

FINFISH AQUACULTURE SITE AQUACULTURE STEWARDSHIP COUNCIL REPORT

STEAMER POINT, SITE AREA, BC

SITE LICENSE: AQ1079

SURVEY TYPE: ASC

SURVEY DATE: APRIL 10 AND 11, 2023

REPORT DATE: MAY 20, 2023

PREPARED FOR:

GRIEG SEAFOOD BC, LTD

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Summary

This document presents the qualitative and quantitative assessment of sediment obtained during the survey completed at the Steamer Point finfish aquaculture site operated by Grieg Seafood BC Ltd in Hecate Channel, BC, on April 10 and 11, 2023. Sediment was collected and the data analyzed according to the *Aquaculture Activities Regulations* (AAR) and adapted to address Criterion 2.1,4.7 and 5.2 of the Aquaculture Stewardship Council (ASC) Salmon Standard.

Sediment could not be successfully collected at any of the ASC sampling stations on Transect A or Transect B.

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. Enamectin benzoate was 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)¹.

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

Table of Contents

Summary.....	ii
Table of Contents.....	iii
1.0 Introduction.....	1
2.0 Methods.....	3
2.1 Field Sampling	3
2.2 Data Analysis.....	6
3.0 Results and Discussion	7
3.1 Redox Potential and Sulphide Levels.....	7
3.2 Parasiticide Residue	8
4.0 References	10
Appendix 1 – Sample Photographs	I
Appendix 2 – Steamer Point Field Data	VI
Appendix 3 – Steamer Point ASC Survey Summary	VII

1.0 Introduction

This document presents the marine sediment data collected as part of a benthic study completed at the Steamer Point finfish aquaculture site operated by Greig Seafood BC Ltd (Campbell River, BC). The Steamer Point site is located in Hecate Channel, 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 and Criterion 4.7 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 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, parasiticide residue in sediment collected at the two reference stations and at the station 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).

