

Environmental and Waste Management Plan Guidelines

AQUACULTURE APPLICATION GUIDANCE DOCUMENT
DEPARTMENT OF FISHERIES, FORESTRY AND AGRICULTURE -
AQUACULTURE DEVELOPMENT DIVISION

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List of Abbreviations

Abbreviation	Meaning
AAHD	Aquatic Animal Health Division
AAR	Aquaculture Activities Regulations
AIS	Aquatic Invasive Species
BMA	Bay Management Area
BOD	Biochemical Oxygen Demand
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CSSP	Canadian Shellfish Sanitation Program
DFO	Fisheries and Oceans Canada
HDPE	High Density Polyethylene
HRM	High-Risk Material
GPS	Global Positioning System
FFA	Department of Fisheries, Forestry and Agriculture
LDPE	Low Density Polyethylene
MCTS	Marine Communications and Traffic Service
MF/HF	Medium Frequency/High Frequency
MT	Metric tonne
NL	Newfoundland and Labrador
PMRA	Pest Management Regulatory Agency
PP	Polypropylene
SOP	Standard Operating Procedure
SAR	Species at Risk
SARA	Species at Risk Act
VHF	Very High Frequency

1. INTRODUCTION

The document, 'Environmental and Waste Management Plan Guidelines', is intended to support aquaculture licence applicants to prepare an environmental and waste management plan. A plan is required as part of a complete application package. The guidelines also support the maintenance of a licensee's environmental and waste management plan(s). This plan is in addition to other plans that must be submitted to the department and some aspects of the plans may overlap.

1.1. Background

The Department of Fisheries, Forestry and Agriculture (FFA), Fisheries and Aquaculture Branch conducts a preliminary review of a new application package as part of the aquaculture licensing process. This review includes the applicant's environmental and waste management plan and supporting documents. The review helps ensure applicants provide sufficient information at the beginning of the application process prior to external referral. This helps ensure each regulatory department and agency will have the necessary information it requires to complete a full assessment.

In 2021, FFA updated its aquaculture licence application form to align with the new requirement for an aquaculture applicant or licensee to prepare and maintain an environmental and waste management plan. The new application form no longer itemizes environmental and waste management information. Going forward, applicants will be required to include this information in an environmental and waste management plan, appended to a new application in conjunction with other required plans. FFA requires this plan through the authority of the **Aquaculture Act**.

This guidance replaces the 'Applicant Guidance Document – Environmental Information Reviews, Last Revised August 30, 2019'.

1.2. Scope

The scope of information covered by the guidelines is intended to address environmental and waste management plan requirements for all aquaculture facilities in Newfoundland and Labrador (NL). However, due to the prominence of marine finfish and shellfish in NL, this is the primary focus of the guidance offered. Examples and planning benchmarks intended to support the preparation of a plan will more often than not reference these activities.

The guidance does not outline specific regulatory standards or thresholds. A component of an industry environmental management plan is to demonstrate an operator's familiarity with

the range of federal, provincial and municipal regulations by which it must abide.

If there is an inconsistency between the guidance and an Act or Regulation, a licensee will follow the latter.

1.3. Approach

The guidelines are organized as follows:

- 1) A proposed template.
 - Applicants may choose to use this template, or use their own template.
- 2) Using the proposed template, the guidelines outline the information requirements for each section.
 - More comprehensive guidance for finfish and shellfish culture in NL due to their prominence.
 - Depending on the species and production system used, some of the detailed guidance may not be applicable, or the applicant may need to address site characterization information, risk assessment, and risk management approaches that are not offered in the guidance.

2. PROPOSED ENVIRONMENTAL AND WASTE MANAGEMENT PLAN TEMPLATE

The template (Tables 1 through 4) used in this guidance separates the stages of site characterization, risk identification, and risk management measures.

FFA advises that all environmental and waste management plans separate the site characterization information from the risk identification and management stages.

A licensee may decide that combining its risk identification and management measures is better for its communications and plan implementation. FFA, with the support of other regulators, will review the environmental and waste management plan for comprehensiveness, regarding its clarity and completeness of information.

Table 1: Environmental and Waste Management template and checklist - General Information Guidance

Cover page, declaration of accuracy and document control	<input type="checkbox"/>
<ul style="list-style-type: none"> • Document Identification <input type="checkbox"/> • Operation name <input type="checkbox"/> • Proponent /approval holder <input type="checkbox"/> • Activity <input type="checkbox"/> • Project location(s) <input type="checkbox"/> • Date of the environmental management plan preparation <input type="checkbox"/> • Person accepting responsibility for the environmental management plan <input type="checkbox"/> • Revision log <input type="checkbox"/> 	
Table of contents	<input type="checkbox"/>
Introduction <input type="checkbox"/> <ul style="list-style-type: none"> • Objective(s) <input type="checkbox"/> • Intended audience <input type="checkbox"/> • Structure <input type="checkbox"/> 	
Description of the operation(s)	<input type="checkbox"/>
Identification of applicable regulation and licensing terms and conditions	<input type="checkbox"/>
Environmental management roles and responsibilities	<input type="checkbox"/>
Training	<input type="checkbox"/>
Auditing and review	<input type="checkbox"/>
Emergency contacts and procedures	<input type="checkbox"/>
Reporting	<input type="checkbox"/>

**Table 2: Environmental and Waste Management template and checklist -
Environmental and Site Baseline Information**

Environmental and site baseline information	<input type="checkbox"/>
I. Human activities	<input type="checkbox"/>
a. Dwellings	
b. Fisheries	
c. Recreation	
II. Climate and weather	<input type="checkbox"/>
III. Fish habitat	<input type="checkbox"/>
a. Water conditions	
b. Benthic conditions	
c. Species at risk (SAR)	
d. Atlantic salmon	
e. Aquatic invasive species (AIS)	
IV. Wildlife	<input type="checkbox"/>
a. Migratory birds	
b. Predators and pests	
c. SAR	
V. Land-based facility water availability and quality	<input type="checkbox"/>

Table 3: Environmental and Waste Management template and checklist – Potential Environmental Impacts and Risks, and Environmental Protection and Management Measures

