Testing Facility for Oil Spill Detection In and Under Ice

Prepared for:
Environmental Assessment
Division Newfoundland and
Labrador Department of
Environment and Conservation

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October 27, 2015

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1.0 INTRODUCTION

Fugro GeoSurveys, a division of Fugro Canada Corp., (Fugro, the Proponent), with the planning and funding assistance of Petroleum Research Newfoundland and Labrador (PRNL), is proposing to construct and operate a temporary research facility on the Northern Peninsula of the island of Newfoundland, approximately 62 km southwest of St. Anthony (the "project").

1.1 Proponent

I. Name of Corporate Body:

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III. Chief Executive Officer:

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1.2 The Undertaking

I. Name of the Undertaking:

Testing Facility for Oil Spill Detection In and Under Ice

II. Purpose/Rationale/Need for the Undertaking:

The detection of oil in and under ice is a key limitation to responding to an oil spill in the Arctic and in ice-prone regions. Current operational methods to detect oil under ice are limited to placing personnel on the ice to auger or drill through it. Primarily, this is a safety hazard, and, depending on conditions, access may not be possible. In addition, this process, although effective, progresses slowly due to limitations of travel time and the process of drilling.

The ability to detect oil in and under ice safely and efficiently would be a step-change in oil spill response methods in ice-prone regions. Earth's Field Nuclear Magnetic Resonance (EFNMR) is a remote sensing technology deployed by helicopter, which has the potential to enable detection of oil through ice and snow without the safety and access limitations of existing methods, and with improved coverage and response rates. There are no known adverse health effects of nuclear magnetic resonance (NMR) and magnetic resonance imaging (MRI), a subfield of NMR. MRI does not use ionizing radiation (high-energy radiation that can potentially cause damage to DNA). There are no known harmful side-effects associated with temporary exposure to the strong magnetic field used by MRI scanners (FDA ND).

Remote detection of oil in and under ice has been an area of research for several decades and a variety of technological approaches have been evaluated by researchers around the globe. The use of EFNMR has the potential to be more effective than other approaches as it can be deployed via helicopter, requires a short amount of time to collect measurements, and is less susceptible to interference by ice, which attenuates the signal of most other measurement techniques.

1.3 Description of the Undertaking

1.3.1 Geographical Location

The selected location for the project is Eddies Cove on the Northern Peninsula, approximately 62 km southwest of St. Anthony, and is identified as "Site 1 – Preferred" on Figures 1-1 and 1-2. The project will occupy an area of approximately 1.9 ha. Details on the site selection process, and reasons for selection of the Eddies Cove site, are provided in Section 1.3.1.1.

1.3.1.1 Site Selection

In order to meet the project's research objectives, a location is required with the following features:

- Minimal electromagnetic disturbance and anthropogenic noise.
- Climate conditions that will allow freezing of seawater;
- Proximity to seawater; and
- Proximity to (within two hours helicopter flying time) an airport for transportation and helicopter access.

Based on preliminary desktop review, the Northern Peninsula of Newfoundland was determined to meet the required criteria. To determine the preferred location, a site selection exercise was conducted which included a preliminary characterization of potential sites and a desktop review of known constraints. The objectives of the site selection process included:

- Avoiding sensitive environmental (i.e., wetlands, waterbodies, designated reserves within the limestone barrens) and important historical / cultural sites;

- Reducing disturbance to native plant communities and important landscapes of the Northern Peninsula, in particular, existing limestone barren habitats;
- Satisfying engineering and construction requirements; and
- Reducing overall project costs, where feasible.

Multidisciplinary teams were established, including engineering/geological, construction, and environmental specialists, to assess potential sites for the project. Evaluation criteria were developed during a desktop study/constraints analysis process. Previous studies were reviewed and available information gathered (e.g., location of salmon rivers, Atlantic Canada Conservation Data Centre information) to evaluate a number of potential site options. Evaluation criteria were developed during the desktop study, and potential sites identified for field reconnaissance. The number of potential sites was refined based on groundtruthing of the parameters noted above.

Outcomes of the site selection process led to the identification of preferred, as well as alternative locations, as indicated in Figure 1-1.

Distances from communities and known environmental constraints are provided in Table 1.1.

Figure 1-1 Alternative and Preferred Site Locations

Distances from communities and known environmental constraints are provided in Table 1.1.

Table 1.1 Site Proximity to Communities and Environmental Constraints

Location	Closest Distance to (in km):								
	Salmon River	Transmission Line ROW (100m)	Outfitter	Provincial[1] Protected Area	Critical habitat as delineated by Recovery Strategy for Long's Braya and Fernald's Braya	Archaeological Site[2]	Eddies Cove (Community)	St. Anthony (Community)	Coast Line
Site 1 - Preferred	9.9	16.6	8.4	6.6	9.5	24.2	3.3	62.5	<0.1
Site 2 – Alternative	10.1	16.2	8.5	7.1	9.1	23.8	3.0	62.0	<0.1
Site 3 – Alternative	10.3	15.4	8.7	7.9	8.3	23.0	2.5	61.5	<0.1
Site 4 - Alternative	9.6	18.1	8.3	5.1	11.0	25.7	5.1	60.6	<0.1

[1]Watts Point Ecological Reserve (Provincial Protected Area) and its Management Plan are the responsibility of the Parks and Natural Areas Division, Department of Environment and Conservation. It was established to preserve the unique flora of the calcareous barrens and a representative portion of the Strait of Belle Isle Ecoregion. All reserves in the Province were established under the Wilderness and Ecological Reserves Act (1980).
[2] Borden Number EhBe-02 as recorded in the Provincial Archaeology Office database

Of the several sites along the Northern Peninsula that were initially screened as potential target sites, the above four sites were further evaluated for electromagnetic noise using a small scale tester similar to the equipment proposed for the experiment. Minimal electromagnetic noise is essential for a successful full scale test facility. The Eddies Cove area was favorable from an electromagnetic noise/interference level, is a brown field site with existing disturbance, is accessible, is in close proximity to seawater (required for the test facility), is within a favorable geology and setting for construction of the basin with minimal disturbance to the existing area, is in close proximity to an airport, and avoids critical habitat as delineated by Recovery Strategy for Long's Braya and Fernald's Braya. Other features, such as wetlands, were also considered.

Photos 1 to 7 illustrate the nature of the preferred site.

Photo 1 Eddies Cove Preferred Site -North View 1

Photo 2 Eddies Cove Preferred Site – North View 2

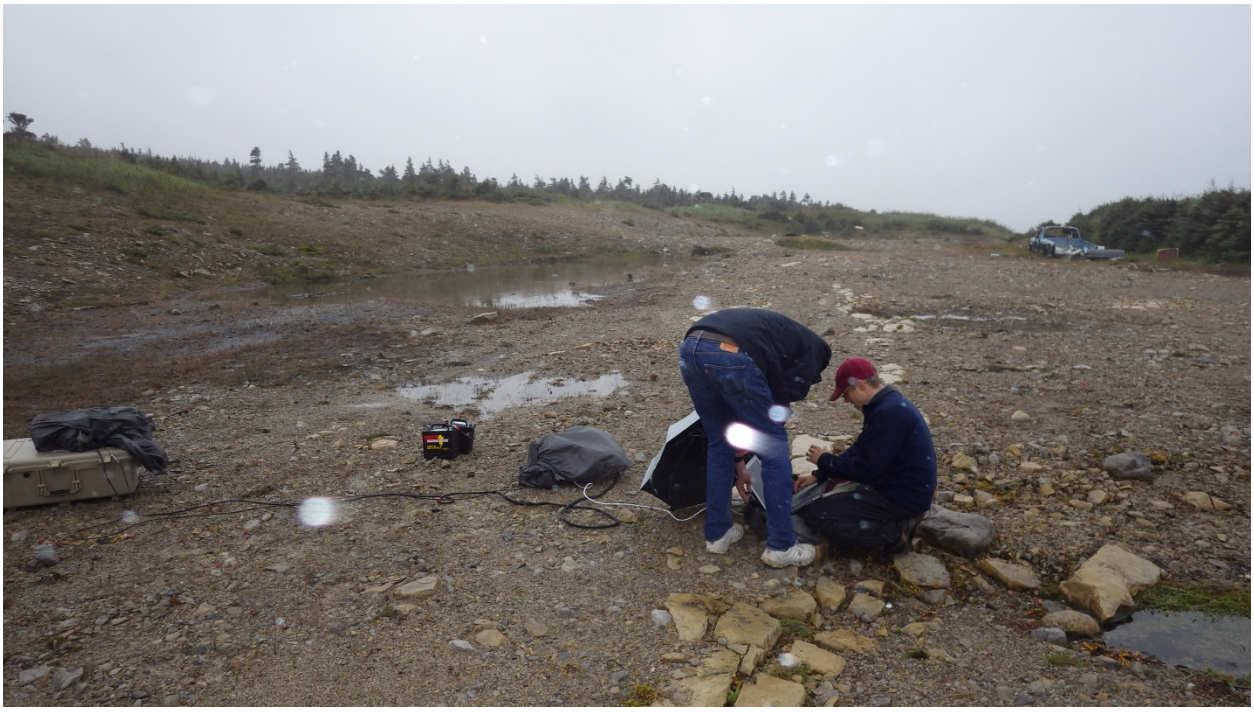

Photo 3 Eddies Cove Preferred Site –South View

Photo 4 Eddies Cove Preferred Site – Overview 1

Photo 5 Eddies Cove Preferred Site – Overview 2

Photo 6 Eddies Cove Preferred Site – Panoramic (West View)

Photo 7 Eddies Cove Preferred Site Panoramic (East View)

1.3.2 Physical Features

The project will include construction of a temporary, lined containment basin at Eddies Cove (Figure 1-1) for the evaluation of oil spill response technology in sea ice conditions. The containment basin will be approximately 24 m x 32 m. The total project footprint will be approximately 1.9 ha. This area includes the containment basin, as well as a helicopter landing area and temporary trailers. While specific locations for the containment basin, helicopter landing site, and trailers have not been finalized, this area represents the maximum potential area of disturbance. Conceptual drawings of the containment basin are provided in Figures 1-4 and 1-5.

