Husky Energy

White Rose Extension Project

Development Application Summary

June 2014

Husky Energy SUNCOR ENERGY nalcor energy

Table Of Contents

LIST OF FIGURES

LIST OF TABLES

ACRONYMS AND ABBREVIATIONS

Term	Description
ALARP	as low as reasonably practicable
AMA	Argentia Management Authority Inc.
BNA	Ben Nevis-Avalon
CDC	Central Drill Centre
CGS	concrete gravity structure
CMA	Census Metropolitan Area
C-NLOPB	Canada-Newfoundland and Labrador Offshore Petroleum Board
CO	carbon monoxide
CRI	cuttings reinjection
DFO	Fisheries and Oceans Canada
FEED	front-end engineering and design
FPSO	floating production, storage and offloading vessel
FVF	formation volume factor
GDP	Gross Domestic Product
GHG	greenhouse gas
GIIP	gas initially in place
HOIMS	Husky Operational Integrity Management System
ICSS	Integrated Control and Safety System
IOR	improved oil recovery
IR	Individual Risk
ISO	International Standards Organization
km	kilometre
kPa	kilopascals
m	metre
m^3	cubic metre
MODU	mobile offshore drilling unit
NDC	Northern Drill Centre
NLDF	Newfoundland and Labrador Department of Finance
NLHC	Newfoundland and Labrador Housing Corporation
NO_x	nitrogen oxides
OOIP	original oil in place
PVT	pressure, volume, temperature
R&D	Research and Development

Term	Description
SBM	synthetic-based mud
SEIS	Socio-economic Impact Statement
SO_2	sulphur dioxide
SWRX	South White Rose Extension
TSP	total suspended particulate
TVDss	true vertical depth subsea
VOC	volatile organic carbon
VSP	vertical seismic profile
WAG	water-alternating gas injection
WHP	wellhead platform
WREP	White Rose Extension Project

1.0 INTRODUCTION

Husky Oil Operations Limited (Husky), on behalf of the White Rose Extension Project (WREP) co-venturers Suncor Energy Inc. and Nalcor Energy – Oil and Gas Inc., is leading the development of the WREP. The WREP will develop the West White Rose pool and other potential resources using a wellhead platform (WHP). The WREP includes the construction of the WHP onshore and installation of the WHP in the White Rose field.

1.1 White Rose Field

The White Rose field and satellite extensions are located in the Jeanne d'Arc Basin, 350 km east of Newfoundland and Labrador, in approximately 120 m of water (Figure 1-1). Development to date has been through subsea drill centres, with flexible flowlines bringing crude oil to a centralized floating production platform, the *SeaRose* floating production, storage and offloading (*FPSO*) vessel. The White Rose field was initially developed with two drill centres; the Central Drill Centre (CDC) and the Southern Drill Centre producing oil. A third drill centre, the Northern Drill Centre (NDC), is used as an injection site for gas that is being stored for future use. First oil from the White Rose field was produced in November 2005.

Figure 1-1 Location of the White Rose Field

In May 2010, production commenced from North Amethyst, the first of a number of potential subsea tie-ins to the main White Rose field. Similar to White Rose, North Amethyst was developed in a subsea drill centre, the North Amethyst Drill Centre, tied back through the CDC to the *SeaRose FPSO* for production, storage and export to tanker.

The North Amethyst field has a separate Development Plan from that of White Rose and it is currently not planned to use the WHP to access the North Amethyst resources. However, opportunities for improved oil recovery from the WHP may be feasible later in field life.

Husky continues to investigate additional potential opportunities within the White Rose region and further delineation has the potential to provide additional resources that may be accessed from the WHP.

1.2 Project Scope

The WHP will be comprised of a concrete gravity structure (CGS) with topsides consisting of drilling facilities, wellheads and support services such as accommodations for up to 144 persons, utilities, a flare boom and a helideck. The primary function of the WHP is drilling. There will be no oil storage in the CGS. All well fluids will be transported via subsea flowlines to the *SeaRose FPSO* for processing, storage and offloading. The design of the WHP will account for the risks posed by icebergs, sea ice and the harsh environmental conditions found offshore Newfoundland and Labrador. The productive life of the WHP facility is currently planned to be 25 years. A conceptual illustration of the WHP is provided in Figure1-2.

The WHP will accommodate 20 well slots using conductor sharing wellhead technology in some or all wells, which allows two wells to be drilled in each conductor, for a total of up to 40 wells. The well count and designation of slot will be finalized once depletion planning is finalized.

The CGS will be constructed in a purpose-built graving dock. A review of potential onshore CGS construction sites on the Island of Newfoundland was undertaken and Argentia was identified as the most suitable location for the construction of the CGS. The Argentia Peninsula is located in Placentia Bay, 130 km southwest of St. John’s, NL. The graving dock at Argentia is depicted in Figure 1-3.

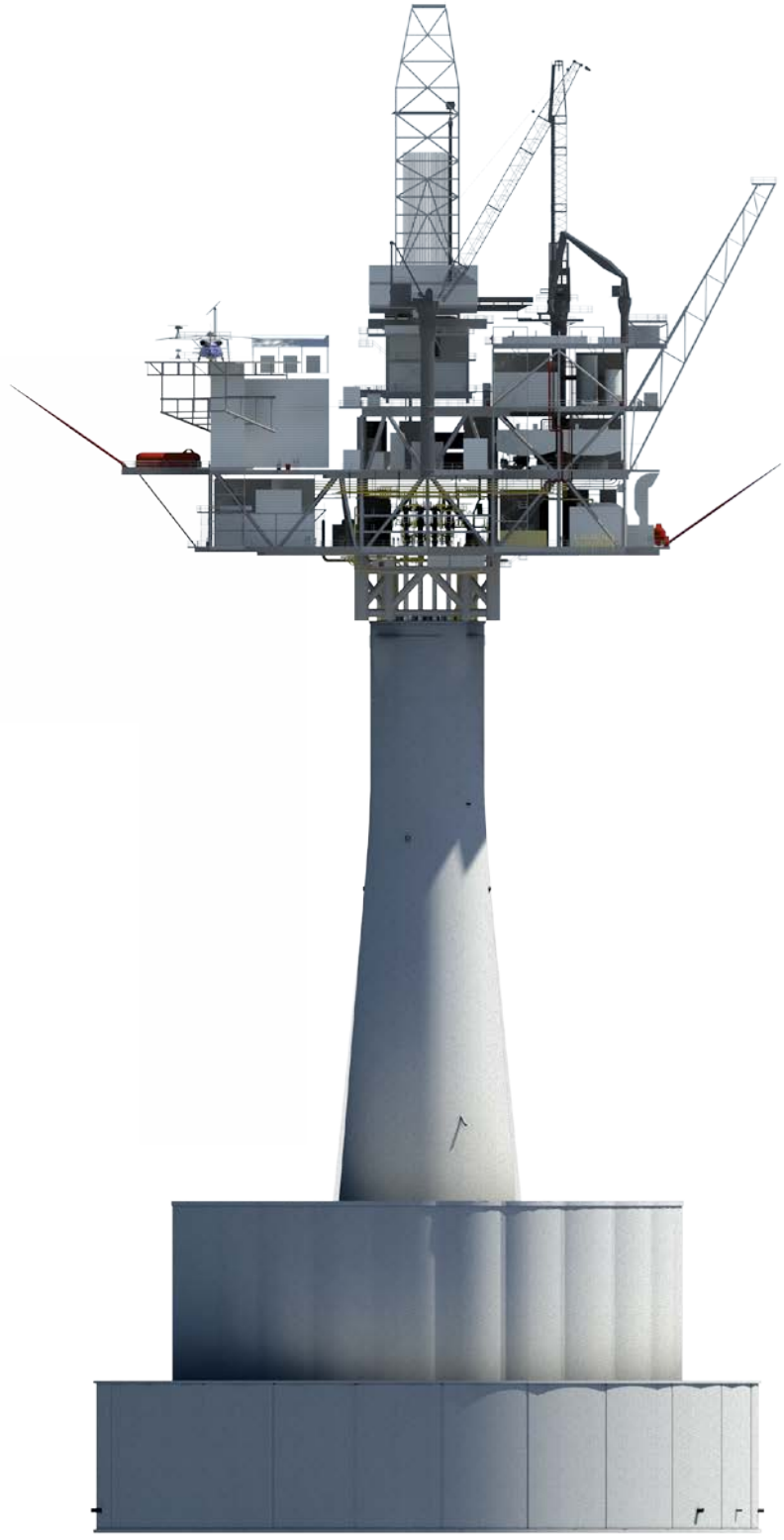

Figure 1-2 Conceptual Wellhead Platform

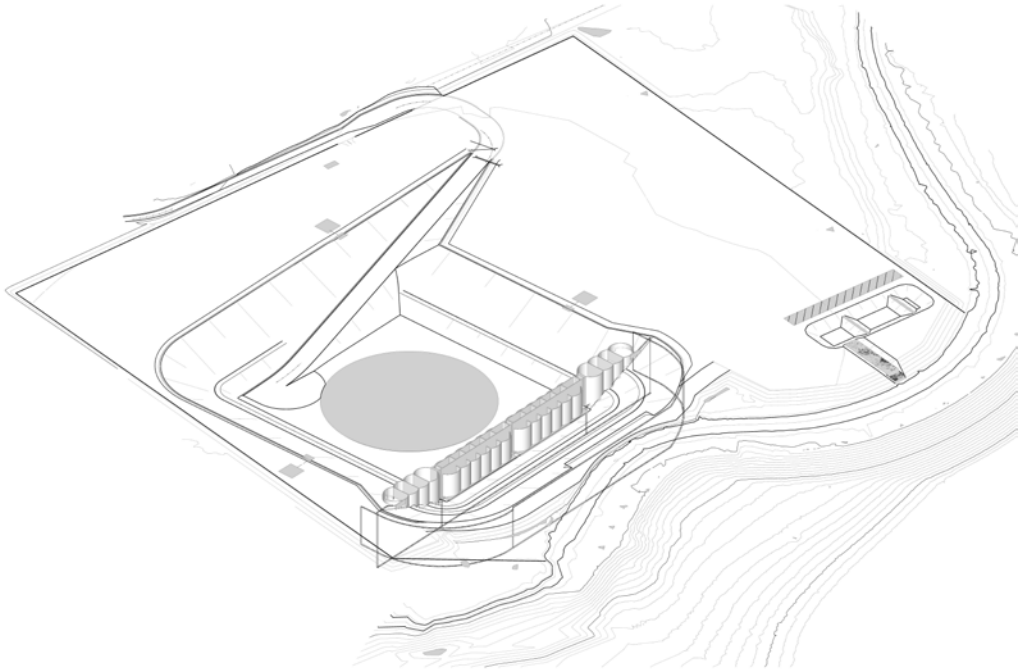

Figure 1-3 Graving Dock with Dock Gates

Following construction, the CGS will be towed to the White Rose field. It is anticipated the transit to the White Rose field from Placentia Bay will take approximately 6 days. Figure 1-4 shows the potential CGS tow-out route from Placentia Bay to the White Rose field. Once the CGS is on location and ballasted, the topsides will be installed by a specialized platform installation vessel and hook up and commissioning will be completed.

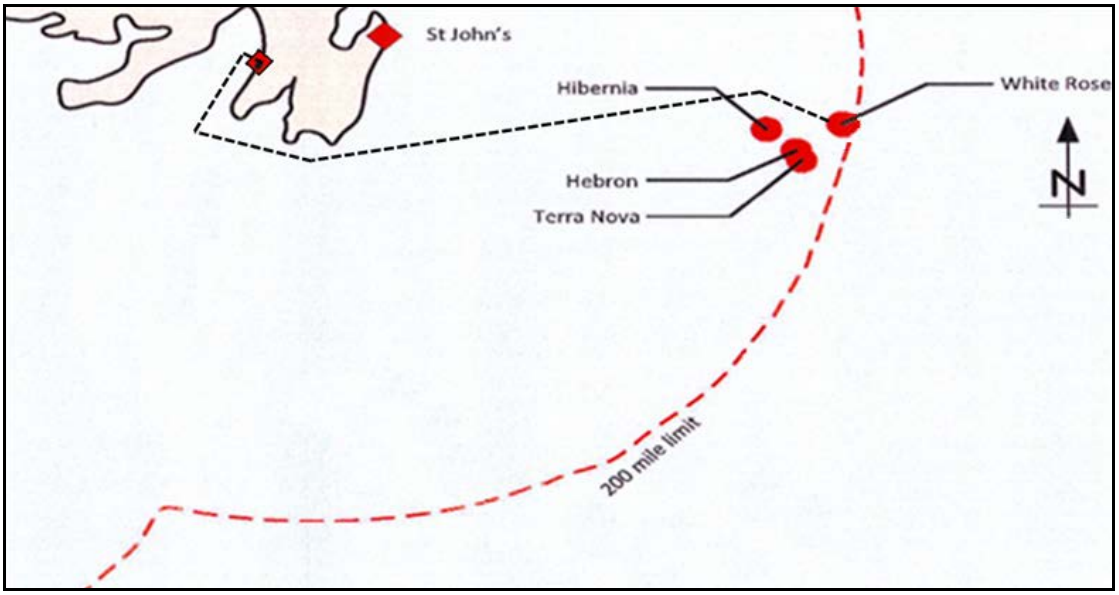

Figure 1-4 Potential Concrete Gravity Structure Tow out Route to White Rose Field

The WREP will continue to use the existing infrastructure in the White Rose field, including the *SeaRose FPSO* and existing drill centres. The *SeaRose FPSO* process facilities will continue to supply injection water and gas to existing subsea drill centres and the WHP. The *SeaRose FPSO* will also continue to process all incoming production well fluids from the WHP, and store and offload crude oil for export.

The WREP is the next step in further development of White Rose area resources. The West White Rose pool was identified for potential development in the original White Rose Development Plan (Husky Oil 2001a) and is the primary focus of the WREP. Development of WREP resources will provide oil production to assist in offsetting the natural decline in production from the main White Rose pool and the North Amethyst field. Oil production from the WREP will also result in additional royalties to the provincial government and a share of profits through Nalcor's equity interest in the WREP.

The evaluation of options for the WREP focused on concepts that used the *SeaRose FPSO* and existing subsea infrastructure. Two alternative development schemes, a subsea drill centre or a WHP, were considered for development of the West White Rose pool. Analysis of these alternatives indicated that the preferred means to recover the identified resources in the White Rose region was through the use of a WHP. The WHP offers lower drilling and completion costs as compared to a semi-submersible drilling rig and because the wellheads would be on the platform, rather than subsea, there are greater opportunities for well interventions and other practices to improve ultimate recovery of resources. The WHP will also be designed to allow for re-injection of synthetic-based mud (SBM) cuttings into a disposal well, rather than discharge of treated cuttings and the main power generation on the WHP will use natural gas rather than diesel fuel. Throughout the development of the White Rose project, Husky has demonstrated a strong commitment to ensuring that maximum project benefits accrue to Newfoundland and Labrador. Husky has in place policies and procedures to provide Newfoundland and Labrador and Canadian companies with full and fair opportunity and first consideration to supply goods and services in support of WREP development.

1.3 Regulatory Context

Oil and gas exploration and development activities in the Newfoundland and Labrador offshore area are regulated by the Canada-Newfoundland Atlantic Accord Implementation Act and the Canada-Newfoundland and Labrador Atlantic Accord Implementation Newfoundland and Labrador Act (collectively, the Atlantic Accord Acts). Under the Atlantic Accord Acts, proponents must submit a Canada-Newfoundland and Labrador Benefits Plan (Benefits Plan) and Development Plan. The Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) was established by the joint operation of the Atlantic Accord Acts. The C-NLOPB provides guidelines to operators for the preparation of a benefits plan and development plan (C-NLOPB 2006a, 2006b).

The WREP is wholly contained within the White Rose field, for which there is an approved Benefits Plan (Husky Oil 2001b) and Development Plan (Husky Oil 2001a). Therefore, as instructed by the C-NLOPB, Husky has prepared a Benefits Plan Amendment and Development Plan Amendment. The C-NLOPB also required preparation of a socio-economic impact statement and sustainable development report as part of the application. As well, according to Section 43 of the Newfoundland Offshore Petroleum Installations Regulations (of the Atlantic Accord Acts), an operator is required to submit to the Chief Safety Officer a concept safety analysis of an installation that considers all components and activities associated with each phase in the life of the production installation.

The C-NLOPB is also required to conduct an environmental assessment of proposed oil and gas projects, such as the WREP, before they may issue authorizations, licenses and permits for the purpose of enabling such projects to be developed. This type of project was listed on the Inclusion List Regulations under the Canadian Environmental Assessment Act (CEAA) and required a Screening level of assessment. The provincial environmental assessment process was also triggered by the requirement for construction of a graving dock at Argentia. The review by the C-NLOPB and provincial and federal agencies was a harmonized process coordinated by the C-NLOPB. The environmental assessment for the WREP was completed in October 2013. A summary of the environmental assessment is provided in Section 6.0 of this document.

1.4 Schedule

The WREP schedule is shown in Figure 1-5.

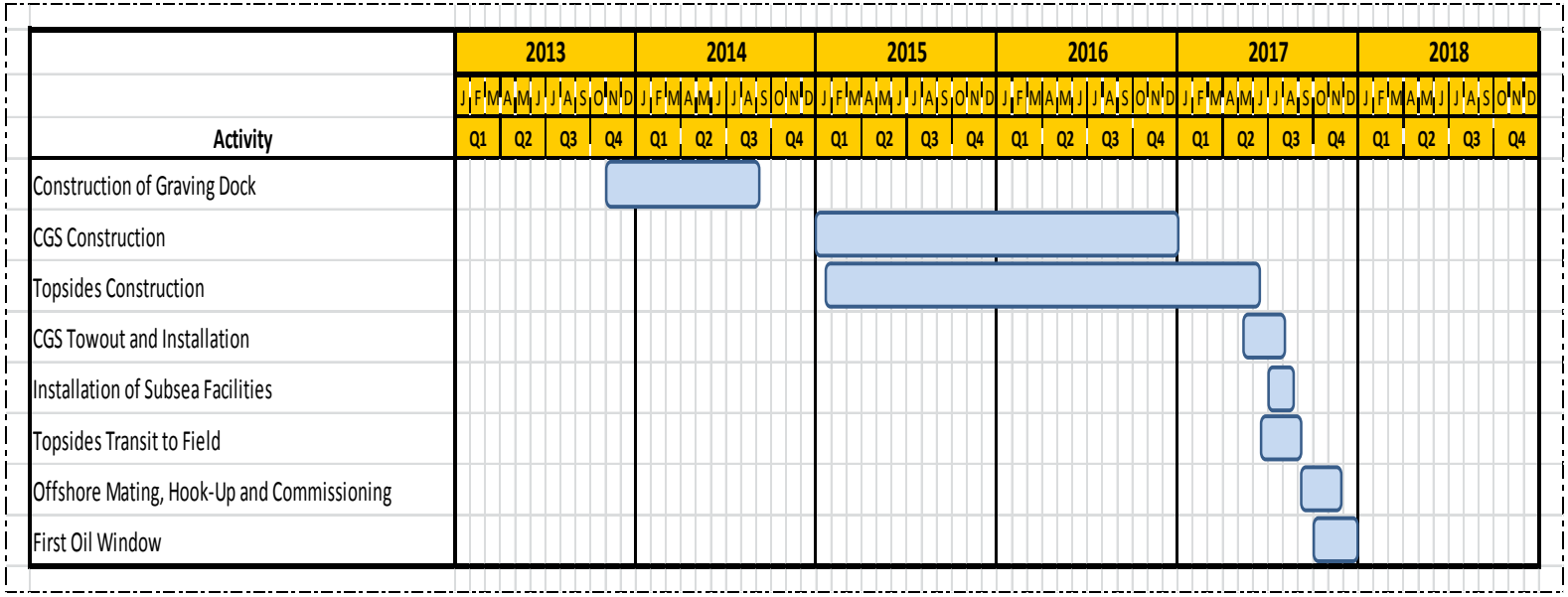

Figure 1-5 White Rose Extension Project Schedule

2.0 CANADA-NEWFOUNDLAND AND LABRADOR BENEFITS PLAN AMENDMENT

Husky (as Operator) and Suncor Energy (previously Petro-Canada) submitted a Benefits Plan for the White Rose development to the C-NLOPB in January 2001 (Husky Oil 2001b). This Benefits Plan was prepared pursuant to the Atlantic Accord Acts. The C-NLOPB approved the White Rose Benefits Plan in December 2001.

