# Husky Energy Exploration Drilling Project – Project Description



Prepared for:
Husky Oil Operations Limited

Prepared by:
Stantec Consulting Ltd.
141 Kelsey Drive
St. John's, NL  A1B 0L2
Tel: (709) 576-1458
Fax: (709) 576-2126

**File No: 121413837.250**

**FINAL REPORT**

September 1, 2016

# Table of Contents

**1.0 INTRODUCTION ..... 1**
1.1 Regulatory Context ..... 3
1.2 Proponent Information ..... 4
1.2.1 Offshore Experience ..... 4
1.2.2 Commitment to Health, Safety and the Environment ..... 5
1.2.3 Proponent Contacts ..... 6

**2.0 PROJECT DESCRIPTION ..... 7**
2.1 General Project Overview ..... 7
2.2 Spatial Boundaries ..... 7
2.2.1 Exploration Drilling Project Area ..... 7
2.2.2 Study Area Spatial Boundaries ..... 8
2.3 Local Benefits ..... 8
2.4 Project Components ..... 10
2.4.1 Drilling Platform ..... 10
2.4.1.1 Semi-submersible ..... 10
2.4.1.2 Drillship ..... 11
2.4.1.3 Jack-up Rig ..... 12
2.4.2 Offshore Exploration Wells ..... 12
2.4.3 Logistical Support ..... 12
2.4.3.1 Supply Base ..... 13
2.4.3.2 Offshore Supply Vessels ..... 13
2.4.3.3 Helicopter Support ..... 14
2.5 Project Activities ..... 14
2.5.1 Well Site/Geohazard/Geotechnical Surveys ..... 14
2.5.2 Drilling ..... 15
2.5.2.1 Riserless Drilling ..... 15
2.5.2.2 Riser Drilling ..... 15
2.5.3 Vertical Seismic Profiling ..... 16
2.5.4 Well Testing ..... 17
2.5.5 Decommissioning and Abandonment ..... 17
2.5.6 Offshore Supply Vessel and Helicopter Operations ..... 18
2.6 Project Scheduling ..... 18
2.7 Waste Discharges and Emissions ..... 18
2.7.1 Drilling Waste ..... 20
2.7.1.1 Drilling Mud and Cuttings ..... 20
2.7.1.2 Cement ..... 21
2.7.2 Atmospheric Emissions ..... 21
2.7.3 Other Wastes ..... 22
2.7.4 Hazardous Wastes and Dangerous Goods ..... 23
2.7.5 Noise ..... 23
2.8 Accidental Events and Emergency Response ..... 23

2.9 Jurisdictional Considerations ..... 26
2.10 Lease Ownership and Tenure ..... 26
2.11 Federal Funding ..... 27

**3.0 ENVIRONMENTAL SETTING ..... 28**
3.1 Physical Environment ..... 28
3.1.1 Geology and Topography ..... 28
3.1.2 Climate ..... 28
3.1.3 Ocean Currents ..... 29
3.1.4 Air Quality ..... 30
3.2 Biological Environment ..... 30
3.2.1 Fish, Fish Habitat and Aquatic Species ..... 30
3.2.2 Marine Birds ..... 33
3.2.3 Special Areas ..... 35
3.3 Existing Ocean Use and Infrastructure ..... 37
3.3.1 Commercial and Aboriginal Fisheries ..... 37
3.3.2 Marine Shipping ..... 38
3.3.3 Marine Research ..... 38
3.3.4 Other Offshore Oil and Gas Activity ..... 40
3.3.5 Department of National Defence Operations ..... 42
3.3.6 Additional Ocean Infrastructure ..... 42
3.4 Existing Environmental Studies ..... 44

**4.0 POTENTIAL PROJECT-RELATED ENVIRONMENTAL EFFECTS ..... 45**
4.1 Routine Project Activities ..... 45
4.2 Non-routine Project Activities ..... 47
4.3 Environmental Effects Considerations ..... 49
4.4 Mitigation ..... 51

**5.0 CONSULTATION AND ENGAGEMENT ..... 52**
5.1 Stakeholder and Community Engagement ..... 52
5.2 Engagement with Aboriginal Groups ..... 53

**6.0 REFERENCES ..... 54**
6.1 Personal Communications ..... 54
6.2 Literature Cited ..... 54

## LIST OF APPENDICES

Appendix A Scientific Names

## LIST OF TABLES

Table 2.1 Project Area Corner Coordinates (NAD_1983_UTM_Zone_22N) ..... 8
Table 2.2 Offshore Waste Treatment Guidelines Discharge Limits ..... 19
Table 2.3 Waste Classification ..... 20
Table 2.4 Expiration Dates for ELs Comprising the Designated Project ..... 27
Table 3.1 Fish Species listed under SARA or Assessed by COSEWIC Potentially Occurring in the Study Area ..... 31
Table 3.2 Marine Mammal and Sea Turtle Species listed under SARA or Assessed by COSEWIC Potentially Occurring in the Study Area ..... 33
Table 3.3 Marine Bird Species Potentially Occurring in the Study Area ..... 34
Table 3.4 Ecologically and Biologically Significant Areas within Offshore Newfoundland ..... 35
Table 4.1 Potential Environmental Interactions with Routine Project Activities ..... 45
Table 4.2 Potential Environmental Interactions with Accidents and Malfunctions during Project Activities ..... 47
Table 4.3 Proposed Environmental Components to be Assessed in the Environmental Impact Statement ..... 50
Table 5.1 Stakeholder Concerns and Comments Raised to Date ..... 53

## LIST OF FIGURES

Figure 1-1 Exploration Drilling Project Area and Designated Project Components ..... 2
Figure 2-1 Proposed Study and Project Areas ..... 9
Figure 2-2 Semi-Submersible Drill Rig ..... 11
Figure 2-3 Drillship ..... 11
Figure 2-4 Jack-up Rig ..... 12
Figure 2-5 Typical Offshore Well Schematic ..... 16
Figure 2-6 Location of Oil Spill Models Conducted in the Jeanne d'Arc-Flemish Pass Region to Date ..... 25
Figure 3-1 Special Areas in and Near the Study Area ..... 36
Figure 3-2 High-density Marine Traffic Transit Routes the Study Area ..... 39
Figure 3-3 Newfoundland and Labrador Crab Management Areas ..... 40
Figure 3-4 Grand Banks and Flemish Pass Licence Areas ..... 41
Figure 3-5 Legacy and Shipwreck Sites in Offshore Newfoundland ..... 43

# Abbreviations

| | |
|---|---|
| BOP | blow-out preventer |
| bopd | barrels of oil per day |
| BSF | below sea floor |
| CEAA 2012 | *Canadian Environmental Assessment Act, 2012* |
| CEA Agency | Canadian Environmental Assessment Agency |
| C-NLOPB | Canada-Newfoundland and Labrador Offshore Petroleum Board |
| c/m | centimetres per second |
| CO | carbon monoxide |
| $CO_{2eq}$ | carbon dioxide equivalent |
| COSEWIC | Committee on the Status of Endangered Wildlife in Canada |
| DFO | Fisheries and Oceans Canada |
| DND | Department of National Defence |
| DP | dynamic positioning |
| EA | environmental assessment |
| EBSA | ecologically and biological significant area |
| EEZ | Exclusive Economic Zone |
| EIS | Environmental Impact Statement |
| EL | Exploration Licence |
| EPCMP | Environmental Protection and Compliance Monitoring Plan |
| FFAW-Unifor | Fish Food and Allied Workers-Unifor |
| FPSO | floating, production, storage, and offloading facility |
| GHG | greenhouse gasses |
| HOIMS | Husky Operational Integrity Management System |
| km | kilometre |
| L | litre |
| m | metre |
| $m^2$ | square metre |
| $m^3$ | cubic metre |
| mg/L | milligrams per litre |
| MARPOL | International Convention for the Prevention of Pollution from Ships |
| MODU | mobile offshore drilling unit |
| NAFO | Northwest Atlantic Fisheries Organization |
| NEB | National Energy Board |
| nm | nautical mile |
| $NO_X$ | nitrogen oxides |

| | |
|---|---|
| OSV | offshore supply vessel |
| OWTG | Offshore Waste Treatment Guidelines |
| PD | Project Description |
| PL | Production Licence |
| POB | persons on board |
| ROV | remotely operated vehicle |
| SARA | *Species at Risk Act* |
| SBM | Synthetic-based drilling mud |
| SDL | Significant Discovery Licence |
| TSP | total suspended particulates |
| TVD | total vertical depth |
| UXO | unexploded ordnance |
| VOC | volatile organic compound |
| VSP | vertical seismic profile |
| WBM | water-based drilling mud |
| WREP | White Rose Extension Project |

# Table of Concordance

**Project Description with Prescribed Information for the Description of a Designated Project**

| Regulation Clause | Requirement | PD Section(s) |
|---|---|---|
| **REGULATION SOR/2012-148** | | |
| **1.0 General Information and Contact(s)** | | |
| 1 | The name of the Project | 1 |
| 1 | The nature of the Project | 1, 2 |
| 1 | The proposed location of the Project | 1.0, 2.2 |
| 2 | The proponent's name and contact information and the name and contact information of their primary representative for the purpose of the description of the Project | 1.2.3 |
| 3 | A description of and the results of any consultations undertaken with any jurisdictions and other parties including Aboriginal peoples and the public | 5.0 |
| 4 | Other relevant information, including the environmental assessment and regulatory requirements of other jurisdictions | 2.9, 6 |
| 4.1 | Information concerning any environmental study that is being or has been conducted of the region where the Project is to be carried out. This includes lands that have been subject to a regional study as described in section 73 to 77 of CEAA 2012 | 3.4 |
| **2.0 Project Information** | | |
| 5 | A description of the Project's context and objectives | 1, 2 |
| 6 | The provisions in the schedule to the *Regulations Designating Physical Activities* describing the Project in whole or in part. | 1.1 |
| 7 | A description of the physical works that are related to the Project including their purpose, size and capacity | 2.4 |
| 8 | The anticipated production capacity of the Project and a description of the production processes to be used, the associated infrastructure and any permanent or temporary structures. | 2.4, 2.5 |
| 9 | A description of all activities to be performed in relation to the Project. | 2.5 |
| 10 | A description of any solid, liquid, gaseous or hazardous waste that is likely to be generated during any phase of the Project and of plans to manage those wastes. | 2.7 |
| 11 | A description of the anticipated phases of and the schedule for the Project's construction, operation, decommissioning, and abandonment. | 2.6 |
| **3.0 Project Location Information** | | |
| 12 | A description of the Project's location, including: | |
| 12(a) | Geographic coordinates | 2.2 |

| Regulation Clause | Requirement | PD Section(s) |
|---|---|---|
| 12(b) | Site maps produced at an appropriate scale in order to determine the Project's overall location and the spatial relationship of the Project components | 1, 2 |
| 12(c) | The legal description of land to be used for the Project, including the title, deed or document and any authorization relating to a water lot | 2.10 |
| 12(d) | The Project's proximity to any permanent, seasonal or temporary residences | 1 |
| 12(e) | The Project's proximity to reserves, traditional territories as well as lands and resources currently used for traditional purposes by Aboriginal peoples | 3.3.1 |
| 12(f) | The Project's proximity to any federal lands | 2.9 |
| **4.0 Federal Involvement** | | |
| 13 | A description of any financial support that federal authorities are, or may be, providing to the Project | 2.11 |
| 14 | A description of any federal land that may be used for the purpose of carrying out the Project | 2.9 |
| 15 | Any federal legislative or regulatory requirements that may be applicable including a list of permits, licences or other authorizations that may be required in order to carry out the Project. | 1.1 |
| **5.0 Environmental Effects** | | |
| 16 | A description of the physical and biological setting | 3 |
| 17 (a) | A description of any changes that may be caused, as a result of carrying out the Project, to fish as defined in section 2 of the *Fisheries Act* and fish habitat as defined in subsection 34(1) of that Act | 4 |
| 17(b) | A description of any changes that may be caused, as a result of carrying out the Project to aquatic species, as defined in subsection 2(1) of the *Species at Risk Act* | 4 |
| 17(c) | A description of any changes that may be caused, as a result of carrying out the Project to migratory birds, as defined in subsection 2(1) of the *Migratory Birds Convention Act, 1994* | 4 |
| 18 | A description of any changes to the environment that may occur, as a result of carrying out the Project, on federal lands, in a province other than the province in which the Project is proposed to be carried out or outside of Canada | 4 |
| 19 | Information on the effects on Aboriginal peoples of any changes to the environment that may be caused as a result of carrying out the Project, including effects on health and socio-economic conditions, physical and cultural heritage, the current use of lands and resources for traditional purposes or on any structure, site or thing that is of historical, archaeological, paleontological or architectural significance. | 4 |
| 20 | Summary of the information required under section 1 to 19 | Project Description Summary Document |

| Regulation Clause | Requirement | PD Section(s) |
|---|---|---|
| **Guide to Preparing a Description of a Designated Project under the *CEAA 2012* (July 2012)** | | |
| **1.0 General Information and Contact(s)** | | |
| 1.1 | Describe the nature of the designated Project, and proposed location (2–3 paragraphs; note that additional location details are to be provided in section 3). | 1, 2.3 |
| 1.2 | Provide proponent contact information:<br>(a) Name of the designated Project.<br>(b) Name of the proponent.<br>(c) Address of the proponent.<br>(d) Chief Executive Officer or equivalent (include name, official title, email address and telephone number).<br>(f) Principal contact person for purposes of the Project description (include name, official title, email address and telephone number). | 1 |
| 1.3 | Provide a list of any jurisdictions and other parties including Aboriginal groups and the public that were consulted during the preparation of the Project description. (A description of the result of any consultations undertaken is to be provided in sections 6 and 7). | 5 |
| 1.4 | Provide other relevant information:<br>Provide information on whether the designated Project is subject to the environmental assessment and/or regulatory requirements of another jurisdiction(s). | 1.1, 2.9 |
| 1.5 | Provide information on whether the designated Project will be taking place in a region that has been the subject of a regional environmental study. Proponents are advised to contact the Agency during the preparation of the project description for information regarding any regional environmental studies that may be relevant. | 3.4.3 |
| **2.0 Project Information** | | |
| 2.1 | Provide a general description of the project, including the context and objectives of the project. | 1, 2 |
| 2.2 | Indicate the provisions in the *Regulations Designating Physical Activities* setting out the designated activities that describe the project in whole or in part. | 1.1 |
| 2.3 | Provide a description of the components associated with the proposed project, including: | 2.5 |
| | Physical works associated with the designated project (e.g., large buildings, other structures, such as bridges, culverts, dams, marine transport facilities, mines, pipelines, power plants, railways, roads, and transmission lines) including their purpose, approximate dimensions, and capacity. Include existing structures or related activities that will form part of or are required to accommodate or support the designated project. | 2.5 |
| | Anticipated size or production capacity of the designated project, with reference to thresholds set out in the *Regulations Designating Physical Activities*, including a description of the production processes to be used, the associated infrastructure, and any permanent or temporary structures. | 2.4 |

| Regulation Clause | Requirement | PD Section(s) |
|---|---|---|
| 2.3 | If the designated project or one component of the designated project is an expansion, the percent of increase in size or capacity from the existing project (relative to the thresholds set out in the *Regulations Designating Physical Activities*). | N/A |
| | A description of all activities to be performed in relation to the designated project | 2.5 |
| 2.4 | Provide a description of any solid, liquid, gaseous or hazardous wastes likely to be generated during any phase of the designated project and of plans to manage those wastes, including the following:<br>Sources of atmospheric contaminant emissions during the designated project phases (focusing on criteria air contaminants and greenhouse gases, or other non-criteria contaminants that are of potential concern) and location of emissions.<br>Sources and location of liquid discharges.<br>Types of wastes and plans for their disposal (e.g., landfill, licensed waste management facility, marine waters, or tailings containment facility). | 2.7 |
| 2.5 | Provide a description of the timeframe in which the development is to occur and the key project phases, including the following:<br>Anticipated scheduling, duration and staging of key project phases, including preparation of the site, construction, operation, and decommissioning and abandonment. | 2.6 |
| | Main activities in each phase of the designated project that are expected to be required to carry out the proposed development (e.g., activities during site preparation or construction might include, but are not limited to, land clearing, excavating, grading, de-watering, directional drilling, dredging and disposal of dredged sediments, infilling, and installing structures). | 2.5 |
| **3.0 Project Location** | | |
| 3.1.1 | Coordinates (i.e. longitude/latitude using international standard representation in degrees, minutes, seconds) for the centre of the facility or, for a linear project, provide the beginning and end points | 2.2 |
| 3.1.2 | Site map/plan(s) depicting location of the designated project components and activities. The map/plan(s) should be at an appropriate scale to help determine the relative size of the proposed components and activities | 1, 2 |
| 3.1.3 | Map(s) at an appropriate scale showing the location of the designated project components and activities relative to existing features, including but not limited to: | 1, 2 |
| (a) | Watercourses and waterbodies with names where they are known | 1 |
| (b) | Linear and other transportation components (e.g., airports, ports, railways, roads, electrical power transmission lines and pipelines) | 3.3 |
| (c) | Other features of existing or past land use (e.g., archaeological sites, commercial development, houses, industrial facilities, residential areas and any waterborne structures) | 3.3 |
| (d), 6(b) | Location of Aboriginal groups, settlement land (under a land claim agreement) and, if available, traditional territory | 3.3.1 |

| Regulation Clause | Requirement | PD Section(s) |
|---|---|---|
| (e), 6(c) | Federal lands including, but not limited to National parks, National historic sites, and reserve lands | 2.9 |
| (f) | Nearby communities | 1 |
| (g) 6(a) | Permanent, seasonal or temporary residences | 1 |
| (h) | Fisheries and fishing areas (i.e., Aboriginal, commercial and recreational) | 2.9, 3.3 |
| (i) | Environmentally sensitive areas (e.g., wetlands, and protected areas, including migratory bird sanctuary reserves, marine protected areas, and National Wildlife areas) | 3.2.3 |
| (j) | Provincial and international boundaries | 2.9 |
| 3.1.4 | Photographs of work locations to the extent possible | N/A |
| 3.1.5 | Legal description of land to be used for the designated project, including the title, deed or document and any authorization relating to a water lot. | 1, 2.11 |
| 3.2 | To the extent that is known at this time, describe the ownership and zoning of land and water that may be affected by the project, including the following: | 2.9 |
| 3..2.1 | Zoning designations | 2.9, 2.10 |
| 3.2.2 | Current land ownership, including sub-surface rights | 2.10 |
| 3.2.3 | Any applicable land use, water use (including ground water), resource management or conservation plans within and near the project site. | 2.9, 2.10, 3.2.3 |
| 3.2.4 | Describe whether the designated project is going to require access to, use or occupation of, or the exploration, development and production of lands and resources currently used for traditional purposes by Aboriginal peoples | 4.0 |
| **4.0 Federal Involvement—Financial Support, Lands and Legislative Requirements** | | |
| 4.1 | Describe if there is any proposed or anticipated federal financial support that federal authorities are, or may be, providing to the designated project | 2.11 |
| 4.22 | Describe any federal lands that may be used for the purpose of carrying out the designated project. This is to include any information on any granting of interest in federal land (i.e., easement, right of way, or transfer of ownership) | 2.9 |
| 4.3 | Detail any federal legislative or regulatory requirements that may be applicable, including a list of permits, Licences or other authorizations that may be required to carry out the designated project. | 1.1 |
| **5.0 Environmental Effects** | | |
| 5.1 | A description of the physical and biological setting, including the physical and biological components in the area that may be adversely affected by the project (e.g., air, fish, terrain, vegetation, water, wildlife, including migratory birds, and known habitat use). | 3 |
| 5.2 | A description of any changes that may be caused as a result of carrying out the designated project to: | 4 |
| (a) | Fish and fish habitat, as defined in the *Fisheries Act* | 4 |
| (b) | Aquatic species, as defined in the *Species at Risk Act* | 4 |
| (c) | Migratory birds, as defined in the *Migratory Birds Convention Act, 1994* | 4 |

| Regulation Clause | Requirement | PD Section(s) |
|---|---|---|
| 5.3 | A description of any changes to the environment that may occur, as a result of carrying out the designated project, on federal lands, in a province other than the province in which the project is proposed to be carried out, or outside of Canada | 4 |
| 5.4 | A description of the effects on Aboriginal peoples of any changes to the environment that may be caused as a result of carrying out the designated project, including effects on health and socio-economic conditions, physical and cultural heritage, the current use of lands and resources for traditional purposes, or any structure, site or thing that is of historical, archaeological, paleontological or architectural significance | 4 |
| **6.0 Proponent Engagement and Consultation with Aboriginal Groups** | | |
| 6.1 | A list of Aboriginal groups that may be interested in, or potentially affected by, the designated project, including contact information (location, name, mailing address, email address, and fax and telephone numbers). | 3.3.1 |
| 6.2 | A description of the engagement or consultation activities carried out to date with Aboriginal groups, including: | 5 |
| (a) | Names of Aboriginal groups engaged or consulted to date with regard to the project | 5 |
| (b) | Date(s) each Aboriginal group was engaged or consulted | 5 |
| (c) | Means of engagement or consultation (e.g., community meetings, mail or telephone). | 5 |
| 6.3 | An overview of key comments and concerns expressed by Aboriginal groups identified or engaged to date, including any responses provided to these groups. | 5 |
| 6.4 | A consultation and information-gathering plan that outlines the ongoing and proposed Aboriginal engagement or consultation activities, the general schedule for these activities and the type of information to be collected (or, alternatively, an indication of why such engagement or consultation is not required). | 5 |
| **7.0 Consultation with the Public and Other Parties (other than Aboriginal consultation included above)** | | |
| 7.1 | An overview of key comments and concerns expressed to date by stakeholders and any responses that have been provided. | 5 |
| 7.2 | An overview of any ongoing or proposed stakeholder consultation activities. | 5 |
| 7.3 | A description of any consultations that have occurred with other jurisdictions that have environmental assessment or regulatory decisions to make with respect to the project. | 5 |
| **8.0 Executive Summary** | | |
| | Proponents are to include as part of the project description an executive summary that summarizes the information identified in Sections 1 to 7 of [the] Guide. Under CEAA 2012, the Agency is required to consult the public on a summary of the project description that has to be posted on the Agency's Internet site in both of Canada's official languages as required under the *Official Languages Act*. As a result, in order to be in a position to initiate the screening phase in a timely manner, the executive summary is to be prepared and submitted to the Agency in both English and French. | Project Description Summary Document |

# 1.0 INTRODUCTION

Husky Oil Operations Limited (Husky) is proposing to conduct exploration drilling activities within the area of its existing offshore exploration licences (ELs) on the Grand Banks (Jeanne d'Arc Basin) and the Flemish Pass, and potential future ELs within the Jeanne d'Arc Basin that may be acquired from the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) by Husky (as operator) during the 2016 Call for Bids process. These existing and potential future ELs on the Grand Banks and Flemish Pass are located approximately 350 km east of St. John's, Newfoundland and Labrador, in the Northwest Atlantic Ocean.

