KELP BLUE TRADING (Pty) Ltd

ENVIRONMENTAL MANAGEMENT PLAN

FOR THE PROPOSED

GIANT KELP CULTIVATION PROJECT

NEAR LÜDERITZ, //KHARAS REGION

COMMERCIAL SCALE PROJECT

Prepared for: Kelp Blue Trading (Pty) Ltd

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Acronyms and Abbreviations

Acronym / Abbreviation	Definition
BCLME	Benguela Current Large Marine Ecosystem
BID	Background Information Document
CSIR	Council for Scientific and Industrial Research
DEA	Directorate of Environmental Affairs
DNA	Deoxyribonucleic acid
EBSA	Ecologically or Biologically Significant Marine Areas
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPL	Exclusive Prospecting Licences
ha	Hectare
HDPE	High-Density Polyethylene
IBA	Important Bird Area
I&AP	Interested and Affected Parties
MEFT	Ministry of Environment, Forestry and Tourism
MFMR	Ministry of Fisheries and Marine Resources
ML	Mining Licence
MME	Ministry of Mines and Energy
MPAs	Marine Protected Areas
NIMPA	Namibian Islands' Marine Protected Area
(Pty) Ltd	Proprietary Limited
TAC	Total Allowable Catch

ENVIRONMENTAL MANAGEMENT PLAN FOR THE PROPOSED GIANT KELP CULTIVATION PROJECT NEAR LÜDERITZ, //KHARAS REGION

1 INTRODUCTION

1.1 THE KELP BLUE PROJECT

Taking advantage of the favourable conditions off the coast of Southern Namibia the privately owned company Kelp Blue Trading Pty. Ltd. ('Kelp Blue') has conducted considerable research into the cultivation of giant kelp and a pilot study to provide proof of the concept. The proposed infrastructure design options were tested and adapted for the commercial phase, while the assumed growth rates, harvestability of the giant kelp, sustainability and costs were validated. Environmental monitoring are carried out to find out if the project has harmful effects on the marine ecosystem. The company is now proposing a feasible commercial-scale project at two sites with a combined extent of ~9,650 hectares (ha) (i.e. effective area of ~ 6,120 ha with navigation space between the plots) near Lüderitz (Figure 1).

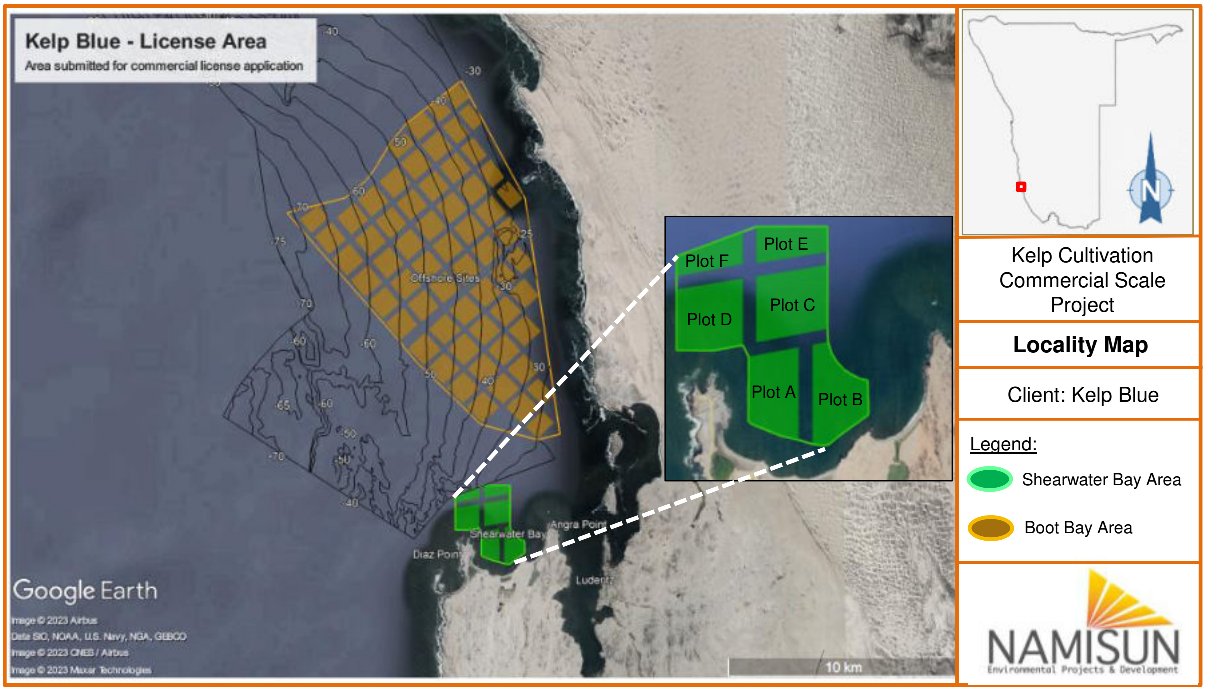

FIGURE 1: PROPOSED KELP FARMING SITES

(Ref: Google Earth)

Likely benefits that would emanate from kelp cultivation include the establishment of a new form of farming that produces essential goods in a sustainable and environmentally positive manner, reduces carbon dioxide and boosts marine biodiversity. The project is expected to create about 200 direct jobs when it reaches its full capacity by 2029, having a positive direct and indirect impact on livelihoods and contributing significantly to the local economy.

This Environmental Management Plan (EMP) has been prepared in conjunction with the Environmental Impact Assessment (EIA) of the proposed commercial kelp cultivation project. The current EIA report is an amendment of the previous EIA Scoping & Impact Assessment Report and EMP for the pilot phase (Namisun, 2020).

The amended EIA and EMP are based on updated specialist studies that consider any new impacts that may arise from the larger scale of the commercial operation. The amended EMP is designed to meet the legal requirements[1], avoid or minimise any negative impacts and enhance the positive outcomes associated with the implementation of the proposed kelp cultivation, considering all associated activities and proposed project changes.

