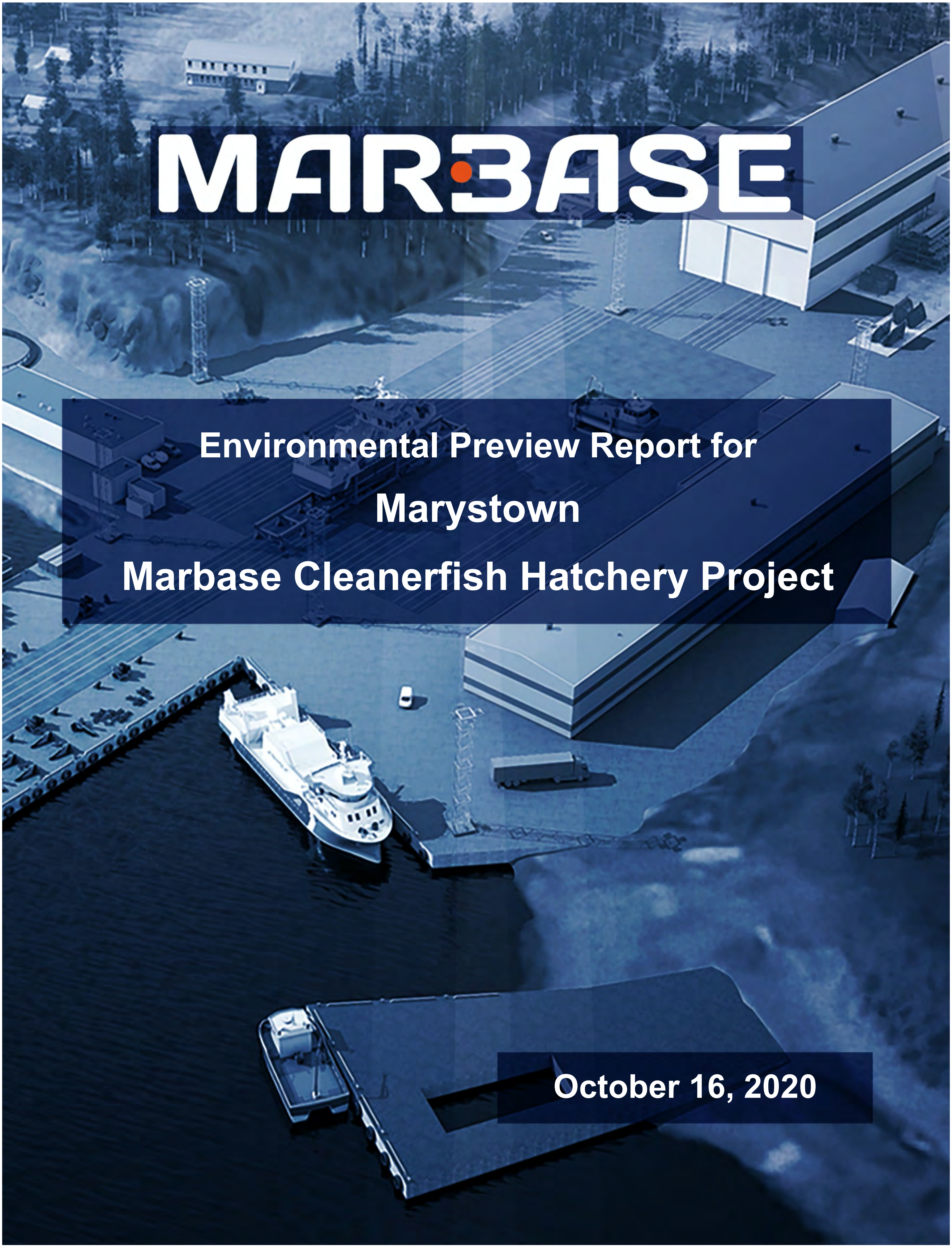

MARBASE

Environmental Preview Report for

Marystown

Marbase Cleanerfish Hatchery Project

October 16, 2020

Executive Summary

This Environmental Preview Report (EPR) has been prepared by Marbase Cleanerfish Ltd. (Marbase) for the Newfoundland and Labrador Department of Environment, Climate Change and Municipalities (DECCM) pursuant to the Minister's Decision Letter of February 12, 2020, and in accordance with the EPR Guidelines issued June 11, 2020. The document addresses issues identified with respect to the construction and operation of a lumpfish hatchery (Marbase Cleanerfish Hatchery) in Marystown, Newfoundland and Labrador, at the Marbase Aquaculture Service Hub site (formerly the Marystown Shipyard).

The Marbase Cleanerfish Hatchery will grow and sell lumpfish to sea-cage rearing operations throughout Atlantic Canada where sea lice may be present as a risk to the farmed salmon. By consuming the sea lice, the lumpfish act as an effective form of natural, biological control. This method of environmental management is not new to the Province of Newfoundland and Labrador. The development of lumpfish as a cleanerfish has evolved out of research and development work carried out at The Memorial University of Newfoundland's (MUN) Ocean Sciences Centre (OSC). For the past five years, MUN has produced juvenile lumpfish in commercial quantities to meet local industry demand. The technology is proven, and it is now more than timely for the university to transfer this capability to the private sector.

This undertaking represents not only the final step in the conversion of university-led research into a viable commercial enterprise but also an environmentally friendly solution for a problem within the aquaculture industry, which also generates economic spin-off. With the addition of the extensive experience available from Marbase's Norwegian partners, the project will in fact represent a considerable improvement in environmental protection measures within the local aquaculture industry over current practices for sea lice.

Construction of the proposed facility is planned to commence upon receipt of all necessary permits and approvals. The current schedule is for site work to commence in late 2020 with completion by Spring 2021. Marbase will refurbish a large existing building at the Marbase Aquaculture Service Hub to serve as a hatchery containing over 300 fish tanks of varying sizes. Since it is an existing, fully serviced industrial-zoned site, a modest construction program will be required for the hatchery. The only project feature that will extend beyond the boundary of the Marbase property is the flowthrough saltwater supply system. Field sampling has confirmed the

suitability of Mortier Bay water for use in the hatchery. Inside the hatchery building, key process machinery will be installed, including filtration and ultraviolet disinfection of both inflow and discharge water. This level of treatment is highly effective and will exceed both industry practice and regulatory requirements.

At full production, the proposed hatchery will be capable of producing 3.0 million lumpfish from egg incubation through to market size (25g) annually. This compares with the current production of 2.0 million fish at MUN's OSC. While the hatchery will form a very important link to the finfish aquaculture service sector, this production level should be placed into context. The total output will amount to 75 tonnes of lumpfish annually. This scale of operation is also reflected in the wastes produced. The largest waste is the material filtered from both the inflow and discharge water. The resulting "sludge" amounts to a modest eight tonnes per month directed for disposal or recycling.

The EPR examines specific project alternatives including site selection, hatchery water supply system, cleanerfish species selection, and the processes for water treatment and disinfection. The information on these alternatives demonstrates that the selected project is technically and environmentally the preferred choice in all respects.

The identified issues of concern have been addressed in the order laid out in the EPR Guidelines. The scope of the project for the purposes of examining environmental effects reflects its status as an evolutionary step, rather than a new undertaking. The scale of the undertaking also needs to be appreciated. The quantity of product is minor, especially in comparison to finfish production. The potential negative effects are small in scale, and all can be addressed through existing regulatory mechanisms. The potential positive effects are impressive, especially for the finfish aquaculture industry. Employment and business activity will contribute significantly to the Town of Marystown and surrounding areas in terms of construction, operation, training, employment, and spin-off economic activity through the continued operation of the facility.

Applications for permits and approvals as identified in the EPR will be made in a timely manner to address regulatory requirements related to aquaculture operations, water quality, aquatic habitat protection, waste management (handling, treatment, recycling, and disposal), employment equity, navigable waters usage, water extraction and allocation, contingency planning, and emergency preparedness.

This EPR is also fully compliant with the Guidelines' requirements for Public Information, a challenge given the realities of COVID-19 precautions. The public information program delivered by Marbase represents an improvement over the conventional requirements. Through social media, a large province-wide audience was reached and given access to information on the undertaking. The use of conferencing software enabled active participation in the public session by "attendees" from across the province. No person had to travel to participate, and the turnout was quite good. During the Public Information Session, Marbase staff responded to all the issues raised and the questions asked and did so well within the time allotted.

The EPR is supported by appended material to address the identified issues in a high level of detail that will adequately address any identified environmental concerns.

It is notable that at all steps in the consultation process the majority and, in some cases, the vast majority of comments were very much in favor of the project acknowledging that this undertaking represents an environmentally responsible venture. The challenge now for the Minister and for Government is to make timely decisions that reflect the environmentally responsible approach that Marbase Cleanerfish Ltd. has presented in pursuing development opportunities for rural Newfoundland and Labrador.

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Introduction

On December 10, 2019, Marbase Cleanerfish Ltd. (Marbase) registered the Marbase Cleanerfish Hatchery as an undertaking in accordance with the Environmental Protection Act (*https://www.gov.nl.ca/mae/files/env-assessment-bulletins-y2019-20191211-004.pdf*). The undertaking was assigned Registration Number 2062. On February 12, 2020, the Minister issued a decision letter requiring the preparation of an Environmental Preview Report (EPR). Subsequently, on June 11, 2020, Guidelines were issued for the EPR (*https://www.gov.nl.ca/mae/files/env-assessment-projects-y2020-2062-EPR-guidelines.pdf*).

This document has been prepared by Marbase Cleanerfish Ltd. (the Proponent) for the Newfoundland and Labrador Department of Environment, Climate Change and Municipalities (formerly the Department of Municipal Affairs and Environment) as an EPR pursuant to the Minister's decision letter and in accordance with the issued Guidelines. The purpose of the information in the EPR is to assist the Minister in determining whether further environmental assessment is required for the proposed undertaking.

This EPR is intended to provide sufficient detail with respect to the undertaking to determine interactions of the project with the environment and the environmental effects. The document will demonstrate to the Minister and to the public the Proponent's ability to conduct the undertaking in an environmentally sound manner using proven, state-of-the-art equipment and technology.

The report includes and updates the information provided in the original Project Registration (https://www.gov.nl.ca/eccm/files/env-assessment-projects-y2019-2062-2062-marbase-registration.pdf) and focuses on the information gaps identified during the government and public review. These information gaps have been addressed in sufficient detail to enable the Minister to make an informed decision as to the potential for significant environmental effects from the undertaking.

This EPR presents the results of an investigation based on readily available information that supplements the information already provided by the Proponent upon registration. The document aims to be as concise as possible while presenting comprehensive information necessary to make an informed decision. Consequently, the document is accompanied by several appendices to provide the detail that supports the main text. These appendices are:

- Appendix I Guidelines and Concordance Table - Environmental Preview Report for the Marystown Marbase Cleanerfish Hatchery
- Appendix II Drawings and Specifications
    - IIa Existing Infrastructure
    - IIb Hatchery
    - IIc Salt Water Supply
- Appendix III Environmental Management and Protection
    - IIIa Marbase Environmental Management Framework
    - IIIb Marbase Environmental Protecion Plan Outline
    - IIIc Aquaculture Application Plans
        - Biosecurity Plan
        - Waste Management Plan
        - Fish Health Management Plan
- Appendix IV Employment
    - IVa Marbase Cleanerfish Project Occupations
    - IVb Marbase Cleanerfish Ltd. Women’s Employment Plan (draft)
- Appendix V Public Information and Consultation
    - Va Pre-Registration Consultation
    - Vb Report of the Public Information Session
    - Vc Stakeholder Consultation
- Appendix VI Salt Water Quality Field Survey Report - Marbase Cleanerfish Hatchery.

This EPR is organized to respond in a concise but comprehensive manner to the Guidelines produced by the EPR Committee. For clarity and ease of reference, Appendix I provides a Table of Concurrence that cross-references the Guidelines to the relevant section of the EPR. In addition, segments of the Guidelines’ text are shown (*in red italics)* at the start of each relevant section of the EPR.

1.0 Name of the Undertaking

"The undertaking has been assigned the Name "Marystown Marbase Cleanerfish Hatchery."

Marbase Cleanerfish Ltd. ("Marbase Cleanerfish") proposes to construct and operate a commercial lumpfish hatchery in Marystown, Newfoundland and Labrador to be located within the Marbase Integrated Aquaculture Service Hub (formerly the Marystown Shipyard).

The name of the undertaking is "**Marbase Cleanerfish Hatchery."**

2.0 Proponent

"Name the Proponent and the corporate body, if any, and state the mailing and e-mail address. Name the chief executive officer if a corporate body, and telephone number, fax number and e-mail address. Name the principal contact person for purposes of environmental assessment and state the official title, telephone number, fax number and e-mail address."

(i) Name of Corporate Body: Marbase Cleanerfish Ltd.

(ii) Address: 137 LeMarchant Road
St. John's, NL A1C 2H3

(iii) Chief Executive Officer

Name:	Mr. Paul Antle
Official Title:	Chairman and CEO
Address:	137 LeMarchant Road St. John's, NL A1C 2H3
Telephone Number:	709-726-0336
E-Mail Address:	pantle@plutoinvestments.ca

(iv) Principal contact person for purposes of environmental assessment:

Name:	Mr. Paul Antle
Official Title:	Chairman and CEO
Address:	137 LeMarchant Road St. John's, NL A1C 2H3
Telephone Number:	709-726-0336
E-Mail Address:	pantle@plutoinvestments.ca

3.0 The Undertaking

"State the nature of the project. State the purpose / rationale / need for the project. If the proposal is in response to an established need, this should be clearly stated. Identify needs that are immediate as well as potential future needs."

The Marbase Cleanerfish Hatchery will grow and provide cleanerfish to act as a natural biological method of sea lice control for farmed Atlantic salmon. The undertaking represents an economic opportunity for the Town of Marystown and will become an important contributor to a viable, self-sustaining finfish aquaculture industry in the province.

The undertaking will generate economic activity through the purchase of goods and services, while generating much needed employment in the region. The Marbase Cleanerfish Hatchery will employ a modest but permanent staff of technically qualified individuals. Appendix IVa describes the project occupations and numbers for both construction and operation of the facility. Appendix IVb includes the draft Women's Employment Plan which illustrates the commitment of Marbase Cleanerfish to fair and equitable employment practices. There continues to be a need for employment in the province especially in rural areas. The hatchery will contribute to meeting this need in a fair, equitable and environmentally responsible manner.

For the past five years there has been an existing cleanerfish production system in place to serve the needs of fish farmers in the province. This system grew out of research being conducted by the OSC at MUN. At the OSC there exists a broodstock of lumpfish taken from the waters surrounding Newfoundland and Labrador that supplies the eggs to produce lumpfish each year. At MUN's facility these eggs are fertilized, incubated, and raised to produce lumpfish weighing approximately 1gram. These lumpfish are then transferred to the finfish producers who transport the lumpfish to tank facilities in Belleoram, Nova Scotia, and New Brunswick where the lumpfish are further grown. When the lumpfish achieve a size of 25-50 grams, they are transported again – this time for distribution to sea cages along the south coast of the province.

This current production system is highly constrained by the capacity of MUN's OSC facilities. It involves some challenging logistics as lumpfish have to be transported considerable distances at least twice in each growth cycle. At present, the system is capable of producing a maximum of 2 million lumpfish per year, which was never intended to provide cleanerfish on a commercial basis. Clearly, a dedicated commercial lumpfish facility is better suited to address the demands in the local sector. Given current industry demand and potential growth forecasts, cleanerfish are an important resource in the supply chain. The objective is to reduce reliance on pesticides, improve fish health, and reduce mortalities, resulting in higher yields and higher quality salmon.

The Marbase Cleanerfish Hatchery represents the commercialization of decades of research, know-how, and intellectual property developed at MUN's OSC, which have already been applied and adopted in many other jurisdictions (Powell et al., 2018).

The new hatchery will operate under the terms and conditions of an Aquaculture License to be issued by the Department of Fisheries, Forestry and Agriculture. The undertaking will adhere to industry standards and will, through its sustainable development principles, operate at high environmental and quality standards.

3.1 Lumpfish as Cleanerfish

"The purpose / rationale / need for the project shall include, but not be limited to: an overview of using lumpfish as cleaner fish. This will include descriptions of the growth / emergence of this practice and its role in integrated pest management plans for the successful biological control of sea lice in salmonids in the province. The overview shall be supported by current scientific and governance literature including industry standards, as well as research and development information from Memorial University's Ocean Sciences Centre."

The current growth and forecasted growth of the global aquaculture industry has given rise to environmental challenges. In terms of losses and treatments, sea lice (Lepeophtheirus salmonis) infestations (Figure 3.1) are one of the biggest problems in salmon aquaculture today, costing producers up to CDN$150 per tonne of produced salmon each year. In 2016, salmonid production increased significantly in Newfoundland and Labrador to 25,411 tonnes valued at $263 million (~$4 million dollars in treatment cost). In most salmon farming countries (Canada, Norway, Chile, Scotland, and Ireland), prolonged use of chemical therapeutants to control sea lice infestations has led to the emergence of resistance in local lice populations and a growing concern over the environmental effects of these treatments. The seriousness of the developing chemical resistance issue in Canada has prompted interest in developing a variety of tools (for example, laser technology, thermodelicers, snorkel nets, functional feeds) including the potential use of local fish species as cleanerfish.

Figure 3.1: Sea lice on salmon

Health Canada's Pest Management Regulatory Agency (PMRA) continues to work in partnership with salmon growers, government officials, therapeutant suppliers, and researchers to develop the elements of an integrated pest management program for sea lice. The key elements of the program are prevention, monitoring, and intervention, which parallel the design of established integrated pest management programs in agriculture. [https://www.gov.nl.ca/ffa/files/licensing-pdf-nl-sea-lice-integrated-pest-mangement-plan.pdf]

Globally, there is a dedicated focus on research and development activities surrounding fish health. One of these activities is the development of non-chemical technologies for sea lice control including commercial production of cleanerfish. Cleanerfish such as lumpfish are being used as a more environmentally friendly way of reducing sea lice, and interest in using them is growing. Cleanerfish can be used successfully over area management zones to keep sea lice infection pressure low throughout the growth cycle.

The move towards cleanerfish is gaining momentum for a number of reasons, not least of which is the decreasing efficacy of many of the medicinal treatments available to farmers. To date, cleanerfish have proven very effective at reducing sea lice levels at a number of Newfoundland and Labrador and New Brunswick Atlantic salmon-rearing sites.

Lumpfish are not a complete barrier against sea lice, but rather they are a biological control mechanism that can form just one of a suite of site-dependent treatment tools. Experience has shown, however, that with enough lumpfish on a site (10-15% ratio of cleanerfish to salmon), lumpfish can keep lice to a low enough level to avoid other treatment tools. This has been demonstrated within salmon sites around Newfoundland and Labrador during the past few years (D. Boyce, personal communication, 2020).

MUN's OSC has been leading in the development of cleanerfish (local stocks of cunner and lumpfish) techniques for the past decade and is the leading research and development centre in North America. It is also the major producer of juvenile lumpfish in Atlantic Canada. Marbase Cleanerfish has formed a partnership with the OSC to use the extensive experience and expertise of their research scientists, management. and technical staff.

Examples of initiatives at the Ocean Science Centre are listed below.

- **Project 1 (June 2011 - March 31, 2012)**

  Cleanerfish - "Examine the Effectiveness of Cunner - *Tautogolabrus adspersus* (Walbaum) - as a Cleanerfish for Sea Lice."

  - Establishment of a collection regime
  - Establishment of transport protocols
  - Establish broodstock-holding regimes
  - Monitor larval growth and survival
  - Establish feeding patterns
  - Monitor fish health through government's aquatic fish health surveillance program

- **Project 2 (April 1, 2013 - March 31, 2015)**

  Cleanerfish - “Focus on Hatchery Production Objectives for Cunners.”

  - Maintain and monitor growth and health of broodstock
  - Obtain fertilized eggs from captive broodstock
  - Establish hatching protocols
  - Establish rearing protocols using conventional marine finfish-rearing methods
  - Establish protocols for weaning and growing fish for use as cleanerfish
  - Establish international linkages with other companies and institutions

- **Project 3 (April 1, 2015 - March 31, 2019)**

  Cleanerfish - “Developing Tools and Solutions to Mitigate and Control Sea Lice on Cultured Atlantic Salmon,” with a focus on both cunner (*Tautogolabrus adspersus)* and lumpfish (*Cyclopterus lumpus*).

  - Broodstock Management
  - Production and Grow-Out
  - Predictive Modelling
  - Technology and Knowledge Transfer
  - Rural Sustainability for our Industry

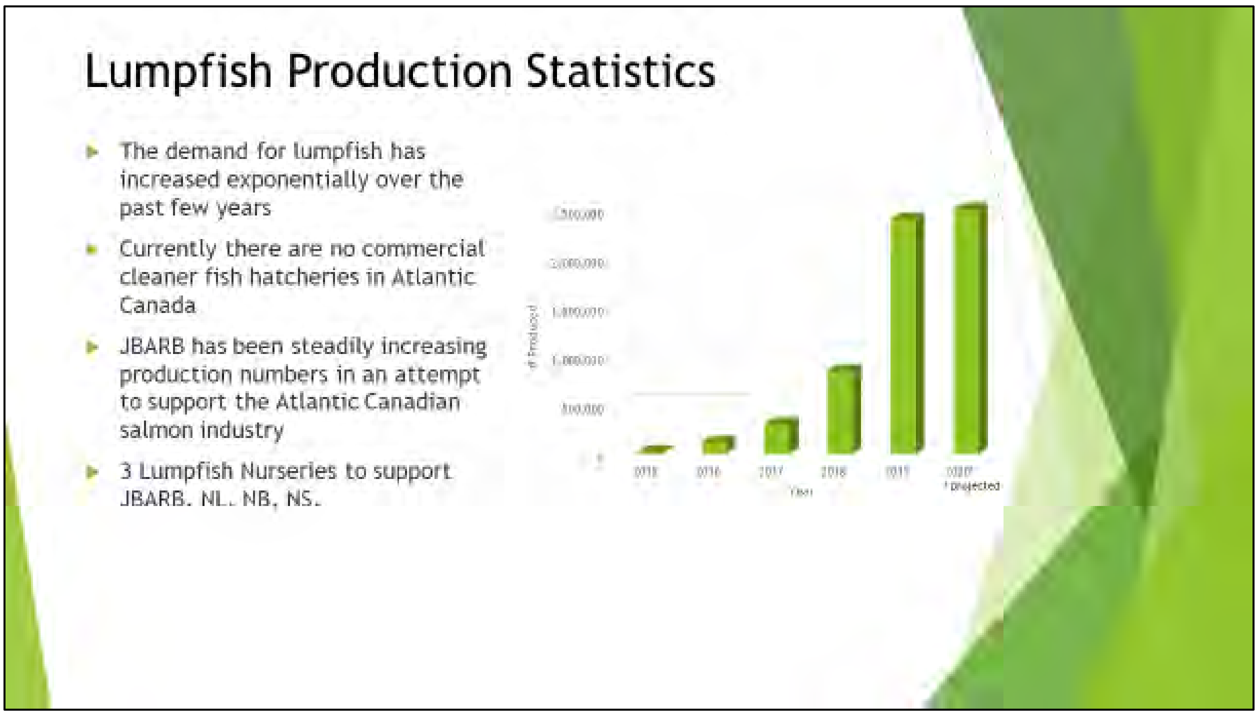
- **Project 4 (April 1, 2019 - March 31, 2022)**

  Cleanerfish – “An Innovative and Green Technology for our Atlantic Salmon Aquaculture Industry.” Major Focus on lumpfish commercial production.

  - Broodstock Development
  - Hatchery Production Technology
  - Juvenile Supply and Grow-Out
  - Fish Health and Vaccine Development
  - Transport Technology
  - Farm-Related Implementation Strategies
  - Training and Support
  - Rural Sustainability for our Industry

In 2018, the Newfoundland Aquaculture Industry Association's Strategy for Targeted Aquaculture Research in Newfoundland and Labrador (NAIA STAR-NL) through industry consultations identified *"Integrated Pest Management Strategies for Sea Lice Control"* as an industry priority for the salmon aquaculture sector (STAR-NL Steering Committee, 2018).

The Dr. Joe Brown Aquatic Research Building (JBARB) at the OSC has been the commercial supplier of juveniles to date. The following is provided by Daniel Boyce with MUN's OSC. It highlights the rationale for MUN's focus on cleanerfish technology.



Cleanerfish have outcomes that are highly useful for the industry and region as follows:

- Cleanerfish use local fish species such as lumpfish and cunners. This approach also serves to mitigate the negative effect that current practices have on "social license to operate," which affects the potential for future expansion
- Cleanerfish are having a major impact with respect to maintaining sustainable communities while producing healthy salmon
- Cleanerfish are helping diminish environmental concerns over the effects of current practices on the surrounding flora and fauna

- Salmon producers in Newfoundland and Labrador are currently using cleanerfish on their salmon farms as a tool towards “Integrated Pest Management Strategies” (IPMS) to combat sea lice
- Cleanerfish are an “Innovative and New Green Technology” for our region
- In most salmon-farming countries (Canada, Norway, Chile, Scotland, and Ireland), prolonged use of chemical therapeutants (e.g., SLICE) to control sea lice (*Lepeophtheirus salmonis)* infestation has led to the emergence of resistance in local lice populations; and environmental concerns grow over the effect of these treatments on the surrounding flora and fauna. The seriousness of the developing chemical resistance issue in Canada has prompted interest in the use of local fish species as cleanerfish
- Adopting tools like cleanerfish will help solidify Atlantic Canada as a world leader in aquaculture innovation and safe farming practices while maintaining the prosperity seen as a direct result of salmon farming operations
- Using cleanerfish will aid rural prosperity and happiness and contribute to healthy lifestyles within these communities due to a robust salmon farming industry
- MUN's OSC team and Cold Ocean Salmon / Cooke Aquaculture (an industry partner) received the 2018 Newfoundland Aquaculture Industry Association 'Excellence in Innovation Award' for their work with cleanerfish
- Commercial production of cleanerfish is an emerging industry that is generating many new jobs. Current value of the project in the region is ~ $20,000,000 for staff, facilities, transport, farm usage, consumables, etc.
- MUN will continue to support the industry with respect to research and development, HQP (Highly Qualified Personnel) training and will remain a dominant player in applying semi-commercial hatchery technology(s) to lumpfish aquaculture and in training staff once the Marbase Cleanerfish hatchery is constructed
- Over the last few years, MUN's OSC has set up a network of cleanerfish experts locally, regionally, nationally, and throughout the UK, Norway, Iceland, USA, Faroe Islands, and Ireland. This network has expanded local capacity and is invaluable to the aquaculture industry

- Lumpfish are not a barrier against sea lice; rather they are a biological control mechanism – a tool that buys the farmers more time between approved chemical treatments. In addition, maintaining cleanerfish on site (10-15% ratio of cleanerfish to salmon) can keep sea lice at a low enough level that no chemical treatment is required
- Sea lice control alone is an expense to farmers valued at CDN$200 per tonne in eastern Canada (lost growth, mortalities, treatments). At current industry production levels of 150,0000 tonnes / year for salmon in all of Canada, this could amount to over $30,000,000 million dollars being spent on sea lice treatments in the coming years. Cleanerfish technology, used as a tool to reduce sea lice, will realize an immediate cost savings.

Other direct benefits include:

- Fewer overall lice treatments: fewer lice and healthier salmon (higher quality, higher quantity, higher market price)
- Fewer handling events on salmon equals less stress and healthier fish (no secondary issues/infections)
- Minimal lost feeding days on the farm equals more product at harvest
- Lower lice levels equal better skin quality and thus more, better skin-on products (whole fish)
- More time for work on site when not in pre / post treatment mode (e.g., net cleaning)
- Frees up assets (staff and boats) to do other work (e.g., net / ring changes and repairs, harvests)
- Helps industry move away from chemical treatments – good for certifications, consumer and public perception and acceptance, regulations, and animal welfare
- Lower costs (e.g., treatment vessels, carbon footprint in shipping chemicals).

4.0 Description of the Undertaking

“Provide complete information concerning the preferred choice of location, design, construction standards, maintenance standards, etc.”

The project involves the construction and operation of a commercial hatchery for lumpfish. The facility will be constructed by renovating an existing building on the Marbase Integrated Aquaculture Service Hub property in Marystown, Newfoundland and Labrador. The hatchery area includes wharf frontage, a dedicated entrance, a large building, and extensive parking / storage space. The footprint of the hatchery will be confined to a 1 ha. section of the property. Appendix II includes drawings and specifications of the existing property as well as design information related to the hatchery and seawater system.

At full production, the proposed hatchery will be capable of producing 3 million lumpfish from egg incubation through to juveniles at a market size of 25 - 40 grams annually. A flow-through saltwater system will include treatment (filtration and purification) before and after use in the hatchery. The saltwater supply will require a pumphouse with intake and discharge pipes. Sales of lumpfish will be made at the facility boundary (dock side or truck loading bay).

Services are currently provided to the Marbase Integrated Aquaculture Service Hub and include road access, electric power, and potable water. An existing site sewage treatment facility and marine outfall will serve the needs of the hatchery facility. The existing site surface water collection and drainage system includes operation of functional sumps and an oil-water separator. A diesel-powered emergency generator will be required on site to ensure uninterrupted electricity service for the hatchery.

The hatchery will be constructed and operated within the context of an Environment, Health and Safety Framework (Appendix IIIa Marbase Environmental Management Framework) that is consistent with sustainable development principles and provides a mechanism for implementation of appropriate environmental mitigation and monitoring measures. The selected location has many features that make it suitable for the intended purpose and that allows for the use of existing, suitably zoned infrastructure.

Design standards will comply with all requirements (municipal, provincial, federal) for construction and operation of the hatchery facility. The basis of design will rely on the operating experience of MUN's OSC as well as the extensive experience available through Marbase's Norwegian partners. Through a comprehensive application process to the Aquaculture Division, Department of Fisheries Forestry and Agriculture, many design, construction, and operation details have been incorporated into the various plans that are part of the application process. Appendix IIIc provides selected material from the Aquaculture Application Plans.

4.1 Geographical Location/Physical Components/Existing Environment

"Provide an accurate description of the proposed site, access road, facilities, infrastructure and equipment, including GPS location coordinates. Attach an original base map (1:25,000 scale) and / or recent air photos".

Marystown is the largest community on the Burin Peninsula with a population of approximately 5,000. The town has significant industrial infrastructure including a new industrial park, an offshore fabrication facility at Cow Head, and the former Marystown Shipyard site. Grieg Seafood Newfoundland Ltd. is currently constructing a land-based Atlantic salmon hatchery in the community and intends to make Marystown the center of its aquaculture operations in Placentia Bay.

Marystown and the other communities on the Burin Peninsula have combined efforts to provide regional services such as community health services, fire protection, and waste management and to undertake regional economic initiatives such as tourism marketing through the Burin Peninsula Chamber of Commerce. While the population of the Burin Peninsula has been decreasing over the past years, there is still ready access in the region to a trained and experienced work force, especially in trades, transportation, and equipment operation (LGL, 2018. Table 4.7.2).

The Marbase Cleanerfish Hatchery site (Figure 4.1) is within the boundaries of the former Marystown Shipyard property within the Town of Marystown. The hatchery is to be located at: Latitude 47.164755°; Longitude 55.149260° and will be housed in an existing building – the Machine Shop / General Stores / Carpenters and Joiners Building (Figure 4.2), referred to now as the "Hatchery Building." The legal survey of the Marbase site is shown in Figure 4. 3.

The south and west boundaries of the site are adjacent to the larger Marbase Integrated Aquaculture Service Hub. The east boundary is Mortier Bay. To the north of the site is the Transport Canada wharf and slipway, a decommissioned tank farm, as well as residential dwellings. There are two road access routes onto the Marbase Integrated Aquaculture Service Hub property – one off Ville Marie Drive and one directly to the Hatchery Building located off Dock Road. Water access is also available from the dock face.

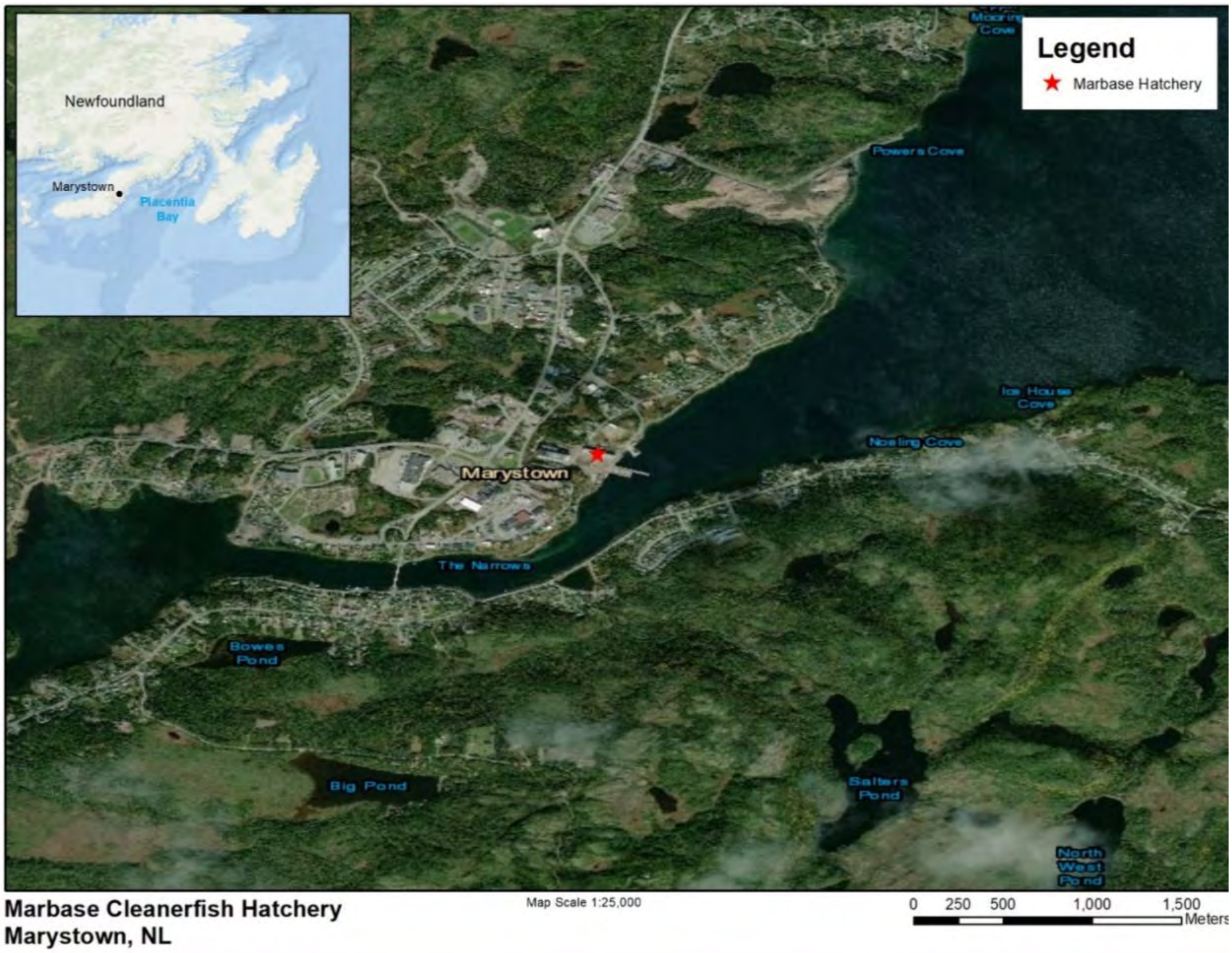


Figure 4.1 Marbase Cleanerfish Hatchery location in Marystown

Figure 4.1: Marbase Cleanerfish Hatchery location in Marbase Integrated Aquaculture Service Hub

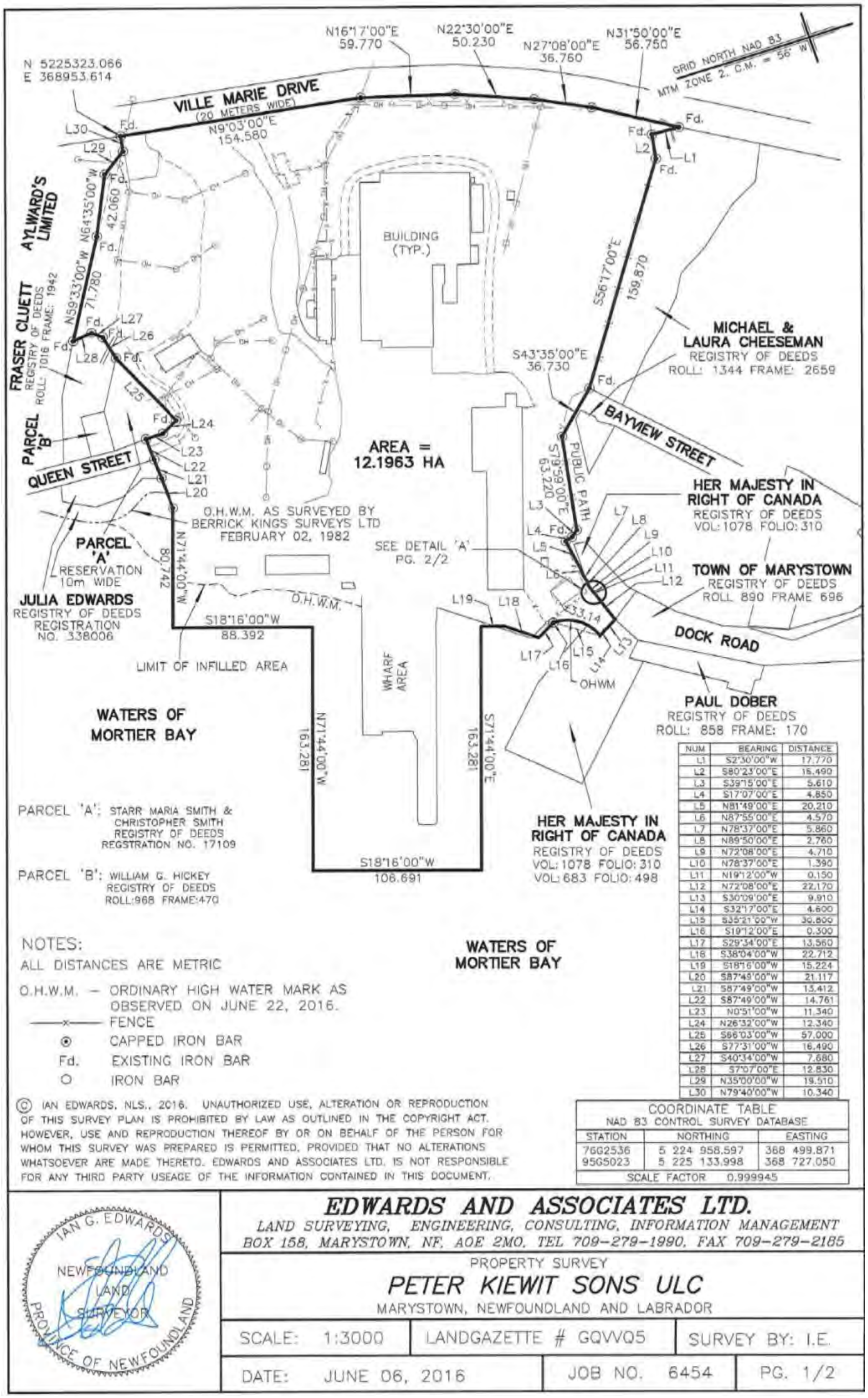


Figure 4.3: Survey of the Marbase Property

4.1.1 Saltwater Intake and Discharge

"This description shall include, but not be limited to: *The routing and depth of the intake lines from the point of intake to the hatcher. The routing and depth of the effluent discharge line from the hatchery to the point of discharge into the marine environment."*

The only facility external to the hatchery property will be piping to supply salt water for the operation (Figure 4.4). This will consist of two intake pipes extending to adequate water depths (15m and 50m) as well as a relatively short discharge pipe. The detailed routing of the piping on the seabed has been addressed through examination of existing multi-beam acoustic surveys. The resulting report (Appendix IIc, Salt Water Supply) shows routing and depth of the intake and discharge lines, the points of intake and discharge, as well as seabed characterization along the route.

The intakes will be capable of supplying marine water to the hatchery complex on a continuous basis and at two temperatures. The discharge line adjacent to the hatchery will return water following treatment and filtration at a water depth of 5m.

The intakes have been located clear of any contaminant sources (sewer and other outfalls including the hatchery outfall). The hatchery discharge will be located near the surface and proximate to the hatchery building, and at a distance of 500m minimum from other intakes. The pipeline routes as well as the intake screening will be in compliance with Fisheries and Oceans Canada's requirements relating to fish habitat and fish protection. A permit will be required under the *Canadian Navigable Waters Act* (https://laws-lois.justice.gc.ca/eng/acts/n-22/). In addition, an Application to Occupy the seabed will be required by the owner of the port, Transport Canada. The water extraction and discharge will require issuance of a Water Use Authorization from Water Resources Branch, provincial Department of Environment, Climate Change and Municipalities.

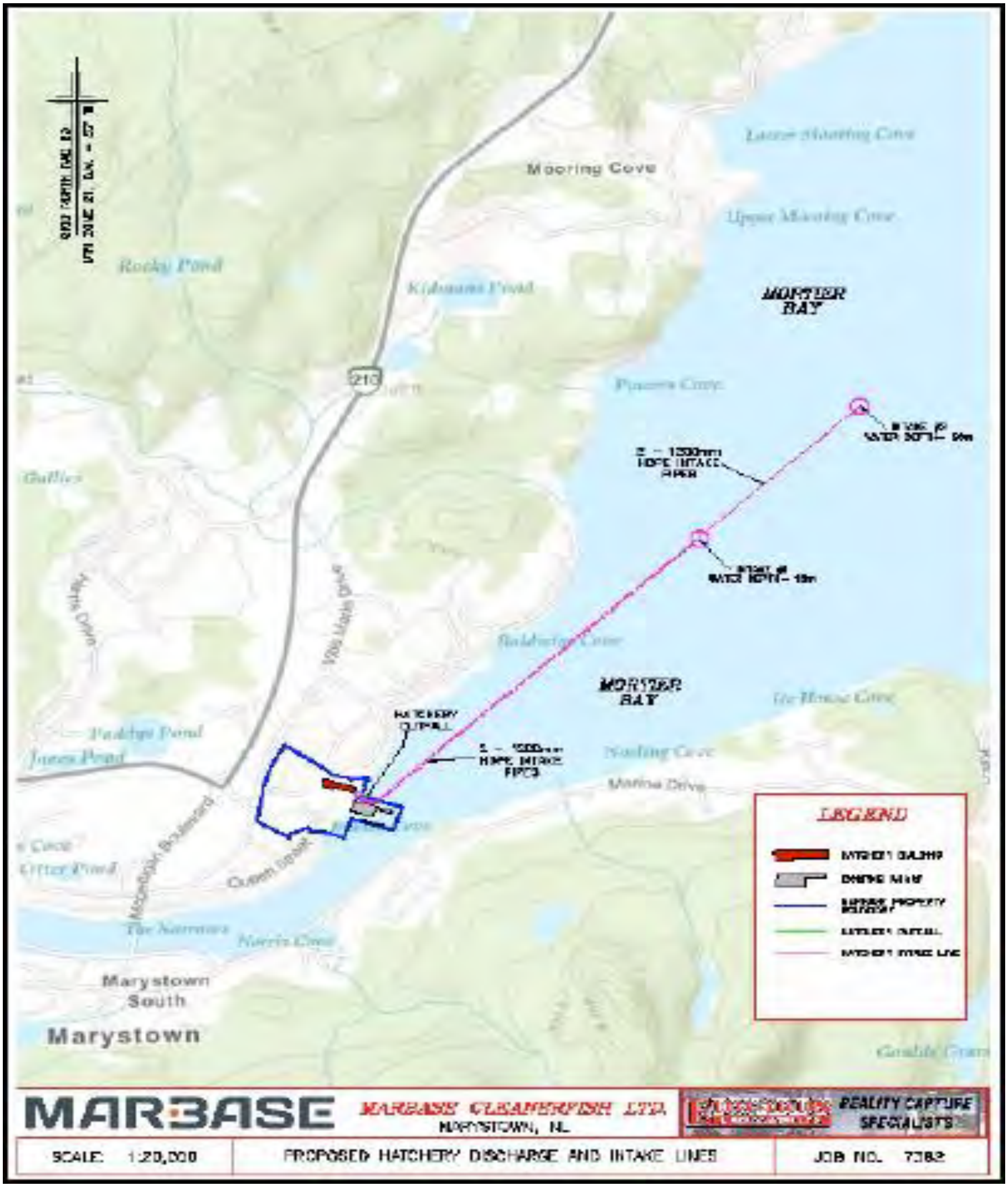


Figure 4.4: Proposed Marbase Hatchery Sea Water Supply

4.1.2 Mortier Bay Biota

"A description of known flora and fauna in Mortier Bay, as described in the literature, including aquatic invasive species and species at risk."

Mortier Bay (Figure 4.5) is connected to and comprises part of Placentia Bay. A generic ecological characterization of Placentia Bay was developed by Fisheries and Oceans Canada (DFO, 2008) as part of an integrated management planning process for Placentia Bay. The poster-like document describes Placentia Bay as having a 145 km-wide mouth and characterized by water depths to a maximum of 240m. Many islands occur along with shoals, reefs, and banks. Marine finfish species listed as present in Placentia Bay include groundfish (cunner, radiated shanny, flounder, Arctic shanny, Arctic eelpout, lumpfish, ocean pout, wrymouth, sculpin, winter flounder, skate, tomcod, Atlantic cod) and pelagics (sand lance, smelt, American eel, brown trout, Atlantic salmon, herring, capelin, mackerel, stickleback). Shellfish noted as present include sea snail, lobster, mussel, scallop, and snow crab. Commercial landings include Atlantic cod, American lobster, snow crab, sea and Icelandic scallops. It is likely that most of these species occur in Mortier Bay where habitat is suitable.

Figure 4.5: Mortier Bay and the proposed Marbase Hatchery site

A more current review of the ecology of Placentia Bay is provided by LGL (2018) who confirm the characterization provided by DFO (2008) and point out that the general absence of sea ice along with bathymetric features appears in part to account for the relatively high productivity of marine life.

Located approximately two thirds of the way down the Burin Peninsula, Mortier Bay is part of the “Burin Peninsula” shoreline classification (Catto et al., 1997). Mortier Bay itself is a large (18 km^2) embayment with a maximum water depth of 100m and a 60m deep sill at the narrow (850m wide) entrance. The watershed drainage for Mortier Bay is relatively modest (in the order of $200km^2$) so that freshwater inflow would be a small proportion of the total volume of water present in Mortier Bay. These features likely act to limit the extent of estuarine mixing and circulation. Portions of the enclosed bay that are below the 60m sill level are likely depositional and probably predominantly comprising mud / fine sediment material. The seabed over much of the embayment is mainly mud to gravel bottom (CHS, 2008). In the vicinity of the Marbase Integrated Aquaculture Service Hub, the bottom is characterized as predominantly fine grain material.

The marine environment of Mortier Bay adjacent to the Marbase facility has been the subject of sampling and dive video surveys (JWEL, 1999). The nearshore habitat and marine species present were described from the video footage along two transects. The sea floor consisted mainly of finer-sized material and gravel with occasional cobble-sized rocks. Invertebrates were identified, including sea urchins {*Strongylocentrus droebachiensis*) and northern sea star (*Asteria vulgaris* – found actively feeding on bivalves). Other species of sea star were also observed but were not identified. Bivalves were represented by the blue mussel (*Mytilus edulis)* and giant scallop (*Placopecten magellanicus*). Many blue mussels were dead, perhaps as a result of the sea star abundance in the vicinity. Rock crab (*Cancer irroratus*) was the only crustacean species observed. Macroalgae were generally scarce with some scattered green {*Enteromorpha sp*.) and occasional brown (*Fucus sp*. and *Laminaria sp*.) seaweeds attached to larger rocks and debris. Some rocks and other hard surfaces were covered with corraline algae (*corallina sp*.). Dock pilings were encrusted with a variety of organisms including green and brown seaweeds, blue mussels, sea stars, and anemones. Sea cucumber (*Cucumaria frondosa*) and brittle stars (*Ophiopholis aculeata)* were observed in scattered areas. Fish species seen during the dive survey included cunner (*Tautogolabrus adspersus*) and winter flounder (*Pseudopleuronectes americanus*).

The marine waters adjacent to the hatchery site and within the area where the saltwater supply is to be located are subject to intermittent fishing activity, which is limited to recreational scallop and cod fishing (CCRI, 2010).

In addition to conducting a literature survey, a series of consultations were held by Marbase to provide more detailed information on known flora and fauna in Mortier Bay, including fish harvesting activities, aquatic invasive species, and species at risk. Fisheries and Oceans Canada reports that Mortier Bay is fished both commercially and recreationally (J. Riggs-Power, DFO, personal communication, 2019) including the presence of recreational scallop dragging, recreational cod fishing, and bait fishing. The presence of a lobster fishery was noted, however, with lobster pots generally set near the mouth of Mortier Bay.

Mr. Francis Farrell (Little Bay Harbour Authority, personal communication, Oct 2019) reported that Little Bay Harbour Small Boat Basin facility holds about 20+ recreational boats but also includes commercial fishing boats. Vessel traffic in the area includes recreational and commercial fishers. Larger vessels entering Mortier Bay require a pilot. Within Mortier Bay, fishing effort is limited to recreational scallop dragging.

Aquatic Invasive Species

There are currently 7 known invasive species of concern in Placentia Bay including green crab, vase tunicate (*Ciona intestinalis*), two other tunicate species (golden star and violet star), a shrimp species (Japanese skeleton shrimp – an amphipod), the coffin box bryozoan, and codium oyster thief (L. Lush, personal communication, 2020). The 2 invasive species of concern with respect to the Marbase Cleanerfish Hatchery operation are green crab and the vase tunicate.

Green crab are widely pervasive in Placentia Bay in part due to their high tolerance of a range of environmental conditions including temperature, salinity, and desiccation. They can survive in fresh water as well as out of water for some time. There would be limited concern related to the saltwater intake and outfall in Mortier Bay; however, the main issue would have to do with solid waste produced at the hatchery and its safe disposal, particularly if this product was to move outside of Placentia Bay.

The vase tunicate is an important concern especially for the aquaculture industry as it acts to bio-foul sea cages, clogging the mesh and weighing down the gear. Unlike green crab, vase tunicate is not distributed throughout Placentia Bay, therefore, containing its spread is very important. Vase tunicate is listed as a member of the subtidal area or deep water up to 500m. Several studies include observations suggesting that outside of its native range, the distribution of *C. intestinalis* is constrained to artificial substrates possibly by competition and / or predation pressure (L. Lush, personal communication, 2020).

Best management practices have been developed to address some invasive species and activities that act as vectors. It is difficult to kill green crab. Effective methods include freezing for 7 days and use of a fine wood-chipper. Solid waste management will be an important concern. Measures to be considered to destroy invasive species within the waste stream include UV filtration and screening. Limitations may be required on distribution beyond Placentia Bay for waste products (as per Aquatic Invasive Species - AIS regulations).

Species at Risk

LGL (2018) provides a listing of species at risk with potential for interaction with activities centered in Placentia Bay and Marystown. “Species at Risk” refers to species/populations designated under the Canadian *Species at Risk Act* (https://laws.justice.gc.ca/eng/acts/S-15.3/) identified by The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) or the Newfoundland and Labrador *Endangered Species Act* (https://www.assembly.nl.ca/legislation/sr/statutes/e10-1.htm). Species at risk are assigned different levels of concern (endangered, threatened, special concern / vulnerable, candidate). The Marbase Cleanerfish Hatchery will be located in an existing industrial site and hence would likely interact only through the saltwater exchange system. Consequently, the listing below (LGL 2018) includes only marine / aquatic species.

Species at Risk		
Marine Fish	**Marine Mammals**	**Other marine species**
White shark	Blue whale	Leatherback sea turtle
Northern wolfish	North Atlantic right whale	Loggerhead sea Turtle
Spotted wolfish	Fin whale	
Atlantic wolfish	Sowerbys beaked whale	Eskimo curlew
Atlantic cod	Harbour porpoise	Ivory gull
Porbeagle shark	Humpback whale	Piping plover
Atlantic bluefin tuna	Killer whale	Red knot
Cusk	Cuviers beaked whale	Barrows goldeneye
Acadian redfish	Sperm whale	Harlequin duck
American plaice	Hooded seal	Red-necked phalarope
Deepwater redfish	Harp seal	Lesser yellowlegs
Lumpfish		Kildeer
White hake		Short billed dowitcher
Basking shark		American golden plover
Roughead grenadier		
Smooth skate		
Spiny dogfish		
Thorny skate		
Pollock		
Atlantic mackerel		
Greenland shark		
Atlantic salmon		
American eel		

A complete listing of endangered species is provided in Schedule 1, Part 2 of the *Species at Risk Act (SARA)* (https://laws-lois.justice.gc.ca/eng/acts/s-15.3/page-17.html#h-435647Species At Risk (SAR))

For some species (e.g., lumpfish, Atlantic cod, Atlantic salmon), commercial and recreational fisheries continue, often with special measures in place (Jason Kelly, pers. com. 2019). The current DFO policy allows for issuance of an experimental licence to allow fish collection including species at risk.

An assessment of lumpfish population status was completed in 2016 (https://waves-vagues.dfo-mpo.gc.ca/library/365981.pdf). In 2017, the COSEWIC produced a paper on the status of Lumpfish (https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/cosewic-assessments-status-reports/lumpfish-2017.html). A decision on status is pending.

4.1.3 Land Ownership and Zoning

"Provide information regarding ownership and / or zoning of the land upon which the project is to be located and any restrictions imposed by that ownership or zoning, including municipal ownership / zoning, Crown, and private land."

The Marbase Integrated Aquaculture Service Hub property is owned by Marbase Marystown Inc. The area is zoned by the Town of Marystown as Industrial; however, there has been little site activity in over fifteen years other than remediation and abatement being carried out for the Government of Newfoundland and Labrador in fulfilment of its environmental liability obligations. None of the project property is Crown land. Adjacent properties include private and Crown land as shown in the property survey (Figure 4.3).

For most of its existence, the site has been referred to as the Marystown Shipyard. It was built by the federal and provincial governments in 1966 and operated initially by Canadian Vickers under the name Newfoundland Marine Works Ltd. In 1979 the name was changed to Marystown Shipyard Ltd. (*https://en.wikipedia.org/wiki/Marystown#Shipyard*). The site is in the Town of Marystown on the shores of Mortier Bay on the Burin Peninsula (Figure 3). The property comprises approximately 9,400m^2 of fabrication area and has a water frontage of 330m (JWA, 2002) During the period 1969 to 1998, fifty vessels were constructed at the shipyard (*http://shipbuildinghistory.com/canadayards/marystown.htm*).

The site originally consisted of a small cove with steep sides (20m cliffs) and a tidal pool that received the outflow from a small stream. The location provided a relatively flat piece of land near sea level. It appears to have been used before 1949 as evidenced by the presence of a building and road. During the 1950s the site was used as a wooden boat building facility complete with a sawmill. In the mid-1960s, dredging and infilling occurred along with construction of the main shed. By 1976 additional site buildings had been constructed, including General Stores, a service building, and office building. From the late 1970s until 1991, the facility constructed, repaired, and serviced a series of vessels with as many as 10 (in 1980) present on the site at the same time.

The shipyard facility includes a combination syncrolift and side-transfer system that provides access to the sea with sufficient water depth and channel width to accommodate vessel sizes up to 19.5m beam and 80m in length. (http://www.noia.ca/Industry-Info/Regional-Infrastructure/Construction-Fabrication-Repair/).

In late 1997 the Government of Newfoundland and Labrador transferred ownership of the Marystown Shipyard to Friede Goldman Marystown Ltd. (FGM – name later changed to Friede Goldman Newfoundland Ltd. – FGNL). As part of the transfer arrangement, the Newfoundland and Labrador Government provided FGM with an environmental indemnity to address historical environmental issues and / or contamination that existed on the site prior to the sale. In 2002 ownership of the Marystown Shipyard again changed with the purchase from FGNL by Peter Kiewit Sons Co. Ltd. (later changed to Peter Kiewit Infrastructure Co. – Kiewit). The purchase conditions included the assignment in March 27, 2002 of the 1997 environmental indemnity to the new owner.

Since 2002, limited industrial activity has occurred at the site. During the White Rose project (2002-05), the syncrolift was used for loadout of steel structures from the Shipyard and for ship repair until 2004. Since 2004, the site has seen infrequent use except for some lifeboat inspections and the occasional welding project.

In September 2019 the site was sold to Marbase Marystown Inc. for the development of the Marbase Integrated Aquaculture Service Hub. The Government of Newfoundland and Labrador retained environmental liability for the site and has recently completed a program to address residual environmental concerns associated with contaminated soil and building materials (lead paint and asbestos-containing materials).

An application to the Town of Marystown will be required as part of the permitting process for the refurbishment of the site in order to convert part of the property into a hatchery operation. Based on the zoning of the property and discussions with Town of Marystown officials, a development permit can be expected to be issued in a timely manner.

4.2 Construction

"State the time period in which proposed construction will proceed (if staged, list each stage and its approximate duration) and proposed date of first physical construction-related activity. The details, materials, methods, schedule, and location of all planned construction activities shall be presented.

The EPR shall include a description of:

a) construction, modification or maintenance of any wharves, boathouses, slipways or breakwaters, with diagrams, imagery or illustrations
b) repairs to the surface water collection system.
c) any infilling or dredging associated with any wharves, boathouses, slipways or breakwaters
d) any infilling within 15m of a body of water"

Given the presence of an existing serviced site with ready access, construction will be completed in 6 months. The commencement date for the work is uncertain given the realities of Covid-19 precautions, the uncertainties associated with timing to receive a decision on the EPR, as well as other various permits and approvals. The commencement of work will need to be timed to enable a smooth transition of operations between Marbase and MUN's OSC.

For purposes of the EPR, Marbase has assumed a start date of December 1, 2020. The construction activities are described and summarized below.

4.2.1 Site Preparation

The existing site will require repairs to the asphalt surface and dock face as well as installation of an access gate and perimeter security fencing. An examination of the area indicates that much of the paved surface is in serviceable condition. There are, however, limited areas where the asphalt surface is either heaved or showing signs of subsidence. In these locations the existing paved surface will be removed and the subgrade assessed. As required, unsuitable material will be removed and replaced with a suitable grade of fill. Then the surface will be re-paved where required and the asphalt painted to designate traffic lanes and parking spaces.

The steel sheet pile dock face forming the east boundary of the hatchery property shows signs of wear. The timber crib cladding has sections damaged or missing, and sections of the sheet pile wall are corroded. A detailed structural / geotechnical examination will be completed to confirm the condition of the dock face and to define areas where repairs or replacement will be required. The use of timbers will not include any creosote. Waste material will be disposed only at approved sites.

A portion of the work on the paved surface as well as all work associated with the dock face will take place within 15m of a body of water and thus will be subject to permit application and approval processes from the Department of Environment, Climate Change and Municipalities (Water Resources Management Division, 2018). As required, mitigation measures (e.g., debris containment boom) will be implemented to achieve environmental protection, especially for the marine environment.

Of note, there are no boathouses, slipways or breakwaters associated with the Marbase Hatchery property. There is no requirement for either additional infilling or dredging of the property that comprises the footprint of the hatchery site. The existing site does not contain any vegetation growth that would represent riparian habitat and require protection. In order to ensure maintenance of water quality, protection of fish / habitat, and protection against erosion, the guidance contained in Water Resources Management Division (2018) will be followed.

Other site preparation activities will include the construction of fencing with access gates and signage to achieve the required level of security and protection.

4.2.2 Building Refurbishment

Building refurbishment activities will include insulation of walls and roofing, a new HVAC system, upgrading of floor drainage and sump, an office, minor laboratory facilities, a food pellet storage and handling area, and a hazardous materials storage area.

An engineering assessment has found that the building is structurally sound:

> "*Overall the shops' building appears to be in good structural condition. There were no noticeable structural defects noted. The building is showing signs of its age, similar to the main shed, and building envelope repairs and minor interior upgrades would be recommended*" (Dillon Consulting, 2018).

A detailed examination will be carried out to determine the load-bearing capacity of the building (ground and second floor) and confirm its ability to support the anticipated loads from the hatchery operation, especially with respect to water tanks.

The existing floor drainage and oily water separation sump has been examined in the past and found to be functional. A detailed assessment and evaluation will be carried out to establish compliance with current permitting requirements, and any necessary modifications / improvements made as part of the facility refurbishment.

4.2.3 Hatchery Installation

The tank arrays, saltwater circulation piping, and water treatment equipment make up the core of the hatchery. A total of approximately 320 fiberglass tanks will be required ranging in size from $0.55m^3$ to $40m^3$ capacity to accommodate the different sizes of growing fish. Each tank will be supplied with saltwater flow adequate to achieve a turnover rate of 1 per hour.

Water treatment systems to be installed include thermal control (incoming water), UV disinfection, and rotary drum screens for filtration. Other installations will include aeration / oxygenation and oxygen monitoring sensors. Examples of this equipment are illustrated in Appendix IIb.

4.2.4 Saltwater Supply

External to the hatchery building, a concrete foundation is required for the saltwater pumphouse and storage tank. The detailed routing of the intake piping on the seabed has been confirmed through examination of existing multi-beam acoustic surveys (Figure 4.4; Appendix IIc). Pipe sections and ballast will be stockpiled at the Marbase Integrated Aquaculture Service Hub dock. A marine contractor will employ a laydown barge to place the pipe and intake along the seabed.

The discharge pipe will extend below the low water mark to a depth of 5m while the intake pipes will extend to water depths of approximately 15m and 50m. The pipeline sizing will be confirmed as hatchery design advances. The intakes will have screening to avoid impingement and entrainment of marine organisms. The installed pipes will be ballasted on the seabed. The intakes will be capable of supplying marine water to the hatchery complex on a continuous basis and at two temperatures. The discharge line adjacent to the hatchery will return water following treatment and filtration.

The intakes will be located clear of any contaminant sources (sewer and other outfalls, including the hatchery outfall). The hatchery discharge will be located near surface (5m) and proximate to the hatchery building at a distance of 500m minimum from other intakes. The pipeline routes as well as the intake screening will need to address Fisheries and Oceans Canada's requirements related to fish habitat and fish protection. The water extraction and discharge will require the issuance of a Water Use Authorization from Water Resources Branch, provincial Department of Environment, Climate Change and Municipalities. Since the waters of Mortier Bay are within the jurisdiction of Transport Canada, federal approval (License to Occupy) will be required for the installation and operation of the water supply pipelines, intakes, and discharge. In addition, approval in accordance with the *Canadian Navigable Waters Act* will be required.

4.2.5 Environmental Protection During Construction

Marbase Cleanerfish is committed to minimizing its environmental footprint throughout the construction period. Potential negative environmental effects from site development and construction have been anticipated, and best practice technology and methods will be used to reduce and avoid effects of construction on the environment.

There are a limited number of potential sources of pollutants during construction. The identified concerns include:

- Airborne – exhaust emissions / noise from mobile and stationary equipment
- Fuel storage and handling
- Washdown and other surface water containing sediments and suspended material
- Stormwater runoff containing sediments and such pollutants as precipitate from vehicle exhaust, oil and lubricants
- Solid waste packaging, excess and scrap building material, and excavated material (removal of unsuitable material and excavation for foundations).

Waste management will be practiced from the start of construction and throughout operation of the hatchery. Waste will be separated into non-hazardous and hazardous materials. All waste produced will be documented, stored appropriately, and either salvaged, recycled, or disposed of appropriately. Appendix IIIb contains an outline of the Marbase Environmental Protection Plan (EPP), and Appendix IIIc contains the draft Waste Management Plan for the project as part of the Aquaculture Application Plans.

4.3 Operation and Maintenance

"All aspects of the operation and maintenance of the proposed development shall be presented in detail, including illustrations where applicable."

The Marbase Cleanerfish Hatchery will operate year-round as a permanent facility. Staff will be present on a twenty-four hour, seven-day-a-week schedule; however, most activities will occur during the daylight shift. The stages from fertilized egg incubation to achieving marketable size lumpfish take 6-9 months. Allowing for maintenance and cleanup activities, the facility will operate on a one-year cycle. Peaks of activity will occur when egg fertilization and incubation occur each spring and when lumpfish are sold.

During start-up of operations, Marbase Cleanerfish will rely on MUN's OSC and commercial fishers for the collection of fertile females to provide an adequate supply of eggs as well as a much smaller number of males for milt. In the first year of production, Marbase Cleanerfish will purchase fertilized eggs and / or juveniles from the OSC and raise these lumpfish to marketable size for sale in the second year of production.

In the second year of production, the hatchery will secure fertilized eggs to start the full reproductive cycle. In this manner, the hatchery will be capable of producing 3.0 million lumpfish from egg incubation annually by the third year of production. It is noted that during the early stages of operation, some fish may be marketed at the 1.0-gram size.

During normal operations, sea water will be continuously pumped into a holding tank and from there to the water treatment area. Drum filters will screen particulates and then the water will be disinfected using Ultraviolet (UV) treatment. Oxygen and gas control will be applied to remove nitrogen and ensure adequate aeration of the water before its introduction to the fish-rearing tanks. Prior to discharge, the sea water will once again pass through drum filters and UV treatment. These processes will act to remove waste material (feces, uneaten food) and destroy pathogens that might be present. Sludge removed by the drum filters will be dewatered, handled, and recycled or disposed of in an appropriate manner.

Feed in the form of pellets sized to stages of fish growth will be distributed daily. Water flow and water quality (temperature and oxygen content) will be monitored automatically but subject to frequent visual inspection. Daily checks will remove any mortalities (morts) and direct them to an acid bath (ensilage) prior to appropriate disposal.

Facility operations will be subject to a number of regulatory requirements. The Aquaculture Branch, Department of Fisheries, Forestry and Agriculture (DFFA, formerly Department of Fisheries and Land Resources - DFLR) is the project's key regulator and monitor. As part of the Hatchery Aquaculture License Application process, the agency requires a series of plans (*https://www.fishaq.gov.nl.ca/licensing/pdf/Aquaculture_Policy_Procedures_Manual.pdf*) including: a Waste Management Plan, a Fish Health Management Plan, and a Biosecurity Plan. The Aquaculture Branch develops and implements revisions to its guidelines on occasion and in response to operating experience. Current versions of Marbase's management plans, to be included in the draft Marbase Hatchery Aquaculture License Application, are included as Appendix III. These documents will be revised and updated as required in response to regulatory directives and to reflect Marbase's operating experience.

4.3.1 Hatchery Operations Flow Through

"A flow through description of hatchery operations from receipt of broodstock / fish from source, through growth stages, to removal of fish for sale".

The hatchery will have two incoming seawater lines (Figure 4.6) that will extend to water depths of 15m and 50m. The intakes will have screening to avoid impingement and entrainment of marine organisms. The intake pipes will be capable of supplying marine water to the hatchery on a continuing basis and at two temperatures. Incoming sea water from Mortier Bay (shallow and deep lines) will enter an outdoor seawater station at up to 4000 m^3/hr. Water will then be directed inside the hatchery for filtration and treatment.

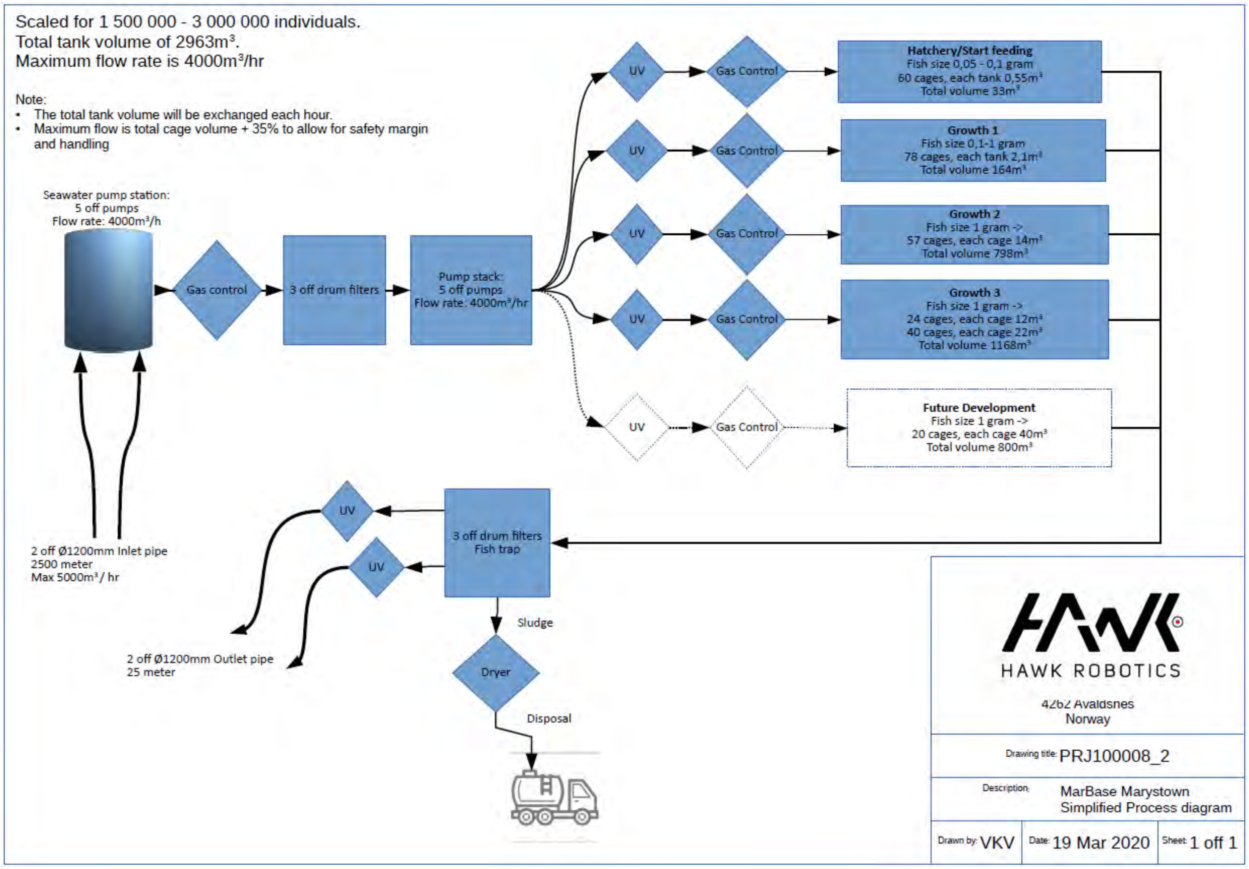


Figure 4.6: Seawater Flow-Through Diagram

The hatchery will house an estimated 319 rearing tanks (Table 4.1) of various sizes reflecting the growth of lumpfish. The tanks will be grouped by size and located on 2 floors of the facility. Generally, the larger (Growth 3) tanks will be on the ground floor.

Table 4.1: Marbase Hatchery Tank Numbers and Volume

Area	Number of Tanks	Tank Volume m^3	Total Volume m^3
Incubators	60	0.10	6
Start Feeding (0.05 - 0.1g)	60	0.55	33
Growth 1 (0.1 - 1.0g)	78	2.1	163.8
Growth 2 (1.0 - 8.0g)	57	14.0	798
Growth 3 (8.0 - 40.0g)	24	12.0	288
Growth 3 (8.0 - 40.0g)	40	22.0	880
Total	319		2168.8

The following text and graphics provide a flow-through description of hatchery operations from receipt of broodstock / fish, through growth stages, and up to removal of fish for sale. This cycle takes approximately 8 months from stripping of eggs until fish reach a size suitable for sale (Figure 4.7).

Figure 4.7: Lumpfish Rearing Cycle from Broodstock to Sale

Table 4.2 illustrates the growth pattern for lumpfish from eggs in incubators up to a size suitable for sale. The importance of water temperature in determining growth rate is illustrated by the indication of “degree-days” in Column 1 of the table. A degree-day multiplies average daily temperature by time in days – 10 degree-days can be reached in 1 day at 10^{0}C, 5 days at 2^{0}C, and 10 days at 1^{0}C.

Table 4.2: Lumpfish Life Cycle and Temperature Effect				
Age C/°days	**Fish size g**	**System**	**Feed**	**Comments**
0-290	Eggs	Incubators	N/A	Upwelling incubators
0-10 post hatch	Yolk sac larvae	Start feeding	N/A	Tanks with hides
10-350	0.005-0.1	Start feeding	Gemma micro 150/300	Tanks with hides
350-600	0.1-0.3	Growth 1	Clean Start 300	1st grade on 4mm (box grader)
600-1050	0.3-1.0	Growth 1	Clean Start 500	2nd grade on 6mm (box grader) 1st dip vaccination
1050-1300	1-3	Growth 2	Clean Assist 0.8-1.0	Grade at 12mm (box or Melbu Verft). 2nd dip vaccination. No furniture
1300-1560	3-8	Growth 2	Clean Assist 1.2	Grade on 16mm (Melbu Verft). IP vaccination
1560-1760	8-16	Growth 3	Clean Assist 1.5	Grade on 20mm (Melbu Verft).
1760-2000	16-40	Growth 3	Clean Assist 1.8	Prepare for transportation: • Starve 48 hours • Fill tanks with UV filtered water at <10°C • Add fish at 45-50kg/m^3 • Transport

Egg Sources and Quantities

"…the sources and quantities of fertile lumpfish females and eggs to be acquired."

Marbase plans to develop its own source of domesticated broodstock on site within the first 3 years of operation. In the short term (1-2 years), eggs and / or juveniles will be secured from the lumpfish program at MUN's OSC. On average a 1kg egg mass comprises 70,000 eggs. With allowance for mortalities during incubation and growth, a supply of 40kg of good quality fertilized eggs is capable of producing 2 million lumpfish to a saleable size.

Each 20kg batch of fertilized eggs will require 100 females and 5 males (domesticated broodstock) or 75 females and 5 males (wild fish). During the initial operating years, juveniles (1 gram) may also be secured and purchased from the lumpfish program at MUN's OSC. These juveniles would then be reared to saleable 20-25g size.

Fertilization

"……. the hatchery process of egg fertilization, the required quantity of male lumpfish, and information on whether wild male lumpfish will require harvesting / collection and / or holding"

MUN's OSC has developed and refined the process of controlled lumpfish spawning and egg fertilization. The graphics depicted in Figure 4.8 a,b,c,d illustrate the fertilization process, starting with stripping of eggs and milt from ripe adults, fertilization of the eggs, the incubation process, and the ultimate hatching of larvae.

