Environmental Assessment of CGG's Newfoundland Offshore Seismic Program, 2016-2025 Addendum

Prepared by

LGL LIMITED
environmental research associates

Prepared for

CGG

July 2016
LGL Project No. FA0067

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INTRODUCTION

This Addendum document contains responses to comments provided by reviewers of the Environmental Assessment of CGG's Newfoundland Offshore Seismic Program, 2016-2025.

GENERAL COMMENTS

Fish, Food and Allied Workers (FFAW/Unifor)

General Comment #1: The timing of the activity coincides with the highest harvesting activity of our Membership.

> ***Response:*** CGG concurs with the FFAW/Unifor that the timing of CGG's proposed geophysical activities coincides with the time of highest harvesting activity by the FFAW/Unifor membership.

General Comment #2: The correct convention for the areas would be NAFO Divisions 3KLMNOPs and 4Vs, not 3K, 3L, 3M, 3N, 3O, 3Ps and 4Vs. There are multiple cases of this error in Section 4.3 Fisheries.

> ***Response:*** CGG notes the correct convention for naming NAFO Divisions.

Fisheries and Oceans Canada (DFO)

General Comment #1: The CGG seismic program area overlaps with a recently initiated Environmental Studies Research Funds (ESRF) Study on potential interactions of seismic sound in the marine environment and marine invertebrates, namely crab. This study is being led by Dr. Corey Morris with DFO Science NL Region. The coordinates of the Study Site and Control Site (Sites 1 and 2 respectively on attached maps and spreadsheet) are provided. The research experiment is scheduled to commence August 15, 2016. The area is to be avoided two weeks prior to this date and to be avoided after the date until notified by the C-NLOPB.

As such the ESRF Study Areas and related restrictions and/or avoidance should be reflected within any response relative to review of the EA Amendment and any subsequent EA Updates for seismic activities planned by CGG.

> ***Response:*** CGG notes the DFO directive related to spatial and temporal avoidance of the ESRF Study Areas. CGG will not conduct seismic survey operations within 70 km of either Study Site (see Appendix 1 for maps and coordinates of Study Site locations) from August 1, 2016 until the experiment is completed (i.e., mid- to late-September 2016). The C-NLOPB will notify CGG when the spatial and temporal avoidance period is over.

SPECIFIC COMMENTS

Canada – Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB)

Specific Comment #1: § 1.0 Introduction, page 1 – the *Canada-Newfoundland Atlantic Accord Implementation Act* is incorrectly reference. It should be *Canada-Newfoundland and Labrador Atlantic Accord Implementation Act*. Please correct accordingly.

> ***Response:*** The text referred to above should be revised to read as follows: "*Canada-Newfoundland and Labrador Atlantic Accord Implementation Act*".

Specific Comment #2: § 2.0 Project Description, page 4 – what types of concurrent surveys may be conducted in any given year? Additionally, are these two types of surveys assessed and do the mitigations address and discuss the concurrent activity of the two surveys?

> ***Response:*** The possible combinations of concurrent seismic survey types that may be conducted by CGG in any given year during 2017-2015 are 2D-2D, 2D-3D, and 3D-3D. Since 4D seismic surveying is time-lapse seismic reservoir monitoring using 3D techniques, 4D has not been included in the above combinations of concurrent seismic survey types.
>
> The potential effects of activities associated with both 2D and 3D seismic surveying on the various VECs have been assessed in § 5.0 of the EA. As indicated in § 5.8 of the EA, cumulative effects within the Project have been assessed. The residual effects described in § 5.7 of the EA include any potential cumulative effects resulting from the CGG seismic program activities in the Project Area, including the residual effects of two concurrent seismic surveys being conducted by CGG. Thus the mitigations discussed throughout the EA and summarized in § 5.9 also pertain to concurrent activity of two surveys.

Specific Comment #3: § 2.2 Project Overview, page 5 –The maximum amount of 2D, 3D and/or 4D to be collected annually between 2017 and 2025 should be identified and included in the effects assessment.

> ***Response:*** The maximum annual amounts of 2D, 3D and 4D seismic surveying that would be conducted by CGG between 2017 and 2015 are 40,000 km, 15,000 km^2, and 5,000 km^2, respectively.
>
> ***C-NLOPB Comment on CGG Response:*** The temporal scope of the program is 2016 to 2025. The reply to annual amount of seismic acquisition should reflect the same temporal scope.

Response: The maximum annual amounts of 2D, 3D and 4D seismic surveying that would be conducted by CGG between 2016 and 2025 are 40,000 km, 15,000 km^2, and 5,000 km^2, respectively.

Specific Comment #4: § 2.2 Project Overview, page 5 – There does not appear to be a discussion of the use of echo sounders and side scan sonar although it is identified as having potential interactions on various VECs in *Section 5.7 Effects of the Project Activities on the Environment*.

