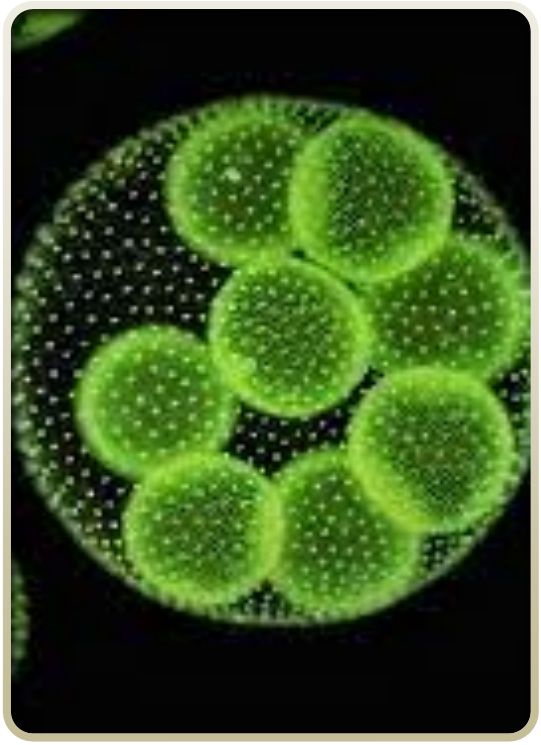
ENVIRONMENTAL MANAGEMENT PLAN (EMP)

Proposed Integrated Seawater Aquaculture & Marine Microalgae Project

Lüderitz, //Karas Region, Namibia



Application Number	241207005057
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Date	23 August 2025

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Abbreviations

Abbreviation	Full Term
EMP	Environmental Management Plan
EIA	Environmental Impact Assessment
ECC	Environmental Clearance Certificate
MEFT	Ministry of Environment, Forestry and Tourism
MFMR	Ministry of Fisheries and Marine Resources
MAWLR	Ministry of Agriculture, Water and Land Reform
NSI	Namibia Standards Institution
NAMPORT	Namibia Ports Authority
BIPA	Business and Intellectual Property Authority
PPE	Personal Protective Equipment
OHS	Occupational Health and Safety
BOD	Biochemical Oxygen Demand
COD	Chemical Oxygen Demand
SDGs	Sustainable Development Goals
QA/QC	Quality Assurance / Quality Control
CSR	Corporate Social Responsibility
HAB	Harmful Algal Bloom
HIRA	Hazard Identification and Risk Assessment
SOP	Standard Operating Procedure
CO_2	Carbon Dioxide

1. Introduction

This Environmental Management Plan (EMP) sets out the environmental and social management framework, mitigation measures, roles and responsibilities, monitoring requirements, and reporting procedures for the Integrated Seawater Aquaculture & Marine Microalgae Project in Lüderitz. The project integrates low-impact, climate-smart aquaculture (shrimp/tiger prawns, sea cucumbers), marine microalgae cultivation, and halophyte agriculture utilising nutrient-rich seawater from the Benguela Current.

The EMP applies to all phases—planning and design, construction, operation, and decommissioning—and is binding on the proponent, employees, contractors and sub-contractors. The EMP aligns with the Environmental Management Act (No. 7 of 2007) and EIA Regulations (GN 30 of 2012), the Marine Resources Act (No. 27 of 2000), Aquaculture Act (No. 18 of 2002), Water Resources Management Act (No. 11 of 2013), the Labour Act (No. 11 of 2007), and applicable international good practice (FAO Code of Conduct for Responsible Fisheries; relevant MARPOL Annexes for vessel operations).

2. Project Description

The project footprint is approximately 10 ha on barren coastal land in the Lüderitz area with road access via the B4 and existing gravel spurs. Core components include:

- Seawater intake and pumping system with screens;
- Aquaculture ponds/tanks for shrimp/prawns and sea cucumbers;
- Marine microalgae cultivation in photobioreactors and open raceways;
- Halophyte plots irrigated with treated aquaculture effluent (e.g., Salicornia spp.);
- Brine and nutrient management with closed-loop recirculation;
- Processing, cold chain, and packing area;
- Solar PV and backup generation;
- Administration, training centre, workshop and stores;
- Internal access ways, stormwater controls, and bunded chemical stores.

Figure 1. The location map of the allocated site shaded in green.

2.1 Objectives & Benefits

• Avoid freshwater use by utilising seawater and nutrient recycling.

• Create 30–40 permanent jobs and 100–150 indirect jobs prioritising local residents.