The Project is defined as a multi-well exploration drilling program on existing ELs 1121 and 1134 and future ELs to be awarded to Husky (as operator) in November 2016 during the 2016 Call for Bids. Activities associated with exploration drilling on existing and potential new ELs will occur within the Project Area delineated within Figure 1-1. The Project includes up to ten wells to be drilled at any time between 2018 and 2025. This document is a Project Description (PD) submitted to the Canadian Environmental Assessment Agency (CEA Agency) to initiate environmental assessment (EA) under the *Canadian Environmental Assessment Act, 2012* (CEAA 2012). Should an environmental assessment be required, the CEA Agency would set the scope of the Project for assessment.

Exploration and delineation drilling on Husky's other existing ELs (EL 1090R, EL 1122) are not considered in the scope of this Project to be assessed under CEAA 2012 as these activities on these ELs are covered by an existing EA approval (CEAR#07-01-28877) issued by the C-NLOPB and are not subject to CEAA 2012 (refer to Section 1.1 for regulatory context).

This PD is based upon information currently available to Husky at the time of writing. The project activities described herein are standard components of an offshore drilling program; however, not all details surrounding the Project have been finalized, such as drilling platform type, selection of contractors and suppliers, and location of wells. Given timing of the award of ELs through the 2016 Call for Bids process (November 2016), additional clarity on the specific ELs that are proposed for inclusion as part of the Project would be provided to the Agency prior to submission of the Environmental Impact Statement (EIS) should it be determined a federal environmental assessment is required.

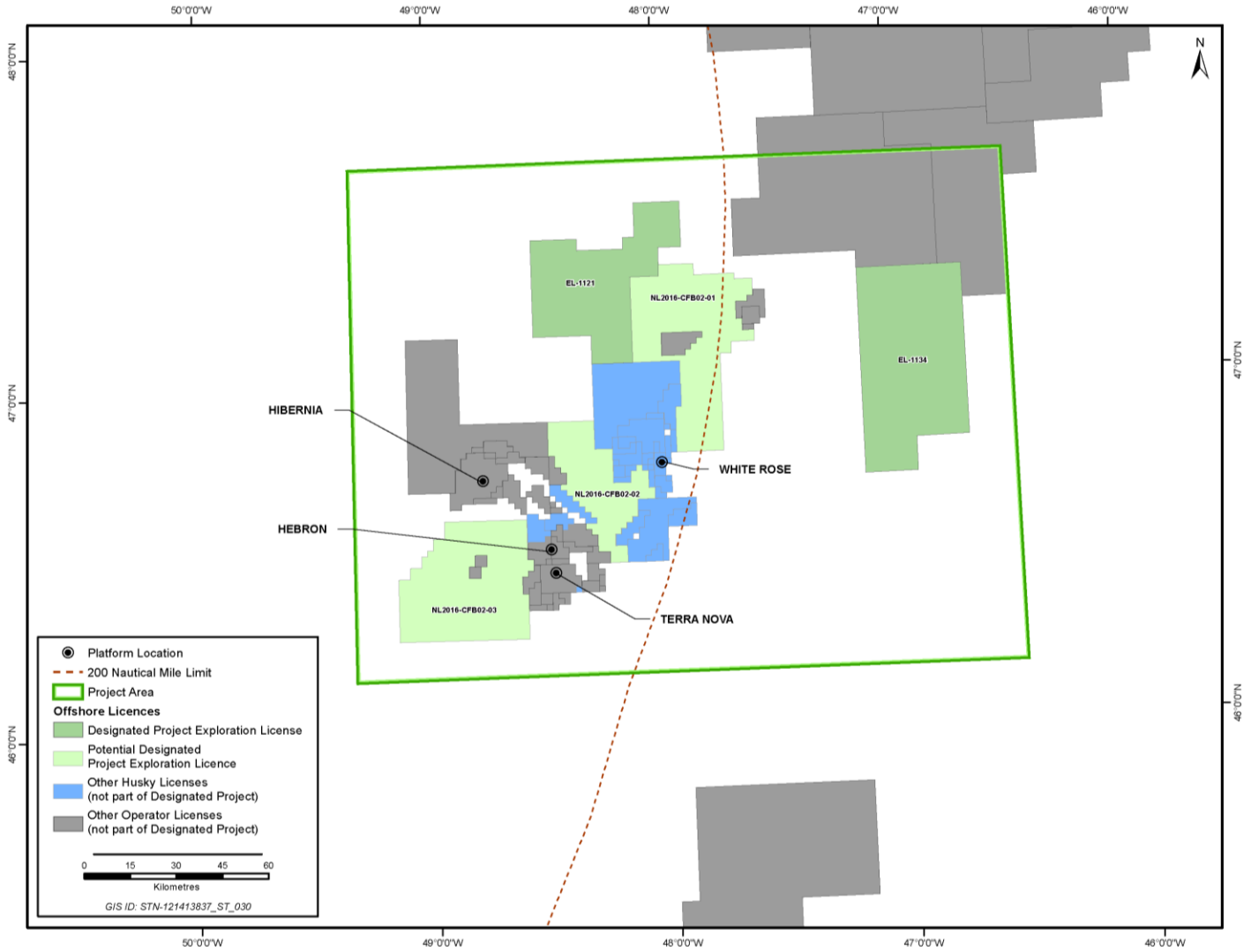



**Figure 1-1 Exploration Drilling Project Area and Designated Project Components**

## 1.1 Regulatory Context

Offshore exploration drilling is a designated activity under CEAA 2012 as stated by section 10 of the *Regulations Designating Physical Activities:*

> *The drilling, testing and abandonment of offshore exploratory wells in the first drilling program in an area set out in one or more exploration licences issued in accordance with the Canada-Newfoundland Atlantic Accord Implementation Act or the Canada-Nova Scotia Petroleum Resources Accord Implementation Act.*

Although previously subject to a C-NLOPB EA process (CEAR#07-01-28877), ELs 1134 and EL 1121 have not had a well drilled during the term of the licence. Therefore, the proposed exploration drilling program will constitute the first drilling program in those ELs (as will also be the case for any new ELs acquired by Husky, as operator, during the 2016 Call for Bid process) and CEAA 2012 will apply.

An EA is also required as part of operations authorizations pursuant to the *Canada-Newfoundland Atlantic Accord Implementation Act*, and the *Canada-Newfoundland and Labrador Atlantic Accord Implementation Newfoundland and Labrador Act* (the Accord Acts) that are granted by the C-NLOPB for the Project.

The C-NLOPB is responsible for regulating activities related to the exploration, development, production, and transportation of oil and gas offshore of Newfoundland and Labrador through permits and approvals. Offshore petroleum activities and the C-NLOPB's decision-making processes are governed by a variety of legislation, regulations, guidelines and memoranda of understanding. Exploration drilling projects require an Operations Authorization under the Accord Acts. Prior to issuing an Operations Authorization, the C-NLOPB requires the following to be submitted:

- an Environmental Assessment Report
- a Canada-Newfoundland and Labrador Benefits Plan
- a Safety Plan
- an Environmental Protection Plan (including a waste management plan)
- Emergency Response and Spill Contingency Plans
- appropriate financial security
- appropriate certificates of fitness for the equipment proposed for use in the activities

Should a federal EA be required, it would be expected an EIS completed to satisfy the CEAA 2012 requirements will also satisfy the C-NLOPB EA requirements. In addition to the requirements for an EA, a Drilling Program Authorization and one (or more) Approvals to Drill a Well are required from the C-NLOPB.

A provincial-level EA under the *Environmental Protection Act* is not anticipated based on the current Project scope.

The Project is subject to various federal legislative and regulatory requirements, including:

- Accord Acts
- *Canada Shipping Act*
- CEAA 2012
- *Canadian Environmental Protection Act, 1999*
- *Fisheries Act*
- *Migratory Birds Convention Act, 1994*
- *Species at Risk Act* (SARA)
- *Navigation Protection Act*

Pending Project design and regulatory review, and an assessment of potential environmental effects, authorizations may be required under the *Fisheries Act* and SARA. A Migratory Bird Handling Permit will likely be required from Environment and Climate Change Canada to permit the salvage of stranded birds on offshore vessels during the Project.

## 1.2 Proponent Information

Husky is a Canadian-based integrated energy company with headquarters in Calgary, Alberta. Through the dedicated efforts of its people, Husky is committed to maximizing returns to its shareholders in an ethical and socially responsible way. Husky is involved in:

- exploration and development of crude oil and natural gas
- production, purchase, transportation, refining, and marketing of crude oil, natural gas and natural gas liquids, and sulfur and
- transportation and marketing of refined products

Atlantic Region operations are managed from the local offices in St. John's, Newfoundland and Labrador, and will be supported using established logistics infrastructure and resources in St John's.

Consistent with the legislative requirements of the Accord Acts, Husky is committed to enhancing the business opportunities for Canada and Newfoundland and Labrador.

### 1.2.1 Offshore Experience

Husky is operator of the White Rose field, located approximately 360 km east-southeast of St. John's, 50 km northeast of the Terra Nova FPSO and 50 km east-northeast of the Hibernia Platform. The White Rose development involves a floating production, storage and offloading (FPSO) facility, with five drill centres (Northern, Central, Southern, North Amethyst, and South White Rose Extension), and subsea flowlines tied-back to the *SeaRose FPSO*. Husky is currently

investigating the development of the White Rose Extension Project, west of the Central Drill Centre, using either a wellhead platform or a drill centre similar to existing drill centres in the White Rose field.

Husky is the operator of several Production Licences (PLs), Significant Discovery Licences (SDLs) and ELs in the Newfoundland and Labrador offshore area, and has conducted exploration in the region since 1982. In addition to the PLs and SDLs, Husky is operator of four ELs, three as the sole interest holder (ELs 1090R, 1121 and 1122) and one in partnership with Suncor Energy (EL 1134). Husky also holds interest in ELs 1112 and 1124, both of which are operated by Statoil Canada Limited. Existing ELs 1121 and 1134 are within the scope of this PD.

To date, Husky has drilled a total of 86 wells. To date, between all operators, there have been 165 exploration wells and 55 delineation wells in the Newfoundland and Labrador offshore.

### 1.2.2 Commitment to Health, Safety and the Environment

Husky is strongly committed to protecting its employees, contractors, general public, assets, and the environment in which they operate. This commitment is clearly communicated in its Health, Safety and Environment Policy. Healthy, safe, secure, reliable, injury- and incident-free operations are key to Husky's success. This commitment requires compliance with applicable laws and regulations, facilities that are designed and operated to a high standard and the systematic identification and management of safety, health, security, and environmental risks.

Husky has developed the Husky Operational Integrity Management System (HOIMS) as a systematic approach towards operational excellence. HOIMS includes 14 fundamental elements that contain well-defined aims and expectations; the elements are:

- Leadership, Commitment and Accountability
- Safe Operations
- Risk Assessment and Management
- Emergency Preparedness
- Reliability and Integrity
- Personnel Competency and Training
- Incident Management
- Environmental Stewardship
- Management of Change
- Information, Documentation and Effective Communication
- Compliance Assurance and Regulatory Advocacy
- Design, Construction, Commissioning, Operating and De-Commissioning
- Contracting Services and Materials
- Performance Assessment and Continuous Improvement

Compliance with HOIMS and regulatory requirements is achieved through the implementation of effective management systems and processes as well as the availability of adequate

resources. The Atlantic Region's management system includes plans for ice management, waste management, oil spill response, and contingency plans for emergency events.

### 1.2.3 Proponent Contacts

Husky's Atlantic Region office is located in St. John's, Newfoundland and Labrador. All communications regarding the EA for this Project should be sent to the following:

David Pinsent
Senior Environmental Advisor
Husky Energy
Atlantic Region
351 Water St. Suite 105
St. John's, NL
A1C 1C2
Phone: (709) 724-3997
Email: David.Pinsent@huskyenergy.com

OR

Don S. Forbes
Vice President, Drilling and Completions
Husky Energy
Atlantic Region
351 Water St. Suite 105
St. John's, NL
A1C 1C2
Phone: (709) 724-3900
Email: Don.S.Forbes@huskyenergy.com

# 2.0 PROJECT DESCRIPTION

## 2.1 General Project Overview

The Project will involve activities associated with exploration drilling within ELs 1134, 1121 and any new ELs acquired by Husky (as operator) within the Project Area, (see Figure 1-1) to the end the respective licence terms. The number of wells to be drilled is contingent upon geophysical surveys, drilling results and whether new ELs are acquired; up to ten wells may be drilled during the Project. Activities associated with a drilling program may include:

- exploration/delineation drilling (using either a semi-submersible mobile offshore drilling unit (MODU), drillship or jack-up rig)
- vertical seismic profiling (VSP), wellsite surveys, well testing, well completions, workovers/data logging and geohazard/environmental surveys and
- decommissioning and abandonment of wells

These activities will be supported by Husky's existing infrastructure (Harvey's Marine Base, offshore support vessels (OSVs), and helicopters). OSVs and helicopters will continue to use established travel routes to and from the Project Area as they have since 2002. Should a federal EA be required, it is proposed that the scope of the Project will be limited to offshore components associated with exploration and delineation drilling. Logistical support from OSVs and helicopters is a shared service among all operators in the Newfoundland offshore. If a different contractor is selected for supply base services over the duration of this Project, all permitting and approvals will be the sole responsibility of the supplier. It is proposed that the scope of the EIS will be limited to OSV and helicopter transit within the Project Area should a federal EA be required.

## 2.2 Spatial Boundaries

### 2.2.1 Exploration Drilling Project Area

The Project Area delineated in Figure 1-1 is intended to encompass ELs 1134 and 1121, as well as leases that are part of the 2016 Call for Bid process that could be acquired by Husky (as operator) as new ELs. The spatial boundary of the Project Area has been delineated to account for all activities related to drilling a well, including offshore OSV and helicopter traffic and vessel traffic associated with geohazard/environmental surveys. The southern boundary is approximately 219 km long; the northern boundary is approximately 213 km long; and each side is approximately 167 km long, creating a total area of approximately 36,050 km$^2$. The corner coordinates of the Project area are provided in Table 2.1.

**Table 2.1 Project Area Corner Coordinates (NAD_1983_UTM_Zone_22N)**

| Corner | Latitude | Longitude |
|---|---|---|
| Northeast | 47 40'0" N, | 46 30'0"W |
| Southeast | 46 10'0" N, | 46 30'0"W |
| Southwest | 46 10'0" N, | 49 20'0"W |
| Northwest | 47 40'0" N, | 49 20'0"W |

There are other existing ELs, PLs, and SDLs in the Project Area, but these are not part of the Designated Project.

### 2.2.2 Study Area Spatial Boundaries

The proposed Study Area (Figure 2-1) for this EA has been determined by oil spill modelling conducted for Husky's White Rose Extension Project (WREP) (Husky Energy 2012). The model boundaries were determined by a worst-case blowout scenario lasting 120 days (http://www.cnlopb.ca/pdfs/whiterose/wrsr.pdf) (see Section 2.8 for details on the spill models conducted in the Study Area to date).

## 2.3 Local Benefits

Consistent with the requirements of the Accord Acts, Husky is committed to enhancing the opportunities for residents of Newfoundland and Labrador and other Canadians to participate in its offshore projects.

Husky maintains a regional office in St. John's, and manages most aspects of its East coast Canada business from St. John's. Husky provides full and fair opportunities to Canadian individuals and businesses, particularly those in Newfoundland and Labrador, to participate in Husky's local activities. Husky supports the principle that first consideration be given to personnel, support, and other services that can be provided in Newfoundland and Labrador, and to goods manufactured in Newfoundland and Labrador, where such goods and services can be delivered at a high standard of health, safety, and environmental competency, be of high quality, and competitive in terms of fair market price. Contractors and sub-contractors that are chosen to work on Husky projects must also apply these principles in their operations.

