HDF ENERGY RENEWSTABLE SWAKOPMUND PROJECT | ENVIRONMENTAL MANAGEMENT PLAN | POWER PLANT AND ASSOCIATED INFRASTRUCTURE

Swakopmund, Erongo Region, Namibia

Prepared for: HDF Energy (Namibia) (Pty) Ltd

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ACRONYMS AND ABBREVIATIONS

Acronym / Abbreviation	Definition
AIS	Alien Invasive Species
BESS	Battery Energy Storage System
CDP	Community Development Plan
CITES	Convention on International Trade in Endangered Species
ECC	Environmental Clearance Certificate
ED	Enterprise Development
EDI	Electro-deionization
EIA	Environmental Impact Assessment
EMA	Environmental Management Act, 2007 (No. 7 of 2007)
EMC	Energy Management System
EMP	Environmental Management Plan
EPC	Engineering Procurement Construction
EPFIs	Equator Principle Financial Institutions
EPRP	Emergency Preparedness and Response Plan
GA	General Arrangement
GHG	Green House Gas
HDF Energy	HDF Energy Namibia (Pty) Ltd
HSE	Health, Safety and Environment
HPP	Harambee Prosperity Plan II (2021-2025)
HWMP	Hazardous Waste Management Plan
IFC	IFC Performance Standards
ILO	International Labour Organisation
IWRM	Integrated Water Resources Management (
LDPE	Low density polyethylene
MEFT	Ministry of Environment, Fisheries and Tourism
MHI	Major Hazard Installation
MMPT	Maximum power point tracking system
MSDS	Material Safety Data Sheets
NACOMA	Namibian Coast Conservation & Management Project
NDP	National Development Plans
NIRP	National Integrated Resource Plan, 2016
O&M	Operations and Maintenance
PEM	Proton-exchange membrane
PLP	Preformed Line Products
POPs	Persistent Organic Pollutants
PPE	Personal Protective Equipment

Acronym / Abbreviation	Definition
PV	Photovoltaic
RC	Reinforced concrete
RO	Reverse Osmosis
S&EP	Social and Environmental Policy
SEA	Strategic Environmental Assessment
SFD	SWAN-FLIGHT Diverter
SWRO	Seawater Reverse Osmosis
TL	Transmission line
UNCBD	United Nations Convention on Biological Diversity
UNDRIP	United Nations Declaration on the Rights of Indigenous Peoples
UNEP	United Nations Environment Programme
WRMA	Water Resources Management Act (No. 11 of 2013)

HDF Energy Renewstable Swakopmund Project | Environmental Management Plan | Power plant and Associated infrastructure

1. INTRODUCTION

HDF Energy (Pty) Ltd is a global market leader in the development and operation of hydrogen-to-energy technology. Having established HDF Energy Namibia (Pty) Ltd (HDF Energy), the company is proposing to benefit from Namibia's considerable renewable energy capacity to create the Renewstable® Swakopmund project.

In an attempt to diversify its local/international energy mix, stimulate local development in line with the Harambee Prosperity Plan II, and decrease Namibia's reliance on fossil fuel dominated power, Renewstable® Swakopmund is Africa's first integrated solar-hydrogen power project.

1.1 PROJECT BACKGROUND

The Renewstable® Swakopmund project seeks to combine solar Photovoltaic (PV) power along with hydrogen production to generate stable, dispatchable power to the national grid to be able to meet the consumer demand. The Renewstable® Swakopmund project concept consists of the following components:

- An eighty-five (85) MW solar PV power plant with tracker configuration;
- A Reverse Osmosis (RO) desalination plant and demineralization plant;
- A hydrogen chain consisting of electrolysers, hydrogen storage, hydrogen fuel cells and a battery energy storage facility;
- An energy management system;
- An overhead electrical transmission line;
- Water pipeline between the desalination plant and the power plant; and
- A hydrogen refuelling station.

The project will be located in the east of the town of Swakopmund in the Erongo Region of Namibia. The approved location is in close proximity to a railway line and C28 highway. The projects locality is shown in Figure 1 1.

Development and operation of the Renewstable® Swakopmund project is subject to the Ministry of Environment, Fisheries and Tourism (MEFT) granting an Environmental Clearance Certificate (ECC) in terms of the Environmental Management Act, 2007 (No. 7 of 2007) (EMA) and the EIA Regulations, 2012. In applying for an ECC, it is necessary for HDF Energy to undertake an Environmental Impact Assessment (EIA) and compile an Environmental Management Plan (EMP) (See Section 1.2).

IMPORTANT NOTE:
The scope of this EMP relates specifically to the management of environmental and social risks associated with the Renewstable® Swakopmund power plant facility and associated infrastructure. A separate Environmental Management Plan has been prepared for the management of the desalination plant

Figure 1-1: Project locality and components

The purpose of this EMP is to ensure that impacts associated with the construction and operational phase are avoided and, where they cannot be avoided, are kept to a minimum and rehabilitated. The EMP, which has as its basis the mitigation measures listed in the EIA Report, sets environmental targets for the Contractors and reasonable standards against which the Contractor's performance can be measured during the construction and operational phase.

The facility is to be operated on behalf of HDF Energy (Table 1-1):

Table 1-1: Applicant details

Component	Description
Company Name	HDF Energy Namibia (Pty) Ltd
Address:	3rd Floor Mandume Park Building, c/o Dr W Kulz & Teinert Street, Windhoek.
Responsible person:	Tashiya Walenga/ Nicolas Lecomte
Tel:	+264 8179 42766
E-mail:	namibia@hdf-energy.com
`Web address	https://www.renewstable-swakopmund.com/contact

While HDF Energy will own the Renewstable® Swakopmund project, the development of the facilities will be undertaken by and Engineering Procurement Construction (EPC) Contractor. Operation of the facility will be done by an Operations and Maintenance (O&M) Contractor.

1.2 PROJECT COMPONENTS

The details of the project components below are based on HDF Energy's current design considerations and has been provided here for reference. Final specifications will only be confirmed during the detailed design phase and based on selected manufacturers specifications.

1.2.1 Solar Photovoltaic plant

The main equipment used to convert the solar energy to electricity is:

- Photovoltaic modules, which convert the solar radiation into direct current;
- The single-axis tracker, which supports and orients the PV modules to minimize the angle of incidence between the incoming sun rays and the PV modules surface during the day;
- The string combiner boxes, which consolidate the output of the strings of photovoltaic modules before reaching the inverter;
- Central inverters, which convert DC from solar field to AC; and
- Power Transformers, which raise the voltage level from low to medium.

The electrical configuration of the PV plant can be seen in (Figure 1-2).

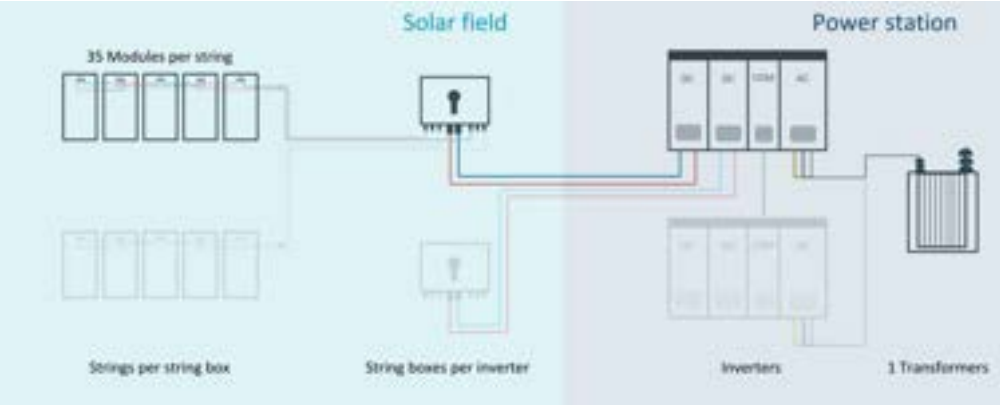

Figure 1-2: Simplified electrical configuration diagram

1.2.1.1PV module

The selected photovoltaic module is the CS7L-570MB-AG 1500V Bifacial model, manufactured by Canadian Solar Inc. It has a peak power of 570.0 W, and the technology of the cells is Simono (refer to Figure 1-3 for an illustrative example).

The features of the photovoltaic module are shown in Table 1-2.

The module has a bifaciality factor of 70.00 %.

Table 1-2: Photovoltaic module characteristics

Photovoltaic module characteristics	
Main characteristics	
Module model	CS7L-570MB-AG 1500V
Manufacturer	Canadian Solar Inc.
Technology	Si-mono
Type of module	Bifacial
Maximum voltage	1500 V
Standard test conditions (STC)	
Peak power	570.0 W
Efficiency	20.23 %
MPP voltage	33.1 V
MPP current	17.31 A
Open circuit voltage	40.1 V
Short circuit current	18.17 A
Temperature coefficients	
Power coefficient	-0.340 %/°C
Voltage coefficient	-0.260 %/°C
Current coefficient	0.050 %/°C
Mechanical characteristics	
Length	2172.0 mm
Width	1303.0 mm
Thickness	0.04 mm
Weight	35.9 kg

Figure 1-3: Bifacial Si-mono photovoltaic module (example)

1.2.1.2Inverter

The inverter converts the direct current produced by the photovoltaic modules to alternating current. It is composed of the following elements:

- One or several DC-to-AC power conversion stages, each equipped with a maximum power point tracking (MPPT) system. The MPPT will vary the voltage of the DC array to maximize the production depending on the operating conditions;
- Protection components against high working temperatures, over or under voltage, over or under-frequencies, minimum operating current, mains failure of transformer, anti-islanding protection, protection against voltage gaps, etc. In addition to the protections for the safety of the staff personnel; and
- A monitoring system, which has the function of relaying data regarding the inverter operation to the owner (current, voltage, power, etc.) and external data from monitoring of the strings in the DC array (if a string monitoring system is present).

In Figure 1-4 a commonly used photovoltaic inverter for utility-scale PV plants is shown.

The main characteristics of the currently selected inverter are shown in Table 1-3.

Table 1-3: Inverter characteristics

Inverter characteristics	
Main characteristics	
Inverter model	INGECON SUN 1800TL B690 IP54 H1000
Inverter type	CENTRAL
Manufacturer	Ingeteam
Maximum DC to AC conversion efficiency	98.54 %
Input side (DC)	
MPPT search range	996 - 1300 V
Maximum input voltage	1500 V
Output side (AC)	
Rated power	1793.0 kVA
Power at 30 C (datasheet)	1793.0 kVA
Power at 50 C (datasheet)	1613.0 kVA
Output voltage	690 V
Output frequency	50 Hz

Figure 1-4: Central photovoltaic inverter (Example)

Table 1-4: Inverters

Inverters	Qty	Input Strings	Power AC	Power DC	DC/AC ratio
INGECON SUN 1800TL B690 IP54 H1000	26	108	1793 kW	2155 kW	1.202
INGECON SUN 1800TL B690 IP54 H1000	10	107	1793 kW	2135 kW	1.191
INGECON SUN 1800TL B690 IP54 H1000	4	109	1793 kW	2175 kW	1.213

Note that this inverter is for reference, but other supplier or inverter can be selected at further stage of the project.

1.2.2 Hydrogen chain

The hydrogen chain consists of the following elements used to produce green hydrogen electricity:

- Electrolysers;
- Hydrogen storages; and
- Hydrogen multimegawatt fuel cells

1.2.2.1 Electrolysers

The electrolyser is a system that uses solar generated electricity to separate water into hydrogen and oxygen in a process called electrolysis. The oxygen residual oxygen molecules are vented to the atmosphere. HDF Energy is investigating if the oxygen could be captured and stored to supply other industrial processes

or even medical gases in some cases, and should a safe and economical solution be found, adequate equipment will be implemented of retrofitted to the installation at later stage.

In its most basic form, an electrolyser contains a cathode (negative charge), an anode (positive charge) and a membrane. The entire system also contains pumps, vents, storage tanks, a power supply, separator and other components. Water electrolysis is an electrochemical reaction which takes place within the cell stacks. Electricity is applied to the anode and cathode) and causes the water (H_20) to split into its component molecules, hydrogen (H_2) and oxygen (O_2).

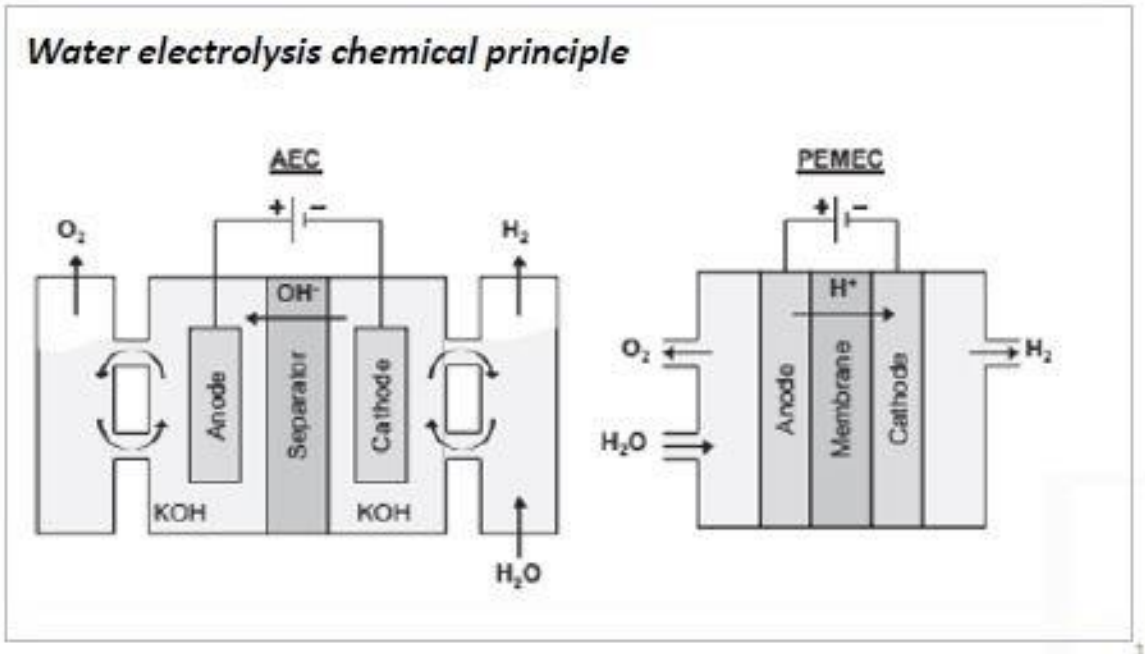

Figure 1-5: Schematic of the electrolysis process

The Renewstable® Swakopmund Project will incorporate an alkaline or Proton-exchange membrane (PEM) pressurized electrolyser and will include (See Figure 1-6):

- Transformer;
- AC/DC Converter (rectifier);
- Stack;
- Balance of plant (water, hydrogen and oxygen piping and separators);
- Hydrogen purification system;
- Control panels; and
- Safety equipment.

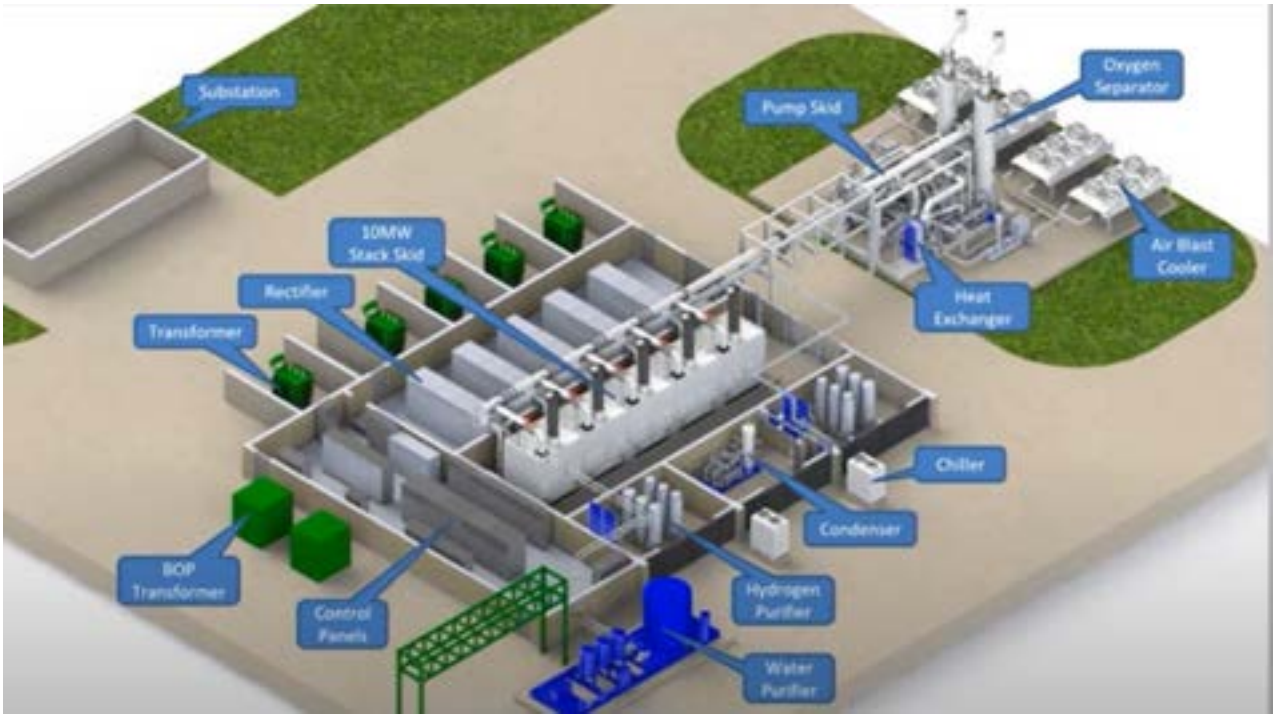

Figure 1-6: Example layout of an electrolyser

1.2.2.2 Hydrogen storage vessels

Produced hydrogen will be stored in a series of hydrogen storage vessels or tank farm.

Tanks to be used are standard steel tanks used by the petrochemical industry with the following specifications:

- Size: approx. 22 m length, 2.8 m diameter;
- Volume per tank: up to 115 m^3;
- Total estimated combined storage: 4 600 m^3;
- Number of vessels: ~ 40; and
- Typical storage pressure: 30 bar.

Base design case is to consider that the tanks will be positioned horizontally and stacked.

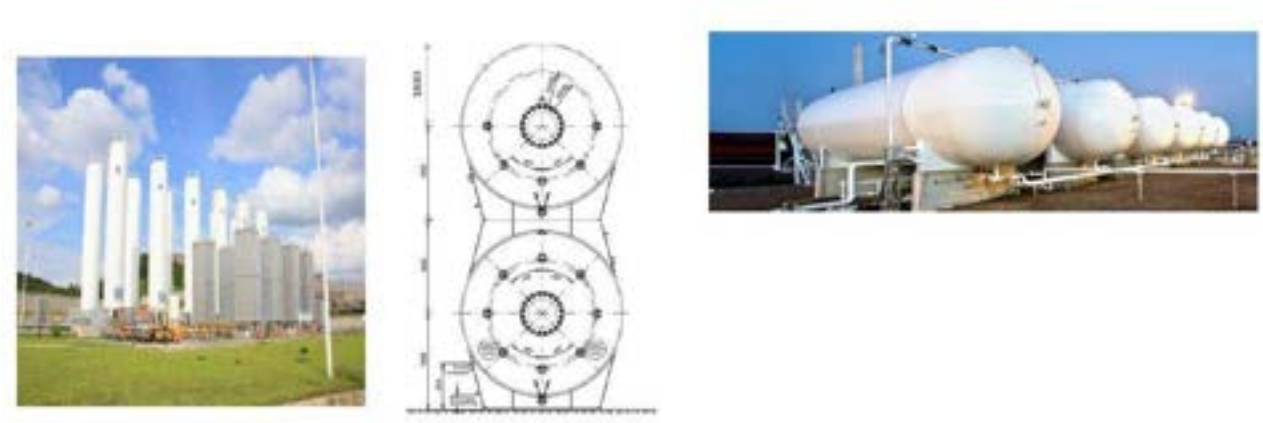

Figure 1-7: Configuration of the tanks
(vertical -left, horizontal – right, stacked horizontal – centre)

1.2.2.3 Hydrogen fuel cells

The purpose of the hydrogen fuel cell is to generate electricity during the periods when the solar PV plant is incapable of meeting demand (nighttime).

Hydrogen fuel cells produce electricity by combining hydrogen and oxygen from the ambient air. The hydrogen reacts with oxygen across a membrane generating electricity, water, and heat.

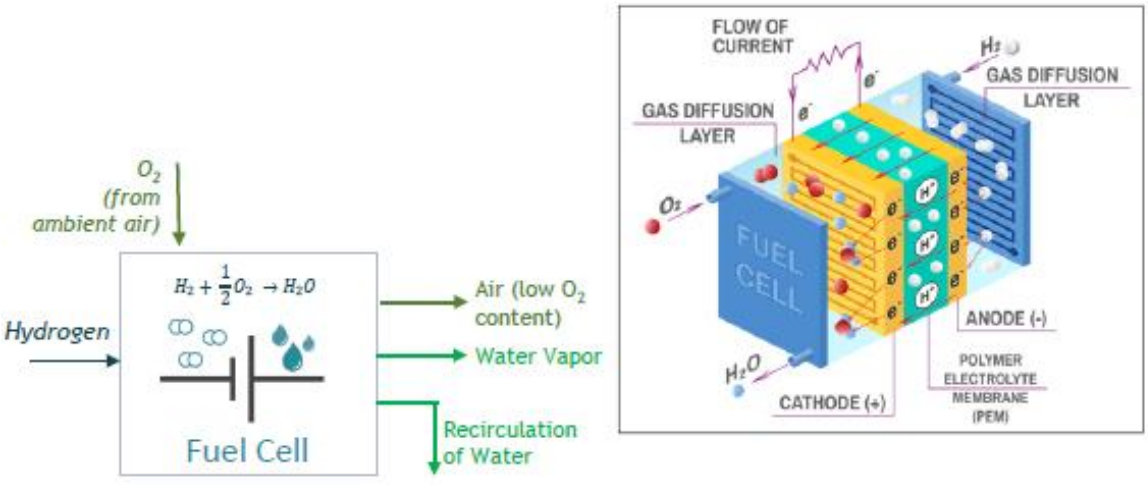

Figure 1-8: Illustration of the chemical reactions (left and centre) which take place within a PEM hydrogen fuel cell

The Renewstable® Swakopmund project incorporates a total of four (4) hydrogen fuel cells rated at 1.5MW each. Each of these hydrogen fuel cells is enclosed in a standard 40 ft container modified with openings (on the roof for vents and ventilation and on the sides for maintenance access).

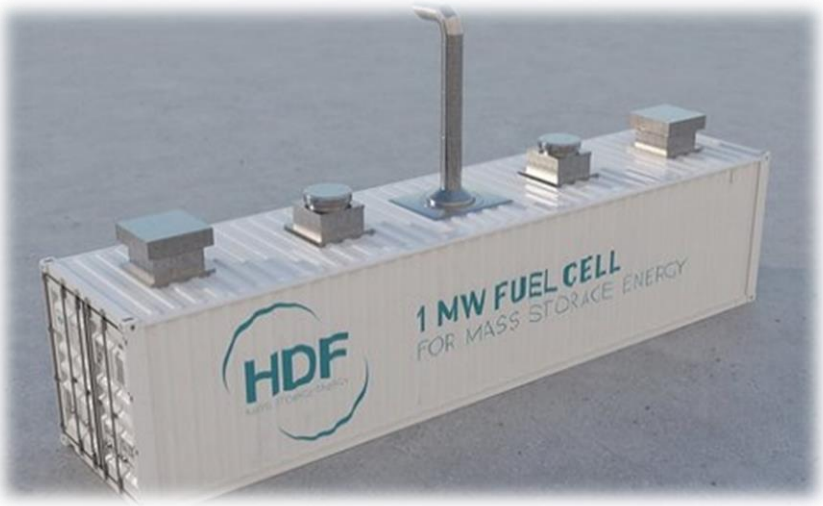

Figure 1-9: Example of an HDF Energy hydrogen fuel cell

1.2.3 Battery Energy Storage System

Battery Energy Storage System (BESS) is used to accommodate or compensate the intermittency of PV system, to provide stable power and support the ramp up and ramp down of the system. BESS is used for small power supply duration compared to hydrogen storage.

The total capacity of BESS considered is 93 MWh for a Power of 31 MW. This total capacity is separated into 25 modules.

Batteries will be contained in cabinets, including the battery cells and management systems, auxiliaries, cooling, and safety systems. Transformers and power conversion systems are also associated to the BESS as per defined electrical arrangement.

A fire-fighting system is implemented including fire detectors and fire containment.

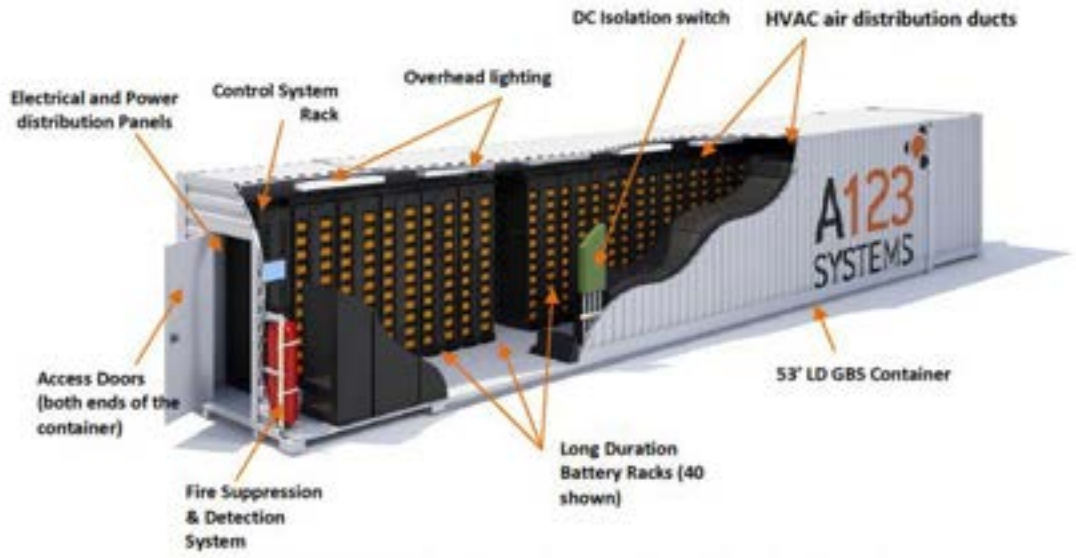

Figure 1-10: Conceptual illustration of a BESS

1.2.4 Operations and Maintenance Buildings

The site includes a maintenance building used to store spare parts, operating and maintenance tools, and to undertake operational maintenance operation.

Alongside the maintenance building there is also the control supervision building (to monitor the plant operation) as well as operators desk, meeting room, changing room, and ablutions.

1.2.5 Access Roads

The layout of the Renewstable® Swakopmund includes a total of ~ 10 km of access roads including a 6 m wide paved main road and ~ 4 km of compacted secondary roads.

1.2.6 Demineralized water production and supply

The project includes a water treatment facility to address its water needs (for hydrogen production via electrolysis, PV panel cleaning, fuel cell and other equipment water top up). While the operation of the plant only requires ~74 m^3 of water per day, HDF Energy is investigation the possibility of using excess water from the plant to support side activities to the project (e.g. agricultural activities).

The water treatment is composed of a Seawater Reverse Osmosis (SWRO) desalination plant shore-based (circa 7km from the site) producing potable water and a second stage of purification at the Power plant site producing ultra-pure water.

The desalination plant can produce up to 200 m^3 per day of potable water from two (2) trains of pre-treatment, purification, and post-treatment, providing a robust constant supply of potable water.

Approximately 200m^3/day of potable water will be supplied to the Renewstable® Swakopmund Project site continuously i.e., a new potable water supply capacity of circa 73 000 m^3/year. These SWRO units will serve

as the 1st pass RO system and will produce product water within the Namibian potable specification (as per the Namibian regulations for potable water and SANS 241: 2015).

The SWRO will be supplied by electricity generated by onsite PV park of 265 kWp.

The preliminary plant layout (General Arrangement (GA) drawing) for the two RO 1st pass trains as well as the solar farm positioning is shown in Figure 1-11. This may vary depending on the final design. Allowance has been made for 2 x 40 ft containers to house the equipment and electrical control cabinets, with an allowance for 2 x 20' containers for office and ablution facilities (if required). The foundations are likely to be reinforced concrete (RC) spread footings, with an RC ground slab. The fixed tilt solar array is likely to have screw-pile type shallow foundations.

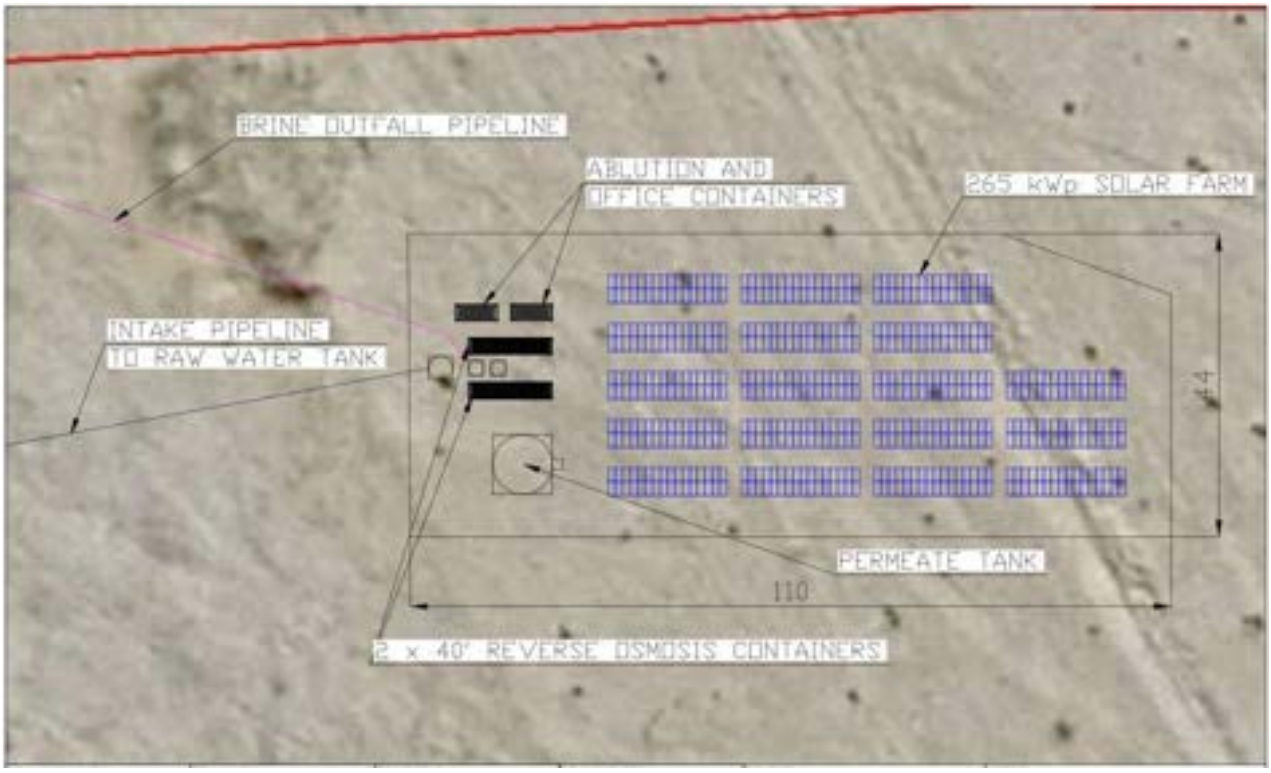

Figure 1-11: Beach compound for 1st pass RO and Solar Farm
(Impact Water Solutions, 2022)

To provide the ultra-pure water requirement, a portion of the supplied potable specification water will be passed through a secondary RO process (2nd pass RO system) and Carbon Dioxide (CO_2) degassing stage to achieve the desired feed water specification to the downstream ultra-pure water process.

The product water (permeate) from the 2nd pass RO process is then treated through an ultra-pure process, known as Electro-deionization (EDI). The preliminary plant layout for the water treatment plant based at the Renewstable® Swakopmund hydrogen plant site is shown in Figure 1-12 below. This may vary depending on the final design. Allowance has been made for 1 x 20' container to house the equipment and electrical control cabinets.

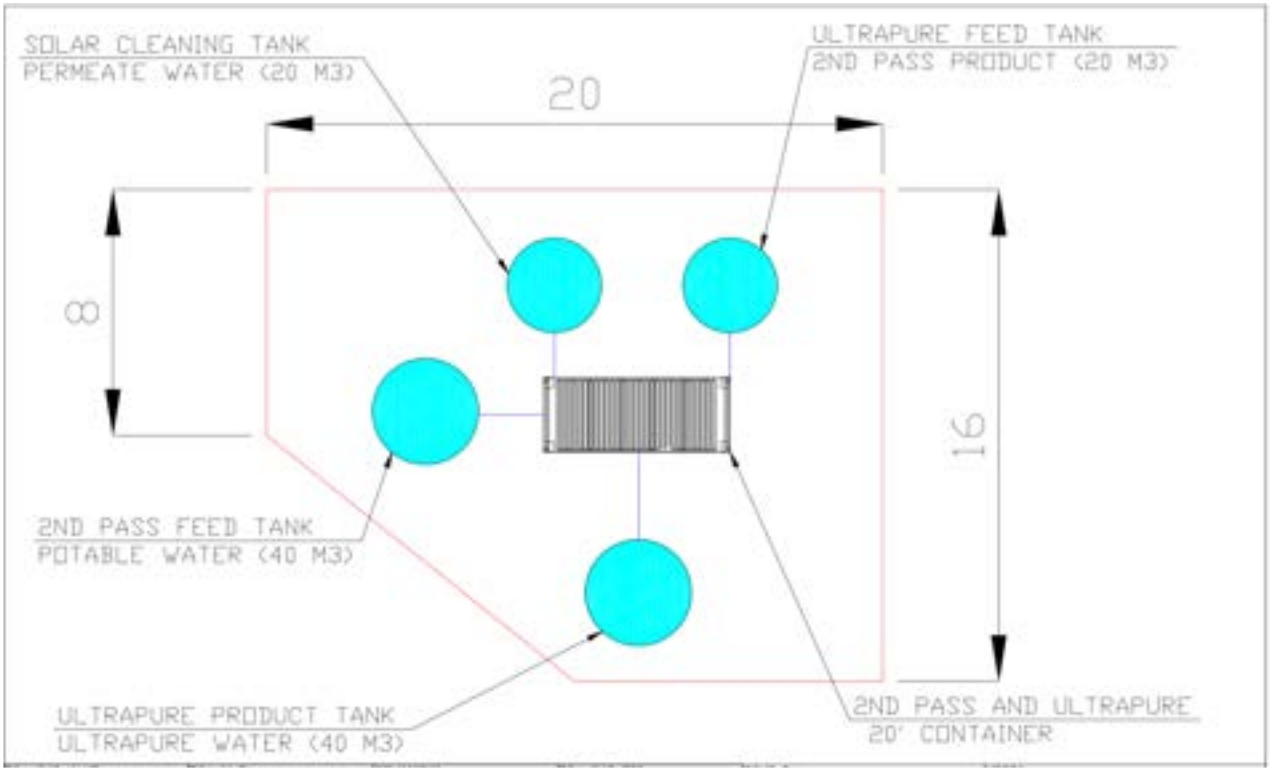

Figure 1-12: RO 2nd pass and 'Ultrapure' plant at Renewstable® Swakopmund site
(Impact Water Solutions, 2022)

Based on the above, the main components of this water treatment system are as follows:

- Sea water intake: Beach-Wells / Gallery Trench system or Direct Intake;
- Raw water storage reservoirs and pre-treatment line;
- Seawater RO plant/s (1st pass RO);
- Post-treatment line, potable water storage reservoir and pumping station;
- Brine outfall (header tank + discharge pipeline / Salt Pan option);
- Solar powered energy supply to maximise off grid operations;
- Transmission of potable water after the proposed bulk water storage via a pipeline and pumping system to Renewstable® Swakopmund;
- Brackish Reverse Osmosis plant (2nd pass RO); and
- EDI ultra-purification as a final treatment step.

