Husky Energy

REPORT

REPORT TITLE

Husky Delineation / Exploration

Drilling Program for Jeanne d'Arc Basin Area

2007 – 2016

Project Description

LGL File SA935

SUBMITTED TO

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COMMENTS IF APPLICABLE

Replaces 18-April-2007 submitted report.

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File Code:	6.2.21	HDMS No.:	003989845	Report No.:	WR-HSE-RP-0284	Version No:	01

Husky Delineation/Exploration Drilling Program for Jeanne d'Arc Basin Area, 2007 - 2016

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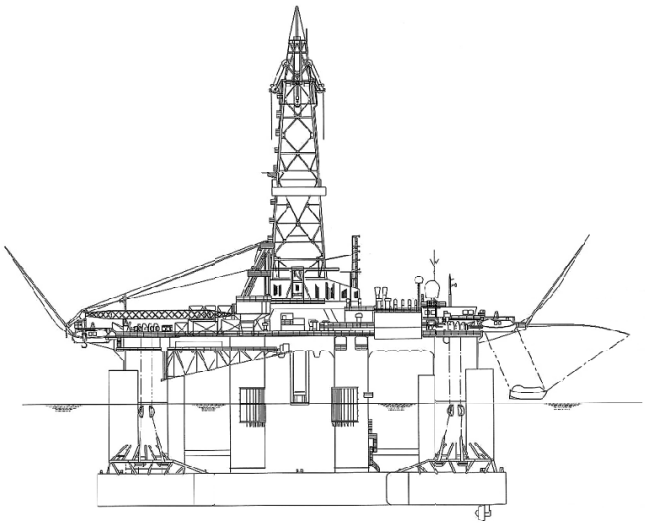

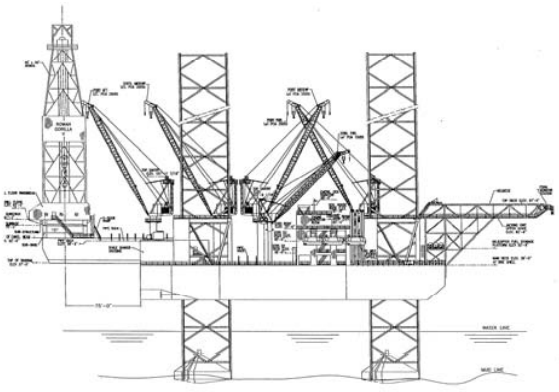

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Table of Contents

Page

Table of Contents i
List of Figures ii
List of Tables ii
1.0 Introduction 1
2.0 The Operator 4
2.1. Operator Contacts 4
2.2. Operator Objectives 4
3.0 Project Overview 6
3.1. Name and Location of Proposed Project 8
3.2. Alternatives to Project/Alternative Means within Project 9
3.3. Personnel 10
3.4. Mobile Offshore Drilling Units 10
3.4.1. General MODU Descriptions 11
3.4.1.1. Semi-submersible 11
3.4.1.2. Jack-up 12
3.4.1.3. Drillship 13
3.5. Logistic Support 14
3.5.1. Marine Support Vessels 14
3.5.2. Helicopter Support 14
3.5.3. Shorebase Facilities 14
3.6. Information on Consultations 14
3.7. Project Components/Structures/Activities 15
3.7.1. Project Phases 16
3.7.2. Project Scheduling 16
3.7.3. Site Plans 16
3.7.4. Description of Waste Discharges, Air Emissions and Treatment 17
3.7.4.1. Drilling Cuttings and Completion Fluids 17
3.7.4.2. Produced Water 18
3.7.4.3. Grey/Black Water 18
3.7.4.4. Bilge Water 22
3.7.4.5. Deck Drainage 22
3.7.4.6. Ballast Water 22
3.7.4.7. Cooling Water 22
3.7.4.8. Waste 22
3.7.4.9. Blowout Preventer Fluid 22
3.7.4.10. Air Emissions 23
3.7.5. Geohazard and VSP Surveys 23
3.7.6. Onsite Environmental/Ice Observers 23

3.7.7. Project Site Information 23
3.7.7.1. Environmental Features 23
3.7.7.2. Species at Risk 24
3.7.7.3. Land Use 24
3.7.7.4. Navigable Waters 24
3.7.7.5. Fish and Fish Habitat 25
3.7.8. Effects of the Environment on the Project 25

List of Figures

Page

Figure 1.1. Locations of Proposed Project Area, Study Area, Proximate Seabird- and Fish-related Sensitive Areas, and Prospective 2007 Drilling Sites Within the Project Area. 2
Figure 3.1. Schematic of a Typical Straight (Vertical) Well Scenario 6
Figure 3.2. Schematic of a Twin Well Scenario 6
Figure 3.3. Schematic of a Deep Vertical Well. 7
Figure 3.4. Current Land Distribution in the Jeanne d'Arc Basin Region 8
Figure 3.5. Typical Semi-submersible Drill Rig *GSF Grand Banks*. 12
Figure 3.6. *Rowan Gorilla VI* operating with 673' leg length over production platform. 13
Figure 3.7. Drillship *Neptune Explorer*. 13
Figure 3.8. Schematic of a Typical Vertical Well Abandonment (Cape Race N-68).. 17

List of Tables

Page

Table 3.1. Current Husky Interests in Jeanne d'Arc Basin Area. 9
Table 3.2. Discharge Estimates for Cuttings and Mud Products – Shallow Vertical Well. 19
Table 3.3. Discharge Estimates for Cuttings and Mud Products – Deviated Twin Well 20
Table 3.4. Discharge Estimates for Cuttings and Mud Products – Deep Vertical Well. 21
Table 3.5. Mud/Cuttings Treatment System. 22

1.0 Introduction

Husky Oil Operations Limited wishes to undertake a program of exploration and delineation well drilling at various locations in the Jeanne d'Arc Basin area over the next nine years (2007 to 2016). The purpose of the Project is to explore likely oil and gas targets identified from interpretation of seismic survey data and to conduct any delineation drilling with respect to currently known oil and gas resources or those that may arise from exploration drilling.

The area in and around the Jeanne d'Arc Basin to be explored, "the Project Area", is approximately 260 km east of St. John's Newfoundland and Labrador (Figure 1.1) and encompasses water depths from 80 to 230 metres. The dimensions of the Project Area are 200 km west to east and and 230 km north to south. Drilling operations are scheduled to commence in mid-July 2007 and will continue through 2016 depending on the maturity of the drilling proposals, drill rig availability and regulatory approval. Approximately 18 single vertical and/or dual side-track wells are contemplated over the period 2007 to 2016. The Study Area to be used in the environmental assessment as also defined in Figure 1.1.