Husky recognizes that the Atlantic Accord Acts provide the legislative basis for the development of the oil and gas resources offshore Newfoundland and Labrador to benefit Canada as a whole and, in particular, the Province of Newfoundland and Labrador. The Atlantic Accord Acts also recognize the right of the province to be the principal beneficiary of the oil and gas resources off its shores. Husky strongly believes in this assertion, and the success of the White Rose and North Amethyst projects are evidence of its commitment to delivering substantial benefits to the Province of Newfoundland and Labrador.

2.1 Management of Industrial Benefits

The policies and procedures outlined in the original White Rose Benefits Plan are still relevant and will remain unchanged as the company pursues other opportunities in the Newfoundland offshore area. This governing document is also aligned with Husky's premise in 2000 that production facilities can be designed to accommodate multi-pool or expanded development concepts.

This Benefits Plan Amendment also takes into consideration the 2013 White Rose Expansion Project Framework Amending agreement with the Government of Newfoundland and Labrador. During execution of the WREP, Husky will fulfill all commitments made in this agreement. Husky has in place a robust procurement and contracting process that ensures full and fair opportunity for Newfoundland and Labrador and Canadian companies to provide goods and services. Canada-Newfoundland and Labrador benefits will continue to be a factor in procurement. The Senior Industrial Benefits Advisor will continue to complete a Canada-Newfoundland and Labrador benefits review of potential contractors as part of the procurement process. The Manager of Administration and Regulatory Affairs, responsible for industrial benefits monitoring and reporting, reviews and signs off on all procurement plans and contract recommendations. Husky's expectations related to Canada-Newfoundland and Labrador benefits, including provision of full and fair opportunity and first consideration in procurement processes and first consideration to Newfoundland and Labrador residents for training and employment, will be made clear to Husky's contractors and they will be expected to have in place processes and procedures to ensure that Husky's Canada-Newfoundland and Labrador benefits requirements are met.

Early in the planning phases of the White Rose Development, Husky developed a Canada-Newfoundland and Labrador Benefits Reporting and Procedure Manual, which continues to guide how Husky and its contractors conduct business. The Canada-Newfoundland and Labrador Benefits Schedule defines contractor requirements with respect to generating and documenting benefits associated with or resulting from the White Rose Project. This schedule is part of bid documentation and all contracts issued by Husky. The Manual and Schedule will continue to be used for the WREP.

2.2 Project Management and Execution

2.2.1 Project Management

Husky has identified Atlantic Canada as a core business area for the company. The WREP management team will be located in Newfoundland and Labrador and has the responsibility for development plan execution and ensuring that all operations are conducted safely, in an environmentally responsible manner, and in accordance with all corporate policies and regulatory requirements. Husky, as the operator of White Rose, will manage the development of the WREP and subsequent operations. The operator's authority, role, responsibility and reporting requirements are outlined in the agreement in place between the WREP co-venturers.

Husky recognizes the maturity and experience of the engineering community within the province and where possible, will endeavour to engage their services to assist in the execution of the WREP. Husky also commits to hiring engineering co-op students to work in the WREP office for the duration of the WREP. Husky recognizes that in Newfoundland and Labrador, registration with Professional Engineers and Geosciences Newfoundland and Labrador is mandatory for anyone practicing engineering or geoscience, as defined in the Engineers and Geoscientists Act, 2008. Professional members licensed by Professional Engineers and Geosciences Newfoundland and Labrador are the only persons permitted by law to undertake and assume responsibility for engineering and geoscience work in the province of Newfoundland and Labrador.

All contractors who are engaged to carry out work on behalf of Husky will be managed from the WREP office and will be required to adhere to all benefits commitments. Instructions for Canada-Newfoundland and Labrador benefits reporting are included in Husky's Canada Newfoundland and Labrador Benefits Schedule, which is issued to all contractors as part of a contract.

2.2.2 Engineering Procurement and Construction

Husky has completed front-end engineering and design (FEED) and is currently conducting detailed engineering for the graving dock and the WHP. ARUP Canada was selected through a competitive bid process to conduct pre-FEED, FEED and detailed

design work on the CGS and the graving dock at Argentia. Mustang/PSN was contracted to complete pre-FEED, FEED and detailed design for the WHP topsides.

The planned contracting strategy for construction is to award five major contracts:

Graving Dock Construction

Following a competitive bid process, the contract for this scope of work was awarded to Dexter Construction Company Limited. Construction of the graving dock at Argentia began in November 2013.

CGS and Dock Gates Construction

Through a pre-qualification process, three respondents have been selected to bid on CGS and dock gates construction. It is anticipated that the invitation to bid for this scope of work will be issued in Q2 2014.

Topsides Fabrication

A pre-qualification process for topsides fabrication was initiated in October 2013. Responses to the pre-qualification request were received in December 2013 and are currently under review. It is anticipated that the invitation to bid for topsides fabrication will be issued in Q2 2014.

Offshore Transportation and Installation

Preliminary planning for this scope of work is ongoing. It is anticipated that this contract will be awarded in Q4 2014.

WHP Subsea Tieback

Preliminary planning for this scope of work is ongoing. It is anticipated that an invitation to bid will be issued in Q2 2014.

The selected contractors will be responsible for subcontracting all required goods and services for each of the above scopes. Contractors and subcontractors will be expected to adhere to Husky's benefits and diversity commitments. Specifically, the successful topsides contractor will be required to procure flare boom and life boat stations from fabrication companies in Newfoundland and Labrador. Husky plans to begin the procurement process for the modular accommodation boxes and helideck components. These components will also be fabricated in Newfoundland and Labrador.

2.2.3 Supplier Development

Husky and its contractors were involved in many proactive supplier development initiatives during the original White Rose project and will continue with similar initiatives for the WREP. Bid lists for contracts and quarterly forecasts will be advertised on the Husky project website and/or its major contractor's project websites. Expressions of interest and requests for bids/quotations will also be advertised on these websites, as well as in the Newfoundland & Labrador Oil & Gas Industries Association Bulletin.

Husky commits to holding supplier development information sessions during the WREP to provide the local business community with a chance to learn about procurement opportunities. Husky's main sub-contractors will also be involved in similar activities as well, including advertising of all procurement opportunities on a timely basis. Where possible, Husky will identify areas where there may be a potential for technology transfer and work with the local business community, governments and educational institutions to explore and develop these opportunities.

2.2.4 Procurement and Contracting

To date, procurement and contracting activities have been conducted consistent with the strategies employed on the original White Rose development (described in Husky's Canada-Newfoundland and Labrador Benefits Reporting and Procedure Manual). Husky intends to continue the practices established in the past that ensure bid specifications and packages are released to the business community structured in a manner that will enable broad participation. As in the past, communication of Husky's bid procedures to qualified Newfoundland and Labrador and other Canadian suppliers and manufacturers will be on a timely basis. Procurement offices of Husky and its contractors will be located in Newfoundland and Labrador.

All contractors will be provided with Husky's Canada-Newfoundland and Labrador Benefits Reporting and Procedures Manual and Canada-Newfoundland and Labrador Benefits Schedule and briefed to ensure they understand Husky's commitments and obligations.

2.2.5 Employment and Training

With respect to training and employment opportunities, Husky and its contractors remain committed to the principle of first consideration for residents of Newfoundland and Labrador. Husky will maximize, to the extent possible, the number of Newfoundland and Labrador and other Canadian residents employed on the project. The project office will be located in St. John's and recruitment will be carried out locally. When qualified Newfoundland and Labrador or Canadian residents are unavailable to fill certain positions, whenever possible, succession plans will be established to qualify local residents to eventually fill positions held by expatriates, particularly for operations

positions. Husky will continue to employ work-term students from Memorial University and other local educational facilities to support the project team.

2.2.6 Skills Development

Husky, as well as many of the White Rose contractors, continue to undertake specific initiatives to promote skills development including participation in the Techsploration program sponsored by Women in Resource Development Council, the Women in Science and Engineering Student Education Employment Program, and participation on the Petroleum Industry Human Resources Committee, which promotes the oil industry as a viable career option to high school students. Husky also provides funding and volunteers for Junior Achievement's Economics of Staying in School program, which communicates the value of staying in school to grade nine students. In 2013, Husky employed 89 work term students through Memorial University's Cooperative Education Program.

Husky will work in collaboration with the provincial government, education and training institutions, unions and project contractors to identify trade skill areas that are in short supply and to work in collaboration with the provincial government, education and training institutions, unions and project contractors to develop programs and strategies for closing those gaps.

For non-apprenticed trades and skills, where programs are not in place, Husky will work in collaboration with these same stakeholders to develop new short-term training programs to ensure the immediate needs of the project are met through the local work force.

2.3 Industrial Benefits Opportunities – Construction Phase

2.3.1 Graving Dock Construction

The CGS will be constructed in a purpose-built graving dock at Argentia, NL. The graving dock will have reinforced concrete gates that will allow future re-use of the facility.

The graving dock can be used future construction of jackets and gravity based structures for offshore oil and gas, wind and marine energy sectors as well as ship/vessel building, repair and maintenance (including mobile offshore drilling units (MODUs) and jack-ups) and decommissioning and dismantling of offshore and marine facilities. Future management of the facility may be done by Husky or by the Argentia Management Authority. Husky also has the ability to lease the facility to a third party.

In the future, also from a research and development perspective, the facility can act as a stepping stone between smaller scale model testing and more complex and expensive offshore field technology trials. Investigations could include glacial ice interactions,

marine soils and geotechnical investigations, marine growth and marine corrosion mechanisms and mitigations and wet testing of prototype subsea processing technologies.

Construction of the graving dock gates will be included in the contract for construction of the CGS. The overall construction site area is approximately 20 hectares. Development of the site will require general excavating, grading and dewatering activities. The use of existing access roads, power and water supplies will be maximized. Roads will be extended into the site and existing roads will be repaired as required. Similarly, overhead power lines will be extended into the site and fed to a site distribution system.

2.3.2 Concrete Gravity Structure

The contractor responsible for the construction of the CGS will establish site infrastructure in accordance with an approved execution plan. Site facilities including temporary buildings will be established to support the construction program.

Potential support facilities include primary and secondary concrete batching plants, offices, mess hall, medical clinic, temporary sheds, lay down areas and storage areas. The construction site will be fully fenced with a security-controlled entrance. All buildings will be temporary and set on concrete sleepers or trailers above ground.

The CGS will be constructed in the dry, meaning the concrete substructure will be completed in the graving dock prior to tow out to a deep water site for topsides mating. The primary materials for CGS construction are cement, sand, gravel and steel rebar for the concrete, and structural steel and pipe for the fitting out of the shaft. The current estimate for the required volume of concrete is approximately 72,000 m^3. Aggregate will be sourced from an existing quarry in Newfoundland and Labrador.

The single shaft of the CGS will contain all the mechanical components for WHP. The shaft will contain J-tubes to house flexible risers for the connection of the facilities to the existing *SeaRose FPSO*, drilling conductor guide frames, caissons for fire water pumps, sea water recovery, treated sewage water disposal, water-based drill cuttings discharge and access within the shaft. It is expected that most mechanical outfitting components will be fabricated in Newfoundland and Labrador (refer to Table 2-1).

Table 2-1 Procurement Opportunities - WREP

Major Equipment Packages	Potential Supplier Locations		
	Newfoundland and Labrador	Other Canada	Foreign
Graving Dock Construction			
Road upgrading	X	X	
Water supply connection	X	X	
Power supply connection	X	X	
Concrete batch plant		X	X
Supporting buildings (offices/mess/medical clinic/temporary sheds)	X	X	
Site excavation	X	X	
Berm construction	X	X	
Cut-off wall installation		X	X
Spoils disposal	X	X	
Pumps (site dewatering)	X	X	X
Settling pond	X	X	
Fencing	X	X	
Site security	X	X	
Diesel fuel	X	X	
Waste disposal	X	X	
CGS Construction			
Cement	X		
Aggregate and add mixtures	X		
Rebar	X		
Fabrication of structural steel	X		
Caisson and embedment plates	X	X	
Dewatering pumps	X	X	X
Tower and luffing cranes		X	X
Jibb cranes		X	X
Heavy duty crawler cranes	X	X	
Personnel and material hoists		X	X
Slipforms	X	X	X
Magnetite ballast	X	X	
Conductor guide frames	X	X	
Ladder tower	X	X	
Vertical pipe guides	X	X	
Caisson roof false work	X	X	
Cap slab false work	X	X	
Fabrication of risers and J-tubes	X	X	
Seawater inlet and ballast manifolds	X	X	
Dill cutting shutes	X	X	
Pipework clamps and guides	X	X	

Major Equipment Packages	Potential Supplier Locations		
	Newfoundland and Labrador	**Other Canada**	**Foreign**
Topsides Fabrication			
Accommodation modules	X		
Helideck	X		
Flare boom	X		
Life boat stations	X		
CGS Tow Out and Topsides Integration			
Tow out channel dredging			X
Berm removal			X
Tow out tugs	X	X	X
Platform installation vessel			X
Accommodation vessel		X	X
Assistant tug	X	X	
Supply vessel	X	X	
Diesel Fuel	X	X	
WHP Tow Out, Hook up and Commissioning			
Tow out route survey	X	X	
Tow out tugs			X
Flowlines, risers, umbilicals			X
Solid Ballast	X	X	X
Dive Support vessel			X
Construction vessel			X
Custom Brokerage	X	X	
Diesel Fuel	X	X	

An illustration of the completed CGS situated in the graving dock, prior to tow out, is provided in Figure 2-1.

Figure 2-1 Proposed Concrete Gravity Structure

2.3.3 Topsides

The topsides is an integrated structure which consists of drilling facilities, wellheads and support services including accommodations for up to 144 persons, utilities and a helideck. Topsides construction will take place in an international fabrication yard identified through a competitive bidding process. It is anticipated that the following components of the topsides will be fabricated in Newfoundland and Labrador and shipped to the topsides fabrication yard for integration into the topsides structure:

- Modular accommodation boxes
- Helideck
- Flare boom
- Life boat stations.

An illustration of the proposed topsides is provided in Figure 2-2.

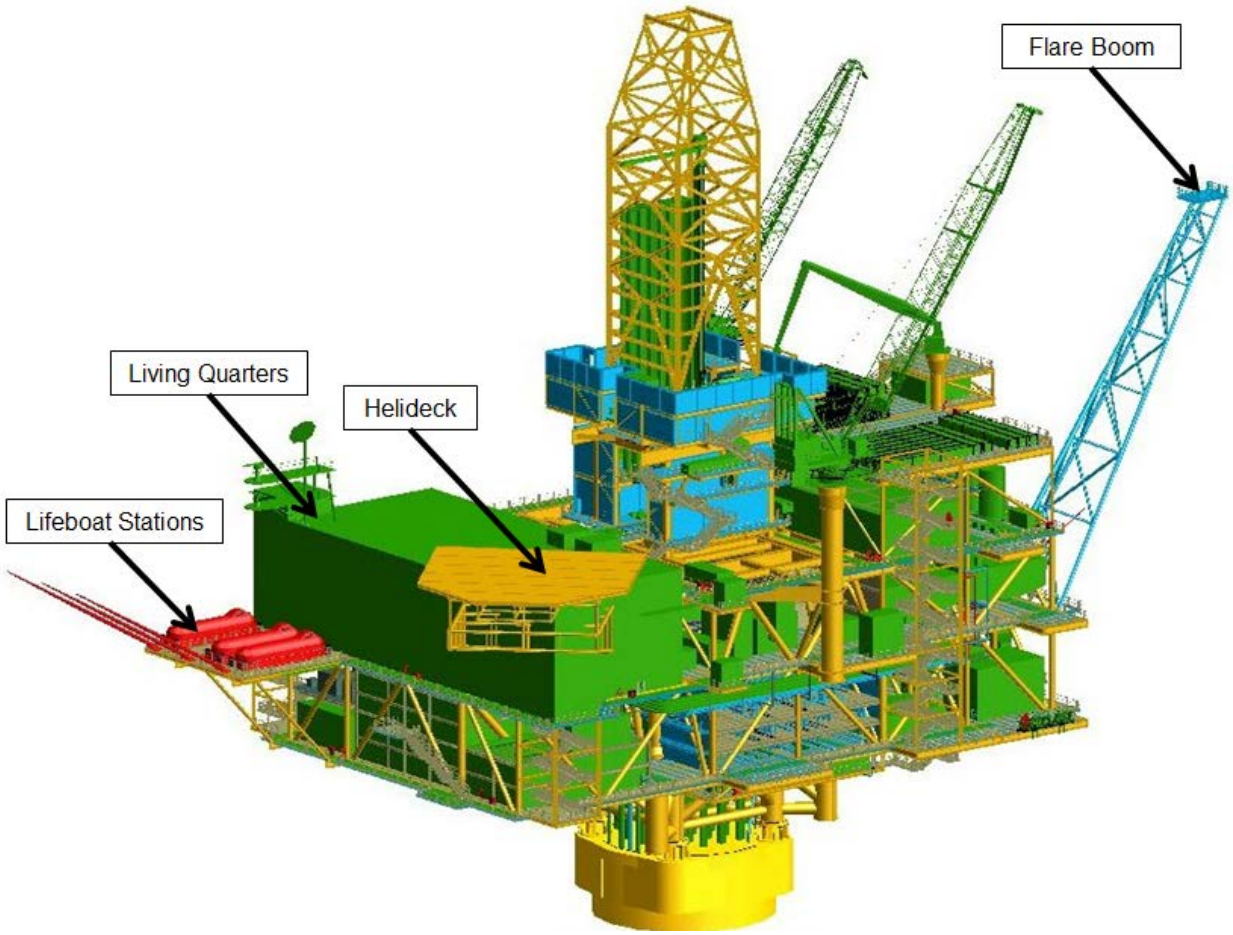

Figure 2-2 Proposed Topsides

Upon completion of fabrication and commissioning work, the topsides structure will be transported to the White Rose field.

2.3.4 Marine-Related Activities and WHP Installation

Upon completion, the CGS will be towed from Argentia to the White Rose field. Some shoreline and channel dredging will be required along the tow route. It is anticipated that four tugs will be used for the transit of the CGS. Once the CGS is on location and ballasted, the topsides will be installed by a specialized platform installation vessel and hookup and commissioning will be completed. There will be an accommodation vessel for the estimated 100 workers engaged in final hook up and commissioning activities. Logistical support will be provided by vessels from the Port of St. John's.

2.3.5 Subsea Components

Offshore the WHP will be connected to the *SeaRose FPSO* via flowlines for production, water injection and gas. The flowlines will be installed by a specialized installation vessel. Tie-in to the WHP risers and to the existing manifolds will be completed by divers deployed from a specialized diving support vessel.

2.3.6 Construction and Fabrication Capacity

Newfoundland and Labrador and Atlantic Canada have a range of facilities available for major construction and fabrication work. Through work on previous offshore oil projects as well as on mining and other types of developments, the construction and fabrication capacity in Newfoundland and Labrador has greatly increased over the last few decades.

There are currently only two fabrication yards that are large enough to fabricate topsides modules such as derrick equipment sets and drilling support modules. These yards are the Bull Arm site at Mosquito Cove and the Kiewit Offshore Services site at Marystown. Both of these yards are currently under contract to the Hebron project for construction of topsides components associated with that project. Kiewit Offshore Services has indicated that they do not have the capacity to build any additional structures outside of those currently identified for the Hebron project. Similarly, the Bull Arm site has been exclusively contracted by the Hebron project and there is no opportunity for other projects to avail of this site while the Hebron project is being constructed there. A market survey has confirmed that there are fabrication facilities in Newfoundland and Labrador that have the capability and capacity to fabricate the modular accommodation boxes, helideck, flare boom and life boat stations. It is also expected that the majority of the CGS mechanical outfitting components can be fabricated in Newfoundland and Labrador.

2.3.7 Goods and Services Requirements and Capacity

It is anticipated that certain WREP goods and services will be provided by Newfoundland and Labrador-based companies, particularly during graving dock construction, CGS/ dock gate construction, appurtenances fabrication and activities related to topsides mating and offshore installation. The opportunities available to the local industry include earth moving equipment to build the graving dock, dewatering services, fencing, security and provision of on-site infrastructure. For CGS/dock gates construction, opportunities include provision of concrete, aggregate, rebar, fabricated assemblies and associated requirements. Fabrication of the accommodation modules, helideck, flare boom and life boat stations will provide opportunities for local fabrication companies. During topsides mating, support of personnel offshore will be required. This will include catering, medical services and fuel for the accommodation and support vessels. Husky commits to

providing full and fair opportunity and first consideration in procurement processes to companies in the province and other parts of Canada.

