

# FINFISH AQUACULTURE SITE AQUACULTURE STEWARDSHIP COUNCIL REPORT MUCHALAT NORTH, MUCHALAT INLET, BC

*SITE LICENSE: AQ1849*

*SURVEY TYPE: ASC*

*SURVEY DATE: JANUARY 9, 2020*

*REPORT DATE: FEBRUARY 9, 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 Muchalat North finfish aquaculture site operated by Grieg Seafood BC Ltd. in Muchalat Inlet, BC, on January 9, 2020. 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.

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 Transects C was less than the ASC Salmon Standard acceptable lower limit of 0 mV. Sediment could not be obtained at the stations outside the AZE on Transect A or B for these analyses.

Mean copper concentration of the station outside the AZE on Transect C was greater than upper limit of 34 µg/g listed in the requirements of Criterion 4.7 of the ASC and was also greater than the mean of both the reference stations sampled. Sediment could not be obtained at the stations outside the AZE on Transect A or B for this analysis.

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 both below detectable limits in all collected samples. Sediment could not be obtained at the stations outside the AZE on Transect A or B for this analysis.

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/>

## Table of Contents

<b>Summary.....</b>	<b>ii</b>
<b>Table of Contents.....</b>	<b>iii</b>
<b>1.0 Introduction.....</b>	<b>1</b>
<b>2.0 Methods.....</b>	<b>3</b>
2.1 Field Sampling .....	3
2.2 Data Analysis.....	6
<b>3.0 Results and Discussion .....</b>	<b>8</b>
3.1 Redox Potential and Sulphide Levels.....	8
3.2 Copper Concentration.....	10
3.3 Parasiticide Residue .....	10
<b>4.0 References .....</b>	<b>12</b>
<b>Appendix 1 – Sample Photographs .....</b>	<b>I</b>
<b>Appendix 2 – Muchalat North Field Data .....</b>	<b>IV</b>
<b>Appendix 3 – Muchalat North ASC Survey Summary .....</b>	<b>VI</b>

## 1.0 Introduction

This document presents the marine sediment data collected as part of a benthic study completed at the Muchalat North finfish aquaculture site operated by Grieg Seafood BC Ltd. (Campbell River, BC). The Muchalat North site, is located in Muchalat 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 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 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. 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). In addition, testing for copper concentration and for parasiticide residue in sediment collected at the two reference stations and at the stations outside the AZE was completed to address Criterion 4.7.4 and Criterion 5.2.1 of the ASC.

