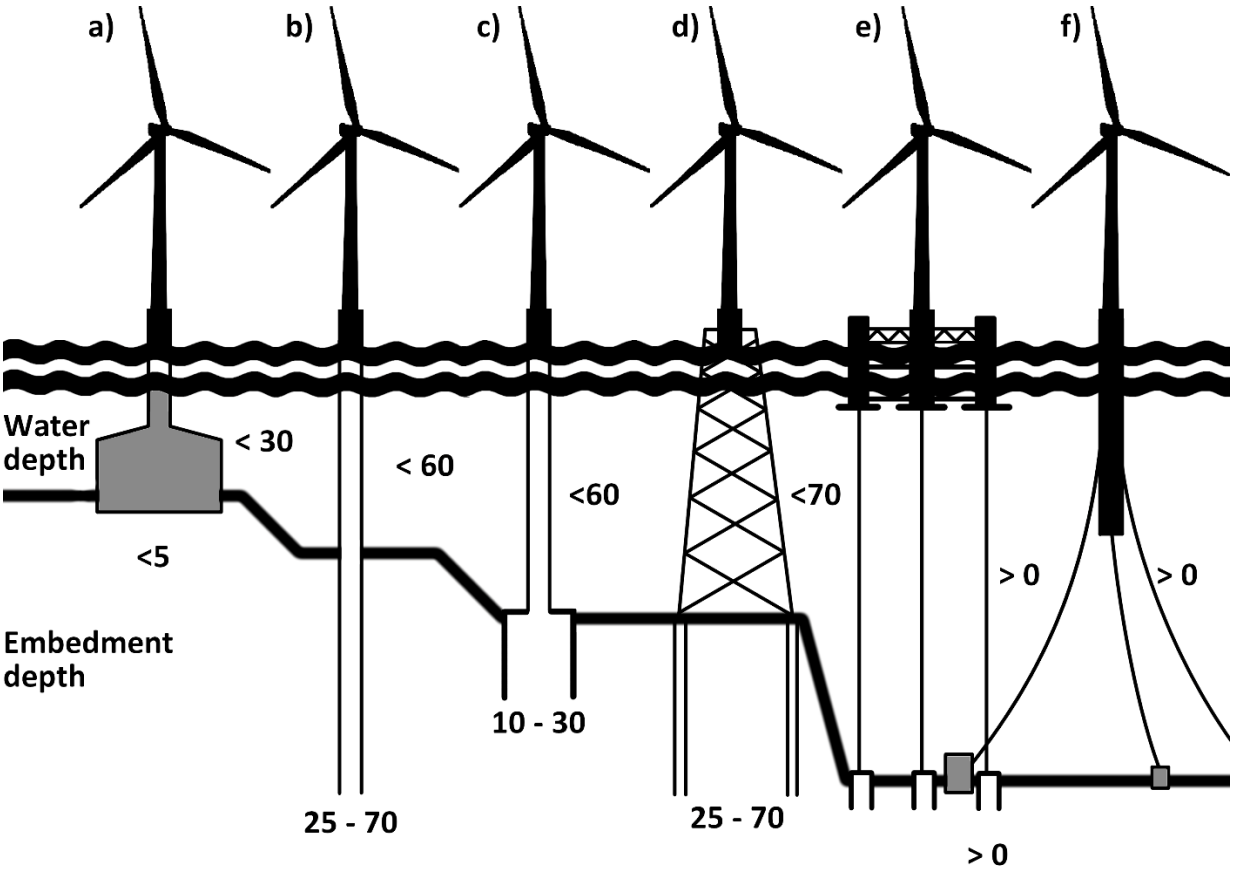
- Depth of Sediment – King (2014) provides depth-of-sediment data and a map product for the non-Gulf shelf areas of Newfoundland in https://doi.org/10.4095/295113, essential data for any fixed-bottom foundations. For context see Eamer et al. 2021 - https://doi.org/10.1016/j.csr.2020.104297





Use of these products can be generally summarized as such – fixed bottom foundations are, as of 2023, in water depths shallower than 70 meters. Surficial geology that is generally supportive of driven piles includes sands and silts, caissons include finer sands and silts ("muds"), and gravity base (~35m water depth limited) can be placed on sands, gravels, tills, and bedrock (may require some surface preparation). Bedrock geology is not particularly important other than the uncertainty around driven piles into Tertiary bedrock, which can be only semi-consolidated (wouldn't result in refusal) in some regions. Piles require > 25m depth of unconsolidated sediment generally, and caissons > 10m.