• Generate high-value products (algae biomass, shrimp, sea cucumber, halophyte seed/oil, salt) for domestic and export markets.

• Enhance climate resilience via carbon sequestration (halophytes/microalgae), wind-resistant infrastructure, and circular resource use.

• Build regional capacity through a skills and training centre.

Figure 2. The barren land on the left and how the land will be developed after the aquaculture project.

2.2 Key Design Assumptions

• Seawater quality supports targeted aquaculture species and algae strains; pre-treatment (UV/filtration) installed.

• Recirculating Aquaculture System (RAS) principles applied to minimise discharge; overflow/bleed only via permitted outfalls.

• Solar PV meets a portion of base load; backup generators sized for critical pumps and biosecurity systems.

• Site layout avoids ecologically sensitive zones and respects coastal setback requirements.

3. Legal and Regulatory Framework

Legislation/Standard	Relevance to Project
Environmental Management Act, 2007 (Act 7) & EIA Regulations, 2012 (GN 30)	EIA, public participation, ECC, compliance reporting.
Marine Resources Act, 2000 (Act 27)	Licensing for marine aquaculture, protection of marine biodiversity; benthic assessments if seabed-based culture is used.
Aquaculture Act, 2002 (Act 18)	Zoning, disease control, biosecurity, feed standards and veterinary inspections.
Water Resources Management Act, 2013 (Act 11)	Water use licensing for large-scale seawater abstraction and discharge quality control.
Labour Act, 2007 (Act 11) & OHS Regulations	Fair labour conditions, PPE, hazard control, training and incident reporting.
Hazardous Substances Ordinance, 1974	Registration, safe storage and disposal of hazardous chemicals and fuels.
Public and Environmental Health Act, 2015 (Act 1)	Sanitation, potable water for staff, food safety and disease reporting.
MARPOL 73/78 (as applicable)	Pollution prevention standards for vessels used in supply/transport, oil/garbage/sewage controls.
National Heritage Act, 2004 (Act 27)	Chance-finds procedure for heritage resources and fossils.
Road Traffic & Transport Act, 1999 (Act 22)	Vehicle roadworthiness, transport of goods/chemicals.

3.1 Permit & Licence Tracker

Permit/Authorisation	Authority	Timing	Status
Environmental Clearance Certificate (ECC)	MEFT Environmental Commissioner	Post-EIA, pre-construction	Pending/To be applied
Marine Aquaculture Licence	MFMR	Pre-operation	Pending/To be applied
Water Use / Abstraction Authorisation	MAWLR	Pre-construction	Pending/To be applied
Effluent/Discharge Authorisation	MAWLR / MEFT	Pre-operation	Pending/To be applied
Hazardous Substance Registration	MoHSS / Chemicals Board	Before chemical procurement	Pending/To be applied
Building Permits & Zoning Consent	Lüderitz Town Council	Pre-construction	Pending/To be applied
Fire Safety Clearance	Municipal Fire Brigade	Pre-commissioning	Pending/To be applied

4. Baseline Environment (Summary)

• Climate & Wind: Arid coastal desert climate influenced by the Benguela Current; strong southerly winds and fog events common.
• Geology & Soils: Coastal sediments and bedrock; saline soils expected near the shoreline; low agricultural potential.
• Hydrology & Marine: Marine environment dominates; near-shore habitats may include rocky shores, kelp beds, and sandy substrates.
• Biodiversity: Marine mammals, seabirds, and intertidal/nearshore communities present; sensitive periods for breeding/roosting to be respected.
• Socio-economic: Lüderitz economy driven by fishing, port, tourism, and energy developments; high demand for jobs and skills.
• Cultural Heritage: Archaeological/heritage sensitivity possible; a formal chance-finds procedure will be followed.
Full baseline datasets (water, sediments, benthos, noise, air/dust, traffic) will be maintained in the project's environmental file and updated during monitoring.

5. Impact Assessment Methodology

Impacts are evaluated using a four-factor matrix: Magnitude, Duration, Extent, and Probability (each scored 1–5). The Impact Severity Score is the product of these factors (max. 625). Severity levels: Low (1–24), Moderate (25–59), High (60–100), and Critical (>100). High and Critical impacts require strong mitigation and close monitoring.