Electricity supply to the desalination plant will be via a dedicated solar PV plant located at the desalination plant which will include:

- PV Panels;
- Ground structure and foundations;
- Junction box;
- Weather station (Solar irradiance);
- Total power: 265 kWp.

Although the desalination plant is powered exclusively by solar PV plant and thus working only at day, a backup line to the grid will allow to power the transfer pump to supply water at night and as a backup for the SWRO in case of low irradiation.

The desalinated and demineralised water is not designed to meet drinking water standards. As a result, potable water for domestic consumption will be sourced via a metered connection to the Swakopmund Municipal reticulation.

Municipally sourced water will also be used as a backup water supply, connecting into the 2nd pass RO plant.

1.2.7 Energy Management System

The Energy Management System (EMS) is the software that will compute the solar irradiance forecast in advance and optimize the use of both the hydrogen and battery storages in order to deliver the maximum amount of power to the grid and minimize the energy losses. In case of low sun resources, it can maximize the energy supply and adapt the generation profile to comply best with the contractual obligations.

1.2.8 Electrical Transmission

The evacuation of electricity from the Renewstable® Swakopmund facility will be via:

- The existing Tamariskia servitude to tie into the existing Tamariskia substation
- To the south to a proposed Sekelduin substation; or
- A loop in – loop out system tying into the nearby existing transmission line and utilising existing infrastructure.

The transmission lines will utilize “Kamerad” (wooden five-pole) structures to support the 66 kV transmission line.

1.2.9 Hydrogen refueling station

As part of the project concept, HDF Energy has proposed the inclusion of a small-scale hydrogen refueling station.

Specific technical components are necessary for the construction of a hydrogen refueling station and include (See Figure 1-13):

- Source of hydrogen – Low pressure hydrogen (H_2) is stored in bottles (cylinder racks), tanks or tube trailers;
- Boosters – H_2 is compressed using boosters;
- Buffers – Once the pressure has been increased, H_2 is stored in bottles known as buffers;
- Exchanger – Before it is distributed, H_2 is cooled using the exchanger and the refrigeration unit;
- Dispenser – It enables distribution of H_2, to the vehicle’s tank filing it in a few minutes;
- Refrigeration unit – It supplies cooling fluid to the exchanger; and
- General control cabinet – The stations electrical control cabinet.

The refueling station will supply hydrogen at 350 bar at a maximum rate of 100 kg/day with one dispenser.

Figure 1-13: Conceptual layout of a hydrogen refuelling station

1.Hydrogen source, 2. Boosters, 3. Buffers, 4. Exchangers, 5. Dispenser, 6. Air compressor, 7. Buffer tank, 8. Refrigeration unit, 9. General control cabinet

1.3 ENVIRONMENTAL IMPACT PROCESS

Prior to the commencement of the proposed project, an ECC is required on the basis of an EIA report and EMP. In accordance with this legal framework the EIA approach included the following:

- The scoping process was conducted to identify the environmental issues associated with the proposed project and to define the terms of reference for the required specialist studies and the EIA.
- Specialist studies were commissioned in accordance with the relevant terms of reference. The specialists were selected on the basis of their expertise and knowledge of the project area. (Refer to Table 1-5 below).
- The EIA report and EMPs were prepared on the basis of the findings of the specialist studies.
- A project specific public participation process was conducted.

The following specialist studies were identified in the scoping phase and undertaken during the EIA. These studies have assisted with the investigation and assessment of the key impacts, as well as providing recommendations to reduce and manage those impacts as best as possible:

Table 1-5: Environmental and Social Specialists

Aspect	Specialist	Description
Visual	SLR SiVest (Pty) Ltd	Assess the potential visual impact caused by the proposed Project.
Surface and groundwater	Nature Stamp (Pty) Ltd	This study will assess the potential Surface and groundwater impacts associated with the proposed HDF Energy Renewstable® Swakopmund Project.

Aspect	Specialist	Description
Noise	WKC Consulting (Pty) Ltd	Identify and assess the potential noise impacts associated with the construction and operation of the proposed HDF Energy Renewstable® Swakopmund Project.
Heritage	Dr. John Kinahan	This study will focus on the probable impacts of the proposed project on heritage and archaeological impacts within the footprint of the proposed project.
Terrestrial biodiversity	Potgieter Consultancy cc	Assess the potential Terrestrial biodiversity impacts by the proposed Project.
Social	Ashby Associates cc	Identify and assess the potential Socio-economic impacts associated with the construction and operation of the proposed HDF Energy Renewstable® Swakopmund Project.
Climate Change	SLR	This study will focus on the impacts on climate change that will be associated with the proposed Project.
Marine biodiversity	Pisces Environmental Consulting Services Ltd	Identify and assess the potential impacts to marine and coastal biodiversity associated with the construction and operation of the proposed HDF Energy Renewstable® Swakopmund Project.
Avifauna	African Conservation Services cc	Identify and assess the potential impacts on local birdlife associated with the construction and operations of the proposed HDF Energy Renewstable® Swakopmund Project and associated infrastructure (most notably a possible overhead powerline).

1.3.1 Summary and overview of the EIA process and findings

HDF Energy's Renewstable® Swakopmund project proposes Africa's first renewable green hydrogen-to-power project. The project principle is based on the generation of solar energy during day light hours to power the regional grid and to power the production of green hydrogen. Green hydrogen is then used to generate off peak power during night times.

Because of the projects renewable capacities, the scope is within Namibia's national policy and legal frameworks and compliments national planning, particularly The Namibia Vision 2030 and Harambee Prosperity Plan II (HPP) (Economic Advancement Pillar and Infrastructure Development Pillar) which promote job creation, skills developments, resource beneficiation, security and sustainable development.

Central to the projects operation is the power plant facility (including solar PV plant, hydrogen chain, energy storage and management systems). The site is located within close proximity to the DRC and Mondesa communities, to the east of Swakopmund town.

The production of hydrogen is reliant on demineralised water which will be produced by a 1st and then a 2nd phase desalination and demineralisation plants. The initial 1st phase treatment will occur at a solar powered reverse osmosis desalination plant located north of Mile 4 and to the west of the Swakopmund Salt Company. Seawater abstraction is planned to be done via a series of beach wells but, if unfeasible, the

abstraction will be done via a direct intake. Seawater treated at the 1st is then piped to the power plant facility via an approximately 6 km pipeline aligned along Ocean View Avenue.

Depending on water quality, the waste brine generated by the 1st reverse osmosis desalination plant will be discharged to the Swakopmund Salt Works salt ponds (pending analysis and formal agreement with the Swakopmund Salt Works) or alternatively be discharged via an outfall pipeline.

The 2nd phase reverse osmosis plant will be located within the extent of the power plant facility and provides for the ultra-treatment of water, removing any remaining minerals and scaling collected during the transportation of water to the facility.

Three alternatives have been proposed for the evacuation of power, being the use of the existing Tamariskia transmission line servitude and tying into the existing Tamariskia substation, the Sekelduin alignment consisting of a greenfield transmission line and substation, and a loop-in, loop out system relying on existing transmission line infrastructure. This assessment considered each of these options and selection of the final option is subject to further design considerations and agreements with existing infrastructure owner agreements.

As with any substantial development, the Renewstable® Swakopmund Project is likely to result in a range of environmental and social impact, being both negative and positive (some of which are motivating factors discussed above). Negative and positive impacts identified and assessed as part of this EIA are summarised in Table 1-6.

Table 1-6: Summary of the significance of potential impacts associated with the proposed project

Impact/Issue	Without Mitigation	With Mitigation
Reduced Efficiency and Design Life of Solar PV Modules	Medium	Medium
Contribution to National Power Grid	Very High (+)	N/A
Contribution to a reduction in carbon intensity of the national power grid	High (+)	N/A
Visual impact associated with construction	Medium	Low
Visual impact associated with operation	Medium	Low
Glint and Glare	Low	Insignificant
Increase in ambient air concentration	Low	Very Low
Increased surface water runoff	Low	Very Low
Increased erosion, sedimentation, and deposition	Low	Very Low
Surface water contamination	Low	Very Low
Decreased infiltration and groundwater recharge (construction and operations)	Low	Very Low
Contamination of groundwater resources	Low	Very Low
Disturbance because of noise contribution at SRs 1-4 due to project construction activities	Low	Very Low [Low]

Impact/Issue	Without Mitigation	With Mitigation
Disturbance as a result of noise contribution at SR1, SR2, SR3 and SR5 due to project operations	Low	Very Low [Low]
Disturbance as a result of noise contribution at SR6 and SR7 due to project operations	Very Low	Very Low
Destruction of habitat and organisms	Low	Very Low
Disturbance of animals and interference with their behaviour	Medium	Very Low
Light Pollution	Medium	Very Low
Disturbance and destruction of marine biota during construction	Low	Low
Contamination of marine environments	Low	Very Low
Increased turbidity	Insignificant	Insignificant
Marine ecology impact from direct intake	Low	Very Low
Changes in water quality from brine discharge	Insignificant	Insignificant
Physical/human disturbance of birds	Very Low	Insignificant
Direct or indirect modification/loss/destruction of bird habitat	Medium	Low
Attraction of birds to novel habitats through the provision of artificial habitats and resources	Medium	N/A
Bird electrocution on power line infrastructure	Low	Very Low
Bird collisions on infrastructure such as solar panel arrays	Low	Very Low
Bird collisions on infrastructure such as fencing and power lines	Medium	Low
Loss of cultural heritage artifacts	Very Low	Insignificant
Economic Impacts	High (+)	High (+)
Creation of jobs and livelihoods	Very High (+)	Very High (+)
Loss of jobs and livelihoods on closure	Very low	Very low
Change in planned land use	Medium (+)	N/A
Community Health and Safety	Low	Low
Loss of containment of hydrogen at the electrolyser with potential explosions impacting the workers on site	Very Low	Insignificant
Loss of containment of the hydrogen storage with potential explosions impacting the workers and the general public (Plant and refuelling storage)	Very Low	Insignificant
Loss of containment of the hydrogen pipeline with potential explosions impacting the workers and the general public	Very Low	Insignificant

2. SCOPE AND OBJECTIVES

The EMP applies to all activities associated with site clearance and construction activities, as well as the operational phase of the Renewstable® Swakopmund power plant facility and associated infrastructure. The EMP includes all activities conducted by, or on behalf of HDF Energy on the project site, including EPC and O&M contractors and sub-contractors.

The project life is expected to extend for at least 25-years, with the potential to be upgraded to extend the projects longevity. As such the decommissioning phase does not fall under the scope of this EMP due to the fact that various legal, Project Ownership and technological changes may occur over the 25-year timespan. This EMP will need to be revised at least 2 years prior to the intended decommissioning date.

The key objective of this EMP is to provide a framework for the implementation of environmental and social management initiatives. Best practice principles require that every reasonable effort is made to reduce, and prevent negative impacts while enhancing the benefits.

This EMP will be reviewed annually. A key feature of the EMP is the idea of continual improvement – an ongoing process of reviewing, correcting and improving the system. The most common approach for this is implemented through the Plan – Do – Check – Review cycle, as shown in Figure 2-1.

Figure 2-1: Plan-Do-Check-Review Cycle

The HDF Energy will have overall responsibility, authority and accountability for environmental and social issues associated with the project. This EMP outlines the key steps to be taken by all project personnel and their contractors, to effectively manage the environmental and social impacts and risks associated with the construction and operation of the project. All personnel engaged on the project are required to fully comply with the requirements of the EMP in order to limit the potential for unacceptable environmental and/or social impacts or regulatory non-compliance.

3. ADMINISTRATION AND REGULATION OF ENVIRONMENTAL OBLIGATIONS

3.1 ROLES AND RESPONSIBILITIES AND ORGANISATIONAL STRUCTURE

Details of the anticipated management structure for this EMP are presented below. All official communication and reporting lines including instructions, directives and information shall be channelled according to the management structure presented below.

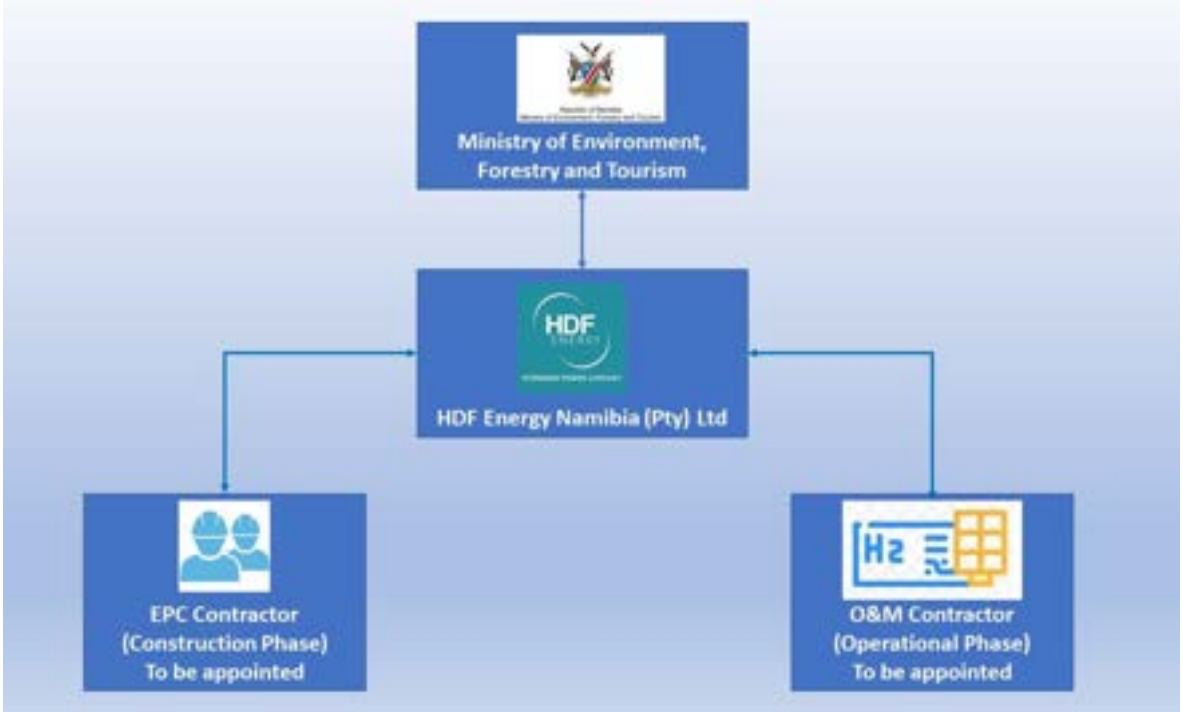

Figure 3-1: Anticipated Organisational Structure

MEFT is the designated authority responsible for authorising this EMP and has overall responsibility for ensuring that the HDF Energy complies with this EMP, and any conditions listed in the ECC. MEFT shall also be responsible for approving any significant amendments that may be required to the EMP.

MEFT may further perform ad hoc site inspections to check compliance with the EMP.

The HDF Energy is ultimately responsible for the implementation of the EMP and the financial cost of all environmental control measures. HDF Energy must ensure that any person acting on its behalf complies with the conditions / specifications contained in this EMP.

HDF Energy is responsible for the appointment of an EPC Contractor who will be responsible for the construction of the plant and an O&M Contractor who will be responsible for operational phase of the facility. Designated roles responsible for the implementation of the EMP will be defined through the contracts between HDF Energy and the EPC Contractor and the O&M Contractor.

The EPC Contractor and the O&M Contractor will be responsible for the implementation of the EMP and HDF Energy will be responsible for providing oversight and will be accountable to MEFT for compliance.

3.2 ENVIRONMENTAL MANAGEMENT PLAN ADMINISTRATION

Copies of the EMP shall be made available to the EPC Contractor and O&M Contractor and be retained on site. EPC Contractor and O&M Contractor staff are to be briefed on the contents and obligations contained in the EMP relevant to the respective construction and operational phases.

The EMP must be updated where the findings of the environmental audit reports indicate insufficient mitigation of environmental impacts associated with the proposed project, or insufficient levels of compliance with the EMP.

Any significant revisions to the EMP document must be approved by MEFT before the EMP is revised.

Other administrative actions to be undertaken by HDF Energy and the EPC Contractor and/or O&M Contactor include:

- **Commencement notification** - HDF Energy or the EPC Contractor shall give MEFT at least two week's (or as specified in the ECC) written notice to the MEFT prior to the commencement of construction. A general notification letter shall also be sent to neighbouring residents and published in a locally distributed newspaper. The O&M Contractor is to provide written notice to MEFT of the facilities operational commencement.
- **Information notice boards** – During construction, the EPC Contractor is to publish notice boards advising the public of contraction activities and provide the contact details of the EPC Contractor. During operation, the O&M Contractor is to erect notices providing contact details.
- **Method Statements** - The EPC Contractor shall submit written Method Statements to HDF Energy for all environmentally sensitive aspects of the work. A list of typical method statements is provided in Appendix A for reference purposes.
- **Record keeping** - The EPC Contractor and O&M Contractor are to keep a record of environmental management activities on site, including but not limited to meetings attended, Method Statements received and approved, issues arising on site, cases of non-compliance with the EMP, and corrective actions taken to solve problems that arise.
- **Review and auditing** - The EPC Contractor and O&M Contractor will establish an internal review procedure to monitor the progress and implementation of the EMP. Compliance auditing is to be undertaken at the discretion of HDF Energy and/or MEFT and is to include review of all environmental and social performance and compliance.
- **Emergency Preparedness and Response Plan** - The EPC Contractor and O&M Contractor are to develop and implement an Emergency Preparedness and Response Plan (EPRP) Health (e.g. snake bites), Safety (e.g. electrocution, explosions), Environment (e.g. a spill), social and local economic development (e.g. fire), labour (e.g. worker demonstrations, explosions) and security (e.g. a civil conflict). In order to create an EPRP, the following steps will be followed:
    - **Step 1:** Assess potential emergency scenarios, probabilities and therefore risk;
    - **Step 2:** Ensure adequate controls to prevent an emergency are reflected within relevant operational procedures and supporting documents;
    - **Step 3:** Develop an EPRP encompassing each scenario and how it will be managed in an easy to read and quickly accessible format;
    - **Step 4:** Ensure that in developing responses to each scenario, all internal departments that will need to work together are consulted and outlined, all external emergency services are consulted (e.g. the fire department) and community representatives (where relevant) are

consulted and their part is understood and agreed to ensure the plans are workable and effective;

- **Step 5:** Communicate and train on the EPRP with all relevant staff, contractors, and where applicable, communities;
- **Step 6:** Test the EPRP regularly (as a minimum annually or more frequently for high risks), and develop lessons learnt, integrating these into any updates of the EPRP; and
- **Step 7:** Conduct periodic review of EPRP, at least annually, but for high risk scenarios more frequently.

- **Close-out audit** - At the conclusion of construction (including rehabilitation) phase, an environmental audit report shall be compiled and submitted to MEFT. It shall, as a minimum, outline the implementation of the EMP, and highlight any problems and issues that arose during the construction period to report, on a formal basis, the lessons learned from this project.

3.3 COMPLIANCE

While HDF Energy will remain ultimately accountable to MEFT for compliance with the EPC Contractor The liabilities associated with the implementation of EMP will be transferred contractually to the EPC Contractor and O&M Contractor.

3.4 STATUS OF THIS DOCUMENT

The development and implementation of environmental specifications is an on-going process that is iterative in nature. Any significant revisions to the EMP document must be approved by the MEFT before the EMP is revised.

4. LEGAL FRAMEWORK

Environmental management in Namibia is subject to compliance with several statutes and legislative provisions which inform this EMP and the obligations of any developer/operator.

4.1 THE CONSTITUTION OF THE REPUBLIC OF NAMIBIA, 1990

There are two clauses contained in The Constitution of the Republic of Namibia, 1990 (No. 1 of 1990) that are of particular relevance to sound environmental management practice, viz. Articles 91(c) and 95(l). In summary, these refer to:

- Guarding against over-utilisation of biological natural resources;
- Limiting over-exploitation of non-renewable resources;
- Ensuring ecosystem functionality;
- Protecting Namibia's sense of place and character;
- Maintaining biological diversity; and
- Pursuing sustainable natural resource use.

The above therefore commits the State to actively promote and sustain environmental welfare of the nation by formulating and institutionalising policies to accomplish the abovementioned sustainable development objectives.

4.2 ENVIRONMENTAL MANAGEMENT ACT, 2007

The EMA was promulgated in December 2007 and came into effect on 6 February 2012. Part 1 of the EMA describes the various rights and obligations that pertain to citizens and the Government. The main objectives of the Act are to ensure that:

- Significant effects of activities on the environment are considered carefully and timeously;
- There are opportunities for timeous participation by I&APs throughout the assessment process; and
- Findings are taken into account before any decision is made in respect of activities affecting the environment.

Part 2 of the EMA sets out a number of principles of environmental management which give effect to the provisions of the Constitution (Section 4.1) for integrated environmental management including:

- Renewable resources shall be utilized on a sustainable basis for the benefit of current and future generations.
- Community involvement in natural resource management and sharing in the resulting benefits shall be promoted and facilitated.
- Public participation in decisions affecting the environment shall be promoted.
- Fair and equitable access to natural resources shall be promoted.
- Equitable access to sufficient water of acceptable quality and adequate sanitation shall be promoted and the water needs of ecological systems shall be fulfilled to ensure the sustainability of such systems.
- The precautionary principle and the strategy of preventative action shall be applied.
- There shall be prior environmental assessment of projects and proposals which may significantly affect the environment or use of natural resources.
- Sustainable development shall be promoted in land-use planning.

- Movable and immovable cultural and natural heritage, including biodiversity, shall be protected and respected for the benefit of current and future generations.
- Generators of waste and polluting substances shall adopt the best practicable environmental option to reduce such generation at source.
- The polluter pays principle shall be applied.
- Reduction, reuse and recycling of waste shall be promoted.
- There shall be no importation of waste into Namibia.
- Promotion of the coordinated and integrated management of the environment.
- The Minister of Environment and Tourism was enabled to give effect to Namibia's obligations
- under international environmental conventions.
- Sustainable Development Commission and Environmental Commissioner have been provided for.

Decision-makers must take these principles into account when deciding whether or not to approve a proposed project. In terms of this legal framework certain identified activities may not commence without an environmental clearance (or amendment thereto) that is issued by the office of the environmental commissioner in the MEFT.

4.3 WATER RESOURCE MANAGEMENT ACT, 2013

The Water Resources Management Act (No. 11 of 2013 (WRMA)), which is yet to be formally gazetted, provides a framework for the management, development, protection, conservation and use of water resources in a sustainable manner. Relevant principles of the Act include, inter alia:

- Equitable access for all people to safe drinking water is an essential basic human right to support a healthy productive life;
- Harmonisation of human water needs with the requirements of environmental ecosystems and the species that depend on them, while recognising that the water resource quality for those ecosystems must be maintained;
- Promotion of the sustainable development of water resources based on an integrated water resources management plan which incorporates social, technical, economic, and environmental issues;
- Development of the most cost-effective solutions, including conservation measures, to infrastructure for the provision of water; and
- Promotion of water awareness and the participation of persons having interest in the decision-making process should form an integral part of any water resource development initiative.

A person may only abstract and use water from a water resource, which exceeds the threshold authorised in terms of a law relating to water resources above a certain threshold, if the person holds a licence issued by the Minister that authorises the abstraction and use of water from that water resource. The WRMA is relevant since the project will abstract seawater and discharge effluent back to the ocean. In terms of the WRMA a "water resource" is defined as "the whole or any part of a watercourse or an aquifer and includes the sea and meteoric water" and thus the provisions of the WRMA apply to seawater abstraction.

The consequence is that HDF Energy will have to obtain a licence to abstract and use seawater and will have to comply with the various provisions of the Act set out in Part VIII of the Act (Sections 32 to 45). Section 32 prohibits the abstraction or use of water without a licence and significantly specifically states that the term

"abstract water" includes the abstraction of marine water for any purpose (Section 32(1)). The required Water Use License will be applied for by HDF Energy independently and as a separate process to the EIA.

There are several requirements which must accompany the application to abstract water. Of particular importance is Section 33(3)(c) which stipulates that an application for a licence to abstract and use water must be accompanied by a number of requirements including "an environmental impact analysis of the proposed abstraction of water upon the environment and existing water users and water resources" .

Part XI of the Act (Sections 56 to 71) which deals with Water Pollution Control is relevant to the proposed desalination plant in light of the brine discharges back to the ocean. The opening section stipulates that a person may not discharge effluent directly or indirectly to any 'water resource' (defined to include the sea as seen above) unless such person is in compliance with a permit issued in terms of Section 60. The term "effluent" is defined to mean *"…any liquid discharged as a result of domestic, commercial, industrial or agricultural activities*". Section 59 gives details on the information required for an effluent discharge permit.

It should be noted that this may be repealed by the new Water Resources Management, 2013 Act (No. 11 of 2013), which has been accepted by parliament but not yet promulgated. Under the new act, HDF Energy may be required to register as a water services provider in terms of Section 41, which reads:

> *41 (1) A person may not operate as a water services provider without holding a licence as a water services*
> *provider issued by the Minister under this Act that authorises the person -*
> *(a) to distribute water to end-consumers; and*
> *(b) to operate a water treatment facility.*

Under the new Act, a combined abstraction and discharge licence may also be applied for in terms of Section 47, as follows:

> *47. The Minister may, with the consent of the applicant concerned, grant a combined licence to abstract and use water and to discharge effluent if the requirements prescribed by this Act for a separate licence for*
> *each type of work or activity are complied with.*

HDF Energy acknowledges the requirements in terms of the new Act and will adhere to these as required after promulgation.

4.4 OTHER RELEVANT NAMIBIAN LEGISLATION

Table 4-1 below provides a summary of other relevant environmental and social legislation that may be applicable to the proposed project.

Table 4-1: Other applicable Namibian environmental legislation

Sector	Law	Key Provisions and relevance to the Project
Transport	*Road Traffic and Transport Act, 1999 (No. 22 of 1999)*	This Act provides for the control of traffic on public roads, the licensing of drivers, the registration and licensing of vehicles, and the control and regulation of road transport across Namibia's borders. Vehicles supplying goods and services to the project during construction and operation will have to comply with the requirements of the Act.
Pollution / Waste	*Pollution Control and Waste Management Bill (3rd Draft September 2003)*	This Bill promotes sustainable development and provides for the prevention and regulation of the discharge of pollutants to the air, water and land; regulation of noise, dust and odour pollutions; and the establishment of a system of waste panning and management. Hazardous and non-hazardous waste will be generated during all projects phases and consideration should be given of the requirements of the bill.
	Atmospheric Pollution Prevention Ordinance (Ordinance 11 of 1976)	This Act provides for the prevention of the pollution of the atmosphere. Construction activities, creating dust near third parties needs to be controlled in terms of the requirements of the Act.
Environmental / Conservation / Land	*National Heritage Act, 2004 (No. 27 of 2004)*	This Act provides for, *inter alia*, the protection and conservation of places and objects of heritage significance. A National Heritage Council has been established to identify, conserve, manage, and protect places and objects of heritage significance. Permits are required for the removal, damage, alteration or excavation of heritage sites or remains. Any person who discovers an archaeological site should notify the National Heritage Council. These aspects could be relevant during the construction activities of the proposed project and will require to be assessed.
	National Monuments Act 28 of 1969	This Act establishes a National Monuments Council and provides for the preservation of certain property as National Monuments and the maintenance of certain burial grounds.
	Nature Conservation Ordinance, 1975 (No. 4 of 1975)	This Ordinance consolidates and amends the laws relating to the conservation of nature; the establishment of game parks and nature reserves; and the control of problem animals. The Ordinance is expected to be replaced by the Wildlife and Protected Areas Management Act in the near future (latest draft 2018). The study area overlaps the Namib NauKluft National Park.
	Marine Resources Act 27 of 2000	This Act provides for the conservation of the marine ecosystem; the responsible utilisation, conservation, protection, promotion of marine resources in a sustainable manner and for the control of marine resources for these purposes. The Minister of Fisheries is empowered to make regulations under section 61 on a broad number of topics including "regulating or prohibiting the discharge in the sea or discarding on the seashore and land of specified substances or materials, or substances or materials not complying with specified requirements or having specified properties" (61(1)(r)).
	Soil Conservation Act (Act 76 of 1969)	The Act makes provision for the prevention and control of soil erosion and the protection, improvement and conservation of soil, vegetation and water supply sources and resources, through directives declared by the Minister. Care is to be taken in identifying any potential impacts on soil, vegetation, water supply sources and resources by firstly trying to avoid these impacts. Where they can't be avoided, management measures should be implemented to reduce the significance of the impact(s).

Sector	Law	Key Provisions and relevance to the Project
	Inland Fisheries Resources Act (Act 1 of 2003)	Conservation and protection of aquatic ecosystems.
	Aquaculture Act (Act 18 of 2002)	The Act aims to regulate and control aquaculture activities; to provide for the sustainable development of aquaculture resources; and to provide for related matters. Section 35 of the Act states that a person may not, unless authorized in writing to do so by the Minister, conduct any business or undertaking other than aquaculture in aquaculture development zones.
	Integrated Coastal Management Bill	Once enacted, the Integrated Coastal Management Bill (2014) aims to establish a system of integrated coastal management in Namibia in order to promote the conservation of the coastal environment, maintaining the natural attributes of the coastal landscapes and seascapes, and ensuring the sustainable development and use of the natural resources within the coastal zone that is also socially, economically and ecologically justifiable.
Hazardous Substances	*Hazardous Substances Ordinance, 1974 (No. 14 of 1974)*	These provide for the control of toxic substances which may cause injury, ill health or death of human beings. Various chemicals would be used and stored; and the desalination plant and hydrocarbons used during the construction activities of all project components.
Labour	*Labour Act, 2007 (No. 11 of 2007) and its amendment: No. 2 of 2012*	These Acts stipulate, amongst other things, sound labour relations, employment equity, fair employment practices, training, minimum basic conditions of service, workplace health and safety and retrenchment. Compliance is enforced and monitored by the Ministry of Labour through the office of the Labour Commissioner.
	Social Security Act, 1994 (No. 34 of 199, as amended	
	Employees Compensation Act, 1995 (No. 5 of 1995)	
	Regulations relating to the health and safety of employees at work (GN 156 of 1997)	These Regulations establish health and safety regulations for the workplace.
	Affirmative Action (Employment) Act, 1998 (No. 29 of 1998)	This Act aims to achieve equal opportunity in employment by redressing, through appropriate affirmative action plans, the conditions of disadvantage in employment experienced by persons in designated groups arising from past discriminatory laws and practices.

4.5 OTHER RELEVANT NAMIBIAN POLICIES AND STANDARDS

Namibia's policies provide the framework to the applicable legislation. Whilst policies do not often carry the same legal recognition as official statutes, policies are used in providing support to legal interpretation or guidance for civil servants and other stakeholders in the implementation of government objectives.

Relevant policies (other than the aforementioned policies) currently in force include the following:

- Namibia's Environmental Assessment Policy for Sustainable Development and Environmental Conservation (1994);
- The National Policy on Coastal Management for Namibia (2013);
- National Development Plan 5 and Vision 2030;
- National Integrated Resource Plan, 2016 (NIRP);

- National Forest Policy (1992);
- National Agricultural Policy (2015);
- National Land Policy, the National Resettlement Policy, the Agricultural (Commercial) Land Reform Act (1995);
- Land Tax and Communal Land Reform Act (2002);
- Poverty Reduction Strategy for Namibia (1998);
- White Paper on Energy Policy (1998);
- National Industrial Policy (2012);
- Policy for the Conservation of Biotic Diversity and Habitat Protection (1994);
- National Policy on Human Wildlife Conflict management (2009);
- Labour Act (2007);
- Hazardous Substances Ordinance (1974);
- Namibia's Integrated Water Resources Management (IWRM) Plan (2010); and
- The National Climate Change Policy of Namibia (2011).

4.5.1 South African National Standards

In many countries, quantities of hazardous material produced, transported or stored on site, that have potential or risk to harm the public are classified as Major Hazardous installations with provisions made for separation distances between these installations and the general public.

The Republic of South Africa has legislation regarding the classification of a Major Hazard Installation (MHI) and the land usage approvals around such installations. Furthermore, all risk assessments of MHIs must be done to the standard SANS 1461:2018 which provides the methodology and benchmarking criteria to be used in the assessment of these installations. There are essentially three criteria for these establishments being:

- Unacceptable where the risks are too high, and the application must be denied;
- Tolerable, providing all reasonable measures have been implemented to limit the risk to as reasonably practicable; and
- Acceptable, for all land usage.

SANS 10103:2008 provides for the measurement and assessment of environmental noise with respect to land use, health, annoyance and speech communication.

4.5.2 Climate Change Policy

Namibia's National Climate Change Policy takes a cross-sectoral approach and elaborates on climate change adaptation and mitigation in Namibia. The policy outlines a coherent, transparent and inclusive framework on climate risk management in accordance with Namibia's national development agenda, legal framework, and in recognition of environmental constraints and vulnerability. After a long process of stakeholder consultation, the policy Ministry of Environment, Forestry and Tourism launched the National Climate Change Strategy and Action Plan.

4.5.3 The Namibia Vision 2030

In 2004, Namibia adopted Vision 2030, a document that clearly spells out the country's development programmes and strategies to achieve its national objectives. Vision 2030 focuses on various themes to realise the country's long term vision. These are:

- Inequality and Social Welfare;
- Human Resources Development and Institutional Capacity Building;
- Macro-economic issues;
- Population, Health and Development;
- Namibia's Natural Resources Sector;
- Knowledge, Information and Technology; and
- Factors of the External Environment.

Vision 2030 targets 1) increasing employment, 2) improving the country's Gini-coefficient (the measurement of income inequality and poverty), 3) increasing income levels, and 4) boosting contributions from the manufacturing and service sectors.

