2021 NSARB-2021-001

Nova Scotia Aquaculture Review Board

BETWEEN:

Kelly Cove Salmon Ltd.

APPLICANT

and-

Minister of Nova Scotia Department of Fisheries and Aquaculture

PARTY

and

Gregory Heming

INTERVENOR

Affidavit of Jessica Feindel

I affirm and give evidence as follows:

1. I am Jessica Feindel, the Manager of Aquaculture Operations in the Department of Fisheries and Aquaculture ("the Department"). As part of this position, I am responsible for the Farm Management Plan Program, the Environmental Monitoring Program and the management of the Department's marine equipment. I started in this position on November 7, 2017. I have been employed with the Department since 2013. Attached to this Affidavit as **Exhibit A**, is a copy of my resume.

2. I have personal knowledge of the evidence affirmed in this Affidavit except where otherwise stated to be based on information and belief.

3. I state, in this Affidavit, the source of any information that is not based on my own personal knowledge, and I state my belief of the source.

Review Team

4. My Team and I participated in the evaluation of the boundary amendment application brought by Kelly Cove for lease AQ #1039. We assisted in evaluating the operational aspects of the boundary amendment application. This included assessing various aspects of the Development Plan from the Department's Operations Section perspective, including the Production Plan, Oceanographic Environment, baseline environmental monitoring, and interactions with other aquaculture operations.

Farm Management Plan Program

5. As the Manager of Aquaculture Operations, one of the programs I am responsible for is the Farm Management Plan Program.

6. Under the *Aquaculture Management Regulations* (AMRs), all aquaculture licence holders must prepare a Farm Management Plan (FMP) that includes detailed information and procedures on:

    - fish health management,
    - containment management,
    - environmental monitoring, and
    - farm operations.

7. A FMP is a comprehensive document prepared by the aquaculture licence holder and is kept at the licence holder's place of business.

8. The AMRs outline in detail the information and procedures the Department requires in an FMP. The Department has established minimum compliance requirements for the procedures contained in FMPs. Attached to this Affidavit as **Exhibit B**, is a chart outlining the minimum compliance requirements for marine finfish aquaculture operations in Nova Scotia that must be described in the FMP.

9. FMP templates were created by the Department to assist licence holders with organizing information on their farm operations, procedures, and records to document that they operate in a way that is compliant with the AMRs.

10. FMPs are reviewed by the Department to ensure that the information is complete, and the aquaculture licence holder's described inputs and procedures comply with the AMRs. A licence holder must have an approved FMP prior to stocking their site.

11. If the licence holder's described inputs and procedures comply with the AMRs, the Department approves the FMP for implementation.

12. Licence holders are required to adhere to the procedures contained in their FMP. Records must be maintained:

(a) To verify adherence to procedures,

(b) To indicate an amendment to the FMP, and

(c) Verify that effective action was taken at a critical control point(s).

13. The Department may audit the implementation of a licence holder's FMP at anytime.

Section 3 Factors

14. The parts of the boundary amendment application that my team and I evaluated are relevant to several of the factors listed in s. 3 of the *Aquaculture Lease and Licence Regulations*. This affidavit is organized by the s. 3 factor most relevant to the Development Plan sections evaluated by my team.

Section 3(b): Contribution of the Proposed Operation to Community and Provincial Economic Development

Description of the Environmental Monitoring Program

15. The Environmental Monitoring Program (EMP) is an industry wide environmental effects monitoring program for aquaculture with specific criteria for marine finfish operations. The program was established in 2002 and was carried out by the Department until 2009. The responsibility to conduct monitoring as part of the EMP was transferred to the industry beginning in 2010.

16. Environmental monitoring is an important part of the management of a marine resource industry like aquaculture. The Department believes that the growing body of data that has been and will continue to be collected, helps to ensure that the aquaculture industry in Nova Scotia remains environmentally sustainable.

17. The EMP examines the relationship between an aquaculture operation and the surrounding marine environment. Environmental monitoring takes place at stations located directly within the lease boundaries and at a reference station(s) that is located outside of the lease boundaries.

18. The EMP uses a risk-based approach to monitoring that recognizes that increased risk requires increased monitoring. This risk-based approach is based on over a decade of empirical data that has been collected across the spectrum of Nova Scotia aquaculture activities and environmental conditions. This approach can be consistently applied to the diverse nature of the aquaculture industry in the province. The dataset includes a variety of environmental indicators and variables to define environmental performance. Over time these site-specific datasets can be used to identify how each aquaculture lease interacts with the surrounding marine benthic environment. Attached to this Affidavit as **Exhibit C**, is the Environmental Monitoring Program Framework for Marine Aquaculture in Nova Scotia which describes the EMP in more detail.

19. One of the primary concerns regarding a marine finfish aquaculture operation is the potential for negative impact on the surrounding marine benthic environment through organic loading.

20. Significant organic deposition can result in increased Biological Oxygen Demand (BOD) in benthic sediments.

21. The primary objective of the EMP is to ensure that the marine environment where aquaculture operations occur maintain oxic sediment conditions. This means that the BOD is *less* than the incoming supply of oxygen.

22. Hypoxic or Anoxic sediment conditions result when BOD is *greater* than the incoming supply of oxygen. Hypoxic or anoxic sediment conditions have the potential to negatively impact localized fish habitat by decreasing the abundance and diversity of faunal populations.

23. The EMP monitors impacts to benthic environments in two ways. First, impacts are monitored by conducting geochemical analysis of sediments (ex. sulfide concentration). Second, benthic impacts are monitored by assessing visual indicators of benthic health.

24. All marine aquaculture leases that currently have production are assessed as part of the EMP. Sites that are larger or have more intensive levels of production are given higher priority during the EMP season. Sites of potential concern are subject to repeat annual sampling and, if it is required, remediation and mitigative actions are implemented.

Maximum Site Biomass

25. In its Development Plan, Kelly Cove proposes a maximum site biomass of 3,504,000 kg for this site. Maximum site biomass is the entire fish population on a site. It is notable that Kelly Cove is not seeking an increase in production, nor additional cages on site, which means there are no proposed changes to biomass.

26. Environmental monitoring plays an important role in evaluating maximum site biomass.

Baseline Assessment

27. Since this amendment is covering an expanded area beyond what has been previously approved, a baseline assessment was required for the expanded space. This information informs the Department of the current condition of the benthic environment and informs monitoring in the future.

28. Baseline assessment reports were submitted to the Department on October 20, 2016 and June 4, 2018.

29. The sediment that was collected as part of these baseline assessment reports showed a healthy oxic environment.

BOD Modelling

30. The baseline assessment also informs the modelling DFO requires under the federal *Aquaculture Activities Regulations* (AAR). The modelling is done to predict BOD impacts from the aquaculture site's proposed operation. In this case the modelling predicted that the site's production level would exceed the 3000 µM sulfide threshold.

31. The 3000 µM sulfide threshold is a regulatory threshold used by DFO for allowable impacts on the benthic environment. If this threshold is exceeded, there can be no restocking of a site until the sulfide concentration has dropped below 3000 µM threshold.

32. However, despite the proponent's modelling prediction, and DFO's calculations/estimations, the actual data from the historical environmental monitoring at this site shows that the 3000 µM sulfide threshold has not been exceeded.

Past Performance of AQ#1039

33. A historical review of the EMP results for this site, shows that this site design and biomass has achieved acceptable environmental performance in accordance with the environmental regulatory requirements.

34. Aquaculture lease #1039 has been in operation since 1994. Kelly Cove took over the operation in 2004. Attached to this Affidavit as **Exhibit D** is a table showing a summary of the environmental monitoring results at this site back to 2004.

35. The table below defines the oxic classifications related to sulfide concentrations as follows:

- Oxic A: 0-749 µM sulfide
- Oxic B: 750-1499 µM sulfide
- Hypoxic A: 1500-2999 µM sulfide
- Hypoxic B: 3000-5999 µM sulfide
- Anoxic: 6000+ µM sulfide

36. The AMRs require certain mitigation and/or steps to be taken if particular thresholds are exceeded. Steps could include mitigative actions regarding overstocking of fish, fish feces settlement, net biofouling, overfeeding, and improper feeding technique.

37. If the mitigative actions do not succeed in bringing down the sulfide average, the Minister may order specific actions be taken such as expediting the harvest program, extending fallowing periods, limiting approved stocking levels or adjusting the site layout.

38. In 2017, the site was classified as Hypoxic A with a sulfide average of 1739 µM. The apparent cause of the poor performance that year was related to waste feed. As a result, Kelly Cove implemented a mitigation plan which included a review of staff training,

equipment and practices related to feeding. The environmental monitoring results the following year showed a return to oxic conditions.

39. In 2011, the site was classified as Hypoxic A. I did not work for the Department at the time so I do not have any first hand knowledge of it. I have not been able to determine the cause of the Hypoxic condition in 2011. The following year the site returned to oxic conditions.

40. As a result of the historical review of the environmental performance of this site, and the current baseline information for this site, my team is satisfied that the maximum biomass is reasonable.

Section 3(d): Oceanographic and Biophysical Characteristics

Current Speed and Direction

41. Current speed and direction are two of the aspects of the oceanographic environment that my Team assesses.

42. Proponents are required to collect current speed and direction data over a minimum 30 days at the center of a proposed lease area, using an Acoustic Doppler Current Profiler (ADCP). Measurements must be made throughout the water column at vertical intervals of no more than 1 meter and at a frequency of no more than every 30 minutes.

43. Hydrodynamic conditions, including current speed and direction, are a key factor influencing the capacity of an area to resist degradation caused by the deposition of BOD matter.

44. Higher current speeds are associated with the maintenance of oxic conditions, as they reduce the spatial concentration of deposition from the site. This allows for enhanced capacity of BOD matter degradation through natural processes over a larger area.

