PROJECT DESCRIPTION

FOR

PROPOSED SESIMIC PROGRAM

OFFSHORE LABRADOR

SUBMITTED TO

CANADA-NEWFOUNDLAND OFFSHORE PETROLEUM BOARD

BY

INVESTCAN ENERGY CORPORATION
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1.0 INTRODUCTION

Investcan Energy Corporation (Investcan) in equal (50%) partnership with Vulcan Minerals Inc. acquired one exploration license (EL), located offshore eastern Labrador – EL 1107. The license was issued on November 15th, 2008 by the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB). The total area of the license is 236,525 hectares (584,445 acres). Investcan Energy is proposing to conduct geophysical (seismic) surveys on it's licence and beyond around the Hopedale and Snorri significant discover licences (SDLs). The location of EL1107 relative to other licenses and SDLs is provided in Figure 1.

For this activity, the Project requires approval through the C-NLOPB. This document is a project description, which is required to initiate the Federal Coordination Regulations process under the *Canadian Environmental Assessment Act* (*CEAA*) to which this Project is subject. The *CEAA* identifies a marine seismic survey with an output level of 275.79 kPa at a distance of one metre from the seismic energy sources (*i.e*. 228.69 dB re 1 µPa@1m) as a trigger for an environmental screening level of assessment. The firing of an air source generates an oscillating bubble in the surrounding water. At the time of firing, the pressure of the air inside the cylinder far exceeds the outside pressure in the surrounding water. This difference in pressure causes a bubble to rapidly expand in the water around the air source. It is this initial bubble expansion that generates the relatively broadband seismic pulse. The produced broadband source level for a typical array is about 252 dB re 1 µPa-m, with the highest energies falling between 10 to 100 Hz.

This project is not supported by federal funding. Federal lands are involved and are administered by the C-NLOPB.

There is also the potential for geohazard surveys in EL1107; therefore, the environmental assessment (EA) for this program will also address all exploration seismic-related activities, including vertical seismic profiles which is an activity related to drilling exploration, but due to its seismic nature will be assessed in the EA for the environmental assessment. In total, seismic-related activities could potentially extend over the entire duration of the life of the License (November 15, 2017).

The purpose of the project description is to identify the basic features of the Project to be assessed under the *CEAA*, as well as potentially affected areas. This Project Description is provided to federal departments with potential decision-making responsibility under the *CEAA* RAs or expert knowledge relevant to the evaluation of potential project impacts. The Project Description is also a component of the environmental assessment that will be conducted by Investcan after the RA (the C-NLOPB in this case) determines the scope of the project and factors to be assessed under the *CEAA*.

This Project Description, as directed under the *C-NLOPB Geophysical, Geological, Environmental and Geotechnical Program Guidelines (April 2004)*, is intended to provide information on Investcan's Geophysical Program. A screening level environmental assessment will be prepared from the C-NLOPB scoping document at least 90 days prior to planned start of operations. Guided by technical and scoping advice received as a result of the review of the Project Description by Investcan, experience with other federal and provincial agencies and other stakeholders in the preparation of petroleum exploration project descriptions, Sikumiut

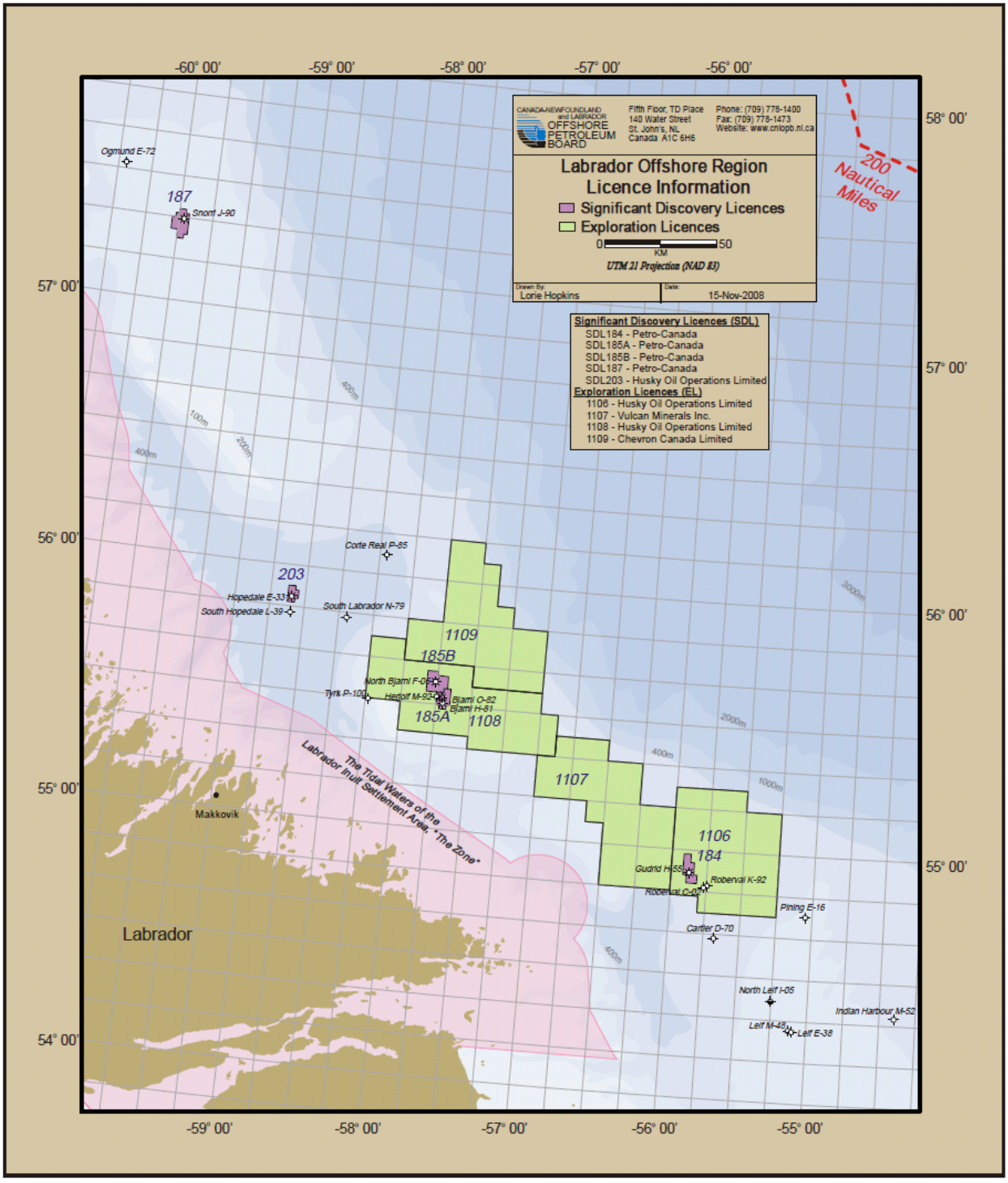

Figure 1: Location of EL1107

Environmental Management Ltd. prepared this Project Description document on behalf of Investcan.

1.1 Proponent Information

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Investcan Energy Corp is a St. John's based company that is incorporated under the laws of the Province of Newfoundland and Labrador. It is a wholly owned subsidiary of SCDM, a privately held company headquartered in Paris, France. SCDM operates a natural gas field in the Ivory Coast through its subsidiary Foxtrot International, based in Abidjan.