The Renewstable® Swakopmund Project compliments the Vision 2030 targets by generating employment opportunities during construction and operation, skills development and transfer in the rapidly expanding green hydrogen/economy and increasing electrical/power sector contributions from local service providers.

4.5.4 Harambee Prosperity Plan II (2021-2025)

The HPP is a targeted action plan to accelerate development in clearly defined priority areas, which lay the basis for attaining prosperity in Namibia. The Plan does not replace but complements the long-term goal of the National Development Plans (NDPs) and Vision 2030. HPP introduces an element of flexibility in the Namibian planning system by fast tracking development in areas where progress is insufficient. It also incorporates new development opportunities and aims to address challenges that have emerged after the formulation of NDPs.

The HPP consists of five (5) Pillars, each with specific Goals and Activities aimed at diving objectives:

- Effective governance;
- Economic Advancement;
- Social progression;
- Infrastructure development; and
- International relations and cooperation.

The Renewstable® Swakopmund project directly contributes toward the HPP Pillar 2 (Economic Advancement) and Pillar 4 (Infrastructure Development) objectives.

4.5.5 Coastal Strategic Environmental Assessments

Two Namibian coastal Strategic Environmental Assessments (SEAs) were undertaken between 2006 and 2008, i.e. one for the northern regions of Kunene and Erongo and another for the southern regions of Karas and Hardap. These draw on international experience and were undertaken at a time of mounting production sector pressures within Namibia. Being an initiative of the Namibian Government through MEFT, the two SEAs seek to inform political and technical decision makers at local, regional and national levels.

The 2008 "SEA for the coastal areas of the Erongo and Kunene Regions" compiled by the Namibian Coast Conservation & Management Project (NACOMA) is aimed at ensuring informed decisions on issues related to biodiversity conservation, land use planning and socio-economic development planning in the Kunene and Erongo coastal regions.

4.6 INTERNATIONAL STANDARDS AND CONVENTIONS

4.6.1 The Equator Principles

The Equator Principles are a risk management framework, adopted by financial institutions, for determining, assessing and managing environmental and social risk in projects and are primarily intended to provide a minimum standard for due diligence to support responsible risk decision-making. Equator Principle Financial Institutions (EPFIs) commit to implementing the Equator Principles in their internal environmental and social policies, procedures and standards for financing projects and will not provide Project Finance or Project-Related Corporate Loans to projects where the client will not, or is unable to, comply with the Equator Principles.

In order to facilitate potential access to funding for project development potential borrowing organisations need to consider the Equator Principles and environmental and social risk management as part of the EIA process.

There are 10 principles as shown below, and these require that Projects conduct an EIA process in compliance with the IFC Performance Standards on Environmental and Social Sustainability.

Table 4-2: The Equator Principles

Principle
1. Review and categorisation Establishes the need for the Equator Principles Financial Institution (EPFI) to categorise the project based on the magnitude of its potential environmental and social risks and impacts as part of its internal environmental and social review and due diligence.
2. Social and environmental assessment Requires the client to conduct an Assessment process to address, to the EPFI's satisfaction, the relevant environmental and social risks and impacts of a proposed Project. It is required that the Assessment documentation will propose measures to minimize, mitigate, and offset adverse impacts in a manner relevant and appropriate to the nature and scale of the proposed project.
3. Applicable environmental and social standards Established that the Assessment process should firstly address compliance with relevant host country laws, regulations and permits that pertain to environmental and social issues.
4. Environmental and Social Management System and Equator Principles Action Plan Requires an Environmental and Social Management Plan/ EMP to be prepared by the client to address issues raised in the assessment process and incorporate actions required to comply with the applicable standards.
5. Stakeholder engagement Requires clients to demonstrate effective Stakeholder Engagement as an ongoing process in a structured and culturally appropriate manner with affected communities and, where relevant, other stakeholders.
6. Grievance mechanism Requires the client to establish a grievance mechanism designed to receive and facilitate resolution of concerns and grievances about the Project's environmental and social performance as part of the ESMS.
7. Independent review Requires that an Independent Environmental and Social Consultant, not directly associated with the client, will carry out an Independent Review of the Assessment Documentation, including the Environmental and Social

Principle
Management Plans/ EMP process documentation in order to assist the EPFI's due diligence, and assess Equator Principles compliance.
8. Covenants Requires that the client pledge its commitment to complying with all relevant host country environmental and social laws, regulations and permits in all material respects in the financing documentation.
9. Independent monitoring and reporting Requires the appointment of an Independent Environmental and Social Consultant or requires that the client retain qualified and experienced external experts to verify its compliance with the Equator Principles and monitoring information which would be shared with the EPFI.
10. Reporting and transparency Deals with the client's reporting requirements in addition to the disclosure requirements in Principle 5. This principle states that the client will ensure that, at a minimum, a summary of the ESIA is accessible and available online and the client will publicly report Green House Gas (GHG) emission levels (combined Scope 1 and Scope 2 Emissions) during the operational phase for Projects emitting over 100,000 tonnes of CO_2 equivalent annually.

4.6.2 IFC Performance Standards on Social and Environmental Sustainability

The IFC Performance Standards (PS) define client's roles and responsibilities for managing their projects and the requirements for receiving and retaining the IFC support or the support from institutions that subscribe to the Equator Principles. The IFC applies the PSs to manage social and environmental risks and impacts and to enhance development opportunities in its private sector financing of projects in the member countries eligible for financing. There are eight Performance Standards as shown in Table 4-3.

Table 4-3: IFC Performance Standards and their applicability to the Project

IFC Performance Standard	*Applicability to this project*
PS1: Assessment and Management of Environmental and Social Risks and Impacts PS1 establishes the importance of (i) integrated assessment to identify the environmental and social impacts, risks, and opportunities of projects; (ii) effective community engagement through disclosure of project-related information and consultation with local communities on matters that directly affect them; and (iii) the client's management of environmental and social performance throughout the life of the project.	Yes
PS2: Labour and Working Conditions PS2 asks that companies treat their workers fairly, provide safe and healthy working conditions, avoid the use of child or forced labour, and identify risks in their primary supply chain.	Yes
PS3: Resource Efficiency and Pollution Preventions PS3 guides companies to integrate practices and technologies that promote energy efficiency, use resources—including energy and water—sustainably, and reduce greenhouse gas emissions.	Yes
PS4: Community, Health, Safety and Security PS4 helps companies adopt responsible practices to reduce such risks including through emergency preparedness and response, security force management, and design safety measures.	Yes

IFC Performance Standard	*Applicability to this project*
PS5: Land Acquisition and Involuntary Resettlement PS5 advises companies to avoid involuntary resettlement wherever possible and to minimize its impact on those displaced through mitigation measures such as fair compensation and improvements to and living conditions. Active community engagement throughout the process is essential.	Yes.
PS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources PS6 recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and managing living natural resources adequately are fundamental to sustainable development.	Yes.
PS7: Indigenous Peoples PS7 seeks to ensure that business activities minimize negative impacts, foster respect for human rights, dignity and culture of indigenous populations, and promote development benefits in culturally appropriate ways. Informed consultation and participation with IPs throughout the project process is a core requirement and may include Free, Prior and Informed Consent under certain circumstances.	No.
PS8: Cultural Heritage PS8 aims to guide companies in protecting cultural heritage from adverse impacts of project activities and supporting its preservation. It also promotes the equitable sharing of benefits from the use of cultural heritage.	Yes.

4.6.3 International Conventions

Relevant international conventions to which Namibia is a signatory are summarised below:

- Convention on Biological Diversity, 1992;
- United Nations Framework Convention on Climate Change, 1992;
- The Convention on International Trade in Endangered Species (CITES) of 1973;
- Convention to Combat Desertification 1994;
- National Rangeland Management Policy and Strategy of 2012;
- National Biodiversity Strategy and Action Plan 1 and 2 (draft);
- Vienna Convention for the protection of the ozone layer (1985);
- Montreal Protocol on substances that deplete the ozone layer (1987);
- United Nations Convention on Biological Diversity (UNCBD); and
- United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) 2007.

5. ENVIRONMENTAL MANAGEMENT PLAN IMPLEMENTATION

5.1 PERMITS AND AGREEMENTS

The following permits and agreements will be required:

- Landowner lease agreement and servitude agreements;
- An ecological walk over must be undertaken prior to construction occurring to designate no-go areas and undertake plant/animal rescue;
- Agreements with Swakopmund Municipality for the supply of:
    - Potable water;
    - Domestic solid waste disposal;
    - Domestic waste water; and
    - Building plans, if required.

5.2 TRANSFER OF COMMITMENTS TO EPC CONTRACTOR AND O&M CONTRACTOR

As part of the appointment of the preferred EPC Contractor and O&M Contractors, HDF Energy is to contractually transfer the responsibilities outlined in this EMP to the respective Contractor.

5.3 ENVIRONMENTAL CONSIDERATIONS IN DESIGNS

- General:
    - Designers should aim to reduce the project footprint to the efficient minimum by optimizing the footprint and clever use (double use) of the areas.
    - All liquid chemical storage areas and tanks should be bunded to 110% of the total maximum volume of chemical storage capacity to contain accidental spills and leaks.
    - All dry chemical storage areas shall restrict unauthorized access (i.e. lockable) and have impervious floors and adequate weather protection (rain and wind) to prevent the accidental spillage, dispersal, or spoilage of chemicals stored. All chemical storage area must be equipped with relevant the emergency provisions required to deal with a potential emergency in that environment.
    - Provision should be made in the facility design for the collection and storage of solid waste. Such storage area should be weather resistant and should make provision for the separation and storage of recyclables and returnable packaging (especially chemical containers) in an effort to reduce the volume of waste (and the hazard level) entering the landfill site. Where potentially hazardous wastes are produced, these should be stored within dedicated, signposted receptacles and transported to an appropriate waste facility for recovery or disposal.
- Surface water:
    - Stormwater infrastructure is to be included in detailed engineering design;
    - All runoff under the development footprint must managed within the site boundary. Discharge from attenuation is to release water to the environment at pre-development discharge rates.
- Socioeconomic considerations:
    - Road safety measures are to be employed to manage traffic and to reduce traffic collision risks. This should be augmented through the appropriate road hazard / information signage to warn road users of the turning of heavy vehicles.

- HDF Energy should develop local employment and procurement targets for the contractor for inclusion into the tender documents.
- The EPC Contractor and O&M Contractor must compile a draft Social and Environmental Policy (S&EP) in line with HDF Energy's Health, Safety and Environment (HSE) policy, statutory requirements and the provision forthwith. The S&EP of the successful bidder will, upon award of the contract, be finalised for approval. Compliance with the S&EP will be reviewed by HDF Energy.
- The Contractor should submit a site-specific health and safety plan, which includes a task-specific risk assessment. The risk assessment covers environmental, health and safety aspects, work methods and construction risks associated with each task that the Contractor team will or is likely to perform in the execution of the works.

- Visual:
  - Lighting must be planned and designed to avoid the spillage of light into the surrounding areas. The earthen berm mentioned above is one mechanism aimed at mitigating this potential impact, and should be levered to further mitigate light pollution from the plant. Care should be given to the type of lighting, height, position, direction and number of outside lights employed to minimise the magnitude of light spilt into the environment.
- Noise:
  - Typical noise abatement/attenuation should be included for, such as
    - Acoustic attenuation devices should be installed on all ventilation outlets and high pressure gas or liquid should not be ventilated directly to the atmosphere, but through an attenuation chamber or device.
    - Vibrating equipment must be equipped with vibration isolation mountings on their mounting plinths.
  - The EPC Contractor and O&M Contractor must establish a noise baseline at the various potentially sensitive receptors prior to construction commencement and again prior to operational commencement.
- Birds:
  - Roads, pipelines, cables should share servitudes as far as possible to reduce the disturbance footprint.
  - Outside lighting of the facility (including security lighting) must be kept to the minimum. Where required, all overhead lighting must be shield and pointed downwards onto the area where illumination is needed, rather than directed upwards or outwards, in order to avoid light pollution. The guidelines by the International Dark-Sky Association for the quality of outdoor lighting (including light design, wattage and light colour [preferably amber]) can be followed as a reference for preserving and protecting the night-time environment, including its wildlife (www.darksky.org).
  - If the facility is to be fenced, the upper wire strand of any fencing should be demarcated to ensure that it is visible to low flying birds in low light conditions.
  - Should any shield/earth wiring be fitted to poles, these earth wires should stop at least 300 mm below the lowest phase to provide an "air space safety gap", in order to reduce the electrocution risk; this procedure is known as "gapping" (Figure 5-2). The gap should be wide enough to avoid being permanently active, but close enough to allow lightning strikes to bridge it. Alternatively, the earth wires could be insulated in high-risk sections (e.g. near cross-bars) using low density polyethylene (LDPE) pipe;

- Transformer/switchgear structures should be designed in such a way that they are not attractive as bird perches/nesting sites; any live components that present an electrocution risk (e.g. "jumper" wires) should be insulated (e.g. using PVC piping or LDPE pipe; Figure 5-1);

Figure 5-2: Example of "gapping" of a pole earth wire to provide an air space safety gap, in order to reduce the electrocution risk, The arrow indicates the upper limit of the earth wire.

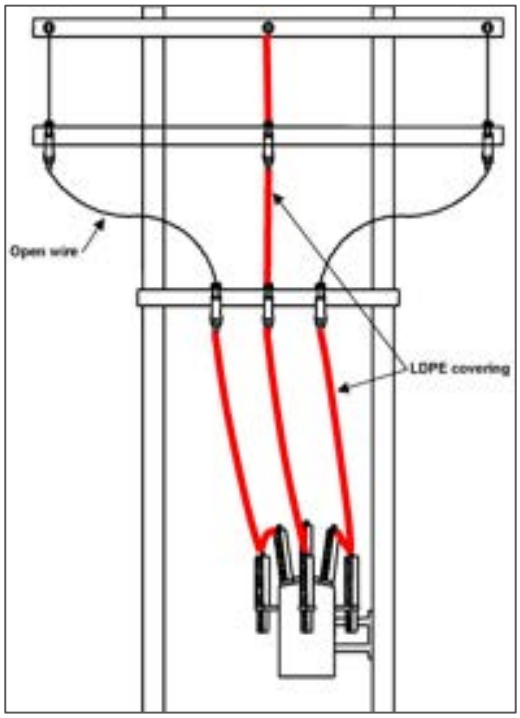

Figure 5-1: Example of use of Low Density Polyethylene (LDPE) pipe on jumpers to insulate selected live components of transformers and switch gears.

- Power line marking: no marking is recommended for the first route alternative for the proposed 66 kV transmission line (i.e. from the new plant substation to the Tamarisk Substation); however, to address the collision risk on the second alternative route (from the new plant substation to the Sekelduin Substation, where movements of aquatic bird species occur), the marking of the more sensitive section of the line to increase visibility is recommended, for 3.3 km as follows (also see Figure 5-3 below):
  - Start (A): 22.661883S 14.5888905E (Rossmund Substation); and
  - End (B): 22.686750S 14.580320E (Sekelduin Substation).
- The two outer conductors should be marked, in an alternating design, for the full length of each span;
- The marking distance between devices should be 10 m and the design/colours offset where possible (e.g. black and white);
- Recommended marking devices include the following, both made by Preformed Line Products (PLP; Figure 5-3):
  - Large SWAN-FLIGHT Diverter (SFD); alternating with;

- Viper Live Bird Flapper ("Viper").

Figure 5-3: Sections of the proposed 66 kV power line recommended for the fitting of marking devices (Marking A to Marking B, 3.3 km), as a mitigation for bird collisions

- Heritage
  - Sites QRS 317/904 and 906 and must be demarcated and treated as no-go sites (See purple and yellow crosses in Figure 5-4).
- Hazardous Risk Assessment
  - The designs of the electrolyser were conceptual and did not cover safety systems of the equipment with particular reference to the monitoring of the hydrogen concentration within the building and associated mitigation to prevent a hydrogen explosion. These safety measures should be more specific and would require a review of the adequacy. For example, included in a Process Hazard Analysis and an emergency response plan developed.

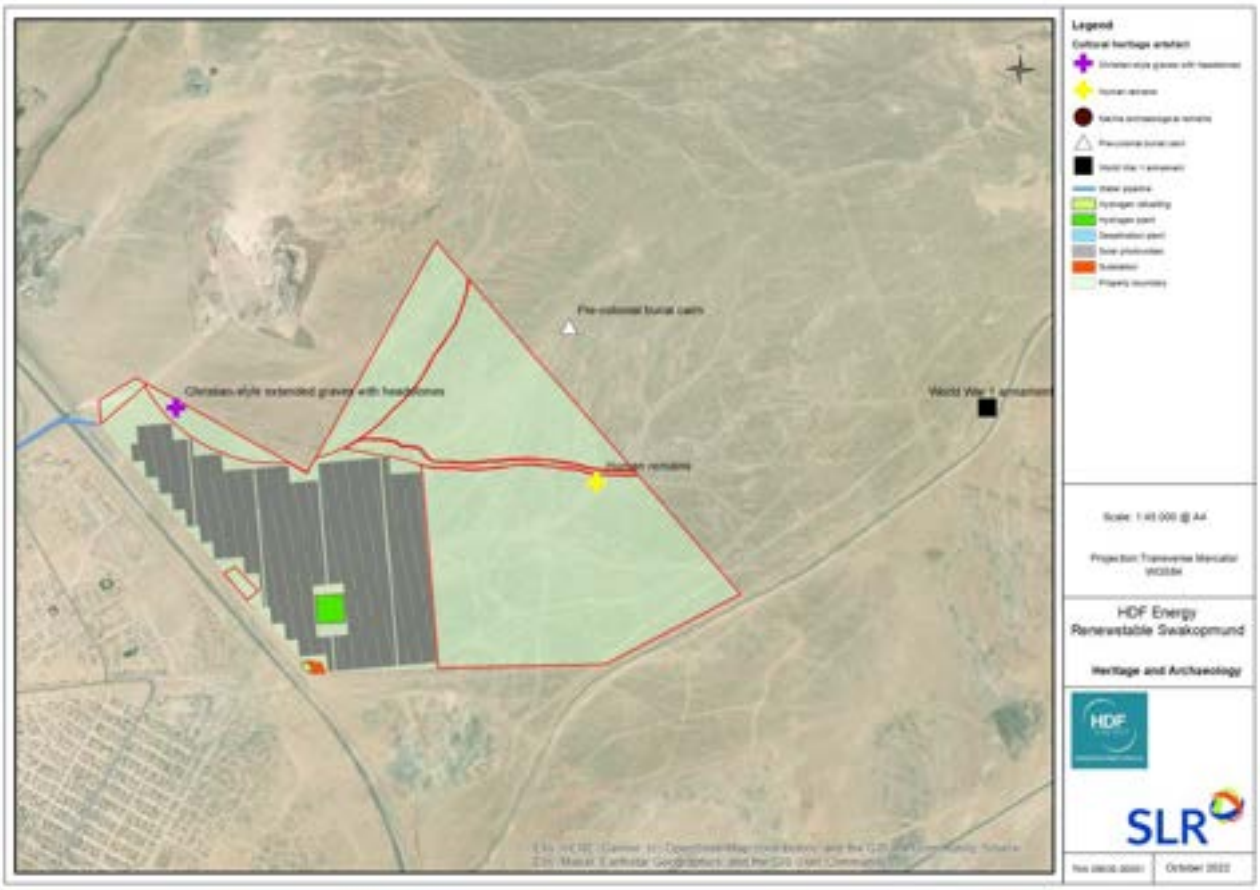

Figure 5-4: Heritage sites to be protected (purple and yellow crosses)

5.4 CONSTRUCTION PHASE

The EMP has been compiled for the management of potential construction phase social and environmental impacts of the project according to the description provided above (Section 1.2). Whilst a EMP is comprised of mitigation measures identified through the and EIA process, the construction phase environmental impacts are mostly generic in nature, are well generally understood, and have an established set of standard mitigation measures and best practices pertaining to construction management and supervision, which are presented here as well.

5.4.1 Scope

The general principles contained within the EMP shall apply to all construction activities (and all maintenance activities involving construction-type activities and decommissioning activities). All construction activities shall observe all relevant environmental legislation and in so doing shall be undertaken in such a manner as to minimise impacts on the natural and social environment.

5.4.2 General

The EMP is to be included into all Tender and Contract documentation to ensure that the EPC Contractor is aware of the obligations and given opportunity to cost for the implementation of the EMP requirements.

The EPC Contractor will carry the following responsibilities:

- Ensuring that all environmental impacts are managed in accordance with this EMP;
- Ensuring that all monitoring and compliance auditing occurs in line with the EMP;
- Ensuring that the environment is rehabilitated as far as practicable to its natural state or existing land use practices;
- Any environmental damage, pollution, pumping and treatment of extraneous water or ecological degradation as a result of activities both in and outside the site boundaries; and
- Any conditions contained in the environmental clearance are upheld.

The EPC Contractor shall conduct his activities so as to cause the least possible disturbance to the existing amenities, whether natural or man-made, in accordance with all the current statutory requirements. Special care shall be taken by the Contractor to prevent irreversible damage to the environment. The Contractor shall take adequate steps to educate all members of his workforce as well as his supervisory staff on the relevant environmental laws, sensitive areas, and protection requirements. The Contractor shall supplement these steps with prominently displayed notices and signs in strategic locations to remind personnel of their environmental obligations (Refer to Appendix B for materials pertaining to environmental awareness).

5.4.3 Environmental Awareness Training

All the EPC Contractor's and any Sub-Contractor's employees and any suppliers that spend more than one day a week or four days in a month on site, must attend an Environmental Awareness Training course developed and presented by the EPC Contractor, before commencement of any construction activities. Subsequent courses shall be held as and when required. A register shall be kept for all environmental awareness training.

Environmental awareness posters will also be erected at a prominent location on the site to remind construction staff of their obligations in terms of the EMP. Refer to Appendix B for an Environmental do's and don'ts poster.

The EPC Contractor shall compile and issue construction staff management/team leaders with an information booklet, based on the environmental awareness training course, at the commencement of the project, containing key information regarding the project, safety regulations and environmental do's and don'ts. All employees will be required to sign a register indicating receipt and understanding of the information booklet. The EPC Contractor will ensure that environmental issues and risks are dealt with as part of daily / weekly "toolbox talks" and that specific environmental duties or tasks are assigned to individuals.

The Environmental Awareness Training shall also address a code of behaviour for employees on Health and safety level (such as alcohol abuse, disease protection…) in alignment with community values.

5.4.4 CONSTRUCTION PHASE EMP

Table 5-1 sets out the relevant management measures to be implemented during the construction phase. Mitigation measures have been divided into Biophysical, Ecological and Socio-economic components as per the EIA structure. The mitigation measures in the table below are relevant to bulk water pipeline, power plant site and electrical transmission line infrastructure. Where mitigation measures are exclusive to the solar PV plant, hydrogen plant or the transmission line, this has been indicated in the table below.

Table 5-1: Construction Phase EMP

Reference Number	E&S Aspect/Issue	Mitigation Measures/Action Plans – Construction Phase	Responsibility
Biophysical Impacts			
EMP-C-001	Air Emissions	Bulk water pipeline, power plant site and electrical transmission line infrastructure: 1. Adopt suitable measures to manage fugitive dust from vegetation clearing during the construction phase. This will include a programme of dust management that limits both occupational and community exposure to dust. 2. Adopt measures to control fugitive dust generated from construction traffic including limiting construction vehicles speeds to the 20 km/hr on unpaved access road to site and on site. 3. Ensure that exposed areas and material stockpiles are adequately protected against the wind (e.g. wetting exposed soil / gravel areas during windy conditions, covering of material stockpiles, etc.); 4. The location of stockpiles shall take into consideration the prevailing wind directions and locations of sensitive receptors. 5. Refer to EMP-C-019 for grievances.	EPC Contractor
EMP-C-002	Noise Emissions	Bulk water pipeline, power plant site and electrical transmission line infrastructure: 1. Avoid or limit noisy construction activities outside of daytime hours. If night time work is required the EPC Contractor should inform nearby residents 24 hours in advance of undertaking the required noisy activities. 2. Noisy work around the western portions of the solar PV site on Sundays should be avoid. 3. Site large generators and similar equipment shall be put way from nearby receptors where possible and where this is not possible put in place noise attenuation measures in the event of noise impacts. 4. Construction vehicles and plant will be serviced according to manufacturer's specifications, and maintenance records must be kept up to date and presented for inspection as required. 5. Adhere to local regulations regarding the generation of noise and hours of operation.	EPC Contractor
Ecological Impacts			
EMP-C-003	Habitat loss, fragmentation and increased edge effects	Power plant site: 1. No activities are to occur beyond the extent of the power plant facility.	EPC Contractor

Reference Number	E&S Aspect/Issue	Mitigation Measures/Action Plans – Construction Phase	Responsibility
		2. The solar PV site shall be fenced off at the start of construction. 3. Rehabilitate any temporary roads as soon as possible after use. 4. No open fires shall be allowed on site, unless in safe areas specially demarcated for that purpose. 5. Harvesting of plants and hunting of animals will not be allowed. 6. Implement traffic calming structures to limit the speed of vehicles (e.g. speed humps) to protect small terrestrial animals. 7. Keep width of roads to a minimum. Run-off control measures on either side of roads must be constructed to allow for small terrestrial animals to cross. Ditches/trenches should have slopes of less than 45° rather than vertical sides. 8. Plan for placement of material stockpiles (topsoil and subsoil and excavated rock) within the areas designated as low sensitivity (ie not in drainage lines). Do not leave the soil or rock mounds in place after construction, but rather spread these out over the area of low sensitivity after construction. 9. Where areas not targeted for development are inadvertently impacted and/or damaged, clear any material dumped and rehabilitate the site as soon as possible, by levelling, ripping compaction and allowing to revegetate. 10. Monitoring of restoration success: areas which have been restored or rehabilitated should be checked regularly to monitor natural plant regrowth and presence of erosion. Refer to EMP-C-010 regarding soil erosion. Transmission Line: 1. Locate transmission line pylon outside of high sensitivity areas along the route. 2. Ensure construction vehicle and equipment are well maintained and not leaking any hydrocarbons. 3. Loss of riparian vegetation associated with the Swakop River (Sekelduin Option) is to be avoided. Where required, minimise construction footprints by demarcating vehicle access routes and clearing the minimum required servitude width. 4. Alien invasive plant control through implementation of an alien invasive species management plan as described for the solar PV site. 5. Sourcing of material for road or pylon construction: any requirement for fill material should be sourced from weed free areas to minimise the risk of spreading alien invasive species and to reduce the ongoing maintenance requirements. 6. Restoration / rehabilitation: All construction disturbed areas not required for infrastructure, including access tracks that are not required for maintenance, should be graded to near natural contours, scarified to decompact soils and allowed to recover naturally. Width of access tracks to be kept to a minimum. 7. Monitor for any emerging Alien Invasive Species (AIS) and ensure that these are rapidly removed. Care should be taken when using chemical sprays. Preferably use them well away from the natural vegetation. Ensure that if herbicide has to be used they are specific to the targeted AIS plant and not a broad spectrum herbicide. If this is unavoidable, take notice of wind direction to prevent drift and be aware that chemicals could runoff or leach through the soil into the habitat and cause extensive	

Reference Number	E&S Aspect/Issue	Mitigation Measures/Action Plans – Construction Phase	Responsibility
		damage. Only environmentally approved brands that comply with Namibian legal requirements and relevant international conventions should be used. Persistent Organic Pollutants (POPs) and Pesticides as listed by United Nations Environment Programme (UNEP) will not be allowed. 8. Use of herbicides for plant maintenance should be avoided but if essential only environmentally approved brands that comply with Namibia legal requirements and relevant international conventions should be used. POPs and Pesticides as listed by UNEP will not be allowed. 9. No fires are allowed along the TL construction corridor. 10. Harvesting of plants and hunting of animals be will not be allowed. 11. Plan for placement of material stockpiles (topsoil and subsoil and excavated rock) within the areas designated as low sensitivity. Do not leave the soil or rock mounds in place after construction, but rather spread these out over the area of low sensitivity after construction. 12. Where areas not targeted for development are inadvertently impacted and/or damaged, clear any material dumped and rehabilitate the site as soon as possible, by levelling, ripping compaction and allowing to revegetate. 13. Monitoring of restoration success: areas which have been impacted should be checked regularly to monitor natural plant regrowth and presence of erosion. Refer to EMP-C-010 regarding soil erosion	
EMP-C-004	Fauna and Flora	Bulk water pipeline and power plant site infrastructure: All mitigation measures for EMP-C-003 must be implemented along with the following additional mitigation measures: 1. Harvesting of plants and hunting of animals will not be allowed. If any protected or endangered plant species are encountered during site clearing, they must be relocated to suitable habitats. 2. Avoid unnecessary drainage line crossings. 3. Design site drainage and stormwater runoff to minimise risk of contaminated water entering the stream course or aquatic features (e.g. seasonal pans). 4. Restrict use of chemicals on site to minimum necessary and ensure storage and use, and vehicle maintenance, complies with standard good practice. Hazardous chemicals, including fuels, should be stored in a bunded and fenced area located at away from ephemeral drainage line or other surface depressions or pans. 5. Conduct site inspections to check for oil spills and leaks on soil surface and water bodies (if any form in the wet season) and implement remediation as required. 6. Vehicle maintenance shall be done on an impermeable surface to prevent soil and water contamination. 7. Chemical containers shall be stored in an enclosed restricted access area (to prevent human re-use) and disposed of at an approved waste facility or by approved waste service providers. 8. Inspection of the site on a daily basis to identify any trapped fauna within the construction footprint (trenches, excavations)	EPC Contractor

Reference Number	E&S Aspect/Issue	Mitigation Measures/Action Plans – Construction Phase	Responsibility
		9. Refer to EMP-C-016 regarding alien invasive vegetation Transmission Line: 1. Transmission line configuration should be designed to minimise electrocution risks to birds perching on the pylon structures by implementing the following types of measures where practically possible: a. Configure the insulators and conductors in such a way that birds landing, perching or taking off cannot connect them by keeping as many elements as possible under the cross-arm; and b. Insulate all the live elements of the structure sufficiently to ensure that birds cannot connect exposed, live elements. 2. Bird diverters: Consideration could be given to installing bird diverters on the line (See Section 5.3). 3. Ensure construction vehicle and equipment are well maintained and not leaking any hydrocarbons. 4. Refer to EMP-C-016 regarding alien invasive vegetation	
EMP-C-005	Alien invasive vegetation	Bulk water pipeline and power plant site infrastructure: 1. Alien invasive plant control through: a. Implementation of an alien invasive species management plan. b. On-site alien invasive plant monitoring and control (removal and disposal); and c. Sourcing of material for road or pylon construction: any requirement for fill material should be sourced from weed free areas to minimise the risk of spreading alien invasive species and to reduce the ongoing maintenance requirements. 2. All alien invasive seedlings and saplings must be removed as they become evident for the duration of construction. 3. Staff at the plant must be educated and made aware of alien vegetation that could be present and that must be eradicated. 4. Sourcing of fill material: any requirement for fill material to create a level platform for site development should be sourced from weed free areas to minimise the risk of spreading alien invasive species and to reduce the ongoing maintenance requirements. 5. On-site alien invasive plant monitoring and control (removal and disposal). 6. Clearing of vegetation should be limited to the development footprint areas. 7. Access roads should be planned in areas that have already been disturbed or transformed to limit additional fragmentation within the landscape and additional loss of vegetative cover. 8. All construction vehicles and equipment, as well as construction material should be free of plant material when leaving the site to avoid contamination of road reserves. Therefore, all equipment and vehicles should be thoroughly cleaned prior to leaving the site Transmission Line: 1. Refer to measures described above.	EPC Contractor
EMP-C-006	Hazardous Substance Storage	Bulk water pipeline, power plant site and electrical transmission line infrastructure:	EPC Contractor

Reference Number	E&S Aspect/Issue	Mitigation Measures/Action Plans – Construction Phase	Responsibility
		1. Hazardous substances stored on site should be within a bunded area and(or) contained in an appropriate, compatible, appropriately labelled containers to prevent reaction with containers and spillage during handling. 2. The relevant MSDS sheets should be clearly displayed in the hazardous substance storage area. 3. Storage to be located away from ephemeral drainage lines. 4. Relevant training should be provided to all employees/contractors on the correct storage and handling procedures and records of this training kept on site.	
EMP-C-007	Hazardous Substance Spills	Bulk water pipeline, power plant site and electrical transmission line infrastructure: 1. Construction vehicles and equipment will be regularly serviced off site. Spills of fuel and lubricants from vehicles and equipment will be contained using a drip tray with plastic sheeting filled with adsorbent material. 2. Accidental spillage of potentially contaminating liquids and solids must be immediately contained and cleaned up by trained staff with the correct equipment and disposed of in an appropriate manner.	EPC Contractor
EMP-C-008	Hazardous Waste	Bulk water pipeline, power plant site and electrical transmission line infrastructure: 1. Hazardous wastes are separated and contained in compatible, appropriately labelled containers to prevent reaction with containers and spillage during handling. 2. Storage of hazardous waste to be located away from ephemeral drainage lines. 3. Storage areas must have clear signage for the various hazardous waste streams. 4. Potentially contaminating fluids and other hazardous wastes must be contained in containers on hard, level surfaces in contained and covered from rain, and be clearly marked. 5. Develop and implement a site specific Hazardous Waste Management Plan (HWMP) for the management, handling and disposal of hazardous waste streams. 6. Hazardous waste will be trucked out and disposed of at a licensed landfill site. A waste manifest must be kept for all hazardous wastes that are disposed of and maintained on site. 7. Disposal and potential treatment of sewage and contaminated soil will be included in the HWMP. 8. Broken PV panels will be stored in covered waste skips or enclosed buildings until they can be removed from site and disposed of according to international best practice and Namibian laws.	EPC Contractor
EMP-C-09	Soil Erosion	Bulk water pipeline, power plant site and electrical transmission line infrastructure: 1. The placement of soil stockpiles will be identified prior to commencement of construction to minimise soil erosion. 2. Site clearing should, where possible, be undertaken in the dry season to minimise the chance of erosion due to run-off. 3. Land clearance will only be undertaken just prior to construction of a particular activity and unnecessary land clearance must be avoided. Work areas will be clearly defined to avoid disturbance outside of the footprint. 4. Construction vehicles to remain on designated prepared roads. 5. Design site drainage and stormwater runoff to minimise risk of erosion.	EPC Contractor