Criterion	Scale (1–5)	Description
Magnitude	1–5	Negligible to severe effect on receptor
Duration	1–5	Temporary to permanent
Extent	1–5	Site-specific to regional
Probability	1–5	Rare to definite

6. Environmental and Socio-Economic Impacts & Mitigation Measures

6.1 Planning & Design Phase

Impact	Mitigation / Design Measure	Responsibility
Inadequate land use/zoning alignment	Engage Lüderitz Town Council early; obtain zoning consent; respect coastal setbacks; integrate storm surge levels.	PM, Consultant
Sensitive habitat siting	Avoid bird roosts, seal haul-outs, and kelp beds; buffer from high-water mark; micro-siting after walk-down.	PM, Environmental Officer
Stakeholder conflict	Early and ongoing engagement; record concerns; incorporate feasible design changes; SEP in place.	PM, CSR Coordinator
Climate & extreme wind loads	Apply wind-resistant designs; secure tanks/pond liners; emergency tie-downs; redundancy for pumps.	Engineer
Cumulative/visual impacts	Low-profile structures; colour schemes matching landscape; maintain tidy site boundaries.	Engineer, PM

6.2 Construction Phase

Impact	Mitigation / Management Action	Responsibility
Habitat disturbance & clearing	Limit works to demarcated footprint; no-go buffers; pre-construction walk-down and toolbox talks.	Contractor, Env. Officer
Dust & noise	Water bowsers for dust; cover loads; daylight hours; maintain equipment; provide ear/eye PPE.	Contractor
Stormwater & erosion	Temporary drains, silt traps, berms; stabilise stockpiles; rehabilitate promptly.	Contractor, Engineer
Waste generation	Segregate, label, and remove to licensed facilities; no burying/burning; monthly waste	Contractor

	logs.	
Fuel & chemical spills	Bunded storage; drip trays; spill kits; training; report and clean within 24h.	Contractor, Safety Officer
Traffic safety	Driver induction; speed limits; warning signage; restrict night driving where possible.	Contractor
OHS risks	HIRA; method statements; induction; PPE; first-aid and firefighting equipment onsite.	Safety Officer

6.3 Operational Phase

Impact	Mitigation / SOP	Responsibility
Seawater/brine discharge quality	Closed-loop RAS; treat bleed streams (screening/settling/UV/biological polishing); discharge only via authorised outfall.	Operations Manager
Nutrient enrichment / HAB risk	Routine nutrient controls (N/P), chlorophyll-a monitoring; adjust feed rates; maintain algae system balance.	Algae Scientist, Aquaculture Manager
Biosecurity & disease	Quarantine new stock; footbaths; vector control; SOPs for mortalities; veterinary oversight; record-keeping.	Aquaculture Manager
Solid waste (organic/plastics)	Compost organics where suitable; recycle plastics; secure bins; contracts with licensed recyclers/landfill.	Ops Manager
Energy consumption & emissions	Maximise solar; efficient pumps; preventive maintenance; energy metering.	Facilities Engineer
Chemical & hazardous waste	Register chemicals; SDS onsite; bunded stores; consignment notes; compliant disposal.	Safety Officer
Community relations	Local hiring; transparent grievance mechanism; periodic open days and reporting.	CSR Coordinator

6.4 Decommissioning Phase

Impact	Mitigation / Management Action	Responsibility
Infrastructure removal impacts	Dismantle in phases; reuse/recycle materials; dust suppression; noise control.	PM, Contractor
Contamination risks	Test soils; remove contaminated media; close and clean ponds; certify with lab results.	Env. Officer
Visual & land stability	Regrade to stable contours; re-establish native vegetation where feasible.	Contractor
Socio-economic transition	Advance notice to staff; training/redeployment support; community engagement on future land use.	PM, CSR Coordinator

7. Monitoring Plan

Aspect	Frequency	Parameters	Method	Responsibility	Reporting
Seawater intake	Monthly	TSS, turbidity, salinity, temperature	Field probe & lab	Ops Manager	Quarterly to MEFT/MFMR
Discharge/bleed stream	Monthly	BOD, COD, nutrients (TN/TP), salinity, pH, chlorophyll-a	Lab (NSI-accredited)	Env. Officer	Quarterly to MEFT/MAWLR
Pond water quality	Weekly	DO, pH, ammonia, nitrite, nitrate, temperature	Field kits & probes	Aquaculture Manager	Internal
Soil salinity (perimeter)	Quarterly	EC, pH	Soil sampling	Env. Officer	Internal
Solid waste	Monthly	Volumes by stream; consignment notes	Weighbridge/records	Ops Manager	Internal
Noise & dust (construction)	Monthly	dB(A); dust fall	Noise meter; dust buckets	Contractor	Internal
Biodiversity (indicator species)	Bi-annually	Presence/abundance; seabird/shoreline checks	Field survey	Env. Officer	Annual to MEFT
Energy use	Monthly	kWh from PV/gen; diesel use	Meters & logs	Facilities Engineer	Internal
Employment/trai	Quarterly	Headcount; %	HR records	CSR	Internal

ning		local; gender; training sessions		Coordinator	

8. Environmental Specifications for Contractors

All contractors shall comply with this EMP and submit method statements covering site establishment, materials storage, hazardous substances handling, waste management, spill response, stormwater control, and rehabilitation. Daily housekeeping, weekly inspections, and a register of incidents/near-misses are mandatory. Toolbox talks must be held at least weekly.