The Project will require authorizations pursuant to Section 138 (1) (b) of the *Canada-Newfoundland Atlantic Accord Implementation Act* and Section 134 (1) (a) of the *Canada-Newfoundland and Labrador Atlantic Accord Implementation Newfoundland and Labrador Act.* Subject to Section 5 (1) (d) of the *Canadian Environmental Assessment Act (CEA Act),* the Canada-Newfoundland Offshore Petroleum Board (C-NLOPB, also referred to as "the Board") is a responsible authority (RA) and federal environmental assessment coordinator (FEAC) and must undertake a screening level environmental assessment (EA) of the Project.

Legislation that is relevant to the environmental aspects of this Project include

- *Canada-Newfoundland Atlantic Accord Implementation Acts*
- *Canadian Environmental Assessment Act*
- *Oceans Act*
- *Fisheries Act*
- *Navigable Waters Protection Act*
- *Canada Shipping Act*
- *Species at Risk Act*
- *Migratory Birds Convention Act*
- *Canadian Environmental Protection Act*

There is no federal funding for this Project. Federal lands are involved and they are administered by the C-NLOPB, a federal-provincial agency operating under the *Accord Acts.* A Drilling Program Authorization (DPA) and one or more Approvals to Drill a Well (ADW) are required to operate a drilling program in the offshore.

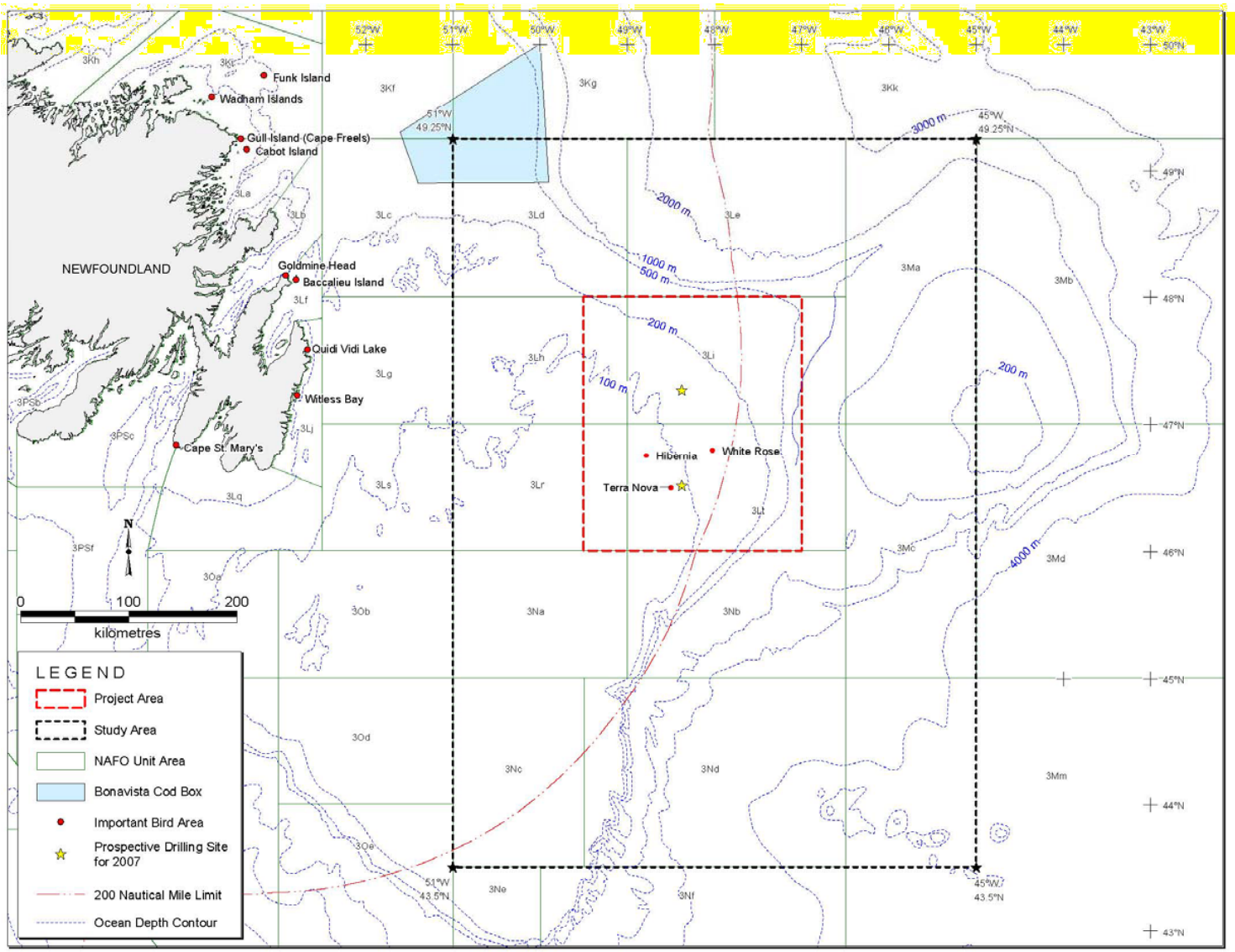

Figure 1.1. Locations of Proposed Project Area, Study Area, Proximate Seabird- and Fish-related Sensitive Areas, and Prospective 2007 Drilling Sites Within the Project Area.

This Project Description is based upon information available to Husky at the time of writing. Not all Project details are presently known because not all contractors and suppliers have been selected, the specific number and location of wells are yet to be finalized, and new leases within the Project Area (Figure 1.1) may be acquired over the coming nine (9) years. However all drilling operations will be carried out within the scope outlined in this document and this Project Description is an accurate reflection of the Operator's present level of knowledge.

2.0 The Operator

Headquartered in Calgary, Alberta, Husky Oil Operations Limited (the Operator) is a Canadian-based integrated energy company serving global customers, committed to maximizing returns to its shareholders in an ethical and socially responsible way, through the dedicated effort of its people. It 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.

The Operator is the management and operating company for the Operator's seven Significant Discovery Areas (SDA) and nine Exploration Licenses, offshore Newfoundland (see Table 3.1) The Operator's largest SDA contains the currently producing White Rose Oil Pool.

2.1. Operator Contacts

Operator Contacts concerning this application are:

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2.2. Operator Objectives

The long-term goals of the Operator are to:

- Execute a cost-effective program, while maintaining health, safety and environmental responsibilities and meeting all due diligence requirements.
- Minimize and phase capital expenditure.

- Re-establish and maintain cost-effective relationships with suppliers and contractors, creating long-term mutual benefits and a local infrastructure.
- Effectively conduct core business activities.
- Optimize synergy opportunities with other operators in the area.
- Conduct operations with a moderate, cost effective, risk profile.

East Coast drilling operations are managed from the local offices of the Operator and supported using the established logistics infrastructure and resources in St. John's, Newfoundland.

3.0 Project Overview

During 2007 to 2016 Husky Oil plans to evaluate 18 oil and gas targets with a combination of vertical and deviated (twin) wells in Jeanne d'Arc Basin (Figures 3.1 and 3.2). These well designs are used for depths of between 2,800 and 3,500 m true vertical depth. Husky is also conisdering deep wells, in the order of 6,000 m true vertical depth. The well design for the deeper targets is illustrated in Figure 3.3.