Reference Number	E&S Aspect/Issue	Mitigation Measures/Action Plans – Construction Phase	Responsibility
		6. Develop soil and storm water management plan for the entire surface area of the solar PV facility that will prevent concentrated runoff into the washes/ephemeral drainage lines areas, including the use of diversion trenches, berms, flow control dams, silt traps etc. Run-off from the developed areas need to be redistributed evenly over large areas through appropriate modelling and design. 7. The construction of surface stormwater drainage systems during the construction phase must be done in a manner that would protect the quality and quantity of the downstream aquatic systems.	
EMP-C-010	Fire	Bulk water pipeline, power plant site and electrical transmission line infrastructure: 1. No open fires shall be allowed on site, unless in safe areas specially demarcated for that purpose. 2. Ensure that the telephone number of the local Fire and Emergency Service is displayed at the site offices. 3. Ensure suitable fire-fighting equipment is provided on site. As a minimum this should include fire extinguishers, fire suppression system (as required, e.g. in power cabins) and a mobile water bowser. 4. Appoint a fire officer(s) from the staff who shall be responsible for ensuring immediate and appropriate action in the event of a fire as well as maintenance of the fire-fighting equipment. The appointed fire officer shall notify the local Fire and Emergency Services in the event of a fire and shall not delay doing so until such time as the fire is beyond his/her control 5. Take all reasonable steps to prevent the accidental occurrence or spread of fire. 6. Ensure that all site personnel are aware of the procedure to be followed in the event of a fire. 7. Hot-work (e.g. welding, grinding, cutting torch, etc.) must take place in specially designated areas only. 8. Smoking is not allowed on site, other than at designated smoking points. Cigarette butts shall not be discarded on the ground.	EPC Contractor
EMP-C-011	Lighting	Bulk water pipeline, power plant site and electrical transmission line infrastructure: 1. Ensure that any lighting installed on the site does not interfere with road traffic or cause a reasonably avoidable disturbance to the surrounding users and local communities.	EPC Contractor
EMP-C-012	Concrete Mixing	Bulk water pipeline, power plant site and electrical transmission line infrastructure: 1. Concrete should be mixed within a mixing tray and/or ready mix should be utilised. Cement should not be mixed within 50 m of the ephemeral drainage lines. 2. If ready-mix cement is not brought to site, concrete batching activities and/or mixing shall be located within the construction camp in areas of low environmental sensitivity and at least 50 m away from the ephemeral drainage lines. 3. Concrete mixing directly on the ground shall not be allowed and shall only take place on impermeable surfaces. 4. If concrete mixers are washed on site then contaminated runoff water must be channelled to an impermeable collection point. 5. Washing of excess concrete into the ground or water resources is prohibited. 6. All cement-contaminated runoff from mixing areas shall be strictly controlled.	EPC Contractor

Reference Number	E&S Aspect/Issue	Mitigation Measures/Action Plans – Construction Phase	Responsibility
		7. At the end of the contract, any ponds used for contaminated water collection shall be dried out and the solids disposed of appropriately. 8. Unused (full) cement bags shall be stored out of the rain and where runoff will not affect them; 9. Used cement bags shall not be used for any other purpose and shall be disposed of on a regular basis. 10. All excess concrete and aggregate shall be removed from site on completion of concrete works and disposed of appropriately.	
EMP-C-013	Construction Camps and Worker Accommodation	Bulk water pipeline, power plant site and electrical transmission line infrastructure: 1. The construction camp(s) shall be located at an easily accessible point and within an area of low environmental sensitivity. 2. The construction camp(s) shall be demarcated by a fence. 3. No camp establishment shall be allowed within 50 m of an ephemeral drainage line. 4. Suitable sanitary arrangements will be provided. There should be minimum one toilet for every 15 workers on site. Toilets must be easily accessible and shall be secured in order to prevent them from blowing over. 5. Toilets shall not be sited within 50 m of an ephemeral drainage line. 6. Ensure that all ablution facilities are maintained in a clean and sanitary condition. 7. Ensure that there is no spillage when the chemical toilets are cleaned and that the contents are properly removed from site. 8. Establish eating areas with adequate temporary shade to ensure that employees do not move off-site to eat. 9. Provide adequate refuse bins at all eating areas and ensure that all eating areas are cleaned up on a daily basis. 10. Ensure that there is access to clean drinking water for all employees on site. If water is stored on site, drinking water and multi-purpose water storage facilities shall be clearly distinguished and demarcated. 11. Any accommodation provided to workers and contractors must comply with the IFC Guidance Note on Worker's Accommodation: Process and Standards (August 2009).	EPC Contractor
Socio-Economic Impacts			
EMP-C-014	Community Development, Local Employment and Local Content	Bulk water pipeline, power plant site and electrical transmission line infrastructure: 1. All local recruitment and labour management will be undertaken by the EPC Contractor, or third-party contractors, consistent with Namibian national labour and occupation health and safety laws. This will include any international obligations (including any applicable International Labour Organisation (ILO) provisions signed and ratified by Namibia). 2. Establish a Community Development Plan (CDP) that will provide annualised funds for the investment in local community development projects, for the construction and operational life of the Project. 3. Establish suitable Human Resources and Recruitment Procedures that establish rules for local recruitment and preferential employment. These procedures will be issued to the construction	EPC Contractor and HDF Energy

Reference Number	E&S Aspect/Issue	Mitigation Measures/Action Plans – Construction Phase	Responsibility
		contractor for adoption with the own internal recruitment procedures during the construction phase. The procedures will also apply to the operational workforce. 4. Establish suitable local content procedures as part of their overall procurement system. The procedures will be issued to the construction contractor for adoption with the own internal procurement procedures during the construction phase. The procedures will also apply to local procurement of materials and services during the operational life of the Project. 5. For the purposes of the CDP, as well as local recruitment and procurement, the terms *local* shall be defined by multiple levels, and priority will be given to household and community in the order below: a. Priority Level 1 – Households immediately surrounding the Project site and final transmission line, with specific focus on residents of DRC and Mondesa. b. Priority Level 2 – Communities nearest to the Project site and final transmission line in Swakopmund and Surrounds. c. Priority Level 3 – Persons and businesses based in Erongo, and thereafter nationally. 6. Measures will be put in place measures to ensure no employee or job applicant is discriminated against on the basis of his or her race, gender, marital status, nationality, age, religion or sexual orientation. 7. Develop a Labour Plan outlining the need to recruit and train local labour. A Local Recruitment Policy should be implemented to ensure that local procurement of labour is maximised. 8. Communicate all recruitment criteria for ongoing recruitment in advance. 9. No employment activities will take place at the entrance to the site. Only formal channels for employment will be used. 10. Management measures should be implemented to enhance skills development and on-the-job training.	
EMP-C-015	Community Health, Safety and Security	Bulk water pipeline and power plant site infrastructure: 1. Establish a grievance mechanism throughout the construction and operation phase to deal with any community complains regarding dust, noise and any other health, safety and security matters. 2. Establish suitable security fencing and other control measures to restrict or control public access to the Project site. This will include any authorised access given the members of the public for visits, casual labour, collecting of cleared vegetation or activities planned under any Community Development or Corporate Social Responsibility programmes. 3. Adopt suitable traffic safety measures, with particular focus on ensuring community commuter and pedestrian traffic safety is considered along the main access roads used. 4. Establish emergency response plans for emergency incidences related to any construction or operational activities, infrastructure or traffic. 5. Establish suitable traffic safety rules to minimise potential traffic hazards on shared access roads that will be used by public traffic and pedestrian traffic. 6. Establish a Code of Conduct, and include it in all Contractor specifications, and individual employee Terms of Employment. The Code of Conduct will establish clear rules to be adopted by the HDF Energy, EPC Contractor or third-party non-local employees with respect to working or interacting in local communities including engagement procedures, obtaining permissions, grievance redress etc.	EPC Contractor and HDF Energy

Reference Number	E&S Aspect/Issue	Mitigation Measures/Action Plans – Construction Phase	Responsibility
		7. Establish a worker health programme during the construction that specifically targets risky behaviours, training and voluntary screening of HIV and other sexually transmitted diseases. 8. Develop a Code of Conduct, as part of the Labour Management Plan for all workers directly related to the project. A copy of the Code of Conduct is to be presented to all workers and signed by each person. 9. Develop and implement a Grievance Mechanism that is easily accessible to the local community, through which complaints related to contractor or employee behaviour can be lodged and responded to. 10. Develop and implement an HIV/AIDS policy and information document for all workers directly related to the Project. The information document will address factual health issues as well as behaviour change issues around the transmission and infection of HIV/AIDS. 11. Workers to be referred to medical professional for early treatment and monitoring of opportunistic infections such as coughs, colds and pneumonia (i.e. illnesses that can be transmitted easily within communities). 12. Education and awareness programmes for local schools and communities should be implemented. Transmission Line: 1. Communities located near the TL route shall be made aware of steps to follow and who to contact in the event of discovering a broken powerline and in the event of a fire. 2. Safety signage shall be placed on pylons to be located near communities, warning of the dangers associated with high-lift/excavation work under powerlines as well as provide emergency contact details. 3. The EPC Contractor, or where relevant third-parties, will establish suitable security and other control measures to restrict or control public access to active construction sites along the powerline route. 4. The EPC Contractor, or where relevant third-parties, will establish suitable dust suppression method to control dust deposition on local farmland and exposure of local people. 5. Adopt suitable traffic safety measures, with particular focus on ensuring community commuter and pedestrian traffic safety is considered along the main gravel access roads used. 6. Establish emergency response plans for emergency incidences related to any construction or operational activities, infrastructure or traffic. 7. Establish standard rules and restrictions where the operational right-of-way may be used to continue small-scale farming. This will include restrictions on constructions (in terms of new buildings) and activities (such as planting trees). 8. Develop a Code of Conduct, as part of the Labour Management Plan for all workers directly related to the project. A copy of the Code of Conduct is to be presented to all workers and signed by each person. 9. Develop and implement a Grievance Mechanism that is easily accessible to the local community, through which complaints related to contractor or employee behaviour can be lodged and responded to.	
EMP-C-016	Access, Traffic and Safety	Bulk water pipeline, power plant site and electrical transmission line infrastructure:	EPC Contractor

Reference Number	E&S Aspect/Issue	Mitigation Measures/Action Plans – Construction Phase	Responsibility
		1. Only demarcated and approved access routes shall be used, routes and detailed schedule of deliveries shall be defined and approved by the EPC Contractor. 2. Driving licences/certificates and proof of training and adoption of drivers code of conduct shall be obtained from all delivery drivers. 3. Ensure that access through the site is maintained at all times for other road users and is in a suitable condition. 4. Ensure that all regulations relating to traffic management are observed. 5. Ensure that adequate traffic accommodation, signage and safety measures (as appropriate) are put in place on site but more importantly along transport routes delivering panels and equipment to site. 6. Ensure that any traffic and safety signage remain clear throughout the construction period and that it is replaced or relocated as appropriate at the end of the construction period.	
EMP-C-017	Occupational Health and Safety	Bulk water pipeline, power plant site and electrical transmission line infrastructure: 1. The EPC Contractor, and where relevant any third-party contractors, will adopt all required occupational health and safety requirements as stipulated in Namibia, as well as conform with any relevant international best practice standards. 2. This will include the establishment of occupational health and safety policies, procedures and actions during both the construction and operational phase that results in strict adherence to health and safety measures by the EPC Contractor staff, third-party contractors and supply chain contractors. 3. Provide Personal Protective Equipment (PPE), training and monitoring as well as ongoing safety checks and safety audits. 4. Provide adequate clean drinking water and safe food for all workers. 5. Workers will be provided with access to primary health care and basic first aid at worksites. 6. Develop and implement an internal Grievance Mechanism that is easily accessible to the employees, contractors and sub-contractors, through which complaints related worker rights and health and safety can be lodged and responded to.	EPC Contractor
EMP-C-018	Landscape and Visual Amenity	Bulk water pipeline, power plant site and electrical transmission line infrastructure: 1. To reduce the visual impact of the Project on road users and nearby residents, a buffer or screen along the perimeter is recommended where technically feasible without restricting solar radiation and project performance. 2. New substation and other buildings on site to be screened where possible by landscaping and planting of indigenous trees and vegetation to minimise the visual impact and not to cause additional shading on the PV panels. 3. Buildings are to be painted using a natural colour pallet. 4. Security fence to be finished in a colour that is not visually intrusive. 5. Security lighting at night to be aimed downward and used according to best practise standards.	EPC Contractor
EMP-C-019	Cultural Heritage	Bulk water pipeline, power plant site and electrical transmission line infrastructure: 1. The site must be fenced off at the start of construction.	EPC Contractor

Reference Number	E&S Aspect/Issue	Mitigation Measures/Action Plans – Construction Phase	Responsibility
		2. The cultural heritage site noted in Section 5.3 are considered no-go areas and must be demarcated prior to any construction occurring within 150 m of their locality. 3. A Chance Find Procedure will be developed and implemented to address any potential finds of cultural heritage value during the construction phase. An example if presented under Appendix C. 4. If an archaeological site/archaeological finds or potential fossil finds are discovered during any construction activity, the work is to be halted and the HDF Energy must be notified. 5. Any human burials unearthed should be immediately reported to the HDF Energy, who in turn must notify the local Police Service and Heritage Authority. Transmission Line: 1. A site walk over must be undertaken to confirm whether any graves have been established subsequent to the heritage assessment being undertaken and confirmation of the transmission line preferred alignment. 2. A Chance Find Procedure will be developed and implemented to address any potential finds of cultural heritage value during the construction phase. 3. If an archaeological site/archaeological finds or potential fossil finds are discovered during any construction activity, the work is to be halted and the HDF Energy must be notified. 4. Any human burials unearthed should be immediately reported to the HDF Energy, who in turn must notify the local Police Service and Heritage Authority.	
Decommissioning Impacts			
EMP-C-020	Rehabilitation of construction areas	Bulk water pipeline, power plant site and electrical transmission line infrastructure: 1. All infrastructure and equipment (including fences, barriers and demarcations) associated with the construction phase shall be removed from the site and recycled or disposed of by approved recycling or disposal facilities as approved by the Project Manager. 2. Take all appropriate and active measures to prevent erosion, especially wind and water erosion, during the construction decommissioning phase. Any erosion caused on site during the decommissioning phase as a result of runoff needs to be rehabilitated. 3. Temporary erosion protection measures must be kept in place until permanent preventative measures (such as establishment of vegetation) is concluded. 4. In the case of accidental spills of oil or chemicals in the construction camp, the affected soil shall be dug out and removed from site for disposal at a hazardous waste site and replaced with fresh topsoil. 5. Areas where disturbance and loss of topsoil have occurred as well as areas where infrastructure have been removed must be filled with subsoil (where required) and covered with topsoil. 6. Compacted ground shall be rehabilitated by ripping to a minimum depth of 200 mm. Ripping will increase the soil's water storage capacity, prevent soil erosion, alleviate re-compaction and allow deep root growth and water infiltration.	EPC Contractor

Reference Number	E&S Aspect/Issue	Mitigation Measures/Action Plans – Construction Phase	Responsibility
		7. Any available topsoil should be placed on top of the ripped soil. Following topsoil, the affected area should be re-vegetated using only indigenous vegetation and plants similar to that of natural undisturbed surrounding areas. 8. Undertake a comprehensive photographic survey of the site before work commences and during rehabilitation to generate an archive of information.	
EMP-C-021	Alien invasive vegetation	Bulk water pipeline, power plant site and electrical transmission line infrastructure: 1. Alien vegetation management shall be undertaken within all areas disturbed by construction activities. 2. No on-site burying, dumping, stockpiling or burning of any weeds and alien plant species may occur. Such material shall be removed from the site and disposed of at a suitable municipal collection point or landfill site from where seed cannot escape.	EPC Contractor
EMP-C-022	Waste Material	Bulk water pipeline, power plant site and electrical transmission line infrastructure: 1. The site is to be cleared of all litter and other waste material. 2. All drainage lines shall be free from building rubble, spoil materials and any other waste materials. 3. All hazardous materials or excess materials (i.e. damaged panels, caballing, etc) should be taken back by the supplier where possible. 4. All wastes on site will be segregated and opportunities for recycling identified where possible. 5. All waste will be disposed of by an authorised waste disposal contractor to an authorised/licenced waste disposal site. 6. Where possible all materials will be recycled, otherwise they will be disposed of in accordance with local regulations and international best practise.	EPC Contractor

5.4.5 CONSTRUCTION PHASE MONITORING PLAN

Table 5-2: Construction Phase Monitoring Plan

Reference Number	E&S Aspect/Issue	Monitoring Aspects – Construction Phase	Monitoring Frequencies	Monitoring Parameters	Key Performance Indicators/Limits	Responsibility
MP-C-001	Ecology	Ensure that the fence surrounding the solar PV plant is erected at the initial stages of construction. Monitor access control during construction. The no-go areas identified during site walk over are to be inspected to ensure integrity has not been compromised during construction	Prior to construction and monthly after construction started.	Changes to pre-construction conditions	NA	EPC Contractor

Reference Number	E&S Aspect/Issue	Monitoring Aspects – Construction Phase	Monitoring Frequencies	Monitoring Parameters	Key Performance Indicators/Limits	Responsibility
MP-C-002	Rehabilitation/Restoration	Areas which have been restored or rehabilitated should be checked regularly to monitor natural plant regrowth and presence of erosion.	Monthly	Extent of regrowth and presence of erosion.	NA	EPC Contractor
MP-C-003	Noise	Monitor community complaints with respect to noise.	Ongoing	Complaints from local communities	Zero complaints	EPC Contractor
MP-C-004	Air Emissions	Visual monitoring of fugitive dust (particulate matter) emissions. Monitoring of complaints by local communities.	Ongoing	Visual inspection	Zero complaints received	EPC Contractor
MP-C-005	General Waste	General waste handling, storage, transport and disposal management.	Monthly	Quantity (m^3) of general waste produced. Quantity (m^3) of waste recycled. On site waste handling and storage area inspections. Tracking of corrective actions.	Zero non-compliances with EMP waste management requirements.	EPC Contractor
MP-C-006	Hazardous Waste	Hazardous waste handling, storage and disposal management	Monthly	Types and quantity (m^3) of hazardous waste generated. Labelling of hazardous waste storage containers (through inspections). Waste Manifest Documentation. Site/contractor/disposal facility weighbridge slips.	100% of hazardous waste disposed of (or recycled) at suitably licensed facilities. Zero non-compliances with EMP waste management requirements. Permits/licenses for all waste transported and disposal facilities used. Accurate waste tracking documents (including disposal records) available for all waste streams.	EPC Contractor

Reference Number	E&S Aspect/Issue	Monitoring Aspects – Construction Phase	Monitoring Frequencies	Monitoring Parameters	Key Performance Indicators/Limits	Responsibility
MP-C-007	Employee Health and Safety	1. H&S Inspections (compliance with H&S plans, procedures, SOP, etc.) 2. H&S legal compliance audits	1. Weekly 2. Annually	Namibian labour law EPC Contract	1. Legal requirements 2. Contractual requirements	EPC Contractor
MP-C-008	Grievances	Grievances logged and tracking of items	Monthly	1. Resolution Time Frame. 2. Satisfaction with Process and Outcome	Zero unresolved grievances	EPC Contractor (records) and HDF Energy (manage & track)
MP-C-009	Local Employment	Number of local people employed compared to total number of people employed. Numbers for woman to be indicated.	Monthly	Number of local people employed compared to total number of people employed.	In line with HDF Energy policies	EPC Contractor
MP-C-010	Community H&S	Number of community H&S incidents	Monthly	Number of community H&S incidents	Zero community H&S incidents	EPC Contractor

5.5 OPERATIONAL PHASE

5.5.1 Scope

Following the construction phase, the project will enter into the commissioning and operations phase of the project lifecycle. It is likely that HF Energy will appoint an O&M Contractor to oversee the operations phase of the project, however, HDF Energy as the applicant will retain ultimate responsibility for the management and compliance of the facility in line with this EMP, all statutory requirements and any conditions associated with the environmental clearance. It is also possible that HDF Energy would develop and extend its HSE system and associated polices and procedure to include the operation of this facility. The O&M Contractor will therefore need to work closely with HDF Energy to ensure the facility meets all the requirement of HDF Energy HSE system and demonstrate commitment to the continual improvement philosophy that underpins and Environmental Management System.

This section of the EMP contains specific measures associated with the operation of the Renewstable® Swakopmund power plant facility and the mitigation of potential social and environmental impacts. Any O&M operations that involve construction type activity or repair work to any of the structures or infrastructure shall be conducted in accordance with the provisions set out under the construction phase (Refer to Section 5.4) of this EMP.

5.5.2 OPERATIONAL PHASE EMP

Table 5-3sets out the relevant management measures to be implemented during the operational phase. Mitigation measures have been divided into Biophysical, Ecological and Socio-economic components as per the EIA structure. The mitigation measures in the table below are relevant to both the solar PV plant and the transmission line. Where mitigation measures are exclusive to the solar PV plant, hydrogen plant or the transmission line this has been indicated in the table below.

It is noted that the owner/operator responsibilities of the transmission line may be transferred to a 3rd party depending on who the off taker is.

Table 5-3: Operational Phase EMP

Reference Number	E&S Aspect/Issue	Mitigation Measures/Action Plans – Operational Phase	Responsibility
Biophysical Impacts			
EMP-OP-001	Air Emissions	Solar PV & Hydrogen Plants: 1. Adopt measures to control the generated of fugitive dust from traffic including limiting vehicles speeds to the 20 km/hr on the access road to site and on site. An appropriate speed must be adopted on access roads to the site to ensure limited dust generation. 2. Ensure that fugitive dust emissions will be actively managed during the operational life of the Project. 3. Establish a grievance mechanism throughout the operation phase to deal with any community complains regarding dust. 4. Refer to EMP-OP-015 for grievances. Transmission Line: 1. Ensure that fugitive dust emissions are managed during the operational life of the powerline. This should include the rehabilitation of cleared areas (notably the powerline right-of-way) once construction has concluded and the ongoing maintenance of these areas unless the land is allocated to local people to continue small-scale farming.	O&M Contractor
Ecological Impacts			
EMP-OP-002	Habitat loss, fragmentation and increased edge effects	Solar PV Plant, Hydrogen Plants & Transmission Line: 1. Refer to EMP-OP-004 regarding alien invasive vegetation.. 2. Monitoring of restoration success: areas which have been restored or rehabilitated should be checked regularly to monitor natural plant regrowth and presence of erosion. 3. Use of herbicides will be in compliance with International and Namibian standards and referring to the applicable MSDS.	O&M Contractor

Reference Number	E&S Aspect/Issue	Mitigation Measures/Action Plans – Operational Phase	Responsibility
EMP-OP-003	Aquatic Ecology	Solar PV & Hydrogen Plants: 1. Restrict use of chemicals on site to minimum necessary and ensure storage and use, and vehicle maintenance, complies with standard good practice. Hazardous chemicals, including fuels, should be stored in a bunded and fenced area located away from any seasonal drainage line or other surface depressions or pans. 2. Conduct site inspections to check for oil spills and leaks on soil surface and water bodies (if any form in the wet season) and implement remediation as required. 3. Vehicle maintenance shall be done on an impermeable surface to prevent soil and water contamination. 4. Chemical containers shall be stored in an enclosed restricted access area (to prevent human re-use) and disposed of at an approved waste facility or by approved waste service providers. 5. Maintenance on vehicles/diesel powered equipment will be conducted off-site or within a designated, paved and bunded area 6. Toilets and general plumbing will be regularly checked for leaks which will be attended to immediately. Transmission Line: 1. Refer to EMP-OP-004 regarding alien invasive vegetation. 2. Restrict use of chemicals on site to minimum necessary and ensure storage and use, and vehicle maintenance, complies with standard good practice. Hazardous chemicals, including fuels, should be stored in a bunded and fenced area located away from the seasonal drainage line or other surface depressions or pans. 3. Repairs to vehicles/diesel powered equipment will be conducted off-site 4. Ensure the necessary spill kits are available on site. All hydrocarbons spills on bare ground will be cleared immediately. This will include the lifting of the contaminated soil for bio-remediation or disposal to a hazardous waste facility. 5. Monitoring of restoration success: areas which have been impacted should be checked regularly to monitor natural plant regrowth and presence of erosion.	O&M Contractor
EMP-OP-004	Alien invasive vegetation	Solar PV Plant, Hydrogen Plants & Transmission Line: 1. Monitor for any emerging AIS and ensure that these are rapidly removed. Only environmentally approved herbicides that comply with Namibian legal requirements and relevant international conventions should be used. POPs and Pesticides as listed by UNEP will not be allowed. 2. Staff at the plant must be educated and made aware of alien vegetation that could be present and that must be eradicated. 3. Quarterly inspections around the site shall be performed in order to identify any alien invasive vegetation. If encountered, then: a. Alien vegetation management shall be undertaken within all areas disturbed by construction activities for a period of a year after project completion; and b. Any alien vegetation removal shall be undertaken by a suitably qualified sub-contractor. 4. No on-site burying, dumping, stockpiling or burning of any weeds and alien plant species may occur. Such material shall be removed from the site and disposed of at a suitable municipal collection point or landfill site from where seed cannot escape.	O&M Contractor

Reference Number	E&S Aspect/Issue	Mitigation Measures/Action Plans – Operational Phase	Responsibility
EMP-OP-005	Hazardous Substance Storage	Solar PV Plant & Hydrogen Plants: 1. Hazardous substances stored on site should be within a bunded area and(or) contained in an appropriate, compatible, appropriately labelled containers to prevent reaction with containers and spillage during handling. 2. Storage to be located at least 150 m from the seasonal drainage line or other surface depressions or pans. 3. The relevant MSDS sheets should be clearly displayed in the hazardous substance storage area. 4. Relevant training should be provided to all employees/contractors on the correct storage and handling procedures and records of this training kept on site.	O&M Contractor
EMP-OP-006	Hazardous Substance Spills	Solar PV Plant, Hydrogen Plants &Transmission Line: 1. Hazardous substances stored on site should be within a bunded area and(or) contained in an appropriate, compatible, appropriately labelled containers to prevent reaction with containers and spillage during handling. 2. Construction vehicles and equipment will be regularly serviced off site. Spills of fuel and lubricants from vehicles and equipment will be contained using a drip tray with plastic sheeting filled with adsorbent material. 3. Concrete to be mixed in designated areas and managed in such a way so that no spillage is allowed to reach the ephemeral drainage lines. 4. Accidental spillage of potentially contaminating liquids and solids must be immediately contained and cleaned up by trained staff with the correct equipment and disposed of in an appropriate manner. 5. Minimise clearing of vegetation around the site to intercept and impede run-off from the site.	O&M Contractor
EMP-OP-007	Hazardous Waste	Solar PV Plant, Hydrogen Plants &Transmission Line: 1. Hazardous wastes must be separated and contained in compatible, appropriately labelled containers to prevent reaction with containers and spillage during handling. 2. Storage to be located away from seasonal drainage lines. 3. Storage areas must have clear signage for the various hazardous waste streams. 4. Potentially contaminating fluids and other hazardous wastes must be contained in containers on hard, level surfaces in contained and covered locations, and be clearly marked. 5. Develop and implement a site specific HWMP for the management, handling and disposal of hazardous waste streams. 6. Hazardous waste will be trucked out and disposed of at a licensed landfill site. A waste manifest must be kept for all hazardous wastes that are disposed of and maintained on site. Solar PV & Hydrogen Plants: 1. Disposal and potential treatment of sewage and contaminated soil will be included in the HWMP. 2. Broken PV panels will be stored in covered waste skips or enclosed buildings until they can be removed from site.	O&M Contractor
EMP-OP-008	Soil Erosion	Solar PV Plant, Hydrogen Plants &Transmission Line: 1. Conduct monthly inspections to identify areas of erosion. If areas are identified then develop and implement an action plan to avoid further erosion and to rehabilitate the areas as identified.	O&M Contractor

Reference Number	E&S Aspect/Issue	Mitigation Measures/Action Plans – Operational Phase	Responsibility
EMP-OP-009	Fire	Solar PV Plant, Hydrogen Plants &Transmission Line: 1. No open fires shall be allowed on site, unless in safe areas specially demarcated for that purpose. 2. Ensure that the telephone number of the local Fire and Emergency Service is displayed at the site offices. 3. Ensure suitable fire-fighting equipment is provided on site. As a minimum this should include fire extinguishers, fire suppression system (as required, e.g. in power cabins) and any additional requirements as specified in the emergency response plan 4. Appoint a fire officer who shall be responsible for ensuring immediate and appropriate action in the event of a fire as well as maintenance of the fire-fighting equipment. The appointed fire officer shall notify the local Fire and Emergency Services in the event of a fire and shall not delay doing so until such time as the fire is beyond his/her control. 5. Take all reasonable steps to prevent the accidental occurrence or spread of fire. 6. Ensure that all site personnel are aware of the procedure to be followed in the event of a fire. 7. Hot-work (e.g. welding, grinding, cutting torch, etc.) must take place in specially designated areas only. 8. Smoking is not allowed on site, other than at designated smoking points. Cigarette butts shall not be discarded on the ground.	O&M Contractor
EMP-OP-010	Lighting	Solar PV & Hydrogen Plants: 1. Ensure that any lighting installed on the site does not interfere with road traffic or cause a reasonably avoidable disturbance to the surrounding users and local communities.	O&M Contractor
		Socio-Economic Impacts	
EMP-OP-011	Community Development, Local Employment and Local Content	Solar PV & Hydrogen Plants: 1. All local recruitment and labour management will be undertaken by the O&M Contractor, or third-party contractors, consistent with Namibian national labour and occupation health and safety laws. This will include any international obligations (including any applicable ILO provisions signed and ratified by Namibia). 2. Establish suitable Human Resources and Recruitment Procedures that establish rules for local recruitment and preferential employment. 3. Establish suitable local content procedures as part of their overall procurement system. The procedures will apply to local procurement of materials and services during the operational life of the Project. 4. For the purposes of the CDP, as well as local recruitment and procurement, the terms *local* shall be defined by multiple levels, and priority will be given to household and community in the order below: a. Priority Level 1 – Households immediately surrounding the Project site and final transmission line, with specific focus on residents of Swakopmund. b. Priority Level 2 – The Erongo Region and Walvis Bay. c. Priority Level 3 – Persons and businesses based in Namibia, and thereafter internationally. 5. Measures will be put in place measures to ensure no employee or job applicant is discriminated against on the basis of his or her race, gender, marital status, nationality, age, religion or sexual orientation. 6. Communicate all recruitment criteria for ongoing recruitment in advance.	O&M Contractor

Reference Number	E&S Aspect/Issue	Mitigation Measures/Action Plans – Operational Phase	Responsibility
		7. No employment activities will take place at the entrance to the site. Only formal channels for employment will be used. 8. Management measures should be implemented to enhance skills development and on-the-job training.	
EMP-OP-012	Community Health, Safety and Security	Solar PV & Hydrogen Plants: 1. Establish a grievance mechanism throughout the construction and operation phase to deal with any community complains regarding dust, noise and any other health, safety and security matters. 2. Establish suitable security fencing and other control measures to restrict or control public access to the Project site. This will include any authorised access given the members of the public for visits, casual labour, collecting of cleared vegetation or activities planned under any Community Development or Corporate Social Responsibility programmes. 3. Adopt suitable traffic safety measures, with particular focus on ensuring community commuter and pedestrian traffic safety is considered along the main gravel access roads used. 4. Establish emergency response plans for emergency incidences related to any construction or operational activities, infrastructure or traffic. 5. Establish suitable traffic safety rules to minimise potential traffic hazards on shared access roads that will be used by public traffic and pedestrian traffic. 6. Establish a Code of Conduct, and include it in all O&M Contractor specifications, and individual employee Terms of Employment. The Code of Conduct will establish clear rules to be adopted by the O&M Contractor or third-party non-local employees with respect to working or interacting in local communities including engagement procedures, obtaining permissions, grievance redress etc. 7. Establish a worker health programme during the construction that specifically targets risky behaviours, training and voluntary screening of HIV and other sexually transmitted diseases 8. Develop and implement a Grievance Mechanism that is easily accessible to the local community, through which complaints related to contractor or employee behaviour can be lodged and responded to. Transmission Line: 1. Establish standard rules and restrictions where the operational right-of-way may be used to continue any predevelopment land activities. 2. Communities located near the TL route shall be made aware of steps to follow and who to contact in the event of discovering a broken powerline and in the event of a fire. 3. Safety signage shall be placed on pylons to be located near communities warning of the dangers associated with high-lift/excavation work under powerlines as well as provide emergency contact details. 4. Develop and implement a Grievance Mechanism that is easily accessible to the local community, through which complaints related to contractor or employee behaviour can be lodged and responded to.	O&M Contractor
EMP-OP-013	Occupational Health and Safety	Solar PV & Hydrogen Plants: 1. The O&M Contractor, and where relevant any third-party contractors, will adopt all required occupational health and safety requirements as stipulated under the Namibian labour law, as well as conform with any relevant international best practice standards.	O&M Contractor

Reference Number	E&S Aspect/Issue	Mitigation Measures/Action Plans – Operational Phase	Responsibility
		2. This will include the establishment of occupational health and safety policies, procedures and actions during both the construction and operational phase that results in strict adherence to health and safety measures by the O&M Contractor staff, third-party contractors and supply chain contractors. 3. Provide PPE, training and monitoring as well as ongoing safety checks and safety audits. 4. Provide adequate clean drinking water and safe food for all workers. 5. Workers will be provided with access to primary health care and basic first aid at worksites. 6. Develop and implement an internal Grievance Mechanism that is easily accessible to the employees, contractors and sub-contractors, through which complaints related worker rights and health and safety can be lodged and responded to.	
EMP-OP-014	Landscape and Visual Amenity	Solar PV & Hydrogen Plants: 1. Security fence to be finished in a colour that is not visually intrusive. 2. Security lighting at night to be aimed downward and used according to best practise standards.	O&M Contractor
EMP-OP-015	Cultural Heritage	Solar PV Plant & Transmission Line: 1. A Chance Find Procedure will be developed and implemented to address any potential finds of cultural heritage value. 2. If an archaeological site/archaeological finds or potential fossil finds are discovered, the work is to be halted and the O&M Contractor must be notified. 3. Any human burials unearthed should be immediately reported to the O&M Contractor, who in turn must notify the national cultural heritage authority and the police.	O&M Contractor
Decommissioning Impacts			
EMP-OP-016	Planning	A detailed Decommissioning and Rehabilitation Plan must be developed at least 2 years prior to the decommissioning of project and the associated facilities. This plan should include, but not be limited to, management of socio-economic aspects such as employment loss, removal, re-use and recycling of materials and vegetative rehabilitation to prevent erosion, infrastructure removals, waste disposal, hazardous substance spillages and alien invasive vegetation control. The plan will detail all site-specific measures to be implemented to rehabilitate all areas disturbed by the project.	O&M Contractor

5.5.3 OPERATIONAL PHASE MONITORING PLAN

Table 5-4: Operational Phase Monitoring Plan

Reference Number	E&S Aspect/Issue	Monitoring Aspects – Construction Phase	Monitoring Frequencies	Monitoring Parameters	Key Performance Indicators/Limits	Responsibility
MP-OP-001	Ecology	Ensure that the fence surrounding the plant is erected at the initial stages of construction. Monitor access control during construction. The no-go areas identified during the site walk over and incidentally during operation should be monitoring to the integrity of these features is maintained	Biannually (for period of 5 years)	Changes/impacts to pre-construction conditions	No nett loss when compared to baseline conditions prior to constriction.	O&M Contractor
MP-OP-002	Alien vegetation	Monitoring of alien invasive plants.	Quarterly	Numbers/areas and locations of alien invasive plant species.	Zero presence of alien invasive plant species.	O&M Contractor
MP-OP-003	General Waste	General waste handling, storage and disposal management.	Quarterly	Quantity of general waste produced. Quantity of waste recycled. On site waste handling and storage area inspections. Tracking of corrective actions.	NA	O&M Contractor
MP-OP-004	Hazardous Waste	Hazardous waste handling, storage and disposal management	Annually	Types and quantity (m^3) of hazardous waste generated. Labelling of hazardous waste storage containers (through inspections). Waste Manifest Documentation. Site/contractor/disposal facility weighbridge slips.	100% of hazardous waste disposed of (or recycled) at suitably licensed facilities. Zero non-compliances with EMP waste management requirements. Permits/licenses for all waste transported and disposal facilities used. Accurate waste tracking documents (including disposal	O&M Contractor

Reference Number	E&S Aspect/Issue	Monitoring Aspects – Construction Phase	Monitoring Frequencies	Monitoring Parameters	Key Performance Indicators/Limits	Responsibility
					records) available for all waste streams.	
MP-OP-005	Employee Health and Safety	1. H&S Inspections (compliance with H&S plans, procedures, SOP, etc.) 2. H&S legal compliance audits	1. Monthly 2. Annually	1. Namibian labour laws	Namibian labour law O&M Contract	1. Legal requirements 2. Contractual requirements
MP-OP-006	Grievances	Grievances logged and tracking of items	Monthly	1. Resolution Time Frame. 2. Satisfaction with Process and Outcome	Zero unresolved grievances	O&M Contractor (records) and HDF Energy (manage & track)
MP-OP-007	Local Employment	Number of local people employed compared to total number of people employed. Numbers for woman to be indicated.	Annually	Number of local people employed compared to total number of people employed.	As per HDF Energy employment policies and Namibian legislative requirements	O&M Contractor
MP-OP-008	Community H&S	Number of community H&S incidents	Monthly	Number of community H&S incidents	Zero community H&S incidents	O&M Contractor
MP-OP-009	Enterprise Development (ED) and Socio-Economic Development (SED)	ED and SED initiatives implementation and progress.	Monthly	TBC	TBC	O&M Contractor

6. MANAGEMENT OF CHANGE

Changes in the Project may occur due to unanticipated situations. Adaptive changes may also occur during the course of final design, commissioning or even operations. The project will implement a formal procedure to manage changes (e.g. layout, technology, resources, etc.). The objective of the procedure must be to ensure that the impact of changes on the health and safety of personnel, the environment, adjacent communities, plant and equipment are identified and assessed prior to the changes being implemented. The management of change procedure must ensure that:

- proposed changes have a sound technical, safety, environmental, social and commercial justification;
- changes are reviewed by competent personnel and the impact of changes is reflected in documentation, including operating procedures and drawings;
- changes are communicated to personnel who are provided with the necessary skills, via training, to effectively implement changes;
- the appropriate developer lead accepts the responsibility for the change; and

Changes to be managed could include a risk to people, the environment, communities or the business, and might be related to a process, equipment, materials, people or the environment or project context. Change management process includes the following steps:

1. Identify and describe the change using Management of Change Form;
2. Assess the E&S risks associated with the change;
3. Identify control measures (for risk that cannot be eliminated);
4. Appoint someone to review the risk assessment;
5. Develop actions to manage the change with clear responsibilities and timeline;
6. Implement actions; and
7. Review the change to ensure it has been effective.