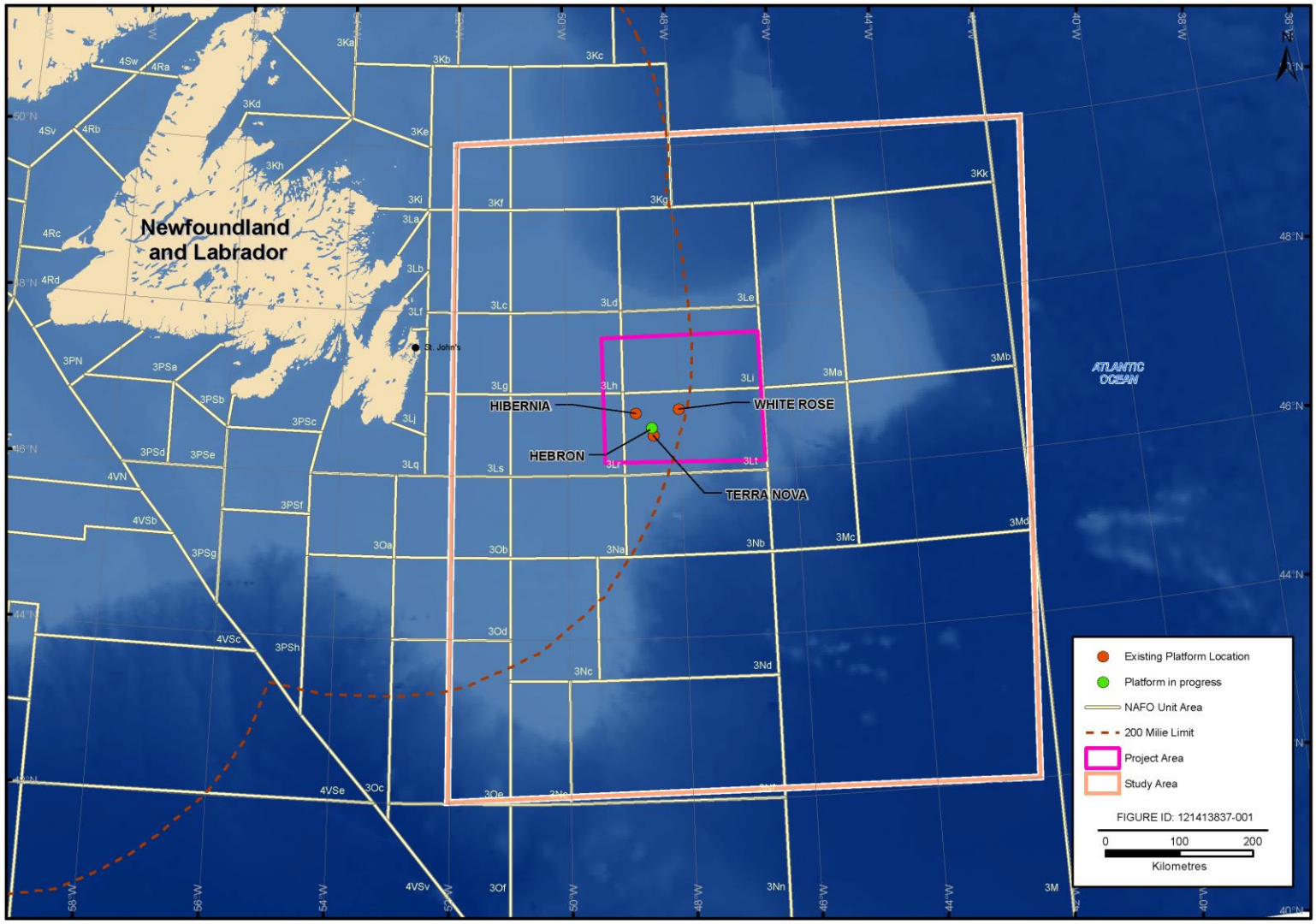



**Figure 2-1 Proposed Study and Project Areas**

# 2.4 Project Components

## 2.4.1 Drilling Platform

A MODU will be used to carry out exploration drilling activities. Three different MODU alternatives are currently being considered:

- semi-submersible
- drillship or
- jack-up rig

The specific MODU to be used for the Project has not yet been selected and will depend on suitability and availability. It is anticipated that the selected MODU will be capable of drilling year-round and be rated to support the potential needs of the Project. Some of the key components of a MODU include:

- dynamic positioning (DP) system, available on some units, used to maintain position while drilling. In addition to monitoring the MODU's position, DP systems also monitor environmental conditions with wind sensors, satellite global positioning system, and gyroscopes
- drilling derrick (housing the drilling equipment)
- maintaining stability through ballast control
- power supplied through diesel generation
- helideck with refueling capabilities
- storage for drilling materials (fuel oil, drilling muds, cement) and equipment (casing)
- storage for subsea equipment (including well control equipment and marine risers)
- waste management facilities including treatment (for offshore disposal) or temporary storage for shipment to shore
- emergency and life-saving equipment, including lifeboats and rafts for emergency evacuation and
- accommodations for up to 200 persons on board (POB), depending on the unit.

Husky establishes a safety zone around all exploration drilling operations. The safety zone typically extends to 500 m beyond the outermost physical footprint of a semi-submersible.

### 2.4.1.1 Semi-submersible

Semi-submersible drill rigs (Figure 2-2) can use either a thruster/DP system to maintain position while drilling in deep water or be moored to the seafloor with anchors while drilling in shallower (up to 1,000 m) water. If moored, the anchor chain length can vary up to a maximum of approximately 1,600 m, depending on water depth and the semi-submersible used for drilling. The drill rig is partially submerged using water-filled pontoons, leaving the deck of the rig floating above water, resulting in a platform that remains stable when the seas are rough. Semi-submersibles are either towed into position or are self-propelled.



Source: C-NLOPB 2008

**Figure 2-2 Semi-Submersible Drill Rig**

### 2.4.1.2 Drillship

Drillships (Figure 2-3) are self-propelled (i.e., do not need to be towed) and use a DP system to remain on location (therefore, no anchors). They are typically used for drilling in deep and ultra-deep water (up to 3,500 m). Onboard equipment typically includes a drilling derrick and moon pool (i.e., opening in the base of the vessel hull that provides direct water access for drilling operations).



Source: C-NLOPB 2008

**Figure 2-3 Drillship**

#### 2.4.1.3 Jack-up Rig

Jack-up rigs (Figure 2-4) have legs that rest on the seafloor while the unit is in operation; therefore, these stationary drilling platforms do not require a DP system. The legs jack down through the hull of the rig, and as the legs are jacked down to the sea floor, the hull is jacked up to the desired distance above the waterline (known as the air gap). A jack-up rig is limited to water depths within the length of its leg. These rigs are typically used in water depths of less than 120 m and cannot move under their own power (Canadian Association of Petroleum Producers 2001). The jack-up rig's hull floats, so it does not need a barge for transportation.



Source: C-NLOPB 2008

**Figure 2-4 Jack-up Rig**

### 2.4.2 Offshore Exploration Wells

Wells are proposed within EL 1134 and EL 1121 and on any new ELs acquired by Husky (as operator) in the 2016 Call for Bids process (see Figure 1-1). The schedule for drilling on each EL will depend on exploration priorities and the term of the licences. If Husky was to acquire new licences in 2016, drilling could occur until licence expiry in 2025. The number of wells to be drilled is contingent upon geophysical/geotechnical surveys, drilling results, and whether new ELs are acquired. Further information regarding the offshore wells and schedule is provided in Section 2.6.

### 2.4.3 Logistical Support

Husky currently maintains logistical support to the *SeaRose FPSO* and to MODUs operating within the White Rose Field. Therefore, the required infrastructure and support services are already in place to support exploration drilling. Key areas of support during operation includes shore-based marine logistics, warehouse services, personnel transportation by helicopter, OSVs, communications, ice management services, marine fuel supply, waste management, medical services, and weather forecasting.

### 2.4.3.1 Supply Base

The current offshore supply base in St. John's Harbour (currently operated by A. Harvey and Company Ltd.) has been providing support to offshore oil and gas activity in the Newfoundland offshore since the early 1990s. These third-party facilities have the required permits and approvals to undertake activities related to offshore oil and gas projects. No additional modifications or changes to the existing supply base will be required. The current facilities are capable of crane support, bulk storage, logistics management services, and fuel and water storage and delivery. The supply base is an ISO 9001:2008 registered company supplying logistic support services to the offshore oil and gas and marine industries. The Marine Base is certified as a compliant port facility under the *Marine Transportation Security Act*. Husky's OSVs take on supplies and offload waste materials and samples at the site. If a different contractor is selected for supply base services during the duration of this Project, all permitting and approvals will be the sole responsibility of the supplier. As a result of the forgoing, it is proposed that the supply base and associated activities not be considered within the scope of the Project should a federal EA be required.

### 2.4.3.2 Offshore Supply Vessels

Husky has a third party contracted to transport supplies (and sometimes personnel) from the supply base to the *SeaRose FPSO* and any MODUs employed. Depending on location of the exploration activity and operating conditions, one to three OSVs may be required. During drilling activities, the OSV responsible for transporting supplies will require one addition trip per week from the supply base to the MODU. One OSV is always on standby with the MODU if it is operating outside the White Rose Field. A third OSV may occasionally be required for ice management.

All OSVs undergo Husky's internal audit process to confirm compliance with Husky, Transport Canada and C-NLOPB requirements. The OSVs are Canadian flagged and adhere to the *Canadian Shipping Act* and its regulations. OSVs will be compliant with the *Eastern Canadian Vessel Traffic Services Zone Regulations* when operating in near shore or harbour areas, and will follow applicable Port Authority requirements when in a port. In addition, the Atlantic Canada Standby Vessel Guidelines assist offshore operators to achieve compliance with the *Newfoundland Offshore Petroleum Drilling and Production Regulations,* which pertain to the suitability and capability of OSVs to act as a standby vessel to supply emergency services (C-NLOPB and Canada-Nova Scotia Offshore Petroleum Board (2015).

OSVs follow established vessel traffic lanes (see Section 3.3.2). Once in the vicinity of the Project Area, the OSV will select the route most appropriate for reaching the destination. OSV transit within the Project Area is considered within the scope of the Project; however, due to the routine and ongoing nature of OSV activity, existing regulatory regime and best management practices, it is proposed that OSV transit outside the Project Area not be considered within the scope of the Project should a federal EA be required.

#### 2.4.3.3 Helicopter Support

Drilling activities will require helicopter support for crew transfer and light supply transport. During drilling activities, it is anticipated that an average of five trips per week from St. John's to the MODU will be required. Helicopter support will also be used in the event that emergency medical evacuation from the MODU is necessary during drilling activities. Helicopter operations fall under the jurisdiction of Transport Canada Civil Aviation. Their policies and procedures, applicable to flight operations, are conducted under Subpart 704 (Commuter Operations), 703 (Air Taxi Operations) including Subpart 702 (Aerial Work) of the *Canadian Aviation Regulations* (CAR) using multi-engine helicopters; these Regulations also describe requirements specific to offshore operations flights (Part VI, Subsection 602.64 to 602.66).

Helicopters file flight plans and follow set flight paths to and between the fields. Helicopter transit within the Project Area is considered to be within the scope of the Project; however, due to the routine and ongoing nature of helicopter activity, existing regulatory regime and best management practices, it is proposed that helicopter transit outside the Project Area not be considered within the Project scope should a federal EA is required.

## 2.5 Project Activities

The following Project activities are associated with the drilling of an exploration well:

- well site/geohazard/geotechnical surveys
- drilling by MODU, drillship, and/or jack-up
- VSP
- well testing, well completions, workovers/data logging
- decommissioning and abandonment of wells
- OSV and helicopter operations

### 2.5.1 Well Site/Geohazard/Geotechnical Surveys

Well site/geohazard/geotechnical surveys are conducted in advance of initiating drilling to identify and avoid unstable areas and hazards or potential hazards (such as seabed instability, obstacles and shallow gas) in the immediate vicinity of proposed well locations. A small air source array is typically used in a restricted area for a 12 to 18 hour period; geohazard surveys may also include sonar. Geotechnical surveys are conducted to determine that substrate is suitable for positioning a jack-up rig as a drilling platform so that drilling activities can be conducted in a manner that does not endanger personnel or the environment. A borehole(s) is typically drilled at each potential well site to collect sediment samples and determine *in situ* sediment conditions.

### 2.5.2 Drilling

Total vertical depth (TVD), drilling string depths, and casing size vary for each well, but an overview of the associated steps for offshore drilling is provided below. As the Project is related to exploratory drilling and associated activities, commercial production of oil from these drill sites will not be considered within the scope of this assessment.

The drilling of an exploration well can be broken into riserless drilling (i.e., an open water operation with no conduit for returns back to the MODU) and riser drilling (i.e., closed loop system with fluid returns back to the MODU). Each well is anticipated to take up to approximately 90 days to drill to TVD.

#### 2.5.2.1 Riserless Drilling

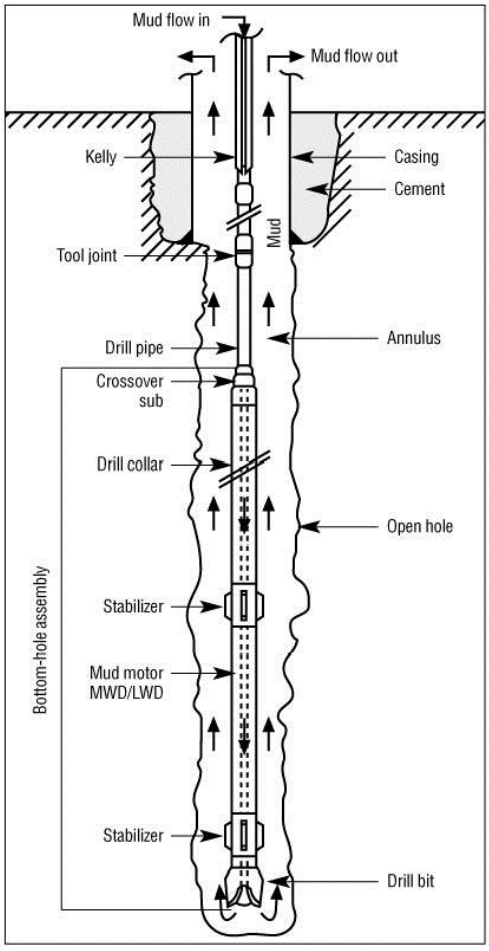
There is no closed loop fluid system in place to return drilling fluid back to the MODU during the drilling of the initial sections of the well. As a result, the associated drilling fluids, excess cement, and cuttings are released directly to the seafloor. The initial well sections (conductor and surface strings) are drilled using water-based drilling mud (WBM) to cool the drill bit as well as transport the cuttings to the seabed. Riserless drilling includes:

- jetting / drilling the conductor section to approximately 100 m below sea floor (BSF)
- inserting the drill string into the conductor pipe and drilling a surface hole section to approximately 800 m BSF. The surface casing is then lowered into the wellbore and cemented in place
- placing a blow-out preventer (BOP) stack at the end of the drilling riser; the BOP is connected to the wellhead via the surface casing, creating a connection between MODU and well via the marine riser system.

#### 2.5.2.2 Riser Drilling

A riser system is required for drilling the additional sections to target depth. Once the BOP stack is installed, the riser system transports the associated drilling fluids and cuttings back to the MODU for further processing. The remaining well sections are drilled to TVD using either a WBM or synthetic-based drilling mud (SBM). Intermediate casing is set at established depths to reinforce the wellbore, based on assessment of geological and pore pressure parameters. The casing is cemented in place at each intermediate section.

Specific section depths and associated casing sizes have not yet been determined and will require review and approval by the C-NLOPB for each well prior to drilling activities. An illustration of a typical well schematic showing the various sections is provided as Figure 2-5. Technical details are provided to the C-NLOPB as part of an Authorization to Drill a Well application submitted in association with the Project.




Source: CAPP 2001

**Figure 2-5 Typical Offshore Well Schematic**

## 2.5.3 Vertical Seismic Profiling

VSP is used to assist in further defining a petroleum resource. The measurements are used to correlate drilled strata with surface seismic data, for obtaining images of higher resolution than surface seismic images, and maybe used for collecting data ahead of the drill bit.

VSP uses a number of different configurations based on the positioning of the associated source and receivers (hydrophones typically placed within the wellbore), including: zero-offset VSP; offset VSP; and walkaway VSP.

VSP uses equipment similar to that used in seismic operations (i.e., a source array); however, the associated size and volume of the array are much smaller than a traditional surface seismic survey. The VSP is focused around a wellbore; therefore sound effects are localized.

### 2.5.4 Well Testing

The flow testing of hydrocarbons is an activity addressed under the C-NLOPB regulations. Wells may be tested by multiple methods to gather additional details on potential reservoirs and to assess the associated commercial potential of a discovery. A decision to proceed or not with a drillstem test on an exploration well may be taken after cuttings, core samples and logs collected during drilling activities are evaluated in conjunction with other considerations. Drillstem testing may not be conducted immediately following drilling activities, but may occur at a later date from a returning MODU or on a subsequent well, as deemed appropriate.

Collecting a fluid sample is a key objective of well testing; drillstem testing generally requires perforating casing that has been set across the hydrocarbon-bearing reservoir. Once the casing and reservoir have been perforated, reservoir fluids are allowed to flow into and up the wellbore to the MODU, which will have a temporary drillstem testing facility installed to handle the flow of any fluids from the wellbore. The hydrocarbons in the reservoir fluids are measured and separated from any produced water. If hydrocarbon flow to surface occurs, it will be flared using a high-efficiency burner to reduce emissions. Once drillstem testing is complete, the associated test string is removed from the well and the well is abandoned in accordance with the Newfoundland Offshore Petroleum Drilling and Production Regulations.

### 2.5.5 Decommissioning and Abandonment

Well abandonment will follow industry standard abandonment procedures and practices in accordance with C-NLOPB regulations. Two possible scenarios exist for either an exploratory well or delineation well; suspension or abandonment. For a suspended well, a suspension cap is installed to protect the wellhead connector. The suspension cap protrudes above the seabed. Proper notification via Notice to Shipping is made to identify the subsea obstruction until it is removed. To abandon a well, all subsea infrastructure is removed upon completion of the well, so there are no protuberances above the seabed.

Well abandonment would include plugging the well with a cement mixture to isolate the wellbore and removing the wellhead and any associated equipment to below the seafloor with mechanical cutters. The plugs are placed at varying depths in the wellbore and the well casing is typically cut just below the surface of the seal. The seabed is inspected using a remotely operated vehicle (ROV) to confirm no equipment or obstructions remain. Husky's preferred method of wellhead severance and recovery is to use a mechanical cutting system, and well head designs make provision for this kind of removal. Wellheads may be removed by the drill rig or by ROV. However, circumstances can arise when mechanical cutting cannot effectively perform the task of wellhead severance. In such instances, shaped charges must be used. If shaped charges must be used then the design objective will be that only the size of charge needed to achieve the task in hand will be used. Furthermore, this method will only be used after the Drilling Superintendent, the C-NLOPB and any of its relevant advisory agencies thoroughly review and approval is granted on a case-by-case basis.

### 2.5.6 Offshore Supply Vessel and Helicopter Operations

OSV and helicopter operations within the Project Area are included within the scope of the Project. It is anticipated that one additional OSV trip per week would be required to support an exploration drilling operation. It is anticipated that five additional helicopter trips per week would be required to support a drilling operation.

Once in the vicinity of the field, the OSV will select the route most appropriate for reaching the destination. OSV transit within the Project Area is considered within the scope of the Project; however, due to the routine and ongoing nature of OSV activity for multiple operators, existing regulatory regime and best management practices, it is proposed that OSV transit outside the Project Area not be considered within the scope of this Project should a federal EA be required.

Helicopters file flight plans and follow set flight paths to and between the fields. Helicopter transit within the Project Area is considered to be within the scope of the Project; however, due to the routine and ongoing nature of helicopter activity for multiple operators, existing regulatory regime and best management practices, it is proposed that helicopter transit outside the Project Area not be considered within the Project scope should a federal EA be required.

## 2.6 Project Scheduling

Project planning is currently ongoing. Stakeholder and regulator engagement has been initiated and will continue throughout the life of the Project as required. Regulatory approvals will be obtained as necessary for each well drilled in the Project Area. Exploration drilling could occur any time within the term of the licences (2018 to 2025); well testing could also occur at any time (dependent upon drilling results). Wells could be decommissioned and abandoned at any time during the temporal scope of a potential EA. The temporal scope of a potential EA accommodates drilling in EL 1121, EL 1134 and any new ELs acquired by Husky (as operator) during the 2016 Call for Bid process for the full term of each licence (period 1 and period 2).

It is currently anticipated that exploration drilling activities would commence in 2018, and potentially continue intermittently, until 2025 (end of second term of any ELs in the Project Area acquired by Husky (as operator) in 2016 as part of the Call for Bid). Drilling activities will not be continuous over the eight years and will be in part determined by rig availability and previous years' results. Drilling may occur year-round if conducted using a semi-submersible or drill ship and during the ice-free season only if using a jack-up rig.

Abandonment or suspension activities will be conducted either following drilling and/or well testing activities.

## 2.7 Waste Discharges and Emissions

Offshore drilling operations generate wastes that will be discharged both offshore and onshore, and air emissions. Wastes discharged offshore will be treated as per the Offshore Waste

Treatment Guidelines (OWTG) (National Energy Board (NEB) et al. 2010) (Table 2.2). All operational discharges during drilling will be in compliance with Husky's Environmental Protection and Compliance Monitoring Plan (EPCMP) for the drilling installation. Any substances, wastes, residues or discharges not identified in the EPCMP are not permitted for discharge. Potential activities that may be associated with exploration drilling and discharges are listed in Table 2.3.