Response: The following text should be included in § 2.0 of the EA.

"The seismic vessel will be equipped with downward-facing echosounders that operate at frequencies ranging from 50 kHz to 200 kHz. They will be used to collect water depth information. Either the guard/picket vessel or the supply vessel will be equipped with a side scan sonar to collect imagery of the ocean floor. In addition, sound velocity profiles will also be acquired in the water column at various locations within the survey area. This is a routine practice during seismic programs. Sound velocity profiles allow for more accurate interpretation of the acoustic data (i.e., seismic pulses) recorded by the seismic streamer. These data are acquired with a small, passive device that will be deployed by one of the support vessels. The device measures pressure, temperature, and salinity, from which the speed of sound can be calculated."

Specific Comment #5: § 2.2 Project Overview, page 5 – As per the *Geophysical, Geological, Environmental and Geotechnical Program Guidelines* (C-NLOPB 2012), operators are expected to implement both a seabird and marine mammal observation program throughout survey activities. Such a program should involve a designated observer trained in marine mammal **and seabird** observations. This should also be addressed in the mitigation measures identified in *Table 5.1 Summary of Mitigations Measures by Potential Effect* on page 137.

Response: The following text should be included in Table 5.1 of the EA.

"Qualified and experienced MMOs will be employed throughout survey activities to monitor/observe marine mammals, sea turtles and seabirds. Employment of qualified and experienced MMOs is considered a mitigation for the following potential effects of project activities.

- Temporary or permanent hearing damage/disturbance to marine mammals, sea turtles and seabirds; and
- Temporary or permanent hearing damage/disturbance to Species at Risk."

Specific Comment #6: § 2.7 Environmental Monitoring, page 12 – there seems to be a lot of description for the MMOs and very little with respect to seabird observations. See comment above with respect to § 2.2 Project Overview.

Response: With respect to LGL protocol, seabird observations are conducted 10 to 15 times daily, each observation period lasting 10 minutes. The seabird observations are conducted by an experienced MMO, during which time a second experienced MMO is observing for marine mammals and sea turtles. Therefore, marine mammal and sea turtle observations are continuous throughout the daytime period.

Specific Comment #7: § 5.1.1.1 CCG's Consultation Policy and Approach, page 132 – the title of this section and the beginning of the first sentence incorrectly identifies the proponent as CCG. Please correct to CGG.

Response: The title of § 5.1.1.1 of the EA should be revised to read as follows: **CGG's Consultation Policy and Approach**.

Specific Comment #8: § 5.5.1 Summary of Mitigation Measures, Table 5.1, page 137 – Under "Fishing gear damage" one of the primary mitigations for this potential effect is the use of a "support vessel". Will this be a dedicated vessel?

Response: The support vessel referred to in § 5.5.1 of the EA will be a dedicated picket/guard vessel. The Table 5.1 text referred to above should be revised to read as follows: "Use of a dedicated picket/guard vessel."

Specific Comment #9: § 5.9 Mitigation Measures and Follow-up, page 180 – "... activities by means of a CCG "Notice to Mariners" and a ... Please correct to CGG.

Response: The text referred to in § 5.9 of the EA should be revised to read as follows: "…activities by means of a CGG 'Notice to Mariners' and a …"

Fisheries and Oceans Canada (DFO)

Specific Comment #1: § 2.1 Spatial and Temporal Boundaries, page 4 and § 2.4.1.1 Physical Environment and Potential Effects on the Project, page 10 – Both sections describe water depths as ranging from "...<100 m to > 4,000 m…" which implies all water depths. Reference to water depth should be corrected to indicate that it ranges between 100 and 4,000 m this should be clarified accordingly.

Response: The Project Area proposed by CGG is characterized by a wide range of water depths. The region of the Project Area with minimum water depth is located inside the 100 m isobath while the region of the Project Area with maximum water depth is located outside the 4,000 m isobath.

Specific Comment #2: § 4.2.2 Fish – Northern Shrimp 2nd sentence 3rd paragraph, page 54 - the reference to "…..*snow crab*….." in this sentence should be removed and replaced with "...northern shrimp…"

Response: The reference to 'snow crab' in **§ 4.2.2 Fish – Northern Shrimp** should be revised to 'northern shrimp'.

Specific Comment #3: § 4.2.3 Fish and Fish Habitat Data Gaps Identified in Relevant SEAs, page 60 - regarding the last sentence in this section *"Any new information that has been made available since the three SEAs were completed…"* there are two SEAs referenced in this section, as such the last sentence be amended to make reference to "*…two SEAs….*".