1.2 THE EIA TEAM

Namisun Environmental Projects and Development is an independent environmental consultancy firm appointed by Kelp Blue Namibia to undertake the EIA and prepare the EMP. Specialist studies were conducted by the following team of experts:[2]

- Marine specialist report: Dr Andrea Pulfrich, Pisces Environmental Services (Pty) Ltd
- Biology, ecology and aquaculture of kelps: E/Prof John J Bolton's
- Marine mammals and turtles: Dr Jean-Paul Roux
- Seabirds and marine protected areas: Dr Jessica Kemper
- Fisheries study: Dave Japp and Sarah Wilkinson of CapMarine (Pty) Ltd
- Heritage: Vanessa Maitland

[1] Please refer to Chapter 3 of the EIA Amendment Report for a list of relevant legislation and international conventions

[2] Please refer to Appendices F & G of the EIA Report for a summary of their expertise

1.3 KEEPING THE EMP CURRENT

Kelp Blue will conduct Bi-Annual reviews of the EMP should circumstances change.

Should a listed activity(s) as defined in the Environmental Impact Assessment Regulations: Environmental Management Act (EMA), 2007 (Government Gazette No. 4878) be triggered (as a result of future modifications/changes), this EMP will be required to be updated through another EIA process as stipulate in the EMA and its Regulations.

2 PROJECT OVERVIEW

Kelp Blue has conducted a successful pilot test to grow giant kelp at Lüderitz, achieving growth rates of 4-5 m in three months, and now want to establish two large kelp farms, starting in January 2024. Kelp Blue will harvest the canopy of the kelp forests at regular intervals to produce an agricultural growth stimulant and a variety of value-added products. Over time, Kelp Blue intends to extend its operations to 70,000 hectares, taking advantage of the optimal nutrient and temperature conditions that exist in this area to create the largest man-made kelp forest on the planet. The current project that forms the subject of this EIA amendment is however limited to two kelp farms, one of ~9,000 hectares (ha) extent (i.e. effective area of ~ 5600 ha with navigation space between the plots) in deeper waters off Boot Bay and a ~ 650 ha site (i.e. effective area of ~ 520 ha with navigation space between the plots) in shallower water at Shearwater Bay in the area of the current pilot tests, which are already providing positive evidence of significant environmental benefits arising from kelp cultivation (Figure 1).

The water depths at the Boot Bay site is up to ~ 70 m. This site will be the main centre of Kelp Blue's offshore operations. The layout of the farms will include open channels for sailing and wildlife movement separating individual kelp islands of 30 hectares maximum size each. The Shearwater Bay site is situated in water of ~ 6 - 30 m depth and is more sheltered than Boot Bay. Kelp Blue has been experimenting here with different methods of growing kelp, including a very promising technique of creating bottom-based artificial substrates. The commercial expansion of kelp farming and processing will involve the following activities (refer to Chapter 4 of the EIA Amendment Report for details):

- Expand the existing onshore hatchery where kelp will be grown from cultures partly harvested at the company's own kelp farms and partly imported from overseas.
- Assemble new multiple floating cultivation arrays and bottom-based reef-structures with seed-lines, transport them to the farm sites in Shearwater Bay and Boot Bay, and anchor the arrays at between 7 - 30 m (Shearwater Bay) and 40 m - 75 m (at Boot Bay) water depths.
- Operate small boats to install arrays and structures on the seabed and place lines impregnated with sporophytes on the growth media.
- Use various vessels to monitor kelp growth, various environmental factors and condition of structures, and to harvest kelp.
- Set up a processing factory process kelp, sell final products.
- Conduct horticultural field trials to test kelp products on different crops and vegetables.

- Run a laboratory to monitor product quality and, most importantly, to conduct research and develop new kelp products.

3 ENVIRONMENTAL MANAGEMENT

3.1 AIM OF THE EMP

The aim of this Environmental Management Plan (EMP) is to summarise the actions required to meet the legal requirements and to effectively implement mitigate and manage negative impacts and enhance positive impacts associated with the construction and operation phases of the proposed kelp cultivation project. Decommissioning and closure measures have not yet been specified. The plan is based on the environmental objectives that have been identified in the EIA process. The responsibilities for EMP implementation are identified for the early stage of the commercial project development.

The commitments contained in this EMP form the overarching contractual agreement for sound environmental management with the Namibian authorities. All employees, contractors and sub-contractors and any visitors to site will be expected to comply with the relevant commitments contained in this document.

3.2 IDENTIFIED IMPACTS AND THEIR SEVERITY

Understanding the biophysical and human environment in which a project is planned is the first step to understanding its environmental impacts (see Chapter 6 of the EIA Amendment Report). The next step is to identify the environmental aspects that may be affected by the project and gauge the severity of the potential impact (Chapter 8).

Table 1 on the next page provides a summary of the key environmental and socio-economic aspects and impacts that have been identified and assessed. The direct ecological effects of an offshore kelp farm are expected to be small due to the limited size of the operation. The restricted occurrence of *Macrocystis* in the Southern Benguela suggests it is unlikely to become so well established in the natural environment off central Namibia that it may pose a competitive threat to local kelp species. Diseases and pathogens are typically species-specific and only develop in the adult crop after many years of intense cultivation.

Any negative effects of the placement of anchors and reef blocks on seabed communities will with time be offset as the blocks will provide an alternative hard substrate to mobile and sessile benthic species. Being ‘ecosystem engineers’ the floating kelp forests will provide shelter, feed and nursery areas for a highly diverse associated fauna. Operation of the kelp farms will potentially disturb foraging seabirds while the ropes and buoys create entanglement hazards, also for marine turtles and mammals.

TABLE 1: POTENTIAL IMPACTS ASSOCIATED WITH THE PROPOSED PROJECT

Potential Impact	Significance	
	Unmitigated	Mitigated
Marine Environment Potential Impacts on the Marine Environment		
Introduction of Non-Native Kelp and associated biosecurity risks	M	L-M
Introduction of kelp diseases, parasites, pests	L	L
Disturbance and/or loss of benthic macrofauna	M	M
Disturbance of seabirds	M	M
Entanglement of seabirds	M	L
Entanglement of marine turtles and mammals	H	L
Habitat creation or modification	H+	H+
Habitat modification: foraging seabirds	M	L
Habitat modification: turtles and mammals	M	M
Jellyfish proliferation	M-H	M
Nutrient uptake and plankton community	L	L
Sediment property changes from biodeposition	L	L
Biological impact on stocks and stock recruitment	L	L
Effects on Namibian islands' marine protected area	L	L
Noise and pollution effects	L	L
Unplanned Events		
Operational spills and vessel accidents	L-M	L
Storm damage and loss of arrays	M-H	L
Socio-economic		
Employment Opportunities	M+	H+
Community concerns	M	L
Interaction with marine traffic	M	L
Interaction with the rock lobster fishery	M	L
Interaction with the line-fishery	M	L
Interaction with Existing (and Future) Mariculture Operations	L	L
Interaction with diamond mining	M	L