In addition to the OWTG, the International Convention for the Prevention of Pollution from Ships (MARPOL) and the *Canada Shipping Act* and its regulations will apply to offshore waste discharges from ships associated with the Project.

Wastes that will be disposed of onshore (either through treatment, recycling, and/or disposal) will meet the requirements of Part V (Waste Management; Sections 18 to 21) of the Newfoundland and Labrador *Environmental Protection Act* (Chapter E-14.2), and will comply with any applicable municipal by-laws. Onshore waste management and disposal will be handled by a third-party contractor.

### Table 2.2 Offshore Waste Treatment Guidelines Discharge Limits

| Discharge | Limit |
|---|---|
| WBM | no treatment required |
| SBM | 6.9 g/100 g or less oil on wet solids |
| Bilge Water | 15 mg/L |
| Deck Drainage | 15 mg/L |
| Well Treatment Fluids | 30 mg/L |
| Ballast Water | 15 mg/L |
| Cooling Water | biocides are screened through operator's chemical management system |
| Sewage and Food Wastes | macerated to a particle size of 6 mm or less |

### Table 2.3 Waste Classification

| Potential Activities | Potential Discharges/Emissions/Wastes from All Activities |
|---|---|
| Power generation and flaring<br>Normal platform operational activities<br>Operation of seawater systems (cooling, firewater)<br>Waste generated (domestic waste, construction waste, hazardous, sanitary waste)<br>Corrosion protection system (use of corrosion inhibitors or biocides (e.g., hypochlorite) flowlines and pipelines)<br>Chemical/fuel management and storage<br>Operation of helicopters and OSVs within the Project Area<br>Well testing<br>Preparation and storage of drilling fluids<br>Management of drilling fluids and cuttings (reconditioning and discharge) (A)<br>Management and storage of BOP fluids and well treatment fluids<br>Cementing wells<br>Oily water treatment (B)<br>Flare system (C)<br>Ongoing wellsite/geohazard/geotechnical/environmental surveys and VSP<br>Operation of ROVs | • Drilling fluids and cuttings (WBM and non-aqueous fluid) disposal (A)<br>• Cement<br>• Air emissions, including flaring<br>• Lights<br>• Bilge water<br>• Deck drainage/open drains<br>• Potable water, fire water, cooling water, and industrial water<br>• Noise (including underwater noise)<br>• Solid, hazardous, domestic and sanitary waste disposal<br>• Well treatment fluids<br>• Ballast water |

Notes:
(A,B) All operational discharges during drilling will be in compliance with Husky's EPCMP for the drilling installation. Any substances, wastes, residues or discharges not identified in the EPCMP are not permitted for discharge.
(C) Small amounts of fuel gas will be used for flare pilots and may also be used to sweep the flare system piping.

## 2.7.1 Drilling Waste

All operational discharges during drilling will be in compliance with Husky's EPCMP for the drilling installation, which are based on the OWTG (National Energy Board et al. 2010). Any substances, wastes, residues or discharges not identified in the EPCMP are not permitted for discharge.

### 2.7.1.1 Drilling Mud and Cuttings

A combination of WBM and SBM will be used to drill a well. Wastes generated from drilling include drilling mud, drilling fluid and cuttings that retain a portion of the drilling muds.

The drilling mud for a WBM system would typically include additives such as potassium chloride, barite (weighting component), a polymer fluid, an encapsulator, mud loss additives and glycol, suspended in seawater.

Drilling mud is comprised of a carrier liquid containing a solution of suspended solids and dissolved materials. Salt or fresh water is the carrier liquid for WBM, while the carrier fluid for SBM is

a synthetic base fluid; PureDrill IA35-LV is typically used in the Newfoundland and Labrador offshore. Both WBM and SBM are typically composed of barite, bentonite or other clays, silicates, lignite, caustic soda, sodium carbonate/bicarbonate, inorganic salts, surfactants, corrosion inhibitors, lubricants and other additives for unique drilling problems (Thomas 1984; GESAMP 1993).

Until the riser is connected, WBM cuttings are transported to the seabed and disposed in place. Once the riser is connected, SBM are generally used and associated cuttings are transported back to the MODU, where they are separated from the drilling fluid for management and disposal through the use of shale shakers, mud recovery units, and centrifuges. Once treated, cuttings will be discharged to the sea in accordance with Husky's EPCMP. The recovered drilling mud is reconditioned and reused. Once spent, SBM is returned to shore for disposal at an approved facility.

The deposition of drill cuttings has been modelled numerous times within the Project Area, most recently (AMEC 2016) for the WREP EA (Husky 2012). Since these models are directly applicable, they will be applied to this Project. Drill cuttings dispersion has also been modelled in the Flemish Pass portion of the Project Area in an EL (Annieopsquotch) adjacent to Husky's EL 1134 (Jacques Whitford Environment Limited 2002a). The potential effects of drill cuttings are well documented (DeBlois et al. 2014a, 2014b, 2014c; Neff et al. 2014; Paine et al. 2014a, 2014b; Whiteway et al. 2014; International Association of Oil and Gas Producers 2016) and are being monitored by all three production facilities through their environmental effects monitoring programs.

#### 2.7.1.2 Cement

Cement is used to set the drill casing strings in place. Any unused cement produced before the riser is installed is disposed on the seabed in accordance with Husky's EPCMP.

### 2.7.2 Atmospheric Emissions

The primary source of atmospheric emissions for the Project are exhaust emissions from the operation of the MODU and OSVs; well testing could result in potential flaring associated with produced gas. Flaring activities will be kept to a minimum, reflecting only those tests necessary to determine reservoir parameters. These emissions will include the following criteria air contaminants: carbon dioxide; sulphur dioxide; nitrogen oxides; and particulate matter.

Air emissions, including greenhouse gasses (GHG), will result from Project activities, including:

- MODU, OSVs and helicopter traffic (carbon monoxide (CO), nitrogen oxides ($NO_X$), total suspended particulates (TSP), volatile organic compounds (VOCs), GHGs)
- power generation (CO, $NO_X$, TSP, VOCs, sulphur dioxide, GHGs)
- flaring (CO, $NO_X$, VOCs, TSP, GHGs)

These exhaust emissions will comply with the Newfoundland and Labrador *Air Pollution Control Regulations, 2004*, Ambient Air Quality Objectives under *the Canadian Environmental Protection Act*, and any relevant regulations under MARPOL. Potential flaring will occur in accordance with the Drilling and Production Guidelines (C-NLOPB and Canada-Nova Scotia Offshore Petroleum Board 2011).

An estimate of GHG emissions ($CO_2$ equivalent units) will be calculated and compared to regional, sector, provincial, national, and global estimates as applicable, as Project planning progresses. A preliminary estimate indicates that the emissions of GHGs from the operation of the MODU, support vessel, and helicopter during the multi-well exploration drilling could be 63,033 tonnes $CO_{2eq}$/yr (Husky 2012). This estimate is an annual rate based on continuous exploration drilling using Husky's current MODU, and likely represents a worst-case scenario. These emissions represent 0.59% of the total reported provincial GHG emissions (10,600,000 tonnes $CO_{2eq}$) for 2014 and 0.009% of the national emissions (732,000,000 tonnes $CO_{2eq}$) (Environment and Climate Change Canada 2016). The EIS will include emissions calculations for project activities based on the predicted operational schedule, and will also include estimates of GHGs associated with flaring during well testing, if required.

### 2.7.3 Other Wastes

Other discharges associated with the drilling program include bilge water, deck drainage, cooling water, produced water, BOP fluid, grey/black water, and ballast water. All operational discharges during drilling will be in compliance with Husky's EPCMP for the drilling installation. Any substances, wastes, residues or discharges not identified in the EPCMP are not permitted for discharge.

Bilge water and deck drainage will be treated onboard the drilling platform via an oil-water separator. Cooling water associated with the drilling program will be treated. Small amounts of produced water may be created during well testing for hydrocarbons. The amounts are usually small enough that they can be discharged in the flare. Produced gas and fluids will be separated on the rig. Gas, oil and condensate, if present, will be flared on the rig during drillstem testing. The flare boom contains a special burner that atomizes the oil and/or gas and mixes it with air. This allows for relatively complete combustion and minimizes air pollution. Produced water will be burned or transported to shore. No produced water will be discharged during exploratory drilling.

Waste generated in the living quarters and galley include food waste and grey/black water, which will be macerated to a maximum particle size and treated onboard, then discharged into the ocean in accordance with Husky's EPCMP. To ensure the proper functioning of the BOP, located at the wellhead on the seafloor, for safe well operations a regular program of testing the BOP mechanism is required. This will result in the discharge of a mixture of ethylene glycol and water (typically a 30 percent ethylene glycol solution) that is used as the hydraulic fluid to actuate the BOP. All chemical components of BOP fluids are screened and approved in

accordance with Husky's Chemical Screening Procedure. Solid waste garbage (and other non-hazardous waste) is returned to shore for recycling/disposal.

Ballast water provides stability for both the MODU and OSVs and is stored in dedicated tanks. Contamination of ballast tanks by hydrocarbons is therefore unlikely. The MODU will undergo normal ballast tank flushing procedures prior to transiting into Canadian waters as required under Transport Canada's *Ballast Water Control and Management Regulations* under the *Canada Shipping Act*.

### 2.7.4 Hazardous Wastes and Dangerous Goods

Husky will manage its waste materials in accordance with the Waste Management Plan. Hazardous wastes generated during the Project, including any dangerous goods, will be stored on the MODU in designated areas in appropriate containers/containment for transport to shore in compliance with the *Transportation of Dangerous Goods Act* and its regulations. Once onshore, a third-party contractor will collect and dispose of the hazardous waste at an approved facility and in compliance with any federal and provincial regulations and requirements.

### 2.7.5 Noise

Atmospheric and underwater noise is generated from various activities associated with exploration drilling, including the operation of helicopters, OSVs and the drill rig. DP drillships and semi-submersibles are typically noisier than anchored semi-submersibles which, in turn, are noisier than jack-ups (Richardson et al. 1995). Underwater noise from MODU and OSVs in the Newfoundland offshore has been modelled several times in offshore Newfoundland. The most recent and directly applicable model was undertaken by JASCO for the WREP EA, the results of which (JASCO 2012) will be applied to this Project.

## 2.8 Accidental Events and Emergency Response

To properly assess the effects of a drilling program, a range of potential spill scenarios is typically required to delineate the Study Area; these scenarios usually involve blowouts, batch spills and OSV spills. The EA for Husky's Delineation/Exploration Drilling Program 2008-2017 (LGL 2007)) modelled hydrocarbon spills from one location on the Grand Banks and one in deeper water, off the continental shelf. The modeling scenarios for subsea blowouts included two discharge flow rates (4,170 and 20,250 barrels of oil per day (bopd)), two seasons (winter and summer), and two blowout locations ((one in 85 m water depth (47°N; 49.25°W), the other beyond the shelf in 285 m water depth (47.5°N; 49.6°W)).

More recently, the WREP EA (Husky 2012) used worst-case accidental event scenarios in its effects assessment. Subsea and surface blowout rates of 40,476 bopd were the highest modelled in the Newfoundland offshore and for as long as any previous scenario modelled. Trajectories were run for 120 days or until the oil evaporated and dispersed from the surface, or

the average oil concentration on the surface dropped below 1 gram per 25 m². This level of contamination of highly weathered crude is considered innocuous to wildlife (French-McCay 2004).

The spill trajectories were run for a maximum duration of 120 days, since it is the estimated time required to drill a blowout relief well. The boundaries of the WREP Study Area were determined by the oil spill trajectory model. The same spill model results used in the WREP have been proposed for the current drilling Project; therefore, the same Study Area used in the WREP is proposed for this potential EA (Figure 2-1). The hydrocarbon spill modelling scenarios used in the WREP EA are applicable to an exploration drilling EA since they consider the worst-case scenarios for blowout, batch spill and SBM spill models during drilling with a mobile offshore drilling rig. Model results for the WREP EA were reviewed and accepted by regulators.

In addition to highly applicable spill modelling from the WREP EA, several other EAs have used hydrocarbon spill modelling results from previous assessments. The Husky White Rose Development Project New Drill Centre Construction and Operations Program EA 2007-2020 (LGL 2006) used blowout and spill scenarios from three previous Husky EAs, along with analysis from the Terra Nova and Hibernia project EAs. The Statoil EA for exploration drilling in the Flemish Pass (LGL 2008) used hydrocarbon spill models from the Husky Exploration Drilling 2008-2017 EA (LGL 2007) and the Petro-Canada Flemish Pass exploration drilling EA (Jacques Whitford Environment Limited 2002b). Of the total 18 oil spill models conducted in the Jeanne d'Arc and Flemish Pass, 14 have been conducted for exploration drilling (Figure 2-6).

Husky asserts that the size of the study area used in the WREP EA is sufficient to accommodate the area potentially affected by a spill within Husky's ELs (current or acquired through the 2016 Call for Bid process) in the Project Area indicated within Figure 2-1. Therefore, the results of the previously modelled oil spill scenarios are applicable to the Project.

Each of the models conducted for the hydrocarbon spill modelling in the Newfoundland offshore have demonstrated a tendency to disperse in a northeasterly to southeasterly direction, regardless of point of origin. Very few trajectories have ever approached land. The Study Area for the Project encompasses the extent of the area for which there is reliable oceanographic data. It is unlikely that a new spill model originating within the Husky-operated licences (Project Area in Figure 2-1) and run for 120 days, would offer substantially different results.

Whole mud spills of SBMs have also been modelled for the WREP (AMEC 2012b) and for the Hebron project (ExxonMobil Canada Properties 2011), the results of which will be applied to this Project.

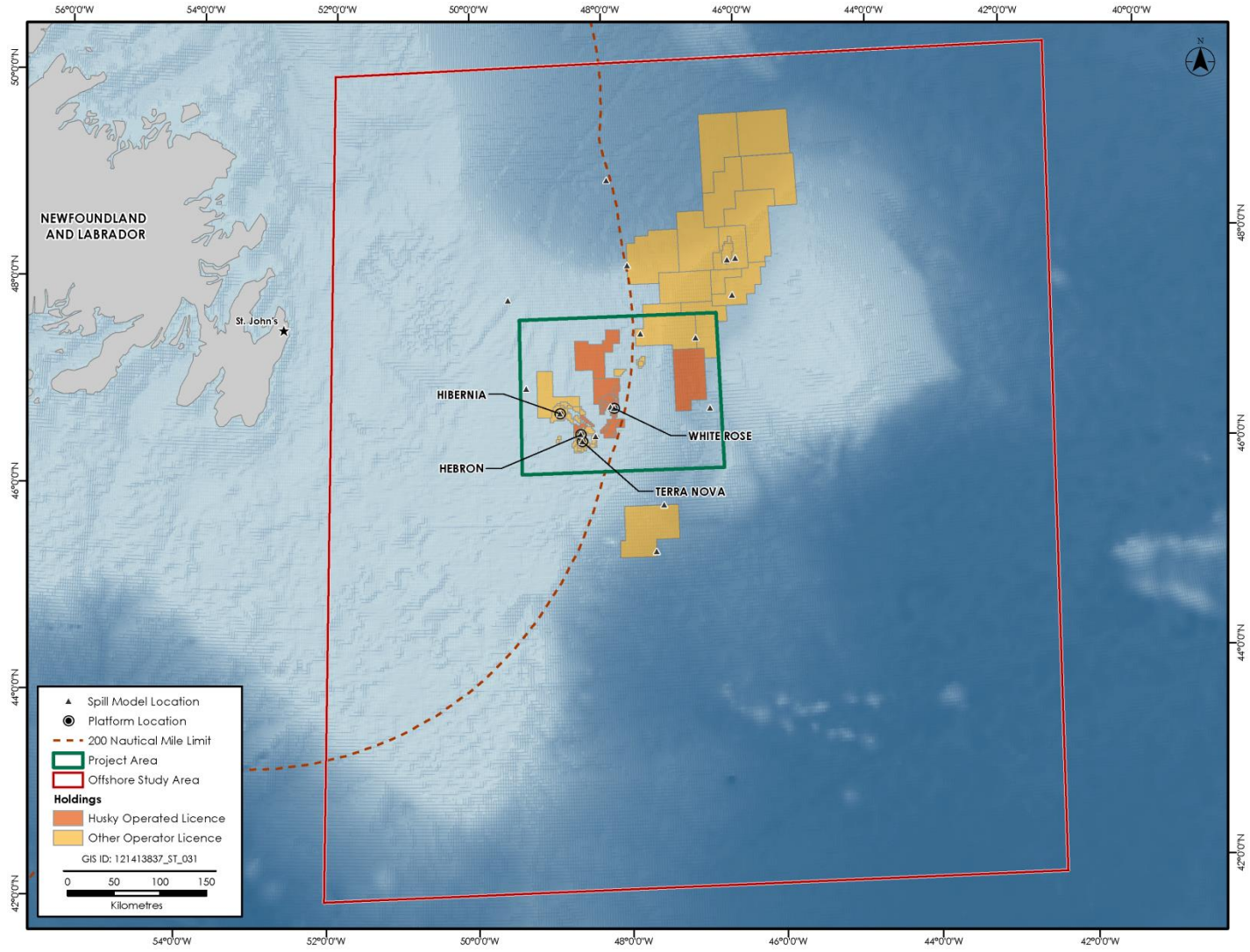



**Figure 2-6 Location of Oil Spill Models Conducted in the Jeanne d'Arc-Flemish Pass Region to Date**

Husky has a robust emergency response program. The Incident Coordination Plan - EC-M-99-X-PR-00003-001 outlines the necessary resources, personnel, logistics and actions to implement a prompt, coordinated and rational response to any emergency. It offers an efficient and balanced approach to dealing with the issues resulting directly from an emergency. In the event of an emergency, personnel are mobilized onshore as soon as possible to provide the necessary support required by an emergency site.

Husky has instituted a spill prevention program with an intention of zero spills into the marine environment. Any unintentional discharge (hydrocarbon or otherwise) is considered to be an oil spill requiring an appropriate level of response potentially including activation of the Oil Spill Response Procedure - East Coast Oil Spill Response Plan (EC-M-99-X-PR-00125-001). This document details the response actions to be taken by Husky in the event of an oil spill while operating offshore Newfoundland and Labrador. These procedures are responsive to regulatory requirements for oil spill contingency planning and will be applied to exploration/delineation drilling activities.

## 2.9 Jurisdictional Considerations

The Project Area is located both within and outside the 200 nautical mile (nm) limit of Canada's Economic Exclusion Zone (EEZ). This area is subject to regulations by both the federal government of Canada, which maintains jurisdiction over fisheries within its EEZ, and jurisdiction over seabed resources on the continental shelf, and by the Northwest Atlantic Fisheries Organization (NAFO) that regulates fisheries in international waters.

The C-NLOPB is responsible on behalf of both federal and provincial governments for petroleum resource management of offshore Newfoundland and Labrador. The C-NLOPB's mandate is guided by the Accord Acts, and responsibilities include the issuance and administration of exploration, development, and production rights; promoting and regulating environmental protection in the offshore region; and approval of Canada-Newfoundland and Labrador benefits and development plans (AMEC 2014).

The Study Area includes the Jeanne d'Arc Basin and Flemish Pass. The C-NLOPB has regulatory jurisdiction over Husky's ELs, SDL's and PLs in both of these offshore areas. Assessment of ongoing drilling beyond 2017 in those areas within the Project Area excluded from the Designated Project will be satisfied through the requirements of the C-NLOPB EA process.

## 2.10 Lease Ownership and Tenure

As one of three oil-producing operators in offshore Newfoundland, Husky has been involved in the region for a number of years and has various licences in the area. The term of the licences comprising the Designated Project is provided in Table 2.4.

**Table 2.4 Expiration Dates for ELs Comprising the Designated Project**

| Licence | Duration |
|---|---|
| EL 1121 | Second Term expires January 15, 2020 |
| EL 1134 | Second Term expires January 15, 2022 |
| NL16-CFB02-01* | Second Term expires November 30, 2025 |
| NL16-CFB02-02* | Second Term expires November 20, 2025 |
| NL16-CFB02-03* | Second Term expires November 30, 2025 |
| * Husky may or may not be successful in acquiring ELs (as operator) on any of these leases during the 2016 Call for Bid process. | |

As noted above in Table 2.4, Husky may be awarded additional ELs within the Project Area issued from the 2016 Call for Bid process. It is expected that exploration drilling on any ELs awarded to Husky (as operator) within the Project Area resulting from the 2016 Call for Bid process would be included in the EA, should it be determined that one is required, and covered within the scope of this PD. Additional information on the specific ELs comprising the Project would be provided to the CEA Agency prior to submission of the EIS should it be determined a federal EA is required.