Response: The sentence referred to in the comment should be revised to read as follows:

"Any new information that has been made available since the two SEAs were completed is noted throughout § 4.2."

Specific Comment #4: § 4.3.4 Traditional and Aboriginal Fisheries, pages 85-89 – there are a number of sentences (e.g. 3rd sentence 1st paragraph (page 85), 1st sentence 1st paragraph and last sentence 1st paragraph (page 89) that incorrectly reference "*….DFO, Resource Management and Aboriginal Affairs…….*" These sentences should be amended to refer to "*…DFO, Resource Management and Aboriginal Fisheries…..*"

Response: All references to "DFO, Resource Management and Aboriginal Affairs" in **§ 4.3.4 - Traditional and Aboriginal Fisheries** should be revised to "DFO, Resource Management and Aboriginal Fisheries".

Specific Comment #5: § 5.5 Mitigation Measures, page 136 – the 4th bullet should also include reference to the *Species at Risk Act.* This section should also note that the *Marine Mammal Regulations (MMR)* under the *Fisheries Act* is currently undergoing amendment. While public consultation on proposed amendments have only just recently ended it should be noted that Schedule 11 of the proposed amended *MMR* provide approach distances for marine mammals based on species, vehicle (vessel, aircraft, etc.), area and timing. Given that the proposed seismic survey(s) are scheduled to run from 2016 to 2025 it is recommended that the proponent be aware of any potential implications that may arise if any proposed amendments to *MMR* are accepted during the timeframe covered by the proposed survey program.

Response: The need of a reference to the *Species at Risk Act* and indication of ongoing amendment of the Marine Mammal Regulations (MMR) under the *Fisheries Act* are noted by CGG. The program will comply with all regulations and future amendments of the MMR.

Specific Comment #6: § 5.5 Mitigation Measures, page 137 – the last sentence of Section 5.5 (page 137) notes that "*Details of the seven mitigation categories are provided in § 5.5 of LGL (2015a,b).*" It should be noted however that six (not seven) mitigation categories are listed on page 136 and described in LGL 2015a and b, as such this sentence should be corrected appropriately.

Response: The sentence referred to above should be revised to read as follows:

"Details of the six mitigation categories are provided in § 5.5 of LGL (2015a,b)."

Specific Comment #7: §5.7.4.1 Sound, pages 141-144 – The 2nd sentence 3rd paragraph (page 143) which notes that "*Available experimental data suggest that there may be physical impacts on the fertilized eggs of snow crab and on the egg, larval, juvenile and adult stages of cod at very close range*" requires an appropriate reference. The 1st sentence 4th paragraph (page 143) which notes that "*Snow crab, thought to be sensitive to the particle motion component of sound only...*" requires an appropriate reference and since this is the first mention of particle motion a definition / description should be provided. The 1st sentence 6th paragraph (page 143) which notes that "*The physical effects of exposure to sound with frequencies >500 HZ are negligible, based on the available information from the scientific literature*" requires an appropriate reference.

Response: The statements and associated references, and the definition of particle motions are provided below.

"*Available experimental data suggest that there may be physical impacts on the fertilized eggs of snow crab and on the egg, larval, juvenile and adult stages of cod at very close range*" (Booman et al. 1996; Christian et al. 2003; Sierra-Flores et al. 2015).

"*Snow crab, thought to be sensitive to the particle motion component of sound only"* (Popper et al. 2001).

Particle motion is the component of underwater acoustic stimuli generated partly by hydrodynamic flow near the acoustic stimulus source and partly by the oscillations associated with the sound pressure waves as they propagate from the acoustic source as a cyclic compression and rarefaction of water molecules (Higgs et al. 2006).

"*The physical effects of exposure to sound with frequencies >500 HZ are negligible, based on the available information from the scientific literature*." This statement is based on several studies in the literature. Most fishes and invertebrates appear to be most sensitive to very low frequency sound (i.e., <500 Hz). Under natural conditions, the physical effects of exposure to anthropogenic sound with frequencies <500 Hz appear to be *negligible*. Even less physical effect has been observed after exposure to the higher frequency sound.

Specific Comment #8: § 5.7.4.1 Sound (Fish and Fish Habitat VEC), pages 141-144 – this section should include a short summary discussion (similar in detail to that provided for physical effects) of the potential behavioural effects in fish in relation to seismic sound (e.g. startle response; change in swim speed, depth and direction; schooling; reproduction; recruitment; feeding) that are reported in literature including among others - Popper and Hawkins 2012 Advances in Experimental Medicine and Biology

Vol 730 - and other project EAs and applicable SEAs. This will also provide support to the linkage to discussion on effects of seismic sound on Fisheries VEC noted in Section 5.7.5.1 of the EA Report.