Figure 4.8a:. Lumpfish Fertilization - Broodstock Stripping

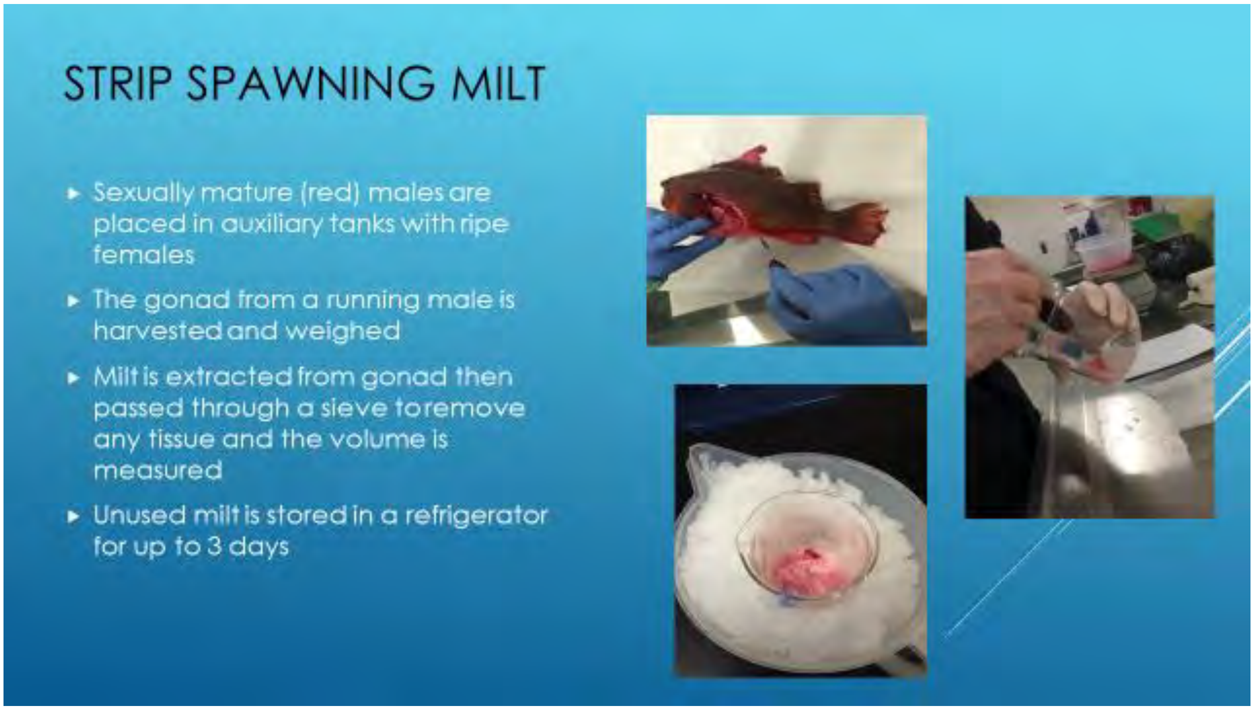


Figure 4.8b: Lumpfish Fertilization – Milt Stripping

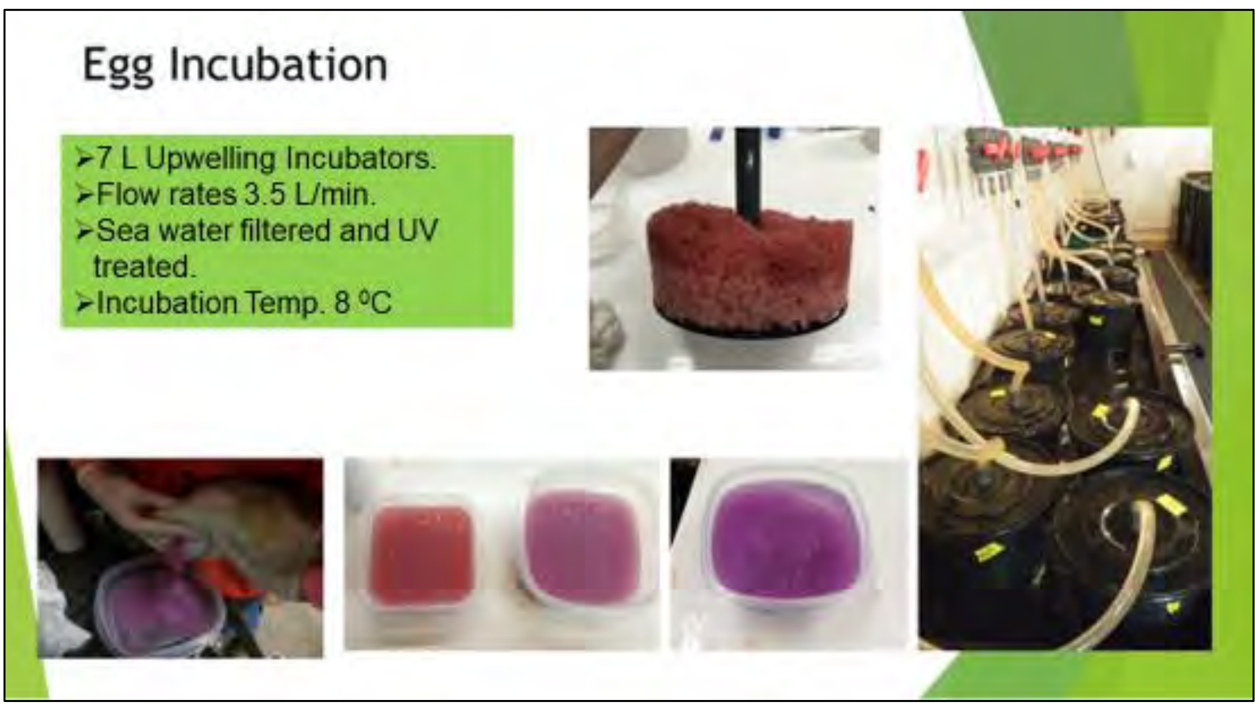


Figure 4.8c: Lumpfish Fertilization – Egg Incubation

Figure 4.8d: Lumpfish Fertilization – Egg Development

Wild male lumpfish (~20 fish per year) may require ongoing collection and harvesting to address the objective of introducing new genetic lines / pool to the juvenile program and to supplement the male domesticated lumpfish program.

Development of a Domesticated Broodstock

"……methods for developing the domesticated broodstock that will form the hatchery's egg supply".

MUN's OSC has an established lumpfish broodstock program (Figure 4.9). Over the next 5 years, Marbase will partner with MUN to further develop this broodstock program using both facilities. Note that during this timeframe, the use of two locations will give added biosecurity to the program. Once completed, the cooperative program will result in Marbase achieving broodstock self-sufficiency.

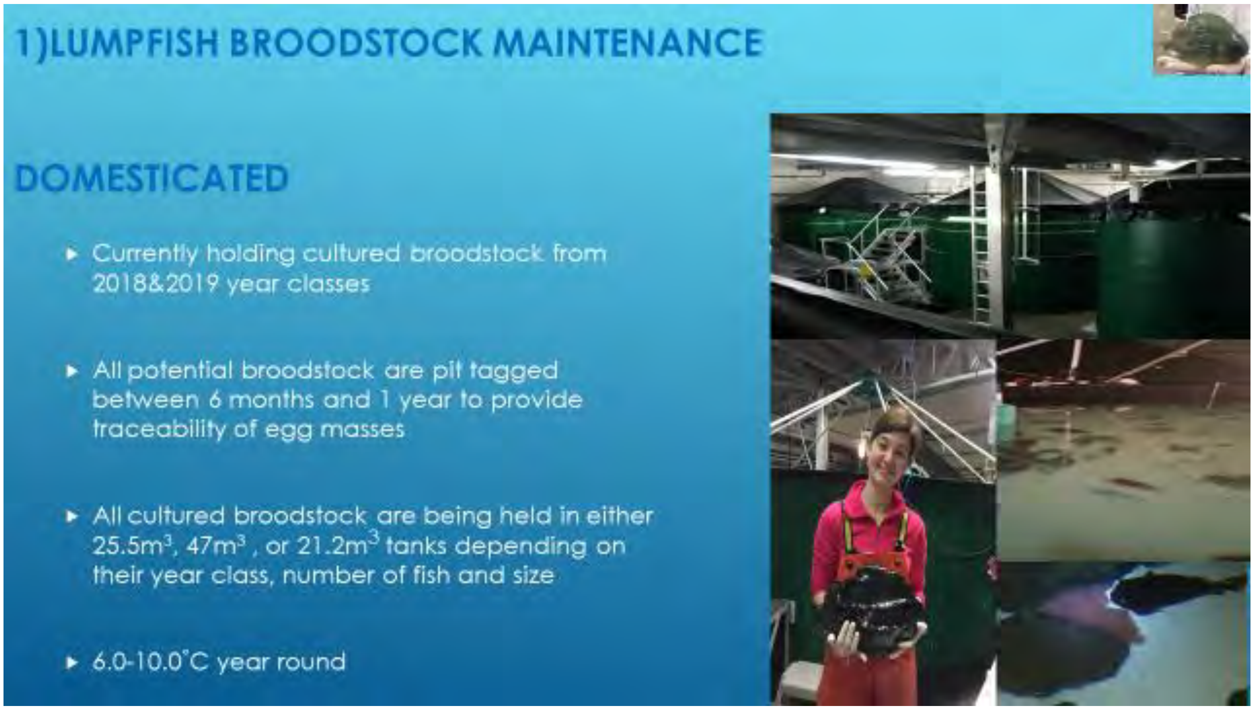


Figure 4.9: Memorial University Ocean Sciences Broodstock Program

4.3.2 Water Quantity

"Provide the quantity of water required for operations on a per annum basis".

In order to calculate the total annual seawater demand, a monthly projection was made of the number and size of incubating fish present based on an annual production of 3 million lumpfish. The optimal requirement is to achieve one-hour replacement of tank water where fish are present. It was also assumed there will be some water circulation even during periods when no fish are present. Allowing for a margin of safety, monthly demand was projected as shown in Table 4.3.

Table 4.3: Calculation of Total Annual Seawater Demand

Month	J	F	M	A	M	J	J	A	S	O	N	D
Demand m^3/hr.	1086	1966	1966	1966	880	6	6	33	33	164	798	1086

Based on these calculations, the quantity of sea water required for the Marbase Cleanerfish Hatchery operations on a per annum basis is 7×10^6 m^3.

4.3.3 Source Water Quality

"Describe the water quality at intake sites, accounting for any potential seasonal variation in tested parameters."

A field program was conducted on November 3, 2019, to collect information on the proposed intake and discharge sites for the hatchery seawater supply. Appendix VI contains the report on the field data collection and laboratory analyses. A summary of key results is presented below. Water quality parameters measured were in accordance with the Newfoundland and Labrador *Water Resources Act* (https://www.assembly.nl.ca/legislation/sr/regulations/rc030065.htm), Environmental Control Water and Sewage Regulations 2003. Table 4.4 below summarizes the analysis. For clarity, results are reported in the units listed in Schedule A of the regulations (e.g., converted to mg/l even where the analysis was reported as µg/l).

Table 4.4: Water Quality Results Mortier Bay November 2019

Parameter*	Site 1 Deep Water		Site 2 Shallow Water		Site 3 Outfall		Schedule A Regulations*
	0m	25m	45m	0m	10m	5m	
Ammonia (as N)	0.08	<0.02	0.1	0.18	0.23	0.02	20
BOD	<6	<6	<6	<6	<6	20	21
Chlorine (total)	<0.03	<0.03	0.03	0.03	0.03	<0.03	1
pH	7.73	7.69	7.72	7.78	7.73	7.78	
TDS	32461	33062	33152	32433	32917	32481	1000**
TSS	17	21	10	8	22	3	30**
Nitrate (asN)	<2.37	<2.37	<2.37	<2.37	<2.37	<2.37	10
0-phosphate	<25	<25	<25	<25	<25	<25	1
Total cyanide	0.007	0.009	0.007	0.008	0.008	0.009	0.025
Sulfide	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	0.5
Hex. Chromium	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	0.05***
Triv. Chromium	<3	<3	<3	<3	<3	<3	1***
Total O&G	<2	5	<2	3	3	4	15
Phenolics	0.14	0.14	0.13	0.11	0.17	0.14	0.1
Boron	20.2	19.5	15.6	16.3	17.0	17.2	5
Iron	0.043	0.042	0.052	0.043	0.041	0.037	10***
Nickel	0.0009	0.0008	0.010	0.006	0.0056	0.0003	0.5***
Copper	0.002	0.001	0.002	0.001	0.001	0.0015	0.3***
Zinc	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.5***
Arsenic	0.0028	0.0029	0.0028	<0.0028	<0.0028	0.0026	0.5***
Selenium	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	0.01
Silver	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	0.05***
Cadmium	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.05***
Barium	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	5***
Mercury	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.005***
Lead	<0.0003	<0.0003	<0.0003	0.0003	0.0003	<0.0003	0.2***

*Environmental Control Water and Sewage Regulations – Schedule A. Note all parameters (except pH) reported as mg./l.
** "*If water is being abstracted from a water course, used, treated, and subsequently returned to the same water course, these solids data mean the effluent should not contain more than 1000 or 30 milligrams per litre more than was in the water originally abstracted.*"
*** For all metals *"the maximum content is the amount in excess of the background level as determined upstream of the discharge".*

There are several values reported for the analysed water samples that appear to exceed the limits shown in Schedule A. It should be noted, however, that for water returned to the same source from which the influent was extracted, the TSS and TDS limits as well as metals values listed represent the permissible increment over background, i.e., levels in the influent water.

During the field program, the physical characteristics of the water column were determined for temperature, salinity, and dissolved oxygen at the sampling sites. A set of two casts were taken at each of the three sites, and a consistent pattern was displayed for each pair of casts giving confidence in the results as reported. A summary of results is presented in Table 4.5 below.

Table 4.5: Physical Characterization Mortier Bay November 2019

Sampling Site	Depth meters	Temperature ^{0}C		Salinity 0/00		Dissolved Oxygen
		cast 1	cast 2	cast 1	cast 2	
Shallow Intake	0	8.85	8.84	30.8	30.8	10.94[a]
	10	9.07	9.08	31.2	31.2	
	15	8.48	8.52	31.6	31.5	10.94[b]
Deep Intake	0	8.45	8.50	30.2	30.3	11.11[a]
	15	8.15	8.06	31.5	31.5	
	30	6.39	6.47	31.8	31.8	10.95[c]
	45	5.26	5.22	32.0	32.0	11.58
Outfall	0	8.80	8.81	28.6	28.8	
	10	9.07	9.06	31.2	31.2	10.98[d]

Note: Salinity calculated from conductivity/temperature readings.
a= 2m depth: b=13m depth: c = 25m depth; d = 5m depth

All sites showed evidence of a thermocline and a halocline. Surface conditions indicated the influence of air temperature as well as freshwater runoff, especially at the outfall location where conductivity (salinity) was approximately 10% lower than at deeper strata. Nevertheless, all bottom water sampled was at or over 30 parts per thousand (ppt).

At the 2 candidate intake locations, bottom water temperature was noticeably different: 8.5 ^{0}C at the shallow (15m) intake compared with 5.2 ^{0}C at the deep (45m) intake.

Salinity was not greatly different at the 2 intake sites, showing similar profiles. Surface values at both sites were similar – 30.8 ppt and 30.2 ppt. The bottom values were slightly elevated – 31.6 ppt at the shallow (15m) site compared to 32.0 ppt at the deep (45m) site.

The outfall site proximate to the Hatchery had a slightly lower salinity at surface (28.6 ppt). At a depth of 10m the salinity was 31.2 ppt.

Dissolved oxygen levels were similar and relatively high (11 mg/l) at both sites, reflecting a saturated condition at the ambient temperature.

During the field program, samples were also collected to detect the presence of pathogens of concern. The samples collected from both the “shallow” (15m) and the “deep” (45-50m) water sites showed no evidence of the subject pathogens (Table 4.6). In addition, with the exception of the surface sample from the candidate outfall location, the samples demonstrated low-to-undetectable values for coliform bacteria. This may be evidence of effective sewage treatment (and dispersal) for the proximate outfalls.

Table 4.6: Pathogen Presence Mortier Bay November 2019

Analysis	Units	Shallow Intake		Deep Intake			Outfall
		2m	13m	2m	25m	45m	5m
Bacteria							
Total coliforms	MPN/100 ml.	<1.8	<1.8	2.0	<1.8	<1.8	33
Faecal coliforms	MPN/100 ml.	<1.8	<1.8	2.0	<1.8	<1.8	<1.8
E. coli	MPN/100 ml.	<1.8	<1.8	2.0	<1.8	<1.8	<1.8
Total bacterial count	CFU/ml.	n/a	< 1	n/a	n/a	<1	n/a
Pathogens							
Aeromonas salmonicida		n/a	negative	n/a	n/a	negative	n/a
NNV- all genotypes		n/a	negative	n/a	n/a	negative	n/a
Loma salmonea		n/a	negative	n/a	n/a	negative	n/a
VHS		n/a	negative	n/a	n/a	negative	n/a
n/a – not sampled.							

Given that the source water is saline, the field sampling results indicate the available water supply from Mortier Bay is of good quality and suitable for hatchery usage. Temporal / seasonal variation is likely to occur with some water quality parameters. A regular sampling program will be established in order to detect and address cases where such variations may compromise hatchery water quality.

4.3.4 Water Temperature Control

"Describe the process for temperature control of hatchery water using the blending of the two intake lines located at different depths. Describe how the process accounts for any seasonal variations in ambient temperatures."

Each seawater intake (at 15m and 50m water depth) will have its own pump and pipeline for water extraction. The inflow water from both depths will report to a single storage tank. Inflow temperatures will be monitored continuously and the two flow rates adjusted to achieve optimal temperature. There will be no separate heating or cooling capability; however, friction from passage through pipes and pumps will increase water temperatures by approximately 1 ^{0}C above ambient.

Based on water temperature profiles for Placentia Bay (Figure 4.10), the inflow water is predicted to be within the tolerance range for lumpfish at all seasons. Note that the profile for November as presented by LGL (2018) is consistent with the water column temperature profile measured by Marbase for Mortier Bay in 2019, hence the extrapolation of this Placentia Bay data to Mortier Bay is considered to be reliable.

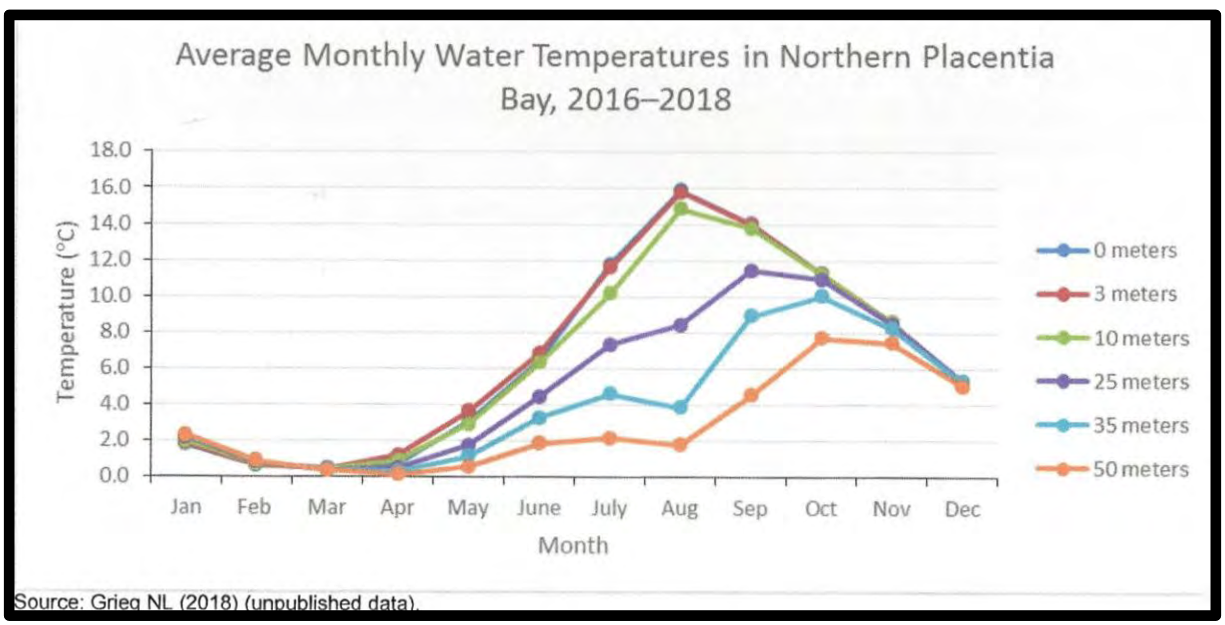


Figure 4.10: Average monthly water temperatures in northern Placentia Bay in the upper 50 m of the water column, 2016-2018. (LGL, 2018. Extracted from Figure 4.6, pp. 154,).

An examination of monthly water temperatures makes it possible to consider the potential for the hatchery seawater discharge to alter water temperature in the receiving waters. Table 4.7 shows predicted monthly average water temperatures (based on the profile shown in Figure 4.5) for intake water from the two depths (15m, 50m) as well as at surface. Blending of the intake water sources ("*Inflow Water Temp ^0C*") will produce water temperatures that facilitate growth. Since the hatchery will contain a single year class of fish, a single temperature adjustment will achieve optimal growth conditions for the hatchery fish. The "*Hatchery Discharge Water Temp*." allows for incidental heating due to friction as water passes through pipes and pumps. The discharge temperature is compared with the near surface receiving water temperature, and the last column indicates the temperature differential by month. For 9 months of the year, there will be negligible difference (interpreted as 1 ^{0}C or less). For 3 months (July, August, September) there will be a differential ranging from 2 ^{0}C to 7 ^{0}C, when the discharge water will be colder than the receiving water.

Table 4.7: Hatchery Sea Water Seasonal Temperature Variance

Month	Inflow Water Temperature ^{0}C		Hatchery Discharge Water Temperature ^{0}C*	Receiving Water Temperature ^{0}C	Temperature Differential C^0
	15m	50m			
January	2	2	3	2	+1
February	1	1	2	1	+1
March	0.5	0.5	1.5	0.5	+1
April	1.0	0.5	1.5	1	+0.5
May	2.5	1	3.5	4	-0.5
June	5	2	6	7	-1
July	9	2	8	12	-4
August	13	2	9	16	-7
September	13	4	10	14	-4
October	11	8	11	11	0
November	9	7	10	9	+1
December	5	5	6	5	+1

*Note – mechanical friction is assumed to increase temperature by up to 1C^0

4.3.5 Water Quality Management

"State the minimum water quality parameters required to support all hatchery operations as well as the industry or regulatory standards they meet or exceed. (information provided in Appendix B of the registration document shall be brought forward and added to the applicable Operations sections of the EPR). Describe all treatment, testing and monitoring of intake water to ensure sufficient quality to support hatchery fish health, including processes and technology involved with screening and filtration, UV radiation, oxygenation, aeration, and nitrogen removal, or any other proposed treatment."

Marbase has established Water Quality Standards to support its hatchery operations. These standards address the parameters required for successful egg incubation, hatching and rearing of healthy lumpfish. Importantly as well, they incorporate both regulatory and industry standards for hatchery operations, including discharges. The following comprise the Marbase Water Quality Standards:

- Adequate seawater flow rates to provide one complete tank water exchange a minimum of every two hours
- 50 µm filtration of both incoming and outgoing sea water
- Ultraviolet (UV) treatment at 250,000- 300,000 µW-s/cm^2 (microwatt-seconds per centimetre squared) on all incoming and outgoing sea water
- Adequate seawater degassing (maximum 103% total gas saturation) to remove nitrogen (lumpfish do not have a swim bladder)
- Maintenance of 90 - 110% oxygen saturation of sea water within lumpfish tanks and 80-90% saturation at discharge (minimum 6-8 mg/l)
- Maintain seawater temperatures adequate to ensure survival and achieve target growth rates (minimum 4^{0}C for broodstock / eggs - maximum 14°C for larval and juvenile stages)
- Maintain a minimum salinity in sea water of 28 ppt (lumpfish can tolerate fresh or brackish water for short periods)
- Maintain pH within the range of 7.3-8.1
- Maintain total ammonia levels at <0.5mg/l
- Maintain Nitrite levels at <50mg/l
- Maintain Nitrate levels at <500 mg/l (probably higher tolerance possible)
- Maintain Redox levels within the range of 200-350 mv
- Meet or exceed regulated standards for sea water discharge (Environmental Control Water and Sewage Regulations, Schedule A; see Tables 4.3, 4.9)
- Meet or exceed permit requirements issued by Aquaculture Division, DFFA.

The industry standard has been effectively developed by MUN's OSC through their lumpfish development efforts and operation of a hatchery and rearing facility. The relationship between Marbase and MUN will facilitate adherence to, and further development of, these standards.

The Aquaculture Permit issuance process includes the development of several documents related to quality standards. These are included for reference as Appendix IIIc. The applicable regulatory standards for saltwater discharges are discussed and described in Appendix VI.

Notably, the Marbase Water Quality Standards exceed external requirements, e.g., by the use of ultraviolet treatment and filtration of inflow and discharge salt water.

Water Treatment – Incoming Salt Water

Incoming salt water will be circulated to and through the hatchery using an array of 5 low-footprint, low-maintenance, low-power consumption pumps (Figure 4.11).

Figure 4.11: Large, efficient saltwater Garman pumps

The incoming water from Mortier Bay (shallow and deep lines) will enter the Seawater Pumping Station (Figure 4.12) at 4000 m^3/hr. Water will then pass into the hatchery building to a series of rotary drum filters (Figure 4.13) equipped with 50-micron mesh.

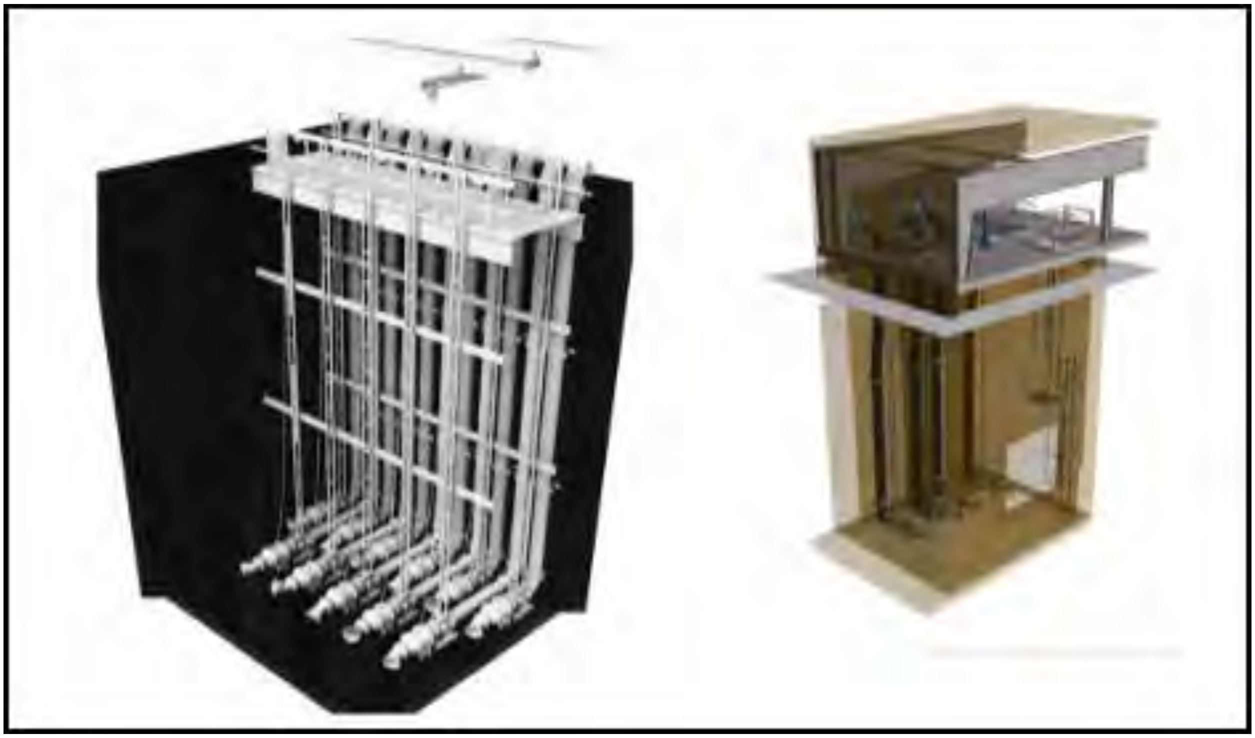


Figure 4.12: Saltwater pumping station - 4000 m^3/hr capacity

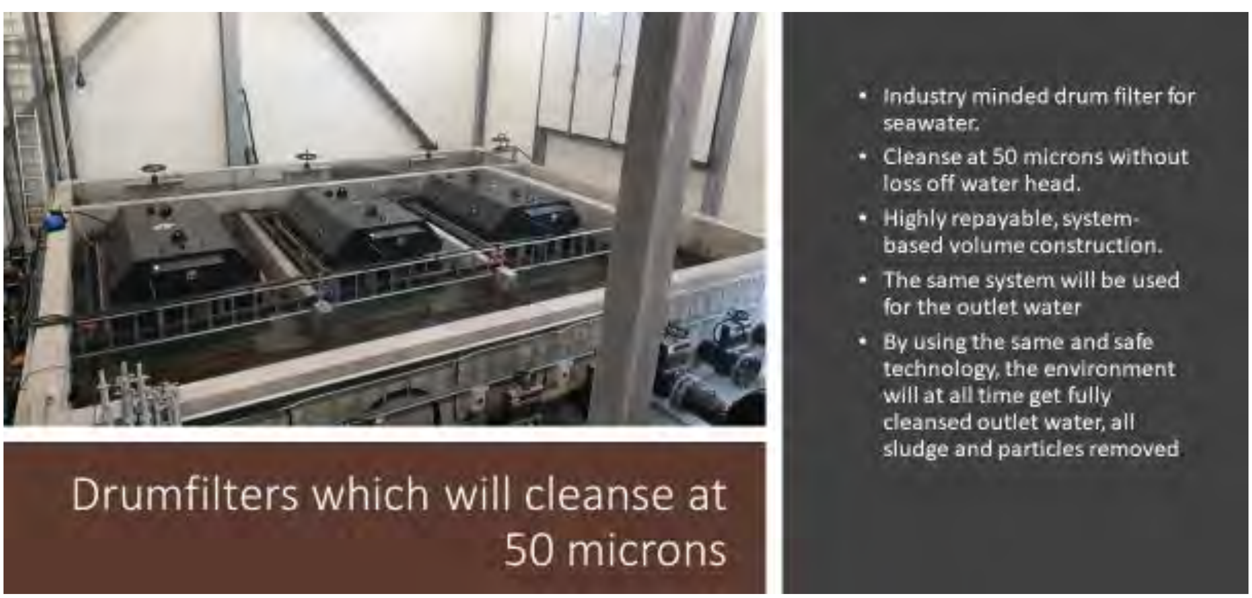


Figure 4.13: Drum filters for filtering incoming sea water at 50 microns

The filtered salt water will then be pumped through a series of ultraviolet (UV) disinfection units as illustrated in Figure 4.14. UV disinfection is a non-chemical process where a pathogen contained within a liquid or gaseous medium or present on a surface is exposed to a dosage of ultraviolet radiation near the peak of germicidal effectiveness, 265 nanometres (nm), resulting in the deactivation of the pathogen's DNA such that the pathogen is unable to reproduce (see http://www.purgoenvirotech.com/). (Pathogens include bacteria, viruses, and fungi.) In simpler terms, exposure of a particular disease-causing organism to UV light having a specific wavelength, intensity, and duration will prevent the organism from reproducing. As a green technology, UV disinfection is finding its way into a broad range of applications.

Marbase disinfection treatment will employ 250,000 - 300,000 μW-s/cm^2 (microwatt-seconds per centimetre squared).

Figure 4.14: UV disinfection units (300,000 μW-s/cm^2)

Gas Control (Nitrogen and Oxygen)

Following drum-filtration, aeration, and UV filtration, and before introduction to the rearing tanks, all salt water will be degassed to remove nitrogen; and oxygen will be injected as necessary. An innovative inline total gas-controller will be employed for this purpose (Figure 4.15).

The oxygen system will employ a patented oxygenation device developed by Nordic Clean Pumps Ltd. (NCP). The device is a gas controller that will provide stable oxygen levels at 110-

120% saturation before water is delivered to tanks. Additionally, each tank will have a control system and probes to detect and adjust the level of oxygen. The ability to detect and adjust oxygen levels at each tank is important since the differing levels of biomass in each tank will act to vary oxygen levels; and the maintenance of adequate oxygen levels is crucial for good control over survival and growth. Figure 4.16 illustrates the arrangement at each tank where an optical sensor detects oxygen levels and the inline total gas-controller will adjust oxygen levels. Figure 4.17 illustrates the inline gas controller unit with oxygen injection to individual fish tanks.

Figure 4.15: Gas controller - inline oxygen injection to various fish areas

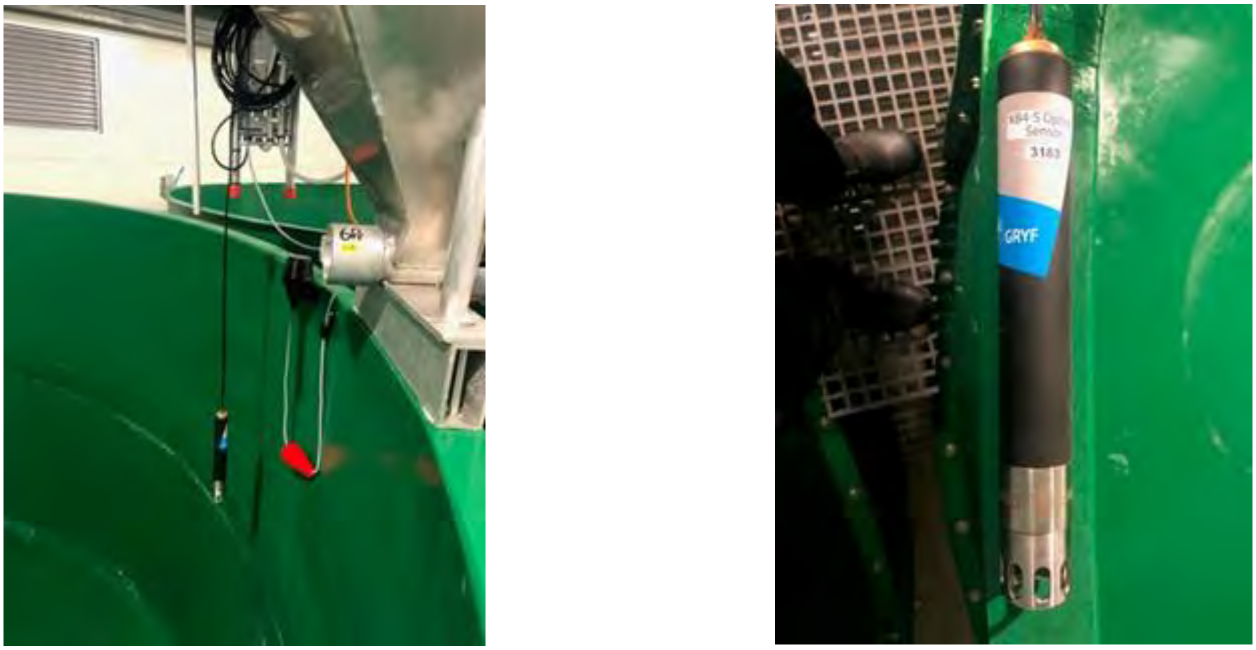


Figure 4.16: Optical oxygen tank probe sensor(s) and tank water level probe

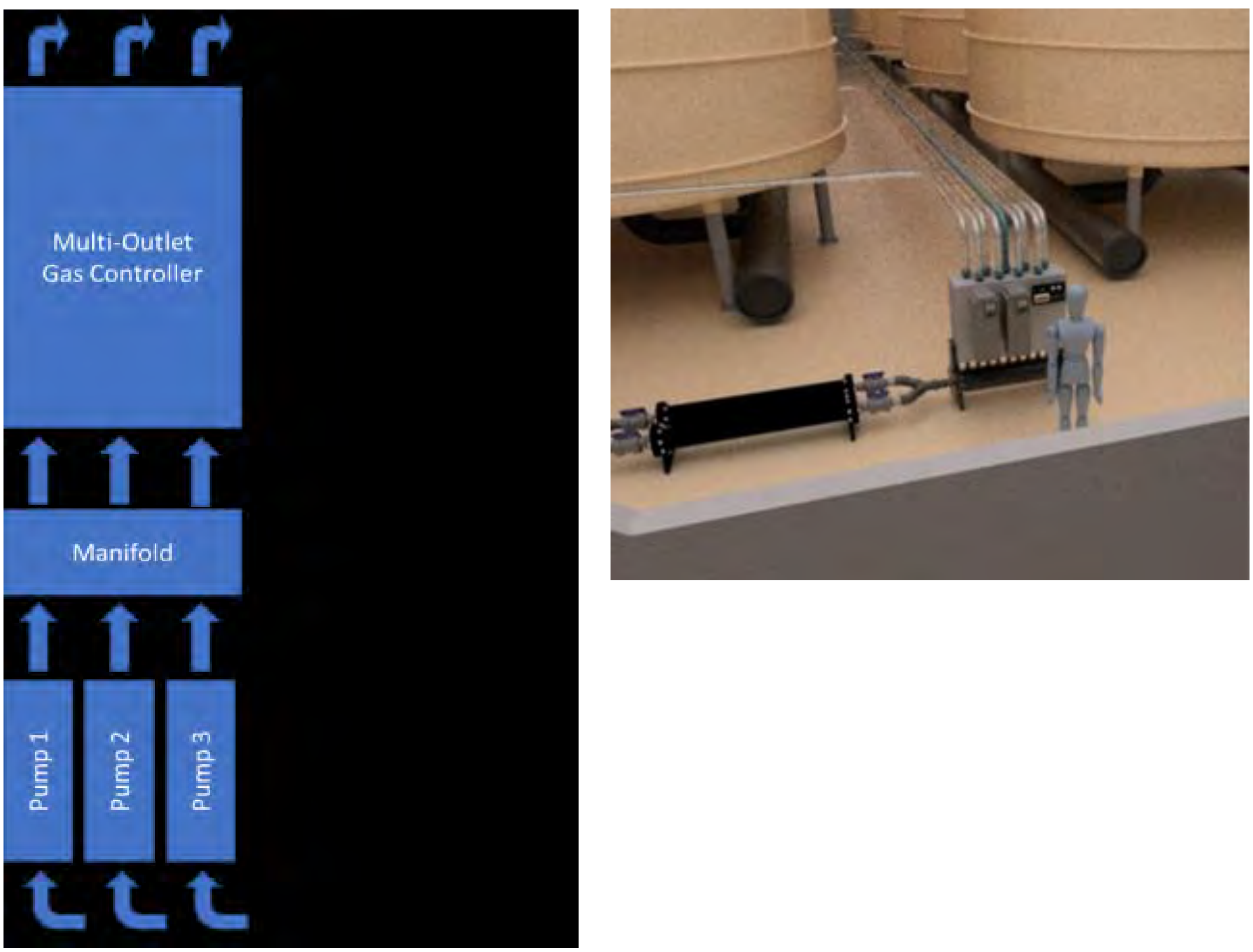


Figure 4.17: Gas controller - inline oxygen injection to individual fish tanks

Water Filtration

"Provide the rationale for proposing a 50-micron drum filter and how it works in combination with secondary treatment."

Both incoming as well as outgoing sea water will be filtered. On the incoming cycle, filtration will serve to clarify water, remove potential sources of problems, and facilitate water treatment. On the outgoing (discharge) cycle, the environmental quality of the discharge will be returned to incoming values or better. Since there are no regulatory or industry standards that apply to this treatment activity, Marbase has selected a level of filtration that will be both practical and effective.

Physical screening to 50 microns was selected for both inflow and outflow filtration. This level of screening will remove particulate material that could compromise UV treatment. Water filtered to 50 microns will have sufficient transparency to render UV treatment effective at 250,000 - 300,000 $\mu W\text{-}s/cm^2$. The same level of screening of outflow water will also be effective in removing material such as uneaten feed as well as feces (note that the bulk of fish feeds used are 1mm+ in size).

Water Treatment Standards

"Describe industry / regulatory standards for the treatment of hatchery water and whether the proposed hatchery treatment meets or exceeds industry/regulatory standards".

A review of regulations, consultation with regulatory authorities, and industry practice has identified that there are few standards in place with respect to treatment of influent or effluent hatchery water. The only applicable standard is with respect to the Environmental Control, Water and Sewage Regulations as discussed in Appendix VI. It is notable that these standards do not appear to be applied to other hatchery / aquaculture operations or to such facilities as fish processing plants.

The proposed treatment of incoming and effluent sea water meets and / or exceeds industry and regulatory standards in Newfoundland and Labrador for a marine (seawater) lumpfish hatchery. It is noted that the Aquaculture Licence issued for the operation may well identify and impose requirements specific to the Marbase operation.

4.3.6 Pathogens

"Identify the known and potential lumpfish pathogens in natural seawater and in lumpfish hatcheries."

The known and potential pathogens related to lumpfish in natural seawater in Atlantic Canada are:

Known

- *Vibrio salmonicida*
- *Vibrio anguillarium*
- Atypical Furunculosis *(Aeromonas salmonicida*)
- *Exophiala psychrophila*
- Ecto Parasites - *Ichthyobodo* (Costia) and *Trichodina*

Potential

- Nodavirus
- Viral hemorrhagic septicemia (VHS)

Each of the listed known pathogens have been found to be present in lumpfish hatcheries in Atlantic Canada. Experience to date has shown that infections in lumpfish hatcheries are usually limited to vibriosis.

There have been several identified pathogens globally associated with lumpfish production:

- Vibrio serotype 01
- *Vibrio ordalii*
- Atypical Furunculosis (*Aeromonas salmonicida*)
- *Psuedomonas anguilliseptica*
- *Pasteurella sp*
- *Tetramicra brevifilum* (microsporidian)
- *Piscirickettsia salmonis*
- *Montella viscos*
- *Tenacibaculum spp*
- Amoebic Gill Disease (*Neoparamoeba perurans*) NB. Only infection transmitted between salmon and lumpfish
- VHS (identified in Icelandic brood stock lumpfish)
- *Nucleospora cyclopterid*
- *Exophiala spp;*
- Lumpsucker virus (Flaviviridae);
- *Trichodina sp*.
- *Gyrodactylus sp*.
- *Kudoa islandica*
- *Myxobolus albi*
- Nematodes

Pathogen Inactivation

"Demonstrate whether the proposed treatment of hatchery water will be sufficient to inactivate lumpfish pathogens in the water."

The key tools employed in preventing the introduction of pathogens to the Hatchery are described in detail in the Biosecurity Plan (Appendix IIIc).

All incoming sea water will pass through filtration and UV systems as described previously. Filtration will remove suspended particles and serve to improve the effectiveness of UV treatment. The performance of a UV system is based on the 254-nanometer UV transmission factor of the water being treated (Yanong, 2003). This is referred to as the "UVT." The target rate of UVT is 85-95% after filtration. Most bacteria are deactivated in the range of 4,000 – 20,000 μW-s/cm^2. Viruses are deactivated in the range of 7,000 – 25,000 μW-s/cm^2, and parasites such as *Trichodina* at 35,000 μW-s/cm^2.

A regime of filtration to 50 μm and UV treatment at a dose of 250,000 - 300,000 μW-s/cm^2 as proposed will be sufficient to inactivate marine finfish pathogens of concern for both incoming and discharged sea water.

4.3.7 Chemotherapeutant Use

"Describe whether chemotherapeutants may be used to treat lumpfish, under what circumstances, and whether the chemotherapeutants may persist in hatchery water."

Given the preventative measures to be employed by Marbase in treating inflow sea water, there is a low likelihood that treatment measures will be required at this facility to cure infestations. It is notable that MUN's OSC has consistently produced commercial numbers of lumpfish (1 – 2 million per year) without any treatments during the last four production seasons. On the global scene, however, there have been instances of systemic bacterial infections in some hatcheries. Hence, there may be a future need for Marbase to use treatment methods including possible application of chemotherapeutants where they have proven to be effective, e.g., for treatment of vibriosis (bacteria) or ectoparasites such as *Trichodina* or Costia. The two most common therapies are oral treatment using an antibiotic (Oxytetracycline) for vibriosis and low dose (250ppm) formalin baths for ectoparasites.

Vibriosis is one of the most prevalent fish diseases and is caused by bacteria belonging to the genus *Vibrio,* a marine bacterium that is pathogenic to a number of aquatic organisms including several species that are important to the aquaculture industry. Organisms infected by *Vibro anguillarum* or *Vibrio salmonicida* are diagnosed with vibriosis, which, depending on the severity, can cause losses of lumpfish.

Efforts to understand and control *Vibrio* virulence have been of high priority among international aquatic researchers. Vaccine programs against this fish pathogen have been identified as a high priority for lumpfish and are taking place at MUN and other locations around the world. The Department of Fisheries Forestry and Agriculture (DFFA) is actively engaged with MUN's OSC Marine Microbial Pathogenesis Laboratory under the leadership of Dr. Javier Santander.

A positive Vibriosis diagnosis has to be confirmed by a licensed veterinarian; and then prior to treatment, a prescription issued by an approved designated fish health veterinarian. One treatment could be a broad-spectrum antibiotic such as Oxytetracycline (Tetra 250). This drug acts against infections of Vibrio and Furunculosis. It works by interfering with the ability of bacteria to produce essential proteins. Without these proteins, the bacteria cannot grow or reproduce. Oxytetracycline therefore stops the spread of the infection, and the remaining bacteria are killed by the immune system or eventually die. It also has a low toxicity rate.

Oxytetracycline was patented in 1949 and came into commercial use in 1950. Besides being used for preventing bacterial growth in cats and dogs, Oxytetracycline is effective for the treatment of bacterial enteritis and bacterial pneumonia in marine finfish species, pigs, cows, sheep, chicken, turkey, and even honeybees.

Parasite outbreaks can occur in lumpfish hatcheries due to poor water quality, increases in water temperature, high stocking densities, and / or poor tank husbandry. The two most common external parasites observed are *Ichthyobodo* (Costia) and *Trichodina*.

Ichthyobodo **(Costia):** *Icthyoboda* is a small external parasite naturally present in sea water. Organisms have the potential to pass through filtration units. Costia, as it is commonly referred to, is more prevalent during the spring and early summer months when water temperatures begin to increase. Costia infestations cause a typical irritation response from the fish such as flashing and rubbing, excess mucous production causing a skin cloudiness, heavy and laboured breathing (as observed by the movements of the operculum), and general listlessness.

Trichodina: *Trichodina* is a genus of ciliate protists that is parasitic to fish. It is characterised by the presence of a ring of interlocking cytoskeletal denticles that provide support for the cell and allow for adhesion to surfaces including fish tissue. *Trichodina* is typically found on the gills, skin, and fins.

Ectoparasite infestations may require treatment with "Parasite S." Treatment involves isolating tanks, reducing water volumes (while monitoring and maintaining dissolved oxygen levels), and inserting the treatment into the tank water at a dose level of 250 ppm concentration, equivalent to 0.025%. By reducing the tank water volume, the actual quantity of dosage is minimized. Typically, treatment is for a duration of 30- 45 minutes and may be repeated as often as 3 times in succession.

All use of chemotherapeutants is governed by regulatory standards and incident specific (DFFA, veterinarian) authorizations. In general, following treatment the residual levels of any chemotherapeutant are below detection levels and safe for discharge to the marine environment.

Marbase will be proactive in mitigation against pathogens by using state-of-the-art equipment and highly qualified staff to promote healthy lumpfish thereby avoiding production issues that warrant chemotherapeutant usage.

4.3.8 Pathogen / Parasite-Free Measures

"Identify measures to ensure that hatchery produced eggs and fish are pathogen and parasite free."

Marbase will take a number of measures to ensure that hatchery-produced eggs and fish are pathogen and parasite free. These will encompass bacteriology, virology (including nodavirus), and histology on a case-by-case basis. In addition, staff will carry out necropsy examination of morts as required.

Surveillance measures are documented in the material produced as part of the licencing requirements issued by the Department of Fisheries, Forestry and Agriculture (formerly

Department of Fisheries and Land Resources) Aquaculture Division (DFLR, 2019). The applicable plans are contained in Appendix IIIc. These and a series of other required plans will be updated and revised through ongoing consultations with staff of the Aquatic Animal Health Division (AAHD), provincial Department of Fisheries, Forestry and Agriculture to ensure each plan is adequate and meets updated policy guidelines. During implementation, Marbase will seek to work cooperatively and, as appropriate, in partnership with the AAHD.

The requirements of the Fish Health Surveillance Plan will be fulfilled as follows:

a. A Designated Veterinarian will oversee a surveillance visit every 30-45 days
b. The surveillance visit can only be conducted by a Designated Veterinarian or by a Designated Fish Health Technician under the direction of a Designated Veterinarian.
c. Samples will be submitted to a Designated Laboratory
d. Test results obtained for the purposes of the AAHD Surveillance Plan will be submitted to the AAHD upon receipt from the laboratory
e. AAHD staff will conduct quarterly surveillance visits.

The Marbase fish health surveillance effort will focus on the detection of clinical disease proactive and rely on the regular sampling of specimens from within the hatchery every 30 - 45 days by the Designated Veterinarian and suitably qualified staff. Sampling will be designed to ensure there are adequate numbers of individuals tested to have confidence in results and their applicability to the entire operation. Hatchery staff will receive training as needed for detection / observation of clinical signs as well as in protocols for disease detection reporting.

In addition, the AAHD will be expected to carry out quarterly surveillance visits. These efforts can be anticipated to be risk-based, targeted, active surveillance as referenced in the Aquatic Animal Health Disease Surveillance Designation Policy (https://www.gov.nl.ca/ffa/files/licensing-pdf-aquaculture-policy-procedures-manual.pdf, pp. 103-104).

Marbase will also use a nationally certified, locally owned and operated laboratory (Avalon Laboratories Inc). for analytical services and related technical support (toxicology, microbiology, water quality). This private laboratory has accredited sampling procedures and protocols that will completely support the daily operations of the hatchery on an ongoing basis.

4.3.9 Disease and Mass Mortality Contingency Planning

"Describe a contingency plan in the event of a disease outbreak or mass mortality event at the hatchery, including management of diseased fish and fish mortalities, and management of hatchery water and solid waste in contact with diseased fish and fish mortalities."

The Aquaculture Licence Application includes a requirement for documentation to address the issue of contingency planning in the event of a disease outbreak and potential mass mortality. Appendix IIIc includes the draft Fish Health Management Plan and Waste Management Plan. The Hatchery Aquaculture Application process includes other requirements for contingency plans (Mortality Management Plan, Fish Disposal Plan) that address Marbase's preparedness to deal with disease outbreaks and associated mortalities. The intent of this documentation is to address policy guidance from the Aquaculture Division, Department of Fisheries, Forestry and Agriculture (2019).

The essentials of the Marbase approach to contingency planning are:

- **Prevention** – take actions to identify hazards, reduce risk, and prevent situations from developing into emergency incidents
- **Preparedness** – maintain a high level of preparedness to respond quickly and effectively to unplanned events. Preparedness includes organization, training / practice, and availability of adequate and effective resources
- **Response** – take immediate and effective action to manage consequences in the event of an unplanned event
- **Recovery** – identify and implement mitigation and compensation measures to return conditions and resources to an acceptable level.

Mass Mortality Management Plan

The Marbase Mass Mortality Management Plan is a requirement of licence issuance. Unlike major fish producers, a mass mortality at the Marbase Hatchery would result in a modest volume of fish (maximum 80 tonnes per year). Disposal of such a volume is well within the capacity of available resources.

In the event of a mass mortality and / or a Depopulation Order, Marbase would promptly notify regulatory agencies and be prepared, if so directed, to sacrifice fish up to the total contents of the facility. If the mass mortality event was not as a result of a reportable disease, the mortalities would be collected and ensilaged for disposal as per normal operations (see discussion on ensilage below).

If the event were to be disease-related, bio-secure handling and transport would be used under the direction of the regulator. This could include sludge disposal or even, in an extreme case, hatchery rearing water. Sludge would be stored in a secure location on site until an appropriate approved disposal approach has been identified. Water would be secured by closing inflow and discharge valves and the suspect water stored in place until a storage / treatment / disposal protocol was approved.

All lumpfish mortalities would be removed using equipment and procedures similar to that employed during routine fish sale / transfers. For the Marbase site, bio-secure containers will be available for storage of mortalities pending their transport for disposal. Trucks equipped with industry-standard containers would be used to transport the mortalities to a designated disposal site. In the case of a confirmed presence of a reportable fish disease, only pre-approved service providers would be used to receive and dispose of the collected material.

Marbase would adhere to governmental guidelines and regulations for the disposal of organic material, fish mortalities, and any compromised water.

Fish Disposal Plan

The Aquatic Animal Health Division (AAHD), Department of Fisheries Forestry and Agriculture (DFFA) has developed a Policy on Fish Disposal (AP-23). Key components include:

- All licenced aquaculture operations are to have in place an approved Fish Disposal Plan
- During a Reportable Disease event, the licensee must address AAHD requirements, including adherence to the AAHD Contingency Plan and requirements of other (federal) regulatory authorities
- If a Quarantine Order has been issued,
    - a specific disposal plan must be submitted for approval and
    - a License to Move is required before any fish mortalities may be moved off site.

Note that the AAHD has the authority to issue a Depopulation Order requiring, for example, the dispatch of the entire contents of the Marbase Hatchery. This action can be taken to prevent the spread of a reportable disease.

Ensilage

"Clarify the ensilage process and equipment, particularly with respect to managing and disposal of regular mortalities and mortalities due to reportable disease. Describe procedures when both types of mortalities occur simultaneously."

Ensilage is a practice that is common and proven both nationally and internationally for finfish mortalities and culls. The resulting product is often used for agriculture as a feed additive or as a source of energy in systems such as anaerobic digesters. Ensilaging of culls and mortalities represents "best practice" to reduce the risk of infectious disease transmission as well as for optimizing the use of the organic material by other industries (e.g., agriculture, renewable energy sector). This process inactivates bacteria and viruses including the virus that causes infectious salmon anemia (ISA) and has been proven effective and adopted in many finfish farming jurisdictions in Norway, Chile, and Scotland (Dixon et al., 2012; NAIA, 2017).

During routine operations, fish mortalities at the Marbase Hatchery will be monitored and collected daily from tanks. The fish (depending on size) will be placed into a grinder that chops the mortalities into small pieces while a dose dispenser (doser) adds formic acid to produce a slurry with a pH of 4.5 or lower. The slurry will be held in a storage tank on-site at the hatchery facility until sufficient quantities are acquired to justify transport. For disposal, Marbase will contract local companies that are interested in using the product, e.g., as a fertilizer or animal feed additive.

Should mortalities occur or depopulation be ordered due to a reportable disease, the mortalities will be ensilaged using the same process as regular mortalities; however, disposal options are limited. Disposal of mortalities that are the result of a reportable disease will be under the joint direction of Aquatic Animal Health Division (AAHD - Government of Newfoundland and Labrador) and the Canada Food Inspection Agency (CFIA). Currently in Newfoundland and Labrador, the only approved facilities to receive ensilage from mortalities with a reportable fish disease are the New World Dairy in St. David's and Barry Group at their Burgeo facility. New World Dairy operates an anaerobic digester and the Barry Group operates a rendering facility that produces fishmeal from the ensilage.

Marbase would work with regulators to determine the appropriate facility for disposal of a mass mortality incident. It is noted that in some jurisdictions (e.g., United Kingdom), no distinction (with or without a reportable disease) is made for ensilage products since the process inactivates bacteria and viruses including the virus that causes Infectious Salmon Anemia (ISA) (Dixon et al., 2012).

In the event mortalities occur as the result of both regular activities as well as a reportable disease outbreak, all animals would be treated as diseased; and the rules and procedures applicable to a “Mass Mortality” and / or “Reportable Disease” would take precedence.

Reporting Procedures

The reporting requirements related to a disease outbreak or a mass mortality are specified in policy guidance issued by Aquaculture Division, Department of Fisheries, Forestry and Agriculture (DFLR, 2019). The management plans to be developed as part of the Hatchery Aquaculture Application will describe the specific protocols and procedures that will be followed by Marbase in reporting of a disease outbreak or a mass mortality.

4.3.10 Hatchery Seawater Treatment at Discharge

“Describe proposed treatment of hatchery effluent immediately prior to discharge. Identify industry/regulatory standards for the treatment of hatchery effluent prior to discharge.”

Before discharge, hatchery sea water will be filtered and then receive UV treatment. On the outgoing (discharge) cycle, the environmental quality of the discharge will be returned to incoming values or better.

Physical screening to 50 microns was selected for both inflow and outflow filtration. This level of screening will remove a high proportion of particulate material. Water filtered to 50 microns will also have sufficient transparency to render UV treatment effective. The same level of screening of outflow water will be effective in removing material such as uneaten feed (note that the bulk of fish feeds used are 1mm+ in size) as well as feces.

The filtered salt water will then be pumped through a series of UV disinfection units. UV disinfection is a non-chemical process whereby a pathogen contained within a liquid or gaseous medium or present on a surface is exposed to a dosage of UV radiation near the peak of germicidal effectiveness (265 nanometres) resulting in the deactivation of the pathogen's DNA such that the pathogen is unable to reproduce (Yanong, 2003). Pathogens include bacteria, viruses. and fungi. In simpler terms, exposure of a particular disease-causing organism to UV light having a specific wavelength, intensity, and duration will prevent the organism from reproducing. As a green technology, UV disinfection is finding its way into more and more applications.

A review of regulations, consultation with regulatory authorities, and industry practice have identified that there are few standards in place with respect to treatment of hatchery water. The only applicable standard is with respect to the Environmental Control – Water and Sewage Regulations as discussed in Appendix VI. These regulations set water quality standards at the discharge point but do not specify standards for treatment of hatchery effluent prior to discharge.

The hatchery treatment process proposed by Marbase meets and exceeds industry / regulatory standards. It is noted that when the Aquaculture Licence is issued for the Marbase Cleanerfish Hatchery operation, it may well identify and impose standards.

4.3.11 Sludge

"Describe sludge handling and dewatering process and technology, and characteristics of end product."

Sludge is viewed as a "valuable resource" by Marbase. Solid waste collected by the drum filters (Figure 4.13) will be in the form of a wet concentrate that will, in turn, be fed into its own processing plant for a further dewatering to 15% moisture content. This relatively dry, light-weight product can be more efficiently transported.

The dried sludge will be stored in an approved holding facility. A nutrient-rich product, this sludge will be collected on a routine schedule by the Burin Peninsula Waste Management Corporation (BPWMC) for use in their composting facility. All sludge will be disposed of in an environmentally appropriate manner in accordance with all provincial regulations. Drainage water from sludge dewatering will be cycled through UV filtration and join the seawater discharge.

4.3.12 Effectiveness of Effluent Treatment

"Indicate whether proposed effluent treatment will be sufficient to inactivate pathogens associated with wild/hatchery lumpfish."

The key tools employed in prevention of pathogen introduction to the hatchery are described in detail in the Biosecurity Plan (Appendix IIIc).

All outgoing sea7 water will pass through filtration and UV systems as described previously.

Filtration will remove coarser items and serve to improve the effectiveness of UV treatment. Most bacteria are deactivated in the range of 4,000 – 20,000 µW-s/cm^2. Viruses are deactivated in the range of 7,000 – 25,000 µW-s/cm^2, while parasites such as *Trichodina* are deactivated at 35,000 µW-s/cm^2 (Yanong, 2003)

A regime of filtration to 50µm and UV treatment at a dose of 250,000 - 300,000 µW-s/cm^2 will therefore be sufficient to inactivate lumpfish pathogens of concern that might be present in outgoing sea water.

4.3.13 Effluent Testing

"Describe effluent testing that will be conducted, including parameters to be analyzed, procedures, frequency of testing, record-keeping and reporting procedures."

Appendix VI discusses effluent testing. As noted, the Water Resources Division of the Department of Environment, Climate Change and Municipalities (ECSM - formerly MAE) has advised that the Water Resources Act, Environmental Control, Water and Sewage Regulations (Schedule A) will apply to the hatchery seawater discharge. To date no other regulator has identified a requirement for effluent monitoring.

Once an approval has been received from the Water Resources Division, the frequency of sampling will be identified as a compliance condition. The test parameters are specified in regulation. Commercial analytical laboratories offer a standard suite of tests using approved analytical techniques and levels of detection. In summary, Table 4.8 (from Schedule A of the regulations) lists the parameters to be monitored. Of special relevance is the provision that where extracted water is being returned to the same water body, the limits on solids (total and dissolved) as well as metals are incremental over background. In addition, the regulations specify a maximum effluent temperature (32^0C) and pH range (5.0-9.0).

Independent of regulatory requirements, Marbase will monitor the sea water frequently as required and at various stages in the cycling process, including at discharge. Oxygen (dissolved), temperature, pH, turbidity, and redox will be monitored using handheld meters. In addition, test kits will be used to determine ammonia and nitrate levels. These parameters will be monitored on a daily / weekly basis until the company reaches maximum stocking to give a base line. Thereafter frequency will likely be reduced. Electronic records will be maintained and made available upon request for review by regulators.

Sampling for compliance with regulatory requirements, including frequency, record-keeping, and reporting, will be established by the regulator; and Marbase will ensure compliance.

Table 4.8: Water Quality Parameters

(Based on NL Environmental Control Water and Sewage Regulations, 2003 Schedule A)

Constituents	Maximum Content (in milligrams per litre unless noted)
B.O.D.	20
Coliform - faecal	1000/100 ml
Coliform - total	5000/100 ml
Total Dissolved Solids	1000
Total Suspended Solids	30
Oils (Ether extract)	15
Floating debris, oils and grease	None to be visible
Arsenic	0.5
Barium	5.0
Boron	5.0
Cadmium	0.05
Chlorine	1.0
Chromium (hexavalent)	0.05
Chromium (trivalent)	1.0
Copper	0.3
Cyanide	0.025
Iron (total)	10
Lead	0.2
Mercury	.005
Nickel	0.5
Nitrates	10
Nitrogen (ammoniacal)	2.0
Phenol	0.1
Phosphates (total as P_2O_5)	1.0
Phosphorus (elemental) *	0.0005*
Selenium	0.01
Sulfides	0.5
Silver	0.05
Zinc	0.5
pH	
Dissolved Oxygen	

*Analysis of this parameter is not required. Replace with Total Phosphorus at higher detection limit

4.3.14 Lumpfish Delivery

"Describe the transfer and transport of market ready hatchery fish to clients."

Marbase will be selling its live lumpfish product to third parties Free on Board (FOB) at the hatchery gate. The transport and delivery of fish will be the responsibility of the purchaser and outside the scope of this registered undertaking. Nevertheless, based on the experience at MUN's OSC, the following description is provided for information.

Lumpfish can be transported by road using specialized fish transporters or by sea in well boats. The procedure for preparing fish for sale/transport involves the steps listed in Table 4.9.

Table 4.9: Lumpfish Transport Procedures

By Road	By Sea
Transport tanks on truck	Wet well on boats
Fish are starved 24-36 hours prior to transportation	Fish are starved 24-36 hours prior to transportation
Fish transportation tanks are disinfected prior to transport	Fish transportation tanks are disinfected prior to transport
Fish transporter tanks are filled with UV-filtered water at <10C (or ambient)	Fish transporter tanks are filled with UV-filtered water at <10C (or ambient)
Fish added to tanks either by hand net or fish pump (hose) /counter to a maximum stocking density of 45-50kg/m^3	Fish added to tanks either by fish pump (hose) / counter to a maximum stocking density of 45-50kg / m^3
Check pH, temperature and oxygen before departure	Check pH, temperature and oxygen before departure
Transport to destination	Transport to destination
Fish are discharged either directly into fish cages or transported to sites in tanks aboard a farm boat	Fish are discharged directly into receiving cages

Lumpfish Escapes

"Describe the potential of hatchery fish to escape during transfer to well boat, mitigations for prevention, and a contingency plan in the event of a mass escape."

Lumpfish are not nervous or skittish in behaviour and do not generally jump out of fish tanks (they can easily be caught by hand or with a hand net). In the case of road or well boat transports (fishing vessels designed to carry live fish in a tank or well), there is minimal likelihood of fish escaping during loading and / or during transportation. For potential escapes into the sea, there may be an opportunity to recapture the fish if they attach themselves to a surface such as a buoy or cage structure. Marbase will be culturing lumpfish produced from local stocks so the issue of escapes does not have negative consequences for the receiving environment.

It should be noted that Grieg Seafood Newfoundland Ltd. has developed a monitoring plan to address the potential for escaped cleanerfish to interact with wild lumpfish stocks. (LGL Limited, 2020*).*

4.3.15 Management Plans

"Include the following plans in the body of the EPR or as Appendices:

- *i. Fish Health Management Plan*
- *ii. Biosecurity Plan*
- *iii. Waste Management Plan – The plan must include but shall not be limited to a statement of the maximum volume of waste that may be generated by a disease outbreak, mass mortality or depopulation event; a description of agreements in principle or Memoranda of Understanding with candidate service providers to dispose of hatchery wastes; and confirmation that the candidate service providers have the capacity to handle the maximum volume of waste that may be generated by a disease outbreak, mass mortality or depopulation event*
- *iv. Environmental Protection Plan (outline to be provided in EPR)"*

The Marbase Environmental Management Framework (Appendix IIIa) provides a policy and organizational context for implementation of the various environmental plans associated with project licencing. Appendix IIIb is an outline of the Project Environmental Protection Plan. Attached as Appendix IIIc are draft versions of the Marbase Fish Health Management Plan, the Biosecurity Plan, and the Waste Management Plan as developed to date for the Hatchery Aquaculture Application to be submitted by Marbase Cleanerfish Hatchery to the Aquaculture Division, DFFA. The full suite of plans required for this licence application are listed in Section 10.0. The preparation of these plans and their review and acceptance by the regulator will be part of the provincial government's approval process that follows the release of the undertaking from the Environmental Assessment process. All plans are subject to review and update as appropriate.

The Waste Management Plan (Appendix IIIc) includes a statement of the maximum volume of waste that may be generated by a disease outbreak, mass mortality, or depopulation. The discussions with service providers who would handle and dispose of waste material (including from a disease outbreak, mass mortality, or depopulation event) have been to confirm their capacity to handle the volumes associated with such events. While there are no agreements-in-principle or Memoranda of Understanding currently in place for such services, appropriate agreements will be established based on the proven capacity and capabilities of service providers.

4.3.16 Hatchery Production Capacity

"The environmental assessment Registration document indicates a production level of 3 million fish once the hatchery is at full operation. "Attachment 1: Project Summary Description" states that there is the potential for hatchery production to expand to 5 million lumpfish. The EPR shall clearly state the intended production volume based on the infrastructure, operational processes and environmental mitigations presented, and a commitment to describe any future expansion to this production volume to the minister"

The proposed annual production level for the Marbase Cleanerfish Hatchery is 3 million fish at full capacity. In developing its plans, Marbase has made provision to accommodate potential future expansion; however, there are no plans in place or under development for expansion beyond the stated production level. This EPR describes project features (including infrastructure, operational processes, and environmental mitigation measures) based on an operation of 3 million fish per year.

If Marbase were to consider future expansion, an application for approval of such an activity would be made to regulators, including the Minister of Environment, Climate Change and Municipalities at that time.

5.0 Alternatives

"Alternative means of carrying out the project to meet the stated purpose and rationale must be provided.

The EPR must identify, describe and evaluate alternative means and locations of carrying out the project, including those alternatives which cost more to build and/or operate but which cause less harmful environmental effects.

The following steps for addressing alternative means and locations are recommended:

- *Identify any alternative means and locations to carry out the Project;*
- *Identify the environmental effects of each alternative means and location;*
- *Identify the **preferred** means and location;*
- *Provide reasons for the rejection of alternative means and sites"*

Marbase Cleanerfish considered several alternatives in the process of developing the optimum project – a project that is financially viable, uses proven but innovative technology, has minimal negative environmental effects, and that addresses sustainability objectives in an environmentally responsible manner.

One major consideration is the "no project" alternative. In addition to a lost opportunity for economic activity in the province, the "no project" alternative results in two major disadvantages. The first is the potential loss of cleanerfish as an Integrated Pest Management (IPM) tool for controlling sea lice. While there are alternative strategies that can be employed to address sea lice infestations, these all have some limitations. The alternatives include exposing farmed salmon to low concentrations of chemicals, including hydrogen peroxide. In European jurisdictions products such as hydrogen peroxide, deltamethrin, azamethiphos, and abamectin benzoate have been used. The use of chemicals can be effective in some cases of high infestation; however, the procedure can add stress to the salmon, reduce the time spent feeding, and lose effectiveness over time (Duchene, 2017). It is also important to note that these alternatives will result in some release of chemicals into the marine environment. Another alternative involves thermal systems (e.g., Thermolicer) that use brief 20 - 30 second exposure to elevated water temperatures. This forces the lice to detach from the skin but imposes a stress on the salmon and can lead to mortalities. These techniques have to be used multiple times during a single farming cycle.

The use of cleanerfish produces prolonged reductions in sea lice presence in sea cages while imposing no stress on the farmed fish, all as a result of the natural feeding behaviour of lumpfish. As a biological approach to a biological problem, the use of lumpfish as a cleanerfish represents the preferred approach to sea lice control. A recent review has provided validation of cleanerfish as a preferred and effective means to control sea lice (Lopes, 2020).

The second disadvantage of the “no project” alternative is the continuation of the current supply chain. Should this proposed project not go ahead, the Atlantic salmon aquaculture industry in eastern Canada will be faced with a challenging issue. The OSC cannot continue to provide cleanerfish on a commercial basis since such a service lies outside its mandate of research and development. Nor can OSC’s aging infrastructure continuously meet commercial demands. In the absence of a domestic supply of lumpfish as cleanerfish, the industry may seek other less environmentally friendly alternatives to sea lice management. As noted above, all of these alternatives have disadvantages when compared to the use of lumpfish.

Another operator might propose a similar undertaking to this one but would be faced with similar challenges and a longer timeframe before product is available on the market. In addition, the important advantages presented by the Marbase geographic location and existing infrastructure would not be available to another enterprise.

Marbase has therefore considered and rejected the “no project” alternative. The company has also considered the following alternative means of carrying out the project:

- Alternate locations
- Alternate saltwater supply sources
- Use of other cleanerfish species
- Alternate treatment / disinfection methods.

5.1. Alternate Locations

“Include information from previous project related studies describing alternate locations that were considered, including the expansion of existing sites, reasons for rejection, and reasons supporting the proposed site as the preferred location. Alternative locations shall be clearly outlined on maps of a suitable scale (i.e. 1:50,000, 1:25,000)”.

Marbase has not conducted any project-related studies of alternate locations since the focus has been on the revitalization of the Marystown Shipyard site. There has, however, been an exercise conducted to identify candidate locations for a lumpfish hatchery (D. Boyce, personal communication, 2020). This examination included existing fish plants as well as new builds. The results of this study are client confidential; however, the search criteria are available. The evaluation considered general location criteria, site suitability, infrastructure, as well as environmental and socio-economic issues. These evaluation criteria are described in Table 5.1.1. An assessment was conducted of the Marbase Marystown Cleanerfish Hatchery site against these criteria. Each criterion was assigned a value based on the following scale:

1. Not adequate, could not be addressed with extra effort
2. Not adequate, would require extensive effort
3. Marginal – could meet the requirement, subject to minor effort
4. Fully meets requirement
5. Exceeds requirement.

As shown in Table 5.1, the Marbase site ranks high in all categories.

Table 5.1: Hatchery Selection Criteria and Rating of Marbase			
Category	**#**	**Definition**	**Marbase Ranking**
General Location	!	Proximity to salmon sea cage farming sites	5
	2	Proximity to Regional waste site	4
	3	Distance from a commercial airport	4
	4	Distance from Memorial University's Ocean Sciences Centre to facilitate collaboration and scientific support	4
Infrastructure	5	Adequate, reliable electric power supply	5
	6	Adequate road system to accommodate transport trucks	5
	7	Snow-clearing services	4
	8	Internet (wi-fi) accessibility to support computer and alarm system need	4
Site-Specific Features	9	Suitably zoned property adjacent to a saltwater body	5
	10	Adequate docking facilities for fish transport and ocean deliveries of equipment and feeds	5
	11	Topgraphy that facilitates pumping with minimal head loss	5
	12	Water body with year-round access (ice free)	5
	13	Available seawater supply, adequate depths, oxygenated, currents / water exchange	5
Environmental, Socioeconomic	14	Acceptable water-quality standards for hatchery water supply	4
	15	Access to a skilled labour force, contractors, and suppliers	5
	16	Positive relations with municipalitiy, residents, organized labour, and interest groups	5
	17	Community amenities for staff housing, hospitals, and schools	5
Average score			**4.6**

The choice of Marystown was linked to the availability of an existing marine industrial facility, its geography in relationship to existing aquaculture operations, the presence of suitable infrastructure, an experienced workforce, a base of support services, and the initiation of a large-scale finfish aquaculture operation in the region. Alternative locations do not have such a combination of positive features.

5.2 Hatchery Saltwater Supply

"A discussion of alternatives shall include:

a) a rationale on the use of a flow-through seawater system as opposed to a recirculating seawater system and freshwater aquifer based recirculating system."

The hatchery will require a suitable growth medium, i.e., clean, good-quality salt water at an optimal temperature. The basic operational choices are:

- recirculate the hatchery saltwater supply or
- refurbish the seawater using a flow-through system.

In accordance with the EPR Guidelines, consideration has also been given to using a freshwater aquifer to feed a recirculating system.

Both recirculation and flow-through approaches require water purification and filtration equipment along with continuous monitoring of water quality.

The recirculating approach relies on extensive temperature control (heating and cooling) and very extensive water-quality treatment systems to provide optimal conditions for growth and maintenance of fish health. The consumption of salt water would be relatively low but would require some top-up capability. The degree of interaction between the hatchery and surrounding marine waters would be reduced but not eliminated. The main challenge for recirculating systems is to maintain suitable water quality for fish growth and avoidance of pathogen accumulation.

A flow-through system requires less energy consumption by locating intakes at different water depths (and temperatures). The mix of incoming water can be blended to produce optimal tank temperatures thereby reducing or eliminating energy demands for heating / cooling. A flow-through system requires two sets of filtration and purification stages (one for inflow water and the other prior to discharge); however, this requirement is more than offset by the energy savings realized by using ambient temperatures. One important feature of a flow-through system is the availability of clear, low-turbidity water. This is important for UV disinfection as the presence of high quantities of suspended material can compromise UV penetration. This can be a significant concern for recirculating systems.

Flow-through systems involve a high quantity of water circulation and hence interaction with the surrounding marine environment. The main concern is the hatchery acting as the catalyst to degrade water quality or to inadvertently culture diseases and disease vectors. This can be offset with thorough treatment of effluent water and diligent monitoring of water quality at all stages in the system.

A freshwater aquifer-based recirculating system would require development of groundwater wells to access freshwater, extraction of a relatively large volume of groundwater, conversion to saline water by the addition of salts, and operation of a water recirculation unit. The extraction of groundwater would raise issues related to competing use of the freshwater resource. The conversion of fresh to saltwater would be likely be viewed as an inappropriate use of the resource by regulators as well as other resource users. Otherwise, this option involves the same issues as recirculating sea water.

The use of a flow-through system is consistent with relevant operating experience at the existing lumpfish hatchery (MUN's OSC) and nursery facilities in Atlantic Canada (Belleoram, NL; St. Andrews, NB; Dalhousie University, NS; Clarkes Harbor, NS). All of these sites have had a high degree of success and few issues related to water quality (D. Boyce, personal communication, 2020). It is notable that, in comparison to these existing facilities, the Marbase Cleanerfish Hatchery will involve a much higher degree of water treatment (filtration and UV disinfection), monitoring and regulatory control. For these reasons, Marbase selected a flow-through seawater system as the most practical, cost-effective, and environmentally responsible choice.

5.3 Cleanerfish Species

"the use of other species as cleanerfish and the rationale for the preferred selection."

The choices for cleanerfish species include both lumpfish (*Cyclopterus lumpus*) and cunner (*Totogolabrus adspersus).* There are several other candidate fish species used in other jurisdictions, but these do not occur naturally in the marine waters off Newfoundland and Labrador and are therefore not suitable or acceptable for this undertaking.

MUN's OSC has conducted a research program to develop husbandry skills for the cunner so the capability exists to produce, fertilize, incubate, and hatch eggs to rear these fish. The species is compared with lumpfish in Table 5.2. Cunner have the advantage of being relatively abundant and available as a wild stock. They are robust and have a high temperature tolerance that might increase their survival during episodes of elevated natural temperatures. The species exhibits a tendency to feed on sea lice and has a high survival and fidelity rate when present in sea cages. Currently, however, cunner are difficult and costly to hatch and rear, the eggs are quite small, and the larvae difficult to culture. Growth rates are relatively slow so that the rearing cycle to market size is about two years versus eight months with lumpfish. Local husbandry knowledge for this species, while improving, is relatively low on the learning curve. The cunner offers potential and could become a complement to lumpfish as cleanerfish; however, further research and development is required to address the identified challenges.

Table 5.2: Comparison of Cleanerfish – Cunner v. Lumpfish

Cleanerfish Characteristics	Lumpfish	Cunner
Availability of wild stock	Available, but species status is a concern	Readily available
Temperature tolerance	Cold water species – good low temperature tolerance	Warmer water species – good high temperature tolerance
Robustness	Very robust	Very robust
Sea lice eating tendency	Good	Good
Survival rate – hatchery	High – 70-80%	Low – 10-20%
Survival rate – sea cages	High	High
Mobility / fidelity in sea cages	With hides present, fish remain in cages	Strong swimmer; uses entire cage. Hides required.
Cost of production	Moderate	High
Egg / larvae size for life cycle stages - handling, containment, incubation.	Large egg; sucker for attachment	Small eggs
Growth rate to market size	6-8 months	24 months
Husbandry knowledge	High	Low for Newfoundland and Labrador

In comparison, lumpfish have several distinct advantages. The eggs are relatively large and easy to handle. The larvae use their sucker to attach to surfaces, and this feature makes for success in tank rearing. Growth and survival rates from egg to juvenile (market size) fish are comparatively high. In large measure as a result of research and development at MUN's OSC, the culture of lumpfish is the furthest advanced. This includes a vaccination program that improves fish health and provides protection from infections.

It is notable that because of harvesting pressure, lumpfish are a species at risk. This raises concern about access to wild stock; however, the research into genetic makeup and husbandry will be an asset to any species' recovery efforts. Overall, lumpfish are seen as the cleanerfish of choice for salmonid finfish aquaculture operations in Newfoundland and Labrador.

At present, Marbase does not consider cunner to be a viable alternative to lumpfish as cleanerfish. With further research and development, the species might eventually be added to the Marbase Cleanerfish Hatchery operations. If so, all appropriate environmental approvals would be sought and obtained before commencement.

