

FINFISH AQUACULTURE SITE AQUACULTURE STEWARDSHIP COUNCIL REPORT HECATE CHANNEL, HECATE CHANNEL, BC

SITE LICENSE: AQ1862

SURVEY TYPE: ASC

SURVEY DATE: FEBRUARY 11, 12 AND 17, 2021

REPORT DATE: FEBRUARY 19, 2021

PREPARED FOR:

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Summary

This document presents the qualitative and quantitative assessment of sediment obtained during the survey completed at the Hecate Channel finfish aquaculture site operated by Grieg Seafood Ltd in Hecate Channel, BC, on February 11, 12, and 17, 2021. Sediment collection was attempted 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 was not collected from any stations outside the Allowable Zone of Effect (AZE) on transects A, B, or C. Sediment collection was attempted at each of these stations; however, due to the substrate composition, collection of sufficient sample quantities was not possible at any of these stations. No comparison to the ASC Salmon Standard acceptable limits for sulphide or redox potential could be made following this survey.

Without samples, monitoring for parasiticide residue outside the AZE could also not be completed at the stations outside the AZE on Transects A, B and C as required by Criterion 5.2 of the ASC.

Sediment was successfully collected from the 0A station and the station inside the AZE on Transect C. The results of the analysis of that sediment is included in this report.

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	9
Appendix 1 – Sample Photographs	I
Appendix 2 – Hecate Channel Field Data	VI
Appendix 3 – Hecate Channel ASC Survey Summary	VIII

1.0 Introduction

This document presents the data collected as part of a benthic study completed at the Hecate Channel finfish aquaculture site operated by Greig Seafood BC Ltd (Campbell River, BC). The Hecate Channel 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 of the Aquaculture Stewardship Council (ASC) Salmon Standard. Additional analysis of collected sediment is also required 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 also required 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).