o **Historical seismic events / activities (last 50 years) within the Study Area, and general trends on potential seismic events / geohazards that may occur within the Study Area**

A database that contains earthquake events to 1985 is available:

https://earthquakescanada.nrcan.gc.ca/stndon/NEDB-BNDS/bulletin-en.php

and the record does show a dearth of seismic events in the regional assessment area (the following map shows earthquakes from 1985 – present that are greater than 3 in magnitude, sorted by size) –

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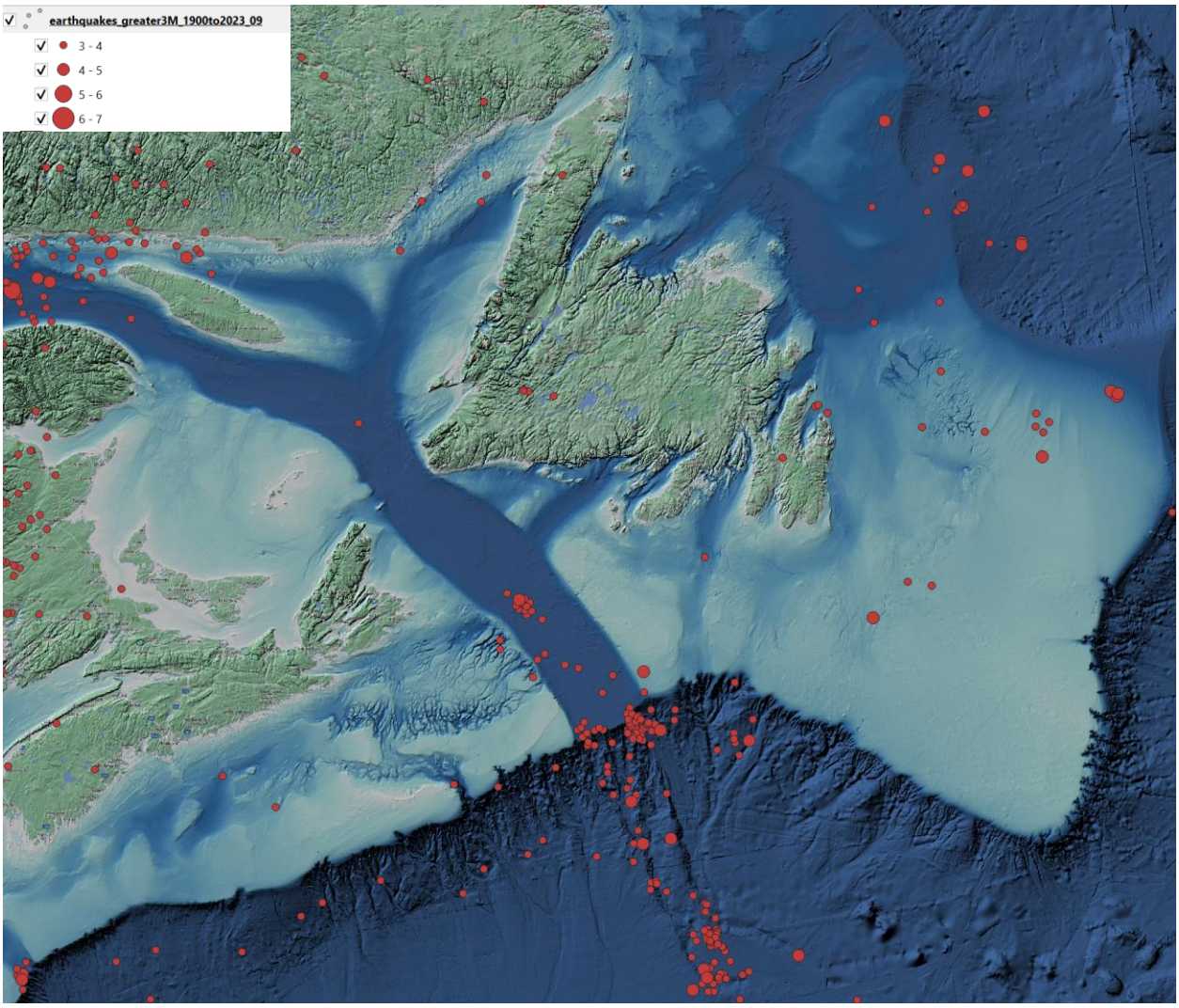

Note that Canada's largest, and deadliest, historically recorded tsunami occurred due to an offshore earthquake and subsequent landslides (e.g., see https://doi.org/10.1016/j.margeo.2004.11.007, https://doi.org/10.1046/j.1365-3091.1999.00204.x), so although the frequency may be low, there could be a risk.

