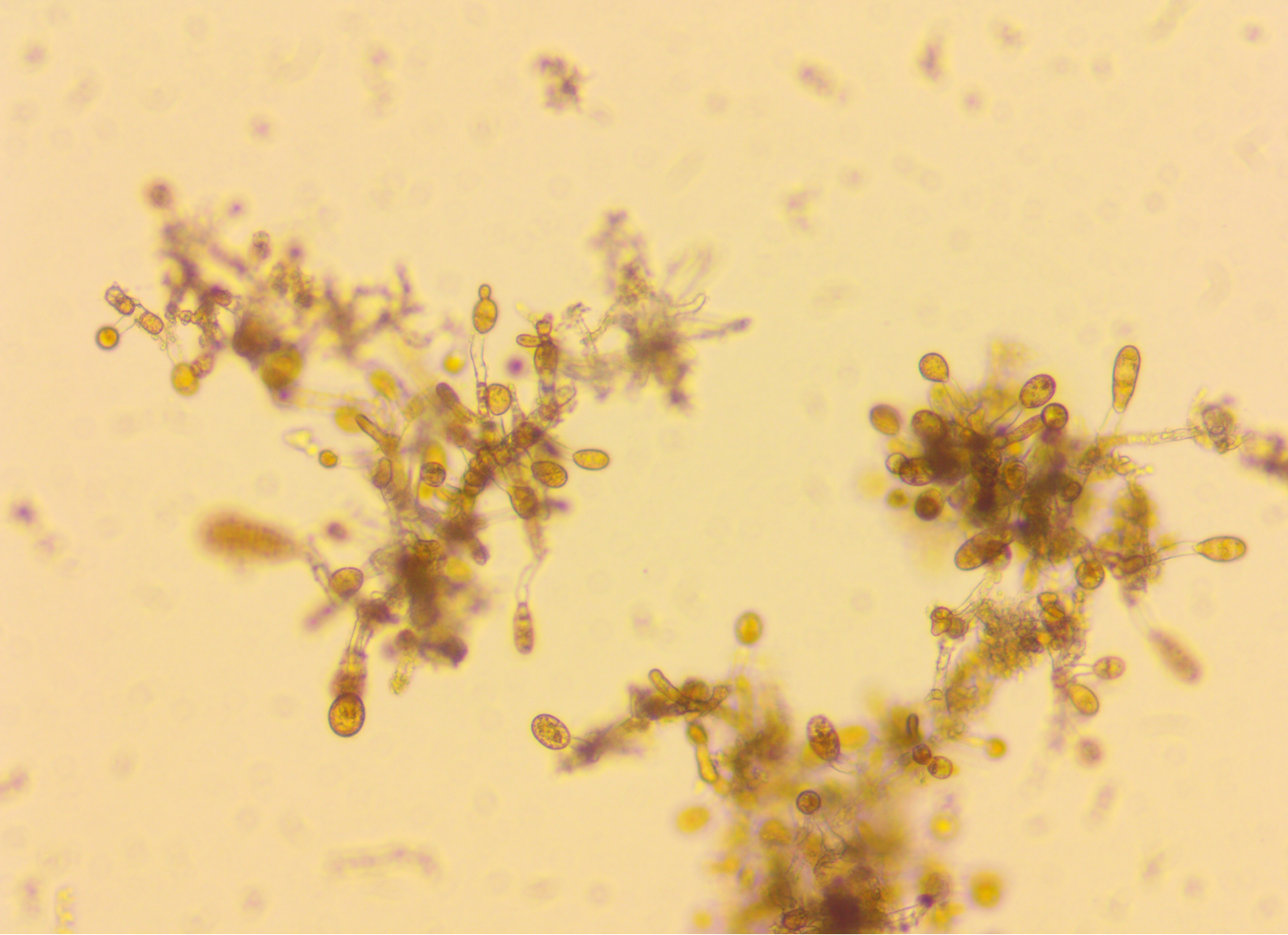




Eden-1

Biosecurity Plan 2026

AL21/004 – Disaster Bay, NSW

DOCUMENT DETAILS

Document details	The details entered below are automatically shown on the cover and the main page footer. PLEASE NOTE: This table must NOT be removed from this document.
Document Title	Eden-1 Biosecurity Plan 2026
Document Subtitle	AL21/004 – Disaster Bay, NSW
Business	Auskelp Pty Ltd ABN 33 644 315 613
Lease Area	AL21/004
Lease Size	200 ha
Kelp Species	Ecklonia radiata
NSW Case ID	SSD-41680467
Date	18 June 2026
Version	2.5
Previous Version	2.4
Prepared By	Christopher Ride
Cover Image Credit	Ecklonia radiata gametophytes, Auskelp, 2025
Disclaimer	The information contained in this document is based on knowledge and understanding at the time of writing (May 2026)
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Project Definition	Kelp Aquaculture Farm
Update Frequency	12 months

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Biosecurity Contact Directory

Eden-1 Kelp Aquaculture Farm • Disaster Bay, NSW

Lease AL21/004 • 200 ha • NSW Case ID SSD-41680467 • Auskelp Pty Ltd (ABN 33 644 315 613)

Report any suspected disease, unusual or unexplained mortality, exotic pathogen or introduced marine pest immediately to the Emergency Animal Disease Watch Hotline on 1800 675 888. Do not clean or dislodge a suspected pest into the water. The Farm Manager (Biosecurity Lead) is responsible for ensuring reportable events are notified and recorded in the biosecurity incident register.

Auskelp Emergency Contacts

Primary Auskelp personnel for biosecurity notifications. The Farm Manager is responsible for ensuring marine-based reportable events are notified and recorded in the biosecurity incident register. The Lead Scientist is responsible for ensuring land-based reportable events are notified and recorded in the biosecurity incident register.

Auskelp Contact	Role	Mobile
Christopher Ride	Director	0437 555 555
Jake Bailey	Operations Manager	0408 556 944
Ignacio Retamal	Hatchery Manager / Lead Scientist	0468 523 506
Andre Robert	Farm Manager	0439 393 081

Priority Biosecurity Reporting

Organisation / Contact	Phone / Email	When to use
Emergency Animal Disease (EAD) Hotline	1800 675 888	Suspected emergency aquatic animal disease, unusual or unexplained mortality, suspected exotic pathogen, or suspected introduced marine pest. 24/7 national hotline (administered in NSW by DPIRD).
NSW DPIRD – Aquatic Biosecurity: Emergency Animal Disease (EAD) Hotline	1800 675 888 / aquatic.biosecurity@dpi.nsw.gov.au	Report suspected aquatic pests or disease and introduced marine pest (IMP) detections in biofouling. Do not clean or dislodge a suspected pest into the water.

NSW Aquaculture Regulator (DPIRD Fisheries)

Organisation / Contact	Phone / Email	When to use
NSW DPIRD Fisheries – Information Line	1300 550 474	Aquaculture biosecurity requirements, reportable biosecurity incidents, seedstock provenance / Reef Adapt evaluation, and audit guidance under the permit and lease.
NSW DPIRD – Aquaculture Service Desk	02 4916 3900	Aquaculture lease and permit administration and operational notifications.

Organisation / Contact	Phone / Email	When to use
Fishers Watch	1800 043 536	Illegal or suspect fishing, fish kills, or damage to fish habitat.

Water Quality & Algal Events

Organisation / Contact	Phone / Email	When to use
NSW EPA – Environment Line (24/7)	131 555	Water pollution, fuel or chemical spills, runoff or contamination events, and fish kills causing or threatening material environmental harm.
Water NSW – Algae Hotline	1800 999 457	Harmful algal bloom information and alerts (Section 7.3 / BC13).

Reportable events are notified under the general biosecurity duty (Biosecurity Act 2015 NSW) and the conditions of the aquaculture permit and lease. Review at least every 12 months, on any biosecurity incident, or on regulatory change.

Document: Eden-1 Biosecurity Plan (v2.3, 29 May 2026) | Last reviewed: 27 / 05 / 2026 Reviewed by: CLR

1.0 Project Details

Eden-1 Kelp Aquaculture Farm

Auskelp Pty Ltd | 2026

- **Aquaculture Location:** Offshore in Disaster Bay
- **Seaweed Type:** Golden Kelp – *Ecklonia radiata*
- **Seedstock Provenance:** Southern NSW – Disaster Bay Bioregion
- **Hatchery Location:** 18-20 Weecoon St Eden NSW 2550
- **Lot/Plan Number:** Lot 25 DP771427
- **Zoning:** MU1 Mixed Use Harbour Quarter
- **Stage 1 Research and Development Facility:** 18-20 Weecoon St Eden NSW 2550
- **Stage 2 Processing Facility:** Edrom TBA – not before calendar year 2028
- **Company ABN:** Auskelp Pty Ltd 33 644 315 613
- **Contact Email:** info@auskelp.net
- **Primary Contact:** Christopher Ride 0437 555 555 or christopher@auskelp.net
- **Class A Aquaculture Permit #:** TBA
- **Lease Location:** AL21/004
- **SSD Case ID:** SSD-41680467
- **Offtake Agreements:** None
- **Saltwater Capacity:** 5000 litres total (Stage 1)
- **Water Filtration:** Multi-stage 25 µm → 5 µm → 1 µm → 0.2 µm
- **UV sterilisation:** Yes – permanent
- **Other protections:** Laminar flow hood, pasteurisation and autoclaving

2.0 Purpose and Scope

This Biosecurity Plan (BP) establishes the framework for identifying, managing and mitigating biosecurity risks associated with the Eden-1 offshore kelp aquaculture facility (AL21/004) located in Disaster Bay, NSW. The Plan applies to all aspects of the development, including seedstock, hatchery facilities and systems, offshore cultivation infrastructure, hatchery-to-farm seedstock transfer, vessels, equipment, personnel, and biomass handling and transport. This BP is implemented in conjunction with the Eden-1 Monitoring and Maintenance Plan (MMP), with biosecurity controls embedded within day-to-day operational procedures.

This Biosecurity Plan should be read in conjunction with the detailed policies and protocols set out in the following management documents:

- B1 Marine Fauna Interaction Plan
- B2 Cultural Heritage Response Plan
- B3 Emergency Response Plan
- B4 Traffic Management Plan
- B5 Biosecurity Plan (this document)
- B6 Monitoring and Maintenance Plan
- B7 Environmental Management Plan
- B8 Waste Management Plan
- B9 Construction Deployment Management Plan
- B10 Decommissioning Management Plan

2.1 Document Status and Ongoing Review

The overarching objective of this Biosecurity Plan is to identify, manage and minimise biosecurity risk across all stages of the Eden-1 operation – hatchery, seedstock transfer, deployment, cultivation, harvest and equipment and vessel movement – so as to protect the cultivated crop, the surrounding marine environment, and the wild *Ecklonia radiata* populations and ecosystems of Disaster Bay.