Potential environmental impacts and risks	<input type="checkbox"/>
I. Construction	<input type="checkbox"/>
a. Potential impacts and risks presented by the environment to the aquaculture operation.	
b. Potential impacts and risks presented by the aquaculture operation to the environment.	
II. Operations	<input type="checkbox"/>
a. Potential impacts and risks presented by the environment to the aquaculture operation.	
b. Potential impacts and risks presented by the aquaculture operation to the environment.	
Environmental protection and management measures (see Table 4).	<input type="checkbox"/>
I. Construction	<input type="checkbox"/>
a. Environmental management activities, controls and performance targets	
b. Operational inspection and monitoring	
c. Corrective actions	
II. Operations	<input type="checkbox"/>
d. Environmental management activities, controls and performance targets	
e. Operational inspection and monitoring	
f. Corrective actions	
Glossary	<input type="checkbox"/>
Append supporting plans and procedures.	<input type="checkbox"/>

Table 4: Supplement for Table 3, Potential environmental impacts and risks, and Environmental protection and management measures

Decommissioning/restoration	<input type="checkbox"/>
Waste Management	
•Chemicals	<input type="checkbox"/>
○Antifoulant	<input type="checkbox"/>
○Cleaner and disinfectants	<input type="checkbox"/>
○Hydrocarbons	<input type="checkbox"/>
○Paints	<input type="checkbox"/>
•Organics	
○Biochemical oxygen demand (BOD)	<input type="checkbox"/>
○Fish discard/mortality	<input type="checkbox"/>
▪Fish Disposal Plan	
▪Emergency Response and Contingency Planning	<input type="checkbox"/>
○Fouling	<input type="checkbox"/>
○Septic	<input type="checkbox"/>
○Waste water	<input type="checkbox"/>
•Inorganic/bulk materials	
○Expired buoys/piping	<input type="checkbox"/>
○Expired netting/socking/ropes	<input type="checkbox"/>
○Feed bags/packaging	<input type="checkbox"/>
○Pallets	<input type="checkbox"/>
○Refuse	<input type="checkbox"/>
Wildlife Interactions	
•Migratory birds	
○Mitigation	<input type="checkbox"/>
○Monitoring	<input type="checkbox"/>
○Response	<input type="checkbox"/>
○Reporting	<input type="checkbox"/>
•Pest and predator control	
○Mitigation	<input type="checkbox"/>
○Monitoring	<input type="checkbox"/>
○Response	<input type="checkbox"/>
○Reporting	<input type="checkbox"/>

<ul style="list-style-type: none"> •SAR <ul style="list-style-type: none"> ○Education <input type="checkbox"/> ○Mitigation <input type="checkbox"/> ○Monitoring <input type="checkbox"/> ○Response <input type="checkbox"/> ○Reporting <input type="checkbox"/>
<ul style="list-style-type: none"> •Wild Salmon <ul style="list-style-type: none"> ○Containment <input type="checkbox"/> ○Integrated Pest Management Plan <input type="checkbox"/>
<ul style="list-style-type: none"> •AIS <ul style="list-style-type: none"> ○Education <input type="checkbox"/> ○Mitigation <input type="checkbox"/> ○Monitoring <input type="checkbox"/> ○Response <input type="checkbox"/> ○Reporting <input type="checkbox"/>
<p>Regulatory monitoring</p> <ul style="list-style-type: none"> • Aquaculture Activities Regulations (AAR) <input type="checkbox"/> • Containment (Code of Containment for the Culture of Salmonids in Newfoundland and Labrador) <input type="checkbox"/> • Water use and waste water treatment (Environmental Control Water and Sewage Regulations) <input type="checkbox"/> • Water conditions and quality (i.e., biophysical data) <input type="checkbox"/>

3. GENERAL INFORMATION GUIDANCE

3.1. Cover page, declaration of accuracy, and document control

The **cover page** should clearly identify the following:

- 1) Title
- 2) Name of the undertaking
- 3) Applicant/licensee
- 4) Activity
- 5) Project location(s) (i.e., can be site specific or regional, as most reflective of the scope of operations covered by the plan)
- 6) Date of preparation
- 7) Record identification number (good administrative practice for larger organizations,

and organizations that participate in auditing programs)

A **declaration of accuracy** should be presented near the beginning of the environmental and waste management plan. The person accepting responsibility for the plan can provide a signed declaration. FFA will hold the licensee responsible for ensuring finalized plans are accurate.

A method of **document control** will help ensure revisions are clearly recorded. Typically, a revision log is near the beginning of the plan that includes:

- 1) Section(s) revised
- 2) Date
- 3) Signature of person responsible for approving revisions

3.2. Table of contents

The scope and detail of information provided in an environmental and waste management plan requires a table of contents to assist users.

3.3. Introduction

The introduction should set the context of the environmental and waste management plan. This should include the following:

- 1) Objective/purpose statement to explain what the document intends to do
- 2) Identify the intended audience
- 3) Outline the structure of the document

3.4. Description of the operation(s)

This section is an overview, and describes the aquaculture development in enough detail to relate the undertaking to its place in the environment. State the following:

- 1) The species to be cultured
- 2) The stage(s) of production
- 3) Scale of production
- 4) The type of system and placement
- 5) Facilities and equipment
- 6) Location
- 7) Water use
- 8) Primary activities and movements

Maps showing exact location of site and details of the layout should be included.

The corner coordinates of the site should be included on supporting maps. Coordinates expressed as degrees and decimal minutes.

Provide information on the system type and placement, an illustration of the system and layout, as well as the cross-section in relation to water depth.

Land-based developments should clearly describe its water use as follows:

- Freshwater facility:
 - Water intake type (i.e., municipal, public, private)
 - Provide coordinates of water intake
 - Water intake source (i.e., surface or groundwater)
 - Production type (i.e., flow through versus recirculation)
 - Annual intake volume (i.e., both in litres/day and annually)
 - Treatment of the water intake and discharge
 - Coordinates/location of receiving water body
 - Discharge volume and water quality
- Saltwater facility:
 - Provide coordinates of intake
 - Water intake source (i.e., the ocean or saltwater well)
 - Depth of the intake
 - Production type (i.e., flow through versus recirculation)
 - Intake volume
 - Coordinates of the discharge point
 - Depth of the discharge point
 - Discharge volume and water quality

Describe any routine facility maintenance procedures, including frequency, associated with the following:

- 1) Activities that are intended to maintain the site's performance and prevent impacts to the operation as a result of the environment
- 2) Activities that contribute to the release of materials/substances to the environment

The following is a suggested format, including examples:

Activity	Purpose	Frequency
Remote operated net cleaning system (finfish)	Remove biofouling and maintain effective water exchange	Spring, summer and fall: biweekly Winter: monthly
Cage rotation (shellfish)	Remove biofouling and maintain effective water exchange, and growth	Spring, summer and fall: weekly
De-icing	Remove ice from vessels and containment system	Winter: Daily or weekly as required
Feeding	Fish growth	Daily
In-situ treatment of pests	Fish health	As needed
Etc.		

