

APP-003194

**ENVIRONMENTAL MANAGEMENT PLAN FOR THE CAPITAL AND
MAINTENANCE DREDGING AT THE NAVAL BASE IN THE PORT OF
WALVIS BAY**



Assessed by:



Assessed for:



April 2024

Project:	ENVIRONMENTAL MANAGEMENT PLAN FOR THE CAPITAL AND MAINTENANCE DREDGING AT THE NAVAL BASE IN THE PORT OF WALVIS BAY	
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1 BACKGROUND AND INTRODUCTION

Geo Pollution Technologies (Pty) Ltd (GPT) was appointed by the Ministry of Defence and Veterans Affairs of Namibia (the Proponent) to undertake an environmental assessment for the proposed dredging operations at the Naval Base located in the Port of Walvis Bay. Dredging can, in terms of harbours, be defined as the process of removing substrate like sediments, soils, clays, silt, rock, sand and debris from a water environment, with the aim of increasing or maintaining water depth, to allow for safe passage and manoeuvring of ships / vessels. In harbours, it is generally performed to create and maintain the entrance channel, berthing areas, turning circles and other operational areas. One can typically distinguish between capital and maintenance dredging. Capital dredging being the deepening of new areas through a first round of dredging, and maintenance dredging being the periodic removal of material such as sediments, soils, clays, silt, sand and debris (hereafter referred to collectively as sediment) from previously dredged areas, in order to maintain water depth. Maintenance dredging is periodically required due to natural sedimentation and seabed scouring by vessels' propellers that results in gradual siltation of the seafloor.

2 ENVIRONMENTAL MANAGEMENT PLAN

The EMP provides management options to ensure impacts of the proposed project are minimised. An EMP is a tool used to take pro-active action by addressing potential problems before they occur. This should limit the corrective measures needed, although additional mitigation measures might be included if necessary. The environmental management measures are provided in descriptions below. The management measures are separated into two sections: 1) those to be performed by the Proponent and all their subcontractors and consultants; and 2) those to be performed by the dredging contractor and all their subcontractors and consultants. During dredging, the Proponent's function will be more of a management and monitoring function, whilst the dredging contractor execute the actual dredging activities, inclusive of monitoring. These management measures should be adhered to during the various phases of dredging. This section of the report can act as a stand-alone document. All personnel taking part in the dredging exercise should be made aware of the contents of this section, so as to plan the operations accordingly and in an environmentally sound manner.

The objectives of the EMP are:

- ◆ to include all components of dredging, dredged material disposal and related activities;
- ◆ to prescribe the best practicable control methods to lessen the environmental impacts associated with the project;
- ◆ to monitor and audit the performance of operational personnel in applying such controls; and
- ◆ to ensure that appropriate environmental training is provided to responsible operational personnel.

2.1 IMPLEMENTATION OF THE EMP

Various potential and definite impacts will emanate from the project. The majority of these impacts can be mitigated or prevented. The impacts, risk rating of impacts, as well as prevention and mitigation measures are listed below.

Impacts are expected to mostly be of medium-high significance and can mostly be mitigated to have a low to medium-low significance. The spatial extent of impacts are mostly limited to the dredging area and the immediate surroundings. Impacts are not of a permanent nature. Due to the nature of the surrounding areas, limited cumulative impacts are possible.

2.1.1 Planning

During the planning phase for dredging and related activities, it is the responsibility of the Proponent and the dredging contractor to ensure they, and all sub-contractors, consultants and other personnel involved with the dredging activities are, and remain, compliant with all legal and industry specific requirements. Management measures must be put in place prior to, and during all activities, to ensure potential environmental impacts and risks are minimised. The following actions are recommended for the Proponent and the dredging contractor during the planning phase and should continue during various activities of the project:

Proponent

- ◆ Ensure that all necessary permits from the various ministries, local authorities and any other bodies that govern or authorise operations related to dredging are in place and remains valid. This includes notifications to Namport, the directorate of maritime affairs, potentially affected port users, etc.
- ◆ Ensure the selected reputable dredging contractor, and any other third party contractors that may be involved with the dredging process, enters into an agreement, that includes adherence to the EMP.
- ◆ Assign a Health, Safety and Environmental Coordinator to oversee implementation of and compliance to the EMP, by all relevant responsible parties.
- ◆ Communicate emergency response procedures and operational procedures which are relevant to the dredging operations to the relevant parties involved in the dredging operations.
- ◆ Develop the terms of reference for the determination of baseline conditions (dredged material quality, water quality, total suspended solids and air quality) by an independent consultant prior to dredging.
- ◆ Develop the terms of reference for the appointment of an independent third party to conduct environmental monitoring (dredged material quality, water quality, total suspended solids and air quality) and EMP compliance monitoring.
- ◆ Ensure sufficient insurance cover is available for aspects of environmental damage, pollution clean-up or restoration, if ever needed.
- ◆ Establish and maintain a reporting system to report on aspects of dredging as outlined in the EMP.
- ◆ Submit monitoring reports to the Department of Environmental Affairs as per the conditions of the ECC.
- ◆ Update the EIA and EMP if required and apply for renewal of the environmental clearance certificate prior to expiry.