There has been no systematic mapping of subsea landslides in the coastal areas of Newfoundland that are readily available, which could be a risk to offshore infrastructure. These are common in fiord-type coastlines and have been observed in many datasets on the west coast of Newfoundland as well as offshore Labrador. However, there is very limited information regarding their distribution, age, and recurrence. A detailed assessment of this hazard should be undertaken to evaluate the potential risk that they pose to future infrastructure.

• If applicable to the above components, what would the effects of climate change have on these components in terms of forecasted outlook for the future.

- Not really applicable in the marine environment but all current offshore wind energy projects involve a connection to land through a high-voltage cable (and future installations may involve hydrogen pipelines or other land connections). As such, relative

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sea-level rise and increased storminess may have an effect over the lifetime of an offshore wind installation. James et al. (2021) have the most up-to-date projections of sea-level rise for various regions of Canada - https://doi.org/10.4095/327878

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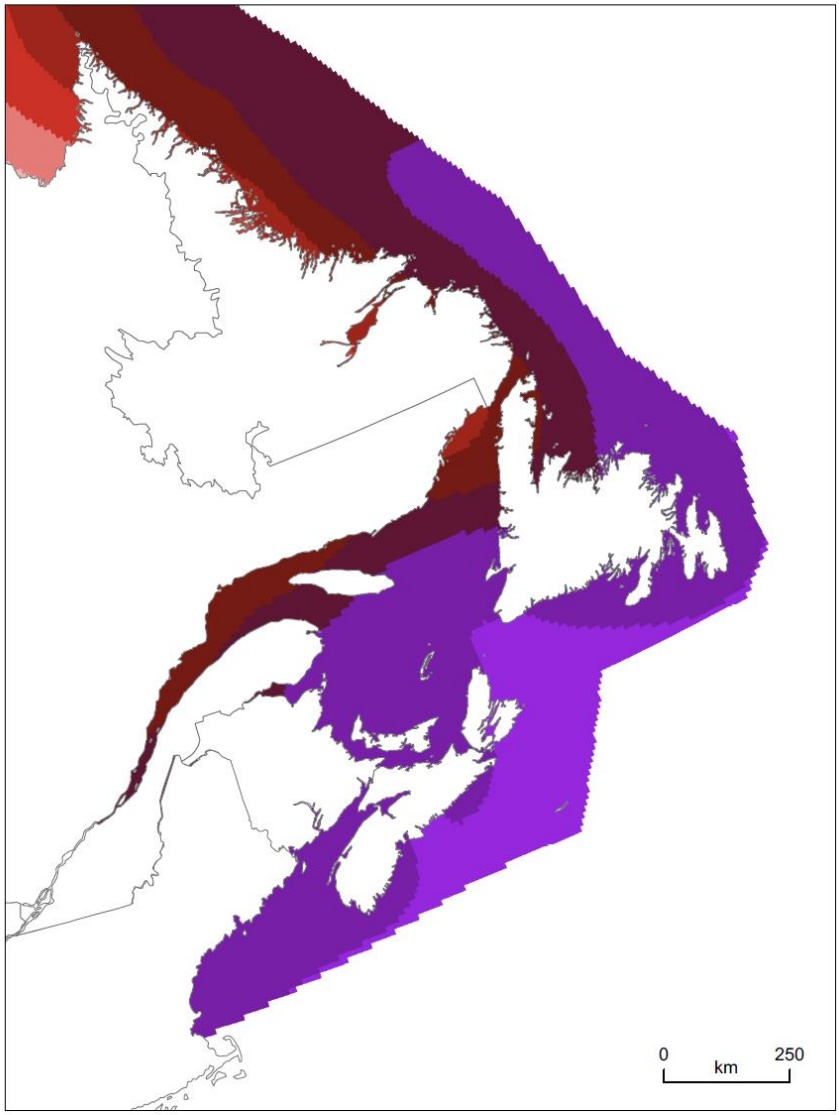
Projected Relative Sea-Level Change for Enhanced Scenario at 2100
Additional Meltwater Sourced from Antarctica



Projections are provided relative to a baseline of 1986 to 2005.