5.4 Treatment / Disinfection Methods

"alternative methods of hatchery water treatment and disinfection and the rationale for the preferred method"

The Marbase Hatchery proposes to use mechanical (drum) filtration for removal of particulates as well as UV treatment for disinfection of salt water. Each treatment will be applied at two stages in the hatchery flow-through circuit – at the inflow as well as prior to discharge of the water.

The alternatives for mechanical filtration include settlement basins, micro-screen filters, and foam fractionators. For the Marbase Hatchery, consideration was given to two alternatives – mechanical (drum) filters and particulate (sand) filtration systems. For disinfection, Marbase considered only UV disinfection since this is an industry standard. For the purposes of the EPR, a comparison is provided below of UV and ozone treatment alternatives.

Mechanical filtration acts to reduce suspended solids by passing water through media that separate particles from the water flow. A drum filter is made of solid stainless-steel perforated plates. Water enters the inside of the drum then passes through the fine holes (screening) in the surrounding stainless-steel plate. Suspended particulate matter cannot pass through the holes and becomes trapped inside the drum. The drum rotates slowly (3-6 rpm) directing the solids away from the main water flow. The system can be installed quickly as it is self-contained. It also requires little maintenance since the operative cycle is simple and the moving parts consist entirely of stainless-steel suitable for saltwater applications. The filter has a large capacity; however, the unit is a complex (and expensive) piece of equipment, requiring specialist skills for maintenance or repair.

5.4.1 Filtration Alternatives

A sand filter involves a process in which a fluid stream (salt water) contacts granular media ("sand" or other "activated" filter material) for physical and / or chemical removal of suspended particulates. The filters are very effective at solids capture. Water may be pressurized or simply gravity fed to pass through the filtrate. Pressurized systems are rapid and may employ multiple filter layers. The recovered particulate material is removed from the system by a periodic backwash operation in which the water flow direction is reversed. The deposited particulate matter, once removed from the filter system, is then directed to the effluent waste line. This filtration system has the advantage of extreme simplicity as it needs only simple accessories, has a low capital cost, and can be made of almost any material. For this reason, such systems are probably the most used and the most common type of filter for relatively large particle size filtration. Operating costs are very economic as the filtrate medium is inexpensive and usually readily available. The disadvantages of this system include a requirement for relatively large floor space. In addition, the system is not effective in removing relatively fine suspended material.

Some local marine facilities. such as MUN's OSC and Department of Fisheries and Oceans, White Hills, use sand filters to treat the incoming sea water. Both sand filters and drum filters are effective on particulate removal on incoming salt water. Based on experience with commercial lumpfish hatchery operations in other jurisdictions, Marbase has selected drum filters as the more effective (albeit more costly) system for removal of a broad range of suspended solid sizes.

5.4.2 Disinfection Alternatives

Marbase has selected UV treatment for its undertaking because it is the standard for disinfection in aquaculture water treatment systems. An overview description of the proposed UV system is provided in Section 4.3.5 (Hatchery Operation – Water Quality Management).

Ozone treatment is a potential alternative approach to disinfection of salt water in the Marbase Cleanerfish Hatchery. Ozone (O_3) is an unstable gas comprising three oxygen atoms. The gas will readily degrade back to oxygen. During this transition a free oxygen atom, or free radical form, is released. The highly reactive (albeit short-lived) free radicals of oxygen are the primary oxidant that provides the benefits of ozone (Kuhn et al., 2017).

Ozone (O_3) can be generated from ambient air or, more efficiently, from oxygen. An ozone generator is required on site and can employ one of several technologies. In general, the process passes dry, clean air through a high voltage electric discharge, i.e., corona discharge, which creates an ozone concentration of approximately 1% or 10,000 mg/l. At the molecular level, ozone is typically generated in a silent corona discharge unit that uses electrical discharge on oxygen molecules (O_2) to cause the release of free radicals of oxygen ($O^\bullet$) and ultimately the formation of ozone.

Ozone is delivered to treatment water via a diffuser, injector, or turbine. The ozone interacts with the water and particulate matter present. Since the ozone will react with metals to create insoluble metal oxides, post filtration (activated carbon) is required.

Using ozone in conjunction with filtration can be a highly effective control measure for removing particulate and dissolved organic matter, disinfecting or reducing the load of bacteria in the culture water, reducing levels of algal toxins, removing off-flavor compounds, and purifying shellfish. The treatment does not add chemicals to the water but does provide a very short reaction time.

There are several disadvantages to ozone treatment, especially for sea water. The chemistry of ozone in sea water is complicated by the high concentration of salts (elements) that are present. Sea water contains numerous primary elements (calcium, chloride, magnesium, potassium, sodium, sulfate, bromide) with trace levels of other elements (beryllium, copper, silicon). Bromide is one particular element in sea water that is problematic in ozonated aquaculture systems. Bromide also reacts with ozone to form harmful by-products (hypobromite and bromate).

Ozone oxidizes nitrite to nitrate (NO_3) very efficiently, essentially out-competing nitrite-oxidizing bacteria. So when the ozone is turned off, the population of bacteria might not be sufficient to remove nitrite.

Use of ozone requires monitoring of levels in the air as there are exposure limits applicable for humans. For systems that use oxygen in ozone production, there are fire hazards associated with storage and handling; and precautions need to be addressed.

Care has to be taken to remove any residual ozone from the treatment process. Ozone in the water can harm or kill fish. Ozone attacks the epithelium that covers gill lamella (burning the gills) and decreases the ability of fish and shellfish to regulate ions and minerals in their blood / hemolymph. This leads to organ damage as well as suppressed immunity and an increased risk of disease. Therefore, it is important to manage ozone properly.

Ozone equipment failures (elevated levels by the smallest fractions) can kill all fish immediately. Marbase rejected ozone treatment as a method for disinfection of flow-through sea water given the major disadvantages associated with this technology.

Marbase has selected UV treatment as the preferred approach to disinfection of salt water at its Cleanerfish Hatchery. This is based on the proven performance of this technology for sea water flow-through systems as well as the greater practicality of this technology for disinfection.

The combination of deep-water intakes and drum filters with UV is sufficient to provide good quality sea water for lumpfish production. It is worth noting that the selected methods of treatment and disinfection represent a higher level of performance than is the industry standard in Atlantic Canada. The method also exceeds all regulatory requirements set to date for cleanerfish hatcheries or nursery operations in Newfoundland and Labrador.

6.0 Potential Environmental Effects and Mitigation

"Provide detailed information regarding the potential effects of the project on the environment and the proposed mitigation to be used to avoid adverse environmental effects.

Potential environmental effects associated with the construction and operation of a lumpfish hatchery facility may include, but are not limited to, the following:"

The decision letter issued by the Minister of Municipal Affairs and Environment (now the Minister of Environment, Climate Change and Municipalities) identified the main issues that justified the call for an EPR. A more detailed description was then provided in the Guidelines issued for the EPR (Appendix I).

For each identified issue, this section of the EPR provides a description of the environmental management measures that will be employed including, where appropriate, a program of mitigation measures, monitoring procedures, and reporting protocols. As required, environmental impact predictions are made.

6.1 Air Quality

"a) Impact on the health of potentially sensitive human receptors immediately adjacent to and near the project boundary. The registration document states that the proposed location was a previous industrial site and that environmental investigations and site remediation have been completed. The EPR shall describe mitigations for potential air quality concerns arising from aerosolization and potential off-site migration of contaminants during site preparation and building refurbishment."

As part of the ownership transfer of the Marystown Shipyard facility, the Government of Newfoundland and Labrador carried out site remediation and rehabilitation measures to recover residual contaminants including contaminated soils, lead paint, and asbestos in buildings. This work was the culmination of a long-term remediation effort initiated by previous owners following a Phase Two Environmental Site Assessment (JWEL, 1998) and ongoing annually since that time. Over the past twenty years, a lengthy program of site investigation and remediation has rendered the site compliant with standards for usage compatible with an industrial site. The Government of Newfoundland and Labrador has provided Marbase with written assurance of that status.

There are no residual air quality concerns associated with aerosolization or potential off-site migration of airborne contaminants. The construction and operations activities associated with the Marbase Cleanerfish Hatchery will not involve any potential sources of air emissions beyond those associated with vehicle and heavy equipment exhaust.

There are no potential health concerns present at the site as a result of compromised air quality, either for site workers or for nearby residents.

It is possible but unlikely that site preparation work associated with the preparation of the asphalt surface and dock face could result in the release of previously undetected soil contamination. The Marbase Environmental Protection Plan (Construction) will make allowances for such an event; and both Marbase and site contractors will have the capacity to respond effectively to such an unplanned event with the prime objective of containment then recovery of contaminant materials.

6.2 Wild Lumpfish and Broodstock Collection

"Impacts to wild lumpfish populations. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) has designated lumpfish as "threatened". The EPR shall clearly indicate how the hatchery project will consider this species' status and potential impacts to wild lumpfish populations through the harvesting and acquisition of fertile females, eggs and broodstock. The sustainability of this hatchery project, with respect to wild lumpfish populations, shall be clearly described."

During the early days of the Marbase operation, eggs and /or newly hatched fry will be secured from the lumpfish program at MUN's OSC. Initially Marbase will purchase newly hatched fry for rearing at its facility. Once in full operation, Marbase will seek approval to commence its own program of egg incubation.

Marbase will use the same supply chain as MUN's OSC to access eggs, i.e., commercial fishermen from three different locations on the island. During this period, Marbase will also develop its own domesticated broodstock as a source of eggs. In the wild, lumpfish reach sexual maturity in 5 years. Thus, Marbase expects to be able to develop a functioning broodstock over a span of 3-5 years following establishment of a domestic stock. For a period of 3-5 years, there will be an overlap where both wild and domestic sources are employed to supply the required number of eggs.

At full production (and allowing for an egg-to-juvenile mortality rate of 30%) Marbase will require an estimated 4 million eggs – a total of 80kg from a wild stock of 300 females and 5 males. The. domesticated broodstock can be expected to produce a smaller number of eggs per female, so approximately 400 ripe domesticated females per year will be required.

6.2.1 Species Status.

A review of the species has been provided by Simpson *et al*. (2016). This document describes the natural history of the species and its population status throughout its range. The purpose of the report was to inform COSEWIC in their deliberations on the status of the population. The main reason for concern with respect to the species is the 58% decline in abundance over 20 years as reflected in fishery surveys off the south coast of Newfoundland; however, abundance appears to have remained stable across other parts of the Canadian range such as the northern Gulf of St. Lawrence.

The lumpfish fishery is directed entirely at harvesting the roe from females. The fishery occurs in Spring to early Summer (May - June) and in Canada is exclusively pursued on the Island of Newfoundland by inshore small boat fishers. There is no commercial fishery in the Maritimes, Gulf of St. Lawrence, or Arctic regions; nonetheless, the decline in harvest is notable. Catches are recorded as quantity of roe and have declined from a peak of over 2000 tonnes annually from 1987-2002 to 79 tonnes annually from 2009-14. Despite continuing high market prices in recent years and no changes in the way the resource was managed, Canadian landings declined rapidly in the mid-2000s returning to catch levels observed in the early 1970s.

On the basis of the scientific advice received, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) prepared and released an Assessment and Status report in 2017 with a recommendation that the species be assigned the status of “Threatened.”

The Assessment summary states:

> *Reason for designation: This marine fish species is broadly distributed across the Northwest Atlantic. Directed commercial fishery landings have declined sharply since 2005, in spite of high market demand. There have been declines in abundance of about 58% indicated in bottom trawl surveys over 19-20 years, conducted in the core part of its Canadian range (off southern Newfoundland). However, abundance appears to have remained stable across other parts of the Canadian range such as the northern Gulf of St. Lawrence, making recolonization possible.*

Occurrence: Nunavut, Manitoba, Ontario, Quebec, New Brunswick, Prince Edward Island, Nova Scotia, Newfoundland and Labrador, Atlantic Ocean

Status history: Designated Threatened in November 2017.

6.2.2 Hatchery Sustainability

The Marbase Cleanerfish Hatchery has the potential to affect lumpfish through direct removal of mature adults from the stock and through improved knowledge of the species.

In its early years of operation, the Hatchery will require the harvest of roe from wild fish. The demand (4 million eggs) will amount to an estimated 80 kg to be harvested from as many as 300 females, plus five males. This amounts to a harvest in the order of 0.15 % of the 2019 Atlantic Canada commercial fisheries harvest (52,420 kg). (http://www.nfl.dfo-mpo.gc.ca/publications/reports_rapports/land_Inshore_Debarquer_cotiere_2019_eng.htm)

This supply of eggs would be taken by commercial fishers holding the appropriate license and offered a premium to supply live specimens. Thus the activity represents a small diversion of (rather than an increase in) the commercial harvest with the harvested lumpfish used for the propagation of lumpfish. In the event the commercial fishery was to be limited or shut down entirely, current DFO policy would allow for the issuance of an Experimental License (including for species at risk) to enable fish collection in accordance with specified conditions.

As Marbase develops its own broodstock, the Hatchery (along with MUN's OSC) will not only ensure its own sustainability but will be able to develop an improved knowledge of the biology and husbandry of the species. This knowledge, when shared with the scientific community, could contribute to the recovery efforts required to ensure the survival of the species.

The predicted environmental impact of Marbase broodstock collection and hatchery operation on wild lumpfish stocks will be positive. The presence of the project will contribute positively to the sustainability of wild lumpfish populations in the future.

6.3 Hatchery Mortality Rates

"The Registration document states that 4 million eggs will be required to produce 3 million lumpfish. Identify the expected quantities and sources of lumpfish mortality during all stages of hatchery operations."

Marbase anticipates that the Cleanerfish Hatchery will achieve a survival rate (from fertilized egg to market-size juveniles) of 70%. This estimate forms the basis of the calculation for the number of eggs needed in the operation. A survival rate of 70% is considered very high for aquaculture reared finfish. The experience of MUN's OSC consistently shows achievement at this level of performance, so with adequate planning and collaboration with MUN's experienced and qualified personnel, Marbase is confident it can achieve similar survival rates.

The potential sources of mortality include:

- Egg Incubation failure – a poor hatch
- Deformities in larvae
- Starvation during the interval between yolk sac absorption and first feeding
- Predation / cannibalism
- Minor disease outbreak, e.g., vibrio, parasite infections
- Water quality issues, e.g., oxygen depletion, thermal shock
- Maintenance failures, e.g., inadequate tank cleaning.

There is no data available to support an estimate of Marbase mortality rates attributable to each of these different causes. At MUN's OSC, hatching success has ranged between 85-95%, while survival from hatch to a size of 1-2 gram has been in the range of 80-90%. Thus, production protocols in place at the facility have resulted in achievement of overall survival rates of 70% or better (D. Boyce, personal communication).

6.4 Hatchery Effluent Effects

"Impact of hatchery effluent on the marine environment including potential impacts on wild lumpfish and salmon populations. The EPR shall address any potential for hatchery operations to transmit pathogens to wild populations."

The hatchery seawater discharge, while technically an effluent, will essentially comprise water that has been altered from the influent in the following ways:

- Reduced suspended material as a result of 50 µm filtration of outgoing sea water
- Twice disinfected through UV 250,000- 300,000 µW-s/cm^2. (microwatt-seconds per centimetre squared)
- Moderately reduced oxygen levels (80-90% saturation at discharge) (minimum 6-8 mg/l)
- Adequate seawater degassing (maximum 103% total gas saturation) to remove nitrogen
- Maintaining pH within the range of 7.3-8.1
- Ammonia, nitrate levels slightly elevated (total ammonia levels at <0.5mg/l, Nitrite levels at <50mg/l, Nitrate levels at <500 mg/l)
- Redox levels within the range of 200-350 mv
- Meet or exceed regulated standards for seawater discharge (Environmental Control Water and Sewage Regulations – Schedule A; see Table 4.3-2)
- Meet or exceed permit requirements issued by DFFA – Aquaculture Division
- Thermal content slightly different from receiving waters during some periods of the year.

These features will all fall within the range of natural variation of sea water that occurs in Mortier Bay. Consequently, Marbase is confident in predicting that there will be no negative environmental effects on the receiving environment from these characteristics of hatchery effluent.

There is potential for hatchery operations to transmit pathogens to wild populations of fish species including Atlantic salmon and lumpfish. The primary source of pathogens in the hatchery will be from their introduction through the seawater supply. The list of known potential pathogens (and methods of inactivation) are described in Section 4.3.6. The scenario that would need to unfold for the project to transmit pathogens to wild populations would see pathogens introduced to the hatchery, proliferate there, and then exit through the seawater discharge.

As noted, the hatchery design is intended to prevent the entry of pathogens into the hatchery, and to prevent the discharge of pathogens so there would need to be complete and total system failures for this scenario to occur. As described in sections 4.3.10, 4.3.12, and 4.3.13, Marbase will exert considerable effort to prevent disease occurrences in accordance with Management Plans to be approved by the Aquaculture Division, Department of Fisheries, Forestry and Agriculture (Appendix IIIc – Fish Health Management Plan, Biosecurity Plan.).

Certifications are required for any transfer of fish or eggs, both into the hatchery and at the point of sale for market-size fish. These certifications address disease status and are meant to detect and control any disease outbreak.

Internally Marbase will monitor hatchery fish on a daily basis, remove any distressed or dead fish, examine for causes, and conduct testing as appropriate. The early detection of pathogen occurrence in the hatchery (as expressed in the fish disease profile), along with the regular monitoring of discharge seawater quality will serve to reduce and, hopefully, avoid any pathogen transmission to the receiving environment.

There is also the potential for marketed lumpfish to transmit pathogens to other marine species upon their introduction to sea cages. As noted, any transfer of fish will require a determination of disease status as certified by a qualified professional.

We have conducted a summary Accidental Events Effects Prediction for two pathways for pathogen introduction to the receiving environment as described above. Table 6.1 summarizes the result of this examination. The terms used are consistent with current effects assessment methods (LGL, 2018).

Based on this evaluation, the predicted effect is rated as **'Not Significant."** This conclusion is reinforced by the experience of existing lumpfish hatchery / nursery operations, which have not had a reported incident of pathogen transfer to wild stocks. Given that Marbase proposes to include a level of discharge treatment (filtration and UV disinfection) that is in excess of current practice, there is a **High** Level of Confidence attached to this prediction.

Table 6.1: Potential Environmental Effects of Accidental Events – Pathogen Transfer

Scenario	Potential effects	Key mitigation measures	Evaluation Criteria (see key below)					
			Mag.	Extent	Frequency	Duration	Revers.	Context
Water-borne transfer of pathogens	Spread of disease or parasites to wild fish	Filtration, disinfection, husbandry, monitoring, certification, biosecurity, vaccination,	2	3	1	2	R	2
Fish borne transfer of pathogens			2	4	1	2	R	2

Key

Magnitude
0 = negligible
1 = minor
2 = moderate
3 = major

Duration
(months)
1=< 1
2 = 1-12
3 = 13-36
4 = 37-72
5 = >72

Frequency
(events per year)
1 = < 11
2= 11-50
3= 51-100
4= 101-200

Extent
(Geographic – km^2)
1 = <1
2 = 1-10
3 = 11-100
4 = 101-1000
5 = 1001- 10000
6 = > 10 000

Reversibility
R = reversible
I = irreversible
(Refers to population)

Context – Ecological/Socio-Cultural & Economic
1 = Relatively pristine area not affected by human activity
2 = Evidence of existing effects

6.5 Species at Risk

"Impact to Species at Risk. Identify any Species at Risk in the area that may be impacted by hatchery operations and provide mitigations for protection."

As per the Guidelines, Section 4.1.2 provides a listing of marine species at risk that have been identified for Placentia Bay. Only species likely to be present for any time in Mortier Bay are likely to interact with the project.

These could include:

- Marine fish
    - Northern wolfish
    - Spotted wolfish
    - Atlantic wolfish
    - Atlantic cod
    - American plaice
    - Lumpfish
    - Smooth skate
    - Thorny skate
    - Atlantic mackerel
    - Atlantic salmon
    - American eel.
- Marine mammals
    - Harbour porpoise
- Other marine species
    - Ivory gull
    - Piping plover
    - Lesser yellowlegs
    - American golden plover

Neither marine bird nor marine mammal species are likely to have any direct, sustained interaction with either the seawater intake or discharge systems.

Among marine fish, only species that use benthic and epibenthic habitats are likely to be present and interacting with the project seawater discharge located at 5m water depth or at the intakes at 25 and 45m depth. As noted, there is potential for pathogen transfer to some species, including Atlantic salmon and lumpfish. These interactions are addressed in Section 6.4, along with a discussion of monitoring and mitigation measures.

There are a large number of mitigation measures that will apply to the operation and have the effect of reducing potential environmental effects and affording protection of species at risk.

The standard procedures identified in section 6.4 will apply and are considered adequate to protect species at risk that might interact with the project.

In addition, location-specific information will be collected on the pipelines, intakes, and discharge that comprise the seawater exchange system for the hatchery. This information will support permitting processes for protection of fish and fish habitat, and measures will be identified through that process to ensure protection of fish and fish habitat during both construction and operation of the facility.

It is noted that the terrestrial footprint of the Marbase Hatchery is an existing industrial site. It does not include any natural terrestrial features (vegetation cover, aquatic water bodies) that might provide usable habitat for any terrestrial or bird species including species at risk.

6.6 Aquatic Invasive Species

“Potential for proliferation of aquatic invasive species in the area of effluent discharge and measures that will be undertaken to mitigate potential effects.”

Section 4.1.2 provides a review of aquatic invasive species known to be present in Placentia Bay. Of the seven know invasive species present in Placentia Bay, the two of concern with respect to the Marbase Cleanerfish Hatchery operations are green crab and vase tunicate (L. Lush, personal communication, March 13, 2020).

6.6.1 Green Crab

Green crab are widely pervasive in Placentia Bay in part due to their high tolerance of a range of environmental conditions including temperature, salinity, and desiccation. They can survive in fresh water as well as out of water for some time. It is difficult to kill green crab. Effective methods include freezing for seven days and use of a fine woodchipper. In some cases, UV treatment and filtration are effective measures to destroy invasive species.

There is limited concern related to the saltwater intake and outfall in Mortier Bay, both because of the treatment of sea water (twice filtered and treated with UV disinfection) and the geographic spacing of the pipe system, all within Mortier Bay.

The main concern will be with solid waste produced at the hatchery and its safe disposal, particularly if this product was to move outside of Placentia Bay. At present, the Marbase Waste Management Plan identifies composting at the Burin Peninsula Waste Management (BPWMC) facility near Marystown as the means of handling hatchery sludge. Other organic material (mortalities) will generally be ensilaged but could be transported for disposal at facilities outside Placentia Bay. In the event of a major mortality event, ensilage might not be possible. In such a case, care would be required to avoid distribution beyond Placentia Bay for waste products as per Aquatic Invasive Species (AIS) Regulations.

Best management practices have been developed to address some invasive species and activities that act as vectors. Marbase will consult with AIS specialists in Fisheries and Oceans Canada to ensure the incorporation into its management plans (Appendix III) of such best management practices as they are developed for green crab and other relevant aquatic invasive species.

6.6.2 Vase Tunicate

The vase tunicate is an important concern, especially for the aquaculture industry, as they act to bio-foul sea cages by clogging the mesh and weighing down the gear (Carver et al., 2006). It is of particular concern because, unlike green crab, vase tunicate is not distributed throughout Placentia Bay; therefore, containing its spread is very important (L. Lush, personal communication, March 13, 2020).

Vase tunicate is listed as a member of the subtidal area or deep water up to 500m. Several studies include observations suggesting that outside of its native range, the distribution of *C. intestinalis* is constrained to artificial substrates possibly because of competition and/or predation pressure (Petersen & Riisgard, 1992).

Measures to be considered for the destruction of invasive species (such as the vase tunicate) within the waste stream include UV filtration and screening.

Marbase will collect information on the proposed intake and discharge sites for the hatchery sea water supply. The effort will include measures to establish whether tunicates are present. It may also be practical to examine water samples for the presence of larva and determine the effectiveness of treatment measures (filtration, UV).

As noted, best management practices have been developed to address some invasive species and activities that act as vectors. As such procedures are developed for vase tunicate, Marbase will work with Fisheries and Oceans Canada to incorporate them into its management practices.

In addition, as results become available on the efficacy of existing proposed Marbase seawater treatment methods, the information will be shared with other stakeholders.

6.7 Fish and Fish Habitat

Impacts to fish and fish habitat in the area of water intake and effluent discharge pipes and measures that will be undertaken to mitigate the effects"

The potential interactions between fish / fish habitat and the proposed project will occur only in respect of the seawater supply system. A preliminary characterization of the fish habitat associated with the seawater system has been constructed through a review of available information as well as by a brief field survey (Appendix VI). Much of the area (1,400m of the line route northeast of the Marbase Hatchery site) is characterized by fine sediment bottom; however, coarser material (predominantly gravels) is present from 1,400m to 2,600m to a depth of 50m. The outfall will be located over fine-grained material while the two intakes will sit on gravel-dominated substrate. Biological sampling can confirm the biota comprising these sites and along the pipeline route. The reports of recreational cod fishing and scallop collection (Section 6.12) confirm that the area includes productive fish habitat.

The seawater system is modest in scale and extent. The lengths of the proposed intake pipes will be 2.6 km (deep intake), and 1.5 km (shallow intake) while the outfall line will be 0.3 km. The footprint of the lines will be approximately 1m wide and extend from the shoreline depth at the Marbase dock face to 50m depth at the deepwater intake.

The lines will be made up of commercial-grade and corrosion-resistant piping, likely polyethylene (HDPE, PEX, PVC) that is robust and can be easily connected by section. Ballast (likely concrete blocks) will be placed at intervals along the line to provide stability. The intake structures will include screening to reduce uptake of larger objects. Construction activities could include some limited excavation of seabed material and placement of granular material (crushed rock screened to size) as a foundation for the intakes and the outfall.

Installation can occur any time of year but is likely to be scheduled for the construction season. Construction activities will follow a sequence:

- site preparation of the intake and outfall sites
- placement of intake structures
- assembly of pipe sections, ballast
- joining of sections and placement of piping and ballast on the seabed
- connection of pipeline ends to intake / outfall and to shore structure (pumps, valves, and holding tank)
- inspection of the integrity of the installation
- commissioning.

Once in operation, the main interaction between the project and the marine environment will be associated with the pumping of sea water. Currents will be induced at the intakes and at the outfall. A rough calculation indicates that these will be detectable at distances in the order of 100m from the intake and up to 200m from the outfall. At intakes, there is potential for the water to impinge upon marine organisms. The presence of increased water currents could act to attract some species while deterring others; however, if it does occur, such an effect would be very local in nature. Screening and other measures can act to reduce intake velocity or divert material from becoming impinged on the screening.

There will be caution marker buoys placed on the water surface over the intakes and outfall. These are required for navigation purposes and could result in minor adjustments to small boat travel routes but are unlikely to have any effect on fish or fish habitat

During operations the route will be inspected periodically to check on the integrity and stability of the pipelines as well as the condition of the intakes and outfall. Maintenance activities could include cleaning of intakes as well as monitoring of any fish habitat features that might be identified through the approval process of Fisheries and Oceans Canada (DFO).

The potential fish / habitat interactions associated with construction and operation of the seawater supply system are summarized in Table 6.2 as are the potential mitigation and monitoring measures to protect fish and fish habitat. These are preliminary and subject to more detailed examination and consultation with Fisheries and Oceans Canada.

Table 6.2: Seawater System and Fish / Habitat		
Interaction	**Seawater System Activity, Location**	**Mitigation**
Substrate habitat disturbance	Outfall, intakes; pipeline installation - during construction	Sediment control / containment Timing of the work
Loss of benthic habitat	Footprint of intake, outfall structure; ballast structures, during operations	Presence of new potential habitat - monitor, encourage settlement Installation of habitat features
Alteration of benthic habitat	Pipeline presence during operations	Monitor, encourage resettlement, consider installation of habitat features
Induced currents	Seawater pumping, discharge during operations	Monitor for impingement at intakes; scouring of benthic habitat at outfall.

The above table illustrates that there are conventional, proven mitigation measures available to address potential negative environmental effects on fish / fish habitat.

Some mitigation measures may be able to take advantage of features of the seawater system itself. For example, the pipeline and ballast structures may offer habitat opportunities. While the surface features of these materials will differ from the seabed, it is likely that frontier species will settle on these structures; and the introduced variety of habitat features could serve to mitigate any habitat disturbance effects.

6.8 Environment on the Project

"Impacts of the environment on the project including the potential effects of ice, water currents and storm surge on intake and outflow lines and measures that will be undertaken to mitigate potential effects. Consideration of local climate change projections shall be included."

The Marbase Hatchery is located in a sheltered coastal location on the western side of Mortier Bay, itself a sheltered water body; nevertheless, the site and the activities associated with hatchery construction and operations will be exposed to the natural environment, and there is the potential for interactions to result in effects on the project by the environment.

The following potential interactions between the project and the natural environment were identified for assessment:

- Ice presence at the dock face and at the seawater system outfall
- Rising seawater levels, and storm surges inundating the property
- Storm conditions (extreme tide / storm surge and water currents) affecting the functioning of the seawater system – pipelines, outfall, intakes.

6.8.1 The Physical Environment

Marystown has a maritime climate dominated by the influence of the ocean. Mortier Bay is well known as a large, safe, ice-free harbour. The physical environment – climate and oceanography features of the area – render the Marbase site well suited for the proposed Cleanerfish Hatchery operation.

There are several information sources available for characterizing the physical environment that will act on the project. The climate and physical oceanography of Placentia Bay is presented in two environmental impact assessments – for the Long Harbour Commercial Nickel Processing Plant (Vale, 2008) and for the Placentia Bay Atlantic Salmon Aquaculture Project (LGL, 2018). These two documents provide an overview of historical and forecasted climate features for the region including ice and water currents, tides, and storm surges.

Site specific climate data (annual records for temperature and precipitation) are available for Winterland – located to the west of Marystown (Station id. 8404240; 8404241) through Community Accounts (https://nl.communityaccounts.ca/climate/yearly_multi.asp?_=k4SUW1pPt6Z8InIYXnCRIA__).

The circulation pattern in Mortier Bay is the combined result of tides, winds, and the residual (counter clockwise near surface) current pattern of Placentia Bay. The narrow entrance to the bay, combined with freshwater runoff from adjacent watersheds, act to influence the pattern of circulation. Winds are dominantly from the west and southwest in summer and from the west and northwest in winter (Vale, 2008. Figure 5.25). The general pattern of currents is expected to be counter clockwise. The presence of outflow from the narrows to the southwest of the Marbase site likely results in a predominantly northeast current flow in the area of the dock face and at the seawater intakes and outlet. Tidal influence is likely the dominant driver of currents in this area.

A storm surge is a pronounced increase in sea level associated with the passage of storm systems and is defined as the difference between the observed water level and the predicted astronomical tide. Storm surges of about 1m (positive and negative) have been recorded on the coast of Placentia Bay at Argentia (Vale, 2008). The Marbase site in Mortier Bay is very sheltered so that while any storm surges would affect water levels at the Hatchery dock site, it is unlikely they would be accompanied by large, destructive waves.

6.8.2 Climate Change

The fact that the Marbase site (Marystown Shipyard) has been in place and operating for a period of over fifty years bears evidence to the fact that the site can cope with the historical range of climate conditions. The key concern would be changes in climate conditions and the suitability of the design for the seawater system.

Local climate change forecasts are available through two important sources – the Climate Change Branch of the Department of Environment, Climate Change and Municipalities (https://www.gov.nl.ca/eccm/occ/) and the Department of Environment and Climate Change, Government of Canada (https://www.canada.ca/en/services/environment/weather/climatechange.html). A useful guideline on coastal change (Batterson, 2020) is also available through the provincial site. There are a myriad of variables, reporting parameters, and model outputs available from these sources to describe climate change forecasts. These predictions form valuable input to detailed design.

The process of forecasting climate changes produces an array of projections for various time frames and parameters. Batterson (2020) provides a summary in lay terms of expected climate changes that need to be considered. By adapting his terminology, Table 6.3 provides an overview of the potential effects of the environment on the project including the effects of predicted climate changes. Incorporated into the table are quantitative estimates developed by LGL (2018) and Vale (2008) generally for the period 2021-2050 (the nominal operating life of the hatchery). Note that there are no climate change forecasts that specifically address water current patterns in the marine environment.

Table 6.3: Climate Change Predictions and Potential Interactions with the Project

*Climate Predictions (2012-2050)	Consequence	Project Relevance
Increase of 2.23% in mean daily precipitation. Intensification of precipitation. Increase in frequency of precipitation events. Increase in the maximum precipitation falling over 3, 5, and 10 consecutive days	Exceedances of design limits for water passage and retention structures - culverts, bridges, dams, storm sewers.	Falls within the capabilities of existing surface drainage systems.
0.6 m rise in sea level for the time period 2081-2100 (LGL, 2018).	Increase vulnerability to seawater inundation (flooding) of the coastal areas.	Reduce clearance at the dock face; increase potential for saltwater inundation.
Decrease in the duration and extent of sea ice.	Improves navigation season; reduces potential for nearshore ice scour.	Reduced exposure for seawater system.
Increase in severity and number of hurricanes over the Atlantic Ocean and in the severity of other storms.	Increased frequency and severity of storm events and potential storm damage.	Potential to induce currents / waves that damage seawater system.
Average annual air temperature increase in the order of 1.5 C^0 (from 5.4^{0}C to 6.8^{0}C).	Increase in growing degree-days; milder weather; changes in precipitation patterns and snow accumulation.	No direct interactions.
*Adapted from Batterson 2020.		

6.8.3 Effects Predictions

The predictions listed below include climate change forecasts and address the interaction of ice, precipitation, water currents, and storm surges.

The aspects of the project that could interact with the physical environment and result in significant effects are the seawater system, the dock face, and the surface water drainage system.

Seawater System

The seawater system could interact with ice, water currents, and storm surges. The system will be located below any areas of ice scour potential. At depths of 15 and 50m, the intakes will be located clear of any potential interaction with ice. The outfall will be set at a depth of 5m and also located to avoid potential ice scour. The pipelines, intakes and outfall will be securely ballasted; and the shore connections will be secured to resist any influence from water currents, ice scour, or storm surges. It is possible but unlikely that a downward storm surge could expose a portion of the outfall to the water surface. Such an unlikely event would be transitory and not likely to affect the function of the system.

The climate change forecast is for a reduction in sea ice and an inferred increase in storm surges. There are no predictions available for changes in marine water currents. There is no increased risk to the project as a consequence of these changes. For these reasons, the predicted effect of the environment on the seawater system is rated as “not significant.”

Dock Face

The section of dock face to be enclosed within the Marbase Hatchery site could interact with ice, water currents, and storm surges. The dock face is located approximately 2.6m above mean sea level. An increase in sea level would make the dock structure more vulnerable to storm surges with resulting damage to the dock and inundation of the surface area surrounding the Hatchery building. There is also the potential for ice scour from current and tidal movement to damage the structure. Water currents are not likely to have a direct effect on the dock face.

As noted, climate change forecasts indicate a reduction in the occurrence of sea ice so the potential for interaction will be reduced.

There is potential for the physical environment to have a minor, but negative effect on the dock face and surface area surrounding the Hatchery facility as a result of a combination of sea level rise and increased storm surge activity.

Surface Drainage

Precipitation in the form of rain especially will place a demand on the surface drainage capacity of the Marbase Hatchery paved outdoor surfaces. The drainage system has performed adequately over the 50-year life of the Marystown Shipyard so its capacity is proven. The modest increase forecast in precipitation is not predicted to exceed the design capability of the system. The effect of precipitation on the project is rated as “not significant.”

The forecast effects of climate change in Placentia Bay are modest. These changes are unlikely to affect design parameters for the Marbase Project; however, they will be taken into account in detailed design of the seawater system and in any required repairs or upgrades of the dock face and site surface drainage system.

6.9 Chemical Waste

“Impact of chemical waste. Identify the use and disposal of all chemicals associated with hatchery operations which may include therapeutants and anaesthetics”

The chemicals used during hatchery operations include cleaners / disinfectants, anesthetics, and therapeutants. The handling and disposal of these products will be in compliance with regulatory requirements (Workplace Hazardous Materials Information System – WHMIS regulations; *Transportation of Dangerous Goods Act* https://laws-lois.justice.gc.ca/eng/acts/t-19.01/) in accordance with the guidance provided by Material Safety Data Sheets (MSDS) and in compliance with the applicable Marbase management plans (Appendix III - see Biosecurity Plan, Waste Management Plan).

Most of the disinfectants to be used in hatchery operations have been developed to be of low toxicity to fish and generally pose little danger to marine life especially when diluted in a flow-through system.

In some cases, special precautions will be required, e.g., where therapeutants or anesthetics are used. In such situations, the water supply will be diverted away from the discharge stream to prevent any unintended release of these chemicals. If extensive bath treatments need to be employed, the treatment water would be pumped out into a container / truck suitable for the disposal of hazardous biological waste and disposed of under instruction from the environmental authorities.

The use of therapeutants and anesthetics will be an infrequent requirement at the Marbase Hatchery so the potential frequency of any environmental interaction will be equivalent to an unplanned event.

In general, any releases to the surrounding marine environment will therefore be at a level below detection.

Table 6.4 provides a summary of products that will be used by Marbase, including the precautions associated with their handling and disposal.

Table 6.4: Chemical Products Usage, Handling, and Disposal

Product	Usage	Handling / Disposal	MSDS*
Disinfectant			
Virkon	Regular usage in foot dip stations at all entry points and vulnerable locations.	Comes as a powder; PPE when mixing.	1
Bleach - Clorox 12	Cleaner used regularly to clean floors and a variety of surfaces.	PPE required when using product.	2
Therapeutant			
Parasite S	Infrequent usage in the event of an outbreak and a requirement to treat a range of fish parasites, e.g., Trichodina and Costia.	Contains formalin and methanol; requires PPE when handling.	3
Anesthetic			
Tricaine methane sulfonate (MS222; Tricaine-S/Aqualife)	Infrequent usage for special procedures such as manual spawning (fish stripping), weighing, measuring, marking, surgical operations, transport, photography, and research.	Requires PPE when handling.	4

*MSDS References

1. https://www.gov.mb.ca/sd/eal/registries/5433bipole/jul252016updates/sds_sheet_virkon.pdf
2. https://www.thecloroxcompany.com/wp-content/uploads/2018/03/Clorox-Commercial-Solutions-Javex-12-Bleach-by-Clorox-Canada.pdf
3. https://syndel.com/wp-content/uploads/2019/01/Parasite-S-US-SDS.pdf
4. https://syndel.com/wp-content/uploads/2019/01/Aqua-Life-TMS-CDN-SDS-09-15-Rev.08-17.pdf

6.10 Chemotherapeutant Use

"Describe measures that will be undertaken to ensure that hatchery effluent is free of chemotherapeutants prior to discharge, and solid waste is free of chemotherapeutants prior to removal from hatchery."

Section 4.3.7 provides a discussion of chemotherapeutant use at the Marbase facility. It describes chemotherapeutants products, the situations where their usage might be required, and the potential for their persistence in hatchery water. In general, chemotherapeutant usage will be highly infrequent and in response to an unplanned event. When used, such substances, while present at extremely low concentrations, will be difficult to remove completely from hatchery water.

The application of these substances will be under direction of a qualified veterinarian and in accordance with approvals from the Aquaculture Division, DFFA. If extensive bath treatments are to be employed, the treatment water could be pumped out into a container / truck suitable for appropriate waste disposal. Chemotherapeutants in the solid waste can be tested for if the hatchery records show that they have been used, and the waste disposed of accordingly.

6.11 Adjacent Properties and Noise

"Identify how the project will avoid interference with the rights of other legitimate landowners/users, including but not limited to:

k) Impacts to local noise levels due to 24/7 operation of the facility and how public concerns about noise will be addressed."

The noise level associated with hatchery operations will be minimal. During the short construction period there will be limited heavy machinery present (trucks, excavators, loaders) carrying out the preparation work associated with the outside yard area. The level of activity and noise generation will be less than was associated with the recent remediation work carried out at the site on behalf of the Government of Newfoundland and Labrador.

Hatcheries are quiet operations (D. Boyce, personal communication). During hatchery operations, workers will not be required to wear ear protection as PPE. When dealing with the main intake pumps within an enclosed area, there may be a requirement for such equipment. In general, the operation will be characterized by low levels of noise – much less than would occur at a typical industrial-zoned site.

The 24/7 nature of the operation does not imply continuous noise either within or outside the hatchery. Based on extensive stakeholder consultation by Marbase, both in advance of submitting the Project Registration and during the preparation of this EPR, no expressions of concern related to noise were raised.

The operation will not generate levels of noise that will be a concern either for site workers or for neighbouring properties. The absence of any potential interaction or of any expression of concern by the public provides the rationale for the prediction that there will be no negative environmental effects of the Marbase Cleanerfish Hatchery Project as a result of noise.

Marbase is not aware of any other potential interactions related to the project that would affect the rights of other legitimate landowners / users. Should any such concerns arise, they would be addressed through the Town of Marystown's approval process, which includes zoning compliance confirmation and issuance of a development permit.

6.12 Food Harvesting

"Impacts of hatchery infrastructure and operations, including hatchery effluent on recreational fisheries/country food harvesting in Mortier Bay".

The Hatchery itself is located on an industrial site, so the area does not present any opportunity for country food collection such as berries, mushrooms, or other terrestrial plants. The seawater pipelines, intakes, and discharge will be located in Mortier Bay and could interact with recreational fisheries that takes place in the Bay.

The seawater system (Appendix IIc) will be placed on the seabed with minimal features on the surface. The intake and discharge locations will be marked with a caution buoy, and marine traffic will be advised to exercise caution when transiting these areas. Otherwise, there will be limited potential interference between hatchery operations and recreational food harvesting / country food collection.

The information collected from local communications and a review of relevant literature indicates that there is a recreational fishery for cod and occasional recreational harvesting of scallops, but limited commercial fishing in the area near the Hatchery and proposed seawater system.

From the Grieg EIS (LGL, 2018) the commercial landings database of DFO is used to present information about the fisheries harvest locations in Placentia Bay. The database shows one harvest location (LGL, 2018. p. 216) at the mouth of Mortier Bay but otherwise none within the bay proper. The data for fixed gear distribution (2010-15) shows (LGL, 2018. p. 222) gear present at the mouth and east side of Mortier Bay but not in the area of the project. Snow crab gear for the same period is shown (LGL, 2018. Fig. 4.33) as present on the east side of Mortier

Bay only. Again, no gear locations are shown within the project area. Sea scallop (Fig. 4.39) commercial harvest locations (2010-15) show no harvest areas near Mortier Bay. No landings are reported for Mortier Bay, presumably because of the lack of a fish processing facility in the area. The dismantled OCI plant site retains a cold storage unit, but this does not appear to be a landing site for harvested fish.

The Little Bay Harbour Authority (F. Farrell, personal communication, 2019) indicated that there is a fair amount of small boat traffic in Mortier Bay, but most recreational fishing occurs further out in the bay. Some lobster traps are reported as being set along the western side of the approach to Mortier Bay. The Community-Based Coastal Resource Inventory (CCRI) maps (CCRI, 2000) show no pelagic or groundfish harvesting activity in Mortier Bay.

Recreational cod fishing is not expected to be affected by the presence of the Marbase seawater system given that only hand lines are permitted for this fishery. Recreational scallop fishers using drags will need to be aware of the pipeline, and hauls made perpendicular to the pipeline will need to take care to avoid snagging in the pipeline and ballast structures. Similarly, commercial fishers will need to consider the presence of the pipeline when setting some fishing gear, e.g., baited trawl lines. There should be no interference with gill nets or other types of stationary gear.

As noted in section 6.13 below, the potential interactions between the seawater system and other maritime users will be the subject of a permit application under the Canadian Navigable Waters Act. In addition to standard requirements (marker buoys, notices to mariners), the application and public review process will be expected to identify any special mitigation measures to address concerns from harvesters.

The physical area taken up by the seawater system is modest in relation to the size of Mortier Bay, the frequency of interaction will be low, and standard mitigation measures apply to installations of this type. On this basis, the predicted residual impact of the project on recreational fisheries / food harvesting is rated as “not significant.”

6.13 Navigable Waters

"Potential interferences to navigation in navigable waters due to the placement of intake and outfall lines/shipping interactions with scallop draggers and commercial and recreational fishers"

The placement and operation of the Marbase seawater system has little potential to hamper navigation. The only features that might affect vessel activities would be the seawater outfall and the caution buoys at the two intakes. The outfall will be in shallow water, and caution will need to be exercised by vessels whose draft might cause contact with the structure. A marker buoy will identify the location. Vessels approaching the Transport Canada wharf and slipway will need to exercise caution when entering or exiting this area. The intakes will be well below the water surface at depths of 15m and 50m. It is possible that precautions will be required for vessel anchoring in the area of the intakes as well as along the pipeline route.

As discussed in Section 6.12, there is limited commercial fishing in the area of the proposed seawater system; however, recreational fishing for cod and scallops may occur.

Recreational cod fishing is not expected to be affected by the presence of the seawater system given that only hand lines are permitted for this fishery. Scallop fishers using drags will need to be aware of the pipeline, and hauls perpendicular to the pipeline will need to be careful to avoid snagging in the pipeline and ballast structures. Similarly, commercial fishers will need to consider the presence of the pipeline when setting some fishing gear, e.g., baited trawl lines. There should be no interference with gill nets or other types of stationary gear.

Marbase intends to apply under the *Canadian Navigable Waters Act* for permission to install and operate its seawater system. Should the proposed location have the potential to interfere with navigation, there are opportunities for mitigation, including relocation of specific features of the system.

7.0 Decommissioning and Rehabilitation

“Describe all aspects of the decommissioning and rehabilitation plans for the project, assuming the eventual need to eliminate the entire project footprint from the landscape”

The Marbase Cleanerfish Hatchery is intended as an ongoing enterprise to supply lumpfish as cleanerfish to the salmonid aquaculture industry. There are no plans in place for closure or decommissioning as would be the case for a resource-extraction industry such as a mine where operation is dependent on a limited resource such as an ore body. In addition, should the nature of the industry change, the site would likely be attractive to other users, and all or portions of the property would be sold.

The EPR Guidelines require that the assumption be made that there will be an eventual need to eliminate the entire project footprint from the landscape. This is interpreted as meaning that the site would be returned to its current status. Should such an occasion arise, Marbase would develop and implement an approved decommissioning plan that would be compliant with the regulations and industry standards of the day.

Decommissioning and rehabilitation of the facility is straight forward. The seawater system will be rehabilitated in accordance with the requirements and instructions from the landowner (Transport Canada for the Government of Canada).

Removal of the seawater system would occur in reverse order to its installation. Given the relatively shallow depths and proximity to land, the recovery operation will be straightforward. The intake and outfall structures would be removed followed by the pipelines. A work barge and remotely operated vehicles would be used for much of the work. Remotely operated cameras would be used to inspect progress and confirm completion of the work. In general, divers would be used only for specialist tasks and available on stand-by as a contingency resource.

Some features such as ballast structures might be considered suitable to remain in place as features of the substrate, i.e., having become habitat for epibenthic biota; nevertheless, any features that represent a concern for navigation would be removed in accordance with regulatory requirements, and appropriate notices to mariners would be issued in advance and following completion of the work.

The decommissioning of the hatchery would include removal of the security fence and gates as well as the water storage / mixing tank. The building contents including pumps, machinery, and supplies (parts, feed, lab supplies, and analytical equipment) would likely be sold where a market exists. Depending on any anticipated future use of the building, some features could remain in place, e.g., water circulation.

At the completion of decommissioning, the project footprint of the Marbase Cleanerfish Hatchery would be eliminated from the landscape.

8.0 Project-Related Documents

"Provide a bibliography of all project-related documents already generated by or for the Proponent (e.g., feasibility study, engineering reports, etc.).

The EPR shall reference the engineering assessment confirming the structural integrity and weight bearing capacity of the proposed building."

A full list of references is presented in Section 11.0. This includes any project-related documents that are available to the public.

As noted in Section 4.2.2, an engineering assessment has found that the building is structurally sound. As required, a more detailed examination will be carried out to determine the load bearing capacity of the building (ground and second floor) and to confirm its ability to support the anticipated loads from the hatchery operation, especially with respect to water tanks.

9.0 Consultation

"A Public Information Session will be required in order to:

- *provide information concerning the undertaking to the people or other stakeholders whose environment may be affected by the undertaking;*
- *record and respond to the concerns of the local community regarding the environmental effects of the undertaking;*
- *present the information gathered to fulfill the requirements of Section 5 of these guidelines.*

The Public Information session must adhere to all restrictions to mitigate the impacts of COVID-19 that are in place at the time of the session. Information sessions may be conducted by virtual means through a live streaming, video conferencing or teleconferencing process, such as Facebook Live, Zoom, Microsoft Teams, Skype, Webex, Go To Meeting, and others.

You are required to notify the Minister and the public of the scheduled meeting ***not fewer than 7 days*** *before that meeting. Public concerns shall be addressed in a separate section of the EPR.*

Protocol for these public sessions will comply with Section 10 of the Environmental Assessment Regulations, 2003. Public notification specifications are outlined in Appendix A, and additional measures to notify the public of the information session shall be undertaken, such as the use of twitter and Facebook, notification on the Proponent's web site and if permitted, on local community web sites and local community TV channels,"

Marbase Cleanerfish Ltd. has conducted an extensive program of consultation with the general public as well as interested stakeholders. This program was initiated prior to submission of the Project Registration and continues to date. Appendix V provides documentation of the various consultation initiatives, including the Public Information Session required by the EPR Guidelines. The main components of the Marbase Stakeholder Consultation Program include:

- Consultation with resource agencies and regulatory authorities
- Hosting of an Open House consultation in Marystown prior to submission of the Project Registration
- Ongoing distribution of project information via the Marbase website and on Facebook (https://marbase.ca/lumpfish-hatchery/) (https://www.facebook.com/search/top?q=marbase%20nl);
- Dialogue with identified stakeholders
- Completion of a Public Information Session in accordance with the EPR Guidelines.

The Public Information Session planning and execution complied fully with the requirements of the Environmental Assessment Regulations, Section 10. Also important is that Marbase ensure the program was carried out in full compliance with COVID-19 precautions. As a result, the publicity in advance of the required session was well in excess of minimum requirements through use of electronic media and social networks in addition to the regulatory requirement for newspaper ads and posting within the community.

The session itself was held as a Zoom video conference. The project presentation included the required material describing the project as well as a discussion of project alternatives. This presentation was available on-line in advance of the session and was presented in full at the session. The event itself was well attended, and following the project description presentation, a question-and-answer session was held with Marbase technical advisors and company executives providing responses. The meeting was adjourned when there were no further questions or comments from participants. Appendix Vb is the full report on the Public Information session including the record of concerns expressed by participants and responses provided by Marbase.

As another initiative and at the suggestion of Environmental Assessment staff, Marbase contacted three identified stakeholders who had contacted the Department of Environment Climate Change and Municipalities during the Registration review process. Two of the stakeholders provided Marbase with their submissions. Appendix Vc provides a commentary on the issues raised by these stakeholders. The third stakeholder declined to provide their submission. The majority of the issues raised appear to have been reflected in the EPR Guidelines, and hence the Marbase text will address most of the issues identified. The remaining issues are discussed in Appendix Vc.

As a general comment, the dominant result of Marbase efforts at consultation confirm the acceptance by stakeholders that this undertaking is environmentally responsible and is seen as an urgently needed source of employment and economic activity for the Marystown area. The EPR Guidelines appear to have accurately and thoroughly identified the issues of concern identified by the public.

10.0 Approval of the Undertaking

"a) List the main permits, licences, approvals, and other forms of authorization required for the undertaking, together with the names of the authorities responsible for issuing them (e.g., federal government department, provincial government department, municipal council, etc.)".

The proposed project will require authorizations (permits and approvals) from the federal, provincial, and municipal governments. Table 10.1 provides a list of the approvals that may apply as the project develops.

A key approval is the Aquaculture License Application. The contents of an Aquaculture Application are extensive, and include:

- Fish Health Management Plan
    - Fish Health Surveillance Plan
- Biosecurity Plan
- Waste Management Plan
- Business Plan
- Fish Disposal Plan
    - Mass Mortality Plan
- Integrated Pest Management Plan
- Incident Management Plan

As with other regulatory approvals, a permit / license cannot be issued until the requirements of the Provincial Environmental Assessment Process have been satisfied. Marbase has commenced preparation of the application in part because elements of the application have been required for completion of the EPR (items underlined as per Guidelines section 4.3u).

Table 10.1: Authorizations and Permits Required for the Project		
Agency	**Division**	**Approval Form**
Transport Canada	Transport Canada – Ports Program	Canadian Navigable Waters Act approval Application to Occupy Federal Land
	Port of Marystown	Application to Occupy form with legal survey
Fisheries and Oceans Canada	Fisheries Protection Program	Permit – Discharge Line
	Fish and Fish Habitat Protection Program, Ecosystems Management Branch	Application for Project Review - Species at risk Habitat disruption; Invasive species assessment
Department of Fisheries Forestry and Agriculture	Aquaculture Branch	Aquaculture License
Department of Environment, Climate Change and Municipalities	Assessment Division	Release of Undertaking
		Environmental Protection Plan
	Water Resource Division	Alterations to Body of Water
		Water Use Licence
	Pollution Prevention Division	Certificate of Approval for Industrial Facility or Processing Work may be required
		Registration under Used Oil and Used Glycol Control Regulations
Government of Newfoundland and Labrador, Executive Council	Office for the Status of Women	Women's Employment Plan
Services NL	Government Services	Waste Management Plan
		Certificate of approval for storage of gasoline and related products to run emergency generator
		Storage Tank Application
		National Fire Code; National Building Code; Life Safety Codes
		Building Accessibility
Department of Human Resources, Labour and Employment	Human Resources Labour and Employment	Occupational Health and Safety Compliance Standards
Town of Marystown	Planning and Development	Zoning Compliance confirmation; Development Permit

Canadian Food Inspection Agency Role.

"b) Include a description of any regulatory oversight that may be required by the Canadian Food Inspection Agency if any of the organic waste from the hatchery is intended to be used as / as a component of agricultural fertilizer."

Marbase will seek to find diversion opportunities for waste produced by the hatchery operation. The dewatered sludge produced as a result of sea water treatment has the potential to be used as a nutrient source in agriculture. This raises the possibility that the Canadian Food Inspection Agency (CFIA) would have a regulatory role to play. In response to an enquiry from Marbase, it was confirmed that the agency does not have oversight during the manufacturing process for fertilizer (K. Furey, personal communication). It was noted that should the product be sold as a fertilizer or a supplement, it would fall under the authority of federal Fertilizers regulations (https://laws-lois.justice.gc.ca/eng/regulations/c.r.c.,_c._666/index.html). As such, the product would have to comply with labelling and / or registration requirements. Any final product could also be subject to sampling as part of marketplace place monitoring under the CFIA national sampling plan.

It was also pointed out that any shipment of product outside the province would involve additional plant protection implications. Such export is considered highly unlikely. In fact, concern over aquatic invasive species spread will likely confine any potential usage to the Placentia Bay area.

Existing Approvals

c) Provide verification of approvals from the Department of Service NL for the existing sewage treatment system and outfall.

d) Provide verification of approval from the Department of Municipal Affairs and Environment for the existing on-site oily-water separator."

Marbase has examined the records available to it and also made enquiries with staff at Service NL as well as the Department of Environment, Climate Change and Municipalities. No records of a permit for the existing sewage treatment system could be located (R. Locke, personal communication). Similarly, there does not appear to have been any approval issued for the existing on-site oil-water separator (S. Elliott, personal communication).

As part of the permit approval process, Marbase will consult with regulators to identify the required permits for these site features and make timely application for any required approvals.

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Appendix I

Guidelines and Concordance Table

for

Environmental Preview Report

for the

Marystown Marbase Cleanerfish Hatchery

https://www.gov.nl.ca/eccm/files/env-assessment-projects-y2020-2062-EPR-guidelines.pdf

Concordance Table			
Guideline #	**Guideline Text**	**EPR Heading**	Page
Preamble	The following guidelines are intended to assist the proponent, Marbase Cleanerfish Limited, with the preparation of the Environmental Preview Report (EPR) for the proposed Marystown Marbase Cleanerfish Hatchery. The EPR is a report that presents the results of an investigation based on readily available information that supplements the information already provided by the proponent upon registration of the undertaking. The purpose of the information in the EPR is to assist the Minister of Municipal Affairs and Environment in making a determination as to whether an Environmental Impact Statement (EIS) will be required for the proposed undertaking. The EPR is expected to be as concise as possible while presenting the comprehensive information necessary to make an informed decision. The EPR shall include and update the information provided in the original registration and focus on the information gaps identified during the government and public review of the registration. The EPR shall address the information gaps in sufficient detail to enable the Minister of Municipal Affairs and Environment to make an informed decision as to the potential for significant environmental effect from the undertaking. For clarity and ease of reference, the EPR shall include a Table of Concordance that cross references the EPR guidelines so that points raised in the guidelines are easily located in the EPR. The contents of the EPR shall be organized according to the following format:	Introduction.	4
1	**NAME OF UNDERTAKING:** The undertaking has been assigned the Name "Marystown Marbase Cleanerfish Hatchery."	1.0 Name of Undertaking	6
2	**PROPONENT:** Name the proponent and the corporate body, if any, and state the mailing and e-mail address. Name the chief executive officer if a corporate body, and telephone number, fax number and e-mail address. Name the principal contact person for purposes of environmental assessment and state the official title, telephone number, fax number and e-mail address.	2.0.Proponent	6
3	**THE UNDERTAKING:**	3.0.The Undertaking	7

	State the nature of the project. State the purpose/rationale/need for the project. If the proposal is in response to an established need, this should be clearly stated. Identify needs that are immediate as well as potential future needs. The purpose/rationale/need for the project shall include, but not be limited to: an overview of using lumpfish as cleaner fish. This will include descriptions of the growth/emergence of this practice and its role in integrated pest management plans for the successful biological control of sea lice in salmonids in the province. The overview shall be supported by current scientific and governance literature including industry standards, as well as research and development information from Memorial University's Ocean Sciences Centre.	Appendix IV Appendix IIIa 3.1 Lumpfish as Cleanerfish	8
4	**DESCRIPTION OF THE UNDERTAKING:** Provide complete information concerning the preferred choice of location, design, construction standards, maintenance standards, etc.	4.0 Description of Undertaking	15
4.1	**4.1 Geographical Location/Physical Components/Existing Environment:** Provide an accurate description of the proposed site, access road, facilities, infrastructure and equipment, including GPS location coordinates. Attach an original base map (1:25,000 scale) and/or recent air photos. This description shall include, but not be limited to:	4.1 Geographical Location/Physical Components/Existing Environment	16
	a) The routing and depth of the intake lines from the point of intake to the hatchery.	4.1.1 Salt Water Intake and Discharge Appendix IIc	20
	b) The routing and depth of the effluent discharge line from the hatchery to the point of discharge into the marine environment	4.1.1 Salt Water Intake and Discharge Appendix IIc	20
	c) A description of known flora and fauna in Mortier Bay, as described in the literature, including aquatic invasive species and species at risk.	4.1.2 Mortier Bay Biota Appendix VI	22
	Provide information regarding ownership and/or zoning of the land upon which the project is to be located and any restrictions imposed by that ownership or zoning, including municipal ownership/zoning, Crown, and private land.	4.1.3 Land Ownership and Zoning Appendix IIa	27
4.2	**4.2 Construction:** State the time period in which proposed construction will proceed (if staged, list each stage and its approximate duration) and proposed date of first physical construction-related activity The details, materials, methods, schedule, and location of all planned construction activities shall be presented.	4.2 Construction Appendix IIb	29
4.2a	The EPR shall include a description of:	4.2.1 Site Preparation	29

	a) construction, modification or maintenance of any wharves, boathouses, slipways or breakwaters, with diagrams, imagery or illustrations.		
4.2b	b) planned repairs to the surface water collection system.	4.2.2 Building Refurbishment	30
4.2c	c) any infilling or dredging associated with any wharves, boathouses, slipways or breakwaters	4.2.1 Site Preparation	29
4.2d	d) any infilling within 15m of a body of water	4.2.1 Site Preparation	29
4.3	**4.3 Operation and Maintenance:** All aspects of the operation and maintenance of the proposed development shall be presented in detail, including illustrations where applicable, and shall include but not be limited to the following:	4.3 Operation and Maintenance	33
4.3a	a) A flow through description of hatchery operations from receipt of broodstock/fish from source, through growth stages, to removal of fish for sale. The following features shall be included in this description:	4.3.1 Hatchery Operations Flow Through.	34
	i. the sources and quantities of fertile lumpfish females and eggs to be acquired.	4.3.1 Hatchery Operations Flow Through – Egg Sources and Quantities.	37
	ii. the hatchery process of egg fertilization, the required quantity of male lumpfish, and information on whether wild male lumpfish will require harvesting/collection and/or holding.	4.3.1 Hatchery Operations Flow Through- Fertilization	38
	iii. methods for developing the domesticated broodstock that will form the hatchery's egg supply.	4.3.1 Hatchery Operations Flow Through - Development of a Domesticated Broodstock.	40
4.3b	b) Provide the quantity of water required for operations on a per annum basis.	4.3.2 Hatchery Operation -Water Quantity	41
4.3c	c) Describe the water quality at intake sites, accounting for any potential seasonal variation in tested parameters.	4.3.3 Hatchery Operation- Source Water Quality	42
4.3d	d) Describe the process for temperature control of hatchery water using the blending of the two intake lines located at different depths. Describe how the process accounts for any seasonal variations in ambient temperatures.	4.3.4 Hatchery Operation - Water Temperature Control	45
4.3e	e) State the minimum water quality parameters required to support all hatchery operations as well as the industry or regulatory standards they meet or exceed. (information provided in Appendix B of the registration document shall be brought forward and added to the applicable Operations sections of the EPR). Describe all treatment, testing and monitoring of intake water to ensure sufficient quality to support hatchery fish health, including processes and technology involved with screening and filtration, UV radiation, oxygenation, aeration, and nitrogen removal, or any other proposed treatment.	4.3.5 Hatchery Operation - Water Quality Management	47

4.3f	f) Provide the rationale for proposing a 50-micron drum filter and how it works in combination with secondary treatment.	4.3.5 Hatchery Operation- Water Quality Management – Water Filtration	53
4.3g	g) Describe industry/regulatory standards for the treatment of hatchery water and whether the proposed hatchery treatment meets or exceeds industry/regulatory standards.	4.3.5 – Hatchery Operation – Water Quality Management – Water Treatment Standards	54
4.3h	h) Identify the known and potential lumpfish pathogens in natural seawater and in lumpfish hatcheries.	4.3.6 Hatchery Operation - Pathogens	54
4.3i	i) Demonstrate whether the proposed treatment of hatchery water will be sufficient to inactivate lumpfish pathogens in the water.	4.3.6 Hatchery Operation - Pathogens – Pathogen Inactivation	56
4.3j	j) Describe whether chemotherapeutants may be used to treat lumpfish, under what circumstances, and whether the chemotherapeutants may persist in hatchery water.	4.3.7 Hatchery Operation – Chemotherapeutant Use	56
4.3k	k) Identify measures to ensure that hatchery produced eggs and fish are pathogen and parasite free.	4.3.8 Hatchery Operation - Pathogen/Parasite Free Measures	58
4.3l	l) Describe a contingency plan in the event of a disease outbreak or mass mortality event at the hatchery, including management of diseased fish and fish mortalities, and management of hatchery water and solid waste in contact with diseased fish and fish mortalities.	4.3.9 Hatchery Operation – Disease and Mass Mortality Contingency Planning	60
4.3m	m) Clarify the ensilage process and equipment, particularly with respect to managing and disposal of regular mortalities and mortalities due to reportable disease. Describe procedures when both types of mortalities occur simultaneously.	4.3.9 Hatchery Operation - Disease and Mass Mortality Contingency Planning - Ensilage	62
4.3n	n) Describe reporting procedures to be followed in the event of a disease outbreak or a mass mortality event at the hatchery.	4.3.9 Hatchery Operation – Disease and mass Mortality Contingency Planning - Reporting Procedures	63
4.3o	o) Describe proposed treatment of hatchery effluent immediately prior to discharge. Identify industry/regulatory standards for the treatment of hatchery effluent prior to discharge.	4.3.10 Hatchery Operation – Hatchery Sea Water Treatment at Discharge	63
4.3p	p) Describe sludge handling and dewatering process and technology, and characteristics of end product.	4.3.11 Hatchery Operations – Sludge	64
4.3q	q) Indicate whether proposed effluent treatment will be sufficient to inactivate pathogens associated with wild/hatchery lumpfish.	4.3.12 Hatchery Operations – Effectiveness of Effluent Treatment.	65

4.3r	r) Describe effluent testing that will be conducted, including parameters to be analyzed, procedures, frequency of testing, record-keeping and reporting procedures.	4.3.13 Hatchery Operations - Effluent Testing.	65
4.3s	s) Describe the transfer and transport of market ready hatchery fish to clients.	4.3.14 Hatchery Operations-Lumpfish Delivery	67
4.3t	t) Describe the potential of hatchery fish to escape during transfer to well boat, mitigations for prevention, and a contingency plan in the event of a mass escape.	4.3.14 Hatchery Operations-Lumpfish Delivery - Escapes	68
4.3u	u) Include the following plans in the body of the EPR or as Appendices:	4.3.15 Management Plans Appendix III	69
4.3ui	i. Fish Health Management Plan	4.3.15 Management Plans Appendix IIIc	69
4.3uii	ii. Biosecurity Plan	4.3.15 Management Plans Appendix IIIc	69
4.3uiii	iii. Waste Management Plan – The plan must include but shall not be limited to a statement of the maximum volume of waste that may be generated by a disease outbreak, mass mortality or depopulation event; a description of agreements in principle or Memoranda of Understanding with candidate service providers to dispose of hatchery wastes; and confirmation that the candidate service providers have the capacity to handle the maximum volume of waste that may be generated by a disease outbreak, mass mortality or depopulation event.	4.3.15 Management Plans Appendix IIIc	69
4.3uiv	iv. Environmental Protection Plan (outline to be provided in EPR)	. 4.3.15 Management Plans Appendix IIIb	69
4.3uv	v) The environmental assessment Registration document indicates a production level of 3 million fish once the hatchery is at full operation. “Attachment 1: Project Summary Description” states that there is the potential for hatchery production to expand to 5 million lumpfish. The EPR shall clearly state the intended production volume based on the infrastructure, operational processes and environmental mitigations presented, and a commitment to describe any future expansion to this production volume to the minister.	4.3.16 Hatchery Production Capacity	70
5	**5. ALTERNATIVES** . Alternative means of carrying out the project to meet the stated purpose and rationale must be provided. The EPR must identify, describe and evaluate alternative means and locations of carrying out the project, including those alternatives which cost more to build and/or operate but which cause less harmful environmental effects. The following steps for addressing alternative means and locations are recommended: Identify any alternative means and locations to carry out the Project;	5.0 Alternatives	71

	□ Identify the environmental effects of each alternative means and location; □ Identify the **preferred** means and location; □ Provide reasons for the rejection of alternative means and sites.		
5a	Include information from previous project related studies describing alternate locations that were considered, including the expansion of existing sites, reasons for rejection, and reasons supporting the proposed site as the preferred location. Alternative locations shall be clearly outlined on maps of a suitable scale (i.e. 1:50,000, 1:25,000). A discussion of alternatives shall include: a rationale on the use of a flow-through seawater system as opposed to a recirculating seawater system and freshwater aquifer based recirculating system.	5.1 Alternate Locations 5.2 Hatchery Salt Water Supply	73 75
5b	b) the use of other species as cleanerfish and the rationale for the preferred selection.	5.3 Cleanerfish Species	76
5c	**a)** alternative methods of hatchery water treatment and disinfection and the rationale for the preferred method	5.4 Treatment/Disinfection Methods	78
6	**6. POTENTIAL ENVIRONMENTAL EFFECTS and MITIGATION:** Provide detailed information regarding the potential effects of the project on the environment and the proposed mitigation to be used to avoid adverse environmental effects. Potential environmental effects associated with the construction and operation of a lumpfish hatchery facility may include, but are not limited to, the following:	6.0 Potential Environmental Effects and Mitigation	82
6.a	a) Impact on the health of potentially sensitive human receptors immediately adjacent to and near the project boundary. The registration document states that the proposed location was a previous industrial site and that environmental investigations and site remediation have been completed. The EPR shall describe mitigations for potential air quality concerns arising from aerosolization and potential off-site migration of contaminants during site preparation and building refurbishment.	6.1 Air Quality	82
6.b	b) Impacts to wild lumpfish populations. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) has designated lumpfish as “threatened”. The EPR shall clearly indicate how the hatchery project will consider this species’ status and potential impacts to wild lumpfish populations through the harvesting and acquisition of fertile females, eggs and broodstock. The sustainability of this hatchery project, with respect to wild lumpfish populations, shall be clearly described.	6.2 Wild Lumpfish and Broodstock Collection	83
6.c	c) The Registration document states that 4 million eggs will be required to produce 3 million lumpfish. Identify the expected quantities and sources of lumpfish mortality during all stages of hatchery operations.	6.3 Hatchery Lumpfish Mortality Rates	86

6.d	d) Impact of hatchery effluent on the marine environment including potential impacts on wild lumpfish and salmon populations. The EPR shall address any potential for hatchery operations to transmit pathogens to wild populations.	6.4 Hatchery Effluent Effects.	87
6.e	e) Impact to Species at Risk. Identify any Species at Risk in the area that may be impacted by hatchery operations and provide mitigations for protection.	6.5 Species at Risk	89
6.f	f) Potential for proliferation of aquatic invasive species in the area of effluent discharge and measures that will be undertaken to mitigate potential effects.	6.6 Aquatic Invasive Species	91
6.g	g) Impacts to fish and fish habitat in the area of water intake and effluent discharge pipes and measures that will be undertaken to mitigate the effects	6.7 Fish and Fish Habitat	93
6.h	h) Impacts of the environment on the project including the potential effects of ice, water currents and storm surge on intake and outflow lines and measures that will be undertaken to mitigate potential effects. Consideration of local climate change projections shall be included.	6.8 Environment on the Project	95
6.i	i) Impact of chemical waste. Identify the use and disposal of all chemicals associated with hatchery operations which may include therapeutants and anaesthetics.	6.9 Chemical Waste	100
6.j	j) Describe measures that will be undertaken to ensure that hatchery effluent is free of chemotherapeutants prior to discharge, and solid waste is free of chemotherapeutants prior to removal from hatchery.	6.10 Chemotherapeutant Use.	101
6.k	Identify how the project will avoid interference with the rights of other legitimate land owners/users, including but not limited to: k) Impacts to local noise levels due to 24/7 operation of the facility and how public concerns about noise will be addressed.	6.11 Adjacent Properties and Noise	102
6.l	l) Impacts of hatchery infrastructure and operations, including hatchery effluent on recreational fisheries/country food harvesting in Mortier Bay.	6.12 Food Harvesting	103
6.m	m) Potential interferences to navigation in navigable waters due to the placement of intake and outfall lines/shipping interactions with scallop draggers and commercial and recreational fishers.	6.13 Navigable Waters	105
7	**7. DECOMMISSIONING and REHABILITATION:** Describe all aspects of the decommissioning and rehabilitation plans for the project, assuming the eventual need to eliminate the entire project footprint from the landscape	7.0 Decommissioning and Rehabilitation	106
8	**8. PROJECT- RELATED DOCUMENTS**: Provide a bibliography of all project-related documents already generated by or for the proponent (e.g., feasibility study, engineering reports, etc). The EPR shall reference the engineering assessment confirming the structural integrity and weight bearing capacity of the proposed building.	8.0 Project Related Documents	108
9	**9. PUBLIC INFORMATION MEETING:** A Public Information Session will be required in order to:	9.0 Consultation. Appendix V	109

	□ provide information concerning the undertaking to the people or other stakeholders whose environment may be affected by the undertaking; □ record and respond to the concerns of the local community regarding the environmental effects of the undertaking; □ present the information gathered to fulfill the requirements of Section 5 of these guidelines. The Public Information session must adhere to all restrictions to mitigate the impacts of COVID-19 that are in place at the time of the session. Information sessions may be conducted by virtual means through a live streaming, video conferencing or teleconferencing process, such as Facebook Live, Zoom, Microsoft Teams, Skype, Webex, Go To Meeting, and others. You are required to notify the Minister and the public of the scheduled meeting **not fewer than 7 days** before that meeting. Public concerns shall be addressed in a separate section of the EPR. Protocol for these public sessions will comply with Section 10 of the Environmental Assessment Regulations, 2003. Public notification specifications are outlined in Appendix A, and additional measures to notify the public of the information session shall be undertaken, such as the use of twitter and Facebook, notification on the proponent's web site and if permitted, on local community web sites and local community TV channels,		
10	**10. APPROVAL OF THE UNDERTAKING:** a) List the main permits, licences, approvals, and other forms of authorization required for the undertaking, together with the names of the authorities responsible for issuing them (e.g., federal government department, provincial government department, municipal council, etc.).	10.0 Approval of the Undertaking	111
	b) Include a description of any regulatory oversight that may be required by the Canadian Food Inspection Agency if any of the organic waste from the hatchery is intended to be used as/as a component of agricultural fertilizer	10.0 Approval of the Undertaking-Canadian Food Inspection Agency Role	112
	c) Provide verification of approvals from the Department of Service NL for the existing sewage treatment system and outfall.	10.0 Approval of the Undertaking-Existing Approvals	113
	d) Provide verification of approval from the Department of Municipal Affairs and Environment for the existing on-site oily-water separator.	10.0 Approval of the Undertaking-Existing Approvals	113
10	The required 10 copies of the EPR, and an electronic version for posting to the Environmental Assessment website, should be sent together with a covering letter to: Minister Municipal Affairs and Environment P.O. Box 8700 St. John's NL A1B 4J6	Covering Letter	

Appendix II

Drawings and Specifications
for
Environmental Preview Report
for the
Marystown Marbase Cleanerfish Hatchery

Appendix IIa
Existing Infrastructure

2.4.2 Outfit & Stores Building

Use
This building has a variety of purposes; general storage, machine / joinery / pipefitting / electrical shops.

Age
Originally constructed in 1967/68 with newer mezzanine additions

Condition
The Dillon report indicates the building to be in overall good structural condition.

Sections
The Outfit & Stores building consists of a Machine Shop, General Store, Electrical Shop, Joiners Shop and a Pipefitting Shop.

Pictures and floor areas can be found on the following two pages.

Building Description	
Number of Storeys	2
Ground Floor Area	35,318 sf
Second Floor Area	18,583 sf
Clear Height & Area Breakdown	
Foundation	Poured reinforced concrete foundation walls and footings.
Frame	Heavy steel frame construction, with heavy steel crane wails and supports.
Exterior Walls	Pre-painted, vertical metal siding on steel frame.
Roof	Built-up composite on metal roof panels on steel frame over heavy steel trusses.
Cranes	1x 1T crane in the Mezzanine, a 1T crane in the Machine Shop and a 5T crane in the Outfit Shop.