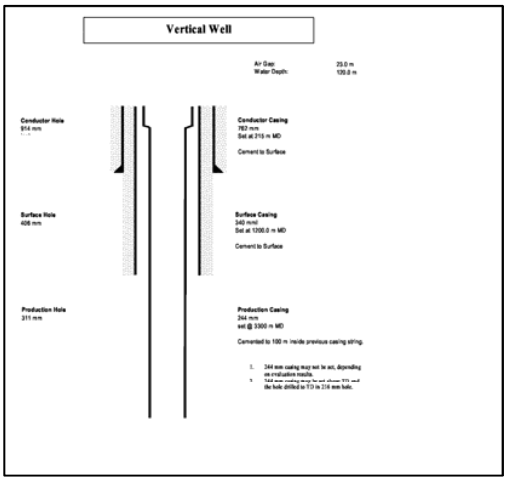

Figure 3.1. Schematic of a Typical Straight (Vertical) Well Scenario.

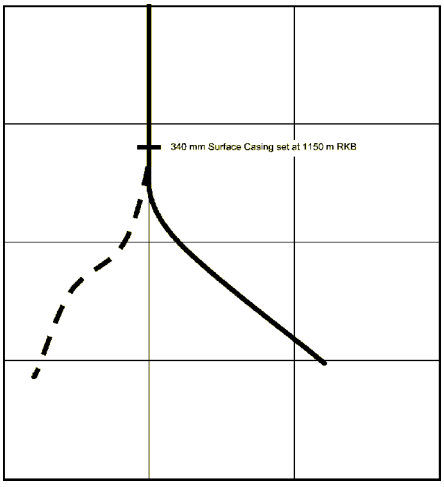

Figure 3.2. Schematic of a Twin Well Scenario.

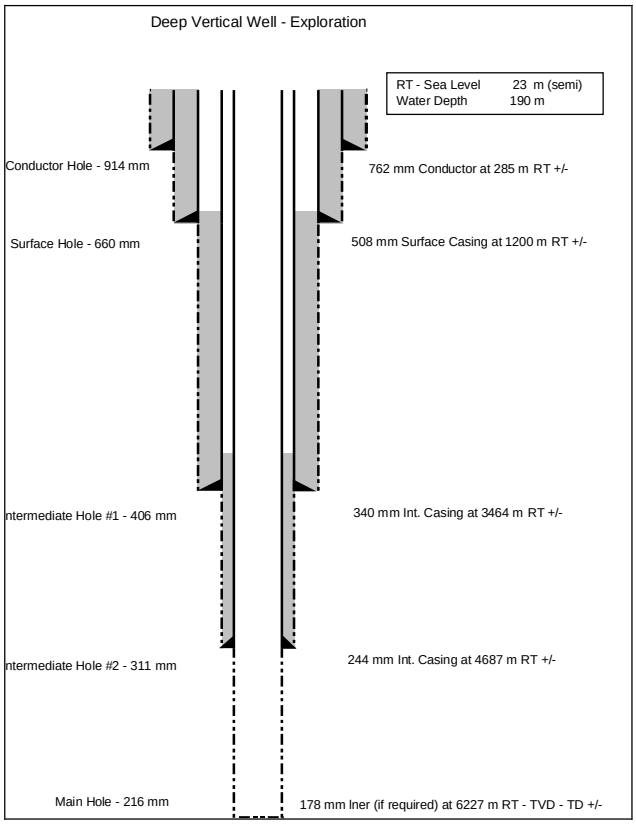

Figure 3.3. Schematic of a Deep Vertical Well.

The Operator will maintain a marine shore base in the St. John's area during the 2007-2016 drilling campaign. The re-supply of drilling equipment and materials will be performed from this location. The transport of personnel to and from St. John's and the Project Area will be conducted mainly by helicopter, but in isolated situations, supply boats may be used.

The Project Area as defined in this Project Description (see Figure 1.1) encompasses all of the Operator's land holdings offshore Newfoundland that will be considered in the environmental assessment (see Figure 3.4). No new shore-based facilities will be constructed for this operation.

Consistent with the legislative requirements of the *Canada Newfoundland Atlantic Accord Implementation Acts*, Husky Oil Operations Limited is committed to enhancing the business opportunities for Canada and Newfoundland as outlined in the Company's Canada-Newfoundland and Labrador Benefits G/L outlined in the Benefits Plan. Consequently, Husky will utilize the services of Newfoundland and other Canadian companies and personnel wherever possible.

3.1. Name and Location of Proposed Project

The official name of the Project is the Husky Exploration and Delineation Drilling Program for the Jeanne d'Arc Basin Area, 2007-2016. It is located on the northeastern Grand Banks (Figure 1.1). Exploration or delination wells could be drilled on any current or future Husky land holdings in this area from 2007 through 2016 (Figure 3.4).