James, T.S., Robin, C., Henton, J.A., and Craymer, M., 2021. Relative sea-level projections for Canada based on the IPCC Fifth Assessment Report and the NAD83v70VG national crustal velocity model; Geological Survey of Canada, Open File 8764, https://doi.org/10.4095/327878

Canada

2. Additional Information

Note that in addition to the following information, a list of data and studies was previously provided to the Committee in March 2023 (see appendix).

Preliminary Considerations Analysis of Offshore Wind in Atlantic Canada, Natural Resources Canada 2023

The report - https://doi.org/10.4095/331855 - supports the identification of candidate regions within Atlantic Canada that could become designated offshore wind energy areas in the future. These areas would define the boundaries within which developers could bid on the rights to develop offshore wind projects. These candidate regions may be included in government-led regional assessments and may also become the focus of further characterization of various geophysical, socio-economic, and environmental considerations. The study area for this analysis includes the Gulf of St. Lawrence, the western and southern coasts of the island of Newfoundland, and the coastal waters south of Nova Scotia. Twelve input data layers representing various geophysical, ecological, and ocean use considerations were incorporated as part of a multi-criteria analysis (MCA) approach to evaluate the effects of multiple inputs within a consistent framework. Six scenarios were developed to allow for visualization of a range of outcomes according to the level of influence accorded to the input layers and the elements within them.

The science questions underpinning the potential for offshore wind turbines on Atlantic Canada's continental shelves

Additional environmental components have been identified in a recent publication, Eamer et al. 2023 - https://doi.org/10.4095/331697 - where some of the key unresolved scientific questions (and references to key information and data) have been developed after several years of working in this field:

- the distribution of buried valleys under the banks – relevant in the NL RA study area, having been identified under St. Pierre Bank and the Grand Banks
- the magnitude and distribution of sediment mobility in shallow waters – affecting the stability and sustainability of infrastructure in the offshore
- offshore mass failures (landslides) – most documented mass failures on the shelf are considered to be relict, a product of the last glaciation, however, a more detailed inventory should be available.
- a detailed inventory and distribution of shallowly buried salt features (salt diapirs) and whether they are actively migrating, and if there is an associated geohazard risk.
- in areas where sea level was lower following ice retreat thousands of years ago, there may be buried coastal and terrestrial sediments that may pose a geotechnical risk to offshore and landfalling infrastructure.

Open Science and Data Platform

Natural Resources Canada is collaborating with numerous Federal, Provincial and Territorial contributors to provide access to data, scientific publications and information about development

and regulatory activities through the Open Science and Data Platform (OSDP): https://osdp-psdo.canada.ca/dp/ The goal of the platform is to provide single-window access to a broad suite of content to support impact, regional and cumulative effects assessments and evidence-based decision making. Amongst over 150,000 content records, the OSDP includes a curated content collection entitled Resources to Understand Potential Effects from Future Offshore Wind Development in Atlantic Canada, which was developed in collaboration with the Impact Assessment Agency of Canada. The content in this collection has been selected to support the understanding of cumulative effects in the area surrounding region. This collection features data and scientific publications within the study areas. Through open access to science and data, the OSDP is a tool available to participants in the Offshore Wind Regional Assessments, and through data integration, can support, modelling, risk analysis and decision making.

3. Data gaps

Basically, all the above highlights the gaps in data that exist to properly assess the impact of future offshore wind infrastructure in the reginal assessment study area. Data and information are lacking particularly, high-resolution mapping, subsurface, and sample data from shallow areas of the shelf, particularly relevant for offshore wind.