3.5. Applicable regulation and licensing terms and conditions

Aquaculture operations must satisfy a relatively complex coordination of Federal and Provincial (and in some instances municipal) regulations and policies. It is therefore beneficial to outline the primary Federal and Provincial authorities and regulations that the environmental and waste management plan will address.

Table 5 lists federal regulators and Table 6 lists provincial regulators that have a direct or indirect role in environmental regulation, and can be used as resources to support the preparation of an environmental and waste management plan.

This list is larger than the list of standard, aquaculture licence application, referral agencies. FFA Aquaculture Policy and Procedures Manual lists these agencies. Some applications may require the referral of a broader group of regulators, depending on site placement/location, and/or the type of aquaculture development.

Table 5: Federal regulators, applicable legislation, and permits and/or programs

Regulator	Licence referral (Yes/No)	Applicable legislation	Permit and/or programs
Canadian Food Inspection Agency	No*	<ul style="list-style-type: none"> • Feeds Act (Feeds Regulations) • Health of Animals Act <ul style="list-style-type: none"> ○ (Health of Animals Regulations) ○ (Reportable Diseases Regulations) 	<ul style="list-style-type: none"> • National Aquatic Animal Health Program • Aquatic Animal Health Import Permit
Environment and Climate Change Canada	Yes (Shellfish only)	<ul style="list-style-type: none"> • Canadian Water Act • Environmental Protection Act • Migratory Birds Convention Act, 1994 <ul style="list-style-type: none"> ○ (Migratory Birds Regulations) ○ (Migratory Bird Sanctuary Regulations) 	<ul style="list-style-type: none"> • Canadian Shellfish Sanitation Program (CSSP), Water classification
Health Canada Pest Management Regulatory Agency (PMRA)	No*	<ul style="list-style-type: none"> • Food and Drugs Act (Food and Drug Regulations) • Pest Control Products Act (Pest Control Products Regulations) 	<ul style="list-style-type: none"> • Veterinary Drugs Directorate
Fisheries and Oceans Canada (DFO)	Yes	<ul style="list-style-type: none"> • Fisheries Act (Aquaculture Activities Regulations) • Fisheries Act (Aquatic Invasive Species Regulations) • Fisheries Act (Fishery (General) Regulations) • Species at Risk Act (SARA) • Oceans Act 	<ul style="list-style-type: none"> • Aquaculture public reporting • Canadian Shellfish Sanitation Program • National Introductions and Transfers Committee, Introduction and Transfer Licence • Protecting fish health • Protecting aquatic ecosystems
Transport Canada	Yes	<ul style="list-style-type: none"> • Canadian Navigable Waters Act • Canada Shipping Act, 2001 (Private Buoys Regulations) • Transportation of Dangerous Goods Act • Wrecked, Abandoned or Hazardous Vessels Act 	<ul style="list-style-type: none"> • Navigation Protection Program • Canadian Navigable Waters Act Approval

*Some regulators regulate a supply, and are not directly involved in the assessment of an aquaculture site; however, the licensee is responsible to source from an approved supplier or service provider.

Table 6: Provincial regulators, applicable legislation, and permits and/or programs

Regulator	Licence referral (Yes/No)	Applicable legislation	Permit and/or program
Environment and Climate Change	Yes	<ul style="list-style-type: none"> • Environmental Protection Act (Environmental Assessment Regulations) • Water Resources Act (Environmental Control and Water Sewage Regulations) 	<ul style="list-style-type: none"> • Water use licence • Permit for constructing a non-domestic well • S48 permit for intakes, infilling, etc.
Fisheries, Forestry and Agriculture	Yes	<ul style="list-style-type: none"> • Aquaculture Act (Aquaculture Regulations) • Fish Inspection Act (Fish Inspection Operations Regulations) • Lands Act • Wild Life Act 	<ul style="list-style-type: none"> • Administration of the aquaculture licensing process • Aquaculture licence <ul style="list-style-type: none"> ○ Fish transfer permit • Fish processing licence • Crown land lease
Tourism, Culture, Arts and Recreation	Yes	<ul style="list-style-type: none"> • Historic Resources Act 	<ul style="list-style-type: none"> • Archaeological management and protection

3.6. Environmental management roles and responsibilities

Summarize the key roles and responsibilities of staff and staffing levels in the preparation, review, approval, and implementation of the environmental and waste management plan. The following is a suggested template to follow:

Staff level	Environmental roles and responsibilities
Managing director	
Production manager	
Site manager	
Aquaculture technician	
Etc.	

3.7. Emergency contacts and procedures

An Incident Management System that includes environmental protection and corrective actions will address the information requirements of this section. FFA requires all aquaculture licensees to have and register an incident management system; therefore, referencing applicable documentation is satisfactory to address this section.

3.8. Training

Outline the commitment and describe staff orientation and training regarding the environmental and waste management plan and supporting standard operating procedures (SOPs).

3.9. Auditing and review

Beyond internal use, many aquaculture operators maintain 3rd party certifications and prepare environmental and waste management plans to meet the standards and performance targets under these certifications.

The environmental and waste management plan should describe the internal process to review and update the plan, as well as any certifications under which the plan is audited.

FFA requires aquaculture licensees to submit updated environmental and waste management plans on an annual basis when there are changes.

3.10. Reporting

The following type of environmental reporting commitments are applicable to the environmental and waste management plan:

- 1) Company initiated reporting (e.g., annual reports that communicate environmental

performance to stakeholders and the public)

- 2) Regulatory reporting (e.g., annual reports, incident reports, monitoring reports)

4. ENVIRONMENTAL AND SITE BASELINE INFORMATION

This section of the environmental and waste management plan will provide an overview of the applicable regional and site-specific human activities, climate, weather, fish habitat and wildlife that are likely to interact with the aquaculture development.

Supporting documentation not prepared by the developer should be referenced, and supporting documents that the aquaculture developer had to prepare to meet a regulatory requirement in support of the development should be appended if not already registered with FFA, or referenced if it is already registered with FFA.

Traditionally applicants have emphasized benthic assessment work, but examples of other aquaculture assessments are introductions and transfers risk assessment, assessment of a site’s water and climate suitability, and environmental assessment registration of an undertaking. The following is a suggested format to clearly reference supporting data collection and assessments:

Assessment	Date	Company
e.g., AAR baseline site characterization report	August 2018	Newco Consulting
Etc.		