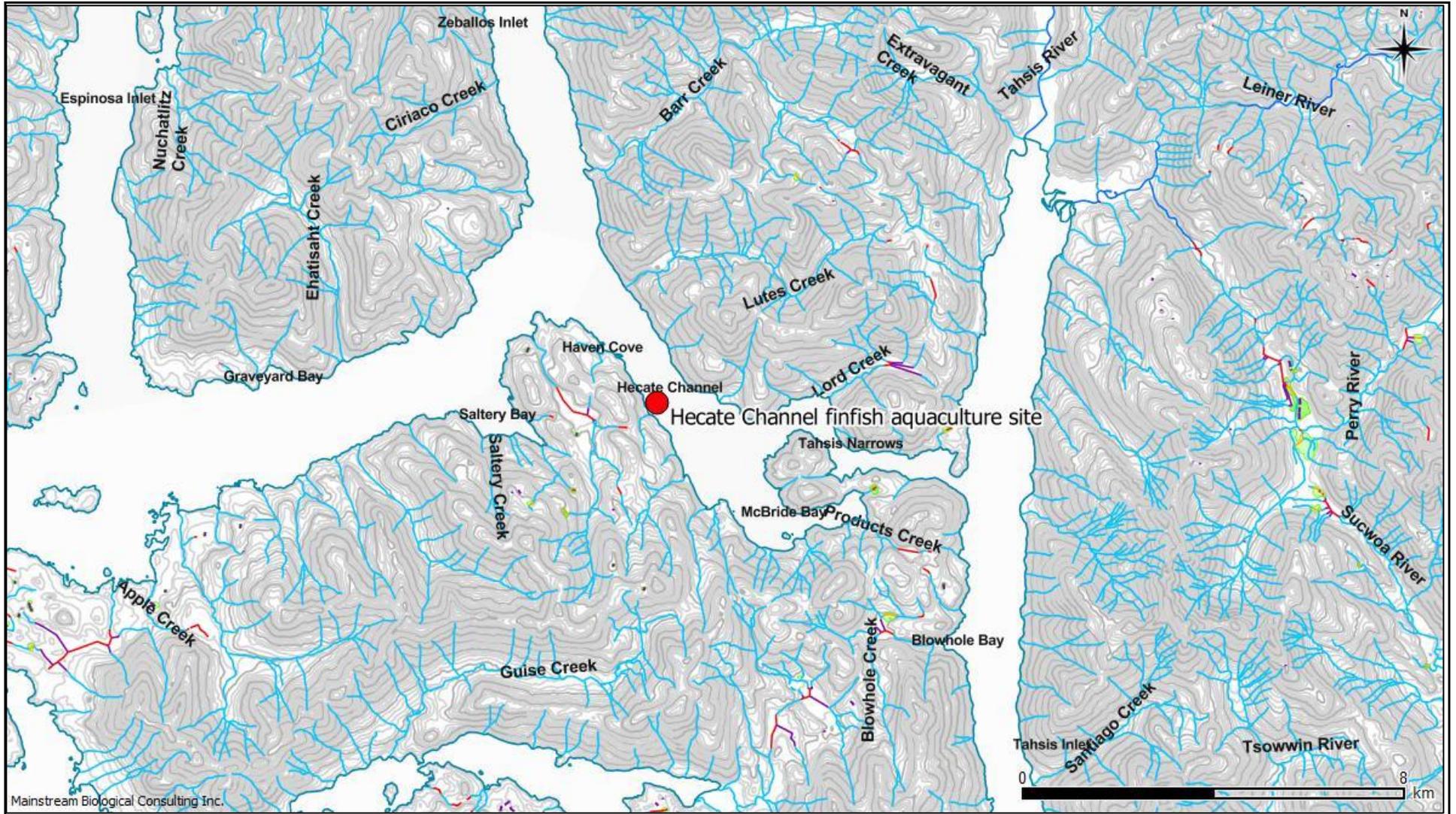


Figure 1: An overview map showing the approximate location of the Hecate Channel finfish aquaculture farm site (red dot) in Hecate Channel, BC.

2.0 Methods

The substrate at the designated sampling locations at the Hecate Channel finfish aquaculture site had not been previously identified to consist of “soft” sediment. 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 located along three transects (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. Stations outside the AZE were located 25 m outside of the 1 g DEPOMOD contour and stations were also located at the perimeter of the containment system for Transects A and B. Additional stations were established at two reference sites within the range of 500 m to 1000 m from the aquaculture containment system as outlined in the ASC Salmon Standard (Figure 3).

Attempts to collect sediment were made using a Petite Ponar grab sampler. When sediment could be collected two sediment samples were retained at each station. If three unsuccessful grab attempts were made the sampling location was considered hard bottom.

The coordinates of the attempted 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)², 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 Nootka base station (NTKA).

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 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.