Dredging Contractor

- ◆ Enter into an agreement with the Proponent which includes determination of baselines, environmental compliance, monitoring and reporting as required by the EMP and MEFT.
- ◆ Ensure that all port procedures are understood as per Part III of the regulations proclaimed under the Namibian Ports Authority Act, the Merchant Shipping Act and the Marine Traffic Act. This includes compliance to, among others, the following (inclusive of any amendments and updates):
 - International Convention for the Safety of Life at Sea (SOLAS), 1974
 - Convention on the International Regulations for Preventing Collisions at Sea (COLREG)
 - Convention on the International Maritime Organization (IMO), 1948
 - International Convention for the Prevention of Pollution from Ships (MARPOL), 1973
 - Annex I –Regulations for the Prevention of Pollution by Oil
 - Annex II –Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk

- Annex III –Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form
- Annex IV –Regulations for the Prevention of Pollution by Sewage from Ships
- Annex V –Prevention of Pollution by Garbage from Ships
- Annex VI –Regulations for the Prevention of Air Pollution from Ships
- Namibia’s National Marine Pollution Contingency Plan, 2017
- ◆ Appoint an independent environmental consultant to conduct environmental baseline determination and environmental monitoring as outlined in the EMP.
- ◆ In consultation with the environmental consultant, finalise the baseline and monitoring strategy to be employed, reporting parameters and frequency, and the emergency response procedures to be followed in the event of a potential or actual environmental incident.
- ◆ Where relevant, include the EMP as part of all contracts for the procurement of services.
- ◆ Assign a Health, Safety and Environmental Coordinator to oversee the implementation of, and compliance to, the EMP, by both the dredging contractor and all applicable sub-contractors and consultants.
- ◆ Implement emergency response and operational procedures relevant to the dredging operations.
- ◆ Ensure sufficient insure cover is available for aspects of environmental damage, pollution clean-up or restoration, if ever needed.
- ◆ Establish and maintain a reporting system to report on aspects of dredging as outlined in the EMP and as in agreement with the Proponent.

2.1.2 Employment

Dredging operations will require a small crew consisting of local Namibians. Some support services will be provided by local Namibian companies and consultants and thus local employment will be created and/or sustained.

Desired outcome: Provision of employment to local Namibians and adhering to Namibian legal requirements with respect to work permits.

Actions:

Responsible Body	Enhancement / Prevention / Mitigation
Proponent Dredging Contractor	<ul style="list-style-type: none"> ◆ If the skills exist locally, employees and sub-contractors must first be sourced from the town, then the region and then nationally. Deviations from this must be justified.

Data Sources and Monitoring:

- ◆ Employee contracts on file
- ◆ Close-out report or bi-annual reporting, whichever comes first, based on employee records that provides details on number of employees and demographic profile such as male vs. female, local vs. foreign, and disabled employees.

2.1.3 Revenue Generation

During dredging operations, resources and services will be procured locally, contributing to the economy of the town, region and Namibia.

Desired outcome: Revenue generation and contribution to the local, regional and Namibian economy.

Actions:

Responsible Body	Enhancement / Prevention / Mitigation
Proponent Dredging Contractor	<ul style="list-style-type: none"> ◆ Resources and services must be procured locally, if available. Deviations from this must be justified.

Data Sources and Monitoring:

- ◆ Where requested, proof must be provided to show that goods and services are procured locally, and if this is not the case, justification for foreign acquisition of such goods and services must be provided.

2.1.4 Skills, Technology and Development

Through employment and contracting of local companies and employees for certain aspects of the dredging operations, some skills may be transferred to an unskilled workforce and technologies that are new to Namibia may be introduced. Development of people and technology are key to economic development.

Desired outcome: To see an increase in skills of local Namibians, as well as development and technology advancements in the port and port users.

Actions:

Responsible Body	Enhancement / Prevention / Mitigation
Proponent Dredging Contractor	<ul style="list-style-type: none"> ◆ If the skills exist locally, contractors, sub-contractors and employees must first be sourced from the town, then the region and then nationally. Deviations from this practice must be justified. ◆ Training and skills development must be focussed on Namibians. ◆ Employees to be informed about parameters and requirements for references upon employment.

Data Sources and Monitoring:

- ◆ Record should be kept of all training or development programmes provided to Namibians.
- ◆ Ensure that all training is certified or managerial references provided (proof provided to the employees) inclusive of training attendance, completion and implementation.
- ◆ Close-out report or bi-annual reporting, whichever comes first, summarising any training or skills development programmes provided to Namibians.