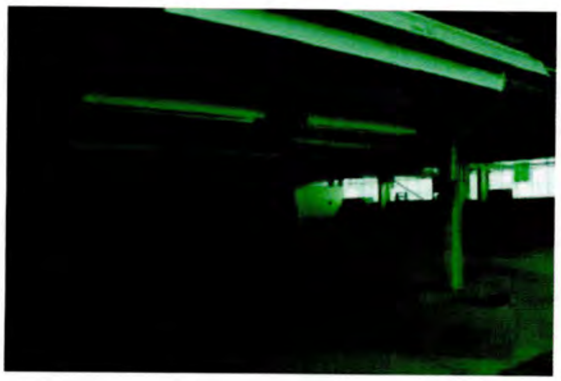
Clear Height & Area Breakdown:

	Height by Section (feet)	Area by Section (sq.ft.)
Outfit	38	12,835
Joiners Shop	15	6,080
General Stores	15	12,160
Machine Shop	23	2,470
Mezzanine	23	15,483
2-Storey Storage	14	1,260
Quonset Hut	14	3,613

Photographs of Subject Building

Outfit and Stores Building Exterior

Outfit and Stores Building Exterior



Outfit and Stores Building Interior

Outfit and Stores Building Interior

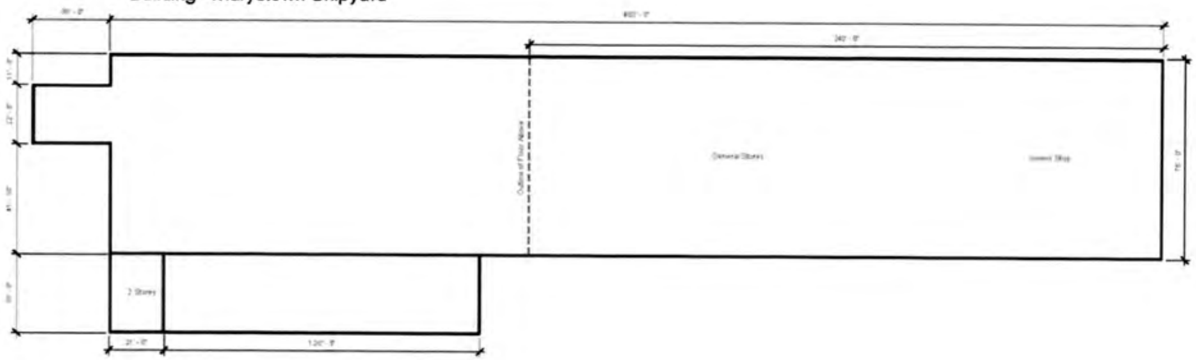
Outfit and Stores Building Interior

Outfit and Stores Building Interior

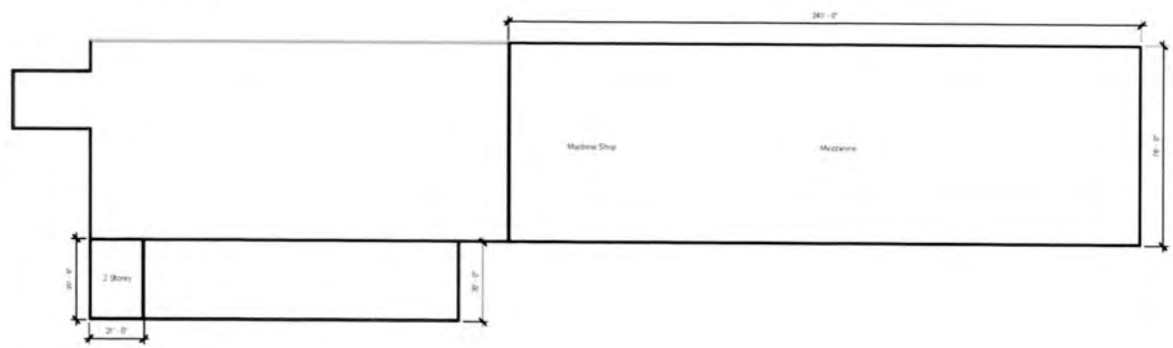
AltusGroup

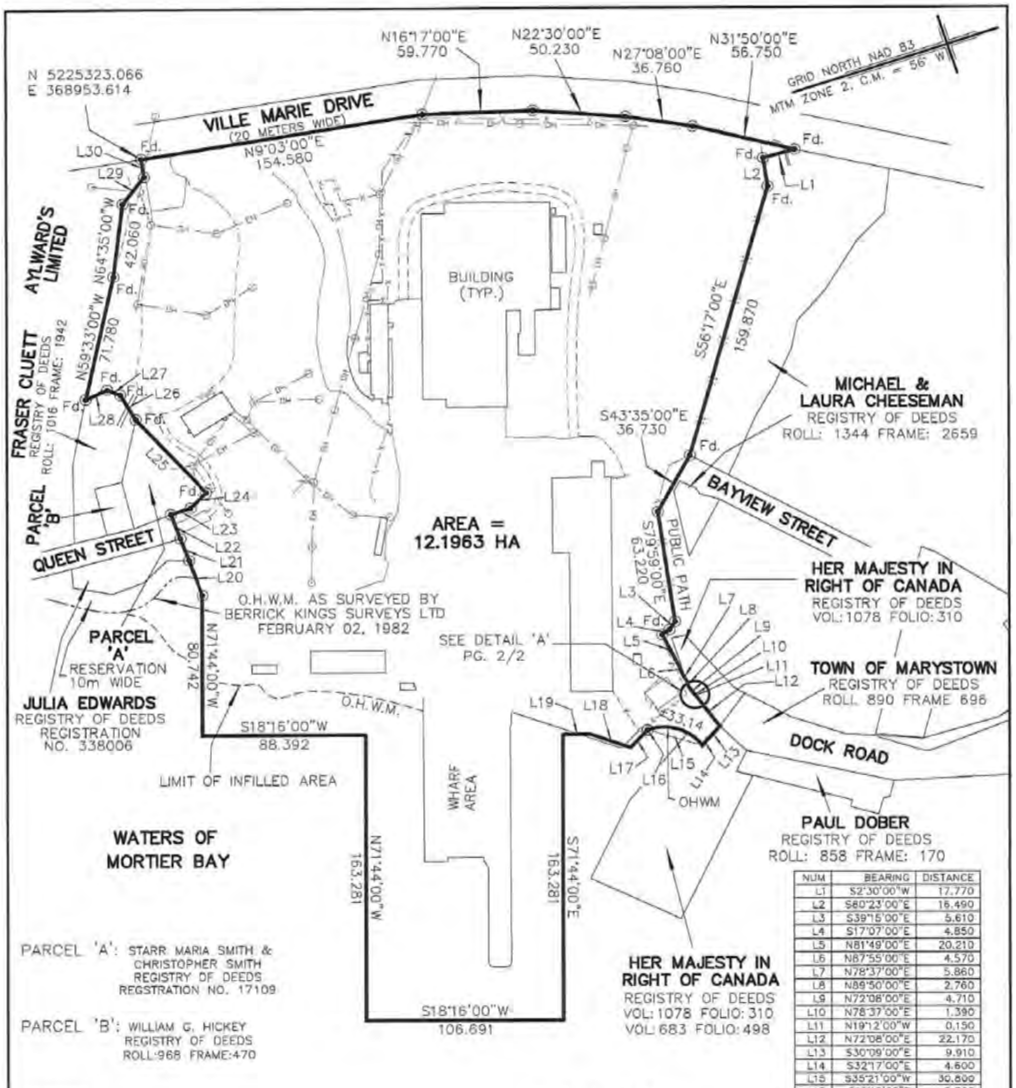
Floor Plan

Ground Level - Outfit & Stores
Building - Marystown Shipyard



Second Level





NUM	BEARING	DISTANCE
L1	S2°30'00"W	17.770
L2	S60°23'00"E	16.490
L3	S39°15'00"E	5.610
L4	S17°07'00"E	4.850
L5	N81°49'00"E	20.210
L6	N87°55'00"E	4.570
L7	N78°37'00"E	5.860
L8	N89°50'00"E	2.760
L9	N72°08'00"E	4.710
L10	N78°37'00"E	1.390
L11	N19°12'00"W	0.150
L12	N72°08'00"E	22.170
L13	S30°09'00"E	9.910
L14	S32°17'00"E	4.600
L15	S35°21'00"W	30.800
L16	S19°12'00"E	0.300
L17	S29°34'00"E	13.560
L18	S38°04'00"W	22.712
L19	S18°16'00"W	15.224
L20	S87°49'00"W	21.117
L21	S87°49'00"W	13.412
L22	S87°49'00"W	14.761
L23	N0°51'00"W	11.340
L24	N26°32'00"W	12.340
L25	S66°03'00"W	57.000
L26	S77°31'00"W	16.490
L27	S40°34'00"W	7.680
L28	S7°07'00"E	12.830
L29	N35°00'00"W	19.510
L30	N79°40'00"W	10.340

NOTES:

ALL DISTANCES ARE METRIC

O.H.W.M. – ORDINARY HIGH WATER MARK AS OBSERVED ON JUNE 22, 2016.

—x— FENCE

⊙ CAPPED IRON BAR

Fd. EXISTING IRON BAR

○ IRON BAR

COORDINATE TABLE
NAD 83 CONTROL SURVEY DATABASE

STATION	NORTHING	EASTING
76G2536	5 224 958.597	368 499.871
95G5023	5 225 133.998	368 727.050

SCALE FACTOR 0.999945

IAN G. EDWARDS
NEWFOUNDLAND LAND SURVEYOR
PROVINCE OF NEWFOUNDLAND

EDWARDS AND ASSOCIATES LTD.
LAND SURVEYING, ENGINEERING, CONSULTING, INFORMATION MANAGEMENT
BOX 158, MARYSTOWN, NF, A0E 2M0, TEL 709-279-1990, FAX 709-279-2185

PROPERTY SURVEY

PETER KIEWIT SONS ULC

MARYSTOWN, NEWFOUNDLAND AND LABRADOR

SCALE: 1:3000	LANDGAZETTE # GQVVQ5	SURVEY BY: I.E.
DATE: JUNE 06, 2016	JOB NO. 6454	PG. 1/2

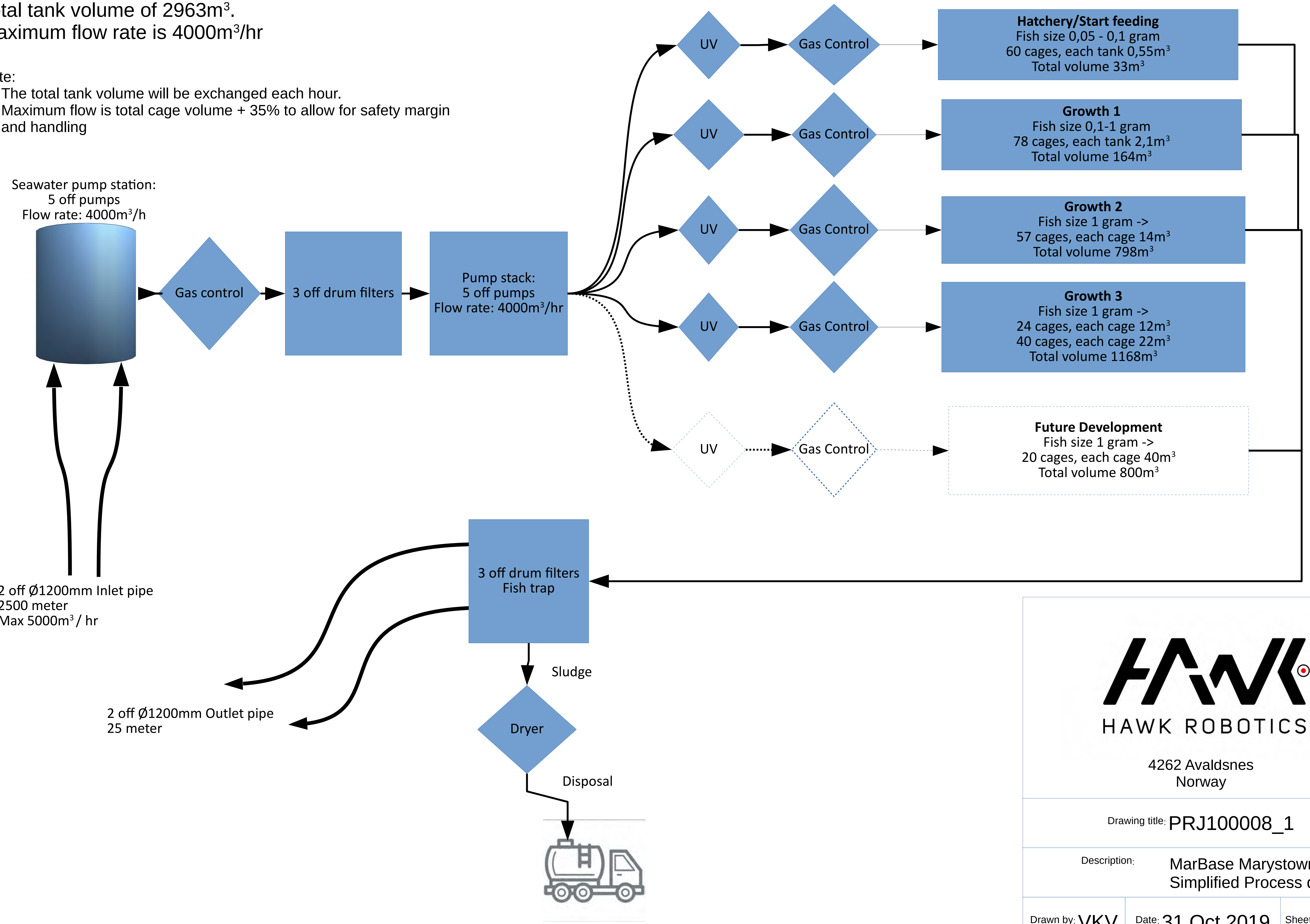
Hatchery Building looking West (Nov. 2020)

Hatchery Building looking North (Nov. 2020)

Appendix IIb
Hatchery

Scaled for 1 500 000 - 3 000 000 individuals.
Total tank volume of 2963m³.
Maximum flow rate is 4000m³/hr

Note:
- The total tank volume will be exchanged each hour.
- Maximum flow is total cage volume + 35% to allow for safety margin and handling



HAWK ROBOTICS

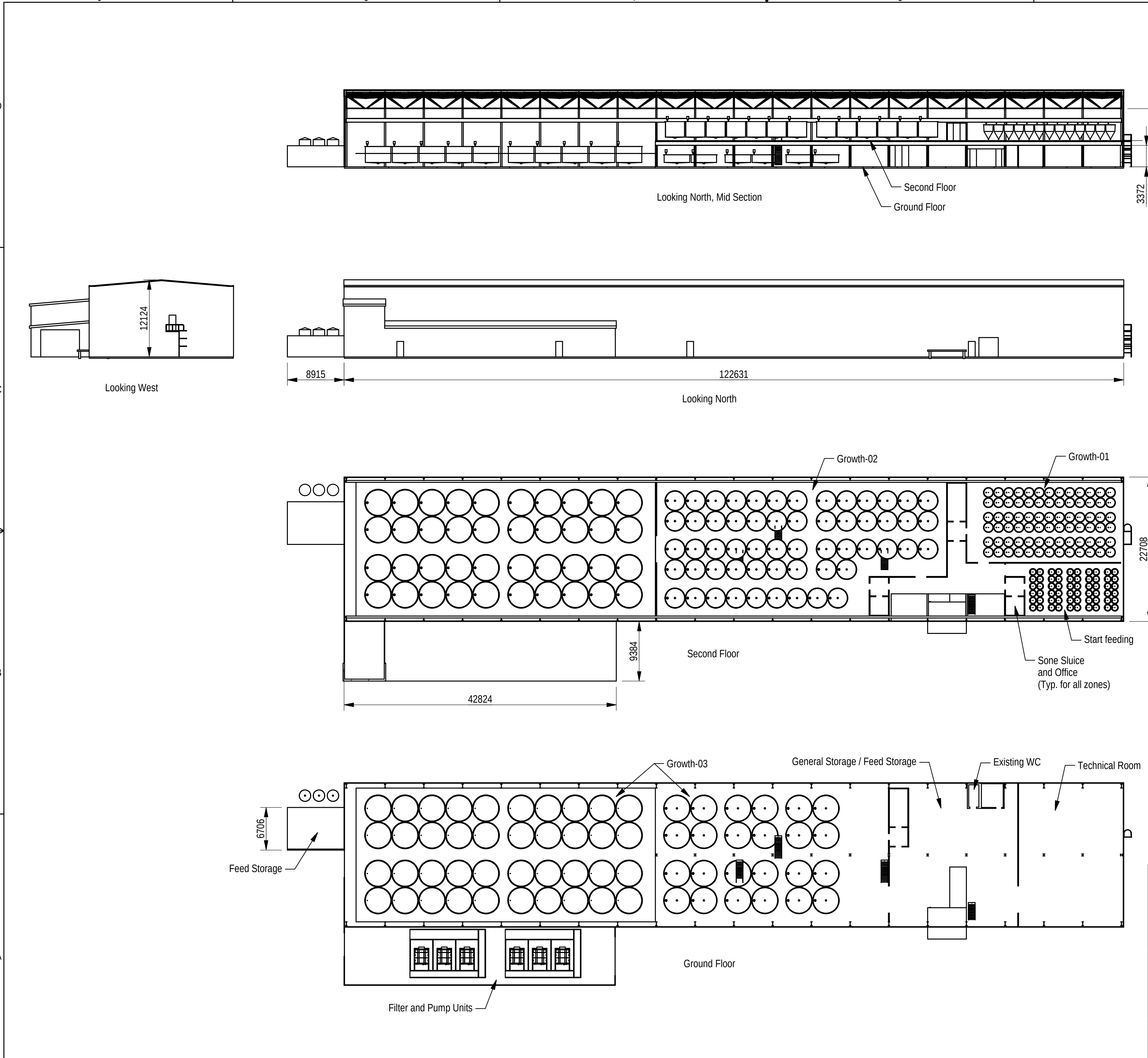
4262 Avaldsnes
Norway

Drawing title: PRJ100008_1

Description: MarBase Marystown
Simplified Process diagram

Drawn by: VKV | Date: 31 Oct 2019 | Sheet: 1 off 1

	Number of tanks	Volume each tank in m3	Total m3
Hatchery/Start feeding	60	0.55	33
Growth 1	78	2.1	163.8
Growth 2	57	14	798
Growth 3	24	12	288
Growth 3	40	22	880
Future Development	20	40	800
		Total	2962.8
	Safety margin %	Total	Max flow rate
	35	2962.8	3999.78

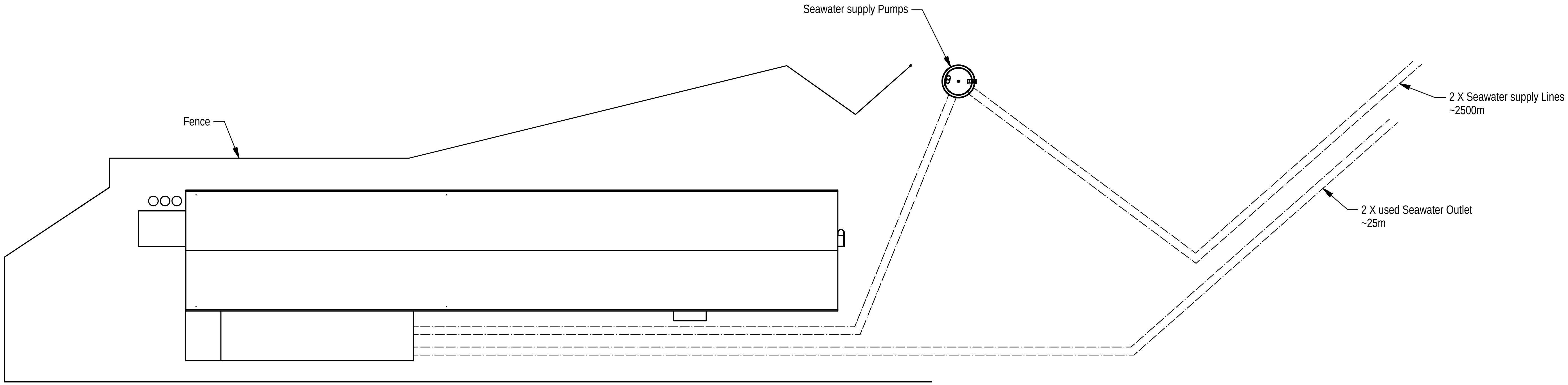


HAWK ROBOTICS	Drawn by FVI 04.11.2019	Checked by	Approved by
	Mass 0,0 kg	State For Comments	

Title
Marbase Marystown - Lumpfish

Description
Plant General Arrangement

Material	Drawing No	Rev	Sheet
	100047	01	1 / 2

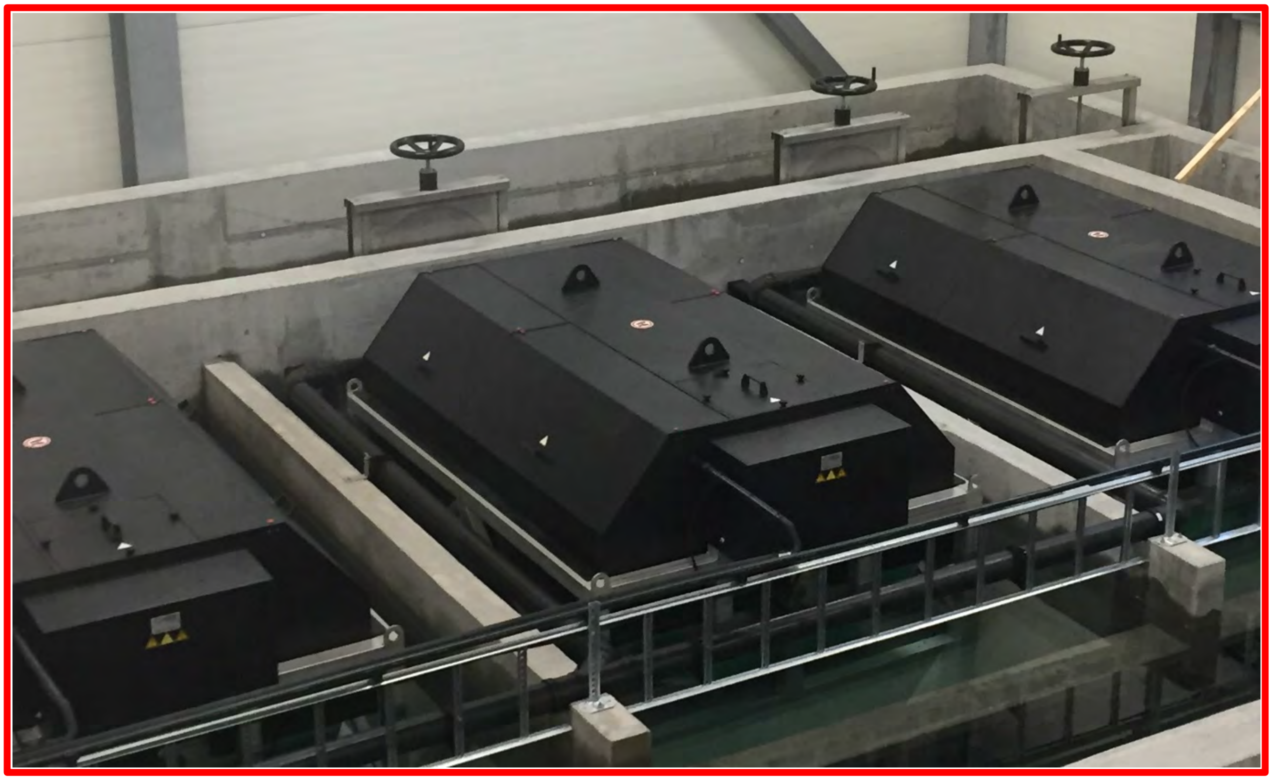


HAWK ROBOTICS	Drawn by FVI 04.11.2019	Checked by	Approved by
		Mass 0,0 kg	State For Comments

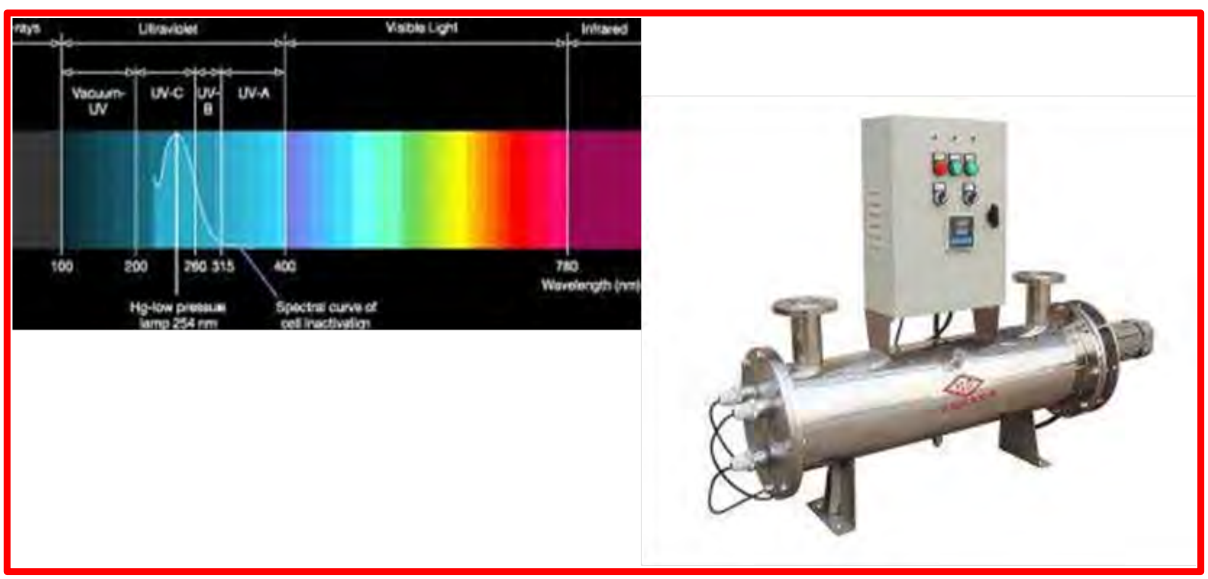
Title
Marbase Marystown - Lumpfish

Description
Plant General Arrangement

Material	Drawing No	Rev	Sheet
	100047	01	2 / 2



Typical Drum Filters for Water Treatment.



Typical Ultra Violet (UV) System for Water Treatment

Appendix IIc
Salt Water Supply

MARYSTOWN MARBASE CLEANERFISH HATCHERY

MARYSTOWN, NL
PROJECT NUMBER 7382

LIST OF DRAWINGS

TITLE SHEET

C1	PLAN AND PRFILE 0+000 TO 1+700
C2	PLAN AND PROFILE 1–700 TO 2+600

MARBASE

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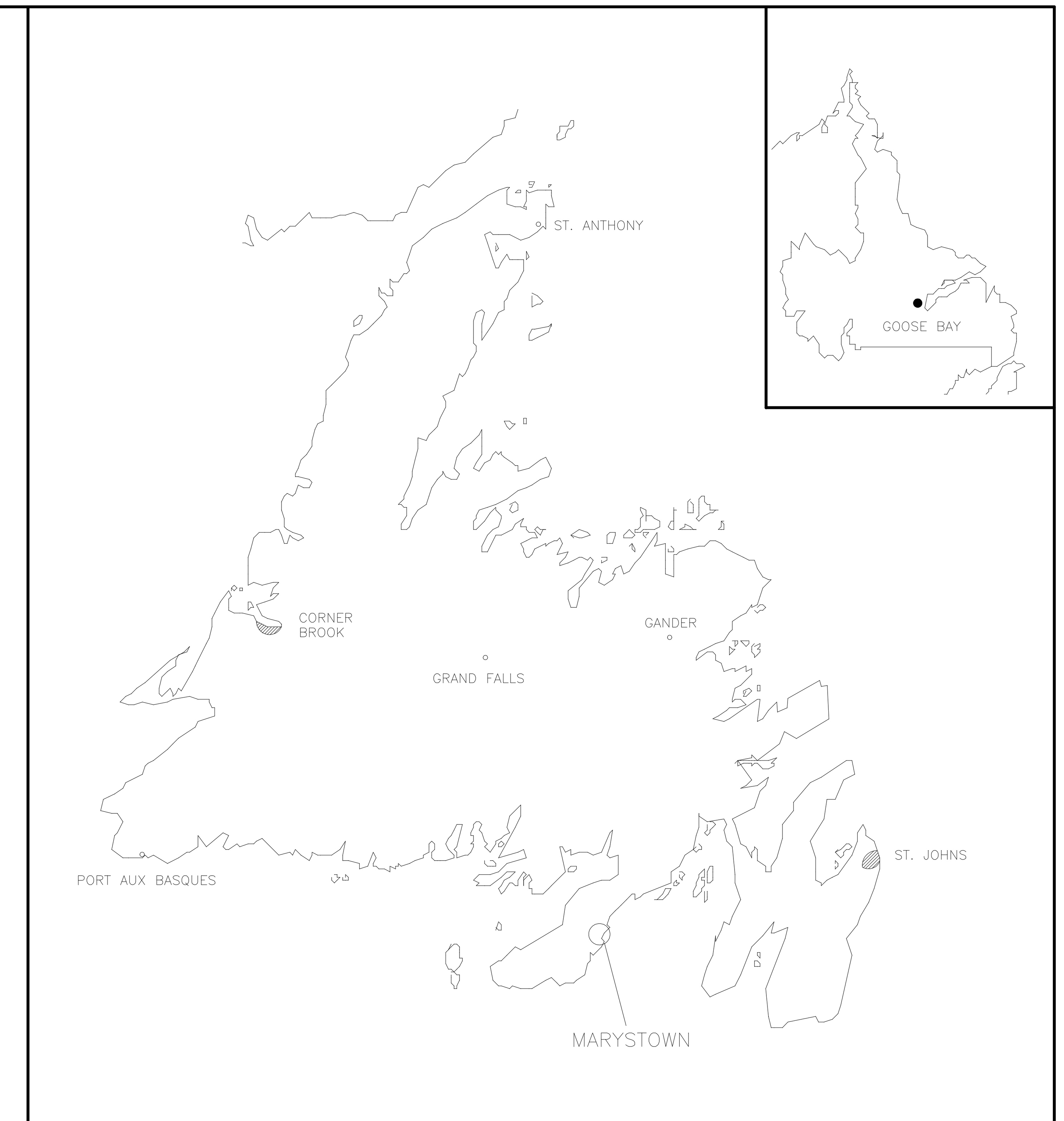

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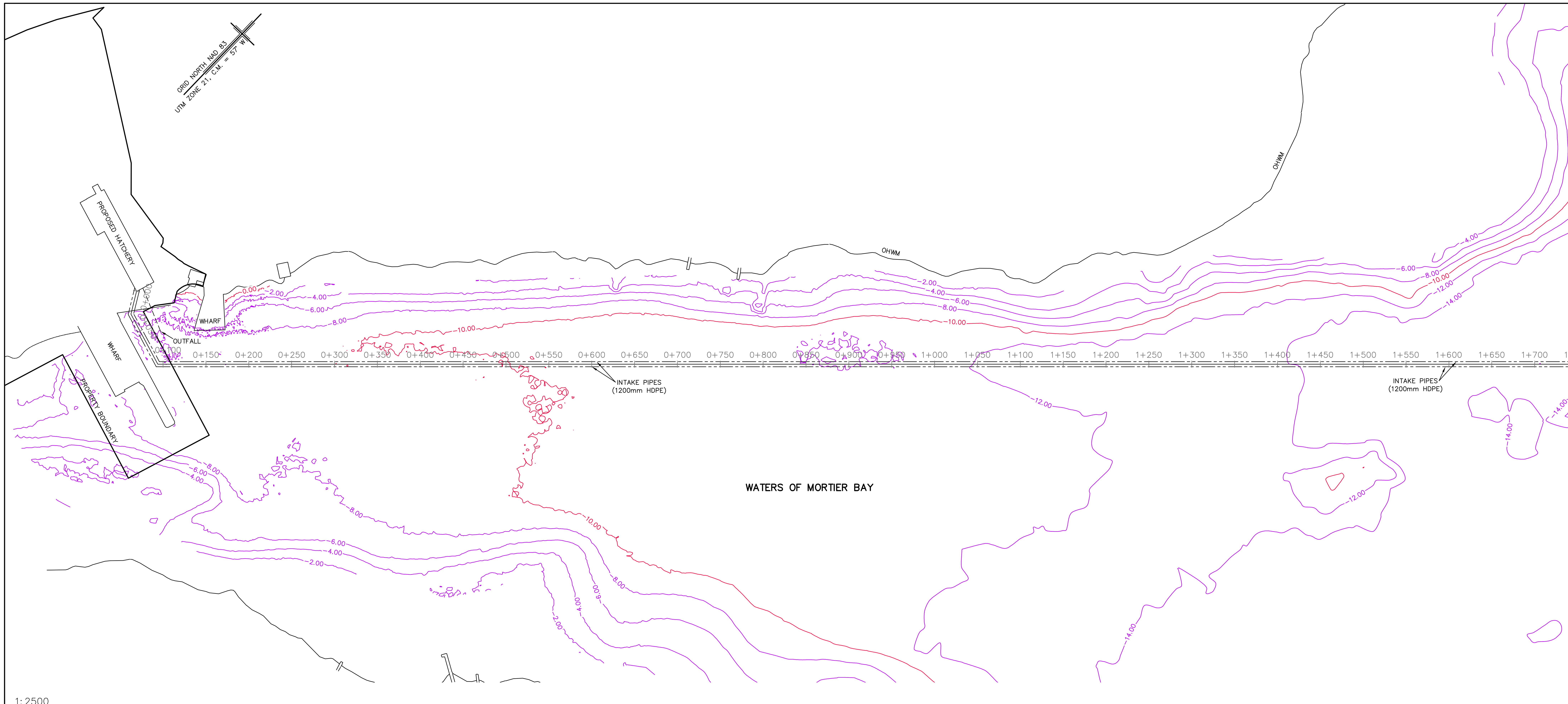
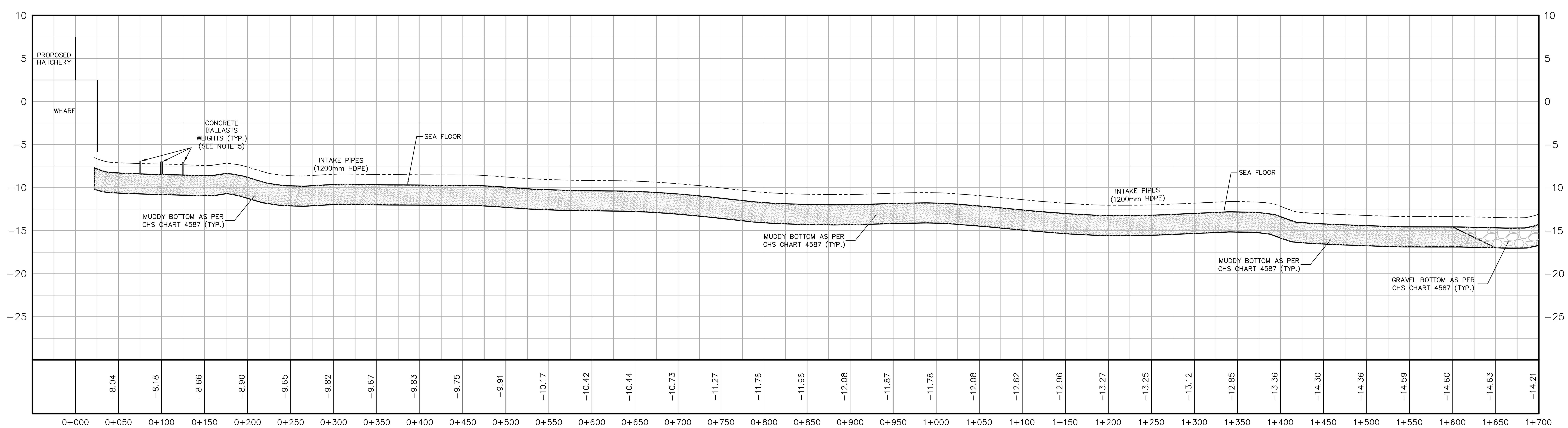


HOR: 1:2500
VERT: 1:250



LEGEND

	MINOR CONTOUR (2 METRES)
	MAJOR CONTOUR (10 METRES)
	PROPOSED INTAKE LINES (APPROXIMATE LOCATION)

NOTES

1. DO NOT SCALE FROM DRAWING.
2. MULTIBEAM DATA PROVIDED BY CANADIAN HYDROGRAPHIC SERVICES.
3. ELEVATIONS REFERENCED TO CHART DATUM.
4. ORDINARY HIGH WATER MARK TAKEN FROM 1:2500 MAPPING. MAP NUMBERS 01M03433, 01M03434, AND 01M03444.
5. BALLAST WEIGHTS TO ANCHOR INTAKE PIPES TO SEA FLOOR. WEIGHT AND SPACING TO BE DETERMINED. BALLASTS REMOVED FROM SOME SECTIONS FOR CLARITY.
6. YELLOW CAUTIONARY BUOY AT CONCRETE HEADWALL TO BE INSTALLED IN ACCORDANCE WITH THE CANADIAN NAVIGABLE WATERS ACT.
7. THESE PLAN NOT INTENDED FOR CONSTRUCTION.
8. LIMITS OF SEA FLOOR SEDIMENTS TAKEN FROM CHS CHART 4587 AND ARE APPROXIMATE ONLY. NO FIELD DATA WAS COLLECTED TO DETERMINE THESE LIMITS.

NO.	DESCRIPTION	DATE	BY
1	ISSUED FOR REVIEW	07/13/2020	I.E.

REVISIONS

A – PLAN,SECTION,ELEVATION,OR DETAIL NO.
B – NO. OF DRAWING WHERE ABOVE IS DRAWN

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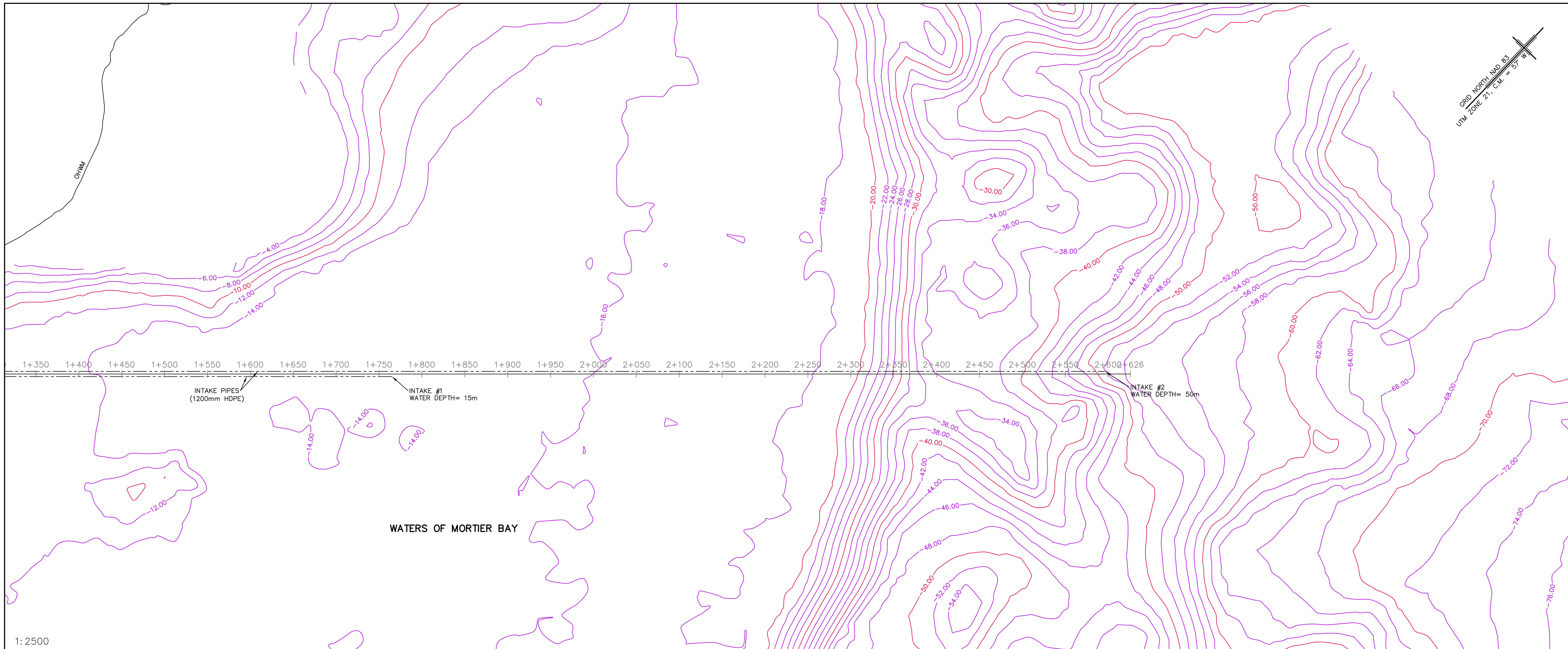
PROJECT

MARBASE CLEANERFISH LTD.
MARYSTOWN, NL

DRAWING

PLAN & PROFILE B
0+000 TO 1+700

DRAWN BY: C.H.	CHECKED BY: R.B.	APPROVED BY: I.E.
	DRAWING FILE: 7382.dwg	EAL PROJECT NO.: 7382
DATE: JULY 13, 2020	SCALE: AS NOTED	DRAWING NO. C1



LEGEND

	MINOR CONTOUR (2 METRES)
	MAJOR CONTOUR (10 METRES)
	PROPOSED INTAKE LINES (APPROXIMATE LOCATION)

NOTES

1. DO NOT SCALE FROM DRAWING.
2. MULTIBEAM DATA PROVIDED BY CANADIAN HYDROGRAPHIC SERVICES.
3. ELEVATIONS REFERENCED TO CHART DATUM.
4. ORDINARY HIGH WATER MARK TAKEN FROM 1:2500 MAPPING. MAP NUMBERS 01M03433, 01M03434, AND 01M03444.
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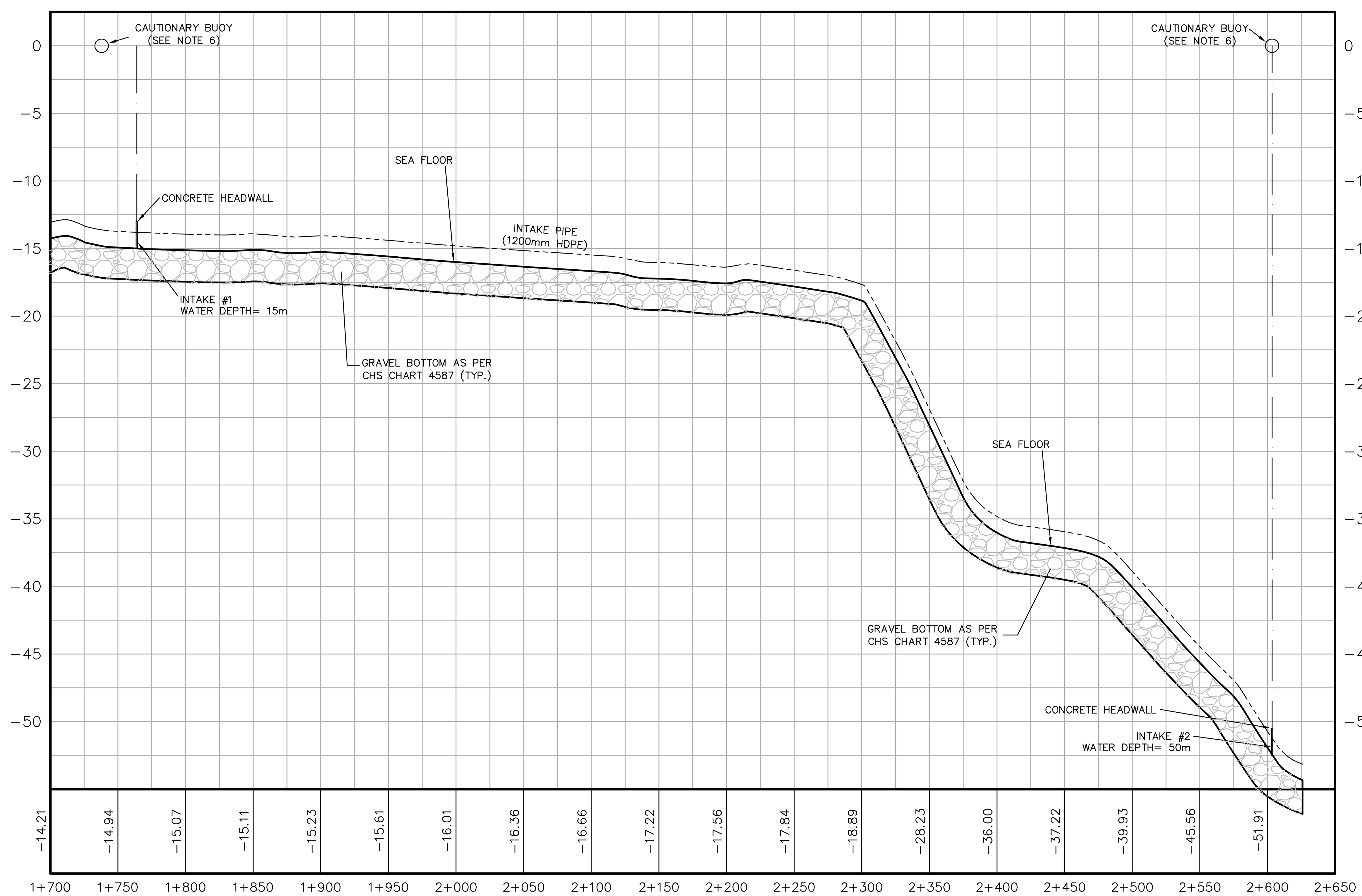
NO.	DESCRIPTION	DATE	BY
1	ISSUED FOR REVIEW	07/13/2020	I.E.

REVISIONS

A – PLAN,SECTION,ELEVATION,OR DETAIL NO.
B – NO. OF DRAWING WHERE ABOVE IS DRAWN

HOR: 1:2500
VERT: 1:250



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TEL: 709-279-1990, FAX 709-279-2185

PROJECT

MARBASE CLEANERFISH LTD.
MARYSTOWN, NL

DRAWING

PLAN & PROFILE B
1+700 TO 2+600

DRAWN BY: C.H.	CHECKED BY: R.B.	APPROVED BY: I.E.
	DRAWING FILE: 7382.dwg	EAL PROJECT NO.: 7382
DATE: JULY 13, 2020	SCALE: AS NOTED	DRAWING NO. C2

Appendix III

Environmental Management

Appendix IIIa

Marbase Environmental Management Framework

1. Marbase Cleanerfish Ltd. Environmental Management

Environmental management is necessary to help minimize environmental effects, track environmental performance, and advance long-term environmental sustainability.

Effective environmental management requires a shared commitment to the principles of sustainable development, pollution prevention, environmental protection and enhancement, and due diligence. Marbase is accountable for sound environmental stewardship through continuous measurement that demonstrates performance improvement.

Marbase operational policies and procedures, including its Environmental Management Framework, seek to avoid or reduce negative environmental effects, track environmental performance, promote sustainable practices and set out requirements for environmental incident reporting for employees.

Marbase provides all employees with education and training on environmental policies, procedures and practices to enable them to work with respect for the environment and their community.

While complying with applicable environmental legislation, regulations and policies, Marbase applies industry best practices for sound environmental stewardship and recognizes the environmental effect of individual and corporate activities.

Environmental performance is measured by comparing environmental management achievements against environmental policy and, more specifically, the associated environmental management objectives and targets.

2. Vision and Policy

The Marbase vision is encompassed by the following statements:

- Marbase will be a successful enterprise and a corporate leader in effective environmental management.
- Marbase presence in the Province will be valued in the community.

The following is the Marbase Corporate Environmental Management Policy.

Marbase Cleanerfish Ltd. is committed to environmental protection and sustainability as it endeavours to carry out its operations in an environmentally responsible manner.

This commitment is three-fold:

- *Marbase contributes to environmental sustainability by reducing greenhouse gas emissions, solid and hazardous waste, and energy consumption.*
- *Marbase management strives to improve the organization's day-to-day environmental performance in the areas of water quality treatment, use of consumables and production of waste, and energy efficiency. To this end, Marbase incorporates environmental values into its purchasing decisions and contractor selection.*
- *Marbase employees have a shared commitment to incorporate into business practices the principles of sustainable development, pollution prevention, environmental protection and enhancement, and due diligence.*

3. Environmental Management Framework

Marbase has established an Environmental Management Framework (EMF) to guide the implementation of its Environmental Management Policy.

This EMF is intended to achieve the following benefits through its implementation:

- avoided or reduced negative environmental effects
- pro-active rather than re-active environmental and community management planning and control
- facilitation of continuous improvement
- improved operational structure and efficiency with regard to environment management
- foster good relations with the community and stakeholders
- achieve a level of environmental performance that goes beyond compliance with applicable laws
- effective management of environmental risks
- efficient use of resources

The EMF and associated management plans are ***Life Of Project*** endeavours. They apply from the onset of construction, throughout operations and eventually during closure phases of the Project. The key elements of the framework are illustrated in Figure ?.1.

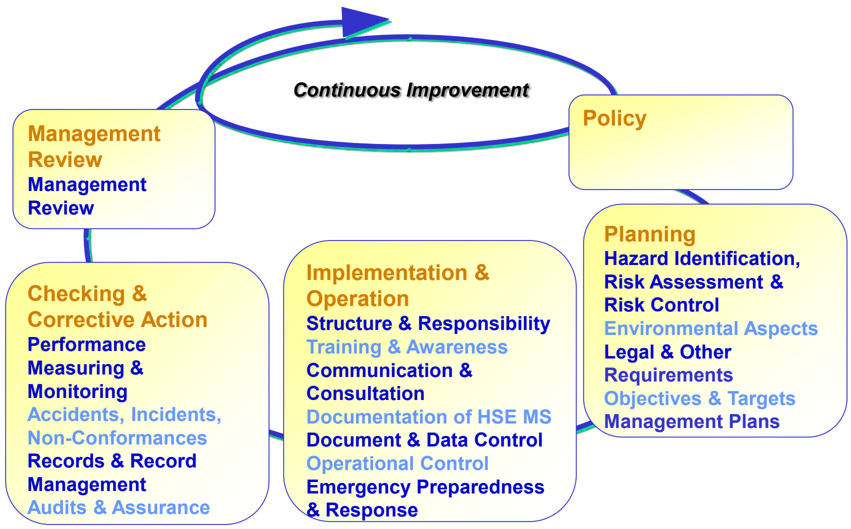


Figure ?.1 Relationships between the core principles and the elements of an effective EHS Management Framework

The Marbase approach follows the sequence of "***Policy – Planning – Implementation and Operation – Checking and Corrective Actions – Management Review Process***" that must be in place to ensure that the Project is executed in an environmentally and socially acceptable manner, consistent with a **continuous improvement cycle** and employing adaptive management principles.

3.1 Roles and Responsibilities

The Chief Executive Officer of Marbase is responsible for obtaining an annual written statement of assurance regarding the degree of implementation and effectiveness of the Marbase EHS Management System.

The Operations Manager is responsible for the EHS performance, the implementation of the EHS Management System, the maintenance of the EHS Management System, and for providing an annual statement of assurance to the Chief Executive Officer.

The HSEQ Officer will have prime responsibility for health, safety, and environmental duties including: provision of advice to management in meeting their EHS Management System responsibilities; development and implementation of a program for awareness, training and competency validation for staff; and Plan maintenance and performance documentation.

Employees will comply with all EHS rules and regulations, and promptly report any Health, Safety and Environmental incidents. Employees will follow all Operational Controls. The public will provide input on EHS management plans through public meetings. All citizens will be able to access the Marbase Policy on Sustainability.

3.2 Resources

Marbase will implement and maintain the EHS Management System by providing the necessary human, material and financial resources.

3.3 Planning

Planning encompasses a series of actions leading to development of management plans for selected environmental aspects. As part of the preparatory work associated with the Project, Marbase will conduct a Hazard Identification exercise for its planned operational activities. As reflected in the Project Registration, the company has identified the suite of legal and other regulatory requirements associated with the proposed undertaking. For each environmental aspect, manageable objectives and targets are being developed as a means to measure progress and success in implementation of specific management plans.

By initiating environmental, health and safety practices early in the Project life cycle, Marbase has been able to avoid many potentially adverse effects through the “designed in mitigation” approach.

Measures identified through this approach, include:

- appropriate water quality standards and treatment methods;
- biosecurity measures that address disease vectors as well as AIS prevention measures;
- allowance for climate changes (marine water levels) in aspects such as wharf face design and construction;

- using state-of-the-art equipment with well maintained exhaust emission controls to reduce GHG emissions during the relatively brief construction period;
- development and application of a Diversity Plan for personnel hiring, training and promotion; and
- implementing energy efficiency measures into the building refurbishment.

3.3.1 Management Plans

Marbase is developing a suite of Management Plans to address identified environmental issues and concerns. Each plan will follow a similar format as a means to ensure completeness and consistency. Table 3.3.1 provides a listing of Marbase Plan standard components with a description of the required contents for each section. Individual plans may vary depending both on the selected topic, but also to address external requirements (e.g. regulatory permit conditions, industry standards).

Table 3.3.1 Marbase Management Plan Format

#	Title	Description
1	Cover Page - Document Identification	a. Document title b. Corporate Identification (Owner of the document) c. Project Phase, Activity d. Affected Facility/Location e. Effective date
2	Document Control	a. Approval Page- name, title signature of persons responsible for I. Document development II. Document approval III. Document implementation b. Documentation Record of Updates and Amendments c. Document Distribution list
3	Table of Contents	Provide listing of sections of the plan. Paginate by section (1-1, 2-1 etc.) to facilitate updates.
4	Introduction	a. Describe the rationale for generating this document. b. Identify relevant Environmental Aspects and anticipated Interactions c. Identify how the document is to be communicated to users, and results reported to relevant stakeholders.
5	Legal	a. Identification of applicable legislation and regulations, as well as permits and approvals. b. Identify reporting and compliance conditions associated with permits and approvals.
6	Scope	Describe the scope for the plan, including: a. The subject matter (environmental aspect) addressed by the document

		b. relationship to other plans, c. potential overlap/redundancy and how this is addressed/resolved. d. The relationship if the plan to employees, contractors and other entities.
7	Objectives	a. Describe the planned outcome of the plan, including long term Goal as well as interim Objectives and achievable Targets. b. Performance targets will comply (and where possible exceed) regulatory limits.
8	Roles and Responsibilities	Identify personnel responsibilities and reporting relationships for: a. monitoring, b. measuring, c. observing, d. acting (incident response) , e. reporting, f. evaluating and g. approval.
9	Monitoring and Reporting	Identify: a. the parameters to be measured; b. the methods and procedures to employ; c. the means of documentation; d. The frequency of measurement; e. the contents of reports; f. Regulatory requirements for measurement and reporting; and g. Plan review procedures and participation.
10	Training	a. Identify required training by task and role. b. Identify orientation requirements for Project employees, site visitors, material and service contractors. c. Describe method for records maintenance of training and qualification (append relevant records).
11	Emergency Contacts and Procedures	a. Provide contact information for internal (Marbase) reporting, as well as incident reporting (e.g. HSE emergencies. b. Include reporting forms to utilize in addressing emergencies.
12	Auditing	Identify audit procedures and provisions to facilitate task completion by internal audit team.
13	Plan Review and Updating	Describe procedures for participating in plan review, and for submitting suggestions for changes, improvements and updating.
	Appendices	As required to supplement plan documentation. All appendices need to be referenced in the main document.

3.4 Implementation

At the current Project phase (Planning and Approval), and based on extensive consultation with Aquaculture Division as well as other regulators and resources, the suite of management plans identified to date is listed in Table ?.2 These plans, and others to be developed as and when a need is identified, will be implemented in all Project phases including construction, operations and ultimate closure.

The prime regulator with respect Marbase aquaculture operations will be the Aquaculture Division, Department of Fisheries and Land Resources. Marbase has relied on the guidance documents produced by the Aquaculture Division in developing its Environmental Management System, The available guidance documents include:

1. Aquaculture Policy and Procedures Manual, Fisheries and Land Resources, Government of Newfoundland and Labrador; September 20, 2019. 136 pages. Contains a series of policy statements (AP1 to AP 46)
2. Applicant Guidance Document - Environmental Information Reviews. Sept 2019.
3. Cleanerfish Surveillance Plan, n.d. issued by Fisheries and Land Resources, Government of Newfoundland and Labrador.
4. Aquatic Animal Reportable and Notifiable Diseases. n.d. Two lists of disease /vectors.(refers to NL-FLR Aquatic Animal Disease Contingency Plan)
5. Sea Lice Integrated Pest Management Plan 11/04/2019 (applies to sea cage operations).
6. Annual Aquatic Animal Health Report – Finfish - a report form, no date.

The Application Process for an Aquaculture Permit is exhaustive. Table 3.4.1 provides a summary of the required plans as laid out in the Aquaculture Policy and Procedures Manual. The plans that will be required to be developed by Marbase in its Aquaculture Permit Application are shown as **bold** in Column two.

Table 3.4.1 Summary of Plans Required for Aquaculture Application – Government of Newfoundland and Labrador			
#	**Plan Title**	**Reference**	**Notes**
1	**Business Plan.**	#1 – P&P Manual – AP2, AP 4	Specific information requirements listed (p. 10). Includes reference to several component plans. See also Project Plan, Aquatic Animal Health Requirements, Environmental Requirements, Also referred to as Business Plan/Development Plan (AP 4 Item 2, p.24).
2	**Project Plan**	#1 – P&P Manual AP2 See p.13.	Specific information requirements listed, including reference to several "plans" similar to listing for Business Plan.
3	**Environmental and Waste Management Plan**	#1 -P&P Manual. AP2 + Environmental Requirements AP 7 Annual Reporting, Item 1e AP 16 Feedbag Handling	*"information included in each plan may differ*". Calls for construction and operations plans " *related to environment and waste management".* Refers to the departments *"Environmental Guidance Documen*t" (# 6). The guidance text is focused on sea cage operations. Annual reporting required (AP 7). AP 17 provides Specific requirements for handling of feedbags.
		#1-P&P Manual AP23 Fish Disposal	*"All farms will have a Fish Disposal Plan, outlined in a Waste Management Plan"*
4	**Incident Management System Plan.**	#1 - P&P Manual AP2, also AP4 (p.24).	Requires "*plans related to Incident Management*"
5	**Production Plan**	#1 P&P Manual – AP2 - Business Plan 2, bullet 8	*A Production Plan specific to proposed species that may include month and year of stocking, number of fish to be stocked, grow-out period, average weight at introduction and harvest, anticipated losses, feed conversion ratios, final production quantity and fallow schedule, total number of collectors and socks deployed.*
6	Dive Inspections plan – finfish operations	#1 P&P Manual – Business Plan 2, bullet 9	*A plan related to below surface (dive inspections) inspections to be conducted and recorded every 30 days for finfish operations;* (NA?)
7	Aquatic Animal Disease Contingency Plan	#1 -P&P Manual AP 33.	Refers to two contingency plans in place with AAHD and requires compliance by permit holders. Requires preparation of SOPs in the event a Quarantine Order and/or a Depopulation Order is issued by the Department.
8	Veterinarian Oversight Statement	#1 P&P Manual – Business Plan 2, bullet 10	*A statement outlining how veterinary oversight will be accomplished and the Designated Veterinarian (e.g. private veterinarian, company veterinarian, etc.);*
9	**Fish Health Management Plan**	#1 P&P Manual – Business Plan AP 2, bullet 11 ; Aquatic Animal Health Requirements (p.12). Also AP4	*A Fish Health Management Plan, which is to include* • *a Biosecurity Plan,* • *Integrated Pest Management Plan, and* • *Fish Disposal Plan.*
10	**Biosecurity Plan**	#1 P&P Manual AP 4, AP 35, AP36, AP 37	Requires each operator to have a Biosecurity Plan in place and compliant with the government's Aquatic Animal Health Division (AAHD) Biosecurity Audit Plan. AP 36 makes provision for motor vehicles and trailers to be subject to the Biosecurity Audit Plan. AP 37 makes provision for aquaculture equipment to be subject to the Biosecurity Audit Plan.

11	**Integrated Pest Management Plan**	#1 P&P Manual AP 4, AP 25; AP 40	AP 25 Species Separation allows for the use of Cleanerfish. AP 40 addresses Integrated Pest Management Plans (IPMPs) including Sea Lice Management Plans. Each licensee must have a pest specific IPMP implemented and monitored by the company veterinarian.
12	**Fish Disposal Plan**	P&P Manual AP 4, AP 23 Fish Disposal Plan	"*All farms will have a Fish Disposal Plan, outlined in a Waste Management Plan*" A table of contents is provided in AP-23.
13	Sea Lice Abundance Reporting	#1 P&P Manual – Business Plan 2, bullet 12	*As of January 1, 2021, sea lice abundance numbers must be reported to the department on a monthly basis and the operator must post sea lice abundance numbers publicly, on a monthly basis, on the industry association or corporate website. Further details as to sea lice reporting parameters will be determined through stakeholder engagement, prior to this date;*
14	Mitigation Measures	#1 P&P Manual – Business Plan 2, bullet 13	To prevent mortality events Prior to October 2020, mitigation measures must be implemented to prevent mortality events. Mitigation measures must be approved by Fisheries and Land Resources
15	Biophysical Data	#1 P&P Manual – Business Plan 2, bullet 14	DO, temperature, salinity – presumably for sea cage operations. *Submission of biophysical data to include, but not limited to, dissolved oxygen, temperature and salinity at different depths at all active aquaculture marine sites daily. Submission of this data must occur quarterly to the Aquaculture Development and Aquatic Animal Health Divisions of the Department of Fisheries and Land Resources*
16	Aquatic Animal Health Division (AAHD) Contingency Plan	#1 P&P Manual AP 33	Implemented by the Department; Permit holders are required to comply with the Plan.
17	Aquatic Animal Health Division (AAHD) Surveillance Plan	#1 P&P Manual AP 34	Implemented by the Department; Permit holders are required to comply with the Plan.

The organization of the required plans applicable to the Marbase Cleanerfish Hatchery Project are summarized in Table 3.4.2 below. Each of the indicated documents has been prepared to at least a full draft stage, subject to internal and/or external/regulatory review.

Implementation of each plan will include training and orientation for assigned tasks and responsibilities. Briefings will be arranged to familiarize all staff with the Marbase EHS Management System, and workshops used to familiarize staff with monitoring and documentation requirements.

Table 3.4.2 Marbase Environmental Management Plans			
#	**Plan Title**	**Components**	**Table ?.2 Reference**
1	Fish Health	a. Hatchery Management b. Fish Health Surveillance c. Emergency Measures (see 5) d. Mass Mortality Management (see 3 d.) e. Integrated Pest Management Plan	9, 11
2	Biosecurity	a. Pest Management (see 1e) b. Feed Storage c. Lumpfish Welfare d. Mortality Handling, Storage and Disposal (see 3d) e. Cleaning	9. 10
3	Waste Management	a. Organics b. Bulk material c. Hazardous materials d. Fish Disposal (see 1d)	3, 9, 12
4	Environmental Protection	a. Construction b. Operation	
5	Emergency Preparedness	a. Contingency Plans (see 1c) b. Mass Mortality Management (see 1d) c. SOP for Quarantine Order, Depopulation Order d. Incident Management System Plan	4, 7, 16, 17

3.5 Checking and Corrective Action

Continuous Improvement follows the "Plan, Do, Check, Act" cycle. The Check phase involves an evaluation of performance to confirm the effectiveness of management plans. This is achieved through a process of monitoring performance and measuring performance against the environmental performance objectives and targets set within each plan. In all cases performance targets are made with awareness of regulated standards. Where possible, internal performance standards are set well within regulatory requirements. In that manner, corrective action can be taken in advance of any compliance failure.

In all cases where there is an incident or performance failure (e.g. material spill), a review will be conducted to discuss lessons learned and identify opportunities for improvement. This review will form the basis of implementing corrective action to reduce the likelihood of future system failures.

3.6 Management Reviews and Assurance

It is important that senior management regularly review the EHS Management System as well as individual plans to determine their continued suitability, adequacy and effectiveness.

Marbase will conduct internal audits to determine the degree of success in implementation of its EHS Management System, and to verify the level of performance within individual management plans.

At least once a year, Marbase Management will conduct a formal review to assess corporate environmental, health and safety performance and to reconfirm their commitment to the Marbase Sustainable Development Policy.

Appendix IIIb

Marbase Environmental Protection Plan Outline

Marbase Cleanerfish Ltd.

Project Environmental Protection Plan

Annotated Outline

Preface

Distribution List – *Documents approved recipients of the EPP*

Maintenance of the EPP – Provides a record of d*ocuments changes made by date and source.*

Revision Request Initiation Form- *Any user is encouraged to submit suggestions for changes and improvements to the EPP. A form is provided to assist those providing suggestions.*

Revision Control Record – Identifies and r*ecords changes by date, source, and indicates approval of changed text.*

1.0 Introduction

1.1 Environmental Health and Safety Management System – *describes the Marbase Cleanerfish Ltd. policy on EH&S.*

1.1.1 Roles and Responsibilities- *Describes the management responsibility and accountability for implementation of EH&S policy*

1.2 Purpose of the EPP –

Describes the EPP as a stand-alone document that targets the responsible company staff including front line workers, occupational health and safety staff, environmental staff. The role of the document with respect to government environmental surveillance staff is also referenced.
The scope of the EPP is designated as addressing specific project phases - construction and operation and maintenance.

1.3 Owners Policy –

Establishes a link between the EPP and the corporate policy on Sustainability.

1.4 Organization of the EPP

Provides an overview of the sections of the document, and instructions for users.

Describes the contents of the EPP, including:

- *proponent's environmental policies;*
- *environmental compliance monitoring;*
- *environmental protection measures;*
- *mitigation measures;*
- *permit application and approval planning;*
- *contingency planning for accidental and unplanned events;*
- *statutory requirements; and*
- *revision procedures and contact lists.*

1.5 Development and Implementation of the EPP

Provides advice on the use of the EPP as a guide to taking appropriate environmental protection actions, and points out the series of task-specific Protection Measures.

1.5.1 Site Specific Approach to EPP Development

Describes the geographic- specific information that is utilized to direct EPP actions at each specified site.

1.6 Environmental Orientation

Describes the employee orientation that is to be provided to all new employees as part of their orientation.

1.7 Project Description

Provides a brief overview summary of the scope of the project, with a focus on the activities carried out to produce and market a quality product.

2.0 Environmental Concerns

2.1 Construction Activity Environmental Concerns

Lists the environmental interactions associated with this Project Phase, and the potential for unplanned events that could produce negative environmental effects.

2.2 Operation and Maintenance Environmental Concerns

Lists the environmental interactions associated with this Project Phase, and the potential for unplanned events that could produce negative environmental effects.

3.0 Environmental Protection Procedures

3.1 Introduction

Describes the template to be applied in describing the required measures to be employed with respect to identifiable Project activities.

3.2 Storage, Transportation, Transfer,Handling and Disposal of Fuel and Other Hazardous Substances

3.3 Storage, Transportation, Handling and Dispensing of Fish Feed

3.4 Sewage Sludge Disposal

3.5 Storage, Transportation, Handling and Disposal of Solid Waste

3.6 Equipment Use and Maintenance

3.7 Noise Control

3.8 Dust Control

3.15 Protection of the Marine Environment

3.16 Water Quality Monitoring

3.17 Pumps and Generators

3.18 Marine Traffic

3.19 Vehicular Traffic

3.20 Concrete Handling and Placing

3.21 Storage, Handling and Dispensing of Therapeutants

3.22 Storage, Transport, Handling and Disposal of Silage

3.23 Storage, Handling and Disposal of Mortalities

4.0 Contingency Plans

4.1 Introduction

Identifies the plans applicable to unplanned events, their inter-relationship, and where each is located/accessible.

4.2 Fuel or Hazardous Material Spills

refer to separate Plan

4.3 Fires and Explosions

Refers to Emergency Response Plan

4.4 Extreme Weather Events

R*efers to Emergency Response Plan*

Flooding

Ice

Wind/Waves

5.0 Legislation, Permits and Authorizations

L*ists all relevant rules and regulations, as well as required permits and authorizations.*

5.1 Legislation

5.2 Permits and Authorizations

Refers to an Appendix which holds copies of all permits and authorizations, as well as terms and conditions and compliance records.

6.0 Contact List

Provides a listing of corporate personnel, contractors, external resources, regulators, emergency contacts, and other advisory resources.

6.1 Emergency Numbers

6.2 Advisory and Other Contact Numbers

7.0 Resource Material

7.1 Key Reference Material

Identifies and, as appropriate includes as appendices, various guidelines and resource material relevant to environmental protection measures, mitigation and monitoring.

8.0 Site Specific Environmental Protection Plan

Describes site-specific conditions, available resources, and relevant site activities to which EPP measures can apply.

8.1 Environmental Issues

8.2 Environmental Protection Procedures

8.3 Relevant Documents

8.4 Permits, Approvals and Authorizations

8.5 Compliance Monitoring Requirements

Appendices

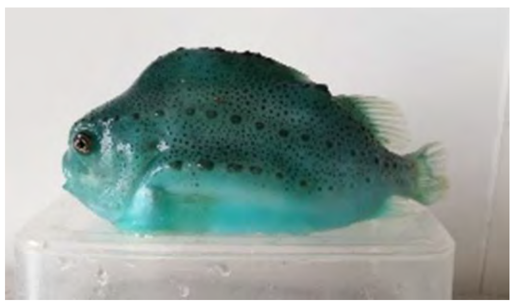
Includes a variety of resource material as identified in construction of the EPP including – permits and conditions, contact lists, advisory resources, emergency contacts, relevant literature,

Appendix IIIc

Aquaculture Application Plans

(i) Biosecurity Plan
(ii) Waste Management Plan
(iii) Fish Health Management Plan

Marbase Cleanerfish Ltd (*MCF*)
BIOSECURITY PLAN



Biosecurity is part of our Business Culture

Table of Contents

1.0 BIOSECURITY

Biosecurity is defined as a management practices that prevent non-infected, healthy animal populations from being exposed to infectious or parasitic agents. Canadian Food Inspection Agency (CFIA) states, "Biosecurity is the process of taking precautions to minimize the risk of introduction and spread of infectious organisms into or between populations."

Disease causing organisms are often spread by vectors, such as people or equipment. If these vectors are properly disinfected as critical control points then exposure to disease causing organisms will be greatly reduced.

MCF abides by regulations set forth by The Department of Fisheries and Oceans, Canada (DFO) and the Provincial Department of Fisheries and Land Resources (DFLR) Aquatic Animal Health Division (AAHD) in order to obtain license(s) for the transfer of live fish and eggs to our facility, plus outbound live shipments. If protocols below are not followed than *MCF* is subject to disciplinary actions from governing agencies who provides us services (licenses, audits and veterinary services etc.).

Biosecurity is an evolving process and requires expertise and input from varied sources. An all-encompassing failsafe protocol has not been developed to date. To decrease pathogen risk to the Marbase Cleanerfish Hatchery, cooperation is needed with all *MCF* stakeholders. Biosecurity is very important to aquaculture because it prevents or limits the introduction and spread of disease within or between aquatic animal production facilities and sites. Since very few effective treatments are available for most aquatic animal diseases, effective biosecurity is the key to preventing these diseases.

Disease agents that infect aquatic animals are frequently spread between aquatic organisms in the environment, or with equipment used to transfer animals from one holding unit or site to another. Some diseases can also be spread directly through the water by animals releasing the infectious agent or by sick animals dying.

MCF supports and will adhere to all NL DFLR policies and regulation outlined below with respect to Biosecurity as per *AP 35 – Biosecurity and Biosecurity Audits. Legislative References: Aquaculture Act s. 4.(4)(g), s.7*

MCF supports the sustainable growth of our aquaculture industry by implementing and utilizing our Biosecurity Plan.

***MCF* supports all items below as per Policy:**

1. Licensed sites are required to have a company-specific biosecurity plan approved by the Aquatic Animal Health Division (AAHD) at the time of licensing, enforced at all times, with responsibility designated to an employee of the licensed site.

2. Biosecurity plans must be submitted to the department for review and approval at the time of licensing, when updates are made to the company's plan or upon request by the Chief Aquaculture Veterinarian (CAV).

3. Licensees must grant AAHD staff or a designated representative access to their aquaculture sites/facilities to conduct biosecurity audits of the premises and/or activities, as described by the Biosecurity Audit Plan.

4. Licensees must grant AAHD staff or a designated representative access to company records for the purposes of conducting an audit as part of the Biosecurity Audit Plan.

5. All components of finfish and shellfish aquaculture, including but not limited to: shipping and receiving, equipment, personnel, vehicles, vessels, and facilities may be subject to audit by the AAHD as outlined in the Biosecurity Audit Plan.

Powers of the Auditor

1. An auditor may do any of the following:
   - a. Enter and inspect any aquaculture site/facility or location
   - b. Accompany individuals who are collecting or analyzing samples
   - c. Accompany individuals who are auditing equipment or gear
   - d. Document procedures and activities
   - e. Obtain samples
   - f. Inspect records (both written and electronic).

2.0 DEVELOPMENT OF A BIOSECURITY STRATEGY

Development of a Biosecurity Strategy involves the following two essential processes:

- Determination of the disease status of the epidemiological unit (tank, facility) through:
    - Disease surveillance,
    - Disease monitoring,
    - Disease reporting programs.

- Risk analysis:
    - Hazard identification,
    - Risk assessment,
    - Risk management,
    - Risk communication

Employees are one of the most important elements when implementing a biosecurity plan, as nearly all biosecurity measures will be executed by employees during their day-to-day work activities. A training program that is well-developed, communicated and implemented helps provide employees with an understanding of the importance of proactive biosecurity. In addition, visitors will frequently require access to the hatchery. Communicating the necessary biosecurity measures to visitors will help mitigate the risk of pathogen introduction and spread during their visit.

Make Biosecurity A Part of Your Business Culture

3.0 SITE LOCATION

The Marbase Cleanerfish Ltd. "MCF" will establish a cleanerfish hatchery within the boundaries of the former Marystown Shipyard property within the Town of Marystown. Cleanerfish are used as a biological weapon against infestations of sea lice within salmon fish farms. Below is a survey of the property (Figure 1). The hatchery is to be located in the Machine Shop/General Stores/Carpenters and Joiners Building, referred to now as the "Hatchery Building".

There is one main road access route onto the Marbase Aquaculture Service Hub property- Ville Marie Drive and one emergency exit road directly behind the Hatchery located at Dock Road. Water access is also available from the dock face.

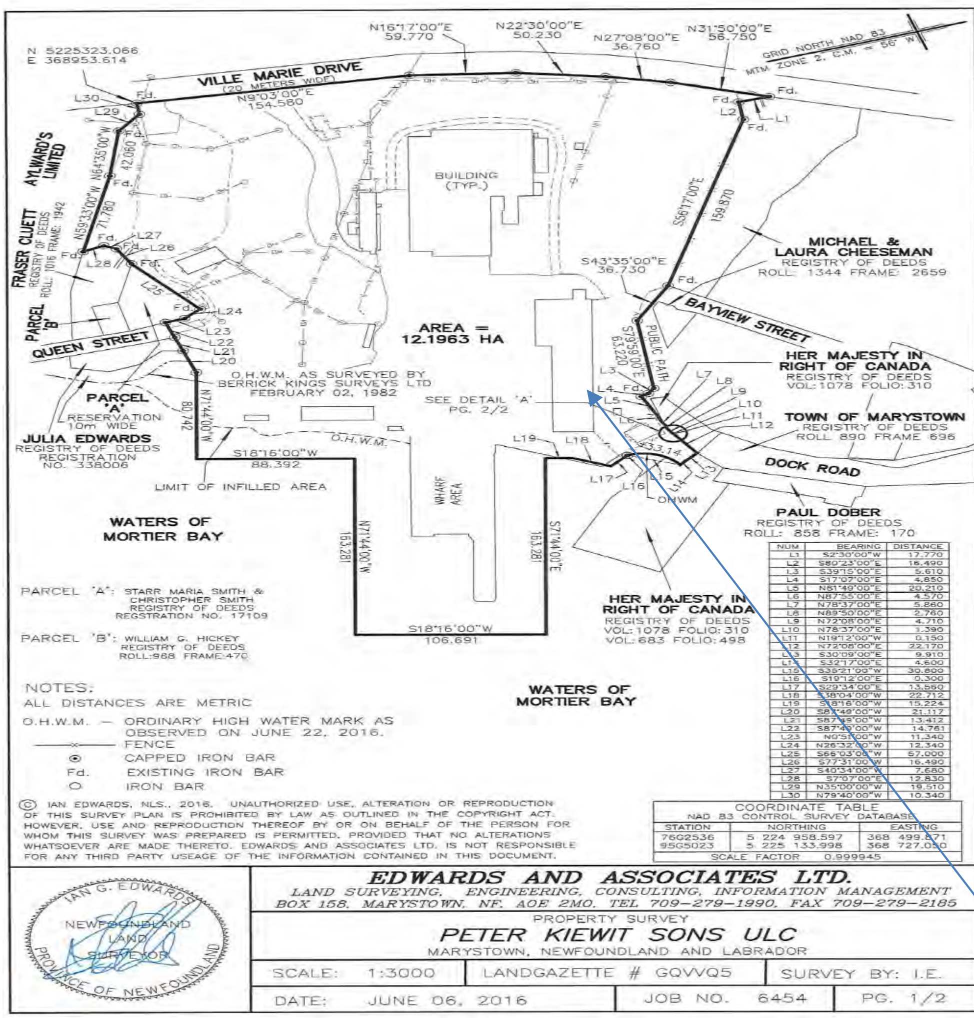


Figure 1: Edwards and Associates Land Survey of Property.

3.1: Site Description

The location of the Marbase Cleanerfish Hatchery is shown in Figure 2. An image of the marine setting (Mortier Bay) is shown in Figure 3, while Figure 4 shows the property comprising the Marbase Integrated Aquaculture Service Hub (formerly the Marystown Shipyard).

The south and west boundaries of the hatchery site are adjacent to the larger Marbase Aquaculture Service Hub. The east boundary is Mortier Bay. To the north of the site is the Transport Canada wharf and slipway, a decommissioned tank farm as well as residential dwellings.