The Company is heavily involved, as a Joint Venture Partner, with the Robinson's #1 Well that was drilled by JV Partner Vulcan Minerals Inc. (Operator) has just reached Total Depth and has been cased pending evaluation, stimulation and testing. Red Brook #2, the second Well of the 3 Well Program, is presently in the early drilling stage. The Company is also an interest holder in the Parson's Pond Project, under the leadership of the Operator, Nalcor Energy.

Investcan Energy Corp will foster a collaborative approach to building long-term relationships with all stakeholders, but more importantly the people who live in the Communities in which we work. The Company believes that stakeholder consultations are more than just a regulatory requirement; they are the seed from which partnerships grow. Respect for the land, and for the people who live and work that land is of utmost importance. We can only say the same for the sea.

Words such as sustainable development and environmental protection are taken seriously and are incorporated in every aspect of our work. We will make every effort to establish new standards of excellence.

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1.2 Regulatory Context

In accordance with its mandate under the *Atlantic Accord Implementation Acts,* the C-NLOPB may issue an *Authorization to Conduct a Geophysical Program* to allow Investcan to carry out the seismic survey program described herein. Offshore geophysical surveys (including geohazard surveys) on federal lands are subject to screening under the *Canadian Environmental Assessment Act (CEA Act).* In addition, Section 19.1 (a) of the *CEAA*'s Inclusion List Regulations identifies those projects relating to seismic surveys for which a screening level of assessment is required. Under Part II Oil and Gas Projects, physical activities that require an authorization referred to in paragraph 138(1)(*b*) of the *Canada-Newfoundland Atlantic Accord Implementation Act* or paragraph 142(1)(*b*) of the *Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation Act* and relate to a marine or freshwater seismic survey

during which the air pressure measured at a distance of one metre from the seismic energy source is greater than 275.79 kPa (40 psi) requires completion of an environmental assessment.

The C-NLOPB is the designated federal representative mandated under the Atlantic Accord Implementation Acts as well as the *Canadian Environmental Assessment Act*. The C-NLOPB acts as the federal environmental assessment coordinator in this context. Because seismic survey activities have the potential to affect seabirds, marine mammals, and fish and fisheries, both Fisheries and Oceans and Environment Canada are the primary federal agencies with interests and expertise in the environmental aspects of the proposed program. Relevant government regulations and guidelines to be reviewed during the issues scoping process will include:

- Canada-Newfoundland Atlantic Accord Implementation Acts
- Canadian Environmental Assessment Act
- Fisheries Act;
- Oceans Act
- Migratory Birds Convention Act and Regulations;
- Canadian Environmental Protection Act;
- Committee on Endangered Wildlife in Canada (COSEWIC)
- Species at Risk Act
- Navigable Waters Act
- Canada Shipping Act
- Offshore Waste Treatment Guidelines (NEB *et al.* 2002); and
- Geophysical, Geological, Environmental and Geotechnical Program Guidelines, (C-NLOPB 2008)

As per the C-NLOPB Geophysical, Geological, Environmental and Geotechnical Program Guidelines (April 2008), an approval to conduct the planned survey must be granted from the C-NLOPB.

1.2.1 Environmental Assessment Approach

The environmental assessment methodology for the Project has been developed to satisfy regulatory requirements of the *CEAA*. The methodology used in this report has evolved from methods proposed by Beanlands and Duinker (1983), who stressed the importance of focusing the assessment on environmental components of greatest concern to potentially affected parties. In general, the methodology is designed to produce an environmental assessment document that:

- is focused on issues of greatest concern;
- addresses regulatory requirements;
- addresses issues raised by the public and other stakeholders;
- integrates engineering design and mitigative and monitoring programs into a comprehensive environmental management planning process; and
- integrates cumulative effects assessment into the overall assessment of residual environmental effects.

A focused environmental assessment requires a process of scoping to define the components and activities that are to be considered in the assessment, to identify the key environmental issues, and to set the spatial and temporal boundaries of the assessment. While the Project activities are generally focused within the footprint of the Project activities (*i.e.*, area of influence), the effects of these activities may extend beyond these footprints.

Valued environmental components (VECs) will be identified by the C-NLOPB in their scoping process. The following VECs are likely to be included but not limited to consideration in EA document

- marine and migratory birds;
- marine fish and shellfish
- marine mammals
- marine turtles
- species at risk
- sensitive areas; and
- commercial fisheries.

1.3 Canada- Newfoundland and Labrador Benefits

Investcan is committed to benefits for Canadian companies with emphasis on organizations from Newfoundland and Labrador. A benefits plan is being finalized for Investcan which will govern all company operations in the future with it's guiding principles as follows:

Companies from Canada and Newfoundland and Labrador in particular will be given full and fair opportunity to provide goods and services to Investcan. Investcan must make decisions based on what optimizes value to its projects; value to Investcan will be quantified through vendor impact on project economics, product and/or service quality, timing, vendor experience and reputation and other similar metrics.

1.4 Stakeholder Consultation

Investcan recognises the importance of communications to keep stakeholders informed about its proposed program and to obtain valuable input that may serve to contribute to the Project's overall success. A focused environmental assessment requires a process of scoping to define the components and activities that are to be considered in the assessment, to identify the key environmental issues, and to set the spatial and temporal boundaries of the assessment. Candidates for stakeholder consultations are well established in the environmental assessment arena of Newfoundland and Labrador and could include:

- Association of Seafood Producers
- Atlantic Salmon Association
- Clearwater Seafoods
- Combined Councils of Labrador
- Environment Canada/Canadian Wildlife Service
- Fish, Food and Allied Workers
- Fisheries and Oceans Canada (NL Region)
- Innu Nation
- Metis Nation
- NL Department of Fisheries & Aquaculture
- Nunatsiavut Government
- One Ocean

- Parks Canada
- Regional Economic Development Associations

Other interest groups and stakeholders may also be identified during the consultation process.

2.0 PROJECT DESCRIPTION

2.1 Project Name and Location

The official Project name is Geophysical Surveys for Exploration License 1107. The block is located offshore Labrador.

The current licence is held by Investcan and Vulcan Minerals. Not all Project details are presently known, however, based on acquired 2-D seismic survey information, areas of interest have been chosen. Not all contractors and suppliers have been selected for the surveys.

2.1.1 Project Overview

Investcan's holdings lie about 100 kilometres offshore the coast of Labrador. Interest in oil and gas offshore Labrador dates back to the late 1960s. At that time, several industry companies acquired exploration permits in the Labrador Shelf area. Drilling in the area commenced in 1971 and continued intermittently until 1983. Twenty-eight wells were drilled during that period. This early drilling proved the presence of 4.2 trillion cubic feet (tcf) of recoverable natural gas in five separate wells, which demonstrated the presence of a petroleum system in the area.

The proposed Project is a marine 2-D and 3-D geophysical program with the potential to perform a yet-to-be-determined area of geohazard survey. Vertical seismic profiling (VSPs), which is an exploration drilling activity, is also included in the environmental assessment to address all petroleum exploration seismic-related activities.

The seismic survey vessel will tow a sound source (airgun array) and streamer(s) composed of receiving hydrophones. If performed, geohazard surveys will be conducted over a much shorter time frame using a smaller vessel and a combination of smaller scale seismic equipment, sonars, sparkers and boomers.

A seismic Contractor nor vessel has not been retained at this juncture. A procurement process will commence in late November 2009 to retain a suitable seismic vessel. In the interest of cost

savings, opportunities will be sought to cooperate with other operators conducting seismic programs within the same time frame.

