

# FINFISH AQUACULTURE SITE AQUACULTURE STEWARDSHIP COUNCIL REPORT AHLSTROM, JERVIS INLET, BC

*SITE LICENSE: AQ1698*

*SURVEY TYPE: ASC*

*SURVEY DATE: MAY 27, 2020*

*REPORT DATE: JUNE 16, 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 Ahlstrom finfish aquaculture site operated by Grieg Seafood BC Ltd in Jervis Inlet, BC, on May 27, 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.

The ASC survey completed on May 27, 2020 focused on attempting to collect sediment at the predetermined ASC sampling locations. Sediment could not be successfully collected from the station inside the AZE on Transect A and only a single sediment sample could be successfully obtained at the station outside and AZE on Transect A. Subsequent grab attempts could not replicate the sample. In addition, the 0m station on Transect A could not be accessed due to the presence of a compressor float, feed shed and associated anchor lines.

The measured and observed characteristics of the sediment collected during the sampling confirmed that the stations outside the Allowable Zone of Effect (AZE) on Transects B and C had mean sulphide levels less than the ASC Salmon Standard acceptable limit of 1500 µm. Redox potential measured in sediment obtained outside the AZE on Transect B and 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 Transects A, B and C and at three reference stations. Emamectin benzoate and florfenicol 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)<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 Ahlstrom finfish aquaculture site operated by Grieg Seafood BC Ltd (Campbell River, BC). The Ahlstrom site is located in Jervis 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.

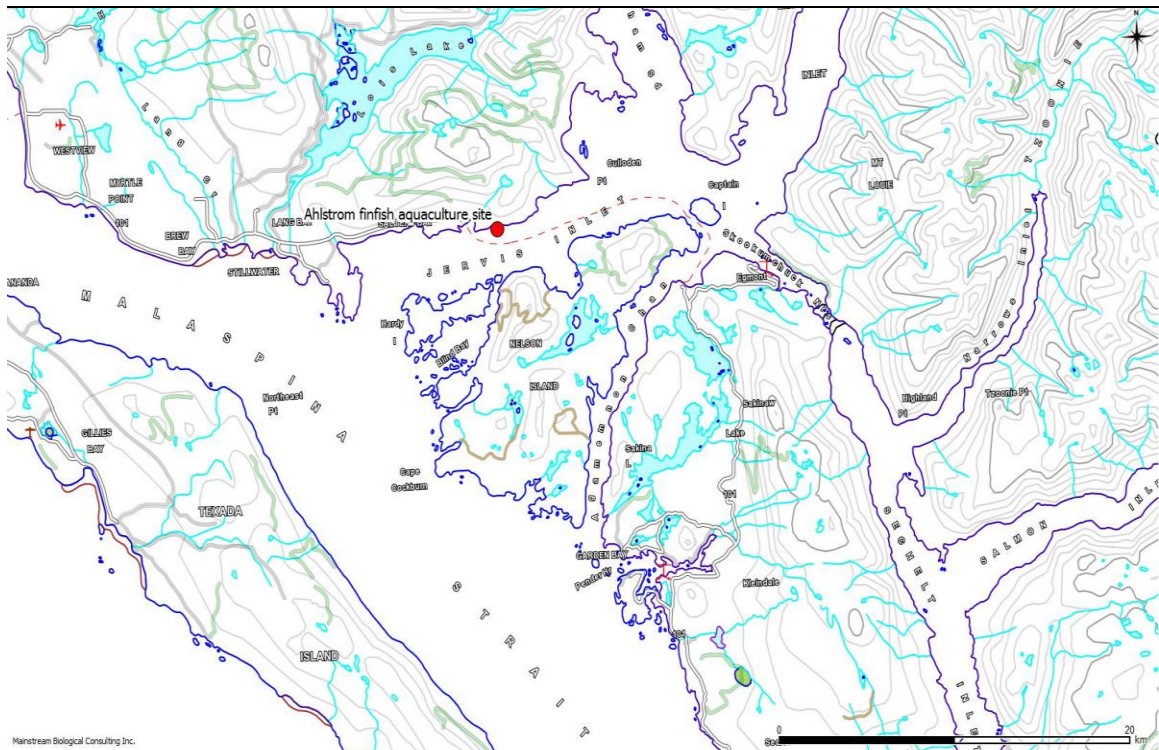


Figure 1: An overview map showing the approximate location of the Ahlstrom finfish aquaculture farm site (red dot) in Jervis Inlet, BC.