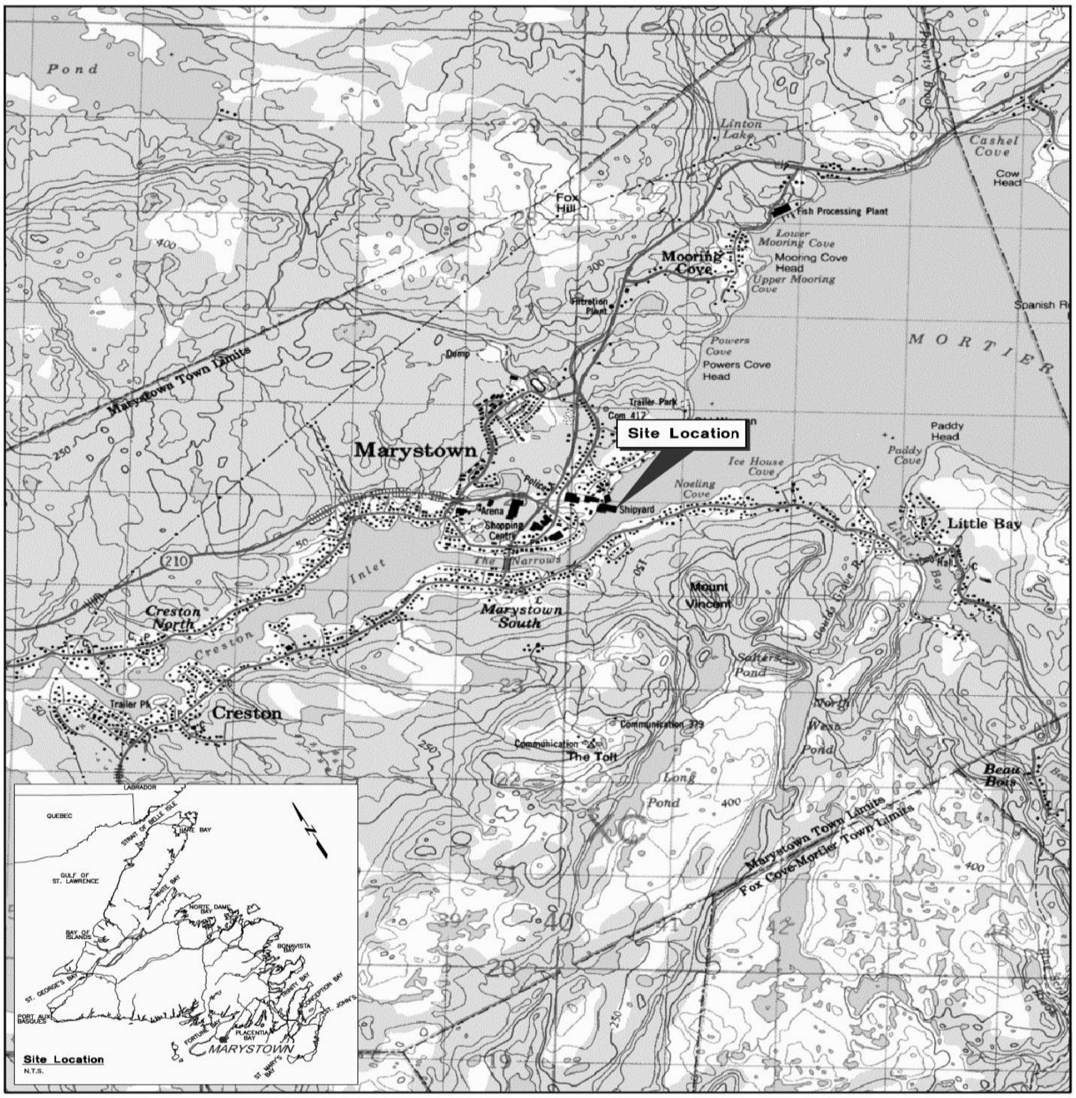


Figure 2: Marbase Cleanerfish Hatchery - Location in NL.

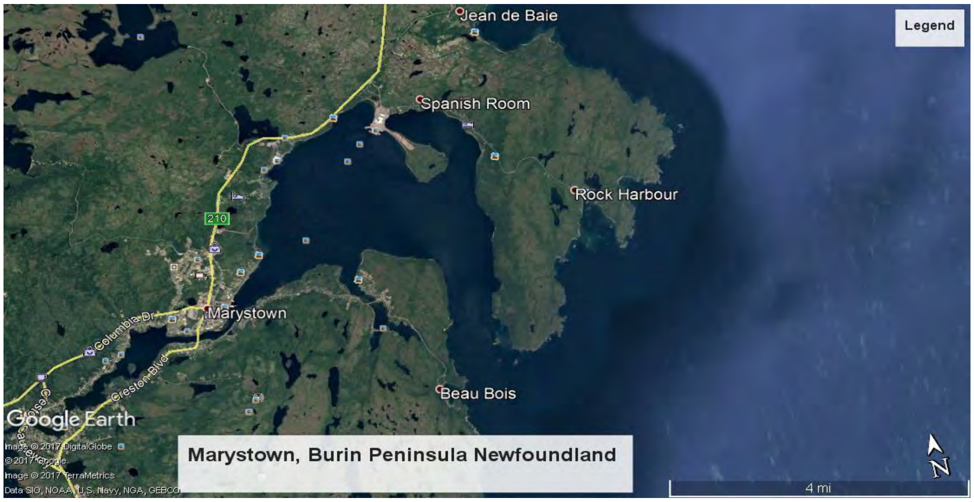


Figure 3: Marbase Cleanerfish Hatchery - Location in Marystown.

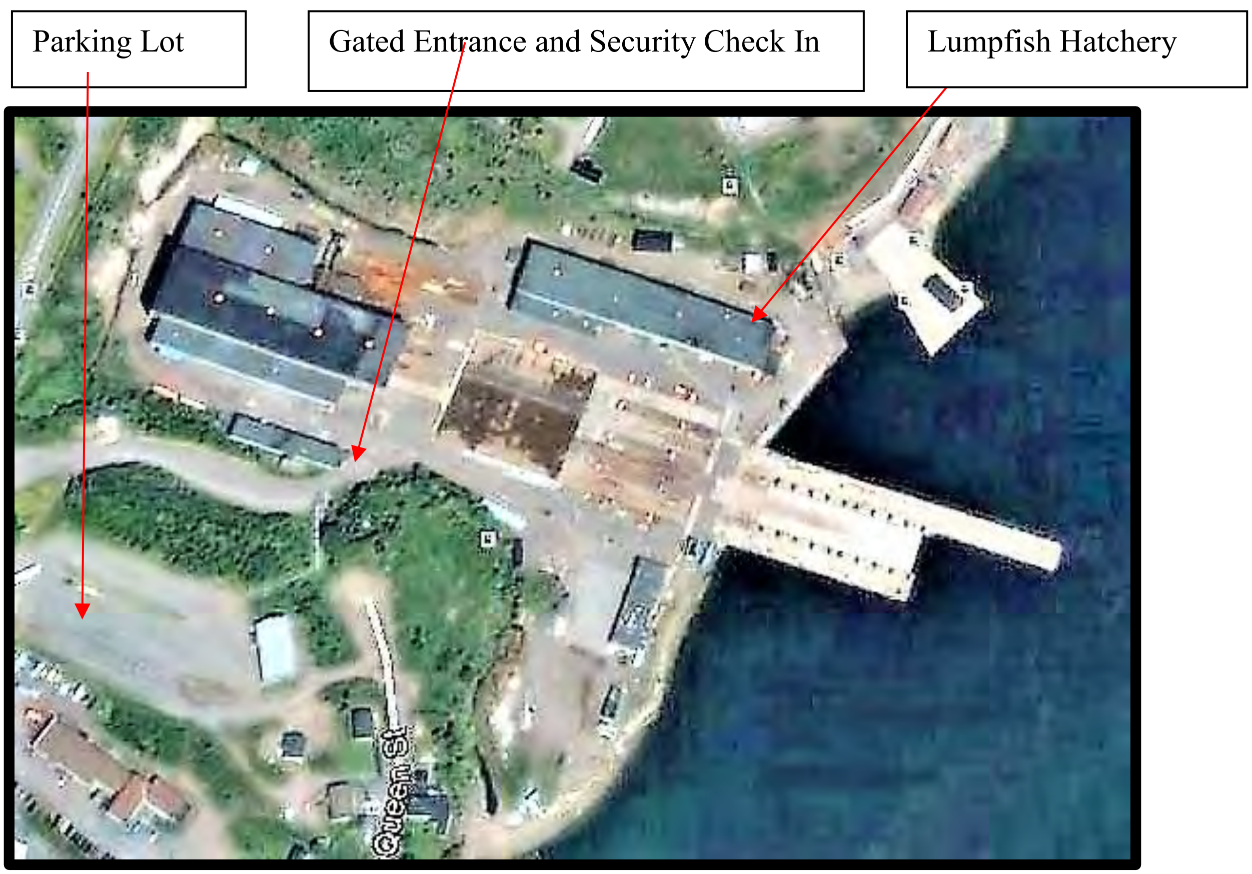


Figure 4: Marbase Cleanerfish Hatchery Proposed Site Aerial View - Location within Marbase Service Hub. Staff and Guest Parking, Gated Entrance with Security and Hatchery Location.

3.2: Site Perimeter Fencing

Perimeter fencing of the site is shown in Figure 5. Fencing serves a number of purposes essential to maintaining the health and welfare of the hatchery area including: safe containment and protection from predators, and identification of property boundaries. The figure shows the entrance to hatchery site, fish loading zone, hatchery main entrance and an emergency exit from site.

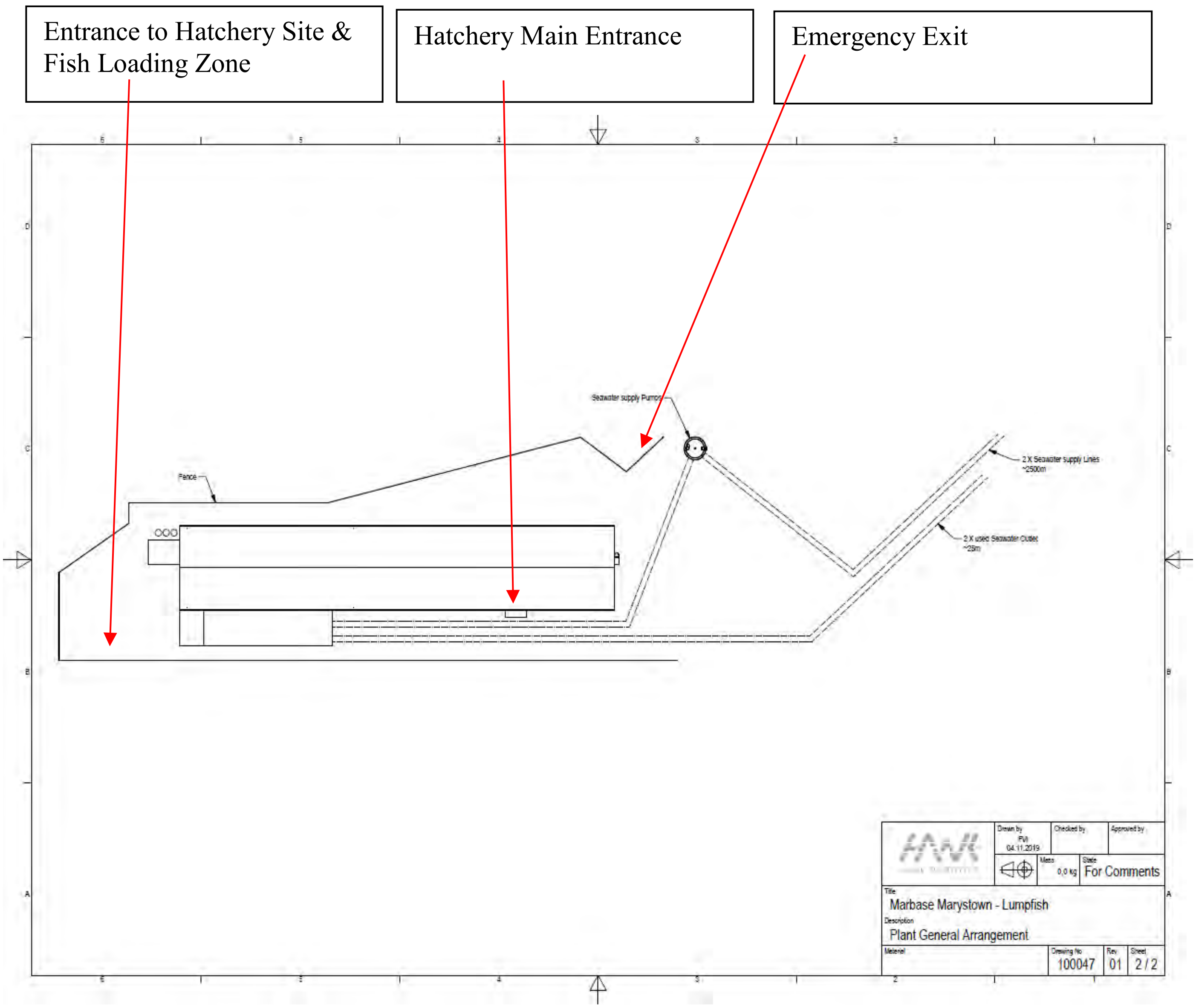


Figure 5: Perimeter Fencing of Full Hatchery Property.

3.3: Facility Security and Access

Unauthorized access to hatchery location is restricted by use of a fence and locked doors. All fish culture facilities are indoors. Therefore, birds and other predators are not of a concern. However, a pest management plan (Section 6.0) will be used to control rodents, a potential source of pathogens. Water sources (pump house, pipelines), filtration systems are also secured inside this perimeter.

3.4: Visitor Access and Procedures

MCF will require that all visitors act as follows:

- Obtain approval from site general manager before their visit.
- Check in at gated entrance and security building and wait for *MCF* staff.
- Understand established biosecurity protocols.
- Sign in the visitor log book.
- Limit their access to the production areas in general and
- Limit their "direct access" to fish and feed storage.

The hatchery will be a 2 level facility (Figure 6). Areas will be categorized as:

- Hatchery / Start Feeding-(0.05 - 0.1g) Level 2 (CAZ) No visitor access
- Growth 1- (0.1 - 1.0g) Level 2 (CAZ)No visitor access
- Growth 2- (1.0 - 8.0g)* Level 2 (CAZ)No visitor access
- Growth 3- (8.0 - 40.0g)* Level 1
- Future Development Level 1

*Growth 2&3 may have some overlap from time to time depending on production numbers and timing.

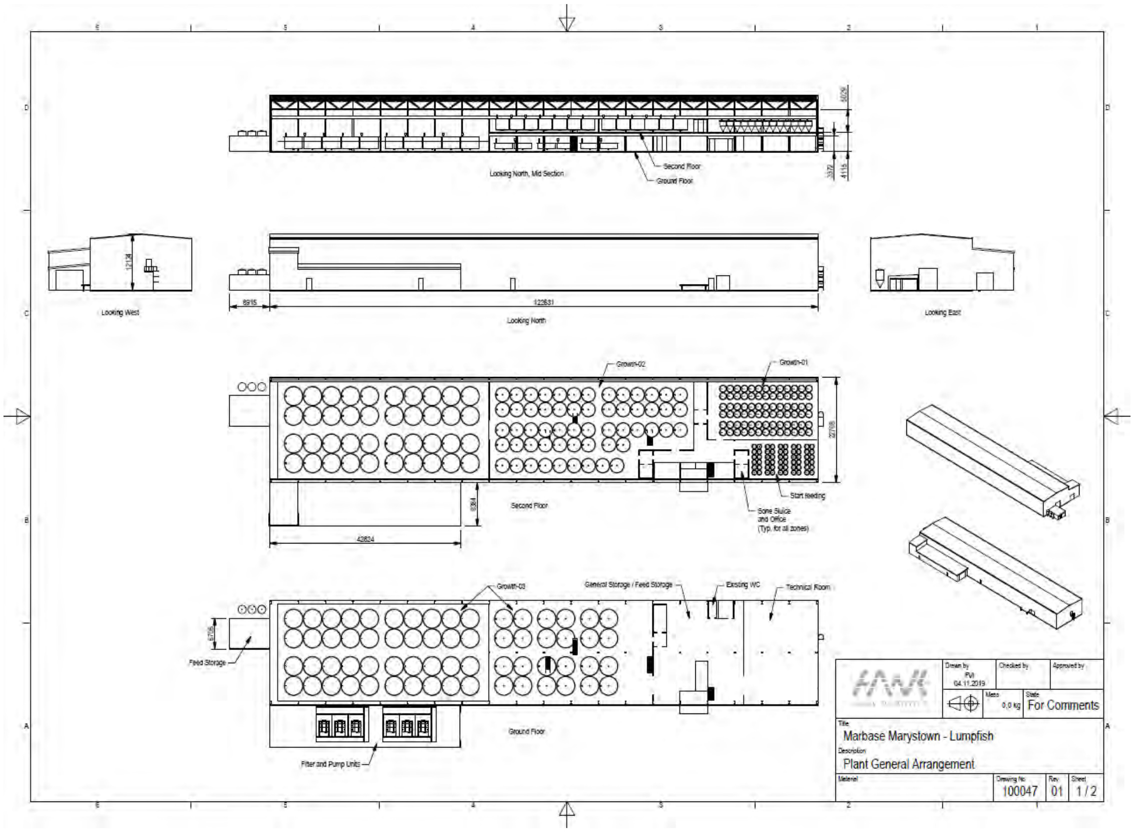


Figure 6: Facility Layout- Level one and Level two.

Hatchery / Start Feeding and Growth 1 and 2 on Level 2 will be considered a Controlled Access Zones (CAZ). This high-risk larval area is considered off limits for any tours. Access to these areas is restricted to authorized staff personnel only and is controlled by signs, barriers and key entry. Level 1- Growth 3 will be given access for visitors.

Visitor access to the facility will be tightly controlled and only authorized by the Site General Manager in advance. Personnel traffic flow will be minimized to decrease the risk of pathogen transfer. Visitors (all designated as high risk) who have recently visited other farms or facilities within 7 days prior to the visit will be denied access to the site. There should be no chance of cross-contamination between the “clean” and ‘dirty’ sides of this entrance.

All visitors will park in designated parking zones located off Ville Marie Drive next to the union office building and walk to the gated entrance / security building and wait for an assigned *MCF* staff member. There will be two secured gates, one from inside the shipyard to the hatchery site premises area and an exterior fence that opens onto Dock Road for Emergency purposes.

Visitors will be welcomed onto the site premises through the locked gated entrance. Visitors will be escorted to the hatchery entrance and advised of all biosecurity, health & safety rules pertaining to conduct while on the premises. All visitors will be required to sign into the visitor log book (Figure 7).

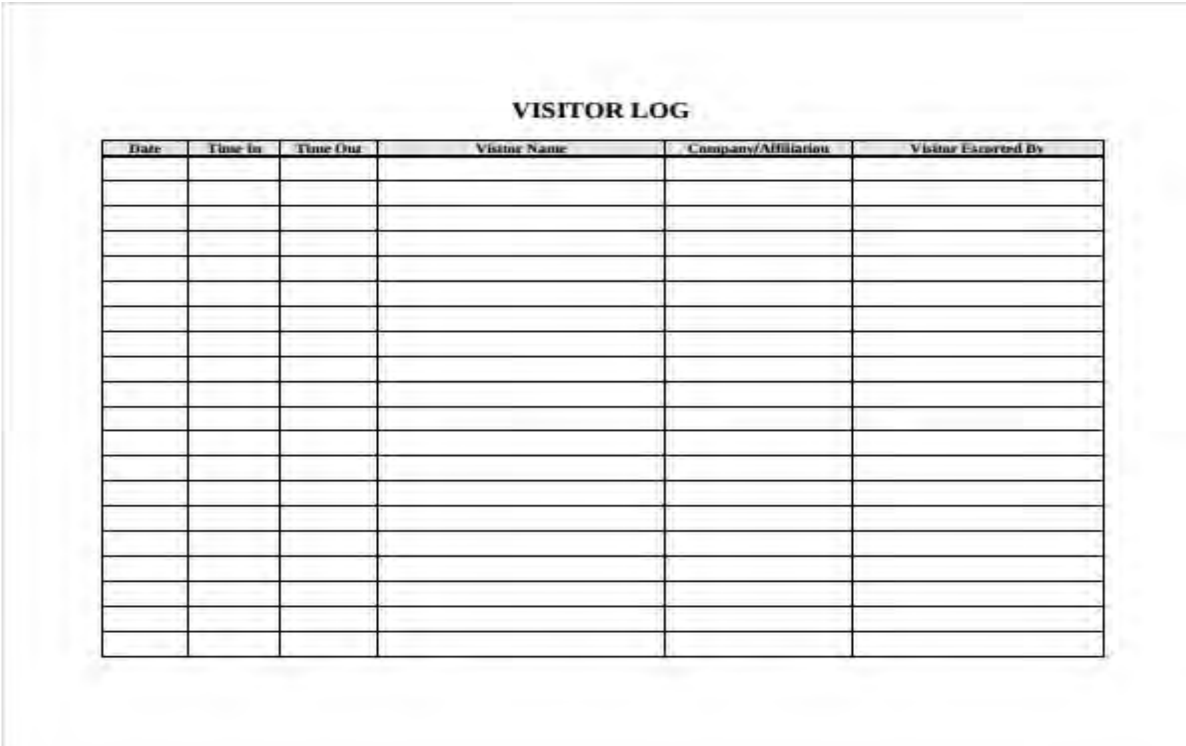
Once inside, visitors will be directed to a designated "Primary Hygiene Area" area to remove outside footwear, jackets and store personal belongings in the "Dirty Zone". They will then proceed to the "Clean Area" (Figure 8) whereby they will receive designated clean boots and lab coats. They will be reminded of all rules again before proceeding and it will be mentioned here that all visitors should leave their hands in their pockets for the remainder of the tour. Footbaths (Virkon) and hand sanitation dispensers are provided and stationed at every entrance of a fish culture room.

Footbaths are inspected daily and are maintained to ensure germicidal effectiveness. Entering and exiting the hatchery building is only permitted through the inflow area only (Primary Hygiene Zone) unless an emergency is in progress. All other doors are fire exit doors only.

Keys are issued to personnel working in the *MCF* only. All other people will have to be admitted to the building by *MCF* staff upon request. Outside contractors entering the building have to be accompanied by *MCF* staff at all times and follow protocols outlined above. When moving through the buildings both *MCF* staff and visitors are to move from youngest fish to oldest fish and never the reverse.

Procedures:

1. Meet *MCF* Personnel at site entrance locked gate / security building.
2. Proceed with *MCF* personnel to main entrance of hatchery.
3. Change outside clothing and footwear in Primary Hygiene Area- Figure 6.
4. Enter the main culture facilities through the primary hygiene area. Visitors will be given both clean boots and a clean lab coat to wear.
5. Upon entry to the first culture room(s), all visitors use hand sanitizer and step in the footbath filled with Virkon.
6. Upon entry to any additional rooms visitors will utilize hand sanitizer and step in the footbath.
7. Visitors will return to the primary hygiene area where they can remove their footwear and lab coats.
8. Step into the footbath and utilize provided hand wash station.
9. After visiting, visitors are restricted to the office area of the main building, and need to sign out at the Biosecurity building upon leaving.



VISITOR LOG

Date	Time In	Time Out	Visitor Name	Company/Affiliation	Visitor Escorted By

Figure 7: Visitor Log Book

Figure 8: Primary Hygiene Room. Example of dirty and clean zone for Biosecurity. Dirty on the right and clean on the left.

3.5: Staff Flow

Staff will be provided with lockers just inside the main entrance of the facility. All outer clothing and footwear will be removed and placed inside their assigned lockers. Staff are provided with open shoes in which they will wear from this point to the primary hygiene room / area. Once inside the primary hygiene room, all staff will change from the dirty side to a clean side with own assigned clean pair of boots and coveralls before proceeding into the culture areas. All *MCF* footwear and clothing will be left in the facility in which it is worn. If clothing becoming wet or soiled in these areas, then it will be washed and dried on site.

Other areas within the main entrance are a locker room, designated lunch room, washrooms, offices, water quality and fish health space, food storage, workshop and general storage (Figure 5).

All *MCF* staff are to remain in their assigned areas (Hatchery/ Start Feeding, Growth 1, 2, 3) unless directed otherwise to prevent the potential for cross contamination between areas. Management and *MCF* staff that are permitted to move between areas are to adhere to the strictest bio-security and disinfection procedures as outlined below.

When moving through the building all *MCF* staff are to move from youngest fish to oldest fish and never the reverse. All movement of personnel through the buildings will require adherence to personal disinfection procedures. All people entering the hatchery facility has to do so, through the primary hygiene room / area, just adjacent from staff lockers/ lunch room/ office area. Staff will be reminded to minimize wearing jewellery and scent free policy.

Hatchery/Start Feeding/Growth 1-2 are on Level 2 and only larval staff and other assigned staff are permitted in this area. Growth 3 is on Level 1 and only juvenile staff and other assigned staff are permitted in this area (Figure 6)

On level 2, each of the Hatchery/Start Feeding/Growth 1-2 areas are separated by walls and or hygiene barriers. Each room has its own dedicated foot dips, hand sanitation and equipment.

On level 1, each of the Growth 3 areas are separated by walls and or hygiene barriers. Each room has its own dedicated foot dips, hand sanitation and equipment as well.

In each area (Hatchery/Start Feeding, Growth 1-3 rooms- Figure 6) there are marked entrances permitted to be used for entering and exiting. All of the above mentioned entrances will have foot dips containing Virkon® Aquatic as well as alcohol hand sanitizing stations which must be used by all personnel when entering or exiting each room.

- Each individual will step into the available foot dip ensuring contact with the disinfectant and boots has taken place.

- Each individual will thoroughly sanitize their hands using the alcohol sanitizer dispenser(s).

- Both foot dips and hand sanitizer dispensers will be maintained as per manufacturer directions. Records will be kept relating to who, when and where foot dips and hand sanitizing stations have been changed, refilled or otherwise maintained .

- Foot dips or mats shall be maintained at each entrance into each room, and are to be changed on a daily basis or as required basis based on colour.

- All entrances are to have virucidal, bactericidal and fungicidal foot dips (e.g. 1% w/v Virkon solution). Preparation of Virkon Foot Dips and Mats - A 1% w/v solution of Virkon (active ingredient = 21.4% potassium monopersulfate) is to be prepared by dissolving 40g of Virkon in 4 L of warm water (or equivalent proportions).

- Detailed instructions and specifications on Virkon can be found on the product container. Caution: Virkon powder is a skin and respiratory irritant. Observe appropriate precautions while handling and preparing foot dips. Refer to the MSDS sheets within MSDB binder in each area for further details. Virkon in a 1% solution is non-toxic.

Safety: Full PPE and relevant training will be provided to all *MCF* staff members in relation to biosecurity measures.

3.6: Fish Production Flow

The hatchery will house 339 tanks (Table 1) of various sizes when at full capacity. The hatchery will be a 2 story / level facility. Areas will be categorized as:

- Hatchery / Start Feeding-(0.05-0.1g) Level 2
- Growth 1- (0.1-1.0g) Level 2
- Growth 2- (1.0-8.0g)* Level 2
- Growth 3- (8.0-40.0g)* Level 1
- Future Development

*Growth 2&3 may have some overlap from time to time depending on production numbers and timing.

Area	# of tanks	Volume each tank in m^3	Total m^3
Hatchery-Incubators above Start Feeding Tanks (eggs)	60	0.10	6
Start Feeding (0.05 - 0.1g)	60	0.55	33
Growth 1 (0.1 - 1.0g)	78	2.1	163.8
Growth 2 (1.0 - 8.0g)	57	14	798
Growth 3 (8.0 - 40.0g)	24	12	288
Growth 3 (8.0 - 40.0g)	40	22	880
Future Development	20	40	800
		Total	2968.8
	Safety margin (%)	Total	Max flow rate
	35	2968.8	~4000 m^3/hr

Table 1: Hatchery flow of fish, tanks, numbers, sizes, water flows.

Fish Production Flow:

2020, 2021, 2022, 2023, 2024, 2025 schedule of production identified below.
Eggs and/or ~1 gram juveniles to be introduced on (month/year**).** No eggs at this point in time until a disease free, reliable third party supplier is available.

2020 Production Fish Flow Plan:

2,000,000 1 gram, pathogen free juveniles to start in September - November 2020, with 1,771,448 individual unit output scheduled for May 2021 at 25-40 grams each.

Fish will flow from Growth 1to Growth 2 to Growth 3 (25-40 grams) and then sold FOB hatchery door to third party salmon companies in May 2021 (Table 1&2).

Fish from Growth 3 will be pumped from tanks inside facility into transport tanks on trucks at point of sale. Transport trucks will be assigned a load zone just inside the main entrance onto hatchery premises.

2021-2025 Production Fish Flow Plan:

Hatchery will be in full production (month/year) starting in August –November 2021 with introduction of 3,000,000 1 gram, pathogen free juveniles and an output of 2,646,554 individual unit output scheduled for May 2022-2025. Production at full capacity will be approximately ~81,008 kg of biomass.

Fish will flow from Growth 1 to Growth 2 to Growth 3 (25-40 grams) and then sold FOB hatchery door to third party salmon companies in May 2022-2025 (Table 1&2).

Fish from Growth 3 will be pumped from tanks inside facility into transport tanks on trucks at point of sale. Transport trucks will be assigned a load zone just inside the main entrance onto hatchery premises.

Hatchery-Incubators above Start Feeding Tanks (eggs)
Start Feeding (0.05 - 0.1g)
Growth 1 (0.1 - 1.0g)
Growth 2 (1.0 - 8.0g)
Growth 3 (8.0 - 40.0g)
Growth 3 (8.0 - 40.0g)

Table 2: Designated fish areas and sizes. Flow of Fish from size.

4.0 WATER SOURCE

The hatchery will have 2 incoming sea water lines (Figure 9) which will extend to water depths of 15m and 50m approximately 2 kms from the hatchery (Figure 10). The intakes will have screening to avoid impingement and entrainment of marine organisms. The installed pipes will be ballasted on the seabed. The detailed routing of the intake piping on the seabed will be confirmed through examination of existing multi-beam acoustic surveys. Pipe sections and ballast will be stockpiled at the Marbase Service Hub dock. A marine contractor will employ a laydown barge to place the pipe and intake along the seabed.

The intakes (Appendix #2) will be capable of supplying marine water to the hatchery complex on a continuing basis and at two temperatures. Incoming sea water from Mortier Bay (shallow and deep lines) will enter an outdoor Sea Water Station (Figure 11) at 4000 m^3 / hr. Water will then be pumped from this sea water station inside the facility to a series of rotary drum filters with 50 - micron mesh for further processing.

The intakes will be located clear of any contaminant sources (sewer and other outfalls, including the hatchery outfall). The pipeline sizing will be established as hatchery design advances. The pipeline routes as well as the intake screening will need to address Federal Fisheries requirements related to fish habitat and fish protection. The water extraction and discharge will require the issuance of a Water Use Authorization from Water Resources Branch, provincial Department of Municipal Affairs and Environment. The pipeline sizing will be established as hatchery design advances.

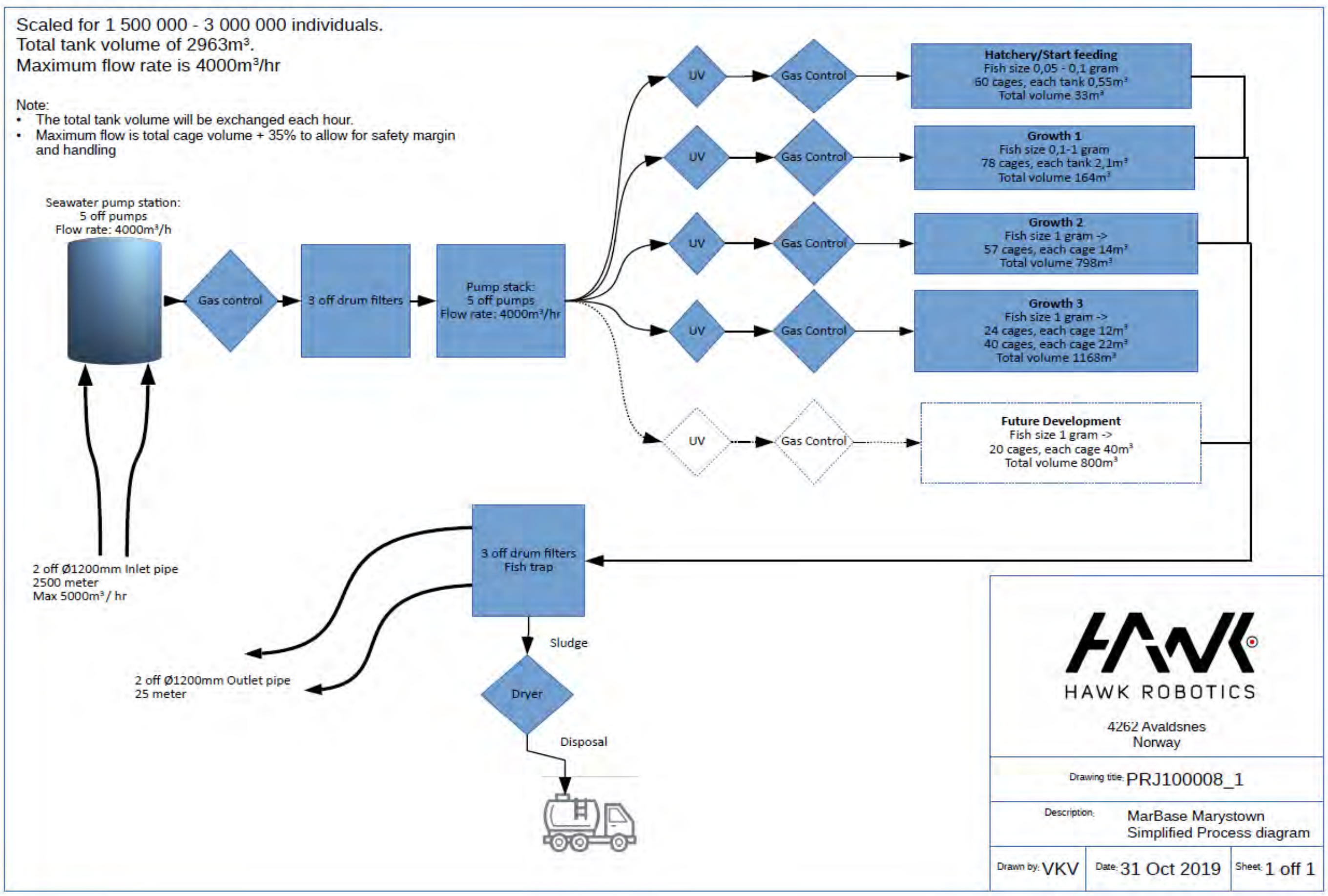


Figure 9: Flow Rate Diagram

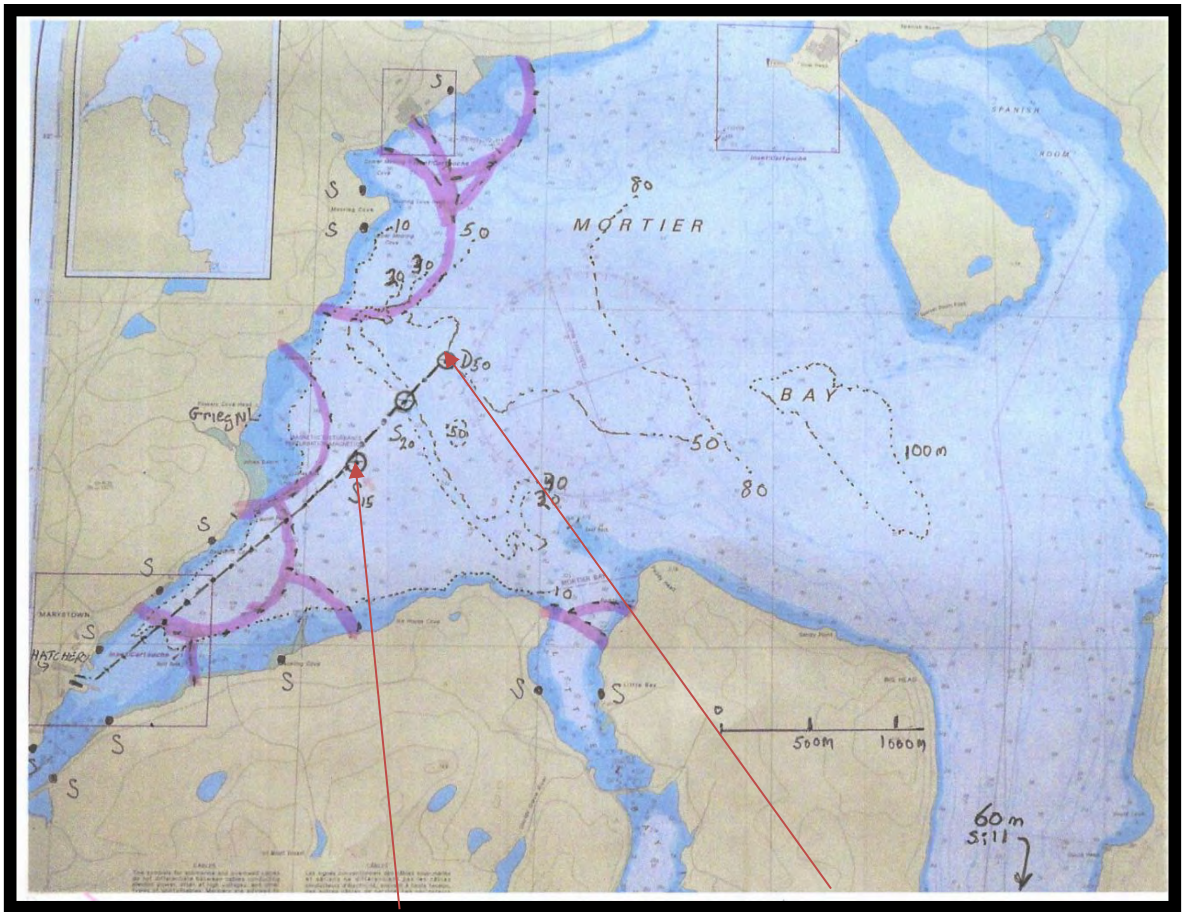


Figure 10: Intake Locations (Shallow -15 meter depth and Deep -50 meter depth).

4.1: Water Treatment – Incoming Sea Water

Incoming sea water from Mortier Bay (shallow and deep lines) will enter an outdoor Sea Water Pumping Station (Figure 11) at 4000 m^3 / hr. Water will then be pumped from this sea water station inside the facility to a series of three rotary drum filters with 50 - micron mesh for further processing. Refer to video- https://www.youtube.com/watch?v=9f_ObWCv358&t=106s .

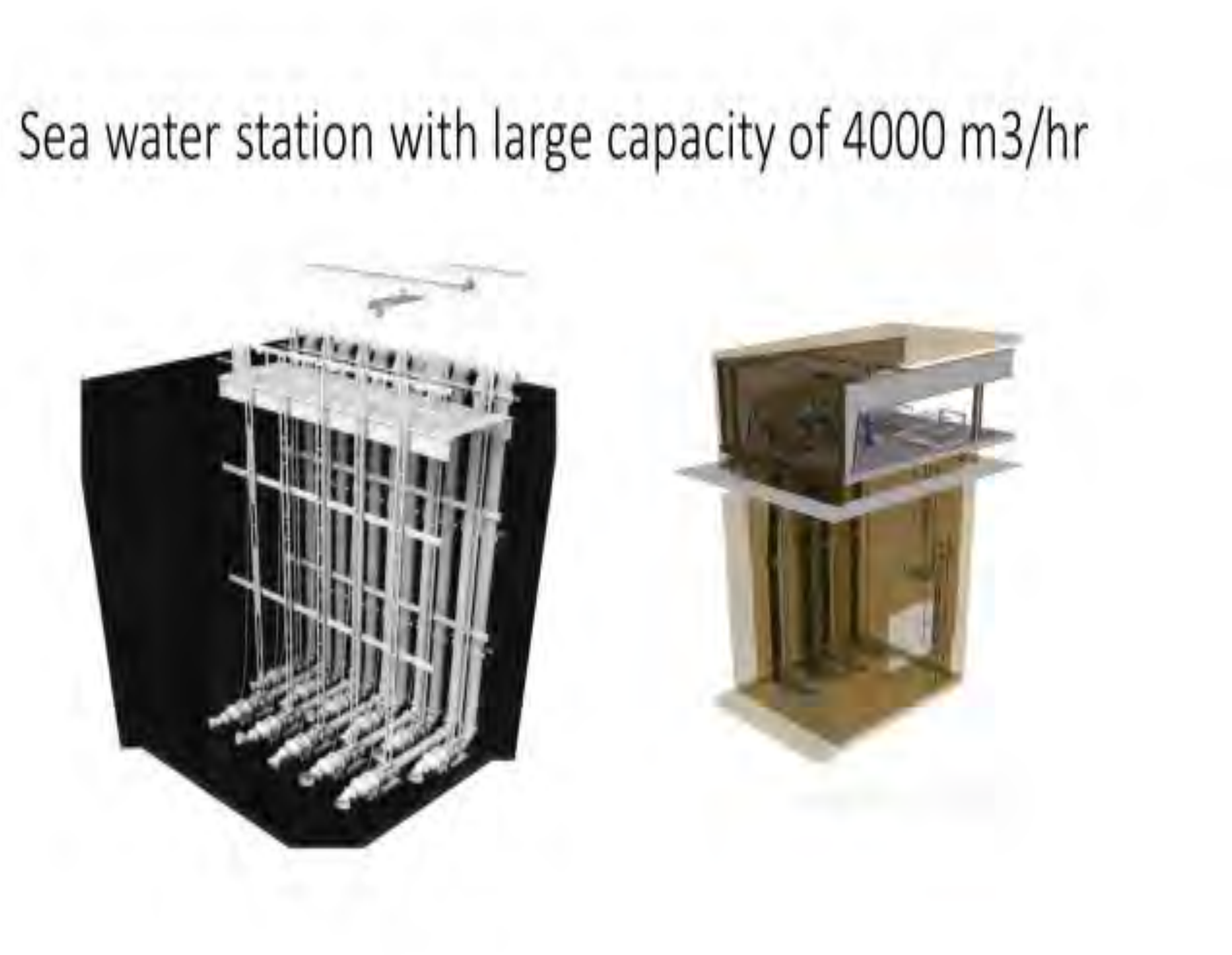


Figure 11: Sea water pumping station- 4000 m3/hr capacity.

4.2: Water Filtration

All incoming seawater from the pumping station will pass through a series of three rotary drum filters with 50 - micron mesh and fill a large reservoir (Figure 12).

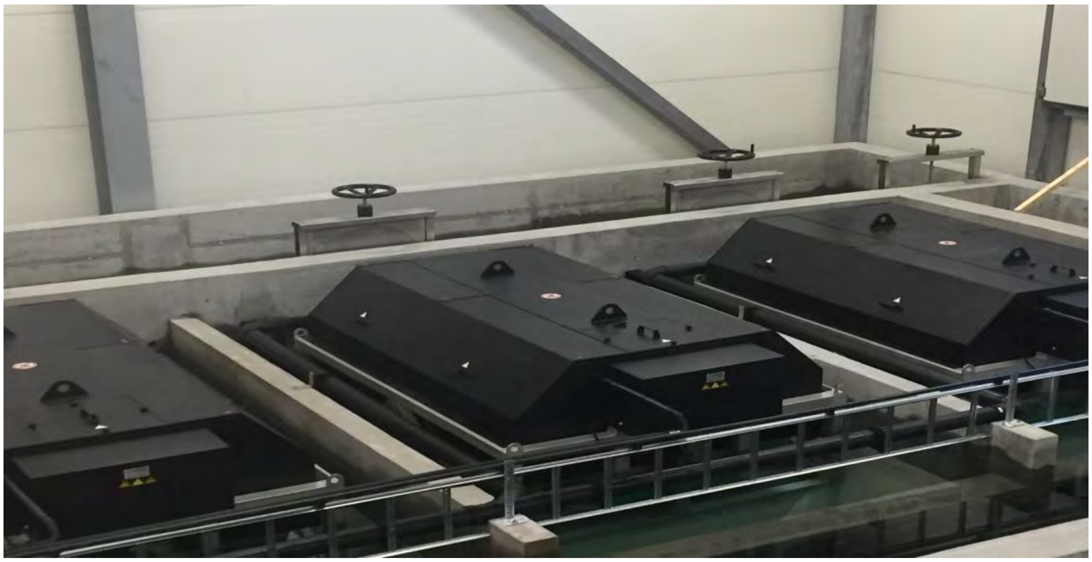


Figure 12: Drum Filters for Filtering Incoming Sea Water at 50 - microns.

The 50 – micron filtered seawater will then be pumped (Figure 13-15) from this reservoir through a series of UV's, inline degassing, oxygen addition and then delivered to various fish units as identified in Table 1.

4.3: Water Pumping

The five pumps (Figure 13) will be a low footprint, low maintenance cost, low power consumption type pump.

Figure 13: Large Efficient Saltwater Garman Pumps

4.4: UV Disinfection

Sea water will be UV disinfected (Figure 14) at 300,000 mW /cm2 before reaching individual tanks in various areas of the facility. Redundancy will be in place.

Figure 14: UV Disinfection Units (300,000 mW/cm2).

4.5: Hatchery Tanks

The hatchery will house 339 tanks (Table 1) of various sizes when at full capacity. Areas will be categorized as:

- Hatchery / Start Feeding-(0.05 - 0.1g)
- Growth 1- (0.1 - 1.0g)
- Growth 2- (1.0 - 8.0g)*
- Growth 3- (8.0 - 40.0g)*
- Future Development

  *Growth 2&3 may have some overlap from time to time depending on production numbers and timing.

Area	# of tanks	Volume each tank in m^3	Total m^3
Hatchery-Incubators above Start Feeding Tanks	60	0.10	6.0
Start Feeding (0.05-0.1g)	60	0.55	33.0
Growth 1 (0.1-1.0g)	78	2.10	163.8
Growth 2 (1.0-8.0g)	57	14.0	798.0
Growth 3 (8.0-40.0g)	24	12.0	288.0
Growth 3 (8.0-40.0g)	40	22.0	880.0
Future Development	20	40.0	800.0
		Total	2968.8
	Safety margin (%)	Total	Max flow rate
	35	2968.8	~4000 m^3 / hr

Table 1: Number of Tanks, Tank Volume and Location within Facility

4.6: Primary Effluent Water Treatment

All effluent water will pass through a series of rotary drum filters of 50 - micron mesh (Figure 15) after leaving the culture tanks. All faecal material, uneaten feed and other metabolic waste extracted from the outlet water via a series of 50 - micron drum filters. Using this 50 - micron drum filter technology will ensure fully cleansed outlet water free of all suspended solids.

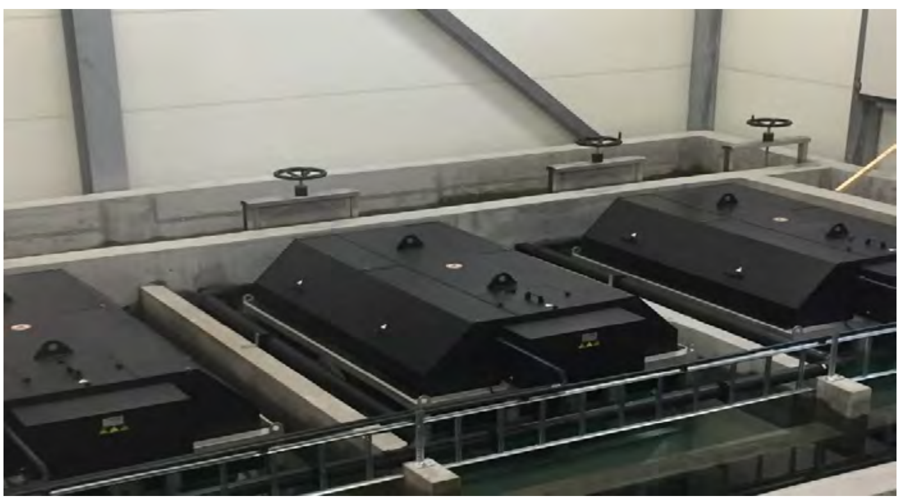


Figure 15: Drum Filters for Filtering Effluent Sea Water at 50 - micron.

The hatchery discharge pipes will be located 3-5 M below surface at low tide and proximate to the hatchery building and at a distance of 2000 m and 2500 m minimum from other intakes (Figure 16). The pipeline routes will address Federal Fisheries requirements related to fish habitat and fish protection. The discharge will require the issuance of a Water Use Authorization permit from Water Resources Branch, provincial Department of Municipal Affairs and Environment. The pipeline sizing will be established as hatchery design advances. Refer to Appendix #2 for Marbase Cleanerfish Hatchery Field Program Report.

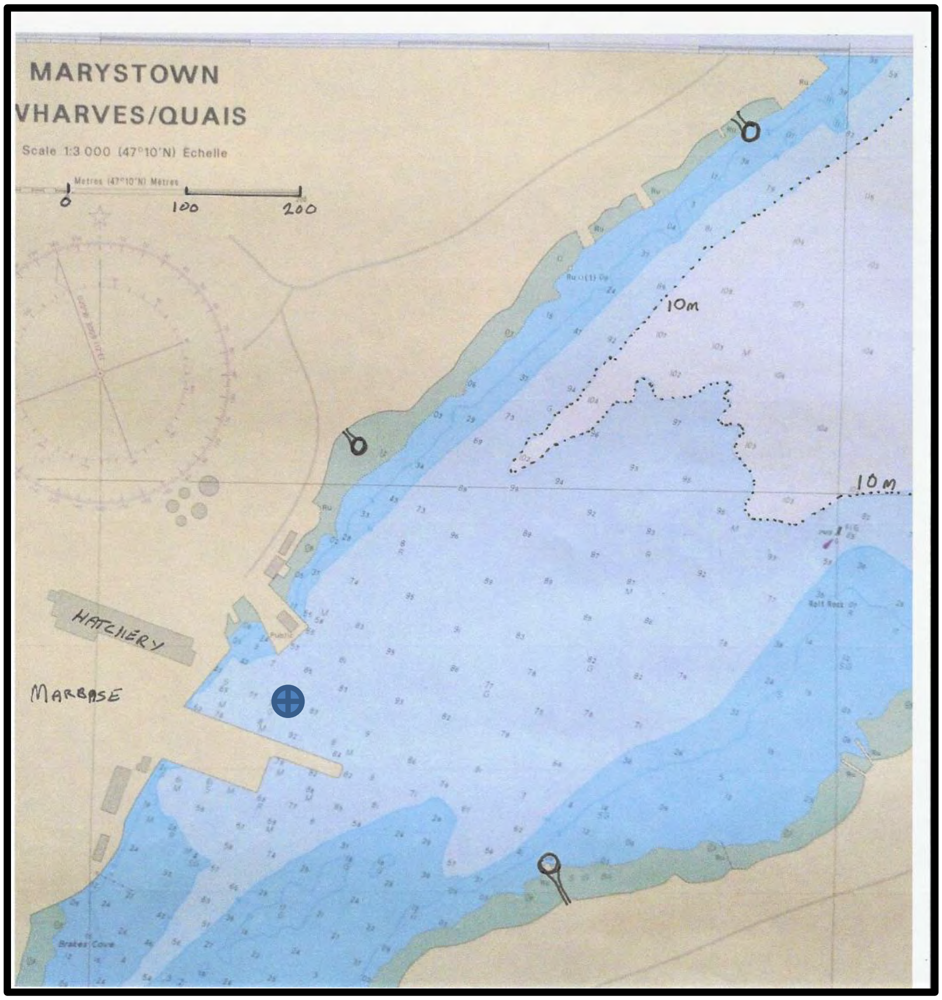


Figure 16. Bathymetry and Outfalls in the area of the Marbase Site (with Outfall sampling location indicated - ⊕). Refer to Appendix #2.

4.7: Sludge Treatment

Sludge is viewed as a "valuable resource" by *MCF*. Solid waste collected by the drum filters mentioned above, will be in the form of a wet concentrate. All of this wet concentrate will be fed into its own processing plant for a further dewatering.

To improve waste transport efficiency, the sludge waste will be dewatered to 15% moisture (Figure 17) prior to disposal. The sludge produced from the culture of the fish in the hatchery will be stored in an approved holding facility. A *nutrient-rich product*, this sludge will be collected on a routine schedule by the Burin Peninsula Waste Management Corporation (BPWMC) for use in their composting facility. Refer to sludge after dewatering video below. All sludge will be disposed of in an environmentally friendly manner in accordance with all provincial regulations. Refer to Appendix #1.

Sludge after dewatering.mp4

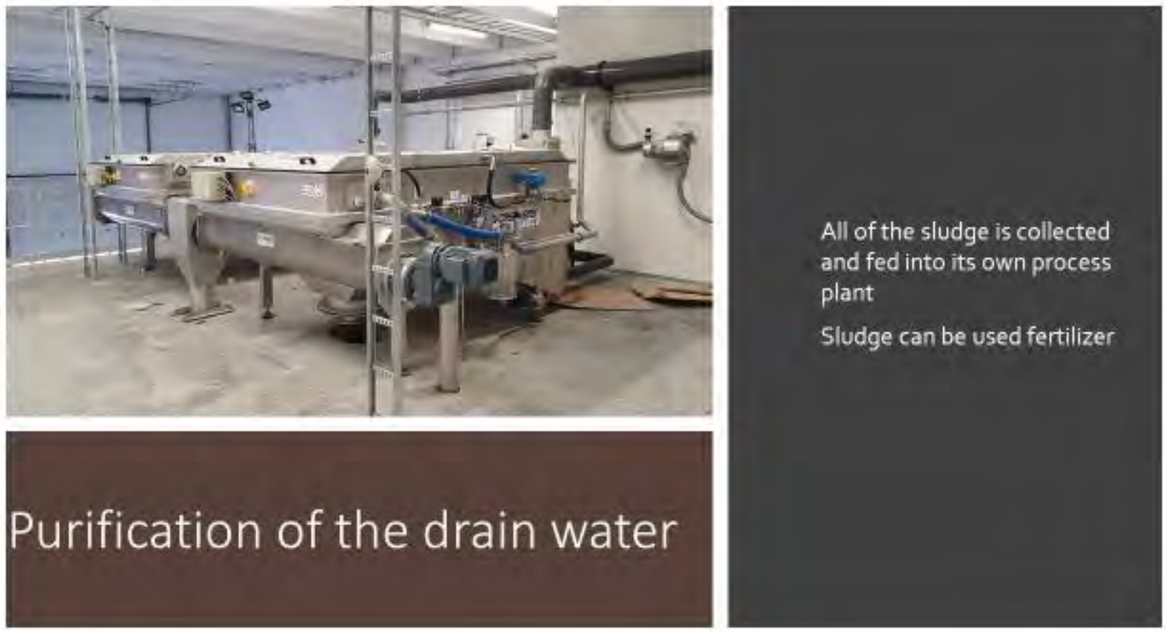


Figure 17: Purification of the Drain Water- Sludge Dewatering Machines

5.0 STAFF TRAINING

Fish Health and Biosecurity- all *MCF* managers (General, Operations and Technical) will share a responsibility to ensure all staff and fish receive the best care possible.

The Operations Manager of the facility will appoint a Fish Health (FH) and Biosecurity (BS) person whom is trained in these specific area(s). This person will be responsible for maintaining and updating both the fish health and biosecurity plans as well as demonstrating its effectiveness through use of good record keeping.

A fundamental requirement when identifying risks to *MCF* is an awareness of the following;

- diseases that can affect your stock,
- clinical signs of disease,
- host susceptibility and the range of environmental parameters that could precipitate clinical outbreaks.

The Operations Manager of the facility will also appoint a Water Quality Specialists (WQ) whom is trained in chemistry / water quality. This person will be responsible for maintaining acceptable water quality within the hatchery systems, maintain water quality equipment as well as demonstrating its effectiveness through use of good record keeping.

All staff will be trained in suitable fish handling procedures and husbandry techniques for the lumpfish on site at *MCF*. Husbandry procedures will be fully checked to identify any actions that increase the risk of contracting or spread of disease to our lumpfish. It is essential that all staff are aware of biosecurity measures implemented at this hatchery. It will be recorded that staff have read and understand the Biosecurity Plan and comply with all appropriate measures.

Veterinary health contacts- The Fish Health person will have direct contact with an Aquatic Fish Health Veterinarian and a certified Fish Health Laboratory(s) such as DFLR- NL or AVC- UPEI. Veterinary Services will have to be sourced from the Provincial Vet or a 3rd-party vet equipped for that task. Laboratory Services will be provided by Avalon Laboratory in St. John's.

5.1: Training in the Proper Care of Aquatic Animals

<u>Purpose:</u> To identify the areas of instruction needed to train individuals in the proper care, maintenance, and handling of lumpfish.

<u>Procedures:</u>

1. All personnel who work with lumpfish will have to complete "The Experimental Fish Course" provided by the University of PEI online.

2. System specific instruction will be provided by *MCF* management or their trained and appointed representatives through practical experience and written protocols for lumpfish care.

   Topics to be covered during training include:

- Feeding fish (includes proper size, type, and amount of diet; special diets such as medicated feeds or treated diets; rate and duration of diet feeding; methods of feeding, and storage of feed).
- Maintaining records (includes daily record sheets for tanks; inventories; movement of fish; activities affecting fish in tanks, such as removal or addition of fish, data collection, etc).
- Cleaning equipment and tanks (includes disinfection of tanks, floors, nets, buckets, balances, graders, fish pumps, fish counters, transport hoses, feed silos and feeders etc.; use and storage of disinfectants; treatment rates and durations).
- Identifying diseased or stressed fish (includes observation of changes in feeding activity or behaviour; removal and disposal of dead and dying fish; procedures for obtaining proper diagnostic samples; treatment rates and durations).
- Handling fish (includes routine inventory procedures, movement among tanks, netting, transport, anesthetics, euthanasia and disposal).

5.2: Record Keeping for Care and Maintenance of Lumpfish

Purpose: To provide guidance for documentation of fish receipt, placement, care and disposal.

Procedures:
Records for each of the areas (Hatchery/Start Feeding, Growth 1-3) are kept in the notebooks kept at the prep rooms of all fish areas and then to the main office.

Items to be recorded in the system notebooks include:
- Changes in feed (date, type, size, use of slice, etc.)
- Delivery of feed (delivery date, manufacturer, lot number, etc.)
- System disinfection (date, etc.). Methods will follow the procedures within *MCF* SOP unless otherwise noted.
- Changes in water quality (date, SW, adjustments in flow rate, temperature, etc.)
- Euthanization of Fish (date, approximate number). Methods will follow the procedures within the *MCF* SOP unless otherwise noted.

- Transfer/transport/shipment of fish onsite or offsite - fish movement (date, survival rates, year class, approximate weight and number of fish, off feed for 48 hrs, etc.). Methods will follow the procedures within *MCF* SOP unless otherwise noted.
- Daily physical appearance of fish
    - Date
    - Feeding Response
    - Mortality (tank #)
    - Growth and Development

Water Quality data are recorded daily on forms and then placed in the binders in the Water Quality Lab. The information will then be electronically added via ipad / computer into the network drive for storage and usage. System and tank data will also be logged through sensors in tanks and recorded within the mainframe computerized system. All computerized systems will have the proper back up and storage techniques.

DO, temperature and feed records are to be recorded automatically on the automated Robotic / Arvo Tech centralized feed computer, plus manually on paper for each tank and group of tanks assigned to each of the four areas.

6.0 PEST MANAGEMENT

The purpose of a Pest Control Program is to regulate "Pests" that could cause health concerns to the animals and potentially humans.

All fish culture facilities are indoors. Therefore, birds and other predators are not of a concern. However, a pest management plan will be implemented to control rodents (mice, rats etc.), a potential source of pathogens. A local third party service provider will be contracted for rodent control. Water sources (pump house, pipelines), filtration systems are also secured.

An effective rodent control program involves three areas of activity:

- Prevention,
- Monitoring and
- Control

MCF will deter rodents by following some basic steps:

- Early Detection
- Securing the Hatchery Building
- Cleanliness
- Safe Feed Storage
- Third Party Local Service Provider

Rodents (rats, mice etc.) are documented carriers of pathogens and therefore present a serious concern for public health. The results of inspections and monitoring programmes will always be recorded and any trends in pest activity noted and discussed at management level meetings. This will help ensure the efficiency of pest control programmes is monitored and that, if necessary, they are adapted to meet the critical needs of the *MCF* hatchery. Whether you are dealing with a pest problem or are simply looking to prevent one, it is important that you know who to contact. For any third party local service provider, part of their role is to be fully up-to-speed on the latest legislation in their area of expertise ie; (DFO Aquaculture Activities Regulations- Section 6: Pest Control Products).

An entire hatchery can be contaminated by the presence of a single infected rodent, thus posing a risk. Besides the danger of infection, rodents cause damage to buildings, electrical lines and water pipes, thereby affecting production and profitability. For these reasons, an effective rodent control program will be implemented at the *MCF* Hatchery.

Rodent infestation can quickly take hold without even seeing a single animal, because their nocturnal habits tend to keep them away from human eyes. If a single rat is seen during daytime, there is already a sizeable infestation. To control rodents requires constant attention - and it is common for hatcheries, especially in the case of larger operations like *MCF*, to place responsibility for rodent control in the hands of a specialized pest control company as stated above.

7.0 FEED STORAGE AND INVENTROY CONTROL

MCF will have a designated feed storage room (Figure 16) for all feeds. A feed inventory control program will be established, which details all feed inventory on site, expiry dates of feeds and projected feed usages and order dates including quantities and sizes. This will be incorporated into all areas of the hatchery- Hatchery / Start Feeding, Growth 1-3).

Feed shipments on arrival will go into a feed inventory control system; feed name, type, size, quantity and lot # will be recorded, manufactured date, expiry date etc. (Skretting, Clean Assist CA 0.5 mm, 10 kg, ie; lot # 6832104)(Figure 18).
Because fish feeds usually contain relatively high amounts of fish meal and/or fish oil, they are very susceptible to rancidity. Feeds will be stored in a cool, well-ventellated, dry place and will never be kept on hand for more than three months. Feed inventory should be kept in a first in fist

out system to utilize oldest to newest feed and reduce expired feed.Opened feed bags will be stored in closed containers with tightly closed lids to seal out moisture, insects, or rodents.

Designated feed storage areas, such as the primary feed room, will be kept clean and neat and also provide adequate containment for control of pests. The importance of careful attention to the specific requirements for proper storage and handling of aquaculture feeds can't be overstated. At most hatcheries that raise fish, feed cost is the largest single expense item. Therefore, even a small reduction in wasted feed can significantly affect production cost and directly impact bottom line profitability. Unused feeds will be disposed of following town bylaws. These feeds are not considered hazardous material and can go to local land fill.

Figure 18: Feed Storage Area and Feed Inventory Control

8.0 LUMPFISH WELFARE

"The World Organisation for Animal Health (OIE) defines animal welfare by the way in which an animal copes with the conditions in which it lives; an animal is in a good state of welfare if, as indicated by scientific evidence, it is healthy, comfortable, well nourished, safe, able to express innate behaviour, and not suffering from unpleasant states such as pain, fear, and distress. Thus, animal welfare refers to the state of the animal. The treatment that an animal receives is covered by other terms, such as animal care, animal husbandry, and humane handling." (Business Benchmark on Farm Animal Welfare-www.bbfaw.com).

MCP supports and will adhere to *AP 42 – Animal Welfare (NL, DFLR) - Legislative References: Aquaculture Act s. 4.(4)(g).*

Scope:
MCF in partnership with "The province" will oversees the welfare of animals in aquaculture, in conjunction with federal counterparts, covering their welfare throughout the life of the fish.

Policy:

1. A licensee must ensure optimal animal welfare during transport, sampling, fish handling, depopulation and normal operations.

2. A licensee must have their designated veterinarian performing, overseeing, or instructing employees on the humane euthanasia of fish during fish handling, sampling events, depopulation and normal operations.

3. Proper tools necessary for humanely euthanizing animals must be available and supplied to personnel performing euthanasia where required.

4. A licensee using fish for research, teaching and testing must follow the Canadian Council on Animal Care (CCAC) guidelines for care and use of fish, including the euthanasia of animals.

MCF will abide by the above statement and ensure all lumpfish are in a good state of welfare at all times. All *MCF* hatchery employees who handle animals will have completed the "Experimental Fish Course" provided by the University of PEI, plus have appropriate education and training.

MCF wants its fish to thrive, grow and be healthy. A fish with good welfare will be healthier and ultimately have better lice eat capabilities which is essential for the sustainability of *MCF*.

Fish welfare depends on a range of biological and environmental factors. *MCF* will continually strive to meet the needs of the lumpfish, strive for constant improvement through research and innovation as part of the company culture. *MCF* will ensure that the lumpfish in its care are treated well and has hence will abide by a set of Lumpfish Welfare principles for its operations.

***MCF*'s Lumpfish Welfare Principles**

This policy is based on the universally recognized "Five Freedoms" as described by the World Organization for Animal Health's (OIE) guiding principles on animal welfare.

The OIE defines the Five Freedoms as:

- Freedom from hunger, thirst and malnutrition;
- Freedom from fear and distress;
- Freedom from physical and thermal discomfort;
- Freedom from pain, injury and disease; and
- Freedom to express normal patterns of behaviour.

MCF aims to be an industry leader in fish welfare through application of best available scientific and operational knowledge that goes above and beyond legal requirements. Improving fish welfare is a central objective for *MCF*'s operations, research and technological development.

Based on the Fish Welfare Principles below, *MCF* assesses the welfare of the fish through welfare indicators to ensure that each lumpfish is treated well and that consistent standards are applied throughout the operations.

MCF is dedicated to monitoring and improving the welfare status of the lumpfish.

1. Proper Nutrition

MCF commits to:

- Provide the lumpfish with nutritious feed to ensure healthy growth, adequate amounts to reduce stress and competition for food, and actively optimize diets.

- Contribute to the development of feed products on the basis of strong scientific knowledge gained through Research and Development (R&D) and collaboration with feed suppliers, and be transparent on which feed suppliers it uses.

- Carefully assess sufficient fasting time for fish before handling with pumping, grading, vaccination and transport and to ensure that fish welfare is not at risk.

- As regards feed, we will be assured that the amount and nature of the feed used shall advance fish welfare.

2. Fish Health Care

MCF commits to:

- Take a preventative approach to fish health by prioritizing the development and use of appropriate vaccines, hatchery technology and practices to reduce handling, stress and the need for any medical treatment.

- Fish welfare considerations are also to be taken into account as regards vaccinations, and the Regulation provides that vaccination equipment shall be tested before being used to make sure that they are safe from a fish welfare perspective. Care has to be taken that vaccinations are done in a correct way.

- Practice husbandry and bio-security procedures which enhances disease control, and when needed, administer appropriate medical treatment to avoid suffering, or if necessary, humane culling of lumpfish.

- Have fish health management plans in place with procedures describing disease monitoring, fish sampling, diagnostics and eventual treatment options.

- Assess disease risks throughout the entire life cycle of the lumpfish and develop solutions to any critical welfare risks identified in all stages, from egg to 40 grams.

3. Stress Management

MCF commits to:

- Protect the lumpfish in its tank environmental from physical stressors, including cannibalism, through the means of prevention, careful monitoring and the implementation of stress mitigation measures based on good practice of grading, tank hygiene, water quality, hides and feeding practices and hides.

4. Optimize Lumpfish Environment

MCF commits to:

- Design its installations over the large tanks in a way that allows for response to changing tank conditions, optimal movement and minimal handling of the lumpfish to avoid discomfort and injuries.

- Maintain stocking densities in tank facilities within recognized limits.

- Implement comprehensive water quality plans in all areas of hatchery to ensure good water quality including monitoring and management of parameters such as oxygen levels, nitrogen and temperature, as well as monitoring of environmental risk factors such on incoming sea water from Mortier Bay.

- Research and trialing of innovative technologies to optimize lumpfish welfare within hatchery.

- Ensure optimal living conditions through tank management, hides, lighting and light levels, tank coloration, hygiene, noise etc.

- Gentle handling and transport and of the lumpfish.

- Inspections of lumpfish can easily be carried out.

- All areas have good hygiene.

- Reliable sources of electricity and access to emergency supplies of electricity (aggregate) and oxygen.

- Tests for surveying oxygen values, pH value, temperature and salinity shall not expose the fish to substantial harm. The salinity of the water in which the fish is kept shall not exceed 35 per thousand.

- The fish shall be grouped according to size to the extent this is of importance and taking into consideration fish welfare. The fish shall not be handled and taken out of the water unless this is necessary. If the fish show signs of considerable discomfort or deviant behaviour, measures to secure the welfare of the fish shall be put in place.

- The hatchery shall be equipped with an alarm that is activated in case of power outage, low oxygen levels, low water supplies and other deficiencies that are of concern to fish welfare.

- If living on will cause unnecessary or considerable suffering for the fish, it shall as soon as possible be killed duly. The fish shall be given a direct blow to head or given anaesthetics before being killed and shall be unconscious when death occurs.

- Furthermore, the record of operations for the production of lumpfish with MCF hatchery-reared animals, shall include details regarding the welfare status of the animals.

9.0 MORTALITY HANDLING, STORAGE AND DISPOSAL

MCF will ensure the following with respect to Routine Stock Mortalities.

- Designated mort totes will be used.
- Moribund lumpfish and mortalities will be removed from tanks daily.
- All personnel involved in mort removal will be required to wear rubber gloves which are used only during mortality collection.
- Youngest/healthiest tanks attended to first and older or unhealthy lumpfish last in each area.

In terms of Mortality Storage

- Morts will be covered when stored.
- Morts will be stored away from feed in an appropriate location.
- Appropriate disinfection will be in place around the mortality storage area.
- Mort storage containers will be emptied on a daily basis.

A practice that is common and proven both nationally and internationally for finfish mortalities and culls is ensilaging. The resulting product is often used for agriculture, as a feed additive or used as a source of energy in systems such as anaerobic digesters. *MCF* staff recognizes the benefits of ensilaging mortalities and culls as a best practice to reduce the risk of infectious disease transmission as well as for optimizing the use of this product in other industries (agriculture, renewable energy sector). This process inactivates bacteria and viruses including the virus that causes infectious salmon anemia (ISA) (Dixon et al. 2012) and has been proven effective and adopted in many finfish farming jurisdictions in Norway, Chile and Scotland (NAIA 2017b).

Fish mortalities at the *MCF* Hatchery will be monitored and collected daily from tanks. The fish (depending on size) will be placed into a grinder that chops the mortalities into small pieces while a dose dispenser (“doser”) adds formic acid to produce a slurry with a pH of 4.5 or lower. The slurry is held in a storage tank on-site at the hatchery facility until sufficient quantities are acquired to justify transport. Marbase Cleanerfish Ltd. prefers, where possible to use local companies that are interested in this product. Companies may utilize this product as a commercial fertilizer or animal feed additive. Refer to Appendix # 1 Marbase Cleanerfish Hatchery Ltd. Waste Management Plan.

Should depopulation be ordered due to a reportable disease, the mortalities will be ensilaged using the same process as regular mortalities. Disposal of mortalities that are a result of a reportable disease will be under the direction of CFIA. Marbase Cleanerfish Ltd. will work with CFIA to determine the appropriate facility for disposal in this instance. Refer to *MCF* Fish Health Management Plan and *MCF* Waste Management Plan.

The worst case scenario, the total facility will hold 2,705,483 - ~30 gram lumpfish or 81,008 kg or 88 tonne of raw product which is a small biomass by industry standards.

Fish hatcheries, similar to fish farmers must submit standard operating procedures for abnormal mortality removal for review and approval. They will also have to update the government's chief aquaculture veterinarian every 10 days and report the final number of fish removed once removal operations are complete.

Fish hatcheries, similar to fish farmers must publicly report their incident response plan within 24 hours of approval being granted by the required agencies. Refer to NAIA (Provincial Salmonid Aquaculture Mortality Management Plan). January 2020.

10.0 CLEANING - GENERAL GUIDELINES

10.1: Hatchery / Tank Equipment

This is a new lumpfish hatchery and thus all equipment will be purchased new. However, all new equipment will be disinfected / sanitized with Virkon prior and during initial stages of start-up.

No personal protective and work related equipment is permitted to be removed from the premises and no outside personal equipment is permitted in the clean areas. The sharing of personal protective and work equipment between facilities is prohibited. Guest workers and visitors to the compartment will be provided with personal protective equipment to use during their visit.

Equipment will not be shared between any of the rearing systems. Equipment in each fish area such as dip nets, siphons, hides, skimmers, air and oxygen hoses, feeding equipment are assigned to a tank and considered part of that tank and thus not moved from tank to tank or within other areas of the hatchery. No wood will be used in any of these areas as part of equipment.

General equipment such are nets, buckets, brushes, hand held graders, fish totes etc. are kept in large disinfectant baths located in each area. No equipment is to be moved between rearing systems for any reason. All nets, brushes and buckets are specifically identified by colour for the rearing system to which they are dedicated.

Equipment not in use will be thoroughly cleaned, disinfected, dried and stored in the storage area of each designated rearing area for future use.

Safety: Full PPE and relevant training will be provided to all *MCF* staff members in relation to biosecurity measures (Section 13.0).

10.2: Some Additional Basic Disinfection Guidelines at *MCF* Hatchery

Equipment

- All equipment, such as nets, hides, siphons or feeders, will remain in the same fish rearing room and not used in other parts of the facility.
- All equipment will be cleaned and disinfected after each use.
- Disinfection guidelines,
    - Clothing
        - All rain gear used while working within fish culture systems (ie. Fish movement, grading, cleaning of tanks, etc.) is required to be disinfected after each use and hung to dry.

      Rain gear includes:
        - Rubber boots – dipped into Virkon baths in hygiene barrier rooms
        - Rain pants and coats – washed with detergent and chlorine bleach and rinsed.
        - Gloves – dipped in a 200 ppm chlorine solution and rinsed and/or run through a cycle in the washing machine with bleach detergent.

        Rain gear can be hung to dry. Gloves will be turned inside out prior to drying.

All equipment used while working within fish culture systems (ex. Fish movement, cleaning of tanks, etc.) must be disinfected after each use and before reusing:

Equipment includes:

- Brushes/Nets/Siphons/Hides/Feeders/Trays/Weigh Boats – dipped in a 200 ppm chlorine solution for 1hour and then rinsed thoroughly. Nets and long handled brushes should be stored upright or by sinks.

- Fish Totes, Grading Equipment – Fish tanks and other equipment associated with fish transport is disinfected with 200ppm chlorine for 1 hour and neutralized with sodium thiosulfate at a rate of 2.85 x the amount of chlorine (g) according to the OIE International Animal Health Code.

- Electronic Equipment – any waterproof surfaces can be cleaned with a 200 ppm chlorine solution, any other equipment will be wiped down with a 70% ethanol solution.

- Table tops/surfaces – all working surface areas will be disinfected with a 70% ethanol solution before and after each use.

Hygiene Barriers

Hygiene barriers will be present in areas of need to prevent splash and or separation of various size classes of lumpfish.

Disinfection is a structured process that uses physical and chemical procedures to remove organic material and destroy or inactivate pathogenic agents.

The disinfection process will include the following phases:

- **Cleaning and Washing**

Cleaning and washing of surfaces and equipment is necessary to remove solid waste, organic matter (including biofouling) and chemical residues as these may reduce the efficacy of disinfectants. The use of detergent is also important to break down biofilms. The detergent used will be compatible with the disinfectant and the surface being treated. After cleaning, any excess water will be drained and before the application of disinfectants all surfaces and equipment will be inspected to ensure there is no remaining organic material.

Where treatment of water is required, the presence of suspended solids may also reduce the efficacy of some disinfectants. Removal of suspended solids through various processes such as filtration, sedimentation, coagulation or flocculation will be performed.

Biofilms, often referred to as slime, are a thin film of microorganisms and extracellular polymeric substances that adhere to surfaces. Biofilms physically protect embedded microorganisms against disinfectants. In order to achieve effective disinfection, biofilms will be removed during the cleaning and washing stage prior to the application of disinfectants.

All waste (sludge, silage) produced will be disposed of in a biosecure manner because it may contain viable pathogens that have the potential to spread infection if not controlled.

- **Application of Disinfectants**

This phase involves the application of chemical compounds or physical processes that are appropriate to inactivate the pathogenic agent.

The application of disinfectants will take into account the type of material requiring disinfection and how disinfectants will be applied. Hard non-permeable materials (e.g. polished metal surfaces, plastics and painted concrete) can be cleaned thoroughly and allow contact with the disinfectant because there is little opportunity for infective material to lodge in crevices. Disinfection efficacy will decrease if the surface is corroded, pitted or paint is flaking, therefore proper maintenance of surfaces and equipment is essential. For permeable surfaces and materials (e.g. woven material, nets and soil), a higher disinfectant concentration and a longer contact time is required because the surface area is greater, chemicals cannot penetrate easily and residual organic matter may be present.