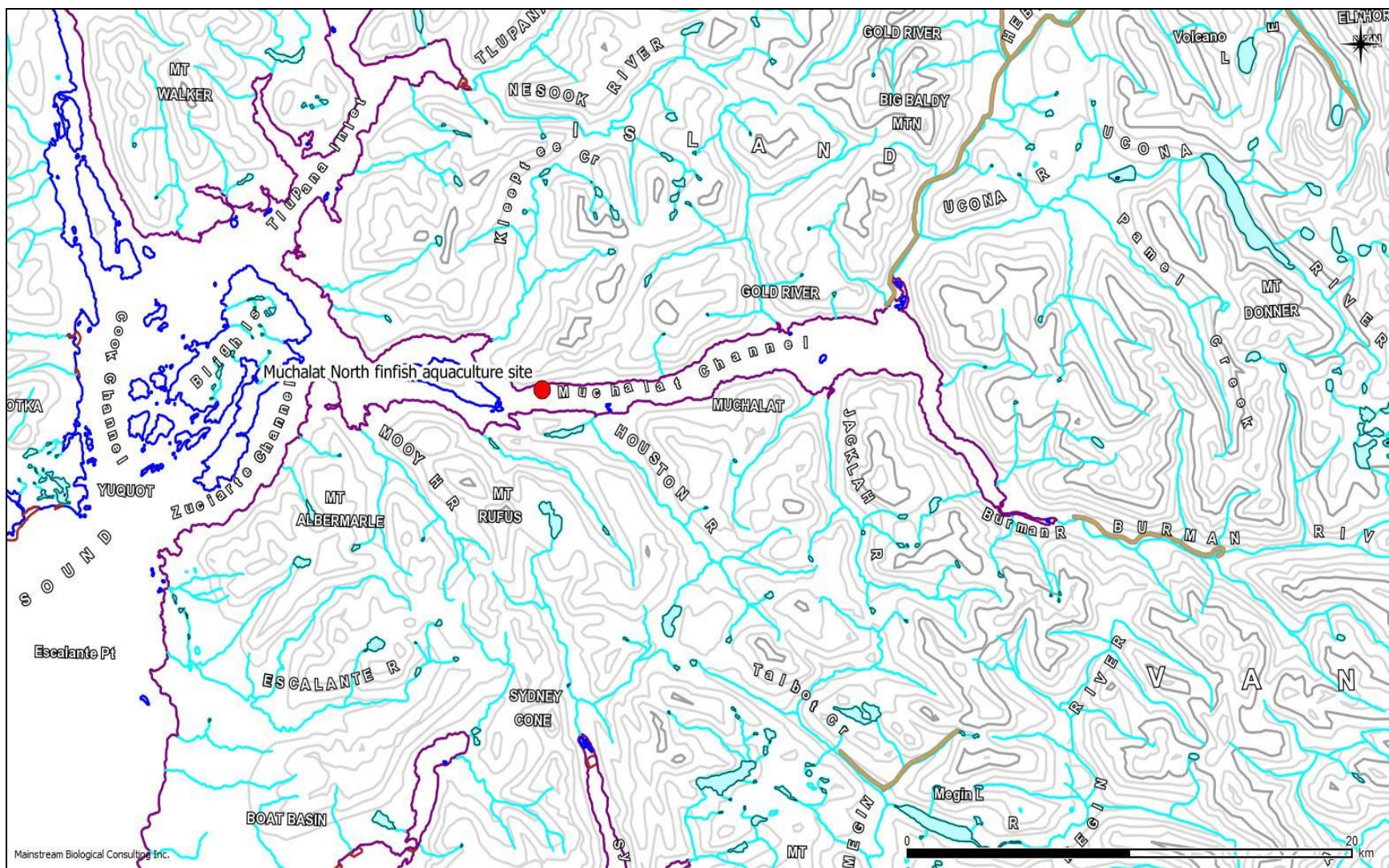


Figure 1: An overview map showing the approximate location of the Muchalat North finfish aquaculture farm site (red dot) in Muchalat, BC.

## 2.0 Methods

The substrate at the designated sampling locations at the Muchalat North finfish aquaculture site had not been previously been 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. Sediment collection was first attempted during a preliminary survey on June 18, 2019<sup>2</sup> to identify locations at which sediment could be successfully obtained.

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 stations that were outside the range of 500 m to 1000 m from the aquaculture containment system outlined in the ASC Salmon Standard (Figure 3) due to the difficulty in finding sediment within that area in Muchalat Inlet, BC.

The results of the preliminary assessment concluded that sediment could only be successfully obtained at stations outside the AZE on Transect A and inside and outside the AZE on Transect C. During this survey the collection of sediment could not be replicated at the station outside the AZE on Transect A. Therefore, this survey included the analysis of sediment from the stations inside and outside the AZE on Transect C and from two reference stations.

Sediment was collected using a Petite Ponar sampler. Three sediment samples were collected at each 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>3</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 Ucluelet base station (UCLA).

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> Benthic Biodiversity Assessment Muchalat North Finfish Aquaculture Site. An unpublished report prepared for Grieg Seafood BC Ltd. by Mainstream Biological Consulting Inc. July 8, 2020.

<sup>3</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.