45. According to the data submitted by Kelly Cove in their Development Plan, the depth-averaged current speed at AQ#1039 was approximately 24 cm/s during the deployment period of the ADCP (June 29 to August 4, 2016). The average current speeds near the seafloor and surface were approximately 20 cm/s and 33 cm/s, respectively.

46. The ADCP used to collect these data was owned, deployed and retrieved by the Department.

47. Reported average current speeds are relatively high for a well sheltered, inshore location such as the proposed lease and it is expected that they will continue to be sufficient to support the proposed level of production.

Bathymetry (Water Depth)

48. Proponents are required to illustrate the water depth conditions throughout the proposed lease area, with a minimum contour resolution of 10 meters.

49. Kelly Cove contracted with a service provider to collect depth data throughout the site using a sonar sounder and interpolated the results to produce approximated 5-meter depth contours, relative to the lowest point of the tidal cycle.

50. Depths appear to range from a maximum of approximately 38 meters towards the north east boundary, to a minimum of effectively 0 meters where the western lease boundary approximately follows the Lower Low Water mark of the shoreline.

51. The tidal range at the proposed location is extremely high with water levels regularly varying by as much as 9 meters over the course of a tidal cycle.

52. Increased depth beneath an aquaculture site is associated with lower sediment sulfide concentrations as settling organic material has a greater distance over which to be influenced and distributed by the local currents.

53. The combination of bathymetric, tidal and water current conditions at the proposed site AQ#1039 are expected to be sufficient to support the proposed infrastructure and level of production.

54. I was not physically present before Ms. Campbell when I affirmed this affidavit. I was linked with Ms. Campbell using video conferencing technology.

Affirmed before me by videoconference from Shelburne (location of affiant) to Halifax, Nova Scotia (location of lawyer taking oath) on the 22nd day of April 2021.

Signature of Authority
Alison Campbell
Solicitor

Jessica Feindel

ALISON CAMPBELL
A Commissioner of the Supreme
Court of Nova Scotia

TAB

A

2021 NSARB-2021-001
This is Exhibit "A" referred to in the
Affidavit of Jessica Feindel
affirmed before me by videoconference
on April 22nd, 2021

Alison Campbell
Signature

ALISON CAMPBELL
A Commissioner of the Supreme
Court of Nova Scotia

Jessica Feindel, M.Sc.

[redacted], Shelburne, NS, B0T 1W0 | [redacted] | [redacted]@gmail.com

EDUCATION & TRAINING

- **Master of Science – Biology** *2009 – 2012*
  University of New Brunswick – Fredericton, NB
- **Bachelor of Science (Honours) – Marine Biology** *2004 – 2008*
  University of New Brunswick – Saint John, NB

- **Ecosystem Modelling for Aquaculture** *2018*
- **Small Vessel Operator Proficiency** *2016*
- **Restricted Operator Certificate – Maritime Commercial** *2016*
- **Marine Emergency Duties A1** *2016*
- **Introduction to Simulated Electronic Navigation** *2016*
- **Remotely Operated Vehicle Training** *2016*

EMPLOYMENT HISTORY

Manager of Aquaculture Operations *2017 – present*
NS Dept. Fisheries and Aquaculture – Shelburne, NS

- Manages the day to day administration of the Environmental Monitoring and Farm Management Plan Programs to ensure policies and procedures are followed
- Supervises a working unit to ensure services and projects are accomplished efficiently and effectively
- Ensures a risk-based management strategy is applied to respective aquaculture programs, while promoting sustainability
- Conducts comprehensive reviews and assessments of Farm Management Plans (FMPs) to ensure operations reflect strong and sustainable management practices
- Evaluates environmental suitability of new sites and performance of existing sites using data and modelling results
- Plans and coordinates inter-related field work efforts, including the maintenance, operation and scheduling of all marine field equipment
- Represents the department on federal and provincial committees, forums and at meetings to collaborate on the development of environmental and operational aquaculture programs, policies and regulations
- Interacts with industry, communities, municipalities and special interest groups/individuals on all aquaculture environmental management matters

Environmental Monitoring Program (EMP) Supervisor *2013 – 2017*
NS Dept. Fisheries and Aquaculture – Shelburne, NS

- Led the implementation of provincial environmental management and compliance practices for aquaculture

- Planned and coordinated the ongoing development and implementation of a risk-based environmental monitoring program for aquaculture
- Reviewed program submissions and conducted data analysis to ensure standards of quality were met
- Conducted data interpretation to evaluate environmental suitability of new sites and performance of existing sites
- Conducted internal and external audits to ensure field and laboratory operations followed program standard operating procedures
- Represented the department on federal and provincial committees, forums and meetings to collaborate on the development of standard operating procedures, guidelines and protocols for the environmental management of aquaculture
- Provided consultative and specialized expertise to senior department staff on aquaculture environmental management
- Interacted with industry, communities, municipalities and special interest groups/individuals on all aquaculture environmental management matters
- Responsible for maintenance and safe storage of laboratory equipment, supplies and resources
- Responsible for accurate calibration of laboratory equipment and ensures technical requirements meet ISO standards
- Deployed Acoustic Doppler Current Profilers and temperature loggers to inform oceanographic research related to aquaculture siting
- Policy development
- Familiarity with Hazard Analysis Critical Control Point system

Marine Environmental Biologist *2011 – 2013*

Sweeney International Marine Corp. – St. Stephen, NB

- Conduct environmental monitoring of marine aquaculture farms in NB, NS and NL with a field team
- Adhere to field sampling and sediment analysis SOPs
- Experience with Ekman, Ponar and Hunter Simpson sediment grabs
- Familiar with underwater drop cameras with top side units and amphibico diver-held cameras
- Perform sulphide and redox analysis on marine sediments
- Extensive experience of Windows and Microsoft Office
- Experience writing Environmental Monitoring, Baseline, Environmental Assessment (CEAA), current meter and temperature profile reports
- Perform current meter deployments
- Analyze sulphide, redox, water current and temperature data
- Initiation and development of R&D projects
- Writing funding applications (NRC-IRAP, ACOA, NB TACP, ACRDP)
- Knowledge of MapSource, GPS devices and formats
- 3D visualization, contouring and surface modeling of side scan sonar data
- Conduct third party audits of farms with poor environmental ratings

Teacher's Assistant – Aquaculture in Canada *2011*

UNB, Fredericton, NB

- Supervised and provided academic support to students during labs and field trips
- Graded and provided constructive feedback toward reports and presentations

Lab Assistant – Biological Effects Study

St. Andrews, NB (DFO) *2011*

- Assisted with biological effects studies related to oil and gas program
- Responsible for daily collection of Atlantic cod gametes
- Prepared chemical solutions
- Exposed gametes and cod larvae to produced water, chemical dispersants and oil
- Assessed fertilization rates, hatching success and lethality of chemicals acting upon larvae

Lab Assistant – Fish Physiology *2011*

St. Andrews, NB (DFO)

- Executed care for diploid and triploid Atlantic cod larvae
- Conducted routine tank husbandry
- Measured and recorded water quality parameters
- Administered hand feedings
- Observed and recorded fish behaviour

Master of Science – Biology *2009 - 2012*

UNB (Fredericton, NB) & DFO (St. Andrews, NB)

Research: *Ovarian development and sex ratios of gynogenetic Atlantic cod (Gadus morhua)*

- Handled Atlantic cod broodstock
  - Familiar with finfish anaesthesia
  - Applied spawning techniques for gamete collection
  - Constructed and used catheters for milt collection
- Implemented UV treatments for DNA inactivation
- Performed artificial fertilization procedure
- Operated hydrostatic pressure shocker for ploidy manipulation
- Prepared samples for genotyping (fin clips and embryos)
- Experience rearing embryos via flow-through incubation systems
- Participated in rotifer culture practices
- Practiced with larval tank set-up and larval rearing
- Programmed and operated "AMD" feeding systems
- Conducted histology on ovarian tissue
- Experience writing scientific documents
  - Master's thesis, Aquaculture Journal manuscript, AAC Bulletin article, Animal Use Protocol, ACRDP project update
- Presented scientific research

- Well versed with Microsoft Office (Excel, Powerpoint, Word, Outlook)
- Familiar with both ImagePro Plus and ImageJ
- Analyzed data with SPSS, SigmaPlot, MS Excel and Minitab
- Utilized SigmaPlot for graph design
- Demonstrated effective experimental design

Aquaculture Research Technician *2008 - 2009*

St. Andrews, NB – Huntsman Marine Science Center

(Employed by the Cod Genome Project)

- Handled Atlantic cod Broodstock
    - Familiar with finfish anaesthesia and sedation
    - Performed weight, length measurements and data entry
    - Administered injections: Ovaplant, antibiotic, floy tags
    - Practiced with spawning techniques
- Knowledgeable of recirculation systems (backwashing, pump changes, flows)
- Performed sea cage assessments (length, weight, external morphologies)
- Participated in fish quality assessments at fish processing plant
- Implemented artificial fertilization procedures
- Practiced in fertilization rates and photo capture
- Prepared biological samples
- Utilized "Image J" for egg diameter analysis
- Familiar with ozonating procedures for sterilization
- Acquainted with incubation systems
- Performed larval tank set-up and administered larval care
- Contributed and performed live feed culture (algae, rotifers and artemia)
- Experienced with "Sweeney Automatic Feeding Systems"
- Conducted submersion vaccinations of juveniles
- Demonstrated effective pit-tagging skills and deformity recognition
- Performed water quality analysis via spectrophotometry

AWARDS

- **Student Scholarship & Travel Award** *2011*
  Aquaculture Association of Canada Conference, Quebec City, QC

- **2nd Place - Graduate Presentation** *2011*
  APICS Aquaculture & Fisheries Conference, Halifax, NS

- **Best Student Presentation & Travel Award** *2010*
  Aquaculture Association of Canada Conference, St. John's, NL

- **Dean's List Graduate – BSc** *2008*
  UNB - Saint John, NB

- **Ward Chipman Founder's Scholarship** *2004*
  UNB - Saint John, NB

PUBLICATIONS

Whitehead, J.A., Benfey, T.J., and Martin-Robichaud, D.J. 2011. Ovarian development and sex ratio of gynogenetic Atlantic cod (*Gadus morhua*). Aquaculture:324-325, 174-181.