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).

## 2.0 Methods

The substrate at the designated sampling locations at the Ahlstrom 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 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 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 within the range of 500 m to 1000 m from the aquaculture containment system as outlined in the ASC Salmon Standard (Figure 3).

Sediment collection was attempted using a Petite Ponar sampler.

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 Nanoose WCDA 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.







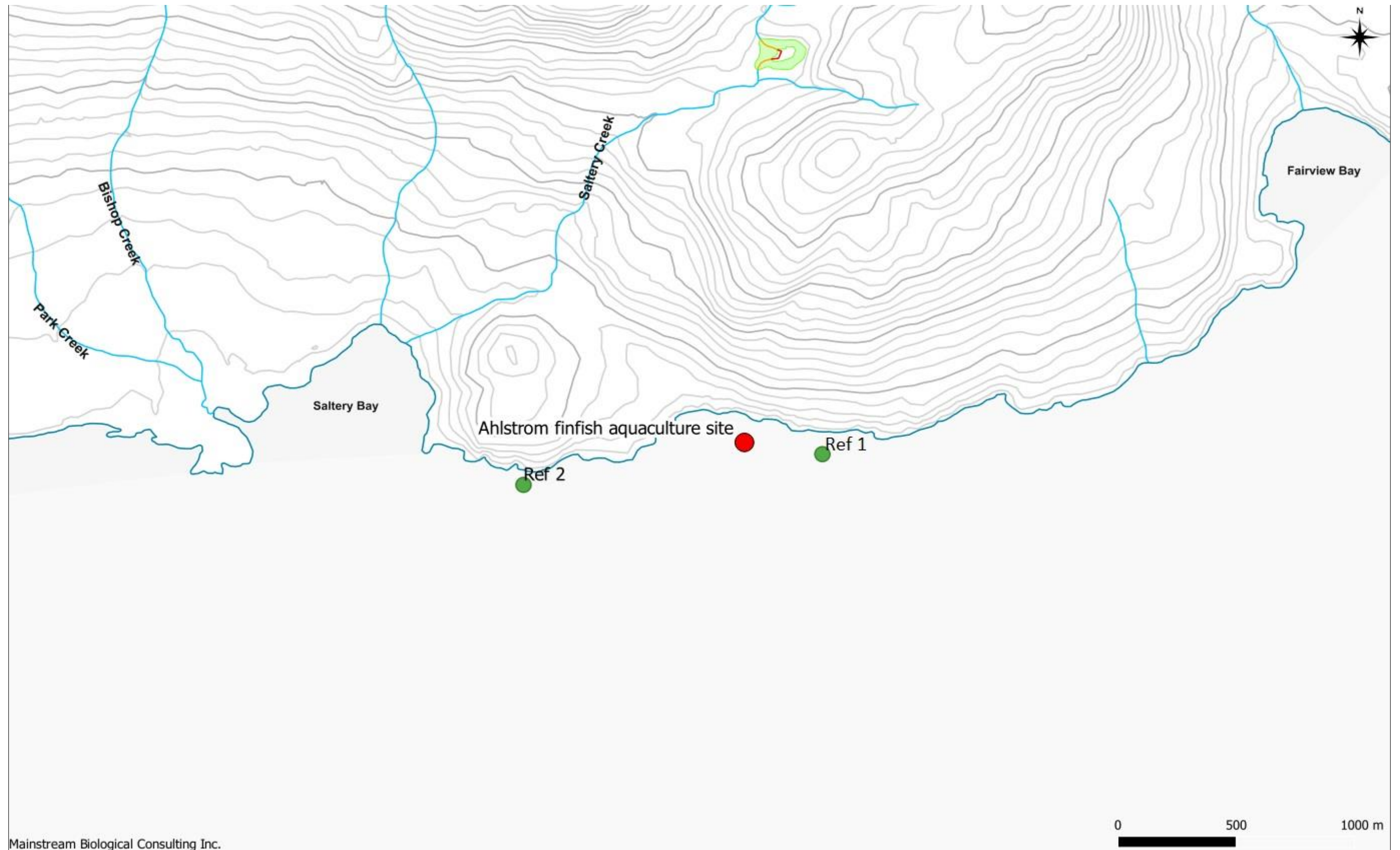


Figure 3: The locations of the reference stations for the ASC survey at the Ahlstrom finfish aquaculture site in relation to the site and surrounding area on May 27, 2020



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 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 and florfenicol.