2.1.5 Demographic Profile and Community Health

Impacts related to the demographic profile and community health relate to the influx of people (foreigners and Namibians) to the town, and the potential social ills and deviant behaviour that often accompany such events. This includes the spread of communicable diseases such as HIV/AIDS and increased criminal activities. Additional employment opportunities also mean more spending power which can lead to increased misuse of alcohol and drugs. Due to the scale and duration of dredging it is not foreseen that an influx of people will create a significant or permanent change in the demographic profile of the local community, or result in significant instances of socially deviant behaviour. The potential impact is further minimized as employment will be sourced locally as far as possible.

Desired Outcome: To prevent social ills, the spread of communicable diseases and prevent / discourage socially deviant behaviour and criminal activities.

Actions:

Responsible Body	Enhancement / Prevention / Mitigation
Proponent	<ul style="list-style-type: none"> ◆ Local contractors and people from Namibia, and specifically from the town or region (if available), must be employed. Deviations from this practice should be justified appropriately.
Dredging Contractor	<ul style="list-style-type: none"> ◆ For support services, local people from Namibia, and specifically from the town or region (if available), must be contracted. Deviations from this practice should be justified appropriately. ◆ Employees must be educated on the dangers and prevention of communicable diseases such as HIV/AIDS. ◆ Educational programmes must include issues such as alcohol and drug abuse. No such substances, or persons under the influence of such substances, may be allowed in the work place. ◆ Adhere to all applicable laws and regulations relating to public and environmental health (e.g. sanitation requirements, living conditions, etc.) for both onshore and offshore (dredging vessel) environments. ◆ The steps for disciplinary action in the event of employees not adhering to rules and regulations such as the restrictions on alcohol or drug use to be part of employee contracts.

Data Sources and Monitoring:

- ◆ Close-out report or bi-annual reporting, whichever comes first, summarising employee demographics, educational programmes provided and training conducted.

2.1.6 Health, Safety and Security

The protection of personnel, the public and equipment is paramount. The Namibian coast is characterised by very cold water and rough conditions. Falling overboard and being exposed to cold water will quickly result in hypothermia which may rapidly become fatal.

During dredging activities, there is a risk of gaseous emissions engulfing ship personnel. Hazardous gasses are likely to be hydrogen sulphide and methane. Hydrogen sulphide gas is specifically very dangerous and can be fatal to humans at concentrations anywhere from 300 to 600 ppm. It is initially recognised as a rotten egg smell, but within a short period the olfactory nerves adapt to the smell, and it is no longer detected. At this stage it may be thought that the gas is no longer present, but the contrary could be true.

Other health impacts include mechanical equipment and moving parts causing physical injury, and slipping and falling on wet surfaces.

Security measures must be in place to protect equipment from theft, especially for land based infrastructure and equipment.

Desired Outcome: To prevent injury, health impacts and theft.

Actions

Responsible Body	Enhancement / Prevention / Mitigation
Proponent	<ul style="list-style-type: none"> ◆ Appointment of a reputable dredging contractor with a known history of responsible and safe operations.
Dredging Contractor	<ul style="list-style-type: none"> ◆ All health and safety standards specified in the various legislation, guidelines, regulations, etc. should be complied with. ◆ Selected personnel should be trained in first aid and a first aid kits must be available in areas of operation. ◆ The contact details of all emergency services must be readily available. ◆ Ensure that all personnel receive adequate training on the operations of equipment and handling of hazardous substances. ◆ Clearly label dangerous and restricted areas as well as dangerous equipment and products. This includes the onshore dredged material disposal site (landfilling area) where access should be strictly controlled / prevented. ◆ Provide all employees with required and adequate personal protective equipment (PPE). This includes life jackets at sea. ◆ All seafaring vessels used must have all the required safety and emergency equipment as per maritime standards. ◆ Equipment must be placed and secured in such a way as not to encourage criminal activities (e.g. theft). ◆ To prevent and/or mitigate the impacts of hydrogen sulphide and methane gas, the following must be in place: <ul style="list-style-type: none"> • Ensure that the dredging and support vessels are equipped with appropriate technology, and correct placement of such technology, to avoid poisonous gases from affecting crew. • Ensure that appropriate breathing apparatuses are available to crew to protect them from any dangerous gas that is liberated from the submerged and dredged material. • Continuous hydrogen sulphide monitoring must be performed in all areas identified to be at risk of being engulfed by the gas. This include real time remote monitoring or portable (handheld) monitoring devices to be carried on person. Areas to be monitored include all areas of the vessel that are at risk and on quays, jetties and berths when dredging is in close proximity thereof. • Near the quays, jetties and berths, dredging must be done mainly while there are fewer activities and preferably when no vessels are moored.

Responsible Body	Enhancement / Prevention / Mitigation
	<ul style="list-style-type: none"> • If sensors are triggered, dredging must stop and gas levels allowed to drop to acceptable safe levels. If required, the dredging vessel must be manoeuvred away from the area where high gas levels are detected. • Seafaring traffic may not come within 100 m of the dredger unless authorised to do so and must, if possible, pass upwind of the dredger. • Real time H₂S monitoring sensors with alarm levels set at 150 µg/m³ (0.015 ppm) must be placed between the landfilling area and the Naval accommodation for troop protection. • Similar devices should be placed along the eastern wall of the property to protect community health.