Certain requirements will be manufactured and sourced outside of Newfoundland, including flowlines and other subsea support equipment. Installation of the subsea components to support the wellhead platform will be done by specialized vessels. However, there will be short term employment opportunities for qualified Newfoundland and Labrador and Canadian personnel on these vessels during the installation program.

2.3.8 Labour Requirements

Offshore development activity generates both direct and indirect employment opportunities. For the WREP, employment opportunities will be realized through construction of the graving dock and dock gates at Argentia, construction of the CGS and some components of the topsides facilities. The location of engineering and project management in the province will provide opportunities for engineers and technicians as well as other office support staff.

It is estimated that over 5 million hours of employment will take place in Newfoundland during the engineering and construction phase of the WREP. This includes detailed design, graving dock construction, CGS construction, subsea components, marine installation and project management.

The construction phase of the WREP is going to require a wide range of skill sets. For graving dock construction, the following types of skills will be required:

- Electrical trades
- Machinery and transportation equipment mechanics
- Crane operators and drillers
- Motor vehicle and transit drivers
- Heavy equipment operators
- Trades helpers and labourers.

CGS/dock gates construction will require the following types of skills:

- Ironworkers
- Concrete finishers
- Electrical trades
- Plumbers, pipefitters and gas fitters
- Carpenters and cabinetmakers

- Machinery and transportation equipment mechanics
- Other mechanics and related repairers
- Crane operators and drillers
- Motor vehicle and transit drivers
- Heavy equipment operators
- Trades helpers and labourers.

Fabrication of the topsides appurtenances will require the following types of skills:

- Iron workers
- Pipefitters
- Painters
- Construction inspectors
- Carpenters
- Electrical trades
- Plumbers
- Trades helpers and labourers.

Other skills required to support the WREP construction phase include:

- Contract analysts
- Procurement specialists
- HSE specialists
- Document control specialists
- Medics
- Security
- Project controls specialists
- Estimators
- Project planners
- Administrative assistants
- Engineers (electrical, chemical, geological, civil, mechanical, petroleum)
- Architects.

Total person hours for the construction phase of the WREP are estimated to be 8,138,000. The number of person hours estimated to be executed in Newfoundland and Labrador is 5,454,000.

The skill sets noted above were also required for construction of the Vale Inco nickel processing plant in Long Harbour. This construction program will be winding down when Husky anticipates start of graving dock construction. Therefore, there will be a pool of workers that can move from the Vale Inco site to the Argentia site.

Work on the Hebron project and the Lower Churchill project will also be getting underway in the same timeframe and that project will require some of the same skills sets required by Husky for CGS construction. However, the workforce that will be required for the WREP is significantly smaller than that required for both the Lower Churchill and Hebron construction projects. Husky is confident that the required workers will be sourced through collaboration with our contractors and the relevant trade unions.

Where specific skill development is required to meet Project needs, Husky and its contractors and suppliers will work with educational institutions, industry and other stakeholders to facilitate the delivery of training to residents of Newfoundland and Labrador, including members of designated groups. Training may include regulatory/ safety, technical, competency and leadership training, and will be delivered through various means including on the job training and apprenticeships.

The estimated person hours required for graving dock, CGS/dock gates construction and topsides appurtenances fabrication in Newfoundland and Labrador are listed in Table 2-2.

Table 2-2 Newfoundland and Labrador Person Hours for Construction of the WREP

Activity	Newfoundland and Labrador Person Hours
Engineering	
Front-end Engineering Design Engineering	74,000
Graving dock	8,000
Gates	42,000
CGS and Mechanical Outfitting	254,000
LQ Module	45,000
Marine	92,000
Integrated Drilling and Utilities Module	23,000
Husky Project Management	631,000
Total Engineering & Project Management	**1,169,000**
Construction/Fabrication	
Graving dock	347,000
Gates	300,000
CGS and Mechanical Outfitting	3,146,000

Activity	Newfoundland and Labrador Person Hours
Flareboom	23,000
Helideck	26,000
Life Boat Stations	26,000
LQ module	128,000
Total Construction & Fabrication	**3,996,000**
Other	
Marine Operations	289,000
Total	**289,000**
Total NL Engineering and Construction Hours	**5,454,000**
Note: Numbers have been rounded to nearest 1,000.	

Approximately 68 percent of the person hours associated with development of the project will take place in Newfoundland and Labrador, including graving dock construction, CGS/dock gates construction, topsides appurtenances fabrication, supporting subsea infrastructure, marine installation and project management. Approximately 2 percent of the person hours will take place in other places in Canada. The preliminary calculation of project-related expenditures in Newfoundland and Labrador is estimated to be 62 percent (this does not include development drilling which is considered part of operations). Approximately 2 percent of project-related expenditures will occur in other places in Canada.

Labour represents approximately 52 percent of the project-phase expenditures and purchase of materials represents approximately 48 percent of project-phase expenditures.

2.4 Industrial Benefits Opportunities - Operations Phase

Extension of the production plateau on the *SeaRose FPSO* due to the WREP will result in a continuation of employment levels at peak for an additional five-plus years. Currently the steady state employment associated with the White Rose and North Amethyst operations is approximately 1,500 people, including direct Husky employees as well as contractors and subcontractors.

The WHP will have capacity for a maximum of 144 persons on board. This represents new employment for up to 288 persons since the WHP will operate 24/7 with a rotation similar to that currently on the *SeaRose FPSO* and MODUs (three weeks on, three weeks off). Development drilling on the WHP is anticipated to require approximately 7.3 million person hours.

The operations phase positions are of long duration and represent career opportunities rather than short-term employment opportunities.

Following is a listing of the main anticipated positions on the WHP during operations:

- Offshore installation manage
- Drilling supervisor
- Toolpusher
- Driller
- Assistant driller
- Derrickman
- Roughneck
- Deck coordinator
- Roustabout
- Maintenance supervisor
- Senior mechanic
- Rig mechanic
- Electrical technician
- Assistant engineer/clerk
- Motorman
- Materials manager
- Crane operator
- Radio operator
- Medic
- QHSE specialist
- Logistics technician
- Geologist.
- Drilling engineer
- Completions engineer
- Completions equipment supervisor
- Completions equipment technician
- Cement pump operator
- Well intervention supervisor
- Datalogger
- Mudlogger
- Chef
- Steward
- Well test supervisor
- Well test surface technician
- Flare boom technician
- Well tester
- Electric line logging engineer
- Electric line winch operator
- Operations assistant/clerk
- Wellhead/tree technician
- Production supervisor
- Production operator
- Instrumentation technician

Table 2-3 outlines the estimated person hours associated with WREP operations (hours have been rounded to the nearest 1,000):

Table 2-3 Newfoundland and Labrador Person Hours for Operation of the WREP

Operations (life of field, 38 wells)	Person Hours in NL
WHP Drilling	7,355,000
SeaRose FPSO Production and Operations	11,188,000
Total Operations Hours	**18,543,000**

Goods and services required on the WHP will be similar to those required on MODUs currently operating in the Jeanne d'Arc Basin. The goods and services required for the WHP during operations will be additive since it is anticipated that a MODU will still be required in the field for substantial periods to support development and maintenance of existing and any future subsea drill centres as well as for drilling of exploration wells.

The following goods and services are anticipated to be required during WHP operations:

- Drilling contractor
- Drilling services (coring, well testing, tubulars, casing, slickline, solids control and well fluids, well bore cleanout, cementing, drilling tools)
- Engineering, procurement and construction and maintenance campaign support
- Telecommunications
- Independent verification services
- Accommodation services
- Maintenance services (fire safety equipment, crane, lifesaving appliances, rotating equipment, turbines)
- Condition monitoring and inspection services
- Medical services
- Helicopter services
- Supply and support vessels
- Waste management
- Weather forecasting
- Ice management
- Personal protective equipment
- Laboratory supplies.

Based on current operational data, during the operations phase of the WREP it is anticipated that Newfoundland and Labrador content for expenditures will be in the range of 60 to 70 percent and employment will reach over 90 percent as operations become established.

2.5 Project Monitoring and Reporting

Husky has been reporting person hours and expenditures associated with WREP activities since October 2012. Husky also has an established reporting system with its contractors through which data on head count and person hours are reported by location, discipline and gender. This reporting system will apply to the WREP.

Forecasts of upcoming contracting and procurement opportunities for the development phase will be provided to the C-NLOPB in accordance with the applicable guidelines. Husky will also continue to adhere to the reporting requirements associated with any contracts designated for review by the C-NLOPB.

Husky will continue to provide annual forecasts of procurement and contracting activity throughout the operations phase, including contract renewals or extensions.

2.6 Summary of Benefits Commitments

The following is a summary of benefits commitments contained in this Benefits Plan Amendment:

1) Maximize benefits for the province where practically and commercially achievable on a competitive basis and identify potential areas where Newfoundland companies and residents can participate in the WREP.

2) Locate the project office for the WREP in St. John's.

3) Project management and the majority of engineering work to take place in Newfoundland and Labrador, with the exception of detailed engineering design for the topsides. Consistent with the international nature of topsides fabrication, detailed engineering of the topsides is taking place in Houston, Texas.

4) Construction of a graving dock at Argentia.

5) Construction of concrete gates on the graving dock in Argentia so that the facility may be used for future industrial activity or research.

6) Construction of the concrete gravity structure at Argentia.

7) Fabrication related to mechanical outfitting of the CGS done in Newfoundland and Labrador.

8) Commitment to fabricate modular accommodation boxes, helideck, flare boom and life boat stations in Newfoundland and Labrador.

9) Provide full and fair opportunity and first consideration in procurement processes to companies in the province and other parts of Canada.

10) Canada-Newfoundland and Labrador benefits will be a factor in procurement.

11) All contractors and subcontractors will be required to adhere to Husky's benefits philosophy as detailed in the Canada-Newfoundland and Labrador Benefits Schedule appended to all contracts.

12) Commit to continuing expenditures in the areas of research and development (R&D) and Education and Training consistent with the C-NLOPB Guidelines.

13) Support efforts to build a work force that represents individuals from all sectors of society.

14) Maximize to the extent possible the number of Newfoundland and Labrador and other Canadian residents employed on the project.

15) Carry out recruitment locally.

16) Continue to work with government departments and private and public training institutions to identify and develop programs that not only are related to the project, but also for the operations phase and the industry in general.

17) Hold supplier development information sessions during the project to provide the local business community with an opportunity to learn about procurement opportunities.

18) Hire work term students to support the project team.

19) Maintain a project website which provides information regarding procurement opportunities and other related project information.

Construction of the WHP represents an innovative and new way of developing smaller fields off the coast of Newfoundland and Labrador. It introduces a new technology to local industry and makes the most of the WREP resource. More than that, the WREP construction phase will provide over 5 million person hours of employment in Newfoundland and Labrador. The placement of gates on the graving dock at Argentia will result in the establishment of a permanent facility at Argentia that can be used for future industrial activity or research. The benefits of the WREP will continue to be felt well beyond the WHP construction period. Approximately 18 million person hours will be associated with WHP operations, representing direct long-term employment and substantial indirect benefits to the people of Newfoundland and Labrador.

3.0 DEVELOPMENT PLAN AMENDMENT

This Development Plan Amendment outlines the current basis for development of the West White Rose pool and also provides an overview of additional resources that could be developed from the WHP. The overviews will present the current basis under consideration for development of the South Avalon and North Avalon pools from the WHP. The basis of development for these pools will evolve with learning from further production history and field performance. The amendment also outlines the location, timing and nature of the proposed development including drilling, completions and interventions, WHP design, construction and installation, asset management, emergency response and Husky's commitment to safety.

The evaluation of options for the WREP focused on concepts that used the *SeaRose FPSO* and existing subsea infrastructure. Two alternative development schemes, a subsea drill centre or a WHP, were considered for development of the West White Rose pool. Analysis of these alternatives indicated that the preferred means to recover the identified resources in the White Rose region was through the use of a WHP. The WHP offers lower drilling and completion costs as compared to a semi-submersible drilling rig and because the wellheads would be on the platform, rather than subsea, there are greater opportunities for well interventions and other practices to improve ultimate recovery of resources. The WHP will also be designed to allow for re-injection of drill cuttings into a disposal well, rather than discharge of treated cuttings and the main power generation on the WHP will use natural gas rather than diesel fuel.

Throughout the development of the White Rose Project, Husky has demonstrated a strong commitment to maximizing project benefits to Newfoundland and Labrador. Husky has policies and procedures in place to provide Newfoundland and Labrador and Canadian companies with full and fair opportunity and first consideration to supply goods and services in support of WREP development.

3.1 Subsurface

3.1.1 Introduction

The White Rose region is a highly faulted complex of rotated fault blocks, underlain by a basin-wide salt layer at depth. The White Rose region is bounded to the north and west by basinward-dipping flanks of a prominent high. The eastern margin of the structure abuts against the basin-bounding Trave Fault, while the southern boundary of the field encompasses the South White Rose Extension (SWRX) and North Amethyst pools.

The Ben Nevis-Avalon (BNA) Formation is Aptian to Albian-aged, and consists of fine-to very fine-grained quartzose sandstones deposited in shallow marine settings, dominantly shoreface. As of 2012, the White Rose region has been penetrated by 22 exploration and delineation wells. Three intersecting fault systems oriented northeast-southwest,

north-northwest to south-southwest and north-south compartmentalize the area. As indicated by reservoir pressure data, a few major faults (for example, West Amethyst, Central and Twin), together with a low structural trend oriented north-northeast to south-southwest, segment the area into the following:

- South Avalon pool
- SWRX pool
- North Avalon pool
- North Amethyst field
- West White Rose pool.

Figure 3-1 shows the areas listed above.

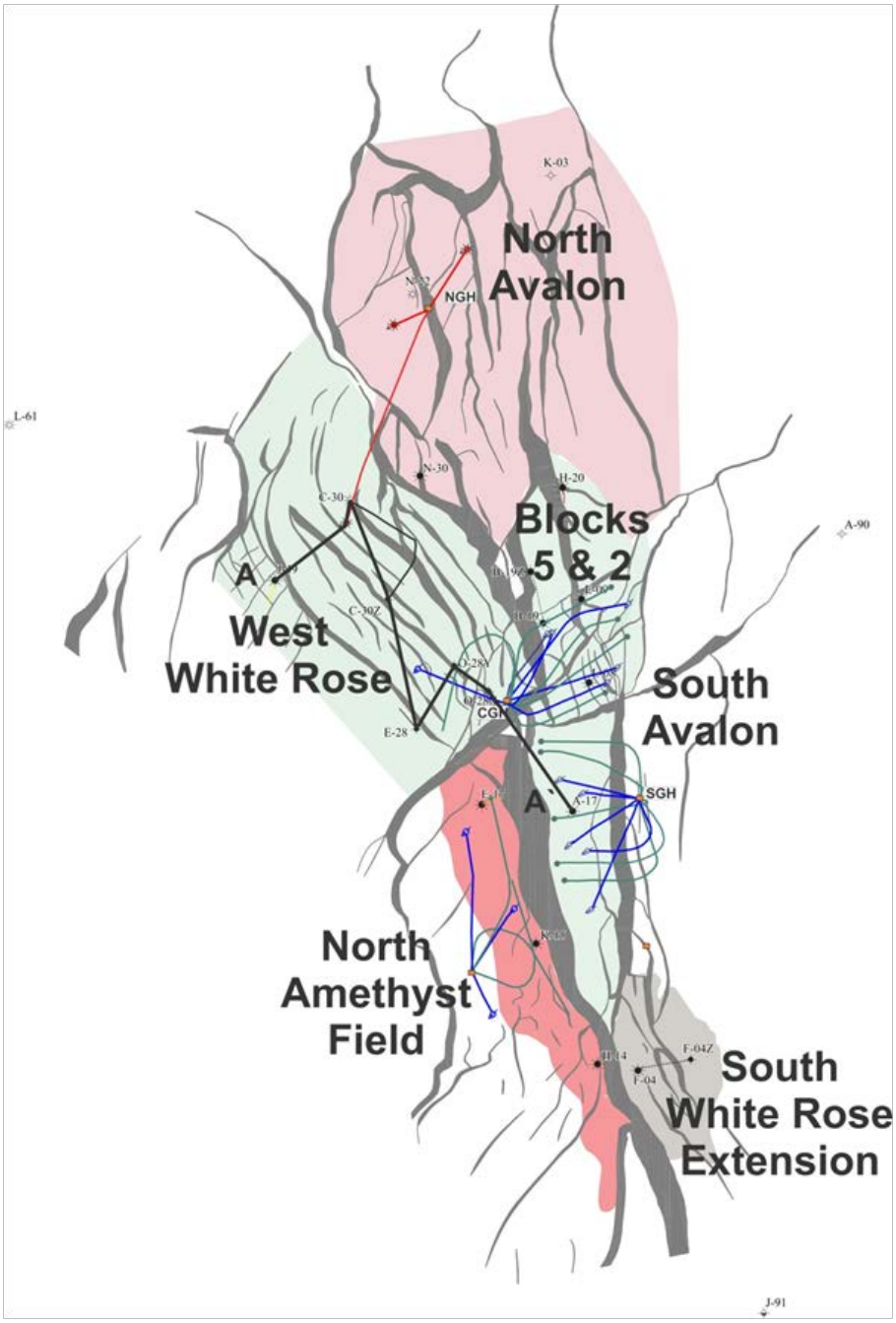

Figure 3-1 Location of Pools in the White Rose Field

3.1.2 Geology and Geophysics Summary

The following sections provide a geological and geophysical overview on a pool by pool basis. The West White Rose pool is the primary pool to be accessed by the WHP and will be addressed first. In addition, the South Avalon and North Avalon pools, which are

located within reach of the WHP, are considered as potential WHP resources for development.

3.1.2.1 West White Rose

The West White Rose pool is situated to the northwest of the North Amethyst field and to the west of the South Avalon pool. Structurally, it is the most deeply buried BNA pool in the White Rose field. It is a structurally complex area, with a series of post-depositional northwest-southeast trending faults that segment the area into thin, rotated fault blocks. The southern region of the West White Rose pool has over 350 m of stacked BNA sandstones with an approximately 280 m oil column. The reservoir degrades to the north and west as the shallow marine shoreface transitions from proximal to more distal settings.

The current geologic interpretation used for geological modeling is an updated version of that presented in the 2001 White Rose Development Plan. The updated West White Rose model is confined to the West White Rose area and contains six delineation wells as well as the pilot oil producer/water injector pair from the CDC, and a gas injector from the NDC, for a total of nine wells.

The West White Rose pool contains some of the most distal expressions of the BNA reservoir in the White Rose field, and also captures the degradation from proximal to distal depositional environments. As a result, it is generally of lower reservoir quality than the South Avalon pool and is much more interbedded, containing more prominent parasequence boundaries (flooding surfaces).

3.1.2.2 South Avalon (including Block 2 and 5)

The South Avalon pool, which is the focus of the White Rose development, is segregated into South Avalon, central Terrace and Blocks 2 and 5. Production and injection wells have been drilled from two subsea drill centres, the CDC and the Southern Drill Centre.

Geologically, the South Avalon pool is situated in a more proximal environment of deposition than the other BNA pools discussed in this document. It has a relatively high net reservoir, which deteriorates to the northwest. Reservoir parameters are such that there are few vertical baffles/barriers to flow within the reservoir. Structurally, the pool depth is approximately 2,850 to 2,900 m TVDss and contains approximately 130 to 140 m of oil column.

Two large fault blocks, Block 2 and Block 5, comprise the undeveloped northern extent of the South Avalon pool. South Avalon delineation well, H-20 (Block 2, the larger eastern block), which was drilled in 2000 and encountered 4.5 m of oil bearing sandstone and 146 m of reservoir-quality sandstone. The follow-up delineation well,

B-19Z, tested the smaller up-dip block to the west (Block 5) in 2005. It discovered gas and oil over water. The majority of the reservoir quality BNA sandstones of Blocks 2 and 5 are below the oil/water contact, which is consistent with the depositional model of the BNA in the White Rose region.