Benfey, T.J., Feindel, N.J., Lin, S., Whitehead, J.A., Martin-Robichaud, D.J., Trippel, E.A., Duffy, M. 2011. The production of single-sex and sterile populations of Atlantic cod (*Gadus morhua*) for aquaculture: fish health considerations with a focus on *Loma morhua*. Bulletin of the Aquaculture Association of Canada 109-1, 28-32.

Whitehead, J.A., Benfey, T.J., and Martin-Robichaud, D.J. 2010. Gynogenesis and the genetic basis of sex determination of Atlantic cod (*Gadus morhua*). Bull. Aquacul. Assoc. Canada 108-2, 21-24.

REFERENCES

Available upon request.

TAB

B

2021 NSARB-2021-001
This is Exhibit "B" referred to in the
Affidavit of Jessica Feindel
affirmed before me by videoconference
on April 22nd, 2021

Signature

ALISON CAMPBELL
A Commissioner of the Supreme
Court of Nova Scotia

Marine Finfish Farm Management Plan Minimum Compliance Requirements

The following document outlines the minimum compliance requirements for marine finfish aquaculture operations in Nova Scotia. The minimum compliance requirements are organized by Farm Management Plan (FMP) section.

Section 2.0: Stocking Level

Before initial stocking or restocking of an aquaculture site, the population number to be stocked must be reported and approved. This section outlines the stocking plan for the site for the time period covered within the FMP and provides information required to assess the stocking level. This section includes a production plan, site diagram, fallowing plan, and production reporting information.

Subject	Species	Minimum compliance requirement
2.1 Production plan	*All finfish*	• Production plan must be provided
2.1 Species and year class	*Atlantic salmon*	• One year-class stocking
	Rainbow Trout	• Up to a maximum of two year-classes stocked
	Other species	• Subject to review by Chief Aquatic Animal Health Veterinarian or Veterinary Administrator
2.2 Site plan	*All finfish*	• Scaled site diagram must be provided
2.3 Historical environmental monitoring and production information	*Atlantic salmon*	• Historical production levels and environmental monitoring results (two previous production cycles minimum) provided upon stocking request
	Rainbow Trout	• Historical production levels and environmental monitoring results (four previous years minimum) provided upon stocking request
	Other species	• Historical production levels and environmental monitoring results provided according to request by NSDFA
2.4 Aquaculture Management Area (if AMA is established)	*All finfish*	• Written AMA agreements with other licence holders if required by the Minister
2.5 Fallowing plan (for sites NOT within an AMA)	*Atlantic salmon*	• Maximum of 36 months continuous stocking • Fallowing period according to stocking cycle length, as described
	Rainbow Trout	• Maximum of two consecutive year class stockings before fallowing • Fallowing period according to stocking cycle length, as described
	Other species	• Subject to review by Chief Aquatic Animal Health Veterinarian or Veterinary Administrator
2.5 Fallowing plan (for sites within an AMA)	*Atlantic salmon*	• Fallowing according to AMA agreement
	Rainbow Trout	• Fallowing according to AMA agreement
	Other species	• Fallowing according to AMA agreement
2.6 Inventory control and reporting	*All finfish*	• Reporting of stocking level upon request

Section 5.0: Description of Inputs

This section describes the physical components and material elements of the farm. These inputs affect all components covered within the FMP, including Fish Health Management, Containment Management, Farm Operations, and Environmental Monitoring.

Subject	Species	Minimum compliance requirement
5.1 Site, infrastructure and holding system	*All finfish*	• Provide technical specifications of containment equipment and infrastructure • Describe installation processes for containment equipment and infrastructure • The design of the structures in place for containment management follow requirements as defined in AMR 15(g)
5.4 Veterinary service provider	*All finfish*	• Provide name of veterinary service provider

Section 6.0: Procedures for Fish Health Management and Containment Management

This section defines the procedures and plans required for meeting compliance requirements common for all operations (as defined by species) to ensure they meet the AMR requirements for Fish Health Management and Containment Management. Topics affecting fish health are often relevant for containment management and vice versa, so that the procedures relevant to these aspects have been combined within this template plan.

Subject	Species	Minimum compliance requirement
6.1 Bird deterrence	*All finfish*	• Bird deterrent strategies described
6.2 Predator management	*All finfish*	• Predator deterrent strategies described
6.3 Equipment maintenance	*All finfish*	• Removal of nets from the water after each production cycle for cleaning, disinfection, and testing • Up to date net inventory records • Up to date net history records • Up to date net testing records • Net biofouling control strategy(ies) described • On-site net repair kit • Net repair procedure described • Up to date net inspection records • Net mesh sizing strategy described • Net changing procedure described • Records to support application of net changing SOP • Minimum weekly bird net inspections • Up to date inspection and history records for bird nets • Biannual mooring and anchor inspection • Up to date inspection and repair records (moorings and anchors) • Biannual grid system inspection • Inspection and repair records (grid system)
6.4 Equipment inspection	*All finfish*	• Weekly surface inspections • Up to date surface inspection records (to include enclosure nets, bird nets, predator nets, moorings and anchors, and grid) • Below-water net inspection (every 60 days) • Up to date below-water net inspection records (to include enclosure nets, predator nets) • Biannual below-water infrastructure inspection • Up to date below-water infrastructure inspection records (to include moorings and anchors, and grid)

Section 6.0: Procedures for Fish Health Management and Containment Management

Subject	Species	Minimum compliance requirement
6.5 Response to a breach of containment	*All finfish*	• Areas of potential impact of a breach described • Procedures to respond to a breach described • Immediate notification of knowledge or suspicion of a breach
6.6 Unusual event and severe weather response	*All finfish*	• Strategy for responding to unusual events described • Strategy for responding to severe weather described
6.7 Biosecurity	*All finfish*	• Wharf usage biosecurity SOP described • Up to date records demonstrating application of wharf usage biosecurity SOP • Cleaning and disinfection standard operating procedures described • Up to date records demonstrating application of cleaning and disinfection SOP • Staff and visitor cleaning and disinfection standard operating procedures described • Up to date records demonstrating application of staff and visitor cleaning and disinfection SOP
6.8 Feeding	*All finfish*	• Structured monthly feeding schedule • Recorded feed consumption and up to date calculated feeding rate records
6.9 Pest management	*All finfish*	• Pest management strategy described • Pest management records
6.10 Waste management	*All finfish*	• Strategy to manage waste described • Blood water and offal containment and treatment strategy that assures the killing or rendering of pathogens of concern inert
6.11 Water quality	*All finfish*	• Up to date daily and monthly water quality monitoring and recording of oxygen and temperature • Described algae monitoring regime and up to date records of algae monitoring according to regime • Strategies for responding to low oxygen, low and high temperatures, and suspected algae effects on fish health described
6.12 Mortality collection	*All finfish*	• Described mortality collection procedures that include all aspects of storage and disposal • Records supporting application of mortality collection SOP • Described mortality collection schedule- a minimum of one mortality dive for each of the stocked cages per week is mandatory • Up to date mortality collection records • Classification of all mortalities • Up to date records of mortality classification

Section 6.0: Procedures for Fish Health Management and Containment Management

Subject	Species	Minimum compliance requirement
6.13 Fish handling	*All finfish*	• Euthanasia method(s) described • Anesthesia method described • List anesthetics • Described mean weight determination procedure • Records supporting application of mean weight determination SOP • Described grading or splitting procedure (if applicable) • Records supporting application of grading or splitting procedure • Described harvesting procedure • Records supporting application of harvesting procedure
6.14 Transport	*All finfish*	• Defined live transport procedure • Certificate of Health for Transfer (COHFT) permit for all live transfers (refer to Section 6.19.5) • All pertinent Federal transfer permits • Records supporting application of live transport procedure • Defined dead fish transport procedure • Fish transport biosecurity procedures described • Records supporting application of fish transport biosecurity procedures
6.15 Broodstock	*All finfish*	• Described method for egg and milt collection • Described egg disinfection procedures • Up to date egg disinfection records • Egg and milt records to identify parentage or batch
6.16 Vaccination	*All finfish*	• Vaccination status described
6.17 Stock treatment	*All finfish*	• Up to date stock treatment records • Reporting of antibiotic use to the Province • Reporting of products to treat sea lice to the Province
6.18 Sea lice management	*Atlantic salmon and Rainbow trout*	• At a minimum, weekly sea lice counts from April 1 to January 15th of each year • Personnel to perform sea lice counts must be trained and records of training kept • Sea lice counts records kept on file and made available for review within 7 days of count • If weekly sea lice count is not complete an explanation for the omission must be recorded in the sea lice count record • Site access for auditors during sea lice counting, if requested • Sea lice treatments applied according to Farm Management Plan (unless deviations from this schedule were approved) • Sea lice treatment plans approved by Chief Aquatic Animal Health Veterinarian • Record of sea lice treatment • Sea lice biosecurity procedures described

Section 6.0: Procedures for Fish Health Management and Containment Management

Subject	Species	Minimum compliance requirement
6.19 Disease surveillance	*All finfish*	• Adherence to and documentation of routine surveillance • Adherence to minimum sampling and testing requirements for fish transfers from a marine site (if applicable) • Adherence to the Health Policy for the Transfer of Live Cultured Fish in Atlantic Canada • Possession of a Certificate of Fish Health for Transfer permit during and post transport • Use of an approved laboratory for testing • Possession of health records for current stock
6.19.9 Mandatory reporting	*All finfish*	• Reporting of provincially reportable diseases • Reporting of mass mortality events • Reporting of significant mortality events of unknown etiology
6.19.10 Managing disease outbreaks	*All finfish*	• Adherence to authority requests during disease outbreak (if applicable) • Adherence to a Quarantine Order (if ordered) • Disease management measures approved by Chief Aquatic Animal Health Veterinarian

Section 7.0: Hazard Assessment for Fish Health Management and Containment Management

This section allows the completion of hazard analyses to define procedures that have critical control points necessary for effective Fish Health and Containment Management. These supplement the procedures described in Section 7 by ensuring that operation specific hazards are accounted for in the FMP.