## 2.2 Data Analysis

In order to evaluate if the benthic conditions at and near the Ahlstrom 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 Ahlstrom 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.

The sediment successfully collected at the Ahlstrom sampling stations typically consisted of grey or brown mud with abundant dead sponge material.

Sediment could not be successfully collected inside the AZE on Transect A and only one sediment sample was successfully collected outside the AZE on Transect A. The results and location of each unsuccessful grab attempt are presented in Table 2. In addition, grab attempts could not be made at the 0A station due to the presence of a compressor float, feed shed and its associated anchor lines.

Table 2: The location and results of each unsuccessful grab attempt at the Ahlstrom finfish aquaculture site during the ASC survey on May 27, 2020.

Station	Grab Attempt	Latitude	Longitude	Depth (m)	Comments
Inside AZE A	1	49 46.77734	124 09.09192	101	Rock in jaws.
Inside AZE A	2	49 46.77790	124 09.09086	101	3 cm dead sponge.
Inside AZE A	3	49 46.77727	124 09.09303	101	Empty.
Inside AZE A	4	49 46.77635	124 09.09350	101	3.5 cm Dead sponge and cobble.
Outside AZE A	1	49 46.77532	124 09.06867	95	Skiff of dead sponge.
Outside AZE A	2	49 46.77683	124 09.06784	95	Skiff of dead sponge.
Outside AZE A	3	49 46.77574	124 09.06813	95	3.5 cm dead sponge.
Outside AZE A	4	49 46.77736	124 09.06749	95	Skiff of shell hash.

#### 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 name facility was meeting the certification requirements (Appendix 3).

The mean sulphide level in sediment collected at the stations outside AZE on Transects B and C (55.7  $\mu\text{M}$  and 6.22  $\mu\text{M}$  respectively) on May 27, 2020 were less than the ASC Salmon Standard sulphide upper limit of 1500  $\mu\text{M}$ .

Mean redox potential in sediment collected at the stations outside the AZE on Transects B and C (267.6 mV and 165.9 mV respectively) were 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 A, B, C and the two reference stations for emamectin benzoate and florfenicol 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 Transects A, B, C and the two reference stations at the Ahlstrom finfish aquaculture site on May 27, 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 A	1	<1.0	<2.00	<5.00
Outside AZE B	1	<1.0	<2.00	<5.00
Outside AZE B	2	<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

## 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**

A typical missed grab attempt at the station inside the AZE on Transect A at the Ahlstrom site on May 27, 2020..



**Photo 2**

The single sediment sample collected at the station outside the AZE on Transect A at the Ahlstrom site on May 27, 2020.



**Photo 3**

Sediment sample collected at the 0B station at the Ahlstrom site on May 27, 2020.



**Photo 4**

Sediment sample collected at the station inside the AZE on Transect B at the Ahlstrom site on May 27, 2020.





**Photo 5**

Sediment sample collected at the station outside the AZE on Transect B at the Ahlstrom site on May 27, 2020.



**Photo 6**

Sediment sample collected at the station inside the AZE on Transect C at the Ahlstrom site on May 27, 2020.





**Photo 7**

Sediment sample collected at the station outside the AZE on Transect C at the Ahlstrom site on May 27, 2020.



**Photo 8**

Sediment sample collected at the Reference 1 at the Ahlstrom site on May 27, 2020.





**Photo 9**

Sediment sample collected at the Reference 2 at the Ahlstrom site on May 27, 2020.

