

# FINFISH AQUACULTURE SITE AQUACULTURE STEWARDSHIP COUNCIL REPORT SITE 13, SECHELT INLET, BC

*SITE LICENSE: AQ746*

*SURVEY TYPE: ASC*

*SURVEY DATE: APRIL 23, 2020*

*REPORT DATE: MAY 12, 2020*

***PREPARED FOR:***

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## Summary

This document presents the qualitative and quantitative assessment of sediment obtained during the survey completed at the Site 13 finfish aquaculture site operated by Grieg Seafood BC Ltd in Sechart Inlet, BC, on April 23, 2020. Sediment was collected and the data analyzed according to the *Aquaculture Activities Regulations* (AAR) and adapted to address Criterion 2.1 and 5.2 of the Aquaculture Stewardship Council (ASC) Salmon Standard.

Sediment grabs were attempted along three Transects, A, B and C. All grab attempts on Transects A and B were unsuccessful with the exception of the grabs attempted at the station inside the AZE on Transect A. Grab attempts could not be made at Station 0B as a house float and generator float were blocking access to the station location. Successful grabs were completed at both stations on Transect C and at two reference locations.

The measured and observed characteristics of the sediment collected during the sampling confirmed that the station outside the Allowable Zone of Effect (AZE) on Transect C had a mean sulphide level less than the ASC Salmon Standard acceptable limit of 1500 µm. Redox potential measured in sediment obtained outside the AZE on Transect C was greater than the ASC Salmon Standard acceptable lower limit of 0 mV.

As required by Criterion 5.2 of the ASC monitoring for parasiticide residue was completed at the station outside the AZE on Transect C and at two reference stations. Emamectin benzoate and florfenicol were below detectable limits in all collected samples.

An assessment and identification of the benthic organisms present in the sediment was not completed to evaluate for potential impacts to habitat, as BC salmon farms have been granted a variance to Indicators 2.1.2 and 2.1.3 and instead rely on the scientifically proven and federally regulated sulfide surrogates (ASC VR224)<sup>1</sup>.

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<sup>1</sup> <http://variance-requests.asc-aqua.org/questions/vr-224-benthic-biodiversity-and-benthic-effects-salmon-v1-0-2-1-2-2-1-3/>

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## 1.0 Introduction

This document presents the marine sediment data collected as part of a benthic study completed at the Site 13 finfish aquaculture site operated by Grieg Seafood BC Ltd (Campbell River, BC). Site 13 is located in Sechelt Inlet, BC (Figure 1).

The study was completed by adapting the methodology required for operational monitoring of waste dispersion required under *Aquaculture Activities Regulations* (AAR) and comparing the results with the indicators listed in Criterion 2.1 of the Aquaculture Stewardship Council (ASC) Salmon Standard. Additional analysis of the collected sediment was also completed to address Criterion 5.2 of the ASC.

The purpose of the ASC Salmon Standard is to evaluate concerns of potential environmental impact related to salmon farming. The Standard is based on a combination of requirements and performance levels that must be reached in order to determine if potential impacts are being addressed. Principle 2 of the Standard addresses the “*potential impacts from salmon farms on natural habitat, local biodiversity and ecosystem function*” (ASC, 2012).

This survey was specifically designed to address Criterion 2.1 within Principle 2 of the ASC Salmon Standard which involved the collection of sediment within and outside of the Allowable Zone of Effect (AZE). Sediment was analyzed for redox potential and sulphide levels to evaluate benthic habitat conditions. In addition, testing for parasiticide residue in sediment collected at the two reference stations and at the stations outside the AZE was completed to address Criterion 5.2.1 of the ASC.

An assessment and identification of the benthic organisms present in the sediment was not completed to evaluate for potential impacts to habitat, biodiversity and ecosystem function, as BC salmon farms have been granted a variance to Indicators 2.1.2 and 2.1.3 and instead rely on the scientifically proven and federally regulated sulfide surrogates (ASC VR224).