Operation will include filling of the basin with seawater, development of a variety of ice conditions, injection of crude oil, and testing of the EFNMR system. Upon completion, the seawater will be treated and drained, and the containment basin decommissioned.

Details on construction, operation, and decommissioning of the project, including environmental management measures, are provided in Sections 1.4, 1.5, and 1.6.

To simulate natural conditions as closely as possible, the containment basin will be filled with seawater and allowed to freeze naturally during the winter.

Project design will incorporate a number of mitigation measures to reduce potential interaction with the surrounding environment. These measures include the use of a geo-environmental welded liner, incorporation of berms constructed of low permeability material, and the use of containment hoops to control oil location during the experiment. Additionally, during the decommissioning phase, an oil-water separator will be used prior to the release of water into the environment. An Environmental Protection Plan (EPP), Spill Response Plan, and Decommissioning Plan will be in place for the project. East Coast Response Corporation (ECRC) will be engaged as part of the Spill Response Plan.

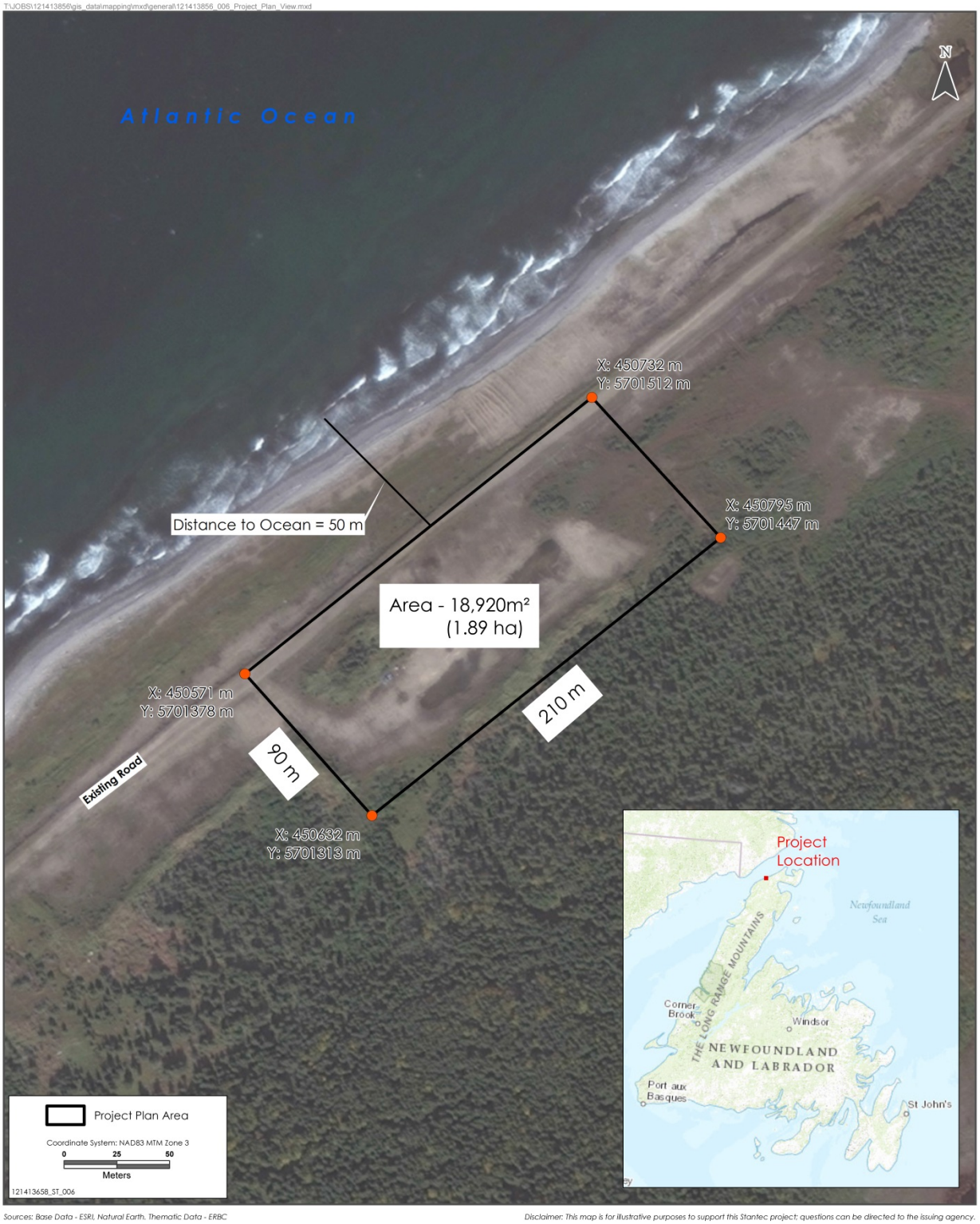

Figure 1-2 Preferred Site

1.3.2.1 Alternative Site Plan

As an additional avoidance strategy, in order to manage potential interactions with habitat for plant species at risk, and in consultation with Wildlife Division NLDOEC, an alternative site adjacent to the preferred site at Eddies Cove is being considered Figure 1-3). Siting the project within this scrub forest (dominated by balsam fir, black spruce, tamarack, and white spruce) will also avoid potential interaction with the Braya's and their habitats. The technical feasibility of this site will be determined.

Table 1.2 shows the proximity to communities and environmental constraints as determined using the center point of the alternative site plan (Figure 1-3)

Table 1.2 Site Proximity to Communities and Environmental Constraints (Alternative Site Plan)

Location	Closest Distance to (in km):								
	Salmon River	Transmission Line ROW (100m)	Outfitter	Provincial[1] Protected Area	Critical habitat as delineated by Recovery Strategy for Long's Braya and Fernald's Braya	Archaeological Site[2]	Eddies Cove (Community)	St. Anthony (Community)	Coast Line
Alternative Site	9.1	17.5	8.4	6.8	9.5	24.3	3.4	57.6	0.2

[1]Watts Point Ecological Reserve (Provincial Protected Area) and its Management Plan are the responsibility of the Parks and Natural Areas Division, Department of Environment and Conservation. It was established to preserve the unique flora of the calcareous barrens and a representative portion of the Strait of Belle Isle Ecoregion. All reserves in the Province were established under the Wilderness and Ecological Reserves Act (1980).

[2] Borden Number EhBe-02 as recorded in the Provincial Archaeology Office database