## 2.11 Federal Funding

No federal funding will be provided to the proponent from any federal authorities in association with the Project.

# 3.0 ENVIRONMENTAL SETTING

## 3.1 Physical Environment

### 3.1.1 Geology and Topography

The geology and topography of the Study Area (see Figure 2-1) are highly variable. Mesozoic rocks comprise the majority of the Study Area as a result of rifting and heating of the continental crust and lithosphere. The settling of the rocks after these events has formed complex basins, which have been advantageous for hydrocarbon creation and storage (Bell and Campbell 1990, in AMEC 2014).

Water depths on the Grand Banks average 75 m, and extend out to the 200 m contour. The shelf break off the outer Grand Banks begins at approximately 240 m below sea level, as it descends into the Flemish Pass. Husky's White Rose development is located in the northeast sector of the Grand Banks and is located in a water depth of approximately 120 m. In the immediate area, the bottom relief is relatively featureless, but steep slopes occur to the north and east at the edge of the Grand Banks.

The Flemish Pass is a mid-slope basin that is bordered by the Grand Banks and the Flemish Cap, with depths ranging between 1,000 and 1,500 m (Suncor Energy 2013; AMEC 2014). The Flemish Pass lies above a graben that was created as a result of rifting in the North Atlantic, with thin Paleogene and Miocene sediments overlying a Mesozoic sequence (Grant 1972, in Jacques Whitford Environment Limited (JWEL) 2002a; Kennard et al. 1990, in JWEL 2002a).

The surficial geology of the Study Area ranges from fine grain sand, mud, and clay, to coarse boulders and bedrock. Surficial sediments in the Flemish Pass are predominantly mud and silt, where water depths exceed 900 m. The floor of the Flemish Pass is receiving little sediment, as it is swept away primarily by the deep slope portion of the Labrador Current (Morin and Pereira 1987, in JWEL 2002a).

### 3.1.2 Climate

Eastern offshore Newfoundland has a climate that is characteristic of many marine environments, with typically cooler summers and warmer winters with increased precipitation compared to continental climates (JWEL 2002a; LGL Limited 2008; Suncor Energy 2013). The climate can be harsh and dynamic due to the intersection of high and low-pressure systems, with the Flemish Pass affected by approximately eight low-pressure systems per month (Oceans Ltd 2001, in JWEL 2002a). Eastern offshore Newfoundland typically has intense mid-latitude low-pressure systems in the fall and winter, tropical storm systems in the late summer and into the fall, and sea ice and icebergs during the winter and spring (Husky 2012). Intense winter storms occur frequently and have winds from the southwest, west, or northwest. The highest waves usually occur in January and February (Husky 2012).

In spring, icebergs are a common occurrence within the Study Area, including the Flemish Pass, although highly variable in abundance (Oceans 2001). Icebergs originate from the glaciers in Greenland and Ellesmere Island, and drift south with the Labrador Current.

In winter, spring, and fall, the dominant winds in the area are westerly and in summer, southwesterly, with winds being more intense in the winter months than summer (JWEL 2002a). Winter storms are more intense and frequent than those in the summer. Hurricane season in the North Atlantic is typically from June to November, with storms reaching offshore Newfoundland at lower intensities than their southern origins. The associated winds can reach storm and gale force winds, and sometimes attain hurricane force (LGL Limited 2008).

Precipitation in the Study Area is highest in January and lowest in July. Rainfall is most likely in autumn, with moderate to heavy rainfall occurring most frequently from September to January. Snow is most likely to occur in January through March, while moderate to heavy snowfall is most likely to occur in January and February. Fog frequently occurs in the offshore area, with the foggiest period occurring between May and July. In July, visibility is often reduced to less than 1 km (ExxonMobil Canada Properties 2009, in Husky 2012).

### 3.1.3 Ocean Currents

The Study Area is located within an open ocean environment with water circulation influenced primarily by the Labrador Current, which carries sub-polar waters from the Arctic, southeast along the margins on the continental shelf, and both inshore and offshore Newfoundland and Labrador. The offshore component of the Labrador Current flows through both the Grand Banks and the Flemish Pass, and averages between 21 to 28 cm/s (Gregory 2004, in AMEC 2014).

Near the tail of the Grand Banks, the Labrador Current comes into contact with the Continental Slope and follows it northeast around Flemish Cap. In this area, it also meets the Labrador Current flowing south. The entire area of the southeastern Grand Banks is a massive mixing area between two water masses with very different temperature and salinity characteristics.

White Rose is located inshore of the Labrador Current where, most of the time, the flow is weak, with variable mean flows, compared to the strength of the two major current systems in the vicinity. At times, the variability in the mixing and interactions created by these two major current systems can have an effect on the current flow at White Rose.

The general circulation and mean currents on the Grand Banks are well understood from geostrophic calculations, drifter data, current modelling, and direct measurements. The variability is becoming more understood as the quantity of data collected at White Rose increases.

### 3.1.4 Air Quality

Air quality within the Study Area is anticipated to be good, with only occasional exposure to exhaust products from OSV traffic, helicopters, and existing offshore oil production facilities at White Rose, Terra Nova, and Hibernia. The Jeanne d'Arc Basin also receives long-range contaminants from the northeastern seaboard and industrial mid-west of the United States (ExxonMobil Canada Properties 2011, in Husky 2012).

## 3.2 Biological Environment

Offshore Newfoundland and Labrador supports a wide variety of marine species and biological diversity. Extensive biology survey work has been conducted by government, academia and industry within the Study Area. Scientific names of species that occur within the Project and Study Areas are provided as Appendix A.

### 3.2.1 Fish, Fish Habitat and Aquatic Species

A variety of fish species occur in offshore Newfoundland over a depth range of approximately 700 m along the slope of the Grand Banks and the Flemish Pass (JWEL 2002a; AMEC 2014). Currently, the major source of commercial species abundance data within the offshore Newfoundland region is determined by Fisheries and Oceans Canada (DFO) surveys, inside the 200 nm limit and North Atlantic Fisheries Organization surveys outside the 200 nm limit. These surveys, along with both domestic and international commercial fish landings can be indicative of the most abundant species within the Study Area.

Commercially important fish species that exist within the Study Area include Atlantic and Greenland halibut, yellowtail and witch flounder, roughhead and roundnose grenadier, redfish, skate, capelin, and mackerel (JWEL 2002a; Suncor Energy 2013; AMEC 2014). There are also NAFO quotas for white hake (in 3NO) and squid (NAFO Subareas 3+4) (NAFO 2015).

American plaice and Atlantic cod were historically abundant within the Study Area, but have become uncommon and the moratoria on commercial fishing of these species remain. Other species under moratoria include redfish (in 3LN) and witch flounder (in 3NO). Common non-commercial fish species within the Study Area include sculpin species, Arctic cod, sand lance, and alligatorfish (Husky 2012).

Species that have been listed under the *Species at Risk Act* (SARA) and assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) that could occur within the Study Area are listed in Table 3.1.

## Table 3.1 Fish Species listed under SARA or Assessed by COSEWIC Potentially Occurring in the Study Area

| Common Name | SARA* | COSEWIC* |
|---|---|---|
| White shark (Atlantic population) | Schedule 1 Endangered | Endangered |
| Northern wolffish | Schedule 1 Threatened | Threatened |
| Spotted wolffish | Schedule 1 Threatened | Threatened |
| Atlantic wolffish | Schedule 1 Special Concern | Special Concern |
| Atlantic bluefin tuna (Grand Banks of Newfoundland only) | No Status | Endangered |
| Atlantic cod (Newfoundland and Labrador Population) | No Status | Endangered |
| Cusk | No Status | Endangered |
| Porbeagle shark | No Status | Endangered |
| Roundnose grenadier | No Status | Endangered |
| Winter skate (Eastern Scotian Shelf – Newfoundland population)) | No Status | Endangered |
| Acadian redfish (Atlantic population) | No Status | Threatened |
| American eel | No Status | Threatened |
| American plaice (Newfoundland and Labrador population) | No Status | Threatened |
| Atlantic salmon (Southern Population) | No Status | Threatened |
| Deepwater redfish (Northern population) | No Status | Threatened |
| Shortfin mako shark (Atlantic population) | No Status | Threatened |
| White hake (Atlantic and Northern Gulf of St. Lawrence population) | No Status | Threatened |
| Basking shark (Atlantic population) | No Status | Special Concern |
| Blue shark (Atlantic population) | No Status | Special Concern |
| Roughhead grenadier | No Status | Special Concern |
| Spiny dogfish (Atlantic population) | No Status | Special Concern |
| Thorny skate | No Status | Special Concern |
| *As of COSEWIC November 2015 meeting and review of SARA Registry (http://www.sararegistry.gc.ca/sar/index/default_e.cfm) | | |

The Study Area is known to support a range of benthic species, including various species of anemones, clams, polychaete worms, crabs, hydroids, and corals (Husky 2012). Benthic invertebrate species that are commercially important include rock crab, sea scallop, cockle, surf clam, snow crab, and northern shrimp (Suncor Energy 2013). Epibenthic invertebrate species collected during White Rose environmental effects monitoring programs included snow crab, Iceland scallop, toad crab, and various species of echinoderms and sponges. Commercial fish surveys during the environmental effects monitoring programs found northern shrimp to be the most abundant epibenthic species, followed by sea urchin and sand dollar (Husky 2009, in Husky 2012). Samples in the Flemish Pass have found marine worms, such as polychaetes to be the most abundant benthic species within that area. Clams have also been collected in the Flemish Pass between depths of 895 m and 1,500 m (Imperial Oil, 1976, in JWEL 2002a).

Deepwater corals and sponges located within the Study Area include stony corals, black wire and gorgonian corals, soft corals, sea pens, and sponges. These organisms help increase habitat complexity, and provide habitat to a variety of juvenile fish and invertebrate species. The slopes of the Flemish Cap are important for sea pens, large gorgonians (also along the northern Flemish Pass) and black corals (Knudby et al. 2013, in AMEC 2014). The Flemish Cap and Flemish Pass are also important for sponges (LGL Limited 2008; NAFO 2011, in AMEC 2014). NAFO has established protected areas for corals and sponges (see Section 3.2.3) that prohibit bottom trawling (NAFO 2011).

Approximately 20 species of marine mammals are known to occur within the Study Area, and include whales, dolphins, porpoises, and seals. Many mammal species occur seasonally to feed in the area, primarily occurring near shelf breaks where ocean productivity is highest. This includes areas on the shelf edge of the Grand Banks where it descends into the Flemish Pass. While some species like humpbacks and minke whales may occur year round, whales are in their highest numbers during summer and fall (Husky 2012). If pack ice conditions are heavy, harp seals and hooded seals may occur within the Study Area, as the ice provides important overwintering and whelping area for the species (DFO 2000, in AMEC 2014).

Two species of sea turtles, the leatherback turtle and the Atlantic loggerhead turtle have been documented in the Study Area during the summer and fall months.

Marine mammal and sea turtle species at risk that may occur within the Study Area are listed in Table 3.2.

**Table 3.2 Marine Mammal and Sea Turtle Species listed under SARA or Assessed by COSEWIC Potentially Occurring in the Study Area**

| Common Name | SARA | COSEWIC |
|---|---|---|
| Blue whale (Atlantic population) | Schedule 1 Endangered | Endangered |
| North Atlantic right whale | Schedule 1 Endangered | Endangered |
| Fin whale (Atlantic population) | Schedule 1 Special Concern | Special Concern |
| Sowerby's beaked whale | Schedule 1 Special Concern | Special Concern |
| Harbour Porpoise (Northwest Atlantic Population) | Schedule 2 Threatened | Special Concern |
| Leatherback sea turtle (Atlantic population) | Schedule 1 Endangered | Endangered |
| Loggerhead sea turtle | No Status | Endangered |
| Killer whale (Northwest Atlantic-Eastern Arctic population) | No Status | Special Concern |
| Northern bottlenose whale (Davis Strait-Baffin Bay-Labrador Sea population population) | No Status | Special Concern |
| *As of COSEWIC November 2015 meeting and review of SARA Registry (http://www.sararegistry.gc.ca/sar/index/default_e.cfm) | | |

### 3.2.2 Marine Birds

The Grand Banks and Flemish Pass provide important habitat for millions of marine birds, with over 60 species reported. Approximately 19 of these species are pelagic and could occur in the Project Area. Such species include gannets, phalaropes, gulls, petrels, alcids, and shearwaters, (AMEC 2014). While there are a large proportion of pelagic seabirds that are resident in the Study Area year-round, summer brings many migratory birds to the Study Area to forage and breed. The peak seabird density is typically from July to September, with the highest densities occurring on the shelf edges where upwelling and nutrients are most abundant (JWEL 2002a; Lock et al. 1994, in LGL Limited 2008). Seabirds are least abundant during fall months, as species leave to migrate south for the winter (Fifield et al. 2009, in AMEC 2014).

Marine birds that have been sighted and are known to occur within the Study Area are listed in Table 3.3.

## Table 3.3 Marine Bird Species Potentially Occurring in the Study Area

| Family | Species |
|---|---|
| ***Procellariidae*** | Northern Fulmar |
| | Greater Shearwater |
| | Sooty Shearwater |
| | Manx Shearwater |
| ***Hydrobatidae*** | Leach's Storm-Petrel |
| | Wilson's Storm-Petrel |
| ***Sulidae*** | Northern Gannet |
| ***Alcidae*** | Dovekie |
| | Common Murre |
| | Thick-billed Murre |
| | Razorbill |
| | Atlantic Puffin |
| ***Laridae*** | Black-legged Kittiwake |
| | Ivory Gull |
| | Herring Gull |
| | Iceland Gull |
| | Lesser Black-backed Gull |
| | Glaucous Gull |
| | Great Black-backed Gull |
| | Roseate Tern |
| | Arctic Tern |
| ***Phalaropdinae*** | Red Phalarope |
| | Red-necked Phalarope |
| ***Stercorariidae*** | Great Skua |
| | South Polar Skua |
| | Pomarine Jaeger |
| | Parasitic Jaeger |
| | Long-tailed Jaeger |
| Source: modified from AMEC 2014 | |

The only at-risk marine bird species that may occur near the Project is the Ivory Gull (a SARA-listed species).

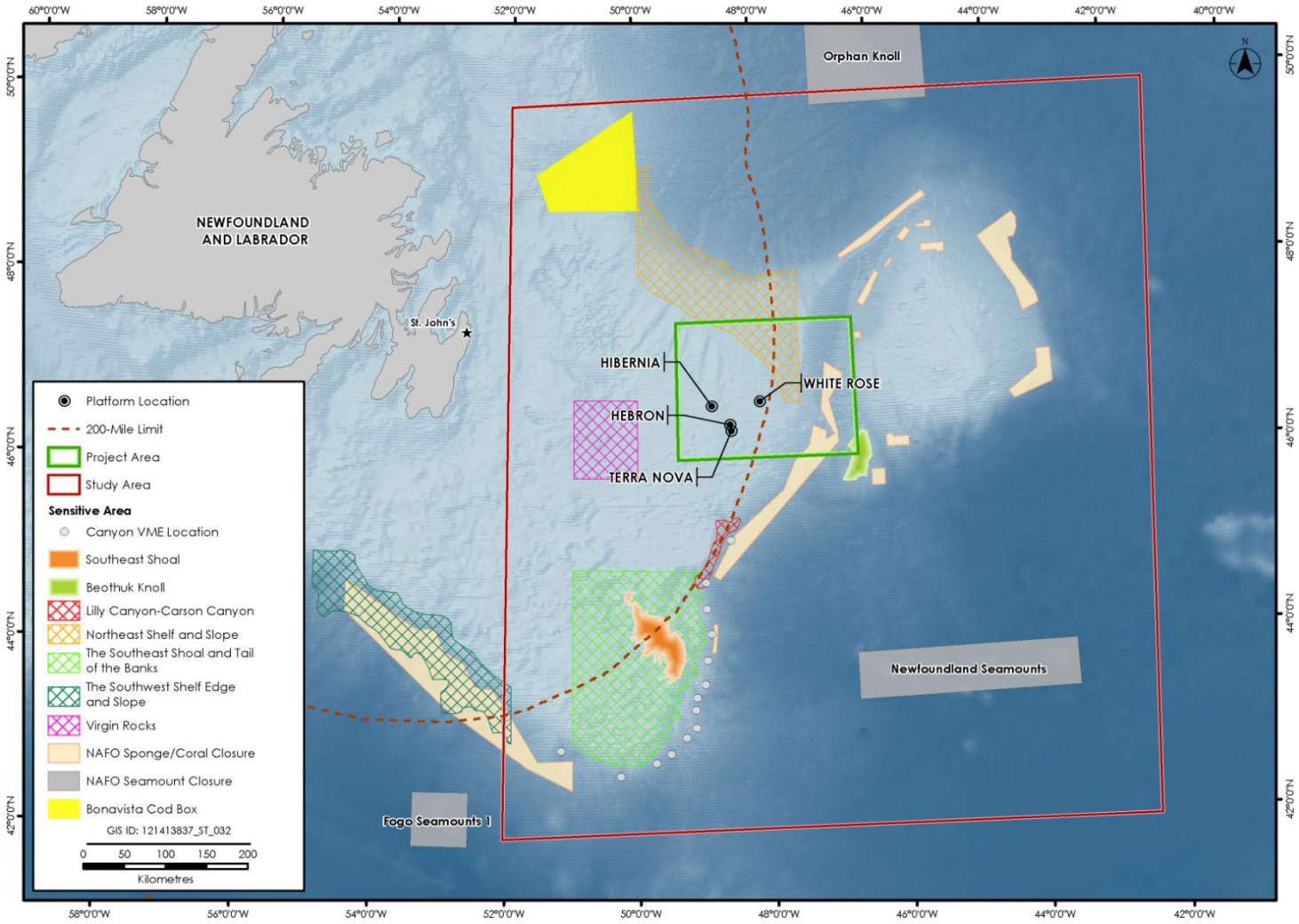
### 3.2.3 Special Areas

DFO has identified Ecologically and Biologically Significant Areas (EBSAs) within offshore Newfoundland (DFO 2004) (Table 3.4; Figure 3-1), but there are no designated Marine Protected Areas within the Study Area.

**Table 3.4 Ecologically and Biologically Significant Areas within Offshore Newfoundland**

| EBSA | Purpose/Rationale |
|---|---|
| The Southeast Shoal and Tail of the Banks EBSA | • Only sandy offshore shoal in the Placentia Bay-Grand Banks Large Ocean Management Area<br>• Only known offshore spawning site for capelin<br>• Single nursery area of entire yellowtail flounder stock<br>• Contains highest benthic biomass on the Grand Banks<br>• Contains relict populations of blue mussel, wedge clam, and capelin associated with beach habitat |
| Southwest Shelf Edge and Slope EBSA | • Supports northernmost population of haddock in the Northwest Atlantic, which spawns along the southwest slope<br>• Important spawning area for redfish species<br>• Greatest diversity of groundfish on the Grand Banks<br>• Highest density of pelagic seabirds feeding in the area |
| The Northeast Shelf and Slope EBSA | • Contains two important coral areas at Tobin's Point and Funk Island Spur (Canadian Parks and Wilderness Society (CPAWS) 2009)<br>• Spring aggregations of spotted wolffish<br>• High spring concentrations of Greenland halibut and marine mammals such as harp seals and pilot whales |
| Lily Canyon-Carson Canyon EBSA | • High proportion of Iceland scallop known to occur<br>• Year-round aggregations of marine mammals for feeding and overwintering (CPAWS 2009) |
| The Virgin Rocks EBSA | • Known to attract aggregations of capelin and marine birds<br>• Support for breeding of Atlantic cod, American plaice, and yellowtail flounder |

The locations of a number of NAFO-identified Vulnerable Marine Ecosystems are also illustrated in Figure 3-1. NAFO has designated several canyons along the edge of the continental shelf, seamounts, and knolls in offshore Newfoundland and Labrador (NAFO 2008). NAFO also has designated areas that are closed to shrimp trawling in areas of the Grand Banks and Flemish Pass (Figure 3-1). These areas are designated to protect the habitat of deepwater corals (e.g., large gorgonians, black corals) and sponges (NAFO 2011).