Although the environmental assessment has not been completed to fully address environmental mitigations for the planned geophysical surveys, it is anticipated that a marine mammal observer and fisheries liaison officer will form a component of the operational crew. Furthermore, procedures will be implemented to minimize effects on the local marine ecosystem. For example, “soft-starts” or “ramp-ups” industry standard procedures of the air gun arrays will be implemented.

To complement previous geophysical surveys in the area, Investcan proposes to conduct 2-D surveys over EL1107, SDL Hopedale and SDL Snorri; conduct a 3-D program over EL1107; and other drilling-related geophysical surveys on EL1107. The general coordinates of the application area are provided in Table 1.

Table 1 Corner Coordinates of Project Areas (UTM Zone 21, NAD 83)

Easting	Northing
EL1107 and SDL Hopedale Area	
364356.799	6194357.588
379267.567	6212081.708
469857.514	6190981.565
543567.348	6156095.995
601803.743	6084636.843
578171.583	6039341.870
533931.366	6060148.598
533068.242	6072075.400
525535.525	6088003.957
496468.389	6089536.389
452414.730	6135558.522
SDL Snorri Area	
301545.638	6368852.397
314845.818	6334096.267
341069.757	6343883.191
327142.210	6378011.954

The technical specifications for the survey and for the 2-D and 3-D parameters will be finalised when the Geophysical Contractor has been selected. There have been numerous seismic surveys conducted within Atlantic Canada offshore waters. The energy source will be a dual airgun array system. A soft start approach would occur at the beginning of a new line within the perimeter or at the start of operations anywhere within the program area.

2.1.2 Project Schedule

Investcan proposes to undertake a geophysical 2-D and 3-D seismic survey program on their landholding off the east coast of Labrador commencing in the end of the second to fourth quarter 2010. The 2-D surveys over EL1107, SDLs Hopedale and Snorri will be undertaken from between June to November 2010, followed by a 3-D survey over EL1107 between June and November in 2011. After 2011, subsequent surveys would be based on speculative efforts.

Surveys may be 20 to 30 day period with a 10 streamer towed arrangement or up to 75 days for a smaller four streamer arrangement. Well site survey data acquisition typically requires only 3 to 5 days for a 2 x 2 km area and often last less then three days. Typically VSP surveys are completed in 9 to 15 hours.

2.1.3 Project Activity Area

The Project Activity Area encompasses the geographic area within which Investcan expects to undertake seismic surveys and associated activities within the next eight years. The 2-D and 3-D surveys would be conducted over the exploration licence and in the areas of interest as depicted in Figure 2. Investcan acknowledges that the scope of the Project to be assessed in the EA Report extends over several years, during which time the regulatory, biophysical, and socio-economic environment may change from that assessed in this report. Investcan will periodically review the EA Report, as directed by the C-NLOPB, for current applicability, will continue stakeholder consultations as required, and will work with regulatory authorities to ensure that the EA remains fit for purpose.

Geohazard surveys will be conducted on areas of drilling interest in advance of exploration drilling. During drilling operations, vertical seismic profiles (VSPs) may be conducted at the well sites. At this time there is no intention to conduct any activities in the Marine Zone as defined in the Labrador Inuit Land Claims Agreement.

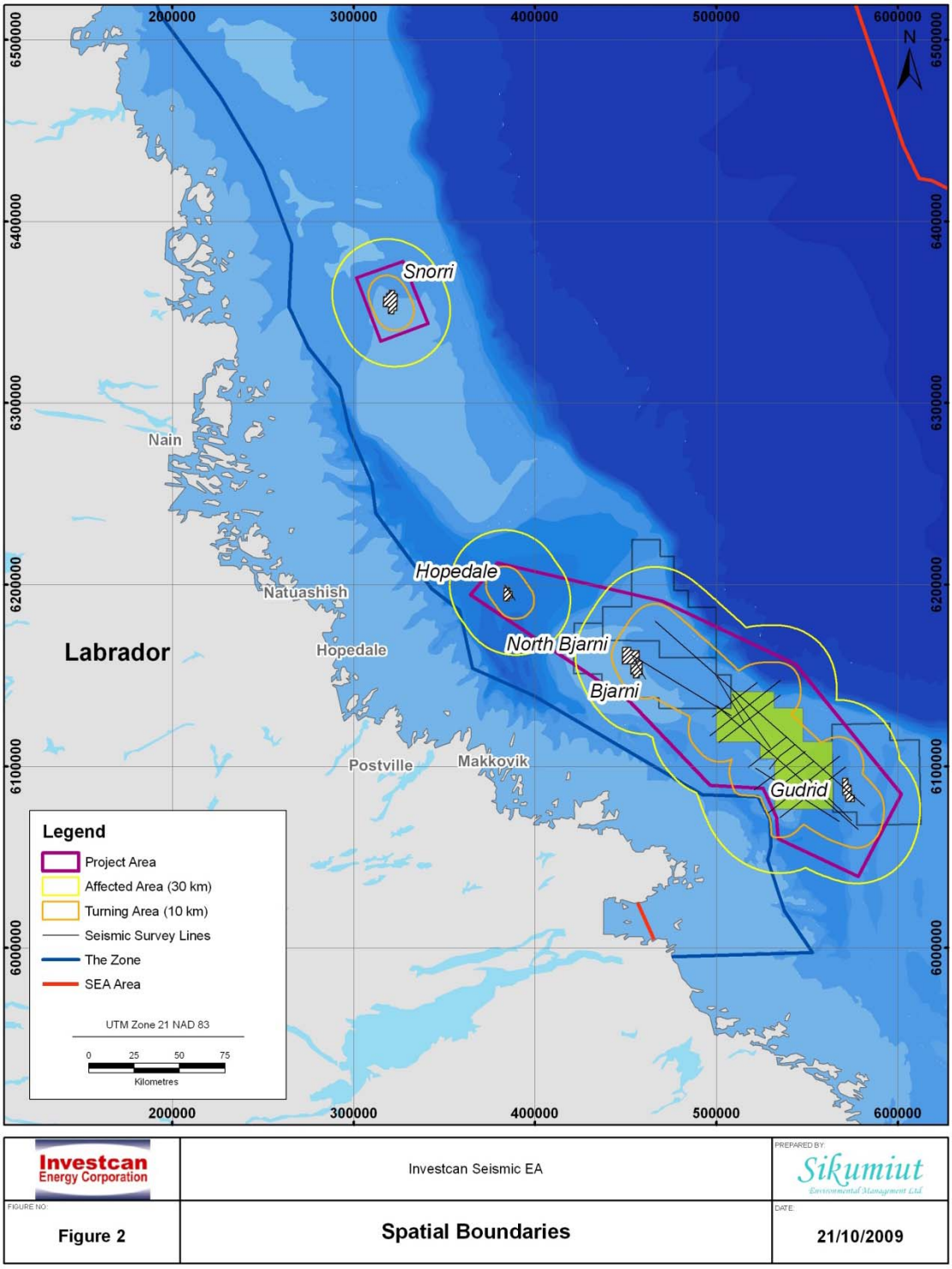

Figure 2 Spatial Boundaries

Exact survey areas are to be finalized when a seismic acquisition company has been chosen as cost and vessel availability may affect survey area. The survey areas will have an allocation for seismic vessel turn radius. Geohazard surveys and VSPs on drilling locations may be conducted in the survey area as well.

2.2 Alternatives to the Project & Alternatives for the Project

Alternatives to the Project are defined as functionally different ways of achieving the same end (CEA Agency 1997). An alternative to the proposed 2-D and 3-D seismic surveys is the 'do-nothing' scenario, or null alternative.