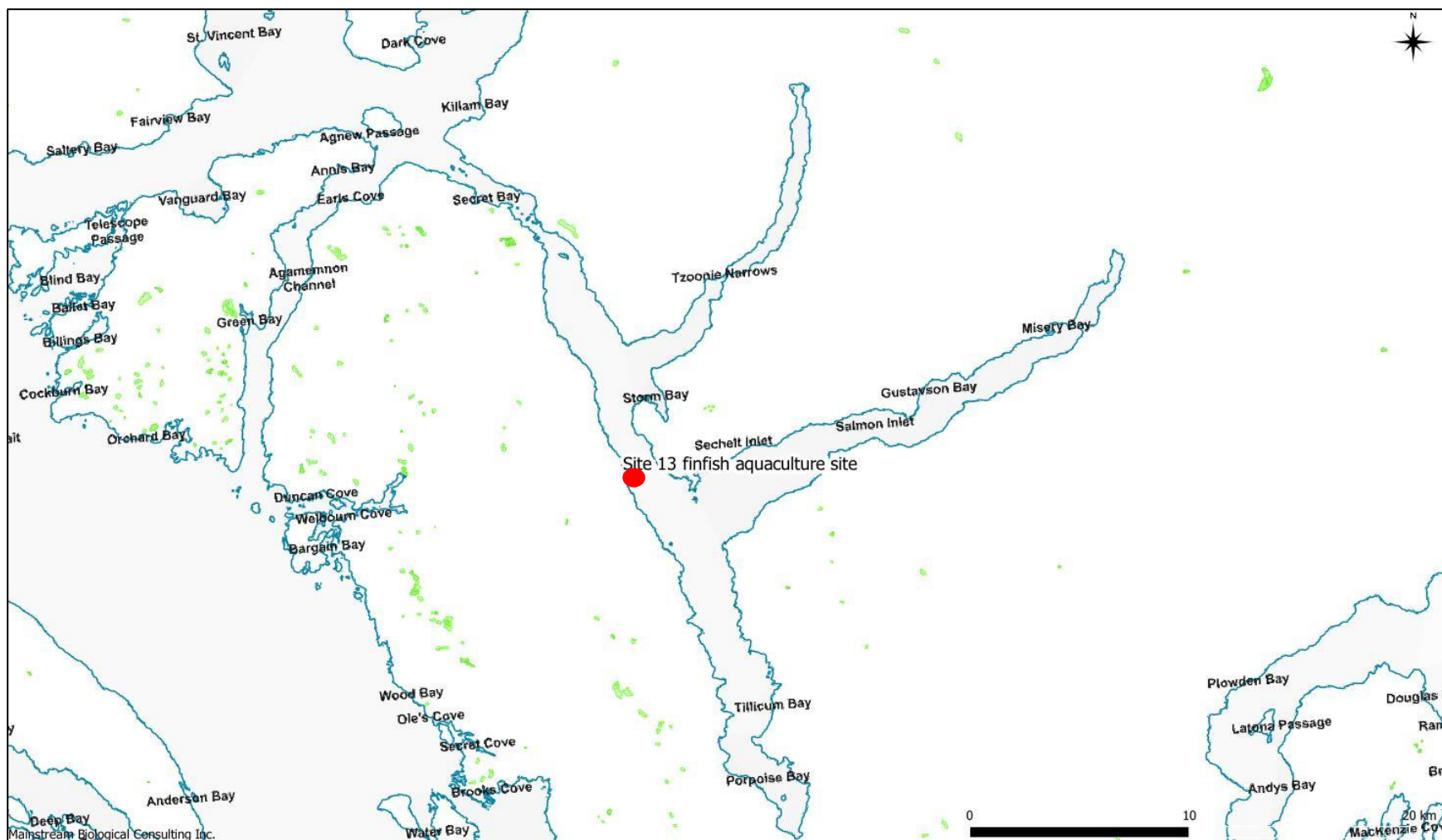


Figure 1: An overview map showing the approximate location of the Site 13 finfish aquaculture farm site (red dot) in Sechart Inlet, BC.

## 2.0 Methods

Sampling had never been attempted at the ASC locations at the Site 13 finfish aquaculture site. Therefore, the field activities involved the attempted collection of sediment samples for physical and chemical analysis.

### 2.1 Field Sampling

The locations of sediment sampling stations were provided by Greig Seafood BC Ltd.