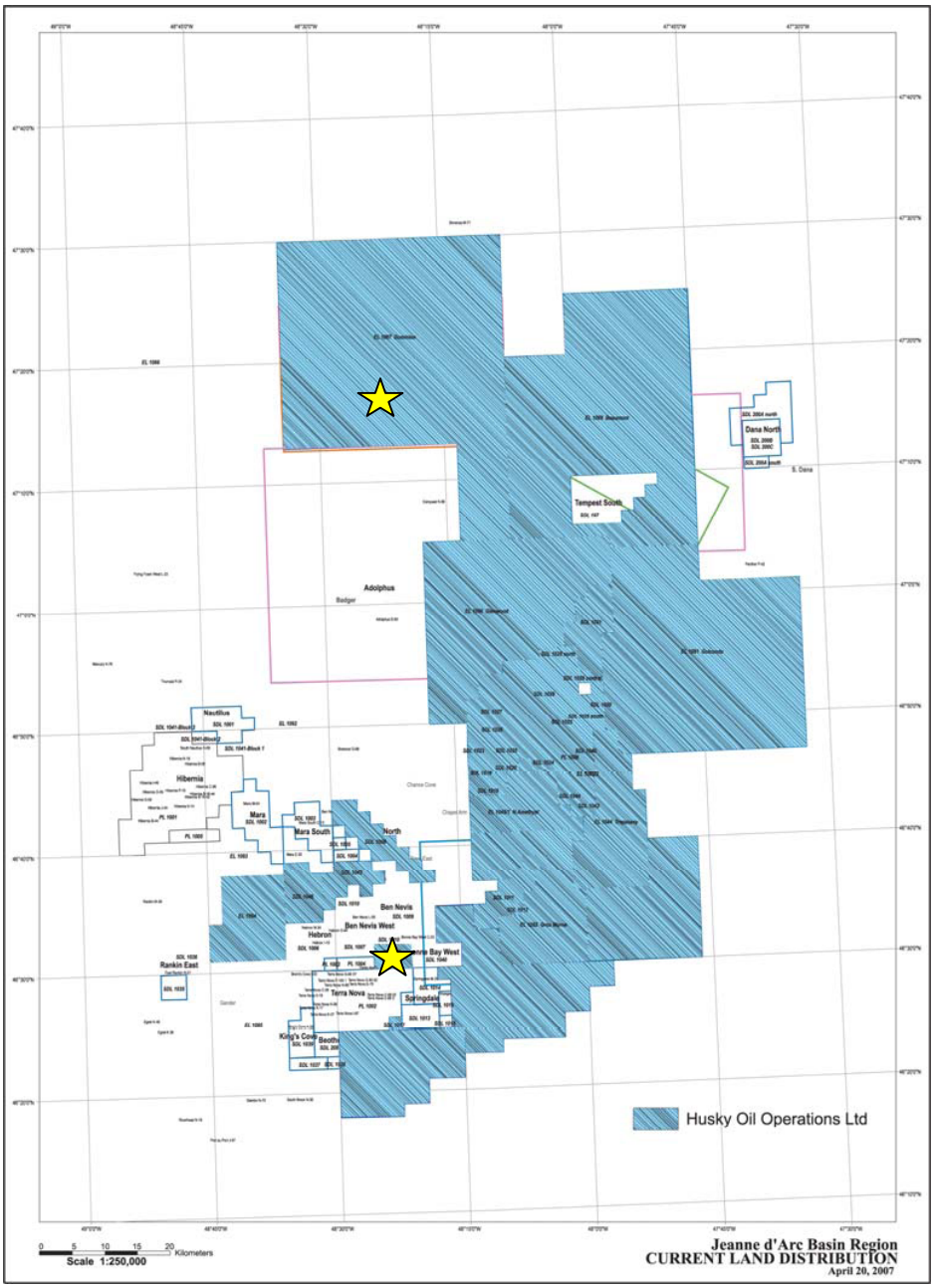

Figure 3.4. Current Land Distribution in the Jeanne d'Arc Basin Region (Yellow Stars Indicate Approximate Locations of Prospective Drill Sites in 2007).

The current list of licenses held by Husky exclusively or in partnership with others are provided in Table 3.1 below.

Table 3.1. Current Husky Interests in Jeanne d'Arc Basin Area.

License #	Name	Hectares
EL 1044	Trepassey	19,472
EL 1045	North Amethyst	12,744
EL 1055	Gros Morne	24,467
EL 1067	Dominion	118,224
EL 1089	Beaumont	91,107
EL 1090	Glenwood	52,125
EL 1091	Golconda	84,270
EL 1096	Emerald	2,130
EL 1094	Saphire	13,485
EL 1099	SEArcher	24,838
EL 1100	Parcel 2	30,572
EL 1101	Parcel 3	21,009
SDL 1042	Ben Nevis	3,897
SDL 1011	Fortune	5,321
SDL 1012	Fortune	355
SDL 1008	North Ben Nevis	6,372
SDL 1017	Springdale	356
SDL 1031	Trave	7,045
SDL 1018	White Rose	1,062
SDL 1019	White Rose	1,416
SDL 1020	White Rose	1,062
SDL 1023	White Rose	353
SDL 1024	White Rose	1,061
SDL 1025	White Rose	5,648
SDL 1026	White Rose	2,471
SDL 1027	White Rose	1,765
SDL 1028	White Rose	11,649
SDL 1029	White Rose	2,824
SDL 1030	White Rose	1,412
SDL 1043	White Rose	708
SDL 1044	White Rose	2,124
SDL 1045	White Rose	353
SDL 1046	Hebron	5,320
PL 1006	White Rose	2,828

3.2. Alternatives to Project/Alternative Means within Project

The alternative to the Project is to not drill any wells in these locations but to seek oil and gas elsewhere in order to satisfy market demand. However, Husky has been awarded rights to explore in these areas through a regulated competitive bidding process and is now seeking to fulfill commitments made as part of this process.

Alternative means evaluated within the Project include the use of a semi-submersible, a jack-up drilling rig or a drillship. Within the oil and gas industry, these rig types are all considered MODU or mobile offshore drilling units because they move under their own power and/or can be towed between locations. The harsh environment jack-up rig types are typically limited to water depths of 122 m for year round operations off the East Coast of Canada and presently have not been approved for operations during the ice season.

While there are differences between rig types, their overall environmental "footprints" and emissions are similar. The semi-submersible and jack-up approaches were selected because they provided the best:

- technological solution given environmental conditions likely to be encountered,
- scheduling given availability of other suitable vessel types, and
- economics compared to other qualified vessels.

Of potential offshore drilling rigs, the rig will be selected through a technical and competitive process with consideration given to synergy opportunities with other projects.

Another alternative within the Project is the use of vertical wells (i.e., one well per one hole) versus dual side-track wells where there are two wells drilled per one hole (see Figure 3.2).

Any other alternatives that may be identified in the course of Project development will be discussed further in the environmental assessment to follow.

3.3. Personnel

The overall Project will be managed by Husky's East Coast Operations vice president located in St. John's. The vice president has the authority to effectively manage the overall operational aspects of the Project on an ongoing basis. Day-to-day drilling operations will be directed by the Husky oil drilling and completions manager. The shore-based drilling operations management team in addition includes the senior drilling engineer, completions manager, logistics coordinator(s), HSEQ coordinator and the public affairs manager.

Offshore, the management team includes of the senior drilling supervisor (Husky's senior offshore representative), the Husky night drilling supervisor, the offshore Husky drilling engineer, the Husky logistics coordinator, the Husky HSEQ coordinator, the designated offshore installation managers, and supply vessel masters.

3.4. Mobile Offshore Drilling Units

Mobile Offshore Drilling Units (MODUs) will be used to carry out this driling program. MODUs can be considered to fall into one of the following three general categories:

- Semi- submersible drill rigs that are moored to the seafloor with anchors while they are operating and may or may not have a thruster or dynamic positioning system to assist in maintaining position or in transiting.

- Drill ships that are moored to the seafloor with anchors while operating and may or may not use dynamic postioning to help maintain position while operating

- Jack-up drill rigs that have extending legs that rest on the seafloor while operating

The lengths of anchor chains used by the MODUs (excluding jack-ups) during this Project will vary in size up to approximately 1,400 m therefore the anchor patterns and total area they may encompass will vary depending on the MODU used, water depth and technical considerations.

The foregoing MODU type drilling rigs will be assessed in the environmental assessment. Drilling and abandonment procedures, and emissions associated with all these rigs are similar.

3.4.1. General MODU Descriptions

In this Project Description and ensuing environmental assessment it is necessary to describe and consider typical rigs because contracts are not in place for the duration of the drilling program, and rig and contractor selection is not yet final. Thus, this Project Description and ensuing environmental assessment consider the following MODUs as offshore drilling rigs typical for East Coast Operations.