Potential Impact	Significance	
	Unmitigated	Mitigated
Seawater abstraction and waste water discharges		
Potential impacts to marine communities during construction of the Desalination plant and associated infrastructure	L	L
Seawater Abstraction at Hatchery, Processing Plant and Desalination Plant	L	L
Detrimental effects on marine organisms due to residual chlorine levels in the mixing zone	L	L
Discharge of brine and reduced physiological functioning of marine organisms and impacts on nearest users abstracting seawater	M-H	L
Detrimental effects on marine organisms through discharge of waste streams from the hatchery and processing plant	M	L
Heritage		
Damage to archaeological resources, esp. shipwrecks	M-H	L+

The design of the arrays and their positioning at ~15 m depth should ensure that entanglement of marine fauna would be minimal, with highest risks occurring during installation or in the event of array failure or loss. The arrays will create a new substrate for the attachment of jellyfish polyps, adding to the nuisance their proliferation already causes in Namibian waters. By extracting nutrients from the water column, there may be localised changes in plankton abundance and diversity in the vicinity of the arrays, and changes in sediment properties and composition due to organic deposition that may affect benthic communities below the arrays. Biological impacts on fish stocks and stock recruitment, as well as existing mariculture activities are not expected to be significant. All these threats are amenable to mitigation.

Noise and pollution from vessel movements during the installation and maintenance of arrays, kelp harvesting and monitoring, as well as unplanned spills and vessel accidents have been assessed and found to be manageable. Whereas the loss of kelp biomass and array infrastructure during severe storms will need constant attention. It is crucial that materials are rigorously tested in the pilot plots to gauge the wear and tear of the design and the likelihood of losing arrays in rough sea conditions.

The impacts of seawater abstraction for desalination in a reverse osmosis plant and subsequent discharges of brine mixed with wastewater have been assessed as low (in the mitigated scenario), mainly due to the small size of the proposed plant and effective mitigation that can be applied.

Positive socio-economic benefits are expected to arise from job creation through the direct or indirect employment of workers, contractors and service providers, as well as the upgrading of amenities at Lüderitz and Kelp Blue's corporate social investment programme. Potential negative impacts are related to community concerns and conflict with other users of ecosystem services on land or at sea. The positioning of the kelp plots must be coordinated with marine vessel traffic, diamond mining licence holders and fishing right holders to avoid any potential conflict. As fishing is a high-risk industry with many economic constraints, any new development can potentially reduce catch rates and affect the commercial fish stocks.

Potential impacts on shipwrecks that may be found during the installation of arrays can be turned into a benefit to science if the cultivation areas are surveyed and wrecks are detected beforehand.

3.3 Management and Mitigation Measures

Mitigation measures and recommendations for the improved management of impacts have been identified in the assessment of the various environmental issues in Chapter 6 of the EIA report. The specific measures to be implemented are listed in Table 2, Table 3, Table 4, Table 5 and Table 6, while the associated monitoring programmes are summarised in Section 3.8.

3.3.1 Marine Environment

TABLE 2: MITIGATION MEASURES FOR THE MARINE ENVIRONMENT

Potential Issue	Mitigation
Introduction of non-native kelp	• None required, however washup Macrocystis should be removed when economically feasible to be collected at accessible locations.
Introduction of associated diseases, parasites and pests	• Ensure strict biosecurity controls are in place in all laboratory and culture facilities.
Disturbance and/or loss of benthic macrofauna	• Survey the seabed at the offshore site using geophysical (e. g. side-scan sonar, multibeam echo sounder) or remote visual techniques (ROV-mounted video) to determine the distribution of sediments, covering an area well in excess of the array spread to enable flexibility in final positioning. • If significant topographic features (e. g. rocky outcrops) or vulnerable habitats (e. g. hard grounds) are detected, adjust the final position of the arrays to avoid such features or habitats.
Disturbance of seabirds	• Limit any activities that could create a disturbance in the vicinity of the seabird islands, including loud, sudden noises.

Potential Issue	Mitigation
	• No islands may be accessed, except to retrieve lost gear that may have washed up at an island. In this case permission must be sought from the MFMR Lüderitz office. • Avoid the use of permanent artificial lighting at grow-out sites unless dictated by maritime regulations. If necessary, consider using green or red flashing light rather than white, permanent lighting. • Consider limited use of (shielded) lighting when installing or dismantling arrays, if operating at the sites at night and at the onshore facility. • Consider pre-assembling structures (as far as logistically possible) that are to be installed close to the shore, away from Halifax Island and the Dias Point and Shearwater Bay bird roosts.
Entanglement of seabirds	• Choose twine and rope material carefully. Materials to be used should (a) be thick enough to limit tangling into shapes in which seabirds could become entangled and (b) not be prone to produce loose strands that break off easily. • Seeding twine should be wrapped tightly around ropes and not become loose and form loops that could trap seabirds. • Regular inspection of arrays and seeding ropes needs to be done, damaged ropes and twine to be replaced or re-tensioned before they become an entanglement hazard. • Damaged ropes and twine to be retrieved and disposed of in a manner that they do not pose an additional entanglement risk elsewhere. • If arrays are damaged or lost, immediate action must be taken to retrieve arrays and to secure loose ropes, twine and other materials that could pose an entanglement threat to seabirds.
Entanglement of marine turtles and mammals	• All mooring hawsers, rope arrays and ropes to floats should be rigid or under constant tension. • Install navigational warning devices (e. g. buoyed radar reflectors) marking the outer boundaries of the arrays • Consider the use of pencil buoys with short mooring lines. • Mooring lines / blocks and tensioning lines to be placed more than 25 m apart for the offshore structure. For the bottom-based structures a spacing of +/- 2 m is used. • In case a whale or a turtle is sighted in the immediate vicinity or within a farm, it should not be approached closer than 300 or 500 m, no attempt should be made to chase the animal away, noisy activities should be reduced as much as possible and the animal should be carefully observed and monitored until it has left the farm. • Basic training for a few employees in whale disentanglement techniques through the South African Whale Disentanglement Network and to have the right tools at hand.