Subject	Species	Minimum compliance requirement
7.1 Hazard analysis for Fish Health Management	*All finfish*	• A hazard analysis of the production process must be completed for Fish Health Management • Each procedure contained in a Farm Management Plan must include any of the following that apply to with respect to that procedure: a) Critical control points b) Critical control limits c) Details about how the procedure is monitored d) Details about corrective actions to be taken
7.2 Hazard analysis for Containment Management	*All finfish*	• A hazard analysis of the production process must be completed for Containment Management • Each procedure contained in a Farm Management Plan must include any of the following that apply to with respect to that procedure: a) Critical control points b) Critical control limits c) Details about how the procedure is monitored d) Details about corrective actions to be taken

Section 8.0: Farm Operations

This section describes aspects that demonstrate responsible operation of a marine shellfish operation. The FMP must include information and procedures that are consistent with industry best practices relating to the following:

Subject	Species	Minimum compliance requirement
8.1 Supply storage	*All finfish*	• Strategy for the storage and disposal of fuel described • Strategy for the storage and disposal of lubricants and chemicals described
8.2 Accumulated refuse and decommissioned farm supplies and equipment	*All finfish*	• Strategy to deal with accumulated refuse and decommissioned farm supplies and equipment described • Immediate reporting to NSDFA and DFO regarding equipment dropped to the bottom
8.3 Retrieving loose gear	*All finfish*	• Strategy for retrieval of loose gear or debris described
8.4 Maintaining the site in good order	*All finfish*	• Strategy to maintain the site in good order described
8.5 Noise	*All finfish*	• Strategy to minimize noise disruption described

Section 9.0: Environmental Monitoring

This section defines the procedures and plans required for effective environmental monitoring of a marine finfish operation. A hazard analysis defines those procedures that can be put into place in the event that poor environmental performance is indicated by monitoring.

Subject	Species	Minimum compliance requirement
9.1.2, 9.1.3 Benthic monitoring, Level I	*All finfish*	• Annual Level I benthic monitoring for active sites • Electronic site diagram (kg fish/cage and number and location of proposed monitoring locations) submitted at least two weeks prior to monitoring • Anticipated monitoring date submitted at least two weeks prior to monitoring • Monitoring method submitted at least two weeks prior to monitoring
9.1.4 Benthic monitoring, Level II	*All finfish*	• Level II benthic monitoring for Hypoxic B and Anoxic sites • Electronic site diagram (kg fish/cage and number and location of proposed monitoring stations submitted within one week of monitoring • Monitoring to occur no later than 35 days after the date of the Level I monitoring event
9.1.5 Benthic monitoring, Level III	*All finfish*	• Level III monitoring for sites that consistently fail to meet oxic conditions • Compliance with enhanced monitoring regimen determined by AESMC in discussion with the site operator
9.1.7 Benthic monitoring procedures	*All finfish*	• Procedures for collection of samples for benthic monitoring provided
9.1.8 Video recording	*All finfish*	• Video recording procedures for benthic monitoring provided
9.1.9 Field observations	*All finfish*	• Recording of field observations during benthic monitoring
9.1.10 Analysis of sediment samples	*All finfish*	• List of chemicals and equipment to be used for EMP approved by NSDFA prior to monitoring season • Procedures for sediment sample analysis provided
9.1.11 Benthic monitoring reporting	*All finfish*	• For Level I monitoring, field observations, coordinate table, redox and sulfide analysis results reporting within 14 days of sediment collection • For Level I monitoring, all remaining sample analyses results (porosity and organic matter), video and grab log sheets, and photos and video recordings reporting within 21 days of sediment collection • For Level II monitoring, all reporting must be within 14 days of sample collection

Section 9.0: Environmental Monitoring

Subject	Species	Minimum compliance requirement
9.2 Mitigation plan	*All finfish*	• A hazard analysis of the production process must be completed for Environmental Impact to determine mitigation plan options to address poor environmental performance • Each mitigation procedure must include any of the following that apply to with respect to that procedure: a) Critical control points b) Critical control limits c) Details about how the procedure is monitored d) Details about corrective actions to be taken
9.3 Oxic condition remediation, for change from Oxic to Hypoxic A site classification	*All finfish*	• Mitigation plan and timeline for implementation described • Updated mitigation plan described
9.3 Oxic condition remediation, for change to Hypoxic B, or Anoxic site classifications	*All finfish*	• Level II monitoring conducted no later than 35 days after the Level I monitoring event • Results of Level II monitoring submitted no later than 14 days following monitoring • Updated mitigation plan submitted no later than 14 days following Level II monitoring • Compliance with additional directives from NSDFA to reduce environmental impact, if applicable.

Section 10.0: Record Keeping

This summarizes the minimum record keeping requirements for the operation, as determined by compliance requirements, procedures, and critical control points established within the risk analyses.

Subject	Species	Minimum compliance requirement
10.1 Compliance record requirements	*All species*	• Records must be kept to verify adherence to the procedures and to demonstrate that effective action was taken at critical control points, when applicable. • Records must be kept for at least seven years from the date the record is created or updated • Records must be available when requested

Section 13.0: Record of Amendments

Once the FMP is approved, records must be kept by the aquaculture licence holder of any amendments to the FMP.

Subject	Species	Minimum compliance requirement
13.0 Record of Amendments	*All species*	• Records must be kept of any amendments to the FMP

TAB

C

2021 NSARB-2021-001
This is Exhibit "C" referred to in the
Affidavit of Jessica Feindel
affirmed before me by videoconference
on April 22, 2021

Signature

ALISON CAMPBELL
A Commissioner of the Supreme
Court of Nova Scotia

ENVIRONMENTAL MONITORING PROGRAM FRAMEWORK FOR MARINE AQUACULTURE IN NOVA SCOTIA

Fisheries and Aquaculture

June 2020

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Environmental Monitoring Program Framework for Marine Aquaculture in Nova Scotia

1. INTRODUCTION

The Nova Scotia Aquaculture Environmental Monitoring Program (EMP) began in the fall of 2002 when the Aquaculture Association of Nova Scotia (AANS) produced a draft plan recommending that the Province implement and regulate an EMP for the marine aquaculture industry. This draft plan originated from the document *Design of the Environmental Monitoring Program for the Marine Aquaculture Industry in Nova Scotia* (Smith et al., 2002). The Aquaculture Division of the Nova Scotia Department of Fisheries & Aquaculture (NSDFA) accepted the lead role and began implementing the EMP.

The EMP examines the relationship between an aquaculture operation and the surrounding marine environment. Environmental monitoring takes place at stations located directly within the lease boundaries and at a reference station(s) that is located outside of the lease boundaries.

The EMP applies to all active and inactive, marine finfish and shellfish aquaculture leases in Nova Scotia. As of April 2020, there were a total of 201 licensed marine aquaculture sites in Nova Scotia (160 shellfish, 35 finfish, and 6 shellfish/marine plant sites). Species grown at marine aquaculture leases in Nova Scotia include: salmon, trout, mussels, scallops, clams, quahogs and oysters.

The regulatory provisions for the EMP are referenced in the Aquaculture Management Regulations (S.10-11 and S.30-32) created pursuant to the Fisheries and Coastal Resources Act. Each licence holder is responsible to include all information and procedures related to the EMP in their site-specific Farm Management Plan. In addition, a Memorandum of Understanding (MOU) has been signed by both the NSDFA and Fisheries and Oceans Canada (DFO) stating responsibilities of each party:

"The Parties will co-operate in the development of an industry wide environmental effects monitoring program. Nova Scotia will be responsible for the implementation of the environmental effects monitoring program and the implementation of a follow-up program, where applicable, and will report to Canada in a manner that is mutually agreeable to the Parties."

The EMP uses a risk-based approach to monitoring that recognizes that increased risk requires increased monitoring. This risk-based approach is based on over a decade of empirical data that has been collected across the spectrum of Nova Scotia aquaculture activities and environmental conditions. This approach can be consistently applied to the diverse nature of the aquaculture industry in the province. The dataset includes a variety of environmental indicators and variables to define environmental performance. Over time these site-specific datasets can be used to identify how each aquaculture lease interacts with the surrounding marine benthic environment.

All marine aquaculture leases that currently have production are assessed as part of the EMP. Sites that are larger or have more intensive levels of production are given higher priority during the EMP season. Sites of potential concern are subject to repeat annual sampling and, if it is required, remediation and mitigative actions are implemented. Although this approach is consistent for both finfish and shellfish operations, it should be recognized that these types of culture are different

with respect to environmental interactions, and that the monitoring, and management practices reflect this difference.

Environmental monitoring is an important part of the management of a marine resource industry. NSDFA believes that the growing body of data that has been and will continue to be collected, helps to ensure that the aquaculture industry in Nova Scotia remains environmentally sustainable.

This document is designed as a companion paper to the *Standard Operating Procedures for the Environmental Monitoring of Marine Aquaculture in Nova Scotia* (SOP; PNS 2020). These documents are intended to be used as a framework and protocol for environmental monitoring of the Nova Scotia aquaculture industry. From time to time, these documents will be reviewed and adjusted as needed.