A 2-D survey is typically used for exploring a large area to identify potential prospects which require further study. The 3-D survey can cover relatively large geographical areas, but have a short-term duration at any given location. The 3-D seismic survey enables a greater resolution of potential existing oil and gas reservoirs. These surveys provide a detailed picture of the area under investigation allowing for a more detailed analysis of the potential quantity and distribution of hydrocarbons. Results of 3-D surveys are then used to find potential locations for exploration drilling. With regard to location, the proposed lines were selected based on a current understanding of the geological conditions.

Alternative means for the Project are defined as methods of similar technical character or methods that are functionally the same (CEA Agency 1997). Alternative means for carrying out this Project include variations in technology, Project schedule and location.

The proposed program is scheduled to commence between Summer (mid-June) and late Fall (November). Specific timing of the program within this period depends on a variety of factors, including vessel availability, weather conditions, timing and sensitivities associated with biological and socio-economic constraints. For example, mitigative options to minimise impacts include modification of the operations schedule within specific areas (*e.g.,* scheduling of specific lines so as to minimise fisher interactions).

With respect to the technology proposed, airgun arrays are the most common, environmentally responsible and practical energy sources for marine geophysical surveys (Richardson *et al.*

1995). Noise pulses with high peak levels are produced; however, each pulse is short, limiting total energy. Richardson *et al*. (1995) also indicated that pulses from airgun arrays generally decrease in intensity, but increase in duration further away from the site. Sleeve exploders and gas guns have similar effects to airguns. Although marine vibrators produce lower instantaneous pressure than airguns, the total acoustic energy transmitted is similar due to the extended duration of the signal. Marine vibrators are also in their development infancy and are not a practical alternative. Marine vibrators cannot substitute for the airgun array in seismic surveys as they provide a lower output at low frequencies.

2.3 Other Seismic Programs

2.3.1 Well Site/Geohazard Surveys

It is possible that a well site geohazard survey will be conducted at one or more locations within the geophysical survey area. Investcan will communicate any plans to the C-NLOPB if a well site geohazard survey becomes a part of the geophysical program.

A typical wellsite survey uses the following acquisition equipment: side-scan sonar, sub-bottom profiler and echosounder, multichannel seismic and magnetometer. The survey vessel will trail one streamer of approximately 600 metres in length. The air gun array that is used is much smaller than traditional seismic and is usually <200 in^3, which produces a higher frequency and lower power signal. This results in a faster attenuation of sound to background levels and less effect on marine life in the area.

2.3.2 Vertical Seismic Profile (VSP) Surveys

During drilling exploration, VSPs of each proposed exploration well may be required. It is estimated that each VSP could take place within a radius of 2.5 km from each well site. The number of well sites is not known at this stage.

VSP are typically acquired using a cluster of medium size airguns (total volume of 450 to 1500 cu in) and a peak pressure of 240 to 250 dB re 1µPa at 1m (Davis *et al*. 1998). The sound

source to be used in VSP surveys is typically deployed from the drill rig. However, the source may also be deployed from a vessel and fired in a pattern all around the drilling platform but rarely more than 500 m away. The guns will be charged with nitrogen or compressed air at 2000 psi and suspended at a constant depth of four to seven metres, depending on sea-state. VSP surveys are usually a one-time event and extend from one day to over a week. No streamers are deployed for these kinds of surveys.

2.4 Survey Vessel

The survey vessel for 2-D and 3-D surveys has not been selected at this time; however, it will be a conventional, dedicated seismic research vessel, with a crew of 30 to 50 people. Vessel speed will be approximately 4.5 knots when the survey gear is deployed. Typical survey vessels are capable of cruising at 10 knots while in transit (with gear onboard). It is estimated that the survey vessel will require a turning radius of 2.5 to 3 kilometres outside the identified survey area. Seismic operations can generally continue up to a Sea State of 5 or wave heights of about 3 m.

Geohazard surveys are conducted by small supply vessel type ships which are outfitted to trail the equipment. Crew size is about 10-20 persons. Transit speeds are the same as above.

The VSP surveys are conducted using the large offshore supply vessels that are part of the overall support for the exploration drilling program.

2.5 Logistics & Support

Details of logistical operations to support the subject geophysical program will largely depend on seismic acquisition company, season and weather.

Helicopters

Helicopters may or may not be utilized depending on type of helicopter available and seismic vessel procured. For the duration of the seismic program, it is possible that the fleet of helicopters available out of St John's will be Sikorsky S-92's only. The implication of this is that

many of the seismic vessels currently available on the market are not capable of allowing S-92's to land on their helideck. Super Pumas or equivalent are the only type of helicopter potentially available that are approved for landing on the helidecks of the anticipated seismic vessels.

Shore Base

Due to the location of the planned geophysical survey area, it is possible a shorebase and supply area will be staged out of the Avalon Peninsula in St. John's. A final decision cannot be made on this issue until a seismic vessel company is chosen.

Support Vessels

Supply vessels may be utilized for crew changes and supply of materials and consumables. Also, it is possible the seismic vessel may interrupt its geophysical program for logistical requirements. Again, final determination on these points can only be made when a seismic vessel company is chosen as well as the season of operations is known.

The vessels incorporate a chase or picket boat that scouts for other vessels or fishing gear that may interact with the survey while underway. The bridge crew on the seismic vessel maintains close surveillance of approaching vessels. Radar reflectors are attached to the streamers for detection by other vessels.

2.6 Routine Discharges

Discharges and emissions from this program will be similar to those of any standard marine vessel. They will be minor and could include the following:

- Atmospheric Emissions - emissions from ship engines and onboard equipment will comply with the Air Quality Management (Newfoundland and Labrador Environmental Protection Act) and the Ambient Air Quality Objectives (Canadian Environmental Protection Act).
- Ballast Water - ballast water is stored in dedicated ballast tanks to improve vessel stability. No oil will be present in these tanks or in any discharged ballast/preload water. If oil is suspected to be in the water, it will be tested and, if necessary, treated to ensure

- that oil concentrations in the discharge do not exceed 15 mg/L as required by the MARPOL 73/78 (International Convention for the Prevention of Pollution from Ships, 1973, and the Protocol of 1978 related thereto), International Maritime Organisation (IMO) and the Offshore Waste Treatment Guidelines (OWTG) (NEB et al. 2002).
- Bilge Water - Bilge water often contains oil and grease that originate in the engine room and machinery spaces. Before discharge, bilge water is treated in accordance with MARPOL 73/78, IMO and OWTG, using an oil/water separator. The extracted water is tested to ensure that the discharges contain no more than 15 mg/L of oil.
- Grey and Black Water - It is anticipated that the survey ship will carry a crew of 30 to 50 people. For accommodating about 100 people, Mobil (1983) estimated that grey water discharge (showers, dishwashing, deck drains, etc.) would be 40 m3/d and that black water discharge would be 19 m3/d. The survey vessel should produce less than half of this volume. Sanitary and food wastes will be macerated to a particle size of 6 mm or less and then discharged as per the OWTG.
- Solid Waste - All solid waste will be transferred to shore and disposed of at an approved on-shore-based facility. Any hazardous materials (e.g., oily rags) will be handled separately in hazardous materials containers.

2.7 Accidental Events

There will be limited amounts of marine fuel and lube oil on board that could potentially be spilled to the ocean. Small spill events of kerosene and mineral oil (*i.e* floatation fluid) from streamers can result from tears in the streamers from rough weather-induced entanglement, debris damage and possibly shark bites.