> ***Response:*** Studies suggest that effects on fish behaviour due to exposure to airgun sound are temporary in nature, and that response thresholds for various demersal and pelagic species are quite variable. Numerous studies have reported startle/alarm responses by fish (Pearson et al. 1992; Fewtrell and McCauley 2012). Pearson et al. (1992) also reported observations of localized distributional shifts, tightening of schools, and random movement and orientation. Løkkeborg et al. (2012) reported differences between species in terms of catchability after being exposed to seismic sound. They observed higher catches in gill nets but lower catches on baited hooks, possibly resulting from increased random movement by the fish causing a higher incidence of fish being caught up in gill nets but a lower incidence of fish targeting baited hooks. There is some thought that the degree of behavioural response by fishes to exposure to anthropogenic sounds such as seismic airgun sound depends on what natural behaviour the fish is exhibiting at the time of exposure. For example, fish exhibiting reproductive and/or feeding behaviour may have a higher response threshold to anthropogenic sound than fish exhibiting migratory behaviour. More study is obviously required to test this hypothesis. A more comprehensive discussion regarding the behavioural effects of exposure to seismic sound on fishes is contained in the appendices of recently completed seismic EAs (e.g., LGL 2015a,b).

Specific Comment #9: § 5.7.7.1 Sound (Marine Mammals and Sea Turtle VEC), pages 159-163 – with respect to the discussion of Masking while it is safe to say (see 4th sentence on page 160) that "*Based on past and current reviewed research, the potential for masking of marine mammal calls and/or important environmental cues is considered low….*" it is felt that this section should provide a short summary (similar to that provided on pages 161 and 162 for Disturbance, Hearing Impairment and Non Auditory Physical Effects) of some of the potential effects on masking that are provided within among others Erbe *et al.* 2015 and Guan *et al.* 2015.

> ***Response:*** Erbe et al. (2015) is a review paper and therefore does not present any new relevant information that would not have been covered in previous SEAs and EAs. The final Scoping Document indicated that only new information should be included in the current EA. Guan et al. (2015) was only briefly summarized in the EA as it was specific to a study in very shallow water (<15 m) and has little relevance to the Project Area due to the differences in sound propagation and the impact of reverberation in such shallow environments.
>
> ***DFO Comment on CGG Response:*** It is felt that the response offered to DFO does not provide the short summary of potential effects of masking that are provided for within Erbe et al. (2015). It is felt that the project specific EA should/could still benefit from a short summary of the potential effects of masking rather than referring readers back to SEAs completed in 2010 and 2014.

Response: The following text provides a summary of the potential effects of masking.

"Masking is the obscuring of sounds of interest by interfering sounds, generally at similar frequencies. Introduced underwater sound will, through masking, reduce the effective communication distance of a marine mammal species if the frequency of the source is close to that used as a signal by the marine mammal, and if the anthropogenic sound is present for a significant fraction of the time (Richardson et al. 1995; Clark et al. 2009). Conversely, if little or no overlap occurs between the introduced sound and the frequencies used by the species, communication is not expected to be disrupted. Also, if the introduced sound is present only infrequently, communication is not expected to be disrupted much if at all. The biological repercussions of a loss of communication space, to the extent that this occurs, are unknown.

The duty cycle of airguns is low; the airgun sounds are pulsed, with relatively quiet periods between pulses. In most situations, strong airgun sound will only be received for a brief period (<1 s), with these sound pulses being separated by at least several seconds of relative silence, and longer in the case of deep-penetration surveys or refraction surveys.

Although masking effects of pulsed sounds on marine mammal calls and other natural sounds are expected to be limited, there are few specific studies on this. Some whales continue calling in the presence of seismic pulses and whale calls often can be heard between the seismic pulses (e.g., Richardson et al. 1986; McDonald et al. 1995; Greene et al. 1999a,b; Nieukirk et al. 2004, 2012; Smultea et al. 2004; Holst et al. 2005a,b, 2006, 2011; Dunn and Hernandez 2009; Broker et al. 2013; Cerchio et al. 2014). However, some of these studies found evidence of reduced calling (or at least reduced call detection rates) in the presence of seismic pulses (Clark and Gagnon 2006; Blackwell et al. 2013). Di Iorio and Clark (2010) found that blue whales in the St. Lawrence Estuary increased their call rates during operations by a lower-energy seismic source. There is some evidence that fin whale song notes recorded in the Mediterranean had lower bandwidths during periods with versus without airgun sounds (Castellote et al. 2012).