This Plan is a living document and will be reviewed and updated on an ongoing basis. Offshore kelp aquaculture in Australian waters is an emerging field, and Auskelp's understanding of site-specific biosecurity risk will continue to develop through operational experience, monitoring data and research. Accordingly, the Plan will be revised as knowledge improves to ensure it remains current, effective and aligned with best practice. Reviews and updates will be informed by:

- operational experience and monitoring outcomes from the farm and hatchery;
- biosecurity incidents, near-misses and the outcomes of corrective actions;
- new scientific research and improved understanding of kelp diseases, pests and biosecurity pathways;
- changes to relevant legislation, regulatory guidance and permit or lease conditions; and
- advice from DPIRD Fisheries and other relevant authorities.

The Plan will be formally reviewed at least every 12 months and additionally if triggered by a significant biosecurity incident, a regulatory change or a significant change in operations or environmental conditions (refer Section 19.0 and Appendix BM1, B41 and B50). All revisions are version-controlled, and the current approved version supersedes all previous versions. Through this adaptive, continuous-improvement approach, the Plan ensures that biosecurity risk is managed effectively and proportionately throughout the operational life of the Project.

3.0 Biosecurity Management Framework and Supporting Appendices

This Biosecurity Plan is implemented through an integrated biosecurity management framework comprising risk assessment, operational controls, monitoring, reporting and adaptive management measures. The framework has been developed to identify potential biosecurity hazards, assess risk pathways, establish preventative controls, define monitoring requirements and provide clear response actions should a biosecurity event occur. Collectively, these documents provide multiple independent layers of risk management and ensure biosecurity risks are identified, monitored and managed throughout the operational life of the Project.

The Biosecurity Plan is supported by the following appendices:

- **Appendix BM1 – Biosecurity Management Table (AL21/004):** provides a consolidated summary of identified biosecurity risks, management measures, monitoring requirements and responsibilities.
- **Appendix BC1 – Biosecurity Control – Eden-1 (AL21/004):** details the specific operational controls, preventative measures and management actions implemented to minimise biosecurity risks across hatchery, vessel, cultivation and harvesting activities.
- **Appendix BRA1 – Biosecurity Risk Assessment (Pathway × Receptor):** provides the formal assessment of biosecurity hazards, exposure pathways, receptors, risk ratings, residual risks and uncertainties associated with the Project.
- **Appendix HAZ1 – Biosecurity Monitoring, Triggers and Responses:** establishes monitoring parameters, trigger thresholds, detection limitations, reporting requirements and corrective actions to ensure emerging risks are identified early and managed appropriately.

Together, these appendices provide a structured and auditable framework that supports compliance with the Fisheries Management Act 1994 (NSW), Biosecurity Act 2015 (NSW), aquaculture permit conditions and industry best-practice biosecurity management principles.

4.0 Project Description

Auskelp proposes the development of a 200-hectare offshore seaweed farm located in Disaster Bay, southern New South Wales. Located approximately 23 km southwest of Eden, the farm will cultivate native kelp species *Ecklonia radiata* using longline infrastructure designed for open ocean environments. The Project's goal is to develop sustainable kelp farming in Australian waters with an annual harvest cycle. The biomass created from operations will be used for human food products, nutraceutical extracts, and liquid fertilisers.

The Eden-1 farm will deploy modular 1-hectare kelp rigs within the proposed lease area (AL21/004), located >1.1 km offshore. Each rig includes low-profile, sub-surface longlines anchored to the seafloor, supporting vertical droppers which will be annually seeded with locally propagated kelp sporophytes. No permanent structures will be installed. Operations occur seasonally, with activities including deployment, monitoring, maintenance, and harvest conducted via vessels operating from Snug Cove and Edrom, in Twofold Bay. All marine infrastructure is removable and designed to minimise ecological disruption. The Kelp Aquaculture Farm will use longline structures which are used globally for seaweed cultivation, and similar to those already being used in Twofold Bay, Jervis Bay and Port Stephens for mussel aquaculture.

At full production, the Project proposes to grow >1,500 tonnes of wet seaweed annually and employ 30 full-time staff to meet the increasing demand for domestically produced, sustainably sourced seaweed. To meet commercial demand, reliable biomass requires consistent ocean cultivation and appropriate processing and storage infrastructure. The quality and quantity of kelp biomass directly determines the market viability of downstream products. Without sufficient biomass, industries seeking to utilise regenerative seaweed cannot be developed. Therefore, establishing offshore kelp farms are fundamental to unlocking the environmental and economic potential of the seaweed sector in Australia.

Auskelp has been conducting open ocean testing of *Ecklonia radiata* since 2022, with ocean trials continually undertaken in both Twofold Bay and Disaster Bay. These trials have focused on refining and documenting offshore kelp farming of *Ecklonia radiata* in high-energy ocean conditions. Through extensive testing, monitoring and adaptive design, Auskelp has demonstrated secure and consistent biomass growth in exposed offshore settings. To date, the Auskelp offshore testing program objectively represents the most successful offshore kelp farming program for this species, globally.



Figure 1: Regional map (including Eden and Wonboyn) with the proposed kelp farm indicated by the green rectangle (Source: Google Maps).

5.0 Project Location

The proposed lease area is not located within a declared Marine Park, Aquatic Reserve, whale migration corridor, or recognised whale resting area. The surrounding coastline adjoins terrestrial conservation areas, including Nadgee Nature Reserve and Beowda National Park, but does not overlap with any protected areas or statutory exclusion zones under New South Wales or Commonwealth legislation. The site is not located within, nor does it directly affect any Matters of National Environmental Significance (MNES) protected under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), and does not intersect with any Commonwealth-declared protected areas or other EPBC-listed conservation overlays.

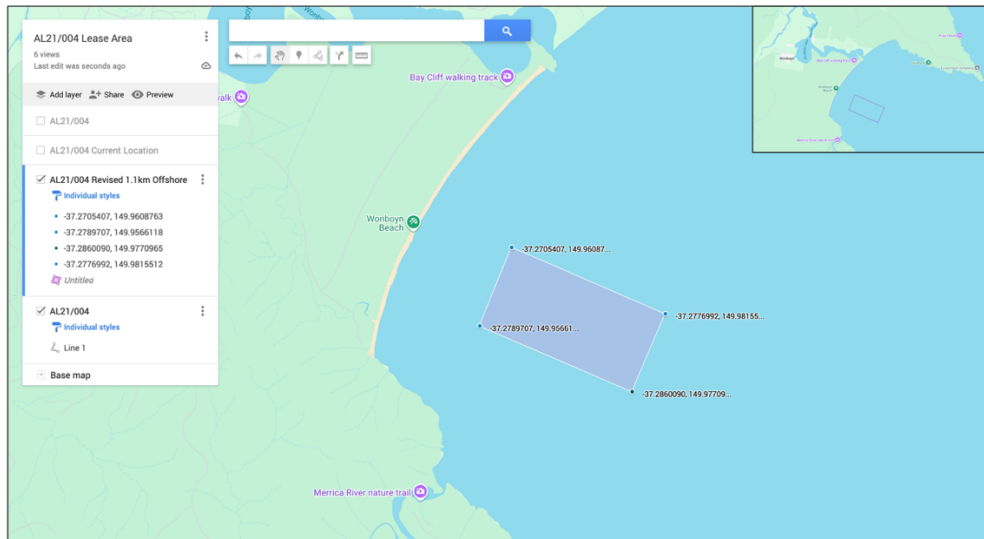


Figure 2: AL21/004 Lease coordinates (Credit: Google and Auskelp).

The Eden-1 cultivation lease is located within a highly flushed open-ocean environment over unconsolidated sandy seabed at depths of approximately 20–25 metres, avoiding rocky reef habitats and established macroalgal communities. The nearest identified natural *Ecklonia radiata* stands are located a minimum of approximately 1.1 km from the cultivation infrastructure, with additional separation from other mapped kelp habitats throughout Disaster Bay. The site is subject to strong oceanic water exchange and regular coastal currents, resulting in rapid dilution and dispersal of suspended material and reducing the potential for localised accumulation of biological matter.



Figure 3: AL21/004 Lease, Disaster Bay, NSW, distances to key areas (Credit: Google and Auskelp).

6.0 Biosecurity Risk Context

The Eden-1 project is a non-intensive, extractive aquaculture system characterised by:

- no feed, fertilisers or chemical inputs
- native endemic species only
- use of locally sourced *Ecklonia radiata* seedstock
- no genetic modification
- submerged, tensioned longline infrastructure
- operation within an open marine environment with high water exchange
- hatchery-controlled propagation
- minimum 1.1 km separation from wild stands
- harvest prior to reproductive maturity
- no intentional reseedling into natural systems
- temporary biomass with annual harvest cycle
- biosecurity monitoring and adaptive management

As a result, the biosecurity risk profile is primarily limited to naturally occurring or operationally introduced factors, as follows:

- vessel fouling or contamination in ballast water
- water quality events, pollution or eutrophication
- biofouling and epiphyte colonisation
- naturally occurring algal bloom events
- pathogen transfer via equipment, vessels or personnel
- herbivory by native marine species
- increasing ocean temperatures

There is no introduction of non-native species, no nutrient enrichment, and no waste discharge, significantly reducing risk compared to intensive aquaculture systems. The identification, assessment and management of these risks are summarised in the Biosecurity Management Table (Appendix BM1) and implemented through the operational controls outlined in the Biosecurity Management Controls (Appendix BC1).

7.0 Key Biosecurity Risks

7.1 Water Quality

Excess pollution in runoff, sewerage, pesticides, excess nitrogen from synthetic fertiliser runoff.

7.2 Biofouling and Epiphytes

Existing risks: Colonisation of cultivation infrastructure by algae or marine organisms, potentially affecting growth performance, increasing drag, and reducing biomass quality. Regular cleaning of lines is critical, see Section 15.0 Biofouling Removal.

7.3 Harmful Algal Blooms (HABs) and Water Quality

Naturally occurring environmental events, including harmful algal blooms, elevated sea temperatures, or reduced water quality or pollution (e.g. turbidity, excess land runoff, nutrient pulses or external contamination events), may temporarily impact kelp health and growth performance.

7.4 Pathogens and Disease

International kelp farming experience indicates that disease risk in non-intensive, open-water seaweed aquaculture systems is low. Potential risks are primarily associated with the transfer of pathogens or contaminants via hatchery operations, equipment, vessels or personnel. These risks are mitigated through controlled hatchery production, the use of locally sourced seedstock, strict hygiene protocols, and routine monitoring of kelp health throughout the cultivation cycle.