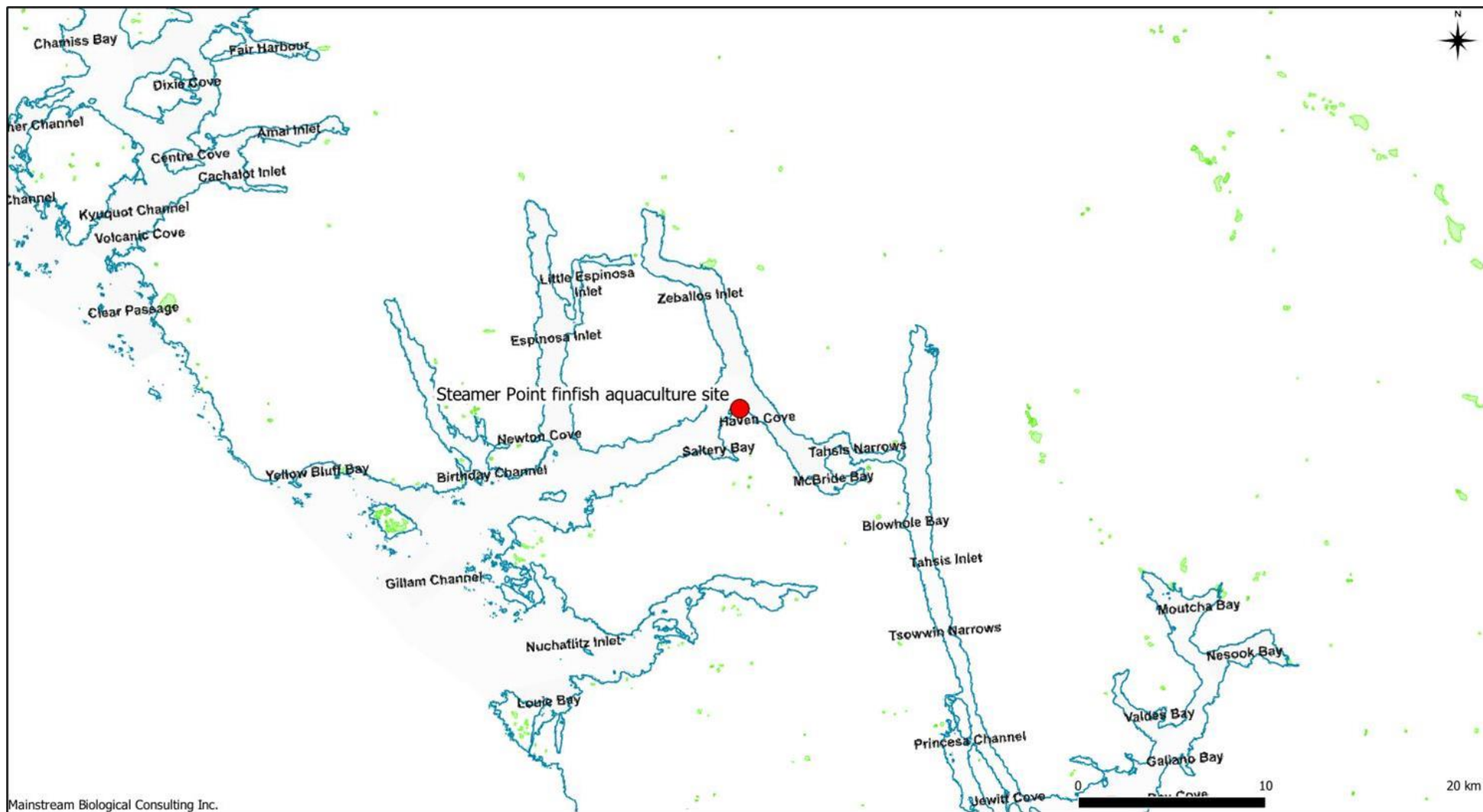


Figure 1: An overview map showing the approximate location of the Steamer Point finfish aquaculture farm site (red dot) in Hecate Channel, BC.

2.0 Methods

The substrate at the previously designated sampling locations at the Steamer Point finfish aquaculture site had been previously identified to consist of “soft” sediment on Transect C and at two reference stations. However due to a change in the containment array location new ASC sampling stations were established and grabs were attempted at all new sampling locations. 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 developed from maps provided by Grieg Seafood BC Ltd.

Individual sediment sampling stations were located 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 Transect B. Transect A perimeter station could not be accessed due to a compressor float anchored directly above the proposed station. Stations outside the AZE were located 25 m outside of the 1 g DEPOMOD contour. Two reference sites within the range of 500 m to 1000 m from the aquaculture containment system are required as outlined in the ASC Salmon Standard (Figure 3). However, reference sites from the Aquaculture Activities Regulation (AAR) and the associated Monitoring Standard (Annex 7 and Annex 8)² were utilized for sample collection in which Reference 1 was greater than 1000 m from the containment system.

Sediment was collected using a Petite Ponar and Van Veen sampler. Two sediment samples were collected at each station if possible.

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)³, 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 PABH (Pacific Beach, WA) base station.

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.

² <http://www.gazette.gc.ca/rp-pr/p2/2015/2015-07-15/html/sor-dors177-eng.php>

³ 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.