Among the odontocetes, there has been one report that sperm whales ceased calling when exposed to pulses from a very distant seismic ship (Bowles et al. 1994). However, more recent studies of sperm whales found that they continued calling in the presence of seismic pulses (Madsen et al. 2002; Tyack et al. 2003; Smultea et al. 2004; Holst et al. 2006, 2011; Jochens et al. 2008). Dolphins and porpoises are also commonly heard calling while airguns are operating (Gordon et al. 2004; Smultea et al. 2004; Holst et al. 2005a,b, 2011; Potter et al. 2007). Masking effects of seismic pulses are expected to be negligible in the case of the smaller odontocetes, given the intermittent nature of seismic pulses plus the fact that sounds important to them are predominantly at much higher frequencies than are the dominant components of airgun sounds.

Pinnipeds have best hearing sensitivity and/or produce most of their sounds at frequencies higher than the dominant components of airgun sound, but there is some overlap in the frequencies of the airgun pulses and the calls. However, the intermittent nature of airgun pulses presumably reduces the potential for masking.

Some cetaceans are known to increase the source levels of their calls in the presence of elevated sound levels, shift their peak frequencies in response to strong sound signals, or otherwise modify their vocal behaviour in response to increased noise (Dahlheim 1987; Au 1993; reviewed in Richardson et al. 1995:233*ff*, 364*ff*; also Lesage et al. 1999; Terhune 1999; Nieukirk et al. 2005; Scheifele et al. 2005; Parks et al. 2007a, 2009, 2011, 2012; Hanser et al. 2009; Holt et al. 2009; Di Iorio and Clark 2010; McKenna 2011; Castellote et al. 2012; Melcón et al. 2012; Risch et al. 2012; Tyack and Janik 2013). It is not known how often these types of responses occur upon exposure to airgun sounds."

Specific Comment #10: § 5.7.7.1 Sound (Marine Mammals and Sea Turtle VEC) – Disturbance, page 161 –the last sentence on page 161 "*Based on available data, it is likely that sea turtles would exhibit behavioural changes and/or localized avoidance near a seismic vessel*" requires a reference as well a very brief summary / description of "behavioural changes" that are likely to occur in sea turtles should be provided in this paragraph accordingly.

Response: References and summaries associated with conclusions presented in the EA are provided in previous SEAs and EAs cited in the current EA. Some the key references in the SEAs and previous EAs include O'Hara and Wilcox (1990), McCauley (1994, 2000a,b), Moein et al. (1994), Pendoley (1997), and Weir (2007). Available evidence suggests that the zone of avoidance around seismic sources is not likely to exceed a few kilometers (McCauley et al. 2000a,b).

Specific Comment #11: § 5.7.7.1 Sound (Marine Mammals and Sea Turtle VEC) Hearing Impairment, page 162 – Regarding the 2nd sentence of the 5th paragraph examples of the "*Several aspects of the planned monitoring and mitigation measures for this project are designed to detect marine mammals and sea turtles occurring near the airgun array*" should be provided either here or more likely in the discussion of project mitigations and monitoring (Sections 5.5 and 5.9). If monitoring other than visual monitoring of the 500 m safety zone is planned then the EA Report (e.g. Sections 5.5 and/or 5.9) should specify same and a linkage provided in the above noted 4th paragraph.

Response: Only visual monitoring is planned. The aspects of the monitoring and mitigation plan include the use of trained and experienced MMOs, the use of the ship's bridge for MMOs from which to conduct observations (i.e., good sight lines all around the vessel), and the use of reticle binoculars and other distance estimators to accurately estimate the location of the animal with respect to the safety zone.

Specific Comment #12: § 5.9 Mitigation Measures and Follow up, pages 180-183 – the 6th and 7th sentences of the 3rd paragraph on page 182 note that *"...observers will watch for marine mammals and sea turtles when the air gun array is active .."* and that *"…the array will be shut down whenever endangered and/or threatened marine mammals or sea turtles are sighted within the safety zone"*. That being said it is not clear what measures will be employed to monitor for *SARA* listed endangered and/or threatened mammals and sea turtles during periods of darkness and/or low visibility. This should be clarified accordingly.

> ***Response:*** No additional mitigation measures will be employed during periods of darkness and/or low visibility.

Fish, Food and Allied Workers (FFAW/Unifor)

Specific Comment #1: § 5.7.4.1 Sound, page 143 - ""In the case of eggs and larvae, it is likely that the numbers negatively affected by exposure to seismic sound would be negligible when compared to those succumbing to natural mortality," is a very strong statement to make. It is noted that LGL identifies and acknowledges the data gaps existent in this base of knowledge and that "available experimental data suggest that there may be physical impacts on the fertilized eggs of snow crab and on the egg, larval, juvenile and adult stages of cod at very close range." Therefore, the former statement is problematic as a sound knowledge set to back the statement up is lacking. Likewise, stating that spatial and temporal avoidance of key life stages, as well as ramp-up procedures, should mitigate these effects is unsatisfactory when we do not know the effects of seismic activity on these species.