3.1.2.3 North Avalon Geology and Geophysics Summary

The North Avalon pool contains the White Rose discovery N-22 location, which encountered gas within the BNA. The NDC is located in the North Avalon area. NDC currently has three gas injection wells (J-22 1, J-22 2 and J-22 3), two of which are within the North Avalon pool (J-22 3 is drilled into the West White Rose pool). The N-30 delineation location is drilled in the southwest region of the North Avalon pool. Oil and gas were encountered at this location. The K-03 location was drilled to delineate the North Avalon reservoir and fluid contacts. It encountered very low reservoir quality and was wet upon penetration. North Avalon is the northernmost pool within the White Rose region and is the most distal representation of the distribution of the lower shoreface deposit that comprises the BNA Formation. Net reservoir is significantly lower than that of the South Avalon pool. There are two fault blocks accessed by the two North Avalon gas injectors. Compartmentalization is due to the thin reservoir being juxtaposed against non-reservoir across fault blocks

3.1.3 Reservoir Engineering

The following section provides a reservoir engineering overview on a pool by pool basis. The West White Rose pool is the primary pool to be accessed by the WHP and will be addressed first. In addition, the South Avalon and North Avalon pools, which are located within reach of the WHP, are considered as potential WHP resources for development.

3.1.3.1 West White Rose

Reservoir pressures in the West White Rose pool are defined by hydrocarbon contacts and gradients encountered in a number of the exploration and delineation wells in the area. An oil-water contact of -3,170 m TVDss has been assumed for the West White Rose pool. Gas-oil contacts of -3,069 and -3,085 m TVDss have been assumed within the J-49 region and C-30 region, respectively.

The expected West White Rose reservoir temperature is from 110°C to 117°C based on logging tools from delineation wells in the area.

Reservoir fluid samples were obtained in the O-28Y, C-30, C-30Z, E-28 and J-22 3 wells. The most representative pressure, volume, temperature (PVT) data set for West White Rose has a gas-oil ratio of 127 m^3/m^3, a saturation pressure of 29,710 kPa and an initial formation volume factor (FVF) of 1.356 m^3/m^3.

PVT analysis conducted on gas samples are very similar to other gas samples obtained in the White Rose field. Water compositional analysis was also conducted on water samples taken from two wells in the field.

3.1.3.2 South Avalon (including Blocks 2 and 5)

Reservoir pressures in the South Avalon pool, including Blocks 2 and 5, are defined by hydrocarbon contacts and gradients encountered in several exploration, delineation and development wells. A gas-oil contact of -2,872 m TVDss has been assumed in the northern region of the Terrace and a gas-oil contact of -2,859 m TVDss has been assumed in the southern region of the Terrace. In the CDC region of the South Avalon pool, oil-water and gas-oil contacts of -3009 m TVDss and -2872 m TVDss, respectively, have been assumed. In Block 2, oil-water and gas-oil contacts of -3005 m TVDss and -2872 m TVDss, respectively, have been assumed. In Block 5, oil-water and gas-oil contacts of -3003 m TVDss and -2893 m TVDss, respectively, have been assumed.

The temperature gradient in South Avalon is well understood due to the number of South Avalon development wells that have been drilled. The estimated reservoir temperature at South Avalon and Blocks 2 and 5 is 106°C.

The most representative PVT data set for South Avalon, including Blocks 2 and 5, has a gas-oil ratio of 128.5 m^3/m^3, a saturation pressure of 29,100 kPa and an initial FVF of 1.359 m^3/m^3.

3.1.3.3 North Avalon

Reservoir pressures in North Avalon were defined by hydrocarbon contacts and gradients obtained in four wells within the region. An oil-water contact of -3,084 m TVDss has been assumed for the North Avalon pool.

North Avalon reservoir temperature data has been estimated from two primary sources: downhole temperatures from current gas injectors J-22 1 and J-22 2; as well as West White Rose temperature data. The anticipated temperature in the North Avalon pool ranges from 108°C to 115°C.

The most represented PVT data set for North Avalon has a saturation pressure of 30,751 kPa at 106°C, a Rs of 120.1 m^3/m^3 and a FVF of 1.313 Rm^3/m^3.

3.1.4 Reservoir Exploitation

The WHP will be primarily used to access the West White Rose pool. However, other resources are located within reach of the WHP and are considered as potential resources for development from the new facility. A phased approach to the development of West White Rose is anticipated and would allow time for understanding of the reservoir as the depletion plan progresses.

3.1.4.1 West White Rose Pool Development Strategy

Within West White Rose, a Pilot Scheme production and injection well pair had been successfully completed. The production well, E-18 10, was completed in Q3 of 2011. First oil was established on September 5, 2011.

The original objectives of the West White Rose Pilot Scheme were to acquire static and dynamic information with respect to the West White Rose pool. The objectives identified included:

- Obtain dynamic productivity and injectivity information, including:
  - Productivity index of a producer
  - Water injection fracture and propagation pressure
- Improved understanding of technical risks and appropriate mitigation, including:
  - Vertical barriers
  - Fault sealing
  - Compartmentalization
  - Reservoir connectivity
  - Lateral extent and quality of upper reservoir facies
- Improved evaluation of the pool for development.

Progression of an optimal depletion plan and completion design.The Pilot Scheme results have provided a clearer picture on the overall vertical and horizontal interfaces within the reservoir. This knowledge has led to a well placement strategy.

Horizontal or highly deviated wells have been identified as the general well placement philosophy in the depletion plan. The selection of horizontal or highly deviated wells was driven by structure and low vertical permeability. More specifically, the ability to target multiple parasequences with horizontal or highly deviated wells facilitates higher sweep efficiencies.

Water injectors were also identified to be highly deviated or horizontal under the current development philosophy.

The West White Rose base depletion plan currently has 26 wells (13 producers and 13 water injectors). This plan is based on the current deterministic geological interpretation of the reservoir and is the result of prediction simulation modeling found to best recover oil from the pool. The well count has leveraged learnings from the Pilot Scheme as well as existing developments.

There will be further optimization of well design and, therefore, well counts and well planning may change as the region is developed. The number and location of the West White Rose wells will be optimized based upon the actual reservoir geology and performance as development occurs.

3.1.4.2 South Avalon Development Strategy

South Avalon was initially developed with eight horizontal production wells and ten water injection wells, four production wells in the Terrace block via the SDC and four in the Central block via the CDC and five water injectors in the Terrace block and five in the Central block. Horizontal intelligent water injectors were used where pressure support was required to multiple fault blocks.

With maturing production in the South Avalon pool, methods are being evaluated to improve oil recovery from the field. This work has resulted in the successful drilling of infill well B-07 11 in 2012, which targeted attic oil accumulation in the northern most part of the Terrace block. Infill drilling results confirmed the presence of attic oil with virgin oil conditions.

A possible development approach for South Avalon would involve targeting the largest remaining attic oil accumulations with infill horizontal production wells. Further to infill drilling, water and gas injection into the gas cap could be used to displace the remaining attic oil to existing producers. Gas injection and/or water-alternating gas (WAG) injection into the gas cap could enable pressure support that is favorable to oil recovery via a sweep of attic oil to the existing mid-column producers. The reservoir management plan for the South Avalon pool would remain unchanged.

The development scenario used to support the overview of South Avalon improved oil recovery (IOR) potential was a five-well program (three infill producers and two gas injectors). Final well count and layout for South Avalon IOR may change upon further optimizations, and will ultimately be based upon the development viability in the area.

3.1.4.3 Blocks 2 and 5 Development Strategy

The current base development philosophy for Blocks 2 and 5 is similar to that of South Avalon, which includes horizontal producers in the oil column and horizontal underlying water injectors providing vertical pressure support from below. The reservoir management plan will be consistent with that of the South Avalon pool, which is to maintain a voidage replacement ratio between 1.0 and 1.2. This development scenario will be adapted as further geological and reservoir understanding is obtained.

The development scenario used to support the overview of Blocks 2 and 5 potential was a three-well program, two producers and one combined water injector. This plan is based on geological structure and contacts within the blocks and the current probabilistic

evaluation of potential remaining recoverable within the pool. Final well count and layout for Blocks 2 and 5 may change upon further optimizations, and will ultimately be based upon the development viability in the area.

3.1.4.4 North Avalon Development Strategy

The current depletion scenario for North Avalon uses a single producer/injector well pair. The producer was placed at the south edge of the oil rim along a bounding fault in the centre of the oil column. Although near horizontal, the producer intersects several horizons due to the dipping nature of the reservoir in this orientation. The supporting water injector was placed to the northeast of the producer in a near parallel orientation. The highly deviated injector also intersects several horizons to maximize vertical sweep.

As reservoir and geological understanding is matured, the development plan will be adapted.

The development scenario used to support the overview of North Avalon pool potential was a two-well program, one producer and one water injector. This plan is based on simulation modelling and the current probabilistic evaluation of potential remaining recoverable within the pool.

3.1.5 WREP Production Profile

The WREP production forecast was development in an Integrated Production Model and incorporates all the individual field simulation results. Downtime was added for annual turnarounds and forecasted *SeaRose FPSO* off-station programs. The full field WREP production profile is depicted in Figure 3-2, which includes:

- West White Rose
- South Avalon IOR targeted through WHP
- Blocks 2 and 5
- North Avalon.

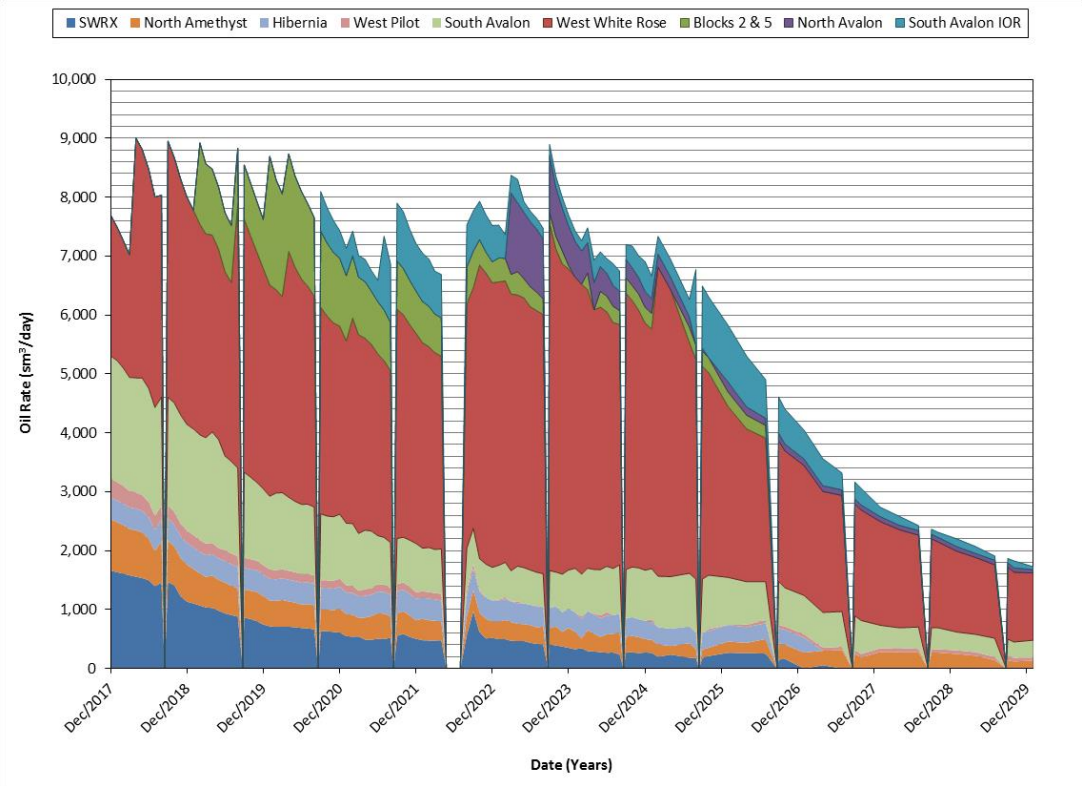

Figure 3-2 Full Field Oil Production Profile

3.1.6 WREP Gas Management Plan

Produced gas from the WREP will be re-injected through existing gas injection infrastructure within the White Rose region. Gas will be used primarily for further oil recovery through gas flood. The first gas flooded region will be SWRX. Additionally, a portion of the gas may be used for gas flood or WAG schemes to support oil production from various pools associated with WREP.

The White Rose gas utilization strategy includes a base injection as well as identification of potential future gas utilization opportunities. The following are expected to provide full field gas injection utilization:

- Continued gas injection into North Avalon and West White Rose gas storage wells
- Gas flood into SWRX and South Avalon southern terrace region
- Gas flood into South Avalon northern terrace region and the central region.

3.1.7 Hydrocarbon Resource Estimates

The probabilistic estimated Original Oil in Place (OOIP) and Gas Initially in Place (GIIP) for the West White Rose pool and other potential development areas have been summarized in Table 3-1.

Table 3-1 Original Oil in Place and Gas Initially in Place - Pool Summary

Pool	OOIP (10^6 m^3)		
	P90	**P50**	**P10**
West White Rose	50.5	72.9	94.0
North Avalon	4.8	6.2	8.0
Blocks 2 and 5			
Block 2	2.9	3.8	4.9
Block 5	1.5	1.9	2.6
South Avalon			
Terrace (Block 7)	40.3	47.6	56.1
Central (1 and 3)	29.2	34.6	40.6
Central (4)	3.7	4.3	5.1
	Solution GIIP (10^9 m^3)		
West White Rose	6.1	8.7	11.4
North Avalon	0.6	0.8	1.0
Blocks 2 and 5			
Block 2	0.4	0.5	0.6
Block 5	0.2	0.3	0.3
South Avalon			
Terrace (Block 7)	5.0	6.1	7.3
Central (1 and 3)	3.7	4.4	5.3
Central (4)	0.5	0.6	0.7
	Free GIIP (10^9 m^3)		
West White Rose	10.2	14.5	19.7
North Avalon	7.1	9.5	12.6
Blocks 2 and 5			
Block 2	0.3	0.4	0.6
Block 5	0.2	0.2	0.4
South Avalon			
Terrace (Block 7)	7.6	9.8	12.7
Central (1 and 3)	2.1	2.7	3.3
Central (4)	0.2	0.2	0.3

The probabilistic recoverable resource range for the West White Rose pool and other potential development areas is provided in Table 3-2.

Table 3-2 Recoverable Resource Estimate Summary

WREP Case	Recoverable (10^6 m^3)		
	P90	P50	P10
West White Rose	7.8	14.8	18.9
Blocks 2 and 5	1	1.5	2.7
North Avalon	0.5	0.6	1.0
South Avalon	0.8	1.4	2.4

The recoverable volumes are probabilistic ranges that use White Rose region historic well performance, pool-specific reservoir quality attributes and WHP-specific potential technology applications. The matured fields are supported by deterministic reservoir models that typically represent an approximate P50 basis.

In the case of West White Rose and South Avalon where existing infrastructure will recover a portion of the oil-in-place, the recoverable volume represents the incremental portion associated with the WREP.

Consideration of the current West White Rose depletion plan recoverable basis and the additional potential resources that may be developed from the WHP, yields a combined potential recoverable resource of 18.3 10^6 m^3.

The recoverable basis will evolve with learning through further technical evaluation, future drilling results, field performance history and maturing technology application.

3.2 Drilling, Completions and Interventions

Drilling, completions and intervention operations will be conducted from the WHP. The drilling rig will be designed for year-round operation. The drilling package will comprise a single derrick and associated drilling utilities. The rig design will allow for simultaneous drilling and wireline (electric and slick) and coiled tubing operations. Design of the drilling facilities will incorporate lessons learned from the design, construction and operation of White Rose, Terra Nova, Hibernia developments and other successful harsh environment projects around the world.

The WHP will target the West White Rose reservoir and other potential prospects in the area. Wellbores will be extended reach with 3-D trajectories and horizontal or near-horizontal sections. Torque, drag and wellbore stability will be among the key well design considerations. Completions will be similar in range (with both open-hole and perforated designs) to those currently used on the subsea wells in the White Rose region. However, completions may vary in complexity due to the relative ease of subsequent access to the wellbore when compared to subsea completions. The ratio of producers to injectors, well targets and well trajectories will be refined as the WREP progresses.

The WHP will include a provision for cuttings re-injection as part of the base design for instances where SBM is used. For portions of any well drilled using SBM, associated cuttings will be injected into a dedicated injection well. The base plan is to drill two cuttings reinjection wells for cuttings disposal purposes. In addition, the WHP will have a secondary cuttings dryer system consistent with technology currently employed by MODUs operating in the area. This secondary dryer will be employed until the cuttings reinjection (CRI) system is functional. This secondary system will also be employed in the event of difficulties with the CRI system. Prior to having a CRI system in place, and in the event of CRI system failure, cuttings would be discharged overboard following processing with the secondary dryer. Typical potential issues that may be encountered during development drilling include shallow gas hazards, borehole stability, formation pressure and hydrogen sulfide potential. Details of potential drilling hazards for each well will be provided in individual Approval to Drill a Well applications that will be submitted to the C-NLOPB prior to the drilling of each well.

Wellbore safety systems will include the use of two subsea barriers on all wells, operating in a failsafe manner in the event of a Xmas tree or wellhead failure. Production and water injection wells will incorporate, for each well, a total of three barriers against well flow. Of these, one will be a surface barrier (wellhead/Xmas tree) and two will be subsea barriers (i.e., TR-SSSVs, packer, kill weight packer fluid).

During drilling, primary well control will be in place at all times by maintaining a hydrostatic pressure gradient greater than the highest pore pressure gradient of any exposed productive formation in the wellbore. Secondary well control will be provided with a blowout preventer system designed in accordance with all applicable regulations and standards. In addition to the blowout preventer, a choke-and-kill manifold will be used to support the well control system. The manifold will allow for controlled flow to/from the wellbore as required for well control purposes, and will be sized appropriately for the application.

The WHP will employ dual conductor technology as part of well construction activities. This technology allows for the placement of up to two wells in each well slot, and may be deployed on any of the WHP well slots. The wellhead and tree design will meet all applicable regulations and standards. The tree will include provisions for two subsurface safety valves, gas lift and chemical injection.

Interventions are expected to be a standard operating practice and the flexibility that they offer will be leveraged to assist with improved depletion strategies that will assist with maximizing field recovery factors.

3.3 Design Criteria

The WHP will be constructed in consideration of environmental conditions in the offshore Newfoundland environment, including wind, air and sea temperatures, waves, currents, sea ice and icebergs. Geotechnical criteria including seismic hazard potential, soil characteristics, iceberg scour and shallow gas will also be considered in the design of the WHP.

The effect of physical environmental loadings (wind, waves, current, ice, iceberg) on the WHP will be analyzed using established recognized methods, and will be determined in accordance with the site's physical environmental criteria and governing design codes and standards. Model testing will be carried out to verify wave loads on the structure. The WHP will be designed to meet International Standards Organization (ISO) 19906 L2 classification for ice loading on the structure. In all other aspects the WHP is designed for an L1 exposure level. The ISO 19906 L2 classification for ice loading on the WHP was selected based on the fact that the WHP is not an oil storage facility and is therefore deemed to have only a medium environment consequence should there be an impact to the facility from an ice event exceeding the design limits. The WHP will have minimal processing equipment on board and limited export line release potential due to the low volume of oil in the export line at any given time. Also, each well will have a total of three barriers against well flow (one surface barrier and two subsea barriers) and the production system, including flowlines, will be designed for sour service according to National Association of Corrosion Engineers, MR-01-75. As part of the requirements for design to the L2 classification, the WHP will require a plan to allow controlled evacuation of the facility as part of standard operations.

Engineering and design practices will be common across the existing White Rose field. Development and all designs will conform to the codes and standards referenced in the relevant regulations and associated guidelines. Generally accepted international standards, such as ANSI/ASME specifications, ISO standards and American Petroleum Institute recommended practices, will be applied as appropriate and in cases where they are considered equal to or exceed the requirements of the Canadian equivalent. Alternative standards or codes not specified in the regulations and associated guidelines will only be used if accepted via the regulatory query process.

3.4 Wellhead Platform Design

The main function of the proposed WHP is to provide a platform for 'dry tree' drilling and completions. Reservoir fluids produced to the WHP will be transported to the *SeaRose FPSO* for processing. The WHP will be equipped with minimal processing equipment.

The WHP will consist of a CGS with topsides consisting of drilling facilities, wellheads and support services such as accommodations for up to 144 persons, utilities, flare boom and helideck. Main mechanical outfitting comprises risers, J-tubes, caissons,

conductor guides and guide frames, deck connections, structural steelwork, access stairs and ladders, drill cuttings recovery system and temporary installation systems.

The ballasting system will be designed to reliably control and monitor the floating draft of the CGS at float out, during the sea tow and during final installation. The components of the ballasting system will be specified to suit the environmental and operating conditions both at the construction site and during the installation phase offshore and will meet all requirements of the Newfoundland Offshore Petroleum Installations Regulations.