7.4.1 Kelp Disease and Biosecurity

While disease risk in non-intensive, open-water *Ecklonia radiata* cultivation is low, a number of disease agents and conditions are recognised in the scientific literature as relevant to golden kelp and are monitored for under this Plan:

- **Bleaching and depigmentation** – a loss of photosynthetic pigment ("bleached" phenotype) associated with thermal stress and disruption of the kelp-associated microbial community, which can reduce growth and biomass quality (Campbell et al. 2019, 2020).
- **Viral agents and dieback** – virus-like particles and single-stranded DNA viruses have been detected in bleached and dieback-affected *E. radiata*; their causative role is not fully established but they are recorded in association with diseased tissue.
- **Opportunistic bacterial pathogens** – bacteria capable of degrading kelp tissue or inducing bleaching, typically expressed under elevated temperature or physiological stress.
- **Filamentous brown-algal endophytes** – endophytic algae that colonise host tissue and can cause deformation or weakening of blades and stipes.
- **Oomycete and protistan parasites** – pathogens documented in large brown algae (including kelps) that can compromise tissue integrity and, in some species, disperse over distance at sea (Sugumaran 2022; Ward et al. 2026).

These conditions are managed through the use of locally sourced, hatchery-verified seedstock, routine kelp-health monitoring across the cultivation cycle, batch separation in the hatchery, and the early-removal thresholds defined in Appendix BC1 (BC8). No chemical or therapeutic treatments are applied in the marine environment. Suspected disease is recorded and, where reportable, notified in accordance with Section 18.0.

7.4.2 Recognition of Naturally Occurring Fouling Organisms

An important component of marine biosecurity monitoring is the ability to distinguish between naturally occurring native fouling organisms and potential introduced marine pests (IMPs). The waters of Disaster Bay naturally support a range of marine organisms that commonly colonise artificial structures, ropes and cultivation infrastructure, including:

- **Blue Mussel (*Mytilus galloprovincialis*)**
A naturally occurring bivalve mollusc commonly found attached to rocky reefs, kelp holdfasts, wharves, ropes and other hard surfaces throughout NSW coastal waters. Juvenile blue mussels may settle on aquaculture infrastructure as part of normal marine recruitment processes. Their presence is not considered a biosecurity concern.
- **Hydroids**
Small colonial invertebrates related to jellyfish and corals that form branching, feather-like or filamentous colonies on ropes, floats, kelp, shells and other submerged surfaces. Hydroids are widespread throughout NSW marine environments and are among the most common natural fouling organisms encountered on aquaculture infrastructure.
- **Bryozoans (Moss Animals)**
Colonial filter-feeding invertebrates that form thin encrusting mats, lace-like sheets or branching colonies on hard surfaces. Bryozoans commonly occur on rocky reefs, shells, kelp holdfasts, ropes and marine infrastructure. They are a normal component of temperate marine fouling communities and provide habitat for other small marine organisms.

■ Native Ascidians (Sea Squirts)

Soft-bodied filter-feeding marine invertebrates that attach permanently to hard surfaces including reefs, kelp holdfasts, ropes, floats and vessel infrastructure. Ascidians occur either as solitary individuals or colonial groups and are naturally present throughout NSW coastal waters. Native ascidians are distinct from several introduced ascidian species that are recognised marine pests.

■ Native Algae

A diverse group of naturally occurring seaweeds and filamentous algae that may colonise cultivation infrastructure, ropes and floats. Native algal growth is a normal ecological process in marine environments and may vary seasonally according to water temperature, nutrient availability and light conditions. The presence of native algae is not considered a biosecurity concern unless abnormal growth patterns indicate broader environmental changes.

■ Winged Pearl-Oyster (*Electroma georgiana*) ("Butterfly Shell")

A native bivalve epibiont commonly associated with wild *Ecklonia radiata*, rocky reef habitats and submerged structures throughout southern NSW. The species attaches to hard surfaces using byssal threads and is a naturally occurring component of local marine ecosystems. It is not an introduced marine pest and is not listed as Prohibited Matter under the Biosecurity Act 2015 (NSW).

Understanding the composition and seasonal variability of naturally occurring fouling communities assists farm personnel in identifying unusual, non-native or potentially invasive species that may require further investigation or reporting. Routine monitoring, staff training and biosecurity inspections therefore focus not only on detecting introduced marine pests, but also on establishing a clear understanding of the native fouling assemblages expected within the local environment. This improves the accuracy of biosecurity surveillance, reduces false alarms and supports the early detection of genuinely abnormal or high-risk organisms.

7.4.3 Hazard Identification and Statutory Listing

The hazards relevant to the Project are identified below and mapped against the relevant statutory lists: Prohibited Matter (Schedule 2, *Biosecurity Act 2015* (NSW)); Notifiable Matter (Schedule 1, *Biosecurity Regulation 2017* (NSW)); and Australia's National List of Reportable Diseases of Aquatic Animals. Two hazard classes are distinguished: (i) disease agents and conditions of cultivated *Ecklonia radiata*; and (ii) introduced marine pests that could arrive via the vessel, equipment or biofouling pathway. The National List of Reportable Diseases of Aquatic Animals applies only to finfish, molluscs, crustaceans and amphibians and contains no macroalgae (seaweed) disease; accordingly, no kelp disease agent is a listed reportable disease, and suspected exotic or unusual kelp disease is instead managed and notified under the general biosecurity duty (refer Section 18.0).

7.4.4 TABLE – Hazard Identification: Disease and Conditions for *Ecklonia radiata*

Hazard / condition	Type	Distribution / status	Transmission & potential impact on operations	Statutory listing & reporting
Bleaching & depigmentation	Abiotic / microbiome condition	Recorded in wild <i>E. radiata</i> , SE Australia incl. NSW; not a listed organism	Thermal stress and disruption of the kelp microbiome; can affect cultivated lines under marine-heatwave conditions. Reduces growth and biomass quality.	Sch 2 PM: No Sch 1 NM: No Nat. Reportable: No Manage under general biosecurity duty; notify if exotic/unusual
Viral agents & dieback <i>virus-like particles;</i> <i>ssDNA viruses</i>	Virus (causative role unconfirmed)	Detected in bleached / dieback-affected <i>E. radiata</i> in Australia; not listed	Recorded in association with diseased tissue; transmission pathway not established. Associated with dieback and tissue loss.	Sch 2 PM: No Sch 1 NM: No Nat. Reportable: No Manage under general biosecurity duty; notify if exotic/unusual
Opportunistic bacterial pathogens	Bacteria	Environmental; widely distributed; not listed	Capable of degrading kelp tissue or inducing bleaching, typically expressed under	Sch 2 PM: No Sch 1 NM: No

Hazard / condition	Type	Distribution / status	Transmission & potential impact on operations	Statutory listing & reporting
			elevated temperature or physiological stress. Localised tissue loss and quality reduction.	Nat. Reportable: No Manage under general biosecurity duty; notify if exotic/unusual
Filamentous brown-algal endophytes	Endophytic alga	Recorded in kelps including in Australia; not listed	Colonise host tissue and can spread within a stand. Cause deformation or weakening of blades and stipes.	Sch 2 PM: No Sch 1 NM: No Nat. Reportable: No Manage under general biosecurity duty; notify if exotic/unusual
Oomycete & protistan parasites	Oomycete / protist	Documented in large brown algae; some disperse at sea; not listed	Waterborne; some species disperse over distance. Compromise tissue integrity.	Sch 2 PM: No Sch 1 NM: No Nat. Reportable: No Manage under general biosecurity duty; notify if exotic/unusual

7.4.5 TABLE – Hazard Identification: Introduced Marine Pests of Biosecurity Concern (Vessel / Equipment / Biofouling Pathway)

Pest (common / scientific name)	Type	Distribution / NSW status	Pathway & relevance to Eden-1	Statutory listing & reporting
Wakame / Japanese seaweed <i>Undaria pinnatifida</i>	Brown macroalga (invasive kelp)	Established in Vic & Tas; not established at the lease	Drift fragments and hull / equipment biofouling; could foul lines or compete with the crop.	Sch 2 PM: No Sch 1 NM: Yes Nat. Reportable: No Report within 1 working day
Caulerpa <i>Caulerpa taxifolia</i>	Green macroalga	Invasive strain present in some NSW estuaries (control program)	Fragment transfer on anchors, ropes and vessels.	Sch 2 PM: No Sch 1 NM: Yes Nat. Reportable: No Report within 1 working day
Red macroalga <i>Grateloupia turuturu</i>	Red macroalga	Introduced; limited Australian / NSW records	Fouling of infrastructure and vessels.	Sch 2 PM: No Sch 1 NM: Yes Nat. Reportable: No Report within 1 working day
Japanese wireweed <i>Sargassum muticum</i>	Brown macroalga	Exotic to Australia; not present	Drift and biofouling pathway on hulls / equipment.	Sch 2 PM: Yes Sch 1 NM: – Nat. Reportable: No Report immediately (EAD Hotline 1800 675 888)
Northern Pacific seastar <i>Asterias amurensis</i>	Echinoderm (seastar)	Established Vic & Tas; exotic to NSW	Larvae / juveniles via biofouling, equipment and vessels; predator of bivalves and other fauna.	Sch 2 PM: Yes Sch 1 NM: – Nat. Reportable: No Report immediately (EAD Hotline 1800 675 888)
European fan worm <i>Sabella spallanzanii</i>	Polychaete (tubeworm)	Present in SE Australian ports, incl. parts of NSW	Biofouling on lines, anchors, buoys and hulls.	Sch 2 PM: No Sch 1 NM: Yes Nat. Reportable: No Report within 1 working day

Pest (common / scientific name)	Type	Distribution / NSW status	Pathway & relevance to Eden-1	Statutory listing & reporting
European green / shore crab <i>Carcinus maenas</i>	Crustacean (crab)	Established in SE Australia	Transfer via fouling, equipment and water retained on board.	Sch 2 PM: No Sch 1 NM: Yes Nat. Reportable: No Report within 1 working day
Colonial sea squirt <i>Didemnum vexillum</i>	Ascidian (colonial tunicate)	Limited Australian distribution	Biofouling overgrowth of ropes, droppers and infrastructure.	Sch 2 PM: Yes Sch 1 NM: – Nat. Reportable: No Report immediately (EAD Hotline 1800 675 888)
New Zealand screwshell <i>Maoricolpus roseus</i>	Gastropod (snail)	Established in SE Australia incl. NSW	Fouling and sediment transfer on equipment and anchors.	Sch 2 PM: No Sch 1 NM: Yes Nat. Reportable: No Report within 1 working day
Exotic marine mussels <i>e.g. Mytilopsis sallei</i> ; <i>Perna viridis</i>	Bivalves	Exotic to Australia	Spat fouling on droppers, buoys and ropes.	Sch 2 PM: Yes Sch 1 NM: – Nat. Reportable: No Report immediately (EAD Hotline 1800 675 888)

Notes: PM = Prohibited Matter (Schedule 2, Biosecurity Act 2015) – it is an offence to deal with prohibited matter, and suspected detections must be reported immediately to the Emergency Animal Disease Watch Hotline (1800 675 888). NM = Notifiable Matter (Schedule 1, Biosecurity Regulation 2017) – suspected detections must be notified within one working day. Prohibited Matter is not separately listed as Schedule 1 Notifiable Matter (shown “–”). Classifications are drawn from NSW DPIRD Primefact PUB21/3 (Notifiable marine pests in NSW, 2023) and the current Schedules; distribution is indicative and subject to change – check currency with NSW DPIRD Aquatic Biosecurity. Kelp disease references: Campbell et al. 2019, 2020; Sugumaran 2022; Ward et al. 2026 (refer Section 7.4.1). Routine detection, recording and response are implemented through Sections 13.0–14.0, 18.0 and Appendices BM1 / BC1.