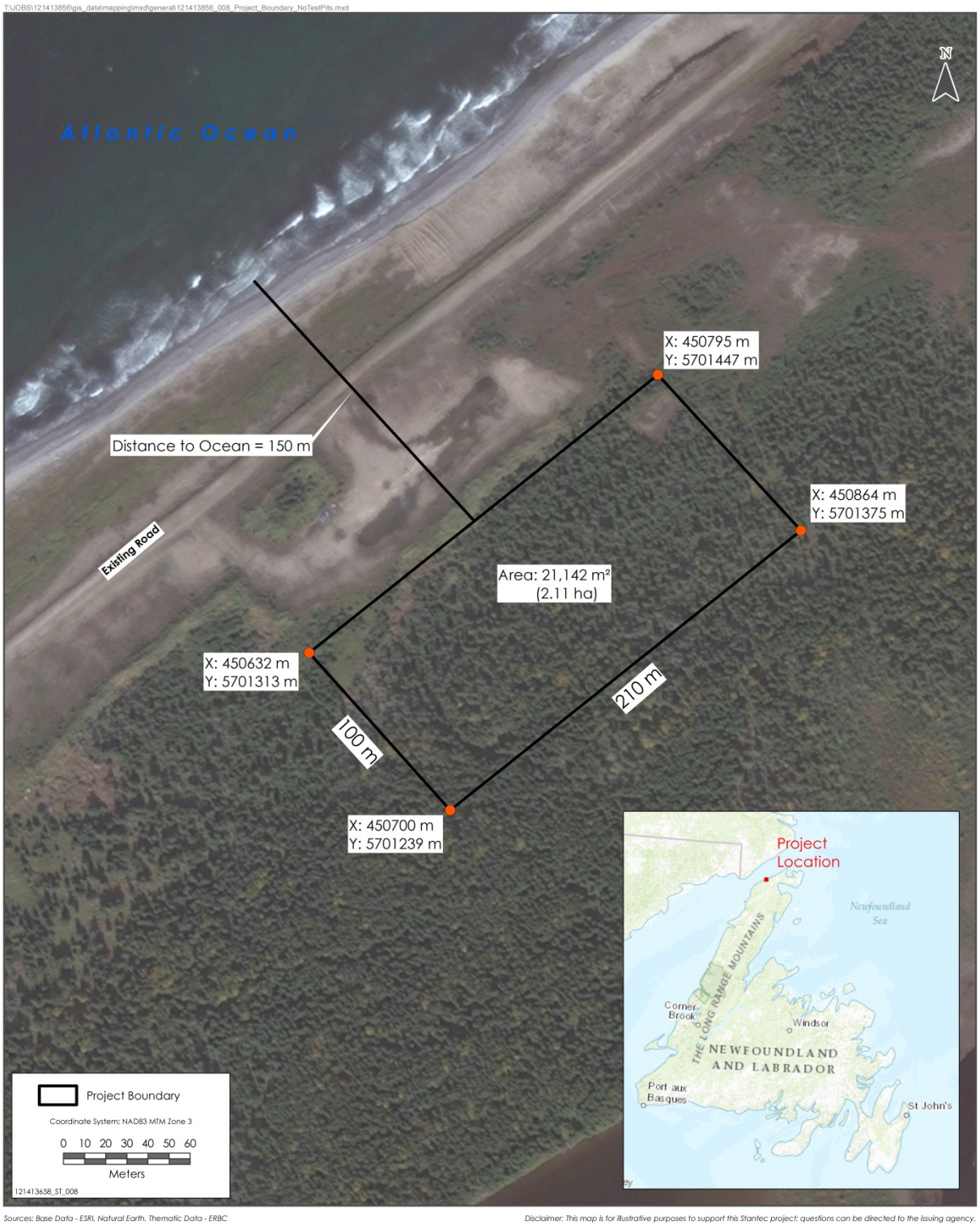

Figure 1-3 Alternative Site Plan

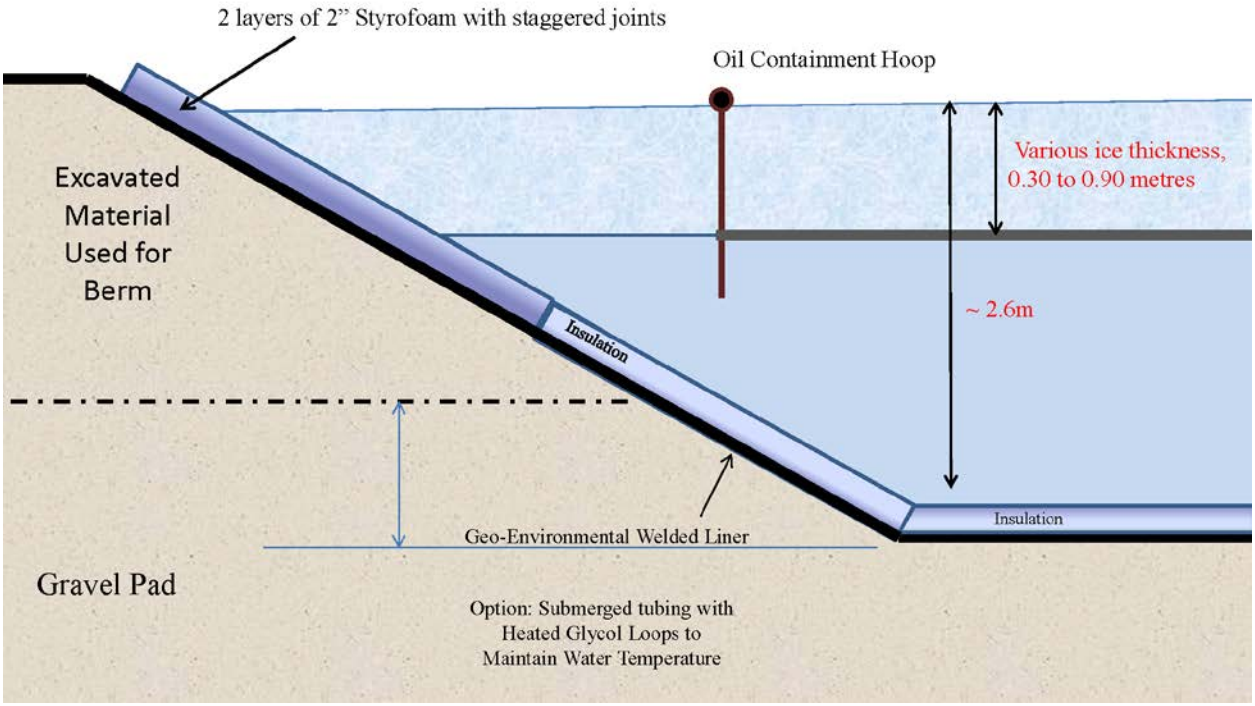

Figure 1-4 Preliminary Test Facility Schematic (Schematic 1)

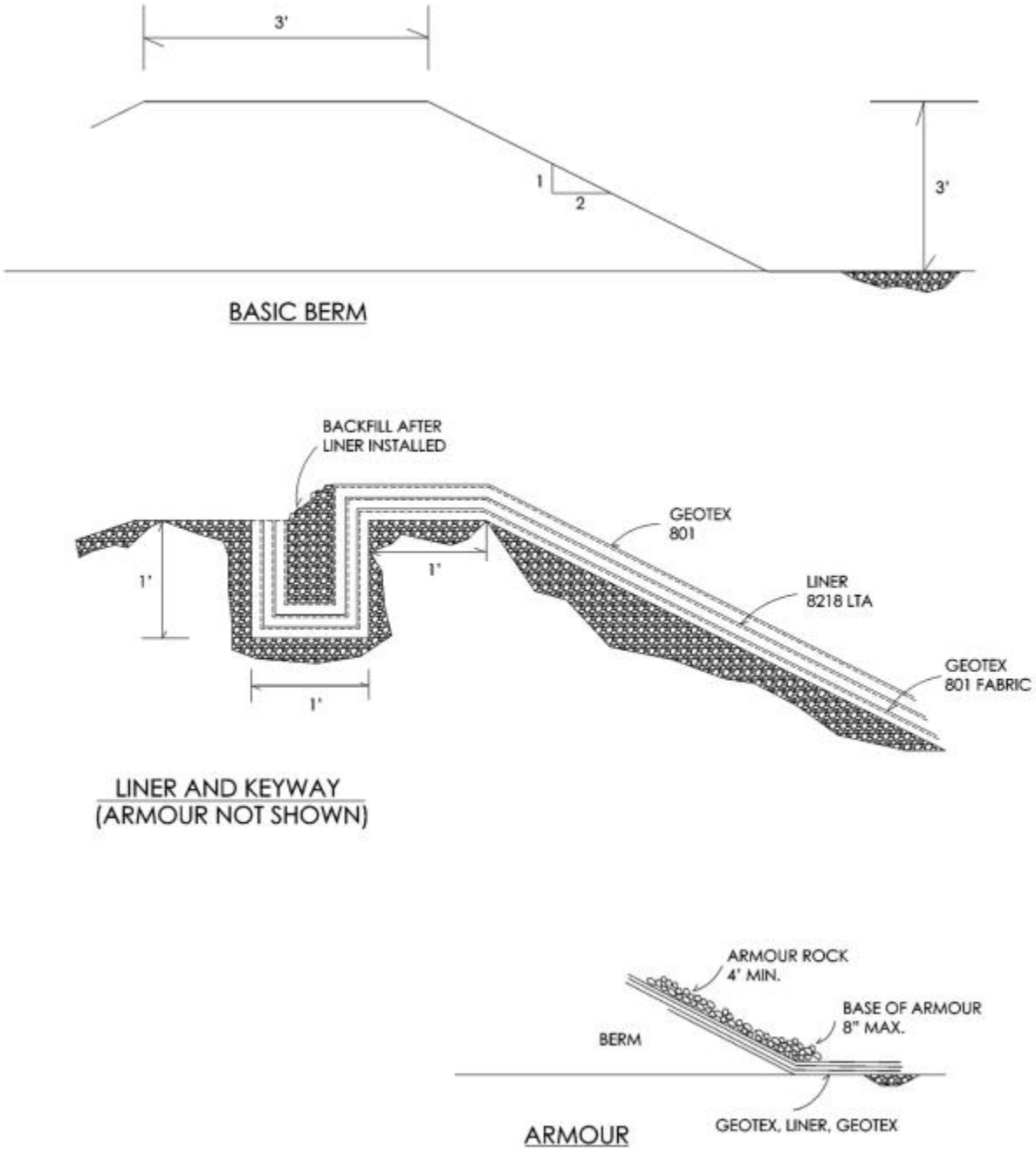

Figure 1-5 Preliminary Test Facility Schematic (Schematic 2)

The physical and biological environments potentially affected by the project are discussed in Section 2.0. These include:

- Physiography, Topography, and Drainage, including geology;
- Atmospheric Environment;
- Hydrogeology;
- Vegetation;
- Wildlife;
- Socio-economic Environment; and
- Historic Resources.

A summary of physical features is provided in Table 1.3.

Table 1.3 Summary of Physical Features

Major physical features of the undertaking	• The project will require the construction of a temporary, lined containment basin • Helicopter landing site (within the footprint defined on Figure 1-2)
Size of the area to be affected by the undertaking	• Preferred site is approximately 18,920 m^2 (Figure 1-2) - Alternative site is approximately 21,142 m^2 (Figure 1-3) • The base of the containment basin will measure approximately 24 m x 32 m and the containment basin will be 3.0 m deep
Artists conceptual drawing	• Figures 1-4 and 1-5
Physical and biological environments within the area potentially affected by the project	• Section 2.0

1.4 Construction

The main construction activities will be associated with the containment basin, including the construction of a fence and the locating of one to two temporary trailers for site support. The total area of the project (preferred site plan) is approximately 18,920 m (1.9 ha) (Figure 1-2). The total footprint for the alternative site plan (Figure 1-3) is approximately 21,142 m^2 (2.1 ha).