The WHP topsides will be designed for operation in the environmental conditions found in the Grand Banks area. There will be no oil storage on the WHP. All crude oil produced through the WHP will be stored on the *SeaRose FPSO* for offloading to shuttle tankers. The oil handing capacity of *SeaRose FPSO* is 22,300 standard cubic metres per day (140,000 barrels per day). The oil handing capacity of the *SeaRose FPSO* is anticipated to accommodate the requirements of the WHP, therefore no upgrades to the process systems will be required.

The topsides facilities will have an operating weight of approximately 28,000 metric tonnes. The topsides facilities configuration will be designed to ensure maximum isolation of hazardous/ process equipment and well bay from the living quarters and helideck. The facilities will comprise:

- Drilling, completions and well intervention equipment
- Well bay and wellheads
- Oil production, test, water injection, gas injection, and gas lift manifolds
- High pressure water injection booster pumps
- Fuel gas heating and treatment
- Test separator and metering
- Safety and utility systems
- Integrated control and safety systems
- Telecommunications systems
- Power generation and distribution systems
- 144 person living quarters.

The production handling and testing system will consist of production manifolds and test manifolds. The production manifold arrangement will have approximately half of all 19 production wells leading to one side of a common but split production header and the remaining production wells leading to the other side of the header, with a crossover line joining the two. The common production header will be equipped with blind flanges to

account for future well additions. The well fluids will be transferred via two flowlines to the *SeaRose FPSO* for processing.

The drilling package will be a fit for adverse weather unit with an integrated single drilling rig capable of drilling, completions, specialized well intervention and work-over operations. The drilling package will be comprised of a drilling equipment set and drill floor with derrick on the topsides. Other drilling equipment and support utilities will be incorporated within the topsides design. The drilling equipment set will be comprised of a drill floor supporting the derrick, associated equipment and the drilling control room supported by a substructure housing the blowout preventer and associated well control equipment. Table 3-3 summarizes the equipment comprising the drilling package.

Table 3-3 Drilling Package Equipment

System	Equipment
Well Control System	BOP, BOP control unit, diverter system, choke and kill manifold, mud/gas separator, drilling risers, high-pressure choke and kill lines
Hoisting and Rotating System	Derrick, deadline anchor, drilling line, crown block, travelling block, top drive, drawworks, rotary table
Tubular Handling System	Pipedeck, fingerboard, knuckle boom crane, catwalk machine, iron roughneck, power slip, mousehole, pipe handling systems
Drilling Hydaulic Power Unit	Central hydraulic power unit
High-pressure Mud System	High-pressure mud pumps, high-pressure manifolds and piping system
Drilling Control and Data Acquisition System	Drilling control room, remote operation and monitoring of drilling equipment and systems
Mud Solids Control System	Mud returns, shale shakers, degasser and centrifuges
Mud Mixing and Storage System	Mud building and conditioning systems, low pressure transfer and storage
Bulk Barite, Bentonite and Calcium Carbonate	Storage vessels and transfer system
High-pressure Cement System	High-pressure cement pump, high-pressure manifolds and piping system
Cement Mixing System	Mixing tub, liquid additive system, transfer pumps and piping system
Bulk Cement System	Storage vessels and transfer system
Rig Skidding System	Hydraulic jacks, grippers and clamping system
Cuttings Processing System	Fluidizing of cuttings and injection equipment and drying equipment
Drilling Drains System	Hazardous and non-hazardous open drains
Base Oil System	Storage vessels and transfer system, washdown unit

System	Equipment
Brine System	Storage vessels, filtration and transfer systems
Drill Water System	Storage vessels and transfer system
Drilling General System	Pressurized washdown system, vacuum system, boat loading stations
Well Completions System	Fracturing and wellbore fluid handling systems
Well Interventions System	Wireline, logging, slickline and coiled tubing

Gas lift, gas flood and fuel gas will be supplied from the *SeaRose FPSO* gas compression/injection system via a single, high-pressure gas flowline teed into the subsea flowline. There is no processing of produced fluids on the WHP and as such, produced water from WHP wells will be separated, treated and disposed on the *SeaRose FPSO*. The *SeaRose FPSO* produced water handling systems will be used to treat the produced water from the WHP production system along with the produced water from the existing production wells. Water injection will continue to be used as the primary means to support reservoir pressure in the White Rose field. The *SeaRose FPSO* will supply treated water injection to the WHP via the CDC water injection manifold.

The main power generation for the topsides will comprise dual-fuel (gas/diesel) turbine-driven generators. A diesel-driven emergency generator and distribution system will supply all emergency electrical loads in accordance with the relevant regulations.

Control and measurement on the WHP will be achieved with the use of an Integrated Control and Safety System (ICSS). The WHP ICSS will be integrated with the *SeaRose FPSO* ICSS via a microwave communication system, allowing for bi-directional monitoring of all topsides and subsea systems. Control of WHP utilities, manifolds, Xmas trees, water injection, metering and export systems related to oil production will be permitted from the *SeaRose FPSO*. WHP drilling operations will not be controlled from the *SeaRose FP*SO. The WHP will not have control capability of any facilities on the *SeaRose FPSO* but it will be able to monitor activities.

Active fire protection systems will meet the specific requirements of the Newfoundland Offshore Petroleum Installations Regulations and referenced standards. In general, active fire protection will be designed to prevent fire from spreading to other areas, and to limit damage to structures and equipment.

The WHP will have two muster points. One muster point will be in the accommodations area temporary safe refuge, close to the lifeboat station. The other muster area will be located in a suitable area near the second lifeboat station. Escape routes will be designed in accordance with the Newfoundland Offshore Petroleum Installations

Regulations. Every work area will have at least two well-marked separate escape routes that are situated as far apart as is practicable. The WHP will be provided with a minimum 200 percent capacity of persons on board in lifeboats and 100 percent capacity in life rafts and 200 percent capacity in personnel environment survival suits.

Some provisions for future expansion will be included in the WHP design. Husky may also develop up to two additional subsea drill centres in the White Rose region. The WHP design will include provision for future tie-back of one subsea drill centre for oil development in the near-field. Specifically, the WHP design includes risers for production, water injection, gas lift and a J-tube for controls from a future subsea tie-back and provision for a heater on the test separator inlet. The WHP design will include provision of a gas export riser and a chemical riser for potential future gas production to a future gas processing facility.

3.5 Wellhead Platform Construction and Installation

3.5.1 Graving Dock Construction

The CGS will be constructed in a purpose-built graving dock at Argentia, NL. The graving dock will be excavated and constructed within a 20 hectare plot that has been leased from the Argentia Management Authority (AMA).

Construction of the graving dock will take approximately nine months. The graving dock will be fitted with concrete gates that will allow the facility to be re-used. The graving dock will be fitted with concrete gates that will allow the facility to be re-used. The two gates will each be 27.5 m high, 72 m long and 30 m wide. When the graving dock is in the flooded condition, the gates will be drained of water until they become buoyant. Once buoyant, the gates are towed out of the graving dock, allowing open movement from the graving dock to the sea. To de-water the graving dock, the gates will be placed in position and filled with water providing the necessary seal which allows the graving dock to be pumped dry.

The graving dock gates with the natural bund in place are shown in Figure 3-3.

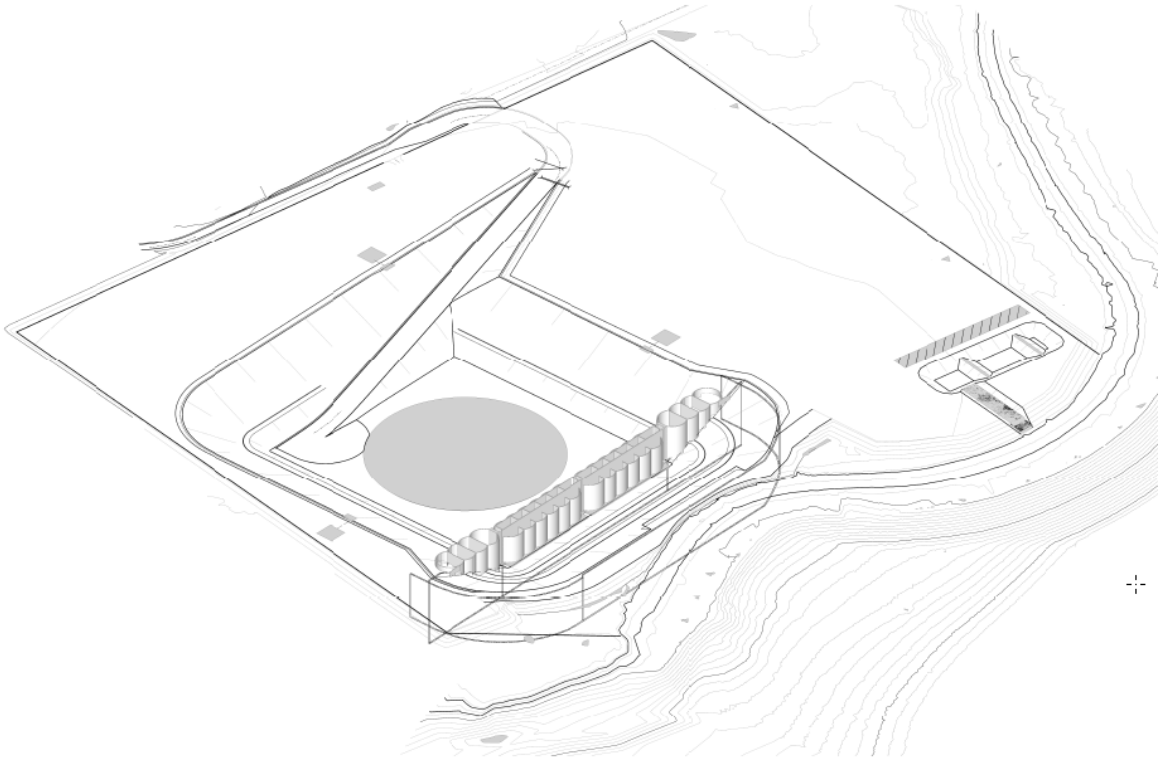

Figure 3-3 Graving Dock with Natural Bund and Dock Gates

3.5.2 Concrete Gravity Structure Construction

Potential support facilities for CGS construction include a concrete batching plant, offices, mess hall, medical clinic, temporary sheds, lay down areas and storage areas. The construction site will be fully fenced with a security-controlled entrance. All buildings will be temporary and set on concrete sleepers or trailers above ground.

The primary materials that will be used in construction of the CGS are cement, sand, gravel and rebar for the concrete component, and structural steel and pipe within the CGS shaft. Approximately 72,000 m³ of concrete will be poured over a 20-month period.

The single shaft of the CGS will contain all the mechanical components for WHP. The shaft will contain J-tubes to house flexible risers for the connection of the facilities to the *SeaRose FPSO*, drilling conductor guide frames, caissons for fire water pumps, sea water recovery, treated sewage water disposal, water-based drill cuttings discharge and access within the shaft.

Once the CGS construction is completed, preparations will be made for the float out of the structure and tow to the White Rose field. The graving dock will be flooded to equalize the hydrostatic pressure on either side of the bund. A combination of land excavation and dredging at the shoreline will be used to remove the bund. The dredger

will also be used to dredge, as required, a channel from the graving dock to accommodate the draft of the CGS.

3.5.3 Topsides Fabrication

The topsides facilities will be constructed in an established fabrication yard. The contractor for topsides construction will be selected in 2014. The flare boom, helideck, life boat stations and modular accommodation units will be fabricated in Newfoundland and Labrador and shipped to the location of the main topsides fabricator for incorporation into the topsides structure. The topsides structure will be fully integrated and commissioned to the extent possible at a fabrication yard, prior to being transported to the White Rose field.

3.5.4 Platform Integration

Four tugs will be required to tow the CGS to the White Rose field. It is anticipated that the transit time will be approximately six days. The CGS will be ballasted into position at its permanent location in the White Rose field. The topsides will be installed on the CGS by the Pieter Schelte. The Pieter Schelte is a dynamically positioned platform installation / decommissioning vessel with a topsides lift capacity of 48,000 tonnes (Figure 3-4).

A detailed hook up and commissioning plan will be developed prior to mating of the topsides with the CGS. Use of a flotel and the availability on the *SeaRose FPSO* for housing personnel until the required safety systems are up and running on the WHP will be assessed as part of hook-up and commissioning plan development.

Figure 3-4 Pieter Schelte Platform Installation Vessel

3.5.5 Subsea Infrastructure

Subsea flowlines will interconnect the WHP with the *SeaRose FPSO* via valved mid-line tie-in structures in the existing production flowlines between the CDC and the *SeaRose FPSO*. A subsea water injection flowline will connect the WHP and the *SeaRose FPSO* via a flowline termination module that will be added to the end of the existing CDC water injection manifold. A gas supply flowline will be connected between the WHP and a gas injection flowline between the NDC and the SWRX Drill Centre.

3.6 White Rose Extension Project Asset Management

The WHP will be integrated into Husky's current operations organization. The integration of the WHP into Husky's onshore management organization may require hire of some additional personnel in various departments including production operations, drilling and completions, health, safety, environment and quality and logistics. The existing onshore Husky management systems that currently support operation of the *SeaRose FPSO* and for MODUs under contract to Husky will continue to apply. There will be no organizational changes required from an operations or production point of view on the *SeaRose FPSO.*

The WHP will be maintained and operated in accordance with the Husky Operational Integrity Management System (HOIMS). Husky intends to use its existing infrastructure and established service contracts to support operations on the WHP. The Offshore Installation Manager on the *SeaRose FPSO* will have overall field responsibility for all installations, including the WHP. The WHP will have a dedicated Offshore Installation Manager, who will be responsible for overall operations on the WHP.

A computerized Maintenance Management System will be implemented for the WHP, similar to that in place for the *SeaRose FPSO*. The system database will collect all relevant maintenance data, including key technical lists, schedules, registers, inspection and test plans and supplier service life inspection and maintenance plans.

Husky has developed and implemented environmental monitoring procedures requiring compliance with Husky requirements and applicable legislation and regulations. These plans and procedures will be updated as required to include all infrastructure and activities associated with the WREP. An Environmental Protection and Compliance Monitoring Plan will be developed specifically for the WHP.

Husky has an Ice Management Plan that outlines the ice management policies and procedures developed to support offshore operations. The plan covers operating in anchored, fixed, or dynamic positioning mode and is designed to cover both production and exploration activities. A WHP-specific Ice Management Plan section will be developed to meet the operational requirements of ISO 19906 as part of the L2 exposure class. The plan will have defined T-Times specific to the facility that are suitability designed to detect an abnormal ice level event and to allow controlled down-staffing of the facility.

A strong emergency response program supports the integrity of Husky operations. Husky's Incident Coordination Plan outlines the necessary resources, personnel, logistics and actions to implement a prompt, coordinated and rational response to any emergency. An installation-specific emergency response plan will be developed for the WHP. The WHP will have designated emergency response personnel.

Husky has instituted a spill prevention program with the goal of zero spills into the marine environment. Any unintentional discharge of a hydrocarbon will be considered to be an oil spill and may result in the activation of the East Coast Oil Spill Response Plan.

As described in the *White Rose Extension Project Environmental Assessment* (December 2012), the WHP will be decommissioned and abandoned by first abandoning the wells in accordance with standard oil field practices, then decommissioning of the topsides, followed by decommissioning and abandonment of the CGS. All infrastructure will be abandoned in accordance with the relevant regulations. The topsides will be removed from the CGS in a manner determined to be most effective at the time of

decommissioning. The WHP will not be disposed of offshore, nor converted to another use on site.

Subsea wells will be decommissioned and abandoned in accordance with standard oilfield practices. All equipment located in excavated drill centres will be removed and the drill centres will be left as they are. Xmas trees and manifolds will be purged, rendered safe and recovered.

All other subsea facilities on or above the seafloor, including riser base manifolds, loading riser manifolds and flowlines, will be purged and decommissioned in accordance with regulations prevailing at the time. Flowline sections that have been rock-dumped will not be recovered, and will be cut by divers at the locations where rock dumping ceases. Rock berms are approved by Fisheries and Oceans Canada (DFO) as compensation for fish habitat loss and removal may constitute a harmful destruction of fish habitat and as such could require a *Fisheries Act* Authorization.

All risers and umbilicals will be decommissioned, rendered safe and recovered.

3.7 Development Costs

Total estimated WHP construction capital costs are $2.35 billion. Total estimated development drilling costs are $1.608 billion. The majority of WHP annual costs are included in the development drilling and completions capital cost estimate. Operating costs for the WHP associated with production operations are expected to increase total field production operating costs by 10 percent per year (or approximately $20 million per year increase over operating cost levels without the WHP).

3.8 Commitment to Safety

The health, safety, environment and quality requirements for the WHP will be developed, implemented and managed in accordance with the principles and requirements of HOIMS. Husky's policies and procedures related to the management of the WHP will be assimilated into the existing management system. This management system has been the foundation for the successful administration and safe operation of complex offshore facilities since commencement of White Rose production operations in 2005. In striving for continuous improvement, Husky's management system continues to be subject to rigorous audit and assessment internally, as well as by the C-NLOPB and other regulatory bodies.

Pursuant to the requirements of the Newfoundland Offshore Petroleum Drilling and Production Regulations, the WHP safety plan will outline the measures implemented for the safety and well-being of personnel, preservation of the environment and protection of the installation. Similarly, the WHP Environmental Protection and Compliance Monitoring

Plan will set out the procedures, practices, resources and monitoring to manage hazards and protect the environment.

Effective risk management is an integral part of Husky's culture and is embedded into the company's operating philosophy, practices and business processes. The Atlantic Region risk management process is a comprehensive process that requires that hazard identification studies and risk assessments be conducted at appropriate project and operation stages, and that the results of the assessments be incorporated into facility design and operation. The overall objective is the design, construction and operation of facilities that will permit incident-free performance for the life of their operation.

As required under the C-NLOPB Certificate of Fitness Regulations, the Certifying Authority is responsible for requiring that pertinent safety related statutory requirements, industry codes and standards are complied with during the design, construction, installation and operation stages of the WHP. Husky's Certifying Authority will be involved in all aspects of the WREP from design through operations.

Husky maintains a robust personnel competency and training program that is administered to all onshore departments and offshore facilities within the Atlantic Region. For each department or facility, Husky maintains a training and competency matrix that identifies requirements for individuals employed in each position. These matrices contain regulatory requirements as set forth in the Canadian Association of Petroleum Producers Standard Practice for the Training and Qualifications of Personnel within the Atlantic Canada Offshore Petroleum Industry, as well as Husky's own position-specific and Transport Canada requirements deemed necessary for safe operations. A training and competency matrix will be developed for each position associated with the WHP.

The development of security-related processes specific for the WHP will be based on existing security systems and processes already in place for the *SeaRose FPSO* as appropriate. The WHP security plan will comply with the requirements of the C-NLOPB's Requirements Respecting the Security of Offshore Facilities.

3.9 White Rose Extension Project Gas Resource

Husky continues to evaluate opportunities to develop the White Rose gas resource. However, with the existing identified gas resource and at the current stage of development in the White Rose region, available gas will be used in support of incremental oil recovery. Produced gas will also continue to provide primary power to the S*eaRose FPSO* and will also be used for primary power on the WHP.

The total remaining estimated gas resources for the WREP area as of January 1, 2014, are summarized in Table 3-3. The in-place volumes are based on the most recent deterministic geological models along with the volumes of produced gas that have been re-injected for storage and conservation.

Table 3-3 Estimated WREP Gas Resource

Area	Free Gas (10^9 Sm^3)	Solution Gas (10^9 Sm^3)	Injected Gas (10^9 Sm^3)	Total Gas (10^9 Sm^3)
South Avalon	12.5	8.5	-	21.0
Blocks 2 and 5	0.2	0.8	-	1.0
North Avalon	9.0	1.0	3.2	13.2
WWRX	11.6	8.0	0.4	20.0
SWRX	6.7	2.0	-	8.7
Total	40.0	20.3	3.6	63.9

The Development Plan Amendment outlines the opportunity to use the gas as a secondary flood mechanism in a complementary fashion with water flood throughout the White Rose region. The development of SWRX will include recovery of the oil resource using a gas flood mechanism. SWRX has a large gas cap and gas will be injected and used as voidage replacement for development of the pool.

The base plan also includes gas flooding the southern portion of the South Avalon Terrace from the SWRX drill centre. The IOR plans for the South Avalon Terrace require gas injection in the southern area to gas flood the gas cap and move oil down into the existing oil producers and planned infill well. This will enable increased recovery of the “attic oil” in the South Avalon pool.