Individual sediment sampling stations were proposed along three Transects A, B, and C. Stations within the AZE were located 5 m inside the 1 g DEPOMOD contour (Figure 2) for all three transects and also at the perimeter of the containment system for Transects A and B. Stations outside the AZE were located 25 m outside of the 1 g DEPOMOD contour. Additional stations were established at two reference sites. Reference sites could not be found within the range of 500 m to 1000 m from the aquaculture containment system as outlined in the ASC Salmon Standard (Figure 3).

Sediment was collected using a Petite Ponar sampler. Two sediment samples were collected at each successful station.

The coordinates of the sample locations were recorded using a Trimble GeoExplorer GeoXT (Firmware v1.05) using TerraSync 3.30 software and equipped with an external Hurricane antenna.

Data filters were set to standards recommended by the Resource Inventory Standards Committee (RISC)<sup>2</sup>, with at least 15 fixes taken per location, using satellites greater than 15 % above the horizon with signal to noise ratios (SNR) greater than 40 and a horizontal dilution of precision (HDOP) of five. The GPS data was corrected post-mission with Pathfinder Office v5.40 software using data from the Nanaimo base station (NANO).

The Trimble antenna was attached to the grab davit and positional fixes were obtained while the grab was completing the estimated bottom third of its descent. Positional fixes were completed when the grab was on the bottom and the drop line was as close vertical as possible.

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<sup>2</sup> Integrated Land Management Bureau. 2008. Province of British Columbia Standards, Specifications and Guidelines for Resource Surveys Using Global Positioning System (GPS) Technology. Release 4.0d.