Source: adapted from Husky Energy 2012; updated with data from NAFO 2015.

**Figure 3-1 Special Areas in and Near the Study Area**

## 3.3 Existing Ocean Use and Infrastructure

The Study Area has a number of users, including fishers, marine shipping, marine research, other oil and gas operations, and Department of National Defence (DND).

### 3.3.1 Commercial and Aboriginal Fisheries

Two regulatory jurisdictions related to marine fish and fisheries exist within the Study Area. The Government of Canada has jurisdiction over commercial fishing activities for sedentary and non-sedentary species within its 200 nm EEZ. Canada also has jurisdiction for sedentary species and commercial fisheries up to the extent of the defined continental shelf. Beyond the EEZ, NAFO has jurisdiction over commercial fisheries for non-sedentary species, and to designate protected areas.

For management purposes, the Northwest Atlantic Ocean is divided into a series of NAFO divisions, subdivisions, and unit areas (refer to Figure 2-1) that are used to regulate and assess fishing activity throughout eastern Canada. The Project Area is within NAFO Area 3L. The proposed Study Area is within NAFO Areas 3KLMNO.

Currently, the Miawpukek First Nation, Qalipu Mi'kmaq First Nation Band, Nunatukavut Community Council, Innu Nation, and the Nunatsiavut Government hold communal commercial fishing licences within the Study Area, including within NAFO Area 3L (D. Ball, pers. comm.). These licences are issued under *Aboriginal Communal Fishing Licences Regulations* of the *Fisheries Act*. Although the licences are issued, the Aboriginal groups may not execute these fisheries. For example, groundfish is still under moratoria (cod, haddock, redfish, American plaice, witch founder and grenadier), while other licences in 3L are traded for licences off Labrador. There are no food, social and ceremonial fisheries in 3L. The only food, social and ceremonial fishery in Newfoundland and Labrador is executed by Miawpukek First Nation in Conne River; it is a multi-species coastal fishery (D. Ball, pers. comm.). The closet Aboriginal reserve to the Project is Conne River, approximately 900 km west of the Project Area.

Key fisheries for the NAFO Division 3L are snow crab and shrimp. Other commercial fish species that occur in the offshore area include surf clam, cockles, capelin, Atlantic halibut, Greenland halibut (turbot), yellowtail flounder, large pelagic species such as swordfish, and various tunas and sharks. The peak harvesting months in the offshore area are April to September.

The majority of commercial fish harvesting occurs along the slope of the continental shelf, and along the slope of the Flemish Cap, where upwelling creates a productive marine environment (LGL Limited 2008). The domestic 3L fishery consists mainly of snow crab, northern shrimp, and other benthic invertebrates, and is confined to shallower waters along the edges of the Grand Banks and Flemish Cap. The main foreign fisheries in 3L consist of Greenland halibut and roughhead grenadier, which are found in deeper waters of the Flemish Pass, outside the 200 nm limit (JWEL 2002a).

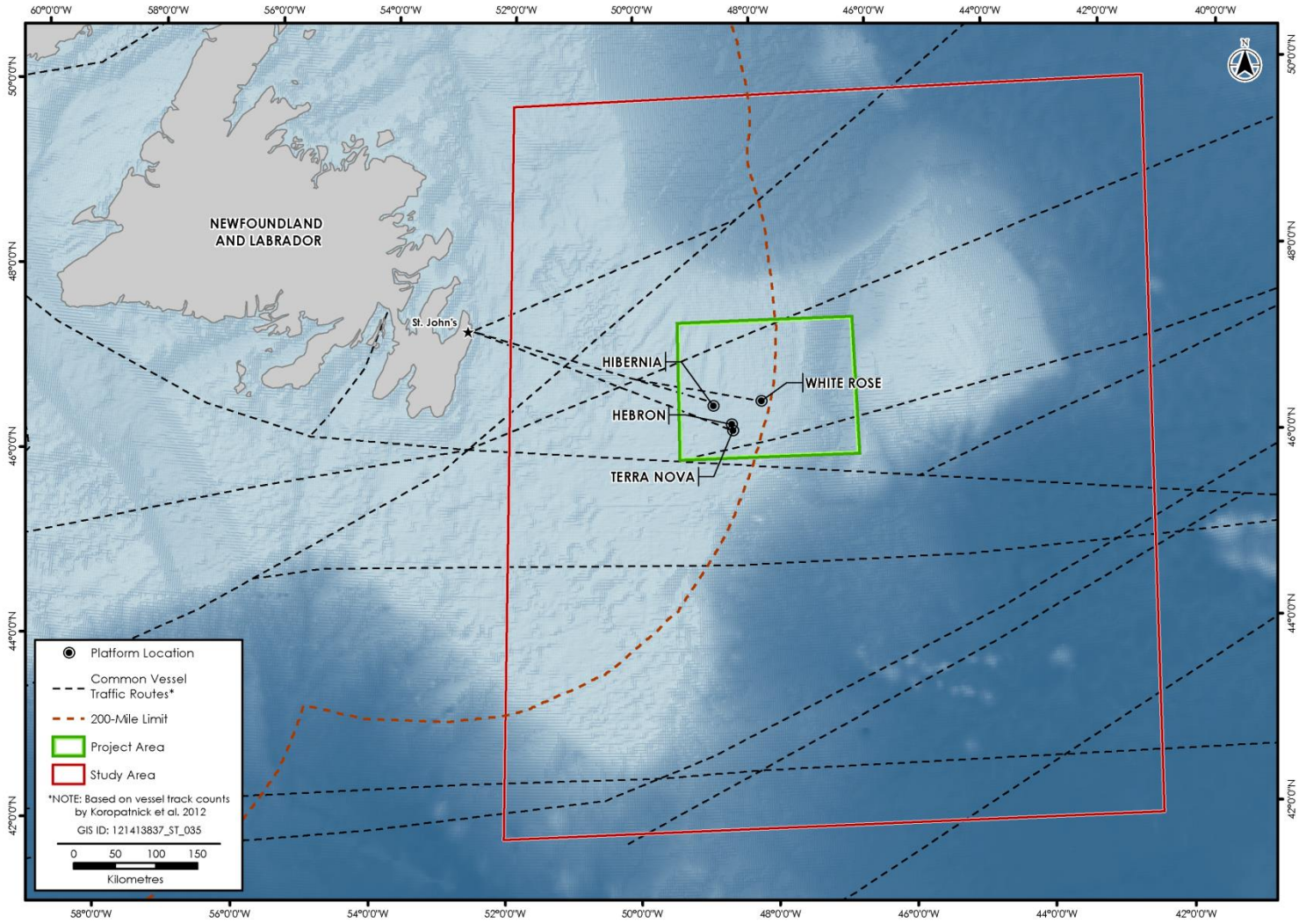
### 3.3.2 Marine Shipping

The eastern region of Newfoundland has approximately 17 ports that are used for both domestic and international shipping activities. Nine of which include both domestic and international shipping; four ports are used exclusively for international shipping; and four are used for domestic shipping (AMEC 2014). In 2011, the eastern region of Newfoundland included approximately 698 international shipping movements, handling 16,654 t of total tonnage. In the same year, domestic shipping included 3,044 movements, handling 27,248 t of total tonnage (Statistics Canada No Date a; Statistics Canada No Date b). Harbours are regulated under federal jurisdiction of the federal *Fishing and Recreational Harbours Act*. DFO, through the Canadian Coast Guard, provides communications and traffic management services in certain Canadian ports. International shipping lanes transit through the Study Area and corners of the Project Area. The highest density traffic lanes are illustrated in Figure 3-2.

### 3.3.3 Marine Research

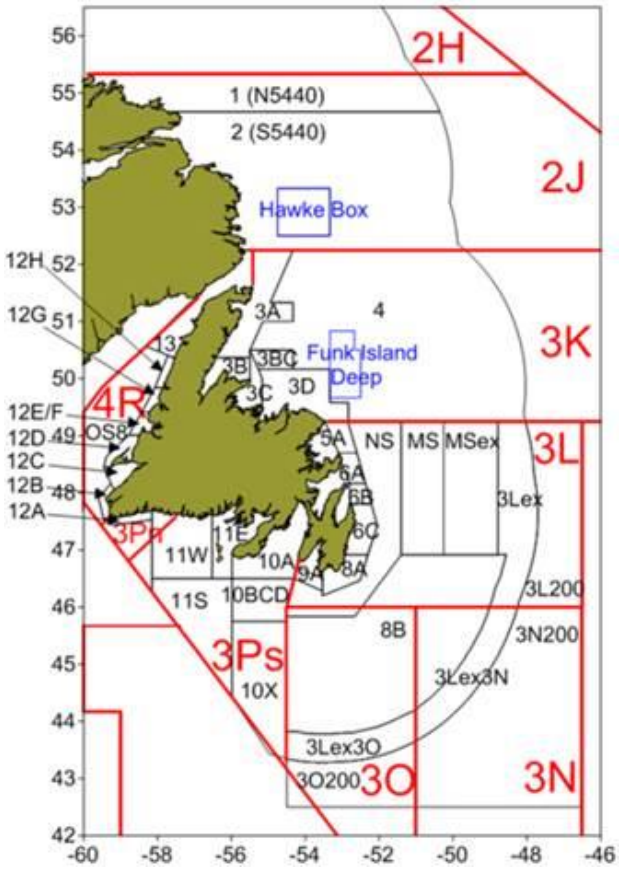
Fish, Food and Allied Workers (FFAW)-Unifor conducts annual industry-DFO collaborative post-season trap surveys for snow crab in NAFO Divisions 2J3KLOPs4R after the commercial snow crab fishery has closed. Each year approximately 1,500 stations are sampled in all Crab Management Areas (Figure 3-3). The survey covers a broad range of the Grand Banks, including areas near offshore installations and established vessel traffic lanes. OSVs deviate from routine course while those stations are being surveyed (DFO 2016).

DFO conducts annual research studies, such as the Atlantic Zone Monitoring Program and the RAPID Climate Change Program Study throughout NAFO divisions within Canada's 200 nm EEZ. Research activities include bottom trawl surveys to collect information for managing and monitoring marine resources in the offshore Newfoundland and Labrador region. Parts of the Study Area overlap with DFO research surveys in 3K, 3L, 3N and/or 3O. The 3LNO spring survey is typically conducted in May to June, while the fall survey is typically conducted from early October to mid-December (Husky 2012).




Source: Koropatnick et al. 2012, data files provided by S. Coffen-Smout, DFO, Dartmouth, NS.

**Figure 3-2 High-density Marine Traffic Transit Routes the Study Area**




Source: DFO 2016
Note: Black lines indicate Crab Management Areas; blue boxes indicate trawling and gillnetting closures.

**Figure 3-3 Newfoundland and Labrador Crab Management Areas**

### 3.3.4 Other Offshore Oil and Gas Activity

Offshore oil and gas production activities have been occurring off the coast of Newfoundland and Labrador for approximately 20 years; exploration has occurred for a much longer period. There are currently three producing fields within the Jeanne d'Arc Basin: Hibernia (Hibernia Management and Development Company Limited), Terra Nova (Suncor Energy Inc.), and White Rose (Husky Energy Inc.). Hebron (ExxonMobil Canada Properties), the newest production field, is set to begin production in 2017.

In addition to production operations, oil and gas exploration is very active in the Newfoundland offshore. The C-NLOPB moved into a scheduled land tenure system in 2013, dividing offshore Newfoundland and Labrador into eight regions. As of March 31, 2015, there were 27 ELs, 54 SDLs, and 11 PLs in the offshore area (C-NLOPB 2015). Within the Study Area, Husky holds three ELs (1090R, 1121, and 1122) in the Jeanne d'Arc Basin, and one EL (1134) in the Flemish Pass. These licences are bordered by other ELs, SDLs, and PLs owned by other operators (Figure 3-4).

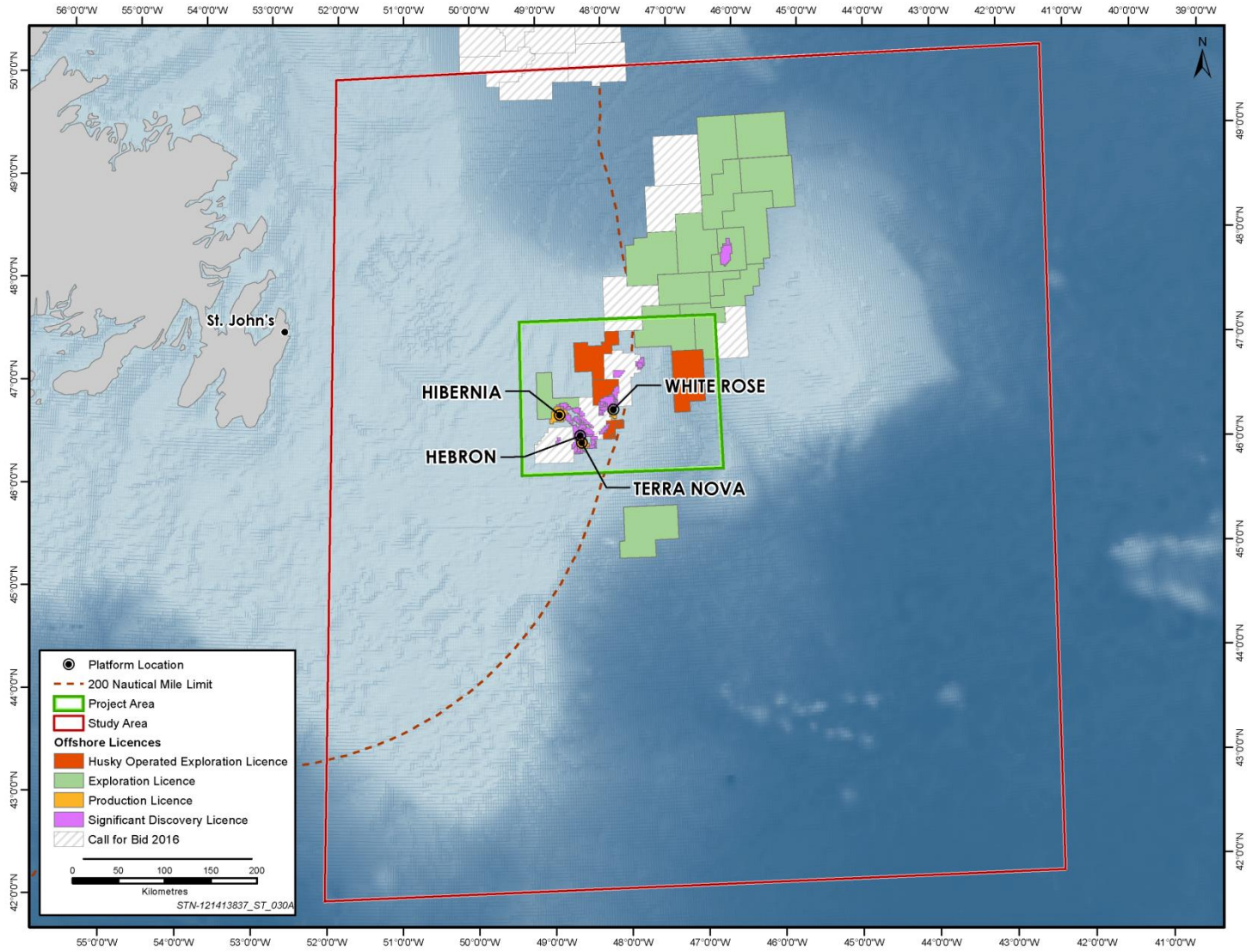



**Figure 3-4 Grand Banks and Flemish Pass Licence Areas**

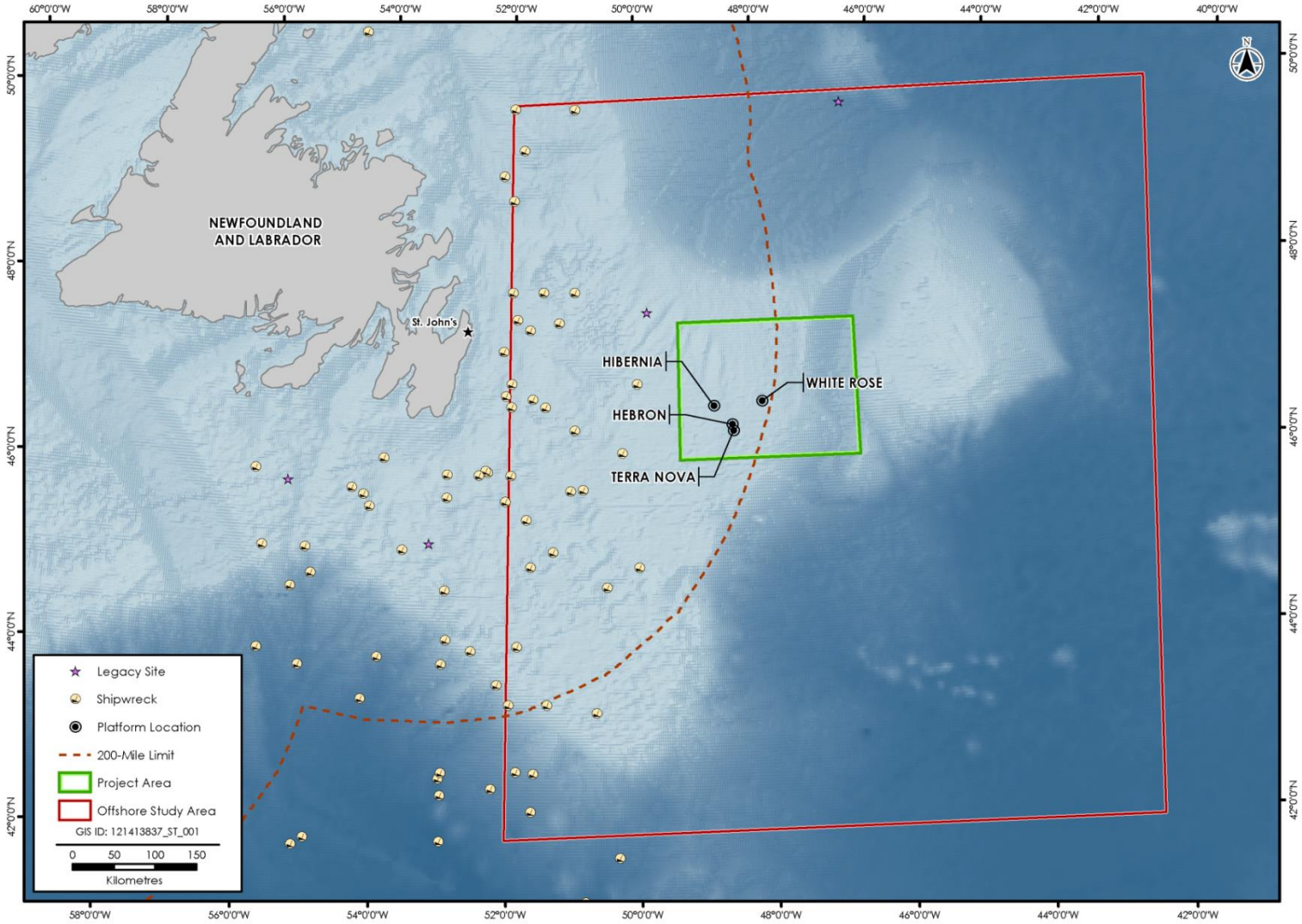
### 3.3.5 Department of National Defence Operations

The DND is responsible for overseeing national security, including the defence and protection of Canada's marine jurisdiction. In order to meet this mandate, the Royal Canadian Navy and Air Force conduct routine surveillance operations throughout Atlantic Canadian waters which may include aircraft or marine patrols within the Study Area. Military vessels sometimes support DFO with research operations or conducting fishery patrols (AMEC 2014).

In the past, many sites across Canada have been used for military training and weapons testing by DND. Legacy sites exist across Canada's coastline where unexploded ordnance (UXO) may still remain, and there are 1,100 known UXO sites that exist off Canada's east coast (AMEC 2014). There are 32 shipwrecks and two legacy sites within the Study Area, there are none within the Project Area (Figure 3-5).