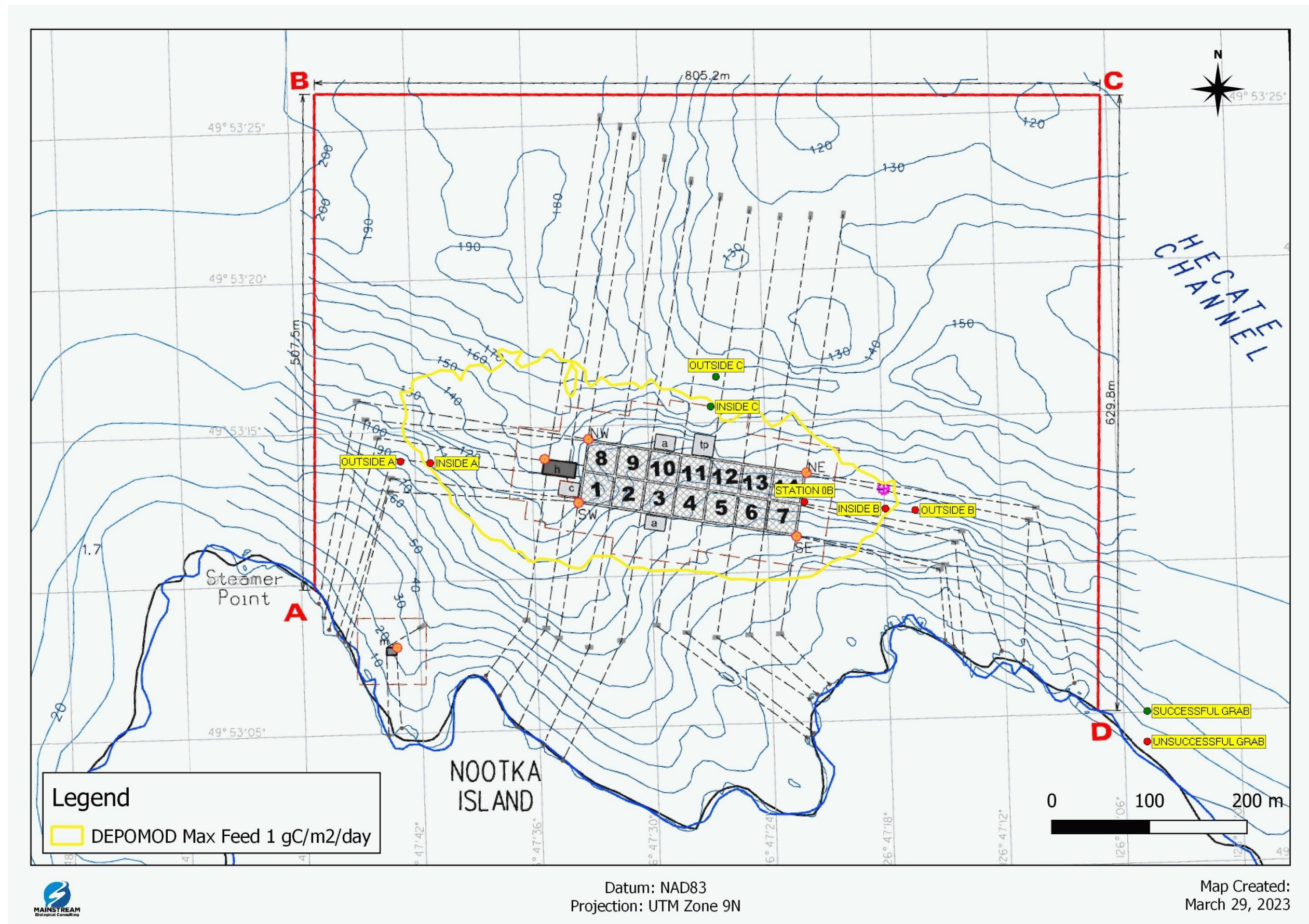


Figure 2: The locations of the sampling stations for the ASC survey at the Steamer Point finfish aquaculture site in relation to the pen system and surrounding area on April 10, 2023.