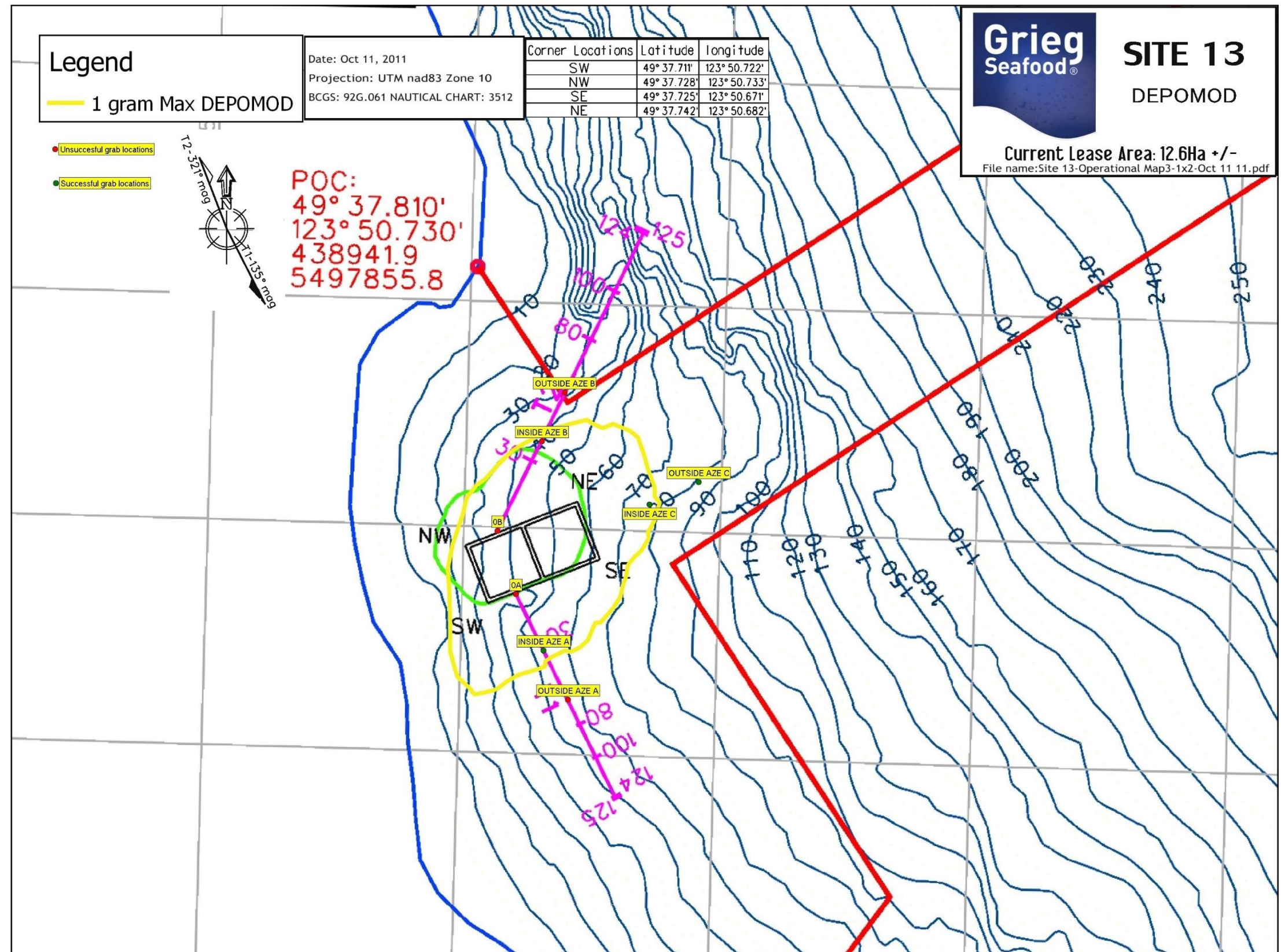


Figure 2: The locations of the sampling stations for the ASC survey at the Site 13 finfish aquaculture site in relation to the pen system and surrounding area on April 23, 2020.