4.1.Human activities

Describe any fishing activities (e.g., commercial, Indigenous or recreational fisheries), tourism operations, cabins, recreational activities (e.g., boating, diving, water skiing, swimming, etc.), or industrial facilities, and water uses that are located within a two-kilometre radius of the site lease boundary. Provide information on their time(s) of operation and proximity to the site.

Although, Fisheries and Oceans Canada (DFO) has in-house knowledge of fishing activities, local knowledge is helpful in providing context to the scale of activity and anticipating potential resource user issues. The following is a suggested template to help itemize the activities with examples:

Activity	Season	Proximity
Lobster harvest	Spring and early summer	0-2km
Municipal water supply	All seasons	<1km
Etc.		

4.2. Climate and weather

Describe the regional climate and seasonality with a focus on the following:

- 1) Temperature and variability
- 2) Prevailing winds and variability
- 3) Anticipated conditions that have the potential to be adverse to the aquaculture operations

4.3. Fish habitat

Provide an overview of the following environmental conditions and valued environmental components:

- 1) Water conditions
- 2) Benthic conditions
- 3) Aquatic SAR
- 4) Wild Atlantic salmon
- 5) AIS

4.3.1. Water and benthic conditions

This section should emphasize the water condition and benthic parameters that are important to an operation(s) construction and viability, as well as the parameters required under the AAR that are important to environmental sustainability. Applicants must submit baseline data as per the AAR. DFO will assess this baseline information. The AAR guidance document can be found at this link, <https://www.dfo-mpo.gc.ca/aquaculture/management-gestion/aar-raa-gd-eng.htm>.

Supporting documentation can be referenced, so long as it is appended, or already registered as part of a previous application package.

Where applicable, the applicant or licensee shall consider the following items to assess the site environment and how it may positively or negatively affect the aquaculture development:

- Bathymetry
- Current profiling
- Tidal fluctuations (i.e., differences between high and low tides)
- Fetch
- Seasonal profiling of biophysical data relevant to the development (e.g., chlorophyll, total faecal coliforms, dissolved oxygen, salinity, etc.)
- Substrate at site (e.g., sand, cobble, boulder, bedrock, etc.)
- Aquatic flora and fauna species and locations
- Presence/absence of SAR

- Presence/absence of AIS
- Abundance of wild Atlantic salmon in the region.

4.3.2. Species at Risk (SAR)

With respect to SAR, this section should focus on species that are likely to interact with the aquaculture development. At the time of writing, DFO offers information on SAR via the following webpage, <https://www.dfo-mpo.gc.ca/species-especes/sara-lep/index-eng.html>.

The webpage provides links to various services and information, such as, the SARA Public Registry, search aquatic SAR, recovery planning, aquatic SAR maps. These links will help identify SAR possibly observed around aquaculture sites in NL. Schedule 1 of the SARA is updated periodically, and the public registry can be directly accessed at the following link,

<https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html>

The applicant is also encouraged to be familiar with species being considered by the COSEWIC, as they may be listed under SARA during the life of the site operation.

4.3.3. Wild Atlantic salmon

Studies have demonstrated that farmed and wild salmon interaction has occurred on the south coast in Atlantic salmon aquaculture production regions. Regulators request that the licensee provide the following information to demonstrate familiarity with Atlantic salmon in the aquaculture development region covered by the environmental and waste management plan:

- An overview of current knowledge on Atlantic salmon populations
- Rivers
- Presence
- Abundance
- Behaviour

4.3.4. Aquatic invasive species (AIS)

The following is a list of AIS of particular concern to aquaculture, sourced from DFO 'Aquatic Invasive Species Identification Booklet' at <https://waves-vagues.dfo-mpo.gc.ca/Library/365586.pdf>, and FLR Overview of Aquatic Invasive Species (2008) at https://www.flr.gov.nl.ca/wildlife/biodiversity/invasive_alien_species/dfa.pdf: coffin box; European green crab; gold star tunicate; oyster thief; vase tunicate; and violet tunicate.

4.3.5. Land-based facility water availability and quality

Land-based aquaculture developments will need to evaluate and characterize the available water use, water source limitations, and water quality parameters. It may be necessary to identify alternative water sources to the primary source. Characterize water quality at all intakes as follows:

Parameter	Spring	Summer	Fall	Winter
Dissolved oxygen (mg/l)				
Carbon dioxide (mg/l)				
Total alkalinity (mg/l)				
Hardness (as calcium carbonate) (mg/l)				
Dissolved Reactive phosphorous (mg/l)				
Ammonia (mg/l)				
Nitrate (mg/l)				
Nitrite (mg/l)				
Copper (mg/l)				
Zinc (mg/l)				
Iron (mg/L)				
Total suspended solids (mg/L)				
pH				
Hydrogen sulphide (mg/L)				
Temperature (°C)				

4.4. Wildlife

This section should identify migratory birds, predators and pests that are likely to interact with the aquaculture development. These species may be regionally specific, or due to their behavior may not be relevant to all aquaculture developments.

For example, a development within intertidal areas of the southwest coast may have to consider piping plover nest areas; however, this is not a foreseeable concern in other regions of the province.

For example, raptors are a likely concern for marine finfish grow-out operations; however, they do not present a foreseeable concern that would require intervention for enclosed hatcheries, or mussel longline cultures

5. POTENTIAL ENVIRONMENTAL IMPACTS AND RISKS

This section should focus on foreseeable areas of concern identified during the characterization of the site conditions. If there is uncertainty, regulators should be approached, and the public feedback from community consultations should be considered.

The section should be in two parts for a new aquaculture development, construction and operations. Pre-existing aquaculture facilities that are updating their environmental and waste management plans need only focus on activities that are foreseeable going forward, and may only need to address ongoing operational concerns.

The type of aquaculture development will also effect the level of attention given to each development phase. For example, a new land-based facility that results in permanent land preparation and placement, and/or use of freshwater resources, will need to address different valued environmental components than a marine based system, positioned with an anchor and mooring system.

A land-based development is less exposed to adverse environmental events than a moored marine development, and affected differently.