There is some potential for flotation fluid to be lost from a non-solid-streamer if the streamer becomes damaged. It is Investcan's preference to utilise a seismic vessel equipped with solid-streamer technology, as this type of streamer is not reliant on floatation fluid to achieve a neutral ballast state, risks of accidental spill or incident is minimised. Accidental spills will be reported to the C-NLOPB immediately.

Other accidental events could include damage or loss of seismic gear, entanglement of seismic gear with fishing gear, and vessel collisions. Best management practices will be used on the

seismic vessel to avoid gear loss or damage. Gear will be retrieved from the water if wave heights reach or exceed unacceptable limits. In case of severe weather, the vessel may return to shore until conditions improve. A trained fisheries liaison observer will be onboard during the seismic program to liaise with fishers who may have gear deployed in the Project Activity Area, in order to ensure effective and ongoing communication and avoid unnecessary gear conflicts and possible vessel collisions. Entanglement of marine mammals in seismic gear is not likely since streamers have no tangle gear and marine mammals are expected to avoid the vessel during operations. The onboard fisheries observer will be trained to keep watch for marine mammals during the program.

2.8 Health & Safety

Investcan will submit a Safety Plan to the C-NLOPB outlining the company's commitment and philosophy toward ensuring personnel's health and safety are first and foremost in all Investcan operations.

3.0 SETTING OF ENVIRONMENTAL COMPONENTS

A number of studies have already been performed in the area which will be key references to the environmental assessment (EA) Investcan will have performed. These are:

- Strategic Environmental Assessment Labrador Shelf Offshore Area (2008);
- GSI-Labrador Shelf 2D Seismic Program 2007 - 2009 (2007);
- Husky Energy Labrador Shelf Seismic Program (ongoing); and
- Chevron-Offshore Labrador Seismic Program, 2010-2017 (ongoing).

The Strategic Environmental Assessment (SEA) for Offshore Labrador will form the base of the EA report. A stand alone document will be provided, but the effort in the SEA will not be reiterated. The purpose of the SEA is to provide a broad scale review and assessment of important resources in the Labrador Offshore Area in light of potential oil and gas activities over the next five years. Strategic environmental assessment (SEA) is defined as "*The systematic and comprehensive process of evaluating the environmental effects of a policy, plan or program and its alternatives"*. The SEA is essentially a planning document intended to assist the C-NLOPB in their decision process concerning which areas may or may not be suitable for offshore exploration, and/or which areas may require special mitigations if exploration activity is to proceed. Data that require updating will be species at risk, the commercial fishing efforts and public consultation. Mapping of resources will focus in on EL1107.

The Labrador SEA Report concluded that petroleum exploration activity generally can proceed in the Labrador Offshore Area with the application of standard mitigation measures currently applied to offshore exploratory activities elsewhere in the Newfoundland and Labrador offshore. The findings of this SEA Report identified areas potentially affected by the planned geophysical program proposed by Investcan.

3.1 Meteorology and Climate

Winters are very cold, with typical daytime temperatures for January between -10 and -15˚C, colder than Newfoundland and more like the frigidity of the southern Prairies. An occasional incursion of Atlantic air will warm up the winter. The summer season is brief and cool along the coast because of the cold Labrador Current. July average temperatures are from 8 to 10˚C

along the coast but are 3 to 5˚C warmer in the interior. The pleasantness of the summer day along the coast is often determined by the wind direction - westerly winds bring clear, mild continental air, whereas easterlies, blowing off the Labrador Current, bring cold, cloudy, and moist weather.

The limitation of the ocean's influence; however, is not a serious disadvantage, because in this region its effect on the climate is generally unpleasant. The Labrador Sea is infested with floating pack ice and icebergs for eight months of the year. The masses of ice keep sea temperatures below 4˚C. An east wind off the Labrador Current is a cool wind in summer, often with light rain or drizzle. In winter, when the Atlantic air is relatively mild, the accompanying weather includes cloud and frequent snowflurries. Whenever easterly winds bring very moist air from the Atlantic, widespread fog occurs.

Precipitation in Labrador is heaviest in the south and decreases northwards. On the whole it is much lighter than in Newfoundland, although amounts can vary considerably from year to year. Southern Labrador is not unlike the moist northern shores of Newfoundland, with 1000 mm, as a typical yearly fall of precipitation. About 45% of this occurs as snow. Over much of Labrador 800 mm is a more typical amount, with about half of it snow. In summer, rainfall is seldom less than 175 mm in the north and 275 mm in the south. Snowfall is heavy, with Churchill Falls in the interior having 481 cm, making it one of the snowiest places in Canada. Goose Bay has a mean snowfall of 445 cm. In the south, Cartwright averages 440 cm, and in the north Nain is typical with 424 cm. The ground is snow-covered for eight months in the far north and for six months in the south.

The monthly wave statistics for MSC50 grid point 13643 within EL1107 (values are based on 50 years of hindcast data) show the highest waves typically occur from November to March. The maximum significant wave height of 12 m was recorded in January. Significant wave height >3 m occur from November to February.

Sea surface temperatures in the Labrador Shelf Area remain relatively cold in the north (typically -2°C to 0°C) throughout the year. South of 55°N temperatures range from approximately 0°C during the winter months to approximately 10°C during summer. Salinity hovers around 30 psu (practical salinity units) inshore and over the banks during spring and

summer, and increases to greater than 35 psu at the edge of the Labrador Shelf. During fall and winter, it tends to increase to approximately 33 psu inshore and remains fairly constant at approximately 35 to 36 psu over the edge of the shelf.

3.2 Ice Conditions

The average start of the ice season ranges from mid-November in the north, to December, in the south. Ice growth typically continues until late spring, when the pack ice begins to melt and dissipate through the month of July. The ice season ends, on average, by late-June/early-July in the south but extends until late-July/early-August in coastal and northern regions. The mean annual number of weeks for ice presence is one week in the offshore areas. The average annual concentration in the vicinity of the banks is 3/10 to 4/10, decreasing with distance from shore. This observation includes all conditions (including areas designated as open water and ice-free). When ice is present, the mean annual concentration varies from 3/10 to 9/10 over the entire Labrador Shelf Area; and multi-year ice concentration displays a high degree of variability. Occasionally occurring in small areas of concentrations of 2/10, it tends to appear in trace amounts within the overall pack throughout most of the season.

3.3 Physical Oceanography

The Labrador Current, originating in the Davis Strait, is a combination of the West Greenland Current, the Baffin Island Current and inflow from Hudson Bay. It flows along the Labrador coast and consists of two major streams, the inshore and offshore stream. The inshore stream, consisting of water from Hudson Strait and the Baffin Current, flows along the coast and in the Marginal Trough, located inside the banks. The offshore stream consists of water from the West Greenland current and flows along the outer edge of the banks and over the continental slope. Hydrographic observations in the Labrador Sea from the 1930s to the 1990s reveal large annual and decadal variations in water mass properties. In the late 1960s – early 1970s, the intermediate and deep waters of the Labrador Sea were at their warmest and saltiest since the 1930s. It took only two decades for all the waters to reach the lowest ever observed temperature and salinity of the entire water column.

The presence of the banks between the two main streams of the Labrador Current tends to limit mixing of the streams so that they maintain their water properties along the length of the coast. Mixing of the streams occurs through the saddles, which are oriented approximately perpendicular to the coast. The currents on the banks between the two streams are weak and much more variable. Mean velocities are greatest along the slope and in the Marginal Trough, while the maximum speeds are greatest along the slope and in the Cartwright Saddle.