Potential Issue	Mitigation
Habitat creation or modification	• Maximise the benefit of this positive impact by considering a block design that provides habitat for beneficial animal species, particularly rock lobsters.
Habitat modification: foraging seabirds, marine turtles and mammals	• Leave a carefully designed corridor network of appropriate width (~150 – 200 m) between arrays to allow marine mammals and turtles to navigate easily through the site. • Limit continuous farm units to ~800-1,000 m and limit arrays to at least 300 m from the shore or other developments".
Proliferation of jellyfish polyps	• Routine cleaning of the arrays to remove polyps is impractical, clean structures only if the weight of epifauna threatens their stability.
Nutrient concentrations and alteration of plankton community	• No mitigation other than monitoring is required.
Sediment property changes due to organic deposition	• No mitigation other than monitoring is required.
Biological impact on fish stocks and stock recruitment	• Apply the precautionary principle to the development of the offshore kelp farms by managing the scale of future operations conservatively, thereby avoiding potential irreversible impacts over large areas of the NIMPA • Systematically monitor the ecosystem using reliable ecosystem indicators. This could include: 1) Benthic habitat indicators (e. g. sediment structure, abundance, biomass and species richness) to measure changes in/on the seabed beneath the arrays and at selected sites at increasing distance from the arrays. 2) Biochemical indicators of the water column (e. g. dissolved oxygen, nitrate levels, particulate organic carbon). 3) Pelagic community indicators (e. g. video monitoring of certain fish species, seabirds and marine mammals associated with the arrays relative to open-water areas).
Effects on the NIMPA	• No mitigation measures are necessary.
Noise and pollution effects	• Ensure that operational discharges are handled in a manner consistent with good international industry practice, in compliance with the requirements of MARPOL 73/78, regardless of the size of the vessel, and in compliance with local legislation. • Ensure that all wastes generated on board are stored in dedicated, clearly labelled, containers (bins, skips) and frequency removed to a licenced landfill site.

3.3.2 Land-based Activities and Seawater Desalination

TABLE 3: MITIGATION MEASURES FOR LAND-BASED ACTIVITIES INCLUDING THE DESLANIATION PLANT AND ASSOCAITED ACTVITIES

Potential Issue	Mitigation
Waste and sewage management	• Ensure proper removal of waste from site and disposal at a licensed disposal site, obtain records of safe disposal. • Separate all general waste according to type and dispose or recycle accordingly, give preference to recycling. • Provide bins with labels indicating waste type and lids to prevent wind-blown litter at strategic locations on the sites, empty them regularly to prevent overflow. • No littering will be permitted. • Ensure all onshore working areas have proper hygienic toilet facilities connected to the municipal sewage system. • Any remaining fresh kelp resulting from the production process to be supplied to local kelp producers. • Develop a management plan / procedure for all types of waste from the factory to address wastewater, sewage and solid non-hazardous waste, aligned with the above.
Hydrocarbons spills	• Immediately clean up accidental spills and safely dispose of hydrocarbon-contaminated material. • Include checking for hydrocarbon spills in the daily inspections.
Noise, dust and odour	• Develop a grievance procedure and publicise it to neighbours and relevant stakeholders, so that issues and concerns can be addressed adequately and promptly.
Construction of a seawater desalination plant	• Apply good house-keeping practices during construction of the desalination plant and any other required infrastructure. • No dumping of construction materials into the intertidal and subtidal zones. • Restrict construction noise and vibration-generating activities to the absolute minimum required. • Install screens on the end of the intake pipe, or use a screen box or shroud. • Adjust peak intake velocities to <0.15 m/s.
Operation of a seawater desalination plant	• If feasible, undertake 'pigging' of the intake pipeline to reduce the need for and costs of biocides. • Incoming seawater treatment and effluent discharge at the hatchery must comply with Annexure H of the Regulations relating to the Import and Export of Aquatic Organisms and Aquaculture Products (2010). • Apply for a discharge permit for any effluents released to the marine environment.

Potential Issue	Mitigation
	• Use a non-oxidising biocide (DBNPA) in preference to chlorine, avoid overdosing with SMBS and aerate effluent before discharge. • Limit the use of scale-control additives to minimum practicable quantities, avoid polyphosphate anti-scalants. • Use low-toxicity CIP chemicals as far as practicable.
Effluent discharge from the seawater desalination plant	• Blend brine with wash water from the processing plant before discharge to ensure adequate dilution and mixing with other waste streams. • Lalandii jetty Option: Discharge the combined effluent through a dedicated pipeline extending 500 m beyond the end of the Lalandii jetty to maximise mixing of the effluent with the receiving water. • Namport Old Seaflower Cold Storage facility option: Discharge the combined effluent through a dedicated pipeline extending to a similar location as for the Lalandii where the shallow-subtidal environment is expected to carry a substantial amount of turbulent energy, thereby transporting the brine further offshore into the bay (see Figure 27 in the EIA Amendment Report). However, first undertake a detailed Plume Modelling study to better quantify the dispersion of the waste stream in this area and confirm the discharge point (i.e. discharge pipeline location) to avoid / minimize impacts to the marine environment and nearest users abstracting seawater. • Install a diffuser at the end of the discharge pipeline to ensure adequate dilution and dispersion of the brine thereby reducing the size of the sacrificial zone. • Ensure compliance with existing waste water discharge permit conditions.

3.3.3 Unplanned Events

TABLE 4: MITIGATION MEASURES FOR UNPLANNED EVENTS

Potential Issue	Mitigation
Operational spills and vessel accidents	• Ensure that vessels operate in accordance with Namibian safety regulations to minimise the risk of accidents. • Require the vessel operator to prepare and implement a Shipboard Oil Pollution Emergency Plan and an Oil Spill Contingency Plan, taking cognisance of the Namibian National Marine Pollution Contingency Plan, which sets out national policies, principles and arrangements for the management of emergencies including oil pollution in the marine environment. • In case of a major spill that cannot be absorbed with a spill kit immediately, the Lüderitz office of MFMR and the Namibian Foundation for the Conservation of Seabirds (NAMCOB) should be alerted immediately to coordinate oiled seabird rescue. Ensure adequate resources are available to collect and transport oiled birds to the cleaning station. Depending on the need for rescue and rehabilitation arrange for additional assistance, if necessary, from outside Namibia. • Ensure that sunken vessels are removed from the sea floor before chronic leaks can occur. • Use low toxicity dispersants that rapidly dilute to concentrations below most acute toxicity thresholds. Only use dispersants with the permission of MEFT/MFMR.
Storm damage and loss of arrays	• Frequently check that equipment and structural integrity remain intact. • Factor redundancy and material stress into engineering designs to ensure that lost equipment will still be recoverable at or near the surface. • Plan for the effective retrieval of equipment lost to the seabed and factor the costs of such retrieval into project budgets. • Establish a hazards database listing the type of gear lost to the seabed with the dates of abandonment/loss and locations, and where applicable, the dates of retrieval.