5.1. Construction

With consideration for the human activities, climate and weather, fish habitat and wildlife gathered under the characterization of the site, describe the:

- 1) Potential impacts and risks presented by the environment to the aquaculture development
- 2) Potential impacts and risks presented by the aquaculture development to the environment

5.2. Operations

With consideration for the human activities, climate and weather, fish habitat and wildlife gathered under the characterization of the site, describe the:

- 1) Potential impacts and risks presented by the environment to the aquaculture development
- 2) Potential impacts and risks presented by the aquaculture development to the environment

5.3.Environmental concerns and valued environmental components

5.3.1.Human activities

Describe industrial, domestic and/or recreational activities that have the potential to impact or conflict with the aquaculture development. The following is a proposed format with examples:

Activity	Proximity	Potential Impact
Cabin	2 km	Negligible
Fish processing plant	1 km	Effluent/bloodwater contamination
Municipal wastewater treatment system	1 km	Treatment failure/ changes to water quality for shellfish harvest
Shared aquifer/municipal water supply	<1 km	Water use limitations/ production limitations
Etc.		

5.3.2.Climate and weather

Identify any potential impacts or risks to the project caused by the environment. Consider aspects of the environment, adverse changes in temperature, storms, tides, algal blooms, etc.

The following is a suggested format that includes examples for various aquaculture developments:

Event	Frequency*	Duration*	Impact(s)
Intense rainfall event	Annually	<day	Increase in faecal coliforms/ Shellfish harvest closure
High water temperature	Annually	<month	Low oxygen/higher stock mortality/modified site activities
High winds	Annually	<week	Power disruption to facility
Super chill	Decade	<month	Higher stock mortality/ modified site activities
Etc.			

*Frequency/duration can be approximated as: daily/<day; weekly/<week; monthly/<month; annually/<year; decade/>year.

5.3.3. Fish habitat

Identify potential impacts or risks to fish habitat caused by the aquaculture development.

Give particular attention to the following:

- 1) Water conditions/quality
- 2) Benthic habitat
- 3) Aquatic SAR
- 4) Wild Atlantic salmon
- 5) AIS
- 6) Waste generation

5.3.3.1. Water conditions/quality

Examples of potential environmental effects an aquaculture development may have on water quality/conditions include:

- Increased oxygen demand
- Organic waste deposition and accumulation (feed and faeces/pseudofaeces)
- Disruptions to nitrogen cycling
- Increased algal growth

5.3.3.2. Benthic habitat

Examples of potential environmental effects an aquaculture development may have on the benthos include:

- Changes in benthic community structure
- Smothering of benthic habitat/creation of anoxic or anaerobic benthic conditions

5.3.3.3. Aquatic Species at Risk (SAR)

Identify potential impacts/risks to aquatic SAR that are likely to interact with the aquaculture development referencing the outcome of information collected from baseline surveys, as well as government records. The following is a suggested format with examples:

Aquatic SAR	Frequency*	Impact(s)/Risk
Atlantic wolffish	seasonal	Deposits/habitat disruption, alteration
Leatherback sea turtle	seasonal	Collision, entanglement
Etc.		

*Frequency can be approximated as: daily; weekly; monthly; annually; seasonal.

5.3.3.4. Wild Atlantic salmon

If the aquaculture development(s) have the potential to interact with wild Atlantic salmon populations, the activity/event, and potential impact(s)/risk(s) shall be considered in the environmental and waste management plan. The following is a suggested format with examples:

Activity/event	Impact(s)/Risk
Farmed salmon escapement	Escapes, genetic introgression/ Displacement, competition, loss of fitness
On farm sea lice infections	On farm amplification of parasites/ Increased infection of migrating wild salmon
Bottom culture harvest near the mouth of a schedule salmon river	Noise, suspend solids/disruption of salmon migration
Etc.	

5.3.3.5. Aquatic invasive species (AIS)

If the aquaculture development is located in an area ‘positive’ for AIS, or relies on supplies or vessels that may reside, or enter a positive area, the risks to aquaculture or the fish habitat that are associated with the AIS should be described. The risk to aquaculture depends on the type of development. All new introductions present a potential risk to native fish habitat.

5.3.3.6. Waste generation

Because the siting and conduct of aquaculture depends on water use, fish habitat is considered the primary valued environmental component for waste management. Therefore, the guidelines address waste generation under fish habitat.

Describe all deposits that are expected to be generated by the aquaculture development that shall be released into the water (i.e., faecal matter, food particles, biofoul, in-situ treatments, etc.) or will require secure handling and disposal on land.

The key objective is to identify and qualify/quantify (where possible) all possible waste streams. The applicant or licensee should describe each of these. If the offered template is used, note wastes that are not generated as not applicable.

The following is a list of typical materials used or generated by aquaculture and the associated activity that can result in waste:

Deposits/ discharges	Activity	Frequency*	Duration*	Approximate amount (MT/annually)**
Biofouling	Finfish net maintenance/ Shellfish harvest			
Drop-off	Suspended culture			
Feed/faeces	Feeding/grow-out			
In-situ treatments	Fish health management			
Wastewater	Bloodwater/ Land-based facility effluent			

*Frequency/duration can be approximated as: daily/<day; weekly/<week; monthly/<month; annually/<year; decade/>year.

**If there is no method to approximate (e.g., biofouling) note as not determined (n.d.), or if it is reasonable to be approximated <1MT/a note as negligible.

Organic collection	Activity	Frequency*	Duration*	Approximate amount (MT/annually)**
Fish discard/ Stock mortality	Processing/ rearing			
Septic	Hygiene/ sanitation			
Sludge	Land-based facility water conditioning			

Packaging/ refuse	Activity	Frequency*	Duration*	Approximate amount (MT/annually)**
Crates/ pallets	Supplies/ equipment handling			
Feed bags	Feeding			
Intermediate bulk containers (IBCs)	Chemical supplies			
Paper/cardboard	Administration			

Construction and demolition	Activity	Frequency*	Duration*	Approximate amount (MT/annually)**
Expired HDPE*** buoys	Navigation/ Suspension			
Expired HDPE*** piping	Stock containment			
Expired netting, and socking	Stock containment/ Culture substrate			
Expired nylon and PP*** ropes	Mooring/containment/ longlines			

***High density polyethylene (HDPE); Low density polyethylene (LDPE); Polypropylene (PP)

Other chemicals	Activity	Frequency*	Duration*	Approximate amount (MT/annually)**
Antifoulant	Net maintenance			
Cleaners and disinfectants	Maintenance and biosecurity			
Hydrocarbons/ Alternatives	Fueling, maintenance, and hydraulics			
Paint	Maintenance			

5.3.4. Wildlife

Identify potential interactions between wildlife and the aquaculture development. Give particular attention to the following:

- 1) Migratory birds
- 2) Predators and pests
- 3) SAR

The following is a suggested format with examples:

Wildlife	Frequency*	Impact(s)/Risk
Seabirds	Daily/Seasonal	Light attraction, collisions/ Stock predation, entanglement
Raptors	Daily	Stock predation, entanglement
Blue shark	Daily/Seasonal	Stock mortality scavenging, net damage
Bluefin tuna	Daily Seasonal	Collisions, net damage
Otters/seals/mink	Daily	Stock predation, net damage
Rodents	Daily	Feed consumption, damage, Occupational health and safety
Etc.		