3.4.1.1. Semi-submersible

The *GSF Grand Banks* rig, an East Coast typical rig, has been operating in the Grand Banks area since July 2002. Prior to this it was operating in the British sector of the North Sea. The *GSF Grand Banks* is a rectangular, twin hull, column stabilized, MODU, constructed to an Aker H3.2 design. There are two 29.5 ft. (9.0 m) diameter corner stability columns plus two 24.3 ft. (7.4 m) diameter intermediate stability columns rising from each hull to support the main deck. The deck is arranged with the drilling mast in the centre and modules on the perimeters, housing the living quarters, equipment, storage area and workshops.

The *GSF Grand Banks* was built in 1984 to comply with the 1979 Rules for Building and Classing Offshore Mobile Drilling Units. The unit has the capability of drilling in 1,500 feet (457 m) of water to a depth of 25,000 feet (7,620 m), and can be used for exploration or appraisal wells, completion and template drilling (Figure 3.5).

Figure 3.5. Typical Semi-submersible Drill Rig *GSF Grand Banks*.

Detailed specifications of the MODU systems and equipment have been described in the *GSF Grand Banks* Safety Case filed with the C-NLOPB in support of Husky's previous Drilling Program Work Authorization application. The rig has a valid Certificate of Fitness issued by DNV for Canadian waters and has been inspected by the CA. In addition, a Transport Canada Marine Safety Inspection has been conducted as part of the requirements for a Letter of Compliance issued by that agency. Several previous Husky drilling environmental assessments (Jeanne d'Arc Basin Program, Lewis Hill Program) have been conducted based on this rig.

3.4.1.2. Jack-up

A typical East Coast jack-up rig, the *Rowan Gorilla VI* (LeTourneau Hull No. 220, Class Super Gorilla), is a Self-Elevating Mobile Offshore Drilling Unit built in Vicksburg, Mississippi, 2000. (Figure 3.6). It is capable of drilling 10,700 m in 122 m of water. The unit is provided with accommodation for 120 persons including a six-person sickbay. The unit has been designed and built to class in accordance with the rules of the American Bureau of Shipping (ABS) and Det Norske Veritas (DNV) and in accordance with the regulations of the United States Coast Guard (USCG), the Health & Safety Executive (United Kingdom) and the Norwegian Petroleum Directorate (NPD). The unit also conforms to the regulations of IMO, MARPOL, Norwegian Maritime Directorate, the C-NLOPB and the C-NSOPB.

The diameter (maximum effective) and footing area of one spud can are approximately 17.4 m (57.1 ft) and 243.1 m^2 (2,616.5 ft^2), respectively. Based on these dimensions, the total area of substrate affected by three spud cans would be approximately 729 m^2 (7,846 ft^2).

Figure 3.6. *Rowan Gorilla VI* operating with 673' leg length over production platform.

3.4.1.3. Drillship

Brief descriptions of two drillships are provided below.

The *Neptune Explorer* is a typical moored, ice classed, self-propelled drillship (Figure 3.7). Its length, beam, and maximum draft are 149.3 m, 23.8 m, and 7.5 m respectively. It typically operates in water depths ranging from 30 to 230 m, and is capable of drilling to a depth of 6,100 m.

The *Deepwater Millenium* is a Samsung/Reading & Bates designed dynamically positioned drillship capable of drilling up to approximately 9,000 m in water depths up to 2,470 m. Its operating conditions include maximum wave heights of 15 m and maximum wind speeds of 75 knots. Its length, beam, and operating draft are 221 m, 42 m, and 13 m respectively.

Figure 3.7. Drillship *Neptune Explorer.*

All these rigs of similar design have been approved for operations on the East Coast for several years and have met Canadian regulatory requirements, including the *Offshore Waste Treatment Guidelines* (NEB, C-NLOPB and C-NSOPB 2002).

3.5. Logistic Support

3.5.1. Marine Support Vessels

Anchor Handling Tug Supply (AHTS) and Supply/Standby vessels will be Canadian-flagged and Canadian-crewed and will be managed from the Contractor's office in St. John's, Newfoundland. Letters of Compliance for each chartered standby vessel will be in place prior to Project commencement.

3.5.2. Helicopter Support

Cougar Helicopters Inc. (CHI) have been contracted to provide helicopter support for the Project and will have a dedicated AS-332L Super Puma and/or Sikorsky S-91 for Husky Oil based in St. John's to service the Company's requirements. Cougar Helicopter Inc. will also provide all auxiliary flight services including First Response Equipment and technicians, alternate landing site at Long Pond complete with weather station, aviation fuel, helicopter passenger transportation suits and an aircraft maintenance and passenger loading terminal located at the St. John's Airport. Flight following service will be contracted by Cougar Helicopters Inc. from Avflow Aviation Services.

3.5.3. Shorebase Facilities

The Project will be managed and operational decisions will continue to be made from Husky Oil Operations Limited's existing regional office in St. John's at Suite 801, 235 Water Street. A. Harvey and Company Ltd. will provide dock facilities to support Project activity. The existing facilities are capable of servicing multiple operations with the existing infrastructure including office space, crane support, bulk storage and consumable (fuel, water) storage and delivery capability. The existing infrastructure and activity at the Harvey's facility enables the industry to optimize the utilization of supply vessels and other logistic assets. Warehouse facilities will be provided by Project contractors as required and will consist primarily of storage for tubular goods, and the equipment belonging to the drill rig which can be stored onshore.

Operation and co-ordination service of all aeronautical and marine voice and data communication services will be provided from a central facility (contract being finalized) in St. John's. The primary communications link between the drill rig and the Project Operations office in St. John's will be via a dedicated C-Band satellite service. Independent backup communications systems will be provided by high quality HF radio service, available through the coastal radio station. Details on communications systems are outlined in the East Coast Operating Incident Coordination Plan currently on file with C-NLOPB.

3.6. Information on Consultations

As part of the White Rose Development Plan Application, which included an assessment of development activities such as well drilling, Husky conducted very extensive consultations with numerous organizations. These included federal agencies, particularly Fisheries and Oceans and Environment Canada; provincial departments such as Environment and Labour, and Fisheries, Food and

Aquaculture; municipal governments including St. John's, Clarenville and Marystown; special interest groups including the Natural History Society; and the general public at various locations. A detailed list of meetings, totaling well over 100 is contained in the report entitled "White Rose Oilfield Development Public Consultation Report" and summarized in the Comprehensive Study Report. In 2001, the White Rose Development Plan Application also went through a series of public hearings conducted by the Public Review Commission.

In addition, Husky briefed the following parties on the nature of the Jeanne d'Arc Basin exploratory drilling Project, including a description of proposed activities, locations and timing.

- Transport Canada (23 April 2002)
- C-NLOPB (12 April 2002)
- Transport Canada, C-NLOPB, Det Norse Veritas (7 May 2002)
- Environment Canada (May 2002)
- Fisheries & Oceans Canada (May 2002)

For the presently proposed program, the following organizations will be contacted during the preparation of the environmental assessment:

- Natural History Society
- Environment Canada
- Fisheries and Oceans
- ONE OCEAN
- Fish, Food and Allied Workers (FFAW)
- Fish processers with interests in the Project area

and others as appropriate.