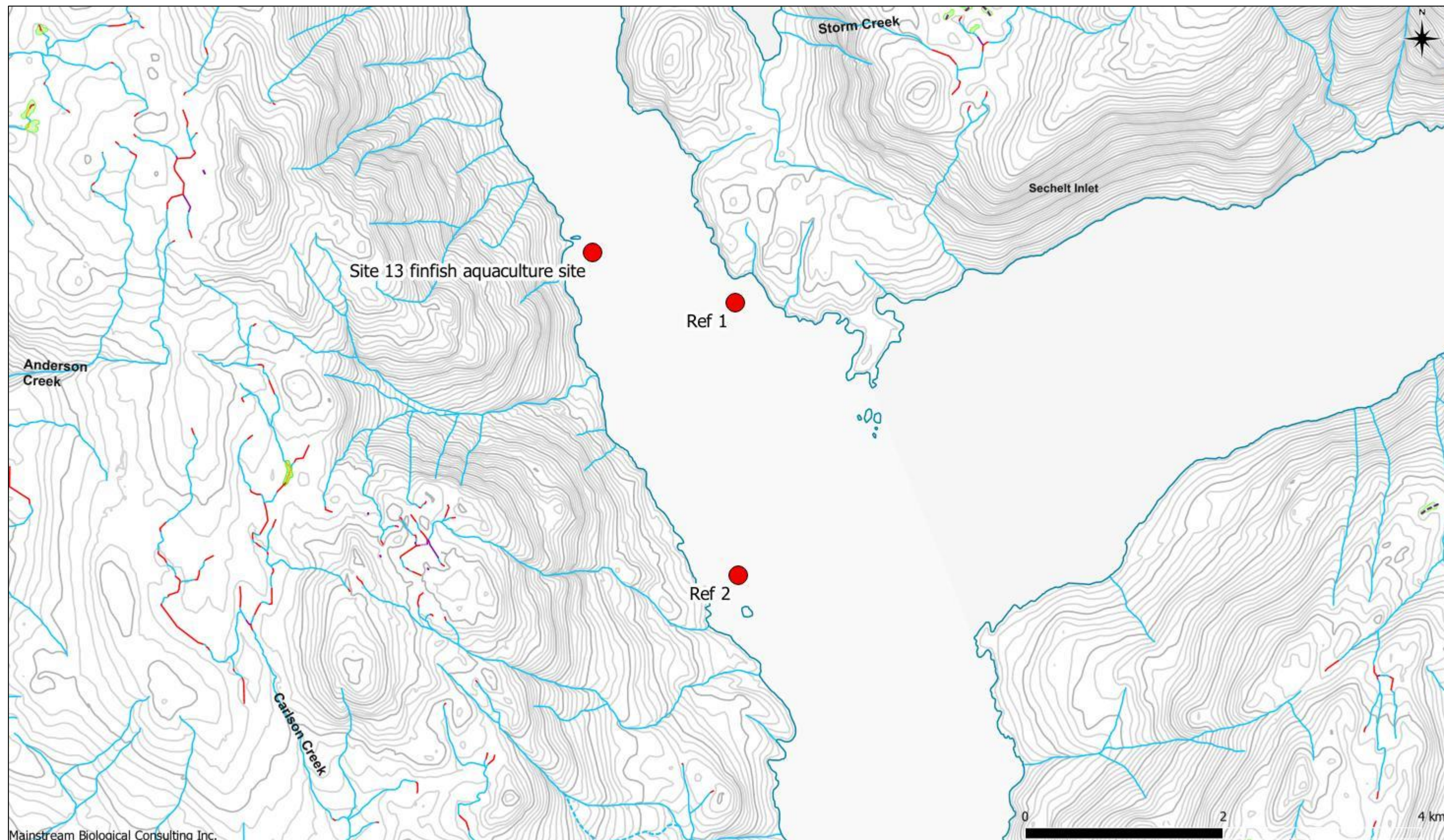


Figure 3: The locations of the reference stations for the ASC survey at the Site 13 finfish aquaculture site in relation to the site and surrounding area on April 23, 2020



The time at which each sample was successfully obtained and physical characteristics of the collected sediment were recorded. A digital photograph of each sample was also taken. As per Indicator 2.1.1, levels of free sulphides and redox potential of each sediment sample were measured in the field using an Orion A324 meter and the appropriate ISE probes. A digital thermometer was used to measure the temperature of the sediment.

As per Indicator 5.2.1, portions of the grab samples collected at the stations outside the AZE on Transect C as well as the reference stations were retained for analysis. Retained samples were stored at 4° Celsius and transported to SGS Canada Inc for analysis for emamectin benzoate and florfenicol.

## 2.2 Data Analysis

In order to evaluate if the benthic conditions at and near the Site 13 site met the requirements of Criterion 2.1 of the ASC Salmon Standard, the data collected was compared to required levels for indicators of potential finfish farm impacts. These indicators represent a combination of chemical and biodiversity measurements to evaluate the status of benthic health, biodiversity and ecosystem function and to detect potential impacts related to the salmon farm operation. The indicators considered for this assessment are summarized below in Table 1.

Additional analysis of parasiticide residue was completed to fulfill the requirement for monitoring of these chemicals but there is no required level presented in the ASC to compare these results to.

Table 1: Summary of indicators of benthic health, biodiversity and ecosystem function that were considered during the evaluation of the Site 13 finfish aquaculture site. The indicators have been adopted from Criterion 2.1 of the ASC Salmon Standard.

Criterion Number	Indicator	ASC Salmon Standard Requirement
2.1.1	Redox potential in sediment outside the AZE <sup>1</sup> .	>0 millivolts (mV)
2.1.1	Sulphide levels in sediment outside the AZE.	≤1500 microMoles / L (µM)

1: AZE = Allowable Zone of Effect

### 3.0 Results and Discussion

Representative photographs of sediment obtained at each sampling station are presented in Appendix 1. Raw data obtained from sediment sampled in the field is presented in Appendix 2 and the summarized data is presented in Appendix 3.

Sediment grabs were attempted along three Transects, A, B and C. All grab attempts on Transects A and B were unsuccessful with the exception of the grabs attempted at the station inside the AZE on Transect A. Grab attempts could not be made at Station 0B as a house float and generator float were blocking access to the station location. Successful grabs were completed at both stations on Transect C and at two reference locations. The results and locations of all unsuccessful grab attempts are shown in Table 3.

The sediment successfully collected at the Site 13 sampling stations typically consisted of grey sand.

#### 3.1 Redox Potential and Sulphide Levels

Following Criterion 2.1.1 of the ASC Salmon Standard, the results of redox potential and sulphide testing at the station outside the AZE were analyzed to help evaluate if the Site 13 facility was meeting the certification requirements (Appendix 3).

The mean sulphide level in sediment collected at the station outside AZE on Transect C (49.7 µM) on April 23, 2020 was less than the ASC Salmon Standard sulphide upper limit of 1500 µM.

Mean redox potential in sediment collected at the station outside the AZE on Transect C (242.9 mV) was greater than the 0 mV minimum requirement cited in Criterion 2.1.1 of the ASC Salmon Standard.