Unplanned events at the Desalination plant	• Develop a contingency plan that examines the risk of contamination and considers procedures to be implemented to mitigate any unanticipated impacts at the intake (e. g. algae blooms and sulphur events) and discharge (emergency incidents and upset conditions).
	• Address the following issues in the contingency plan:
	  ○ Standard operating procedures for the detection of problems and response to emergency incidents and upset conditions.
	  ○ Programmes for checking, maintenance/replacement and surveillance of the physical condition of equipment, facilities and pipelines.

Potential Issue	Mitigation
	- Staff schedules and responsibilities, alternative personnel and services for the continued operation and maintenance of effluent discharge facilities during employee shortages. - Stocklists and suppliers for chemicals, spare parts and equipment components that can adequately ensure the continued operation of the effluent discharge facility during an emergency or breakdown. - Schedule of monitoring and sampling analyses when emergency or upset conditions occur at the plant. - Details on the mitigating measures to be implemented if effluent discharge into the coastal environment exceeds the limits prescribed in the discharge permit. - Reporting procedures and protocols for events of malfunctioning of the effluent disposal system, as well as pollution events. • If 'end-of-pipe' values exceed the water quality guidelines for the coastal zone of the Benguela Current Large Marine Ecosystem (BCLME) at any time, continued operation of the plant would be in violation of the waste water disposal exemption permit; the cause of poor effluent quality must immediately be identified and rectified. • Non-conformance events must be recorded as per internal procedures and reported to the responsible authorities on local, regional, and national levels, including, but not limited to the reporting of emergency incidents in terms of the Marine Resources Act and the Environmental Management Act (and the Water Act).

3.3.4 Socio-economic

TABLE 5: MITIGATION MEASURES FOR THE SOCIOECONOMIC ENVIRONMENT

Potential Issue	Mitigation
Employment opportunities and working conditions	• Ensure that strategies and programmes are in place prior to construction or expansion to maximise the use of local labour and contractors for the construction and operation of kelp farms. • Preferably hire suitably qualified or experienced Namibian citizens as positions become available. • Pay fair salaries and wages. • Be gender sensitive by including women in the recruitment process and training opportunities, where possible. • Promote continuous learning programmes to diversify and upgrade skills of employees. • Establish a workplace wellness policy and programme including prevention measures for communicable diseases (incl. HIV/AIDS

Potential Issue	Mitigation
	and TB) and easy access to treatment, care and support for employees. • Kelp Blue work areas will be alcohol-free and drug-free zones. Random alcohol and drug testing of employees and contractors may be conducted upon entry to site(s). • Promote public health and safety by supporting the Ministry of Health and other stakeholders' initiatives to reduce the spread of communicable diseases by organising awareness programmes and promoting healthy lifestyles. • Use local Namibian suppliers of goods and services from Lüderitz, the !Nami‡Nûs Constituency, or the //Kharas Region, where possible. • Include local service providers in the tendering process for supplies and services.
Potential community concerns	• To mitigate potential job losses in the fishing industry, offer training programmes and provide job opportunities, partner with local fishing cooperatives to ensure that the project does not displace the jobs of fishermen. • Involve the community and update them on the project • Distribute benefits in a way that the community will perceive as fair, e. g. by giving preference to residents and local service suppliers. • Implement the EMP to mitigate the potential negative environmental impacts of the project, and ensure that the project does not harm marine ecosystems. • Work with local authorities and communities to identify any potential conflicts over sea, land, water and energy resources; mitigate or resolve conflicts, e. g. by using renewable energy and desalinated water. • Lobby the national and regional government to improve the town's infrastructure and work with local authorities to improve services in the area and to support economic growth and development.
Interaction with marine traffic	• Ensure that normal maritime traffic rules and Port Authority conditions are followed. • Ensure that kelp grow-out areas are officially allocated to Kelp Blue (i.e. Negotiations around usage of water area and the exact location of grow-out and commercial areas with NamPort and Namibian transport authorities). Further consult with Namport (i.e. Port Captain) regarding the ultimate layouts of the farms to ensure there is no conflict between array location and port plans. • Ensure that suitable navigational warning devices (e. g. buoyed radar reflectors) are installed to mark the outer boundaries of the arrays. • Prior to installation inform the Namibian Ports Authority and South African Navy Hydrographic Office to put out radio navigation

Potential Issue	Mitigation
	warnings throughout the operational period and to publish particulars of the array locations in the Notices to Mariners. • Establish marine traffic lanes in relation to marine traffic density. It should be noted that there will be a higher impact closer to the inner northern and southern boundaries of the kelp cultivation platforms.
Interaction with the rock lobster and line-fishing industries	• Consult with both fishing industries before finalising the positions of the arrays to ensure there is no conflict between array location and lobster or line-fishing target areas, specifically areas of historical ground-fishing.
Interaction with mariculture operations	• Consult with the mariculture industry before finalising the position of the cultivation areas to ensure that it does not affect existing mariculture operations.
Interaction with diamond mining	• Consult with the diamond mining licence holders before finalising the position of the arrays to ensure there is no conflict between arrays and potential diamond resources and associated activities.

3.3.5 Heritage

TABLE 6: MITIGATION MEASURES FOR HERITAGE RESOURCES

Potential Issue	Mitigation
Damage to archaeological resources (shipwrecks)	• Initial mitigation against loss of MUCH resources should consist of the following steps: o Multibeam surveys that are undertaken as part of the development should be investigated for reefs and/or rocks, as well as other anomalies that may pint to MUCH resources. o The divers must undergo a full induction on recognising MUCH resources underwater and steps to follow if such resources are found. This includes information on recording video in order to maximise assessments. o Each area, where concrete blocks are to be installed must be visually surveyed by the divers, video footage and still photographs must be taken. o An underwater metal detector should be used on any area where there are reefs and rocks, it is difficult to distinguish between reef and MUCH resources. o This information must be shared with the maritime archaeologist for assessment. o If the objects found during visual surveys warrant a deeper investigation, a magnetometer survey may need to be undertaken.
	• Secondary mitigation, if necessary:

Potential Issue	Mitigation
	○ A magnetometer survey records changes in the earth's magnetic field caused by ferrous objects on the seabed. Old historical ships were constructed with a lot of iron in the form of fastenings, anchors, cannon, etc. Once a map of anomalies has been recorded, the anomalies need to be dived on to ascertain if they are shipwrecks or debris. ○ If the anomaly is covered in sand, and is of sufficient size, the edges of the site can be mapped using a combination of a GPS buoy and metal detector. ○ If the site is uncovered, it can be surveyed as before with the addition of photography and photogrammetry. These site maps can be used to create no-go zones during development. ○ In-situ preservation of a site is the best practice. ○ These site maps can be used to create no-go zones during development. In-situ preservation of a site is the best practice.
	• Those resources that cannot be avoided and that are directly impacted by the proposed development can be excavated/recorded (with a permit from the NHC) and a management plan can be developed for future action. Those sites that are not impacted at this time on can be written into the management plan, whence they can be avoided or cared for in the case of future expansion.
	• The Environmental Officer should be given a short induction, by the heritage practitioners, on archaeological site and artefact recognition. • Notify all relevant contractors and workers that their activities might expose archaeological sites on the seabed. • Stop work immediately if any heritage artefacts are discovered, notify the Environmental Officer and NHC as soon as possible. • Where possible, take photographs of the artefacts, noting the date, time, location and types of artefacts found. • Contact a heritage practitioner to investigate and evaluate the finds. Acting upon advice from the specialists, the Environmental Officer will advise management on the necessary actions to be taken. • Under no circumstances may any artefacts be removed, destroyed or interfered with by anyone on the site, unless under permit from the NHC.

3.4 RESPONSIBILITIES

At Kelp Blue, the team works collaboratively across workstreams. The Operations Manager oversees all operational activities of the workstreams to ensure strict compliance with the EMP commitments. To support the Operations Manager, there are designated Workstream Leads responsible for guiding their respective teams to ensure compliance in different areas of the project.

Each Workstream Lead focuses on specific aspects of the Kelp Blue project, such as Marine Monitoring, Biosystems (Lab &Hatchery), Engineering and Operation, Harvesting, Processing, and Offtake. The Marine Monitoring workstream is responsible for all monitoring activities at sea, while the Biosystems workstream oversees lab and hatchery operations, with a focus on biosecurity enforcement. The Engineering and Operation workstream handles the design, installation, and decommissioning of arrays, as well as managing marine traffic-related risks and harvesting activities. The Harvesting, Processing, and Offtake workstream is responsible for all activities related to seaweed harvesting, processing, desalination, renewable energy, logistics, and sales of products, along with mitigating associated risks.

Each workstream enforces specific mitigation measures relevant to their responsibilities, and the Operations Manager ensures that all these measures are implemented effectively. With this collaborative approach, the project maintains a strong focus on compliance, environmental protection, and risk mitigation throughout its various operations. Together, they monitor the execution of tasks to ensure adherence to the EMP.

Environmental awareness training is provided by Kelp Blue's workstream leads during induction, based on the activities being conducted, emphasizing the significance of the EMP and mitigation measures.

The Chief of staff who is responsibility to oversee and give support to all employees, of which trainings forms part, will keep records of all environmental training sessions and inductions, including names of attendees, dates of their attendance and the information presented to them. Records of environmental training sessions are made available to the Operations Manager.

Regular inspections and audits to ensure strict adherence to the EMP throughout the project's development will be conducted. Updates and amendments will be made as needed, looking at a span of 6 months reviews & updates.

The operations manager oversees compliance, while Workstream Leads focus on specific aspects of the project. Overall, the collaborative approach ensures environmental protection and risk mitigation across all operations at Kelp Blue.

3.5 INTERNAL REVIEW, AUDITING AND REPORTING

As stipulated in the EMA and its Regulations, Kelp Blue will keep the EMP current by means of conducting periodic internal reviews on bi-annual basis and updating or amending the EMP when circumstances change, especially if future modifications or changes of the project design trigger a listed activity as defined in the Environmental Impact Assessment Regulations.

The Kelp Blue Operations manager oversee which workstream will establish a procedure to monitor progress with the implementation of the EMP and ensure that regular inspections and audits are carried out throughout the project development. The following actions are essential to ensure EMP compliance:

- Provide environmental awareness-training and copies of the EMP to all contractors and employees before they commence any physical work.
- During the construction phase, daily inspections and monthly audits should be conducted. The frequency can be reduced to weekly inspections and quarterly audits during the operational phase.
- Retain an independent professional to conduct annual external audits to assess compliance with the EMP commitments and the continued adequacy of the EMP relative to the activities on site.
- Document inspection and audit findings for record-keeping and to demonstrate continual improvement.
- Summarise the results of the environmental monitoring programmes and the EMP compliance audit records in biannual environmental reports to MEFT.

3.6 PERMITS AND OTHER REQUIREMENTS

Permitting and licensing requirements applicable to the Kelp Blue project are summarised in Table 7.

TABLE 7: LIST OF LEGAL REQUIREMENTS FOR THE KELP BLUE PROJECT

Issue	Legislation	Requirement / authority
Aquaculture licence	Aquaculture Act, No. 18 of 2002 and Licensing Regulations, 2003	Licence from MFMR
Import and export kelp products	Regulations for the Import and Export of Aquatic Organisms and Aquaculture Products, 2010	Licence from MFMR
Abstraction of sea water	Section 2 m of the Water Act, No. 54 of 1956, as amended	Permit for seawater abstraction from the Directorate of Water Affairs at MAWLR
Discharge of waste water	Section 21 (1) (2) (3) (4) (5) & 22 of the Water Act	Permit for industrial wastewater disposal from DWA
Kelp Blue vessel traffic in the port area	Namibian Ports Authority Act, No. 2 of 1994 and Port Regulations	Clearance from NamPort
Access islands to retrieve lost gear	NIMPA Regulations No. 316 of 2012	Permission from the MFMR Lüderitz office
Disturbing/destroying national heritage, archaeological sites	National Heritage Act, No. 27 of 2004, Section 48-52, and 55	Notify the National Heritage Council
Major petroleum spill response (>200 litres)	Section 49 (1), (4)	Notify Directorate of Petroleum Affairs of MME
Notification 30-days prior to commence-ment of construction	Labour Act, No. 6 of 1992, Regulations for Labour Act 1992, Section 20	Notify MLIREC and MHSS
Approval to work on Sundays and public holidays	Labour Act, No. 6 of 1992, Regulations for Labour Act 1992, Section 33	Apply at MLIREC
Register for social security	Social Security Act, No. 34 of 1994, Section 20	Register at the MLIREC
Affirmative action compliance certificate	Affirmative Action Act, No. 29 of 1998, Section 42	Certification from MLIREC
Register for VAT and income tax	Value-added Tax Act, No. 10 of 2000, Income Tax Act, No. 24 of 1981	Certification from NAMRA

Key: NIMPA = Namibian Islands' Marine Protected Area, MFMR = Ministry of Fisheries & Marine Resources, MME = Ministry of Mines & Energy, MHSS = Ministry of Health & Social Services, MLIREC = Ministry of Labour, Industrial Relation & Employment Creation, NAMRA -= Namibian Revenue Agency

4 MONITORING PROGRAMMES

4.1 ENVIRONMENTAL MONITORING STRATEGY BEING IMPLEMENTED

The description of the monitoring carried out during the pilot phase is based on the Marine Specialist report (Pisces, 2023).