Execution of this plan will lead to further learning and potentially greater application of gas flood mechanisms for increased oil recovery throughout the White Rose region. Future development could include gas flood into the South Avalon northern terrace region and the central region. Although current development schemes leverage gas to provide increased oil recovery, Husky continues to keep abreast of existing and evolving gas development technologies. Husky is aware of the limitations and advances of technologies such as compressed natural gas, floating liquefied natural gas, pipelines and associated onshore liquefied natural gas terminal options. As industry gains experience with these applications worldwide, Husky will continue to monitor these technologies with the goal of understanding the development potential for White Rose area gas resources at the maturation of the gas flood/WAG phase and/or in the event that the existing gas resource or discovery of additional resources provides a feasible development opportunity.

4.0 SOCIO-ECONOMIC IMPACT STATEMENT AND SUSTAINABLE DEVELOPMENT REPORT

The Socio-economic Impact Statement (SEIS) studied the same valued environmental components that were considered in the original White Rose project SEIS (Husky Oil 2000) and the North Amethyst satellite tie-back SEIS (Husky 2007): Employment and Business; Community Social Infrastructure; and Community Physical Infrastructure and Services. These valued environmental components have been used for previous offshore petroleum projects in the province and they represent the socio-economic issues that have typically been of the greatest public interest for this type of development.

The temporal scope for the SEIS covers the initial development phase, through installation and operations and decommissioning and abandonment. The geographic scope of the analysis is provincial, with those areas most likely to experience direct effects from the WREP, the St. John's and Argentia areas, examined in greater detail.

4.1 Public Consultation

Husky held public consultations, in the form of open houses and socio-economic workshops, in Placentia, Marystown and St. John's during the week of June 25, 2012.

Workshop participants had few concerns about the potential effects of the Project on nearby communities. In all three locations, stakeholders confirmed that community members view the WREP as being beneficial to the communities and to the local and provincial economies. In St. John's, it was recognized by the workshop participants that the challenges of growth confronting the region were the result of multiple projects and associated government spending of taxes and royalties, that the Project would make only a very minor additional contribution to the size of these challenges, and that it was the provincial government's responsibility to spend resource revenues to address them.

Issues that were raised at the workshops included:

- Road traffic in and out of Placentia has become heavy and difficult to monitor due to the number of workers commuting to the Long Harbour plant – mitigations such as staggered work shifts and busing employees to the site should be considered
- High volumes of traffic or movement of materials may affect the condition and maintenance of St. John's roads
- The importance of communication between Husky and the Royal Canadian Mounted Police/Royal Newfoundland Constabulary for the purpose of monitoring traffic and criminal behaviour

- Additional Royal Canadian Mounted Police members are needed in Placentia, particularly to monitor traffic
- Potential for an increase in crime, particularly drug use, related to Project employment and measures has in place to prevent drug use by employees
- Importance of involving police in criminal activity at Project sites
- Concern that local non-unionized workers will not be hired to work on the Project
- Affordable housing is limited and rental units are hard to come by in Placentia and St. John's
- Demand for recreation facilities and programs is increasing in Placentia and St. John's
- Source of skilled workers for this and similar projects
- The Port of St. John's is expecting 2016 to be a very busy year so it is important that Husky keep the Port informed about the Project schedule and if materials will be going through St. John's
- Project-related opportunities for the Marystown Marine Industrial Park.

4.2 Socio-economic Context

Newfoundland and Labrador has undergone strong economic growth during the past decade, during which offshore oil production has been a primary economic driver. The Newfoundland and Labrador Department of Finance (NLDF) report that the provincial real Gross Domestic Product (GDP) increased 58.8 percent between 1997 and 2010. Approximately half of this growth was attributed to oil and gas production. GDP growth was expected to be 5.8 percent in 2013, the highest growth among provinces (NLDF 2013).The province's economic performance marks a recovery from the economic downturn of the 1990s. Newfoundland and Labrador has experienced a long period of population decline, which was largely due to economic consequences of the 1992 fisheries moratorium. However, the recent period of relative prosperity has influenced demographic changes and the provincial population has stabilized in recent years. The 2011 Census reported a provincial population of 514,536, representing a 1.8 percent increase since 2006 (Statistics Canada 2012).

The economy of the St John's area has been comparatively strong by provincial standards over the past decade, and the area continues to enjoy a boom in economic growth and activity. Real GDP in the St. John's Census Metropolitan Area (CMA) increased by 2.9 percent in 2011 over 2010 as a result of increased capital investment related to major projects but fell slightly in 2012 due to natural declines in offshore oil production. The population of the St. John's CMA has been increasing steadily since 2001. Between 2006 and 2011, the population of the St. John's CMA grew by 8.8

percent to 196,966 (Statistics Canada 2012). The 2011 population counts for both the City of St. John's and the St. John's CMA are the highest on record.

Economic conditions in the Argentia area are not as strong as in the St. John's area, but a relatively diverse economy and proximity to several large industrial projects have enabled a stronger economy than many other rural areas of the province. However, the area has not avoided the population decline that has characterized the province as a whole. According to the 2011 Census, the population of the Argentia area is approximately 7,600, which represents a decline of 8.5 percent since 2001, when the population was over 8,000 (Statistics Canada 2012).

4.2.1 Employment and Business

Employment conditions in the province have improved in recent years. The labour force has increased steadily since the mid-1990s. Between 2006 and 2012, average annual employment increased from 251,800 to 263,300. In 2013, there was a slight decrease in the labour force. However, employment rose by 0.3 percentage points, while the unemployment rate fell from 12.5 percent in 2012 to 11.4 percent in 2013. In 2013, the total population aged 15 years and older was approximately 429,500 and the participation rate was 61.6 percent, up from 59.1 in 2006. Employment conditions are expected to remain strong for 2013 (Newfoundland and Labrador Statistics Agency 2014).

In 2013, the provincial labour force was comprised of 51.8 percent males and 48.2 percent females. The participation rate for males stood at 65.4 percent, while for females this figure was 57.2 percent. At 12.7 percent, the male unemployment rate was higher than that for females, which stood at 10.0 percent (Newfoundland and Labrador Statistics Agency 2014).

After a recession-related decrease in 2009, labour markets in the province have remained robust (NLDF 2013). Employment growth resumed in 2010, and continued through 2013. In 2012, several labour market indicators, including employment, participation rate and wage rates, reached the highest level ever recorded in the province. In 2014, employment is expected to remain relatively stable, with some decline as employment from major projects is reduced (NLDF 2013).

In 2013, there were 17,657 businesses in Newfoundland and Labrador. Small businesses formed the majority, with 53.7 percent of businesses in the province employing one to four persons. A further 6,095 businesses (34.5 percent) employed 5 to 19 employees, 1,731 (9.8 percent) employed 20 to 99 people and 303 (1.7 percent) had between 100 and 199 employees. Businesses that employ over 500 people are relatively rare in this province; in 2013, there were 51 businesses in this category, representing 0.3 percent of all businesses (Newfoundland and Labrador Statistics Agency 2014).

Employment in the St. John's CMA increased 3.6 percent between 2011 and 2012; however, employment in the St. John's CMA decreased by 1.1 percent between 2012 and 2013, primarily as a result of public sector reductions, decreasing construction activity at Long Harbour and the slowing housing market (NLDF and the City of St. John's 2014). Overall, the past decade has seen a steady decline in the unemployment rate of the St. John's CMA; in 2001, unemployment stood at 9.2 percent and in 2013 the unemployment rate was 6.1 percent (NLDF and the City of St. John's 2014). The labour force in the St. John's CMA increased by 4.3 percent between 2011 and 2012, as more people participated in the labour market and substantial net in-migration to the region continued. In 2013, the labour force decreased by 2.3 percent to 115,000. In 2011, there were 7,279 businesses in the St. John's CMA, representing approximately 40 percent of the total for the province. The business capacity of the St. John's CMA is primarily composed of small businesses; businesses in the employment size range of one to four employees represent approximately 50 percent of total businesses in the St. John's CMA. Companies with less than 20 employees accounted for approximately 85 percent of the total. There were 919 businesses with 20 to 99 employees, 187 businesses with 100 to 499 employees and 32 companies that employed 500 or more people (Newfoundland and Labrador Statistics Agency 2014).

In 2006, the labour force for the Argentia area stood at approximately 4,000, with a participation rate of approximately 53 percent (Community Accounts, no date). The unemployment rate for the Argentia area was 28.5 percent in 2006, with approximately 2,800 people employed. The area has experienced relatively high unemployment compared to provincial averages. The provincial unemployment rate during the same period in 2006 was 18.6 percent. As of 2006, unemployment in the Argentia area varied considerably according to gender and age group. For Regional Economic Zone 18, which includes the majority of the Argentia area, the 2006 unemployment rate was 30.2 percent. There was higher unemployment among females, with an unemployment rate of 31.2 percent compared to 28.7 percent for males. Higher unemployment rates were also recorded for the 15 to 24 age group (34.8 percent) and for the 25 to 34 age group (38.8 percent), while the unemployment rate for people aged 35 to 54 stood below the regional rate at 26.5 percent (Community Accounts no date).

4.2.2 Community Physical and Social Infrastructure and Services

In terms of supply, there were 208,842 occupied private dwellings in Newfoundland and Labrador in 2011, an increase of 5.9 percent from 2006 (Statistics Canada 2006, 2012). There has been a steady growth in the St John's area housing stock and the number of occupied private dwellings increased by 23.0 percent between 2001 and 2011, from 64,830 to 79,836. In 2011, approximately 56 percent of all occupied private dwellings in the St. John's area were located in the City of St. John's (Statistics Canada 2001, 2006, 2012).

In 2006, the Argentia area had approximately 3,500 occupied private dwellings. The majority (approximately 86 percent) of these dwellings was owned and approximately 14 percent were rented (Community Accounts no date). By 2011, the number of occupied private dwellings in the Argentia area had increased to approximately 4,500 (Statistics Canada 2012).

More people have moved into the Argentia area in recent years to take advantage of employment associated with projects such as the nickel processing plant in Long Harbour. There are also two major fabrication companies in the Argentia Industrial Park, employing 150 to 200 people. As a result of this activity, housing sales have increased and it is becoming difficult to find housing to rent or buy in the Argentia area (Dooley 2011).

Housing starts in the province totaled 2,862 units in 2013, a decrease of 26.3 percent compared to 2012, which experienced the highest number of starts in 36 years. There was a decline in starts across the country in 2013, which reflected, in part, the tightening of mortgage regulations over the past five years, as well as higher mortgage rates in the latter half of 2013 (NLDF 2014). Total housing starts in the St, John's Area in 2013 were 1,734, a decrease of nearly 20 percent from 2012. However, during the fourth quarter of 2013, new construction activity was up 6.3 percent compared to the same period in 2012 (Canadian Mortgage and Housing Corporation 2014).

In 2007, there were 17 housing starts in Placentia and the surrounding area and in 2008, this number dropped to eight. In 2010, the number of housing starts rose to 19. There were 24 multiple sales listings multiple sales listingssales in the area in 2007 and the average house price was $68,500. By 2010, the average house price increased to $78,352 and there were 27 multiple sales listings sales (C. Janes, pers. comm.). As of January 2012, there were approximately 25 homes for sale in the Argentia area, ranging in price from $40,000 to $399,000 (J. King, pers. comm.).

Urban vacancy rates in Newfoundland and Labrador increased from 2.2 percent in October 2012 to 2.7 percent in October 2013. Despite this increase, rates remain historically low in the province and among the lowest in Canada. Since 2006, the vacancy rate in the St. John's Area has declined and was at 1.5 percent in 2011. This has increased to 3.2 percent in October 2013, up from 2.8 percent in October 2012. This is due to recent investment in new multi-unit apartment developments for the first time in 25 years, which will slowly increase the supply of apartments into 2014 (Canadian Mortgage and Housing Corporation 2012).

There are no data on vacancy rates in Placentia and the surrounding area, but there is a shortage of rental units because the majority currently house workers from the Long Harbour nickel processing plant. At the end of 2011, there were approximately 40 rental units in the area and fewer than five of these were vacant (J. King, pers. comm.).

According to the Mayor and Deputy Mayor of the Town of Placentia, residential development is a priority for the Town and there are a number of areas within the Placentia area that could be looked at for future residential development (Placentia Town Council 2011). Two areas in particular, in Dunville and southeastern Placentia, have been identified as possible areas for residential development and the Town of Placentia is looking for companies that may be interested in developing them. These two areas could accommodate up to 100 new homes (W. Hogan, pers. comm.).

A 500–person camp facility has been constructed in Long Harbour to house workers associated with the Long Harbour nickel processing plant construction. The camp was intended to provide those employees from outside the local area with an option to remain on site versus travelling long distances or attempting to secure accommodations locally. The camp was intended to help supplement the supply of local accommodations, which has had to respond to the increased demand since construction began at the facility (Newfoundland and Labrador Department of Natural Resources 2011). However, concern has been expressed that many employees have opted to live within the local communities, rather than at the camp, creating increased demand for local housing. With construction of the Long Harbour nickel processing plant almost complete and the operations phase set to begin in 2013, it appears that the construction camp and the local community have been able to provide all of the required accommodations (Fitzpatrick 2012).

At the outset of Long Harbour nickel processing plant construction, the Town of Long Harbour-Mount Arlington Heights responded to an immediate demand for additional residential accommodation with the creation of a 28 unit mini-home development in 2010. A new 38-lot residential subdivision, called Middle Pond, is also under development in Long Harbour-Mount Arlington Heights. The sub-division could increase the number of homes in the town by just over 20 percent from current levels. A development strategy will be presented to the Town Council for approval and then the lots will be offered to the public for sale (Long Harbour Development Corporation 2011).

Social housing in the province is administered by Newfoundland and Labrador Housing Corporation (NLHC), the housing arm of the provincial government. In 2010-2011, more than 16,000 households were assisted through the province's social housing programs. During that time period, funding of $22.8 million was allocated by the province and through the Federal/Provincial Economic Stimulus Plan to modernize and improve approximately 1,582 rental units. In addition, 259 new affordable housing units were completed, of which 167 (64.5 percent) are rentals for seniors (NLHC 2011).

In terms of emergency housing, there were 16 shelters with a total of 194 beds in Newfoundland and Labrador in 2010. Of these, 13 were women-only facilities with 161 beds available. In 2010, women-only facilities had an occupancy rate of 93.0 percent, the highest rate reported in Canada that year (Burczycka and Cotter 2011). Social

housing in the St John's area is provided by the City of St. John's and NLHC. As of July 2011, there were 4,572 social housing units in the St. John's area. At the end of January 2012, there were 523 families on the waiting list for social housing in the Avalon regional area, which includes communities on the Avalon Peninsula as far as, and including, Little Harbour (J. Bowering, pers. comm.).

Social housing in the Argentia area is administered by Newfoundland and Labrador Housing Corporation. In 2011, there were 126 social housing units in the Argentia area. Almost 50 percent of these are owned, operated and maintained by Newfoundland and Labrador Housing Corporation and the majority of the units (approximately 63 percent) are located in Placentia. At least 95 percent of these homes are occupied and are generally only vacant while they are being prepared for new tenants (J. Bowering, pers. comm.). There is no emergency shelter for women or men in the Argentia area.

There are approximately 90 hotels, motels, inns, cottages/vacation homes and bed and breakfasts in the St. John's area. More than half of these are located in the City of St. John's (Newfoundland and Labrador Tourism 2012). Construction is underway on a number of new hotels in the St. John's area, including a Hilton Garden Inn and a Sandman Signature Hotel, as well as some boutique hotels in the downtown area, to be completed by 2015 (NLDF 2014).

There are 13 hotels, motels and bed and breakfasts in the Argentia area. These provide more than 80 rooms in total (Newfoundland and Labrador Tourism 2012). There are also two campgrounds in the Argentia area. One of these is a recreational vehicle travel trailer park called Argentia Sunset Park, opened in 2007 by the AMA. The recreational vehicle park includes 40 lots and provides all of the necessary amenities for recreational vehicle users, including water, sewer and a 30-amp electrical service (AMA no date). The other campground, Fitzgerald's Pond Park in Dunville, also offers 24 sites for campers and recreational vehicle users (Newfoundland and Labrador Tourism 2012).

4.3 Assessment of Project Effects

The SEIS focuses on the direct effects of the WREP, mostly through expenditures or activities. Secondary effects are also considered, including those of any WREP-related demographic change on community services and infrastructure, both social and physical. The great majority of socio-economic effects will occur during the construction phase of the WREP.

Provincially, the WREP will generate a range of positive effects on the economy. The WREP is expected to directly contribute positive employment and business effects during construction and operations. The WREP will also create indirect economic benefits, including employment and business for those companies providing goods and services during WREP construction and operations. Induced benefits of the WREP will come from spending by direct and indirect employees, providing new sources of

government revenue. Potential adverse effects at the provincial level are expected to be minor and are likely within the capacity of existing services, facilities and infrastructure. Adverse effects will also be minimized and addressed through Husky's ongoing engagement with communities, government agencies and stakeholders.

The WREP will also generate some positive economic effects particular to the St. John's and Argentia areas. As the primary location for administrative, engineering, training, regulatory and supply and service activity, the St. John's area will see a range of socio-economic benefits during WREP construction and some degree of continued benefits during operations. These positive economic effects are expected to be similar to, but much smaller in scale than, those resulting from Hibernia, Terra Nova or White Rose, or those expected for Hebron. These include the provision of local employment, training, business and R&D. More generally, the WREP will result in the further development of provincial expertise and capabilities, contributing to sustainable economic development.

The Argentia area will also see direct, indirect and induced positive economic effects as a result of WREP construction. Local opportunities for employment and business will be provided where possible. Induced effects on the economy are expected to result from increased employment and higher wages resulting from the WREP.

Construction-related employment and business opportunities will have direct economic benefits, while secondary multiplier benefits will also substantially benefit the economy. During operations, the WREP will continue to provide employment and contribute both direct and indirect benefits to the St. John's and provincial economies. While the WREP may lead to some increased demand on community services and infrastructure, it is not anticipated that any such increased demand will exceed the capacity of communities to respond. Furthermore, given the smaller-scale of the WREP in relation to other industrial projects, past experience indicates that these communities will be able to meet the demands that may result from the WREP.

It is recognized that the St. John's region is experiencing some housing and other challenges as a result of growth and prosperity. However, these are principally the cumulative indirect and induced effects of numerous oil and mining industry projects, including their effects on: provincial employment and business; income, business and sales taxes; and resource taxes and royalties. These have contributed to government expenditures, and thus to the increased growth and prosperity. They also provide provincial and municipal governments with additional revenues to assist them in managing both the positive and negative effects of the growing economy.

It is unlikely that the WREP will put substantially increased pressure on housing in the Argentia area. Some of the WREP employees will come from the local area and already have their own accommodations, and a portion of the construction labour force currently working on the Long Harbour nickel processing plant will gain WREP employment,

further reducing new WREP-related increases on demand for local housing. In addition, close to 90 percent of the Long Harbour nickel processing plant's construction workforce live outside of the Argentia area and commute to the project site on a daily basis, and a similar situation is expected with the WREP.

The relatively small number of construction workers who come from distant communities, such that they cannot commute on a daily basis, will require temporary accommodations in the vicinity of the WREP construction site. However, with the expected completion of the Long Harbour nickel processing plant construction in May 2013 (MacDonald 2012), the demand on the local housing market will ease before the 2014 start of CGS construction at Argentia, and while the WREP will contribute to the demand for local accommodations, it is likely that this will be absorbed by the housing market. However, Husky will continue to monitor the situation and, if required, the provision of additional housing for WREP construction workers could come from continued use of the Long Harbour nickel processing plant camp facility after that construction project has ended.

4.4 Sustainable Development

For Husky, sustainability means the integration of social, environmental and economic considerations into its core business to create a lasting contribution to Newfoundland and Labrador. Engaging with key stakeholders and conducting its business in a manner that seeks to maximize positive benefits on current and future generations are core elements of Husky's sustainability commitment and values.

To support sustainable development, Husky continually analyzes and improves upon its activities and proposed projects in order to meet, and often exceed, industry and government regulatory requirements. Husky strives to use initiative, leadership and expertise so that its projects meet the needs of today's economy and society while not compromising the needs of future generations, and also contribute to the development of a strong economy and society over time.

Husky has introduced a number of initiatives to contribute to positive and sustainable economic and social change. These include employment, supporting petroleum industry R&D work, involving the local business community in operations through the Atlantic Region business unit and promoting and supporting workplace diversity within Husky and the local oil and gas industry.