The objective of this document is to detail key components of the NS EMP. These are:

- **Environmental Management Framework** – this section describes the rationale for the regulatory framework and determining appropriate levels of monitoring.
- **Site Management Responses** – this section describes site management responses based on the environmental quality classification reported from a sample location with reference to industry Best Management Practices (BMP).
- **Committees for Regulation and Development of Environmental Management Outcomes** – this section describes the role and responsibilities of the committee to make recommendations on the conduct of the EMP.
- **Annual Schedules** – this section describes the timing deadlines for monitoring and mitigation.
- **Auditing and Reporting** – this section describes the types of auditing that will be performed by NSDFA as well as the reporting requirements for Industry self-monitoring.

2. EVIRONMENTAL MANAGEMENT FRAMEWORK

The NS EMP lays out a series of principles and criteria to guide the management process and to determine the level of monitoring required for each aquaculture lease. Depending on the monitoring results, the EMP also provides guidance on the level of mitigation required for an aquaculture lease.

2.1. Monitoring Principles

The information obtained from the monitoring program is valuable both to government and the aquaculture industry. Monitoring is carried out to:

- ensure compliance with conditions of a site approval
- ensure environmental quality objectives (EQOs) and other standards are met
- assess the effects of an operation on the environment
- verify and validate mathematical models (if any)
- determine action to be taken and
- audit the results of self-monitoring

One of the primary concerns regarding a marine aquaculture operation is the potential for negative impact on the surrounding marine benthic environment through organic loading. Significant organic deposition can result in increased Biological Oxygen Demand (BOD) in benthic sediments. If BOD is greater than the incoming supply of oxygen, hypoxic or anoxic sediment conditions will result, potentially impacting localized fish habitat and decreasing the abundance and diversity of macrofauna populations.

The EMP aims to monitor such impacts to benthic communities through both geochemical analysis of sediments and the assessment of visual indicators of hypoxic conditions. These assessments are used to classify the environmental performance of an aquaculture lease based on established relationships between the collected parameters and benthic community health. In instances where site classification indicates compromised benthic conditions as a result of organic loading, the EMP dictates increasing levels of monitoring to improve understanding of the scope and severity of the impacts as well as mandatory management responses to be undertaken by the facility operator.

The primary Environmental Quality Objective (EQO) for the marine environment where an aquaculture operation occurs is to maintain oxic sediment conditions. If oxic sediment conditions cannot be maintained within a lease, operators must comply with the regulatory process that identifies steps required to improve onsite conditions.

2.2. Station and Site Classifications

In July of 2015, the Aquaculture Activities Regulations (AARs) were introduced by the Department of Fisheries and Oceans Canada (DFO), resulting in the creation of federal monitoring requirements which aquaculture site operators must comply with in addition to the provincial program. The AAR's inclusion of assessment requirements for stations where sediments can not be collected has since led to the incorporation of similar considerations within the Nova Scotia Environmental Management Program for assessing and classifying both soft and hard bottom stations and leases. While previous iterations of the EMP relied solely on measurements of sediment sulphide ion concentration to determine environmental impacts, the inclusion of hard bottom sampling methodologies has required the consideration of additional benthic health indicators and classification metrics for the assessment of the environmental performance of aquaculture operations.

2.2.1. Determination of Monitoring Station Type

All monitoring events conducted under the Environmental Monitoring Program consist of the assessment of a series of individual Monitoring Stations. The means by which these stations are assessed and how the results are used in the classification of the environmental performance of an aquaculture lease as a whole is dependant on the representative bottom types present. Within the context of the EMP, Monitoring Stations can be considered as either hard bottom or soft bottom stations. A monitoring location is considered to be a soft bottom station only when a sufficient number of sediment samples can be collected which satisfy the methodology and quality criteria presented in Section 4 of the EMP Standard Operating Procedures (PNS 2020). Where the composition or consolidation of the benthic substrate is such that sufficient, acceptable samples can not be collected, a sampling location will be considered to be a hard bottom station for the purposes of that sampling event.

2.2.2. Environmental Indicators and Definitions

The NS EMP focuses on benthic marine habitat in the immediate vicinity of the aquaculture site. The objectives of the environmental parameters assessed for soft and hard bottom stations are to:

- Maximize habitat information by providing scientific confidence in the parameters and methods of sampling and analysis used to describe changes to the benthic community structure
- Provide long-term record of habitat quality with variables that are sensitive to the potential organic enrichment effects of aquaculture
- Provide repeatability and consistency in sampling and analysis
- Provide clear specification of spatial and temporal bounds
- Optimize logistics and field efforts while ensuring cost effectiveness.

Several additional, well-established, environmental indicators allow for the classification of sediment conditions into oxic, hypoxic and anoxic categories based on the following Environmental Quality Definitions (EQD). These indicators may be used, in addition to environmental performance classification metrics (Section 2.2.3) in determining specific site management response requirements resulting from the monitoring and classification of aquaculture leases.

Table 1. Environmental Quality Definitions

	Sediment Classification		
Measurement	**Oxic**	**Hypoxic**	**Anoxic**
Sediment colour	Tan to depth > 0.5 cm	Tan to < 0.5 cm with some black sediments at surface	Surface sediments black
Microbial presence	No sulphur bacteria present	Patchy sulphur bacteria	Widespread bacterial mats
Macrofaunal Assemblage	Wide array of infauna and epifauna	Mixed group of mostly small infauna	Small infauna only
Sulfide, µM	**< 750 (A) 750 to 1499 (B)**	**1500 to 2999 (A) 3000 to 5999 (B)**	**> 6000**
Redox (Eh), mV	>100 (A) 100 to -50 (B)	-50 to -100 (A) -100 to -150 (B)	< -150
Organic matter, %	<= reference*	1.5 to 2X ref.	> 2X reference
Porosity, %	<= reference*	1 to 10X ref.	> 10X reference

Modified from the *Design of the Environmental Monitoring Program for the Marine Aquaculture Industry in Nova Scotia, 2002*, (Smith et al 2012) and *Towards a Classification of Organic Enrichment in Marine Aquaculture, 2008*, (Hargrave et al. 2008a)

2.2.2.1. Soft Bottom Environmental Indicators

The primary environmental indicator used to assess the benthic health at a soft bottom monitoring station is the mean concentration of free sulfide in the sediment. The use of mean sediment sulfide to classify the environmental quality of a soft bottom aquaculture station or lease is based on recommendations made by Wildlish et al. (1999) in the paper, *A recommended method for monitoring sediments to detect organic enrichment from mariculture in the Bay of Fundy.* Sediment is generally considered to be hypoxic when sulfide levels exceed 1500 micromoles per litre (μM).

Additional environmental indicators are assessed at soft bottom stations as a means of validating mean sediment sulphide results. These include oxidation-reduction potential (redox), porosity and organic matter prevalence in sediment. These indicators are incorporated into the calculation of a Benthic Enrichment Index (BEI), which provides a multi-variate measure of sediment organic enrichment. The index is correlated with total 'free' sulfides and biological indicators such as macrofauna biodiversity indices that can be altered by increased organic matter sedimentation, and the formation of hypoxic or anoxic conditions in sediment. It serves as an internal check by applying more than one method for quality control in monitoring programs using geochemical methods to measure benthic organic enrichment (Hargrave 1994, Shaw 1998, Holmer et al. 2005, Hargrave et al. 2008 a, b). The index can, therefore, be used to verify the degree of benthic organic enrichment in marine sediment based on measures of sulfide (Hargrave, 2009).

Comparison of the relative sensitivity of variables for detecting sediment organic enrichment due to aquaculture, has shown that porosity and organic matter are not as good indicators of differences between farm and reference sites as redox. However, when combined with measures of redox to calculate the BEI, detection of differences between farm and reference site sediments using BEI, approaches levels obtained using sulfide (Hargrave et al., 1997).

Measurements of porosity and organic matter therefore serve more than one purpose. Primarily, they allow inference of sediment texture to ensure that the depositional-erosional characteristics at farm and reference sites are comparable. In addition, they provide an internal check on data quality. Sediments with high porosity typically have higher levels of organic content. Over time, as data are collected from the same location, a database can be developed, allowing temporal trends in organic matter to be detected independent of the effect of grain size inferred from porosity measurements. Finally, porosity must be known if the absolute mass of organic matter in surface sediments is to be calculated on a dry weight basis (Hargrave 2009). This is required not only for comparisons of organic matter in sediments from farm and reference locations, but to ensure that organic content inventories are being compared on the same basis between locations where porosity differs (Hargrave 2009).

Sulfate reduction and the production of sulfide are closely related to redox potential. While the relationship weakens somewhat for oxic sediments, redox acts as a quality control measure for sulfide measurements and vice versa (Grant 2010).

Detailed instruction for collecting and analyzing sediment and video for the assessment of soft bottom environmental indicators can be found within the EMP Standard Operating Procedures (PNS 2020).

2.3.2.1 Hard Bottom Environmental Indicators

The inability to collect sufficient acceptable sediment samples characterizes a monitoring station as hard bottom. For hard bottom stations, the primary environmental indicators used to assess benthic health result from visual observation of the seafloor at and nearby the monitoring station. The three hard-bottom environmental indicators include: the abundance of *Beggiatoa* or similar bacterial species, opportunistic polychaete complexes, and barrenness. The decision to use these indicators to asses the benthic health of hard bottom stations is based on recommendations made by DFO.

Methodology for assessing these indicators is explained in the Aquaculture Activity Regulations which can be found on DFO's website and in the EMP Standard Operating Procedures (PNS 2020).

2.2.3. Environmental Performance Classification of Sites

The metrics by which an aquaculture site's environmental performance is classified will depend on the proportion of monitoring stations which are determined to be soft and hard bottom during a given monitoring event. The Environmental Performance Classification of an aquaculture lease resulting from an annual Level I monitoring event will determine the necessary site management response (if any) required (Section 3).

2.2.3.1. Predominantly Soft Bottom Sites

At sites where 75% or more of non-reference monitoring stations are determined to be soft bottom, the site's environmental performance classification will be determined using the mean sulphide ion concentration of sediment samples collected from these stations (Table 1).