The lined containment basin will be approximately 3 m deep, with the base of the containment basin measuring approximately 24 m x 32 m. This will allow for a 3 m x 4 m grid partitioning the containment basin into 12 cells, each approximately 8 m x 8 m, in which various experimental scenarios (i.e., ice thickness) can be executed. Using a 3:1 side slope, the top of the containment basin would measure approximately 42 m x 50 m and the volume would be approximately 4,100 m^3.

The berm construction at the preferred site could be dominated by excavation of an existing bank to take advantage of the topography or berms could be constructed by placing and compacting fill to the required shape. For example, to limit the depth of excavation, suitable cut material could be used to construct a berm to achieve the required 3 m depth. The berm would also have side slopes of 3:1 and include a 2 m wide path along the top for access to the containment basin. The preferred site contains exposed bedrock within the floor of the basin and as a result, there may be no excavation required beneath this elevation.

Excavation within the adjacent embankment is required to obtain the necessary borrow materials for construction. For alternative sites, to balance the cut and fill, the excavation would need to be approximately 1.5 m deep. If the excavation is limited to 1.2 m, approximately 800 m^3 of material will be required to build the berm. A design dominated by excavation may involve the movement of up to 4,100 m^3 of material. The volume of borrow material would be reduced with a narrowed berm. A preliminary schematic of the facility, based on a similar testing facility is provided in Figures 1-3 and 1-4.

The above estimates will be finalized through an engineering survey and a geotechnical investigation of the site, and confirmation of available and suitable construction materials.

The tank will be lined with a geomembrane designed for oil containment and arctic conditions (i.e., XR5). As necessary, the containment basin design may also incorporate an insulation layer. Depending upon anticipated temperatures in the area, it may be necessary to install heating or cooling systems to control containment basin ice growth. Fugro is currently investigating power sources for the project; however, it is likely that the site will be powered by mobile diesel generators such as the Magnum Mobile Generator MMG25FHI. Generators will be maintained by a local site maintenance group.

A summary of construction details are provided in Table 1.4.

Table 1.4 Summary of Construction

Approximate total construction period	• Three weeks beginning early December
Proposed date of first physical construction related activity on site	• December 1st, 2015
Potential sources of pollutants and associated management measures	• Sources of pollutants during construction are limited to atmospheric emissions from construction equipment and dust resulting from construction activity • Management Measures: - Due to the remoteness of the location, relatively short duration and timing of construction, it is not anticipated that dust will interact with human receptors - However, standard operating procedures for managing dust during construction will be defined in the Project EPP (e.g., water application)
Potential resource conflicts and associated management measures	• The site is within or in proximity to potential habitat for plant Species at Risk • Management Measures: - Ongoing consultation with the Department of Environment and Conservation, Wildlife Division - avoidance of known provincially listed species at risk, including endangered or threatened species, or species of special concern - Should any potentially listed species be identified, an appropriate mitigation strategy will be developed/implemented, in consultation with the regulatory agencies - reduced workspace, use of perimeter fencing, and the establishment of “No-Entry” zones, in consultation with NLDOEC, and during all stages of construction and operation

1.5 Operation

The containment basin will be located in proximity to the coastline so the basin can be filled with seawater through a temporary pump and pipeline. While this is the preferred method of filling the basin, trucking the water may also be considered. The containment basin will be filled with seawater such that the maximum water depth will be 2.6 m, leaving approximately 0.4 m to the top of the berm.

The containment basin will have sufficient area for several different testing scenarios, where ice thickness and the placement of oil within the ice matrix can be varied, along with non-oiled (control) ice scenarios. Ice growth will be controlled to maintain various ice thicknesses between 30 cm and 90 cm. Ice thickness will be controlled by laying insulating material on the ice when the appropriate thickness is achieved in each grid section. To prevent ice from freezing to the

bottom of the containment basin, a circulation system (e.g., a pump or bubbling unit) may be installed and/or the bottom of the basin will be insulated beneath the containment liner.

As ice develops on the surface of the containment basin, oil (ranging between 30° and 35° API) will be injected into containment hoops made of floating cutoff booms. Testing scenarios, including ice thickness and oil thickness, are shown in Figure 1-6. It is estimated that approximately 40 US barrels (6.25 m^3) of oil will be required for the experiment.

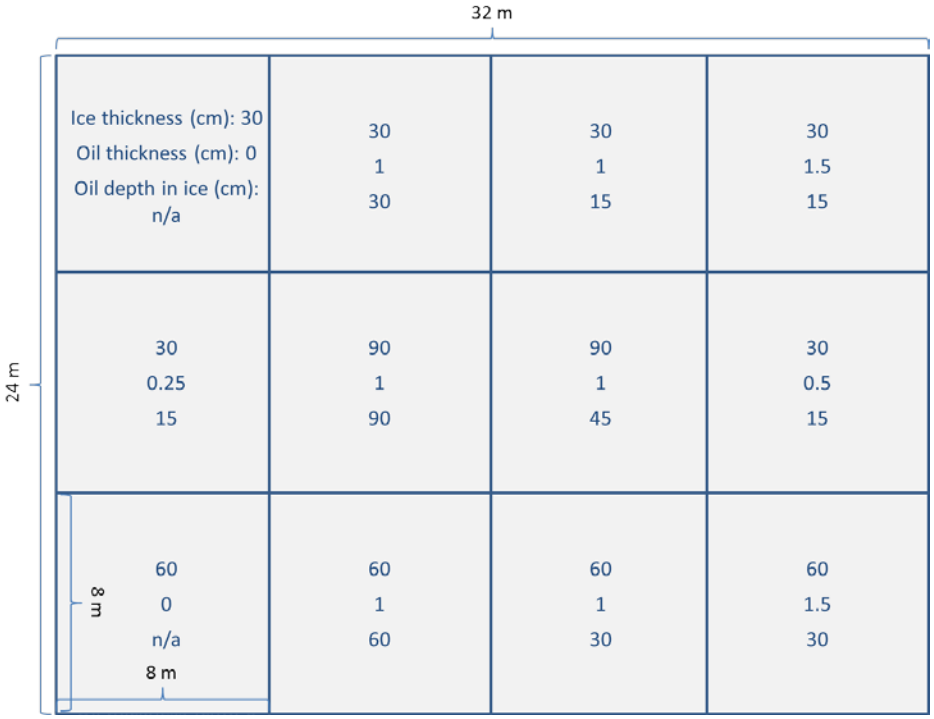

Figure 1-6 Testing Scenarios (Ice Thickness, Oil Thickness, and Oil Depth in Ice)

Oil injection will be done using a mobile unit operated by a licensed contractor and there will be no requirement to store oil on site. Injection is expected to take place over five separate occasions between December 2015 and March 2016, as ice in each grid section reaches the appropriate thickness as defined in Figure 1-5. Each injection will be between one to two days in duration. Oil will not be injected until a minimum layer of ice has formed. Both the containment hoops and ice layer will serve as additional containment. The containment hoops will also enable oil recovery once the ice melts. In the event of a melt event, where oil will be released from the ice, the containment hoops will prevent the oil from coming in contact with the containment basin liner and berms. Site inspections by trained personnel will occur on a regular basis.

Oil will be injected through the ice such that it is located within a containment hoop at a predetermined point within the ice to manage the volume and location of oil, and prevent the oil from coming into direct contact with the primary liner. C-Core has been engaged to develop the oil injection method based on previous research findings.

Ice experts located in Newfoundland and Labrador, ice experts will be consulted regarding optimum methods to control ice growth and inject oil through it. To maintain required ice thicknesses in each 8 m x 8 m cell, it is initially conceived that the surface of the ice will be covered with insulating construction blankets (i.e., R2.5).

Air, ice, and water temperatures will be monitored within the basin as well as at the location of injection through monitoring ports in each grid cell. Water and ice temperature will be monitored at regular intervals using a string of thermistors. A data logger with an uplink (i.e., cell phone, satellite) will be use to allow remote monitoring and documenting conditions. Discharge may be required during operation in order to maintain water levels, An oil-water separator system (e.g. a sand filter system), approved by NLDOEC, Industrial Compliance Division, will be used to treat all discharged water from the containment basin. The discharge water, once treated will be discharged along the shoreline to permit infiltration back into the marine environment. Samples will be taken at the discharge point to monitor salinity and concentration of potential deleterious substances in compliance with Environmental Control Water and Sewage Regulations, 2003 under the *Water Resources Act.*

The facility will be secured by a fence surrounding the containment basin. Signage will be used to minimize interactions with local users and reduce the risk of accidental events resulting from unauthorized access to the site.

Testing of the oil detection technology will occur over a two to three day period, beginning on a date to be determined within the March/April 2016 timeframe. The EFNMR oil detection unit will be suspended under the helicopter, flown over the basin, and lowered into place. The unit will be connected to the helicopter, where test results will be captured and processed. Photos of similar tests and conceptual drawings are provided in Photos 8-10.