*Frequency can be approximated as: daily; weekly; monthly; annually; seasonal.

6. ENVIRONMENTAL PROTECTION AND MANAGEMENT MEASURES

This section of the environmental and waste management plan will describe the environmental protection and management measures that will prevent or mitigate environmental impacts. The aquaculture development's site characterization results and the potential environmental impacts and risks identified will heavily influence the scope and format.

Similar to the identification of potential environmental impacts and risks, this section should be in two parts for a new aquaculture development: construction and operations. Pre-existing aquaculture facilities that are updating their environmental and waste management plans only need

to focus on activities that are foreseeable going forward, and may only need to address ongoing operational concerns.

The environmental and waste management plan will describe the following measures for the identified impacts/risks:

- 1) Environmental management activities, controls and performance targets
- 2) Operational inspection and monitoring
- 3) Corrective actions

The guidelines provide more in-depth guidance in areas that are normally of particular interest to federal and provincial regulators.

6.1.Human activities

Discuss measures to mitigate conflicts with area residences and industries.

This may include:

- Accommodation (i.e., site access, or navigational channels)
- Scheduling of certain activities
- Siting
- User agreements for shared infrastructure, resources, or services
- Water supply assessment, and monitoring
- Decommissioning

Describe the decommissioning/closure of the aquaculture development(s), and the measures to restore the area to its natural setting. Provide details on the removal of all associated infrastructure from the site if the site is no longer required. Explain how this material will be disposed of.

The potential risk of site abandonment due to environmental or financial factors requires applicants to outline the following information:

- Capacity to execute
- Time of year when gear will be removed
- Types of gear to be removed
- Disposal of unwanted/damaged gear (i.e., how, where)
- List of gear to remain onsite (i.e. anchors, navigation aids, etc.)
- Identify what equipment is salvageable

- Identify cleaning and disinfection of reusable gear salvaged from site.

6.2. Climate and weather

Discuss plans to prevent accidents and malfunctions that may occur during installation, operation, and decommissioning phases of the development that can result from adverse weather and environmental conditions. Present contingency plans to deal with each of these potential situations. Discuss plans to mitigate the impact of adverse environmental conditions on production.

Key information requirements include:

- 1) Maintenance practices (e.g., net washing, de-icing)
- 2) Preparation of an incident management system (reference)
- 3) Retrieval methods for lost lines/cages/gear
- 4) Measures to limit escapees (reference the code, and outline measure above and beyond)
- 5) Refueling procedures (i.e., when, where, and how)
- 6) Spill response equipment and capacity (i.e., first response, equipment present)
- 7) Weather information and monitoring of the water quality and conditions
- 8) Mitigation of adverse environmental conditions and water quality
- 9) Communications

The applicant or licensee can reference applicable plans or procedures it has prepared to address this section.

6.2.1. Retrieval

Applicants and licensees should address shoreline cleanup and debris retrieval. Also, describe measures that prevent refuse and waste containers from tipping or blowing offsite.

6.2.2. Hazards

In circumstances damage presents a potential navigational hazard, the plan should include the Canadian Coast Guard Emergency Line to ensure there is appropriate notice to vessels, and report on corrective actions. The Coast Guard offers guidance on its website <https://www.ccg-gcc.gc.ca/contact/MCTS-contact-STCM-eng.html>.

‘To report emergencies or navigational hazards, contact your nearest Marine Communications and Traffic Services (MCTS) centre on:

- VHF channel 16 (156.8 MHz)
- MF/HF frequency 2182 kHz/4125 kHz (where available)

- *16 on a cellphone (where available)'

6.2.3. Containment

Salmonid producers can endorse and reference the 'Code of Containment for the Culture of Salmonids in Newfoundland and Labrador', and will outline construction and operational measures that exceed the code standards.

6.2.4. Fueling

Regulators will assume the possibility of handling some fuel on the water; therefore, the applicant should address the maintenance of a spill kit with absorbents, absorbent pads, and/or boom on vessels. In addition, if there is potential to spill hydraulic fluid, the same rationale applies.

6.2.5. Spills

Uncontained spills at the site or observed from other sources must be reported using the appropriate Canadian Coast Guard Emergency Line. Coast Guard offers the following guidance on its website at <https://www.ccg-gcc.gc.ca/contact/emergency-urgence/marine-pollution-marine-eng.html>.

'Vessels and oil handling facility operators must report all pollution or threats of pollution. When calling in a spill report, you'll need to provide:

- your name
- your telephone number
- location of the spill
- quantity of the spill
- type of product spilled
- on-scene weather

Report an incident by calling your nearest office. You may also report marine pollution incidents by contacting a MCTS center on VHF channel 16. All numbers are open 24 hours a day.

Newfoundland and Labrador toll-free:1-800-563-9089.'

6.2.6. Transportation of dangerous goods

In the event of an emergency involving dangerous goods, call CANUTEC, which is the Canadian Transport Emergency Centre operated by Transport Canada to assist emergency response personnel in handling dangerous goods emergencies. This national bilingual advisory centre is

specialized in interpreting technical information, providing advice, and emergency response. CANUTEC offers 24-hour emergency telephone service at 1-613-996-6666 or *666 on a cellular phone.

6.2.7. Weather information and biophysical data

The environmental and waste management plan should outline the weather information and biophysical data collected by the operation to monitor site in order to prepare for adverse conditions. Some aquaculture developments require the collection and reporting of data at a prescribed frequency as a term and condition of licensing, due to the potential magnitude and range of associated impacts.

6.2.8. Mitigation of adverse water conditions/quality

This can include system design to accommodate a range of environmental conditions, modified scheduling of activities (e.g., feeding, diving functions), as well as equipment to modify/counteract water conditions (e.g., aerators in response to a decrease in dissolved oxygen).