4.1.1 Establishment of *Macrocystis* along the Coast in the Pilot Project Areas

A sampling plan has been drafted based on the outcome of the dispersion modelling and this will be implemented once the *Macrocystis* currently being grown has reached maturity. It is recommended that during the commercial phase of the project this be extended outside the pilot project area, including any accessible areas of rocky substratum, to validate the results of the drift modelling study. This may be done at a lower frequency than within the project area, but it is important to regularly monitor the local wider area to check for the establishment of attached *Macrocystis*. In addition, there must be monitoring of washed up *Macrocystis* to find out where on the coast large amounts drift ashore. The kelp should be removed where possible, and commercially utilized if feasible.

4.1.2 Biodiversity Monitoring with eDNA

Monitoring changes in shallow marine ecosystems with traditional methods can be a massive undertaking that has not previously worked in Southern Africa. Long-term monitoring to assess the impact of sediment discharged from diamond treatment plants has been undertaken around Elizabeth Bay south of Lüderitz, so that some general information exists for the nearby coasts, but there are no detailed baseline data for the commercial kelp farming sites.

The use of environmental DNA (eDNA) is a new phenomenon, driven by the availability and ubiquity of Next Generation DNA sequencing. Kelp Blue have selected this method to estimate biodiversity patterns, in collaboration with the Kelp Forest Foundation. All marine species release some DNA into the surrounding environment and recent research highlights the value of eDNA monitoring across space and time to enable biodiversity characterizations. It thus seems logical and innovative to use eDNA as a biodiversity monitoring tool. Kelp Blue is presumably aiming at eDNA monitoring of eukaryotic animals only. However, while there was obvious potential identified for the meaningfulness of the results, there are also major pitfalls indicating that a clear set of primers (encompassing species or taxa that are deemed important for the local ecosystem) should be carefully selected. It would be possible to include algae or marine prokaryote diversity (bacteria), since bacteria have been studied with eDNA methods for much longer than eukaryotic algae and animals.

4.1.3 Sediment Sampling and Carbon Analysis

It is important to monitor sediment composition and particle size at both coastal and offshore aquaculture sites (particle size can affect biological and infauna communities considerably). During the commercial phase, it is critical that the kelp farm samples be compared with control sites at significant distance from the aquaculture sites. A control site for Shearwater Bay should be selected in an adjacent bay at similar depth and coastal distance because samples from small gaps without aquaculture in the actual bay may be similarly affected as samples from immediately under the aquaculture structures. Analysis of sediment samples collected to date has focused on the chemical composition and not yet determined sediment particle size, oxygen profiles or carbon content. This should be undertaken as part of the monitoring programme for the commercial phase.

4.1.4 Water Chemistry Analysis

As part of their baseline monitoring programme for the pilot phase, Kelp Blue have been monitoring the geochemistry of the water column and analysed nutrients such as nitrate (NO_3), ammonium (NH_4), nitrite (NO_2), phosphate (PO_4) and silicate (SiO_2). In addition, pH and water temperature are measured at various water depths and chlorophyll is determined from satellite data. A full array of oceanographic nutrient samples should be included in the monitoring plan for the commercial phase. The various forms of nitrogen (nitrate, nitrite, ammonia) must be included as the kelp ecosystem may affect the balance between these parameters. A control site for Shearwater Bay should be selected in an adjacent bay at similar depth and coastal distance.

4.2 Monitoring Programmes for the Commercial Phase

Table 8Table 9, Table 9 and Table 10, as well as Sections 3.8.4 and 3.8.5 summarise the monitoring programmes for the aspects addressed in the specialist reports in the same sequence as the mitigation tables in Section 3.4.

4.2.1 Marine Environment

TABLE 8: MONITORING PROGRAMME FOR THE MARINE ENVIRONMENT

Potential Issue	Monitoring Needs
Introduction of non-native kelp	• Continue close observation of rocky shores in the region to look for attached material, particularly in areas identified as high risk by the dispersion modelling study. • Once commercial operations are in place, the prevailing currents will carry dislodged material from the aquaculture arrays to certain areas of coastline, which may change with prevailing wind and current conditions and must be continually monitored.
Introduction of associated diseases, parasites and pests	• Monitor the developing crop regularly for any sign of disease or parasites.
Disturbance and/or loss of benthic macrofauna	• No monitoring specified.
Disturbance of seabirds	• No monitoring specified.
Entanglement of seabirds	• Monitor and report on the incidence of seabird entanglements. • Consider incorporating a section on quantifying the production of marine litter that may entangle seabirds into general monitoring protocols.
Entanglement of marine turtles and mammals	• Monitor line, cable, rope and twine tension regularly. • Presence of cetaceans and turtles in the vicinity or within the farm should be frequently monitored by the designated monitoring team working from the vessel at least once per hour (with binoculars), logged and photographed if possible.
Habitat creation or modification	• Continue regular inspection of the arrays for the establishment of biofouling organisms and quantify the abundance, biomass and species diversity of colonising benthos on the reef blocks, arrays and on the kelps themselves. • Monitor eukaryotic, prokaryotic and photosynthetic biodiversity with eDNA techniques.
Habitat modification: foraging seabirds,	• Monitor and report on habitat use by marine mammals and turtles and seabirds, particularly to detect impacts on open-water foragers.