Photo 8 Experimental Prototype EFNMR Coil

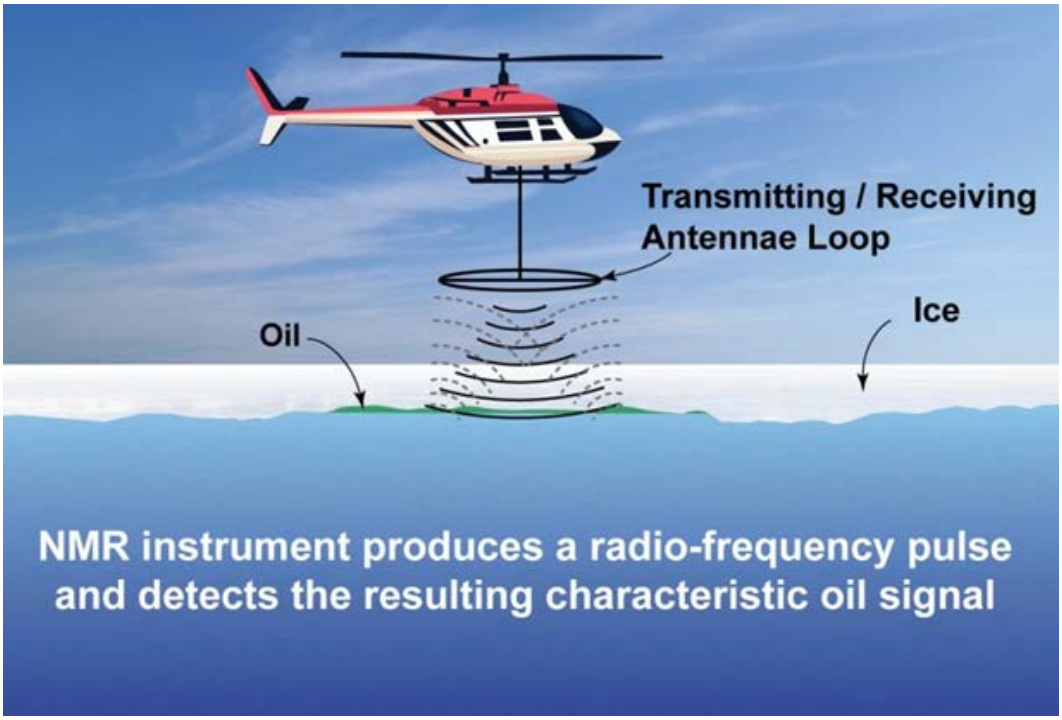

Photo 9 General Overview of System Configuration and Project Goals

Photo 10 Example of a Helicopter Deployed Geophysical Sensor

There will be no drainage from the basin, drainage outside the basin will match the existing local topography. Due to the proximity of the facility to the shoreline, ECRC will be engaged as part of the Spill Response Plan. ECRC is certified by Transport Canada – Marine Safety, as a Response Organization under the *Canada Shipping Act*.

A summary of Operation is provided in Table 1.5.

Table 1.5 Summary of Operation

Describe how the undertaking will operate.	• See description provided in Section 1.5
Estimated period of operation, if not a permanent facility	• One testing season, i.e., December 2015 (when basin is filled) to April 2016
Potential sources of pollutants and associated management measures	• Sources of pollutants during normal operation (i.e., no accidental event) is limited to noise and air emissions from the diesel generator and vehicles. In the event of an unplanned release, oil and seawater could be discharged. • Management measures: - Site inspections by trained personnel will occur on a regular basis. - The containment basin will be lined with a geo-environmental welded liner. This liner is certified for use in environmental applications - Design of berms as described in Section 1.4 - Containment hoops and ice layer will serve as additional containment - In the case of ice melt, the containment hoops will prevent released oil from coming in contact with the basin liner and berm - Standard operating procedures for managing environmental interactions during construction will be defined in the project EPP o Standard measures will include, regular vehicle maintenance and use of noise control equipment (e.g. mufflers) - If it is determined that excessive volumes of dust are resulting from construction activities, or if complaints are received, additional management measures will be implemented
Potential resource conflicts and associated management measures	• Reduced workspace, use of perimeter fencing, and the establishment of “No-Entry” zones, in consultation with NLDOEC, and during all stages of construction and operation

1.6 Decommissioning and Closure

The facility will be decommissioned following the 2016 test. A full Decommissioning Plan will be developed and approved prior to decommissioning. Key components of this plan are described below:

- As ice thaws in the containment basin, free oil will be skimmed from the surface using vacuum trucks for free oil recovery;
- Water will be pumped from the bottom of the containment basin and cycled through a certified oil/water separator and treatment system prior to discharge into the marine environment;
- Samples will be taken at the discharge point to monitor salinity and concentration of potential deleterious substances in compliance with Environmental Control Water and Sewage Regulations, 2003 under the *Water Resources Act*;
- After pumping, remaining oil and water will be removed and processed by a certified waste management contractor;
- All liners, lines and pumps will be removed and disposed of in accordance with best practice;
- All power sources will be removed;
- The containment basin area, including berms, will be contoured and cleared areas will be revegetated; and
- Soil testing will be completed to determine post-closure conditions.

1.7 Occupations and Economic Benefits

Construction is anticipated to require approximately 20 to 30 persons over a three week period in December 2015. An estimated breakdown of occupations required for this undertaking according to the National Occupational Classification (2011) is provided in Table 1.6. Employment during operation will be limited and will likely be limited to fewer than ten workers. With exception of work carried out directly by the proponent, all work related to the Project will be carried out by contractors.

Table 1.6 Estimated Construction Phase Employment by NOC 2011

Discipline	NOC Code	Estimated number of Employees
Truck Drivers	7511	5-10
Heavy Equipment Operator	7521	15-20
Mechanic	7312	1-2

Research and development has been identified as an avenue whereby petroleum resource development has the potential to contribute to the sustainable economic development of the Province (Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) 2004).

Facilitated by the participation of PRNL, the project will operate under the C-NLOPB *Guidelines for Research and Development Expenditures*, and has the potential to provide Newfoundland and Labrador with the international exposure and recognition associated with advanced research activity.

The Project will result in substantial knowledge building and technology transfer in the areas of EFNMR, ice formation, and simulation/testing of oil spill detection under ice. Fugro will investigate opportunities to facilitate this, including engaging resident experts in relevant subject areas from Memorial University, the National Research Council, and the College of the North Atlantic (CNA). Fugro will also look to facilitate opportunities for students from local CNA campuses (St. Anthony and Corner Brook), and students from Sir Wilfred Grenfell College, to participate as monitors, testing support, and general research assistants.

Fugro will use local companies for the construction, operation and maintenance of the facility and will source local materials (e.g., containment basin lining, construction aggregate, ice growth control materials, and fencing) wherever possible. Additional services that can be provided locally include waste management, supply of temporary facilities (mobile generators, office trailers), as well as fuel, logistics services, travel, and accommodations.

In addition to the immediate opportunities outlined above, the Project has the potential to result in long-term opportunities for Newfoundland and Labrador, including potential for a local company to manufacture, maintain, and operate these systems, as well as contributing to the research and development capacity required for the advancement of the Province as a Centre of Excellence for Arctic Oil Spill Research.

1.8 Project Related Documents

Fugro has applied for a Permit to Construct and a Licence to Occupy Crown Lands. These applications were submitted in September 2015.

2.0 EXISTING REGIONAL ENVIRONMENT

The characterization of environmental components, management, and interactions detailed below are applicable for both the preferred and alternative site plans.

The sites are located northwest of the community of Eddies Cove, on the Northern Peninsula of Newfoundland. The preferred site appears to have been previously developed as a gravel pit operation. Existing and previously operational gravel pits are present throughout the area. Based on a review of Google Earth imagery, the closest residences to the site are located approximately 3 km southwest.

The overburden-bedrock contact is estimated to be less than 1 m below ground level within the immediate area of the preferred location, with areas of exposed bedrock prevalent throughout

the region. Fluctuating water levels and standing water resulting from local precipitation at the preferred location also maintain the structure and composition of the plant communities. Periods of high water (i.e., ponding) restrict vegetation growth in this area, preventing woody plants invading from surrounding uplands.

No rare and endangered species of calciphillic plants were observed within the Project site.

The following subsections provide detail on the condition of the existing environment.

2.1 Physiography, Topography and Drainage

The project is located in a low-lying coastal area that slopes gently northwest towards the waters of the Strait of Belle Isle in the Gulf of St. Lawrence. A small, northeast-trending ridge is located approximately 1 km southeast of the site and rises moderately to a maximum elevation of approximately 30 meters above sea level (masl) at its crest. Elevations within the vicinity of the project range from approximately 7 to 9 masl.

Surface water in the Vicinity of the project is expected to follow local topography and flow overland northwest towards the coast. With the exception of the waters of the Strait of Belle Isle, no other substantial surface water features are present within 1.5 km of the site. However a number of small, first-order streams and ponds are present in the vicinity of the site that flow directly to the coast.

An existing gravel road leading from the main highway (Provincial Highway Route 430, Viking Trail) at Eddies Cove provides access to the project site.

2.1.1 Geology

The island of Newfoundland is divided into four regional tectonic zones: the Humber, Dunage, Gander, and Avalon. The Project is located on the Northern Peninsula, which falls within the region of the Humber zone. The rocks in the Humber zone can be dated back to the early Paleozoic period, and are mainly comprised of carbonate rocks such as limestone and dolomite on the western side of the peninsula.

Towards the central area of the peninsula, the geology shifts from carbonate rocks towards to granitic intrusive rocks from the Precambrian period that help formulate the 3,500 km long Appalachian Mountain chain, which extends from the Northern Peninsula down to the southeastern United States. Along the east coast of the peninsula, the rocks are typically sedimentary sequences of the Deer Lake Basin and comprise shales and sandstones. These rocks are Carboniferous in age and were deposited in localized lowlands during the formation of inland lakes and are therefore generally fluvial and alluvial in origin.