Environmental concerns expressed during some of the meetings on the White Rose Project that could be of relevance to exploratory drilling included those associated with the discharge of waste including drilling muds and cuttings (more so synthetic based muds as opposed to water based muds), produced water, any oily discharges (particularly accidental oil spills) fishery exclusions, and attraction of several species of seabirds to the rig. The consensus of the meetings was that offshore oil could be developed on the Grand Banks in an environmentally responsible manner and in coexistence with the fishing industry. These issues were addressed during the White Rose Development Application review process and will be considered in the environmental assessment together with issues that arise from the specific consultations planned for the exploration program.

3.7. Project Components/Structures/Activities

For most wells it is currently planned to use a semi-submersible drilling rig will, which is typically moored using an eight or twelve point anchoring system (e.g., Stevin NK3 anchors). For other wells, the drill rig may be a jack-up which does not require anchors. The rig will be supplied and supported by two

or three supply boats operating from Harvey's wharf in St. John's Harbour. The supply boats (anchor-handling) will have a range of 12-15,000 HP and be capable of storing and delivering drilling fluids and diesel fuel. On average there will be two or three supply boat trips per week between the base and the rig. Helicopter support may consist of about six trips per week ferrying personnel and light supplies and equipment.

On the shallower well designs the final total well depths will range up to 3,550 m MD (Tables 3.2 and 3.3). Deeper exploration wells may exceed 6,000 m MD (Figure 3.8). The actual hole size and casing setting depth will vary on the individual well design and reflect the specific well requirements and design criteria.

Well abandonment procedures will consist of the removal of any wellhead and associated equipment. Offshore wells are abandoned in two stages. During the first stage, the wellbore is isolated using mechanical and cement plugs in accordance with existing regulations. During the second stage the wellhead and any associated equipment items are removed from the seabed. Removal of the wellhead will routinely involve the use of mechanical cutters. In some circumstances, however, subsurface cutting (i.e., below the seabed) using shaped charges may be required.

On some occassions the wells may be suspended for future re-entry. This is similar to the abandonment process described above, but the wellhead is not removed. A suspension cap is installed to protect the wellhead connector.

3.7.1. Project Phases

For the purposes of this environmental assessment, the Project is considered to consist of two phases: (1) the drilling of exploration/delineation wells, inclusive of routine activities such as vertical seismic profiling (VSP), and testing, and (2) abandonment.

3.7.2. Project Scheduling

The first well is planned for July 2007. Drilling will commence in mid-July 2007 and last about 40 days per well. Testing, if conducted, can be expected to take about 20 days per well. In general, the scheduling window for drilling will be year round for semi-submersible MODUs and drillships and from July to December for jack-up rigs when ice will not hinder their operations. All wells will be suspended or abandoned and the drilling program terminated by the end of 2016.

3.7.3. Site Plans

Locations of prospective sites for 2007 are presented in Figures 1.1 and 3.4. Conductor, graphics of the rigs, and abandoned well are shown in Figures 3.1, 3.5, 3.6, 3.7 and 3.8, respectively. Note that a well head will only be left in place in the event of an unscheduled well suspension. Otherwise the well will be abandoned at least one metre below the sea floor as shown in Figure 3.8.

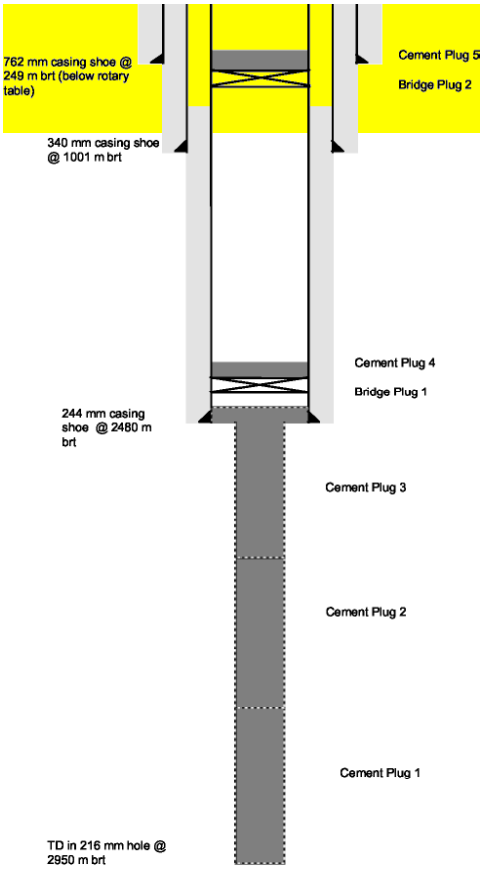

Figure 3.8. Schematic of a Typical Vertical Well Abandonment (Cape Race N-68). Well Head and Casings Cut at Least 1 m Below Sea Floor.

3.7.4. Description of Waste Discharges, Air Emissions and Treatment

Waste discharges will include drill muds and cuttings, produced water, grey and black water, ballast water, bilge water, deck drainage, discharges from machinery spaces, cement, blowout preventer (BOP) fluid (not released when using a jack-up rig), and air emissions. All discharges will be in compliance with the *Offshore Waste Treatment Guidelines* (*OWTG*). Details are provided in the following sections.

3.7.4.1. Drilling Cuttings and Completion Fluids

If technically feasible the wells will be drilled to depth using water-based muds (WBM). However, some conditions may be encountered that would potentially require the use of synthetic-based muds (SBM) and thus this assessment also considers SBM.

Components and additives typically differ somewhat by well, the specific conditions encountered in drilling, and by the depth and purpose for drilling. Typical formulations for water based drilling mud and the quantities likely to be used when drilling a vertical well hole for the surface and intermediate casings, and the conductor are provided in Tables 3.2 and 3.3.

The first part of the hole (i.e., the surface casing and conductor) is drilled without the riser in place and thus the drilling mud and associated cuttings are discharged directly to the marine environment. Approximately 230 m^3 of cuttings will be discharged per well during this stage of the drilling (see Table 3.2).

Some exploration wells may exceed 6,000 m in total vertical depth and require more hole sections and casing to reach TD. Due to the anticipated duration of these wells, SBM will be used to ensure hole stabilty and allow optimal formation evaluation with wireline logs. Table 3.4 shows predicted discharges from the 6,207 m well.

During the drilling of the hole for the intermediate casing, the riser and associated BOP are in place and mud is transported back to the rig. Cuttings are then removed from the drilling mud in successive separation stages through shakers, hydrocyclones, and centrifuges. After passing through the solids control system (Table 3.5), the cleaned cuttings are then discharged overboard through a cuttings shute. The recovered mud is then reconditioned and reused. Up to 175 m^3 of cleaned cuttings could be discharged during the installation of the intermediate casing (see Table 3.2). All discharges of mud and cuttings will be in accordance with the C-NLOPB *OWTG* – August 2002 Revision.