Appendix 2 – Ahlstrom Field Data

Reference Information:

<b>Farm site:</b>	Ahlstrom	<b>Field Crew:</b>	N. Delange, E Weiss
<b>Aquaculture Company:</b>	Grieg Seafood BC Ltd	<b>Field Investigator:</b>	Mainstream Biological Consulting Inc.
<b>Site Reference #:</b>	AQ1698	<b>Laboratory:</b>	SGS Canada Inc
<b>Geographic Region:</b>	Jervis Inlet, 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>
A	Out A	1			161	Ponar	0.02			2020-05-27	10:57	49	46.7762	124	9.0683	Post-process corrected	94.8	6
A	Out A	1			161	Ponar	0.02	Y	Duplicate	2020-05-27	10:57	49	46.7762	124	9.0683	Post-process corrected	94.8	6
A	Out A	1			161	Ponar	0.02	Y	Triplicate	2020-05-27	10:57	49	46.7762	124	9.0683	Post-process corrected	94.8	6
B	0m	1			0	Ponar	0.02			2020-05-27	12:41	49	46.7387	124	9.3118	Post-process corrected	73.8	6
B	0m	2			0	Ponar	0.02			2020-05-27	12:43	49	46.7386	124	9.3120	Post-process corrected	73.8	5
B	In B	1			65	Ponar	0.02			2020-05-27	13:08	49	46.7267	124	9.3677	Post-process corrected	71	7
B	In B	2			65	Ponar	0.02			2020-05-27	13:23	49	46.7257	124	9.3670	Post-process corrected	71	6
B	Out B	1			95	Ponar	0.02			2020-05-27	13:36	49	46.7194	124	9.3899	Post-process corrected	45	8
B	Out B	2			95	Ponar	0.02			2020-05-27	13:42	49	46.7190	124	9.3896	Post-process corrected	45	7
C	In C	1			70	Ponar	0.02			2020-05-27	11:45	49	46.7174	124	9.2190	Post-process corrected	129	9
C	In C	2			70	Ponar	0.02			2020-05-27	11:54	49	46.7174	124	9.2204	Post-process corrected	129	7
C	Out C	1			100	Ponar	0.02			2020-05-27	12:07	49	46.7014	124	9.2079	Post-process corrected	138	6
C	Out C	2			100	Ponar	0.02			2020-05-27	12:18	49	46.7013	124	9.2099	Post-process corrected	139	6
Ref 1	Ref 1	1		Y	580	Ponar	0.02			2020-05-27	14:05	49	46.7523	124	8.8377	Post-process corrected	112	7
Ref 1	Ref 1	2		Y	580	Ponar	0.02			2020-05-27	14:11	49	46.7525	124	8.8342	Post-process corrected	112	6
Ref 2	Ref 2	1		Y	700	Ponar	0.02			2020-05-27	14:35	49	46.6710	124	9.8903	Post-process corrected	88	10
Ref 2	Ref 2	2		Y	700	Ponar	0.02			2020-05-27	14:37	49	46.6698	124	9.8857	Post-process corrected	88	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	25m	1	11.8	13.2	136.7	347.7								N	N	N	N	0	N	N
A	25m	1	20.8	13.2	126.4	337.4								N	N	N	N	0	N	N
A	25m	1		13.2	150.3	361.3								N	N	N	N	0	N	N
B	0m	1	60.7	10.5	-212.3	0.7								N	N	N	N	1	N	N
B	0m	2	149	9.8	-300.3	-86.3								N	N	N	N	1	N	N
B	5m	1	64.2	12.6	108.1	319.1								N	N	N	N	0	Y	N
B	5m	2	39.6	13.3	95.7	306.7								N	N	N	N	0	N	N
B	25m	1	23.7	11.8	-13	199								N	N	N	N	0	N	N
B	25m	2	5.15	12.4	124.2	336.2								N	N	N	N	0	N	N
C	5m	1	22	10.8	31.1	244.1								N	N	N	N	0	N	N
C	5m	2	21.4	11	-6.6	206.4								N	N	N	N	0	N	N
C	25m	1	7.73	11.2	-51.1	161.9								N	N	N	N	0	N	N
C	25m	2	4.71	10.6	-43.1	169.9								N	N	N	N	0	N	N
Ref 1	Ref 1	1	2.66	12.9	175.1	386.1								N	N	N	N	0	N	N
Ref 1	Ref 1	2	3.09	13.2	164.5	375.5								N	N	N	N	0	N	N
Ref 2	Ref 2	1	2.49	12.1	102	314								N	N	N	N	0	N	N
Ref 2	Ref 2	2	10.2	11.9	160.3	372.3								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><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	25m	1	N	N	N	N	N	N	Brown	Mud	Abundant dead sponge, worm tubes
A	25m	1	N	N	N	N	N	N	Brown	Mud	Abundant dead sponge, worm tubes
A	25m	1	N	N	N	N	N	N	Brown	Mud	Abundant dead sponge, worm tubes
B	0m	1	N	Y	Y	N	N	N	Grey	Mud	Pine needles, dead sponge, wood debris
B	0m	2	N	Y	Y	N	N	N	Grey	Mud	Cedar needle, dead sponge
B	5m	1	N	Y	Y	N	N	N	Brown	Mud	Cedar needle, dead sponge
B	5m	2	N	N	Y	N	N	N	Brown	Mud	Cedar needle, abundant dead sponge
B	25m	1	N	N	Y	N	N	N	Green	Mud	Pine needles, abundant dead sponge
B	25m	2	N	N	N	N	N	N	Brown	Mud	Abundant dead sponge, minimal sediment
C	5m	1	N	N	N	N	N	N	Brown	Mud	Abundant dead sponge, worm tubes
C	5m	2	N	N	N	N	N	N	Brown	Mud	Abundant dead sponge, worm tubes
C	25m	1	N	N	N	N	N	N	Green	Mud	Abundant dead sponge, 2 pieces of cobble
C	25m	2	N	N	N	N	N	N	Green	Mud	Abundant dead sponge, worm tubes
Ref 1	Ref 1	1	N	N	N	N	N	N	Green	Mud	Abundant dead sponge
Ref 1	Ref 1	2	N	Y	N	N	N	N	Green	Mud	Abundant dead sponge, muscle shell
Ref 2	Ref 2	1	N	N	N	N	N	N	Green	Mud	Abundant dead sponge
Ref 2	Ref 2	2	N	N	N	N	N	N	Green	Mud	Abundant dead sponge