Data Sources and Monitoring:

- ◆ Labour Act; International Convention for the Safety of Life at Sea; International Convention on Maritime Search and Rescue; Operational procedures and emergency response plans
- ◆ Real-time hydrogen sulphide gas monitoring during dredging
- ◆ All monitoring and analysis reports kept on file.
- ◆ Any incidents and complaints received must be recorded with action taken to prevent future occurrences.
- ◆ Close-out report or bi-annual reporting, whichever comes first, of all complaints, incidents and monitoring, including corrective action taken. The report should contain dates when training was conducted and when safety equipment and structures were inspected and maintained.

2.1.7 Air Quality

During dredging activities, there is a risk of gaseous emissions at the landfilling area. Hazardous gasses are likely to be hydrogen sulphide and methane. Apart from being foul smelling, it may also pose health risks to any nearby people.

Desired Outcome: To limit the reduction in air quality at the landfill site or at the and near the dredger.

Actions

Responsible Body	Enhancement / Prevention / Mitigation
Proponent	<ul style="list-style-type: none"> ◆ Appointment of a reputable dredging contractor with a known history of responsible and safe operations.
Dredging Contractor	<ul style="list-style-type: none"> ◆ Refer to section 2.1.6 to prevent and/or mitigate the impacts of hydrogen sulphide and methane gas.

Data Sources and Monitoring:

- ◆ Labour Act; International Convention for the Safety of Life at Sea; International Convention on Maritime Search and Rescue; Operational procedures and emergency response plans
- ◆ Real-time hydrogen sulphide gas monitoring during dredging
- ◆ All monitoring and analysis reports kept on file.
- ◆ Any incidents and complaints received must be recorded with action taken to prevent future occurrences.
- ◆ Close-out report or bi-annual reporting, whichever comes first, of all complaints, incidents and monitoring, including corrective action taken. The report should contain dates when training was conducted and when safety equipment and structures were inspected and maintained.

2.1.8 Fire and Explosion Risk

Products used on board vessels, e.g. fuel, may be flammable. The primary causes of fire related accidents may include human error, technical failures and inadequate maintenance. Methane and hydrogen sulphide can be released from dredged material and both are flammable.

Desired Outcome: To prevent injury or physical damage as a result of fire or explosions.

Actions

Responsible Body	Enhancement / Prevention / Mitigation
Proponent	<ul style="list-style-type: none"> ◆ Appointment of a reputable dredging contractor with a known history of responsible and safe operations. ◆ Verify the Dredging Operator's adherence to the requirements of the maritime industry with regard to fire safety and firefighting equipment and training.
Dredging Operator	<ul style="list-style-type: none"> ◆ All fire precautions and fire control on board the dredger must be in accordance with maritime standards, inclusive of sufficient firefighting equipment, water, foam, etc. ◆ A holistic fire protection and prevention plan is essential and all crew must be familiar with this plan, with regular training and fire drills. ◆ All crew must be sensitised about the risk of fire and responsible fire prevention measures. ◆ Regular inspections must be carried out to inspect and test fire-fighting equipment which must be readily available throughout the vessel. ◆ Regular inspections and maintenance must be performed on all electrical circuits, fuel installations and flammable material storage areas to ensure their integrity and prevent electrical short-circuits and leaks. Where maintenance is no longer possible, defective equipment must be replaced and all obsolete consumables must be disposed of in accordance with their respective material safety data sheets (MSDS) documents. ◆ Real-time explosimeter monitoring should be conducted on the vessel. ◆ In the event of a fire, the firefighting and/or evacuation plan must be initiated immediately.

Data Sources and Monitoring:

- ◆ International Convention for the Safety of Life at Sea; Convention on the International Maritime Organization; Operational procedures and emergency response plans
- ◆ Record should be kept of all inspections and maintenance performed on firefighting equipment (date of last service, date of next service, replacement date, etc.).
- ◆ Record should be kept of all training related to firefighting, fire drills and evacuation procedures.
- ◆ Record should be kept of all inspections and maintenance performed on equipment whose failure may result in a fire. This include electrical wiring, fuel storage and reticulation, etc.
- ◆ Any incidents must be recorded with action taken to prevent future occurrences.
- ◆ Close-out report or bi-annual reporting, whichever comes first, of all record keeping and incidents, including corrective action taken.

2.1.9 Noise and Vibration

Noise and vibrations are closely linked. The noise and vibrations generated by the dredging vessel and its operations may impact both the crew and marine organisms, especially marine mammals. Continuous exposure to loud noise may lead to hearing impairment. Vibration can be hand-arm vibration or whole body vibration that may lead to hand-arm vibration syndrome, inflammation and fatigue.

It is expected that, under normal operational conditions, and given the small dredger and modern machinery and technologies, the noise and vibrations generated by the dredging vessel will not have a significant impact on marine mammals, but may temporarily scare them away. Similarly, birds feeding in the area may temporarily move away. Due to the location and small footprint of maintenance dredging, birds on islands are not expected to be affected.