The most comprehensive physical study of currents offshore Labrador was contracted by Petro-Canada during the summer of 1980. Prior to the 1980 Physical Oceanography Study offshore Labrador, currents were measured by various researchers. The measurements on the continental slope were made mainly during the winter season, and the banks during the summer season. The current information indicates that the net flows are stronger over the steepest portion of the continental slope than over the continental shelf or locations further offshore. While the magnitude of the vector mean currents are much less on the continental shelf than those measured on the slope, the current speeds on the shelf can still be strong. The maximum current speed on the slope was measured as 0.94 m/s at a depth of 100 m, and the maximum speed on the shelf was measured as 0.79 m/s at a depth of 13 m.

The largest tidal variations occurred at semi-diurnal frequencies. For the semi-diurnal M2 constituents, the largest amplitude in the Project Area was 2.6 cm/s at 269 m depth. The amplitude of the largest diurnal constituent (K1) was 1.1 cm/s. With the exception of tides, the major part of the temporal variability of the currents occurred at periods greater than two days. Over the banks, relatively more activity occurs at periods of four to seven days.

The currents offshore Labrador is dominated by low frequency oscillations. Fissel and Lemon (1982) found that despite the general similarity of the flow within each regime, cross-spectral analysis between horizontally separated pairs of current records did not reveal statistically significant coherences beyond those that would be expected to arise at random. Much of the spatial variability is linked to bathymetry, while the temporal variability may be linked to meteorological forcing as suggested by the period of the oscillations.

3.4 Bathymetry

Water depths within the Project Activity Area range from about 150 m to 250 m.

3.5 Marine Benthos

Benthos are relevant to offshore planning because benthic communities are relatively immobile, are an important link to commercial fisheries, and generally exhibit some level of zonation in their distribution. Benthic community assemblages are mainly dictated by substrate type. Subtidal sedimentary, soft bottom habitats are dominated by marine worms, crustaceans such as ostracods, amphipods, isopods, tanaids, mysids and small decapods. Echinoderms are common and include brittle stars, urchins, sand dollars, sea cucumbers and sea stars. Subtidal hard substrates support low-growing encrusting plants and animals. Dominant species include sponges, tunicates, bryozoans and various cnidarians like anemones and hydroids. Macrobenthos in the Project Activity Area that are particularly important to fishermen and include snow crab.

Populations of deep sea coral are most dense in the southeastern region between Makkovik Bank and Belle Isle Bank. Scientific surveys by DFO detected a peak occurrence of coral, at the mouth of the Hawke Saddle. At least two tows had four to seven sets of gear containing coral (Edinger et al. 2007).

3.6 Marine Mammals

There are five species of baleen (Mysticetes) cetaceans including blue, fin, sei, humpback, and minke whales that are likely present in the Project Area. Five species of toothed (Odontocetes) whales occur off Labrador and include Sowerby's beaked Whale, harbour porpoise, killer whale, Atlantic white-sided dolphin and long-finned pilot whale.

Six species of seals (pinnipeds) are known to occur regularly in the Labrador offshore region including: harbour, harp, hooded, grey, bearded and ringed seals.

In April 2006, the Atlantic walrus in Canadian waters was reassessed as a single species and was classified as special concern by COSEWIC (2006a). However, the Northwest Atlantic Population is listed on Schedule 1 of SARA as extirpated and as such, a recovery strategy was developed for that population.

The other species of marine mammals that could occur in Labrador region are the North American river otter and polar bear. Otters in Newfoundland and Labrador belong to a distinct subspecies, *L. canadensis degener* (Parks Canada n.d.). Their abundance is unknown. North American river otters occur in rivers and streams throughout much of North America; in the northern portion of their range, they occur in coastal marine areas as well (Estes and Bodkin 2002). Due to the distance from shore and its preferred habitat consists of rugged coastal areas with irregular shorelines that have short intertidal lengths (Melquist et al. 2003), it will not occur in the Project Area.

Based on distribution data provided in the Labrador Offshore SEA report, polar bears are not present in EL1107.

The potential effects on marine mammals that occur in the Project Activity area will be included in the EA.

3.7 Sea Turtles

Two species of sea turtle could potentially occur offshore Labrador. In order of decreasing abundance in North American waters, these are as follow: (1) the loggerhead turtle and (2) the leatherback turtle.

The Atlantic loggerhead sea turtle (*Caretta caretta*) is the most common sea turtle in North American waters and the largest hard-shelled sea turtle in the world (Ernst et al. 1994). They are found from coastal areas to more than 200 km out to sea. The North American population is declining, and has been estimated to be between 9,000 and 50,000 adults (Ernst et al. 1994). Individuals found in Canadian waters are smaller than those found in the US and are likely younger animals (Witzell 1999). Seventy percent of loggerheads captured accidentally by fishing gear (936 captures) from the Caribbean to Labrador between 1992 and 1995 were

captured in waters on and east of the 200-m isobath off the Grand Banks, with captures peaking in September (Witzell 1999). In this area, loggerhead captures correspond closely with fishing effort, as the oceanographic features near the 200-m isobath results in a concentration of loggerhead prey species, such as jellyfish and crustaceans.

Leatherback turtles have been recorded throughout the year in Canadian waters (including off the coasts of Newfoundland (Goff and Lein 1988, in Atlantic Leatherback Turtle Recovery Team 2006; Lawson and Gosselin 2003, in Atlantic Leatherback Turtle Recovery Team 2006) and Labrador (Threfall 1978, in Atlantic Leatherback Turtle Recovery Team 2006; DFO 2005b, in Atlantic Leatherback Turtle Recovery Team 2006) with the peak occurring August to September (James 2000 in Atlantic Leatherback Turtle Recovery Team 2006; McAlpine et al. 2004, in Atlantic Leatherback Turtle Recovery Team 2006; James et al. 2005a, in Atlantic Leatherback Turtle Recovery Team 2006; James et al. 2005b, in Atlantic Leatherback Turtle Recovery Team 2006). They migrate into Canadian waters to feed in late May or September, particularly in productive shelf and slope areas, where jellyfish and other soft-bodied invertebrates on which leatherbacks feed is concentrated. The northernmost records for Atlantic Canada are along the coast of Labrador, within the Labrador Shelf SEA Area, at almost 54°N (Atlantic Leatherback Turtle Recovery Team 2006).

This species is currently listed as endangered under Schedule 1 of *SARA*. In 1998 and 1999, 300 leatherback sightings were recorded in Nova Scotian waters by the Nova Scotia Leatherback Turtle Working Group, a group that study the distribution of leatherbacks in the Northwest Atlantic (James 2000).

The potential effects on sea turtles occur in the Project Activity area will be included in the EA.

3.8 Marine Birds

The avian biodiversity of marine Labrador is heavily influenced by the oceanic effects of the Labrador Current. Numerous species of seaducks and seabirds use the Labrador coast for breeding, overwintering, or as a migratory or moulting stopover. Several of these species are at the limits of their ranges in the waters off Labrador (Chaulk et al. 2004). Razorbill (*Alca torda*), Common Murre (*Uria aalge*), Leach's Storm Petrel (*Oceanodroma leucorhoa*), and Atlantic

Puffin (*Fratercula arctica*) are all at their northern limits, while substantial colonies of Thick-billed Murre and Glaucous Gull are at their southern range limits. Many of the breeding marine species nest on the islands off the coast. Millions of seabirds and shorebirds use the Labrador coast on migration from the Arctic and Greenland. Spring migration is a time of high sensitivity because birds are obtaining breeding condition and are concentrated in high numbers, especially along ice edges. Although all areas of the shelf are used, the shelf edge and the Hawke Channel show notably high densities of pelagic seabirds; areas around colonies will also have unusually high densities during the breeding season. Some overwinter off Newfoundland and others will migrate to southern climes. The Harlequin Duck breed in inland Labrador, moults off the Labrador coast, and then winters off Greenland (Russell and Fifield 2001). Other bird species that use the Labrador coast are resident birds like the Black Guillemot and some of the gull species. The Ivory Gull is designated as Endangered by COSEWIC (2006b) and as a species of Special Concern under *SARA*. It is also protected under the *Migratory Birds Convention Act* (1994) and *Migratory Bird Regulations* (COSEWIC 2006b). The abundance and seasonal use of the Labrador Sea by Ivory Gulls is essentially unknown.