## Appendix 3 – Ahlstrom ASC Survey Summary

<b>Company:</b>	Grieg Seafood BC Ltd	<b>Sample date:</b>	May 27, 2020
<b>Farm Site:</b>	Ahlstrom	<b>Field crew:</b>	N. Delange, E. Weiss
<b>Site License #:</b>	AQ1698	<b>Analytical:</b>	SGS Canada Inc
<b>Site Location</b>	Jervis Inlet, BC		

SULPHIDES Indicator 2.1.1 Requirement $\leq 1500$ ( $\mu\text{m}$ )					
Station	Rep 1	Rep 2	n	Mean	ASC Criteria Met
0m A	-	-	0	-	
Inside AZE A	-	-	0	-	
Outside AZE A	59.4	-	1	-	-
0m B	60.7	149	2	105	
Inside AZE B	64.2	39.6	2	51.9	
Outside AZE B	61.9	49.5	2	55.7	Yes
Inside AZE C	22.0	21.4	2	21.7	
Outside AZE C	7.73	4.71	2	6.22	Yes
Reference 1	2.66	3.09	2	2.88	
Reference 2	2.49	10.2	2	6.35	

REDOX POTENTIAL Indicator 2.1.1 Requirement $> 0$ mV					
Station	Rep 1	Rep 2	N	Mean	ASC Criteria Met
0m A	-	-	0	-	
Inside AZE A	-	-	0	-	
Outside AZE A	347.7		1	-	-
0m B	0.7	-86.3	2	-42.8	
Inside AZE B	319.1	306.7	2	312.9	
Outside AZE B	199.0	336.2	2	267.6	Yes
Inside AZE C	244.1	206.4	2	225.3	
Outside AZE C	161.9	169.9	2	165.9	Yes
Reference 1	386.1	375.5	2	380.8	
Reference 2	314.0	372.3	2	343.2	