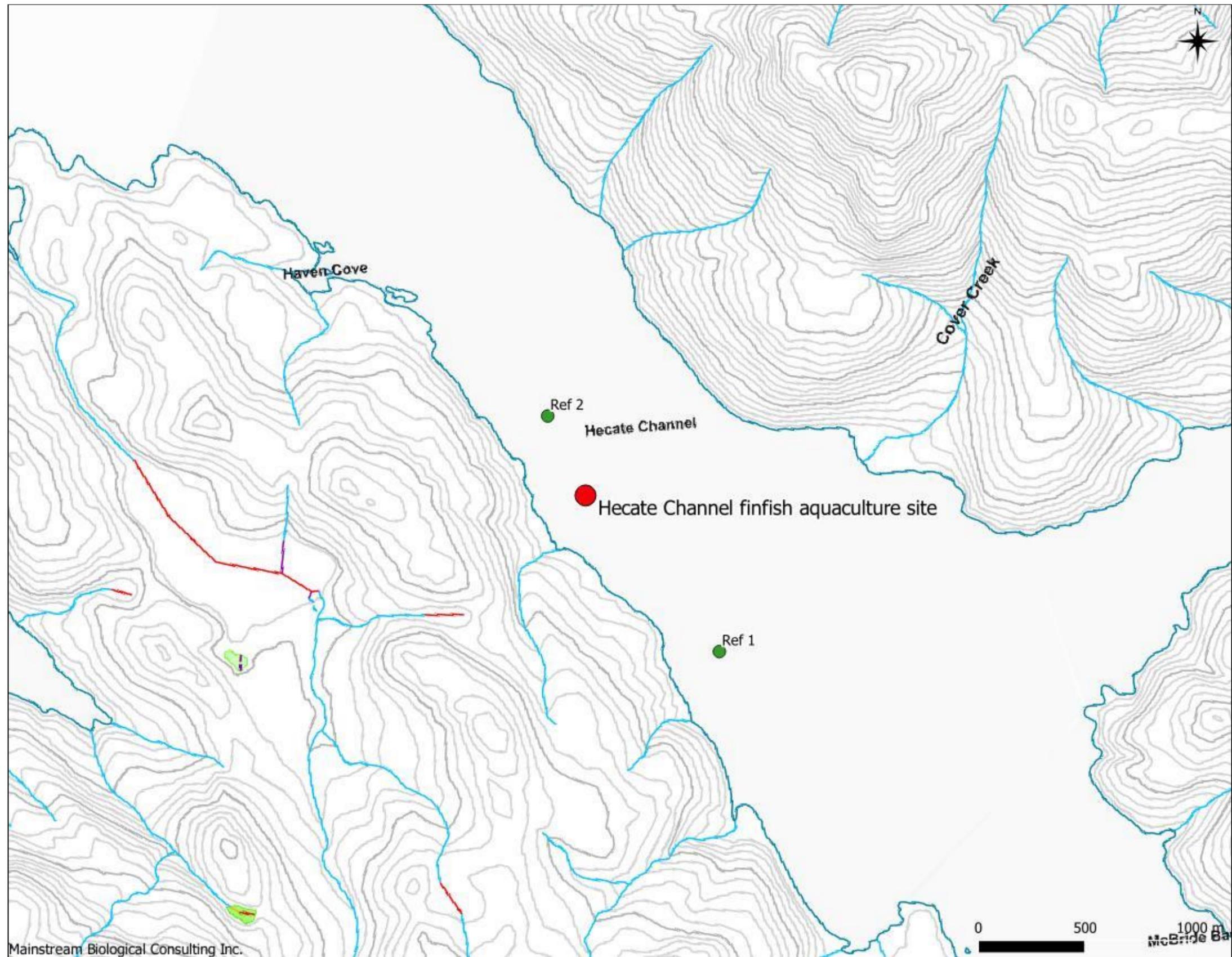


Figure 3: The locations of the reference stations for the ASC survey at the Hecate Channel finfish aquaculture site in relation to the site and surrounding area on February 11, 12, and 17, 2021.

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 outside the AZE at the reference stations would have been retained for analysis. Retained samples would be 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 Hecate Channel 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.

If sample collection outside the AZE was successful, additional analysis of parasiticide residue would have been 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 Hecate Channel 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 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 and of missed grab attempts, with the exception of the station outside the AZE on Transect A, 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 locations of unsuccessful grab attempts are shown in Table 2 below.

The sediment successfully collected at the Hecate Channel sampling stations typically consisted of green and black mud. Sediment could only be collected at the 0A station and the station inside the AZE on Transect C at the Hecate Channel finfish aquaculture site.

Table 2: The location and results of each unsuccessful grab attempt at the Hecate Channel finfish aquaculture site on February 11, 12 and 17, 2021.

Station	Latitude	Longitude	Distance from Pens (m)	Sampling Device	Comments
Inside AZE A	49 52.19454	126 45.69756	240	Petite Ponar	Unidentifiable, grey slimy organism.
Inside AZE A	49 52.19240	126 45.70289	240	Petite Ponar	Empty.
Inside AZE A	49 52.19312	126 45.70177	240	Petite Ponar	Empty.
Outside AZE A	49 52.20685	126 45.71496	270	Petite Ponar	
Outside AZE A	49 52.20562	126 45.71506	270	Petite Ponar	
Outside AZE A	49 52.21096	126 45.71524	270	Petite Ponar	
Station 0B	49 51.99636	126 45.49453	0	Petite Ponar	Empty.
Station 0B	49 51.99634	126 45.49460	0	Petite Ponar	Sampling device seemed to roll down a bluff.
Station 0B	49 51.99642	126 45.49459	0	Petite Ponar	Hit hard bottom.
Inside AZE B	49 51.92348	126 45.39337	180	Petite Ponar	Insufficient amounts of gravel and shell hash.
Inside AZE B	49 51.92517	126 45.39045	180	Petite Ponar	Insufficient amounts of gravel, sand, and shell hash.
Inside AZE B	49 51.92163	126 45.39651	180	Petite Ponar	Insufficient amounts of gravel, sand, and shell hash.
Outside AZE B	49 51.91149	126 45.37724	210	Petite Ponar	Chunks of bark and a rock.
Outside AZE B	49 51.91266	126 45.37520	210	Petite Ponar	Skiff of sediment.
Outside AZE B	49 51.91001	126 45.37996	210	Petite Ponar	Skiff of sand and shell hash.
Outside AZE C	49 52.08256	126 45.44610	270	Petite Ponar	Empty.
Outside AZE C	49 52.08232	126 45.44601	270	Petite Ponar	Small amount.
Outside AZE C	49 52.08216	126 45.44597	270	Petite Ponar	Skiff of sediment.