Desired Outcome: To ultimately reduce noise and vibration levels in order to prevent hearing loss in workers, side-effects of vibration, a nuisance to nearby receptors, and impacts on animals. Where noise and vibration levels cannot be lowered, the potential impacts thereof must be minimized.

Actions

Responsible Body	Enhancement / Prevention / Mitigation
Proponent	<ul style="list-style-type: none"> ◆ Appointment of a reputable dredging contractor with a known history of responsible and safe operations.
Dredging Contractor	<ul style="list-style-type: none"> ◆ As far as is practically possible, use state of the art equipment that is designed to reduce the production of noise and vibrations. ◆ Regularly servicing and/or lubricating equipment and isolating noisy equipment/environments with barriers or enclosures, may reduce noise and vibration. ◆ To protect workers, where noise and vibrations cannot be reduced to safe levels, hearing protectors must be worn at all times, crew must be rotated frequently to reduce exposure time, and the number of workers in close proximity to the noise and vibrations source must be reduced.

Data Sources and Monitoring:

- ◆ International Maritime Organization Code on Noise Levels on Board Ships (Resolution MSC.337(91); ISO 21984:2018 Ships and marine technology — Guidelines for measurement, evaluation and reporting of vibration with regard to habitability on specific ships; International Labour Conference: Maritime Labour Convention, 2006; IMO MEPC.1/Circ.833: Guidelines for the Reduction of Underwater Noise from Commercial Shipping to Address Adverse Impacts on Marine Life; World Health Organisation Guidelines on Community Noise
- ◆ Maintain a register to record complaints received from workers and the general public. Complaints should be investigated and if required, a noise and vibration survey should be conducted.
- ◆ Close-out report or bi-annual reporting, whichever comes first, of all record keeping, including corrective action taken.

2.1.10 Waste Production

On-board the dredging vessel, domestic waste, sewage, and potentially hazardous waste may be produced. Where waste is not securely stowed, it may be blown off the dredger by strong winds and end up in the sea and may wash up on the coastline. This form of pollution will not only have a visual impact, but may also negatively impact on marine animals and birds (e.g. entanglement, accidental ingestion, etc.).

Dredged material disposed of on land, other than for beneficial use, is a form of waste that may be contaminated. It must thus be treated as a waste that must be disposed of at a suitable and approved waste disposal facility.

Desired Outcome: To reduce the amount of waste produced and prevent pollution of the environment.

Actions

Responsible Body	Enhancement / Prevention / Mitigation
Proponent	<ul style="list-style-type: none"> ◆ Appointment of a reputable dredging contractor with a known history of environmental responsibility. ◆ Communicate proper waste disposal procedures to the dredging contractor. ◆ For any material to be dredged and disposed of on land, the contamination levels must be determined and the dredged material then handled and disposed of according to the results. For heavily contaminated dredged material it should be treated as hazardous waste and disposed of in agreement with the Municipality of Walvis Bay at the hazardous waste disposal site.
Dredging Contractor	<ul style="list-style-type: none"> ◆ Waste reduction measures should be implemented and all waste that can be re-used / recycled must be kept separate. ◆ Ensure adequate storage facilities for waste are available on-board and that such waste cannot be blown away by strong wind. ◆ Waste should be disposed of at appropriately classified disposal facilities, this includes hazardous materials (empty chemical containers and contaminated rugs, paper, water and soil), if any. ◆ For hazardous substances, see the material safety data sheets available from suppliers for disposal of contaminated products and empty containers.

Data Sources and Monitoring:

- ◆ International Convention for the Prevention of Pollution from Ships (MARPOL); Namport operational procedures and emergency response plans
- ◆ A record should be kept of any disposal of hazardous waste.
- ◆ Any complaints received regarding waste should be recorded with notes on action taken.
- ◆ Close-out report or bi-annual reporting, whichever comes first, of all record keeping, including corrective action taken.

2.1.11 Dredged Material Quality

Marine sediments / substrate may contain elevated levels of elements that may be potentially toxic to organisms. These may be from natural sources or may be as a result of anthropogenic activities. The latter expected from the industrial activities associated with harbours. Thus, the material to be dredged may contain elevated levels of heavy metals originating from harbour activities. Based on previous sediment sampling, it is reasonable to expect elevated cadmium, arsenic, zinc and lead levels.

In the unlikely event that significantly contaminated material is present in areas earmarked for dredging, it would not be prudent to, without due regard, use the dredged material for landfilling purposes.

Desired Outcome: To prevent or limit the spread of toxic material and prevent the build-up of highly contaminated conditions at the landfilling site.

Actions.