Potential Issue	Monitoring Needs
marine turtles and mammals	
Proliferation of jellyfish polyps	• Continue monitoring the settlement plates on the kelp-growing infrastructure for at least 18 months as appearance of medusa inshore is highly seasonal.
Nutrient concentrations and alteration of plankton community	• Establish nutrient availability and uptake by the arrays relative to 'control' sites for the inshore and offshore sites, viz: ○ Water samples from within, up-current and down-current of the arrays and from suitable control areas, to establish nitrogen and phosphorus flux. ○ Nitrogen, carbon and phosphorus content of different portions of the kelp plant. It may be useful to include the various forms of nitrogen (nitrate, nitrite, ammonia) as the kelp ecosystem may affect the balance between these parameters. ○ Growth rates (in length) of marked kelp uprights. ○ Measure many uprights to give estimates of monthly loss rates. • Monitor the plankton abundance, biomass and species richness within each plot and at selected sites at increasing distance from the arrays.
Sediment property changes due to organic deposition	• Set up a regular (biannual and replicated) monitoring programme to establish changes in sediment carbon content and structure, abundance, biomass and species richness of macrofaunal communities in/on the seabed at both coastal and offshore aquaculture sites and a selected suitable control site and monitoring sites at increasing distance from the installations. • Monitor changes in oxygen levels below the inshore and offshore aquaculture systems, 1) biannually and 2) ad hoc when there are large anoxic events occur in the area.
Biological impact on fish stocks and stock recruitment	• Implement systematic before-after/control-impact (BACI) monitoring using reliable ecosystem indicators. This should include: ○ Benthic habitat indicators (e. g. sediment structure, abundance, biomass and species richness) to measure changes in/on the seabed beneath the arrays, upstream and downstream of cultivation sites. ○ Biochemical indicators of the water column (dissolved oxygen, nitrate levels, particulate organic carbon). ○ Pelagic community indicators (video monitoring of certain fish species, seabirds, marine mammals associated with the arrays relative to open water).
Effects on the NIMPA	• No monitoring is necessary.

Potential Issue	Monitoring Needs
Noise and pollution effects	• No monitoring is necessary.

4.2.2 Land-based Activities and Seawater Desalination

TABLE 9: MONITORING PROGRAMME FOR LAND-BASED ACTIVITIES AND RO PLANT

Potential Issue	Monitoring Needs
Waste and sewage management	• Environmental Officer to check and enforce compliance with the EMP.
Hydrocarbons spills	• Include checking for hydrocarbon spills in the daily inspections.
Noise, dust and odour	• Maintain a grievance register to record all stakeholder issues and document that they have been addressed.
Construction of a seawater desalination plant	• Environmental Officer to check and enforce compliance with the construction phase EMP.
Operation of a seawater desalination plant	• Considering the potentially substandard quality of the seawater in Lüderitz, regularly monitor the quality of the intake water to the hatchery and desalination plant and ensure that filtration systems are functioning effectively • Implement an ‘end of pipe’ effluent monitoring programme at an initial frequency of once a month for 6-12 months of operation to ensure that the discharge system is functioning correctly (the results will serve to 'protect' the company from negative public perceptions regarding the RO plant and discharge of effluents into the marine environment and provide evidence of due diligence that the RO plant is operating correctly and the effluent complies with discharge permit conditions). • Effluent quality samples should be submitted to an accredited analytical laboratory for analysis of trace metals (As, Cd, Cu, Cr, Fe, Hg, Ni, Mn, Pb, Zn, if these are present at detectable concentrations), total suspended solids, total dissolved solids, pH and for any biocides, antiscalants and CIP chemicals that are used in the plant, as well as the parameters specified in the abstraction and discharge permits. • Ensure compliance with the waste water discharge permit conditions and internally determined site-specific limits for parameters of concern.

4.2.3 Unplanned Events

TABLE 10: MONITORING PROGRAMME FOR UNPLANNED EVENTS

Potential Issue	Monitoring Needs
Operational spills and vessel accidents	• Ensure that vessels operate in accordance with Namibian safety regulations to minimise the risk of accidents. • Require the vessel operator to prepare and implement a Shipboard Oil Pollution Emergency Plan and an Oil Spill Contingency Plan, taking cognisance of the Namibian National Marine Pollution Contingency Plan, which sets out national policies, principles and arrangements for the management of emergencies including oil pollution in the marine environment. • In case of a major spill that cannot be absorbed with a spill kit immediately, the Lüderitz office of MFMR and the Namibian Foundation for the Conservation of Seabirds (NAMCOB) should be alerted immediately to coordinate oiled seabird rescue. Ensure adequate resources are available to collect and transport oiled birds to the cleaning station. Depending on the need for rescue and rehabilitation arrange for additional assistance, if necessary, from outside Namibia.
Storm damage and loss of arrays	• Determine the loss of kelp biomass after severe storms and recover kelp for processing, if feasible. • Frequently check that equipment and structural integrity remain intact. • Establish a hazards database listing the type of gear lost to the seabed with the dates of abandonment/loss and locations, and where applicable, the dates of retrieval.
Unplanned events at the desalination plant	• Develop a contingency plan that considers procedures to be implemented to mitigate any emergency incidents and upset conditions. • Schedule monitoring and sample analyses when emergency or upset conditions occur at the plant. • Report events of malfunctioning of the effluent disposal system, as well as pollution events to the authorities.

4.2.4 Socioeconomic Environment

To monitor potential socioeconomic impacts Kelp Blue has developed an impact tracking programme that reports on progress with the following priority issues:

- Employment and employee capacity building
- Local procurement (together with the Lüderitz Business Forum)
- Research (in partnership with the Kelp Forest Foundation), kelp industry-related research scholarships and apprenticeships for young Namibians

- Education (Lüderitz Blue School), engagement with local schools
- Support to local initiatives, such as improved infrastructure

A comprehensive community engagement and corporate social investment plan will be prepared for the commercial phase.

4.3 DECOMMISSIONING

Since the kelp arrays are situated in the NIMPA it is critical to completely remove them at the end of their life span (estimated at >12 years). Kelp Blue must prepare a decommissioning plan for concurrent rehabilitation and the end of the commercial operation to ensure adequate decommissioning of the project. At a conceptual level, the demolition and removal of infrastructure can be considered a reverse of the construction phase.

The steel anchors will remain in the seabed, while the artificial reef blocks will probably have crumbled by then. All moorings, ropes, floats, array frames and buoys must be effectively removed at the end of the project to reduce the potential for entanglement. Ease of removal should therefore be factored into the engineering design of the project. Finally, when all decommissioning activities have when completed and the environment has been restored to something resembling its original state, the sites can be relinquished to their former owners.