The last glacial event that Newfoundland and Labrador experienced was during the Wisconsin stage, approximately 12,000 years ago, which created the present day landforms. In the coastal

areas of the Northern Peninsula, the surficial deposits generally consist of a veneer of clays, sands, and gravels that have been recorded at levels up to 150 m above sea-level. Exposed bedrock and rock concealed by vegetation are also common on the Northern Peninsula. The majority of the interior of the peninsula is comprised of exposed bedrock, mainly at higher elevations along the Long Range and Appalachian Mountain chains; however, there are some areas that contain till, sand, and gravel outwashes.

Based on most recent 1:250,000-scale mapping (Liverman and Taylor1994), the surficial geologic materials in the area are comprised mainly of a thin discontinuous sequence (typically less than 1.5 m thick) of undivided deposits of till and marine-derived clay, sand, gravel and diamicton. Numerous areas of bedrock outcrop are exposed within the till and marine surficial deposits, but may be partially or fully concealed by a thin mat of vegetation and forest. Along with glacial units, deposits of organic and peaty soils are also present throughout the vicinity of the project, overlying either surficial till and marine deposits or bedrock.

Beneath the surficial materials or exposed at surface, the vicinity of the project is underlain by a sequence of Middle to Late Cambrian-age bedded limestone, dolostone and minor shale and sandstone of the Port au Port Group (Knightet. al., 1986). A number of occurrences of epigenetic lead and zinc mineralization have been identified in the rocks underlying the vicinity of the project, occurring as void-infilling or replacement of the carbonate host rocks. No structural features (i.e., faults or folds) have been identified in the vicinity of the project. However, numerous small scale fractures and partings resulting from dissolution processes are common in the rocks underlying the area and can enhance the permeability of the bedrock unit (secondary porosity), and be important water-bearing structures.

2.1.2 Summary of Management Measures and Potential Interactions

Where possible, berm construction will take advantage of existing topography. To limit the depth of excavation, suitable cut material will be used to construct a berm to achieve the required 3 m depth.

Due to the absence of surface water features at the site, no interaction between surface water or drainage is anticipated. Interactions with overall physiography and topography are limited to pit construction which will be rehabilitated to the extent feasible following the test. Given the current disturbed condition, interactions with physiography and topography are considered to be negligible.

2.2 Atmospheric Environment

The climate of the Northern Peninsula is described as maritime, with cool summers and mild winters (Bell 2002), with locally severe winter winds. The climatic station in the nearby town of Flower's Cove recorded average daily temperatures ranging from -11.4°C (February) to 13.4°C (August) from 1981 to 2010. Average yearly rainfall was recorded to be 762.8 mm between 1981 and 2010, with the greatest rainfall amount occurring in July (107.6 mm) and the lowest amount

occurring in February (12.4 mm). Precipitation as snow was recorded to occur from October to May, with an average yearly snowfall of 276.3 cm. January had the greatest monthly average contribution to yearly snowfall with 71.9 cm (Environment Canada 2015). The annual average temperature on the Northern Peninsula is approximately 4°C, with summer temperatures averaging 12°C and winters averaging -4°C. Based on the remoteness of the area and lack of commercial or industrial activity in the area, air quality is likely to be good.

Baseline noise levels in the environment are low throughout much of the Northern Peninsula, with levels increasing in closer proximity to highways, industrial sites, and communities. Background noise levels are typically low, but variable pending wind direction and speed.

2.2.1 Summary of Management Measures and Potential Interactions

Standard operating procedures for managing environmental interactions during construction will be defined in the project EPP. If it is determined that excessive volumes of dust are resulting from construction activities, or if complaints are received, additional management measures will be implemented. Such measures may include the use of water application to reduce the amount of dust on unpaved roads and from the site in general. However, due to the remoteness of the location, relatively short duration of construction, and the timing of construction activities, this not anticipated.

Due to the short duration of construction, the distance to nearby communities and in consideration of the environmental management measures described above, it is anticipated that noise and air emissions will be managed to acceptable levels and will not interact with human receptors.

2.3 Hydrogeology

The project site is located in an area inferred to be underlain by an unconfined aquifer system contained within the underlying shallow carbonate bedrock. The movement of groundwater within the bedrock is expected to mainly occur within secondary openings, such as fractures, joints, and dissolution partings and will be variable depending on the frequency and interconnection of these structural features. The direction of groundwater flow in the vicinity of the project is assumed to follow local topography, which would be northwest towards the Strait of Belle Isle. Groundwater is thought to be recharging along the topographic highs and discharging along the water courses and the coastal area. It is expected that the shallow groundwater system in the area will be largely controlled by surface runoff and local recharge, while at moderate depths the flow system may be influenced by recharge from the regional upland areas to the southeast. The depth to groundwater in the vicinity of the project is not known; however based on water level data provided in the provincial Drilled Water Well Database (NLDEOC 2008) for ten water wells in the nearby community of Eddies Cove, groundwater levels are generally assumed to be within 5 m of ground surface and to be a subdued reflection of the topography. Given its coastal setting, it is possible that groundwater levels in the vicinity of the project may also be influenced by tidal fluctuations. An ocean island

setting is inferred for the area underlying the site, with a freshwater aquifer lens sitting above a denser saltwater aquifer system assumed to be present at some unknown depth in deeper portions of the underlying bedrock.

The area lies within a bedrock hydrostratigraphic unit referred to as Unit 3 in the 2008 NLDEOC-WRMD report on the hydrogeology of western Newfoundland (AMEC, 2008). This bedrock unit is reported to have potential for moderate groundwater yields. Based on a total of 557 well records, yields are reported to range from 0 L/min to 789 L/min, with a mean yield of 37 L/min. Well depths supporting such yields range from 7.3 to 154 m, with an average depth of 36 m. Results of aquifer testing completed on 37 wells in Unit 3 support the average yield estimate from the water well records indicating an average estimated safe yield of 54 L/min with a range of 1 to 250 L/min. Ten of the 557 water well records defining the hydrogeological characteristics of Unit 3, are located in the community of Eddies Cove and were drilled from 1978 to 1993. Based on information provided in the Drilled Water Well Database (NLDEOC 2008), wells completed in Unit 3 in the Eddies Cove area appear to have lower than average well yields for this hydrostratigraphic unit, with a reported average yield of 18.61 L/min and an average well depth of 36.79 m reported.

No groundwater quality data is available for the vicinity of the project. However, based on 101 available analyses from eight different source waters in other areas of Hydrostratigraphic Unit 3, the groundwater in the vicinity of the project can be classified as a calcium-bicarbonate type water, and is expected to have very good to excellent water quality (AMEC 2008).

Interactions with existing groundwater users are not anticipated with this project. The Provincial Water Rights Registry did not identify any active non-domestic withdrawal approvals registered in the vicinity of the vicinity of the project (NLDEOC 2012), and there are no public water supplies located within 10 km of the Site (NLDEOC 2010). The nearest potential water user, the community of Eddies Cove, which is unserviced and relies on private water wells for its municipal supply, is more than 3 km from the project, and separated from the project by a number of surface water features that provide a high degree of hydraulic isolation.

The project will be limited to seawater use, and will not require any withdrawals of local surface water or groundwater resources. As such, potential project interactions with groundwater resources in the area will not occur during normal construction or operational activities. In the event of an accidental release of oil and seawater, the interaction would be limited to localized changes to groundwater quality.

2.3.1 Summary of Management Measures and Potential Interactions

Given the relatively short duration of the project, the lined-design of the containment basin, as well as standard mitigative measures described in Section 1.4, 1.5 and 1.6, including an Emergency Response and Spill Response Plan for accidental releases, and treatment of discharge water during decommissioning, the potential for interactions with groundwater are limited and interactions with existing groundwater users are not anticipated.

2.4 Vegetation

2.4.1 Ecoregion

The project falls within the Strait of Belle Isle Barrens Ecoregion. This ecoregion is dominated by almost treeless tundra vegetation (Amec 2008). White spruce (*Picea glauca*) and balsam fir (*Abies balsamifera*) occur as krummholz, interspersed with Arctic-alpine plants even near sea level. The soils are generally very shallow and outcrops of calcareous bedrock are common throughout. Large stone polygons created by freeze-thaw cycles are common on shallow-exposed mineral soil. The patchy vegetation cover is characterized by a lack of a tree layer and sparse low-lying shrub and herb layers. Typical shrub species are stunted black spruce (*Picea mariana*), balsam fir, and sheep laurel (*Kalmia angustifolia*). Other low-lying species include bunchberry (*Cornus canadense*) and black crowberry (*Empetrum nigrum*), (often extensive) grasses, lichens and mosses (Amec 2008).

Most of the coastal heath barrens are covered with a thin layer of organic substrate and these intermediate areas are covered with low shrub and herb layers that are generally dominated by ericaceous plants such as creeping juniper (*Juniperus horizontalis*), soapberry (*Shepherdia canadensis*), black crowberry, red bearberry (*Arctostaphylos rubra*), blueberry (*Vaccinium uliginosum*), three-toothed cinquefoil (*Sibbaldiopsis tridentata*), false asphodel (*Tofieldia pusilla*), bunchberry, island gentian (*Gentianopsis detonsa*), and birdseye primrose (*Primula laurentiana*). The groundcover frequently consists of scattered, diverse lichen flora (Amec 2008).

There are also patches of trees (i.e., tuckamore) within the barrens, giving way to more or less continuous forest further inland. These stunted tree patches are most commonly white or black spruce (*Picea mariana*) and balsam fir. Areas of tall shrubs are common in some barrens; they may represent an intermediate stage between open barrens with rock outcrops or low shrub assemblages, and fully treed patches (Amec 2008).

No rare and endangered species of calciphillic plants were observed within the project site.