7.5 Herbivory and Grazing

Interaction with native marine species (e.g. fish, turtles, invertebrates, crabs), representing a natural ecological process that may result in biomass loss but does not constitute a biosecurity threat.

7.6 Introduced Marine Pests (IMPs)

The potential introduction or transfer of non-native marine species via vessels, equipment or infrastructure. This risk is low and managed through localised operations, equipment controls, and monitoring.

7.7 Hatchery Contamination or Culture Failure

Contamination or loss of integrity of hatchery cultures (e.g. microbial contamination, cross-contamination between batches), which may affect seedstock quality. This risk is mitigated through biosecure hatchery systems, batch separation, controlled propagation conditions, limited to only locally acquired *Ecklonia radiata* seedstock.

7.8 Biosecurity Transfer via Equipment and Vessels

Transfer of biological material (e.g. fouling organisms, pathogens) between locations via vessels, ropes, anchors or equipment. Managed through inspection, cleaning protocols and restricted inter-site movement.

7.9 Biomass Produced

Harvested biomass has the potential to act as a temporary pathway for the movement of biological material, including naturally occurring fouling organisms, pathogens, epiphytes or disease-affected tissue. Risks are primarily associated with the handling, storage, transport and processing of harvested biomass

prior to final utilisation. These risks are managed through prompt harvest-to-processing timeframes, segregation of abnormal or deteriorating biomass where required, routine monitoring of biomass condition, and the Project's zero-waste utilisation model whereby all harvested biomass is recovered and beneficially reused through food-grade processing or liquid hydrolysate manufacture. No harvested biomass is intentionally returned to the marine environment.

7.10 Genetic Integrity

The potential for genetic interaction between cultivated and wild populations. This is managed through the exclusive use of locally sourced broodstock, maintenance of local provenance, periodic wild replenishment, harvest prior to reproductive maturity, a minimum separation distance of 1.1 km from identified wild kelp beds, and the absence of any genetic modification or translocation of interstate or international genetic material.

7.11 Climate and Environmental Stressors

Elevated ocean temperatures, marine heatwaves, extreme storm events and other climate-driven environmental changes may affect kelp health, growth performance and susceptibility to disease. These risks are managed through ongoing environmental monitoring, adaptive harvest scheduling, routine health assessments and review of operational thresholds.

8.0 Biosecurity Management Framework

Biosecurity is managed through an operational framework implemented via the Monitoring and Maintenance Plan (MMP) and supported by this Biosecurity Plan (BP). This document establishes the procedures for prevention, monitoring, incident response and continuous improvement across project activities. The specific controls, responsibilities, timing and implementation measures are defined in the Biosecurity Management Table (Appendix BM1), which provides the operational basis for the application of this Plan.

The framework comprises:

8.1 Prevention

- Use of only locally derived, hatchery-controlled seedstock
- Biosecure hatchery production (AK4-A / AK4-B)
- Assessment and control of vessels, equipment and personnel
- Cleaning of kelp lines to ensure minimal biofouling

8.2 Monitoring

- Routine inspection of cultivation lines and biomass
- Recording of growth, health, fouling and mortality
- Environmental monitoring of water conditions

8.3 Response

- Isolation, relocation or removal of affected lines
- Implementation of corrective actions
- Notification to NSW DPIRD Fisheries where required

8.4 Continuous Improvement

- Ongoing review of operational performance
- Integration of research outcomes and regulatory updates
- Periodic revision of management procedures

9.0 Record Keeping and Surveillance

Accurate record keeping forms a key component of the Eden-1 biosecurity management framework and supports the early detection of emerging risks, verification of control effectiveness, regulatory compliance and adaptive management. Records must be maintained in electronic or hard-copy format and retained for a minimum period of 10 years.

The following records will be maintained, reviewed and made available to DPIRD Fisheries or other regulatory authorities upon request:

- broodstock collection records, provenance and permit details;
- hatchery batch records and traceability information;
- mortality, disease and abnormal condition records;
- growth rates, biomass production and harvest records;
- water quality monitoring results;
- vessel and equipment inspection, cleaning and movement records;
- introduced marine pest observations and incident reports;
- staff biosecurity training and induction records;
- biosecurity incidents, corrective actions and regulatory notifications;
- filter integrity inspections and replacement records;
- UV disinfection system inspections, maintenance and operational verification records;
- harvested biomass quality records; and
- hatchery water-treatment performance records, including filtration, UV and pasteurisation system functionality.

Routine inspections of filtration systems, UV treatment units and associated water-treatment infrastructure will be undertaken to verify operational integrity and effectiveness. Any equipment malfunction, treatment failure, abnormal monitoring result or suspected reduction in treatment efficacy will be recorded, investigated and rectified as soon as practicable. Where necessary, affected water supplies, culture batches or cultivation activities will be isolated pending investigation and corrective action.

10.0 Staff Training and Responsibilities

Biosecurity responsibilities are clearly defined and implemented through operational procedures, as detailed in the Biosecurity Management Table (Appendix BM1):

The Farm Manager is designated as Biosecurity Lead.

All personnel receive training in:

- biosecurity risks
- biosecurity identification
- hygiene and operational controls
- monitoring and reporting procedures

Training is undertaken at induction and refreshed at regular intervals, with role-specific requirements defined in the OMP.

11.0 Offshore Biosecurity Controls

The Eden-1 facility operates as an open-water aquaculture system. As such, the physical exclusion of marine organisms is not practicable.

Biosecurity is managed through:

- site selection in a high-energy offshore environment

- operational controls and work sequencing
- monitoring and adaptive management
- primary harvesting prior to Stage 3 reproductive maturity

These controls are implemented through the procedures outlined in the Biosecurity Management Table (Appendix BM1). The lease area is defined by navigation markers, establishing a clearly identifiable operational and biosecurity zone.

12.0 Hatchery Interface

Biosecurity is primarily controlled at the hatchery stage prior to offshore deployment. The hatchery and seedbanks are managed in a biosecure environment.

Controls include:

- multi-stage water filtration and UV
- autoclaving water used for seed banks
- controlled propagation and culture conditions
- separation and quarantine of seedstock batches
- strict hygiene and access protocols
- verification of seedstock health prior to deployment

Only seedstock of known and acceptable health status is transferred to the offshore farm, consistent with the requirements set out in the Biosecurity Management Table (Appendix BM1).

12.1 Hatchery Ocean Water

Hatchery Water Source and Treatment

The Eden-1 hatchery (18–20 Weecoon St, Eden NSW 2550) is located adjacent to Twofold Bay, a working commercial port that receives **international and domestic shipping**. Twofold Bay shipping represents a recognised biosecurity pathway for introduced marine pests and pathogens via ballast water and hull biofouling. The hatchery water-intake and treatment system is designed to manage this risk:

- **Intake:** seawater is drawn from a controlled intake point, sited and managed to minimise the uptake of contaminated or port-influenced water.
- **Filtration and treatment:** intake seawater is filtered (to 0.2 µm) and either pasteurised/UV-treated prior to use in culture, removing pathogens, spores, larvae and particulate matter.
- **Life-stage isolation:** recirculation and culture systems are isolated by life-stage (spores, gametophytes, sporophytes, juveniles) to prevent cross-contamination.
- **Monitoring:** intake water and culture tanks are monitored for contamination consistent with the hatchery biosecurity controls in Appendix BM1.

These controls ensure that the proximity of the hatchery to international shipping in Twofold Bay does not compromise the biosecurity status of cultured seedstock prior to offshore deployment.

12.2 Water Collection

Seawater used in the hatchery is collected primarily from offshore, clean-water sources and is treated before use to prevent the introduction of marine pests, pathogens or contaminants into the culture system. The hatchery (18–20 Weecoon St, Eden) is adjacent to Twofold Bay – a working commercial port that receives international and domestic shipping, and therefore a recognised pathway for introduced marine pests via ballast water and hull biofouling. To manage this pathway, the source, timing and treatment of collected water are deliberately controlled.

- **Primary source – offshore collection** – seawater is collected primarily from open, well-flushed offshore water away from the port, berths, ballast-discharge zones and stormwater outfalls, avoiding the international-shipping biosecurity pathway at the point of collection.

- **Secondary source – dock collection** – where conditions allow, water may be collected from the dock at Twofold Bay. Dock collection is undertaken only when conditions are suitable and lower-risk – for example, outside active shipping movements in the immediate vicinity, and not during visible surface contamination, harmful algal bloom conditions, or significant terrestrial runoff.
- **Treatment on intake (all sources)** – regardless of collection source, all seawater is filtered (to 1 µm) and pasteurised/UV-treated before use in culture, removing pathogens, spores, larvae (including any pest propagules) and particulate matter. This treatment provides a consistent biosecurity barrier independent of where the water was collected.
- **Life-stage isolation** – treated water is supplied to recirculation and culture systems that are isolated by life-stage (spores, gametophytes, sporophytes, juveniles) to prevent cross-contamination.
- **Records** – each collection event is logged (date, source/location, volume and conditions) to support traceability and review, consistent with the recordkeeping requirements in Appendix BM1.

By prioritising offshore collection, restricting dock collection to suitable conditions, and applying multi-stage filtration and UV treatment to all water regardless of source, the proximity of the hatchery to international shipping in Twofold Bay does not compromise the biosecurity status of water entering the hatchery.

12.3 Water Treatment

To minimise the risk of introducing pathogens, pests, nuisance organisms, competing algae or other biological contaminants into the hatchery, all seawater used for propagation and cultivation activities is subjected to a multi-barrier treatment process prior to use. Source seawater is initially passed through a 25 µm pre-filter and protein skimmer system incorporating ozone treatment to remove suspended solids, organic material and dissolved contaminants. Water then enters a holding tank before passing through sequential 5 µm and 1 µm cartridge filtration stages, with an optional 0.2 µm filtration stage available where enhanced biosecurity control is required. Following physical filtration, the water is treated using ultraviolet (UV) disinfection prior to entering the hatchery culture system. Recirculated hatchery water is further treated through dedicated 0.2 µm filtration and UV disinfection prior to reuse within cultivation tanks.