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 stations outside the AZE would be analyzed to help evaluate if the Hecate Channel facility was meeting the certification requirements (Appendix 3).

However, due to benthic substrate composition, attempts to collect samples at stations outside the AZE on Transects A, B and C were unsuccessful. Therefore, comparisons could not be made to ASC limits for sulphide and redox potential.

3.2 Parasiticide Residue

As sediment could not be successfully obtained from the stations outside the AZE on Transects A, B, C, no analysis could be carried out for parasiticide residue at the Hecate Channel finfish aquaculture site during this survey.

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

Sediment sample collected at Station 0A at the Hecate Channel site on February 11, 2021.



Photo 2

A typical unsuccessful grab attempted inside the AZE on Transect A at the Hecate Channel site on February 12, 2021.



Photo 3

A typical unsuccessful grab attempted at Station 0B at the Hecate Channel site on February 17, 2021.



Photo 4

A typical unsuccessful grab attempted inside the AZE on Transect B at the Hecate Channel site on February 17, 2021.



Photo 5

A typical unsuccessful grab attempted outside the AZE on Transect B at the Hecate Channel site on February 17, 2021.



Photo 6

Sediment sample collected inside the AZE on Transect C at the Hecate Channel site on February 11, 2021.



Photo 7

A typical unsuccessful grab attempted outside the AZE on Transect C at the Hecate Channel site on February 12, 2021.



Photo 8

Sediment sample collected at Reference 1 at the Hecate Channel site on February 12, 2021.



Photo 9

Sediment sample collected at Reference 2 at the Hecate Channel site on February 12, 2021.

Appendix 2 – Hecate Channel Field Data

Reference Information:

Farm site: Hecate Channel	Field Crew: E. Cicon, P. Jones
Aquaculture Company: Greig Seafood BC Ltd	Field Investigator: Mainstream Biological Consulting Inc.
Site Reference #: AQ1862	Laboratory:
Geographic Region: Hecate Channel, BC	

Transect A, B, C Name	Sampling Station Name	Replicate Number	Transect A, B, C Bearing (Magnetic)	Reference Station (Y/N)	Distance from Pens (m)	Sampling Device Type	Sampling Device Capacity (m2)	Quality Control Replicate (Y/N)	Replicate Analysis Type	Sample Date (YYYY-MM-DD)	Sample Time (24HH:MM)	Sample Latitude (Degrees)	Sample Latitude (Minutes)	Sample Longitude (Degrees)	Sample Longitude (Minutes)	GPS Correction Status	Ocean Depth (m)	Sample Depth (cm)
A	0m	1		N	0	Petite Ponar	0.02	N		2021-02-12	11:18	49	52.0866	126	45.5839	Post Process Corrected	89	7
A	0m	1		N	0	Petite Ponar	0.02	Y	Duplicate	2021-02-12	11:18	49	52.0866	126	45.5839	Post Process Corrected	89	7
A	0m	1		N	0	Petite Ponar	0.02	Y	Triplicate	2021-02-12	11:18	49	52.0866	126	45.5839	Post Process Corrected	89	7
A	0m	2		N	0	Petite Ponar	0.02	N		2021-02-12	11:26	49	52.0865	126	45.5841	Post Process Corrected	89	7
C	5m	1		N	60	Petite Ponar	0.02	N		2021-02-11	14:55	49	52.0777	126	45.4657	Post Process Corrected	137	7
C	5m	2		N	60	Petite Ponar	0.02	N		2021-02-11	15:02	49	52.0777	126	45.4636	Post Process Corrected	137	7
Ref 1	Ref 1	1		Y	500	Petite Ponar	0.02	N		2021-02-12	12:20	49	51.8203	126	45.2128	Post Process Corrected	155	5
Ref 1	Ref 1	2		Y	500	Petite Ponar	0.02	N		2021-02-12	12:32	49	51.8237	126	45.2019	Post Process Corrected	155	5
Ref 2	Ref 2	1		Y	700	Petite Ponar	0.02	N		2021-02-12	11:24	49	52.4261	126	45.8555	Post Process Corrected	131	8
Ref 2	Ref 2	2		Y	700	Petite Ponar	0.02	N		2021-02-12	11:33	49	52.4066	126	45.8398	Post Process Corrected	131	5