All changes to the project shall be subject to a Risk Assessment. All environmental and social legal requirements related to the change shall also be identified and implemented as required. Mitigation measures and monitoring requirements associated with significant environmental and social risks as related with the change shall be captured in this EMP. Substantive changes to the mitigation measures described in this EMP will need to be communicated to the MEFT

7. DECOMMISSIONING PHASE

The plant will be designed to have a 25-year operational life, which coincides with the current HDF Energy Life of Project plan. At the end of the design life period, the plant may be refurbished for continued operation, upgraded, or may be decommissioned, broken down and the site rehabilitated, or sold as a going concern, depending on the situation and needs at that time.

However, in the event that the plant is decommissioned and dismantled and the site rehabilitated, the provision made under the construction phase of this EMP shall be amended as required and apply to all de-construction activities. In the event of decommissioning, HDF Energy shall make every effort to have the various materials in the plant reclaimed for recycling or reuse elsewhere and reduce the volume of waste going to landfill.

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APPENDIX A: GUIDELINE LIST OF METHOD STATEMENTS

The purpose of the following list is to provide guidance as to Method Statements (MS) to be prepared. The list is not to be considered prescriptive or exhaustive:

MS1: Construction camp location and layout;
MS2: Site clearing;
MS3: Hazardous substances;
MS4: Solid waste management;
MS5: Wastewater management;
MS6: Erosion and sediment control;
MS7: Cement and concrete batching;
MS8: Fire control;
MS9: Dust control programme;
MS10: Temporary site closure;
MS11: Emergency procedures;
MS12: Rehabilitation Plan.

APPENDIX B: ENVIRONMENTAL DO'S AND DONTS


PROTECTION OF THE ENVIRONMENT IS YOUR RESPONSIBILITY/ BESKERMING VAN DIE OMGEWING IS JOU VERANTWOORDELIKHEID
REMAIN WITHIN WORKING AREAS
BLY BINNE WERKGEBIEDE
NO SWIMMING
SWEM VERBODE
DO NOT HARM OR DAMAGE PLANTS AND ANIMALS
MOENIE PLANTE EN DIERE BESKADIG NIE
SMOKE CAUTIOUSLY
ROOK VERSIGTIG
BE AWARE OF FIRES
PASOP VIR VUUR
PREVENT OIL POLLUTION
VOORKOM OLIE-BESOEDELING
CONTROL DUST
BEHEER STOF
LIMIT NOISE
VERMINDER GERAAS
USE TOILETS
GEBRUIK DIE TOILETTE
toilet
USE THE EATING AREAS
EET BINNE DIE EETGEBIED
USE RUBBISH BINS
GEBRUIK ASBLIKKE
DON'T SPEED/ SECURE LOADS
RY STADIG/ MAAK VRAGTE VAS
KNOW THE EMERGENCY NUMBERS
KEN DIE NOOD NOMMERS
ASK QUESTIONS
VRA VRAE

APPENDIX C: CHANCE FINE PROTOCOL

Archaeological Chance Finds Procedure

A "Chance Find" refers to any cultural heritage site or associated material encountered during the course of construction works, as opposed to finds made in the course of intentional archaeological investigation. Chance Finds include, but are not limited to artefacts, archaeological deposits, ruins, monuments, and human remains.

The Chance Find Procedure presented in this document serve as international best practice policy for the accidental discovery of cultural and heritage resources as well as burial grounds/graves. Based on the definitions provided within this document and the proposed lines of communication, HDF Energy will be able to mitigate the accidental discovery of these items through the various phases of the project

All intrusive site activities such as land clearing, open pit excavation and earth works within the Power Plant site and along the transmission line will be carefully monitored.

All personnel involved in land clearance and excavation will be responsible for managing archaeological protection, including the adoption of this Chance Finds Procedure.

HDF Energy will provide training for EPC Contractor personnel to help identify archaeological objects and make them aware of how to implement the Chance Finds Procedure. HDF Energy and the EPC Contractor will make all employees aware of the cultural and social significance of any chance finds during the life of the project and ensure that they understand that they will be strictly prohibited from interfering with or disturbing cultural heritage sites and artefacts. This will be included in induction training, as well as provided for in any third-party contracts.

Excavation in and around sites of known cultural interest (notably local graveyards) will be entirely avoided. HDF Energy will define these areas as exclusions zones and will place suitable boundary makers. Where the disruption of such sites is unavoidable, prior discussions must be held with the relevant authorities to undertake pre-construction excavation or assign an archaeologist to log discoveries as construction proceeds.

HDF Energy will ensure that all records and reports of any fortuitous finds are made available to the national institution responsible for the management of cultural heritage.

Chance Find Process:

Where historical remains, archaeological artefacts (relics, tools, bones, ceramics, graves, etc.) or any other object of cultural or archaeological importance are unexpectedly discovered during construction in an area not previously known for its archaeological interest, the following procedures should be applied:

1. Stop construction activities and inform site supervisor/foreman;
2. The site supervisor/foreman will notify the EPC Contractor/ O&M Contractor immediately.
3. The EPC Contractor/ O&M Contractor will delineate the discovered site area, and secure it to prevent any damage or loss of removable objects.
4. HDF Energy will appoint a qualified archaeologist to assess the significance of the suspected chance find.

5. The HDF Energy HSE Manager will liaise with the relevant ministry/authority to determine the need for further investigation and appropriate action.
6. In the case of human remains the local authorities and police must be notified and an autopsy process may be triggered. Where it is confirmed that the remains are unclaimed graves, HDF Energy will ensure their relocation.
7. Decisions on how to handle the findings will be reached based on the above assessment and could include conservation, preservation, restoration, or salvage. The final action will be established in agreement between HDF Energy and the relevant authority.
8. Any subsequent investigation or excavation works will be conducted by a suitably-qualified archaeologist/palaeontologist.
9. Construction work can resume only when permission is given from the relevant authority after the decision concerning the safeguard of the heritage is fully executed**.**

If further detailed excavation works are required (as determined under the guidance of the relevant national and regional authorities), HDF Energy will ensure that:

1. Any necessary permits and licenses for archaeological investigation and removal will be obtained from the relevant authorities.
2. Archaeological chance finds will be discussed with the local community to establish local significance, and community buy-in in terms of any actions to be undertaken.
3. Mapping will be carried out to identify the likely spatial extent of archaeological site, and trial pits will be dug by hand excavation.
4. The excavation process and the different archaeological material (ceramics, stones, charcoal, seeds, bones, etc.) will be registered in detail using photographs and field diaries.
5. Any material found in the pits will be treated (washed and tagged) and later classified in accordance with accepted criteria.

If archaeological/paleontological excavation or retrieval processes are required for chance finds of cultural sites within the project footprint the following additional procedures will apply:

1. Work must be completed by a qualified archaeologist/ palaeontologist.
2. Activities may be monitored by representatives of the local communities.
3. Consideration will be given to supplementing excavation work with non-destructive means of investigation (e.g., geophysical survey, remote sensing, geochemical survey, field scanning).
4. Arrangements will be made with local communities and authorities if storage or relocation of the artefact is required.
5. Records (written, graphic, electronic, and photographic as appropriate) will be made for all works.
6. A post-excavation assessment report will be produced**.**

Some types of cultural heritage resources (e.g., ethnographic stone pits) cannot be excavated, salvaged and relocated. Procedures for documenting these sites will involve the following:

1. Consultation with all relevant parties (e.g., local communities and authorities) to determine if these items should be destroyed.
2. Prior to destruction, the items will be documented to record the physical extent of the item and the physical environment in which the item is located.

Photographs may be taken and added to Company records.

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Report Number:	01
Client:	HDF Energy (Namibia) (Pty) Ltd

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HDF ENERGY RENEWSTABLE SWAKOPMUND PROJECT | ENVIRONMENTAL MANAGEMENT PLAN | DESALINATION PLANT

Swakopmund, Erongo Region, Namibia

Prepared for: HDF Energy (Namibia) (Pty) Ltd

Authority References: APP-003487

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REPORT SIGN OFF AND APPROVALS

Theo Wicks
(Project Manager)

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ACRONYMS AND ABBREVIATIONS

Acronym / Abbreviation	Definition
AIS	Alien Invasive Species
BCLME	Benguela Current Large Marine Ecosystem
CDP	Community Development Plan
CITES	Convention on International Trade in Endangered Species
DAF	Dissolved air flotation
DMF	Dual Media Filtration
ECC	Environmental Clearance Certificate
ED	Enterprise Development
EDI	Electro-de-ionization
EIA	Environmental Impact Assessment
EMA	Environmental Management Act, 2007 (No. 7 of 2007)
EMP	Environmental Management Plan
EPC	Engineering, Procurements, Construct
EPFIs	Equator Principle Financial Institutions
EPRP	Emergency Preparedness and Response Plan
HDF Energy	HDF Energy Namibia (Pty) Ltd
HSE	Health, Safety and Environment
IFC	International Finance Corporation
ILO	International Labour Organisation
IWRM	Integrated Water Resources Management
MEFT	Ministry of Environment, Fisheries and Tourism
MHI	Major Hazard Installation
MS	Method Statement
MSDS	Material Safety Data Sheets
NACOMA	Namibian Coast Conservation & Management Project
NDPs	National Development Plans
NIRP	National Integrated Resource Plan, 2016
O&M	Operations & Maintenance
POPs	Persistent Organic Pollutants
PPE	Personal Protective Equipment
PS	Performance Standard
PV	Photovoltaic
RO	Reverse Osmosis
SEAs	Strategic Environmental Assessments
SED	Socio-Economic Development
S&EP	Social and Environmental Policy

Acronym / Abbreviation	Definition
SMBS	Sodium Metabisulphate
SWRO	Seawater Reverse Osmosis
TOC	Total organic carbon
TDS	Total dissolved solids
TSS	Total suspended solids
UNCBD	United Nations Convention on Biological Diversity
UNDRIP	United Nations Declaration on the Rights of Indigenous Peoples
UNEP	United Nations Environment Programme
WRMA	Water Resources Management Act (No. 11 of 2013)

HDF Energy Renewstable® Swakopmund Project | Environmental Management Plan | Desalination Plant

1. INTRODUCTION

HDF Energy (Pty) Ltd is a global market leader in the development and operation of hydrogen-to-energy technology. Having established HDF Energy Namibia (Pty) Ltd (HDF Energy), the company is proposing to benefit from Namibia's considerable renewable energy capacity to create the Renewstable® Swakopmund project.

In an attempt to diversify its local/international energy mix, stimulate local development in line with the Harambee Prosperity Plan II, and decrease Namibia's reliance on fossil fuel dominated power, Renewstable® Swakopmund is Africa's first integrated solar-hydrogen power project.

1.1 PROJECT BACKGROUND

The Renewstable® Swakopmund project seeks to combine solar Photovoltaic (PV) power along with hydrogen production to generate stable, dispatchable power to the national grid to be able to meet consumer demand. The Renewstable® Swakopmund project concept consists of the following components:

- An eighty-five (85) MW solar PV power plant with tracker configuration;
- A Reverse Osmosis (RO) desalination plant and demineralization plant;
- A hydrogen chain consisting of electrolysers, hydrogen storage, hydrogen fuel cells and a battery energy storage facility;
- An energy management system;
- An overhead electrical transmission line;
- Water pipeline between the desalination plant and the power plant; and
- A hydrogen refuelling station.

The project will be located in the east of the town of Swakopmund in the Erongo Region of Namibia. The approved location is in close proximity to a railway line and C28 highway. The projects locality is shown in Figure 1 1.

Development and operation of the Renewstable® Swakopmund project is subject to the Ministry of Environment, Fisheries and Tourism (MEFT) granting an Environmental Clearance Certificate (ECC) in terms of the Environmental Management Act, 2007 (No. 7 of 2007) (EMA) and the Environmental Impact Assessment (EIA) Regulations, 2012. In applying for an ECC, it is necessary for HDF Energy to undertake an EIA and compile an Environmental Management Plan (EMP) (See Section 1.2).

IMPORTANT NOTE:
The scope of this EMP relates specifically to the management of environmental and social risks associated with the Desalination Plant. A separate Environmental Management Plan has been prepared for the management of the Renewstable Swakopmund power plant facility and associated infrastructure

Figure 1-1: Project locality and components

The purpose of this EMP is to ensure that impacts associated with the construction and operational phase are avoided and, where they cannot be avoided, are kept to a minimum and rehabilitated. The EMP, which has as its basis the mitigation measures listed in the EIA Report, sets environmental targets for the Contractors and reasonable standards against which the Contractor's performance can be measured during the construction and operational phase.

The desalination plant is to be operated on behalf of HDF Energy (Table 1-1):

Table 1-1: Applicant details

Component	Description
Company Name	HDF Energy Namibia (Pty) Ltd
Address:	3rd Floor Mandume Park Building, c/o Dr W Kulz & Teinert Street, Windhoek.
Responsible person:	Tashiya Walenga/ Nicolas Lecomte
Tel:	+264 8179 42766
E-mail:	namibia@hdf-energy.com
`Web address	https://www.renewstable-swakopmund.com/contact

1.1.1 Desalination plant components

The site for the proposed desalination plant is located between the Mile 4 caravan park and the southern portion of the existing Mile 6 Salt Works (See

Figure 1-2).

Figure 1-2: Location of the proposed HDF Renewstable® Swakopmund Desalination Plant

The project will comprise the following components (Figure 1-3):

- A seawater intake system comprising either beach-wells (preferred alternative) or intake through a pipeline from the existing tidal pool to the southwest of the RO Plant site;
- A feed pump configuration capable of drawing raw feed-water and providing the pressure requirements for moving the raw water through all pre-filtration phases
- Raw sea water storage reservoirs and pre-treatment line;
- A modular Seawater Reverse Osmosis (SWRO) plant (1st pass RO) with an average potable water production of 200 m^3/day (~70 000 m^3/year). The desalination plant will be housed in an enclosure and fenced off area together with the post- and pre-treatment infrastructure;
- Potable water storage reservoir, pumping station and post-treatment line to a holding tank at the HDF Energy power plant site;
- Brine discharge through a pipeline extending westwards to beyond the surf zone or a discharge pipeline into the adjacent / Salt Pan (Preferred alternative);
- Solar powered energy supply to maximise off grid operations;
- Transmission of desalinated water after the proposed bulk water storage *via* a pipeline and pumping system to Renewstable® Swakopmund power plant site;
- Brackish RO and CO_2 degassing plant (2nd pass RO) to achieve the desired feed water specification to the downstream ultra-pure water process;
- Electro-de-ionization (EDI) ultra-purification as a final treatment step; and
- Related services and structures i.e. offices, access road, etc.

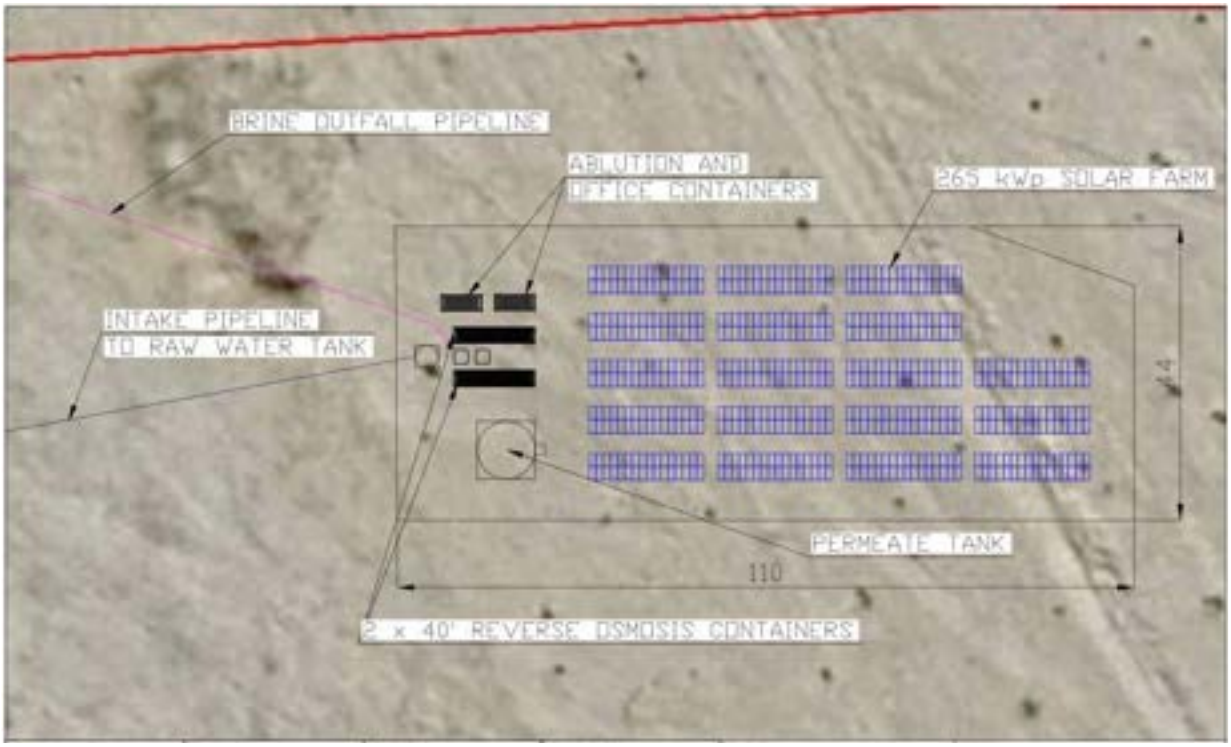

Figure 1-3: Beach compound for 1st pass RO and Solar Farm
(Impact Water Solutions, 2022)

While HDF Energy will own the Renewstable® Swakopmund project, the development of the facilities will be undertaken by and Engineering Procurement Construction (EPC) Contractor. Operation of the facility will be done by an Operations and Maintenance (O&M) Contractor.

1.2 ENVIRONMENTAL IMPACT PROCESS

Prior to the commencement of the proposed project, an ECC is required on the basis of an EIA report and EMP. In accordance with this legal framework the EIA approach included the following:

- The scoping process was conducted to identify the environmental issues associated with the proposed project and to define the terms of reference for the required specialist studies and the EIA.
- Specialist studies were commissioned in accordance with the relevant terms of reference. The specialists were selected on the basis of their expertise and knowledge of the project area. (Refer to Table 1-2 below).
- The EIA report and EMPs were prepared on the basis of the findings of the specialist studies.
- A project specific public participation process was conducted.

The following specialist studies were identified in the scoping phase and undertaken during the EIA. These studies have assisted with the investigation and assessment of the key impacts, as well as providing recommendations to reduce and manage those impacts as best as possible

Table 1-2: Environmental and Social Specialists

Aspect	Specialist	Description
Visual	SLR SiVest (Pty) Ltd	Assess the potential visual impact caused by the proposed Project.
Surface and groundwater	Nature Stamp (Pty) Ltd	This study will assess the potential Surface and groundwater impacts associated with the proposed HDF Energy Renewstable® Swakopmund Project.
Noise	WKC Consulting (Pty) Ltd	Identify and assess the potential noise impacts associated with the construction and operation of the proposed HDF Energy Renewstable® Swakopmund Project.
Heritage	Dr. John Kinahan	This study will focus on the probable impacts of the proposed project on heritage and archaeological impacts within the footprint of the proposed project.
Terrestrial biodiversity	Potgieter Consultancy cc	Assess the potential Terrestrial biodiversity impacts by the proposed Project.
Social	Ashby Associates cc	Identify and assess the potential Socio-economic impacts associated with the construction and operation of the proposed HDF Energy Renewstable® Swakopmund Project.
Climate Change	SLR	This study will focus on the impacts on climate change that will be associated with the proposed Project.
Marine biodiversity	Pisces Environmental Consulting Services Ltd	Identify and assess the potential impacts to marine and coastal biodiversity associated with the construction and operation of the proposed HDF Energy Renewstable® Swakopmund Project.
Avifauna	African Conservation Services cc	Identify and assess the potential impacts on local birdlife associated with the construction and operations of the proposed HDF Energy Renewstable® Swakopmund Project and associated infrastructure (most notably a possible overhead powerline).

1.2.1 Summary and overview of the EIA process and findings

HDF Energy's Renewstable® Swakopmund project proposes Africa's first renewable green hydrogen-to-power project. The project principle is based on the generation of solar energy during day light hours to power the regional grid and to power the production of green hydrogen. Green hydrogen is then used to generate off peak power during night times.

Because of the projects renewable capacities, the scope is within Namibia's national policy and legal frameworks and compliments national planning, particularly The Namibia Vision 2030 and Harambee Prosperity Plan II (HPP) (Economic Advancement Pillar and Infrastructure Development Pillar) which promote job creation, skills developments, resource beneficiation, security and sustainable development.

Central to the projects operation is the power plant facility (including solar PV plant, hydrogen chain, energy storage and management systems). The site is located within close proximity to the DRC and Mondesa communities, to the east of Swakopmund town.

The production of hydrogen is reliant on demineralised water which will be produced by a 1st and then a 2nd phase desalination and demineralisation plants. The initial 1st phase treatment will occur at a solar powered reverse osmosis desalination plant located north of Mile 4 and to the west of the Swakopmund Salt Company. Seawater abstraction is planned to be done via a series of beach wells but, if unfeasible, the abstraction will be done via a direct intake. Seawater treated at the 1st is then piped to the power plant facility via an approximately 6 km pipeline aligned along Ocean View Avenue.

Depending on water quality, the waste brine generated by the 1st reverse osmosis desalination plant will be discharged to the Swakopmund Salt Works salt ponds (pending analysis and formal agreement with the Swakopmund Salt Works) or alternatively be discharged via an outfall pipeline.

The 2nd phase reverse osmosis plant will be located within the extent of the power plant facility and provides for the ultra-treatment of water, removing any remaining minerals and scaling collected during the transportation of water to the facility.

Three alternatives have been proposed for the evacuation of power, being the use of the existing Tamariskia transmission line servitude and tying into the existing Tamariskia substation, the Sekelduin alignment consisting of a greenfield transmission line and substation, and a loop-in, loop out system relying on existing transmission line infrastructure. This assessment considered each of these options and selection of the final option is subject to further design considerations and agreements with existing infrastructure owner agreements.

As with any substantial development, the Renewstable® Swakopmund Project is likely to result in a range of environmental and social impact, being both negative and positive (some of which are motivating factors discussed above). Negative and positive impacts identified and assessed as part of the EIA are summarised in Table 1-3.

Table 1-3: Summary of the significance of potential impacts associated with the proposed project

Impact/Issue	Without Mitigation	With Mitigation
Reduced Efficiency and Design Life of Solar PV Modules	Medium	Medium
Contribution to National Power Grid	Very High (+)	N/A
Contribution to a reduction in carbon intensity of the national power grid	High (+)	N/A
Visual impact associated with construction	Medium	Low
Visual impact associated with operation	Medium	Low
Glint and Glare	Low	Insignificant
Increase in ambient air concentration	Low	Very Low
Increased surface water runoff	Low	Very Low
Increased erosion, sedimentation, and deposition	Low	Very Low
Surface water contamination	Low	Very Low

Impact/Issue	Without Mitigation	With Mitigation
Decreased infiltration and groundwater recharge (construction and operations)	Low	Very Low
Contamination of groundwater resources	Low	Very Low
Disturbance because of noise contribution at SRs 1-4 due to project construction activities	Low	Very Low [Low]
Disturbance as a result of noise contribution at SR1, SR2, SR3 and SR5 due to project operations	Low	Very Low [Low]
Disturbance as a result of noise contribution at SR6 and SR7 due to project operations	Very Low	Very Low
Destruction of habitat and organisms	Low	Very Low
Disturbance of animals and interference with their behaviour	Medium	Very Low
Light Pollution	Medium	Very Low
Disturbance and destruction of marine biota during construction	Low	Low
Contamination of marine environments	Low	Very Low
Increased turbidity	Insignificant	Insignificant
Marine ecology impact from direct intake	Low	Very Low
Changes in water quality from brine discharge	Insignificant	Insignificant
Physical/human disturbance of birds	Very Low	Insignificant
Direct or indirect modification/loss/destruction of bird habitat	Medium	Low
Attraction of birds to novel habitats through the provision of artificial habitats and resources	Medium	N/A
Bird electrocution on power line infrastructure	Low	Very Low
Bird collisions on infrastructure such as solar panel arrays	Low	Very Low
Bird collisions on infrastructure such as fencing and power lines	Medium	Low
Loss of cultural heritage artifacts	Very Low	Insignificant
Economic Impacts	High (+)	High (+)
Creation of jobs and livelihoods	Very High (+)	Very High (+)
Loss of jobs and livelihoods on closure	Very low	Very low
Change in planned land use	Medium	N/A
Community Health and Safety	Low	Low
Loss of containment of hydrogen at the electrolyser with potential explosions impacting the workers on site	Very Low	Insignificant
Loss of containment of the hydrogen storage with potential explosions impacting the workers and the general public (Plant and refuelling storage)	Very Low	Insignificant
Loss of containment of the hydrogen pipeline with potential explosions impacting the workers and the general public	Very Low	Insignificant

2. SCOPE AND OBJECTIVES

The EMP applies to all activities associated with site clearance and construction activities, as well as the operational phase of the Renewstable® Swakopmund desalination plant and associated infrastructure. The EMP includes all activities conducted by, or on behalf of HDF Energy on the project site, including EPC and O&M contractors and sub-contractors.

The project life is expected to extend for at least 25-years, with the potential to be upgraded to extend the projects longevity. As such the decommissioning phase does not fall under the scope of this EMP due to the fact that various legal, Project Ownership and technological changes may occur over the 25-year timespan. This EMP will need to be revised at least 2 years prior to the intended decommissioning date.

The key objective of this EMP is to provide a framework for the implementation of environmental and social management initiatives. Best practice principles require that every reasonable effort is made to reduce, and prevent negative impacts while enhancing the benefits.

This EMP will be reviewed annually. A key feature of the EMP is the idea of continual improvement – an ongoing process of reviewing, correcting and improving the system. The most common approach for this is implemented through the Plan – Do – Check – Review cycle, as shown in Figure 2-1.

Figure 2-1: Plan-Do-Check-Review Cycle

The HDF Energy will have overall responsibility, authority and accountability for environmental and social issues associated with the project. This EMP outlines the key steps to be taken by all project personnel and their contractors, to effectively manage the environmental and social impacts and risks associated with the construction and operation of the project. All personnel engaged on the project are required to fully comply with the requirements of the EMP in order to limit the potential for unacceptable environmental and/or social impacts or regulatory non-compliance.

3. ADMINISTRATION AND REGULATION OF ENVIRONMENTAL OBLIGATIONS

3.1 ROLES AND RESPONSIBILITIES AND ORGANISATIONAL STRUCTURE

Details of the anticipated management structure for this EMP are presented below. All official communication and reporting lines including instructions, directives and information shall be channelled according to the management structure presented below.

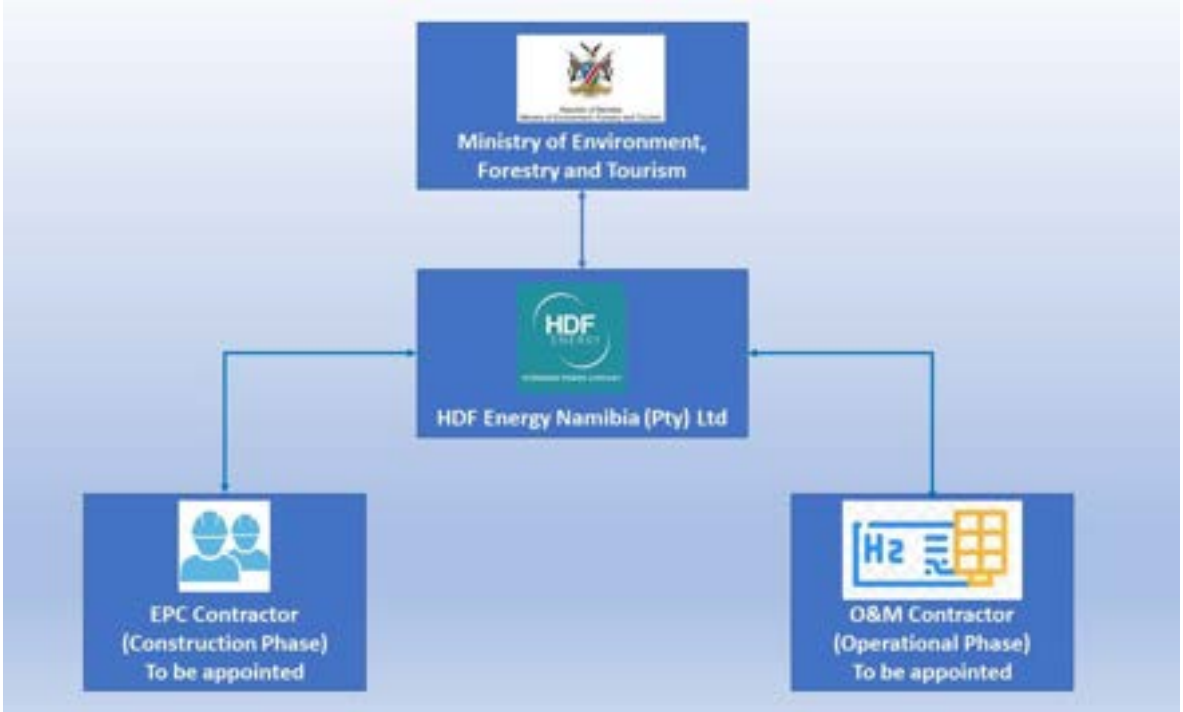

Figure 3-1: Anticipated Organisational Structure

MEFT is the designated authority responsible for authorising this EMP and has overall responsibility for ensuring that the HDF Energy complies with this EMP, and any conditions listed in the ECC. MEFT shall also be responsible for approving any significant amendments that may be required to the EMP.

MEFT may further perform ad hoc site inspections to check compliance with the EMP.

The HDF Energy is ultimately responsible for the implementation of the EMP and the financial cost of all environmental control measures. HDF Energy must ensure that any person acting on its behalf complies with the conditions / specifications contained in this EMP.

HDF Energy is responsible for the appointment of an EPC Contractor who will be responsible for the construction of the plant and an O&M Contractor who will be responsible for operational phase of the facility. Designated roles responsible for the implementation of the EMP will be defined through the contracts between HDF Energy and the EPC Contractor and the O&M Contractor.

The EPC Contractor and the O&M Contractor will be responsible for the implementation of the EMP and HDF Energy will be responsible for providing oversight and will be accountable to MEFT for compliance.

3.2 ENVIRONMENTAL MANAGEMENT PLAN ADMINISTRATION

Copies of the EMP shall be made available to the EPC Contractor and O&M Contractor and be retained on site. EPC Contractor and O&M Contractor staff are to be briefed on the contents and obligations contained in the EMP relevant to the respective construction and operational phases.

The EMP must be updated where the findings of the environmental audit reports indicate insufficient mitigation of environmental impacts associated with the proposed project, or insufficient levels of compliance with the EMP.

Any significant revisions to the EMP document must be approved by MEFT before the EMP is revised.