2.4.2 Review of Potential Suitable Habitats

The distribution of Fernald's Braya and Long's Braya on the Northern Peninsula is well documented by the NLDOEC Wildlife Division. Both Braya species are endemics, ranked G1 globally and restricted to the unique coastal limestone barren ecosystems of the Northern Peninsula of Newfoundland. Long's Braya and Fernald's Braya are designated as "Endangered " and "Threatened", respectively, under the Species at Risk Act (SARA) and *Newfoundland and Labrador Endangered Species Act* (NL ESA). Occurrences of Long's Braya have been identified at five sites along a 10 km stretch of limestone barrens habitat and Fernald's Braya have been located at 14 sites (from Port au Choix to Burnt Cape, spanning approximately 150 km length of coastline with similar limestone barrens habitat) Proximity of the site to closest of these areas is presented in Table 1.1.

Locations where suitable habitat areas occur or have potential to occur within the project footprint were preliminarily investigated through desk-top review of existing information sources and in the field during the site selection phase. The results of reconnaissance-level field investigations to evaluate the biophysical attributes of the habitat were used to inform final siting of the containment basin, temporary construction workspace and facilities, to avoid suitable habitat for Long's and Fernald's Braya and/or other potential sensitive species and to reduce disturbance and fragmentation of existing natural habitats[1].

The preferred site is located within an area of existing disturbance and thus the amount of native and non-native habitat that could potentially be disturbed as a result of the project is limited. If data acquired through further investigation (i.e., NLDOEC Wildlife Division) indicates that element occurrences of Long's and/or Fernald's Braya and their critical habitats are located within the preferred site, these locations will be avoided.

At present, the preferred site is not expected to contain habitat capable of supporting Braya populations as habitat associations at the preferred site (see Figure 1-1) were primarily in or adjacent to wetted or inundated, shallow depressions associated with gravel extraction adjacent the previously disturbed gravel roadsides. Alternatively, the preferred site is within the range of potential critical habitat delineated for Fernald's Braya (Environment Canada. 2012; Figures 2 & 3). Therefore, disturbance to Long's and Fernald's Braya critical habitat, as delineated in the Recovery Strategy for Long's Braya and Fernald's Braya (EC 2012), as a result of the project is not anticipated. Alternatively, siting the project within the adjacent scrub forest (dominated by balsam fir, black spruce, tamarack, and white spruce – Figure 1-3) also avoids to the extent practical interaction with the Brayas and their habitats.

Additional opportunities for avoidance will be pursued where possible during the project execution should listed plant species be identified.

2.4.3 Summary of Potential Interactions

Interactions between SARA and NLESA listed plants and Project activities will be mitigated by the use of standard construction and best management practices including the identification and avoidance of known occurrences of listed plants and/or species of interest as identified within the preferred and alternative Project locations.

Given the nature and location of the site, the timing of construction and operation, and in consideration of the environmental management measures described in Sections 1.4, 1.5 and 1.6, the likelihood of interaction is low tomoderate. This is a conservative characterization

[1] Recommendations contained within the Long's and Fernald's Braya recovery strategy apply to this project.

2.5 Wildlife

Wildlife species most likely to occur within the vicinity of the Project includes small mammals, avifauna, and seabirds. The small mammal and bird species that occur within this area are both common and wide spread within insular Newfoundland. The proposed sites have small footprints, are situated near the shoreline, and are mostly located on brownfield sites. As such, there will most likely be minimal overlap with large mammal or furbearer species.

2.5.1 Small Mammals

The small mammals species most likely to occur in the vicinity of the project include masked shrew (*Sorex cinerius*), deer mouse (*Peromyscus maniculatus*), meadow vole (*Microtus pennsylvanicus*), northern long-eared bat (*Myotis septentrionalis*), and little brown bat (*Myotis lucifugus*).

Masked shrew, deer mouse and meadow vole have been identified at sampling sites on the Northern Peninsula through the Small Mammal Monitoring Network (Rodrigues 2009). Deer mice are found in a wide variety of habitats including boreal forest, alpine tundra and coastal areas (Novak 1999). Meadow vole populations are relatively sparse in insular Newfoundland. Individuals are most frequently found in open meadows, grassland and occasionally in barrens, and tend to avoidance disturbed areas (Folinsbee et al. 1973).

Although not observed directly, two bat species, northern long-eared bat (*Myotis septentrionalis*), and little brown bat, potentially occur near the Project site. Both species are listed as Endangered under SARA, based on the threat posed by White Nose Syndrome. In general, they are associated with forested and agricultural areas, and will roost in large trees, caves, and buildings. Northern myotis form maternity colonies in trees while little brown myotis tend to favour man-made structures (e.g., cabins). Based on the absence of these types of habitat at and near the project site, populations of these two species are not likely to occur in the immediate area. In winter, bats hibernate in frost-free areas, including caves, mineshafts, or unoccupied buildings. Both species generally avoid open and disturbed areas (COSEWIC 2013).

Additionally, red squirrel (*Tamiasciurus hudsonicus*) may occur in the vicinity of the project (Garland 2008). Red squirrels are predominantly found in forested areas and are therefore unlikely to be present in large numbers near the Project site.

2.5.2 Avifauna

Many species of birds are found along the Strait of Belle Isle and Northern Peninsula. Loons, seabirds, marine ducks, and shorebirds including gulls, murres, terns, puffins, cormorants, guillemots, ducks, mergansers, scoters, sandpipers, plovers, and yellowlegs use the area for moulting, over-wintering, migration, and for breeding. Songbird species also occur in the area during migration and breeding, with some species overwintering in the area. Songbird species documented in the vicinity of the project include sparrows, warblers, jays, thrushes, and

chickadees. As project activities are scheduled to occur between October and March, only migration, staging and overwintering that will overlap with project activities are considered below.

Loons, seabirds, and marine ducks occur in the Strait of Belle Isle area during spring and fall migrations. Systematic monitoring in the Strait of Belle Isle has focused on spring migration and has documented large numbers of eider ducks (>60,000) and auks (e.g., murres, guillemots, and puffins; >40,000) (Stantec 2012). A variety of songbird species may also occur in the vicinity of the project during spring and fall migration; however, it is expected that migration of most songbirds would occur outside of scheduled project activities.

Many species of birds overwinter on the Island of Newfoundland and may overlap with project activities. Common winter species associated with coastal areas include ducks [e.g., Common Eider (*Somateria mollissima),* Common Goldeneye (*Bucephala clangula*), and Red-breasted Merganser (*Mergus serrator*)], gulls [e.g., Herring Gull (*Larus argentatus*), Iceland Gull (*Larus galucoides*), and auks (e.g., Thick-billed Murre (*Uria lomvia*)] (Warkentin and Newton 2009). Other relatively common bird species that are associated with barren and brush habitats and that may occur on the Northern Peninsula during winter include Willow Ptarmigan (*Lagopus lagopus*), Snow Bunting (*Plectrophenax nivalis*), Pine Grosbeak (*Pinicola enucleator*) and Common Redpoll (*Carduelis flammea)* (Warkentin and Newton 2009).

Several species of special conservation concern under SARA and/or NLESA may occur in this area of the Northern Peninsula. Additional details related to avifauna in Strait of Belle Isle and the Northern Peninsula, including lists of species present in the area, are available in Stantec (2011b, 2012, 2013).

2.5.3 Summary of Potential Interactions

The above characterization is appropriate to both the preferred and alternate site plan. However, while the preferred site plan is located on disturbed ground with minimal vegetation, the alternative site is located in coastal scrub forest. As a result, some species (i.e. red squirrel) associated with this habitat may be more prevalent at the alternative location. However, no unique species or species assemblage is anticipated at either site and interactions were evaluated for all species discussed in sections 2.5.1 and 2.5.2. The containment basin will be fenced to prevent wildlife intrusion. Where appropriate, additional measures will be implemented to deter birds from landing in the containment basin. Additionally, the lining of the containment basin, as well as the construction of berm, and implementation of the project EPP and Spill Response Plan, will limit potential interactions between the project and wildlife/wildlife habitat. The EPP will also include provisions for the management of wildlife encounters on site.

Given the nature and location of the sites, the timing of construction and operation, and in consideration of the environmental management measures described above, the potential for interaction between the project and wildlife is low.

2.6 Socio-economic Environment

The Northern Peninsula (Census Division No. 9), including all communities north of River of Ponds, is characterized by population decline, low income levels, and an aging population (Gibson 2013). The population of the Northern Peninsula was 16,786 in 2011, down 7.2 percent from the 2006 population of 18,084 (Statistics Canada 2012). All of the communities in the vicinity of the Project, with the exception of Flower's Cove, whose population increased by 14 percent, experienced population decline between 2006 and 2011. The unemployment rate in Division No. 9 is 37.3% as compared with 14.6% for the Province.

Natural resource extraction has been a constant throughout the history of the Northern Peninsula's economy. The reliance on fishing and forestry continues today in the region (Gibson 2013). Compared to the province, the Northern Peninsula's economy has a higher unemployment rate and lower family incomes. Employment and unemployment in the Northern Peninsula vary throughout the year, depending on seasonal work. The region consistently has lower employment rates than the province.

2.6.1 Land Use

Land uses in the vicinity of the Project include recreational and commercial fishing and hunting. Fishing, hunting and trapping is recognized as an important economic contributor in the province, especially in rural areas. Distances from each and the nearest outfitter are shown in Table 1.1. The distance of the nearest outfitter from the preferred site is 8.4 km, thereby avoiding interaction with outfitters.