This treatment train provides multiple independent barriers against the introduction and transfer of bacteria, fungi, protozoa, algal competitors, marine pests, propagules and other biological contaminants. The combination of mechanical filtration, ozone treatment and UV disinfection significantly reduces biological risk pathways associated with hatchery operations and forms a key component of the Eden-1 biosecurity management framework.

Additional biosecurity controls are applied to sensitive hatchery operations involving broodstock, gametophyte stock cultures and seed-bank maintenance. Seawater used for gametophyte culture, spore induction and other critical propagation stages is pasteurised prior to use to minimise the risk of introducing bacteria, fungi, protozoa, algal competitors, marine pests and other biological contaminants. Pasteurisation provides a further independent treatment barrier beyond filtration and UV disinfection and assists in maintaining pathogen-free culture conditions.

All instruments, glassware, culture vessels, media containers and propagation equipment used in gametophyte and stock-culture work are sterilised using an autoclave prior to use. Gametophyte stock cultures are maintained under aseptic laboratory conditions within a laminar-flow environment using sterile handling procedures to minimise contamination risk and preserve culture integrity. These measures support the maintenance of pathogen-free broodstock and gametophyte lines, reduce the likelihood of culture contamination or cross-contamination between batches, and provide a high level of biosecurity protection for the propagation program.

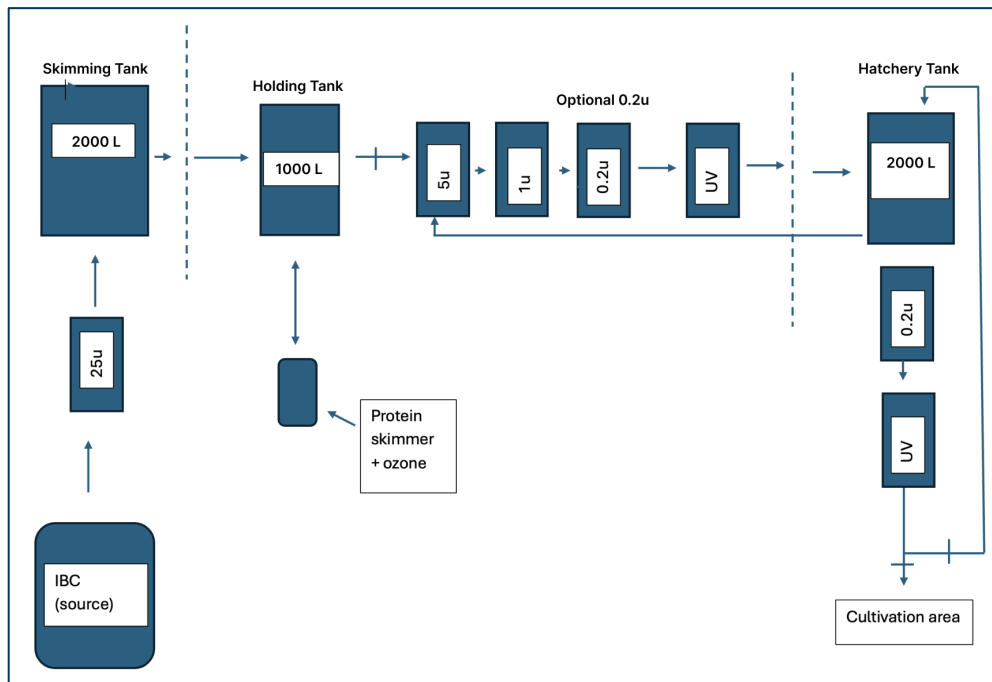


Figure 4. Simplified schematic of the Eden-1 hatchery water treatment and recirculation system showing sequential filtration, ozone treatment and UV disinfection barriers used to minimise biosecurity risk.

13.0 Equipment, Vessels and Personnel Controls

Vessels and ballast water are recognised pathways for the introduction and spread of marine pests, pathogens, diseases and nuisance fouling organisms within marine environments. Although the Project does not involve international vessels and routine ballast water discharge within the aquaculture lease area is not anticipated, vessel movements associated with construction, maintenance, monitoring and harvesting activities have the potential to transfer marine organisms through hull fouling, sea chests, anchors, equipment and residual water retained onboard. These risks will be managed through vessel biosecurity procedures including the use of appropriately maintained vessels, pre-arrival inspections where required, compliance with applicable national ballast water and biofouling management requirements, routine cleaning and maintenance of vessel hulls and equipment, reporting of suspected marine pests or disease events, and implementation of the Project Biosecurity Plan.

Biosecurity controls relating to equipment, vessels and personnel are implemented in accordance with the Biosecurity Management Table (Appendix BM1) and include:

- assessment of all vessels and equipment prior to use
- regular cleaning and hull maintenance
- No release of ballast water near the farm area
- application of cleaning and handling protocols where required
- allocation of equipment to operational zones where feasible
- controlled personnel access and hygiene protocols
- management of movement between hatchery and offshore operations

14.0 Prohibited Matter Response Protocol

Prohibited Matter and Marine Pest Detection

The introduction or transfer of introduced marine pests (IMPs) via biofouling on vessels, ropes, moorings, anchors and infrastructure is a recognised pathway under the Biosecurity Act 2015 (NSW), under which certain marine pests are classified as prohibited matter or are otherwise notifiable. Where a suspected IMP or notifiable marine organism is detected in biofouling, the following response protocol applies:

1. **Isolate** – cease movement of the affected vessel, equipment or infrastructure to prevent further spread; do not clean or dislodge the organism into the water.
2. **Record and photograph** – document the organism, location and circumstances of detection in the biosecurity incident register.
3. **Notify** – report the suspected detection to NSW DPIRD Aquatic Biosecurity (and the Emergency Animal Disease Watch Hotline, 1800 675 888, where applicable) as soon as practicable, in accordance with the general biosecurity duty.
4. **Contain and manage** – undertake cleaning, removal or disposal only under direction and in a manner that captures and contains biological material on land (no in-water cleaning of suspected pests), in accordance with regulator advice.
5. **Review** – apply corrective actions and review preventive controls (vessel and equipment biofouling management, inter-site transfer restrictions) to prevent recurrence.

Routine biofouling management to minimise this risk is set out in Appendix BM1 (B47) and Appendix BC1 (BC9, BC10).

15.0 Biofouling Removal

Beyond its effect on kelp growth and biomass quality, biofouling is actively managed to prevent the cultivation infrastructure from acting as a propagation vector for native settling organisms – in particular the winged pearl-oyster *Electroma georgiana* ("butterfly shell") and mussel spat, which naturally settle on hard substrate in Disaster Bay. Although these species are native and already established on wild *Ecklonia radiata* and rocky reef in the bay, an unmanaged farm structure could provide additional artificial settlement habitat. Regular cleaning prevents this by removing settling spat while small, before it can mature, reproduce and contribute propagules to the surrounding environment.

The principle is that frequency keeps biomass minimal: when lines and infrastructure are cleaned on a routine cycle, fouling is removed at the spat or early-juvenile stage, when biomass and reproductive capacity are negligible and removal is simple and low-impact. This avoids the accumulation of mature fouling communities that are heavier, more difficult to remove, and capable of releasing larvae. Specific controls include:

- **Routine line cleaning** – horizontal backbone and surface lines are cleaned periodically by manual methods on a regular cycle, targeting fouling while biomass is low.
- **Removal of spat while small** – *Electroma* and mussel spat are removed during routine cleaning before reaching reproductive maturity, minimising any contribution to local propagule supply.
- **Annual removal of vertical dropper lines** – the principal settlement substrate is removed from the water each year during harvest/servicing, seasonally interrupting any population build-up on the farm.
- **No introduced species or novel host** – only locally sourced *Ecklonia radiata* is cultivated; the Project introduces neither a new species nor a new host substrate to the bay.
- **Natural dispersal context** – Disaster Bay's high flushing (1.5–2.5 day turnover) and wide (~9.8 km) ocean-facing mouth disperse any propagules across the open-coastal system rather than concentrating them near wild kelp beds, which are spatially separated (Greenglades ~1.1 km; Merrica River mouth several kilometres) and potentially at natural carrying capacity.

Through routine, frequent cleaning, the infrastructure is prevented from functioning as a meaningful propagule source for *Electroma georgiana*, mussel spat or other epibiota, addressing the risk of spread to wild *Ecklonia radiata* beds.

16.0 Waste and Environmental Interaction

The Eden-1 system does not generate operational waste (however, see Auskelp Waste Management Plan for further details). High level factors are as follows:

- no feed inputs

- no effluent discharge
- no chemical use

Any detached kelp biomass is biodegradable and native to the local environment. Where required, biomass may be removed as part of operational management in accordance with the Biosecurity Management Table (Appendix BM1).

17.0 Emergency Response

In the unlikely event of a biosecurity incident, response procedures are defined in the Biosecurity Management Table (Appendix BM1) and Biosecurity Control Table (Appendix BC1) include:

- isolation, relocation or removal of affected cultivation lines
- implementation of corrective actions
- notification to NSW DPIRD and relevant authorities where required

18.0 Disease Reporting

Disease and Notifiable Incident Reporting Auskelp will report suspected disease and other notifiable biosecurity events in accordance with the **Tables in Section 7** of this Biosecurity plan as required by the *Biosecurity Act 2015* (NSW) and the conditions of its aquaculture permit and lease. Reporting arrangements are:

- **Prohibited Matter** (Schedule 2, Biosecurity Act 2015) – e.g. *Sargassum muticum*, *Asterias amurens*, *Didemnum vexillum* etc. report immediately to an authorised officer via the **EAD Hotline 1800 675 888**.
- **Notifiable Matter** (Schedule 1, Biosecurity Regulation 2017) – e.g. *Undaria pinnatifida*, *Caulerpa taxifolia*, European fan worm etc: notify within one working day, by **EAD Hotline 1800 675 888**, or email aquatic.biosecurity@dpi.nsw.gov.au, or a NSW DPIRD authorised officer, or the online reporting form.

The Farm Manager (or Biosecurity Lead) is responsible for ensuring reportable events are notified, as required by the biosecurity incident register (Appendix BC1), and tracked to close-out (Appendix BM1, B49, B50).

19.0 Monitoring, Review and Audit

Monitoring, review and audit processes are undertaken in accordance with the Biosecurity Tables (Appendix BM1 and Appendix BC1) and will be reviewed annually.

Additional reviews will be triggered by:

- disease or biosecurity incidents
- regulatory changes
- significant environmental variation
- grouped to hatchery deployment of genetic strain

20.0 Integration with Monitoring and Maintenance Plan

This Biosecurity Management Plan is implemented through the Eden-1 Monitoring and Maintenance Plan and the Emergency Response Plan. All monitoring, operational controls, training and response procedures described in this document are operationalised within the MMP and detailed in the Biosecurity Management Tables (Appendix BM1 and Appendix BC1). These documents are all reviewed concurrently to ensure consistency, alignment with regulatory requirements, and continuous improvement of management practices.