6.3. Fish habitat

Where applicable to the aquaculture development, key information requirements include:

- 1) Measures that prevent or mitigate the deposit of authorized material(s) that contribute to biochemical oxygen demand (BOD)
- 2) Measures that prevent or mitigate the deposit/release of authorized in-situ therapeutic treatments to the environment
- 3) Protection of aquatic species at risk
- 4) Initiatives and measures that support the mitigation of farmed and wild Atlantic salmon interactions
- 5) Measures to prevent the transfer of aquatic invasive species
- 6) Waste management
- 7) Wastewater treatment

6.3.1. Biochemical oxygen demand (BOD)

Discuss the measures that prevent, mitigate and monitor the deposit of authorized material(s) that contribute to BOD. The key materials are faeces, feed and biofouling washed in-situ.

The AAR aquaculture monitoring standard can be found at this link <https://www.dfo-mpo.gc.ca/aquaculture/management-gestion/aar-raa-ann7-eng.htm>.

Finfish sea pens should consider the potential outcomes of the benthic monitoring program administered by DFO under the federal AAR. If an operation regulatory monitoring demonstrates exceedance of a benthic BOD regulatory threshold, the operation will not be able to begin new production until follow-up monitoring demonstrates benthic indicators of BOD are below the regulatory threshold. A site that performs poorly in this regard may see its fallow extended. If the fallow is extended, bay management area (BMA) stocking policy for that area may cause the operator to miss their stocking window for the following production cycle.

Applicants should consider all elements of site management that affects the operation's contribution to BOD, and include proposed actions in the event operations exceed BOD indicators.

The following are examples of best practices established in NL that mitigate the impact of BOD:

Activity	Standard Practice/ Mitigation Measures	Benefits
Site selection (i.e., local)	<ul style="list-style-type: none"> • Locating cages in water depths greater 30 m • Baseline assessment that includes current measurements, carbon footprint modelling at 10m contour intervals, and the collection of visual and/or chemical data within the predicted $\text{g/m}^2/\text{d}$ carbon footprint 	Avoidance of productive fisheries habitat (e.g., eelgrass and lobster habitat) as well as promote dispersion.
Site selection (i.e., regional)	<ul style="list-style-type: none"> • Mandatory > one kilometre site separation for sites owned by the same company. • Mandatory > five kilometre site separation for sites owned by different companies. • One kilometre separation from scheduled salmon rivers 	Promote dispersion. Fisheries protection.
Fallowing	<ul style="list-style-type: none"> • Fallow period following a production cycle 	Facilitates breakdown of organics deposited below cages.
Stocking density	<ul style="list-style-type: none"> • Maximum 18 kg/m^3 stocking density during growing season 	Caps production of feeding and faecal material over an area.
Feeding	<ul style="list-style-type: none"> • Avoiding use of wet feed • Feed cameras monitor feed administration 	Control of feeding, and avoid over feeding.
Net cleaning	<ul style="list-style-type: none"> • Frequent and efficient in situ net washing/ • Heavily fouled nets are removed from site to a centralized net washing facility 	Prevent the establishment of net fouling organisms.

The following are examples of actions that can be considered in a proposed mitigation plan to decrease an operation’s organic deposits:

Activity	Action	Benefit
Site selection (i.e., local)	<ul style="list-style-type: none"> • Conduct further current and loading analysis to adjust site origination and/or location 	Promote dispersion.
Fallowing	<ul style="list-style-type: none"> • Maintain fallow until monitoring demonstrates that the site meets regulatory standards for operation • Identify an alternate site in a contingency plan to avoid loss of production 	Supports breakdown of organics deposited below cages.
Stock density	<ul style="list-style-type: none"> • Prescribe a reduction in stock density for the next production cycle. • Identify an alternate site stock. 	Reduced feed requirements.
Feeding	<ul style="list-style-type: none"> • Conduct a third-party audit of feeding protocols • Check level of feeding in comparison to water temperatures • Monitoring - direct staff monitoring in combination with submerged cameras • Daily records for feed type and amount (i.e., numbers, biomass, temperature, growth rates) • Investigate and apply new technologies that capture and circulate feed • Investigate and apply more efficient feed monitoring technologies 	<p>Improve efficiencies in feeding.</p> <p>Review feed system maintenance schedule and monitored more regularly through internal audits.</p>
Net cleaning	<ul style="list-style-type: none"> • Investigate and apply more efficient technologies for onsite net maintenance and cleaning • Change frequency of cleaning and release of biofouling 	Disrupt colonization of fouling species, and avoid the release of large quantities at once.

6.3.2. In-situ treatments

Describe the therapeutents that are administered in-situ and have the potential to deposit in the environment. Describe the procedures and mitigations that prevent or mitigate the release of these substances in critical or sensitive habitat.

6.3.3. Aquatic Species at Risk (SAR)

The SARA prohibits the killing, harming or harassing of a threatened, endangered or extirpated species; the damage or destruction of an individual species' residence; and the destruction of any part of a species' critical habitat. The environmental and waste management plan must outline appropriate management measures for SAR that have the potential to interact with aquaculture development.

State the management measures that will be in place, to respond to sightings and/or potential farm interaction with species of concern. Measures can include any one or more of the following:

- Preventative measures
- Observation and recording
- Reporting
- Handling and freeing of entangled or penned animals

Where recovery strategies and action plans are available, they can be used to gather information on the species in question. Recovery strategies and action plans can be found at <https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html>.

6.3.4. Wild and farmed Atlantic salmon interaction

Describe specific mitigation measures and efforts to support the protection of farmed and wild salmon that include, but not limited to, containment measures, traceability, conservation efforts and partnerships with stakeholders as follows:

- Describe mitigation measures to preventive and minimize the risk of farm/wild interactions.
- Outline containment and escape management plan that meets or exceed the minimum requirements of the 'Code of Containment for the Culture of Salmonids in Newfoundland and Labrador'.

- Note any partnerships with other organizations that are investigating better practices, containment, or understanding of farmed/wild interaction via study and monitoring.
- Proposed measures to enable identification and traceability of farm stock in the event of an escape.

The potential risk that pathogens (e.g., infectious salmon anemia virus, sea lice) can transfer back and forth between wild and farmed fish are a predominant and persistent public concern. In NL, regulatory oversight of pathogens falls under the purview of aquatic animal health, and can be satisfactorily addressed in the environmental and waste management plan by simple reference to the 'Fish Health Management Plan', which will include biosecurity and integrated pest management planning.

6.3.5. Aquatic invasive species (AIS)

Discuss the measures that will be in place to educate, monitor, mitigate the introduction and transfer of, and report AIS.