Responsible Body	Enhancement / Prevention / Mitigation
Proponent	<ul style="list-style-type: none"> ◆ For any once-off dredging exercise targeting more than 5,000 m³ of dredged material, appoint an independent specialist to collect and analyse substrate from the area to be dredged for elevated levels of chemicals of concern (see list below).
Independent Specialist	<ul style="list-style-type: none"> ◆ Prior to dredging, devise a substrate sampling protocol with the aim of providing information with regard to contamination levels of the various dredge areas. The data generated must inform and enable Namport and the relevant authorities to decide on the correct disposal methods and locations for dredged material. Different areas may have different contamination levels and may have different disposal requirements. ◆ At all predetermined sampling locations, three individual samples must be taken and mixed into a homogenous mixture from which one sample (composite) must be collected for analysis. ◆ Samples must be analysed for at least: tributyltin (TBT), cadmium (Cd), mercury (Hg), copper (Cu), chromium (Cr), lead (Pb), zinc (Zn), arsenic (As), nickel (Ni), polychlorinated biphenyls (PCBs), total petroleum hydrocarbons (TPH) and polycyclic aromatic hydrocarbons (PAHs) ◆ The analysis must be carried out by an accredited laboratory, using suitable analytical methods with a detection limit below the current BCLME maximum limit values for the given parameter. ◆ Compare results with BCLME guidelines (if available) and compile baseline report with recommendations regarding dredged material disposal. ◆ Where any of the chemicals of concern tested is elevated to more than 100 times the BCLME guideline value, dredged material from that area requires special approval for dumping at the disposal site. ◆ Repeat sampling and analysis during dredging as per the dredging contractor's responsibility outlined below.
Dredging Contractor	<ul style="list-style-type: none"> ◆ Based on the outcome of the baseline sediment assessment, devise a dredging and disposal schedule, to be approved by Namport or the relevant authorities, to conform to the requirements for disposal of uncontaminated or insignificantly contaminated dredged material versus significantly contaminated dredged material. <p>Substrate sampling and analysis by an independent consultant has to be repeated as follows:</p> <ul style="list-style-type: none"> ◆ For less than 5,000 m³ no sampling required ◆ Maintenance dredging: one sample per 10,000 m³ dredged material, or part thereof, before dredging that material.

Responsible Body	Enhancement / Prevention / Mitigation
	<ul style="list-style-type: none"> ◆ Capital dredging: one sample per 50,000 m³ dredged material, or part thereof, before dredging that material. ◆ Analysis and interpretation of results, and subsequent handling of dredged material, must be the same as for the baseline sampling.

Data Sources and Monitoring:

- ◆ BCLME Guideline Values or any updates or replacement guidelines that may come in force
- ◆ Baseline and subsequent sampling reports with recommendations
- ◆ Close-out report or bi-annual reporting, whichever comes first, of all sampling records and recommendations as well as actual actions taken.

2.1.12 Suspended Particulate Matter and Water Quality

Dredging can result in the excessive suspension of particulate matter in the water column. This may negatively affect aquatic organisms and seawater intakes. Excessive suspension of particulate matter in the water column can especially occur where very fine, diatomaceous ooze are present. Agitation of the seabed by the dredger, will be the main cause of suspension of particulate matter. The use of a plain suction dredger, and the disposal of sediments via a pipeline on land, will significantly reduce the suspension of sediments if operated correctly.

Impacts of increased suspension of such particulate matter include: reduced light penetration in the water column and thus reduced photosynthesis by algae resulting in less oxygen production; clogging of fish gills, inundation of benthic organisms when suspended particles settle to the seafloor; and increasing the bioavailability of toxic elements that may occur naturally in, or may have accumulated through anthropogenic impacts in, the substrate. Increased bioavailability of heavy metals like cadmium or lead for example, may result in reproductive abnormalities and reduced fertility, which may put the local food web at risk. It may also accumulate in organisms, especially filter feeders like mussels.

Various preventative and mitigating methods can be employed to prevent excessive suspension of particulate matter. Some of these are listed below, but it is important to note that not all of the modifications or procedures mentioned should necessarily be employed. It is the responsibility of the contractor, in consultation with the Proponent, to determine which modifications or procedures would best prevent particulate matter suspension, while keeping in mind operational timeframes and financial feasibility. Also, dredging techniques that result in lower suspension of particulate matter, that, as a result of the techniques required to lower such suspension occur over longer periods of time, may have more serious adverse effects. This is because acute, high level exposure to negative impacts may have less consequences than, chronic low level exposure.

Environmental conditions that may increase the risk of elevated total suspended solids reaching the sensitive receptors include: tidal conditions; rough sea conditions (high wave/swell action); wind conditions.

Total suspended solids is determined through turbidity measurements (nephelometric turbidity units (NTU)) that can be converted to total suspended solids (mg/ml) through turbidity sensor calibration techniques.

Desired Outcome: To protect sensitive receptors against impacts of suspended sediments and reduced water quality by limiting the suspension of particulate matter to acceptable levels, especially where contaminated substrate / sediments are present.

Actions.