#### 3.2 Parasiticide Residue

Analysis of the sediment collected from the stations outside the AZE on Transects C and the two reference stations for emamectin benzoate and florfenicol are shown in Table 2. The analysis was completed to fulfill the requirement of the ASC Salmon Standard Criterion number 5.2.1. All of the collected sediment samples analyzed had parasiticide residue concentrations less than the laboratory detectable limit.

Table 2: The parasiticide residue concentration of collected sediment at the stations outside the AZE on Transect C and the two reference stations at the Site 13 finfish aquaculture site on April 23, 2020.

Station Name	Sample Number	Emamectin Benzoate (ppm)	Florfenicol (ng/g)	Florfenicol Amine (ng/g)
Detection Limit		1.0	2.00	5.00
Outside AZE C	1	<1.0	<2.00	<5.00
Outside AZE C	2	<1.0	<2.00	<5.00
Reference 1	1	<1.0	<2.00	<5.00
Reference 1	2	<1.0	<2.00	<5.00
Reference 2	1	<1.0	<2.00	<5.00
Reference 2	2	<1.0	<2.00	<5.00

Table 3: The location and result of each attempted grab at the Site 13 site during the ASC survey completed on April 23, 2020.

Station	Grab Attempt	Latitude	Longitude	Ocean Depth (m)	Sample Depth (cm)	Comment
Inside AZE B	1	49 37.75932	123 50.69494	40.2	0	Skiff of sediment, 2 pieces cobble
Inside AZE B	2	49 37.75971	123 50.69612	40.8	0	Skiff of sediment (gravel) & mussel shell
Inside AZE B	3	49 37.75945	123 50.69527	40.4	<1cm	Skiff of gravel
Outside AZE B	1	49 37.77585	123 50.68685	26.1	0	Skiff of duff
Outside AZE B	2	49 37.77508	123 50.68421	26.5	0	Skiff of duff
Outside AZE B	3	49 37.77517	123 50.68445	27.0	0	Empty
0A	1	49 37.71934	123 50.70539	41.6	<1	Skiff of feces & sediment
0A	2	49 37.71935	123 50.70543	41.6	0	2 pieces gravel, 1 mussel shell
0A	3	49 37.71932	123 50.70548	41.6	0	Skiff of duff, 10 pieces of gravel
Outside AZE A	1	49 37.68094	123 50.68627	52.2	0	Skiff of sand, few pieces of gravel
Outside AZE A	2	49 37.68049	123 50.68814	47.8	1	Sand & gravel
Outside AZE A	3	49 37.67934	123 50.69493	48.8	0	Wood, skiff of sand & gravel
Inside AZE C	2	49 37.74008	123 50.64686	75.1	0	Skiff of sand & gravel



## 4.0 References

- Aquaculture Stewardship Council. 2012. ASC Salmon Standard Version 1.3. Available online: [www.asc-aqua.org](http://www.asc-aqua.org).
- Salas, F., Patrício, J. and Marques, J.C. 2006. Ecological Indicators in Coastal and Estuarine Environmental Quality Assessment - A user friendly guide for practitioners. Imprensa da Universidade de Coimbra.

## Appendix 1 – Sample Photographs



**Photo 1**

Attempted grab at the 0m station on Transect A at Site 13 on April 23, 2020.



**Photo 2**

Attempted grab at the station inside the AZE on Transect A at Site 13 on April 23, 2020



**Photo 3**

Attempted grab at the station outside the AZE on Transect A at Site 13 on April 23, 2020



**Photo 4**

Attempted grab at the station inside the AZE on Transect B at Site 13 on April 23, 2020.





**Photo 7**

Sediment sample collected at the station inside the AZE on Transect C at Site 13 on April 23, 2020.



**Photo 8**

Sediment sample collected at the station outside the AZE on Transect C at Site 13 on April 23, 2020.



**Photo 9**

Sediment sample collected at the Reference 1 at Site 13 on April 23, 2020.



**Photo 10**

Sediment sample collected at the Reference 2 at Site 13 on April 23, 2020.