21.0 Seedstock and Species

21.1 Species, provenance and genetic controls

- The Project cultivates only the native endemic NSW kelp species *Ecklonia radiata*.
- No exotic, introduced or non-native seaweed species are used at any stage of the Project.
- All broodstock is sourced exclusively from wild specimens collected within 10 km of the lease, within the Disaster Bay bioregion, maintaining genetic compatibility with surrounding wild populations and eliminating the introduction-of-non-native-species pathway responsible for most reported seaweed-aquaculture biosecurity incidents globally.
- Broodstock collection is undertaken only under a valid Section 37 permit issued by DPIRD Fisheries under the Fisheries Management Act 1994 (NSW), with >12 separate wild parent individuals used in each annual broodstock collection, and wild replenishment undertaken every 12 months throughout the operational life of the Project to maintain genetic diversity and continuing genetic exchange with wild populations.
- The plant is not removed, and no more than 5% of plant biomass is taken to obtain zoospore sori areas for propagation material, with collection approved under permit or to storm-cast (wrack) kelp.
- No genetically modified organisms (GMOs), gene-editing technologies, transgenic methods, induced polyploidy or other forms of artificial genetic modification are used at any stage of hatchery propagation, cultivation or deployment.
- Seedstock is deployed in cotton twine at an early juvenile sporophyte stage (approximately 1–3 mm length) to ensure attachment success. The deployed biomass is negligible relative to surrounding natural kelp ecosystems and is incapable of producing reproductive material. Deployment occurs at a relative scale that does not materially contribute to genetic interaction, introduction, pathogen amplification, habitat modification or alter other ecological processes.
- The Project will evaluate Reef Adapt and equivalent genetic tools for the mapping of local genetic seedstock provenance in Southern NSW, supporting alignment between cultivated provenance and natural population genetic structure.

21.2 Hatchery biosecurity and propagation controls

- Hatchery propagation occurs within a fully enclosed, controlled-access biosecure facility with separate entry and viewing zones, PPE protocols, life-stage separation (spores, gametophytes, sporophytes, juveniles), and pre-deployment health verification. All propagation work is conducted within a laminar flow hood, with autoclaved instruments and flasks used throughout to maintain aseptic conditions.
- Hatchery intake seawater is filtered to 1 µm and pasteurised, with pasteurised water used for all seed bank work and UV treatment applied during spore induction events, reducing the risk of pathogen, pest, propagule or contaminant introduction from surrounding marine waters.
- The hatchery water-source pathway – including proximity of intake to international shipping movements in Twofold Bay, a recognised introduced marine pest (IMP) vector – has been explicitly assessed within the Biosecurity Plan, with intake multi-stage filtration, pasteurisation and contamination-testing controls applied to manage that pathway.
- Ongoing contamination testing of hatchery water and culture tanks is undertaken for bacterial contamination (including *Vibrio* spp.), fungal spores, protozoa and algal competitors or pests (diatoms, cyanobacteria), with response procedures if abnormal results are detected.
- All incoming wild kelp material is inspected for disease, fouling and abnormalities prior to sori induction; and a population of pathogen-free broodstock is retained in an alternate hatchery facility as an emergency contingency in the event of a hatchery-wide incident.

22.0 Genetic Integrity and No Genetic Modification

No genetic modification of *Ecklonia radiata* will be undertaken at any stage of the hatchery, cultivation or deployment process. Auskelp does not use, and will not use, genetically modified organisms (GMOs), gene-editing techniques (including CRISPR or equivalent technologies), transgenic methods, induced polyploidy, or any other form of artificial genetic alteration in the production of seedstock or cultivated kelp.

All cultivated stock is derived from wild-sourced sporophytes collected within the Disaster Bay bioregion (within 10 km of the lease) through natural sexual reproduction – spore release and gametophyte culture – preserving the natural genetic diversity and local provenance of the wild population. Selective handling, where undertaken, is limited to the propagation of naturally occurring, high-performing local genotypes and does not involve any modification of the genome. This maintains genetic compatibility between the cultivated population and the surrounding wild *Ecklonia radiata* beds.

From a biosecurity perspective, the absence of genetic modification removes an entire category of risk:

- **No novel genetic material is introduced to the marine environment.** Because the cultivated kelp is genetically representative of the local wild population, any incidental release of spores, gametophytes or biological material from the farm carries no risk of introducing modified or non-local genetic material into wild *Ecklonia radiata* beds.
- **No GMO regulatory requirement.** The Project is not a dealing with a GMO under the *Gene Technology Act 2000* (Cth) and does not require a licence from the Gene Technology Regulator.
- **Provenance is tracked, not engineered.** Genetic tools used by the Project – including the evaluation of Reef Adapt (refer Section 23.0) – are limited to mapping and matching locally adapted provenance. They inform the *sourcing* of seedstock and do not alter the genome.
- **Local genetic integrity is preserved.** Maintaining the natural genetic diversity and local adaptation of the cultivated stock supports the resilience of, and compatibility with, the wild population, consistent with the genetic-integrity and provenance controls recorded at Appendix BM1 (B16) and the seedstock controls throughout this Plan.

23.0 Reef Adapt Evaluation

23.1 Evaluation of Reef Adapt for Local Seedstock Provenance

As requested by NSW DPIRD Fisheries, Auskelp will evaluate Reef Adapt as a tool for mapping and selecting locally adapted *Ecklonia radiata* seedstock provenance in Southern NSW. Reef Adapt is a genetic-provenance and assisted-gene-flow mapping framework used to match restoration and cultivation stock to local genetic and environmental conditions. Its use in this Plan is limited to informing the sourcing and provenance tracking of locally adapted seedstock – it does not involve, and is not a substitute for, any genetic modification of the species. The evaluation supports Auskelp's commitment to maintaining local genetic integrity and provenance (consistent with the no-genetic-modification position recorded at Appendix BM1, B16), and any adoption of Reef Adapt outputs will be undertaken in consultation with DPIRD Fisheries.

Appendix BM1 – Biosecurity Management Table (AL21/004)

Guideline	Management Response	Responsibility	When	Resources
Movement records (B1)	Maintain records of seedstock transfer, deployment, movement, harvesting and biomass condition	Farm Manager, Operations Manager	During all operations	B6: Monitoring and Maintenance Plan, B7: Environmental Management Plan
Health monitoring (B2)	Monitor growth, fouling, mortality and environmental conditions, photograph results	Farm Manager, Technicians	Every site visit	B6: Monitoring and Maintenance Plan, B7: Environmental Management Plan
Biosecurity responsibility (B3)	Farm Manager designated as Biosecurity Lead – responsible for biosecurity identification	Auskelp Management	Ongoing	B5: Biosecurity Plan
Staff training (B4–B5)	Staff trained in biosecurity, hygiene, monitoring and response procedures	Farm Manager, Operations Manager	Induction + annual	B5: Biosecurity Plan, B7: Environmental Management Plan
Defined biosecurity zone (B6)	Lease boundary defined by navigation markers; entry to designated hatchery and seedstock areas	Farm Manager, Operations Manager	Ongoing	B9: Construction Deployment Management Plan, B7: Environmental Management Plan
Assessment of inputs (B7)	All inputs assessed for biosecurity risk prior to entry	Farm Manager	Prior to deployment	B5: Biosecurity Plan, B7: Environmental Management Plan
Production unit identification (B8)	All longlines uniquely identified and tracked	Farm Manager, Vessel Skipper	Deployment and ongoing	B6: Monitoring and Maintenance Plan
Open system acknowledgement (B9)	Offshore system managed through monitoring and adaptive response	Vessel Skipper	Ongoing	B7: Environmental Management Plan
Access control (B10–B11)	Controlled access and visitor induction	Farm Manager, Technical staff	Prior to access	B5: Biosecurity Plan, B7: Environmental Management Plan
Personnel hygiene (B12)	Hygiene protocols including PPE and controlled movement in hatchery areas	All Staff	On entry/exit	B5: Biosecurity Plan
Restricted hatchery access (B13)	Hatchery access restricted and controlled	Hatchery Manager	Ongoing	B5: Biosecurity Plan
Zonal management (B14)	Farm operated in modules to limit spread	Farm Manager	Ongoing	B6: Monitoring and Maintenance Plan
Operational sequencing (B15)	Work from high health to low health areas	All Staff	All operations	B6: Monitoring and Maintenance Plan
Seedstock health (B16)	Only local, hatchery-controlled seedstock deployed, no genetic modification	Hatchery + Farm Manager	Prior to deployment	B5: Biosecurity Plan
Hatchery quarantine (B17)	Seedstock batches isolated and controlled	Hatchery Manager	Ongoing	B5: Biosecurity Plan
Backup seedstock (B18)	Maintain emergency pathogen-free broodstock in alternate hatchery facility	Hatchery Manager	Ongoing	B5: Biosecurity Plan
Treatment protocols (B19)	Apply treatments only where appropriate and compliant	Farm Manager	As required	B7: Environmental Management Plan
Movement between zones (B20)	Movement minimised; infected lines isolated or relocated	Farm Manager	As required	B6: Monitoring and Maintenance Plan
Isolation of infected lines (B21)	Isolate or remove affected lines	Farm Manager	Upon detection	B6: Monitoring and Maintenance Plan
Removal of biomass (B22)	Remove affected biomass where required	Farm Manager, Hatchery Manager	Upon detection	B8: Waste Management Plan, B6: Monitoring and Maintenance Plan
Open system constraints (B23–B25)	Open-water system; no physical exclusion—managed through monitoring and response	N/A	Ongoing	B7: Environmental Management Plan
Herbivory monitoring (B26)	Monitor grazing impacts and manage if required	Farm Manager	Ongoing	B1: Marine Fauna Interaction Plan, B6: Monitoring and Maintenance Plan
Equipment risk (B27)	Assess all equipment and vessels prior to use	Farm Manager	Prior to use	B5: Biosecurity Plan, B7: Environmental Management Plan
Equipment cleaning (B28)	Cleaning protocols implemented where required, no chemicals used offshore	All Staff	As required	B5: Biosecurity Plan, B6: Monitoring and Maintenance Plan