Table 2. Environmental performance classification levels and associated mean sediment sulphide concentrations for predominantly soft bottom sites

Site Classification	Sediment Sulfide Concentrations
Oxic A	<750 µM
Oxic B	750 - 1499 µM
Hypoxic A	1500 - 2999 µM
Hypoxic B	3000 - 5999 µM
Anoxic	≥ 6000 µM

2.2.3.2. Predominantly Hard Bottom Sites

At sites where 25% or fewer of non-reference monitoring stations are determined to be soft bottom, the site's environmental performance classification will be determined using the proportion of stations which pass or fail visual assessment of benthic impacts. Monitoring locations which are determined to be hard bottom stations are subject to spatially expanded visual assessments consisting of multiple video collection locations, as described in the EMP SOP Section 3.2.2. If, during these assessments, evidence of hard bottom indicators (Section 2.3.2.1) is observed at 70% or more of the video collection locations, the monitoring station will be considered as having failed to meet the Environmental Quality Objectives of the EMP (PNS 2020). If the number of stations which pass this visual assessment is greater than the number of stations which fail, the site will be classified as having passed. If the number of stations which fail is greater than or equal to the number of stations which pass this visual inspection, the site will be classified as having failed.

2.2.3.3. Mixed Bottom Sites

At sites where the number of stations determined to be soft bottom is between 25% and 75%, environmental performance classification will be determined using a combination of average sulphide ion concentrations from soft bottom stations and visual assessment results from hard bottom stations. Sampling locations which have been determined to be hard bottom stations will be assessed as having passed or failed visual assessment, as described in Section 2.2.3.2. Soft bottom stations will be considered as having passed or failed based on the mean sulphide ion concentration of sediments collected from that sampling location. Where mean sulfide concentrations are found to be $\geq$3000 µM, the station will be considered as having failed. If the number of stations which pass is greater than the number of stations which fail, the site will be classified as having passed. If the number of stations which fail is greater than or equal to the number of stations which pass, the site will be classified as having failed.

2.3. Levels of Monitoring

A risk-based approach is required to address the variety of potential impacts on the marine benthic environment. The risk-based approach is based on the interaction of site conditions, culture methods and culture intensities that vary greatly among finfish and shellfish marine aquaculture operations in Nova Scotia. Sites are subject to baseline environmental monitoring. For more information on baseline requirements, please refer to Section 7 of the NS EMP SOP (PNS 2020).

Determination of appropriate monitoring actions for existing sites is summarized in Figure 2 and is based on the knowledge of the risk of impact from different culture types in different biophysical conditions throughout Nova Scotia. Up to three levels of monitoring events may be required in the annual assessment of a given aquaculture lease. Detailed methodology for conducting the required monitoring associated with each of these events is presented in the NS EMP SOP (PNS 2020).

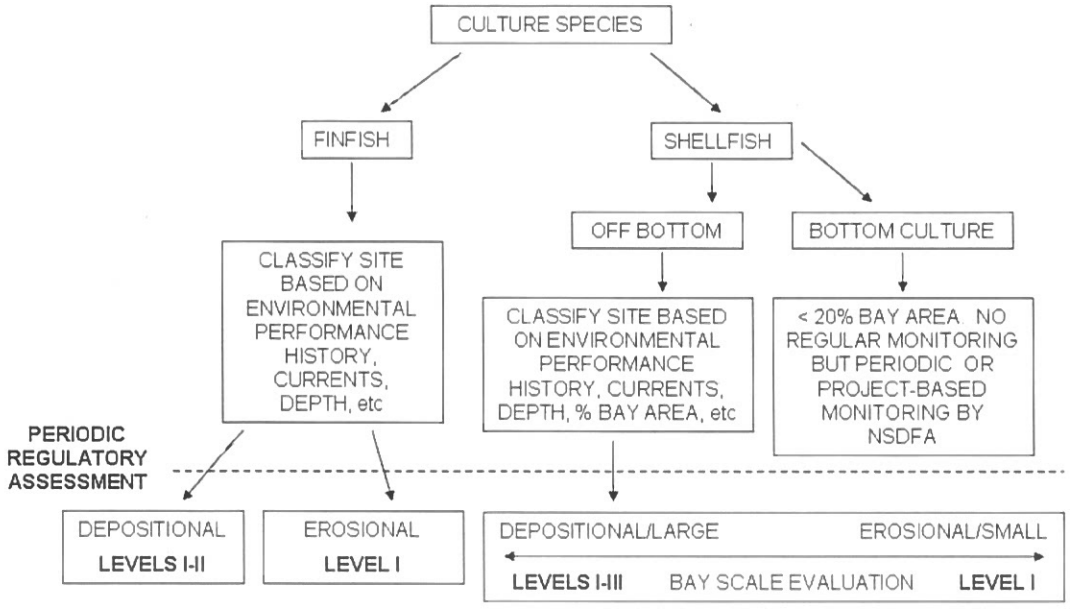

Figure 1: Risk-Based Monitoring Decision Matrix

Level I – Depositional sites are classified based on the site characterization and/or if past sampling results indicated elevated sulfide levels. For these sites, annual EMP sampling is required to ensure oxic conditions are maintained. Erosional sites are also classified based on the site characterization and/or past sampling event results. For these sites, basic site sampling is required to ensure oxic conditions are maintained; however, unlike depositional sites, erosional sites only need to be sampled every 1 to 2 years. The sampling event frequency may change if there is a significant increase in the production on a lease. For new aquaculture sites, annual EMP monitoring will be required until these sites have been determined to be erosional sites. Level I sampling procedures are described in the NS EMP SOP (PNS2020).

Level II – Additional monitoring is required when the results of annual Level I monitoring classify a lease as Hypoxic B, Anoxic, or having failed based on the mixed or hard bottom classification (Section 2.2.3). The additional information gathered during a Level II sampling event is used to better delineate the affected area and more effectively define the zone of influence. Level II sampling procedures are described in the NS EMP SOP (PNS2020).

Level III – For sites that consistently fail to meet oxic conditions or in cases where the results of annual Level I monitoring classify a lease as Anoxic or otherwise severely impacted, a third monitoring event will be required. This sampling is used to capture seasonal variation on a lease and is used to closely monitor affected areas within the lease boundaries through increased temporal sampling intensity. Additional requirements may be imposed at the discretion of NSDFA in order to better assess the environmental impacts and ongoing sustainability of an aquaculture operation. These may include, but are not limited to:

- The addition of more sampling stations
- The addition of seasonal sampling events

- Sediment profiling
- Collection of current data
- Development of oceanographic models (e.g. flushing, carrying capacity, depositional)
- Collection of additional water quality parameters.

Details and specific conditions of all follow-up monitoring are to be determined by NSDFA and DFO in discussion with site operator.

3. SITE MANAGEMENT RESPONSES

In order to meet the EQO of oxic sediment conditions, it is important to define a suite of measures that could be implemented to achieve the goal. These measures include Best Management Practices (BMP) that are determined by industry and are deemed to be effective in mitigating potential environmental effects. If after monitoring occurs on the site and there is evidence of organic enrichment, then enhanced BMP's are to be implemented on that particular lease (see Appendix B).

Required site management responses as outlined in Appendix B of this document will be based on results of annual Level I monitoring events. Other parameters and information, such as redox, porosity, organic matter and video/visual observations will continue to be included as part of the weight-of-evidence approach for the overall site assessment and classification. These other parameters will aid in determining cause-effect relationships and appropriate management responses.

The following are management responses based on site classification of marine finfish aquaculture sites in Nova Scotia. Responses within the shellfish sector will be similar but more prescribed to the differences between shellfish and finfish growing operations (infrastructure, growing environments, etc.).

3.1. Oxic Site Responses

Sites classified as Oxic A or Oxic B are considered to have low environmental effects on the marine sediments. The site operator will continue to follow the site's operational BMP's and will continue to complete annual Level I monitoring. If a site remains 100% oxic for two production cycles, and there is no significant stocking increase, the EMP would require sampling every 2 years, instead of annually.

3.2. Hypoxic A Site Responses

Sites classified as Hypoxic A may be causing adverse environmental effects on marine sediments. In addition to following the sites BMP's for the lease, the site operator will submit an updated mitigation plan to NSDFA for approval and must identify which predetermined risk control plans from their Farm Management Plan are appropriate to address the sub-optimal environmental performance. The updated mitigation plan must be implemented in a timeframe determined by the Minister. The site operator will be required to conduct Level I monitoring for the next sampling season.

3.3. Hypoxic B Site Responses

Sites classified as Hypoxic B are likely causing adverse environmental effects on the marine sediments. Level II monitoring will be required at sites receiving this classification. In addition to following operational BMP's, the site operator will submit an updated mitigation plan to NSDFA for approval and must identify which predetermined risk control plans from their Farm Management Plan are appropriate to address the lease's poor environmental performance. The updated mitigation plan must be implemented in a timeframe determined by the Minister. The operator must also provide a strong rationale for maintaining or increasing production levels.

3.4. Anoxic Site Responses

Sites classified as Anoxic are considered to be causing adverse environmental effects on the surrounding marine sediments. Large portions of the site are likely affected due to the excessive accumulation of organic material. The site operator must conduct both Level II and Level III monitoring on the site. The site operator will work closely with regulators to resolve the situation.

For sites classified as Hypoxic and Anoxic, the known production history of the site along with historical EMP performance and site characteristics will be an important determination of mitigation options and must be incorporated into a site operator's updated mitigation plan.

4. COMMITTEES FOR REGULATION AND DEVELOPMENT OF ENVIRONMENTAL MANAGEMENT OUTCOMES

On an ongoing basis NSDFA consults with the Nova Scotia Aquaculture Environmental Coordinating Committee (NSAECC) which is co-chaired by NSDFA and DFO through the Canada-Nova Scotia MOU.