9. Emergency Response & Contingency Plan

Trigger events include fire, major spill, structural failure of tanks/ponds, disease outbreak in stock, marine harmful algal blooms, extreme wind/storm surge, and serious injury. The Project Manager maintains the Emergency Contacts List and ensures annual drills.

Scenario	Immediate Actions
Fire	Raise alarm; evacuate to muster point; fight only if trained; call municipal fire brigade; isolate power/fuel; incident report within 24h.
Fuel/Chemical Spill	Stop source; contain with booms/absorbents; protect stormwater; collect contaminated media for licensed disposal; notify authorities if reportable.
Biosecurity/Disease	Quarantine affected units; veterinary inspection; adjust stocking/feeding; disinfect; record mortalities; communicate to MFMR if required.
Storm/King Tide	Secure loose items; shut non-essential systems; ensure backup power for life-support pumps; post-event inspection checklist.
Worker Injury	First aid; call ambulance if needed; secure area; record incident; investigate root cause; implement corrective actions.

10. Waste & Chemicals Management

Implement a waste hierarchy: avoid, reduce, reuse, recycle, recover, and dispose as last resort. Maintain a waste register and consignment notes. Hazardous wastes (oily rags, chemical containers, spent filters) are stored in bunded, ventilated stores and removed by licensed contractors. If vessels are used, comply with relevant MARPOL Annexes for sewage, garbage and oil. Maintain Safety Data Sheets (SDS) and chemical inventory; label containers and ensure secondary containment.

11. Biosecurity & Stock Health SOPs

- Quarantine new stock; health certificates for imports.
- Control vectors (insects, birds) and restrict visitor access to culture areas.
- Disinfection barriers (footbaths, hand-wash); dedicated equipment per unit.
- Mortality handling: collect daily; store in sealed containers; render/compost or dispose via licensed facility.
- Record keeping: water quality, feed conversion, treatments, mortalities.

12. Stakeholder Engagement & Grievance Mechanism

A Stakeholder Engagement Plan (SEP) will guide ongoing communication with authorities, neighbouring users, fishing associations, and the broader community. A grievance log will register, investigate, and close out complaints within 7 working days where practicable. Feedback will be provided in writing or via community meetings.

13. Roles and Responsibilities

Role	Key Responsibilities
Project Director (Proponent)	Overall accountability, resources, and compliance oversight.
Project Manager	EMP implementation, permits, contractor control, reporting to authorities.
Environmental Officer	Monitoring, audits, biodiversity checks, training, record keeping.
Safety Officer	OHS compliance, HIRA, emergency drills, chemical safety.
Aquaculture Manager	RAS performance, stock health, biosecurity, water quality.
Algae Scientist/Technician	Strain management, photobioreactor efficiency, CO_2 dosing, yields.
Facilities Engineer	Pumps, power, preventative maintenance, stormwater systems.
CSR Coordinator	Local hiring, training programmes, grievance handling, reporting.
Contractors	Method statements, compliance with specs, housekeeping, incident reporting.

14. Reporting, Audits & Review

- Monthly internal environmental checks and waste logs.
- Quarterly monitoring reports to MEFT/MAWLR/MFMR where applicable.
- Annual environmental performance review and EMP update if required.
- Incident/near-miss report within 24 hours; corrective action tracking.
- External audit at least every two years or as required by the ECC.

15. Decommissioning & Site Closure

Decommissioning will follow an approved Closure Plan: inventory assets, drain and clean systems, remove hazardous materials, validate soils/sediments, and rehabilitate landforms. A final environmental audit will confirm compliance, and any residual impacts will be addressed to achieve acceptable post-closure land use agreed with authorities and stakeholders.

Appendices (Templates)

A. Monitoring Data Sheet Templates (water quality, soil salinity, biodiversity)

B. Incident & Spill Report Form

C. Emergency Contacts List

D. Training & Induction Log

E. Chance-Finds Procedure (stop-work, secure area, notify MEFT/Heritage Council)