The choice of the application method will ensure all surfaces come into contact with the agent for the required period of time. The application of disinfectants will be undertaken methodically (e.g. using a grid pattern) to ensure that complete coverage and adequate contact times are achieved. Each phase will start from the highest point and proceed downwards, commencing from the least contaminated areas. However for some equipment, rinsing of surfaces with the disinfectant may be sufficient. When disinfectants are applied to vertical surfaces, care will be taken to ensure that the required contact time is maintained before the disinfectant drains away. Vertical surfaces may need retreatment or require the addition of compatible foaming agents to prolong adherence to surfaces.

For pipes and biofilters, complete filling with the disinfectant solution will be done to ensure contact with all surfaces. Difficult to access and complex areas may require fumigation or use of misting equipment.

- **Removal or Inactivation of the Disinfectant**

Removal or inactivation of chemical residues is important to avoid toxicity to aquatic animals, corrosion of equipment and environmental impacts. Processes that may be employed for the removal or inactivation of chemical residues may include: rinsing of surfaces, dilution to acceptable levels, treatment to inactivate chemical agents or, time to allow deactivation or dissipation of the active compound. These processes may be used in isolation or in combination.

Disinfectants will be used in accordance with relevant legislation. Disinfectants may present risks to the health of people, aquatic animals and the environment. Chemical disinfectants will be stored, used and disposed of in accordance with regulations and manufacturer's instructions.

Disinfection will be monitored to ensure appropriate dose of disinfectant and disinfection efficacy. Depending on the application process and the pathogenic agent of concern, this may be done in different ways.

MCF staff will keep records of the disinfection processes applied. The records will be sufficient to allow evaluation of the disinfection plan.

Information below are MCF considerations for effective disinfection of different types of aquaculture establishments and equipment.

- **Tanks**

Tank construction material (e.g. fibreglass, concrete or plastic) will determine the type of disinfection method used. Bare concrete tanks are susceptible to corrosion by acids and potential damage by high pressure sprayers. They are also porous and therefore require longer application of chemicals to ensure disinfection. Plastic, painted and fibreglass tanks are more easily disinfected because they have smooth, non-porous surfaces that facilitate thorough cleaning and are resistant to most chemicals.

Tanks will be drained of water and have as much organic matter as possible removed prior to disinfection. Water and organic matter will be disinfected or disposed of in a biosecure manner. Tank equipment will be removed for separate cleaning and disinfection, and all organic waste and debris removed. Tank surfaces will be washed using high-pressure sprayers or mechanical scrubbing with detergent to remove fouling such as algae and biofilms. Heated water may be used to enhance the cleaning process. Before application of disinfectants any excess cleaning water will be drained and disinfected or disposed of in a biosecure manner.

When disinfectants are applied to vertical surfaces, care will be taken to ensure that adequate contact time is maintained before the disinfectant is drained. Following disinfection, tanks will be rinsed to remove all residues and allowed to dry completely.

- **Pipes**

Disinfection of pipes may be difficult due to lack of access. Pipe construction material will be taken into consideration when selecting the disinfection method.

Pipes can be cleaned through the use of alkaline or acid solutions, or foam projectile pipe cleaning systems. For cleaning to be effective, biofilms must be removed followed by flushing of the resulting particulate matter and thorough rinsing. Once pipes are cleaned, chemical disinfectants or circulation of heated water can be used. All steps require pipes to be fully filled so that internal surfaces are treated.

- **Building**

Building refer to all culture areas and other areas of the facility associated with storage of feed and equipment.

The approach to disinfection may vary depending on the structure of the building and degree of contact with contaminated material and equipment.

MCF building will be designed to allow effective cleaning and thorough application of disinfectants to all internal surfaces. Some areas will contain complex piping, machinery and tank systems that may be difficult to disinfect. Wherever possible, areas will be cleared of debris and emptied of equipment, prior to disinfection. Misting or foaming agents are options for disinfection of complex areas and vertical surfaces.

- Containers

Containers range from simple plastic totes used or dead aquatic animals through to complex tank systems used for the transport of live aquatic animals.

Containers are generally manufactured using smooth non-porous material (e.g. plastic, stainless steel) which can be easily disinfected. They will be considered high risk items because they are in close contact with aquatic animals or their products. In the case of transport of live aquatic animals, containers may also have pipes and pumping systems and confined spaces that will also be disinfected.

All water will be drained from the container and any aquatic animals, faecal matter and other organic material removed by flushing with clean water and disposed of in a biosecure manner. All pipes and associated pumps will also be inspected and flushed.

Containers will then be washed using appropriate chemical detergents combined with high-pressure water cleaners or mechanical scrubbing. All internal and external surfaces of containers will be treated using an appropriate disinfection method. They will then be rinsed and inspected to ensure there are no organic residues and stored in a manner that allows them to drain and dry quickly.

10.3: System Cleaning Protocols at the End of each Production Run

MCF System Disinfection on Day 1

• All air lines and associated tank equipment are to be detached, removed and cleaned thoroughly using chlorine and Virkon.

• All other general equipment (totes, carts, pumps, graders, counters, vaccination tables) are to be cleaned thoroughly using chlorine and Virkon.

• The system (all drum filters, main lines to each room, tanks, pipes, pumps) is to be charged with chlorine and free chlorine levels are to be monitored every hour for a period of 24 hours. The goal is to maintain free chlorine levels above 100 ppm.

• The chlorine is to be neutralized with sodium thiosulfate and released into the septic tanks on site.

• All tanks are pressured sprayed (interior and exterior) using an alkaline detergent.

• All tanks are then sprayed with Virkon.

• All pipe lines are cleaned with a sewer snake containing a rotating brush head.

***MCF* System Disinfection on Day 2**

• The system is to be re-charged with chlorine and free chlorine levels were monitored every 2 hr's for a total of 72 hr's at different locations. Chlorine readings should be above 100 ppm.

• During the chlorine charge, all MCF interiors and fish equipment are to be sprayed with Virkon, including large drum filters, tanks and oxygen/nitrogen charging equipment.

• All fittings in each room are to be dissembled, cleaned and soaked in chlorine.

• The interior (floors, walls and ceilings where possible) of each room will be was sprayed with Virkon, during the chlorine charge.

• At the end of the 72 hr chlorine charge, all buildings will be flooded with 100 ppm free chlorine. The remaining fluids are to be neutralized and discharged into the septic system.

• All equipment, vehicles and gear is to be sprayed with Virkon.

• All tanks, water and air lines will remain dry for the next 14 days.

11.0 TRANSPORT VEHICLE(S) CLEANING AND DISINFECTION

Vehicles (Figure 19) will be required to be disinfected prior to arriving on site at *MCF* Hatchery premises. This will be certified by *MCF* personnel prior to truck enter premises and fish transport. The truck will also undergo disinfection on site as well for wheels etc.

Live Fish Transport Truck/Trailer/Equipment Disinfection (SOP).

Figure 19: C&D of truck.

Purpose and Scope

The purpose of this SOP is to provide guidelines to thoroughly disinfect trucks, trailers and transport equipment involved in live fish transport prior to arrival at the Marbase property.

Sodium hypochlorite (J12).

Materials and Supplies

- Appropriate cleaners and disinfectants.
- Long handled, hard bristled scrub brush (non-wood handle)
- Power sprayer and/or portable hand pump with clearly marked liter levels.
- Personal Protective Equipment "PPE" (rain gear, rubber boots, protective eyewear, gloves, etc.)
- Pressure washer.
- Measuring cup.

Disinfectant solution(s):
Example:

- 12.5% sodium hypochlorite product (e.g. J12)
- 1% J-12 (ie: 100mL J-12 in 9L water)
- 333.3 Liters of J-12 must be added to 30,000 Liters of freshwater.

Cleaning and Disinfection Procedure (Exterior of truck and associated equipment).

- The outside of the truck, trailer and associated equipment must be cleaned to ensure no mud or other organic material is present; and rinsed before disinfectant applied.
- High pressure cleaning, from the top of the truck and trailer to the bottom will be performed.
- All personnel engaged in C & D procedures that involves getting onto the truck and/or trailer must disinfect their appropriate PPE before cleaning can begin.
- The exterior of the truck will be applied with a disinfectant (1% J-12) for 10 minutes.

Cleaning Procedure for Box holds (exterior).

- The surface of the fish holding tanks must be cleaned to ensure any organics that may be present are removed.
- Cleaning the interior of the tanks (including air lines, stones, valves, etc.) will be performed with a pressure washer and scrub brush.
- Mix 1% J-12 solution in a portable sprayer.
- Spray all exterior holding surfaces with the 1% J-12 while using a brush to scrub away any residue. Let sit for 10 minutes.
- Rinse exterior surfaces with well water.

Cleaning Procedure of Fish holding tanks (interior).

- Over fill tanker with well water allowing all air lines and diffusers to be fully submerged. Add enough J-12 to reach a 1% solution and mix thoroughly allowing solution to overflow the overflow outlet valves. Let sit for 1 hour.
- Isolate fill lines with a 1% J-12 solution (ie: 100mL J-12 in 9L water). Let sit for 10 minutes minimum, drain and flush with well water to transport site.
- The fish holding tanks will be filled completely with a freshwater solution of 1% J-12 solution and held for a minimum of 1 hour.
- All air stone diffusers, valves, etc., normally in contact with the live fish transport water, will be left in contact with the disinfection solution.
- After cleaning tanker holds, use a 1% J-12 solution and scrub brush to clean the 6" outlet tubes from both the top and bottom.
- Use a brush and scrubby with the 1% J-12 solution to clean the aluminum camlock caps.
- Once the tank(s) are empty of the disinfection solution, the tank(s) will be filled and rinsed with freshwater to remove any residual chlorine.
- Ideally, the tanks will be left to dry completely before use.

Record Keeping

- Safety Data Sheets for products used.
- Chemical mixing directions
- Disinfection Log

Transport Companies will adhere to this SOP and maintain accurate records, which will be available upon request of our clients.

Transport Truck and Trailer Cleaning and Disinfection Log
1% of J-12 solution will be used to clean the following

Vehicle Description/Identification	Date	Owner, Operator	Person(s) performing C&D

Description of recent activity(ies) vehicle was involved in:

____

____

____

	Signature
Raingear	
Oxygen Meter	

Transport Trailer	
Exterior of Fish Boxes	
Interior of Fish Boxes	
Rinsed	

Notes:

Date& Time	Notes

12.0 BIOSECURITY SIGNAGE

Examples of signage at Marbase Cleanerfish Ltd. are shown below in Figures 20-22:

Figure 20: Biosecurity Management Plan and Farm Biosecurity Pan in Place signage.

Figure 21: Vehicle(s) entering and exiting sites.

Figure 22: No Admittance without Prior Approval and Foot Dip signs.

13.0 PERSONAL PROTECTIVE EQUIPMENT (PPE)

Disinfection of personal equipment can be consider the likelihood and degree of contamination associated with previous use. Where possible, personal equipment should be fish area specific as per hatchery design.

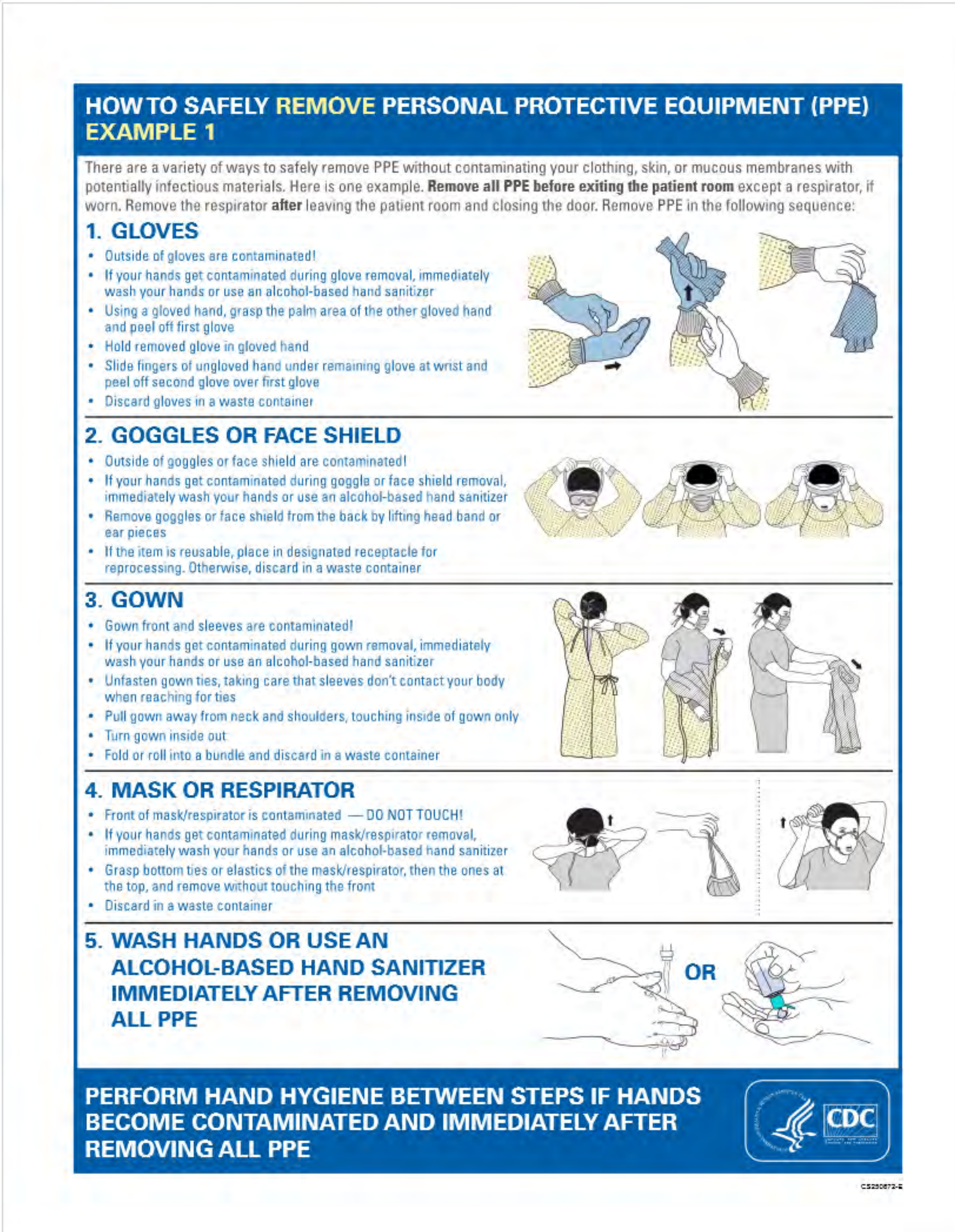
Equipment chosen will be non-absorbent and easy to clean. All staff entering a production area will use protective clothing that is clean and uncontaminated. On entry and exit of production areas boots will be cleaned and disinfected- (Section 3.4-3.5).

Footbaths will incorporate a cleaning procedure to remove accumulations of organic material and be sufficiently deep to cover boots and *MCF* will use a *disinfectant* solution that is not inactivated by organic matter (Virkon).

Frequent rinsing (fresh water) of equipment will assist in reducing build-up of organic matter and make *disinfection* more efficient. Equipment will be allowed to dry thoroughly to ensure that moist microenvironments that may harbour *pathogenic agents* are minimised.

Safety: Full PPE and relevant training will been provided to all staff members.

Guide to donning and doffing Personal Protective Equipment (PPE)-Figure 23. PPE required may be different from below.



HOW TO SAFELY REMOVE PERSONAL PROTECTIVE EQUIPMENT (PPE) EXAMPLE 1

There are a variety of ways to safely remove PPE without contaminating your clothing, skin, or mucous membranes with potentially infectious materials. Here is one example. **Remove all PPE before exiting the patient room** except a respirator, if worn. Remove the respirator **after** leaving the patient room and closing the door. Remove PPE in the following sequence:

1. GLOVES

- Outside of gloves are contaminated!
- If your hands get contaminated during glove removal, immediately wash your hands or use an alcohol-based hand sanitizer
- Using a gloved hand, grasp the palm area of the other gloved hand and peel off first glove
- Hold removed glove in gloved hand
- Slide fingers of ungloved hand under remaining glove at wrist and peel off second glove over first glove
- Discard gloves in a waste container

2. GOGGLES OR FACE SHIELD

- Outside of goggles or face shield are contaminated!
- If your hands get contaminated during goggle or face shield removal, immediately wash your hands or use an alcohol-based hand sanitizer
- Remove goggles or face shield from the back by lifting head band or ear pieces
- If the item is reusable, place in designated receptacle for reprocessing. Otherwise, discard in a waste container

3. GOWN

- Gown front and sleeves are contaminated!
- If your hands get contaminated during gown removal, immediately wash your hands or use an alcohol-based hand sanitizer
- Unfasten gown ties, taking care that sleeves don't contact your body when reaching for ties
- Pull gown away from neck and shoulders, touching inside of gown only
- Turn gown inside out
- Fold or roll into a bundle and discard in a waste container

4. MASK OR RESPIRATOR

- Front of mask/respirator is contaminated — DO NOT TOUCH!
- If your hands get contaminated during mask/respirator removal, immediately wash your hands or use an alcohol-based hand sanitizer
- Grasp bottom ties or elastics of the mask/respirator, then the ones at the top, and remove without touching the front
- Discard in a waste container

5. WASH HANDS OR USE AN ALCOHOL-BASED HAND SANITIZER IMMEDIATELY AFTER REMOVING ALL PPE

OR

PERFORM HAND HYGIENE BETWEEN STEPS IF HANDS BECOME CONTAMINATED AND IMMEDIATELY AFTER REMOVING ALL PPE

CDC

Figure 23: Personnel Protective Equipment (PPE) examples and protocol.

14.0 TRACEABILITY AND RECORD KEEPING

MCF will follow the movement of lumpfish from larval/juvenile through first feeding and growth 1-3 stage(s) of production and then distribution through 3rd party sales through an internal audit tracking system. *MCF* will carry out a systematic approach in record keeping which in turn will ensure effective monitoring. All records pertaining to the lumpfish hatchery operation will be maintained.

Items such as water quality parameters, visitors logbook, feed inventory, fish treatments, vaccinations(tbd), grading and handling procedures, tank changes, mortalities, equipment inventory, maintenance records, fish sales, general expenditures etc. will all be recorded on paper / tablet and computerized with adequate back-up systems.

15.0 REFERENCES

https://www.inspection.gc.ca/plant-health/plant-pests-invasive-species/biosecurity/nursery-sector-biosecurity-guide/eng/1485922257359/1485922305072?chap=0

https://www.inspection.gc.ca/animal-health/aquatic-animals/biosecurity/eng/1320594187303/1320594268146

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Business Benchmark on Farm Animal Welfare (www.bbfaw.com)

Canadian Biosafety Standards, 2nd edition (2015).

Containment Standards for Facilities Handling Aquatic Animal Pathogens. (Canadian Food Inspection Agency, Biohazard Containment and Safety Science Branch, 2010).

Department of Fisheries and Land Resources, AAHD (NL) Biosecurity in Hatchery Documents.

Laboratory Biosafety Manual. (World Health Organization, 2004).

NAIA- Provincial Salmonoid Aquaculture Mortality Management Plan. 2017b

NAIA (Provincial Salmonoid Aquaculture Mortality Management Plan). January 2020

OIE - Aquatic Animal Health Code - 29/08/2019. Chapter 4.3. Disinfection of Aquaculture Establishments and Equipment (Article 4.3.1. Pages 1-8).

16.0 APPENDICIES

#1 Marbase Cleanerfish Ltd. Waste Management Plan.
#2 Marbase Cleanerfish Ltd. Hatchery Field Program Report.
#3 Marbase Cleanerfish Ltd. Fish Health Management Plan.

17.0 ADDITIONAL FACILITY TANK LAYOUT SCHEMATICS:

Figure 24-26, tank placement in facility.

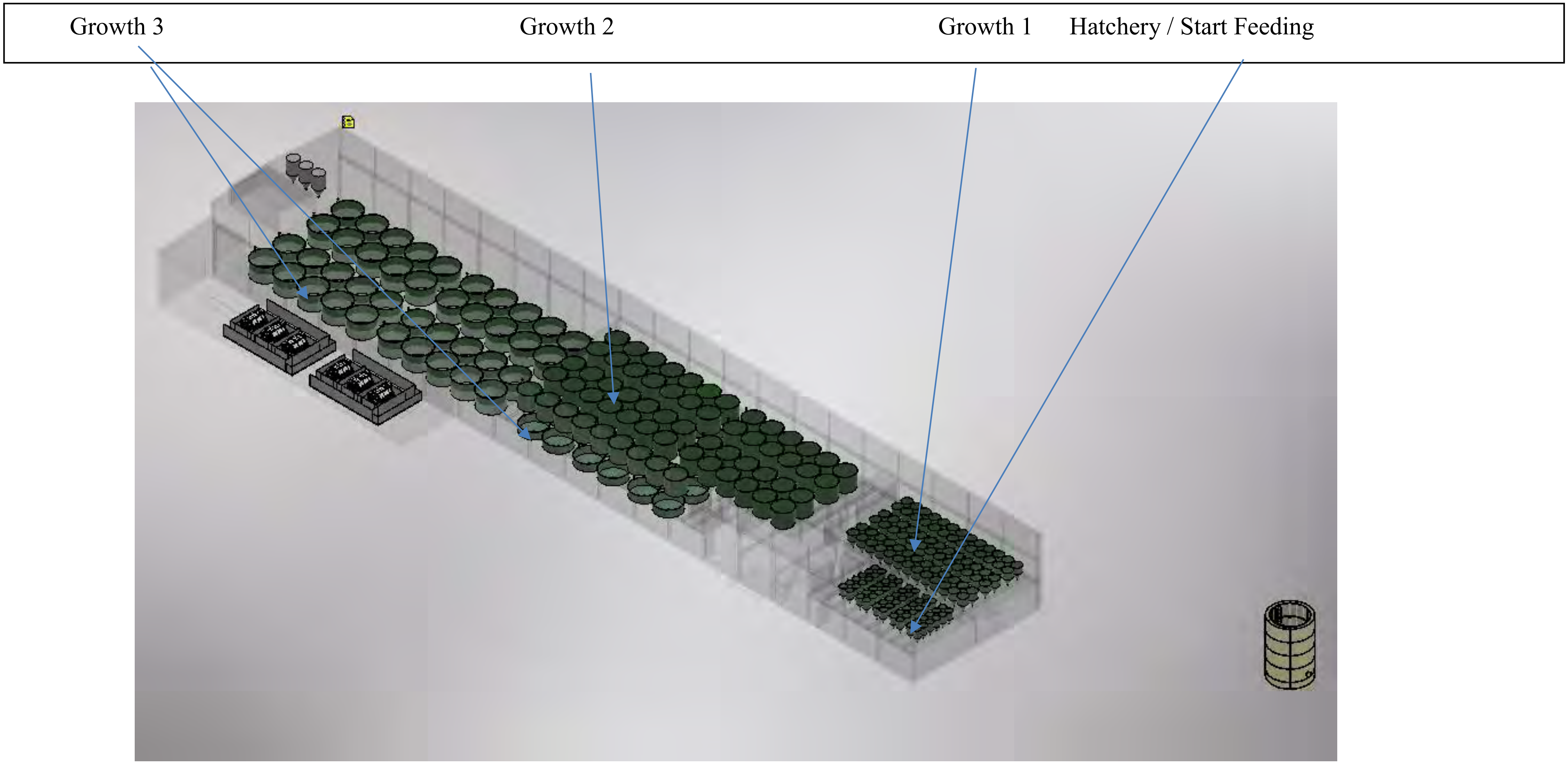

Figure 24: Operational Layout of Tanks in Facility- Level 1&2 floors

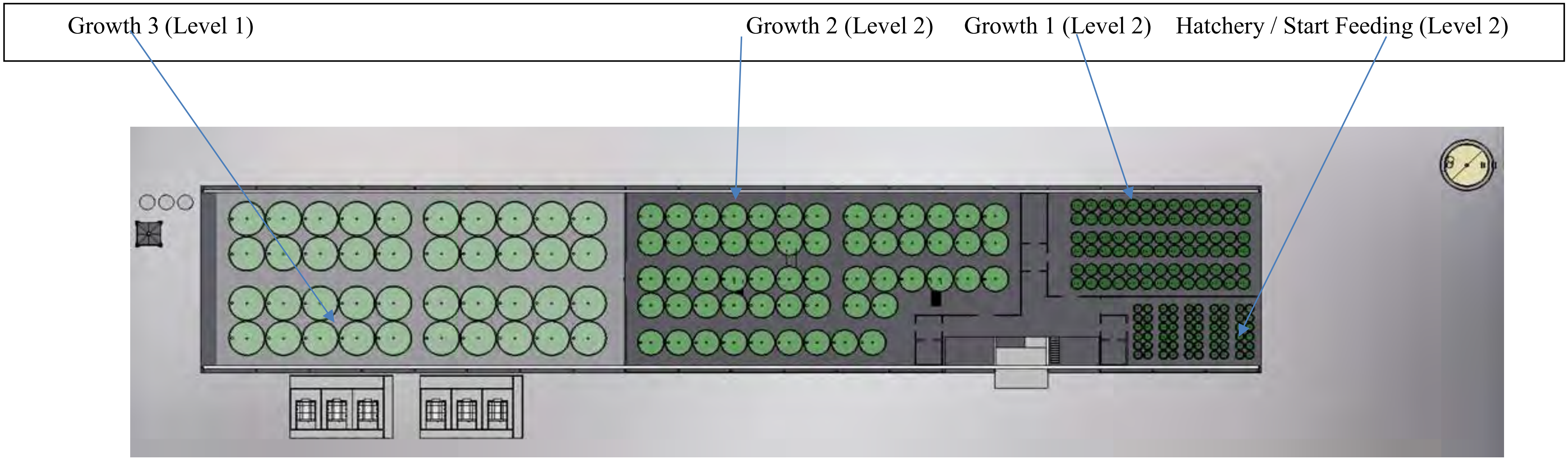

Figure 25: Operational Layout of Tanks in Facility. Level 2

Growth 3 (Level 1)	Growth 3 (Level 1)

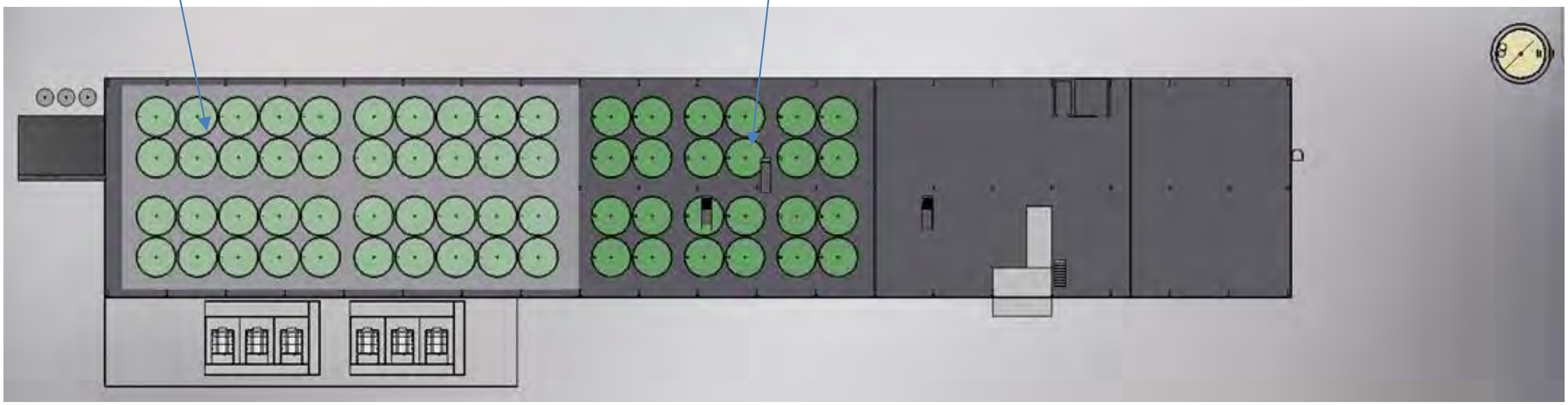

Figure 26- Operational Layout of Tanks in Facility - Level 1- Bottom Floor.

Marbase Cleanerfish Ltd. (*MCF*)
Waste Management Plan

MARBASE

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Marbase Cleanerfish Ltd.

Waste Management Plan

Document Number:

Rev. 03

Prepared by: Bevin LeDrew

Title: Consultant

Name

Signature

Approved by: Paul Antle

Title: CEO

Name

Signature

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Issue Date	Revision #	Prepared by	Approved by	Issue Purpose
April 21, 2020	01	Bevin LeDrew bevinledrew@gmail.com		First draft for internal review
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April 29, 2020	03	Bevin LeDrew bevinledrew@gmail.com	Paul Antle	Revised submission to DFLR

Document Distribution List

Name	Position, Title	Contact	Status

1.0 INTRODUCTION

Marbase Cleanerfish Ltd. ("Marbase") has developed this Waste Management Plan to outline the principles and procedures to manage waste potentially generated by the lumpfish hatchery in Marystown, Newfoundland and Labrador.

Marbase has developed this plan to ensure waste is immediately identified, classified, handled properly, reduced and reused where possible. The document outlines measures to manage and mitigate waste while limiting resource consumption during construction and operations. This plan is part of the Marbase Environmental Management System that was established to support the Marbase Environmental Policy and Commitment.

The Marbase Waste Management Plan is intended for use by all Marbase employees including line managers with direct responsibility for waste management.

This plan also provides guidance, expectations and instructions for Marbase contractors and suppliers. Contractors and suppliers will be mandated to comply with this Waste Management Plan and operate in conformance with this document. During project construction, the General Contractor will contractually require all sub-contractors to comply with the waste reduction strategy set forth in this document. A copy of this Waste Management Plan will accompany all Sub-contractor Agreements ensuring compliance.

Regulators can be expected to use this plan as a reference document in monitoring the company's performance and compliance.

This Waste Management Plan is available to the interested public as a demonstration of the Company's commitment to environmental protection and sustainability.

2.0 REGULATORY CONTEXT

Aquaculture activities at the Lumpfish Hatchery will generate a limited variety of waste. Several federal, provincial and regional organizations are involved in aquaculture waste management as regulators and financial stakeholders. Marbase has reviewed and intends to follow policy guidelines and recommendations as developed by the Department of Fisheries and Land Resources (GNL, 2019; GNL, 2019a), as well as the Newfoundland Aquaculture Industry Association's (NAIA) *Salmonid Aquaculture Waste Management Contingency Plan* (NAIA 2017a [draft version]).

Action plans are focused on priorities such as fish discards, mortalities and emergency preparedness, as well as adhering to the guiding principles to maintain biosecurity, fish health and market potential. Marbase is committed to be a leader in the aquaculture supply chain for its focus on progressive waste management strategies.

Other applicable legislation that applies to Marbase waste management activities includes:

Government of Canada:

- Fisheries Act – Aquaculture Activity Regulations (AAR; GC2018) - Sanitation Regulations; and
- Transportation of Dangerous Goods Act.

Province of Newfoundland and Labrador:

- Public Health Act Sanitation Regulations;
- Environmental Control Water and Sewage Regulations 2003 (GNL 2003);
- Occupational Health and Safety Regulations (GNL 2012); and
- Provincial Animal Health Care Plan.

Marbase will also operate in conformance with the requirements of the Workplace Hazardous Materials Information System (WHMIS).

The Department of Fisheries and Land Resources, Aquaculture Division provides a set of policy statements (GNL 2019 - AP 1 to AP 46). Guidance is also provided on specific topics. While much of the emphasis is on marine (sea cage) operations, the Marbase Waste Management Plan has applied this guidance wherever applicable.

This Marbase Waste Management Plan should be read in the context of other, related plans, including the Marbase:

- Fish Health Management Plan;
- Fish Disposal Plan;
- Biosecurity Plan; and
- Environmental Protection Plan.

Note, the Environmental Protection Plan includes Emergency Preparedness and Contingency Planning.

3.0 SCOPE AND GOALS

This Plan applies to Marbase operations at the Marbase Cleanerfish Hatchery, Marystown, NL. It addresses all waste streams potentially generated including sludge, “routine” mortalities, feed containers, domestic garbage, liquid discharges (treated sewage, salt-water outfall) and chemical/hazardous waste.

This Plan is intended to be a life-of-project document that will be reviewed and updated as required, but at a minimum once every year. The Plan is to form part of the Marbase Cleanerfish Aquaculture Licence issued by the Aquaculture Division, Department of Fisheries and Land Resources.

Marbase will prioritize waste management options that are sustainable and will divert aquaculture waste where possible from rural landfills. At Marbase the goal is to place emphasis on value and market potential of waste material. Wherever possible Marbase will also reduce, reuse, recycle and/or recover waste materials.

All waste management practices will adhere to strict biosecurity protocols to reduce the risk of transmission of infectious disease.

Marbase will minimize the production greenhouse gases by utilizing local waste management facilities where feasible to decrease travel. The company will also review alternate-use methods for fish by-products versus sending these materials to landfills.

4.0 OBJECTIVES - WASTE PREVENTION PLANNING

Marbase will, to the extent possible, prevent the production of waste through the use of efficient technology and operating protocols. When waste is generated Marbase will look to first recycle or reuse as much of the waste material as possible.

The company will work with the Burin Peninsula Waste Management Coorporation (“BPWMC”) and comply will any Burin Peninsula Waste Management landfill restrictions, i.e., no landfill disposal of tires, appliances, yard waste, mandatory recyclables, hazardous waste, batteries, fluorescent tubes, and large metal items.

Both during project construction and operation, Marbase will ensure that all contractors and suppliers meet these company requirements for waste management practices.

5.0 ROLES AND RESPONSIBILITIES

The Marbase Operations Manager will have responsibility for the implementation of the Waste Management Plan. Each area supervisor will be responsible in accordance with their scope of work as summarized in the listing below.

Position	Role and Responsibility
CEO	Annual Management Review
Operations Manager	Plan Approval; Update Approvals
Technical Manager	Plan Review
HSEQ Lead	Plan Implementation; Plan Documentation
Start Feed Manager	Handling of Feed Pallets, Feedbags
Operators – Technicians	Fish mortality handling, ensilage, transfer to contractor.
Water Quality Technician	Salt-water Discharge; Sludge Production
Veterinarian	Oversight in the event humane dispatch of fish is required; Oversight of disease prevention measures associated with plan implementation.
Administrator	Plan Maintenance, Distribution
Security	Implement and enforce biosecurity measures associated with Waste Management.
Facility Maintenance Staff	Domestic Waste Separation, Handling
Project Manager-Construction	All Construction waste management requirements.
Contractors	Material handling, transport, disposal as specified.

Roles and responsibilities will be reviewed as the implementation process advances.

6.0 WASTE TYPES

The construction and operation of the Lumpfish Hatchery will potentially generate a variety of wastes as listed in Table 1, including:

- organics (i.e. land debris, wood, mortalities);
- general inorganic waste (i.e. feed bags), which can also include obsolete or worn infrastructure (i.e. piping, netting); and
- contaminated or hazardous waste (i.e. diseased stock, chemicals, petroleum products).

Table 1. Waste Characterization Profile Marbase Cleanerfish Ltd.

Waste Types	Frequency [1]	Duration[1]	Est. Annual Production [2]
Metal scrap, building material	Daily	Three months during Construction	200[3]
Unsuitable fill material (rock, asphalt, concrete)	Daily	Two months during Construction	150[3]
Fuels, oils and lubricants (e.g., base oil from motors, hydraulic fluid)	Contractor equipment maintenance and re-fuelling offsite.	Three months during Construction.	neg.
Salt-water Return	Continuous	Continuous disposal during operation	32 X 10^6
Treated sewage[4]	Daily	Continuous disposal during operation	0.75 X 10^6 litres
Hatchery sludge	Daily	Weekly disposal during operation	96
Mortality (routine)	Daily	Weekly disposal during Operation	17
Feed rejects	Daily (assumed 1%)	Monthly disposal during operation	1
Mortality (mass)[5]	Unplanned event.	Unplanned event during operation	n.a.[6]
Paper and cardboard	Daily	Weekly disposal during operation	2
Feed Bags	Daily	Weekly disposal during operation	2
General refuse (e.g., trash, meals, packaging)	Daily	Weekly disposal during operation	<1
Used/expired parts (i.e. piping, connections, plastics)	Less than once per month - scheduled and unplanned maintenance and repair.	Infrequent and following each incident during operation.	<1
Fuels, oils and lubricants (e.g., base oil from motors, hydraulic fluid)	Daily equipment maintenance	Weekly-monthly disposal during operation.	<1
Wood (plywood, particle board, dimensional, pallets)	Weekly to monthly deliveries.	Weekly-monthly disposal during operation.	<1
Hazardous materials (paints, glycol, resins, cleaners, disinfectants, anaesthetics, pharmaceuticals)	Daily	Monthly – as required during operation.	<1

Notes

1. As per FLR guidance frequency/duration is approximated as: daily/<day; weekly/<week; monthly/<month; annually/<year; decade/>year. Or, can be related to activity if frequency and duration are not consistent (Kawaja, personal communication). "Frequency" refers to the rate of production of the waste; "Duration" describes the disposal pattern and the Project Phase applicable.
2. Tonnes per year unless otherwise indicated. "n.d." indicates there is no data available to support an estimate. Quantities less than 1 tonne per year are indicated as "neg." – negligible; "n.a". indicates that a value is not applicable.
3. Construction is a one-time activity, lasting less than a year, so production is shown as the total for the construction phase of the Project.
4. https://www.mae.gov.nl.ca/waterres/waste/groundwater/guidelines_for_design_constr_oper_wss.pdf
Guidelines for the Design Construction and Operation of Water and Sewerage Systems. 2005 Government of Newfoundland and Labrador Department of Environment and Conservation, Water Resources Management Division. December 2005. 525 pp. Table 5.1 (p.5- 4) – Factories (8-hour shift) = 115l/day; assume 12 person-shifts per day; 80 per week = 478,400 l
5. See Fish Disposal Plan for details on this Unplanned/Emergency Event.
6. Infrequent, unplanned event estimated at 81 tonnes maximum, but occurrence will be less than annually.

Any materials not currently listed in this document but identified during construction and/or operations will be assessed for proper disposal procedures then added to the Marbase Waste Management Plan.

Table 2 provides a description of the applicable waste management practices to be employed by Marbase and its contractors during project construction and operations. Handling and disposal options are discussed in the following sections.

6.1 Organics

There are several sources of organic waste that will be potentially generated by Marbase (Table 2). Organic waste should constitute the largest volume of waste generated during operations. Insignificant volumes of organic waste will be generated during the construction phase.

During operations, fish feces and uneaten feed are organics that will be captured in filtration equipment and filter-pressed to remove salt-water. Another source of organic waste is mortalities of the stock due to general losses or from removal (culling) of stock under circumstances such as poor growth performance. Mortalities can also result from a depopulation order (i.e. a reportable disease), a disease, or an operational event (e.g. thermal shock). Mortalities will be treated according to best practice techniques and under the guidance and recommendation of federal, provincial and municipal regulators. The Fish Disposal Plan addresses such occurrences. Where there is a requirement to dispatch fish, humane practices will be followed under the direction of a veterinarian.

6.1.1 Saltwater Return

While not typically considered to be a waste product, this project feature has been identified as requiring consideration under the Waste Management Plan. The saltwater supply will be pumped from Mortier Bay, treated, cycled through the hatchery, treated again and discharged as described in the Project Registration (Marbase 2019).

6.1.2 Fish Disposal

As per directions from the Department of Fisheries and Land Resources – Aquaculture Division (see GNL, 2019 - AP23), a separate Fish Disposal Plan has been generated to describe measures applicable to this waste stream. The document addresses both routine mortalities as well as major incidents where large numbers are affected.

6.2 Inorganic Waste

The majority of inorganic waste generated by Marbase will consist of plastics, mostly feed bags. A compactor will reduce the volume of plastic waste before recycling/disposal.

During construction a limited quantity of waste material will be generated, much of which may be suitable for recycling (i.e. wood, steel) or as backfill (i.e. gravel, concrete).

Table 2. Waste Types and Management Practices for Marbase Cleanerfish Ltd. Lumpfish Hatchery Project (Construction and Operation Phase).

Waste Type	Management Approach	Waste Practice
Organics		
Site clearing organic soil	Re-use; residual disposal	1. Re-use on site: or 2. Remove to other user locations
Hatchery salt-water return	Residual disposal	Treat and discharge
Sewage	Residual disposal	1. Treatment; then 2. Marine discharge
Hatchery Sludge	Recovery	1. Water content reduction 2. Composting at BPWMC or another approved purchaser
Reject Feed	Recovery	Composting at BPWMC or other purchaser
Fish Mortality (routine)[1]	Recovery	1. Ensiled; then 2. Anaerobic digestion at approved purchaser (e.g. New World Dairy in St. David's)
Fish Mortality (mass)[1]	Recovery	1. Ensiled; then 2. Anaerobic digestion at approved purchaser (e.g. New World Dairy) or disposal at BPWMC.
Paper and cardboard products, clean dimensional wood and wood pallets (equipment and feed delivery)	Reduce, recycle, and residual disposal.	1. Waste stream separation; then 2. Re-use on site; then 3. Delivery to BPWMC or approved waste facility
Feed bags	Reduce, residual disposal	1. Reduce through bulk delivery, storage; or 2. Compacting bags; then 3. Delivery to BPWMC or approved waste facility.
Domestic garbage/refuse	Reduce, recycle, residual disposal	1. Waste stream separation; then 2. Re-use on site; then 3. Delivery to BPWMC or approved waste facility
Expired & excess piping	Re-use or Landfill	Reuse on-site or BPWMC
Plastic components	Re-use or landfill	Recycle at approved metals recycling location
Inorganics		
Metals	Recycle	MMSB
Bottles and cans	Recycle	Approved hazardous waste facility
Fuels (petroleum)	Hazardous disposal	Approved hazardous waste facility
Glycol (antifreeze)	Hazardous disposal	Approved hazardous waste facility
Oil, lubricants and oily waste	Hazardous disposal	Approved recycling or hazardous waste facility
Paints	Reuse, recycle or hazardous disposal	Reuse or approved hazardous waste facility
Resins	Reuse or hazardous disposal	Reuse or approved hazardous waste facility
Acetone	Reuse or hazardous disposal	BPWMC or approved hazardous waste facility
Cleaning and disinfecting	Landfill or hazardous disposal	Approved Hazardous waste facility and/or treated in HATCHERY system
Anaesthetics	Hazardous disposal and/or treated in HATCHERY system	

BPWMC= Burin Peninsula Waste Management Corporation.
Note 1. See Marbase Fish Disposal Plan.

6.3 Contaminated or Hazardous Waste

Human waste (sewage) will be generated at the Lumpfish Hatchery by employees. The Marbase sewage treatment plant meets the codes and requirements of the Sanitation Regulations under the *Public Health Act*. On occasion, the system may require removal of accumulated sludge. A contractor will remove the material and transport it for disposal to the Burin Peninsula Waste Management site.

Should Marbase have a disease event that results in fish mortality or an ordered depopulation of fish, the stock that has died must be disposed of under direction of the Canadian Food Inspection Agency (CFIA). Marbase will adhere to their regulations and guidelines.

Only a small quantity of chemicals will be used and disposed of by Marbase. These chemicals will include petroleum products such as oils, fuels and greases. Chemicals such as cleaning and disinfecting products will also be used but are food grade and not considered hazardous.

7.0 WASTE MANAGEMENT

Marbase is committed to reducing the number of fish mortalities. As part of best practice, control techniques including the following will be implemented:

- Stress during procedures such as transportation, sampling and inspections as well as mortality removal will be minimized;
- In addition to the Provincial Animal Health Plan, Marbase will implement, in consultation with provincial and private veterinarians, a health plan to ensure the welfare of fish as required;
- Records of inspections, mortalities, as well as likely causes of mortalities will be maintained and submitted to the regulatory agencies and maintained within the Marbase documentation program; and
- Daily removal and disposal of any dead or moribund fish to prevent risk of disease spread or attraction of predators.

To reduce plastic waste as a result of feed bags, Marbase intends, where possible to purchase fish feed in bulk (pallet loads) to be delivered to silos at the Lumpfish Hatchery. This bulk transport will reduce the use of plastic bags and ultimately reduce waste generated. Attempts will be made to source biodegradable feed bag containers and to minimize these purchases. Alternatively, recycling will be used should this be available. All of these measures will take precedence over disposal. Other waste plastic generated will be reused or repurposed if possible before disposal at an approved waste management facility.

Recycling of materials will be undertaken whenever possible instead of sending waste to landfills. This will also include recycling the organic material such as the fish mortalities, feces and uneaten feed from the Lumpfish Hatchery. These materials can be repurposed to generate fertilizers and compost.

7.1 Waste Collection and Disposal

Marbase is committed to working with the federal, provincial and municipal organizations that govern waste management in Newfoundland and Labrador's aquaculture industry. Therefore, the Marbase Waste Management Plan is compliant with all relevant regulatory requirements and policy guidance. Additionally, waste collection and disposal will comply with Marbase corporate goals and industry best practice.

7.1.1 Hatchery Culture Water and Sewage

All discharged saltwater will be in compliance with the requirements of the Environmental Control Water and Sewage Regulations- Schedule A (GNL 2003). After passing through the culture tanks, the water will be processed through a series of 50 - micron mesh size rotary drum filters. This process will extract faecal material, uneaten feed and other metabolic waste from the outlet water. This will result in suspended solids levels that meet regulatory specification (no more than 1000 mg/l above ambient). The discharge water will then be disinfected by a UV system at 250,000 - 300,000 mW/cm^2. The parameters listed in Table 3 will be sampled and analysed for regulatory compliance, as per Schedule A of the Environmental Control Water and Sewage Regulations.

Table 3. Ambient Water Quality and Regulatory Standards – Candidate Intake Locations, Marbase Cleanerfish Hatchery (from LeDrew, 2019).

Parameter*	Site 1 – Deep Water			Site 2 Shallow Water		Site 3 Outfall	Schedule A Regulations*
	0m	25m	45m	0m	10m	5m	
Ammonia (as N)	0.08	<0.02	0.1	0.18	0.23	0.02	2
BOD	<6	<6	<6	<6	<6	20	21
Chlorine (total)	<0.03	<0.03	0.03	0.03	0.03	<0.03	1
pH	7.73	7.69	7.72	7.78	7.73	7.78	
TDS	32461	33062	33152	32433	32917	32481	1000**
TSS	17	21	10	8	22	3	30**
Nitrate (asN)	<2.37	<2.37	<2.37	<2.37	<2.37	<2.37	10
0-phosphate	<25	<25	<25	<25	<25	<25	1
Total cyanide	0.007	0.009	0.007	0.008	0.008	0.009	0.025
Sulfide	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	0.5
Hex..chromium	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	0.05***
Triv. chromium	<3	<3	<3	<3	<3	<3	1***
Total O&G	<2	5	<2	3	3	4	15
Phenolics	0.14	0.14	0.13	0.11	0.17	0.14	0.1
Boron	20.2	19.5	15.6	16.3	17.0	17.2	5
Iron	0.043	0.042	0.052	0.043	0.041	0.037	10***
Nickel	0.0009	0.0008	0.010	0.006	0.0056	0.0003	0.5***
Copper	0.002	0.001	0.002	0.001	0.001	0.0015	0.3***
Zinc	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.5***
Arsenic	0.0028	0.0029	0.0028	<0.0028	<0.0028	0.0026	0.5***
Selenium	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	0.01
Silver	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	0.05***
Cadmium	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.05***
Barium	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	5***
Mercury	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.005***
Lead	<0.0003	<0.0003	<0.0003	0.0003	0.0003	<0.0003	0.2***

*Environmental Control Water and Sewage Effluent Regulations – Schedule A. Note all parameters (except pH) reported as mg./l.
** " *If water is being abstracted from a water course, used, treated and subsequently returned to the same water course, these solids data mean that the effluent should not contain more than 1000 or 30 milligrams per litre more than was in the water originally abstracted.*"
*** For all metals *"the maximum content is the amount in excess of the background level as determined upstream of the discharge".*

7.1.2 Hatchery Sludge

Sludge is viewed as a "valuable resource" by Marbase. Solid waste collected by the drum filters mentioned above, will be in the form of a wet concentrate. All of this wet concentrate will be fed into its own processing plant for a further dewatering (see figure below)

.

Sludge Processor.

To improve waste transport efficiency, the sludge waste will be dewatered to 15% moisture, then sent to the denitrification area that further digests, while reducing total volume. Denitrification converts nitrates into nitrogen gas while purifying the water for reuse in the fish production system. The dried sludge will be collected on a routine schedule by the Burin Peninsula Waste Management Corporation (BPWMC) for use in their composting facility. All sludge will be disposed of in an appropriate manner in accordance with all provincial regulations.

The water extracted from the sludge at the drum filters will be reintroduced to the saltwater discharge line and then passed through UV treatment before being discharged.

7.1.3 Stock Mortalities and Culls

A practice that is common and proven both nationally and internationally for finfish mortalities and culls is ensiling. The resulting product is often used in agriculture as a feed additive or used as a source of energy in systems such as anaerobic digesters. Marbase recognizes the benefits of ensiling mortalities and culls as a best practice to reduce the risk of infectious disease transmission as well as optimizing the use of this by-product in other industries (agriculture, renewable energy sector). This process deactivates bacteria and viruses including the virus that causes infectious salmon anemia (ISA) (Dixon et al. 2012). It has been proven effective and adopted in many salmon farming jurisdictions around the world such as Norway, Chile and Scotland (NAIA 2017b).

Fish mortalities at the Lumpfish Hatchery will be monitored and collected daily from tanks. The fish (depending on size) will be placed into a grinder that chops the mortalities into small pieces while a dose dispenser ("doser") adds a mild acid to produce a slurry with a pH of 4.5 or lower. The slurry is held in a storage tank on-site at the hatchery facility until sufficient quantities are aggregated to justify transport. Marbase prefers, where possible to use local companies that are interested in this by-product. Candidate user companies are listed in the Fish Disposal Plan.

Should mortalities or depopulation be ordered due to a reportable disease and hence cannot be harvested and processed, the mortalities will be ensiled using the same process as regular mortalities. Disposal of mortalities that result from a reportable disease will be under the direction of CFIA and DFLR. Marbase will work with regulators to determine the appropriate facility for disposal in accordance with the Fish Disposal Plan. In the UK, ensilage is not designated as with or without a reportable disease since the process deactivates bacteria and viruses including the virus that causes infectious salmon anemia (ISA) (Dixon et al. 2012).

7.1.4 Domestic Sewage

All sanitary waste from the Lumpfish Hatchery (toilets, sinks, showers, etc.) will conform to the Environmental Control Water and Sewage Regulations 2003 (GNL 2003). Sanitary waste will be collected by the existing onsite sanitary system, an "all-in-one" packaged sewage treatment plant that is stand-alone.

The plant is designed to accept raw sewage and produce a high-quality effluent without the need for auxiliary equipment or tankage. Aerobic treatment is via a rotating biological contactor. Lamella plates are used to provide primary and final settlement of sludge. Sludge storage is provided within the unit and when full is removed by a qualified waste management firm such as BPWMC for disposal. BPWMC will either compost this material if possible or dispose at the local landfill.

7.1.5 Other Organics

Other organic waste generated by operations such as wood pallets, paper and cardboard and food waste generated at the hatchery will be collected and stored at a select location in approved containers for disposal by BPWMC. Where possible, material will be re-used or recycled before collected by BPWMC and used as part of their composting facility.

Currently, the Multi-Materials Stewardship Board (MMSB) does not recycle paper or cardboard on the Burin Peninsula, however, BPWMC can use it in their composting facility if operational. Paper products will be separated and collected by BPWMC for composting. Marbase will encourage employees to separate their food waste so organics can be composted instead of transported to local landfills.

7.1.6 Inorganic Waste

The majority of inorganic waste generated at the Lumpfish Hatchery will be the plastic feed bags. The volume and size of this feed is purchased in 25 kg plastic bags. Consistent with FLR feed bag handling policy (AP 16), emptied bags will be compressed and baled prior transport to a waste management facility.

There are currently no recycling facilities on the Burin Peninsula that can process the plastic feed bags. Until such facilities exist, Marbase will dispose of this waste through BPWMC.

Recycling of employee domestic waste such as plastic packaging, beverage containers and the like will be encouraged where appropriate. Material that cannot be recycled will be disposed as with other inorganic waste through BPWMC.

7.1.7 Chemical Waste

Chemicals such as formic acid and hazardous compounds such as oil and fuels will be moderately used during operations and subsequent waste may be generated. Marbase recognizes the hazards these materials can pose for the natural environment and fish stocks (both wild and farmed). As such, Marbase will ensure that these waste materials are stored in conformance with the Workplace Hazardous Materials Information System (WHMIS) and disposed of in accordance with federal and provincial regulations. Marbase will follow the suggestions and directions contained in the *Guidance Document: Best Management Practices for the storage of waste dangerous goods/hazardous waste (WDG/HW) at business sites* (GNL 2015).

Hazardous waste generated at the hatchery will be stored in containers clearly labelled according to WHMIS requirements. These containers will be appropriate for holding the material and will be in good condition as well as free of rust and cracks. A designated storage area as prescribed by Occupational Health and Safety Regulation, 2012 (GNL 2012, s.59) will be used for waste storage with a sign clearly indicating "**Hazardous Waste – Authorized Personnel Only**". Waste will be stored until quantities are sufficient to justify transportation for disposal. The waste anaesthetic water generated during procedures such as vaccination and sampling will be disposed according to local regulations.

Marbase intends to utilize companies within Newfoundland and Labrador that specialize in, and are approved for, handling and disposing of hazardous waste. In the case of a leak or spill during petroleum storage and handling, the Environmental Emergencies 24-Hour Report Line will be notified at 1-800-563-9089. Marbase will also have an Emergency Response Plan in place and a Response Organization contract.

Any vaccine or diluent requiring disposal, as well as biomedical waste such as needles will be handled according to biomedical waste disposal guidelines and municipal regulations. Vaccines will be prescribed and administered by a qualified veterinarian.

7.1.8 Emergency Preparedness

In order to address an unplanned event, it will be important to develop a capability that includes prevention measures, preparedness and response measures. In compliance with DFLR requirements, The Marbase Environmental Protection Plan includes provisions for emergency preparedness in the form of a series of Contingency Plans, as well as an Operator Incident Event reporting procedure for specified unplanned events.

Marbase Contingency planning incorporates such possibilities as:

- Major fish mortality;
- Disease Outbreak;
- Depopulation order;
- Spills (hydrocarbons, feed);
- Fire/explosion; and
- Facility evacuation.

8.0 TRAINING, MONITORING AND REPORTING

A training program will be implemented to ensure all staff are aware of the Plan and its goals and objectives. Those staff with designated responsibilities (Section 5.0) will be provided with appropriate training to ensure they have the necessary skills and are aware of best practices that apply to their assigned duties. All staff will be familiarized with the Marbase Environmental Management System, as well as specific topics such as emergency first aid, incident reporting, Emergency Response, access to and use of PPE.

All Marbase staff, as well as third-party service contractors, will be provided with a copy of the Marbase Waste Management Plan in conjunction with on-site waste management training. This training will focus on Marbase goals and ensure they are understood and followed.

Mass mortality events must be reported to the Aquatic Animal Health Division, CFIA and DFLR if there is suspicion of a significant fish disease. Based on the recommendations of these regulatory agencies and stakeholders, Marbase will be required to conduct investigations and submit detailed documentation on the event.

9.0 AUDITING

An annual internal review of waste management performance will be completed including a review of documentation, discussions with key staff, and briefing to senior executives on the findings.

To facilitate the audit process, records will be kept of waste streams including volumes generated, handling/treatment methods and final disposition.

An annual audit report will be produced comparing goals and objectives against actual performance and recommendations for improvement. The report will be delivered to the CEO.

In the event of a major incident (mass mortality) an audit may be initiated by site management or the CEO.

10.0 PLAN REVIEW AND UPDATES

Revisions and updates to the Marbase Waste Management Plan will be in accordance with an approved process and signed off by the responsible Senior Manager. Suggestions for changes can be made by any participant in the Waste Management Plan but are to be approved prior to issuance of amendments or updates to the plan.

Amendments and Updates will be issued on an as-needed basis, however at a minimum the Plan will be reviewed and revised annually, and a copy distributed to all document holders, including the Aquaculture Division, Department of Fisheries and Land Resources. Users of the Plan should ensure they have the most updated version of the document on hand.

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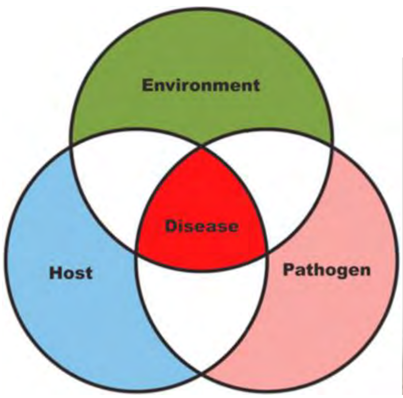
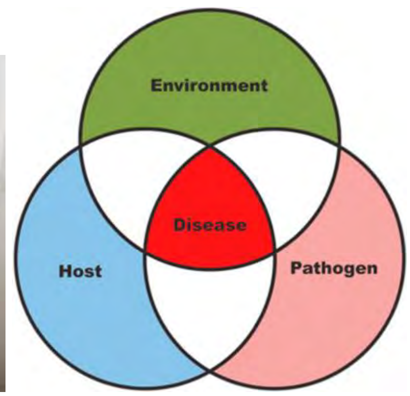
Marbase Cleanerfish Ltd (*MCF*)
Fish Health Management Plan





Fish Health Management is part of our Business Culture

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1.0 Fish Health Management Plan

Aquaculture industries throughout the world use Health Management Programs to maximize the health of the farmed fish stock and ensure that a healthy clean product is reared in optimum environmental conditions. Health management programs do provide a number of benefits to the industry and individual producers. Some of the potential program benefits are:

- minimizing risks from disease;
- demonstrating to potential markets, investors and insurers that a quality assurance program is in place;
- allowing certification of broodstock, eggs and /or grow-out stock as free of specific diseases - again allowing improved access to local and external markets;
- satisfying reporting requirements to provincial / national agencies and international agencies that depend on this data to allow continued access to markets;
- alerting industry members to the introduction of new and exotic diseases and prevent the spread of any exotic or endemic diseases; and enhancing public perception of the aquaculture industry, as being proactive in the area of environmental awareness.

The health of the lumpfish stocks held at *MCF* will be protected from infection by disease organisms that could be borne by the water, animals, people and equipment entering the facility.

1.1 What Is Fish Health Management

Fish health management is a term used in aquaculture to describe management practices which are designed to prevent fish disease. Once fish get sick it can be difficult to salvage them.

A Fish Health Management Program (FHMP) is essential for successful fish production and husbandry. The components of this program must address the exclusion or control of pathogens, good health practices; and then assembling a contingency or security system that minimizes potential fish losses due to disaster or disease at the *MCF* facility. A successful Fish Health Management Plan requires commitment by management and staff to follow operational policies and procedures, continually assessing those protocols, and modifying them, as necessary.

Fish Health Management is part of

***MCF* Business Culture**

Successful fish health management begins with prevention of disease rather than treatment. Prevention of fish disease is accomplished through good water quality management, nutrition, and sanitation. Without this foundation it is impossible to prevent outbreaks of opportunistic diseases. The fish is constantly bathed in potential pathogens, including bacteria, fungi, and parasites. Even use of sterilization technology (i.e., ultraviolet sterilizers, ozonation) does not eliminate all potential pathogens from the environment. Suboptimal water quality, poor nutrition, or immune system suppression generally associated with stressful conditions allow these potential pathogens to cause disease. Medications when and if used to treat these diseases provide a means of buying time for fish and enabling them to overcome opportunistic infections, but are no substitute for proper animal husbandry.

Daily observation of fish behavior and feeding activity allows early detection of problems when they do occur so that a diagnosis can be made before the majority of the population becomes sick. If treatment is indicated, it will be most successful if it is implemented early in the course of the disease while the lumpfish are still in good shape.

A good "Fish Health Management Plan" that is carried out successfully will greatly protect *MCF* business by protecting the fish they raise and the customers. Finally, it should be stressed that each FHMP must be tailored to each specific facility. Protocols need to be developed, based upon the disease risks associated with a particular facility or market sector, financial and human resources and facility design limitations. Implementing even a basic FHMP is better than doing nothing. It is always more expensive to implement biosecurity measures after a major disease or mortality event has occurred.

MCF staff commits to ensuring the above FHMP criteria is met or exceeded. *MCF* also commits to working in partnership with both the Newfoundland and Labrador Department of Fisheries and Land Resources – Aquatic Animal Health Division (NL DFRL – AAHD)and Canadian Food Inspection Agency (CFIA) going forward.

MCF will also work in partnership with NL DFLR in adhering to all new policies as per "Aquaculture Policy and Procedures Manual", recently released in September 2019 by Minister Byrne. We all realize these new policies will take time to implement and are a work in progress with various timelines and amendments. Nevertheless, *MCF* will conduct its business with all these new policies in mind. Many are referenced within this document as it pertains to *MCF* FHMP.

2.0 Hatchery Production Plan

Refer to both *MCF* Hatchery Aquaculture Application and *MCF* Business Plans for further information.

The plan for 2020 is to purchase 2,000,000 certified / disease free 1 gram juveniles to start in August – November from the Department of Ocean Sciences (DOS) ongoing cleanerfish R&D production program with 1,771,448 individual 25-40 gram juveniles output for sale in spring of 2021. The supply of juveniles in the area is limited and seasonal. In addition, as is the case in Norway, the customers are likely to request few, large deliveries during the year.

The plan for 2021 is to purchase 2,000,000 certified / disease free 1 gram juveniles to start in August –November from the Department of Ocean Sciences (DOS) ongoing cleanerfish R&D

production program with 2,646,554 individual 25-40 gram juveniles output for sale in spring of 2022. Production at full capacity will be approximately ~81,008 kg.

Assuming annual batches results in conservative projections for the production, as it means that there will substantial back-up tank capacity in the facility. Marbase will optimize the production depending on the customer needs.

2.1 Production Tanks

The hatchery will house 339 tanks (Table 1) of various sizes when at full capacity. Areas will be categorized as:

- Hatchery / Start Feeding-(0.05 - 0.1g)
- Growth 1- (0.1 - 1.0g)
- Growth 2- (1.0 - 8.0g)*
- Growth 3- (8.0 - 40.0g)*
- Future Development

  *Growth 2 and 3 may have some overlap from time to time depending on production numbers and timing.

Area	# of tanks	Volume each tank m^3	Total m^3
Hatchery-Incubators above Start Feeding Tanks	60	0.10	6
Start Feeding (0.05 - 0.1g)	60	0.55	33
Growth 1 (0.1 - 1.0g)	78	2.1	163.8
Growth 2 (1.0 - 8.0g)	57	14	798
Growth 3 (8.0 - 40.0g)	24	12	288
Growth 3 (8.0 - 40.0g)	40	22	880
Future Development	20	40	800
Total			2968.8
	Safety margin (%)	Total	Max flow rate
	35	2968.8	~4000 m^3 / hr

Table 1: Number of Tanks, Tank Volume and Location within Facility

2.2 Production Numbers at Full Operation

Fully Operational in 2021-2022

Number fish to be stocked:

- 3 million 1 gram lumpfish.
- Estimated grow out time in months: ~7-9 months to 25-40 grams.
- Estimated losses over that growth period (11.33%): and
- Quantity of animals expected 2,646,554

Stocking Number	Growth Period	Expected Losses	Amount Expected
3,000,000	9 months	11.33% from 1gm – 25 gm juvenile.	2,646,554

Table 2: Full operational stock, growth period, expected losses and amount expected.

2.3 Production Biomass

The range of biomass (kg) on site within the following calendar years will be as follows:

Year	August	December	April
	Max	Max	Max
2020	2	15,137	44,407
2021	2	27,613	81,008
2022	2	27,613	81,008
2023	2	27,613	81,008
2024	2	27,613	81,008
2025	2	27,613	81,008

Table 3: Biomass in a calendar year.

Note: Minimum biomass is usually the amount on hand immediately after shipment of production. Maximum biomass is usually the amount on hand just before shipment of production starts.

2.4 Feed Quantities and Sources

Marine feeds will be purchased from local feed suppliers in Atlantic Canada. Current registered feeds for lumpfish in Canada (0.150 mm through to a 1.8 mm) are Skretting Canada and Cargill Aqua Nutrition. At current there are other international companies, looking at registering feed products in Canada through CFIA. Both Skretting and Cargill feeds have been used to date in Atlantic Canada with the current lumpfish program.ie Skretting Canada diet availability and sizes below.

We plan to use the "Clean Start and Clean Assist" lumpfish marine feeds from Skretting (Table 4). This has proven to be very efficient in Norway and used at MUN.

Phase	Fish weight (grams / dph*)	Weight from	Weight to	Feed type no	Feed type
Larvae and juveniles	2 dph			1	Gemma Micro 150
	10 dph			2	Gemma Micro 300
	28 dph			3	Clean Start 300
	0,5	0,50	0,99	4	Clean Start 500
Pre on-growing	1	1,00	1,99	5	Clean Assist CF 0,8
	2	2,00	3,99	6	Clean Assist CF 1,0
	4	4,00	7,99	7	Clean Assist CF 1,2
	8	8,00	15,99	8	Clean Assist CF 1,5
	16	16,00	100,00	9	Clean Assist CF 1,8

* dph = days post hatching

Table 4 – Feed Types

Feed quantities will vary from week to week. Refer to *MCF* Hatchery Aquaculture Application and *MCF* Business Plan.

2.5 Feed Storage

MCF will have a designated feed storage room (Figure 1) for all feeds. A feed inventory control program will be established, which details all feed inventory on site, expiry dates of feeds and projected feed usages and order dates including quantities and sizes. This will be incorporated into all areas of the hatchery- Hatchery / Start Feeding, Growth 1 - 3).

Feed shipments on arrival will go into a feed inventory control system; feed name, type, size, quantity and lot # will be recorded, manufactured date, expiry date, etc. (ie: Skretting, Gemma Wean CA 0.5 mm, 10 kg, lot # 6832104)(Figure 1).

Because fish feeds usually contain relatively high amounts of fish meal and/or fish oil, they are very susceptible to rancidity. Feeds will be stored in a cool, well-ventilated, dry place and will never be kept on hand for more than three months. Opened feed bags will be stored in closed containers with tightly closed lids to seal out moisture, insects, or rodents. Feed inventory will be kept in a first-in first-out system to utilize oldest to newest feed and reduce expired feed.

Designated feed storage areas, such as the primary feed room, will be kept clean and neat and also provide adequate containment for control of pests. The importance of careful attention to the specific requirements for proper storage and handling of aquaculture feeds can’t be overstated. At most hatcheries that raise fish, feed cost is the largest single expense. Therefore, even a small reduction in wasted feed can significantly affect production cost and directly impact bottom line profitability. Unused feeds will be disposed of following Town bylaws and provincial regulations. These feeds are not considered hazardous material and can go to local landfill.

Figure 1: Feed Storage Area and Feed Inventory Control

2.6 Feed Bag Handling

MCF will try where possible to reduce plastic waste as a result of feed bags. *MCF* intends to purchase fish feed in bulk when possible (pallet loads) to be delivered to silos at the hatchery.

This bulk transport will reduce the use of plastic bags and ultimately reduce the waste generated. Attempts will be made to source biodegradable feed bag containers and to minimize these purchases.

MCF will ensure of proper disposal of all feed bags to ensure its part in environmental stewardship. Please refer Appendix #1 – *MCF* Waste Management Plan.

The majority of inorganic waste generated by *MCF* will consist of plastics, mostly feed bags. A feed bag press (Figure 2) will reduce the volume of plastic waste materials before disposal. All bags will be handled, secured and disposed of in a safe, environmentally and friendly manner and in accordance with the department standards.

Figure 2: Feed Bag Press / Bailer.
https://www.finn.no/bap/webstore/ad.html?finnkode=124407938

MCF will support and adhere to ***AP 16 – Feed Bag Handling*.**

Effective Date: September 24, 2019. Legislative References: Aquaculture Act s. 4(4)(e)(f)(g) and 4.(9). This policy applies to all aquaculture operations.

Policy:

1. Licensees are required to ensure all feed bags are secured in such a way as to prevent loss at after being emptied of feed.

2. Licensees are required to secure feed bags by means of bales or other mechanism approved by the department prior to land transport to a waste management facility, in order to mitigate the risk of loss prior to disposal.

3.0 Fish Health Surveillance Plan

MCF will implement a regular aquatic animal health surveillance plan and pre-transfer evaluations. Discussions with "NL Aquatic Animal Health Division", Dr. Whelan and Dr, O'Brien will occur in the coming months to ensure the plan is adequate and meets the new policy guidelines.

Surveillance is the systematic ongoing collection, collation and analysis of information related to animal health and the timely dissemination of information to those who need to know so that action can be taken.

Surveillance will be carried out for detection of clinical disease occurrence, or for determination of the presence or absence of pathogens in our hatchery areas.

3.1 Active Surveillance Plan

MCF will implement an **"**Active Surveillance Program" which is strongly reliant on the sampling of aquatic animals "lumpfish" from within the hatchery every 30 - 45 days by a designated individual.

Active sampling will be conducted because it is not practical to test each tank and each individual aquatic animal. We believe if an appropriate sample size is used, we at *MCF* think it is possible to achieve a reasonable degree of confidence in the results of the surveillance, although 100% confidence will never be possible since individuals vary in their disease status and in many other characteristics and testing of different samples would give slightly different results.

Similar to other steps for operation of a surveillance system, capacity building is also essential to ensure that information is transferred in a timely and accurate way.

Capacity building will be included where possible for the training of hatchery staff for detection / observation of clinical signs and disease detection and reporting. This will be achieved by using a 'train the trainers' approach (e.g. with aquatic animal health officials training key staff who are then put in charge of sharing their experience with other staff members within the hatchery) and through the development of clear and simple extension material.

Pathogens of concern for NL juvenile lumpfish in a hatchery to date are:

- Vibriosis (including *Vibrio anguillarum*)
- Parasites (Costia and Trichodina)

However, *MCF* surveillance and diagnostics program will include:

- bacteriology, virology (including nodavirus) and histology on a case by case basis.
- Necropsy/Examination as required.

All of the above will be in partnership with the Newfoundland and Labrador Department of Fisheries and land Resources – Aquatic Animal Health Division (NL DFLR – AAHD).

MCF will adhere to the below policy as per Government of NL DFLR. *As per **AP 29** – Aquatic Animal Health Finish Surveillance Policy NL*.

Scope: The department promotes sustainable growth of the aquaculture industry by effectively managing aquatic animal health surveillance.

The species-specific Aquatic Animal Health Division (AAHD) Surveillance Plan (Surveillance Plan) requires industry to:

a. Provide access to aquaculture facilities for AAHD surveillance; and
b. Conduct diagnostic sampling.

MCF fully supports and encourages the above. The AAHD will conduct a risk-based, targeted, active surveillance in addition to surveillance performed by a Designated Veterinarian as referenced in the Aquatic Animal Health Disease Surveillance Designation policy. The AAHD may conduct multiple activities at the time of the surveillance visit. For example, a biosecurity audit (*MCF* and Biosecurity Plan) and surveillance can occur at the same time to maximize efficiencies.

MCF endorses the below policy.

1. All licensees must have access to a Designated Veterinarian for the purposes of the Surveillance Plan. **AP 29** – Aquatic Animal Health Surveillance.

2. In all cases of increased mortalities, operators must verbally notify the Assistant Deputy Minister immediately, followed by submission of a written report to the Assistant Deputy Minister, Chief Aquaculture Veterinarian and Director of Aquaculture Development within 24 hours.

3. Detection of reportable diseases must be reported to the Chief Aquaculture Veterinarian within 24 hours.

4. Licensees must grant access to AAHD staff, or their designated representative, to their aquaculture site/facility to conduct surveillance activities.

5. Licensees are required to provide tissue samples and disease testing results as described by the species specific Surveillance Plan.

6. Quarterly Aquatic Animal Health Reports must be submitted to the CAV as described in the Aquatic Animal Health Reporting policy.

***MCF* Surveillance Plan:**

To fulfill the requirements of the Surveillance Plan:

a. A Designated Veterinarian will oversee a surveillance visit every 30-45 days.
b. The surveillance visit can only be conducted by a Designated Veterinarian or by a Designated Fish Health Technician under the direction of a Designated Veterinarian;
c. Samples will be submitted to a Designated Laboratory;
d. Test results obtained for the purposes of the AAHD Surveillance Plan must be submitted to the AAHD upon receipt from the laboratory;
e. AAHD staff will conduct surveillance visits quarterly.

3.2 Designated Veterinarian

Fish Health will be viewed as part of the Marbase culture - therefore all *MCF* managers will share a responsibility of all lumpfish receiving the best care and environment possible.

MCF will not have a full time designated veterinarian "on staff" in 2020. However, arrangement will be made for regular surveillance of the facility and fish by a qualified fish health veterinarian as 3rd party contracted services.

MCF will also make a formal written request to the province - Director/Chief Aquaculture Veterinarian Dr. Daryl Whelan- darylswhelan@gov.nl.ca requesting fish health support from the current veterinarians on staff at the DFLR, Aquatic Animal Health Division (AAHD) for the short term. However, we feel a partnership with AAHD for diagnostics and fish surveillance will be on-going.

MCF will also utilize the only nationally certified laboratory in Newfoundland and Labrador for analytical services / support in toxicology, microbiology and water quality – Avalon Laboratories Inc. Avalon Labs has accredited sampling procedures and protocols that will completely support the daily operations on the hatchery on an ongoing basis.

Our expectation, is that the "*MCF* Fish Health staff member "will have direct contact with an Aquatic Fish Health Veterinarian and a Fish Health Laboratory(s) such as DFLR- NL or AVC- UPEI (fee for service). Laboratory Services will be provided by Avalon Laboratory in St. John's and / or RPC- NB, Kennebec-USA etc. for fish health diagnostics services.

MCF supports and will adhere to ***AP 34*** *– Aquatic Animal Health Disease Surveillance Designation.*

- *MCF* will have access to a licensed veterinarian. In accordance with the Veterinary Medical Act, only a licensed veterinarian can practice veterinary medicine, preventative medicine, perform surgery and diagnose with interpretation and treatment (prescriptions and mitigation).

- *MCF* will adhere to the species specific Surveillance Plan for lumpfish. Only Aquatic Animal Health Division (AAHD) designated veterinarians, fish health technicians and laboratories can be utilized as part of the Surveillance Plan. This will be in place prior to opening.

- *MCF* will maintain a list of designated aquaculture veterinarians, fish health technicians and diagnostic laboratories for AAHD associated with the hatchery.

MCF will submit a letter to the CAV indicating who they want to designate and what laboratories they wish to designate for its services in terms of a veterinarian, fish health technician and what laboratory (Avalon Laboratories) to become designated by the AAHD.

3.3 Designated Fish Health and Biosecurity Technician

Fish Health and Biosecurity - all *MCF* managers (General, Operations and Technical) will share a responsibility to ensure all staff and fish receive the best care possible.

The Operations Manager of the facility will appoint a Fish Health (FH) and Biosecurity (BS) person whom is trained in these specific area(s). This person will be responsible for the day to day oversight of fish care and fish welfare within the facility. This person will also be responsible for maintaining and updating the fish health and biosecurity plans as well as demonstrating its effectiveness through use of good day to day record keeping.

A fundamental requirement when identifying risks to *MCF* is an awareness of the following;
- diseases that can affect your stock,
- clinical signs of disease,
- host susceptibility and the range of environmental parameters that could precipitate clinical outbreaks.

All staff will be trained in suitable fish handling procedures and husbandry techniques for the lumpfish on site at *MCF*. Husbandry procedures will be fully checked to identify any actions that increase the risk of contracting or spread of disease to our lumpfish. It is essential that all staff are aware of biosecurity measures implemented at this hatchery. It will be recorded that staff have read and understand the Biosecurity Plan and comply with all appropriate measures.

3.4 Designated Water Quality Technician

Water Quality - all *MCF* managers (General, Operations and Technical) will share a responsibility to ensure all staff and fish receive the best care possible.

The Operations Manager of the facility will appoint a Water Quality Specialists (WQ) whom is trained in chemistry / water quality. This person will be responsible for maintaining acceptable water quality standards within the hatchery systems, tanks, maintain water quality equipment as well as demonstrating its effectiveness through use of good record keeping.

3.5 Designated Fish Health and Water Quality Laboratories

MCF will designate adequate space for a multipurpose fish health and water quality laboratory / prep areas within various locations of the hatchery.

MCF will utilize the only nationally certified laboratory in Newfoundland and Labrador for analytical services in toxicology, microbiology and water quality – Avalon Laboratories Inc. Avalon Labs has accredited sampling procedures and protocols that will completely support the daily operations on the hatchery on an ongoing basis. The constant analysis of water quality will have a significant impact on fish health and water quality laboratory (Figure 3).

The facility is equipped as a biosafety level one laboratory applicable for work with lumpfish. Avalon has a full staff of including microbiologists and chemists with expertise compatible with the requirements of the hatchery. Professionals with specialized knowledge of larval and juvenile lumpfish culture and unique special training in both fish health and water quality.