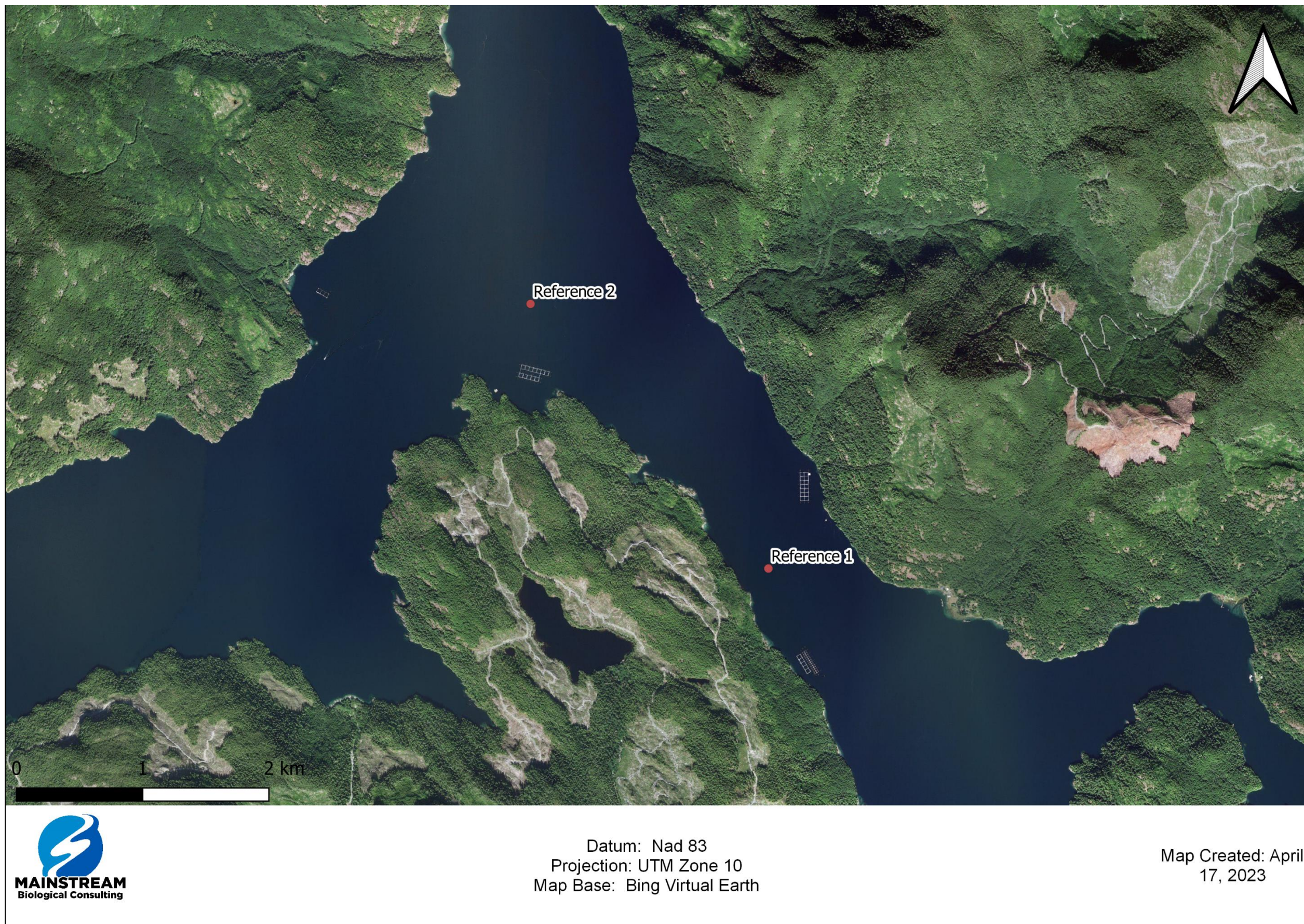


Figure 3: The locations of the reference stations for the ASC survey at the Steamer Point finfish aquaculture site in relation to the site and surrounding area on April 11, 2023.

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 Transects A, B and 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.

2.2 Data Analysis

To evaluate if the benthic conditions at and near the Steamer Point 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 with.

Table 1: Summary of indicators of benthic health, biodiversity and ecosystem function that were considered during the evaluation of the Steamer Point finfish aquaculture site. The indicators have been adopted from Criterion 2.1 and 4.7 of the ASC Salmon Standard.

Criterion Number	Indicator	ASC Salmon Standard Requirement
2.1.1	Redox potential in sediment outside the AZE ¹ .	>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.

The sediment successfully collected at the Steamer Point sampling stations typically consisted of brown mud with no sulphide odor.

Sediment could not be successfully collected at any of the ASC sampling stations on Transect A or Transect B. The results of each unsuccessful grab attempt are presented in Table 2.

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 Steamer Point facility was meeting the certification requirements (Appendix 3).

The mean sulphide level in sediment collected at the station outside AZE on Transect C (2.04 μM) on April 10, 2023, was less than the ASC Salmon Standard sulphide upper limit of 1500 μM .

Mean redox potential in sediment collected at the stations outside the AZE on Transect C (103.0 mV) was greater than the 0 mV minimum requirement cited in Criterion 2.1.1 of the ASC Salmon Standard.

Table 2: The location and results of each unsuccessful grab attempt at the Steamer Point finfish aquaculture site on April 10, 2023.