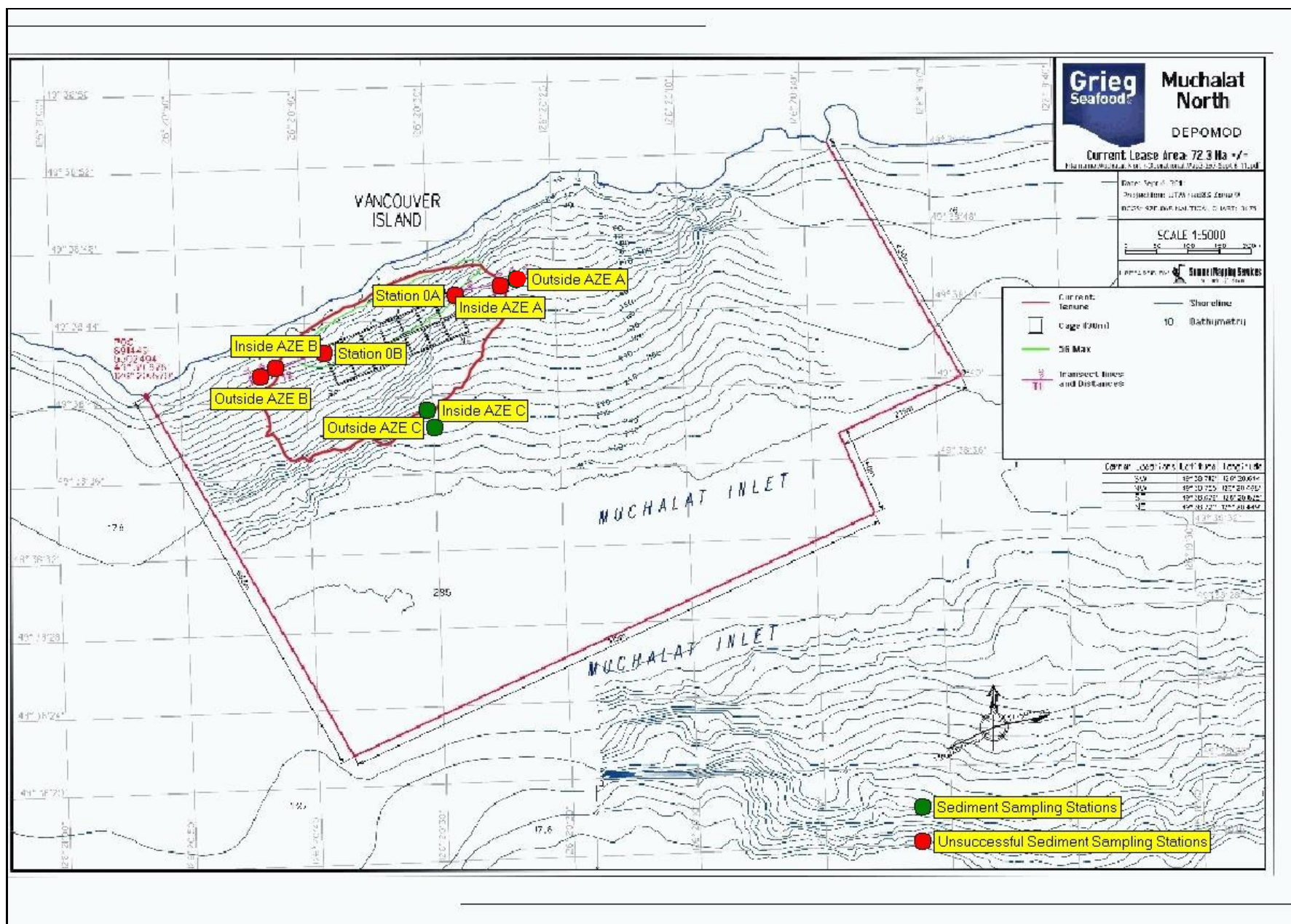


Figure 2: The locations of the sampling stations for the ASC survey at the Muchalat North finfish aquaculture site in relation to the pen system and surrounding area on January 9, 2020.