The lab is equipped microbiological detection and identification equipment for bacterial pathogens, and microscopy equipment including compound, stereoscope, and confocal microscopes for bacterial and parasite identification. The lab is also equipped with water quality testing parameters and associated equipment.

The focus of the Fish Health and Water Quality Laboratory is to assist the MCF hatchery staff and in taking pro-active rather than reactive management actions in safeguarding the fish health.

Stress is a known immune suppressor and when disease is seen, it is usually associated with a stressful condition, whether it be environmental, nutritional, or physical. Fish rearing conditions within the hatchery system and the carrying capacity of Mortiers Bay saltwater will be carefully monitored and managed to foster a low stress environment that naturally promotes robust lumpfish.

The Fish Health and Water Quality Laboratories provide support in terms of:

- Hatchery Support
    - Evaluates indicators of fish welfare and provides feedback to managers
    - Promotes fish husbandry practices focused on disease prevention
    - Trouble shoots problems with fish health and fish quality

- Conducts and Facilitates Ongoing Data for improved fish health
    - Feed quality
    - Water quality
    - Hatchery performance / system

- Husbandry practices
- Biosecurity Practices

Figure 3: Fish Health and Water Quality

3.6 Transfer and Transport Permits:

Pre - transfers approvals of juveniles to and from the hatchery at various times throughout the year for juvenile lumpfish will be required.

We anticipate the “INPUTs” of 1 gram pathogen free juvenile lumpfish from MUN’s Cleaner fish program to be in August-October each year.

A transfer request will be submitted to NL DFLR - Welcome to the Department of Fisheries and Land Resources Online Services (https://licensing.eservices.gov.nl.ca/citizenaccess/) by *MCF* management team 2 months prior to transport, in order to obtain the necessary transport permits in a timely fashion.

We anticipate the "OUTPUTs" of 25-40 gram pathogen free juvenile lumpfish at various intervals, generally April and June each year. The responsibility for transport permits will be the companies that purchase the lumpfish or the receiver.

The above aquatic animal health surveillance plan with routine sampling / diagnostics of lumpfish will complement this process.

Following any transfers into the hatchery, a transport report on the actual number of lumpfish transferred and the immediate mortalities will be reported to the NL DFLR as per protocol. https://licensing.eservices.gov.nl.ca/citizenaccess/

MCF will also support and adhere to ***AP 12*** *– Transfer and Transport Permits*. Legislative References: Aquaculture Act s. 8.

To permit the movement of aquatic plants and animals for aquaculture purposes into and within the Province of Newfoundland and Labrador through the 2003 National Code on Introductions and Transfers of Aquatic Organisms.

Policy as it related to a Hatchery:

1. Written approval is required through the 2003 National Code on Introductions and Transfers of Aquatic Organisms for all transfer and transport permits for aquaculture purposes.

4. Transfer and transport of aquatic plants and animals should be permitted to sites with valid aquaculture licences and that are in compliance with relevant legislation.

5. Transfer and transport permits will be subject to terms and conditions as identified on the permit.

6. All transfers of live aquatic plants or animals into or within the province require the prior written approval of the Minister or designate.

7. Prior to the issuance of transfer and transport permits, aquatic animal health information must be sent to the Aquatic Animal Health Division for a disease risk evaluation. Aquatic animal health information required can be obtained from the Chief Aquaculture Veterinarian.

8. Provided the applicant has met Canadian Food Inspection Agency requirements, the NL Introductions and Transfers Committee will recognize the Certificate of Health for Transfer for live cultured finfish (COHFT) under the Health Policy for the Transfer of Live Cultured Finfish in Atlantic Canada as the disease risk evaluation.

9. In all cases, a transfer and transport permit application must be submitted to the department detailing the product to be moved.

3.7 Record Keeping

This Fish Health Management Plan (FHMP) contains details of how our *MCF* intends to comply with the current Legislation at the hatchery pertaining to record keeping.

MCF will keep all *fish health* records for each year class of lumpfish. These records will be kept for 7 years.

The following records will be retained by *MCF:*

- Increased Mortality
- Finfish Movements between tanks
- All fish sampled for diagnostics and results

3.7.1 Mortality Records:

We retain mortality records which will be made available during site inspections. At a minimum, these records will contain the following information:

- Date dead fish removed
    - Total number of fish removed
    - Number of fish in tank from which dead fish were removed
    - Observations / comments

3.7.2 Movement Records

We will retain records of all fish movements within the hatchery as they move from tank to tank and area to area as they grow, plus to and from this site. At a minimum, these records will contain the following information:

3.7.3 Movements onto - site:

- Date of movement
- Tank number on site
- Stocking density in tank
- Number of fish
- Average weight
- Starvation period prior to shipment
- Transport temperature and water quality data
- Transporter used
- Number of mortalities observed on arrival
- Comments

3.7.4 Movements off - site:

MCF will retain records of all movements off the site. At a minimum, these records contain the following information.

- Date of movement
- Tank number on site moved out
- Number of fish
- Age (months)
- Average weight (g)
- Starvation period prior to shipment
- Name and address of site of destination
- Transporter used
- Transport temperature and water quality data
- Number of mortalities observed on arrival
- Comments

All fish health records, biosecurity audits and transport permits will be kept on file and made available for inspection on request.

4.0 Mortality Categories

4.1 Mortality Categories- Regular and Abnormal

For the purpose of this plan and with reference to **AP32-34**, hatchery mortality events have been divided into two categories related to the cause of mortality; *regular mortalities* and *abnormal mortalities*.

4.1.1 Regular Mortalities

MCF hatchery mortalities are part of a daily experience. Hatchery staff continuously monitor mortality levels in their tanks, as the recording of mortality can give a general impression of the cause of fish mortality, lending to rapid detection of abnormal mortality caused by disease. Rapid detection and response are important concepts in fish health management. However, most often what can be considered routine, day-to-day fish mortality is based on natural causes and most often no causality (e.g. pathogen) can be identified.

The management of regular fish mortalities is an important consideration for all hatchery staff. The onus and responsibility for material management is on the farm owners and operators working in conjunction private and/or public service providers to manage these wastes. *MCF* recognizes the benefits of ensilaging mortalities and culls as a best practice to reduce the risk of infectious disease transmission as well as for optimizing the use of this product in other industries (agriculture, renewable energy sector). Refer to 4.2. Also refer to *MCF* Waste Management Plan document.

4.1.2 Abnormal Mortalities

In any large population of hatchery reared lumpfish low levels of mortality normally occur. Mortality levels in hatcheries are continuously monitored and charting of mortality can give a general impression of the cause of fish mortality, lending to rapid response to abnormal mortality caused by disease.

DEFINITION: Mortality can be classified as "abnormal" if unexpected losses of greater than 2% of tank / facility inventory are encountered within a 24 hour period; or if unexpected losses of greater than 5% are encountered within a five day period. A hatchery operator can also make this determination based on any mortality rates which are unexpected and considered abnormally high for the cage / site / tank / facility in question.

Abnormal mortality is divided into two basic categories related to the cause of the mortality; ***Incident Event-Related*** and ***Disease-Related***.

The management of disease-related mortalities is of critical importance for all hatcheries / farms as protection of existing live lumpfish is a key priority. The onus and responsibility for biosecure material management is on the hatchery owners and staff working in conjunction private and/or public service providers. In addition, because such activities are contingent on the required regulatory approvals, government departments and agencies with jurisdictional authority, such as the Dept. of FLR and the Canadian Food Inspection Agency, have an active role in such activities. Waste management practices for abnormal mortality events are chosen in accordance with provincial guidelines and regulations to provide biosecure and sustainable farming practices. Hatchery companies like *MCF* are required to inform the Assistant Deputy Minister (ADM) of FLR immediately for all cases of increased mortalities in the hatchery, followed by A written report to the Chief Aquaculture Veterinarian (CAV), the Director of Aquaculture Development and the ADM within 24 hours (See also APPM - **AP32**).

In addition to the requirement to have and follow an Environment and Waste Management Plan, for any abnormal mortality event, *MCF* is required to adhere to [pre-approved] Standard Operating Procedures (SOPs) for abnormal mortality removal. These special SOPs are to be submitted to the Dept. of FLR for approval in advance of mort removal and disposal.

- ***Incident Event-Related Mortality***

An Incident Event (see also APPM – **AP 17**) with respect to farm mortality is defined as any event or occurrence, other than disease-related, which caused abnormal mortality, such as by severe weather, or an environmental condition such as low oxygen or extremes of water temperature. Such a mortality event could also be caused by a failure of equipment such as a hatchery pump or electrical failure. In addition to the requirements to have and adhere to Environment and Waste Management Plans and Standard Operating Procedures (SOPs) for abnormal mortality removal, all Incident Events require the operator to implement response plans which have been submitted to [and pre-approved by] the Dept. of FLR, and all other agencies with jurisdictional authority in advance of implementation (APPM – **AP 17**). All Incident Events require the operator to provide written notification of the event to the ADM within 24 hours (APPM – **AP 17**). *MCF* full supports and endorses the above plan and will act accordingly as outlined in *MCF* Waste Management Plan document. Total biomass at peak production is limited/ small at ~80 tonnes of product.

For a minor Incident Event-Related mortality event, *MCF* will again follow their consult their Waste Management Plan and use ensilage.

- ***Disease-Related Mortality***

A disease-related mortality event is defined as an abnormal mortality event that is caused by a diagnosed fish disease. The disease-related mortality category is further sub-divided into *manageable mortality* events and *catastrophic mortality events*. Hatcheries will fall under manageable mortality events which show increases in mortality rates but can be managed by preventative husbandry and/or veterinarian-directed therapeutant application.

Options to be used for the disposal of fish material in connection with disease-related mortality differ based on whether the suspected / diagnosed disease is a Reportable Disease or a Notifiable Disease.

For a manageable disease-related mortality event which is not connected to a Reportable disease the company will consult their EWMP and consider the available options and operational circumstances in deciding how to manage these mortalities.

Options currently being used for the disposal of fish material in connection with manageable disease-related mortality events in Newfoundland and Labrador are listed in section 4.2 below.

MCF will adhere to the below items:

- Quarantine Order: An official containment measure issue by the Department of Fisheries and Land Resources (DFLR) is taken to prevent the introduction or spread of disease by controlling the prohibited movement of fish, fish products, feed, equipment or other things to or from a site.

- Depopulation Order: An official order issued by DFLR to require a licensee to remove finifish from a defined area.

- Any detection of federally reportable diseases or quarantine or depollution orders or directives issued by DFLR to *MCF* will be reported to the public within 24 hours of the detection or order or directive being given.

- Any detection of federally reportable diseases or quarantine or depollution orders or directives issued by DFLR to *MCF* will be publically report on:
    a. Site of hatchery;

b. Species stocked at hatchery;
c. The estimated number of lumpfish on site;
d. Any orders and directives issued in relation to the action incident;
e. Information related to disease detected;
f. The underlying reason for the order, directive and / or action;
g. The method of depopulation or other mitigations;
h. Any other information deemed by DFLR to be reported.

- Any detection of federally Reportable Diseases, or quarantine or depopulation directed or ordered or approved by DFLR will be reported on *MCF*'s corporate website and / or NAIA's website.

- *MCF* will report to the Aquatic Animal Health Division and the Aquaculture Development Division of DFLR, any abnormal mortality event at the hatchery within 24 hours of the event occurring.

4.2 NL Reportable and Notifiable Aquatic Animal Diseases (PSAMMP, Jan 2020).

With respect to juvenile lumpfish – the only Notifiable Diseases to date we are aware of in NL- Vibriosis, Costiasis, Trichodiniasis for juveniles and infection with Exophiala spp for 2 year old lumpfish.

4.2.1 List of Reportable Diseases (NL FLR Aquatic Animal Disease Contingency Plan)

IPN (Infectious Pancreatic Necrosis)
ISA (Infectious Salmon Anemia)
IHN (Infectious Haematopoietic Necrosis)
VHS (Viral Haemorrhagic Septicaemia)
PD (Pancreatic Disease)
Epizootic Haematopoietic Necrosis
Viral Nervous Necrosis
Kudoa
Heart and Skeletal Muscle Inflammation (HSMI)
Whirling Disease
Malpeque disease
PSP (Paralytic Shellfish Poisoning)
ASP (Amnesic Shellfish Poisoning)
DSP (Diarrhetic Shellfish Poisoning)
MSX
SSO
Vibrio vulnificus
Dermo Infection with Francisella
Ceratomyxosis
Amoebic Gill Disease
Proliferative Kidney Disease

Gyrodactylosis
Oncorhynchus Masou Virus
Piscirickettsiosis
Flavivirus
Infection with Bonamia ostreae
Infection with Marteilia refringens
Infection with Mikrocytos mackini
Infection with Perkinsus marinus
Infection with Perkinsus olseni

4.2.2 List of Notifiable Diseases (To be listed on Annual Aquatic Animal Health Report)

BKD (Bacterial Kidney Disease)
Furunculosis
Pseudomoniasis
Saprolegniasis
Mycobacteriosis
Streptococcosis
ERM (Enteric Red Mouth Disease)
Vibriosis
Winter Ulcer Disease
Saddle Back Disease
Columnaris Disease
Nodular Gill Disease
Nocardiosis
Black Spot Disease
Microsporidiosis
Costiasis
Trichodiniasis
Aquareovirus
Infection with Flavobacterium spp.
Infection with Exophiala spp.
Infection with Edwardsiella tarda
Bacterial diseases with evidence of antibiotic resistance

5.0 Emergency Measures Plan

MCF will have a comprehensive and integrated emergency measures plan which demonstrates a shared responsibility between all levels of governments, the private sector, non-governmental organizations and individual citizens.

MCF as a member of NAIA, will follow many of the details outlined in the most current *NAIA-Provincial Salmonid Aquaculture Mortality Management Plan- January 2020*, which includes hatcheries.

Four pillars of MCF Fish Health Emergency Measures / Management plan are:

- **Prevention and mitigation** – *MCF* will take all actions required to identify and reduce the impacts and risks of hazards before an emergency occurs.

- **Preparedness** – *MCF* will be prepared to respond quickly and effectively to emergencies and to recover more quickly from their long-term effects, which will involve actions taken prior to an event to ensure of our capability and capacity to respond.

- **Response** – *MCF* will ensure that actions taken during or immediately after an emergency or disaster will help to manage the consequences.

- **Recovery** – *MCF* will ensure that actions taken after an emergency or disaster will aid to re-establish or rebuild conditions and services to an acceptable level.

5.1 Mass Mortality Management Plan

MCF as a member of NAIA, will follow many of the details outlined in the most current ***NAIA-Provincial Salmonid Aquaculture Mortality Management Plan- January 2020***, which includes hatcheries.
This plan covers finfish farming activities at hatcheries / nurseries and at aquaculture research institutions. This document aligns with provincial aquaculture policy as outlined in the Aquaculture Policy and Procedures Manual (APPM) as updated on Nov 4, 2019.

If a mass mortality of lumpfish occurs at the *MCF* Hatchery, the volume of fish (80 tonne) mortalities will not pose any major issue.

The following procedures will be undertaken:

- *MCF* NL would implement its mass mortality response plan (*MCF* Waste Management Plan 6.1.2) which includes the notification of regulatory agencies and activation of depopulation, if required.

- All mortalities at the *MCF* Hatchery will be removed using equipment and procedures similar to those used during fish transfers to sea cage sites. In this instance, a vessel or truck equipped with industry standard containers will be used to transport the mortalities to a designated outflow wharf or designated transport location in a biosecure manner.

- Biosecure handling and transport will be undertaken to avoid any spillage.

- In the case of a confirmed presence of a reportable fish disease, *MCF* NL will contact local providers that are approved to receive the collected material.

- If the mass mortality event is not as a result of a reportable disease, the mortalities will be collected and ensilaged to disposal as per normal operations.

- *MCF* NL will adhere to governmental guidelines and regulations for the disposal of organic material and fish mortalities.

5.2 Fish Disposal

A practice that is common and proven both nationally and internationally for finfish mortalities and culls is ensilaging. The resulting product is often used for agriculture, as a feed additive or used as a source of energy in systems such as anaerobic digesters. *MCF* recognizes the benefits of ensilaging mortalities and culls as a best practice to reduce the risk of infectious disease transmission as well as for optimizing the use of this product in other industries (agriculture, renewable energy sector). This process inactivates bacteria and viruses including the virus that causes infectious salmon anemia (ISA) (Dixon et al. 2012) and has been proven effective and adopted in many finfish farming jurisdictions in Norway, Chile and Scotland (NAIA 2017b).

Fish mortalities at the *MCF* will be monitored and collected daily from tanks. The fish (depending on size) will be placed into a grinder that chops the mortalities into small pieces while a dose dispenser ("doser") adds formic acid to produce a slurry with a pH of 4.5 or lower. The slurry is held in a storage tank on-site at the hatchery facility until sufficient quantities are acquired to justify transport. *MCF* prefers, where possible to use local companies that are interested in this product as identified below. These companies may utilize this product as a commercial fertilizer or animal feed additive.

Should mortalities or depopulation be ordered due to a reportable disease, the mortalities will be ensilaged using the same process as regular mortalities. Disposal of mortalities that are a result of a reportable disease will be under the joint direction of (NL) Aquatic Animal Health Division (AAHD) and CFIA as per ***AP 23*** below. Currently, in Newfoundland, the only approved facilities to receive ensilage from mortalities with a reportable fish disease are the New World Dairy in St. David's and Barry Group Incorporated in Burgeo. New World Dairy in St. David's operates an anaerobic digester and the Barry Group operates a rendering facility that produces fishmeal from the ensilage. *MCF* will work with CFIA to determine the appropriate facility for disposal in this instance. In the UK, ensilage is not designated as with or without a reportable disease since the process inactivates bacteria and viruses including the virus that causes infectious salmon anemia (ISA) (Dixon et al. 2012).

NAIA Report 2020 - sections 5.2.1, 5.2.2, 5.2.3, 5.2.4., below are taken form that report.

5.3 Disposal Options for Regular Mortalities (Without any Fish Diseases).

Uninfected fish can be disposed of through ensiling, rendering, composting, reuse and burial.

- New World Dairy Material Raw carcasses/fish parts and ensiled material Purpose Anaerobic digester Contact Brent Chaffey Phone 709-645-2793 Address St. David's, NL A0N 1X0

- Barry Group Incorporated Material Raw carcasses and offal Purpose Rendering for fish meal Contact Robert Barry, Vice-President Phone 785-7387 Address 415 Griffin Drive, Corner Brook, NL A2H 3E9

- Greenfield Enterprises / Rothsay Material Raw carcasses and offal (ensiled material) Purpose Mink farm feed Contact Scott Humby Phone 709-425-0886 Address Clarenville, NL

- Oceanview Estates (former Abitibi mill, Stephenville) Material Raw carcasses (hatchery) Purpose Composting (fish meal) Contact Colin Maddock Phone 709 649 6437 Address 97 Front Road, PO Box 456, Port au Port, NL, A0N 1T0

- Town of Sunnyside Material Raw carcasses / fish parts Purpose Direct burial Contact Phil Smith Phone 709-472-4506 Address Town of Sunnyside, PO Box 89, Sunnyside NL A0B 3J0

- Burin Peninsular Regional Service Board. Material - Raw carcasses / fish parts in silage Purpose Direct burial Contact Joe Pittman Phone 709-891-1717 PO Box 510, Burin Bay Arm NL A0E 1GO

5.4 Disposal Options for Incident Event-Related Mortalities (Without any Fish Disease).

- New World Dairy Material Raw carcasses/fish parts and ensiled material Purpose Anaerobic digester Contact Brent Chaffey Phone 709-645-2793 Address St. David's, NL A0N 1X0

- Barry Group Incorporated Material Raw carcasses and offal Purpose Rendering for fish meal Contact Robert Barry, Vice-President Phone 785-7387 Address 415 Griffin Drive, Corner Brook, NL A2H 3E9

- Oceanview Estates (former Abitibi mill, Stephenville) Material Raw carcasses (hatchery) Purpose Composting (also fish meal) Contact Colin Maddock Phone 709 649 6437 Address 97 Front Road, PO Box 456, Port au Port, NL, A0N 1T0

- Town of Sunnyside Material Raw carcasses / fish parts Purpose Direct burial Contact Phil Smith Phone 709-472-4506 Address Town of Sunnyside, PO Box 89, Sunnyside NL A0B 3J0

- Burin Peninsular Regional Service Board. Material - Raw carcasses / fish parts in silage Purpose Direct burial Contact Joe Pittman Phone 709-891-1717 PO Box 510, Burin Bay Arm NL A0E 1GO

5.5 Disposal Options for Disease-Related Mortalities (With a Reportable Fish Disease).

- New World Dairy Material Raw carcasses/fish parts and ensiled material Purpose Anaerobic digester Contact Brent Chaffey Phone 709-645-2793 Address St. David's, NL A0N 1X0

- Barry Group Incorporated Material Raw carcasses and offal Purpose Rendering for fish meal Contact Robert Barry, Vice-President Phone 785-7387 Address 415 Griffin Drive, Corner Brook, NL A2H 3E9

- Town of Sunnyside Material Raw carcasses / fish parts Purpose Direct burial Contact Phil Smith Phone 709-472-4506 Address Town of Sunnyside, PO Box 89, Sunnyside NL A0B 3J0

5.6 Mortality Management Resources

- Trucking

MCF will be responsible for co-coordinating with the local transport companies or disposal service providers to ensure that fish mortalities or ensiled materials are removed to the service provider as rapidly as possible.

If there is an inadequate supply of transport vehicles, each stakeholder is responsible for obtaining the required transport.

During a Disease-Related Mortality Event all transport of mortalities will be governed by SOPs approved by CFIA and/or FLR.

- Containers

MCF will ensure that there is a sufficient amount of bio-secure containers or other means of storing and transporting mortalities for the rapid disposal of fish to the service provider.

During a Disease-Related Mortality Event all use, cleaning and disinfection of containers for mortalities will be governed by SOPs approved by CFIA and/or FLR.

- Hydrated Lime

Lime shall be sourced from a reliable service provider in the local area as required. Lime can be purchased from the following suppliers:

East-Chem Inc., 90 Clyde Avenue Mount Pearl, NL, A1N 4S2 709-747-3777
Eastern Farmers Co-op Society, 1112 Topsail Road Mount Pearl, NL, A1N 5E7 709-368-4321

MCF will support and adhere to the ***AP 23*** *– Fish Disposal* policy as set forth by NL DFLR.

Scope:
The department promotes sustainable growth of the aquaculture industry by effectively managing the handling and disposal of fish (including mortalities) from aquaculture operations.

Fish disposal is jointly regulated federally and provincially. It is the responsibility of the licensee to obtain all required permits and approvals from other departments or federal agencies. The department is not responsible for seeking or obtaining approvals from other departments or federal agencies.

During a Reportable Disease event, the licensee must follow the Newfoundland and Labrador (NL) Aquatic Animal Health Division (AAHD) Contingency Plan and any federal requirements.

Policy:

1. All farms will have a Fish Disposal Plan, outlined in *MCF* Waste Management Plan.

2. Fish Disposal Plans will be submitted by *MCF* and approved by the department, at the time of licensing, and on an annual basis.

3. *MCF* will also submit Fish Disposal Plans to all relevant agencies with a regulatory responsibility for waste management prior to implementation.

4. *MCF* will also submit any amendments for approval by the department and all other external agencies with a regulatory responsibility for waste management prior to implementation.

5. During a Reportable Disease event, the Fish Disposal Plan will be subject to additional requirements as required under the NL AAHD Contingency Plan. *MCF* will adhere.

6. *MCF* will obtain a License to Move before any lumpfish are moved off the hatchery site if considered in quarantined area and under a Quarantine Order.

7. *MCF*, if under a quarantine order, will submit a Fish Disposal Plan to the department for approval.

6.0 Biosecurity Plan

Refer to *MCF* Biosecurity Plan.

7.0 Animal Husbandry and Welfare

Refer to *MCF* Biosecurity Plan.

8.0 References

Dixon, P.F., M. Algoët, A. Bayley, M. Dodge, C. Joiner, and E. Roberts. 2012. Studies on the inactivation of selected viral and bacterial fish pathogens at high pH for waste disposal purposes. J. Fish Dis. 35: 65-72.

NAIA (Newfoundland Aquaculture Industry Association). 2017a. Salmonid aquaculture waste management contingency plan Coast of Bays Region, 23 p.

NAIA (Newfoundland Aquaculture Industry Association). 2020. Salmonid aquaculture waste management contingency plan Coast of Bays Region.

NAIA. 2017b. Final report – The NAIA ensiling demonstration project. 20 p. + appendices.

https://thefishsite.com/articles/an-introduction-to-fish-health-management

Appendix IV

Employment

Appendix IVa

Marbase Cleanerfish Project Occupations

Project Occupations

Marbase Cleanerfish will make a positive contribution to the local economy in the following ways:

1. Provide employment for as many as 60 people during construction;
2. Provide employment for 20 full-time staff during operation;
3. Generate direct economic spinoff to local and provincial service and supply companies;
4. Induce direct and indirect economic spinoff benefits related to provision of amenities and services for Marbase management, employees, contractors, service providers and others associated with the company and the Marbase Hatchery.

Marbase Cleanerfish is committed to being part of the local community and is subject to labour agreements with two local unions. Hiring preference is first within the local unions, then the local community, the Burin Peninsula, the Province and beyond.

A team of experts drawn from within the Province as well as internationally have been collaborating to design the systems for this facility. Once construction is cleared to commence there will be further opportunities for local companies to participate in specific contracted tasks. Simultaneously, recruitment will commence for operations personnel so that they will be on staff during commissioning.

Construction

The project schedule calls for construction to start in April 2020, employing a dominantly local labour force of up to 60 people. The table below lists the number of workers by occupation during the six-month construction period.

Table 1: Construction Worker Requirements by NOC Categories

Construction Worker Requirements by NOC Categories		
Work Task	**Potential # Workers**	**National Occupation Classification***
Project Management and Supervision	2	0211 engineering manager/supervisor 0711 construction managers
Civil Works- external	16	7217 heavy duty equipment operators 0711 construction manager 7611 construction trades
Building re-construction	24	0711 construction manager/supervisor 7215 carpenters 7216 mechanical engineers 7219 installers 7213 pipefitters 7611 construction trades
Pumping, plumbing and intakes	12	7213 pipefitters 7251 plumbers 7611 plumber helper 2274 engineer officers water transport 2273 deck officers water transport 2212 geotech technicians 2231 civil engineer
Installation of tanks, water circulation and water treatment	8	7217 contractor/supervisor 7213 pipefitters
Total	62	
*https://noc.esdc.gc.ca/English/noc/QuickSearch.aspx?ver=06&val65=master%20mariner		

Operation

During operation the facility is estimated to employ 20 full-time staff and create 20-30 indirect jobs through contracted services. The distribution of full-time operations staff is listed in the table below.

Table 2: Operations workers by NOC Categories

Operations workers by NOC Categories		
Position	**Potential # Workers**	**National Occupational Classification***
Manager	1	8257
Assistant Manager	1	8257
Fish Culture Technician	9	2221
Water Quality Technician	1	2131
Fish Health Technician/Veterinarian	2	2221 3213
Administration	2	1411
Security	2	6651
Facility Maintenance	2	0721
Total	20	
* https://noc.esdc.gc.ca/English/noc/QuickSearch.aspx?ver=06&val65=master%20mariner		

Workforce, Contractors and Spinoff Activities

During construction, site activities will generally be carried out by contractors. Spinoff activities would include increased demand for vehicle fueling, vehicle servicing, hotel accommodations and restaurant services.

During Hatchery operations, new positions will be created in accordance with the Collective Agreements established with local unions. Short-term employment might be required during loading and shipment of lumpfish. Specialist services would also be contracted out, e.g. diving/ROV to monitor the saltwater pipeline.

Employment Equity

Marbase Cleanerfish will follow equitable employment practices and provide a workplace that values each employee while affording equal opportunities. A Women's Employment Plan now under development (Appendix IVb) will be finalized and submitted to government prior to initiation of Construction.

Appendix IVb

Marbase Cleanerfish Ltd.
Women’s Employment Plan (draft)

Marbase Cleanerfish Ltd.
Lumpfish Hatchery, Marystown

Women's Employment Plan

1.0 Introduction

Marbase Cleanerfish Ltd. is a Newfoundland and Labrador registered company which plans to construct and operate a Lumpfish Hatchery as part of an aquaculture service hub to be located on the site of the former Marystown Shipyard property. The facility will be contained within an existing building at the former shipyard and will be a land-based operation using seawater from Mortier Bay and municipal services from the Town, utilities and other third parties.

Lumpfish (*Cyclopterus lumpus*), a native species, are utilized in the aquaculture industry as "cleanerfish". When placed together with salmon in a sea cage, lumpfish graze on sea lice that can occur on growing salmon. This biological form of pest control can replace more intrusive and less effective strategies, and is an accepted, regulated and ongoing practice in the Province and internationally. Currently in this region, lumpfish are being provided to aquaculture operations as cleanerfish in limited numbers (and small sizes) through the Department of Ocean Sciences Research Production Program, Memorial University. The Marbase Cleanerfish Hatchery represents the next logical step in the commercialization of this capability.

Wild lumpfish (pre-spawning eggs) will be obtained from local commercial fishers in cooperation with an ongoing program at the Dr. Joe Brown Aquatic Research Building (MUN). At the hatchery, fertilized eggs will be incubated and, upon hatching, larvae will be reared in a sequence of tanks until reaching marketable size (25-40g) for sale to local finfish aquaculture operators. The planning time frame for hatchery operations is fifteen years.

The population of the Burin Peninsula has been decreasing over the past years, primarily due to lack of employment opportunities. Aquaculture and associated businesses represent an opportunity for training, employment and either staying or returning to the region. The Marbase Cleanerfish Hatchery itself is anticipated to require an operational workforce of 15 – 20 individuals, the short term renovation/construction phase will a larger number of people and trades.

2. 0 Marbase Cleanerfish Ltd. Commitment to Diversity

Marbase Cleanerfish Ltd. is committed to being an equal opportunity employer and company policies and practices will support this commitment in relation to recruitment, training, advancement and retention. The company senior management team will appoint a member of the team to be responsible for diversity, including the successful implementation of a company Women's Employment Plan.

Marbase Cleanerfish Ltd. will develop and implement a Women's Employment Plan (WEP) as the project planning proceeds. The intent of a Women's Employment Plan is to "assist companies by helping to establish proactive policies, practices, and lines of accountability aimed at creating inclusive workplaces free from harassment and discrimination. In projects requiring contractors, sub-contractors and unions, it is crucial that shared responsibilities and clear lines of communication are established to ensure adherence to the company's WEP. "(From the template for Women's Employment Plans provided by the Office for the Status of Women, November 2019).

The company will take proactive measures to ensure that women are aware of the potential training and employment opportunities associated with the hatchery project (See Section 4.0). Successful mechanisms to attract and retain women in non-traditional work have been developed in the province and women are now participating in technical, administrative and management roles in the aquaculture industry both in the province and on the Burin Peninsula itself.

3.0 Project Timeframe and Workforce Estimates

The project is scheduled to begin in Spring 2020. Construction of the hatchery is estimated to take 6 months. Wharf repairs will be initiated during this time period. The hatchery is expected to commence operations in the Fall of 2020 and will operate for fifteen years or more.

Construction related employment is estimated at 50 – 60 people (Table 1 and Table 1A) and operations employment at 20 positions (Table 2 and Table 2A). Indirect jobs will likely be primarily in the associated services and material supply businesses, both existing and anticipated to support the growing aquaculture industry around the Burin Peninsula.

Table 1: Estimated Full-time Contractor-Hired (CH) or Direct Employee (DE) Hires, Construction Phase, by Occupation/NOC

Work Task	Potential # Workers	National Occupation Classification*
Project Management and Supervision	2	0211 engineering manager/supervisor 0711 construction managers
Civil Works - external	16	7217 heavy duty equipment operators 0711 construction manager 7611 construction trades
Building reconstruction	24	0711 construction manager/supervisor 7215 carpenters 7216 mechanical engineers 7219 installers 7213 pipefitters 7611 construction trades
Pumping, plumbing and intakes	12	7213 pipefitters 7251 plumbers 7611 plumber helpers 2274 engineer officers water transport 2273 deck officers water transport 2212 geotech technicians 2231 civil engineer
Installation of tanks, water circulation and water treatment	8	7217 contractor/supervisor 7213 pipefitters
Total	62	

*https://noc.esdc.gc.ca/English/noc/QuickSearch.aspx?ver=06&val65=master%20mariner

Table 1A: Employment Targets by Occupational Group – Construction Phase					
Occupation (NOC)	FT/PT/Seasonal	# of Employees	Target Female (%)	Direct Hire (DH) or Contractor (CT)	Estimated Timeframe
Project Management	Seasonal		50	CT	0.5 yr.
0211 engineering manager/supervisor 2231 civil engineer		2 1			
Administration				CT	
Supervisors of Skilled Trades	Seasonal		50	CT	0.5 yr.
0711 construction managers 7217 contractor/supervisor		2 6			
Semi-Professionals, Technicians	Seasonal		30	CT	0.5 yr.
2274 engineer officers water transport 2273 deck officers water transport 2212 geotech technicians		2 2 1			
Skilled Trades	Seasonal		30	CT	0.5 yr.
7217 heavy duty equipment operators 7611 construction trades 7215 carpenters 7216 mechanical engineers 7219 installers 7213 pipefitters 7251 plumbers		4 10 4 4 6 8 8			
Manual Workers/Labourers					
Apprentices	Seasonal		50	CT	0.5 yr.
7611 plumber helpers		2			

Table 2: Estimated Full-time (FT), Contractor-Hired (CH) or Direct Employee (DE) for the Operations Phase by Occupation//NOC				
Occupation	**NOC**	**Duration of Work**	**Number of Employees**	**CH/DE**
Project Management	8257	**Indeterminant, full time**	**2**	**DE**
Supervisors Skilled Trades			**0**	
Professionals	3213	**Indeterminant, full time**	**1**	**DE**
Semi-Professionals and Technicians	2221 3213	**Indeterminant, full time**	**10**	**DE**
Skilled Trades	1411 2131	**Indeterminant, full time**	**3**	**DE**
Manual Workers	0721 6651	**Indeterminant, full time**	**4**	**DE**

Table 2A: Employment Targets by Occupational Group – Operations Phase					
Occupation (NOC)	**FT/PT/Seasonal**	**# of Employees**	**Target Female (%)**	**Direct Hire (DH) or Contractor (CT)**	**Estimated Timeframe**
Project Management	FT	2	50	DH	Ind.
Administration	FT	1	100	DH	Ind.
Supervisors of Skilled Trades		0			
Semi-Professionals, Technicians	FT	10	60	DH	Ind.
Skilled Trades	FT	3	30	DH	Ind.
Manual Workers/Labourers		4	50	CT	Annually
Apprentices					

4.0 Recruitment and Employment Practices

Experience in other projects and industries in the province have identified several measures that enhance the recruitment and retention of women in a workplace.

Marbase Cleanerfish Ltd. will review the various suggested measures in consultation with organizations supporting women in science, trades and technical occupations (such as Office to Advance Women Apprentices (OAWA) and Women in Resource Development Corporation (WRDC), AESL) as well as education and training institutions and determine measures relevant to the scale and nature of the hatchery project.

Marbase Cleanerfish Ltd. will make ongoing efforts to develop and maintain an inclusive workplace culture.

5.0 Communication

Marbase Cleanerfish Ltd. will work with stakeholder organizations and institutions to ensure awareness of project related opportunities. Experience in other projects and industries has identified several measures that are effective in reaching women.

The Newfoundland and Labrador Aquaculture Industry Association (NAIA), individual companies and the Marine Institute have had and continue various initiatives to ensure training, employment and business opportunities offered by the industry are communicated throughout the province. Marbase Cleanerfish Ltd. has already initiated public communication about the project through media and a workshop in Marystown, the site of the proposed lumpfish hatchery.

6.0 Monitoring

Marbase Cleanerfish Ltd. will work closely with its main contractor(s)/sub-contractors during contract negotiation and implementation to ensure compliance with the Women's Employment Plan. The company will include quantitative and qualitative information about the WEP in an annual report to the Office of the Status of Women and pertinent stakeholders (Appendix A).

Appendix A: Employment Tracking Summary

Skilled Crafts and Trades Occupations										
Time Period: From _______________ To: ____________________					Journeyperson		Apprentice		Total Females	
		Total Workers: Male and Female			Female		Female			
Trade	Total	Supervision Name Hire	Name Hire	Union Referral	Name	Union	Name	Union	Total (Number)	Total %
Carpenter										
Electrician										
Heavy Equipment Operator										
….										
Total										
Manual Workers										
Labourers										
Warehouse Worker										
…										
Total										
Administrative/Sales/Service Occupations										
Clerical Worker										
Security Guard										
….										
Total										
Total (Overall)										

Name Hire Efforts	
Trade	Notes

Source: Using Balance To Build: Supporting Gender Diversity in Newfoundland and Labrador Construction Trades, 1990-2017

Appendix C: Women’s Employment Plan – Quarterly Tracking Report – A, Numbers of Workers

Quarterly Report

Company Name: ____

Project Name: ____ **Location:** _____________________________

Contact: ____

Time Period: From ________________ **To:** _____________

Occupations/Job Classification	**National Occupational Code (NOC)**	**Female Representation**	**Total Employees**		**Level Of Trade**			
					Journeyperson		**Apprentice**	
		Number (%)	**M**	**F**	**M**	**F**	**M**	**F**
Management								
……								
Administrative								
…..								
Business/Finance Professionals								
…								
Technicians/Semi-Professionals								
….								
Supervisor/Skilled Trades								
….								
Skilled Trades								
….								
Manual Workers								
…								
Natural and Applied Science Professionals								
……								
Total								

Appendix C: Women's Employment Plan – Quarterly Tracking Report – B, Person Hours

Quarterly Report

Company Name: ____

Project Name: ____ **Location:** _______________________________

Contact: ____

Time Period: From _________________ **To:** ______________

Occupations/Job Classification	**National Occupational Code (NOC)**	**Female Representation (Person Hours)**	**Total Employees**		**Level Of Trade Journeyperson Apprentice**			
		Person Hours (%)	**M**	**F**	**M**	**F**	**M**	**F**
Management								
……								
Administrative								
…..								
Business/Finance Professionals								
…								
Technicians/Semi-Professionals								
….								
Supervisor/Skilled Trades								
….								
Skilled Trades								
….								
Manual Workers								
…								
Natural and Applied Science Professionals								
……								
Total								

Appendix V

Public Information and Consultation

Appendix Va

Pre-Registration Consultation

REPORT OF

Marbase Cleanerfish Hatchery Stakeholder Consultation

MARBASE

Table of Contents

1.0 Overview

The Marbase Cleanerfish Hatchery project was registered with the provincial Department of Municipal Affairs and Environment on December 10, 2019. The deadline for submission of public comments to the Minister is January 15, 2020. Between the date the project was registered and January 15, 2020, as part of the registration process, the proponent, Marbase Cleanerfish Ltd., is encouraged to consult with interested parties including regulators, resource managers, and public stakeholders potentially affected by the proposed undertaking.

During government's review of the Project Registration, public input is invited to help shape the Minister's decision, which is due by January 24, 2020. At that time, the Minister may (1) release the undertaking from the environmental assessment process (subject to terms and conditions), (2) require an Environmental Preview Report, (3) require an Environmental Impact Statement, or (4) reject the undertaking.

In preparing the registration document, Marbase Cleanerfish Ltd. consulted directly with many interested parties, including reaching out to various government departments and agencies. The results of this effort were reported as an appendix to the registration. In addition, the proponent sought to encourage participation in the public review process. This was addressed by holding an Open House in Marystown, NL and inviting the general public to attend. This Open House served to increase awareness of the registration review process by providing information about the proposed undertaking, the proponent, the environmental assessment process, and the means for making submissions to government.

The Open House was successful in providing information to over one hundred attendees and has resulted in several submissions to the Minister in support of the project and supporting a release from any further assessment.

2. Marbase Cleanerfish Open House

2. 1 Promoting the Open House

2.1.1. Facebook

Bridge Communications launched the Marbase Facebook page on December 6, 2019. The page ran two ads aggressively – a short video explaining lumpfish and the hatchery (Leo the Lumpfish) along with an invitation to the Open House. The third proposed ad, about the socio-economic benefits of the project, was flagged by Facebook as issues advertising and was not approved in time to run.

At the time of the Open House, the page had 71 follows / 69 likes.

These are the stats for the two ads.

	**Website Visitors** http://marbase.ca/ Promoted by Judy Snow on Dec 12, 2019 Completed	10,006 People Reached	302 Link Clicks
	**Website Visitors** http://marbase.ca/ Promoted by Judy Snow on Dec 12, 2019 Completed	10,860 People Reached	236 Link Clicks

Ads were targeted to people 18 and up living in a 50-mile radius of Marystown, NL.

Link clicks on a "Learn More" button took people to the Marbase website.

People on Facebook spent over 31 hours (1898 minutes) viewing the 30-second "Leo the Lumpfish" Video. The ad had 6,887 views of 3 seconds or longer.

2.1.2 Website

The Marbase website went live on December 10, 2019. The website, which is informational in nature, provides background information about lumpfish, the hatchery, Marbase, and the socio-economic benefits of the project. Traffic was driven to the website entirely through Facebook advertising. According to Google Analytics, between launch and the date of the Open House, it had 434 users and 508 sessions. The bounce rate of under 1% was exceptional with visitors viewing 2.82 pages (out of 4) on average.

2.1.3 Email Invitations

Between them, Paul Antle, CEO of Marbase, and Joanne Young, Office Manager, issued 38 email invitations to the Open House, which included representatives of Municipal Affairs and Environment, Department of Fisheries and Oceans (DFO), the Town of Marystown, Unifor, NAIA (Newfoundland Aquaculture Industry Association), three Members of the House of Assembly (MHAs), the Burin Campus of College of the North Atlantic, the Burin Peninsula Waste Management Authority, the Burin Peninsula Chamber of Commerce, Marystown Central High, Eastern School District, Little Bay Harbour Authority, Burin Heritage Tourism Association, as well as representatives of Grieg NL, Mowi, and Cooke Aquaculture. A reminder email was sent to invitees on the morning of the Open House.

2.1.4 Media Advisory

On December 10, 2019, Joanne Young sent a media advisory about the Open House to CBC, NTV, VOCM, the *Telegram*, the *Southern Gazette*, and the *Navigator*.

2.2 Event Particulars

The event was held on Monday, December 16, 2019, from 3:30 to 5:00 pm and from 6:00 to 9:00 pm at St. Gabriel's Hall in Marystown, NL which provided ample parking and space.

All stations were visibly numbered, making it easier to direct visitors to a particular spot. Attendees entering the hall were greeted by a "registration" table (Station 1). Joanne Young and Cathy Follett of Ocean Aqua invited people to sign in and provide their email address and / or phone number – but it wasn't mandatory. Everyone attending was counted whether they signed in or not. Everyone was given a floorplan. Joanne also had information packages for the media on hand.

Station 1

The event's flow took people first to Station 2, staffed by Danny Boyce of Memorial University's Ocean Sciences Centre. The station provided information about lumpfish as cleanerfish and the proposed hatchery facility. This station included a 30" video about lumpfish and provided a fact sheet and pop-up banner describing the hatchery.

Station 2

Next was NAIA's booth staffed by Darrell Green, which provided information about the province's aquaculture industry.

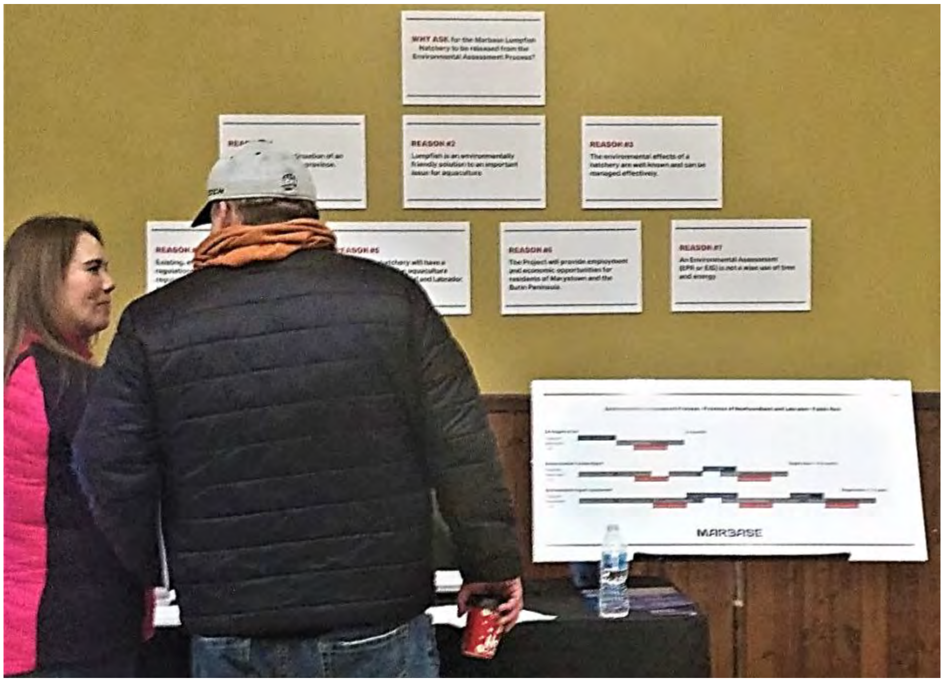
Station 3

The next two stations, which provided information on Marbase the company and the socio-economic benefits of the project, were staffed by Marbase CEO Paul Antle and Knut Trellevik of Marbase, Norway. Information was provided that described Marbase corporate structure and outlined company plans for the revitalization of the former shipyard into an aquaculture service hub.

Station 4

Station 5

These were followed by Station 6, which provided an overview description of the Provincial Environmental Assessment Process, staffed by Bevin LeDrew. Visual aids at this station included a process timeline for an environmental registration and its potential outcomes – a release, an EPR, or an EIS. Posters provided suggestions as to the mechanisms in place to ensure environmental protection and the factors that would be relevant to the decision on the need for further environmental assessment.



Station 6

The final station was staffed by Judy Snow of Bridge Communications, who provided logistical support to attendees who wanted to make their observations known to the Minister as part of the registration review process.

Station 7

Tea, coffee, water, and snacks were offered.

2.2.1 Materials Provided at Open House

Open House attendees were provided with a variety of materials.

2.2.1.1 Print

Business card for job seekers informing them hiring would begin in 2020 and inviting them to send their resumes to employment@marbase.ca

Marbase postcard describing the company and its services, which also provided the bona fides for Paul Antle and Bjorn Apeland.

Hatchery one sheet which provided background information on the hatchery and lumpfish.

Socio-economic benefits one-sheet which provided an overview of what the hatchery and Marbase would mean to Marystown, the region, and the province.

Print piece on key reasons the project should be released from the environmental assessment process.

Print piece with information regarding contacting the department / Minister about releasing the project from the environmental assessment process.

Executive summary of registration document

Floorplan of Open House

2.2.1.2 Signage

Welcome to Open House pop-up banner

About the Hatchery pop-up banner

Marbase pop-up banner

Reasons project should be released from Environmental Assessment Process signage

EA Flowchart sign

How to ask to have the project released from the EA Process sign

2.2.1.3 Video

Leo the Lumpfish video

Benefits of the project video

Video of lumpfish in sea cages with salmon

Copies of print materials are attached as Appendix A.

2.3 Attendee Feedback

60 people attended the afternoon session, and 39 attended the evening for a total of 99 attendees.

As a casual observation, visitors spent on average close to an hour at the Open House, and most spent time at each station in conversation with the hosts.

According to Danny Boyce, he received no negative comments, other than that many of the people felt angry they had failed to get out and support the Grieg NL proposal earlier on, thus slowing that project down for 3-4 years. That appears to be a lesson learned by the general public and business community on the Burin Peninsula – that it's important to get out and support a project – to be vocal and make positive noise on behalf of the proponent if you support a project.

Some of the people who attended the Open House were expecting a presentation and / or a Q&A but that was only because Grieg NL had used that format previously in the region.

Boyce also stated that by the time they left, people felt the station format was excellent and that all stations had someone with a different skill set who could answer their questions. They left with a sense of personal attachment to the people and project. They also have a better understanding of a hatchery and the benefits to salmon farmers.

100% of the people who spoke to Boyce told him some story about the shipyard or how excited they are that is going to be open for business versus sitting idle. This area is a sacred piece of history within that community, and they all feel an attachment and almost ownership / pride to say the least. He thinks it's fair to say they are all in on development of this property.

Bevin LeDrew provided the following feedback. He spent an average of five minutes with small groups of 1-3 of people, describing the Registration, the review process, and laying out reasons to send a letter to the Minister as part of the public review. He estimates he spoke with a total of 80 to 100 people during the afternoon and evening sessions.

Every one of the people he spoke with was supportive of the Project. About half of those he spoke with were seeking employment for themselves or their partner. Nevertheless, all expressed the view that the undertaking needed to be environmentally acceptable. One key rationale accepted by all was the description of the Project as an environmental asset, i.e. a biological answer to a biological problem. For many participants, this was expressed as central to their support. Several suggested additional reasons for Project Release, e.g., the fact that the federal government had already rendered a decision that no EA is required. Many felt the project should not have needed registration given that the activity has been underway for around five years already. Almost everyone was very familiar with the site, and all seemed to feel it would be an ideal location for a hatchery. He spoke of the saltwater intake / outfall as the only required new service for the facility, and there were no negative comments put forward.

Many participants expressed the view that their support for the Grieg proposal was not adequately appreciated or taken into account during that EA process, and they committed to making their views known for this current proposal in order to avoid a prolonged and unnecessary process for the Marbase Project.

He spoke at length with a few business people who were supportive of increased economic activity and the hope for retention of young people within the community. Three young couples were in a similar situation, with only one working, while the other was well-qualified (technical or professional) but unable to find employment.

There was general support for aquaculture as one of a very few development opportunities for the region. Several people, while indicating awareness of recent negative incidents, nonetheless stated that aquaculture is an environmentally compatible development opportunity.

When he finished speaking to people, he directed them to one of the other stands, depending on which ones they had already viewed. A few expressed an interest in speaking to CEO Paul Antle, so he made the appropriate introductions. Most participants moved to the next station where Judy Snow was providing assistance in preparation of letters of support. A couple of individuals returned to chat with him, showing him the communications they had prepared.

Paul Antle spoke to every visitor who came to the Open House. Many of the questions for him related to the timing of the hatchery, how many jobs would be created, when would it produce its first lumpfish, what kinds of people and skills would be needed, how to apply for a job, and whether or not training opportunities will be provided. Many attendees were business leaders in the community who were quite interested in the economic spin-offs for the region. Each and every visitor watched a video at Paul's station showing lumpfish swimming in a sea cage with salmon and eating lice. People's reaction to seeing the lumpfish and the job they was that it was highly educational and created a great deal of understanding quickly regarding the need for and efficacy of using cleanerfish to control sea lice.

2.4 Letters and Emails to Minister

Open House attendees generated 20 letters and 7 emails to the Minister.

3.0 Follow Up

On December 20, 2019 Joanne Young emailed the 68 Open House attendees for whom she had email addresses reminding them of the January 15, 2020 deadline for submissions to the Minister.

On January 6, 2020 Judy Snow emailed the President of the Burin Peninsula Chamber of Commerce and the Local Union Presidents reminding them of the January 15, 2020 deadline for submissions to the Minister.

4.0 Media Coverage

Marbase CEO, Paul Antle, has been quite receptive to doing media interviews – both to distribute information about the project and to create awareness of the review process and opportunities for public input.

Jane Adey of CBC's The Broadcast conducted a telephone interview with Paul Antle on the day of the Open House.

Before Christmas 2019, the *Oil and Gas Magazine* conducted an interview with Paul Antle about Marbase.

On December 12, 2019, CBC's The Broadcast ran "Raising lumpfish for aquaculture" https://www.cbc.ca/listen/live-radio/1-122-the-broadcast/clip/15751467-raising-lumpfish-for-aquaculture-alaskan-cod-fishery-cancelled-for-next-season?fbclid=IwAR2fJJV2WXhxenElHQGyU-UOyWnPiAogC3PUZ10LI10kyDCtbCNuFSuxi5w

On December 12, 2019, VOCM ran "Canada's first lumpfish factory moves forward with environmental assessment in Marystown" https://vocm.com/2019/12/12/canadas-first-lumpfish-factory-moves-forward-with-environmental-assessment-in-marystown/

On December 20, 2019, NTV, which attended the Open House, ran "Marbase about to begin transforming old Marystown shipyard" http://ntv.ca/marbase-about-to-begin-transforming-old-marystown-shipyard/

On December 28, 2019, CBC ran "Lumpfish a 'biological weapon' against sea lice, says CEO of company proposing hatchery" https://www.cbc.ca/news/canada/newfoundland-labrador/lumpfish-marbase-hatchery-1.5402363

On January 2, 2020, Jane Adey of the Broadcast ran a story with CEO Paul Antle discussing the environmental assessment process.

On January 7, 2020, Yahoo News redistributed the December 28th CBC story.

Appendix 1:

Materials Provided at Open House

Employment Business Card

Marbase Postcard

SERVICING THE AQUACULTURE INDUSTRY

Marbase will offer many services to the province's aquaculture industry:

- Cleanerfish (Lumpfish) Hatchery
- Salmon Feed Storage / Production
- Barge Construction / Repair
- Cage Construction / Decommissioning / Disposal
- Aquaculture Vessel Repair
- Rental Space for Suppliers
- Remote Services
- Diving Services
- Net Washing / Repair / Recycling

Marbase hopes to begin work on the hatchery in May 2020.

UPWARDS OF 200 GOOD JOBS

Over the next 5 years, Marbase plans to grow its workforce to upwards of 200 well-paid, sustainable union and management jobs, which will spark other economic activity.

The provincial aquaculture industry already employs twenty-five hundred people. Marbase will help the industry become even more productive and more environmentally safe and secure.

And that's good business for everyone.

Paul Antle owns the St. John's Dockyard (Newdock), Avalon Laboratories, and Humber Motors. He pioneered environmental industries in Newfoundland and Labrador, helping to develop and export environmental technology to 4 continents, working in 15 countries. He is a Canadian Certified Environmental Professional.

Bjorn Apeland is currently the CEO of Amar Group ES. He developed his previous company, Steinsvik, into one of the leading suppliers of aquaculture technology and solutions in the world and a driving force in the development of aquaculture technology.

Hatchery One Sheet

THE HATCHERY

Marbase Cleanerfish Inc. is proposing to build and operate a lumpfish hatchery on the site of the former Marystown Shipyard. It will be a core part of the aquaculture industry service hub Marbase is creating.

A natural way to control sea lice on farmed salmon

The Marbase cleanerfish hatchery will provide lumpfish to Atlantic salmon farming operations where sea lice are present and causing the salmon to stress. Lumpfish, which eat sea lice, are a natural biological method of sea lice control for Atlantic salmon. Marbase decided to use lumpfish as its cleanerfish of choice because they are indigenous to Newfoundland waters, are already being used successfully in Norway and Iceland, and because of the research and development work on lumpfish that has taken place at Memorial University's Ocean Science Centre.

In Norway, 13 hatcheries produce over 30 million lumpfish a year, which are sold to farmers who produce about 1.3 million tonnes of salmon annually, worth $10.4 billion. The science supported Norway's investment in the lumpfish hatcheries. Common sense says salmon farmers wouldn't buy 30 million lumpfish a year if they don't work to control sea lice.

Lumpfish raised in land-based tanks

Lumpfish at the Marbase cleanerfish hatchery will be raised in land-based tanks containing seawater. Marbase is in the process of applying for permits and approvals to address regulatory requirements related to aquaculture operations, water quality, aquatic habitat protection, waste management (handling, treatment, recycling and disposal), employment equity, navigation waters use, water extraction and allocation, contingency planning, and emergency preparedness.

Consultation ongoing

Marbase has consulted all three levels of government, the public, and interested stakeholders as a way to identify issues and concerns related to the project. Marbase can and will address any concerns identified through project design and planning, as well as through regulatory permitting. Marbase is currently in the process of obtaining the required permits and approvals from the federal, provincial, and municipal governments.

Cost estimated at $20 million

Marbase plans to begin construction after it receives all necessary permits and approvals. Marbase will renovate a building at the former shipyard to house the hatchery. Marbase hopes site work will begin in May 2020 with completion forecast by November 2020. The capital cost is estimated at $20 million, with Marbase providing all the funding. Once finished, the hatchery will contain approximately 280 fiberglass tanks of varying sizes to accommodate the different sizes of the growing lumpfish.

Small-scale compared to salmon farms

Once it reaches full production, the hatchery will be able to produce 3-5 million market size lumpfish each year – approximately 75-100 tonnes. In comparison, traditional salmon farmers in the province produce approximately 25,000 tonnes of fish in aggregate each year.

Local broodstock

During the start-up phase, the hatchery will rely on Memorial University's Ocean Science Centre and commercial fishers for the collection of fertile females to provide an adequate supply of eggs. The fertilized eggs will be incubated on site. The resulting fry will be reared in the hatchery until they reach commercial size (~25g).

Water leaving hatchery can sustain sea life

This smaller scale of operation is also reflected in the amount of waste the hatchery will produce. Most of the waste will be material filtered from the intake seawater prior to its use in the tanks and from the outflow seawater prior to its return to Mortier Bay. Marbase estimates this will create eight tonnes of sludge per month, which is small in comparison to a commercial salmon hatchery. The company's waste management plan will explore all opportunities to use this source of organic material, including as agricultural fertilizer.

Both the seawater entering and leaving the hatchery will be treated. The temperatures will be adjusted, and the water will be filtered and purified. Seawater leaving the hatchery will be treated to a standard that supports marine life. Regular monitoring of water quality will ensure compliance with applicable regulations.

Sales will take place dockside at Marbase or at the truck loading bay at Marbase.

Building on Memorial University's expertise

MEMORIAL UNIVERSITY

This project continues to expand on capabilities that already exist at Memorial University and is the final step in converting university-led research into a viable commercial enterprise. In this sense, it is not a new undertaking. The effects of introducing lumpfish into sea cages have already been considered as part of Grieg NL's environmental impact statement.

Lumpfish already used here as cleanerfish

Memorial researchers have been providing lumpfish to local salmon farmers for the last few years. In fact, Memorial University's Department of Ocean Sciences is currently producing between 1.5 and 2.0 million 1g lumpfish a year. These lumpfish fry are shipped to Nova Scotia for grow out. Once they are big enough to be released in sea cages with Atlantic salmon to serve as cleanerfish, they are shipped back to 10-15 salmon farms in NL.

The Marbase hatchery will operate year-round as a permanent facility. Staff will be present on a twenty-four-hour, seven-day-a-week schedule. Most activities will occur during the daylight hours. Peak activity will occur when egg fertilization and incubation happens each spring and when lumpfish are sold.

The hatchery hopes to have its first sales in spring 2021.

A biological approach to a biological problem

The potential positive effects are impressive, especially for the finfish aquaculture industry through the potential elimination of pesticides. It is clear this biological approach to a biological problem will create a net environmental benefit.

marbase.ca

Socio Economic Benefits One Sheet

What Marbase Means to Marystown, the Burin Peninsula, and the Province

Marystown best, most-logical location

Marystown, with a population of roughly five thousand, has a new industrial park, an offshore fabrication facility at nearby Cowhead, and the site of a former shipyard – now home to Marbase. Grieg NL is currently building an Atlantic salmon hatchery in the community and intends to make Marystown the centre of its aquaculture operations in Placentia Bay. Despite recent declines in population on the Burin Peninsula, the region still has a trained, experienced workforce, especially when it comes to the skilled trades, transportation, and equipment operation. All of these factors combined to make Marystown the best, most-logical place to locate a service hub for this province's aquaculture industry.

Over the last fifteen years, the only activity at the shipyard site has been environmental remediation and abatement work carried out for the provincial government in fulfilment of its environmental liability responsibilities as a past owner.

Breathing new life into the region

Once in operation, the Marbase aquaculture service hub will breathe new life into Marystown and the Burin Peninsula – and the lumpfish hatchery will be the heart of that activity.

During construction, the hatchery will provide employment for as many as 60 predominantly local people. Site activities will generally be carried out by contractors. Spinoff activities would include increased demand for vehicle fueling, vehicle servicing, hotel accommodations, and restaurant services.

Sustainable Employment

Once the hatchery is operating, it will provide jobs for 20 full-time staff and create 20-30 indirect jobs through contracted services. Marbase has labour agreements in place with two local unions. Hiring preference is first within the local unions, then the local community, followed by the Burin Peninsula, then the rest of the province, and beyond. Short-term employment might be required during loading and shipment of lumpfish. Specialized services, such as diving / ROV to monitor the saltwater pipeline, would be contracted out.

Lots of other local benefits

Local and provincial service and supply companies will benefit directly from the hatchery. There will also be direct and indirect economic benefits related to the supply of goods and services for Marbase management, employees, contractors, service providers, and others associated with the hatchery.

A team of experts from within the province as well as internationally have been working together to design the systems for the hatchery. Once construction is given the go ahead, there will be further opportunities for local companies to participate in specific contracted tasks. At the same time, recruitment will begin for operations personnel, who will be on staff for the startup of the hatchery.

MARBASE

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WHY ASK for the Marbase Lumpfish Hatchery to be released from the Environmental Assessment Process?

REASON #1

The project is a continuation of an existing activity in the province.

REASON #2

Lumpfish is an environmentally friendly solution to an important issue for aquaculture.

REASON #3

The environmental effects of a hatchery are well known and can be managed effectively.

REASON #4

Existing, effective environmental regulations already apply. These regulations include provisions for public consultation.

REASON #5

The lumpfish hatchery will have a positive effect on the aquaculture industry in Newfoundland and Labrador.

REASON #6

The Project will provide employment and economic opportunities for residents of Marystown and the Burin Peninsula.

REASON #7

An Environmental Assessment (EPR or EIS) is not a wise use of time and energy.

MARBASE

marbase.ca

HOW TO ASK for the Marbase Lumpfish Hatchery to be released from the Environmental Assessment Process

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THE PROJECT:

Marystown Marbase Cleanerfish Hatchery, Registration Number 2062

Public comments can be forwarded to:

EAprojectcomments@gov.nl.ca

Environmental assessment information is available at
http://www.mae.gov.nl.ca/env_assessment/

Twitter:

@GovNL and @MAE_GovNL

Telephone:

Environmental Assessment Division: Toll-free at 1-800-563-6181

Mail:

The Hon. Derrick Bragg, Minister

Department of Municipal Affairs & Environment

P. O. Box 8700 St. John's, NL A1B 4J6

mailto:derrickbragg@gov.nl.ca

We are happy to answer your questions.

Contact:

Paul Antle, CEO

Marbase Hatchery Ltd.

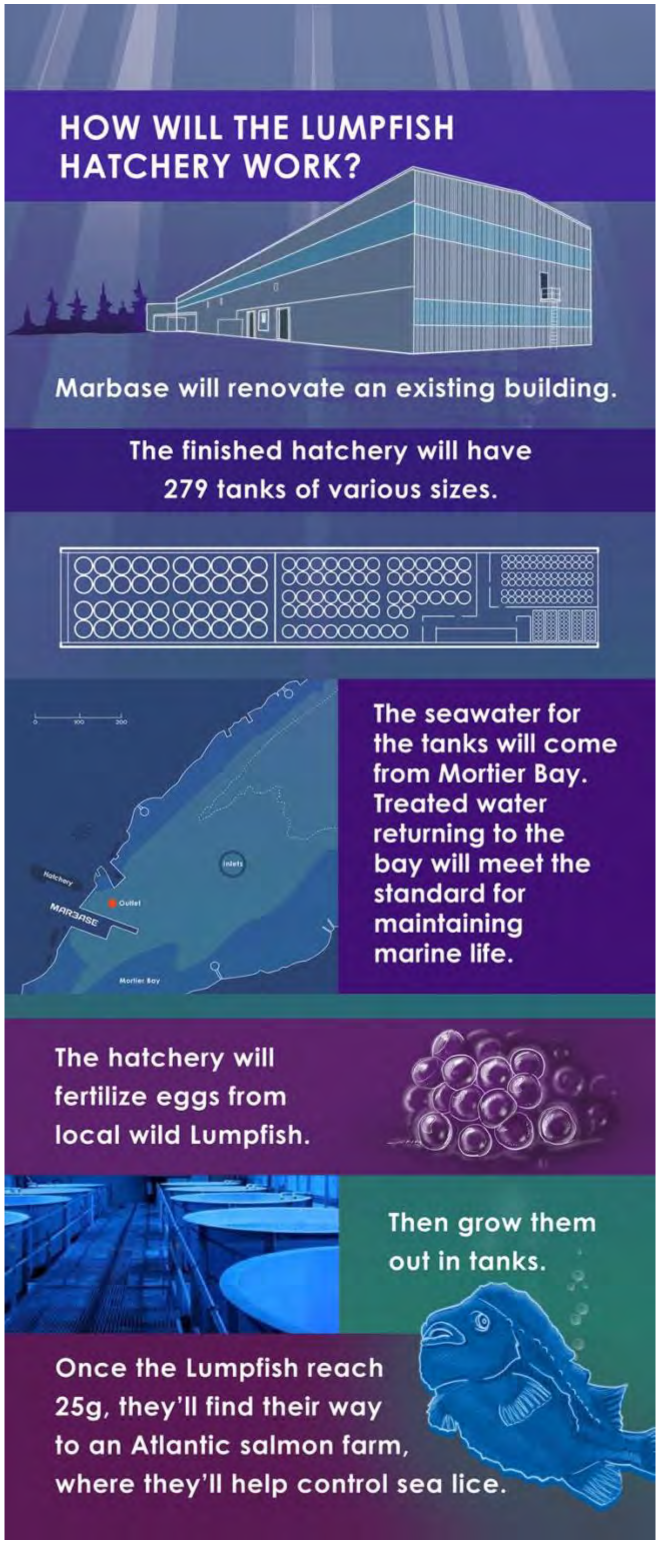
Call 709-726-5544 and select “1”

Email jyoung@plutoinvestments.ca

MARBASE

marbase.ca

About the Hatchery Pop-Up Banner

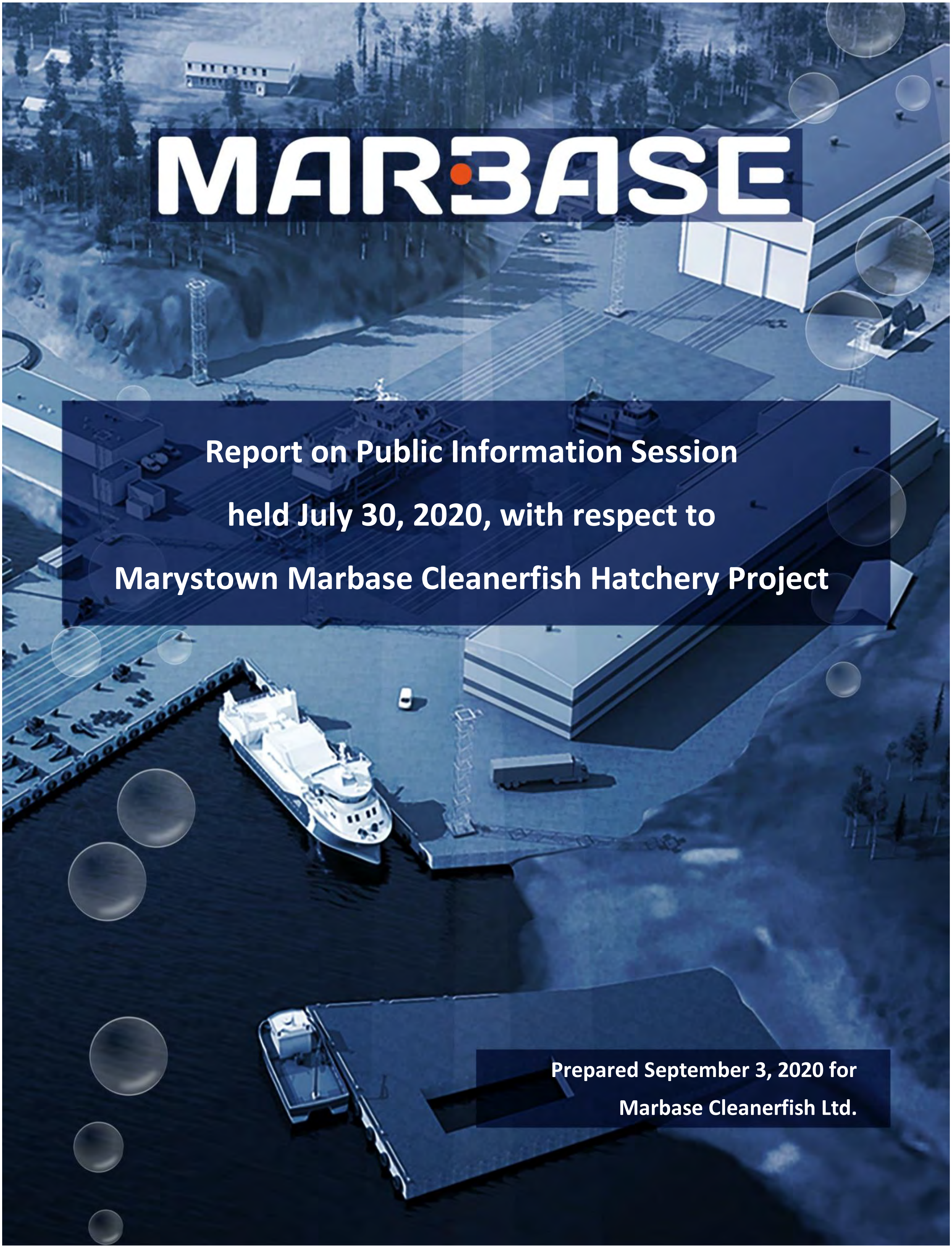


Environmental Assessment Process - Province of Newfoundland and Labrador- Public Role

Environmental Assessment Flowchart

Appendix Vb

Report of the Public Information Session



MARBASE

Report on Public Information Session held July 30, 2020, with respect to Marystown Marbase Cleanerfish Hatchery Project

Prepared September 3, 2020 for

Marbase Cleanerfish Ltd.

Table of Contents

1.0 Requirement for Public Information Session

On February 17, 2020, the Department of Municipal Affairs and Environment advised Marbase Cleanerfish Ltd. (the Proponent) that as part of the environmental assessment process an Environmental Preview Report (EPR) would be required. As part of the preparation of that report, the Proponent would be required to hold a public information session. The purpose of the session would be to describe all aspects of the proposed project, to describe the activities associated with it, and provide an opportunity for all interested persons to request information or state their concerns.

1.1 Implications of COVID-19

On March 18, 2020, the province's Minister of Health signed a Declaration of a Public Emergency under the *Public Health Protection and Promotion Act* on the advice of the Newfoundland and Labrador Chief Medical Officer of Health. As the Proponent began preparation to hold the public information session, it became clear the Public Emergency would place significant restrictions on a conventional public information session, particularly the number of people who would be allowed to attend such a session.

In response, the Proponent approached the Department about conducting the session virtually. The Proponent proposed to conduct the session using Zoom. As part of the session, the Proponent would make a presentation presenting all aspects of the project and describing the activities associated with it. Interested parties would also be able to request information or state their concerns.

On June 11, 2020, after considering the Proponent's proposal, the Department issued Environmental Preview Report Guidelines, which included the requirements for conducting the public information session.

2.0 Design of Public Information Session

In a pre-COVID world, the Proponent would have held a live public information session in Marystown, the community where the proposed project is situated; however, given the situation with COVID-19, this would carry some risk for attendees and would limit people's opportunity to participate. The Proponent sought out the best use of technology to (1) accommodate the largest number of people possible and (2) to make provisions for those who have limited internet access or who are uncomfortable with the use of technology.

Accordingly, the Proponent organized a Zoom session that allowed up to 500 people to participate online. When people registered for the session via Zoom, they were asked if they wished to ask a question; and a list of those who wished to ask a question was compiled and given to the session's moderator. Those joining via Zoom were also able to ask a question or express a concern during the event using Zoom's Q&A function. People could also submit questions in advance by phone or email. Participants were able to indicate to the Moderator if they wished their question to be anonymous or if they wanted the moderator to ask their question for them versus asking the question live themselves. People could register to join the session via Zoom right up to the beginning of the event.

To accommodate people who might not have access to the internet, an unlimited number of people were able to monitor the session by phone using a tollfree number provided by the Proponent. While those joining by phone could not ask a question live, they could submit a question prior to the event by phone or email.

2.1 Organization of the Session

The session took place on July 30, 2020, at 7 pm via Zoom. It was moderated on behalf of the Proponent by environmental consultant Bevin LeDrew. LeDrew opened the session by describing the format of the session and explaining the process by which questions would be asked and answered by panel members. LeDrew explained that the session was being recorded for the public record and to aid in preparation of the report. LeDrew advised those attending via Zoom that they could indicate they wanted to ask a question using Zoom's Q&A function.

The panel consisted of the following people:

- Bevin LeDrew
- Paul Antle, the Proponent's President and CEO
- Danny Boyce of Memorial University's Department of Ocean Sciences
- Knut Trellevik, President, Amar Canada, representing the Proponent's Norwegian partner

The first three panelists were seated at a table while maintaining physical distancing, while the fourth panelist joined via Zoom.

Next the Proponent's CEO, Paul Antle, delivered a presentation that described all aspects of the proposed project and the activities associated with it.

The Moderator then entertained questions. Those who had indicated they wished to ask a question when they registered were invited to ask their questions first, and the moderator also asked questions submitted in advance by those unable to participate in the session or who were participating by phone. Next the Moderator entertained questions from those who had indicated they wished to ask a question via Zoom's Q&A function. The Moderator directed the questions to the three panelists. Where appropriate, the Moderator also answered questions.

Participants whose questions and concerns could not be responded to during the session were told they could submit them to the Proponent by email at info@marbase.ca. Participants were asked to provide comments within five days of the session in order to ensure the Proponent could record and address comments in the EPR.

2.2 Promotion of the Session

2.2.1 Notification of Department

On July 23, 2020, on behalf of the Proponent, Bevin LeDrew formally advised the Department that the session would take place at 7:00 pm on July 30, 2020.

2.2.2 Newspaper Notification of the Public

As required by the guidelines, the Proponent inserted an ad in the *Telegram* (see Appendix A), the newspaper distributed in Marystown, the community where the Proponent proposes to locate the Project. The ad meets the department's requirement for size and content. As required by the Department, it was published on Saturday, July 25 (the Saturday preceding the session) as well as on July 27, 28, and 29 – the three consecutive days immediately preceding the session. The ad provided a number people could call and the URL where people could go to register online. Nobody called in response to the ad. The Proponent is unable to track how many people may have visited the URL as a result of seeing the newspaper ad.

2.2.3 Website Information and Registration Page

The Proponent created a page on its website where people could (1) get information about the session, (2) register for the session including indicating whether or not they would be asking a question or making a comment, (3) find the tollfree number to call into the session, (4) email a question about the process or a question to be asked at the session, and (4) view a prerecorded version of the presentation the Proponent gave at the session. This webpage went live on July 23, 2020 (see Appendix B). In the period from July 23 to August 4, the webpage had 319 views.

2.2.4 Posting at Marystown Post Office and Town Hall

On July 23, the Proponent posted a poster containing the same information as the newspaper ad in the Marystown Post Office (see Appendix C). While the Town Hall had no provisions for posting notices, the Town did make a post on its Facebook Page, Twitter account, and on the Town's app (see Appendix D).

2.2.5 Promotion by Burin Peninsula Chamber of Commerce

At the request of the Proponent, the Burin Peninsula Chamber of Commerce also posted the digital notice on its Facebook page (see Appendix D) as well as emailing its members about the session.

2.2.6 Promotion on Proponent's Facebook Page

The Proponent also posted the notice (see Appendix D) on the Marbase NL Facebook page together with an active link to the registration form on the Proponent's website. The post reached 2616 people and was shared 14 times.

3.0 The Public Information Session

The Public Information Session took place on July 30, 2020, at 7 pm via Zoom.

46 people preregistered for the session. 29 people actually participated – 28 online and 1 by phone.

The moderator welcomed everyone to the session and reviewed the agenda and the manner in which people would be able to ask questions. He indicated that Paul Antle would be making a presentation on behalf of the Proponent that would describe the project, discuss the alternatives, and address environmental issues.

3.1 Presentation by Proponent

Paul Antle delivered a presentation (see Appendix E) that began with the rationale for the project and then moved on to provide an overview of construction (site preparation, facilities, and installation), and operations.

He then discussed alternatives – location, sea lice management tools, other species, saltwater sources, and water treatment.

Next he reviewed the potential effects of climate change on the project.

He concluded by discussing the effects of the project on human health, the marine environment (species at risk, invasive species, fish and fish habitat, and hatchery mortalities), contaminants and pathogens (hatchery effluent, chemicals, and chemotheraputants), the recreational fishery, and marine navigation.