### 3.3.6 Additional Ocean Infrastructure

Both active and inactive marine subsea cables are known to occur within the Study Area. These cables are laid across the seabed between two land-based substations to carry telecommunications between geographic regions (AMEC 2014). The majority of these cables span the Atlantic Ocean, connecting North America to the United Kingdom and Europe. There is the potential for more marine cables to be constructed within the Study Area over the life of the Project.




Source: DND 2015

**Figure 3-5 Legacy and Shipwreck Sites in Offshore Newfoundland**

## 3.4 Existing Environmental Studies

Environmental assessment of Newfoundland offshore oil and gas activities started approximately 35 years ago. Husky alone has conducted six EAs of drilling activities. Key environmental studies, relevant to this EA include:

- Eastern Newfoundland Strategic Environmental Assessment (AMEC 2014)
- White Rose Extension Project Environmental Assessment (Husky 2012)
- Environmental Assessment of StatoilHydro Canada Ltd. Exploration and Appraisal/ Delineation Drilling Program for Offshore Newfoundland, 2008-2016 (LGL 2008)
- Husky Delineation/Exploration Drilling Program for Jeanne d'Arc Basin Area, 2008-2017, Environmental Assessment (LGL 2007)
- Husky White Rose Development Project: New Drill Centre Construction & Operations Program Environmental Assessment (LGL 2006)
- Husky Lewis Hill Prospect Exploration Drilling Program Environmental Assessment (LGL 2003)
- White Rose Oilfield Comprehensive Study (Husky Oil 2000)
- Suncor Energy's Eastern Newfoundland Offshore Area 2D/3D/4D Seismic Program, 2014-2024 (Suncor Energy 2013)
- Hebron Project Comprehensive Study Report (ExxonMobil Canada Properties 2011)
- Orphan Basin Exploration Drilling Program Environmental Assessment (LGL 2005)
- Environmental Assessment of Exploration Drilling in Annieopsquotch (EL 1052), Bonnawinkie (EL 1056) and Gambo (EL 1048) Leases (JWEL 2002b)
- Flemish Pass Drilling Environmental Assessment (JWEL 2002a)

The information from the above reports and other relevant studies will be reviewed and referenced as part of the EIS. While none of the lands have been subject to a regional study as described in section 73 to 77 of CEAA 2012, the C-NLOPB has conducted a Strategic Environmental Assessment (AMEC 2014). Sufficient data are available to characterize the existing environment in the Project and Study Areas, and no new field work is proposed to support the EIS.

# 4.0 POTENTIAL PROJECT-RELATED ENVIRONMENTAL EFFECTS

## 4.1 Routine Project Activities

The following are potential interactions with the environment resulting from Routine Project activities:

- installation and presence of physical structures (e.g., wellheads, MODU)
- underwater noise from VSP survey, helicopters, OSVs, and drilling activities
- lights and flare and
- drilling waste discharge (muds, cuttings) and atmospheric emissions (including flaring during testing)

Under CEAA 2012, the PD must describe potential changes to fish and fish habitat, aquatic species, and migratory birds that may be caused as a result of carrying out the Project. The PD must also provide information on the effects of any potential environmental changes to federal or trans-boundary lands, as well as on Aboriginal peoples.

An overview of the potential environmental interactions with routine Project activities may result in changes to the environmental components identified in CEAA 2012 are provided in Table 4.1.

**Table 4.1 Potential Environmental Interactions with Routine Project Activities**

| Environmental Component of Concern | Relevant Section of CEAA 2012 | Potential Environmental Interactions |
|---|---|---|
| Fish, Fish Habitat, and Aquatic Species | 5(1)(a)(i)<br>5(1)(a)(ii) | Routine Project activities may result in changes affecting fish, fish habitat, aquatic species as defined under SARA, marine mammals, and other aquatic species including the following interactions with the environment:<br>• sensory disturbance to aquatic species from underwater noise emissions associated with drilling and VSP activities<br>• localized degradation and disturbance to the benthic environment (including benthic species) due to seabed deposition at drill site(s) (i.e., drill mud/cuttings, cement) including smothering and mortality of benthic species<br>• localized effects on marine water quality due to discharges to the ocean (e.g., waste water, drill mud/cuttings)<br>• potential injury or mortality to marine mammal(s) from OSV collisions |
| Migratory Birds | 5(1)(a)(iii) | Routine Project activities may result in changes affecting migratory birds, as defined under the *Migratory Birds Convention Act, 1994*, due to the following interactions with the environment:<br>• attraction of migratory birds to the lighting (including flares) and discharges (e.g., food wastes)<br>• mortality or stranding of migratory birds |

| Environmental Component of Concern | Relevant Section of CEAA 2012 | Potential Environmental Interactions |
|---|---|---|
| Project Activities Occurring on Federal Lands | 5(1)(b)(i) | Routine Project activities may result in changes to the environment that would occur in federal waters as a result of the Project Area being located within Canada's EEZ and thus within federal waters under the jurisdiction of the Government of Canada. These potential effects occurring in federal waters are described within this table. |
| Transboundary Issues | 5(1)(b)(ii) | Routine Project activities will result in emissions of GHGs. |
| Health and Socio-Economic Conditions for Aboriginal and Non-Aboriginal People | 5(1)(c)(i)<br>5(2)(b)(i) | Routine Project activities may result in the following changes to the environment that may affect commercial fishing activities, including those carried out under communal commercial licences in and around the Project Area:<br>• establishment of a safety zone, as required by the C-NLOPB, and associated spatial and temporal restrictions on commercial fish harvesting activity<br>• The Project is also expected to have economic benefits, including economic and contracting opportunities<br>• Routine Project activities are not expected to result in any changes to the environment that would have an effect on the health conditions of Aboriginal or non-Aboriginal peoples |
| Physical and Cultural Heritage, or Resources of Historical, Archaeological, Paleontological, or Architectural Significance | 5(1)(c)(ii)<br>5(1)(c)(iv)<br>5(2)(b)(ii)<br>5(2)(b)(iii) | Given the location of the Project offshore, routine Project activities are not anticipated to result in any changes to the environment that would have an effect on physical and cultural heritage areas or resources. Information gathered during 3D seismic surveys, geotechnical and geohazard surveys, and pre-drill ROV site surveys in the Project Area will confirm the absence of cultural heritage resources on the seabed before any seabed disturbance takes place. |
| Current Use of Lands and Resources for Traditional Purposes by Aboriginal Groups | 5(1)(c)(iii) | There are a number of communal commercial licences issued for fishing zones within NAFO Area 3L.<br>Routine Project activities may result in the following changes to the environment that may affect commercial fishing activities, including those carried out under communal commercial licences in and around the Project Area:<br>• establishment of a safety zone, as required by the C-NLOPB, and associated spatial and temporal restrictions on commercial fish harvesting activity<br>• The Project is also expected to have economic benefits, including economic and contracting opportunities |

| Environmental Component of Concern | Relevant Section of CEAA 2012 | Potential Environmental Interactions |
|---|---|---|
| Other Changes to the Environment Directly Related or Necessarily Incidental to a Federal Authority's Exercise of a Power or Performance of a Duty or Function in Support of the Project | 5(2)(a)<br>5(1)(b)(i) | Routine Project activities authorized by the C-NLOPB have the potential to result in directly related or necessarily incidental changes to the atmospheric environment due to the following interactions with the environment:<br>• release of air emissions<br>• generation of noise |

## 4.2 Non-routine Project Activities

In addition to assessment of environmental effects from routine Project activities, environmental effects from non-routine Project activities such as accidents and malfunctions have also been considered (Table 4.2). Potential accidental events that can occur during exploration drilling include blowouts (uncontrolled release of hydrocarbons during drilling), platform and OSV leaks, as well as spills and releases (e.g., hydraulic fluid, drilling mud, and diesel). Collectively, these accidental releases are referred to as "spills".

**Table 4.2 Potential Environmental Interactions with Accidents and Malfunctions during Project Activities**

| Environmental Component of Concern | Relevant Section of CEAA 2012 | Potential Environmental Interactions |
|---|---|---|
| Fish, Fish Habitat, and Aquatic Species | 5(1)(a)(i)<br>5(1)(a)(ii) | An accidental spill or release during Project activities could result in changes to fish, fish habitat, aquatic species as defined in SARA, marine mammals, and other aquatic species, including:<br>• reduced availability and quality of habitat<br>• degradation and reduction in marine water quality<br>• injury, mortality and/or reduced health for fish and other aquatic species |
| Migratory Birds | 5(1)(a)(iii) | An accidental spill or release during Project activities could result in changes to migratory birds, as defined under the *Migratory Birds Convention Act, 1994*, including injury, mortality, and/or reduced health for migratory bird species. |

| Environmental Component of Concern | Relevant Section of CEAA 2012 | Potential Environmental Interactions |
|---|---|---|
| Project Activities Occurring on Federal Lands | 5(1)(b)(i) | An accidental spill or release during Project activities could potentially result in changes to the environment that would occur in federal waters as a result of the Project Area being located within Canada's EEZ and thus within federal waters under the jurisdiction of the Government of Canada. These potential effects occurring in federal waters are described within this table. |
| Transboundary Issues | 5(1)(b)(ii) | An accidental spill may result in transboundary effects outside of Newfoundland and Labrador or Canadian offshore areas. In particular, a spill may enter international waters, which fall outside the Canadian EEZ. Spill-related effects in international waters could include adverse effects to birds, fish, fish habitat, and commercial fisheries. |
| Health and Socio-Economic Conditions for Aboriginal and Non-Aboriginal People | 5(1)(c)(i)<br>5(2)(b)(i) | An accidental spill or release during Project activities could result in the following changes to the environment that may have an effect on commercial fisheries, including Aboriginal communal fishing licences:<br>• contamination-related closure of commercial fishing areas, and associated restrictions on commercial fish harvesting activity<br>• reduced catchability associated with damage to fishing gear (e.g., fouling)<br>• changes in population size and health of individuals among commercial fish species, and associated loss of income through reduced catch value |
| Physical and Cultural Heritage, or Resources of Historical, Archaeological, Paleontological, or Architectural Significance | 5(1)(c)(ii)<br>5(1)(c)(iv)<br>5(2)(b)(ii)<br>5(2)(b)(iii) | Given the location of the Project offshore, non-routine Project activities are not expected to result in changes to resources of Historical, Archeological, Paleontological, or Architectural significance. Information gathered during 3D seismic surveys, geotechnical and geohazard surveys, and pre-drill ROV site surveys in the Project Area will confirm the absence of cultural heritage resources on the seabed before any seabed disturbance takes place. |
| Current Use of Lands and Resources for Traditional Purposes | 5(1)(c)(iii) | There are a number of communal commercial licences issued for fishing zones within NAFO Area 3L<br>An accidental spill or release during Project activities could result in the following changes to the environment that may have an effect on commercial fisheries, including Aboriginal communal fishing licences:<br>• contamination-related closure of commercial fishing areas, and associated restrictions on commercial fish harvesting activity<br>• reduced catchability associated with damage to fishing gear (e.g., fouling)<br>• changes in population size and health of individuals among commercial fish species, and associated loss of income through reduced catch value |

| Environmental Component of Concern | Relevant Section of CEAA 2012 | Potential Environmental Interactions |
|---|---|---|
| Other Changes to the Environment Directly Related or Necessarily Incidental to a Federal Authority's Exercise of a Power or Performance of a Duty or Function in Support of the Project | 5(2)(a)<br>5(1)(b)(i) | An accidental fire occurring as a result of Project activities authorized by the C-NLOPB could potentially result in temporary and localized changes to air quality. |

Preventative measures including appropriate management systems and equipment (e.g., well casing, BOP) will be in place throughout the Project to prevent incidents from occurring and to maintain control and safety. In addition to the preventative measures, response plans will be in place to implement effective response in the unlikely event that an incident should occur. The EIS will provide additional details regarding these preventative, contingency, and emergency response measures that are designed to prevent accidents and malfunctions, and to mitigate any resulting impacts to human health and the environment.

## 4.3 Environmental Effects Considerations

As part of the EIS, the potential interactions of the Project are evaluated by considering individual biophysical and socio-economic components that could be affected by the Project. These interactions are evaluated to determine what environmental effects may occur as a result of the Project.

The proposed environmental components to be assessed in the EIS are described in Table 4.3. This scoping has been based on the interactions discussed above as well as guidance from previously completed C-NLOPB scoping documents, Strategic Environmental Assessments, and project-specific EAs of offshore exploration projects. The selection of environmental components also considers relevant regulations and guidelines for routine exploration-related activities.

## Table 4.3 Proposed Environmental Components to be Assessed in the Environmental Impact Statement

| Environmental Component | Basis for Selection |
|---|---|
| Fish and Fish Habitat | Proposed emphasis on the Study Area's most important past and present commercial species such as snow crab, northern shrimp, Greenland halibut, and Atlantic cod, and SARA species. While it is recognized that there are many other commercial or prey fish species, it is Husky's opinion that this range of species captures relevant issues concerning offshore drilling activities. |
| Marine Birds | Proposed emphasis on those species most sensitive to disruption or disturbance due to offshore oil and gas activity and those species listed under the *Migratory Birds Convention Act, 1994*. |
| Marine Mammals and Sea Turtles | Proposed emphasis on species that are sensitive to disturbance such as low frequency sound (e.g., baleen whales) and SARA species (blue whale). Marine mammals such as whales and seals are important both ecologically and economically as whale watching has become a large tourism activity for Newfoundland and Labrador. |
| Commercial Fisheries and Other Ocean Users | Fisheries include consideration of commercial and Aboriginal fisheries (including commercially important fish species) that could be affected by the Project. Fisheries are proposed to be included due to their cultural and economic importance and their potential interaction with the Project. |
| Special Areas | Special Areas includes consideration of areas that have been designated of special interest due to their ecological and/or conservation sensitivities and that could be affected by Project activities. Routine Project activities may not interact with these Special Areas but potential effects from accidental spills will be assessed. |

The selection of proposed environmental components considers that the onshore activities (i.e., onshore supply base) will occur at an existing, well established facility that is currently servicing Husky and other offshore operations. The onshore supply base has been approved through the C-NLOPB and provincial permitting process, and is compatible with proposed Project servicing and supply requirements. Husky has been using the supply base since it began operations on the Grand Banks (2002). It is proposed that the scope of the EIS will therefore be limited to offshore components should a federal EA be required. Logistical support from OSVs and helicopters is also well established for the offshore Newfoundland oil and gas industry. It is proposed that the scope of the EIS be limited to OSV and helicopter transit within the Project Area. The onshore supply base will be operated by a third party using existing facilities and outside of the care and control of Husky. There are not likely to be any material incremental environmental effects as defined under Section 5 of CEAA 2012 from operation of the onshore supply base while undertaking activities in support of the Husky drilling operations.

## 4.4 Mitigation

There are a number of routine, proven, mitigation measures applied to exploration/delineation drilling to reduce the interaction between a project and the environment, including:

- maintenance and inspections
- management of flaring events
- adherence to *Canada Shipping Act*
- waste not suitable for marine discharge, transported for approved shore base disposal
- adherence to Statement of Canadian Practice on Mitigation of Seismic Noise in the Marine Environment in the Geophysical, Geological, Environmental and Geotechnical Program Guidelines (C-NLOPB 2016)
- avoidance/deviation of course for marine mammals and sea turtles when possible
- minimum altitude of 300 m and lateral distance of 2 km for helicopters over active bird colonies when possible
- adherence to Canadian Wildlife Service recovery and release protocol for stranded bird
- re-use of drill mud
- communication/notification for fishers and other relevant ocean users
- gear damage compensation plan
- Husky's Environmental Protection and Compliance Monitoring Plan
- Husky's Emergency Response

The mitigation measures and plans listed above are examples to be detailed on a component-specific basis in the EIS. In addition to activity-related mitigation measures, there are numerous regulated requirements that are applied to a drilling operation, including:

- approvals for a drill rig issued by the C-NLOPB (required before they enter Canadian waters)
- inspections and audits of a drill rig conducted by the C-NLOPB
- inspections and audits of a drill rig conducted by Husky
- Canadian Standards Association guidelines for drilling
- compliance with all regulatory requirements respecting environmental protection during offshore drilling operations, in accordance with
  - Drilling and Production Guidelines (C-NLOPB and CNSOPB 2011)
  - OWTG (NEB et al. 2010)
  - Offshore Chemical Selection Guidelines for Drilling and Production Activities on Frontier Lands (NEB et al. 2009)
  - Environmental Protection Plan Guidelines (NEB et al. 2011)
  - Offshore Physical Environmental Guidelines (NEB et al. 2008)
  - Geophysical, Geological, Environmental and Geotechnical Program Guidelines (C-NLOPB 2016)

# 5.0 CONSULTATION AND ENGAGEMENT

As part of the planning for Project activities offshore, Husky is developing a consultation plan to establish ongoing communication with relevant stakeholders and to identify any environmental or socio-economic concerns that can be reduced or avoided.

## 5.1 Stakeholder and Community Engagement

Husky understands the importance of meaningful engagement with federal, provincial, and municipal stakeholder groups, including regulatory agencies, the public, and other interested parties. Husky has identified a range of stakeholders who may have an interest in the Project, and who might need or want to be consulted on Project activities. These identified stakeholders include, but are not limited to:

- C-NLOPB
- CEA Agency
- Government of Canada (various departments)
- Offshore Fishing Industry (Ocean Choice International, Groundfish Enterprise Allocation Council, Association of Seafood Producers, Canadian Association of Prawn Producers)
- FFAW-Unifor
- One Ocean
- local environmental non-governmental organization offices (e.g., Nature Newfoundland and Labrador)

To date, Husky has met with One Ocean, Ocean Choice International, Environment Canada and Climate Change, and DFO representatives in St. John's to present with a project summary and to initiate consultations surrounding the Project. Concerns and comments raised during consultation with DFO, Environment and Climate Change Canada, and Ocean Choice International and One Ocean are provided in Table 5.1.

Arrangements to engage all other stakeholders are ongoing.

**Table 5.1 Stakeholder Concerns and Comments Raised to Date**

| Stakeholder | Concern/Comment |
|---|---|
| DFO | • quantifying cumulative effects will be an important aspect of the EA<br>• use available EAs and update with EEM data<br>• meeting regulations, standards, audits and inspections, etc. are important mitigation measures to be included<br>• important that discussion on species at risk be up to date (defining critical habitat for wolffish is in the works)<br>• would the Flemish Pass drill cuttings be different?<br>• seems reasonable to used existing oil spill modelling/new drill cuttings modelling information<br>• Environment and Climate Change Canada will now be responsible for all Section 36 (deleterious substances) issues |
| Environment and Climate Change Canada | • do the 10 wells include delineation?<br>• what is the time frame within which a well had to be drilled?<br>• what oil type surrogate was used in the model? |
| Ocean Choice International and One Ocean | • what is the extent of the well abandonment (i.e., above or below seafloor)?<br>• inability to forecast which fisheries will be undertaken in project Area due to ongoing and future changes (e.g., anticipated changes to the groundfish quota not just for cod)<br>• OCI has been consolidating data they have collected for the past three decades<br>• have there been any changes or improvements on BOPs in NL.?<br>• changing environmental conditions are affecting use of depth and temperature to determine fishing area<br>• drilling is not an issue for the offshore fisheries; constant/ consistent noise does not affect the fish |

## 5.2 Engagement with Aboriginal Groups

DFO has identified five Aboriginal groups that hold communal commercial fishing licences within the Study Area, including NAFO Area 3L (see Section 3.3.1). Husky plans to engage with each of these Aboriginal groups in the context of potential interaction between the Project and their commercial fishing interest.

On June 3, 2016, letters providing information on the Project and soliciting any interest or information were delivered to the following groups:

- Miawpukek First Nation
- Qalipu Mi'kmaq First Nation Band
- Nunatukavut Community Council
- Innu Nation
- Nunatsiavut Government

Husky has not received response to this correspondence to date.

# 6.0 REFERENCES

## 6.1 Personal Communications

Ball, D., A/Resource Manager, Fisheries and Aquaculture Management Branch, Conservation and Protection, Resource Management and Aboriginal Fisheries, Fisheries and Oceans Canada, St. John's, NL.