Appendix 2 – Site 13 Field Data

Reference Information:	
<b>Farm site:</b>	Site 13
<b>Aquaculture Company:</b>	Grieg Seafood BC Ltd
<b>Site Reference #:</b>	AQ746
<b>Geographic Region:</b>	Sechelt Inlet, BC
<b>Field Crew:</b>	L Stewardson, N Delange
<b>Field Investigator:</b>	Mainstream Biological Consulting Inc.
<b>Laboratory:</b>	SGS Canada Inc

<i>Transect A, B, C Name</i>	<i>Sampling Station Name</i>	<i>Replicate Number</i>	<i>Transect A, B, C Bearing (Magnetic)</i>	<i>Reference Station (Y/N)</i>	<i>Distance from Pens (m)</i>	<i>Sampling Device Type</i>	<i>Sampling Device Capacity (m2)</i>	<i>Quality Control Replicate (Y/N)</i>	<i>Replicate Analysis Type</i>	<i>Sample Date (YYYY-MM-DD)</i>	<i>Sample Time (24HH:MM)</i>	<i>Sample Latitude (Degrees)</i>	<i>Sample Latitude (Minutes)</i>	<i>Sample Longitude (Degrees)</i>	<i>Sample Longitude (Minutes)</i>	<i>GPS Correction Status</i>	<i>Ocean Depth (m)</i>	<i>Sample Depth (cm)</i>
A	In AZE	1			43	Petite Ponar	0.02			2020-04-23	9:31:01	49	37.6947	123	50.6978	Postprocessed corrected	54.5	7
A	In AZE	2			43	Petite Ponar	0.02			2020-04-23	9:34:36	49	37.6947	123	50.6974	Postprocessed corrected	56.8	5
A	In AZE	2			43	Petite Ponar	0.02	Y	Duplicate	2020-04-23	9:34:36	49	37.6947	123	50.6974	Postprocessed corrected	56.8	5
A	In AZE	2			43	Petite Ponar	0.02	Y	Triplicate	2020-04-23	9:34:36	49	37.6947	123	50.6974	Postprocessed corrected	56.8	5
C	In AZE	1			40	Petite Ponar	0.02			2020-04-23	9:57:38	49	37.7413	123	50.6472	Postprocessed corrected	77.5	7
C	In AZE	2			40	Petite Ponar	0.02			2020-04-23	10:04:54	49	37.7385	123	50.6467	Postprocessed corrected	77.3	7
C	Out AZE	1			71	Petite Ponar	0.02			2020-04-23	10:11:28	49	37.7444	123	50.6239	Postprocessed corrected	79.1	5
C	Out AZE	2			71	Petite Ponar	0.02			2020-04-23	10:17:27	49	37.7476	123	50.6251	Postprocessed corrected	79.8	5
Ref 1	Ref 1	1		Y	1550	Petite Ponar	0.02			2020-04-23	10:39:23	49	37.9153	123	49.4538	Postprocessed corrected	140	10
Ref 1	Ref 1	2		Y	1550	Petite Ponar	0.02			2020-04-23	10:43:12	49	37.9212	123	49.4679	Postprocessed corrected	140	10
Ref 2	Ref 2	1		Y	2760	Petite Ponar	0.02			2020-04-23	11:11:51	49	36.4717	123	49.3829	Postprocessed corrected	167	10
Ref 2	Ref 2	2		Y	2760	Petite Ponar	0.02			2020-04-23	11:14:14	49	36.4717	123	49.3900	Postprocessed corrected	167	10

<i>Transect A, B, C Name</i>	<i>Sampling Station Name</i>	<i>Replicate Number</i>	<i>Free Sulphide (micromolar)</i>	<i>Sediment Temperature (deg C)</i>	<i>Eh Uncorrected (mV)</i>	<i>Eh Corrected (mV)</i>	<i>Cu (micro-g/g)</i>	<i>Zn (micro-g/g)</i>	<i>Li (micro-g/g)</i>	<i>Gravel Percent</i>	<i>Sand Percent</i>	<i>Mud Percent</i>	<i>TVS Percent</i>	<i>Beggiatoa Observed (Y/N)</i>	<i>OPC Observed (Y/N)</i>	<i>Fish Feed Observed (Y/N)</i>	<i>Fish Feces Observed (Y/N)</i>	<i>Odour Rating</i>	<i>Black Sediment Observed (Y/N)</i>	<i>Gas Bubbles Observed (Y/N)</i>
A	In AZE	1	272	9.2	-372.6	-157.6									N	N	N	N	2	N
A	In AZE	2	212	10	-14.9	199.1									N	N	N	N	0	N
A	In AZE	2	240	10	5.8	219.8									N	N	N	N	0	N
A	In AZE	2		10	-12	202									N	N	N	N	0	N
C	In AZE	1	171	10.4	-58.6	155.4									N	N	N	N	1	N
C	In AZE	2	129	9.8	-9.5	204.5									N	N	N	N	1	N
C	Out AZE	1	35.4	12	70.3	282.3									N	N	N	N	0	N
C	Out AZE	2	63.9	11.4	-9.5	203.5									N	N	N	N	0	N
Ref 1	Ref 1	1	5.02	9.9	114.9	328.9									N	N	N	N	0	N
Ref 1	Ref 1	2	5.47	9.8	137.1	351.1									N	N	N	N	0	N
Ref 2	Ref 2	1	27.5	10	-65.5	148.5									N	N	N	N	0	N
Ref 2	Ref 2	2	16.4	10.8	-68.3	144.7									N	N	N	N	0	N