The NSAECC will provide a mechanism for both industry and regulators to provide input to the NS EMP process. Any program revisions will be vetted through this committee. It has representatives from all aquaculture related regulatory agencies such as NSDFA, DFO, and representatives of the finfish and shellfish industry through the AANS. This body has no regulatory authority to make site specific decisions but is a means of exchanging ideas and making recommendations on the conduct of the EMP.

Under the MOU, NSDFA also takes the lead role in the management of the NS EMP through a Nova Scotia Aquaculture Environmental Site Management Committee (NSAESMC) which is co-chaired by NSDFA and DFO.

The NSAESMC provides a review on site-specific results of the NS EMP. This committee interprets the results of the NS EMP monitoring events and provides site-specific recommendations for any remedial action required. This approach provides a method of integrating the regulatory requirements of both agencies with respect to environmental management.

In summary:

- NSDFA and DFO co-chair the NSAECC
- NSAECC has representation from NSDFA, NSE, DFO, AANS and other provincial and federal government agencies, as needed
- NSAECC will be the advisory body and forum for information exchange with Industry on EMP matters
- NSAESMC will be co-chaired by NSDFA and DFO. The committee will review EMP data and make remediation/mitigation recommendations based on EQOs and a risk-based approach
- NSDFA will perform the lead role on EMP management and will perform the audit function of the EMP, however regulators on the NSAESMC can make any determinations and actions on their own based on their respective legislation and regulations.

5. ANNUAL SCHEDULES

The optimal time for conducting environmental monitoring on a lease is when feeding and waste production (i.e., organic deposition) are at a peak for both marine finfish and shellfish operations. It is also important to complete monitoring when seasonal storm potential is limited.

Annual Level I monitoring of Nova Scotia marine aquacultures sites will be conducted from July 1st to October 31st. Level II monitoring will also be conducted between July 1st to October 31st. Dependent on when Level I sampling occurs, Level II sampling can also take place during the month of November. Level III sampling will occur during the winter/spring months when the weather permits. Site operators are expected to comply with the schedules in Table 3 for the submission of data, materials, and, if necessary, updated mitigation plans. Only complete, final copies of reports, results, coordinates, log sheets and video are to be submitted. Incomplete reports and partial submissions are considered late. Any delays to these timelines require approval by the Director of Aquaculture via written request from the site operator.

The deadlines for each type of monitoring and mitigation response are as follows:

Table 3. Monitoring Deadlines for the Operator and NSDFA

Requirement	Deadline for Industry	Deadline for NSDFA
Annual Level I EMP Monitoring	Must be completed between **July 1st to October 31st**	
Redox and Sulfide Results, and Sampling Coordinates Submitted to NSDFA	Must be submitted within **14 days** of the completion of Level I sampling event.	
Organic Matter, Porosity, Benthic Logs, Transect Video Logs and Video Recordings	Must be submitted within **21 days** of the completion of Level I sampling event.	
Level I Follow-up (Site Classification and QA/QC Audit Results)		Letter provided within **28 days** of Level I sampling
Updated Mitigation Plan	Hypoxic A classification: updated mitigation plan must be submitted **14 days** after site classification notification.	Response provided to Industry within **14 days** of receipt of updated mitigation plan
Level II Sampling (Hypoxic B and Anoxic site classification)	Must be completed within **35 days** of the Level I sampling event.	
Updated Mitigation Plan and all submissions for Level II sampling event	Must be submitted within **14** days of the completion of the Level II sampling event.	
Level II Monitoring Follow-up (final site classification, mitigation plan status)		Letter provided within **14 days** of receiving Level II results.

6. AUDITING, COMPLIANCE AND REPORTING

Auditing will be conducted by NSDFA on an annual basis on a minimum 20% of sites required to conduct environmental monitoring. The purpose of an audit is to ensure that the information submitted to NSDFA is accurate, consistent, and reliable. Access to accurate, consistent and reliable data ensures that government agencies and growers make sound management decisions. Audits are also ensure that the proper sampling methodology is being followed.

Audits will consist of one to all of the following components:

- A review of the monitoring practices on each site, through examination of the sampling documentation, laboratory analysis, quality assurance and quality control procedures, analysis results and supporting data.
- Visual observation of the actual monitoring work in progress. This could include on-water observation of the sampling procedures.
- Laboratory analyses of replicate samples. This may involve additional replicates being collected from a single sampling location. These samples can either be collected by NSDFA or the consultant hired by the site operator. If collected by a consultant, these replicates will be delivered to NSDFA to be processed in the NSDFA EMP Lab.
- Quality Assurance (QA) of all data provided. To continue developing the EMP database of NS Marine aquaculture, all data submitted to NSDFA will be added to the database. Prior to inclusion, the data will be reviewed for outliers and errors. The data will also be processed through quality control measures, such as the BEI.
- NSDFA EMP sampling. NSDFA will conduct on-site monitoring in addition to regular Level I. Farms will be selected throughout the field season for sample collection. These samples will be collected from the same coordinates suggested for Level I or II sampling. NSDFA and the Level I and/or Level II results, as submitted, will be compared. Data collected by auditors will bear relevance to regulatory process.

The principles of transparency and collaboration are tenets of responsible environmental management and described in the original 2002 EMP document (Smith et al., 2002); therefore, one goal of the NS EMP is to release information regarding the monitoring results to the public. NS EMP monitoring results can be accessed through the province's open data portal: https://data.novascotia.ca/.

APPENDIX A: Associated Best Management Practices for Marine Finfish Aquaculture - provided by Aquaculture Association of Nova Scotia (AANS)

These Best Management Practices are extracted from the New Brunswick Environmental Management Program for the Marine Finfish Cage Aquaculture Industry in New Brunswick (July 2006) as requested by industry representatives within the AANS.

The following Operational Best Management Practices are designed to minimize the organic and inorganic loading from marine finfish cage aquaculture sites and are a requirement of all marine finfish cage aquaculture operators.

Waste Management

- Cage site operators are required to develop and comply with site-specific waste management plans developed by their facility as required by provincial and federal regulators. The aim of the plan is to ensure proper disposal of all waste materials generated at the facility. Categories of waste covered include, but are not limited to: operational debris, hazardous waste, human waste, bio-fouling, fish mortalities, fish feed, waste products from harvesting, etc.

Record Keeping and Reporting

- Marine finfish cage aquaculture site operators are required to maintain production records and report information as required by provincial and federal regulators.
- Environmental monitoring data will be reported to NSDFA within timelines set out above in *Section 5: Annual Schedules.*

Equipment Cleaning (nets, cages, mooring, other equipment)

- It is recommended that no net washing be conducted on-site, and that farmers monitor nets for biofouling organisms during routine mortality dives.
- In some circumstances, maintenance washing of lightly fouled nets still attached to cage structures is allowed on-site; however, once nets are removed they must be brought to shore for cleaning.
- Washing of lightly fouled equipment or nets with washing systems at the site will be conducted only under conditions that maximize dispersal of the dislodged materials away from the site and neighboring sites (e.g. strongest currents).
- Nets will be replaced at least at the beginning of each production cycle, and more often as required.
- No nets or other equipment shall be dropped to the bottom for the purpose of storage or cleaning. In the event of emergency circumstances such as worker safety or fish survival, any nets or equipment dropped to the bottom must be within lease boundaries and must be reported to NSDFA and DFO immediately.
- Sites classified as Hypoxic B, or Anoxic will not conduct any on-site net cleaning.

Equipment Disinfection (nets, cages, mooring, other equipment)

- Steam is the only disinfectant to be used on-site to clean cages and equipment.
- The cages will be cleaned on the aquaculture site prior to transport to the off-site location where the disinfection will take place.
- Only the following disinfecting agents will be used to clean cages at a location other than on the aquaculture site: steam, chlorine-based solutions, iodophor-based solutions, and hydrogen peroxide-based solutions.
- Environment Canada has suggested maximum discharge concentrations for each of the indicated disinfectants so that runoff from the disinfection process should not be deleterious to fish. The release of disinfectant solutions to waters frequented by fish could be considered a violation of Section 36(3) of the federal *Fisheries Act* at concentrations above the following maximum values:
    - Chlorine = 0.02 ppm
    - Iodine = 0.1 ppm
    - Hydrogen peroxide = 0.5 ppm
- During disinfection, the disinfectants will be stored such that any spill is contained and not released to the environment. All reasonable precaution will be taken to avoid releases due to spills.
- Disinfection of cages will only take place during sunny days, especially with chlorine-based solutions. Bright sunshine will aid in decreasing the concentration of chlorine, and speed up the evaporation of other disinfectant solutions.
- Care will be taken to ensure that disinfectant is not applied in excess. Direct discharge of disinfectants other than steam to waters of the province or to marine waters will not occur.
- Disinfectant solutions will be directed only at cage structures, with care taken to avoid over-spraying onto the beach.
- Ample drying time will be allotted to ensure that all disinfectant has completely dried prior to inundation with the next high tide.
- The disinfection of the cages will be spread out over a number of days to reduce the potential for impacts from the disinfectant residues.
- Disinfectant storage will occur in an area not in danger of being inundated by tidal waters or any other water source.
- To whatever extent possible, disinfection events will be coordinated with other growers within the same bay/harbour to spread it out over time and space.

Feed Handling and Storage

- Site staff and feed delivery personnel will take all reasonable precautions to reduce spills during delivery of feed to the site.
- Should a spill of feed occur, cleanup will occur immediately to minimize the loss of feed into the ocean.
- Accurate records will be kept of the amount of feed delivered to the site, stored at the site, fed to the fish, spilled and/or returned unused to the manufacturer. These records will provide a mass balance of feed use at the site.
- The amount of feed on site at any one time will be limited to an amount that can be safely and properly stored at the site.

- Feed will be stored, as much as practically possible at the site in covered areas including hoppers, bins, or buildings so that spills and spoilage are minimized.
- Bags or open containers of feed will not be left exposed or uncovered at the site.
- Any feed that is unusable will be removed from the site as new feed is delivered and disposed of at an approved site.