Of the 186 scheduled salmon rivers in Newfoundland and Labrador, approximately half are located on the Northern Peninsula. These include rivers around St. Anthony, Hare Bay, Main Brook, St. Barbe, Canada Bay, St. John Bay, Hawke's Bay, River of Ponds, Portland Creek, Harbour Deep, Main River, and Humber River. Distances from each site and the nearest salmon river are shown in Table 1.1. The distance from the preferred site to the nearest salmon river is 9.9 km, thereby avoiding disturbance to salmon rivers

On the Northern Peninsula, which has a long snow season, snowmobile trails are located near most communities. Two long-distance trails cross the Peninsula, one from New Ferolle to Englee and Conche. The other crosses from Portland Creek to Jackson's Arm. Extensive trails exist around St. Anthony, in the Main River area, from White Bay to Deer Lake, and around the Bay of Islands. Snowmobile trails are maintained by the Long Range Snowmobile Club in Plum Point and the Northwest Trackers in Port Saunders. As noted, a fence and signage will be placed around the site to deter snowmobilers from the area in December 2015 and the 2016 snow season. The project will be removed at or near the end of the snow season in 2016.

2.6.2 Summary of Potential Interactions

Due to the distance of the Project from outfitters and salmon rivers, as well as the disturbed nature of the preferred site, the potential for interaction with land use is negligible. As described in Section 1.7, the Proponent is investigating opportunities to maximize employment opportunities resulting from the project, including opportunities for employment equity. If the alternative site is selected, any cleared wood suitable for firewood will be stacked and made available to local residents.

Although construction is limited to three weeks, due to the potential for employment associated with the project, there is a positive interaction between the project and the socio-economic environment.

2.7 Historic Resources

The preferred site has been previously disturbed, and there are no known archaeological sites in in either the preferred or alternative site plan. Both the preferred and alternative sites are approximately 17 km from an area that has been the subject of recent archeological research associated with the construction of the Labrador Island Link Transmission Link. The nearest documented archeological site is approximately 24 km from the project site (Nalcor 2011).

2.7.1 Summary of Potential Interactions

Due to the existing disturbance of the preferred site, the potential for interaction with archaeological sites is not likely. The EPP will include management measures for an unplanned discovery event.

2.8 Summary of Environmental Management and Mitigation

Project design will be the primary mitigation to control the release of oil or seawater into the environment. In the unlikely event of an accident or malfunction, the contingency planning measures described in Section 1.0 will be implemented. The project EPP will be in place prior to construction. A table of contents for a standard EPP is provided in Table 2.1. The final plan, as well as the Spill Response Plan will be developed in consultation with NLDOEC.

Table 2.1 EPP Table of Contents (Sample)

1.0	**INTRODUCTION**
1.1	Purpose of the Environmental Protection Plan
1.2	Environmental Protection Plan Organization
1.3	Roles and Responsibilities
1.4	Environmental Orientation
2.0	**PROJECT OVERVIEW**
3.0	**REGULATORY REQUIREMENTS AND COMMITMENTS**
3.1	Approvals, Authorizations and Permits
3.2	Environmental Compliance Monitoring
3.3	Decommissioning and Rehabilitation
3.4	Reporting
4.0	**ENVIRONMENTAL PROTECTION PROCEDURES**
4.1	Surveying
4.2	Site Preparation (clearing, grubbing, roads)
4.3	Excavation and Berming (including cutting and filling)
4.4	Erosion Prevention
4.5	Pumps, Lines and Generators
4.6	Storage, Handling and Transfer of Fuel and Other Hazardous Material
4.7	Vehicle Traffic (including Dust and Noise Control)
4.0	**ENVIRONMENTAL PROTECTION PROCEDURES (cont'd)**
4.8	Temporary Buildings and Storage Areas
4.9	Site Water Management
4.10	Decommissioning and Oil Recovery/Disposal
5.0	**CONTINGENCY PLANS**
5.1	Fuel and Hazardous Material Spills (including oiled seawater)
5.2	Wildlife Encounters
5.4	Discovery of Historic Resources
6.0	**ENVIRONMENTAL PROTECTION PLAN CONTROL REVISIONS**
7.0	**CONTACT LIST**
8.0	**REFERENCE MATERIAL**
9.0	**SIGNATURE PAGE**

As noted in Section 2.3, the mitigation measures summarized in Sections 2.8.1, 2.8.2, and 2.8.3 below will be incorporated into project design in order to manage interactions with the environment.

2.8.1 Construction

Standard operating procedures for managing environmental interactions during construction will be defined in the project EPP. If it is determined that excessive volumes of dust are resulting from construction activities, or if complaints are received, additional mitigative measures will be implemented. Such measures may include the use of water spray to reduce the amount of dust. However, due to the remoteness of the location, relatively short duration of construction and the timing of construction activities, this not anticipated. If the alternative site is selected, any cleared wood suitable for firewood will be stacked and made available to local residents.

2.8.2 Operation

The following design elements will be incorporated to limit interaction with the environment and reduce the potential of accidental events during operation:

- The containment basin will be lined with a geo-environmental welded liner. This liner is certified for use in environmental applications;
- The containment basin design will incorporate berms;
- Low permeability material will be used for berm construction to minimize the migration of oil and/or water in the event of a liner breach;
- Containment hoops will form the grid used in the experiment;
- Oil will not be injected until a minimum layer of ice has formed; and
- ECRC will be engaged as part of the Spill Response Plan.

2.8.3 Decommissioning and Closure

As noted in Section 2.5, an approved Decommissioning Plan will be implemented following the end of the 2016 test season (March/April 2016).

A summary of mitigation as it relates to the components of the environment is provided in Table 2.2.

Table 2.2 Summary of Potential Interactions and Associated Management Measures

Component of the Physical, Biological and Socio-Economic Environment	Management Measures
Physiography, Topography and Drainage	• Implementation of Project EPP • Where possible, berm construction will take advantage of existing topography. To limit the depth of excavation, suitable cut material could be used to construct a berm to achieve the required 3 m depth • The containment basin will be lined with a geo-environmental welded liner. This liner is certified for use in environmental applications • Low permeability material will be used for berm construction to minimize the migration of oil and/or water in the event of a liner breach • Onsite and remote monitoring
Atmospheric Environment	• Implementation of Project EPP • Dust control measures as necessary and appropriate
Hydrogeology	• Implementation of Project EPP • The containment basin will be lined with a geo-environmental welded liner. This liner is certified for use in environmental applications • Low permeability material will be used for berm construction to minimize the migration of oil and/or water in the event of a liner breach • Onsite and remote monitoring
Vegetation	• Implementation of Project EPP
Wildlife	• Implementation of Project EPP • Site fencing • The containment basin will be lined with a geo-environmental welded liner. This liner is certified for use in environmental applications. • Low permeability material will be used for berm construction to minimize the migration of oil and/or water in the event of a liner breach • Onsite and remote monitoring
Socio-Economic Environment	• Proponent is investigating opportunities to maximize opportunities resulting from the project, including opportunities for employment equity. • Site Fencing and Signage • If the alternative site is selected, any cleared wood suitable for firewood will be stacked and made available to local residents
Historic Resources	• Implementation of Project EPP

3.0 APPROVAL OF THE UNDERTAKING

Permits and authorizations for the project that may be required, and the associated issuing agencies are presented in Table 3.1.

Table 3.1 Permits, Approvals and Authorizations Anticipated to be Required

Permit, Approval or Authorization	Issuing Agency
Provincial	
• Certificate of Approval (C of A) for Operation • Approval of Contingency and Emergency Response Plan • Approval of Waste Management Plan • Approval of Environmental Protection Plan • Approval of Decommissioning Plan	NLDOEC – Pollution Prevention Division
• Permit to Construct • Licence to Occupy	Municipal and Intergovernmental Affairs
• Approval for Storage and Handling Gasoline and Associated Products • Approval for Temporary Fuel Cache • Approval for Used Oil Storage Tank System (Oil / Water Separator) • Approval for Fire, Life and Safety Program •	Newfoundland and Labrador Government Service Center

While the project is not a designated project under the federal EA legislation (*Canadian Environmental Assessment Act 2012*), the following federal involvement is anticipated:

- Requirement from Environment Canada – Canadian Wildlife Service for the implementation of policies and procedures for the protection of migratory birds in compliance with the *Migratory Bird Convention Act*; and
- As per Section 36(3) of the *Fisheries Act*, release of deleterious substances into fish bearing waters is prohibited.

4.0 PROJECT SCHEDULE

Pending regulatory approval, construction is tentatively scheduled for December 2015. Construction of the containment basin, including installation of all environmental controls (i.e., oil/water treatment, liners, and sumps) is anticipated to take a minimum of three weeks. Flooding of the basin is expected to occur in early January (2016).

Full-scale tests of the EFNMR technology are tentatively scheduled for March 2016. The schedule for testing will depend on climate conditions, regulatory approval and pre-commercial testing of the oil detection unit during fall 2015 and winter 2016. After the completion of the testing season, the containment basin will be decommissioned according to an approved Decommissioning Plan.

5.0 FUNDING

The project will be funded through research and development funding provided and administered by PRNL. No funding from any government department or agency is required. Funding for the project is anticipated to be less than $1.5 million.

6.0 CONCLUSION

The project has the potential to contribute to the Province's position within the Arctic oil and gas research community. Project design and planning, including the temporary nature of the project, its location, and the incorporation of environmental protection measures, will avoid or limit environmental interactions. Additionally, the application of existing permitting processes and controls, and the development of an EPP will effectively manage potential environmental interactions.

Sincerely

Mike Cole
Managing Director
Fugro GeoSurveys, a division of Fugro Canada Corp.

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