Table note:

- Odour rating: ranked on a scale of 0 (no odour) to 4 (very strong sulphide odour)



<i><b>Transect A, B, C Name</b></i>	<i><b>Sampling Station Name</b></i>	<i><b>Replicate Number</b></i>	<i><b>Flocculent Organic Material Observed (Y/N)</b></i>	<i><b>Shell Hash Observed (Y/N)</b></i>	<i><b>Terrigenous Material Observed (Y/N)</b></i>	<i><b>Farm Litter Observed (Y/N)</b></i>	<i><b>Macrophytes Observed (Y/N)</b></i>	<i><b>Megafauna Observed (Y/N)</b></i>	<i><b>Sediment Colour Observations</b></i>	<i><b>Sediment Texture Observations</b></i>	<i><b>Other Sample Observations (Comments)</b></i>
A	In AZE	1	N	N	Y	N	N	N	Grey	Sand	Wood particles
A	In AZE	2	N	N	Y	N	N	N	Grey	Sand	Wood particles
A	In AZE	2	N	N	Y	N	N	N	Grey	Sand	Wood particles
A	In AZE	2	N	N	Y	N	N	N	Grey	Sand	Wood particles
C	In AZE	1	N	N	N	N	N	N	Grey	Sand	Wood particles
C	In AZE	2	N	Y	N	N	N	N	Grey	Sand	Mussel shell, piece of cobble
C	Out AZE	1	N	N	Y	N	N	N	Grey	Sand	Wood particles
C	Out AZE	2	N	N	Y	N	N	N	Grey	Sand	Wood particles
Ref 1	Ref 1	1	N	N	N	N	N	Y	Green	Mud	Sponge particles
Ref 1	Ref 1	2	N	N	N	N	N	Y	Green	Mud	Sponge particles
Ref 2	Ref 2	1	N	N	Y	N	N	N	Green	Mud	Sponge spicules, alder leaf
Ref 2	Ref 2	2	N	N	Y	N	N	N	Green	Mud	Sponge spicules

## Appendix 3 – Site 13 ASC Survey Summary

<b>Company:</b>	Greig Seafood BC Ltd	<b>Sample date:</b>	April 23, 2020
<b>Farm Site:</b>	Site 13	<b>Field crew:</b>	L Stewardson, N Delange
<b>Site License #:</b>	AQ746	<b>Analytical:</b>	SGS Canada Inc
<b>Site Location</b>	Sechelt Inlet, BC		

SULPHIDES Indicator 2.1.1 Requirement $\leq 1500$ ( $\mu\text{m}$ )					
Station	Rep 1	Rep 2	n	Mean	ASC Criteria Met
Inside AZE A	272	212	2	242	
Inside AZE C	171	129	2	150	
Outside AZE C	35.4	63.9	2	49.7	Yes
Reference 1	5.02	5.47	2	5.25	
Reference 2	27.5	16.4	2	22.0	

REDOX POTENTIAL Indicator 2.1.1 Requirement $> 0$ mV					
Station	Rep 1	Rep 2	N	Mean	ASC Criteria Met
Inside AZE A	-157.6	199.1	2	20.8	
Inside AZE C	155.4	204.5	2	180.0	
Outside AZE C	282.3	203.5	2	242.9	Yes
Reference 1	328.9	351.1	2	340.0	
Reference 2	148.5	144.7	2	146.6	