Responsible Body	Enhancement / Prevention / Mitigation
Proponent	<ul style="list-style-type: none"> ◆ Appointment of a reputable dredging contractor with a known history of environmental responsibility. ◆ Determine the baseline turbidity / TSS conditions at strategic locations throughout the harbour for at least one month prior to dredging. The results must serve as baseline for real time turbidity monitoring as indicated in the dredging contractors responsibility below. ◆ For any once-off dredging exercise targeting more than 5,000 m³ of material, appoint an independent specialist to determine baseline water quality conditions by analysing for elevated levels of chemicals of concern (see list below).
Independent Consultant	<ul style="list-style-type: none"> ◆ Prior to dredging, devise a turbidity monitoring and water sampling protocol, with the aim of providing information with regard to spread of suspended solids and contamination in the water column. The data generated must inform the dredging operator and Namport on the

Responsible Body	Enhancement / Prevention / Mitigation
	<p>effectiveness of preventative and mitigation measures aimed at preventing the mobilisation and spread of particulate matter and contaminants. Real time turbidity monitoring can act as a warning system for situations where excessive suspension of particulate matter occur. As real-time water quality (chemicals of concern) monitoring is not possible, turbidity monitoring must act as a pro-active approach to prevent the spread of contaminants while chemical of concern monitoring, with delayed results, will serve to guide future dredging, rather than dictating current dredging.</p> <ul style="list-style-type: none"> ◆ Continue the turbidity monitoring during dredging as per the dredging contractor's responsibility outlined below. ◆ For baseline water quality determination, at all predetermined sampling locations, including the landbased monitoring holes, a water sample must be collected from below the surface. Sampling and subsequent handling of the sample must be according to the approved protocol of the accredited laboratory who will be responsible for the analysis. ◆ Water samples must be analysed for at least: tributyltin (TBT), cadmium (Cd), mercury (Hg), copper (Cu), chromium (Cr), lead (Pb), zinc (Zn), arsenic (As), nickel (Ni), polychlorinated biphenyls (PCBs), total petroleum hydrocarbons (TPH) and polycyclic aromatic hydrocarbons (PAHs) ◆ The analysis must be carried out by an accredited laboratory, using suitable analytical methods with a detection limit below the current BCLME maximum limit values for the given parameter. ◆ Compare results with BCLME guidelines (if available) and compile baseline report. ◆ Repeat sampling and analysis during dredging as per the dredging contractor's responsibility outlined below.
Dredging Contractor	<p>Appoint an independent consultant to conduct real-time turbidity (TSS) monitoring specifically aimed at protecting sensitive receptors (fish factory processing water abstraction points).</p> <p>The following TSS concentrations for the upper portion (-3 m) of the water column are recommended as threshold values for determining responses to real time monitoring:</p> <ul style="list-style-type: none"> ◆ < 20 mg/l or 80th percentile of background levels – desirable low risk scenario. ◆ 20 – 80 mg/l for continuous periods of three days or longer - lower threshold of possible adverse ecological effects. ◆ 80 – 100 mg/l for more than six hours - probable adverse effects, mitigation measures must be considered. ◆ 150 mg/l - proven negative impacts, cease dredge operations. <p>The TSS of the water at monitoring locations must not exceed 80 mg/l or the 80th percentile of the background TSS as determined by a baseline study, whichever is the highest value.</p> <p>Preventative measures used to reduce suspension of particulate matter include:</p> <ul style="list-style-type: none"> ◆ Using the most appropriate dredger and the dredgers most suitable draghead to reduce particulate matter suspension ◆ Shielding of the suction head <p>Mitigation measures used to prevent impacts resulting from suspended particulate matter include:</p> <ul style="list-style-type: none"> ◆ Slowing down the rate of dredging or ceasing dredging altogether when suspended solids reach a predetermined cut-off level (based on baseline results). ◆ The use of silt curtains (not effective in strong currents) ◆ Coordinating dredging near sensitive receptors to coincide with tides, tidal currents and winds that will take plumes away from such receptors. <p>Water sampling and analysis by an independent consultant has to be repeated as follows:</p>

Responsible Body	Enhancement / Prevention / Mitigation
	<ul style="list-style-type: none"> ◆ For less than 5,000 m³ no water sampling required ◆ Maintenance dredging: one water sample before and one water sample after dredging 10,000 m³ dredged material, or part thereof. ◆ Capital dredging: one water sample before, one during and one after dredging 100,000 m³ dredged material, or part thereof. ◆ Water quality during dredging must be compared with baseline data and mitigation measures implemented if a deterioration in water quality, that is suspected to result from dredging activities, is discerned.

Data Sources and Monitoring:

- ◆ Baselines, real time turbidity monitoring and subsequent water sampling and monitoring reports with recommendations.
- ◆ BCLME Guideline Values or any updates or replacement guidelines that may come in force.
- ◆ Close-out report or bi-annual reporting, whichever comes first, of all record keeping, including corrective action taken.