The deviated twin well approach uses less mud and results in lower total volumes of discharged cuttings than individual vertical wells (e.g., roughly 288 vs. 406 m^3 total cuttings per well) (Tables 3.2 and 3.3).

As discussed previously, it is anticipated that SBM will not be required to drill the anticipated simple holes. SBM will be recycled and reused or brought to shore for disposal when spent. Treatment equipment is contained in Table 3.5.

All drilling fluid and solid discharges will be in accordance with the *OWTG* and subject to approval by C-NLOPB.

3.7.4.2. Produced Water

If hydrocarbons are present and testing is conducted then small amounts of produced water may be discharged by atomizing with hydrocarbons and flared. If the flare capacity is exceeded, then small amounts of treated produced water will be brought ashore for disposal.

3.7.4.3. Grey/Black Water

The rig will accommodate about 85-150 personnel. It will discharge about 50 m^3 grey water per day. Black water or sewage will be macerated to 6 mm particle size or less and discharged as per the *OWTG*. Estimated amounts of black water are up to 19 m^3 per day.

Table 3.2. Discharge Estimates for Cuttings and Mud Products – Shallow Vertical Well.

	Unit	Casing Strings			Totals (1 Well)	10 Well Totals	Notes
		Conductor	Surface	Main			
Hole Section	millimetres	914	406	311			
Mud System		Gel / Seawater	Gel / Seawater	WBM			1. RT to seafloor is assumed to be 143-m. This will vary depending on the MODU selected. Cuttings volumes are independent of this measurement.
Depth (see Note 1)	metres RT	215	1,200	3,300			
Gauge Open Hole Volume	m³	47.2	127.5	159.5			
Washout	%	50.0%	25.0%	10.0%			
Products							
Barite	MT (metric ton)	30	60	220	310	3,100	
Bentonite (gel)[1]	MT	20	70		90	900	
Biocide	L (litre)			400	400	4,000	
Caustic Soda	kg			1,125	1,125	11,250	
Corrosion Inhibitor	L			200	200	2,000	
Defoamer	L	20	40	200	260	2,600	
Drilling Detergent	L		100	300	400	4,000	
Fluid Loss Reducer (Starch)	kg (kilogram)			1,021	1,021	10,210	
Fluid Loss Reducer (PAC)	kg			1,816	1,816	18,160	
Kelzan XCD (Viscosifier)	kg			3,000	3,000	30,000	
Lime	kg	200	400		600	6,000	
PEG (Glycol Inhibitor)	L			31,200	31,200	312,000	
PHPA (Inhibitor)	kg			3,632	3,632	36,320	
Potassium Chloride (Inhibitor)	kg			75,000	75,000	750,000	
Oxygen Scavenger	L			1,135	1,135	11,350	
SAPP	kg		454		454	4,540	
Soda Ash	kg	200	375	1,250	1,825	18,250	
Cuttings Volume	m³	71	159	175	406	4,057	

[1] optionally guar gum

Table 3.3. Discharge Estimates for Cuttings and Mud Products – Deviated Twin Well.

	Unit	Casing Strings				Totals (1 well)	5 Well Total	Notes
		Conductor	Surface	Main	SideTrack			
Hole Section	millimetres	914	406	311	311			
Mud System		Gel/Seawater	Gel/Seawater	SBM	SBM			1. RT to seafloor is assumed to be 143- This will vary on the MODU Cuttings volumes independent of this measurement.
Depth	metres RT	215	1,150	3,200	3,550			
Gauge Open Hole Volume	m³	47.2	121.0	155.7	182.3			
Washout	%	50.0%	25.0%	5.0%	5.0%			
Products								
Barite	MT (metric	30	60	346	405	841	4,205	
Bentonite[1]	MT	20	70			90	450	
Calcium Chloride	kg			10,865	12,720	23,585	117,925	
Defoamer (WBM)	L (litre)	20	40			60	300	2. Deviated wells SBM (synthetic mud) in the 31 1- section for efficient drilling and reduced well bore rugosity. A smooth, in-gauge wellbore improves quality of wireline
Drilling Detergent	L		100			100	500	
Emulsifiers (Primary & Secondary)	L			2,050	2,400	4,450	22,250	
Fluid Loss Reducers (SBM - HTHP)	kg			2,255	2,640	4,895	24,475	
Kelzan XCD	kg			100	100	200	1,000	
Lime	kg	200	400	1,845	2,160	4,605	23,025	
PureDrill IA-35 / IA-35LV	m³			99	116	216	1,079	
SAPP	kg		454			454	2,270	
Soda Ash	kg	200	375			575	2,875	
Viscosifier (SBM - Organophillic clay)	kg			2,255	2,640	4,895	24,475	
Wetting Agent (SBM)	L			1,435	1,680	3,115	15,575	
Cuttings Volume	m³	71	151	164	191	577	2,886	

[1] optionally guar gum

Table 3.4. Discharge Estimates for Cuttings and Mud Products – Deep Vertical Well.

	Unit	Casing Strings					Totals (1 Well)
		Conductor	Surface	Intermediate 1	Intermediate 2	Main	
Hole Section	millimetres	914	660	406	311	216	
Mud System		Guar / Seawater	Guar / Seawater	SBM	SBM	SBM	
Depth[1]	metres RT	285	1,200	3,464	4,687	6,227	
Gauge Open Hole Volume	m^3	47.0	313.0	293.0	92.9	56.4	
Washout	%	50.0%	50.0%	5.0%	5.0%	5.0%	
Products							
Guar Gum	kg	675	5,865				6,540
Kelzan XCD (Viscosifier)	kg	90	490				580
NaCl Brine	m^3	91	490				581
Barite	MT (metric ton)			340	184	308	832
Puredrill IA-35LV	m^3			363	82	72	517
Calcium Chloride Brine	m^3			105	40	40	185
Q'Mul I Primary (Emulsifier)	L			7,072	1,664	832	9,568
Q'Mul II Secondary (Emulsifier)	L			6,032	1,456	624	8,112
Lime	kg			16,400	11,123	8,648	36,171
Baragel 3000 (Organophillic clay)	kg			9,035	2,043	1,000	12,078
Q'Wet (wetting agent)	L			1,872	1,040	1,664	4,576
Soltex	kg			2,520	570	484	3,574
Gilsonite	kg			2,520	570	484	3,574
Cuttings Volume	m^3	71	470	307.8	97.5	59.3	1,006

[1]RT to seafloor is assumed to be 213 m. This will vary depending on the MODU selected. Cuttings volumes are independent of this measurement.

Table 3.5. Mud/Cuttings Treatment System.

Equipment	No.	Type	Characteristics
Shale Shakers (Primary)	3 (minimum)	Thule VSM 300 or equivalent	1,000 gpm design flowrate or more
Desilter	1	Swaco or equivalent	16 x 4 in cones Dedicated Mission 6 x 8 centrifugal pump driven by electric motor of 125 hp. Maximum flowrate of 800 gpm.
Centrifuges (Decanting)	2 or more	To be determined	To be determined
Enhanced cuttings cleaning equivalent to the GSF Grand Banks for SBM only.			