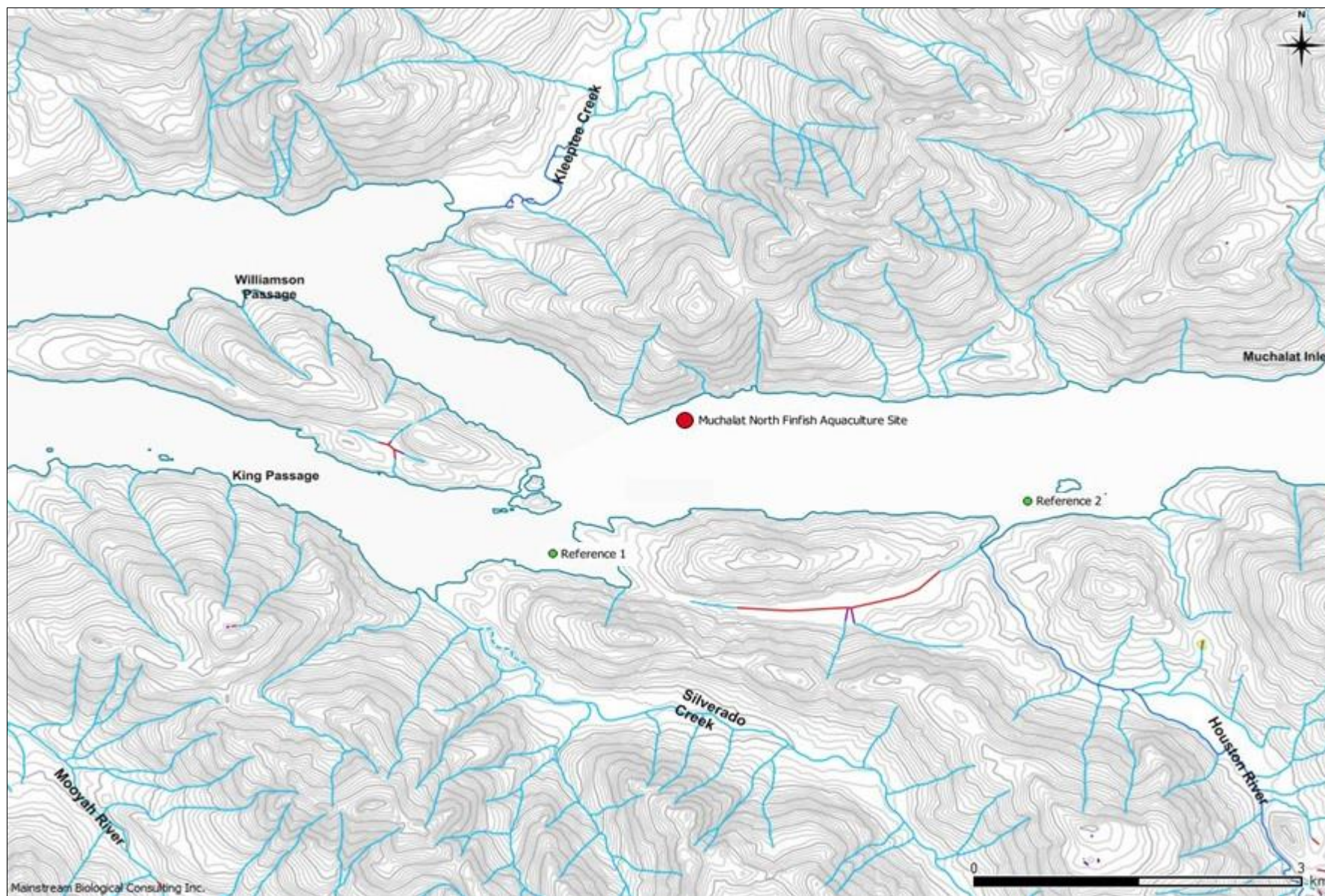


Figure 3: The location of the reference stations (green dots) for the ASC survey at the Muchalat North finfish aquaculture site in relation to the pen system (red dot) and surrounding area on January 9, 2020.



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 4.7.4 and 5.2.1, portions of the grab samples collected at the stations outside the AZE on Transects C as well as the reference stations were retained for copper analysis and parasiticide residue. Retained samples were stored at 4° Celsius and transported to Bureau Veritas for the analysis of copper concentrations and 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 Muchalat North 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 Muchalat North 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 <sup>1</sup> .	>0 millivolts (mV)
2.1.1	Sulphide levels in sediment outside the AZE.	≤1500 microMoles / L (μM)
4.7.4	Copper concentration	Evidence that copper levels are < 34 mg Cu/kg dry sediment weight OR in instances where the Cu in the sediment exceeds 34 mg Cu/kg dry sediment weight, demonstration that the Cu concentration falls within the range of background concentrations as measured at three reference sites in the water body.

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.

In general, the sediment successfully collected at the Muchalat North sampling stations consisted of brown or green odorless mud.

On June 18, 2019 during a preliminary survey a total of four grab attempts were made at the perimeter of the containment system on Transects A and B, at the stations inside the AZE on Transects A and B and outside the AZE on Transect B. All of the attempts were unsuccessful in obtaining sufficient sediment for analysis. The location and results of each of the unsuccessful grab attempts are presented in Table 3.

During the survey completed on January 9, 2020 attempts to replicate the successful grabs obtained on June 18, 2019 at the station outside the AZE on Transect A were all unsuccessful in obtaining sufficient sediment for analysis. The location and results of each of the unsuccessful grab attempts completed on January 9, 2020 are presented in Table 4.