## 6.2 Literature Cited

AMEC 2016 Amec Foster Wheeler Environment & Infrastructure, a Division of AMEC Foster Wheeler Americas Limited. White Rose Extension Project, Drill Cuttings Modelling Update. Prepared for Husky Energy.

AMEC Environment & Infrastructure. 2012a. Environmental Impact Assessment White Rose Extension Project Drill Cuttings and WBM Operational Release Modelling. Prepared for Stantec Consulting Ltd., St. John's, NL.

AMEC Environment & Infrastructure. 2012b. Environmental Impact Assessment White Rose Extension Project SBM Accidental Release and Dispersion Modelling. Prepared for Stantec Consulting Ltd., St. John's, NL.

AMEC Environment and Infrastructure. 2014. Eastern Newfoundland Strategic Environmental Assessment. Final Report, 2014. Available at: http://www.cnlopb.ca/sea/eastern.php. Accessed March 16, 2016.

Canadian Association of Petroleum Producers. 2001. Offshore Drilling Waste Management Review. Technical Report, 2001-2007: 268 pp.

C-NLOPB (Canada-Newfoundland and Labrador Offshore Petroleum Board). 2008. Strategic Environmental Assessment: Labrador Shelf Offshore Area. Prepared by Sikumiut Environmental Management Limited and Jacques Whitford Environment Limited. St. John's, NL. 518 pp.

C-NLOPB (Canada-Newfoundland and Labrador Offshore Petroleum Board). 2016. Geophysical, Geological, Environmental and Geotechnical Program Guidelines. vii + 57 pp.

C-NLOPB (Canada-Newfoundland and Labrador Offshore Petroleum Board). 2015. 2014-2015 Annual Report. Available at: http://www.cnlopb.ca/pdfs/ar2015e.pdf. Accessed March 22, 2016.

C-NLOPB (Canada-Newfoundland and Labrador Offshore Petroleum Board) and Canada-Nova Scotia Offshore Petroleum Board. 2011. Drilling and Production Guidelines. 124 pp.

C-NLOPB (Canada-Newfoundland and Labrador Offshore Petroleum Board) and Canada-Nova Scotia Offshore Petroleum Board. 2015. Atlantic Canada Standby Vessel Guidelines. 37 pp.

CPAWS (Canadian Parks and Wilderness Society). 2009. Special Marine Areas in Newfoundland and Labrador: Areas of Interest in Our Marine Backyards. Prepared for CPAWS-Newfoundland and Labrador Chapter by A. Rao, L.-A. Outhouse and D. Gregory. 179 pp.

DeBlois, E.M., E. Tracy, G.G. Janes, R.D. Crowley, T.A. Wells, U.P. Williams, M.D. Paine, A. Mathieu and B.W. Kilgour. 2014a. Environmental Effects Monitoring at the Terra Nova offshore oil development (Newfoundland, Canada): Program design and overview. Deep-Sea Research II, 110: 4-12.

DeBlois, E.M., M.D. Paine, B.W. Kilgour, E. Tracy, R.D. Crowley, U.P. Williams and G.G. Janes. 2014b. Alterations in bottom sediment physical and chemical characteristics at the Terra Nova offshore oil development over ten years of drilling on the Grand Banks of Newfoundland, Canada. Deep-Sea Research II, 110: 13-25.

DeBlois, E.M., J.W. Kiceniuk, M.D. Paine, B.W. Kilgour, E. Tracy, R.D. Crowley, U.P. Williams and G.G. Janes. 2014c. Examination of body burden and taint for Iceland Scallop (*Chlamys islandica*) and American plaice (*Hippoglossoides platessoides*) near the Terra Nova offshore oil development over ten years of drilling on the Grand Banks of Newfoundland, Canada. Deep-Sea Research II, 110: 65-83.

DFO (Fisheries and Oceans Canada). 2004. Identification of Ecologically and Biologically Significant Areas. Canadian Scientific Advisory Secretariat Ecosystem Status Report, 2004/006: 15 pp.

DFO (Fisheries and Oceans Canada). 2014. Small Craft Harbours. Available at: www.dfo-mpo.gc.ca/sch-ppb/home-accueil-eng.htm. Accessed March 21, 2016.

DFO (Fisheries and Oceans Canada). 2016. Assessment of Newfoundland and Labrador (Divisions 2HJ3KLNOP4R) Snow Crab. Can. Sci. Advis. Sec. Sci. Advis. Rep., 2016/013: 22 pp.

DND (Department of National Defence). 2015. Response to Canada-Newfoundland and Labrador Offshore Petroleum Board Request for Comments on the Project Description for the Seitel Canada Ltd. (Seitel) East Coast Offshore Seismic Program, 2016 to 2025 (response included figure and table of coordinates of legacy sites and shipwrecks).

Environment and Climate Change Canada. 2016. National Inventory Report 1990-2014: Greenhouse Gas Sources and Sinks in Canada. Available at: https://www.ec.gc.ca/ges-ghg/default.asp?lang=En&n=662F9C56-1

ExxonMobil Canada Properties. 2011. Hebron Project Comprehensive Study Report. Submitted to the Canada-Newfoundland and Labrador Offshore Petroleum Board, St. John's, NL.

French-McCay, D.P. 2004. Oil spill impact modeling: Development and validation. Environmental Toxicology and Chemistry, 23(10) 2441-2456.

GESAMP (United Nations Group of Experts on Scientific Aspects of Marine Environmental Protection). 1993. Impact of Oil and Related Chemicals and Wastes on the Marine Environment. Reports and Studies. GESAMP No. 50: 180 pp.

Husky Energy. 2005. White Rose Environmental Effects Monitoring Program. Prepared by Jacques Whitford Limited for Husky Energy, St. John's, NL.

Husky Energy. 2006. White Rose Environmental Effects Monitoring Program. Prepared by Jacques Whitford Limited for Husky Energy, St. John's, NL.

Husky Energy. 2007. White Rose Environmental Effects Monitoring Program. Prepared by Jacques Whitford Limited for Husky Energy, St. John's, NL.

Husky Energy. 2009. White Rose Environmental Effects Monitoring Program. Prepared by Jacques Whitford Limited for Husky Energy, St. John's, NL.

Husky Energy. 2012. Husky Energy White Rose Extension Project Environmental Assessment. Prepared by Stantec Consulting Ltd., St. John's, NL, for Husky Energy. St. John's, NL.

Husky Oil Operations Limited. 2000. White Rose Oilfield Comprehensive Study. Submitted by Husky Oil Operations Limited, St. John's, NL.

International Association of Oil and Gas Producers. 2016. Environmental Fate and Effects of Ocean Discharge of Drill Cuttings and Associated Drilling Fluids from Offshore Oil and Gas Operations. Report 543: 143 pp. (including appendices).

JWEL (Jacques Whitford Environment Limited). 2002a. Flemish Pass Drilling Environmental Assessment. Prepared for Petro-Canada, St. John's, NL. ix + 198 pp. + Appendices.

JWEL (Jacques Whitford Environment Limited). 2002b. Environmental Assessment of Exploration Drilling in Annieopsquotch (EL 1052), Bonnawinkie (EL 1056) and Gambo (EL 1048) Leases. Prepared for EnCana Corporation, Halifax, NS. vii + 153 pp. + Appendices.

JASCO Applied Sciences 2012. Underwater Sound Propagation Assessment for the Environmental Assessment of the White Rose Extension Project. Report P001162-001 by JASCO Applied Sciences, Dartmouth, NS, for Stantec Consulting Ltd., St. John's, NL.

Koropatnick, T., S.K. Johnston, S. Coffen-Smout, P. Macnab and A. Szeto. 2012. Development and Applications of Vessel Traffic Maps Based on Long Range Identification and Tracking (LRIT) Data in Atlantic Canada. Can. Tech. Rpt. Fish. Aquat. Sci., 2966: 27 pp.

LGL Limited. 2003. Husky Lewis Hill prospect exploration drilling program environmental assessment. LGL Rep. SA746. Rep. by LGL Limited, St. John's, NL, Oceans Limited, St. John's, NL, PAL Environmental Services, St. John's, NL, and SL Ross Environmental Research Limited, Ottawa, ON for Husky Oil Operations Limited, St. John's, NL. 324 pp. + Appendices.

LGL Limited. 2005. Orphan Basin exploration drilling program environmental assessment. LGL Rep. SA825. Rep. by LGL Limited, St. John's, NL, Canning & Pitt Associates, Inc., St. John's, NL, SL Ross Environmental Research Limited, Ottawa, ON, Oceans Limited, St. John's, NL, Lorax Environmental, Vancouver, BC, and PAL Environmental Services, St. John's, NL, for Chevron Canada Limited, Calgary, AB, ExxonMobil Canada Ltd., St. John's, NL, Imperial Oil Resources Ventures Limited, Calgary, AB and Shell Canada Limited. 353 pp.

LGL Limited. 2006. Husky White Rose Development Project: New Drill Centre Construction & Operations Program Environmental Assessment. LGL Rep. SA883. Rep. by LGL Limited, St. John's, NL, for Husky Energy Inc., Calgary, AB. 299 pp. + Appendices.

LGL Limited. 2007. Husky Delineation/Exploration Drilling Program for Jeanne d'Arc Basin Area, 2008-2017, Environmental Assessment. LGL Rep. SA935. Prepared by LGL, St. John's, NL, in association with Canning & Pitt Associates Inc., Oceans Ltd., and PAL Environmental Services. Prepared for Husky Energy Inc., Calgary, AB. 231 pp. + Appendices.

LGL Limited. 2008. Environmental Assessment of StatoilHydro Canada Ltd. Exploration and Appraisal/Delineation Drilling Program for Offshore Newfoundland, 2008-2016. LGL Rep. SA947b. Rep. by LGL Limited, Canning & Pitt Associates Inc., and Oceans Ltd., St. John's, NL, for StatoilHydro Canada Ltd., St. John's, NL. 292 pp. + Appendices.

LGL Limited. 2011a. Environmental Assessment of Husky's Jeanne d'Arc Basin/Flemish Pass Regional Seismic Program, 2012-2020. LGL Report SA1144. Prepared by LGL Limited in association with Canning & Pitt Associates Inc., St. John's, NL, and Oceans Ltd., St. John's, NL, for Husky Energy, St. John's, NL. 320 pp. + Appendices.

LGL Limited. 2011b. Environmental Assessment of Statoil's Geophysical Program for Jeanne d'Arc and Central Ridge/Flemish Pass Basins, 2011-2019. LGL Rep. SA1121. Rep. by LGL Limited, in association with Canning & Pitt Associates Inc., and Oceans Ltd., St. John's, NL, for Statoil Canada Ltd., St. John's, NL. 227 pp. + Appendices.

NAFO (Northwest Atlantic Fisheries Organization). 2008. Scientific Council Meeting, Report of the NAFO Scientific Council. Working Group on Ecosystem Approach to Fisheries Management (WGEAFM). NAFO Headquarters, Dartmouth, Canada, 26-30 May 2008. *NAFO Science Council Secretariat Document*, 08/10: 70 pp.

NAFO (Northwest Atlantic Fisheries Organization). 2011. SC WG on the Ecosystem Approach to Fisheries Management – December 2011. Report of the 4th Meeting of the NAFO Scientific Council Working Group on Ecosystem Approaches to Fisheries Management (WGEAFM) NAFO Headquarters, Dartmouth, Canada, 30 November -10 December 2011. 126 pp.

NAFO (Northwest Atlantic Fisheries Organization). 2015. Conservation and Enforcement Measures 2015. NAFO/FC Doc. 15/01: x + 180 pp. (including appendices).

NEB (National Energy Board), Canada-Newfoundland and Labrador Offshore Petroleum Board and Canada-Nova Scotia Offshore Petroleum Board. 2008. Offshore Physical Environment Guidelines. vii + 28 pp. + Appendices.

NEB (National Energy Board), Canada-Newfoundland and Labrador Offshore Petroleum Board and Canada-Nova Scotia Offshore Petroleum Board. 2009. Offshore Chemical Selection Guidelines for Drilling and Production Activities on Frontier Lands. iii + 13 pp.

NEB (National Energy Board), Canada-Newfoundland and Labrador Offshore Petroleum Board and Canada-Nova Scotia Offshore Petroleum Board. 2010. Offshore Waste Treatment Guidelines. vi + 28 pp.

NEB (National Energy Board), Canada-Newfoundland and Labrador Offshore Petroleum Board and Canada-Nova Scotia Offshore Petroleum Board. 2011. Environmental Protection Plan Guidelines. viii + 20 pp.

Neff, J., K. Lee, E.M. DeBlois and G.G. Janes. 2014. Environmental effects of offshore drilling in a cold ocean ecosystem: A 10-year monitoring program at the Terra Nova offshore oil development off the Canadian east coast. Deep-Sea Research II, 110: 1-3.

Oceans Ltd. 2001. Flemish Pass Climatology Study. Prepared for Petro-Canada, St. John's, NL. iv + 66 pp. + Appendices.

Paine, M.D., E.M. DeBlois, B.W. Kilgour, E. Tracy, P. Pocklington, R. Crowley, U. Williams and G.G. Janes. 2014. Effects of the Terra Nova offshore oil development on benthic macro-invertebrates over 10 years of development drilling on the Grand Banks of Newfoundland, Canada. Deep-Sea Research II, 110: 38-64.

Paine, M.D., M.A. Skinner, B.W. Kilgour, E.M. DeBlois and E. Tracy. 2014b. Repeated-measures regression designs and analysis for environmental effects monitoring programs. Deep-Sea Research II, 110: 84-91.

Richardson, W.J., C.R. Greene, Jr., C.I. Malme and D.H. Thomson. 1995. Marine Mammals and Noise. Academic Press, San Diego, CA. 576 pp.

Statistics Canada. No Date a. International Shipping: Number of Movements, Vessel Capacity and Tonnage Transported by Province or Territory and Port. (table 54-205-X). Available at: www.statcan.gc.ca/pub/54-205-x/2011000/t142-eng.pdf. Accessed March 21, 2016.

Statistics Canada. No Date b. Domestic Shipping: Number of Movements, Vessel Capacity and Tonnage Transported by Province or Territory and Port. (table 54-205-X). Available at: www.statcan.gc.ca/pub/54-205-x/2011000/t229-eng.pdf. Accessed March 21, 2016.

Suncor Energy. 2013. Environmental Assessment of Suncor Energy's Eastern Newfoundland Offshore Area 2D/3D/4D Seismic Program 2014-2024. LGL Rep. SA1233. Rep. by LGL Limited, St. John's, NL, for Suncor Energy, St. John's, NL. 210 pp. + Appendices.

Thomas, D.J. 1984. Offshore Oil and Gas Production Waste Characteristics, Treatment Methods, Biological Effects and their Applications to Canadian Regions. Arctic Laboratories Ltd. ESL Environment Sciences Ltd., SKM Consulting Ltd., Atlantic Oceans' Company Ltd. Prepared for EPS Environment Canada, Ottawa, ON.

Whiteway, S.A., M.D. Paine, T.A. Wells, E.M. DeBlois, B.W. Kilgour, E.J. Tracy, R.D. Crowley, U.P. Williams and G.G. Janes. 2014. Toxicity assessment in marine sediment for the Terra Nova environmental effects monitoring program (1997-2010). Deep-Sea Research II, 110: 26-37.

# APPENDIX A
# SCIENTIFIC NAMES

**Table A.1 Scientific Names of Species Potentially Occurring in the Study Area**

| Common Name | Scientific Name |
|---|---|
| **Marine Fish Potentially Occurring in Study Area** | |
| White shark (Atlantic population) | *Carcharodon carcharias* |
| Northern wolffish | *Anarhichas denticulatus* |
| Spotted wolffish | *Anarhichas minor* |
| Atlantic wolffish | *Anarhichas lupus* |
| Arctic cod | *Boreogadus saida* |
| Atlantic bluefin tuna (Grand Banks of Newfoundland only) | *Thunnus thynnus* |
| Atlantic cod (Newfoundland & Labrador Population) | *Gadus morhua* |
| Atlantic salmon (Southern Population) | *Salmo salar* |
| Cusk | *Brosme brosme* |
| Porbeagle shark | *Lamna nasus* |
| Roundnose grenadier | *Coryphaenoides rupestris* |
| Winter skate (Eastern Scotian Shelf – Newfoundland population) | *Leucoraja ocellata* |
| American eel | *Anguilla rostrata* |
| American plaice (Newfoundland and Labrador population) | *Hippoglossoides platessoides* |
| Acadian redfish (Atlantic population) | *Sebastes fasciatus* |
| Deepwater redfish (Northern population) | *Sebastes mentella* |
| Greenland halibut | *Reinharditus hippoglossoides* |
| Atlantic mackerel | *Scomber scombrus* |
| Shortfin mako shark (Atlantic population) | *Isurus oxyrinchus* |
| White hake (Atlantic and Northern Gulf of St. Lawrence population) | *Urophycis tenuis* |
| Basking shark (Atlantic population) | *Cetorhinus maximus* |
| Blue shark (Atlantic population) | *Prionace glauca* |
| Roughhead grenadier | *Macrourus berglax* |
| Spiny dogfish (Atlantic population) | *Squalus acanthias* |
| Thorny skate | *Amblyraja radiate* |
| Yellowtail flounder | *Limanda ferruginea* |
| Witch flounder | *Glyptocephalus cynoglossus* |
| **Marine Mammals** | |
| Blue whale (Atlantic population) | *Balaenoptera musculus* |
| North Atlantic right whale | *Eubalaena glacialis* |
| Leatherback sea turtle (Atlantic population) | *Dermochelys coriacea* |
| Fin whale (Atlantic population) | *Balaenoptera physalus* |

| Common Name | Scientific Name |
|---|---|
| Sowerby's beaked whale | *Mesoplodon bidens* |
| Loggerhead sea turtle | *Caretta caretta* |
| Killer whale (Northwest Atlantic-Eastern Arctic population) | *Orcinus orca* |
| Harbour Porpoise (Northwest Atlantic population) | *Phocoena phocoena* |
| Northern bottlenose whale (Davis Strait-Baffin Bay-Labrador Sea population population) | *Hyperoodon ampullatus* |
| Harp seal | *Pagophilus groenlandicus* |
| Grey seal | *Cystophora cristata* |
| Hooded seal | *Halichoerus grypus* |
| **Marine Birds** | |
| ***Procellariidae*** | |
| Northern Fulmar | *Fulmarus glacialis* |
| Greater Shearwater | *Puffinus gravis* |
| Sooty Shearwater | *Puffinus griseus* |
| Manx Shearwater | *Puffinus puffinus* |
| ***Hydrobatidae*** | |
| Leach's Storm-Petrel | *Oceanodroma leucorhoa* |
| Wilson's Storm-Petrel | *Oceanites oceanicus* |
| ***Sulidae*** | |
| Northern Gannet | *Morus bassanus* |
| ***Hydrobatidae*** | |
| Red Phalarope | *Phalaropus fulicarius* |
| Red-necked Phalarope | *Phalaropus lobatus* |
| ***Alcidae*** | |
| Dovekie | *Alle alle* |
| Common Murre | *Uria aalge* |
| Thick-billed Murre | *Uria lomvia* |
| Razorbill | *Alca torda* |
| Atlantic Puffin | *Fratercula arctica* |
| ***Laridae*** | |
| Black-legged Kittiwake | *Rissa tridactyla* |
| Ivory Gull | *Pagophila eburnea* |
| Herring Gull | *Larus argentatus* |
| Iceland Gull | *Larus glaucoides* |
| Lesser Black-backed Gull | *Larus fuscus* |
| Glaucous Gull | *Larus hyperboreus* |

| Common Name | Scientific Name |
|---|---|
| Great Black-backed Gull | *Larus marinus* |
| Roseate Tern | *Sterna dougallii* |
| Arctic Tern | *Sterna paradisaea* |
| ***Stercorariidae*** | |
| Great Skua | *Stercorarius skua* |
| South Polar Skua | *Stercorarius maccormicki* |
| Pomarine Jaeger | *Stercorarius pomarinus* |
| Parasitic Jaeger | *Stercorarius parasiticus* |
| Long-tailed Jaeger | *Stercorarius longicaudus* |