Other administrative actions to be undertaken by HDF Energy and the EPC Contractor and/or O&M Contactor include:

- **Commencement notification** - HDF Energy or the EPC Contractor shall give MEFT at least two week's (or as specified in the ECC) written notice to the MEFT prior to the commencement of construction. A general notification letter shall also be sent to neighbouring residents and published in a locally distributed newspaper. The O&M Contractor is to provide written notice to MEFT of the facilities operational commencement.
- **Information notice boards** – During construction, the EPC Contractor is to publish notice boards advising the public of contraction activities and provide the contact details of the EPC Contractor. During operation, the O&M Contractor is to erect notices providing contact details.
- **Method Statements** - The EPC Contractor shall submit written Method Statements to HDF Energy for all environmentally sensitive aspects of the work. A list of typical method statements is provided in Appendix A for reference purposes.
- **Record keeping** - The EPC Contractor and O&M Contractor are to keep a record of environmental management activities on site, including but not limited to meetings attended, Method Statements received and approved, issues arising on site, cases of non-compliance with the EMP, and corrective actions taken to solve problems that arise.
- **Review and auditing** - The EPC Contractor and O&M Contractor will establish an internal review procedure to monitor the progress and implementation of the EMP. Compliance auditing is to be undertaken at the discretion of HDF Energy and/or MEFT and is to include review of all environmental and social performance and compliance.
- **Emergency Preparedness and Response Plan** - The EPC Contractor and O&M Contractor are to develop and implement an Emergency Preparedness and Response Plan (EPRP) Health (e.g. snake bites), Safety (e.g. electrocution, explosions), Environment (e.g. a spill), social and local economic development (e.g. fire), labour (e.g. worker demonstrations, explosions) and security (e.g. a civil conflict). In order to create an EPRP, the following steps will be followed:
    - **Step 1:** Assess potential emergency scenarios, probabilities and therefore risk;
    - **Step 2:** Ensure adequate controls to prevent an emergency are reflected within relevant operational procedures and supporting documents;
    - **Step 3:** Develop an EPRP encompassing each scenario and how it will be managed in an easy to read and quickly accessible format;

- **Step 4:** Ensure that in developing responses to each scenario, all internal departments that will need to work together are consulted and outlined, all external emergency services are consulted (e.g. the fire department) and community representatives (where relevant) are consulted and their part is understood and agreed to ensure the plans are workable and effective;
- **Step 5:** Communicate and train on the EPRP with all relevant staff, contractors, and where applicable, communities;
- **Step 6:** Test the EPRP regularly (as a minimum annually or more frequently for high risks), and develop lessons learnt, integrating these into any updates of the EPRP; and
- **Step 7:** Conduct periodic review of EPRP, at least annually, but for high risk scenarios more frequently.

- **Plant Operation and Maintenance Plan** - The Plant Operation and Maintenance Plan is to be developed/updated to align and include measures outlined in Appendix D.
- **Biological monitoring programme** - A biological monitoring programme is to be developed (See Appendix E).
- **Physiochemical monitoring programme** - A physiochemical monitoring programme is to be developed (See Appendix F)
- **Close-out audit** - At the conclusion of construction (including rehabilitation) phase, an environmental audit report shall be compiled and submitted to MEFT. It shall, as a minimum, outline the implementation of the EMP, and highlight any problems and issues that arose during the construction period to report, on a formal basis, the lessons learned from this project.

3.3 COMPLIANCE

While HDF Energy will remain ultimately accountable to MEFT for compliance with the EPC Contractor The liabilities associated with the implementation of EMP will be transferred contractually to the EPC Contractor and O&M Contractor.

3.4 STATUS OF THIS DOCUMENT

The development and implementation of environmental specifications is an on-going process that is iterative in nature. Any significant revisions to the EMP document must be approved by the MEFT before the EMP is revised

4. LEGAL FRAMEWORK

Environmental management in Namibia is subject to compliance with several statutes and legislative provisions which inform this EMP and the obligations of any developer/operator.

4.1 THE CONSTITUTION OF THE REPUBLIC OF NAMIBIA, 1990

There are two clauses contained in The Constitution of the Republic of Namibia, 1990 (No. 1 of 1990) that are of particular relevance to sound environmental management practice, viz. Articles 91(c) and 95(l). In summary, these refer to:

- Guarding against over-utilisation of biological natural resources;
- Limiting over-exploitation of non-renewable resources;
- Ensuring ecosystem functionality;
- Protecting Namibia's sense of place and character;
- Maintaining biological diversity; and
- Pursuing sustainable natural resource use.

The above therefore commits the State to actively promote and sustain environmental welfare of the nation by formulating and institutionalising policies to accomplish the abovementioned sustainable development objectives.

4.2 ENVIRONMENTAL MANAGEMENT ACT, 2007

The EMA was promulgated in December 2007 and came into effect on 6 February 2012. Part 1 of the EMA describes the various rights and obligations that pertain to citizens and the Government. The main objectives of the Act are to ensure that:

- Significant effects of activities on the environment are considered carefully and timeously;
- There are opportunities for timeous participation by I&APs throughout the assessment process; and
- Findings are taken into account before any decision is made in respect of activities affecting the environment.

Part 2 of the EMA sets out a number of principles of environmental management which give effect to the provisions of the Constitution (Section 4.1) for integrated environmental management including:

- Renewable resources shall be utilized on a sustainable basis for the benefit of current and future generations.
- Community involvement in natural resource management and sharing in the resulting benefits shall be promoted and facilitated.
- Public participation in decisions affecting the environment shall be promoted.
- Fair and equitable access to natural resources shall be promoted.
- Equitable access to sufficient water of acceptable quality and adequate sanitation shall be promoted and the water needs of ecological systems shall be fulfilled to ensure the sustainability of such systems.
- The precautionary principle and the strategy of preventative action shall be applied.
- There shall be prior environmental assessment of projects and proposals which may significantly affect the environment or use of natural resources.
- Sustainable development shall be promoted in land-use planning.

- Movable and immovable cultural and natural heritage, including biodiversity, shall be protected and respected for the benefit of current and future generations.
- Generators of waste and polluting substances shall adopt the best practicable environmental option to reduce such generation at source.
- The polluter pays principle shall be applied.
- Reduction, reuse and recycling of waste shall be promoted.
- There shall be no importation of waste into Namibia.
- Promotion of the coordinated and integrated management of the environment.
- The Minister of Environment and Tourism was enabled to give effect to Namibia's obligations
- under international environmental conventions.
- Sustainable Development Commission and Environmental Commissioner have been provided for.

Decision-makers must take these principles into account when deciding whether or not to approve a proposed project. In terms of this legal framework certain identified activities may not commence without an environmental clearance (or amendment thereto) that is issued by the office of the environmental commissioner in the MEFT.

4.3 WATER RESOURCE MANAGEMENT ACT, 2013

The Water Resources Management Act (No. 11 of 2013) (WRMA), which is yet to be formally gazetted, provides a framework for the management, development, protection, conservation and use of water resources in a sustainable manner. Relevant principles of the Act include, inter alia:

- Equitable access for all people to safe drinking water is an essential basic human right to support a healthy productive life;
- Harmonisation of human water needs with the requirements of environmental ecosystems and the species that depend on them, while recognising that the water resource quality for those ecosystems must be maintained;
- Promotion of the sustainable development of water resources based on an integrated water resources management plan which incorporates social, technical, economic, and environmental issues;
- Development of the most cost-effective solutions, including conservation measures, to infrastructure for the provision of water; and
- Promotion of water awareness and the participation of persons having interest in the decision-making process should form an integral part of any water resource development initiative.

A person may only abstract and use water from a water resource, which exceeds the threshold authorised in terms of a law relating to water resources above a certain threshold, if the person holds a licence issued by the Minister that authorises the abstraction and use of water from that water resource. The WRMA is relevant since the project will abstract seawater and discharge effluent back to the ocean. In terms of the WRMA a "water resource" is defined as "the whole or any part of a watercourse or an aquifer and includes the sea and meteoric water" and thus the provisions of the WRMA apply to seawater abstraction.

The consequence is that HDF Energy will have to obtain a licence to abstract and use seawater and will have to comply with the various provisions of the Act set out in Part VIII of the Act (Sections 32 to 45). Section 32 prohibits the abstraction or use of water without a licence and significantly specifically states that the term

"abstract water" includes the abstraction of marine water for any purpose (Section 32(1)). The required Water Use License will be applied for by HDF Energy independently and as a separate process to the EIA.

There are several requirements which must accompany the application to abstract water. Of particular importance is Section 33(3)(c) which stipulates that an application for a licence to abstract and use water must be accompanied by a number of requirements including "an environmental impact analysis of the proposed abstraction of water upon the environment and existing water users and water resources" .

Part XI of the Act (Sections 56 to 71) which deals with Water Pollution Control is relevant to the proposed desalination plant in light of the brine discharges back to the ocean. The opening section stipulates that a person may not discharge effluent directly or indirectly to any 'water resource' (defined to include the sea as seen above) unless such person is in compliance with a permit issued in terms of Section 60. The term "effluent" is defined to mean *"…any liquid discharged as a result of domestic, commercial, industrial or agricultural activities*". Section 59 gives details on the information required for an effluent discharge permit.

It should be noted that this may be repealed by the new Water Resources Management, 2013 Act (No. 11 of 2013), which has been accepted by parliament but not yet promulgated. Under the new act, HDF Energy may be required to register as a water services provider in terms of Section 41, which reads:

> *41 (1) A person may not operate as a water services provider without holding a licence as a water services*
> *provider issued by the Minister under this Act that authorises the person -*
> *(a) to distribute water to end-consumers; and*
> *(b) to operate a water treatment facility.*

Under the new Act, a combined abstraction and discharge licence may also be applied for in terms of Section 47, as follows:

> *47. The Minister may, with the consent of the applicant concerned, grant a combined licence to abstract and use water and to discharge effluent if the requirements prescribed by this Act for a separate licence for*
> *each type of work or activity are complied with.*

HDF Energy acknowledges the requirements in terms of the new Act and will adhere to these as required after promulgation.

4.4 OTHER RELEVANT NAMIBIAN LEGISLATION

Table 4-1 below provides a summary of other relevant environmental and social legislation that may be applicable to the proposed project.

Table 4-1: Other applicable Namibian environmental legislation

Sector	Law	Key Provisions and relevance to the Project
Transport	*Road Traffic and Transport Act, 1999 (No. 22 of 1999)*	This Act provides for the control of traffic on public roads, the licensing of drivers, the registration and licensing of vehicles, and the control and regulation of road transport across Namibia's borders. Vehicles supplying goods and services to the project during construction and operation will have to comply with the requirements of the Act.
Pollution / Waste	*Pollution Control and Waste Management Bill (3rd Draft September 2003)*	This Bill promotes sustainable development and provides for the prevention and regulation of the discharge of pollutants to the air, water and land; regulation of noise, dust and odour pollutions; and the establishment of a system of waste panning and management. Hazardous and non-hazardous waste will be generated during all projects phases and consideration should be given of the requirements of the bill.
	Atmospheric Pollution Prevention Ordinance (Ordinance 11 of 1976)	This Act provides for the prevention of the pollution of the atmosphere. Construction activities, creating dust near third parties needs to be controlled in terms of the requirements of the Act.
Environmental / Conservation / Land	*National Heritage Act, 2004 (No. 27 of 2004)*	This Act provides for, *inter alia*, the protection and conservation of places and objects of heritage significance. A National Heritage Council has been established to identify, conserve, manage, and protect places and objects of heritage significance. Permits are required for the removal, damage, alteration or excavation of heritage sites or remains. Any person who discovers an archaeological site should notify the National Heritage Council. These aspects could be relevant during the construction activities of the proposed project and will require to be assessed.
	National Monuments Act 28 of 1969	This Act establishes a National Monuments Council and provides for the preservation of certain property as National Monuments and the maintenance of certain burial grounds.
	Nature Conservation Ordinance, 1975 (No. 4 of 1975)	This Ordinance consolidates and amends the laws relating to the conservation of nature; the establishment of game parks and nature reserves; and the control of problem animals. The Ordinance is expected to be replaced by the Wildlife and Protected Areas Management Act in the near future (latest draft 2018). The study area overlaps the Namib NauKluft National Park.
	Marine Resources Act 27 of 2000	This Act provides for the conservation of the marine ecosystem; the responsible utilisation, conservation, protection, promotion of marine resources in a sustainable manner and for the control of marine resources for these purposes. The Minister of Fisheries is empowered to make regulations under section 61 on a broad number of topics including "regulating or prohibiting the discharge in the sea or discarding on the seashore and land of specified substances or materials, or substances or materials not complying with specified requirements or having specified properties" (61(1)(r)).
	Soil Conservation Act (Act 76 of 1969)	The Act makes provision for the prevention and control of soil erosion and the protection, improvement and conservation of soil, vegetation and water supply sources and resources, through directives declared by the Minister. Care is to be taken in identifying any potential impacts on soil, vegetation, water supply sources and resources by firstly trying to avoid these impacts. Where they can't be avoided, management measures should be implemented to reduce the significance of the impact(s).

Sector	Law	Key Provisions and relevance to the Project
	Inland Fisheries Resources Act (Act 1 of 2003)	Conservation and protection of aquatic ecosystems.
	Aquaculture Act (Act 18 of 2002)	The Act aims to regulate and control aquaculture activities; to provide for the sustainable development of aquaculture resources; and to provide for related matters. Section 35 of the Act states that a person may not, unless authorized in writing to do so by the Minister, conduct any business or undertaking other than aquaculture in aquaculture development zones.
	Integrated Coastal Management Bill	Once enacted, the Integrated Coastal Management Bill (2014) aims to establish a system of integrated coastal management in Namibia in order to promote the conservation of the coastal environment, maintaining the natural attributes of the coastal landscapes and seascapes, and ensuring the sustainable development and use of the natural resources within the coastal zone that is also socially, economically and ecologically justifiable.
Hazardous Substances	*Hazardous Substances Ordinance, 1974 (No. 14 of 1974)*	These provide for the control of toxic substances which may cause injury, ill health or death of human beings. Various chemicals would be used and stored; and the desalination plant and hydrocarbons used during the construction activities of all project components.
Labour	*Labour Act, 2007 (No. 11 of 2007) and its amendment: No. 2 of 2012*	These Acts stipulate, amongst other things, sound labour relations, employment equity, fair employment practices, training, minimum basic conditions of service, workplace health and safety and retrenchment. Compliance is enforced and monitored by the Ministry of Labour through the office of the Labour Commissioner.
	Social Security Act, 1994 (No. 34 of 199, as amended	
	Employees Compensation Act, 1995 (No. 5 of 1995)	
	Regulations relating to the health and safety of employees at work (GN 156 of 1997)	These Regulations establish health and safety regulations for the workplace.
	Affirmative Action (Employment) Act, 1998 (No. 29 of 1998)	This Act aims to achieve equal opportunity in employment by redressing, through appropriate affirmative action plans, the conditions of disadvantage in employment experienced by persons in designated groups arising from past discriminatory laws and practices.

4.5 OTHER RELEVANT NAMIBIAN POLICIES AND STANDARDS

Namibia's policies provide the framework to the applicable legislation. Whilst policies do not often carry the same legal recognition as official statutes, policies are used in providing support to legal interpretation or guidance for civil servants and other stakeholders in the implementation of government objectives.

Relevant policies (other than the aforementioned policies) currently in force include the following:

- Namibia's Environmental Assessment Policy for Sustainable Development and Environmental Conservation (1994);
- The National Policy on Coastal Management for Namibia (2013);
- National Development Plan 5 and Vision 2030;
- National Integrated Resource Plan, 2016 (NIRP);

- South African Marine Water Quality Guidelines
- Operational Policy for the Disposal of Land-derived Water containing Waste to the Marine Environment;
- National Agricultural Policy (2015);
- National Land Policy, the National Resettlement Policy, the Agricultural (Commercial) Land Reform Act (1995);
- Land Tax and Communal Land Reform Act (2002);
- Poverty Reduction Strategy for Namibia (1998);
- White Paper on Energy Policy (1998);
- National Industrial Policy (2012);
- Policy for the Conservation of Biotic Diversity and Habitat Protection (1994);
- National Policy on Human Wildlife Conflict management (2009);
- Labour Act (2007);
- Hazardous Substances Ordinance (1974);
- Namibia's Integrated Water Resources Management (IWRM) Plan (2010); and
- The National Climate Change Policy of Namibia (2011).

4.5.1 South African National Standards

In many countries, quantities of hazardous material produced, transported or stored on site, that have potential or risk to harm the public are classified as Major Hazardous installations with provisions made for separation distances between these installations and the general public.

The Republic of South Africa has legislation regarding the classification of a Major Hazard Installation (MHI) and the land usage approvals around such installations. Furthermore, all risk assessments of MHIs must be done to the standard SANS 1461:2018 which provides the methodology and benchmarking criteria to be used in the assessment of these installations. There are essentially three criteria for these establishments being:

- Unacceptable where the risks are too high, and the application must be denied;
- Tolerable, providing all reasonable measures have been implemented to limit the risk to as reasonably practicable; and
- Acceptable, for all land usage.

SANS 10103:2008 provides for the measurement and assessment of environmental noise with respect to land use, health, annoyance and speech communication.

4.5.2 Climate Change Policy

Namibia's National Climate Change Policy takes a cross-sectoral approach and elaborates on climate change adaptation and mitigation in Namibia. The policy outlines a coherent, transparent and inclusive framework on climate risk management in accordance with Namibia's national development agenda, legal framework, and in recognition of environmental constraints and vulnerability. After a long process of stakeholder consultation, the policy Ministry of Environment, Forestry and Tourism launched the National Climate Change Strategy and Action Plan.

4.5.3 The Namibia Vision 2030

In 2004, Namibia adopted Vision 2030, a document that clearly spells out the country's development programmes and strategies to achieve its national objectives. Vision 2030 focuses on various themes to realise the country's long term vision. These are:

- Inequality and Social Welfare;
- Human Resources Development and Institutional Capacity Building;
- Macro-economic issues;
- Population, Health and Development;
- Namibia's Natural Resources Sector;
- Knowledge, Information and Technology; and
- Factors of the External Environment.

Vision 2030 targets 1) increasing employment, 2) improving the country's Gini-coefficient (the measurement of income inequality and poverty), 3) increasing income levels, and 4) boosting contributions from the manufacturing and service sectors.

The Renewstable® Swakopmund Project compliments the Vision 2030 targets by generating employment opportunities during construction and operation, skills development and transfer in the rapidly expanding green hydrogen/economy and increasing electrical/power sector contributions from local service providers.

4.5.4 Harambee Prosperity Plan II (2021-2025)

The HPP is a targeted action plan to accelerate development in clearly defined priority areas, which lay the basis for attaining prosperity in Namibia. The Plan does not replace but complements the long-term goal of the National Development Plans (NDPs) and Vision 2030. HPP introduces an element of flexibility in the Namibian planning system by fast tracking development in areas where progress is insufficient. It also incorporates new development opportunities and aims to address challenges that have emerged after the formulation of NDPs.

The HPP consists of five (5) Pillars, each with specific Goals and Activities aimed at diving objectives:

- Effective governance;
- Economic Advancement;
- Social progression;
- Infrastructure development; and
- International relations and cooperation.

The Renewstable® Swakopmund project directly contributes toward the HPP Pillar 2 (Economic Advancement) and Pillar 4 (Infrastructure Development) objectives.

4.5.5 Coastal Strategic Environmental Assessments

Two Namibian coastal Strategic Environmental Assessments (SEAs) were undertaken between 2006 and 2008, i.e. one for the northern regions of Kunene and Erongo and another for the southern regions of Karas and Hardap. These draw on international experience and were undertaken at a time of mounting production sector pressures within Namibia. Being an initiative of the Namibian Government through MEFT, the two SEAs seek to inform political and technical decision makers at local, regional and national levels.

The 2008 "SEA for the coastal areas of the Erongo and Kunene Regions" compiled by the Namibian Coast Conservation & Management Project (NACOMA) is aimed at ensuring informed decisions on issues related to biodiversity conservation, land use planning and socio-economic development planning in the Kunene and Erongo coastal regions.

4.6 INTERNATIONAL STANDARDS AND CONVENTIONS

4.6.1 The Equator Principles

The Equator Principles are a risk management framework, adopted by financial institutions, for determining, assessing and managing environmental and social risk in projects and are primarily intended to provide a minimum standard for due diligence to support responsible risk decision-making. Equator Principle Financial Institutions (EPFIs) commit to implementing the Equator Principles in their internal environmental and social policies, procedures and standards for financing projects and will not provide Project Finance or Project-Related Corporate Loans to projects where the client will not, or is unable to, comply with the Equator Principles.

In order to facilitate potential access to funding for project development potential borrowing organisations need to consider the Equator Principles and environmental and social risk management as part of the EIA process.

There are 10 principles as shown below, and these require that Projects conduct an EIA process in compliance with the International Finance Corporation (IFC) Performance Standards on Environmental and Social Sustainability.

Table 4-2: The Equator Principles

Principle
1. Review and categorisation Establishes the need for the EPFI to categorise the project based on the magnitude of its potential environmental and social risks and impacts as part of its internal environmental and social review and due diligence.
2. Social and environmental assessment Requires the client to conduct an Assessment process to address, to the EPFI's satisfaction, the relevant environmental and social risks and impacts of a proposed Project. It is required that the Assessment documentation will propose measures to minimize, mitigate, and offset adverse impacts in a manner relevant and appropriate to the nature and scale of the proposed project.
3. Applicable environmental and social standards Established that the Assessment process should firstly address compliance with relevant host country laws, regulations and permits that pertain to environmental and social issues.
4. Environmental and Social Management System and Equator Principles Action Plan Requires an Environmental and Social Management Plan/ EMP to be prepared by the client to address issues raised in the assessment process and incorporate actions required to comply with the applicable standards.
5. Stakeholder engagement Requires clients to demonstrate effective Stakeholder Engagement as an ongoing process in a structured and culturally appropriate manner with affected communities and, where relevant, other stakeholders.
6. Grievance mechanism

Principle
Requires the client to establish a grievance mechanism designed to receive and facilitate resolution of concerns and grievances about the Project's environmental and social performance as part of the ESMS.
7. Independent review Requires that an Independent Environmental and Social Consultant, not directly associated with the client, will carry out an Independent Review of the Assessment Documentation, including the Environmental and Social Management Plans/ EMP process documentation in order to assist the EPFI's due diligence, and assess Equator Principles compliance.
8. Covenants Requires that the client pledge its commitment to complying with all relevant host country environmental and social laws, regulations and permits in all material respects in the financing documentation.
9. Independent monitoring and reporting Requires the appointment of an Independent Environmental and Social Consultant or requires that the client retain qualified and experienced external experts to verify its compliance with the Equator Principles and monitoring information which would be shared with the EPFI.
10. Reporting and transparency Deals with the client's reporting requirements in addition to the disclosure requirements in Principle 5. This principle states that the client will ensure that, at a minimum, a summary of the ESIA is accessible and available online and the client will publicly report Green House Gas (GHG) emission levels (combined Scope 1 and Scope 2 Emissions) during the operational phase for Projects emitting over 100,000 tonnes of CO_2 equivalent annually.

4.6.2 IFC Performance Standards on Social and Environmental Sustainability

The IFC Performance Standards (PS) define client's roles and responsibilities for managing their projects and the requirements for receiving and retaining the IFC support or the support from institutions that subscribe to the Equator Principles. The IFC applies the PSs to manage social and environmental risks and impacts and to enhance development opportunities in its private sector financing of projects in the member countries eligible for financing. There are eight Performance Standards as shown in Table 4-3.

Table 4-3: IFC Performance Standards and their applicability to the Project

IFC Performance Standard	*Applicability to this project*
PS1: Assessment and Management of Environmental and Social Risks and Impacts PS1 establishes the importance of (i) integrated assessment to identify the environmental and social impacts, risks, and opportunities of projects; (ii) effective community engagement through disclosure of project-related information and consultation with local communities on matters that directly affect them; and (iii) the client's management of environmental and social performance throughout the life of the project.	Yes
PS2: Labour and Working Conditions PS2 asks that companies treat their workers fairly, provide safe and healthy working conditions, avoid the use of child or forced labour, and identify risks in their primary supply chain.	Yes
PS3: Resource Efficiency and Pollution Preventions PS3 guides companies to integrate practices and technologies that promote energy efficiency, use resources—including energy and water—sustainably, and reduce greenhouse gas emissions.	Yes

IFC Performance Standard	*Applicability to this project*
PS4: Community, Health, Safety and Security PS4 helps companies adopt responsible practices to reduce such risks including through emergency preparedness and response, security force management, and design safety measures.	Yes
PS5: Land Acquisition and Involuntary Resettlement PS5 advises companies to avoid involuntary resettlement wherever possible and to minimize its impact on those displaced through mitigation measures such as fair compensation and improvements to and living conditions. Active community engagement throughout the process is essential.	Yes.
PS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources PS6 recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and managing living natural resources adequately are fundamental to sustainable development.	Yes.
PS7: Indigenous Peoples PS7 seeks to ensure that business activities minimize negative impacts, foster respect for human rights, dignity and culture of indigenous populations, and promote development benefits in culturally appropriate ways. Informed consultation and participation with IPs throughout the project process is a core requirement and may include Free, Prior and Informed Consent under certain circumstances.	No.
PS8: Cultural Heritage PS8 aims to guide companies in protecting cultural heritage from adverse impacts of project activities and supporting its preservation. It also promotes the equitable sharing of benefits from the use of cultural heritage.	Yes.

4.6.3 International Conventions

Relevant international conventions to which Namibia is a signatory are summarised below:

- Convention on Biological Diversity, 1992;
- United Nations Framework Convention on Climate Change, 1992;
- The Convention on International Trade in Endangered Species (CITES) of 1973;
- Convention to Combat Desertification 1994;
- National Rangeland Management Policy and Strategy of 2012;
- National Biodiversity Strategy and Action Plan 1 and 2 (draft);
- Vienna Convention for the protection of the ozone layer (1985);
- Montreal Protocol on substances that deplete the ozone layer (1987);
- United Nations Convention on Biological Diversity (UNCBD); and
- United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) 2007.

5. PROJECT DESCRIPTION

The following provides a detailed description of the desalination plant.

5.1 DESCRIPTION OF THE DESALINATION PLANT FACILITIES

The basic process for the treatment of water in the proposed desalination plant is summarised here for the sake of completeness.

Reverse Osmosis is a membrane filtration process utilised to reduce the salinity of seawater (feed-water). The feed-water is supplied through a seawater intake system and appropriately treated before being pumped to a storage facility. To overcome the natural osmotic pressure of seawater, it is then pumped at high pressure through to the RO membranes. This process retains the brine (high salinity) on one side of the membranes and allows the water containing very low salinity to pass to the other side. The desalinated water is piped to the potable water tank and the brine is discharged. The recovery rate of product water through the process is typically approximately 40-42%.

The Plant is designed to produce 200 m^3/day of desalinated and demineralised water to be used in the hydrogen chain, for cleaning PV panels and for general water supply to the facility. The brine product from the 1st pass RO unit will be split into two lines, the first feeding a wastewater brine tank and the second supplying the backwash process with required water. If not discharged into the salt pan, brine will be discharged into the sea through a dedicated pipeline fitted with a diffuser system to ensure adequate dispersion and dilution.

The engineering technologies to be applied at the desalination plant will be flocculation/coagulation, Dual Media Filtration (DMF), cartridge filtration, de-chlorination, antiscalant and pH correction, and reverse osmosis. The predominant fraction of the sea water abstracted will be returned to the sea as concentrate (brine plus various filter backwash products and sludge from the pre-treatment process). The selected design temperature of the water in the plant is 15 ºC, but the plant will be capable of performing over a range of temperatures, with the RO feed pressure decreasing if the temperature is above 15 ºC and the required feed pressure increasing when the water temperature is below 15 ºC.

The use of a biocide (chlorine) will be required to inhibit biological growth in the pipelines, on the screens and in the media filters. To avoid damage to the RO membranes, the chlorinated water needs to be neutralised before it can pass through the membranes. This will be done with Sodium Metabisulphate (SMBS). Should raw water be abstracted from the tidal pool, a pipe 'pigging' system for regular maintenance and cleaning of the seawater supply lines (only intake) may need to be installed. This involves the use of a 'pig' (bullet-shaped device with bristles), which is introduced into the pipeline which transfers the feed-water from the pump station to the desalination plant to mechanically clean out the structure. Depending on the quality of the feed-water, the RO membranes will need to be cleaned (back-washed) at regular intervals. Backwashing will be undertaken using brine stored in a brine waste tank. Residual streams from the cleaning process would be taken from the 1st pass RO brine line post RO and stored in a backwash tank. This process water and sludge will be added to the brine product and discharged back to the ocean.

5.2 IDENTIFICATION AND SELECTION OF ALTERNATIVES

The number and size of SWRO plants, as well as the environmental awareness related to such projects is increasing, resulting in increased emphasis on intake (and outfall) design and economics. Whereas the design and manufacturing of the desalination unit itself are well established and approved technical solutions are available, the intake and pre-treatment of the seawater, and the discharge of brine need to be specifically adapted to the particular conditions at the plant site. These can differ over a wide range, as not only the raw water quality, but also aspects such as the geological situation, existing infrastructure and logistics need to be taken into consideration during the design, construction and operation of a desalination plant.

Several design options have been investigated as part of the project and are discussed below.

5.2.1 Seawater Intake Structure

Intake alternatives for the supply of seawater to a desalination plant can largely be grouped into direct (open water) and indirect (water filtered through seabed) intakes. An indirect beach well system situated on the beach westward of the southern extreme of the salt pan is proposed for the Renewstable® Swakopmund desalination plant. A beach well system comprises either a vertical or a horizontal source-water collector that is typically located near the sea and acquires its source water from coastal or alluvial aquifers. The seawater is collected in conventional wells and pumped to the plant (Figure 5-1, left), or it is collected in radial, horizontal well-screens that are connected to a vertical well with an integrated pump and a pump house on the beach, like the 'Ranney' system (Figure 5-1, right). The advantage of this system is that the collected source water is pre-treated *via* slow filtration through the subsurface seabed formations thereby reducing the need for pre-treatment. As the productivity of beach wells is relatively small, they are only suitable for smaller plants (<4 Megalitres/day).

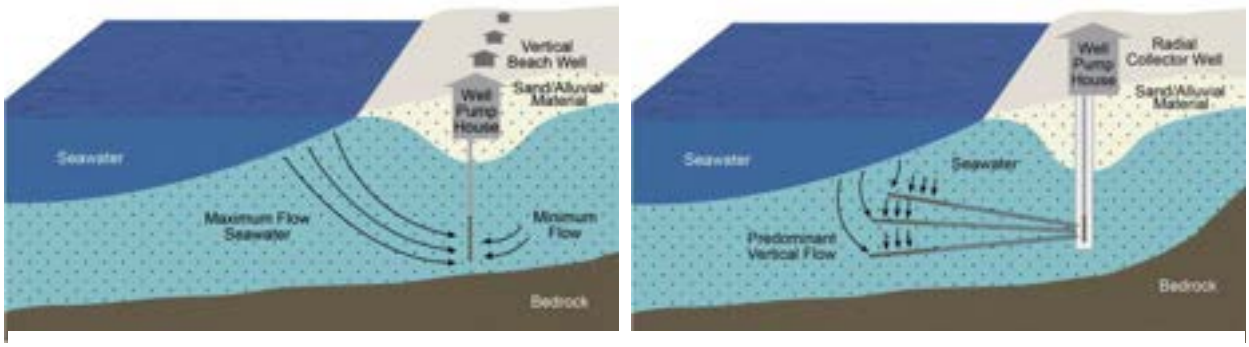

Figure 5-1: Vertical Beach Well (left) and a Horizontal Collector Well or 'Ranney' Collector (right). (Source: Missimer et al. 2013).

If the beach-well intake system is deemed to be unfeasible due to insufficient beach thickness and a shallow rock basement, a direct intake system would become the default intake method. To engineer out potential excessive suspended solids in the feed water, an additional pre-treatment process upstream of the DMFs could be incorporated, and/or a specially designed intake filter would be required. In lieu of hydrogeological and geotechnical investigations, a conservative assumption will be taken to utilise a direct intake system at the existing tidal pool to the southwest of the plant site. This would require a pipeline to transport the feed water from the tidal pool to the RO Plant.

Open water intakes necessitate the need for extensive pre-treatment of intake water. Behind the screening and sand trap, the pre-treatment of the seawater would involve dissolved air flotation (DAF), which gives rise to a waste stream containing the filtered solids and any coagulant used. If this water cannot be returned to the feed-water source (typically the case if a coagulant has been added), the derived sludge must be dewatered either by settlement or by some mechanical process. To eliminate biological growth in the intake system, chlorination is widely used.

5.2.2 Discharge of Brine Effluent

Various discharge alternatives exist for the disposal of effluent from a desalination plant, namely single-point or diffuser effluent pipelines, beach discharge wells, open-channel surf zone discharges, and evaporation ponds. As part of the proposed development of the Renewstable® Swakopmund desalination plant, two methods of brine disposal were considered, namely: surf zone discharge and disposal into the adjacent salt pan. As the viability of the salt pan option is currently unknown a conventional brine discharge pipeline leading into the ocean and fitted with a diffuser at the seaward end is being considered as the preferred discharge alternative as it would ensure the best brine disposal solution for the life of project and magnitude of flow by achieving acceptable brine dilutions and dispersion through engineering design in conjunction with the local wave energy, at the lowest installation capital cost.

Typically, ocean outfalls for large seawater desalination plants extend beyond the surf zone, and are equipped with diffusers in order to provide the mixing necessary to prevent the heavy saline discharge plume from accumulating at the seabed in the immediate vicinity of the discharge. A trade-off Study undertaken for the Rössing Uranium desalination plant[1] (Royal Haskoning DHV & WSP 2014), identified that from a technical, financial, operation & maintenance and health & safety / environmental compliance perspective, a single open surf zone outfall below the spring low water mark was the preferred discharge alternative for discharging the 13 550 m^3/d of brine from the Rössing Uranium desalination plant. For even smaller capacity plants such as being considered by the Renewstable® Swakopmund project, an open surf zone discharge is therefore a feasible alternative. Alternatively, the discharge pipe can be fitted with a suitable diffuser system at its seaward end to ensure rapid and efficient dilution of the effluent with the receiving water, thereby reducing plume footprints near the seabed and minimising impacts on marine ecology. The design of the diffuser and discharge rates would meet the requirements of the South African Marine Water Quality Guidelines and the Operational Policy for the Disposal of Land-derived Water containing Waste to the Marine Environment insofar as they are applicable to this type of installation.

However, the surf zone carries a significant amount of turbulent energy and usually provides much better mixing than the end-of-pipe type of diffuser outfall system, but this zone has a limited capacity to transport the saline discharge load to the open ocean. If the mass of the saline discharge exceeds the threshold of the surf zone's salinity load transport capacity, the excess salinity would begin to accumulate in the surf zone and could ultimately result in a long-term salinity increment in this zone beyond the level of tolerance of the aquatic life (WHO 2007). This salinity threshold mixing/transport capacity of the surf zone can be determined using hydrodynamic modelling. The hydrodynamic modelling exercise commissioned as part of the Rössing Uranium EIA process and its results will inform the impact significance ratings of the marine ecology aspects for this current Renewstable® Swakopmund project.

[1] Four methods of brine disposal were considered, namely: offshore discharge, surf zone discharge, infiltration pond and beach channel disposal.

The outfall would likely consist of a pump station, a long HDPE pipe, which would be trenched along its entire length and with the final extent of pipeline seaward of the high-water mark being encased in concrete and either partially buried and incorporated with a natural rock outcrop. The pipeline (with diffuser) should terminate in a natural deep area below the mean low water level.