DFO guidance for documenting and reporting is as follows:

- 'If you think you've discovered an aquatic invasive species, report it using the listed phone or email information on the webpage <https://www.dfo-mpo.gc.ca/contact/invasive-species-especies-envahissantes-eng.html>.
- For your report, you should:
 - Take photos
 - Take note of identifying features
 - Note the exact location (GPS coordinates) and the observation date
 - Do not return the species to the water.
- The Newfoundland and Labrador reporting contact information is:
 - 1 (855) 862-1815
 - Email: AISEAE.XNFL@dfo-mpo.gc.ca '

6.3.6. Waste management

Describe waste management measures for the construction and operational phases of the aquaculture development. The guidance itemizes typical waste streams associated with aquaculture for context, and a plan can reduce or expand its list as appropriate for the development.

Under 'approximate annual generation', the values are benchmarks offered as

approximations and based on waste generated for every 1,000 MT of farm-gate aquaculture production. An operation may produce more or less waste relative to its production, and using the guidance template, a plan would have provided approximations of the annual generation under its description of potential environmental impacts and risks.

The guidance also provides context as to how the industry has managed these materials, applying the 5Rs of waste management: reduce, reuse, recycle, recovery, and residual disposal. An applicant or licensee’s environmental and waste management plan shall identify the service providers and waste management facilities used to manage the listed materials.

In addition to the waste generated from regular/routine operations, a fish disposal plan is required to address emergency preparedness in the event of abnormally high amounts of fish mortality. Reference FFA, Policy and Procedure Manual, Fish Disposal Plan policy to prepare information and contingency options for early harvesting, depopulation, and abnormal fish mortality. Regarding high-risk material (HRM), the fish disposal plan must also support rigorous fish health requirements.

A plan can reference a prepared incident management system to satisfy communication and reporting requirements associated with abnormal fish mortality.

Chemicals	Annual Generation	Current Management Strategy
Antifoulant	Not quantified	Reduce (e.g., in-situ practices) Residual (e.g., disposal)
Cleaner and disinfectant	Not quantified	Reduce, reuse (e.g., logistics) Residual (e.g., neutralization)
Hydrocarbons	Not quantified	Reduce (e.g., alternatives) Reuse, recovery (e.g., heating) Residual (e.g., designed disposal station)
Paint	Not quantified	Reduce (e.g., Full application) Residual (e.g., disposal)

Construction and demolition	Annual generation*	Current management strategy
Expired HDPE buoys Expired HDPE piping	See next row	Residual (i.e., landfill)
Expired netting Expired nylon and PP ropes Refuse	6-7 MT	Reduce (i.e., larger cages) Reuse (i.e., net mending) Residual (i.e., landfill)

Organics	Approximate Annual Generation	Current Management Practice
Biofouling	14 MT	Reduce (e.g., in-situ practices) Residual (e.g., disposal)
BOD	370 MT	Reduce (e.g., feed management) Residual (e.g., release)
Finfish and its by-product*	200 MT (processing) 190 MT (mortality)	Reduce (e.g., secondary processing and husbandry) Recovery (e.g., rendering and agriculture) Residual (e.g., landfill)
Shellfish and its by-product	300 MT	Reduce (e.g., inventory reconciliation, product diversification) Recovery (e.g., agriculture) Residual (e.g., landfill)
Septic	Not quantified	Recovery (e.g., collection and transfer) Residual (e.g., CSSP monitoring)
Sludge	Not quantified	Reduce (e.g., dewatering) Recovery (e.g., agriculture) Residual (e.g., disposal service)
Wastewater	Not quantified	Reduce (e.g., equipment upgrades) Residual (e.g., treatment)

* The following are current waste management options available for fish and fish by-product for the purpose of emergency preparedness in the event of a depopulation, mass mortality, or accidental spill: salmon processing plants; fish rendering plants; ensiling; anaerobic digestion, or a waste management facility approved for organic disposal. All options that involve HRM must have prior approval from all regulators, including the FFA – AAHD.

Packaging/ refuse	Annual generation	Current management strategy
Crates/pallets	Not quantified	Reuse
Feed bags (i.e., LDPE and PP)	3-4 MT	Reduce (e.g., production scaling, and bulk handling) Residual (e.g., landfill)
Intermediate bulk containers (IBCs)	Chemical supplies	Residual (e.g., landfill)
Paper/ cardboard	Administration	Recycle (e.g., Norris Arm North Material recovery Facility)

6.3.7. Wastewater treatment

Describe the wastewater treatment processes that support federal and provincial effluent discharge requirements. The applicant or licensee should consult DFO on whether there are project specific federal needs to protect fish and fish habitat. The Environment Control and Water Sewage Regulations specify provincial requirements for land-based facilities. The description should include all stages of water conditioning that:

- Decrease suspend solids
- Decrease BOD
- Adjust pH and redox conditions
- Perform nitrification and denitrification
- Destroy AIS
- Deactivate pathogens

Not all of these concerns may be applicable to the aquaculture development.

Emergency preparedness should address options for wastewater treatment disruptions. In addition to adverse weather, this can result from malfunctioning equipment. This discussion directly relates to planning for adverse weather and the licensee’s incident management system. Depending on how the aquaculture applicant or licensee scoped information under adverse weather and incident management in relation to wastewater treatment, they can reference these section(s)/documents(s) to support the environmental and waste management plan.

6.4. Wildlife interaction

The environmental and waste management plan should describe measures to protect wildlife, as well as measures to manage pest and predators that may interact with the aquaculture development. The guidelines separate aquatic animals, avian species, and pests and predators, loosely under fish habitat and wildlife, in a way that is somewhat reflective of how regulations and authorities exist to regulate these animals. Aquaculture operators may choose to organize their plans differently. For example, pests and predators will include amphibious mammals, birds and fish and they are logical to address together. It is important to address the following animals that are identified to potentially interact with the aquaculture development:

- 1) Migratory birds
- 2) SAR
- 3) Any animal deemed to be a pest or predator of the aquaculture culture that is likely to require intervention.

Management measures should be entirely or predominantly non-lethal for most species.

Destructive methods should be a last resort, only executed when all other measures fail, and there is risk to safety or the animals suffering. Destructive methods will require permits from either DFO (i.e., fish and marine mammals) or FFA (furbearers), and applicant or licensee can contact these regulators for further guidance.

Examples of non-lethal measures include:

- Exclusion/containment netting (bird netting)
- Re-enforced containment materials (steel core)
- Containment/securing of feed and stock mortality (feed silos)
- Deterrence devices (electrified barriers)

Contact Information

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