The oil and gas industry remains an important economic driver for Canada, generally, and particularly for Newfoundland and Labrador. Husky projects contribute substantially to the economies of Canada and the province, providing employment and business opportunities through its commitment to generating local benefits. Recognizing the importance of managing effects from both an environmental and social perspective,

Husky contributes to sustainable economic development, keeping health and safety and environmental stewardship as core business values.

5.0 CONCEPT SAFETY ANALYSIS

Husky is committed to conducting all activities in a safe manner. A concept safety analysis (CSA) was carried out to identify major hazards associated with the WHP, taking into account the basic design concepts, layout and intended operations, and assessing the risks to personnel and the environment resulting from hazards associated with each phase in the life of the WHP, including the construction, installation, operation and decommissioning and abandonment.

The objectives of the concept safety analysis were to:

- Identify the potential major hazards associated with the development concept
- Evaluate the identified major hazards in terms of risk to personnel, through event tree-based quantified risk assessment
- Compare predicted risks with Husky's target levels of safety
- Document results, findings, conclusions and recommendations
- Fulfil the concept safety analysis requirements stipulated in Section 43 of the *Newfoundland Offshore Petroleum Installations Regulations*.

This CSA is the initial document that quantifies the risk to personnel and the environment due to operation of the installation, and is prepared and maintained during the pre-FEED and FEED stages of the WREP. The purpose of the CSA is to demonstrate that the WHP design is capable of meeting Husky's Target Levels of Safety and to support the WHP development application. It is intended that this Rev. E3 of the CSA will be the final revision prior to the WREP entering detailed design.

However, during detailed design, the WHP will be subject to a formal program of safety assessment studies. These studies will be reflected in a Quantitative Risk Assessment (QRA), which provides a more substantive assessment of risks and safety, being based on more detailed design information, than does the CSA, which the QRA will supersede. The QRA and associated studies will also be primary inputs into the Basis of Safe Operations for the WHP that will be included as part of the Safety Plan.

Husky will maintain the QRA, the associated safety studies and the Basis of Safe Operations throughout the life of the WHP, and these documents will be reviewed to reflect changes or new knowledge in operating conditions or equipment on the WHP as part of a three year review cycle.

5.1 Prevention, Control and Mitigation of Major Risks

The following are some of the safety design features and safety systems proposed for the prevention, detection and control of potential major hazards (refer to Section 3 of the Concept Safety Analysis for a complete discussion of the prevention, control and mitigation of major hazards):

- Topsides will be designed to provide maximum separation between the wellbay and the living quarters and helideck.
- Sufficient means of escape will be provided of enable efficient and protected evacuation from all areas designated as muster and evacuation stations under foreseeable hazard conditions.
- Survival craft, launch gear and other sea evacuation or escape systems will be oriented to provide the maximum practicable clearance from any part of the platform during deployment, and to avoid adverse effects of wind, waves and currents.

Hazardous areas of the WHP in which hydrocarbon gas or vapours will or may be present will be classified in accordance with the Canadian Electrical Code and the "*Recommended Practice for Classification of Locations for Electrical Installations and Petroleum Facilities Classified as Class 1, Zone 0, Zone 1 and Zone 2*".

- Hazardous areas will be ventilated to prevent accumulation of flammable gases and vapours, to reduce the likelihood of ignition and thereby minimize the risk from fire and explosion.
- Safety features will be incorporated into heating, ventilation and air conditioning systems to prevent the spread of flammable gas, fire and smoke from hazardous areas to closed non-hazardous areas.
- Open and closed drain systems will be provided.
- All areas of the facility will be monitored by automatic fire and flammable gas detection systems (appropriate to the fire or explosion risk).
- The fire and gas system will be integrated into the WHP ICSS.

An emergency shutdown system will be provided that is integrated into the ICSS to maintain safe operating conditions compatible with production systems. This system will comply with the relevant statutory requirements, codes and standards and will be designed to be initiated both manually and automatically. The emergency shutdown system will be interfaced with the *SeaRose FPSO* system to shut down the import/export of hydrocarbons to either facility during emergency situations.

- An emergency power generation system will be installed to allow drilling operations to be made safe and to maintain essential safety and communications systems in the event of loss of main power.

- A combination of active and passive fire protection will be provided that meets regulatory requirements and are appropriate for the fire hazards that exist. Active fire prevention will prevent fire from spreading to other areas and will limit the damage to structures and equipment. The deluge systems will be automatically activated on confirmed fire detection in designated protected areas. Passive fire protection will be provided for offshore topsides primary structures and hydrocarbon vessels that contain significant quantities of hydrocarbons, to prevent fire from escalating through structural collapse or vessel failure.
- Fire- and blast-rated external walls will be installed on the temporary safe refuges. Hazardous areas on the cellar and middle decks will be segregated with two fire- and blast-rated walls running north to south.
- A telecommunications system will be designed to maintain operational performance of the systems/subsystems essential to the safety of personnel and the platform during an emergency situation.
- Every work area will be provided with at least two well-marked separate escape routes that are situated as far apart as practicable. Escape routes will direct personnel to the temporary safe refuge and to the means of evacuation or escape from the platform.
- The temporary safe refuge will be designed to protect and shelter personnel from accidental events for sufficient time to organize and execute a safe evacuation. The temporary safe refuge will be located and oriented with regards to the predominant wind direction, in order to minimize the likelihood of the infiltration of a gas release or smoke into the temporary safe refuge and to minimize the presence of gas or smoke at evacuation routes and escape embarkation areas.
- Evacuation and escape will be provided by helicopter, totally enclosed motor-propelled lifeboats or escape to sea via life rafts (these are listed in descending order of preference).
- Sufficient lifeboats will be provided for a minimum of 200 percent of the maximum persons on board during normal operations. Lifeboats will be distributed between the primary and secondary muster stations at the production end of the platform. The current arrangement locates three 72-person crafts at the west end of the WHP in the vicinity of the temporary safe refuge and one 72-person craft at the alternative muster station on the east side of the WHP.

Existing *SeaRose FPSO* operating and maintenance procedures will be amended (where appropriate) to include the WHP or new WHP procedures will be developed, including maintenance procedures, drilling, production and marine procedures, emergency procedures, facility-specific alert and emergency response procedures, environmental protection and monitoring procedures, simultaneous operations

procedures and a joint operations manual. In developing drilling procedures, particular consideration will be given to the risks associated with dual conductor technology.

5.2 Target Levels of Safety

Risks to personnel will be measured in terms of individual risk (IR), which is a measure of the annual risk to an individual. The target levels for risks to individuals on the WHP will be:

- Intolerable IR greater than 5×10^{-4} per year
- ALARP IR less than 5×10^{-4} per year, but greater than 1×10^{-6} per year
- Negligible IR less than 1×10^{-6} per year.

If risks can be shown to be below the 'negligible' level, no further action is required. If risks are not negligible, it will first be necessary to show that risks are below the intolerable level, and then to demonstrate that risks have been reduced to a level that is ALARP.

Societal risk is a measure of the likelihood of multiple fatality accidents, and can be expressed as the frequency of accidents involving fatalities above a specified level. The most common representation of societal risk is in the form of a Frequency-Number curve. A Frequency-Number curve is a plot of the frequency distribution of multiple fatality accidents, where the cumulative frequency of all events leads to a specific number (or more) of fatalities. Husky's societal risk criteria are summarized in Table 5-1.

Table 5-1 Societal Risk Criterion Thresholds

Level	Frequency of ≥N Fatalities (per year)		
	N=10	N=50	N=100
Intolerable	$\geq 2.6 \times 10^{-3}$	$\geq 2.0 \times 10^{-4}$	$\geq 5.0 \times 10^{-5}$
ALARP	$<2.6 \times 10^{-3}$, but $\geq 1.0 \times 10^{-5}$	$<2.0 \times 10^{-4}$, but $\geq 2.0 \times 10^{-6}$	$<5.0 \times 10^{-5}$, but $\geq 5.0 \times 10^{-7}$
Negligible	$<1.0 \times 10^{-5}$	$<2.0 \times 10^{-6}$	$<5.0 \times 10^{-7}$

The WHP Environmental Assessment considers the potential environmental impact of incidents and provides qualitative targets for environmental effects. The Environmental Assessment includes a determination of historical frequencies of occurrence of environmental incidents for topsides hydrocarbon releases by volume of oil spilled into the sea. Historical data from the environmental assessment is presented in Table 5.2.

Table 5-2 Historical Platform Topsides Spill Frequencies

Volume of Oil Spilled into Sea	Historical Frequency (per well-year)
0 to 49 bbls	0.70
50 to 999 bbls	4.8×10^{-4}
>1,000 bbls	1.5×10^{-5}
>10,000 bbls	5.5×10^{-6}

Husky will use this historical data from Ref. 3 as a benchmark against which to compare the results of the CSA and operational performance going forward.

5.3 Identification of Major Hazards

Hazard identification forms the basis of any risk assessment. All stages of the Project have been considered during the hazard identification. The following major hazards were identified as requiring consideration in the quantified risk assessment:

- Loss of hydrocarbon containment, resulting in:
  - Fire and smoke
  - Explosion
  - Unignited release
- Blowout
- Releases below the platform topsides
- subsea flowline release
- Passing Vessel collision
- Other hazards including
  - Iceberg collision and scouring, sea ice, topsides icing
  - Helicopter transportation
  - Seismic activity
  - Structural failure due to extreme weather
  - Dropped objects.

Each hazard is described in terms of:

- Potential causes
- Safeguards to prevent occurrence
- Consequences and potential for escalation
- Mitigation measures in place to minimize consequences
- Impairment of main safety systems.

5.4 Safety Analysis Results

Judgements were made in the Concept Safety Analysis to estimate the likely number of statistical fatalities arising from each of the hazards considered. Using a conservative analysis, pessimistic judgements were made where there was uncertainty in the data used. This resulted in worst-case scenarios being considered in the risk assessment.

The largest contributors to risk to personnel on the WHP are process loss of containment events resulting in immediate fatalities, helicopter transportation and blowout events resulting in evacuation fatalities.

A review of the adequacy of potential risk reduction measures to prevent, mitigate and safeguard against these main risk contributors will be undertaken at detailed design stage, in order to ensure that risks are ALARP.

5.4.1 Potential Loss of Life

The potential loss of life for a hazard is the average number of fatalities per year on the installation from that specific hazard. For each of the hazards identified, the potential loss of life is calculated as:

Potential Loss of Life = Hazard Frequency (per year) x Potential Fatalities

The risk assessment for each major hazard is based on the potential loss of life and is provided in Table 5-3.

Table 5-3 Potential Loss of Life Risk Summary

Hazard	PLL				Total
	Fatality Classification				
	Immediate	Escape/ Escalation	Precautionary Evacuation	TR Impairment	
Process Loss of Containment	0.016	0.001	0.0014	0.000079	0.018
Blowouts	0.0029	0.000031	0.0061	0.0019	0.011
Releases Below the Platform Topsides[A]	-	-	-	-	-
Subsea Flowline Releases	0.000016	-	0.000024	0.000023	0.000063
Ice Hazards[A]	-	-	-	-	-
Ship Collision	-	-	-	0.000048	0.000048
Helicopter Transportation	0.027	-	-	-	0.027
Seismic Activity	-	-	0.0018	0.0004	0.0022
Structural Failure due to Extreme	-	-	0.000057	0.000072	0.00013

Hazard	PLL				Total
	Fatality Classification				
	Immediate	Escape/ Escalation	Precautionary Evacuation	TR Impairment	
Weather					
Dropped Objects[A]					
TOTAL	**0.046**	**0.001**	**0.0094**	**0.0025**	**0.058**
A Risk to personnel not quantified. However, the likelihood and consequences should be reviewed at detailed design to ensure that risks are ALARP.					

5.4.2 Individual Risk per Annum

The risk to each individual on the installation needs to normalize the potential loss of life calculation to account for the distribution of risk over the entire population of the installation. The average annual risk to an individual on the installation is the average IR per annum, which is calculated as:

$$\text{IR per Annum} = \frac{\text{Potential Loss of Life}}{\text{Persons on Board}} \times \text{Exposure}$$

Exposure is the proportion of the year that an individual would spend on the installation (which is 0.5, based on a three week offshore/three week onshore rotation). The average IR per annum calculated for platform personnel for each assessed hazard is provided in Table 5-4.

Table 5-4 Average Individual Risk per Annum Summary

Hazard	Average IRPA				Total
	Fatality Classification				
	Immediate	Escape/ Escalation	Precautionary Evacuation	TR Impairment	
Process Loss of Containment	5.6×10^{-5}	3.5×10^{-6}	4.9×10^{-6}	2.7×10^{-7}	6.5×10^{-5}
Blowouts	1.0×10^{-5}	1.1×10^{-7}	2.1×10^{-5}	6.6×10^{-6}	3.8×10^{-5}
Releases Below the Platform Topsides[A]	-	-	-	-	-
Subsea Flowline Releases	5.6×10^{-8}	-	8.3×10^{-8}	8.0×10^{-8}	2.2×10^{-7}
Ice Hazards[A]	-	-	-	-	-
Ship Collision	-	-	-	1.7×10^{-7}	1.7×10^{-7}
Helicopter Transportation	7.8×10^{-5}	-	-	-	7.8×10^{-5}
Seismic Activity	-	-	6.3×10^{-6}	1.4×10^{-6}	7.7×10^{-6}
Structural Failure due to Extreme	-	-	2.0×10^{-7}	2.5×10^{-7}	4.5×10^{-7}

Hazard	Average IRPA				Total
	Fatality Classification				
	Immediate	Escape/ Escalation	Precautionary Evacuation	TR Impairment	
Weather					
Dropped Objects[A]	-	-	-	-	-
TOTAL	**1.4×10^{-4}**	**3.6×10^{-6}**	**3.2×10^{-5}**	**8.8×10^{-6}**	**1.9×10^{-4}**

A Risk to personnel not quantified. However, the likelihood and consequences should be reviewed at detailed design to ensure that risks are ALARP.

Comparison of the IR levels in Table 5-4 with the Husky target levels of safety concludes that risks are below the intolerable IR criterion threshold of 5×10^{-4} per year, and within the ALARP region defined by the criteria.

5.4.3 Societal Risks

The Frequency-Number curve estimated for the risk assessment is illustrated in Figure 5-1 and is compared to Husky's societal risk criteria thresholds (Table 5-1). Comparison with the societal risk levels in Figure 5-1 with the Husky target levels of safety (Table 5-1) concludes that all frequencies are below the upper limit defined by the criteria. The frequencies of hazards resulting in three or four fatalities approach the intolerable threshold. The main contributors to these frequencies are fatal in-flight helicopter accidents and unisolated ignited process releases.

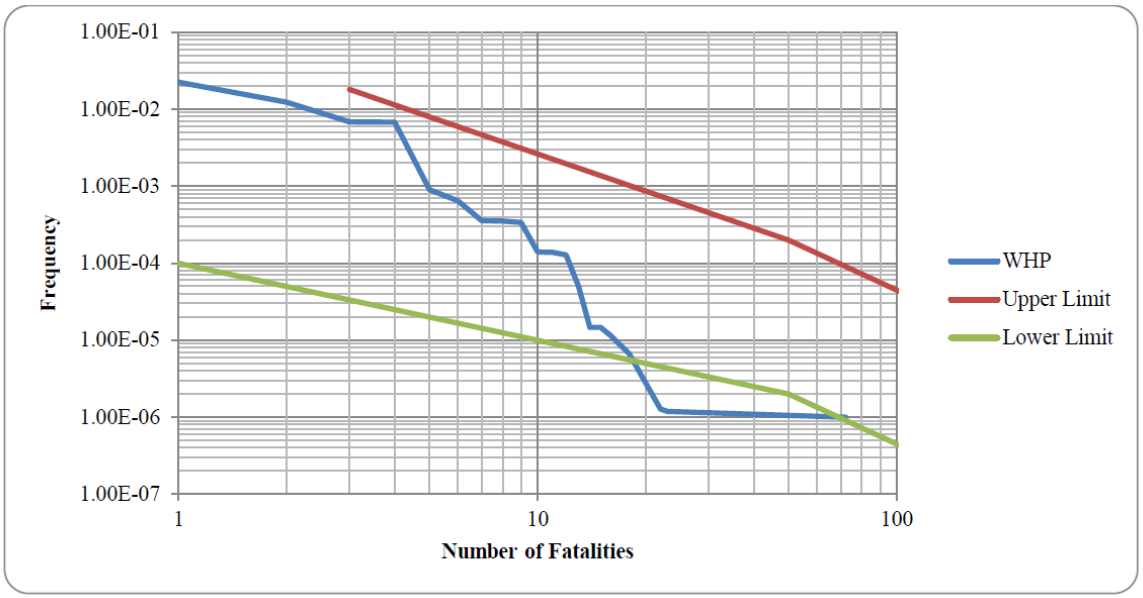

Figure 5-1 Frequency-Number Curve

5.4.4 Environmental Risks

Table 5-5 presents, annual exceedance frequencies for volumes of oil spilled into the sea based on the assessment of environmental risks associated with the major hazards.

Table 5-5 Environmental Risk Summary

	Frequency of Oil Spilled into the Sea (per Year)			
Hazard	**All Spills**	**>50 bbls**	**>1,000 bbls**	**>10,000 bbls**
Process Loss of Containment	5.9×10^{-2}	6.8×10^{-3}	3.0×10^{-5}	-
Blowouts	-	-	-	-
Releases Below the Platform Topsides	-	-	-	
Subsea Flowline Releases	5.8×10^{-3}	5.8×10^{-3}	4.6×10^{-3}	-
Ice Hazards	-	-	-	-
Ship Collision	-	-	-	-
Helicopter Transportation	-	-	-	-
Seismic Activity	2.3×10^{-5}	2.3×10^{-5}	1.6×10^{-6}	1.6×10^{-6}
Structural Failure due to Extreme Weather	-	-	-	-
Dropped Objects	-	-	-	-
TOTAL	**6.5×10^{-2}**	**1.3×10^{-2}**	**4.6×10^{-3}**	**1.6×10^{-6}**

The environmental risks from the activities associated with the WHP have been assessed in the *White Rose Project Environmental Assessment* (Husky 2012) and the Consolidated Response to Review Comments on the White Rose Extension Project Environmental Assessment and Addendum (Husky 2013). The environmental assessment is based on Project-specific modelling and included air quality dispersion, underwater noise, dredging, drill cuttings deposition, SBM whole mud spill trajectory and nearshore and offshore oil spill trajectories.

In general, the conclusion is that implementation of proposed mitigation measures should mean any environmental effects will be not significant during the construction, installation, operation and maintenance and decommissioning and abandonment of the WHP (see Section 6.3, Table 6-1). Marine birds (including species at risk) could potentially be exposed to significant residual adverse environmental effects in the event of a large or prolonged oil spill; however, the likelihood of such an event is considered to be low due to the design and maintenance of hydrocarbon-containing equipment/piping, pollution prevention measures and emergency response procedures to be put in place (see Section 3.8).

5.4.5 Conclusions

The largest contributors to risk to personnel on the WHP (Table 5-2) are helicopter transportation (accounting for approximately 47 percent of overall platform risk in terms

of potential loss of life), process loss of containment events resulting in immediate fatalities (approximately 28 percent of overall platform risk) and blowout events resulting in evacuation fatalities (approximately 10 percent of overall platform risk).

The concept safety analysis recommends that a review of the adequacy of potential risk reduction measures to prevent, mitigate and safeguard against these three main risk contributors be undertaken at the detailed design stage to confirm that risks are ALARP.

The risk from blowouts will decrease substantially once the frequency of drilling activities decreases, as the blowout risk associated with drilling activities is greater than that associated with well activities carried out on production wells.

To comply with the Husky's target levels of safety, it will be necessary to show, for hazards that are assessed as being in the ALARP region, that all practicable means of risk reduction have been employed to ensure that the risk is demonstrably ALARP. To achieve this, cost-benefit studies may be required at the detailed design stage to ensure that appropriate measures of risk reduction are incorporated into the final design.

It is concluded that there are no areas for concern that could prevent demonstration that risks have been reduced to a level that is ALARP at the detailed design stage. However, further detailed studies will be required at the detailed design stage to confirm or refine the assumptions that have been made in this concept safety analysis.

6.0 ENVIRONMENTAL ASSESSMENT

6.1 Scope of the Assessment

The scope of the WREP included a near shore component, an offshore component and potential future expansion activities within the White Rose field. Topsides for the WHP are being constructed at an existing facility so were not included within the scope of the WREP environmental assessment.

Note that the original plan identified in the environmental assessment envisioned topsides mating taking place at a deep water site in Placentia Bay. However, further investigation has indicated that mating of the topsides to the CGS at the permanent location in the White Rose field is a technically superior option. This option is described in the Development Plan Amendment summary in Section 3.0. The summary of the environmental assessment that follows reflects the original plan for mating at a deep water site.