Table 5-1 lists the expected composition of the brine effluent and the typical cleaning reagents and pre-treatment chemicals to be used should standard conventional RO technology be implemented for the HDF Energy RO plant. The brine effluent at the maximum plant capacity is anticipated to have a temperature of between 2–4° Celsius above the ambient average seawater temperature, a salinity of 64 g/ℓ or psu (based on the maximum feed-water salinity of 34.2 g/ℓ or psu), a density of 1,049 kg/m^3, and with an estimated effluent flow of ~280 m^3/day.

Table 5-1: Expected composition and flow of the brine discharge*

Description	Units	Quantity
Average Co-discharge (Pre-treatment and Media Filtration Backwash – intermittent and discharged over 24 h)	m^3/d	1 338 (in 24 h)
Instantaneous Co-discharge (Pre-treatment and Media Filtration Backwash – intermittent and discharged over 24 h)	m^3/d	1 483 (in 24 h)
Co-discharge (CIP rinse water for conventional RO system – 6 x per year only and assumed to be discharged over 12 h)	m^3/d	202 (in 12 h)
Discharge velocity	m/s	~6
Salinity	mg/ℓ	63,947
Change in temperature	°C	2 - 4
pH		7.3 – 8.2
Suspended Solids (average)	mg/ℓ	8 - 12
Phosphonate antiscalant for conventional RO system	mg/ℓ	4 - 5
Chlorine – for conventional RO system	mg/ℓ	0.002
Sodium metabisulphate	mg/ℓ	3 – 3.5
Spent CIP solution in waste flow (6 x per year and blended in over 12 hours) Peroxyacetic acid Low pH cleaner High pH cleaner	mg/ℓ 0.003 0.01 0.01	
Preservative (sodium metabisulfite) in waste flow (twice a year)	mg/ℓ	6.0
Coagulant: Ferric Chloride ($FeCl_3$) will precipitate into Ferric Hydroxide, which will be removed as a solid.	mg/ℓ	3-4

6. ENVIRONMENTAL MANAGEMENT PLAN IMPLEMENTATION

6.1 PERMITS AND AGREEMENTS

The following permits and agreements will be required:

- Abstraction (Section 33(3)(c)) and discharge permit (Section 60) from the Ministry and Agriculture, Water and Land Reform in terms of the Water Resources Management Act (Act 24 of 2004);
- Landowner lease agreement and servitude agreements;
- Agreement with Swakopmund Salt Company to receive brine discharge (if required);
- Agreements with Swakopmund Municipality for the supply of:
    - Potable water;
    - Domestic solid waste disposal;
    - Domestic waste water; and
    - Building plans, if required.
- Prior to commencing with any ocean-based pipe laying activities involving water craft, the EPC Contractor should make contact with the following organisations to inform them of the construction activity, provide details of the operations and details around the specific locations and the expected duration of such activities.
    - NamPort and Walvis Bay Harbor;
    - Swakopmund Sea Rescue Institute; and
    - Any local yacht and recreation boat or fishing clubs.

6.2 TRANSFER OF COMMITMENTS TO EPC CONTRACTOR AND O&M CONTRACTOR

As part of the appointment of the preferred EPC Contractor and O&M Contractors, HDF Energy is to contractually transfer the responsibilities outlined in this EMP to the respective Contractor.

6.3 ENVIRONMENTAL CONSIDERATIONS IN DESIGNS

- General:
    - Designers should aim to reduce the project footprint to the efficient minimum by optimizing the footprint and clever use (double use) of the areas.
    - All liquid chemical storage areas and tanks should be bunded to 110% of the total maximum volume of chemical storage capacity to contain accidental spills and leaks.
    - All dry chemical storage areas shall be restrict unauthorized access (i.e. lockable) and have impervious floors and adequate weather protection (rain and wind) to prevent the accidental spillage, dispersal, or spoilage of chemicals stored. All chemical storage area must be equipped with relevant the emergency provisions required to deal with a potential emergency in that environment.
    - The chlorine storage area must be equipment with the various safety and emergency equipment, including leak detection, ventilation, isolation chambers (secondary containment), isolation valves, personal protective equipment (including breathing equipment), wind vein, emergency alarms, emergency escape routes, fire extinguishers, emergency showers/ eye washing facilities, etc.
    - Provision should be made in the facility design for the collection and storage of solid waste. Such storage area should be weather resistant and should make provision for the

separation and storage of recyclables and returnable packaging (especially chemical containers) in an effort to reduce the volume of waste (and the hazard level) entering the landfill site. Where potentially hazardous wastes are produced, these should be stored within dedicated, signposted receptacles and transported to an appropriate waste facility for recovery or disposal.

- Surface water:
  - Stormwater infrastructure is to be included in detailed engineering design;
- Socioeconomic considerations:
  - Road safety measures are to be employed to manage traffic and to reduce traffic collision risks. This should be augmented through the appropriate road hazard / information signage to warn road users of the turning of heavy vehicles.
  - HDF Energy should develop local employment and procurement targets for the contractor for inclusion into the tender documents.
  - The EPC Contractor and O&M Contractor must compile a draft Social and Environmental Policy (S&EP) in line with HDF Energy's Health, Safety and Environment (HSE) policy, statutory requirements and the provision forthwith. The S&EP of the successful bidder will, upon award of the contract, be finalised for approval. Compliance with the S&EP will be reviewed by HDF Energy.
  - The Contractor should submit a site-specific health and safety plan, which includes a task-specific risk assessment. The risk assessment covers environmental, health and safety aspects, work methods and construction risks associated with each task that the Contractor team will or is likely to perform in the execution of the works.
- Visual:
  - Lighting should be planned and designed to avoid the spillage of light into the surrounding areas. The earthen berm mentioned above is one mechanism aimed at mitigating this potential impact, and should be levered to further mitigate light pollution from the plant. Care should be given to the type of lighting, height, position, direction and number of outside lights employed to minimise the magnitude of light spilt into the environment.
  - The desalination plant building should be planned to minimise the potential visual impact in the landscape. This can be achieved through the considered use of cladding materials and mostly the colour of the facades. As a guideline, the building style and colour should aim to replicate colour and style of the Swakopmund Salt Works building, located nearby. Pastel colours simulating the natural sand colour of the area would also work and could be used in unison with the proposed earthen berm to reduce the prominence of the desalination plant building in the landscape.
- Noise:
  - Typical noise abatement/attenuation should be included for, such as
    - Acoustic attenuation devices should be installed on all ventilation outlets and high pressure gas or liquid should not be ventilated directly to the atmosphere, but through an attenuation chamber or device.
    - Vibrating equipment must be equipped with vibration isolation mountings on their mounting plinths.
  - The EPC Contractor and O&M Contractor shall establish a noise baseline at the various potentially sensitive receptors prior to construction commencement and again prior to operational commencement.

- Birds:
  - Roads, pipelines, cables should share servitudes as far as possible to reduce the disturbance footprint.
  - Outside lighting of the facility (including security lighting) must be kept to the minimum. Where required, all overhead lighting must be shield and pointed downwards onto the area where illumination is needed, rather than directed upwards or outwards, in order to avoid light pollution. The guidelines by the International Dark-Sky Association for the quality of outdoor lighting (including light design, wattage and light colour [preferably amber]) can be followed as a reference for preserving and protecting the night-time environment, including its wildlife (www.darksky.org).
  - If the facility is to be fenced, the upper wire strand of any fencing should be demarcated to ensure that it is visible to low flying birds in low light conditions.
- Marine ecology
  - The O&M Contractor is to develop a Plant Operations and Maintenance Management Plan. The Plan is to include provisions for, amongst others, management of the seawater intake system and sea outfall discharge (See Appendix D for guideline considerations to be included)
  - Adjust designs to ensure that peak intake velocities achieve a <0.15 m/s velocity at the screens, to reduce the impingement and entrainment of marine biota.
  - Ensure the installation of screens on the end of the intake pipes, or the use of a screen box or shroud to limit the impingement and entrainment of marine biota. Design outlet velocities to minimise the potential for flow distortion but still achieve diffusion objectives.
  - To mitigate the potential reduced physiological functioning of marine organisms due to elevated salinity, the seaward end of the discharge pipe should achieve the highest required dilution of brine, thereby limiting increased salinities to the minimum achievable mixing zone only.
  - Make provision for the aeration of brine in the brine release tank in the event that dissolved oxygen levels fall below specified standards and necessitate aeration.
  - Design the plant to reduce corrosion of the RO components to a minimum by ensuring that dead spots and threaded connections are eliminated. Corrosion resistance is considered good when the corrosion rate is <0.1 mm/a (UNEP 2008).
  - International guidelines (WHO 2007; UNEP 2008) recommend that, prior to the design and construction of the desalination plant, a study be conducted on the chemical and physical properties of the raw water. A thorough raw water characterisation at the proposed intake site should include an evaluation of physical, microbial and chemical characteristics, meteorological and oceanographic data, and aquatic biology. Seasonal variations should also be taken into account. The study should consider all constituents that may impact plant operation and process performance including water temperature, total dissolved solids (TDS), total suspended solids (TSS), membrane scaling compounds (calcium, silica, magnesium, barium, etc.) and total organic carbon (TOC).

6.4 CONSTRUCTION PHASE

The EMP has been compiled for the management of potential construction phase social and environmental impacts of the HDF Energy desalination plant according to the project description provided above (Section 5). Whilst a EMP is comprised of mitigation measures identified through the and environmental impact

assessment process, the construction phase environmental impacts are mostly generic in nature, are well generally understood, and have an established set of standard mitigation measures and best practices pertaining to construction management and supervision, which are presented here as well.

6.4.1 Scope

The general principles contained within the EMP shall apply to all construction activities (and all maintenance activities involving construction-type activities and decommissioning activities). All construction activities shall observe all relevant environmental legislation and in so doing shall be undertaken in such a manner as to minimise impacts on the natural and social environment.

6.4.2 General

The EMP is to be included into all Tender and Contract documentation to ensure that the EPC Contractor is aware of the obligations and given opportunity to cost for the implementation of the EMP requirements.

The EPC Contractor will carry the following responsibilities:

- Ensuring that all environmental impacts are managed in accordance with this EMP;
- Ensuring that all monitoring and compliance auditing occurs in line with the EMP;
- Ensuring that the environment is rehabilitated as far as practicable to its natural state or existing land use practices;
- Any environmental damage, pollution, pumping and treatment of extraneous water or ecological degradation as a result of activities both in and outside the site boundaries; and
- Any conditions contained in the environmental clearance are upheld.

The EPC Contractor shall conduct his activities so as to cause the least possible disturbance to the existing amenities, whether natural or man-made, in accordance with all the current statutory requirements. Special care shall be taken by the Contractor to prevent irreversible damage to the environment. The Contractor shall take adequate steps to educate all members of his workforce as well as his supervisory staff on the relevant environmental laws, sensitive areas, and protection requirements. The Contractor shall supplement these steps with prominently displayed notices and signs in strategic locations to remind personnel of their environmental obligations (Refer to Appendix B for materials pertaining to environmental awareness).

6.4.3 Environmental Awareness Training

All the EPC Contractor's and any Sub-Contractor's employees and any suppliers that spend more than one day a week or four days in a month on site, must attend an Environmental Awareness Training course developed and presented by the EPC Contractor, before commencement of any construction activities. Subsequent courses shall be held as and when required. A register shall be kept for all environmental awareness training.

Environmental awareness posters will also be erected at a prominent location on the site to remind construction staff of their obligations in terms of the EMP. Refer to Appendix B for an Environmental do's and don'ts poster.

The EPC Contractor shall compile and issue all construction staff with an information booklet, based on the environmental awareness training course, at the commencement of the project, containing key information

regarding the project, safety regulations and environmental do's and don'ts. All employees will be required to sign a register indicating receipt and understanding of the information booklet. The EPC Contractor will ensure that environmental issues and risks are dealt with as part of daily / weekly "toolbox talks" and that specific environmental duties or tasks are assigned to individuals.

The Environmental Awareness Training shall also address a code of behaviour for employees on Health and safety level (such as alcohol abuse, disease protection…) in alignment with community values.

6.4.4 CONSTRUCTION PHASE EMP

Table 6-1 sets out the relevant management measures to be implemented during the construction phase. Mitigation measures have been divided into Biophysical, Ecological and Socio-economic components as per the EIA structure.

Table 6-1: Construction Phase EMP

Reference Number	E&S Aspect/Issue	Mitigation Measures/Action Plans – Construction Phase	Responsibility
Biophysical Impacts			
EMP-C-001	Air Emissions	1. Adopt suitable measures to manage fugitive dust from vegetation clearing during the construction phase. This will include a programme of dust management that limits both occupational and community exposure to dust. 2. Adopt measures to control fugitive dust generated from construction traffic including limiting construction vehicles speeds to the 20 km/hr on unpaved access road to site and on site. 3. Ensure that exposed areas and material stockpiles are adequately protected against the wind (e.g. wetting exposed soil / gravel areas during windy conditions, covering of material stockpiles, etc.); 4. The location of stockpiles shall take into consideration the prevailing wind directions and locations of sensitive receptors. 5. Refer to EMP-C-019 for grievances.	EPC Contractor
EMP-C-002	Noise Emissions	1. Avoid or limit noisy construction activities outside of daytime hours. If night time work is required the EPC Contractor should inform nearby residents 24 hours in advance of undertaking the required noisy activities. 2. Site large generators and similar equipment shall be put way from nearby receptors where possible and where this is not possible put in place noise attenuation measures in the event of noise impacts. 3. Construction vehicles and plant will be serviced according to manufacturer's specifications, and maintenance records must be kept up to date and presented for inspection as required. 4. Adhere to local regulations regarding the generation of noise and hours of operation.	EPC Contractor
Ecological Impacts			
EMP-C-003	Habitat loss, fragmentation and increased edge effects	1. No activities are to occur beyond the extent of the desalination plant site (including stockpiling/stacking). A similar, but smaller, site establishment area shall be established adjacent to seawater intake and brine discharge sites. 2. The desalination plant site shall be fenced off at the start of construction. 3. Rehabilitate any temporary roads as soon as possible after use. 4. No open fires shall be allowed on site, unless in safe areas specially demarcated for that purpose. 5. Harvesting of plants and hunting of animals will not be allowed. 6. Implement traffic calming structures to limit the speed of vehicles (e.g. speed humps) to protect small terrestrial animals.	EPC Contractor

Reference Number	E&S Aspect/Issue	Mitigation Measures/Action Plans – Construction Phase	Responsibility
		7. Keep width of roads to a minimum. Run-off control measures on either side of roads must be constructed to allow for small terrestrial animals to cross. Ditches/trenches should have slopes of less than 45° rather than vertical sides. 8. Plan for placement of material stockpiles (topsoil and subsoil and excavated rock) within the areas designated as low sensitivity (ie not in drainage lines). Do not leave the soil or rock mounds in place after construction, but rather spread these out over the area of low sensitivity after construction. 9. Where areas not targeted for development are inadvertently impacted and/or damaged, clear any material dumped and rehabilitate the site as soon as possible, by levelling, ripping compaction and allowing to revegetate. 10. Monitoring of restoration success: areas which have been restored or rehabilitated should be checked regularly to monitor natural plant regrowth and presence of erosion. Refer to EMP-C-010 regarding soil erosion.	
EMP-C-004	Fauna and Flora	All mitigation measures for EMP-C-003 must be implemented along with the following measures: 1. Harvesting of plants and hunting of animals will not be allowed. If any protected or endangered plant species are encountered during site clearing, they must be relocated to suitable habitats. 2. Avoid unnecessary drainage line crossings. 3. Design site drainage and stormwater runoff to minimise risk of contaminated water entering the stream course or aquatic features (e.g. seasonal pans). 4. Restrict use of chemicals on site to minimum necessary and ensure storage and use, and vehicle maintenance, complies with standard good practice. 5. Hazardous chemicals, including fuels, should be stored in a bunded and fenced area located at away from ephemeral drainage line or other surface depressions or pans. 6. Conduct site inspections to check for oil spills and leaks on soil surface and water bodies (if any form in the wet season) and implement remediation as required. 7. Vehicle maintenance shall be done on an impermeable surface to prevent soil and water contamination. 8. Chemical containers shall be stored in an enclosed restricted access area (to prevent human re-use) and disposed of at an approved waste facility or by approved waste service providers. 9. Inspection of the site on a daily basis to identify any trapped fauna within the construction footprint (trenches, excavations) 10. Refer to EMP-C-016 regarding alien invasive vegetation. 11. No construction staff member is permitted to engage in any fishing activities whilst undertaking the construction. 12. Feeding or otherwise disturbing any sea or bird life is prohibited. 13. In the event that blasting of rock is required, a visual inspection of the ocean area, approximately 2 km radius, should be conducted by boat to ensure that there are not any sea mammals (i.e. turtles, seals or whales) in the area before such blast. 14. Where multiple blast area required there should not be more than one blast per day. Blasting methods that reduce the magnitude of shock waves should be employed (i.e. sequential blasting).	EPC Contractor

Reference Number	E&S Aspect/Issue	Mitigation Measures/Action Plans – Construction Phase	Responsibility
		15. Care should be taken to avoid the loss of litter and construction debris to the ocean where it may be consumed by or ensnare marine biota. 16. No dumping may occur at sea, including excess concrete or any other inert materials. 17. The Contractor shall restrict noise and vibration causing activities to the minimum required to complete the task and develop a programme that limits the length of beach works and wet works.	
EMP-C-005	Alien invasive vegetation	1. Alien invasive plant control through: a. Implementation of an alien invasive species management plan. b. On-site alien invasive plant monitoring and control (removal and disposal); and c. Sourcing of material for road or pylon construction: any requirement for fill material should be sourced from weed free areas to minimise the risk of spreading alien invasive species and to reduce the ongoing maintenance requirements. 2. Alien invasive seedlings and saplings must be removed as they become evident for the duration of construction. 3. Staff at the plant must be educated and made aware of alien vegetation that could be present and that must be eradicated. 4. Sourcing of fill material: any requirement for fill material to create a level platform for site development should be sourced from weed free areas to minimise the risk of spreading alien invasive species and to reduce the ongoing maintenance requirements. 5. On-site alien invasive plant monitoring and control (removal and disposal). 6. Clearing of vegetation should be limited to the development footprint areas. 7. Access roads should be planned in areas that have already been disturbed or transformed to limit additional fragmentation within the landscape and additional loss of vegetative cover. 8. All construction vehicles and equipment, as well as construction material should be free of plant material when leaving the site to avoid contamination of road reserves. Therefore, all equipment and vehicles should be thoroughly cleaned prior to leaving the site	EPC Contractor
EMP-C-006	Hazardous Substance Storage	1. Hazardous substances stored on site should be within a bunded area and(or) contained in an appropriate, compatible, appropriately labelled containers to prevent reaction with containers and spillage during handling. 2. The relevant Material Safety Data Sheet (MSDS) should be clearly displayed in the hazardous substance storage area. 3. Storage to be located away from ephemeral drainage lines. 4. Relevant training should be provided to all employees/contractors on the correct storage and handling procedures and records of this training kept on site.	EPC Contractor
EMP-C-007	Hazardous Substance Spills	1. Construction vehicles and equipment will be regularly serviced off site. Spills of fuel and lubricants from vehicles and equipment will be contained using a drip tray with plastic sheeting filled with adsorbent material.	EPC Contractor

Reference Number	E&S Aspect/Issue	Mitigation Measures/Action Plans – Construction Phase	Responsibility
		2. All plant that is required to work in the intertidal and subtidal zones shall be inspected daily for oil and fuel leaks, and cleaned or repaired as required, prior to commencing with wet works. 3. Accidental spillage of potentially contaminating liquids and solids must be immediately contained and cleaned up by trained staff with the correct equipment and disposed of in an appropriate manner. 4. The Contractor shall ensure that a spill kit is kept on board vessels and that staff or trained in it used to attend to any spillage of hydrocarbons into the ocean. 5. Refuelling of equipment and plant shall not occur in the intertidal or subtidal zones.	
EMP-C-008	Hazardous Waste	1. Hazardous wastes are separated and contained in compatible, appropriately labelled containers to prevent reaction with containers and spillage during handling. 2. Storage of hazardous waste to be located away from any ephemeral drainage lines. 3. Storage areas must have clear signage for the various hazardous waste streams. 4. Potentially contaminating fluids and other hazardous wastes must be contained in containers on hard, level surfaces in contained and covered from rain, and be clearly marked. 5. Develop and implement a site specific Hazardous Waste Management Plan (HWMP) for the management, handling and disposal of hazardous waste streams. 6. Hazardous waste will be trucked out and disposed of at a licensed landfill site. A waste manifest must be kept for all hazardous wastes that are disposed of and maintained on site. 7. Disposal and potential treatment of sewage and contaminated soil will be included in the HWMP. 8. Broken PV panels will be stored in covered waste skips or enclosed buildings until they can be removed from site and disposed of according to international best practice and Namibian laws.	EPC Contractor
EMP-C-09	Soil Erosion	1. The placement of soil stockpiles will be identified prior to commencement of construction to minimise soil erosion. 2. Land clearance will only be undertaken just prior to construction of a particular activity and unnecessary land clearance must be avoided. Work areas will be clearly defined to avoid disturbance outside of the footprint. 3. Construction vehicles to remain on designated prepared roads. 4. Design site drainage and stormwater runoff to minimise risk of erosion. 5. Develop soil and storm water management plan for the entire surface area of the solar PV facility that will prevent concentrated runoff into the washes/ephemeral drainage lines areas, including the use of diversion trenches, berms, flow control dams, silt traps etc. Run-off from the developed areas need to be redistributed evenly over large areas through appropriate modelling and design.	EPC Contractor
EMP-C-010	Fire	1. No open fires shall be allowed on site, unless in safe areas specially demarcated for that purpose. 2. Ensure that the telephone number of the local Fire and Emergency Service is displayed at the site offices. 3. Ensure suitable fire-fighting equipment is provided on site. As a minimum this should include fire extinguishers, fire suppression system (as required, e.g. in power cabins) and a mobile water bowser. 4. Appoint a fire officer(s) from the staff who shall be responsible for ensuring immediate and appropriate action in the event of a fire as well as maintenance of the fire-fighting equipment. The appointed fire	EPC Contractor

Reference Number	E&S Aspect/Issue	Mitigation Measures/Action Plans – Construction Phase	Responsibility
		officer shall notify the local Fire and Emergency Services in the event of a fire and shall not delay doing so until such time as the fire is beyond his/her control 5. Take all reasonable steps to prevent the accidental occurrence or spread of fire. 6. Ensure that all site personnel are aware of the procedure to be followed in the event of a fire. 7. Hot-work (e.g. welding, grinding, cutting torch, etc.) must take place in specially designated areas only. 8. Smoking is not allowed on site, other than at designated smoking points. Cigarette butts shall not be discarded on the ground.	
EMP-C-011	Lighting	1. Ensure that any lighting installed on the site does not interfere with road traffic or cause a reasonably avoidable disturbance to the surrounding users and local communities.	EPC Contractor
EMP-C-012	Concrete Mixing	1. Concrete should be mixed within a mixing tray and/or ready mix should be utilised. 2. If ready-mix cement is not brought to site, concrete batching activities and/or mixing shall be located within the construction camp in areas of low environmental sensitivity. 3. Concrete mixing directly on the ground shall not be allowed and shall only take place on impermeable surfaces. 4. If concrete mixers are washed on site then contaminated runoff water must be channelled to an impermeable collection point. 5. Washing of excess concrete into the ground or water resources is prohibited. 6. All cement-contaminated runoff from mixing areas shall be strictly controlled. 7. At the end of the contract, any ponds used for contaminated water collection shall be dried out and the solids disposed of appropriately. 8. Unused (full) cement bags shall be stored out of the rain and where runoff will not affect them; 9. Used cement bags shall not be used for any other purpose and shall be disposed of on a regular basis. 10. All excess concrete and aggregate shall be removed from site on completion of concrete works and disposed of appropriately.	EPC Contractor
EMP-C-013	Construction Camps and Worker Accommodation	1. The construction camp(s) shall be located at an easily accessible point and within an area of low environmental sensitivity (ie > 100 m from salt pans, >50 m from the highwater mark). 2. The construction camp(s) shall be demarcated by a fence. 3. Suitable sanitary arrangements will be provided. There should be minimum one toilet for every 15 workers on site. Toilets must be easily accessible and shall be secured in order to prevent them from blowing over. 4. Ensure that all ablution facilities are maintained in a clean and sanitary condition. 5. Ensure that there is no spillage when the chemical toilets are cleaned and that the contents are properly removed from site. 6. Establish eating areas with adequate temporary shade to ensure that employees do not move off-site to eat. 7. Provide adequate refuse bins at all eating areas and ensure that all eating areas are cleaned up on a daily basis.	EPC Contractor

Reference Number	E&S Aspect/Issue	Mitigation Measures/Action Plans – Construction Phase	Responsibility
		8. Ensure that there is access to clean drinking water for all employees on site. If water is stored on site, drinking water and multi-purpose water storage facilities shall be clearly distinguished and demarcated. 9. Any accommodation provided to workers and contractors must comply with the IFC Guidance Note on Worker's Accommodation: Process and Standards (August 2009).	
		Socio-Economic Impacts	
EMP-C-014	Community Development, Local Employment and Local Content	1. All local recruitment and labour management will be undertaken by the EPC Contractor, or third-party contractors, consistent with Namibian national labour and occupation health and safety laws. This will include any international obligations (including any applicable International Labour Organisation (ILO) provisions signed and ratified by Namibia). 2. Establish a Community Development Plan (CDP) that will provide annualised funds for the investment in local community development projects, for the construction and operational life of the Project. 3. Establish suitable Human Resources and Recruitment Procedures that establish rules for local recruitment and preferential employment. These procedures will be issued to the construction contractor for adoption with the own internal recruitment procedures during the construction phase. The procedures will also apply to the operational workforce. 4. Establish suitable local content procedures as part of their overall procurement system. The procedures will be issued to the construction contractor for adoption with the own internal procurement procedures during the construction phase. The procedures will also apply to local procurement of materials and services during the operational life of the Project. 5. For the purposes of the CDP, as well as local recruitment and procurement, the terms *local* shall be defined by multiple levels, and priority will be given to household and community in the order below: a. Priority Level 1 – Households immediately surrounding the Project site and final transmission line, with specific focus on residents of DRC and Mondesa. b. Priority Level 2 – Communities nearest to the Project site and final transmission line in Swakopmund and Surrounds. c. Priority Level 3 – Persons and businesses based in Erongo, and thereafter nationally. 6. Measures will be put in place measures to ensure no employee or job applicant is discriminated against on the basis of his or her race, gender, marital status, nationality, age, religion or sexual orientation. 7. Develop a Labour Plan outlining the need to recruit and train local labour. A Local Recruitment Policy should be implemented to ensure that local procurement of labour is maximised. 8. Communicate all recruitment criteria for ongoing recruitment in advance. 9. No employment activities will take place at the entrance to the site. Only formal channels for employment will be used. 10. Management measures should be implemented to enhance skills development and on-the-job training.	EPC Contractor and HDF Energy
EMP-C-015	Community Health, Safety and Security	1. Establish a grievance mechanism throughout the construction and operation phase to deal with any community complains regarding dust, noise and any other health, safety and security matters. 2. Establish suitable security fencing and other control measures to restrict or control public access to the Project site. This will include any authorised access given the members of the public for visits, casual	EPC Contractor and HDF Energy

Reference Number	E&S Aspect/Issue	Mitigation Measures/Action Plans – Construction Phase	Responsibility
		labour, collecting of cleared vegetation or activities planned under any Community Development Programmes. 3. Adopt suitable traffic safety measures, with particular focus on ensuring community commuter and pedestrian traffic safety is considered along the main access roads used. 4. Establish emergency response plans for emergency incidences related to any construction or operational activities, infrastructure or traffic. 5. Establish suitable traffic safety rules to minimise potential traffic hazards on shared access roads that will be used by public traffic and pedestrian traffic. 6. Establish a Code of Conduct, and include it in all Contractor specifications, and individual employee Terms of Employment. The Code of Conduct will establish clear rules to be adopted by the HDF Energy, EPC Contractor or third-party non-local employees with respect to working or interacting in local communities including engagement procedures, obtaining permissions, grievance redress etc. 7. Establish a worker health programme during the construction that specifically targets risky behaviours, training and voluntary screening of HIV and other sexually transmitted diseases. 8. Develop a Code of Conduct, as part of the Labour Management Plan for all workers directly related to the project. A copy of the Code of Conduct is to be presented to all workers and signed by each person. 9. Develop and implement a Grievance Mechanism that is easily accessible to the local community, through which complaints related to contractor or employee behaviour can be lodged and responded to. 10. Develop and implement an HIV/AIDS policy and information document for all workers directly related to the Project. The information document will address factual health issues as well as behaviour change issues around the transmission and infection of HIV/AIDS. 11. Workers to be referred to medical professional for early treatment and monitoring of opportunistic infections such as coughs, colds and pneumonia (i.e. illnesses that can be transmitted easily within communities). 12. Education and awareness programmes for local schools and communities should be implemented.	
EMP-C-016	Access, Traffic and Safety	1. Only demarcated and approved access routes shall be used, routes and detailed schedule of deliveries shall be defined and approved by the EPC Contractor. 2. Driving licences/certificates and proof of training and adoption of drivers code of conduct shall be obtained from all delivery drivers. 3. Ensure that access through the site is maintained at all times for other road users and is in a suitable condition. 4. Ensure that all regulations relating to traffic management are observed. 5. Ensure that adequate traffic accommodation, signage and safety measures (as appropriate) are put in place on site but more importantly along transport routes delivering panels and equipment to site. 6. Ensure that any traffic and safety signage remain clear throughout the construction period and that it is replaced or relocated as appropriate at the end of the construction period.	EPC Contractor

Reference Number	E&S Aspect/Issue	Mitigation Measures/Action Plans – Construction Phase	Responsibility
EMP-C-017	Occupational Health and Safety	1. The EPC Contractor, and where relevant any third-party contractors, will adopt all required occupational health and safety requirements as stipulated in Namibia, as well as conform with any relevant international best practice standards. 2. This will include the establishment of occupational health and safety policies, procedures and actions during both the construction and operational phase that results in strict adherence to health and safety measures by the EPC Contractor staff, third-party contractors and supply chain contractors. 3. Provide Personal Protective Equipment (PPE), training and monitoring as well as ongoing safety checks and safety audits. 4. Provide adequate clean drinking water and safe food for all workers. 5. Workers will be provided with access to primary health care and basic first aid at worksites. 6. Develop and implement an internal Grievance Mechanism that is easily accessible to the employees, contractors and sub-contractors, through which complaints related worker rights and health and safety can be lodged and responded to.	EPC Contractor
EMP-C-018	Seaworthiness and Construction Staff Competence	1. The Contractor shall ensure that any vessel used to lay the ocean pipes is seaworthy and is equipped with all necessary safety and emergency equipment including flares, buoyancy devices, spill kits, first aid kits, air, or fog-horns and fire extinguishers. 2. All construction staff working at sea or within the active surf zone should first demonstrate a proficiency in swimming and should receive safety training. 3. The EPC Contractor shall limit construction at sea to day light hours, Monday to Friday and no construction on Saturdays, Sundays and public holidays due to the increase in recreational boating over these times and in the target area and increased risks associated with this 4. The Contractor shall also observe weather forecast and only conduct construction operations during suitable weather conditions. The planning of commencement of operations must also take weather forecasts into consideration.	
EMP-C-019	Landscape and Visual Amenity	1. To reduce the visual impact of the Project on road users and nearby residents, a buffer or screen along the perimeter is recommended where technically feasible without restricting solar radiation and project performance. 2. Buildings on site to be screened where possible by landscaping and planting of indigenous trees and vegetation to minimise the visual impact and not to cause additional shading on the PV panels. 3. Buildings are to be painted using a natural colour pallet. 4. Security fence to be finished in a colour that is not visually intrusive. 5. Security lighting at night to be aimed downward and used according to best practise standards.	EPC Contractor
EMP-C-020	Cultural Heritage	1. The site must be fenced off at the start of construction. 2. A Chance Find Procedure will be developed and implemented to address any potential finds of cultural heritage value during the construction phase. An example if presented under Appendix C. 3. If an archaeological site/archaeological finds or potential fossil finds are discovered during any construction activity, the work is to be halted and the HDF Energy must be notified.	EPC Contractor

Reference Number	E&S Aspect/Issue	Mitigation Measures/Action Plans – Construction Phase	Responsibility
		4. Any human burials unearthed should be immediately reported to the HDF Energy, who in turn must notify the local Police Service and Heritage Authority.	

6.4.5 CONSTRUCTION PHASE MONITORING PLAN

Table 6-2: Construction Phase Monitoring Plan

Reference Number	E&S Aspect/Issue	Monitoring Aspects – Construction Phase	Monitoring Frequencies	Monitoring Parameters	Key Performance Indicators/Limits	Responsibility
MP-C-001	Ecology	Ensure that the fence surrounding the solar PV plant is erected at the initial stages of construction. Monitor access control during construction. The no-go areas identified during site walk over are to be inspected to ensure integrity has not been compromised during construction	Prior to construction and monthly after construction started.	Changes to pre-construction conditions	NA	EPC Contractor
MP-C-002	Rehabilitation/Restoration	Areas which have been restored or rehabilitated should be checked regularly to monitor natural plant regrowth and presence of erosion.	Monthly	Extent of regrowth and presence of erosion.	NA	EPC Contractor
MP-C-003	Noise	Monitor community complaints with respect to noise.	Ongoing	Complaints from local communities	Zero complaints	EPC Contractor
MP-C-004	Air Emissions	Visual monitoring of fugitive dust (particulate matter) emissions. Monitoring of complaints by local communities.	Ongoing	Visual inspection	Zero complaints received	EPC Contractor
MP-C-005	General Waste	General waste handling, storage, transport and disposal management.	Monthly	Quantity (m^3) of general waste produced. Quantity (m^3) of waste recycled. On site waste handling and storage area inspections. Tracking of corrective actions.	Zero non-compliances with EMP waste management requirements.	EPC Contractor

Reference Number	E&S Aspect/Issue	Monitoring Aspects – Construction Phase	Monitoring Frequencies	Monitoring Parameters	Key Performance Indicators/Limits	Responsibility
MP-C-006	Hazardous Waste	Hazardous waste handling, storage and disposal management	Monthly	Types and quantity (m^3) of hazardous waste generated. Labelling of hazardous waste storage containers (through inspections). Waste Manifest Documentation. Site/contractor/disposal facility weighbridge slips.	100% of hazardous waste disposed of (or recycled) at suitably licensed facilities. Zero non-compliances with EMP waste management requirements. Permits/licenses for all waste transported and disposal facilities used. Accurate waste tracking documents (including disposal records) available for all waste streams.	EPC Contractor
MP-C-007	Employee Health and Safety	1. H&S Inspections (compliance with H&S plans, procedures, SOP, etc.) 2. H&S legal compliance audits	1. Weekly 2. Annually	Namibian labour law EPC Contract	1. Legal requirements 2. Contractual requirements	EPC Contractor
MP-C-008	Grievances	Grievances logged and tracking of items	Monthly	1. Resolution Time Frame. 2. Satisfaction with Process and Outcome	Zero unresolved grievances	EPC Contractor (records) and HDF Energy (manage & track)
MP-C-009	Local Employment	Number of local people employed compared to total number of people employed. Numbers for woman to be indicated.	Monthly	Number of local people employed compared to total number of people employed.	In line with HDF Energy policies	EPC Contractor
MP-C-010	Community H&S	Number of community H&S incidents	Monthly	Number of community H&S incidents	Zero community H&S incidents	EPC Contractor

6.5 OPERATIONAL PHASE

6.5.1 Introduction

Following the construction phase, the project will enter into the commissioning and operations phase of the project lifecycle. It is likely that HF Energy will appoint an operations and maintenance (O&M) contractor to oversee the operations phase of the project, however, HDF Energy as the applicant will retain ultimate responsibility for the management and compliance of the facility in line with this EMP, all statutory requirements and any conditions associated with the environmental clearance. It is also possible that HDF Energy would develop and extend its HSE system and associated polices and procedure to include the operation of this facility. The O&M Contractor will therefore need to work closely with HDF Energy to ensure the facility meets all the requirement of HDF Energy HSE system and demonstrate commitment to the continual improvement philosophy that underpins and Environmental Management System.