Station	Latitude	Longitude	Distance from Pens (m)	Sampling Device	Comments
Station 0B	49 53.2596	126 47.4470		Ponar	Skiff sand
Station 0B	49 53.2598	126 47.4474		Ponar	Flocculant, fish feces
Station 0B	49 53.2760	126 47.4421		Ponar	
Station 0B	49 53.2752	126 47.4424		Ponar	
Inside B	49 53.2049	126 47.3682		Ponar	
Inside B	49 53.2052	126 47.3681		Ponar	1cm terrigenous
Inside B	49 53.2052	126 47.3680		Ponar	
Inside B	49 53.2053	126 47.3680		Ponar	
Outside B	49 53.2007	126 47.2991		Ponar	
Outside B	49 53.2006	126 47.2999		Ponar	
Outside B	49 53.2002	126 47.2993		Ponar	
Outside B	49 53.2008	126 47.2990		Ponar	
Inside A	49 53.1996	126 47.2736		Ponar	Couple pieces of gravel
Inside A	49 53.1995	126 47.2735		Ponar	
Inside A	49 53.1996	126 47.2733		Ponar	
Inside A	49 53.1998	126 47.2735		Ponar	
Outside A	49 53.2326	126 47.6873		Ponar	
Outside A	49 53.2325	126 47.6875		Ponar	Couple pieces of bark
Outside A	49 53.2320	126 47.6879		Ponar	One small twig
Outside A	49 53.2321	126 47.6873		Ponar	Flecks shell hash

3.2 Parasiticide Residue

Analysis of the sediment collected from the station outside the AZE on Transect C and the two reference stations for emamectin benzoate are shown in Table 3. 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 3: The parasiticide residue concentration of collected sediment at the stations outside the AZE on Transect C and the two reference stations at the Steamer Point finfish aquaculture site on April 10 and 11, 2023.

Station Name	Sample Number	Enamectin Benzoate (ppm)
Detection Limit		1.0
Outside AZE C	1	<1.0
Outside AZE C	2	<1.0
Reference 1	1	<1.0
Reference 1	2	<1.0
Reference 2	1	<1.0
Reference 2	2	<1.0

4.0 References

- Aquaculture Stewardship Council. 2012. ASC Salmon Standard Version 1.3. Available online: 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

Unsuccessful grab attempt at the station inside the AZE on Transect A at the Steamer Point site on June 20, 2019.



Photo 1

Unsuccessful grab attempt at the station outside the AZE on Transect A at the Steamer Point site on April 10, 2023.



Photo 3

Unsuccessful grab attempt at the 0m station on Transect B at the Steamer Point site on April 10, 2023.



Photo 4

Unsuccessful grab attempt at the station inside the AZE on Transect B at the Steamer Point site on April 10, 2023.



Photo 5

Unsuccessful grab attempt at the station outside the AZE on Transect B at the Steamer Point site on April 10, 2023.



Photo 6

Sediment sample collected at the station inside the AZE on Transect C at the Steamer Point site on April 10, 2023.



Photo 7

Sediment sample collected at the station outside the AZE on Transect C at the Steamer Point site on April 10, 2023.



Photo 8

Sediment sample collected at the Reference 1 at the Steamer Point site on April 11, 2023.



Photo 9

Sediment sample collected at the Reference 2 at the Steamer Point site on April 11, 2023.

Appendix 2 – Steamer Point Field Data

Reference Information:

Farm site:	Steamer Point	Field Crew:	M. Haswell, M. Twocock, E. Jarry
Aquaculture Company:	Grieg Seafood BC Ltd	Field Investigator:	Mainstream Biological Consulting Inc.
Site Reference #:	AQ1079	Laboratory:	SGS Canada Inc
Geographic Region:	Hecate Channel, BC		

<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>
C	Inside	1	354	N	84	Ponar	0.02	N		2023-04-10	14:48	49	53.2596	126	47.4470	Post-process corrected	118	10
C	Inside	1	354	N	84	Ponar	0.02	Y	Duplicate	2023-04-10	14:48	49	53.2596	126	47.4470	Post-process corrected	118	10
C	Inside	1	354	N	84	Ponar	0.02	Y	Triplicate	2023-04-10	14:48	49	53.2596	126	47.4470	Post-process corrected	118	10
C	Inside	2	354	N	84	Ponar	0.02	N		2023-04-10	14:54	49	53.2598	126	47.4474	Post-process corrected	119	10
C	Outside	1	354	N	114	Ponar	0.02	N		2023-04-10	15:10	49	53.2760	126	47.4421	Post-process corrected	143	10
C	Outside	2	354	N	114	Ponar	0.02	N		2023-04-10	15:17	49	53.2752	126	47.4424	Post-process corrected	143	10
Ref 1	Ref 1	1		Y	579	Ponar	0.02	N		2023-04-11	10:17	49	52.4255	126	45.8537	Post-process corrected	125	5
Ref 1	Ref 1	2		Y	579	Ponar	0.02	N		2023-04-11	10:30	49	52.4257	126	45.8519	Post-process corrected	124	5
Ref 2	Ref 2	1		Y	2321	Van Veen	0.10	N		2023-04-11	11:39	49	53.5026	126	47.5145	Post-process corrected	150	18
Ref 2	Ref 2	2		Y	2321	Van Veen	0.10	N		2023-04-11	11:48	49	53.5028	126	47.5114	Post-process corrected	149	18