Guideline	Management Response	Responsibility	When	Resources
Equipment allocation (B30)	Allocate equipment to zones or clean between uses	Farm Manager	Ongoing	B6: Monitoring and Maintenance Plan
Environmental monitoring (B31)	Monitor water conditions and environmental indicators	Farm Manager, Vessel Skipper	Ongoing	B6: Monitoring and Maintenance Plan, B7: Environmental Management Plan
Cohort separation (B34)	Group seedstock by planting date and track digitally	Farm Manager	At deployment	B6: Monitoring and Maintenance Plan
No feed inputs (B35–B36)	No feed, fertilisers or nutrient inputs used in the marine environment	N/A	Ongoing	B7: Environmental Management Plan
Waste monitoring (B37)	Monitor detached biomass; no operational waste stream generated	Farm Manager	Ongoing	B8: Waste Management Plan, B6: Monitoring and Maintenance Plan
Waste handling (B38)	Manage biomass removal appropriately	Farm Manager, Vessel Skipper	As required	B8: Waste Management Plan
Incident response (B39)	Implement response procedures and notify authorities	Farm Manager, Vessel Skipper	Upon incident	B3: Emergency Response Plan, B5: Biosecurity Plan
Emergency training (B40)	Staff trained in emergency and incident response	Farm Manager	Induction + refresher	B3: Emergency Response Plan, B7: Environmental Management Plan
Plan review (B41)	Review every 12 months or triggered by events	Management	Annual	B5: Biosecurity Plan
Audit (B42)	Conduct audits in line with NSW DPIRD Fisheries guidance	General Manager	Periodically	B5: Biosecurity Plan
Harvesting (B43)	Harvesting prior to Stage 3 reproductive maturity unless for testing programs	Farm Manager, Science Lead	Annual	B5: Biosecurity Plan, B7: Environmental Management Plan
B44. Regulatory reporting obligations	Suspected disease, unusual mortality, invasive aquatic species, or other reportable biosecurity incidents will be reported to the relevant NSW authority in accordance with licence conditions and legal obligations.	Farm Manager	Upon detection of a reportable event	B5: Biosecurity Plan, B3: Emergency Response Plan
B45. Surveillance and testing compliance	Any required surveillance, sampling, testing or reporting under permit, lease or regulatory conditions will be undertaken in accordance with those requirements.	Farm Manager	As required by approvals or regulator	B5: Biosecurity Plan, B6: Monitoring and Maintenance Plan
B46. Licence and permit compliance	Only approved species, infrastructure, and operational practices will be used and maintained in accordance with lease, licence and approval conditions.	Auskelp Management, Farm Manager	Ongoing	B7: Environmental Management Plan, B5: Biosecurity Plan
B47. Introduced marine pest vigilance	Vessels, equipment and farm infrastructure will be monitored for signs of invasive or introduced marine species, with any suspected detections reported and managed promptly.	Farm Manager	Ongoing and prior to deployment/main maintenance activities	B5: Biosecurity Plan, B6: Monitoring and Maintenance Plan
B48. Biofouling management for vessels and equipment	Vessel hulls, ropes, moorings and operational equipment will be managed to minimise transfer of marine pests and nuisance fouling between locations.	Farm Manager	Prior to mobilising to site and during maintenance cycles	B5: Biosecurity Plan, B6: Monitoring and Maintenance Plan
B49. Record retention and audit trail	Biosecurity records, monitoring records, incident records and corrective actions will be retained in a form that supports audit, review and regulatory verification.	General Manager, Farm Manager	Ongoing	B5: Biosecurity Plan, B6: Monitoring and Maintenance Plan
B50. Corrective action close-out	Any identified biosecurity non-conformance, incident or monitoring trigger will be documented, assigned corrective actions, and tracked to close-out.	Farm Manager	Following any incident or audit finding	B5: Biosecurity Plan, B3: Emergency Response Plan
B51. Periodic biosecurity risk review	The farm biosecurity risk profile will be reviewed against new research, local observations, emerging pest/pathogen information and regulator guidance, and the Plan updated where required.	General Manager, Farm Manager	Annual review	B5: Biosecurity Plan

Guideline	Management Response	Responsibility	When	Resources
B52. Inter-plan consistency review	Biosecurity controls will be reviewed for consistency with the Monitoring and Maintenance Plan, Emergency Response Plan, Environmental Management Plan and Waste Management Plan.	General Manager	At each formal document review	B5: Biosecurity Plan, B6: Monitoring and Maintenance Plan, B7: Environmental Management Plan, B8: Waste Management Plan
B53. Zero Waste	All biomass produced from farm that is not food grade is shredded and fermented into liquid hydrolysate	General Manager	At harvest	B5: Biosecurity Plan, B6: Monitoring and Maintenance Plan, B7: Environmental Management Plan, B8: Waste Management Plan

Appendix BC1 – Biosecurity Control – Eden-1 (AL21/004)

Guideline	Management Response	Responsibility	When	Resources
Record Keeping and Surveillance				
BC1. Biosecurity incident register	A biosecurity incident register will be maintained to record all observed biosecurity issues, actions taken and outcomes to support traceability and review	Farm Manager	Upon any biosecurity observation or incident	B5: Biosecurity Plan, B6: Monitoring and Maintenance Plan
BC2. Data integration and review	Monitoring data (growth, fouling, mortality, environmental conditions) will be reviewed periodically to identify trends and emerging risks	Farm Manager	Ongoing and during formal reviews	B6: Monitoring and Maintenance Plan, B7: Environmental Management Plan
BC3 Biofoul / Spat Identification	Identify if <i>Electroma georgiana</i> (butterfly shell), mussel spat or other epibiota are present	Farm manager	Routine periodic cycle	B5: Biosecurity Plan, B6: Monitoring and Maintenance Plan
Staff Training				
BC4. Biosecurity awareness updates	Staff will be updated on emerging biosecurity risks, new research findings and regulatory changes relevant to seaweed aquaculture	Farm Manager	At least annually or as new information becomes available	B5: Biosecurity Plan, B7: Environmental Management Plan
Biofouling and spat removal				
BC5. Routine line cleaning and spat removal	Lines and infrastructure cleaned on a routine cycle; <i>Electroma georgiana</i> (butterfly shell), mussel spat and other epibiota removed while small to keep biomass minimal and prevent the farm acting as a propagule vector to wild kelp beds	Farm Manager	Routine periodic cycle + at line removal or harvest	B5: Biosecurity Plan, B6: Monitoring and Maintenance Plan
Property / Site Management				
BC6. Marine navigation and third-party interaction	Interactions with third-party vessels will be minimised and managed through defined navigation markers and awareness of lease boundaries	Farm Manager	Ongoing	B9: Construction Deployment Management Plan, B7: Environmental Management Plan
People				
BC7. High-risk activity declaration	Personnel will declare recent exposure to high biosecurity risk environments (e.g. other aquaculture sites, waterways) prior to accessing hatchery or operations	Farm Manager	Prior to site access	B5: Biosecurity Plan
BC8. Movement between facilities	Movement between hatchery, vessels and offshore operations will be controlled to minimise contamination risk	Farm Manager, Hatchery Manager	Ongoing	B5: Biosecurity Plan, B6: Monitoring and Maintenance Plan
Seaweed / Stock Management				
BC9. Performance-based stock selection	High-performing and healthy kelp lines will be preferentially selected for propagation and future seeding	Hatchery Manager	During seedstock selection cycles	B5: Biosecurity Plan, B6: Monitoring and Maintenance Plan
BC10. Early removal thresholds	Trigger thresholds for removal of affected lines (e.g. fouling, deterioration) will be defined and applied consistently	Farm Manager	Upon monitoring trigger	B6: Monitoring and Maintenance Plan, B7: Environmental Management Plan
Equipment, Vehicles and Vessels				
BC11. Vessel biofouling management	Vessel hulls and equipment will be maintained to minimise transfer of marine pests and biofouling organisms	Farm Manager	Prior to mobilisation and periodically	B5: Biosecurity Plan, B6: Monitoring and Maintenance Plan
BC12. Inter-site transfer restriction	Equipment and vessels will not be transferred between aquaculture sites without assessment and appropriate cleaning	Farm Manager	Prior to transfer	B5: Biosecurity Plan
Water				
BC13. Harmful algal bloom response	Environmental monitoring will be used to detect bloom conditions and trigger adaptive management actions (e.g. harvest timing, removal)	Farm Manager	Ongoing and during bloom events	B6: Monitoring and Maintenance Plan, B7: Environmental Management Plan
Waste				
BC14. Biomass decomposition monitoring	Detached kelp biomass will be monitored to ensure no localised environmental impact	Farm Manager	Ongoing	B8: Waste Management Plan, B6: Monitoring and Maintenance Plan

Guideline	Management Response	Responsibility	When	Resources
Emergency Procedures				
BC15. Multi-plan incident coordination	Biosecurity incidents will be managed in coordination with emergency, environmental and fauna interaction procedures	Farm Manager	Upon incident	B3: Emergency Response Plan, B1: Marine Fauna Interaction Plan, B7: Environmental Management Plan
Monitoring and Audit				
BC16. Continuous improvement and audit integration	Biosecurity controls, incidents and monitoring outcomes will be reviewed, recorded and integrated into ongoing improvement and audit processes	General Manager, Farm Manager	Ongoing and during formal reviews	B5: Biosecurity Plan, B6: Monitoring and Maintenance Plan, B7: Environmental Management Plan
Water Controls				
BC17. Hatchery water source control	Seawater collected primarily offshore, away from port, berths and discharge zones; dock collection only under suitable, lower-risk conditions. Source and conditions of each collection logged.	Hatchery Manager, Vessel Skipper	Each collection event	B5: Biosecurity Plan, B6: Monitoring and Maintenance Plan, B7: Environmental Management Plan
BC18. Hatchery water treatment	All collected seawater filtered (1 µm) and pasteurised/UV-treated before use, with culture systems isolated by life-stage to prevent cross-contamination.	Hatchery Manager	Each collection event	B5: Biosecurity Plan, B6: Monitoring and Maintenance Plan, B7: Environmental Management Plan
Harvesting				
BC19. Harvesting prior to Stage 3 reproductive maturity	Harvesting to be completed prior to reproductive maturity unless for testing purposes; visual sori monitoring on the blade is the operational trigger (independent of calendar age); site-specific reproductive-phase monitoring confirms timing (BRA Section 5)	Farm Manager, Science Lead	Every season	B5: Biosecurity Plan, B7: Environmental Management Plan
BC20. Zero Waste Operations	All biomass produced from farm (that is not food grade) is shredded and fermented into liquid hydrolysate; biomass not released into ocean environment. 100% biomass usage at harvest.	Farm Manager	Every harvest	B5: Biosecurity Plan, B6: Monitoring and Maintenance Plan, B7: Environmental Management Plan

Appendix BRA1 – Biosecurity Risk Assessment (pathway × receptor)

Inherent risk is rated before controls; residual risk after the controls in the Biosecurity Plan (Appendix C) and EMP. Residual cells are shaded by band (green = Negligible/Low; amber = Moderate). Document references: EIS = Environment Impact Statement; BP = Biosecurity Plan; EMP = Environmental Management Plan.