Transect A, B, C Name	Sampling Station Name	Replicate Number	Free Sulphide (micromolar)	Sediment Temperature (deg C)	Eh Uncorrected (mV)	Eh Corrected (mV)	Cu (micro-g/g)	Zn (micro-g/g)	Li (micro-g/g)	Gravel Percent	Sand Percent	Mud Percent	TVS Percent	Beggiatoa Observed (Y/N)	OPC Observed (Y/N)	Fish Feed Observed (Y/N)	Fish Feces Observed (Y/N)	Odour Rating	Black Sediment Observed (Y/N)	Gas Bubbles Observed (Y/N)
A	0m	1	6370	7.4	-343.6	-126.6								N	N	Y	N	3	Y	N
A	0m	1	6420	7.4	-363.5	-146.5								N	N	Y	N	3	Y	N
A	0m	1		7.4	-375.2	-158.2								N	N	Y	N	3	Y	N
A	0m	2	3850	7.2	-375.4	-158.4								N	N	N	N	3	Y	N
C	5m	1	236	7.7	-57.1	158.9								N	N	N	N	2	N	N
C	5m	2	415	7.7	-223.3	-7.3								N	N	N	N	1	N	N
Ref 1	Ref 1	1	14.9	6.4	25.7	243.7								N	N	N	N	0	N	N
Ref 1	Ref 1	2	44.5	6.3	29.7	247.7								N	N	N	N	0	N	N
Ref 2	Ref 2	1	23.7	7.1	-73.5	143.5								N	N	N	N	0	N	N
Ref 2	Ref 2	2	37.1	6.6	-36.2	180.8								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)

Transect A, B, C Name	Sampling Station Name	Replicate Number	Flocculent Organic Material Observed (Y/N)	Shell Hash Observed (Y/N)	Terrigenous Material Observed (Y/N)	Farm Litter Observed (Y/N)	Macrophytes Observed (Y/N)	Mega fauna Observed (Y/N)	Sediment Colour Observations	Sediment Texture Observations	Other Sample Observations (Comments)
A	0m	1	N	Y	Y	N	N	Y	black	mud	mussels, cedar needles
A	0m	1	N	Y	Y	N	N	Y	black	mud	mussels, cedar needles
A	0m	1	N	Y	Y	N	N	Y	black	mud	mussels, cedar needles
A	0m	2	N	Y	Y	N	N	Y	black	mud	mussels, cedar needles, stick
C	5m	1	N	Y	N	N	N	N	grey	mud	chunk of bone
C	5m	2	N	Y	N	N	N	Y	grey	mud	flecks of shell, clam
Ref 1	Ref 1	1	N	Y	Y	N	N	N	green	mud	bark
Ref 1	Ref 1	2	N	Y	N	N	N	N	green	mud	flecks of shell
Ref 2	Ref 2	1	N	Y	N	N	N	N	green	mud	worm tube
Ref 2	Ref 2	2	N	Y	N	N	N	Y	green	muddy sand	clams

Appendix 3 – Hecate Channel ASC Survey Summary

Company:	Greig Seafood BC Ltd	Sample date:	February 11, 12, and 17
Farm Site:	Hecate Channel	Field crew:	E. Cicon, P. Jones
Site License #:	AQ1862	Analytical:	
Site Location	Hecate Channel, BC		

SULPHIDES Indicator 2.1.1 Requirement ≤ 1500 (μm)					
Station	Rep 1	Rep 2	n	Mean	ASC Criteria Met
0m A	6370	3850	2	5110	
Inside AZE C	236	415	2	326	
Reference 1	14.9	44.5	2	29.7	
Reference 2	23.7	37.1	2	30	

REDOX POTENTIAL Indicator 2.1.1 Requirement > 0 mV					
Station	Rep 1	Rep 2	N	Mean	ASC Criteria Met
0m A	-126.6	-158.4	2	-142.5	
Inside AZE C	158.9	-7.3	2	75.8	
Reference 1	243.7	247.7	2	245.7	
Reference 2	-143.5	-180.8	2	-152.4	