3.2 Questions from Participants

Following the presentation, the moderator once again reviewed the process for asking question. He then opened the Q&A session by reading the questions submitted via the Proponent's website prior to the Public Information Session.

Because of the overlap in content, the first two questions were read together and answered as one:

1. *Given all the positive aspects of introducing lumpfish to the salmon farms along with strategic important of the finfish aquaculture sector on Newfoundland's southern coastline combined with the fact that the Marbase Cleanerfish Hatchery Project is to be self-funded, can you elaborate on the delays with moving the project forward.*

2. *What is the anticipated time for completion, and why is it taking so long?*

Paul Antle responded that COVID-19 obviously contributed to the delay. The provincial government started remediation activities at the Marystown site to remove their associated [environmental] liabilities prior to any new development. Work began September / October 2019 and wound up last week. During March, April, and part of May work stopped because of COVID. Government will provide the certificate of cleanliness and close out the project in short order. As for the other delay, the Proponent has the EPR itself. The project was registered in late November / early December 2019, and the Proponent received the decision for the EPR from the Minister in April 2020. Because of COVID there was a delay in that process. Today the Project is back on track. The Proponent hopes to complete the EPR within the next month or so and resubmit to the Department. Originally, the Minister had 60 days to review the EPR; but due to COVID that timeline has been extended to 145 days. The Proponent will have to adapt and try to move as quickly as possible. As for the timeline of the project itself, given the delays and the "new normal," if the Proponent gets through the EPR stage and can move on to construction it will take the rest of 2020 and a big chunk of 2021 before the hatchery will be ready for population. That means lumpfish from the Project won't be available to the market until 2022.

3. *What are your plans for vaccination of the fish – using products specified by the purchasing company or exploring other options?*

Danny Boyce responded that Marbase Cleanerfish knows a vaccine program is needed for prevention and protection from bacterial infections in lumpfish. It will be customer specific. Marbase personnel will actively engage with customers and their veterinarians regarding specific vaccines for lumpfish juveniles FOB Marystown. Efforts to understand and control bacterial outbreaks are a high priority internationally throughout cleanerfish research and studies. Marbase also has access to Avalon Laboratories and plans to work closely with the Department of Fisheries and Land Resources' fish health aquatic authorities, with Memorial's scientific community, and with local salmon farms' personnel in providing an effective vaccine. Memorial's Department of Ocean Sciences, under the direction of Dr. Javier Santander, who has a marine microbial pathogenesis lab, has been working on current vaccines that will be available in the short term.

The Proponent has moved toward an autogenous vaccine, which has a pathogen agent (local isolate) that is being isolated in the lab. Primarily, the pathogens being seen in Atlantic Canada for lumpfish are *Vibriosis* and *Aeromonas Salmonicidia*. The Proponent will provide a polyvalent vaccine that induces an immune response against the broadest range of bacteria. In effect there is a business opportunity for a local vaccine company to partner with Memorial to provide an effective vaccine against pathogens for lumpfish.

Because of the overlap in content, the next two questions were read as one and answered together.

4. *Any further details and the expected timelines relating to Marbase's plans, supplier opportunities, and description of the processes that will be utilized for contracting and procurement as well as any specifics anticipated for supplier development and local content objectives.*

5. *Interested in the procurement process for goods and services during the construction phase and asking for a listing of the types of things and timing of requirements. Kindly provide details.*

Paul Antle responded that Marbase has already been contacted by suppliers both from within NL and outside the province about various materials the Proponent might intend to use. The Proponent has created a database of all those inquiries. Once the Proponent's plans are through the environmental assessment process, this process can move forward. The Proponent already has a policy in place where the majority of what is purchased – as far as possible – will be purchased locally from Marystown and the Burin Peninsula. If what is needed isn't available there, the Proponent will push out to the rest of the province and, if necessary, farther. There are a couple of pieces of specialized equipment the Proponent will be bringing in from Norway. Between those two approaches, the Proponent intends to concentrate the majority of its purchasing effort on the Burin Peninsula. As far as timing goes, the construction schedule is not set because the Proponent is still facing this process. The Proponent is unsure about the ultimate timeline for being released from the environmental assessment process. Whether it is 60 days – 180 days. Whether there's going to be a requirement for more study. So until there is some certainty around the Proponent's exit from this process, the construction timeline can't be finalized.

6. *Do you have a market or markets for cleanerfish produced in Marystown?*

Paul Antle responded that the current market in NL is being supplied by the Ocean Science Centre at Memorial, which currently has north of two million lumpfish going in the marketplace annually. That is now considered a commercial activity, which is outside the purview of research. Which is why there's a transition proposed to move that research and knowledge from the university to the hatchery in Marystown. The objective is to slowly take over the market from MUN as the Proponent gets its hatchery up and running. Memorial's presence will be needed as this transition happens. That is how commercial opportunities are brought forward from research activities. So the market is already there. The Proponent hopes to transplant what MUN is already doing and to increase that over time if the demand in the local market increases.

The moderator then invited questions from those participating in the Zoom session.

7. *The location of the hatchery has a long history of industrial development. The adjacent bay has been heavily contaminated with heavy metals and all sorts of things. In the initial proposal, it was mentioned that there are dozens of sewage outfalls in Mortier Bay. Yet the Proponent says the provincial government has completed its remediation of the site, and the site has been approved. What*

water testing has been done as part of that process by the provincial government or the federal government or the Proponent? And is that data available publicly. (Don Ivany, Atlantic Salmon Federation)

Bevin LeDrew responded that remediation activities have been ongoing at the site of the former Marystown Shipyard since approximately 2002 when Kiewitt occupied the property. There's been an ongoing program. The more recent work done on behalf of the province related to some residual issues like lead paint in some of the buildings. As part of that long-term remediation activity, there has been sampling done of groundwater – there's really not much surface water in the site. As well, there's been sampling and ecological risk assessment done of the marine environment. There's a fair body of this work that's contained in technical reports that have been provided to government. In terms of the sewage outfalls in Mortier Bay area, there is an ongoing program under the auspices of legislation implemented under the Fisheries Act. The Marystown area is fortunate – there's actually a fair amount of sewage treatment that goes on. So there is a good history there. There was one program of sampling done specifically for the design of this project, and that related to the hatchery's proposed water intake location. That was sampling mainly aimed at characterizing the physical characteristics of the water column, but it did include the full suite of parameters that would be required by the Water Resources Division. All of the information collected by Marbase is in the registration document and will be included in the EPR. Most information sources would be available to the public, subject to any confidentiality requirements by the originating agencies. By locating the hatchery on an existing industrial site, there is the automatic environmental benefit of not disturbing a greenfield site.

Danny Boyce added that outside the water criteria when looking for a hatchery location, some of the things that Marystown and Mortier Bay have in their favour are very deep, sheltered waters with adequate currents and excellent bay exchange. It's the largest ice-free harbour is eastern North America. It's a large commercial land lot adjacent to a saltwater body at sea level. Pumping capacity with minimal head loss. High quality people in the area. Reliable power and quantity. Adequate road systems. Close proximity to salmon farming operations. Staff amenities like housing, hospitals, and schools. A regional waste site. Relative proximity to an airport and to Memorial University for further collaboration.

8. *You mentioned specific items that are only available from Norway. Can you elaborate on what those items are?*

Paul Antle responded that Norway has had a lot of success in the aquaculture sector. They've been able to develop and innovate quite quickly around issues and challenges that arise. Everything from moorings to pumping systems, feed systems, and feed content. And just the overall knowledge of how to operate a hatchery to the highest standard. The design of the hatchery was initiated by Norwegian company Lumarine, which is a world-class designer of systems. That know-how is Norwegian.

Knut Trellevik added that Norway has several hatcheries like the one proposed for Marystown. The pumping system, UV filters, and drum filters are produced in Norway and approved by Norwegian authorities. These are not produced in Newfoundland and Labrador.

Moderator once again asked if there were further questions.

9. *I would like to pursue the marketing aspect of it just a little bit more. Mr. Antle did respond to the question a moment ago in general terms. I'm just wondering specifically regarding the marketing of the product upon its full growth if you have secured any contracts or are in discussions with any*

aquaculture operations regarding the contracts for supplying cleanerfish produced in Marystown, either with an aquaculture operation currently in existence or who might be opening operations very soon, i.e., the Grieg operation in Marystown, or any other operation either in Fortune Bay or any other place in the province. I'm just wondering how close you are to securing a market for the finished product. (Gary Myles)

Paul Antle responded that the Proponent has no contracts in place with any of the current operators. The intent in working with Memorial is to transfer from the research-based activity and the stop-gap measures of MUN supplying the market to Marbase doing that on a commercial basis with MUN's blessing. If the transition occurs and there's no market, then Marbase would have a problem with its business case. But nevertheless Marbase has no commitments from either of the operators in this province. The Proponent has had discussions with them all, and they're aware of what the Proponent is trying to do. They have supported the process going forward, but that has not translated into written contracts.

Moderator then explained to participants once again that they could use Zoom's Q&A function or raise their hand on Zoom to ask a question.

10. *I represent GFI Composites Ltd. in Bay Bulls. We are fabricators of FRP tanks, and we have fabricated for the aquaculture industry in NL. We're interested in knowing a little bit about when you would expect to have drawings, specifications, and such for the 320 tanks you will be requiring and anything else you are able to tell us at this time with respect to your plans for this part of your development. (Leslie Galway)*

Paul Antle responded that the Proponent is going to try to source as much material as it can locally before moving outward, and [inaudible] GFI Composites is providing a product that meets the specifications of what is required, Marbase will be asking GFI Composites for a proposal for the tank system. As for the timeline, as was said earlier the Proponent is unsure when that construction timeline will be able to start simply because of the distance between now and being released from the EPR or the environmental assessment process in its entirety. The Proponent is doing some parallel work but doesn't want to get too far ahead and create expectations that can't be delivered on based on the outcome of this process.

11. *After reviewing the initial proposal and doing some literature research ourselves, it would appear that when it comes to the use of lumpfish and their success in controlling sea lice that the jury is still out to a large degree. I guess the question I have is what assurances can the Proponent provide to assure us that there will be a high level of success in using lumpfish here in Newfoundland where it hasn't been used commercially before. (Don Ivany)*

Bevin LeDrew responded that Marbase needs to be a little bit careful as lumpfish have been used for several years now, and it has proven to be popular and effective locally. The material prepared by the Atlantic Salmon Federation includes a fairly comprehensive literature review. We've looked at that literature and will be providing a response to that in the EPR. So it will get a fair bit of attention in the Preview Report itself.

Danny Boyce added that the use of cleanerfish has been ongoing in Newfoundland. Memorial started back in 2011 using cunners and then moved into using lumpfish. Marbase has decided as a business case to use lumpfish. Using cleanerfish in Newfoundland has certainly been a positive experience. Companies have used them. Use of chemotheraputants on sea cage sites has been lowered in the last number of years. Memorial hopes that trend continues. Cleanerfish have been used globally very successfully, and he personally has visited sites in the Faroe Islands, Norway, the UK, and Ireland and brought these experiences back to Memorial. And that's how MUN has been able to move the production of lumpfish to the point of commercialization in a relatively short time. Moving forward, some of the things that are concerning globally are animal welfare. It's inadvisable to just put a cleanerfish in a cage site – it needs to be nurtured and taken care of by putting hides and feeders and all these sorts of things. Dedicated staff are needed. The juveniles produced FOB Marystown must be of the highest quality. They have to have good fins, no cataracts, and a good adhesive sucker disk. He is confident Marbase Cleanerfish can produce a good quality juvenile. Memorial's salmon farming partners in Atlantic Canada certainly have success using them to date. He thinks there is a win-win situation here.

Because of the overlap in content, the next two questions were read together and answered as one:

12. *Please elaborate on the use of lumpfish on salmon farms as an environmentally friendly sea lice management regime.*

13. *Why is the Marbase project so important?*

Danny Boyce responded that he's been advocating for and a co-partner in starting production of cleanerfish in North America along with a specialist at Cooke Aquaculture, who started in New Brunswick. He saw this being used globally and said there's no need to reinvent the wheel, i.e., let's see what other countries are doing and adopt appropriately. Thirty years ago, the province was doing lumpfish production in Wesleyville Marine Hatchery for a different reason. So being able to raise lumpfish was not the issue – the issue was what can be done to reduce the use of chemotheraputants in local salmon farms. Cleanerfish are a green, new, innovative technology that can be used here. From a business perspective, companies are concerned about the cost of production. They're on an island producing salmon. They have to be competitive with other nations. Using cleanerfish has many positive benefits. There are no lost feeding times. It produces a good quality product. The business case is made for the salmon farms, and Marbase Cleanerfish will play a role in integrated pest management strategies.

14. *When you move lumpfish, how significant is the mortality rate?*

Danny Boyce responded that transporting lumpfish from Memorial University to the nurseries and / or grow-out sites, including to New Brunswick and Nova Scotia, has produced very little mortality. Memorial uses oxygen, has water quality control, and has standard operating procedures around starving the fish prior to transport. When there is a robust quality of lumpfish from the outset, they should be able to be transported with relative ease. There's always a possibility of having mechanical issues and breakdowns. But relating to transport, Memorial has had very high success.

Paul Antle added that having the hatchery in Marystown and delivering lumpfish directly to sea cage sites will result in far less transport and should reduce the risk of mortality significantly from the present arrangements.

Bevin LeDrew stated that there has been an impression and it has been reported by some media that this undertaking represents something new and foreign to this province when in reality production for the last two years has been in the order of two million lumpfish annually. These lumpfish come from the Ocean Science Centre, but there are grow-out operations at other locations in the province and in Atlantic Canada. Then the fish are put in cages. But there is an effective and operating capacity that is two-thirds of what Marbase is proposing. This isn't an order of magnitude leap. This is an improvement in efficiency.

This is a transfer from university to commercial application of a known and proven undertaking at a scale that's already commercial.

The moderator asked if there are any more questions. The moderator also explained that people can send a question to info@marbase.ca over the next five days for inclusion in the EPR.

[There was a significant pause while moderator waited to see if there are any more questions. Moderator then indicated he would wait a few more minutes to see if there were any more questions.]

15. Other than ASF, have any other interest groups raised concerns? And how did you respond?

Bevin LeDrew responded that when the project was registered, the Minister asked for review comments on the undertaking and expression of any issues and concerns. In a briefing held with the Environmental Assessment Division, the Proponent was advised that there was something like over one hundred submissions made, over ninety per cent of which were supportive of the project. But there were other interested groups that did express concern, and they made submissions to the Department. As he understands it, a submission made during the review of a Registration is treated by the Minister as confidential. So the Proponent does not have access to this commentary other than by making direct contact, which the Proponent did with some identified individuals and groups. So far, contact has been made with three. The general tenor of these has been expressing an overall concern about the aquaculture industry. Plus there have been other expressions of concern about the environmental effects of the undertaking. As LeDrew understands it, those concerns have been reflected in the Guidelines produced.

16. How many more public meetings are required? (Mike Brennan)

Bevin LeDrew responded that the Guidelines require a single public information session. The guidelines recognize that the regulations need to be applied, and those regulations address the provision of notification and the circumstances of holding a public consultation session, the content of information to be provided by the Proponent, and the location of the venue. For the guidelines for the Marbase Cleanerfish Project, the specific requirements that were added related to COVID-19; and those required a virtual consultation and additional publicizing through the internet and these kinds of mechanisms. This was in addition to compliance with the basic regulation. Short answer? One meeting was required, and a report will be produced on the basis of this session.

17. Comment: To congratulate you on the innovation in undertaking this project, combining resources of MUN and the private sector. We need more of this.

The moderator once again indicated he was looking for additional people with their hands up or with other questions.

Paul Antle provided brief closing remarks and thanked everyone for participating, thanked the Town of Marystown and the people of the community, and thanked the moderator.

Moderator again reminded participants to send additional questions or comments to info@marbase.ca.

4.0 Follow Up to Public Information Session

Following the public information, the Proponent kept the pre-recorded presentation on its website together with an invitation to the public to email the Proponent with any follow-up questions or concerns they would like to see addressed in the EPR.

The following table lists the submissions received during the period following the Public Information Session. The response to each submission is also listed, including any reference to sections of the main EPR document where the issue is further addressed.

Table 1: Follow-Up Correspondence from Marbase EPR Public Information Session

#	Source	Comments	Response
1	L. Clark, Skretting Canada Inc.	Information session was useful and informative. Environmental issues were identified. Seeking business opportunities.	Noted; no response required.
2	M. Lane NAIA	Session was well conducted and thorough; material was clearly presented. While the restrictions associated with Covid-19 requirements were all addressed, a broad opportunity for participation was afforded by the approach taken.	Noted; no response required.
3	J. McBriarty, Cooke Aquaculture	The meeting process was straightforward, the material presented clearly, and the fact that the question period ended ahead of time is a testament to the quality of the material presented and responses provided.	Noted; no response required
4	M. Butland, Butland Communications	The information session provided valuable information, indicating that the Province has extensive experience in growing lumpfish with minimal environmental impact.	Noted; no response required
5	A. Kendall, Senior Environmental Biologist, SIM Corp.	Information was available in advance, well planned out, easy to ask questions and participate. Questions posed were answered and follow-up was accommodated.	Noted; no response required
6	A. Craig, Mowi	Process was well planned out. Information was made available in advance. Submission of questions in advance was appreciated.,	Noted; no response required
7	R. Strong	Meeting was well presented; appreciated participation by senior executive and the informative response to questions, even where outside scope of the EPR.	Noted; no response required
8a	B. Bryden (1 of 2)	Described process as a one-sided conversation and non-answers, as well as a lack of notification of the event. Criticized the muting of persons asking questions.	Marbase disagrees with this contention. Every participant was given the opportunity to ask questions. Every question was responded to and interested parties encouraged to review the EPR once submitted. Notification was in accordance with Guidelines and exceeded minimum requirements in many regards. No active speaker was muted during the session.
8b	B. Bryden (2 of 2)	The reviewer appears to have listened to the Project Presentation that was placed	Marbase stands by the material presented.

Table 1: Follow-Up Correspondence from Marbase EPR Public Information Session			
#	**Source**	**Comments**	**Response**
		on the Marbase website and, using time coding presents twelve criticisms of the presentation, concluding that the information was “seriously flawed.” Additionally, the reviewer raises the concern that the hatchery saltwater discharge will be warmer than the receiving water and hence attract wildlife.	Hatchery saltwater discharge will generally be cooler than ambient receiving water. The EPR text describes the anticipated temperature regime.
9	L. Galway, GFI Composites Ltd.	Appreciated that information was made available in advance of the meeting and that the notice of the meeting was inclusive. Questions asked were addressed by Marbase, and follow-up questions allowed.	Noted. No response required.

Appendix A: Telegram Ad

PUBLIC NOTICE

Public Information Session on the Proposed

Marystown Marbase Cleanerfish Hatchery
Marystown, NL

shall be held at
July 30 at 7:00 pm via Zoom
Register at www.marbase.ca/consultation

This session shall be conducted by the Proponent,
Marbase Cleanerfish Ltd.,
(call 709-726-5544 and select 1 from the options)
as part of the environmental assessment for this Project.
The purpose of this session is to describe all aspects of the proposed Project, to describe the activities associated with it, and to provide an opportunity for all interested persons to request information or state their concerns.

ALL ARE WELCOME

Appendix B: Website

MARBASE

Home About Consultation Contact

Consultation

Register Here for the Public Information Session on the Proposed Marbase Cleanerfish Hatchery Marystown, NL

This session is being conducted by the proponent, Marbase Cleanerfish Ltd., as part of the environmental assessment for this project. The purpose of this session is to describe all aspects of the proposed project, to describe the activities associated with it, and to provide an opportunity for all interested persons to request information or state their concerns.

All Are Welcome

When:

Thursday, July 30, 7:00 pm

How:

Register to participate by Zoom here:

Register

Call one of the following numbers on July 30 at 7:00 pm to participate by phone. Those participating by phone will be unable to ask questions.

1-833-548-0276 (Toll Free)
or
1-833-548-0282 (Toll Free)
or
1-877-853-5247 (Toll Free)
or
1-888-788-0099 (Toll Free)

If you have questions about this process or if you are unable to participate in the public informantion session and would like to submit a question please send an email to info@marbase.ca.

This video describes all aspects of the proposed Marbase Cleanerfish Hatchery, including the activities associated with it.

Public session Intro+Presentation final

Watch later Share

Hatchery

MARBASE

marbase.ca

MAR FORTUNE

MARBASE

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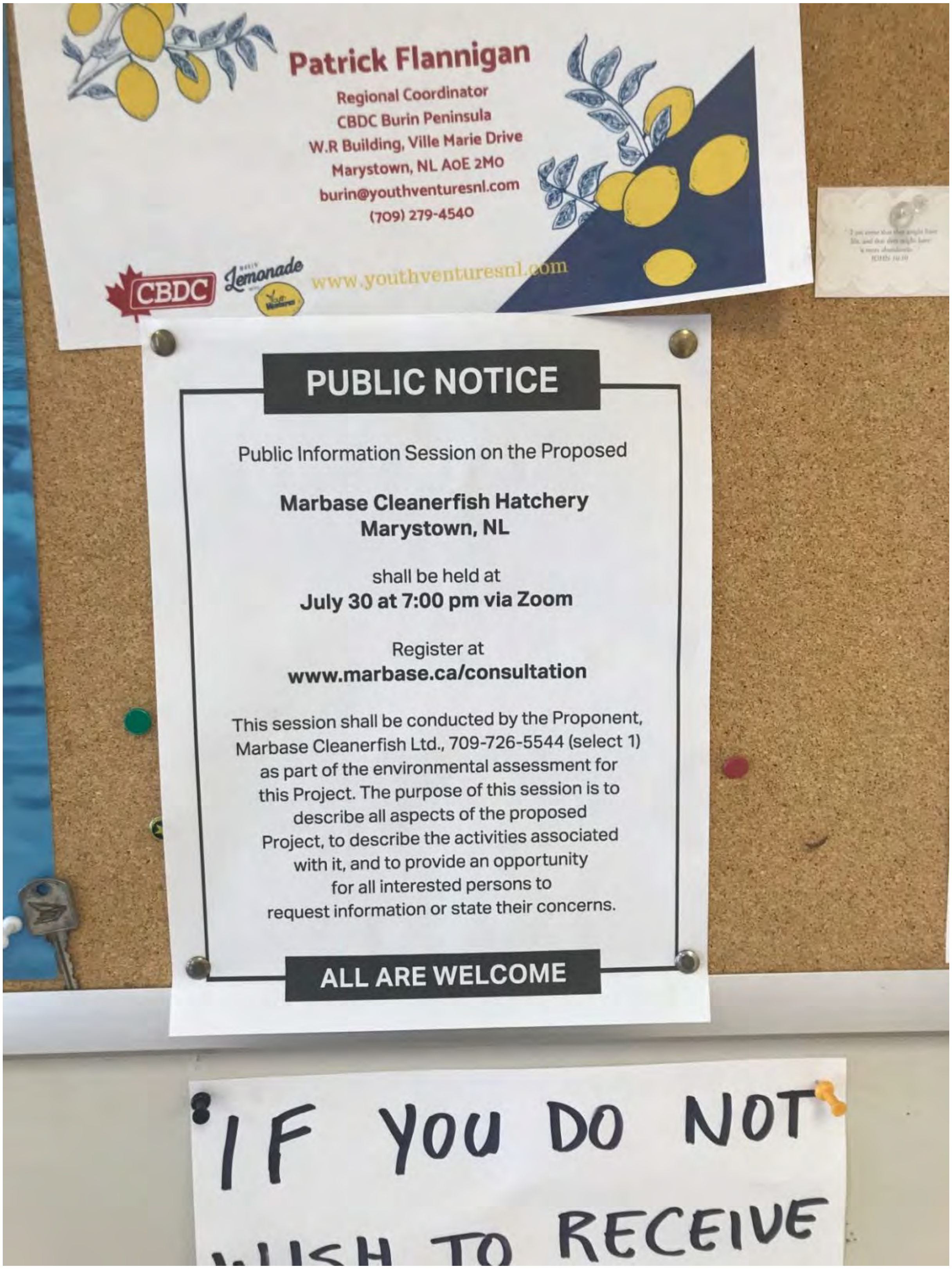
Appendix C: Poster



Appendix D: Digital Poster

Appendix E: Proponent's Presentation

Appendix E: Proponent's Presentation

Slide 1

Welcome to the Public Information Meeting for the Marbase Cleanerfish Hatchery Project. My name is Bevin LeDrew, and I have been retained by Marbase Cleanerfish Ltd. to assist in the preparation of the Environmental Preview Report for the Project. I will act as the Moderator for this session.

One ingredient of the Guidelines for preparation of the Environmental Preview Report is a requirement for the Proponent to conduct this Public Information Session. The Guidelines included a provision that the session adhere to Government restrictions associated with the COVID-19 response. Thus we have arranged this virtual meeting to meet the requirements while hopefully expanding the level of participation.

Please note that because of its nature, this session will be recorded and a report produced for inclusion in the Environmental Preview Report – a public document.

Slide 2

This virtual session will start off with a presentation to describe the proposed project and the anticipated contents of the Environmental Preview Report.

Participants are requested to note any questions they wish to ask. Once the presentation has finished I, as moderator, will identify individuals online to ask their question of the panel. I will unmute your microphone for that purpose. We will have only one person speaking at a time. Ms. Judy Snow will be acting to coordinate questions from participants through the question feature via text. You can direct your requests to her, and she will work to have each question placed in turn. The session will conclude at 900 pm. Note, the EPR will document and address all questions received, including those not discussed this evening. We will allow five days for public comments to be received and included in the public consultation record.

In order to respond to your comments and questions, we have a number of people from Marbase Cleanerfish present here in the studio and others online. First, we have Mr. Paul Antle, Chairman and CEO of Marbase. He is joined by Mr. Danny Boyce from Memorial University's Ocean Science Centre. Danny is an expert in lumpfish husbandry and has been working with Marbase as they developed their plans.

From Norway we have Knut Trellevik of the Amar Group, a co-owner and investor in Marbase. We also have expertise from Norwegian firm LuMarine, a company that is partnered with Marbase and is the designer/operator of several lumpfish hatcheries in the eastern North Atlantic.

Now I will ask Mr. Paul Antle to provide a description of the proposed project.

Slide 3

Marbase Cleanerfish proposes to construct and operate a commercial lumpfish hatchery in Marystown, NL to be located within the Marbase Aquaculture Service Hub (formerly the Marystown Shipyard).

The Marbase Cleanerfish Hatchery will provide cleanerfish to act as a natural, biological method of sea lice control for farmed Atlantic salmon. The undertaking represents an economic opportunity for the town of Marystown and will be an important contributor to ensuring a viable self-sustaining aquaculture industry for the Province.

The Proponent for this project is Marbase Cleanerfish Ltd. I, Paul Antle, serve as the Chair and Chief Executive Officer of the company. I am also serving as the principal contact person for purposes of environmental assessment.

As our moderator mentioned a few moments ago we have a number of industry experts participating in this project including the Amar Group and Lumarine of Norway, and Memorial University's Ocean Sciences Centre. Most of the North American expertise in lumpfish husbandry resides at MUN’s Ocean Sciences Center.

Slide 4

The aquaculture industry in NL is supported by an emerging service sector. There is recurring demand for cleanerfish as a tool in fighting sea lice infestations in Atlantic salmon sea cages.

The present capability is focused at Memorial's Ocean Science Centre where lumpfish eggs are incubated, hatched and reared annually for use by the local aquaculture industry. This project is a spin-off from research done at MUN in support of our marine industries. The challenge for MUN is that at the present scale – two million fish produced per year - the activity is no longer a “research and development” effort but represents a full commercial enterprise that is ready for transfer to the private sector.

This is where Marbase Cleanerfish comes in. Working collaboratively with the Ocean Science Centre, the capability developed under the leadership of Mr. Danny Boyce and others will be transferred to Marbase Cleanerfish. This will allow the University to focus on research, while the cleanerfish service industry can grow through private means to meet industry demand.

Therefore this undertaking represents a continuation and limited expansion of a service capability that already resides in the province and a final step in the conversion of university-led research into a viable commercial enterprise.

Slide 5

The site is in the Town of Marystown on the shores of Mortier Bay on the Burin Peninsula of Newfoundland. The property has approximately 9,400m^2 of industrial workspace and a water frontage of 330m.

The hatchery site is within the boundaries of the Marbase Aquaculture Service Hub. The hatchery is to be located in the historical Joiners Building referred to now as the “Hatchery Building”.

There are two road access routes onto the Marbase Hub, one off Ville Marie Drive and one directly to the Hatchery Building located off Dock Road. Water access is also available from the dock face.

For most of its life, the site has been referred to as the Marystown Shipyard. It was built by the federal and provincial governments in 1966 and operated by a series of owners since that time. In September 2019, the site was sold to Marbase Marystown Inc. for the development of the Marbase Aquaculture Service Hub.

The Government of Newfoundland and Labrador retained environmental liability for the site and recently completed a program to address residual environmental concerns associated with contaminated soil (hydrocarbons) and building materials (lead paint and asbestos). With the remediation and abatement programs completed, the Province can now provide assurance that the site is suitable for future industrial use and Marbase Cleanerfish can now move forward with its plan for a commercial hatchery.

Slide 6

By using an existing industrial site that is serviced, construction can be expedited and completed within six months. The Marbase site will require repairs to the asphalt surface, dock face and the installation of an access gate and perimeter security fencing for biosecurity reasons.

Building renovations will include the installation of insulated paneling of the walls and roofing, a new HVAC system, upgrading of floor drainage and sumps, establishing an office, laboratory, feed pellet storage, and a hazardous materials storage area.

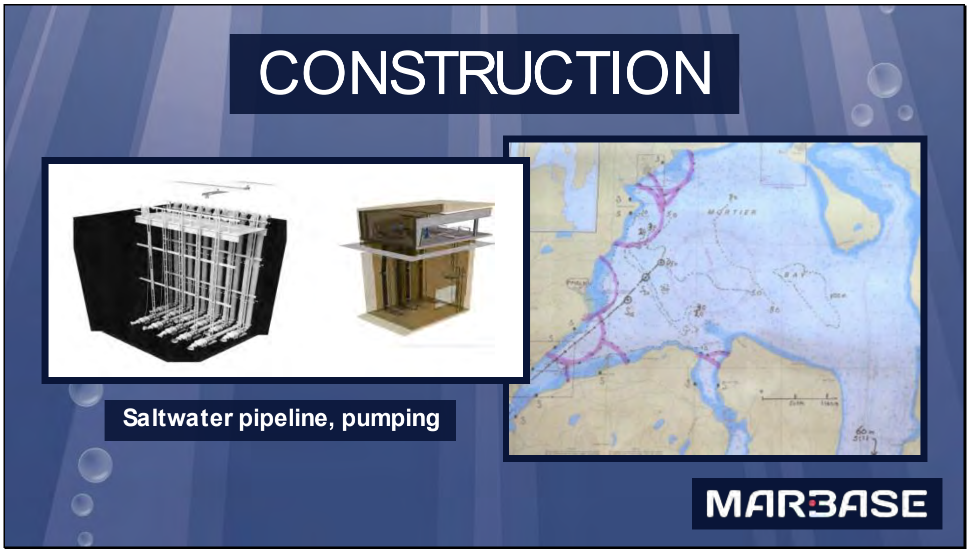
The only Project feature that will extend beyond the boundaries of the existing industrial footprint is the saltwater supply pipelines to the facility.

Slide 7

The tank arrays, saltwater circulation piping and water treatment equipment make up the core of the hatchery. A total of approximately 320 fiberglass tanks will be required to accommodate the different sizes of growing fish, ranging in tank size from 0.5 cubic metres to 40 cubic metres. Each tank will be supplied with saltwater flow adequate to achieve a turnover rate of 1 cycle/hour.

A water treatment system will be installed including large screens for filtration followed by UV disinfection. Other installations will include aeration/oxygenation and oxygen monitoring sensors. A sludge dewatering system will be installed to minimize volumes generated and create opportunities for waste diversion or reuse.

Slide 8



External to the hatchery building will be a pumphouse to deliver saltwater to the facility. This will include a storage tank adjacent to the hatchery building connecting to the underwater pipelines. The detailed routing of the intake piping on the seabed will be confirmed through detailed examination of the seabed.

The intake pipelines will extend to water depths of approximately 15m and 50m and be located clear of any potential contaminant sources, such as sewer outfalls and the hatchery outfall. The intakes will have appropriately sized screening systems to avoid impingement and entrainment of marine organisms. The installed pipelines will be ballasted on the seabed. The intakes will be capable of supplying marine water to the hatchery on a continuing basis at two temperatures.

The discharge pipeline will extend below the low tide water mark and will function to return treated water to the bay. It will be positioned close to the hatchery building but at a minimum distance of 500m from any intakes.

The pipeline routes and intake screening will address Federal Fisheries requirements related to fish habitat and fish protection while meeting the requirements of the Navigation Waters Act. The water intake and discharge require authorization from Water Resources Branch, provincial Department of Municipal Affairs and Environment.

Slide 9

The hatchery will operate year-round as a permanent facility. It will employ an estimated 20 full-time staff and create 20 to 30 indirect jobs through contracted services. Required skills include fish culture technicians, water quality specialists, administrative staff, security and maintenance personnel.

Staff will be present on a twenty-four, seven-day a week schedule; however, most activities will occur during the daylight hours.

The stages from fertilized egg incubation to achieving marketable size lumpfish will take nine months. Allowing for maintenance and cleanup activities, the facility will operate on a one-year cycle.

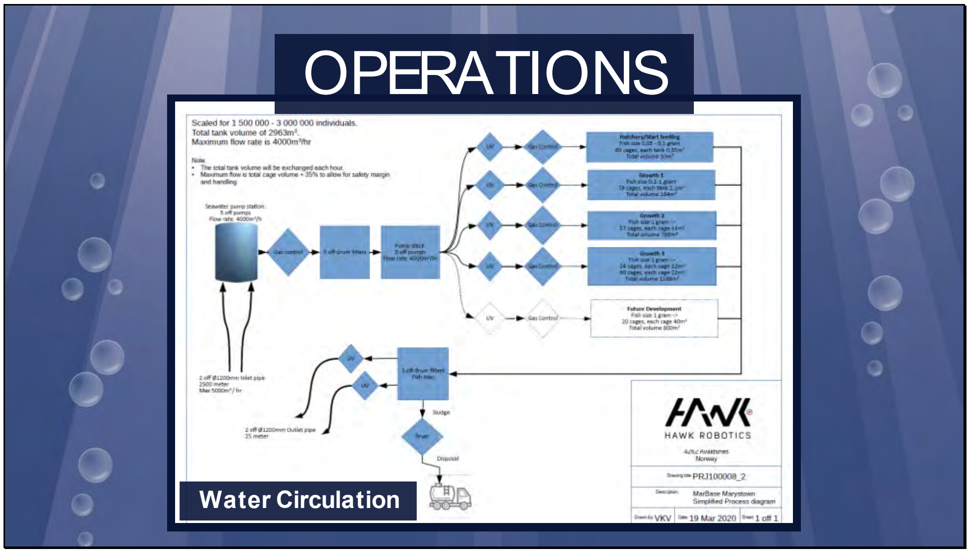
Peaks of activity will occur when egg fertilization and incubation occur each Spring, and when lumpfish are sold.

Hatchery operation will be controlled by regulatory authorities and guided by industry best practices and protocols.

The facility will require permits and approvals from several government agencies, especially the Aquaculture Division of the Department of Fisheries and Land Resources.

As a condition of the approval process, Marbase Cleanerfish has developed a series of implementation documents which will be included or referenced in the Environmental Preview Report.

Slide 10



During normal operations, water will be continuously pumped at a rate ranging between 0.1 and 33 cubic metres/minute into the saltwater holding tank, and from there to the water treatment area.

Drum filters will screen to less than 50 microns, then the water will be directed to header tanks where UV filtration will further disinfect the supply. Oxygen and gas control will be applied to remove nitrogen from the saltwater and ensure adequate aeration before its introduction into the fish rearing tanks.

Return water will be passed through the same treatment process - drum filters to remove waste material (feces, uneaten food) followed by UV treatment to ensure destruction of pathogens prior to discharge.

Slide 11

During full production the hatchery will require 4 million eggs that can be stripped from 300-400 females and fertilized by 20-40 males. Once fertilized, the eggs will be incubated for 30-50 days until hatching. The small fish will then be held in a series of tanks and fed over a period of nine months until they reach 25g and are ready for market.

During start-up operations, Marbase Cleanerfish will rely on Memorial's Ocean Science Centre and commercial fishers for the collection of domestic mature fish to provide an adequate supply of eggs. Eventually, the operation will develop and maintain its own broodstock creating its own capability of annually producing the required number of fertilized eggs.

At full operation, the hatchery will annually produce three million lumpfish for commercial use.

Feed in the form of pellets, sized to stages of fish growth, will be distributed daily. Water flow and water quality (temperature and oxygen content) will be monitored automatically but subject to frequent visual inspection.

Daily checks will be conducted to remove any mortalities and direct them for appropriate disposal. Ensilage – an acid bath - will be used to handle mortalities.

The sludge removed by the drum filters and then dewatered will be regularly transported for re-use or placement in landfill in accordance with an approved Waste Management Plan.

Slide 12

The EPR requires the Proponent to identify alternatives to, and within, the proposed undertaking. This include alternate means and locations while providing rationale for rejection of those alternatives.

The Marbase Environmental Preview Report will discuss the site selection criteria that applies to a Cleanerfish Hatchery and present the rationale for selecting our proposed site.

The various other industry tools available for the control of sea lice will be described and discussed in terms of effects and effectiveness.

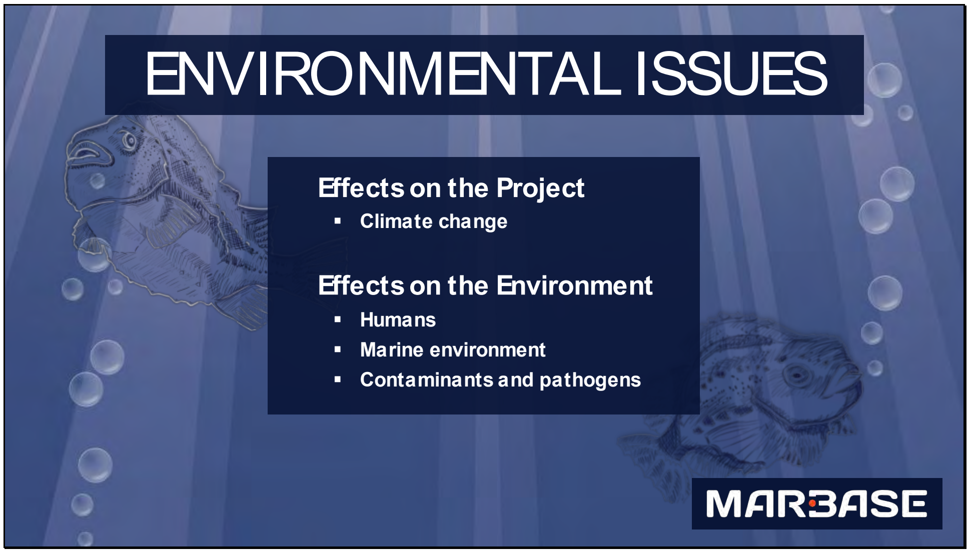
The choice of a suitable cleanerfish species will be highlighted along with an alternative species - the cunner. Our report will describe the features that make lumpfish the preferred choice.

The alternative to flow-through water circulation system is a recirculation (RAS) system. The EPR will present the challenges and opportunities posed by each choice.

The EPR Guidelines also call for a consideration of the use of freshwater, from groundwater, which would be converted to salt water.

And finally we will discuss the different water treatment processes available, the standards, and the choices made for the Marbase cleanerfish.

Slide 13



The Environmental Preview Report Guidelines provide a listing of potential effects that will need to considered and for which appropriate mitigation measures are to be identified.

The list of issues includes the potential impact on the Project of Climate Change, as well as the potential effects of the Project on humans and the marine environment, with a focus on any introduction of contaminants or pathogens.

Slide 14

The EPR is to consider the potential effects of the Project on people and their activities. Human health issues are to be considered for both site workers and near-by residents.

The main concern identified in the guidelines is noise from the hatchery operations and its potential to affect near-by residents. For workers, the identified concern is exposure to residual site contaminants during construction.

Our report will explain how neither of these represent issues of concern.

The Environmental Preview Report will also consider matters affecting recreational and commercial fishing including marine navigation and the potential for interaction with the hatchery pipelines.

Slide 15

The biophysical environment discussion will focus on marine species at risk and the potential effect of the hatchery on wild populations, including lumpfish.

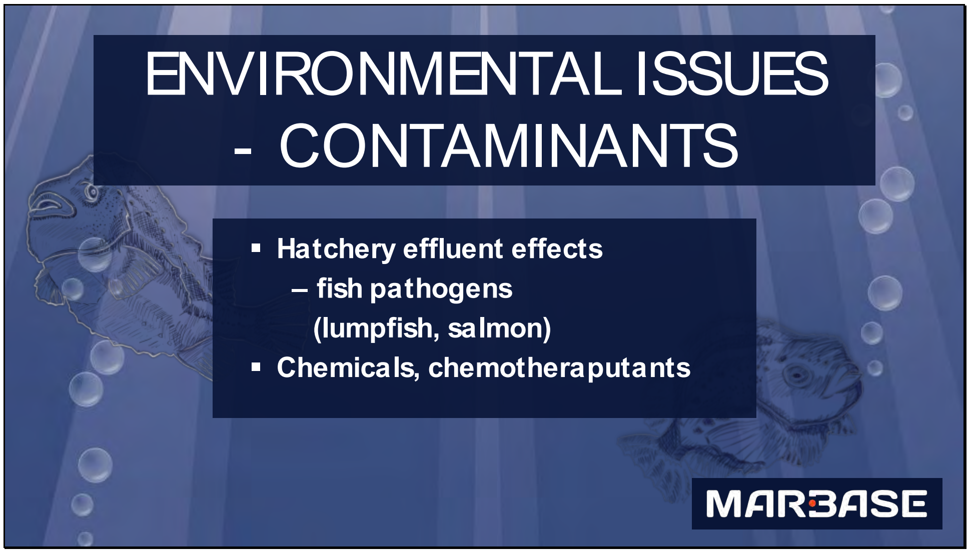
The effects of saltwater discharges on the receiving environment will be covered especially with respect to wild lumpfish and Atlantic salmon.

We will consider the potential for the proliferation of aquatic invasive species as a result of our hatchery operations.

Fish habitat is a concern, especially with respect to placement of the saltwater pipelines.

And finally we will explain the anticipated source of mortalities while rearing lumpfish, together with our intended handling and disposal practices.

Slide 16



The quality of all discharges from the hatchery - saltwater effluent and solid waste, is to be described and we will discuss our handling and treatment methods for those waste streams.

It is Marbase's intention to minimize the use of chemicals in the process, however we will identify all possible chemicals to be used – including therapeutants and anesthetics. Marbase will assure that there will be no residual chemotherapeutants present in the hatchery effluents or solid wastes.

It is worthy to note that most, if not all, of these issues will be addressed through existing and established regulatory permitting processes. The EPR will include a listing of these required permits and approvals, and an outline for a Project Environmental Protection Plan.

Slide 17

This completes our overview of the Project and the identified environmental issues to be addressed in the Environmental Preview Report.

Please note, a higher level of detail is available in the Project Registration that is online with the Department of Municipal Affairs and Environment including the Guidelines for the Environmental Preview Report.

Thank you for your patience. We look forward to answering questions and providing responses where possible.

Appendix Vc

Stakeholder Consultation

At the suggestion of Environmental Assessment staff, Department of Environment, Climate Change and Municipalities, Bevin LeDrew, on behalf of Marbase Cleanerfish Ltd. contacted three identified stakeholders who had made submissions to the Department during the Registration review process. While one stakeholder declined to provide material, the other two provided their submissions. These were generated by the Atlantic Salmon Federation (ASF) and the Freshwater-Alexander Bay Ecosystem Corporation (FABEC). B. LeDrew spoke with Mr. Don Ivany of ASF and had email correspondence with Mr. John Baird of FABEC.

The Atlantic Salmon Federation posted its review on its website -
https://www.asf.ca/news-and-magazine/salmon-news/asf-submits-comments-on-marbase-lumpfish-hatchery-project
The FABEC can be contacted at P.O. Box 153, Glovertown South, NL, A0G 2M0, Attention John Baird President. The points made in the two submissions are summarized in the table below. In most cases, the positions taken were incorporated into the EPR Guidelines, as indicated, and the issued addressed in the main document.

#	FABEC	ASF	Response
1	Limited previous research on use of lumpfish as cleanerfish in Newfoundland		Addressed in EPR Note the five years of production experience at Memorial OSC; ongoing relevant research
2	Lumpfish as cleanerfish have shown to be ineffective	Claims of efficacy of lumpfish as cleanerfish are not justified	Critique developed for literature review See below.
3	Use of lumpfish could affect wild stocks	Potential impacts on wild lumpfish populations not addressed	Addressed in EPR
4	Lumpfish could act as disease vectors to caged and wild salmon.	Potential impacts on wild salmon not addressed	Addressed in EPR
5	High mortality rates lead to problems with disease and disposal of mortalities.		Addressed in EPR. See 5 years production experience Memorial OSC
6.	No water quality data provided; residual contamination from Marystown Shipyard is a concern.	Insufficient information on hatchery sea water quality	Addressed in EPR Field survey report provided.
7	No public engagement, especially with salmon conservation groups.	Public consultation has been inadequate	Addressed in EPR Pre-registration was beyond required consultation process.
8		Ethical issues of use of lumpfish and non-utilization in human consumption	No comment

9		Questions whether the hatchery design has used the best available technology for disease control	Addressed in EPR Superior technology selected - in excess of regulatory requirement
Contact	P.O. Box 153, Glovertown South, NL, A0G 2M0, Attention John Baird President.	See review at : https://www.asf.ca/news-and-magazine/salmon-news/asf-submits-comments-on-marbase-lumpfish-hatchery-project	

It is notable that, of the total of nine distinct issues raised, seven were incorporated into the EPR Guidelines and therefore have been addressed in the relevant sections of this document. The ethical issue (#8) is not one that lends itself to response or comment. The remaining issue is the literature review provided by ASF to support their contention that the efficacy of lumpfish as cleanerfish is not proven.

The position of the ASF is based on an assertion that cleanerfish are not effective but, rather act as a source of disease and threaten the health of both wild lumpfish as well as Atlantic salmon. The ASF submission has been reviewed and the listed citations examined (see table below). The literature, as can be expected, examines challenges and opportunities that indicate the need for ongoing research and monitoring. In general, however the cited literature does not support an argument of opposition to use of lumpfish as cleanerfish. Recent publications provide support for the utility of using lumpfish as cleanerfish, as well as pointing out opportunities for improving cleanerfish performance (see: Lopes,2020. https://thefishsite.com/articles/lumpfish-study-counters-cleaner-fish-critics). The Lopes review summarises findings from trials as well as observations, and provides recommendations for use of lumpfish as a biological control in Atlantic salmon aquaculture. Five recent studies were reviewed, their findings summarized and a set of conclusions reached .The author observed that:
"*lumpfish can indeed be effective as a control of C. elongates. The review indicates several avenues of research that hold the potential for greatly improving on current performance levels, e.g with breeding programs as well as the introduction of live feed to early stage lumpfish diet.*"

Based on these considerations, and its own contact with Atlantic salmon aquaculture operations, Marbase concludes that both the ASF- cited literature, as well as recent publications confirm the utility of using lumpfish as cleanerfish.

ASF Commentary	MCF Response
Anon. 2019. Editorial: Just follow the rules. The Telegram, Jan. 1, 2019. https://www.thetelegram.com/opinion/local-perspectives/editorial-just-follow-the-rules-393350/	
We are also highly concerned about public statements made by the proponent to the effect that environmental assessment of this undertaking is an unnecessary hurdle that serves only to delay progress and prevent economic prosperity (Anon, 2019). These comments, along with the proponent's attempts to generate public and political pressure to influence the outcome of the screening review, lead us to believe that the proponent has little respect for the environmental assessment process and its goals of environmental protection and wise use of the province's natural resources. The proponent also does not seem to grasp the importance of the environmental assessment process for supporting economic prosperity and sustainable development.	The Proponent registered the Project in keeping with the Environmental Protection process of the Province. No registration was required under the Federal EA Process as this level of Government views aquaculture projects as adequately addressed through existing permitting processes. During the review phase for the provincial Registration, the Proponent sought to make the public aware of the registration and urged that submissions be made – all in keeping with the environmental assessment process. The Proponent has followed the environmental assessment process and been an active participant in the process, hence there is nothing in these actions that supports a contention that there has been a lack of respect for the process or of the goals of environmental protection and wise use of resources. The Proponent understands and grasps the importance and relevance of the environmental assessment process. It is surprising that ASF considers active participation in the EA process as inappropriate for a Proponent, but apparently virtuous for an advocacy organization.
2. Barrett, L., Overton, K., Stien, L., Oppedal, F. & Dempster, T. (2019). Effect of cleaner fish on sea lice in Norwegian salmon aquaculture: a national-scale data analysis. International Journal for Parasitology.	
For example, Barrett et al. (2019) reviewed the efficacy of cleaner fish at 488 sites in Norway. They concluded that the use of cleaner fish generally lead to a slight decline in sea lice infection following cleaner fish stocking, but that the effect was small and highly variable, and lice population growth rates remained positive on average, even when large numbers of cleaner fish were used.	The cited review was based on a large dataset, however the analysis was hampered since it was not possible to determine effectiveness at the individual operation level due to the unavailability of cage-level data. - *"the analysis cannot tell if farmers use more CF because they have more lice, have fewer lice because they use more CF, or if louse densities are unaffected by CF stocking"* A similar pattern was described with respect to other louse control measures and led to the comment that "*The lack of a detectable CF effect ….. is not evidence of inefficacy. Instead CF may be used in proportion to the size of a louse problem at a given site"*. It was concluded that CF are not a "silver bullet" for the industry, but *"may be preferable to other louse removal methods in terms of salmon welfare and productivity*." The paper discusses the many variables at work, and observes that there are several (Best Practices) measures available to improve the effectiveness of CF use. This is illustrated by some sites that achieve "above average results with CF.
3. ICES. 2016. Report of the Workshop to address the NASCO request for advice on possible effects of salmonid aquaculture on wild Atlantic salmon populations in the North Atlantic (WKCULEF), 1–3 March 2016, Charlottenlund, Denmark. ICES CM 2016/ACOM:42. 44 pp.	
3. *Domesticated lumpfish will eventually escape from the hatchery and/or sea cages and interbreed with wild lumpfish. Interbreeding between wild and escaped farm salmon has been documented across the North Atlantic, including in NL, resulting in significant impacts on wild populations (ICES 2016; Wringe et at. 2017). This raises obvious questions about the potential for these types of negative impacts from this undertaking on wild lumpfish populations.*	ICES 2016 does not present any information or opinion with respect to interbreeding between domestic and wild lumpfish Note, the Marbase Cleanerfish Hatchery Project proposes to use wild lumpfish stock from Newfoundland waters.

4. A. Imsland, A. Hanssen, A. Nytrø, P. Reynolds, T. Jonassen, T. Hangstad, T. Elvegård, T. Urskog, B. Mikalsen. 2018. It works! Lumpfish can significantly lower sea lice infestation in large-scale salmon farming. Biology Open, 7 (9).	
While the literature does suggest that the use of cleaner fish has the potential to contribute to sea lice control strategies under certain conditions (e.g., Imsland et al. 2018), the long term benefits remain unclear.	The long term benefits seem obvious based on the results reported in this publication "*Overall, the present results indicate that lumpfish are a suitable cold-water option for biological delousing of Atlantic salmon in large-scale production conditions*". "*Sea lice of both species were actively grazed upon, resulting in lower average numbers per fish of chalimus, pre adult and mature female L. salmonis when lumpfish were present in the cages. This is in line with our initial prediction for the study. Lumpfish in the high density group (8%) supressed the numbers of mature female L. salmonis to levels equal to or lower than the pre-treatment count.*"
5. Kibenge, F.S.B. 2019. Emerging viruses in aquaculture. Current Opinions in Virology 34: 97-103.	
It has been documented that lumpfish are susceptible to a range of diseases, and that their use as cleaner fish is now considered a new route of emergence of viruses in fish aquaculture (Kibenge 2019; Saraiva 2019; Powell et al. 2017).	The review by Kibenge addresses the emergence of viruses in aquaculture. It discusses pathways, including cleanerfish, but it does not single out lumpfish. The point is made however, that aquaculture has resulted in a proliferation of virus species.
6. Paradis H, R. Ahmad, J. McDonald, D. Boyce and R.L. Gendron, 2019. Ocular tissue changes associated with anterior segment opacity in lumpfish (Cyclopterus lumpus L) eye, Journal of Fish Diseases, 42(10) (1401-1408).	
Lumpfish in hatcheries and sea cages are highly susceptible to a range of diseases and deformities and there are significant concerns about their welfare in the sea cages (Powell et al. 2018; Paradis et al. 2019; Johannesen et al. 2018).	Lumpfish, like all organisms, are subject to a range of diseases. There is no evidence presented by the reviewer or the cited work to the effect that lumpfish are more highly susceptible than other species. The cited paper describes research into a specific disease of lumpfish, however it does not offer any information as to the relative frequency of disease in the species, nor does it address welfare in sea cages.
7. Powell, A., J.W. Treasurer, C.L. Pooley, A.J. Keay, R. Lloyd, A.K. Imsland and C. G. de Leaniz,. 2018. Use of lumpfish for sea-lice control in salmon farming: challenges and opportunities. Reviews in Aquaculture (2018) 10, 683–702	
These lumpfish will be grown for the sole purpose of eating sea lice in salmon cages, which only the juvenile stages do. They are not used for human consumption and they cannot be reused in the salmon cages. Lumpfish in hatcheries and sea cages are highly susceptible to a range of diseases and deformities and there are significant concerns about their welfare in the sea cages (Powell et al. 2018; Paradis et al. 2019; Johannesen et al. 2018).	The cited paper is a review and gap analysis to identify research needs to support use of lumpfish as cleanerfish. To quote from the Abstract: "*Our gap analysis indicates that the areas in most need of research include better control of maturation for year-round production; formulation of appropriate diets; artificial selection of elite lines with desirable traits; and development of vaccines for certified, disease-free juvenile production. The welfare of farmed lumpfish also needs to be better quantified, and more information is needed on optimal densities and tank design. Finally, the risk of farmed lumpfish escaping from net pens needs to be critically assessed, and we argue that it might be beneficial to recover cleaner fish from salmon cages after the production cycle, perhaps using them as broodstock, for export to the Asian food markets or for the production of animal feeds*."
8. Johannesen A, Joensen NE, Magnussen E. 2018. Shelters can negatively affect growth and welfare in lumpfish if feed is delivered continuously. PeerJ 6:e4837	
These lumpfish will be grown for the sole purpose of eating sea lice in salmon cages, which only the juvenile stages do. They are not used for human consumption and they cannot be reused in the salmon cages. Lumpfish in hatcheries and sea cages are highly susceptible to a range of diseases and deformities and there are significant concerns about their welfare in the sea cages	The cited paper addresses the utility of providing shelters to lumpfish in sea cages. It examined a number of factors (food consumption, weight gain) to determine the relationship to presence or absence of shelter. The paper does not address or support the contentions as stated by the ASF submission.

(Powell et al. 2018; Paradis et al. 2019; Johannesen et al. 2018).	
9. Saraiva, M., Beckmann, M. J., Pflaum, S., Pearson, M., Carcajona, D., Treasurer, J. W., & van West, P. 2019. Exophiala angulospora infection in hatchery-reared lumpfish (Cyclopterus lumpus) broodstock. Journal of fish diseases, 42(3), 335–343.	
It has been documented that lumpfish are susceptible to a range of diseases, and that their use as cleaner fish is now considered a new route of emergence of viruses in fish aquaculture (Kibenge 2019; Saraiva 2019; Powell et al. 2017).	The cited study examined the occurrence of a fungal infection in hatchery-reared lumpfish. The study examined the onset of fungal infection, means to identify the causative species, and tested treatments. The paper did not consider whether the use of cleanerfish provides a route for emergence of viruses. There is no evidence that lumpfish act as a disease vector for Atlantic salmon.
10. Soltveit, T. 2018. A clear threat? Transparent lice cleaner fish can't catch. Fish Farming Expert, Oct. 10, 2018. https://www.fishfarmingexpert.com/article/a-clear-threat-transparent-lice-cleaner-fish-cant-catch-1/	
There is also emerging evidence that sea lice adapt to predation by cleaner fish through the evolution of translucence which renders them less visible (Soltveit, 2018), calling into question the long-term prospects for cleaner fish use	This article reports on evolutionary adaptation by sea lice, apparently to predation by cleanerfish (indicating the cleanerfish are effective- see item 2). The article points out the need for ongoing research, but does not call into question the utility of using cleanerfish.
Wringe, B.F., Jeffery, N.W., Stanley, R.R.E. et al. 2018. Extensive hybridization following a large escape of domesticated Atlantic salmon in the Northwest Atlantic. Commun Biol 1, 108.	
Domesticated lumpfish will eventually escape from the hatchery and/or sea cages and interbreed with wild lumpfish. Interbreeding between wild and escaped farm salmon has been documented across the North Atlantic, including in NL, resulting in significant impacts on wild populations (ICES 2016; Wringe et at. 2017). This raises obvious questions about the potential for these types of negative impacts from this undertaking on wild lumpfish populations.	There are important differences between Atlantic salmon and Lumpfish, including the relative numbers of domestic vs wild salmon. In fact, the use of lumpfish as cleanerfish will result in an improved knowledge of the life cycle and reproductive biology of the species. This knowledge will be valuable in addressing the concerns for the population status of wild stocks of lumpfish.
12. Powell et al. 2017.	
It has been documented that lumpfish are susceptible to a range of diseases, and that their use as cleaner fish is now considered a new route of emergence of viruses in fish aquaculture (Kibenge 2019; Saraiva 2019; Powell et al. 2017).	This citation is not included in the references supplied by ASF.

Appendix VI

Salt Water Quality Field Survey Report
Marbase Cleanerfish Hatchery

Marbase Cleanerfish Hatchery

Field Program

Marine Intakes

November 25, 2019

Bevin LeDrew, LES Ltd.

709 689 2002

bevinledrew@gmail.com

Background

Marbase Cleanerfish Ltd. plans to construct and operate a Lumpfish Hatchery at the Marbase Aquaculture Service Hub in Marystown, NL. The hatchery will require two marine intake lines, as well as a single outfall. The intakes will need to be capable of supplying marine water to the hatchery complex on a continuing basis. A discharge line adjacent to the hatchery will return water (following treatment and filtration). The pipelines sizing will be established as hatchery design advances.

The intakes will be placed to access water at different temperatures and salinities. One intake will be located in shallow water in the order of 10-20m depth while the other will be at 50-80m. The intakes will need to be located clear of any contaminant sources (other outfalls, including the hatchery discharge). The hatchery outfall would be located near surface and proximate to the hatchery building and at a distance of 500m minimum from other intakes. The pipeline routes as well as the intake screening will need to address Federal Fisheries requirements related to fish habitat and fish protection. The water extraction and discharge will require the issuance of a Water Use Authorization from Water Resources Branch, provincial Department of Municipal Affairs and Environment.

Candidate outfall and intake locations were identified based on the available information and design criteria (Figure 1and 2). Outfall locations were located for water depths of 15 and 50m. Each candidate intake site is distant from the Marbase Hatchery site, but fairly close together.

Objective

Identify the closest suitable locations for hatchery marine water supply intakes.

Conduct a field and analytical program to characterize water and seabed features at two candidate intakes (15m, 50m depth).

Program Definition

Suitable intake water will be clean marine water at acceptable levels of temperature, salinity and oxygen year-round. The intake water should be free of potential pathogens and pollutants and have acceptable levels of nutrients and solids (total and dissolved).

Additionally, the field program should be capable of collecting information required to support an Aquaculture Licence application as well as an Environmental Assessment Registration.

Data Requirements

The field program centered on two candidate locations – the 15 m depth and the 50m depth intakes. Most sampling was to focus on the near bottom at each site, however one parameter (temperature) needed to be understood for the water column above each location.

Oceanography

Physical Parameters at survey locations include -

- water column temperature (near-surface to near-bottom); and
- Ancillary data on salinity (conductivity- CTD) and dissolved oxygen.

Geotechnical

Seabed substrate grain size analysis was to be determined at candidate intake locations.

Water Quality

The water quality parameters selected for analysis were based on NL Environmental Control Water and Sewage Regulations, as well as consultation with the analysis lab, regulators and client needs.

During the sampling effort, water samples were to be collected at each site (near-surface, mid-depth and near-bottom) for each candidate intake site, as well as at one depth (mid-water) proximate to the hatchery site (outfall location).

Pathogens

Near-bottom water samples (one suite at each candidate intake site) were to be collected to provide testing for the following pathogens:

- Vibrio salmonicida
- Vibrio anguillarium.
- Aeromonas salmonicida
- VHS
- Noda Virus
- Loma salmonae

A total of two samples (plus any QA requirements for blanks, duplicates) were required.

Other data Needs

All sampling was to include information on date/time, location/water depth, field methods. Sampling was to be coordinated with the contracted analysis lab to ensure adherence to packaging, labelling, chain of custody and related requirements, as well as to arrange timely delivery for required analyses.

Quality Management procedures were to include use of duplicate samples, as well as blanks (as identified by the analytical labs).

Program Execution

Program Manager was Stephen Green, a professional oceanographer with extensive marine and offshore experience. Field support was supplied by Edwards Associates, an engineering and professional services firm headquartered in Marystown with field technicians available as well as a suitable vessel and access to sampling equipment and winches.

Laboratory analyses was provided by Avalon Laboratories. They managed the handling of all collected samples, including provision of collection/labelling/handling/transport protocols, as well as the distribution of specialist analyses to sub-contracted laboratories.

Pathogen testing was sub-contracted by Avalon Laboratories to Kennebec BioSciences-USA-- http://www.kennebecbio.com/ . Grain size analysis was provided by RPC.

Schedule and Timing

The field program focused on providing adequate information to support selection of candidate intake sites, as well as the information requirements to support an Aquaculture Lisence application and an Environmental Assessment Registration.

The target date for sample collection was Oct. 30-31, 2019.

Results

The field program was conducted on November 03, 2019. Collected samples were delivered to the analysis Laboratory the same day. On Monday Nov. 04 Avalon Laboratories commenced analysis of samples and couriered other samples to sub-contracted labs (pathogen and grain size). A field report from the Program Manager was completed on Nov. 21, 2019. This report includes a chronology of data collection as well as all analytical lab results and Quality Management reports.

Sampling locations were georeferenced as :

- S-15 Shallow Intake at 47^0 10' 27" N by 55^0 7" 41" W
- S-50- Deep Intake at $47^0$10' 48" N by 55^0 7' 23" W
- Outfall at 47^0 9' 55" N by 55^0 8' 52" W.

A summary of key results is presented below.

Water Quality – Biological

The samples collected from both the "shallow" (15m) and the "deep" (50m) water sites showed no evidence of the subject pathogens. Additionally, with the exception of the surface sample from the candidate outfall location, the samples demonstrated low-to-undetectable values for coliform bacteria. This may be evidence of effective sewage treatment (and dispersal) for the proximate outfalls.

Analysis	Units	Shallow Intake		Deep Intake			Outfall
		2m	13m	2m	25m	45m	5m
Bacteria							
Total coliforms	MPN/100 ml.	<1.8	<1.8	2.0	<1.8	<1.8	33
Faecal coliforms	MPN/100 ml.	<1.8	<1.8	2.0	<1.8	<1.8	<1.8
E. coli	MPN/100 ml.	<1.8	<1.8	2.0	<1.8	<1.8	<1.8
Total bacterial count	CFU/ml.	n/a	< 1	n/a	n/a	<1	n/a
Pathogens							
Aeromonas salmonicida		n/a	negative	n/a	n/a	negative	n/a
NNV- all genotypes		n/a	negative	n/a	n/a	negative	n/a
Loma salmonea		n/a	negative	n/a	n/a	negative	n/a
VHS		n/a	negative	n/a	n/a	negative	n/a
n/a – not sampled.							

Water Characterization – Physical

A set of two casts were taken at each of the three sampling sites, and a consistent pattern was displayed for each pair of casts, giving confidence in the results as reported. A summary of results is presented in the table below.

Candidate Site	Depth m.	Temp. ^0C		Salinity 0/00		Dissolved Oxygen
		cast 1	cast 2	cast 1	cast 2	
Shallow Intake	0	8.85	8.84	30.8	30.8	10.94[a]
	10	9.07	9.08	31.2	31.2	
	15	8.48	8.52	31.6	31.5	10.94[b]
Deep Intake	0	8.45	8.50	30.2	30.3	11.11[a]
	15	8.15	8.06	31.5	31.5	
	30	6.39	6.47	31.8	31.8	10.95[c]
	45	5.26	5.22	32.0	32.0	11.58
Outfall	0	8.80	8.81	28.6	28.8	
	10	9.07	9.06	31.2	31.2	10.98[d]
Note: Salinity calculated from conductivity/temperature readings. a= 2m depth: b=13m depth: c = 25m depth; d = 5m depth						

At all three stations, surface conditions to 2m water depth indicated the influence of air temperature as well as freshwater runoff, especially at the outfall location where conductivity (salinity) was approximately 10% lower than at deeper strata. The two intake sites showed evidence of a thermocline and a halocline at 12m water depth. All bottom water sampled was at or over 30 parts per thousand (ppt).

At the two candidate intake locations, bottom water temperature was noticeably different: 8.5 ^0C at the shallow (15m) intake, compared with 5.2 ^0C at the deep (45m) intake.

Salinity was not greatly different at the two intake sites, showing similar profiles. Surface values at both sites were similar - 30.8 ppt. and 30.2 ppt. The bottom values were slightly elevated - 31.6 ppt at the shallow (15m) site compared to 32.0 ppt.at the deep (45m) site.

The outfall site proximate to the Hatchery had a slightly lower salinity at surface (28.6 ppt). At a depth of 10m the salinity was 31.2 ppt.

Dissolved oxygen levels were similar and relatively high (11 mg/l) at both sites, reflecting a saturated condition at the ambient temperature.

Water Quality – Chemical

The table below summarizes the analysis results. For clarity, results are reported in the units that are listed in Schedule A, Water and Sewer Effluent Regulations (i.e. converted to mg/l even where the analysis was reported as µg/l).

Parameter*	**Site 1 – Deep Water**			**Site 2 Shallow Water**		**Site 3 Outfall**	**Schedule A Regulations***
	0m	25m	45m	0m	10m	5m	
Ammonia (as N)	0.08	<0.02	0.1	0.18	0.23	0.02	20
BOD	<6	<6	<6	<6	<6	20	21
Chlorine (total)	<0.03	<0.03	0.03	0.03	0.03	<0.03	1
pH	7.73	7.69	7.72	7.78	7.73	7.78	
TDS	32461	33062	33152	32433	32917	32481	1000**
TSS	17	21	10	8	22	3	30**
Nitrate (asN)	<2.37	<2.37	<2.37	<2.37	<2.37	<2.37	10
0-phosphate	<25	<25	<25	<25	<25	<25	1
Total cyanide	0.007	0.009	0.007	0.008	0.008	0.009	0.025
Sulfide	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	0.5
Hex..chromium	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	0.05***
Triv. chromium	<3	<3	<3	<3	<3	<3	1***
Total O&G	<2	5	<2	3	3	4	15
Phenolics	0.14	0.14	0.13	0.11	0.17	0.14	0.1
Boron	20.2	19.5	15.6	16.3	17.0	17.2	5
Iron	0.043	0.042	0.052	0.043	0.041	0.037	10***
Nickel	0.0009	0.0008	0.010	0.006	0.0056	0.0003	0.5***
Copper	0.002	0.001	0.002	0.001	0.001	0.0015	0.3***
Zinc	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.5***
Arsenic	0.0028	0.0029	0.0028	<0.0028	<0.0028	0.0026	0.5***
Selenium	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	0.01
Silver	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	0.05***
Cadmium	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.05***
Barium	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	5***
Mercury	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.005***
Lead	<0.0003	<0.0003	<0.0003	0.0003	0.0003	<0.0003	0.2***

*Water and Sewer Effluent Regulations – Schedule A. Note all parameters (except pH) reported as mg./l.
** " *If water is being abstracted from a water course, used, treated and subsequently returned to the same water course, these solids data mean that the effluent should not contain more than 1000 or 30 milligrams per litre more than was in the water originally abstracted.*"
*** For all metals *"the maximum content is the amount in excess of the background level as determined upstream of the discharge".*

There are several values reported for the analysed water samples that appear to exceed the limits shown in Schedule A. Note however that, for water returned to the same source from which the influent was extracted, the listed TSS and TDS limits as well as metals values represent the permissible <u>increment</u> over background.

Sediment Character

The sediment samples collected validated the information shown on the available marine charts (CHS Chart 4587). Samples from both sites were predominantly gravel (75% for shallow site; 70% deep site), while fines were predominantly sands, with silt and clay comprising minor portions of the recovered material.

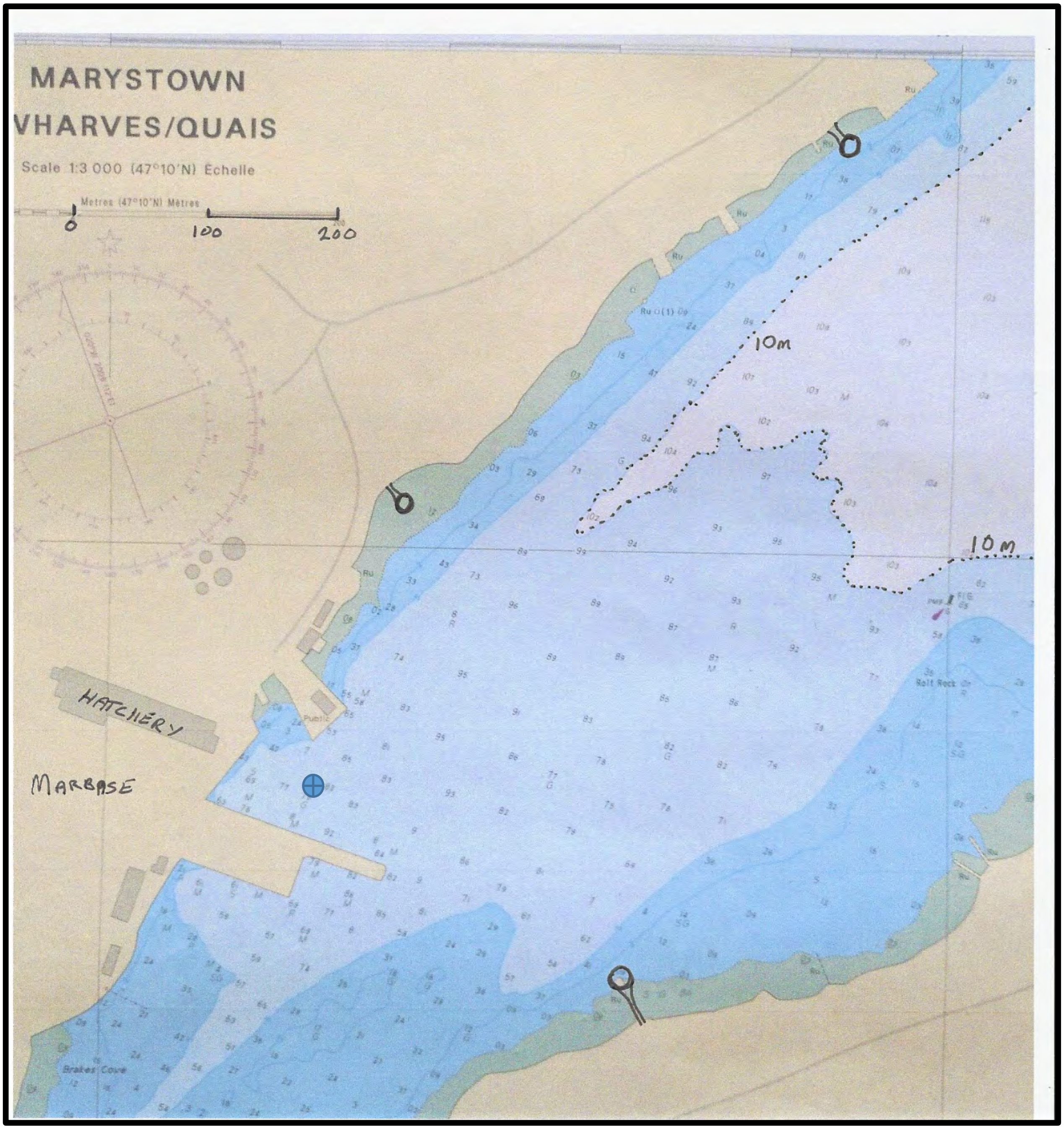


Figure 1. Bathymetry and Outfalls in the area of the Marbase Site (with Outfall sampling location indicated- -).

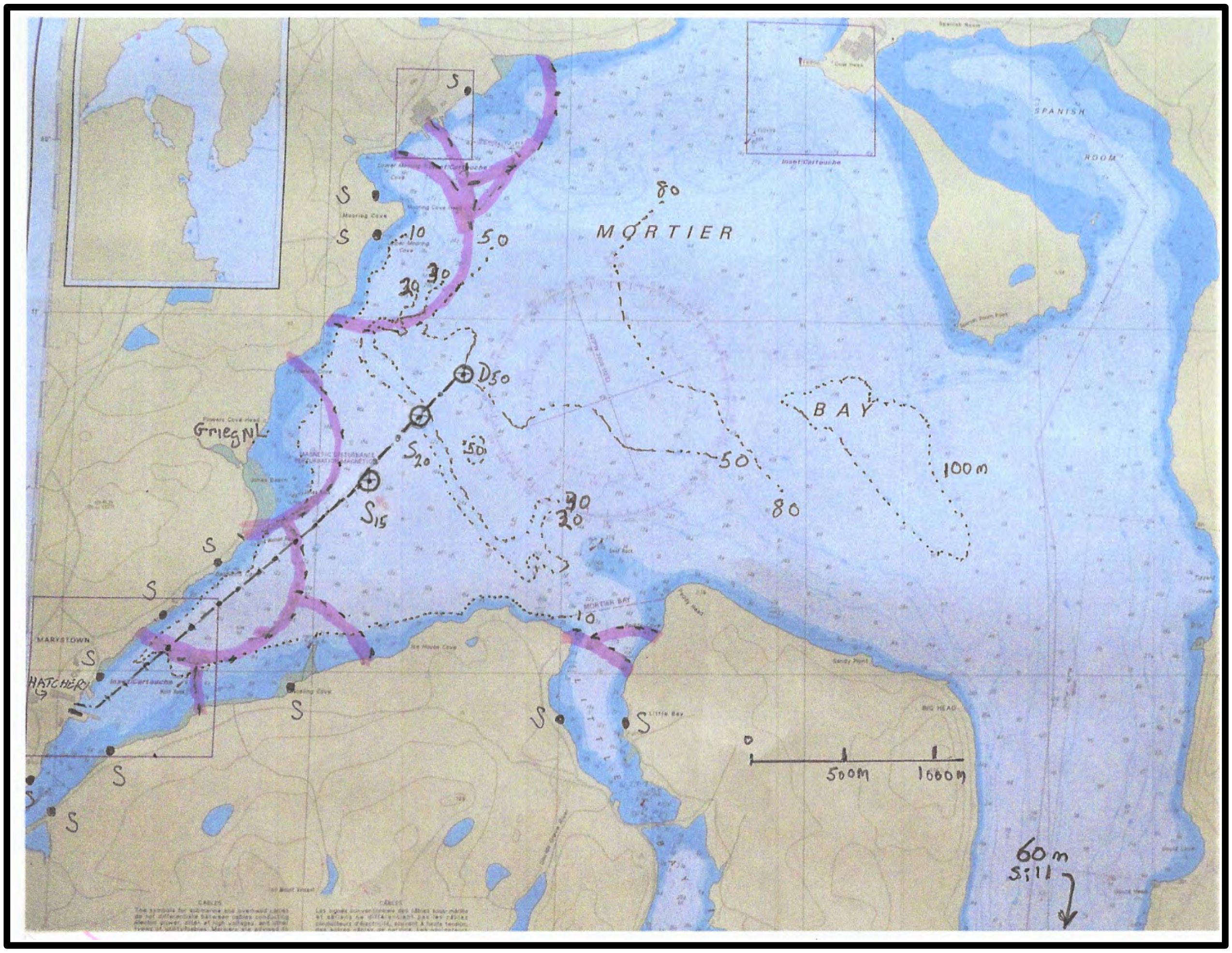


Figure 2. Mortier Bay Bathymetry and Existing Outfalls (with 500m buffer zones) and candidate outfall locations (S 15, D50) and pipeline routing.