#### **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 Muchalat North facility was meeting the certification requirements (Appendix 3).

The mean sulphide level in sediment collected at the station outside AZE on Transect C, (307  $\mu\text{M}$ ) on January 9, 2020 was less than the ASC Salmon Standard sulphide upper limit of 1500  $\mu\text{M}$ .

Mean redox potential in sediment collected at the station outside the AZE on Transect C (-27.2 mV), was less than the 0 mV minimum requirement cited in Criterion 2.1.1 of the ASC Salmon Standard.



Table 3: The location and results of each unsuccessful grab attempt at the stations 0A, Inside AZE A, 0B, Inside AZE B and Outside AZE B at the Muchalat North finfish aquaculture site during the preliminary survey on June 18, 2019.

Station	Latitude	Longitude	Sampling Device	Comments
Station 0A	49 38.75357	126 20.46246	Ponar	Skim sand, shell hash.
Station 0A	49 38.75386	126 20.46372	Ponar	Trace sand.
Station 0A	49 38.75420	126 20.46534	Ponar	Trace sand.
Station 0A	49 38.75428	126 20.46549	Ponar	Trace sand.
Inside AZE A	49 38.76029	126 20.40159	Ponar	Trace sand.
Inside AZE A	49 38.75939	126 20.40142	Ponar	Trace sand.
Inside AZE A	49 38.75968	126 20.40143	Ponar	Gravel, tubeworm.
Inside AZE A	49 38.76009	126 20.40156	Ponar	Empty.
Station 0B	49 38.70639	126 20.63951	Ponar	Trace shell hash, sand.
Station 0B	49 38.70754	126 20.64092	Ponar	Trace shell hash, sand.
Station 0B	49 38.70799	126 20.64123	Ponar	Trace shell hash, sand.
Station 0B	49 38.70809	126 20.64117	Ponar	Trace shell hash, gravel.
Inside AZE B	49 38.69592	126 20.70316	Ponar	Trace shell hash, sand, gravel.
Inside AZE B	49 38.69641	126 20.70353	Ponar	Trace shell hash, sand.
Inside AZE B	49 38.69644	126 20.70347	Ponar	Trace shell hash, sand.
Inside AZE B	49 38.69597	126 20.70316	Ponar	Trace shell hash, gravel.
Outside AZE B	49 38.68882	126 20.72447	Ponar	Trace shell hash, sand.
Outside AZE B	49 38.68942	126 20.72489	Ponar	Trace shell hash, sand.
Outside AZE B	49 38.69044	126 20.72445	Ponar	Trace shell hash, sand, gravel.
Outside AZE B	49 38.68914	126 20.72415	Ponar	Trace shell hash, sand, gravel.

Table 4: The location and results of each unsuccessful grab attempt at the station outside the AZE on Transect A at the Muchalat North finfish aquaculture site on January 9, 2020.

Station	Latitude	Longitude	Sampling Device	Comments
Outside AZE A	49 38.76612	126 20.38522	Ponar	One rock.
Outside AZE A	49 38.76421	126 20.38055	Ponar	Three small rocks.
Outside AZE A	49 38.76498	126 20.38365	Ponar	Empty.
Outside AZE A	49 38.73688	126 20.38257	Ponar	Empty.

### 3.2 Copper Concentration

The copper concentrations of the sediment collected from the station outside the AZE on Transects C and the two reference stations are shown in Table 5. The sediment collected at the station outside the AZE on Transect C had a mean copper concentration (66.5 mg/g) that was above the background mean concentrations measured at both Reference 1 (33.7 mg/g) and Reference 2 (18.9 mg/g). As the mean copper concentration measured at the station outside the AZE on Transect C was higher than 34 mg/g, the benthic conditions at this location did not meet the ASC Salmon Standard in accordance with Criterion number 4.7.4.

Table 5: The copper concentrations of collected sediment at the station outside the AZE on Transect C and the two reference stations at the Muchalat North finfish aquaculture site on January 9, 2020.