Additionally, "Limited data regarding physiological impacts on fish and invertebrates indicate that these impacts are both short-term and most obvious after exposure at close range," states the key issue – "limited data." Until a more thorough examination has been made and conclusions have been agreed upon we cannot be sure that effects are indeed short-term.

> ***Response:*** As is stated in the EA, the predictions made about the effects of seismic activities on VECs are based on what is currently available in the literature, both primary and grey, and on professional judgement. As is the case with all things scientific, there is never too much data. Every year there is more scientific evidence added to the databases related to the potential effects of exposure to seismic airgun sound on marine biota. Over time, the degree of certainty associated with the effects predictions will increase as more and more data become available.

Specific Comment #2: Appendix A, page A-7 - Johan Joensen and Robyn Lee are identified as participants in consultation from our organization. Robyn Lee was the Petroleum Industry Liaison at time of consultation, not Johan Joensen as identified. Also, I, Dwan Street, was also present in consultation.

> ***Response:*** CGG notes that Robyn Lee was the Petroleum Industry Liaison (PIL) at the time of consultation, not Johan Joensen. Additionally, CGG notes that Dwan Street was also present at the consultation meeting.

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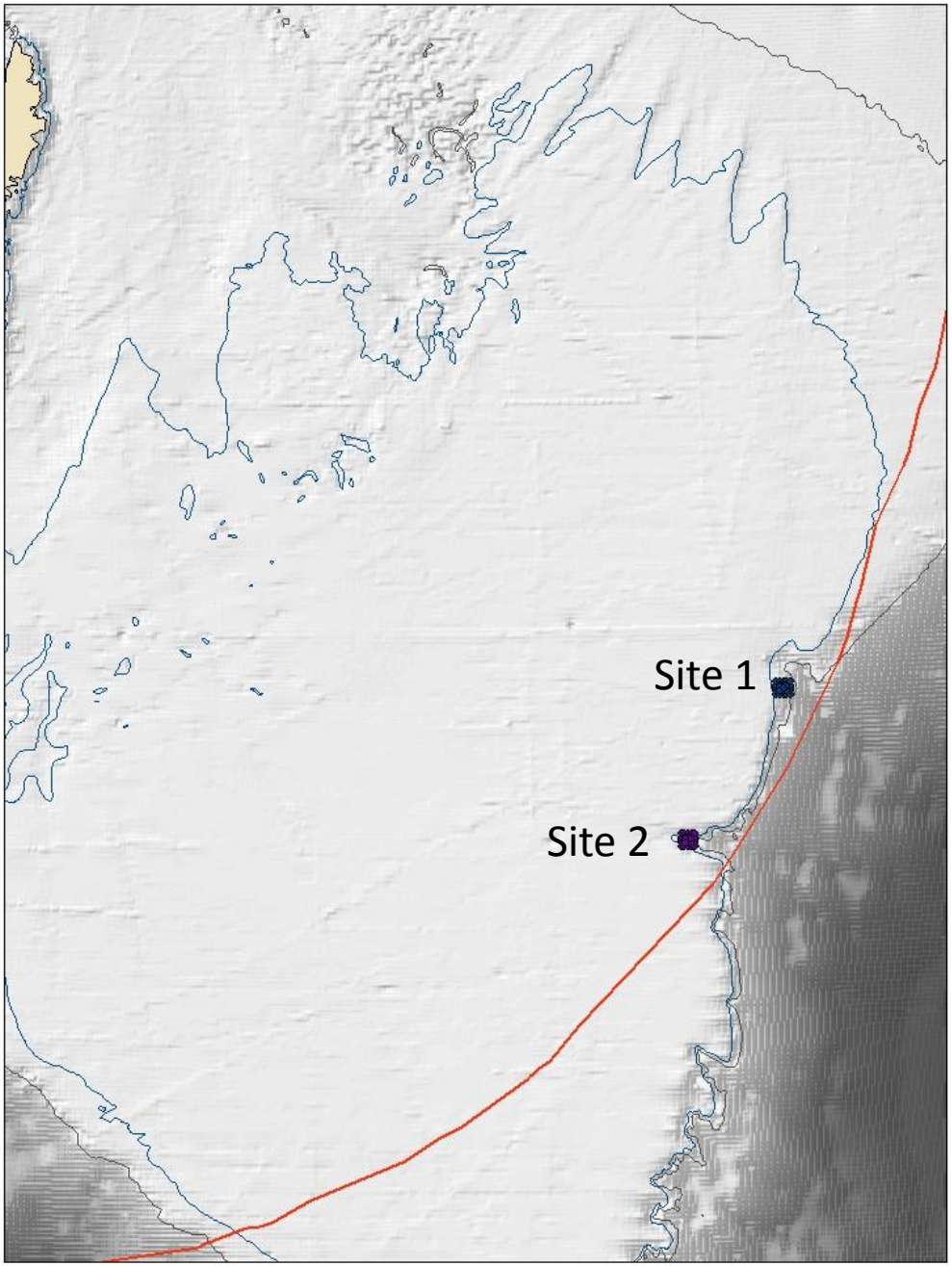
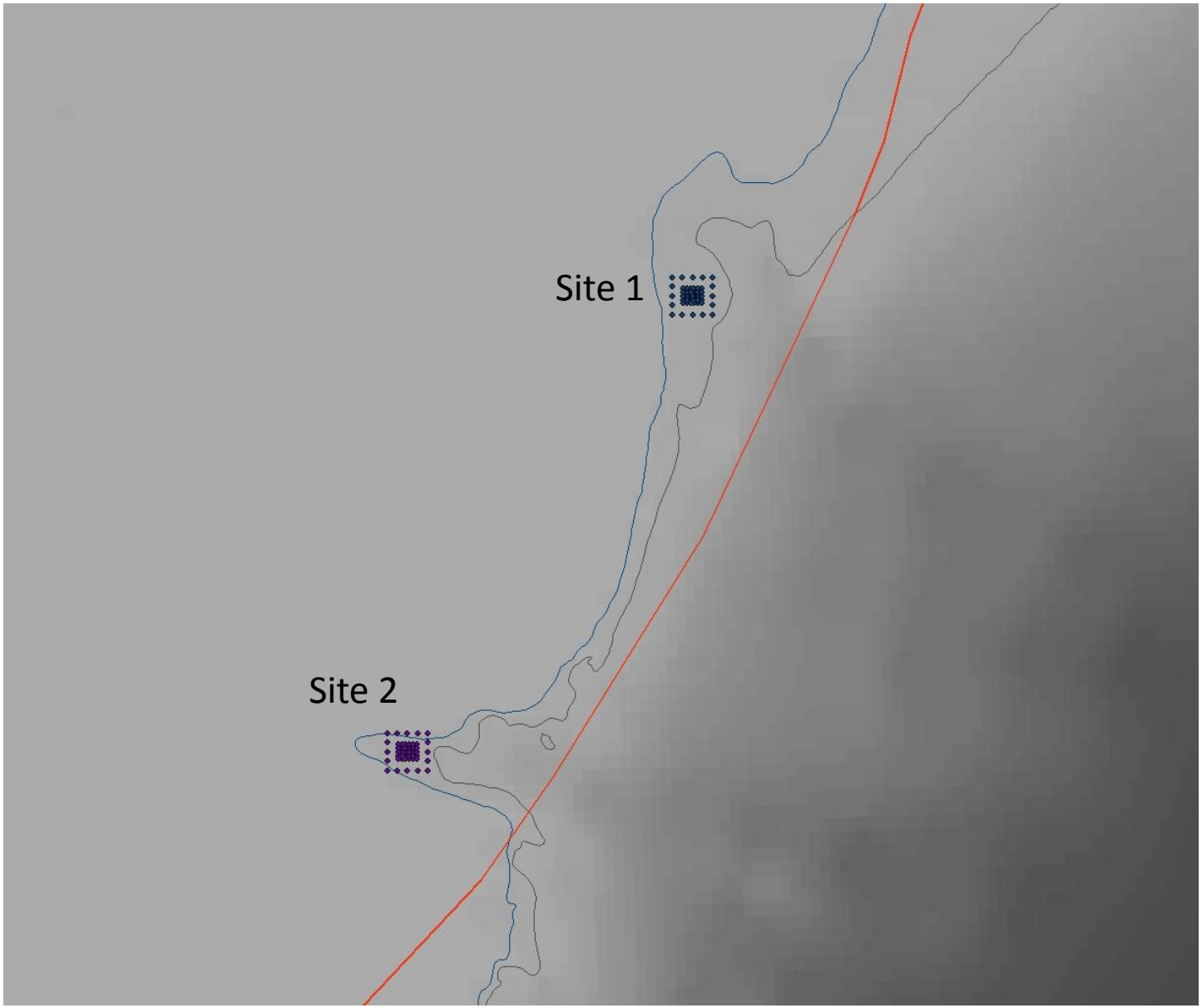
Appendix 1