Note also that at the time the environmental assessment was conducted, the development option (WHP vs. subsea drill centre) had not been finalized; therefore use of a subsea drill centre to develop the West White Rose resources was also assessed.

The following key WREP-related activities were assessed in the Near Shore Project Area:

- Graving dock excavation - associated activities may include graving dock side stability/reinforcement (e.g., sheet piles, bund wall) and site grading and levelling
- Site dewatering and disposal
- Use of The Pond for disposal of excavated soil material and dredged material
- CGS construction in the graving dock
- Shoreline dredging
- Tow-out channel dredging
- Tow-out to the deep-water site
- Topsides mating and commissioning at the deep-water site
- Tow-out of the WHP to the White Rose field
- Operation of support craft associated with the above activities, including but not limited to heavy lift vessels, construction vessels, supply vessels, helicopters, tow vessels and barges

- Associated surveys for all above activities, including: remotely-operated vehicle surveys, diving programs, geotechnical programs, geophysical programs, geological programs, environmental surveys.

The following key WREP-related activities were assessed in the Offshore Project Area:

- Offshore site and clearance surveys
- Installation of the WHP/subsea drill centre at its offshore location (may include site preparation activities such as dredging, seafloor levelling, offshore solid ballasting, piles and mooring points,
- Subsea equipment and flowline installation to tieback to the *SeaRose* FPSO
- Flowline berm protection (i.e., rock piles and/or concrete mats)
- WHP/subsea drill centre commissioning
- Operation, production, maintenance, modifications, decommissioning and abandonment of the WHP/subsea drill centre
- Drilling operations (exploration and development drilling), of up to 40 wells from the WHP, or 16 wells from a MODU through a subsea drill centre, including well testing, well completions and workovers and data logging
- Supporting activities, including diving programs, and operation of support craft associated with the above activities, including but not limited to dredging vessels, light intervention vessels, construction vessels, MODUs, WHP supply and standby vessels and helicopters
- Associated surveys for all above activities, including: remotely-operated vehicle surveys, diving programs, geotechnical programs, geophysical programs (e.g., vertical seismic profiles (VSPs), geohazard/wellsite surveys), geological programs, environmental surveys (including iceberg surveys)
- Potential future activities, including excavation of up to two additional subsea drill centres and installation of infrastructure, including any associated surveys (e.g., VSP, geohazard/wellsite).

6.2 Issue Scoping and Stakeholder Consultation

During the environmental assessment process, Husky had ongoing consultation with federal, provincial and municipal regulatory agencies, stakeholders and the public. The focus of Husky's consultation program was the geographic regions most likely to be affected by the WREP, including Placentia Bay, the Marystown area and St. John's. Husky has met and will continue to meet with various stakeholders to provide information on the WREP and solicit feedback from stakeholders.

Husky's consultation program included:

- Meeting with nearshore and offshore fishers and the Fish, Food and Allied Workers
- Meeting interested environmental non-governmental organizations
- Meeting with government departments and agencies
- Meeting with industry organizations such as the Newfoundland & Labrador Oil & Gas Industries Association
- Conducting public open houses
- Reviewing the environmental assessment documents prepared for previous Newfoundland and Labrador offshore oil and gas developments, including the recent *Hebron Project Comprehensive Study Report* (ExxonMobil Canada Properties 2011), and the relevant White Rose drill centres environmental assessments
- Reviewing issues raised during consultations held for the White Rose drill centres and Hebron platform developments.

6.3 Key Findings of the Environmental Assessment

6.3.1 Air Quality

An emissions inventory (to predict the annual emissions released) and modelling (to estimate the maximum ground-level concentrations) were used to assess potential effects on air quality in the near shore and offshore environments.

Emission sources and types potentially released during graving dock excavation and CGS construction/mating in the Near Shore Project Area include:

- Vehicle traffic, site clearing and grading equipment, earth-moving equipment during excavation of the graving dock, bulk material handling, back-up power generation, shoreline and channel excavation and dredging, vessel (tug boats, accommodation vessel, assistant tug, supply boat, support vessels, logistics vessel, single- or dual-crane heavy lift vessel) and helicopter traffic and topsides stand-by generator – resulting in carbon monoxide (CO), sulphur dioxide (SO_2), nitrogen oxides (NO_X), total suspended particulate (TSP), greenhouse gases (GHGs)
- Concrete production, resulting in total particulate matter, particulate matter less than 10 microns (PM_{10}) and particulate matter less than 2.5 microns ($PM_{2.5}$).

Emission sources and types potentially released during WHP tow-out and installation or subsea drill centre excavation and installation, operation and maintenance, decommissioning and abandonment in the Offshore Project Area include:

- Vessel (ocean-going tugs/vessels, trailing suction hopper dredge vessel) and helicopter traffic and power generation during installation, resulting in CO, SO_2, NO_X, TSP, GHGs

- Vessel (e.g., supply, support, tow, standby) and helicopter traffic, flaring, fugitive and venting emissions (e.g., standby generators, product loading, unloading and storage, chemical and fuel storage, leaking valves, pumps seals, compressor seals, flanges/connectors, and pressure relief valves, packing and seals) during operation and maintenance, resulting in CO, NO_X, TSP, volatile organic carbons (VOCs), GHGs
- Power generation, resulting in CO, NO_X, TSP, VOCs, SO_2, GHGs
- Maintenance activities (e.g., welding) resulting in TSP, VOCs
- Vessel (e.g., supply, support, tow and standby) and helicopter traffic during decommissioning and abandonment, resulting in CO, NO_X, TSP, VOCs, GHGs.

The change in air quality attributable to the construction, operation and decommissioning of the WREP (both development options) is expected to be low in magnitude, local in extent, short-term in duration (during construction, but continue for the life of the WREP during operation) and reversible. Components associated with all phases of the WREP for both development options, including power generation, MODU operation, flaring and fugitive releases, as well as accidental releases and cumulative environmental effects, will result in emissions that will not exceed applicable maximum ground-level concentrations.

By implementing appropriate mitigation measures, the environmental effects on Air Quality during the construction, installation and operation and maintenance phases of the WREP, including accidental events and cumulative environmental effects, are predicted to be not significant.

6.3.2 Fish and Fish Habitat

The near shore activities that have the potential to interact with marine fish and fish habitat include discharge of water from The Pond, dewatering of the graving dock, noise from construction activities (i.e., sheet pile driving and potential grouting), lighting, operation of vessels, near shore surveys (i.e., multibeam, sonar, environmental), dredging, ballasting/deballasting of the CGS, towing to the deep-water site, noise from topsides mating and the establishment of a no-fishing safety zone. The offshore activities that could potentially interact with marine fish and fish habitat include: clearance surveys (e.g., sidescan sonar); operation of helicopters and vessels; installation of flowlines, pipelines and other subsea equipment; potential installation of rock berms; lighting; drilling-associated seismic (VSPs and well site surveys); dredging and disposal of dredge material; the presence of the structure (WHP or subsea drill centre); noise from drilling from a WHP or MODU, water based mud cuttings (from either WHP or MODU); SBM cuttings (from MODU only); lighting; operation of seawater systems; water generation (domestic waste, sanitary waste); cementing and completing wells; surveys (geotechnical, geophysical and environmental), oily water treatment; and

presence of no-fishing safety zone. The decommissioning and abandonment activities that could potentially interact with marine fish and fish habitat include removal of the WHP, plugging and abandoning of wells, operation of vessels, lighting, surveys (geotechnical, geophysical and environmental) and the presence of a safety zone.

An accidental event in the nearshore is not expected to cause a significant adverse effect (defined as a decrease in abundance or alteration in distribution of the population over more than one generation) on Fish and Fish Habitat. Likewise, an accidental event in the offshore is predicted to be reversible and is not expected to cause a significant adverse effect on Fish and Fish Habitat to result in a decrease in abundance or alteration in distribution of the population over more than one generation. Based on planned mitigation (including fish habitat compensation) and the nature of the environmental effects, the environmental effects on Fish and Fish Habitat during the construction, installation and operation and maintenance phases of the WREP, including accidental events and cumulative environmental effects, are predicted to be not significant.

6.3.3 Fisheries

Activities most likely to cause disturbance in the Near Shore Study Area include pile driving associated with the construction of the graving dock, dredging, vessel traffic and establishment of a safety zone. Activities most likely to cause disturbance in the Offshore Study Area include tow-out to the Offshore Project Area, noise from installation-related activities, regular support vessel operations (as well as from other activities such as iceberg towing or geophysical surveys) and potential future expansion of the existing offshore safety zone.

The required safety zones during dredging and topsides mating will create a temporary loss of access to fishing grounds and potential interference with vessel transit. As the majority of material delivered to the site will be by land, marine traffic associated with the WREP will be minimal. Any marine traffic associated with the CGS construction will use designated routes. Dredging will be planned to avoid fish harvesting times, where possible. Husky will also work with active fish harvesters potentially affected by the CGS tow-out from the graving dock to the deep-water mating site and from the deep-water mating site to the White Rose field to ensure safety and minimize disturbance.

The established White Rose Safety Zone has restricted fish harvesting since 2005 to avoid potential interactions between fishing gear and subsea equipment. Considering the relatively low level of fish harvesting within the Offshore Project Area in recent decades, few gear conflicts or effects are likely to occur from the WREP. The greatest potential for interaction is along the route from ports servicing the WREP to the Offshore Project Area. However, the vessels associated with the WREP will use existing routes established by current White Rose field operations.

Economic effects from accidental events resulting in loss of access, gear damage or product marketability could be considered significant to the fisheries. However, the application of appropriate mitigative measures (e.g., economic compensation) would reduce the potential effect to not significant. Likewise, the existing Gear and Vessel Damage Compensation Program would apply to damage resulting from activities associated with the WREP.

With the proposed mitigation measures in place, the environmental effects on Fisheries during the construction, installation and operation and maintenance phases of the WREP, including accidental events and cumulative environmental effects, are predicted to be not significant.

6.3.4 Marine Birds

Activities with the greatest potential for disturbance in the Near Shore Study Area include pile driving, vessel traffic and dredging. Mortality of marine birds is not expected to be an environmental effect of most routine activities in the Near Shore Study Area, except perhaps from night-time collisions with vessels/infrastructure. Offshore activities with the greatest potential for disturbance (e.g., effects on habitat quality) include the operation of helicopters, the operation of vessels (including dredging activities), and well site and VSP surveys. Lighting at night throughout the WREP installation and commissioning phase may attract marine birds,

Adverse environmental effects of attraction of birds to lights on structures and vessels during the construction/installation, operation and maintenance and decommissioning and abandonment phases of the WREP are predicted to be low in magnitude, geographic extent, duration and frequency when mitigation measures are applied (e.g., use only lights as necessary for safe operations). Although light-related effects could result in bird mortality, these environmental effects are predicted to be not significant at the population level.

Adverse environmental effects of accidental events (i.e., hydrocarbon and other chemical spills due to collisions, subsea blowouts, batch spills, marine vessel incidents, graving dock breach, SBM whole mud spills) are predicted to be low to high in magnitude, low to high in geographic extent, low to moderate in duration and low in frequency. Although hydrocarbon spills would likely result in bird mortality, these environmental effects are predicted to be reversible at the population level. The environmental effects of hydrocarbon spills could be significant if spills are large and persistent enough to affect more than one generation. Smaller-scale spills in calm conditions may be mitigated via oil spill response measures and marine bird rehabilitation; however, these mitigations are recognized to be limited. Husky will adhere to safety and risk management systems, management of change procedures and global standards. There will be an emphasis on accident prevention at all phases of the WREP.

The environmental effects on Marine Birds during the construction, installation and operation and maintenance phases of the WREP, including cumulative environmental effects, are predicted to be not significant. While the environmental effects on Marine Birds from a large, persistent accidental event could be significant, such a significant effect is considered not likely.

6.3.5 Marine Mammals and Sea Turtles

Underwater sound produced by the WREP's activities will be the primary source of potential effects on marine mammals and sea turtles. WREP activities that will produce underwater noise include pile driving, vessel and helicopter traffic and dredging in the Nearshore Project Area and drilling and geophysical surveys in the Offshore Project Area. In addition, vessel traffic could affect marine mammals and sea turtles through direct mortality caused by collisions.

Adverse environmental effects of underwater noise on marine mammals and sea turtles during the construction/installation, operation and maintenance and decommissioning and abandonment phases of the WREP are predicted to be mostly localized, of low to medium magnitude, and reversible at the population level when mitigation measures are applied in both the Nearshore and Offshore Study Areas.

Depending on the time of year, location of animals within the affected area and type of oil spill or blow-out, the effects of a nearshore or offshore oil release on the health of cetaceans is predicted to range from negligible to low magnitude over varying geographic extents.

The environmental effects on Marine Mammals and Sea Turtles during the construction, installation and operation and maintenance phases of the WREP, including accidental events and cumulative environmental effects, are predicted to be not significant.

6.3.6 Species at Risk

Species at Risk refers to those species of marine fish, mammals, birds and reptiles listed under the *Species at Risk Act*, or assessed as endangered, threatened, or special concern species by the Council on the Status of Endangered Wildlife in Canada (COSEWIC).

Many of the potential environmental effects of the WREP on Species at Risk (marine fish, birds, marine mammals and sea turtles), and associated mitigation measures, are the same as those for non-listed species.

With the application of required authorizations, compliance standards and mitigations, the potential residual adverse environmental effects of the WREP on marine fish Species at Risk from routine WREP activities are not considered of sufficient geographic extent, magnitude, duration, frequency and/or irreversibility to result significant effects in

the Nearshore and/or Offshore Study Area. The residual adverse environmental effects of an accidental hydrocarbon spill on marine fish Species at Risk populations are predicted to be not significant.

Adverse environmental effects of accidental events (i.e., hydrocarbon and other chemical spills due to collisions, failure of lines, subsea blowouts, batch spills, marine vessel incidents, graving dock breach, SBM whole mud spills) are predicted to be low to high in magnitude, low to high in geographic extent, low to moderate in duration and low in frequency. Although hydrocarbon spills would likely be significant at the individual level, these environmental effects are predicted to be reversible at the population level. Nevertheless, the environmental effects of hydrocarbon spills are potentially significant. Smaller-scale spills and blowouts in calm conditions may be mitigated via oil spill response measures and marine bird rehabilitation; however, these mitigations are recognized to be limited. Husky will adhere to safety and risk management systems, management of change procedures, and global standards. There will be an emphasis on accident prevention at all phases of the WREP.

The environmental effects on marine mammal and sea turtles Species at Risk during the construction, installation and operation and maintenance phases of the WREP, including accidental events and cumulative environmental effects, is predicted to be not significant.

6.3.7 Sensitive Areas

Routine WREP activities that could interact with Sensitive Areas are the graving dock excavation and dredging. An accidental event could also potentially affect sensitive areas in the Near Shore and Offshore Study Areas. During construction activities in the Near Shore Project Area, there will be excavation and dredging activities near the graving dock construction site and dredging activities to deepen the tow-out route for the CGS to the deep-water mating site. Habitat characterization studies indicated eelgrass was absent from tow-out route, but occurred near the graving dock construction site. Outside the area to be dredged, a change in habitat quality due to sedimentation is not expected to have adverse environmental effects since eelgrass is resilient to sedimentation in the water column and assists to improve water quality. As there are multiple eelgrass beds in the Nearshore Study Area, the removal of an eelgrass bed of approximately 1,100 m^2 is considered to be not significant.

Sensitive areas within the Near Shore Study Area (Placentia Bay Extension Ecologically and Biologically Sensitive Area (EBSA), eelgrass beds, capelin beaches, salt marshes, Important Bird Areas, and otter haul-outs) could all be impacted by an accidental spill. Although the likelihood of an oil spill in the Nearshore Study Area from an accidental event or collision occurring is low, spill prevention procedures and contingency planning will be developed to prepare for an accidental event. In the unlikely event of a diesel spill in the Near Shore Study Area, these procedures and plans will be implemented to

reduce the severity and duration of interactions between hydrocarbons and Sensitive Areas. Significant residual adverse environmental effects on these Sensitive Areas are therefore not considered likely.

Sensitive Areas in the Offshore Study Area include EBSAs identified by DFO where there is high productivity and/or aggregations of species, as well as sensitive areas identified by the Northwest Atlantic Fisheries Organization (NAFO) including Vulnerable Marine Ecosystems (canyons, seamounts, knolls), coral-sponge area closures and the Bonavista cod box. Oil spill trajectory modelling indicates that hydrocarbons from a spill at the Offshore Project Area have some potential (0 to 50 percent, depending on wind and wave conditions) to interact with Sensitive Areas (in the absence of countermeasures). Spill prevention and contingency plans will be in place to reduce the likelihood of an accidental event occurring, and the likelihood of hydrocarbons reaching a Sensitive Area. SBM modelling suggests that SBM is unlikely to reach any Sensitive Areas.

A significant adverse residual environmental effect is one that alters (physically, chemically or biologically) the valued habitat of the identified Sensitive Area, to such an extent that there is a decline in abundance of key species or species at risk or a change in community structure, beyond which natural recruitment is unable to return the population or community to its former level (within several generations). The environmental effects on Sensitive Areas from activities associated with the WREP, including accidental events and cumulative environmental effects, are therefore not likely to be significant.

6.4 Follow-up and Monitoring

Husky's White Rose Environmental Effects Monitoring program has been monitoring the effects of its offshore operations since 2005. The current Environmental Effects Monitoring program will be re-designed to incorporate the offshore WREP location in consultation with regulators.

As per requirements under its existing fish habitat compensation approval (Authorization No. 07-01-002), Husky will continue to conduct the fish habitat compensation monitoring program in North Harbour. The requirements for further fish habitat compensation and monitoring will be discussed with DFO in light of changes to the Fisheries Act.

For wellsite and VSP activities in the Offshore Study Area, Husky will implement a marine mammal and sea turtle observation program. The program will be consistent with the requirements outlined in the Geophysical, Geological, Environmental and Geotechnical Program Guidelines (C-NLOPB 2012). Data on marine mammal and sea turtle observations will be provided to DFO and the C-NLOPB where applicable.

In the event of a spill, and depending on the nature and size of the spill, marine bird effects monitoring will be implemented. The details regarding monitoring requirements and protocols are outlined in the existing Oil Spill Response Plan and will be determined in consultation with the C-NLOPB and Environment Canada.

6.5 Summary and Conclusions

As an extension of the White Rose field, the WREP will benefit from the experience of existing operations to mitigate environmental effects of routine construction and operation activities. Husky will comply with legislative requirements and adhere to guidelines and/or codes of practice that have been specifically developed to address environmental protection practices in the Newfoundland and Labrador offshore area.

A summary of the residual environmental effects (i.e., effects remaining after mitigation is applied) assessment for each of the identified Valued Environmental Components (VECs) is provided in Table 6-1.

Table 6-1 Summary of Significance of Residual Adverse Environmental Effects on Valued Environmental Components

VEC	Significance of Residual Environmental Effect					
	Construction and installation	Operation and Maintenance	Decommissioning and Abandonment	Accidental Events	Project Overall	Cumulative Environmental Effects
Air Quality	NS	NS	NS	NS	NS	NS
Marine Fish and Fish Habitat	NS	NS	NS	NS	NS	NS
Fisheries	NS	NS	NS	NS	NS	NS
Marine Birds	NS	NS	NS	S	NS	NS
Marine Mammals and Sea Turtles	NS	NS	NS	NS	NS	NS
Species at Risk						
Marine Fish	NS	NS	NS	NS	NS	NS
Marine Mammal and Sea Turtle	NS	NS	NS	NS	NS	NS
Birds	NS	NS	NS	S	NS	NS
Special Areas	NS	NS	NS	NS	NS	NS
S = Significant residual environmental effect NS = Not significant residual environmental effect						

Most environmental effects are predicted to be reversible, and of limited duration, magnitude and geographic extent. Significant residual adverse environmental effects have been predicted for Marine Birds and marine bird Species at Risk in the case of an

accidental event; however, the likelihood of such an event occurring is considered very low. Husky will incorporate the requirements of the WREP in its existing pollution prevention measures and emergency response procedures.

Routine WREP phases and activities are predicted to result in not significant residual adverse environmental effects on Air Quality, Fish and Fish Habitat, Fisheries, Marine Birds, Marine Mammals and Sea Turtles, Species at Risk and Sensitive Areas.

Husky is committed to planning and executing the WREP as an environmentally responsible development and one that successfully balances environmental and economic needs.

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