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Appendix: Data

Theme	Data Title	Publicly available	Source	Link
Geology	Bedrock Geology	Unknown	NRCan / DFO	
Climatology	Wind speed and direction	Unknown	NRCan / DFO / ECCC	http://www.windatlas.ca/series/index-en.php
Climatology	Fog and visibility	Unknown	NRCan / DFO / ECCC	
Climatology	Precipitation	Unknown	NRCan / DFO / ECCC	
Climatology	Atmospheric Light	Unknown	NRCan / DFO / ECCC	
Oceanography	Waves	Unknown	NRCan / DFO / ECCC	
Oceanography	Currents	Unknown	NRCan / DFO / ECCC	
Oceanography	Extreme Weather Events	Unknown	NRCan / DFO	
Geology	Database of geotechnical information	Yes	NRCan	https://ed.marine-geo.canada.ca/index_e.php
Geology	Database of radiocarbon dates	Yes	NRCan	https://ed.marine-geo.canada.ca/index_e.php
Geology	Database of expedition reports	Yes	NRCan	https://ed.marine-geo.canada.ca/index_e.php
Geology	Database of high-resolution seismic reflection surveys conducted offshore Atlantic Canada.	Yes	NRCan	https://ed.marine-geo.canada.ca/index_e.php

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Geology	Database of underwater photography	Yes	NRCan	https://ed.marine-geo.canada.ca/index_e.php
Geology	High resolution scans of GSC high resolution seismic reflection profiles	Yes	NRCan	https://ftp.maps.canada.ca/pub/nrcan_rncan/raster/marine_geoscience/NRCAN%20Windows%2010%20Software/KMLS/NRCanMarineDataHoldings.kmz
Geology	Geotechnical parameters important for offshore wind energy in Atlantic Canada	Yes	NRCan	https://doi.org/10.4095/329688
Geology	The inner shelf geology of Atlantic Canada compared with the North Sea and Atlantic United States: insights for Canadian offshore wind energy	Yes	NRCan	https://doi.org/10.1016/j.csr.2020.104297
Geology	Seabed conditions on the inner shelves of Atlantic Canada; Geological Survey of Canada	Yes	NRCan	https://doi.org/10.4095/326514
Geology/habitat	Geoscience and Habitat Mapping for Marine Renewable Energy	Yes	NRCan	https://doi.org/10.1016/j.csr.2014.03.014
Geomorphology	The Seafloor of Southeastern Canada	Yes	NRCan	https://doi.org/10.1007/978-3-030-35137-3_20
Geomorphology	Continental Shelves of Atlantic Canada	Yes	NRCan	https://doi.org/10.1144/M41.2
Geomorphology	Geomorphic diversity of the Newfoundland and Labrador Shelves Bioregion	Yes	NRCan	https://doi.org/10.1139/cjes-2022-0080
Oceanography	Sediment mobility data layers for Atlantic Canada: near-bed current, wave parameters, seabed shear stress, sediment mobilization, seabed disturbance	No - soon to be available on FGP	NRCan	https://www.nrcan.gc.ca/earth-sciences/geomatics/canadas-spatial-data-infrastructure/geospatial-communities-and-canadian-geosecretariat/federal-geospatial-platform/11031
Oceanography	Seabed disturbance and sediment mobility due to tidal current and waves on the continental shelves of Canada	Yes	NRCan	https://doi.org/10.1139/cjes-2020-013

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Oceanography	Modelling Seabed disturbance and sediment mobility on the Canadian Atlantic Shelf	Yes	NRCan	https://doi.org/10.4095/328363
Geohazards	A Synthesis of the Distribution of Submarine Mass Movements on the Eastern Canadian Margin	Yes	NRCan	https://doi.org/10.1007/978-94-010-0093-2_32
Geology	Quaternary unconsolidated sediment thickness on the Grand Banks of Newfoundland and northeast Newfoundland Shelf	Yes	NRCan	https://doi.org/10.4095/295113
Geology	Quaternary geology of the Laurentian Channel and the southwestern Grand Banks of Newfoundland	Yes	NRCan	https://doi.org/10.4095/286183
Geology	Surficial sediments, Grand Bank, offshore Newfoundland	Yes	NRCan	https://doi.org/10.4224/12340895
Geology	Quaternary Geology of the Continental Margin of Eastern Canada	Yes	NRCan	https://doi.org/10.4095/125189
Geology	Quaternary geology offshore Avalon Peninsula, Newfoundland and Labrador, Seal Cove to Motion Bay	Yes	NRCan	https://doi.org/10.4095/294836
Technical Requirements of Offshore Wind Energy	Proposed Technical Requirements Paper	Yes	Natural Resources Canada	The Offshore Renewable Energy Regulations Initiative | Natural Resources Canada (rncanengagenrcan.ca)