ESRF Study Site Location Maps and Coordinates


Site 1
Site 2


Site 1
Site 2

Site 1

Stn_Num	Stn_Id	x	y	Depth
43	ST_43	-48.8013	45.42371	-105
42	ST_42	-48.7837	45.42337	-116
41	ST_41	-48.7662	45.42303	-132
40	ST_40	-48.7486	45.42269	-157
39	ST_39	-48.731	45.42234	-191
44	ST_44	-48.8008	45.43496	-104
38	ST_38	-48.7306	45.43358	-136
45	ST_45	-48.8004	45.4462	-105
37	ST_37	-48.7301	45.44483	-164
46	ST_46	-48.8	45.45744	-105
36	ST_36	-48.7297	45.45607	-164
31	ST_31	-48.7995	45.46869	-110
32	ST_32	-48.7819	45.46835	-115
33	ST_33	-48.7644	45.468	-125
34	ST_34	-48.7468	45.46766	-142
35	ST_35	-48.7292	45.46731	-172
12	ST_12	-48.7686	45.44108	-124
15	ST_15	-48.7681	45.45458	-123
13	ST_13	-48.7685	45.44558	-123
8	ST_8	-48.7748	45.44571	-123
19	ST_19	-48.7619	45.44995	-123
27	ST_27	-48.7495	45.44071	-128
30	ST_30	-48.7489	45.4542	-140
21	ST_21	-48.756	45.43634	-128
23	ST_23	-48.7557	45.44533	-140
9	ST_9	-48.7747	45.4502	-123
16	ST_16	-48.7624	45.43646	-124
17	ST_17	-48.7622	45.44096	-124
20	ST_20	-48.7617	45.45445	-123
24	ST_24	-48.7555	45.44983	-140
6	ST_6	-48.7752	45.43671	-111
28	ST_28	-48.7493	45.4452	-140

Site 2

Stn_Num	Stn_Id	x	y	Depth
43	CT_43	-49.3083	44.87966	-116
42	CT_42	-49.2909	44.8794	-181
41	CT_41	-49.2735	44.87914	-180
40	CT_40	-49.2561	44.87887	-161
39	CT_39	-49.2387	44.87861	-150
44	CT_44	-49.308	44.89091	-116
38	CT_38	-49.2384	44.88985	-150
45	CT_45	-49.3077	44.90216	-118
37	CT_37	-49.238	44.9011	-181
46	CT_46	-49.3073	44.9134	-115
36	CT_36	-49.2377	44.91235	-119
31	CT_31	-49.307	44.92465	-115
32	CT_32	-49.2896	44.92439	-117
33	CT_33	-49.2722	44.92413	-118
34	CT_34	-49.2547	44.92386	-107
35	CT_35	-49.2373	44.9236	-119
12	CT_12	-49.2761	44.89718	-142
15	CT_15	-49.2757	44.91068	-117
13	CT_13	-49.276	44.90168	-142
8	CT_8	-49.2823	44.90178	-142
19	CT_19	-49.2695	44.90609	-162
27	CT_27	-49.2571	44.89689	-142
30	CT_30	-49.2567	44.91039	-107
21	CT_21	-49.2636	44.89249	-162
23	CT_23	-49.2633	44.90149	-162
9	CT_9	-49.2822	44.90628	-142
16	CT_16	-49.2699	44.89259	-162
17	CT_17	-49.2698	44.89709	-162
20	CT_20	-49.2694	44.91058	-118
24	CT_24	-49.2632	44.90599	-162
6	CT_6	-49.2826	44.89278	-142
28	CT_28	-49.257	44.90139	-142

7	ST_7	-48.775	45.44121	-111
10	ST_10	-48.7745	45.4547	-123
18	ST_18	-48.7621	45.44546	-123
14	ST_14	-48.7683	45.45008	-123
11	ST_11	-48.7688	45.43659	-124
22	ST_22	-48.7559	45.44083	-128
26	ST_26	-48.7496	45.43621	-128
25	ST_25	-48.7553	45.45432	-140
29	ST_29	-48.7491	45.4497	-140
5	ST_5	-48.7809	45.45482	-112
2	ST_2	-48.7814	45.44133	-111
3	ST_3	-48.7812	45.44583	-112
4	ST_4	-48.7811	45.45033	-112
1	ST_1	-48.7816	45.43684	-111

7	CT_7	-49.2825	44.89728	-142
10	CT_10	-49.2821	44.91078	-117
18	CT_18	-49.2697	44.90159	-162
14	CT_14	-49.2759	44.90618	-142
11	CT_11	-49.2763	44.89268	-142
22	CT_22	-49.2635	44.89699	-162
26	CT_26	-49.2573	44.8924	-142
25	CT_25	-49.2631	44.91049	-118
29	CT_29	-49.2569	44.90589	-142
5	CT_5	-49.2884	44.91087	-117
2	CT_2	-49.2888	44.89737	-142
3	CT_3	-49.2887	44.90187	-142
4	CT_4	-49.2885	44.90637	-142
1	CT_1	-49.2889	44.89287	-142