Feeding Practices

- Amounts of feed given to stock will be based on biomass contained in the pen and environmental conditions present.
- Feeding will be reduced or stopped if conditions such as low temperature, low dissolved oxygen, high tide currents, or heavy weather suggest that utilization of feed by the stock will be affected.
- Site staff will monitor all feeding operations at the facility. Feeding equipment will always be monitored during operations. Staff will closely observe fish feeding behavior.
- The use of underwater video cameras to monitor the feeding activity is recommended for all sites and will be used when available or when required.
- Feeding rates should be reduced or stopped when staff observes changes in fish activity indicating a reduction in appetite and/or if uneaten feed is detected passing through the bottom of the cage nets.
- Feeding will be temporarily reduced or suspended at times of strong currents flowing through the net pens that impact the ability of the fish to eat the feed.
- Hand feeding will be conducted in a manner to ensure an even distribution and reduce the amount of waste feed. Feeding will be slowed or paused if staff observes a reduction in feeding activity.
- Feeding performed with feed blowers will be conducted in a manner to ensure minimum loss of uneaten fish feed. Feeding will be slowed or paused if staff observes a reduction in feeding activity.
- Feeding equipment must be properly maintained to minimize the crushing of the feed pellets that can result in fine feed dust that will not be eaten by the fish. The operator must establish a schedule for the regular maintenance of mechanical feed blowers.
- Mechanical feed blower nozzles must be carefully aimed and controlled to ensure that the feed is being evenly distributed across the surface of the net pen and that no feed is missing the net pen entirely.
- Computer-controlled feeding systems require that a qualified operator be on duty at all times when feed is being administered.
- Detailed records will be kept for each cage of feed type and amount, fish numbers, total fish biomass, water temperature, and growth rates to ensure optimal feed conversion rates are being achieved at the site and that minimal feed losses are occurring.
- Feeding of moist feed will be conducted slowly to ensure that the fish have adequate time to consume the feed being distributed in the net pens.
- Feeding will be timed to coincide with the times of the day that the fish are eating well.
- Close attention will be given to the size of the pellets being used to feed the fish to ensure that the proper size pellets for the size of the fish in the net pens are being utilized.
- All staff must be trained in the above practices. Detailed records of training must be kept for each employee including training received and dates of training.

APPENDIX B: Mitigation Plans and Submissions

Appendix A highlights the standard best management practices that all marine aquaculture operators are expected to implement as part of their daily operations. In addition to these best management practices, aquaculture licence holders are also required to determine enhanced mitigation strategies that can be implemented on a lease when poor environmental performance has been identified. These enhanced mitigation strategies should be used when the EMP results classify the site as **Hypoxic A, Hypoxic B, or Anoxic** or if the site receives a fail under the hard bottom protocol. Enhanced best management practices do not apply to oxic sites.

When poor environmental performance has been determined through a monitoring event, the aquaculture licence holder must implement appropriate enhanced mitigation strategies. These strategies can include those that pre-determined as part of the Farm Management Plan. However, these enhanced mitigation strategies may require site-specific adjustments to ensure the cause(s) of the environmental impacts are addressed.

All enhanced mitigation measures to be implemented on an aquaculture lease must be submitted to NSDFA within **14 days** of receiving a **Hypoxic A, Hypoxic B or Anoxic** site classification. The mitigation plan must specify the timelines in which the mitigation measures will be implemented and provide explanation of how the measure will reduce any environmental impacts caused by the operation. Detailed below are examples of enhanced mitigation measures that can be implemented by the operator when poor environmental performance has been identified. If the operator feels that the recommended enhanced mitigation measures listed below are unsuitable for addressing the cause of the environmental impact(s), they can submit alternative mitigation strategies. These alternate mitigation strategies must be approved prior to implementation.

Environmental Impact: Stocking of Cages

Overstocking of the site or specific areas within the site, can lead to increased organic loading on certain parts of the site.

Enhanced Mitigation Measures

- A cage stocking strategy that helps to ensure oxic conditions based on the results of the environmental monitoring
- Adjustment of the on-site cage stocking levels based on the environmental monitoring results
- Adjustment of the cage position based on the environmental monitoring results

Environmental Impact: Increased Fecal Matter

The settlement of fecal matter on the bottom of the lease can result in increased organic loading and impact the condition of the bottom sediment.

Enhanced Mitigation Measures

- Completion of a tidal current study through the deployment of a current meter on the lease for thirty-five days. The operator should evaluate the tidal patterns on both the overall site and at the individual cages using modelling. The use of the current meter and modelling studies will allow the operator to fully understand the dispersion of organic matter that is released from the farm operation.
- Adjustment in cage stocking levels based on the monitoring results
- Adjustment in cage stocking levels based on the evaluation of tidal current patterns and modelling study
- Adjustment in the cage positions on the lease according to monitoring results
- Adjustment in the cage positions on the lease based on the tidal current study and modelling study during the grow out period
- Modification to the harvest schedule to reduce biomass on the lease over those areas of the lease with greatest amount of degradation
- Readjustment of the cages during the subsequent production cycles to avoid further impacts to areas showing adverse environmental conditions.
- Increase in the fallow period of the site to allow the site to recover
- Conduct an audit of site operations in addition to any regular scheduled auditing. This audit should be completed by an internal employee who can be a site manager who works for the same operator but works at a different farm location. The auditor will examine the waste management practices used on the lease. The auditor will file a written report to NSDFA noting any deficiencies observed and make recommendations for improvements for waste management practices.

Environmental Impact: Net Cleaning

When net cleaning occurs on a lease it can lead to a large release of biofouling from the nets which can settle on the bottom.

Enhanced Mitigation Measures

- Increase frequency of site cleaning practices to reduce amount of biofouling
- Monitor and record the amount and frequency of biofouling over a set period and adjust net cleaning procedures to address biofouling accumulation
- Evaluate site staff in terms of experience, qualification and awareness of site policies and procedures- increase staff training if necessary
- Ensure all net cleaning equipment is maintained and remains in good working order. Ensure records are kept of the equipment maintenance schedules
- Use of alternative methods on site to reduce the amount of biofouling that occurs
- Creation of a standard operating procedure regarding the level of biofouling that is acceptable on a net cage and when net cleaning must occur
- More frequent net changes when net washing not feasible
- Conduct an audit of site operations in addition to any regular scheduled auditing. This audit should be completed by an internal employee who can be a site manager who works for the same operator but works at a different farm location. The auditor will examine the waste management practices used on the lease. The auditor will file a written report to NSDFA noting any deficiencies observed and make recommendations for improvements for net cleaning.

Environmental Impact: Feeding

Improper feeding techniques can lead to the settlement of feed on the bottom of the lease, can lead to increased organic loading on the site.

Enhanced Mitigation Measures

- Evaluation of the site staff in terms of experience, qualifications and awareness of site policies and procedures
- Update staff training on feeding methods when necessary
- Compare feeding activities of the fish, feed conversion rates, and feed usage per cage for cages fed moist feed and dry feed to determine if the switch can be made earlier.
- Evaluate feed records to confirm the switch to dry feed is being made at the correct time according to the critical limit defined by the operator
- Implementation of an equipment maintenance schedule if not in place.
- Implementation of a weekly maintenance schedule of on- site feed equipment. Ensure that all equipment used for feeding is kept in good working order
- Increase record keeping from weekly records to daily records.
- Review the camera settings on site
- Calibration of the feeding equipment
- Conduct an audit of site operations in addition to any regular scheduled auditing. This audit should be completed by an internal employee who can be a site manager who works for the same operator but works at a different farm location. The auditor will examine the waste management practices used on the lease. The auditor will file a written report to NSDFA noting any deficiencies observed and make recommendations for improvements in feed handling and storage; feed equipment maintenance; and, feed equipment cleaning

Environmental Impact: Overfeeding

Overfeeding of fish can lead to the settlement of uneaten feed on the bottom of the aquaculture site.

Enhanced Mitigation Measures

- Calculate the weekly anticipated feed rate
- Increased record keeping on the lease to monitor the weekly feed rate- compare to the calculated weekly feed rate
- Adjust weekly feed rates to ensure it is not over the weekly feed rate
- Increase staff training
- Conduct an audit of site operations in addition to any regular scheduled auditing. This audit should be completed by an internal employee who can be a site manager who works for the same operator but works at a different farm location. The auditor will examine the waste management practices used on the lease. The auditor will file a written report to NSDFA noting any deficiencies observed and make recommendations for improvements in feeding methodology to prevent overfeeding.

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TAB

D

2021 NSARB-2021-001
This is Exhibit "D" referred to in the
Affidavit of Jessica Feindel
affirmed before me by videoconference
on April 22nd, 2021

Signature

ALISON CAMPBELL
A Commissioner of the Supreme
Court of Nova Scotia

EMP History of #1039

	Monitoring Event	Classification	Sulfide average (uM)
Aug-2004	Level I	Oxic	1103
2005	No data		
Sep-2006	Level I	Oxic	1030
2007	No data		
2008	No data		
Aug-2009	Level I	Oxic	580
Aug-2010	Level I	Oxic	1128
Aug-2011	Level I	Hypoxic A	1867
Aug-2012	Level I	Oxic	183
Sep-2013	Level I	Oxic	482
Aug-2014	Level I	Oxic	180
Aug-2015	Level I	Oxic	1012
Aug-2016	Level I	Oxic	1028
Sep-2017	Level I	Hypoxic A	1739
Jul-2018	Level I	Oxic B (Oxic)	1445
Jul-2019	Level I	Oxic A	439.4
Aug-2020	Level I	Oxic B	784

Over the past 10 years this lease has triggered Hypoxic A status once, in 2017. A mitigation plan was submitted to address the environmental performance and through implementation the site returned to Oxic the following year.