Pelagic seabird abundance is high in the Project Activity Area. Their peak vulnerability occurs between April and December (Lock et al. 1994). The potential effects on seabirds that occur in the Project Activity area will be included in the EA.

3.9 Marine Fish and Shellfish

Finfish are the most abundant and diverse type of vertebrates in the ocean with 538 species recorded in the Canadian Atlantic Region alone (Davis and Brown 1996). The familiar commercial species of marine fish comprise only a small proportion of the total number of species. Marine fish can be divided into three groups consisting of demersal (or groundfish), pelagic, and shellfish. Groundfish such as Atlantic cod (*Gadus Morhua*), winter flounder (*Pseudopleuronectes americanus*), and Greenland halibut (*Reinhardtius hippoglossoides*) are those that spend most of their time at or near the bottom of the water column. Pelagic fish, such as Atlantic herring (*Clupea harengus*) and Atlantic mackerel *(Scomber scombrus)* migrate and feed in the middle of the water column and in surface waters. A summary of habitat preferences and spawning behaviour of commercially and ecologically important fish species will be provided in the EA.

The distribution of most fish species varies seasonally in response to physical or chemical changes in the surrounding environment (*e.g.*, depth, substrate, salinity, temperature) and as a result of seasonal habitat requirements (*e.g.*, spawning, feeding). Long annual migrations are undertaken by most pelagic species, such as herring and mackerel, and groundfish species, such as cod.

Marine demersal finfish species that regularly occur in the shallow waters of EL 1107 include argentines, rattails, gadiforms, sculpins, perciformes, sea ravens, goosefishes, pleuronectiformes, skates, torpediniformes, and boreal squid. Marine pelagic finfish species that regularly occur in the shallow waters of EL 1107 include sharks, herring and mackerel.

Marine demersal finfish species that regularly occur in the deeper waters of EL 1107 include chimaeras, hagfish, backfin tapirfishes, spiny eels, deepsea smelts, spookfishes, snaggletooths, viperfishes, greeneyes and spiderfishes, barracudinas, lancetfishes, daggertooths, batfishes, ceratioid anglerfishes, cutthroat eels, bobtail snipe eels and black dogfish. The pelagic zones of the deep sea are dominated by small fish of the families of lanternfishes, lightfishes, and silver hatchetfishes. Other mesopelagic deep-water marine fish include slickheads (Alepcephalidae), loosejaws, scaled dragonfishes, searsids, and pearleyes.

There are seven fish species listed under species at risk and or COSEWIC:

- Atlantic cod (*Gadus morhua*) – COSEWIC species of special concern
- Northern wolffish (*Anarhichas denticulatus*) – SARA, COSEWIC threatened
- Spotted wolffish (*Anarhichas minor*) – SARA, COSEWIC threatened
- Atlantic wolffish (*Anarhichas lupus*) - SARA, COSEWIC threatened
- Porbeagle shark (*Lamna nasus*) – SARA, pending consultation, COSEWIC endangered
- White shark (*Carcharodon carcharias)* – SARA, pending consultation, COSEWIC endangered
- Shortfin mako (*Isurus oxyrinchus)*- COSEWIC threatened
- Cusk (*Brosme brosme*) – COSEWIC threatened

According to the Terra Nova EIS "at least 45 species of fish have been identified as early life stages (i.e., eggs, larvae or pelagic juveniles) in the ichthyoplankton of the Grand Banks and inshore waters of Newfoundland". The most frequently reported of these have been:

- Atlantic herring (Clupea harengus harengus)
- Capelin (Mallotus villosus)
- Atlantic cod (Gadus morhua)
- Sand lance (Ammodytes sp.)
- Redfish (Sebastes sp.)
- Seasnail (Liparis atlanticus)
- Witch flounder (Glyptocephalus cynoglossus)
- American plaice (Hippoglossoides platessoides)
- Yellowtail flounder (Pleuronectes ferruginea).

Seven of these (sand lance, capelin, redfish, witch flounder, yellowtail flounder, American plaice and cod) made up 87% of the total number of fish larvae taken during the Mobil oceanographic cruises in 1980 and 1981 (Petro-Canada 1996). Except for sand lance, all are commercially important species in the Grand Banks or inshore fisheries. The potential effects on marine fish that occur in the Project Activity area will be included in the EA.

3.9.1 Species at Risk

The following is a list of species in the Project Area with their designation under one or more endangered species acts or conventions: *Species at Risk Act* (SARA), Committee on the Status of Endangered Wildlife in Canada (COSEWIC), and *Endangered Species Act* – Government of Newfoundland and Labrador

Blue whale (*Balaenoptera musculus*) (Atlantic population) – SARA, COSEWIC endangered
Fin whale (*Balaenoptera phyalus*) – SARA, COSEWIC special concern
Bowhead whale (Balaena mysticetus) – COSEWIC special concern
Sowerby's beaked whale – SARA, COSEWIC special concern
Harbour porpoise (*Phocoena phocoena*) – SARA, threatened Schedule 2; COSEWIC special concern
Killer Whale (Orcinus orca) – COSEWIC special concern
Humpback whale (Megaptra novaeangliae) – SARA special concern
Atlantic walrus (*Odobernus rosmarus rosmarus*) – COSEWIC special concern
Leatherback sea turtle (*Dermochelys coriacea*) – SARA, COSEWIC endangered

Atlantic cod (*Gadus morhua*) – COSEWIC special concern
Northern wolffish (*Anarhichas denticulatus*) – SARA, COSEWIC threatened
Spotted wolffish (*Anarhichas minor*) – SARA, COSEWIC threatened
Atlantic wolffish (*Anarhichas lupus*) - SARA, COSEWIC threatened
Porbeagle shark (*Lamna nasus*) – SARA, pending consultation, COSEWIC endangered
White shark (*Carcharodon carcharias)* – SARA, pending consultation, COSEWIC endangered
Shortfin mako (*Isurus oxyrinchus)*- COSEWIC threatened
Cusk (*Brosme brosme*) – COSEWIC threatened
Ivory Gull (*Pagophila eburnea*) - SARA special concern
Harlequin Duck (*Histrionicus histrionicus*) – SARA, COSEWIC special concern, Provincial vulnerable

The potential effects on species currently under the assessment by COSEWIC and SARA that occur in the Project Activity area will be included in the EA. Created in 2005, Science Advisory Reports include traditional Stock Status Reports, Ecosystem Status Reports, and Habitat Status Reports. Moreover, management strategies, frameworks and guidelines on the assessment or evaluation on specific issues, impacts of human activities on ecosystem components as well as recovery assessments on a species or population, are also included in this series. DFO has many internal publication options in which to present assessment on marine species at risk. The Science Advisory Reports include traditional Stock Status Reports, Ecosystem Status Reports, and Habitat Status Reports, as well as Research Documents, and Proceedings. COSEWIC and SARA list will be reviewed for the EA report. There are no COSEWIC/SARA listings for smooth skate, spiny dogfish, basking shark (Atlantic), and barndoor skate.