Station	Cu (micro-g/g)	Mean	SD	Median
Outside AZE C	84.7	66.5	16.0	60.5
Outside AZE C	60.5			
Outside AZE C	54.4			
Reference 1	34.8	33.7	1.00	33.3
Reference 1	33.3			
Reference 1	32.9			
Reference 2	31.2	18.9	3.06	20.0
Reference 2	15.4			
Reference 2	20.0			

### 3.3 Parasiticide Residue

Analysis of the sediment collected from the station outside the AZE on Transect C and the two reference stations for emamectin benzoate and florfenicol are shown in Table 6. 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 detectible limits.

Table 6: The parasiticide residue concentration of collected sediment at the station outside the AZE on Transect C and the two reference stations at the Muchalat North finfish aquaculture site on January 9, 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
Outside AZE C	3	<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 1	3	<1.0	<2.00	<5.00
Reference 2	1	<1.0	<2.00	<5.00
Reference 2	2	<1.0	<2.00	<5.00
Reference 2	3	<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 outside the AZE on Transect A at the Muchalat North site on January 9, 2020.



**Photo 2**

Sediment sample collected at the station outside the AZE on Transect C at the Muchalat North site on January 9, 2020.



**Photo 3**

Sediment sample collected at the station outside the AZE on Transect C at the Muchalat North site on January 9, 2020.



**Photo 4**

Sediment sample collected at Reference 1 at the Muchalat North site on January 9, 2020.





**Photo 5**

Sediment sample collected at Reference 2 at the Muchalat North site on January 9, 2020.

Appendix 2 – Muchalat North Field Data

Reference Information:	
<b>Farm site:</b>	Muchalat North
<b>Aquaculture Company:</b>	Grieg Seafood BC Ltd.
<b>Site Reference #:</b>	AQ1849
<b>Geographic Region:</b>	Muchalat Inlet, BC
<b>Field Crew:</b>	L Stewardson, E. Cicon
<b>Field Investigator:</b>	Mainstream Biological Consulting Inc.
<b>Laboratory:</b>	SGS Canada Inc and Bureau Veritas

<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	In AZE	1			86	Petite Ponar	0.02			2020-01-09	10:57	49	38.656	126	20.513	Uncorrected	149	10
C	In AZE	2			86	Petite Ponar	0.02			2020-01-09	11:12	49	38.656	126	20.512	Uncorrected	149	10
C	In AZE	2			86	Petite Ponar	0.02	Y	Duplicate	2020-01-09	11:12	49	38.656	126	20.512	Uncorrected	149	10
C	In AZE	2			86	Petite Ponar	0.02	Y	Triplicate	2020-01-09	11:12	49	38.656	126	20.512	Uncorrected	149	10
C	In AZE	3			86	Petite Ponar	0.02			2020-01-09	11:26	49	38.655	126	20.513	Uncorrected	149	9
C	Out AZE	1			116	Petite Ponar	0.02			2020-01-09	11:50	49	38.641	126	20.502	Uncorrected	172	10
C	Out AZE	2			116	Petite Ponar	0.02			2020-01-09	12:05	49	38.639	126	20.503	Uncorrected	171	10
C	Out AZE	3			116	Petite Ponar	0.02			2020-01-09	12:22	49	38.639	126	20.504	Uncorrected	172	10
Ref 1	Ref 1	1			1650	Petite Ponar	0.02			2020-01-09	13:40	49	38.017	126	21.537	Uncorrected	80.1	5
Ref 1	Ref 1	2			1650	Petite Ponar	0.02			2020-01-09	13:45	49	38.013	126	21.536	Uncorrected	80.5	7
Ref 1	Ref 1	3			1650	Petite Ponar	0.02			2020-01-09	13:50	49	38.023	126	21.520	Uncorrected	79.0	6
Ref 2	Ref 2	1			3210	Petite Ponar	0.02			2020-01-09	14:22	49	38.369	126	17.880	Uncorrected	98.3	8
Ref 2	Ref 2	2			3200	Petite Ponar	0.02			2020-01-09	14:36	49	38.365	126	17.862	Uncorrected	94.4	5
Ref 2	Ref 2	3			3190	Petite Ponar	0.02			2020-01-09	14:44	49	38.372	126	17.877	Uncorrected	98.7	5