#	Hazard / pathway	Receptor(s)	Inherent L×C (band)	Key controls	Residual L×C (band)	Uncertainty / data gap
1	Introduced Marine Pest (IMP) establishment via third-party vessel hull biofouling / bilge	Lease infrastructure → adjacent wild <i>E. radiata</i> reef (≥1.1 km; Merrica River mouth 1.6 km)	Possible(4) × Severe(3) = 12 (High)	Vessel clean/inspect; hull, prop and bilge free of pests, sediment and algae (EMP s4.3); no ballast uptake/release in lease unless treated and logged (DAWE 2021); monthly and annual fouling inspection with organism classification; EAD Hotline 1800 675 888.	Rare(2) × Severe(3) = 6 (Moderate)	Moderate–High. Third-party vessels are not under proponent control; Eden is an international shipping destination; residual relies on detection and procedural compliance. Priority-managed pathway.
2	IMP / pathogen introduction via hatchery intake water (Twofold Bay; proximity to international shipping)	Hatchery stock → lease → wild reef	Possible(4) × Moderate(2) = 8 (Moderate)	Intake filtered to 1 µm and pasteurised; pasteurised water for all seed-bank work; UV treatment during spore induction; laminar flow hood with autoclaved instruments and flasks for all propagation work; recirculation isolated by life-stage; weekly testing for <i>Vibrio</i> spp., fungi/protozoa and algal competitors (EMP s3.2); batch quarantine.	Rare(2) × Minor(1) = 2 (Low)	Low–Moderate. Filtration/pasteurisation efficacy across all pathogen classes; laboratory detection limits.
3	Epibiont propagule spread (incl. <i>Electroma georgiana</i>) via natural dispersal	Adjacent wild <i>E. radiata</i> beds	Occasional(5) × Minor(1) = 5 (Moderate)	Annual removal of vertical dropper lines interrupts build-up; high flushing (1.5–2.5 day turnover) and wide ~9.8 km mouth disperse propagules; wild beds potentially at carrying capacity; periodic backbone cleaning.	Unlikely(3) × Negligible(0) = 0 (Negligible)	Low – species native and already established; evidence-based (EIS s9.4.1).
4	Pathogen / disease transmission from	Wild <i>E. radiata</i> ; reef faunal assemblage	Unlikely(3) × Moderate(2) = 6 (Moderate)	Native species / local provenance; no feed, chemical or veterinary inputs; harvest before Stage 3 reproductive	Rare(2) × Minor(1) = 2 (Low)	Moderate–High. Epidemiology of Australian seaweed pathogens poorly known; nil-

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#	Hazard / pathway	Receptor(s)	Inherent LxC (band)	Key controls	Residual LxC (band)	Uncertainty / data gap
	cultivated to wild kelp (waterborne)			maturity (BRA Section 5) and annual line removal limit host persistence; >1.1km separation from wild kelp stands; health-monitoring records (BP v2.3); emergency pathogen-free broodstock retained in alternate hatchery facility (BP s20.0).		outbreak record partly reflects limited surveillance, not proven absence.
5	Environment → farm pathogen entry and amplification on cultivated biomass	Cultivated stock → wild reef	Unlikely(3) × Moderate(2) = 6 (Moderate)	Annual removal of vertical dropper lines limits year-round host availability; no crowding-stress or water-quality amplification mechanism (autotroph, no feeding); sentinel monitoring; all stock removed at harvest; emergency pathogen-free broodstock retained in alternate hatchery facility.	Rare(2) × Severe(3) = 6 (Moderate)	Moderate – host-amplification dynamics at 100 ha commercial scale untested under Australian conditions; increasing ocean temperatures may change pathogen dynamics.
6	Disease / pest via broodstock collection and stock movement	Wild beds (collection sites); hatchery; lease	Possible(4) × Moderate(2) = 8 (Moderate)	Single native species; local provenance only; min. 12 wild parent/collection added every 12 months; s37 permit; incoming wild kelp zoospores inspected and pre-induction (BP B17); microscopic detection; single-direction provenance (no inter-regional translocation).	Rare(2) × Minor(1) = 2 (Low)	Low – well-controlled, evidence-based.
7	Pest / pathogen via equipment sharing or reuse	Lease; hatchery; wild reef	Possible(4) × Minor(1) = 4 (Low)	Movement records (BP B1); zone separation, biosecure hatchery, handwashing (BP B10–B13); laminar flow hood with autoclaved instruments and flasks for all propagation work; 30-day hatchery contamination, observation and cleaning protocols; equipment-cleaning protocols.	Rare(2) × Minor(1) = 2 (Low)	Pest pathogen relocated from Twofold Bay due to unknown vector; international shipping; algal bloom effects.

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#	Hazard / pathway	Receptor(s)	Inherent LxC (band)	Key controls	Residual LxC (band)	Uncertainty / data gap
8	Genetic dilution / loss of local adaptation via gene flow	Wild E. radiata population, Disaster Bay	Possible(4) × Minor(1) = 4 (Low)	Harvest before Stage 3 reproductive maturity (BRA Section 5; visual sori monitoring as operational trigger) – cultivated stock releases no spores/gametes in open water; local genotype only (swamping, not hybridisation); min. 20 wild parents; wild replenishment addition of 12 wild parents every 12 months; provenance database; Reef Adapt; no GMO.	Remote(1) × Minor(1) = 1 (Low)	Moderate – population-genetic effects of large-scale local-genotype cultivation not well characterised for E. radiata; size-dependent reproductive-maturity threshold under continuing investigation (BRA Section 5).
9	Nuisance fouling reducing stock health or acting as host reservoir	Cultivated stock; infrastructure	Occasional(5) × Minor(1) = 5 (Moderate)	Weekly visual and annual diver inspection with fouling classification and cleaning thresholds (EMP s2.5); annual servicing. Removal of kelp lines after each harvest.	Unlikely(3) × Negligible(0) = 0 (Negligible)	New fouling organisms currently not anticipated; algal blooms; water quality events affecting reservoir dynamics.
10	Climate-stress amplification of disease/pest likelihood (cross-cutting modifier on rows 4, 5, 9)	Cultivated and wild kelp	Modifier – raises likelihood of disease/pest pathways under heatwave / EAC conditions	Adaptive genetic diversity; >3 yr cultivation data; adaptive management; ongoing research and development.	Moderate(3) × Severe(3) = 9 (Moderate)	Moderate – explicitly carried; difficult to anticipate the effects of rising ocean temperatures on wild kelp stands and the subsequent effect on farmed kelp growth rates.
11	Disposal of harvested biomass, fouling organisms and damaged infrastructure creating waste, marine debris or biosecurity pathways	Marine environment, marine fauna, reef habitats	3 × 3 (Moderate)	All harvested biomass, including incidental fouling organisms, is recovered and processed into food-grade products or biostimulants. Damaged ropes, floats and infrastructure are recovered and recycled or disposed of at approved waste facilities. No biomass or	Remote(1) × Minor(1) = 1 (Low)	Fouling rates vary seasonally and between years

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#	Hazard / pathway	Receptor(s)	Inherent LxC (band)	Key controls	Residual LxC (band)	Uncertainty / data gap
				operational waste is intentionally discarded at sea (BP B51)		

Appendix HAZ1 – Biosecurity Monitoring, Triggers and Responses

Exceedance of any trigger feeds the adaptive-management cycle via the three-yearly third-party audits (Mitigation Measures CE3 RE1, RE3) and DPIRD's retained power to vary, suspend or cancel the permit. Items shown in square brackets are calibration values to be finalised – see Section 8.

Hazard (BRA1 ref)	Indicator monitored	Method & frequency	Trigger threshold	Management response	Detection limitation
Introduced Marine Pest (IMP) / novel organism (1, 2)	Presence of unfamiliar / non-native species on infrastructure or in biofouling	Weekly visual (vessel + underwater drone, EMP s2.2); annual diver inspection with organism classification (s2.5)	Any organism not identifiable as local native biota	Photograph in situ; do not dislodge into water; isolate component if practicable; notify EAD Hotline 1800 675 888 and DPIRD Aquatic Biosecurity; suspend movements pending advice	Visual methods miss cryptic / microscopic IMPs and early settlement
Kelp disease / unexplained farm mortality (4, 5)	Kelp condition, lesions, discolouration, die-off, growth rate	Monthly growth/canopy analysis and health-monitoring records (EMP s2.4; BP v2.3)	Deterioration or mortality exceeding 50 % against rolling monthly baseline	Sample affected material; record; notify DPIRD; quarantine / early-harvest affected line, determine source or contributing factors (BP v2.3)	Visual inspection cannot detect sub-clinical pathogens
Hatchery contamination (2)	Vibrio spp., fungi/protozoa, algal competitors in water and tanks	Weekly laboratory testing (EMP s3.2)	Any positive detection above method threshold	Batch quarantine; disinfect water system; isolate affected life-stage; hold seedstock release	Laboratory detection limits; weekly interval – mitigated by life-stage isolation
Biofouling load on equipment (6, 3)	Persistent fouling cover; epibiont density	Weekly visual; annual diver classification (EMP s2.5)	Fouling beyond defined acceptable threshold on annual inspection, weighing down rigs	Manual cleaning of infrastructure / additional floats	fouling accumulation may occur between monitoring events
Vessel / equipment transfer (1, 7)	Hull, prop and bilge cleanliness; movement records	Pre-entry inspection; movement log (BP G1; EMP s4.3)	Visible fouling / sediment / algae, or undocumented movement	Clean and re-inspect before lease entry; no ballast exchange in lease; record	Relies on procedural compliance – audit point at three-yearly review

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Hazard (BRA1 ref)	Indicator monitored	Method & frequency	Trigger threshold	Management response	Detection limitation
Genetic integrity (8)	Provenance of all collections; broodstock parentage; harvest timing v. maturity	Provenance/genetic-spatial database per collection (EMP s3.1); visual sori monitoring as operational trigger (BRA Section 5)	Collection outside Disaster Bay bioregion <10 km; <12 wild parents added to parent stock every 2 years	Reject batch and recollect to provenance rule; bring harvest forward to precede fertility; Reef Adapt cross-check	Population-genetic monitoring periodic, not continuous; maturity threshold under investigation
Climate stress (10)	Sea-surface temperature; heatwave conditions; stock condition under stress	Monthly water-parameter logging (EMP s2.4); seasonal monitoring	Sustained seawater temperatures exceeding 24°C for a period of 7 days or more, coinciding with observable declines in kelp stock condition, including reduced growth rates, tissue degradation, discoloration, increased fouling, disease symptoms, abnormal mortality, or other indicators of physiological stress.	Heighten disease surveillance; review risk ratings; adaptive management; report to DPIRD	SST logging point-in-time; links to disease onset are inferential
Zero Waste Operations (0,1)	Biomass and percentage of fouling	Determined at harvest	N/A	All biomass produced from farm that is not food grade is shredded and fermented into liquid hydrolysate	All biomass physically recovered and processed

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