2.1.13 Impacts on Ecosystems

Dredging poses risks to marine life. Potential negative impacts of dredging include habitat destruction, smothering of benthic communities due to settling of suspended particulate matter, possible temporary displacement of animals (including birds) from the areas that are dredged, marine mammal strikes by the vessels or their propellers, and reduced water quality due to the suspension of particulate matter or through pollution.

Desired Outcome: To prevent or minimise destruction, degradation and disturbance of the ecological environment.

Actions

Responsible Body	Enhancement / Prevention / Mitigation
Proponent	<ul style="list-style-type: none"> ◆ Clearly define the area to be dredged and monitor the dredging contractor's adherence to dredging only this area in order to minimize the impact footprint.
Dredging Contractor	<ul style="list-style-type: none"> ◆ Limit dredging and disposal to within the boundaries of the areas defined by the Proponent. ◆ If any mortalities in marine fauna are observed at or around the dredging location, all dredging activities should be ceased and the cause investigated. Dredging can continue once it is determined to be safe to do so.

Data Sources and Monitoring:

- ◆ International Convention for the Prevention of Pollution from Ships (MARPOL); Operational procedures and emergency response plans
- ◆ Record and marine mammal sightings and/or collisions and any other significant encounters or observations of animals and birds (including sick or dead animals) and report these to the local offices of the MEFT and the Ministry of Fisheries and Marine Resources (MFMR).
- ◆ Close-out report or bi-annual reporting, whichever comes first, of all record keeping, including corrective action taken.

2.1.14 Heritage Impact

The areas to be dredged have all been dredged before and no wrecks or artefacts of archaeological significance are expected to be present or found during maintenance dredging.

Desired Outcome: To prevent the destruction or damage of items of archaeological / heritage value.

Responsible Body	Enhancement / Prevention / Mitigation
Proponent	<ul style="list-style-type: none"> ◆ Appointment of a reputable dredging contractor with a known history of environmental responsibility.
Dredging Contractor	<ul style="list-style-type: none"> ◆ If a wreck or any other artefact of possible archaeological value is found during the dredging activities, the dredging process must be halted and the National Heritage Council must be informed. Dredging may only continue at that location once permission has been given to do so.

Data Sources and Monitoring:

- ◆ National Heritage Act
- ◆ Record any discoveries of potential archaeological value and report it to the National Heritage Council.
- ◆ Close-out report or bi-annual reporting, whichever comes first, of all record keeping and the proof of reporting of any discoveries to the National Heritage Council.

2.1.15 Land-based Infrastructure Impact

Collisions with land-based infrastructure during dredging activities resulting in damage, downtime and financial losses. Excessive accumulation of water at the landfill site may result in damage to nearby infrastructure such as the road or the Naval Base perimeter fence.

Desired Outcome: To prevent the damage to existing land-based infrastructure

Responsible Body	Enhancement / Prevention / Mitigation
Proponent	<ul style="list-style-type: none"> ◆ Appointment of a reputable dredging contractor with a known history of operational responsibility. ◆ Issue the dredging operator with the locations of any known sensitive or problem areas that needs to be considered during the dredging exercise.
Dredging Contractor	<ul style="list-style-type: none"> ◆ Inform relevant stakeholders of the intention to dredge close to their facilities. ◆ Schedule the dredging operations when no traffic is expected to be present at the specific site. ◆ Ensure the proper and correct functioning of all operational equipment, navigational and warning systems. ◆ Heighten the awareness of all personnel on board the dredger to the potential dangers associated with dredging in close proximity to land-based infrastructures. ◆ Care should be taken to also consider underwater moving parts and not only those structure of the vessel that is above water. ◆ Install two groundwater level monitoring points. Conduct weekly water level measurements. ◆ To prevent ponding of water, it is recommended that excess water be pumped to the ocean, preferably to the ocean near Independence Beach

Data Sources and Monitoring:

- ◆ Record any incidents with the corrective actions taken.
- ◆ Close-out report or bi-annual reporting, whichever comes first, of all record keeping and incidents.

2.2 DECOMMISSIONING AND REHABILITATION

Decommissioning will entail ceasing of dredging operations. The following include activities to be undertaken for decommissioning:

- ◆ Continued adherence to all maritime laws and regulations, and specifically Namport's requirements, will be required.
- ◆ Ensure that operational practices are maintained up to the time that the dredger has been removed from the water.
- ◆ Ensure that all reporting requirements are met, inclusive of incidents reports, and a close-out report containing a summary of all monitoring data with recommendations by the independent specialist is prepared and submitted to the Proponent.

3 CONCLUSION

The EMP for the report specifies some of the enhancement measures aimed at increasing the positive impacts of the dredging exercise. This include maximising the appointment of Namibian companies and citizens for support services. Furthermore it is the responsibility of the Proponent to contract a dredging contractor with a history of being environmentally responsible. Parties responsible for transgressing of the EMP should be held responsible for any rehabilitation that may need to be undertaken. The Proponent could use an in-house Health, Safety, Security and Environment Management System in conjunction with the EMP. All operational personnel must be taught the contents of these documents.