3.7.4.4. Bilge Water

Bilge water will be treated to *OWTG* standards (15 mg/L or less).

3.7.4.5. Deck Drainage

Any deck drainage such as the rotary table floor and machinery spaces will undergo treatment as per *OWTG*.

3.7.4.6. Ballast Water

Water used for stability purposes in both supply boats and drilling rigs is stored in dedicated tanks and thus does not normally contain any oil. If oil is suspected in the ballast water it will be tested and if necessary treated to *OWTG* standards.

3.7.4.7. Cooling Water

Top drives and drawworks on rigs are cooled by pumping water through a set of heat exchangers; the water is then discharged overboard in accordance with *OWTG*. Other equipment is cooled through a closed loop system which may use chlorine as a biocide. Water from closed systems will be tested prior to discharge and will comply with the *OWTG*. Any proposals for alternate biocides will be submitted to C-NLOPB for consideration prior to use.

3.7.4.8. Waste

All trash and garbage, including organic waste from galleys, will be containerized and transported to shore for disposal in approved landfills. Combustible waste such as oil rags and paint cans will be placed in hazardous materials containers for transport to shore. The rig will have a recycling program. Waste will be treated in accordance with Husky's Waste Management Plan.

3.7.4.9. Blowout Preventer Fluid

When drilling with semi-submersibles or drillships, BOP test fluid (glycol/water) is released at intervals. A typical BOP function test or pressure test releases approximately 1.0 m^3 of fluid. Function or pressure

testing is conducted approximately once per week. Leakage and intermittent BOP troubleshooting will increase the volume of BOP fluid discharged. A typical annual discharge is approximately 100 m^3.

3.7.4.10. Air Emissions

Air emissions will be reported in accordance with OWTG and the National Pollution Release Inventory.

3.7.5. Geohazard and VSP Surveys

Geohazard/well site surveys and vertical seismic profiling (VSP) using an airgun array may be conducted as part of the drilling activities. The VSP is used to assist in further defining a petroleum resource. The array is similar to that employed by 2-D or 3-D seismic surveys but typically is smaller and deployed in a small area for a 12 to 18 hour period. Well site or geohazard surveys may also deploy a small array and sonar; they are used to identify and avoid unstable areas prior to drilling.

3.7.6. Onsite Environmental/Ice Observers

An onsite environmental observer will also be on board the drilling unit to record and report 24-hour weather, oceanographic and ice parameters. During the potential ice infested water periods, two environmental/ice observers will be stationed on the drilling unit to assist the drilling operations personnel in strategic and tactical planning along with the recording and reporting the weather and oceanographic duties. As part of these duties these personnel will also assist in vessel monitoring under the Collision Avoidance Procedures.

The environmental observers will also conduct seabird and marine mammal observations on a daily basis in accordance with established protocols. The data compiled from these observations will be provided to the Canadian Wildlife Service, Fisheries and Oceans Marine Mammals Section and researchers at Memorial University of Newfoundland.

In addition, an Oceanographic Monitoring Program will again be conducted in accordance with the C-NLOPB Guidelines Respecting Physical Environment Programs. The program will be the same as previous ones and include the installation of current metres and a wave-sensing device.

3.7.7. Project Site Information

3.7.7.1. Environmental Features

The Project has the potential to affect air, water, plankton, fish and fish habitat, fisheries, marine birds and mammals through emissions and discharges, both routine and accidental. There are no known special or unique areas in the Project Area. A description of the physical and biological environment of the northeastern Grand Banks and potential Project interactions and effects are included in the environmental assessment. A valued ecosystem component (VEC) approach is used in the environmental assessment. VECs in the area include seabirds, marine mammals and commercial fisheries. Effects on VECs including cumulative effects (within the Project and with existing and

planned projects) are assessed in the environmental assessment to follow. Focus is on sensitive species, areas and times, including species listed under the Species at Risk Act *(SARA*) and COSEWIC.

3.7.7.2. Species at Risk

Species listed under Schedule I of the *Species at Risk Act* (*SARA*) that may occur to varying degrees in the Project Area include:

- Blue whale (*Balaenoptera musculus*) (endangered)
- North Atlantic right whale (*Eubalaena glacialis*) (endangered)
- Leatherback turtle (*Dermochelys coriacea*) (endangered)
- Northern wolffish (*Anarchichas denticulatus*) (threatened)
- Spotted wolffish (*Anarchichas minor*) (threatened)
- Atlantic wolffish (*Anarchichas lupus*) (special concern)
- Ivory Gull (*Pagophila eburnea*) (special concern)

Other species that are listed as endangered, threatened or special concern on Schedules 2 and 3 of *SARA* or under COSEWIC will also be discussed in the environmental assessment.

3.7.7.3. Land Use

Current and past uses of the area include marine shipping, oil and gas activity, defence-related ship traffic, and commercial fisheries. Hunting of murres, waterfowl, and seals has occurred for many years further inshore from the Project Area.

There are no known sources of contamination in the Project Area although there is a continuing problem on the Grand Banks and the approaches to the Gulf of St. Lawrence in general with oily discharges from disreputable ships. Previous disturbance of the seabed may have occurred from bottom trawling or dredging activity associated with commercial fisheries.

The closest seabird-related protected areas are Cape St. Mary's and Witless Bay which are about 380 and 265 km to the west of the Project Area (Figure 1.1). The closest urban centre is St. John's, about 260 km to the west of the Project Area.

3.7.7.4. Navigable Waters

The physical presence of the rig and supply boats affects navigable waters on the Grand Banks to a small degree. The Project Area is close to major North Atlantic shipping lanes and may receive ship traffic from fishing vessels, tankers, freighters, naval vessels, private yachts and others.

3.7.7.5. Fish and Fish Habitat

The proposed Project Area is on the Grand Banks, a region known to support large and diverse commercial fisheries. In recent years, the most valuable commercial species in the vicinity of the Project Area is snow crab.

Bottom fish habitats appear typical of that area of the Grand Banks. Fish and fish habitat, and fisheries will be covered in detail in the environmental assessment to follow.

The most proximate fish-related protected area, the Bonavista Cod Box, is located approximately 115 km from the Project Area (Figure 1.1). The northwest part of the defined Study Area overlaps with part of the Bonavista Cod Box.

3.7.8. Effects of the Environment on the Project

Effects of the physical environment on the Project include those caused by wind, ice, waves, and currents. A description of these components, including extreme events, will be contained in the environmental assessment to follow.

Effects of the biological environment on the Project are primarily those related to biofouling. Biofouling may affect rig stability and corrosion and may also affect the interior of pipes as well as water intakes and outlets. The biofouling community will be discussed under ‘Fish and Fish Habitat VEC’ in the environmental assessment to follow.