<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>
C	Inside	1	31.5	7.9	-75.0	141.0								N	N	N	N	0	N	N
C	Inside	1	27.5	7.9	-89.1	126.9								N	N	N	N	0	N	N
C	Inside	1		7.9	-85.4	130.6								N	N	N	N	0	N	N
C	Inside	2	20.3	8.1	-105.1	110.9								N	N	N	N	0	N	N
C	Outside	1	2.80	8.2	-106.2	109.8								N	N	N	N	0	N	N
C	Outside	2	1.27	8.1	-119.9	96.1								N	N	N	N	0	N	N
Ref 1	Ref 1	1	14.2	8.0	26.2	242.2								N	N	N	N	0	N	N
Ref 1	Ref 1	2	92.0	7.6	-71.9	144.1								N	N	N	N	0	N	N
Ref 2	Ref 2	1	19.1	8.4	-104.9	111.1								N	N	N	N	0	N	N
Ref 2	Ref 2	2	10.3	8.4	-109.2	106.8								N	N	N	N	0	N	N

Table note:

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

<i>Transect A, B, C Name</i>	<i>Sampling Station Name</i>	<i>Replicate Number</i>	<i>Flocculent Organic Material Observed (Y/N)</i>	<i>Shell Hash Observed (Y/N)</i>	<i>Terrigenous Material Observed (Y/N)</i>	<i>Farm Litter Observed (Y/N)</i>	<i>Macrophytes Observed (Y/N)</i>	<i>Megafauna Observed (Y/N)</i>	<i>Sediment Colour Observations</i>	<i>Sediment Texture Observations</i>	<i>Other Sample Observations (Comments)</i>
C	Inside	1	N	Y	N	N	N	N	Green/Brown	Sandy mud	
C	Inside	1	N	Y	N	N	N	N	Green/Brown	Sandy mud	
C	Inside	1	N	Y	N	N	N	N	Green/Brown	Sandy mud	
C	Inside	2	N	Y	N	N	N	N	Brown	Mud	Flecks shell hash
C	Outside	1	N	Y	N	N	N	N	Brown	Mud	Flecks shell hash
C	Outside	2	N	Y	N	N	N	N	Brown	Mud	Flecks shell hash
Ref 1	Ref 1	1	N	Y	N	N	N	N	Brown	Mud	Flecks shell hash
Ref 1	Ref 1	2	N	Y	N	N	N	N	Grey	Mud	Flecks shell hash
Ref 2	Ref 2	1	N	Y	N	N	Y	N	Brown	Mud	Flecks shell hash, trace seaweed
Ref 2	Ref 2	2	N	Y	N	N	N	N	Brown	Mud	Flecks shell hash

Appendix 3 – Steamer Point ASC Survey Summary

Company:	Grieg Seafood BC Ltd	Sample date:	April 10 and 11, 2023
Farm Site:	Steamer Point	Field crew:	M. Haswell, M. Twocock, E. Jarry
Site License #:	AQ1079	Analytical:	SGS Canada Inc
Site Location	Hecate Channel, BC		

SULPHIDES Indicator 2.1.1 Requirement ≤ 1500 (μm)					
Station	Rep 1	Rep 2	n	Mean	ASC Criteria Met
Inside AZE C	31.5	20.3	2	25.9	
Outside AZE C	2.80	1.27	2	2.04	Yes
Reference 1	14.2	92.0	2	53.1	
Reference 2	19.1	10.3	2	14.7	

REDOX POTENTIAL Indicator 2.1.1 Requirement > 0 mV					
Station	Rep 1	Rep 2	N	Mean	ASC Criteria Met
Inside AZE C	141.0	110.9	2	126.0	
Outside AZE C	109.8	96.1	2	103.0	Yes
Reference 1	242.2	144.1	2	193.2	
Reference 2	111.1	106.8	2	109.0	