<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	In AZE	1	427	6.3	-231.4	-13.4									N	N	N	N	0	N
C	In AZE	2	217	6.5	-229.8	-12.8									N	N	N	N	0	N
C	In AZE	2	254	6.5	-227.6	-10.6									N	N	N	N	0	N
C	In AZE	2		6.5	-230.9	-13.9									N	N	N	N	0	N
C	In AZE	3	219	6.4	-246.3	-28.3									N	N	N	N	0	N
C	Out AZE	1	362	6.7	-238.5	-21.5									N	N	N	N	0	N
C	Out AZE	2	329	6.6	-246.5	-29.5									N	N	N	N	0	N
C	Out AZE	3	230	6.6	-247.5	-30.5									N	N	N	N	0	N
Ref 1	Ref 1	1	133	6.8	-224.4	-7.4									N	N	N	N	0	N
Ref 1	Ref 1	2	127	6.9	-213.3	3.7									N	N	N	N	0	N
Ref 1	Ref 1	3	134	6.8	-231.1	-14.1									N	N	N	N	0	N
Ref 2	Ref 2	1	182	6.6	-216.5	0.5									N	N	N	N	0	N
Ref 2	Ref 2	2	87.4	6.0	-151.4	66.6									N	N	N	N	0	N
Ref 2	Ref 2	3	192	6.3	-192.6	25.4									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>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	In AZE	1	N	Y	N	N	N	N	Brown	Mud	
C	In AZE	2	N	Y	N	N	N	N	Brown	Mud	
C	In AZE	2	N	Y	N	N	N	N	Brown	Mud	
C	In AZE	2	N	Y	N	N	N	N	Brown	Mud	
C	In AZE	3	N	Y	Y	N	N	N	Brown	Mud	Small wood bits
C	Out AZE	1	N	Y	Y	N	N	Y	Olive Green	Mud	Needle and tubeworms
C	Out AZE	2	N	Y	Y	N	N	N	Olive Green	Mud	Cedar needle
C	Out AZE	3	N	Y	Y	N	N	N	Olive Green	Mud	Needle and flecks of shell
Ref 1	Ref 1	1	N	N	Y	N	N	N	Green	Mud	Abundant wood debris
Ref 1	Ref 1	2	N	Y	Y	N	N	Y	Green	Mud	Twigs, needles, tubeworms
Ref 1	Ref 1	3	N	Y	Y	N	N	N	Green	Mud	Small wood bits
Ref 2	Ref 2	1	N	N	Y	N	N	N	Green	Sandy mud	Abundant wood pieces
Ref 2	Ref 2	2	N	N	Y	N	N	N	Green	Sandy mud	Abundant wood
Ref 2	Ref 2	3	N	N	Y	N	N	N	Grey	Sand	Abundant wood bits



## Appendix 3 – Muchalat North ASC Survey Summary

<b>Company:</b>	Grieg Seafood BC Ltd.	<b>Sample date:</b>	January 9, 2020
<b>Farm Site:</b>	Muchalat North	<b>Field crew:</b>	L Stewardson, E Cicon
<b>Site License #:</b>	AQ1849	<b>Analytical:</b>	SGS Canada Inc and Bureau Veritas
<b>Site Location</b>	Muchalat Inlet, BC		

<b>SULPHIDES</b>		<b>Indicator 2.1.1 Requirement ≤ 1500 (µm)</b>					<b>ASC Criteria Met</b>
<b>Station</b>	<b>Rep 1</b>	<b>Rep 2</b>	<b>Rep 3</b>	<b>n</b>	<b>Mean</b>	<b>SD</b>	
Inside AZE C	427	217	219	3	288	121	<b>Yes</b>
Outside AZE C	362	329	230	3	307	68.7	
Reference 1	133	127	134	3	131	3.79	
Reference 2	182	87.4	192	3	154	57.7	

<b>REDOX POTENTIAL</b>		<b>Indicator 2.1.1 Requirement &gt; 0 mV</b>					<b>ASC Criteria Met</b>
<b>Station</b>	<b>Rep 1</b>	<b>Rep 2</b>	<b>Rep 3</b>	<b>n</b>	<b>Mean</b>	<b>SD</b>	
Inside AZE C	-13.4	-12.8	-28.3	3	-18.2	8.78	<b>No</b>
Outside AZE C	-21.5	-29.5	-30.5	3	-27.2	4.93	
Reference 1	-7.4	3.7	-14.0	3	-5.9	8.9	
Reference 2	0.5	66.6	25.4	3	30.8	33.4	