3.9.2 Sensitive Areas

There are two recognized sensitive areas near the Project Activity Area. The National Marine Conservation Areas (NMCA) program was initiated in 1986 and is administered by Parks Canada. The Labrador Shelf marine region is not currently represented in the NCMA system, but two areas have been identified as representative marine areas. Hamilton Inlet, east of Lake Melville, extends offshore to include representation of the Hamilton Bank is closest to the Project Area.

The Gannet Islands Ecological Reserve (established 1983) is an archipelago of seven islands and surrounding marine component at the mouth of Sandwich Bay. It is the largest seabird colony in Labrador and has the largest Razorbill colony in North America. It also hosts important breeding populations of Atlantic Puffins and Common Murres. It is the largest known moult site for Harlequin Ducks in eastern North America.

The IBA (Important Bird Area) program is an international conservation initiative coordinated by Birdlife International and its co-partners Bird Studies Canada and Nature Canada. An IBA is a site providing essential habitat for one or more species of breeding or non-breeding birds. These sites may contain threatened species, endemic species, species representative of a biome, or highly exceptional concentrations of birds. Sites are identified using a set of standardized and internationally agreed upon criteria. IBAs can be identified under four main categories: sites regularly holding large numbers of threatened species; sites regularly holding endemic species or species with restricted ranges; sites regularly holding an assemblage of species largely restricted to a biome or a unique or threatened community type; and sites where birds congregate in large numbers when breeding, in winter, or during migration. IBAs are identified according to their importance (based on specific bird population thresholds) as either globally, continentally, or nationally important (IBA website). There are a total of 10 IBAs outside the Project Activity Area along the coast, including the Gannett Islands.

The potential effects on sensitive area and Ecologically and Biologically Significant Areas (ESBAs) that occur in the Project Activity area will be included in the EA.

3.9.3 Other Users

3.9.3.1 Commercial Fishery

The Project Area occurs with NAFO Area primarily in 2J and to a lesser extent 2H. During consultation meetings in various Labrador communities for the SEA, crab, shrimp, and Greenland halibut (turbot) were recognized as the commercial fish species in the Labrador Shelf SEA Area. Atlantic cod, rock cod, scallop, salmon and charr were also recognized as locally important species.

The Unit Area harvest occurs year-round within the Project Activity Area, with the highest between February to March and June to September owing in large part to ice and weather conditions. This is also when offshore exploration is likely to be active for the same reasons. As a consequence, there is very likely to be temporal overlap between exploration activities and commercial fisheries. Depending on locations chosen by the petroleum industry, there may also be spatial overlap. Mitigation measures are well established in the petroleum industry related to fisheries and expectation by commercial fishers are understood.

3.9.3.2 Research Surveys

Through sentinel fisheries, commercial fishermen and Department of Fisheries and Oceans (DFO) scientists work in partnership, gathering biological data on groundfish stocks under moratorium. Under sentinel fishery projects, commercial fishermen, who are specially trained in data collection methods, gather information on groundfish stocks by fishing in pre-established areas under pre-established guidelines.

Separate research vessel surveys are undertaken by DFO, in collaboration with fishers and fishers have their own surveys. Other fisheries-related organisations that may conduct surveys in the Project Activity Area which will be described in the EA report.

3.9.3.3 Marine Traffic

The Woodward Group provides shipping service along the coast of Labrador. It is called the Coastal Labrador Service and is supported by the MV Northern Ranger and MV Astron which runs coastal supplies from Cartwright to ports north as far as Nain. Because this service virtually hugs the coast there will be no interaction with the seismic vessels in the Project Activity Area.

The tourism industry is increasing in Labrador and is playing a more important role in rural economies than it has before. Scenic, natural and cultural attractions translate into economic opportunities for the resident population and provide domestic, national and international travelers with world-class outdoor recreation activities. The Project Area is about 100 km off the

coast thus relevant offshore-related tourism activities discussed in the SEA include cruise ship and private vessel (sailing) visitation.

The cruise ship industry is promoted by a tourist industry association (Cruise Association of Newfoundland and Labrador (CANAL)) and supported by both the federal and provincial governments. The cruise routing in Labrador is mainly from south to north and return; however, the east to west routing from Europe ports via Iceland, Greenland, Baffin and south to Labrador is being developed. Developments in Labrador such as the Torngat National Park Reserve will increase tourist interest and cruise ships is considered one of the most convenient means of visiting such areas. CANAL (2007) specifies 10 ports of call in Labrador: Saglek Fjord, Nain, Hebron, Hopedale, Rigolet, Northwest River, Happy Valley Goose Bay, Cartwright, Battle Harbour and Red Bay.

3.9.3.4 Other Petroleum Operators

Three petroleum Operators have activities planned in this region as shown on Figure 1. Investcan Energy will coordinate temporal and spatial scales with the other two Operators to minimize potential effects on resources and users. This is important in the discussion on cumulative effects in the EA report.

4.0 MITIGATION

The following mitigation measures will be incorporated into the seismic survey plans:

- Timing is one of the more effective mitigation measures. Although the EA will evaluate the potential for adverse impacts to the VECs, it is prudent to consider the seasonality and seasonal sensitivity of commercially and ecologically important resources in the Project and Affected Areas to reduce the number of interactions.
- Any handling of stranded birds will follow CWS and industry protocols.
- A dedicated Environmental Observer will be on board the seismic vessel to record marine birds, marine mammals and marine turtles, as per protocol.
- Avoidance of bird colonies by vessel.
- Vessel compliant with audit prior to survey.
- Maintenance of streamer equipment and responsible management of such equipment.
- Adherence to the *Statement of Canadian Practice on the Mitigation of Seismic Noise in the Marine Environment,* to the extent reasonably practical.
- To minimize sudden changes in noise levels, a 30 minute ramp up procedure will be implemented.
- Before start of the operations, a meeting will be held with Investcan Energy representatives and seismic company representatives to review sail lines, scheduling, anticipated fishing vessels and gear types, mitigating measures, expectations of all parties and Emergency Response Plans.
- A 20 to 40 minute ramp-up procedure will be undertaken.
- Ramping up will be delayed if a marine mammal is observed in the 500 m safety zone.
- The Environmental Observer will ensure the delay or shut down of seismic operations if endangered or threatened whales are present within 500 m.
- Air sources will be shut down or reduced to a smaller air source while the vessel is doing turns between survey lines.
- Any re-start of the air source array will follow the ramping up procedure.
- Collision avoidance practices, including constant speed and course maintained by seismic and support vessels.
- Vessels will maintain a steady course and speed, and use existing travel routes, where possible.
- A Notice to Mariners on the location and scheduling of seismic activities will be issued.

- Communication mechanisms will be developed with the fishing industry and DFO research surveys.
- The Fisheries Liaison Observer on the vessel will monitor fishing activity in the vicinity of the seismic vessel and serve as a liaison between the fishing vessels and the seismic vessel;
- Investcan Energy will comply with C-NLOPB's compensation guidelines.
- Discharges and emissions from the seismic vessel will include standard vessel solid and liquid wastes streams related to normal vessel activities, atmospheric emissions, light and noise emissions.
- All operational discharges and emissions will comply with the requirements of the Offshore Waste Treatment Guidelines, *Canada Shipping Act*, MARPOL and NWest's Environmental Protection Plan.

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