This section of the EMP contains specific measures associated with the operation of the desalination plant and the mitigation of potential social and environmental impacts. Any O&M operations that involve construction type activity or repair work to any of the structures or infrastructure shall be conducted in accordance with the provisions set out under the construction phase (Refer to Section 6.4) of this EMP.

6.5.2 OPERATIONAL PHASE EMP

Table 6-3 sets out the relevant management measures to be implemented during the operational phase. Mitigation measures have been divided into Biophysical, Ecological and Socio-economic components as per the EIA structure.

Table 6-3: Operational Phase EMP

Reference Number	E&S Aspect/Issue	Mitigation Measures/Action Plans – Operational Phase	Responsibility
		Biophysical Impacts	
EMP-OP-001	Air Emissions	1. Adopt measures to control the generated of fugitive dust from traffic including limiting vehicles speeds to the 20 km/hr on the access road to site and on site. An appropriate speed must be adopted on access roads to the site to ensure limited dust generation. 2. Ensure that fugitive dust emissions will be actively managed during the operational life of the Project. 3. Establish a grievance mechanism throughout the operation phase to deal with any community complains regarding dust. 4. Refer to EMP-OP-015 for grievances.	O&M Contractor
		Ecological Impacts	
EMP-OP-002	Habitat loss, fragmentation and increased edge effects	1. Refer to EMP-OP-004 regarding alien invasive vegetation.. 2. Monitoring of restoration success: areas which have been restored or rehabilitated should be checked regularly to monitor natural plant regrowth and presence of erosion. 3. Use of herbicides will follow International and Namibian standards and referring to the applicable MSDS.	O&M Contractor
EMP-OP-003	Terrestrial and marine ecology	1. Restrict use of chemicals on site to minimum necessary and ensure storage and use, and vehicle maintenance, complies with standard good practice. Hazardous chemicals, including fuels, should be stored in a bunded and fenced area located away from any seasonal drainage line or other surface depressions or pans. 2. Conduct site inspections to check for oil spills and leaks on soil surface and water bodies (if any form in the wet season) and implement remediation as required. 3. Vehicle maintenance shall be done on an impermeable surface to prevent soil and water contamination. 4. Chemical containers shall be stored in an enclosed restricted access area (to prevent human re-use) and disposed of at an approved waste facility or by approved waste service providers. 5. Maintenance on vehicles/diesel powered equipment will be conducted off-site or within a designated, paved and bunded area 6. Toilets and general plumbing will be regularly checked for leaks which will be attended to immediately. 7. Disturbance of any avifauna is prohibited. Staff are to be informed (as part of tool box talks) of the potential of the Damara Tern breeding / nesting season which runs from October to April of every year) 8. Where Damara Terns nesting sites are identified by any operational staff, the location of the site should be communicated to the O&M Contractor, who should in turn communicate this to the rest of the staff and ask that they minimise any potential disturbance in the area. 9. Monitoring of restoration success: areas which have been impacted should be checked regularly to monitor natural plant regrowth and presence of erosion. Refer to EMP-OP-004 regarding alien invasive vegetation.	O&M Contractor
EMP-OP-004	Alien invasive vegetation	1. Monitor for any emerging Alien Invasive Species (AIS) and ensure that these are rapidly removed. Only environmentally approved herbicides that comply with Namibian legal requirements and relevant international	O&M Contractor

Reference Number	E&S Aspect/Issue	Mitigation Measures/Action Plans – Operational Phase	Responsibility
		conventions should be used. Persistent Organic Pollutants (POPs) and Pesticides as listed by UNEP will not be allowed. 2. Staff at the plant must be educated and made aware of alien vegetation that could be present and that must be eradicated. 3. Quarterly inspections around the site shall be performed in order to identify any alien invasive vegetation. If encountered, then: i. Alien vegetation management shall be undertaken within all areas disturbed by construction activities for a period of a year after project completion; and ii. Any alien vegetation removal shall be undertaken by a suitably qualified sub-contractor. 4. No on-site burying, dumping, stockpiling or burning of any weeds and alien plant species may occur. Such material shall be removed from the site and disposed of at a suitable municipal collection point or landfill site from where seed cannot escape.	
EMP-OP-005	Hazardous Substance Storage	1. Hazardous substances stored on site should be within a bunded area and(or) contained in an appropriate, compatible, appropriately labelled containers to prevent reaction with containers and spillage during handling. 2. Storage to be located at least 150 m from the seasonal drainage line or other surface depressions or pans. 3. The relevant MSDS sheets should be clearly displayed in the hazardous substance storage area. 4. Relevant training should be provided to all employees/contractors on the correct storage and handling procedures and records of this training kept on site.	O&M Contractor
EMP-OP-006	Hazardous Substance Spills	1. Hazardous substances stored on site should be within a bunded area and(or) contained in an appropriate, compatible, appropriately labelled containers to prevent reaction with containers and spillage during handling. 2. Construction vehicles and equipment will be regularly serviced off site. Spills of fuel and lubricants from vehicles and equipment will be contained using a drip tray with plastic sheeting filled with adsorbent material. 3. Concrete to be mixed in designated areas and managed in such a way so that no spillage is allowed to reach the ephemeral drainage lines. 4. Accidental spillage of potentially contaminating liquids and solids must be immediately contained and cleaned up by trained staff with the correct equipment and disposed of in an appropriate manner. 5. Minimise clearing of vegetation around the site to intercept and impede run-off from the site.	O&M Contractor
EMP-OP-007	Hazardous Waste	1. Hazardous wastes must be separated and contained in compatible, appropriately labelled containers to prevent reaction with containers and spillage during handling. 2. Storage to be located away from seasonal drainage lines. 3. Storage areas must have clear signage for the various hazardous waste streams. 4. Potentially contaminating fluids and other hazardous wastes must be contained in containers on hard, level surfaces in contained and covered locations, and be clearly marked. 5. Develop and implement a site specific HWMP for the management, handling and disposal of hazardous waste streams. 6. Hazardous waste will be trucked out and disposed of at a licensed landfill site. A waste manifest must be kept for all hazardous wastes that are disposed of and maintained on site. 7. Disposal and potential treatment of sewage and contaminated soil will be included in the HWMP.	O&M Contractor

Reference Number	E&S Aspect/Issue	Mitigation Measures/Action Plans – Operational Phase	Responsibility
		8. Broken PV panels will be stored in covered waste skips or enclosed buildings until they can be removed from site.	
EMP-OP-008	Soil Erosion	1. Conduct monthly inspections to identify areas of erosion. If areas are identified then develop and implement an action plan to avoid further erosion and to rehabilitate the areas as identified.	O&M Contractor
EMP-OP-009	Fire	1. No open fires shall be allowed on site, unless in safe areas specially demarcated for that purpose. 2. Ensure that the telephone number of the local Fire and Emergency Service is displayed at the site offices. 3. Ensure suitable fire-fighting equipment is provided on site. As a minimum this should include fire extinguishers, fire suppression system (as required, e.g. in power cabins) and any additional requirements as specified in the emergency response plan 4. Appoint a fire officer who shall be responsible for ensuring immediate and appropriate action in the event of a fire as well as maintenance of the fire-fighting equipment. The appointed fire officer shall notify the local Fire and Emergency Services in the event of a fire and shall not delay doing so until such time as the fire is beyond his/her control. 5. Take all reasonable steps to prevent the accidental occurrence or spread of fire. 6. Ensure that all site personnel are aware of the procedure to be followed in the event of a fire. 7. Hot-work (e.g. welding, grinding, cutting torch, etc.) must take place in specially designated areas only. 8. Smoking is not allowed on site, other than at designated smoking points. Cigarette butts shall not be discarded on the ground.	O&M Contractor
EMP-OP-010	Lighting	1. Ensure that any lighting installed on the site does not interfere with road traffic or cause a reasonably avoidable disturbance to the surrounding users and local communities.	O&M Contractor
Socio-Economic Impacts			
EMP-OP-011	Community Development, Local Employment and Local Content	1. All local recruitment and labour management will be undertaken by the O&M Contractor, or third-party contractors, consistent with Namibian national labour and occupation health and safety laws. This will include any international obligations (including any applicable ILO provisions signed and ratified by Namibia). 2. Establish suitable Human Resources and Recruitment Procedures that establish rules for local recruitment and preferential employment. 3. Establish suitable local content procedures as part of their overall procurement system. The procedures will apply to local procurement of materials and services during the operational life of the Project. 4. For the purposes of the CDP, as well as local recruitment and procurement, the terms *local* shall be defined by multiple levels, and priority will be given to household and community in the order below: a. Priority Level 1 – Households immediately surrounding the Project site and final transmission line, with specific focus on residents of Swakopmund. b. Priority Level 2 – The Erongo Region and Walvis Bay. c. Priority Level 3 – Persons and businesses based in Namibia, and thereafter internationally. 5. Measures will be put in place measures to ensure no employee or job applicant is discriminated against on the basis of his or her race, gender, marital status, nationality, age, religion or sexual orientation. 6. Communicate all recruitment criteria for ongoing recruitment in advance.	O&M Contractor

Reference Number	E&S Aspect/Issue	Mitigation Measures/Action Plans – Operational Phase	Responsibility
		7. No employment activities will take place at the entrance to the site. Only formal channels for employment will be used. 8. Management measures should be implemented to enhance skills development and on-the-job training.	
EMP-OP-012	Community Health, Safety and Security	1. Establish a grievance mechanism throughout the construction and operation phase to deal with any community complains regarding dust, noise and any other health, safety and security matters. 2. Establish suitable security fencing and other control measures to restrict or control public access to the Project site. This will include any authorised access given the members of the public for visits, casual labour, collecting of vegetation or activities planned under any CDP. 3. Adopt suitable traffic safety measures, with particular focus on ensuring community commuter and pedestrian traffic safety is considered along the main gravel access roads used. 4. Establish emergency response plans for emergency incidences related to any construction or operational activities, infrastructure or traffic. 5. Establish suitable traffic safety rules to minimise potential traffic hazards on shared access roads that will be used by public traffic and pedestrian traffic. 6. Establish a Code of Conduct, and include it in all O&M Contractor specifications, and individual employee Terms of Employment. The Code of Conduct will establish clear rules to be adopted by the O&M Contractor or third-party non-local employees with respect to working or interacting in local communities including engagement procedures, obtaining permissions, grievance redress etc. 7. Establish a worker health programme during the construction that specifically targets risky behaviours, training and voluntary screening of HIV and other sexually transmitted diseases 8. Develop and implement a Grievance Mechanism that is easily accessible to the local community, through	O&M Contractor
EMP-OP-013	Occupational Health and Safety	1. The O&M Contractor, and where relevant any third-party contractors, will adopt all required occupational health and safety requirements as stipulated under the Namibian labour law, as well as conform with any relevant international best practice standards. 2. This will include the establishment of occupational health and safety policies, procedures and actions during both the construction and operational phase that results in strict adherence to health and safety measures by the O&M Contractor staff, third-party contractors and supply chain contractors. 3. Provide PPE, training and monitoring as well as ongoing safety checks and safety audits. 4. Provide adequate clean drinking water and safe food for all workers. 5. Workers will be provided with access to primary health care and basic first aid at worksites. 6. Develop and implement an internal Grievance Mechanism that is easily accessible to the employees, contractors and sub-contractors, through which complaints related worker rights and health and safety can be lodged and responded to.	O&M Contractor
EMP-OP-014	Landscape and Visual Amenity	1. Security fence to be finished in a colour that is not visually intrusive. 2. Security lighting at night to be aimed downward and used according to best practise standards.	O&M Contractor
EMP-OP-015	Cultural Heritage	1. A Chance Find Procedure will be developed and implemented to address any potential finds of cultural heritage value (Refer to Appendix C for guidance).	O&M Contractor

Reference Number	E&S Aspect/Issue	Mitigation Measures/Action Plans – Operational Phase	Responsibility
		2. If an archaeological site/archaeological finds or potential fossil finds are discovered, the work is to be halted and the O&M Contractor must be notified. 3. Any human burials unearthed should be immediately reported to the O&M, who in turn must notify the national cultural heritage authority and the police.	
Decommissioning Impacts			
EMP-OP-016	Planning	A detailed Decommissioning and Rehabilitation Plan must be developed at least 2 years prior to the decommissioning of project and the associated facilities. This plan should include, but not be limited to, management of socio-economic aspects such as employment loss, removal, re-use and recycling of materials and vegetative rehabilitation to prevent erosion, infrastructure removals, waste disposal, hazardous substance spillages and alien invasive vegetation control. The plan will detail all site-specific measures to be implemented to rehabilitate all areas disturbed by the project.	O&M Contractor

6.5.3 OPERATIONAL PHASE MONITORING PLAN

Table 6-4: Operational Phase Monitoring Plan

Reference Number	E&S Aspect/Issue	Monitoring Aspects – Construction Phase	Monitoring Frequencies	Monitoring Parameters	Key Performance Indicators/Limits	Responsibility
MP-OP-001	Ecology	Ensure that the fence surrounding the plant is erected at the initial stages of construction. Monitor access control during construction. The no-go areas identified during the site walk over and incidentally during operation should be monitoring to the integrity of these features is maintained	Biannually (for period of 5 years)	Changes/impacts to pre-construction conditions	No nett loss when compared to baseline conditions prior to constriction.	O&M Contractor
MP-OP-002	Alien vegetation	Monitoring of alien invasive plants.	Quarterly	Numbers/areas and locations of alien invasive plant species.	Zero presence of alien invasive plant species.	O&M Contractor
MP-OP-003	General Waste	General waste handling, storage and disposal management.	Quarterly	Quantity of general waste produced. Quantity of waste recycled. On site waste handling and storage area inspections. Tracking of corrective actions.	NA	O&M Contractor

Reference Number	E&S Aspect/Issue	Monitoring Aspects – Construction Phase	Monitoring Frequencies	Monitoring Parameters	Key Performance Indicators/Limits	Responsibility
MP-OP-004	Hazardous Waste	Hazardous waste handling, storage and disposal management	Annually	Types and quantity (m^3) of hazardous waste generated. Labelling of hazardous waste storage containers (through inspections). Waste Manifest Documentation. Site/contractor/disposal facility weighbridge slips.	100% of hazardous waste disposed of (or recycled) at suitably licensed facilities. Zero non-compliances with EMP waste management requirements. Permits/licenses for all waste transported and disposal facilities used. Accurate waste tracking documents (including disposal records) available for all waste streams.	O&M Contractor
MP-OP-005	Employee Health and Safety	1. H&S Inspections (compliance with H&S plans, procedures, SOP, etc.) 2. H&S legal compliance audits	1. Monthly 2. Annually	1. Namibian labour laws	Namibian labour law O&M Contract	1. Legal requirements 2. Contractual requirements
MP-OP-006	Grievances	Grievances logged and tracking of items	Monthly	1. Resolution Time Frame. 2. Satisfaction with Process and Outcome	Zero unresolved grievances	O&M Contractor (records) and HDF Energy (manage & track)
MP-OP-007	Local Employment	Number of local people employed compared to total number of people employed. Numbers for woman to be indicated.	Annually	Number of local people employed compared to total number of people employed.	As per HDF Energy employment policies and Namibian legislative requirements	O&M Contractor
MP-OP-008	Community H&S	Number of community H&S incidents	Monthly	Number of community H&S incidents	Zero community H&S incidents	O&M Contractor
MP-OP-009	Enterprise Development (ED) and Socio-	ED and SED initiatives implementation and progress.	Monthly	To be defined in O&M Contract	O&M Contract	O&M Contractor

Reference Number	E&S Aspect/Issue	Monitoring Aspects – Construction Phase	Monitoring Frequencies	Monitoring Parameters	Key Performance Indicators/Limits	Responsibility
	Economic Development (SED)					
MP-OP-010	Biological monitoring	Effects of the discharged brine on the receiving water body, and/or intertidal biological communities surrounding the discharge location	As per guideline	As per guideline	As per guideline	O&M Contractor
MP-OP-011	Physiochemical monitoring of brine	Effects of the discharged brine on the receiving water quality surrounding the discharge location	As per guideline	As per guideline	As per guideline	O&M Contractor

7. MANAGEMENT OF CHANGE

Changes in the Project may occur due to unanticipated situations. Adaptive changes may also occur during the course of final design, commissioning or even operations. The project will implement a formal procedure to manage changes (e.g. layout, technology, resources, etc.). The objective of the procedure must be to ensure that the impact of changes on the health and safety of personnel, the environment, adjacent communities, plant and equipment are identified and assessed prior to the changes being implemented. The management of change procedure must ensure that:

- proposed changes have a sound technical, safety, environmental, social and commercial justification;
- changes are reviewed by competent personnel and the impact of changes is reflected in documentation, including operating procedures and drawings;
- changes are communicated to personnel who are provided with the necessary skills, via training, to effectively implement changes;
- the appropriate developer lead accepts the responsibility for the change; and

Changes to be managed could include a risk to people, the environment, communities or the business, and might be related to a process, equipment, materials, people or the environment or project context. Change management process includes the following steps:

1. Identify and describe the change using Management of Change Form;
2. Assess the E&S risks associated with the change;
3. Identify control measures (for risk that cannot be eliminated);
4. Appoint someone to review the risk assessment;
5. Develop actions to manage the change with clear responsibilities and timeline;
6. Implement actions; and
7. Review the change to ensure it has been effective.

All changes to the project shall be subject to a Risk Assessment. All environmental and social legal requirements related to the change shall also be identified and implemented as required. Mitigation measures and monitoring requirements associated with significant environmental and social risks as related with the change shall be captured in this EMP. Substantive changes to the mitigation measures described in this EMP will need to be communicated to the MEFT

8. DECOMMISSIONING PHASE

The plant will be designed to have a 25-year operational life, which coincides with the current HDF Energy Life of Project plan. At the end of the design life period, the plant may be refurbished for continued operation, upgraded, or may be decommissioned, broken down and the site rehabilitated, or sold as a going concern, depending on the situation and needs at that time.

However, in the event that the plant is decommissioned and dismantled and the site rehabilitated, the provision made under the construction phase of this EMP shall be amended as required and apply to all de-construction activities. In the event of decommissioning, HDF Energy shall make every effort to have the various materials in the plant reclaimed for recycling or reuse elsewhere and reduce the volume of waste going to landfill.

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APPENDIX A: GUIDELINE LIST OF METHOD STATEMENTS

The purpose of the following list is to provide guidance as to Method Statements (MS) to be prepared. The list is not to be considered prescriptive or exhaustive:

MS1: Construction camp location and layout;
MS2: Site clearing;
MS3: Hazardous substances;
MS4: Solid waste management;
MS5: Wastewater management;
MS6: Erosion and sediment control;
MS7: Cement and concrete batching;
MS8: Fire control;
MS9: Dust control programme;
MS10: Temporary site closure;
MS11: Emergency procedures;
MS12: Ocean-based construction methods;
MS13: Rehabilitation Plan

APPENDIX B: ENVIRONMENTAL DO'S AND DONTS


PROTECTION OF THE ENVIRONMENT IS YOUR RESPONSIBILITY/ BESKERMING VAN DIE OMGEWING IS JOU VERANTWOORDELIKHEID
REMAIN WITHIN WORKING AREAS
BLY BINNE WERKGEBIEDE
NO SWIMMING
SWEM VERBODE
DO NOT HARM OR DAMAGE PLANTS AND ANIMALS
MOENIE PLANTE EN DIERE BESKADIG NIE
SMOKE CAUTIOUSLY
ROOK VERSIGTIG
BE AWARE OF FIRES
PASOP VIR VUUR
PREVENT OIL POLLUTION
VOORKOM OLIE-BESOEDELING
CONTROL DUST
BEHEER STOF
LIMIT NOISE
VERMINDER GERAAS
USE TOILETS
GEBRUIK DIE TOILETTE
toilet
USE THE EATING AREAS
EET BINNE DIE EETGEBIED
USE RUBBISH BINS
GEBRUIK ASBLIKKE
DON'T SPEED/ SECURE LOADS
RY STADIG/ MAAK VRAGTE VAS
KNOW THE EMERGENCY NUMBERS
KEN DIE NOOD NOMMERS
ASK QUESTIONS
VRA VRAE

APPENDIX C: CHANCE FINE PROTOCOL

Archaeological Chance Finds Procedure

A "Chance Find" refers to any cultural heritage site or associated material encountered during the course of construction works, as opposed to finds made in the course of intentional archaeological investigation. Chance Finds include, but are not limited to artefacts, archaeological deposits, ruins, monuments, and human remains.

The Chance Find Procedure presented in this document serve as international best practice policy for the accidental discovery of cultural and heritage resources as well as burial grounds/graves. Based on the definitions provided within this document and the proposed lines of communication, HDF Energy will be able to mitigate the accidental discovery of these items through the various phases of the project

All intrusive site activities such as land clearing, open pit excavation and earth works within the Power Plant site and along the transmission line will be carefully monitored.

All personnel involved in land clearance and excavation will be responsible for managing archaeological protection, including the adoption of this Chance Finds Procedure.

HDF Energy will provide training for EPC Contractor personnel to help identify archaeological objects and make them aware of how to implement the Chance Finds Procedure. HDF Energy and the EPC Contractor will make all employees aware of the cultural and social significance of any chance finds during the life of the project and ensure that they understand that they will be strictly prohibited from interfering with or disturbing cultural heritage sites and artefacts. This will be included in induction training, as well as provided for in any third-party contracts.

Excavation in and around sites of known cultural interest (notably local graveyards) will be entirely avoided. HDF Energy will define these areas as exclusions zones and will place suitable boundary makers. Where the disruption of such sites is unavoidable, prior discussions must be held with the relevant authorities to undertake pre-construction excavation or assign an archaeologist to log discoveries as construction proceeds.

HDF Energy will ensure that all records and reports of any fortuitous finds are made available to the national institution responsible for the management of cultural heritage.

Chance Find Process:

Where historical remains, archaeological artefacts (relics, tools, bones, ceramics, graves, etc.) or any other object of cultural or archaeological importance are unexpectedly discovered during construction in an area not previously known for its archaeological interest, the following procedures should be applied:

1. Stop construction activities and inform site supervisor/foreman;
2. The site supervisor/foreman will notify the EPC Contractor/ O&M Contractor immediately.
3. The EPC Contractor/ O&M Contractor will delineate the discovered site area, and secure it to prevent any damage or loss of removable objects.
4. HDF Energy will appoint a qualified archaeologist to assess the significance of the suspected chance find.

5. The HDF Energy HSE Manager will liaise with the relevant ministry/authority to determine the need for further investigation and appropriate action.
6. In the case of human remains the local authorities and police must be notified and an autopsy process may be triggered. Where it is confirmed that the remains are unclaimed graves, HDF Energy will ensure their relocation.
7. Decisions on how to handle the findings will be reached based on the above assessment and could include conservation, preservation, restoration, or salvage. The final action will be established in agreement between HDF Energy and the relevant authority.
8. Any subsequent investigation or excavation works will be conducted by a suitably-qualified archaeologist/palaeontologist.
9. Construction work can resume only when permission is given from the relevant authority after the decision concerning the safeguard of the heritage is fully executed**.**

If further detailed excavation works are required (as determined under the guidance of the relevant national and regional authorities), HDF Energy will ensure that:

1. Any necessary permits and licenses for archaeological investigation and removal will be obtained from the relevant authorities.
2. Archaeological chance finds will be discussed with the local community to establish local significance, and community buy-in in terms of any actions to be undertaken.
3. Mapping will be carried out to identify the likely spatial extent of archaeological site, and trial pits will be dug by hand excavation.
4. The excavation process and the different archaeological material (ceramics, stones, charcoal, seeds, bones, etc.) will be registered in detail using photographs and field diaries.
5. Any material found in the pits will be treated (washed and tagged) and later classified in accordance with accepted criteria.

If archaeological/paleontological excavation or retrieval processes are required for chance finds of cultural sites within the project footprint the following additional procedures will apply:

1. Work must be completed by a qualified archaeologist/ palaeontologist.
2. Activities may be monitored by representatives of the local communities.
3. Consideration will be given to supplementing excavation work with non-destructive means of investigation (e.g., geophysical survey, remote sensing, geochemical survey, field scanning).
4. Arrangements will be made with local communities and authorities if storage or relocation of the artefact is required.
5. Records (written, graphic, electronic, and photographic as appropriate) will be made for all works.
6. A post-excavation assessment report will be produced**.**

Some types of cultural heritage resources (e.g., ethnographic stone pits) cannot be excavated, salvaged and relocated. Procedures for documenting these sites will involve the following:

1. Consultation with all relevant parties (e.g., local communities and authorities) to determine if these items should be destroyed.
2. Prior to destruction, the items will be documented to record the physical extent of the item and the physical environment in which the item is located.

Photographs may be taken and added to Company records.

APPENDIX D: GENERAL PLANT OPERATION AND MAINTENANCE

The following provides particular guidance to marine biodiversity considerations to be included for as part of the desalination plant operation and maintenance planning

Introduction

The desalination plant should undergo routine maintenance and repairs to ensure that it continues to operate in accordance with pre-construction section. The use of chemicals on site and the discharge of concentrate containing potentially deleterious chemicals could change with wear and tear of the plant, becoming more detrimental to the marine environment. The O&M Contractor shall conduct regular tests on the water quality to confirm that the plant continues to operate at its design specification.

A detailed Operation and Maintenance (O&M) Manual shall be developed by the plant manufacturer / Engineer. The manual will provide detailed guidance on the safe operation of all equipment and associated systems as well as maintenance inspections, procedures and schedules. The implementation of this manual is seen as proactive management in addressing potential risks to the biophysical environment through breakdowns or equipment failures.

The appearance of all buildings, fences, roadways and all other structures shall be maintained to ensure the plant doesn't detract from the scenic value of the area as viewed by the general public. HDF Energy should conduct inspections to confirm that the maintenance programme is being implemented in accordance with the manual.

All materials should be stockpiled in a neat and orderly fashion in designated areas. The O&M Contractor shall make provision to undertake routine inspections and address areas where housekeeping practices are lacking. Where maintenance work requires construction activity, such activities should be carried out in conformance with the principles contained the Construction phase of this EMP.

Seawater Intake System

Care should be taken through design and operation to ensure that the peak velocity at the intake does not exceed ~0.15m/s, so as to ensure that fish and other organisms can escape the intake current.

Should chlorination of the intake water be necessary, this should be undertaken intermittently to ensure that the intake pipeline and feed-water pumping systems remain free of biofouling organisms, and to prevent bacterial re-growth in the brine. However, as the RO membranes are sensitive to oxidizing chemicals, neutralisation of residual chlorine, with sodium metabisulfite (SMBS), is necessary if membrane damage is to be avoided.

Scaling of the plant pipelines and RO membranes is controlled by the addition either of acid or specific antiscalant chemicals. Acids and polyphosphates cause eutrophication through formation of algal blooms and macroalgae, and should therefore be avoided. The preferred method would be to use phosphonate and organic polymer antiscalants, which have a low toxicity to aquatic invertebrate and fish species.

Depending on the membrane type, the antiscalant product should preferably be one for which relevant eco-toxicological testing has already been undertaken.

Sea outfall brine discharge

The discharge pipe should be fitted with a suitable diffuser system at its seaward end to ensure rapid and efficient dilution of the effluent with the receiving water, thereby reducing plume footprints near the seabed and minimising impacts on marine ecology. The design of the diffuser and discharge rates would meet the requirements of the South African Marine Water Quality Guidelines and the Operational Policy for the Disposal of Land-derived Water containing Waste to the Marine Environment insofar as they are applicable to this type of installation.

During commissioning of the desalination plant, it may be necessary to discard the membrane storage solution and rinse the membranes before plant start-up. If the membrane storage solution contains a biocide or other chemicals these must either be neutralised before being discharged to sea, or the storage solution disposed of at an appropriate waste disposal facility.

Traces of residual chlorine in the brine discharge must be kept below 3µg/ℓ (ANZECC (2000) guideline levels) by neutralising with sodium metabisulfite (SMBS). As marine organisms are extremely sensitive to residual chlorine, it is vital to ensure that the residual chlorine concentration in the discharged brine is at all times reduced to a level below that which may have lethal or sublethal effects on the biota, particularly the larval stages. Should the exceedance of the recommended guideline (<3µg/ℓ) be a more persistent or recurrent event, there could be serious implications for marine biota in the discharge gully and the plant would need to be closed down until the problem has been rectified.

Although it is predicted that residual chlorine levels in the discharge will be below guideline levels, continuous monitoring of the effluent for residual chlorine and dissolved oxygen levels is essential. Should residual chlorine be detected in the brine, SMBS dosing should immediately be increased. The use of SMBS during dechlorination is, however, associated with oxygen depletion in the effluent if overdosing occurs, as this substance is an oxygen scavenger. Shock dosing with SMBS is also an effective way of eliminating re-growth of aerobic bacteria in the discharge pipelines. Aeration of the effluent prior to discharge is therefore recommended, preferably with a permanent aeration system. Alternatively, if a permanent in situ effluent monitoring system is in place, aeration can be undertaken intermittently when monitoring results detect unacceptably low dissolved oxygen levels in the effluent.

If DBNPA (biocide) were to be used as alternative to chlorine, mitigation measures to ensure low residuals of DBNPA in any discharge to the marine environment include appropriate design of the brine basin so as to ensure greater and sufficient dilution of the DBNPA residuals in the effluent stream and higher degradation rate before discharge. A better option would be carefully monitored dosing to ensure minimal DBNPA concentrations in the discharge.

The solids generated by the filtration, backwash, and CIP processes will be mixed with the DAF sludge and co-discharged with the brine. Care should be taken to control the release of co-discharges to avoid sudden spikes in concentration.

Brine discharge impact verification monitoring program

HDF Energy should consider implementing a structured before-after/control-impact monitoring program (Underwood 1992, 1993, 1994), which would commence prior to the start of construction and continue for at least 4-years following the commencement of operation. The results of such a monitoring program will not only inform/ verify the extent and magnitude of the construction impacts for the desalination plant, but also the cumulative effects of the brine discharge.

The waste brine often contains low amounts of heavy metals from corrosive processes, which tend to enrich in suspended material and ultimately marine sediments. It is recommended that the effluent be monitored regularly (every 6-months) for heavy metals until a profile of the discharge in terms of heavy metal concentrations is determined. These heavy metal concentrations in the brine effluent would then need to be assessed based on existing guidelines (DWAF 2005; ANZECC 2000). An inspection program at similar intervals (every 6 months) to check corrosion levels of plant constituent parts and the physical integrity of the intake and outlet pipes and diffuser should be implemented and components replaced or modified if excessive corrosion is identified or specific maintenance is required.

HDF Energy may need to undertake routine environmental monitoring over the long term to satisfy authorities and any conditions of authorisation, permits, and or licensing conditions. The Long-term Marine Monitoring Programme shall be developed by the marine specialist in association with the authorities on the basis of the findings of the marine impact verification monitoring. The responsibility for the environmental monitoring will fall to the O&MCEO. The LMMP monitoring will be focused on chemical monitoring criteria and should be less onerous than that detailed in the impact verification program.

This document should be updated with any the conditions of authorisation and any compliance reporting requirements associated with the environmental clearance or any other water abstraction, effluent discharge or water service provider license/s or permits issued for the operation of the desalination plant.

APPENDIX E: BIOLOGICAL MONITORING

A marine ecologist is to be appointed to assist with the biological marine monitoring, diffusion and whole effluent toxicity test and validation requirements, as explained here.

Monitoring plays a key role in ensuring that plant operations function as intended and achieve the provision of water with minimal environmental impacts. It includes validation, operational monitoring, verification, and surveillance. Validation is the process of obtaining evidence that control measures are capable of operating as required, in other words it should confirm that specific pieces of equipment achieve accepted performance standards. Operational monitoring is the planned series of observations or measurements undertaken to assess the ongoing performance of individual control measures in preventing, eliminating, or reducing hazards. Operational monitoring will normally be based on simple and rapid procedures such as measurement of turbidity and chlorine residuals or inspection of the distribution system integrity. Verification provides assurance that a system as a whole is providing safe water while surveillance reviews compliance with identified guidelines standards and regulations.

A monitoring program should be developed to study the effects of the discharged brine on the receiving water body, and/or intertidal biological communities surrounding the discharge location, particularly as monitoring of the affected subtidal benthic communities is in this case not feasible. This recommendation is reinforced by the Guidelines for Environmental Evaluation for Seawater Desalination published by the South African Department of Water Affairs and Forestry (DWAF 2007), in which it is stated that it is essential that the effects of the discharge of brine into any water body be monitored according to a monitoring program performed at 6-monthly intervals over a period of approximately 4-years. This monitoring program would validate numerical modelling results and/or ecological assessments based on these. Depending on initial results, reduced monitoring (i.e. annually) may be acceptable. This monitoring will include measurement of the main water quality parameters such as temperature, salinity and dissolved oxygen as a minimum. It is further recommended that every effort be made to publish the results in a peer-reviewed journal.

Once the desalination plant is in full operation, a monitoring program should be implemented to ensure that the required level of dilution (as predicted by the numerical modelling) is achieved. Typical brine and thermal footprints need to be confirmed by sampling with a conductivity-temperature-depth (CTD) probe after an initial period of operation of the discharge both to confirm the performance of the discharge system and the numerical model predictions. This should be done for a suitably representative range of “conservative” environmental conditions, i.e. conditions for which dispersion of the effluent is likely to be the most limited. It is envisaged that two to three field surveys of one to two days duration would be adequate to confirm the performance of the discharge system and the accuracy of model predictions. If field observations and monitoring fail to mirror predicted results, the forecasted impacts will need to be re-assessed. To ensure complete confidence in the potential effects of the antiscalant to be used in the desalination plant and that the co-discharged waste-water constituents are being managed to concentrations that will not have significant environmental impacts, it will be necessary to undertake toxicity testing of the discharge for a full range of operational scenarios (i.e. shock-dosing, etc.). Once samples of the different operational scenario effluents have been collected, these should be tested according to the criteria tabulated below and the results (or brine’s physiochemical profile) should be communicated to the Ministry of Fisheries and Marine Resources. Such sampling and whole effluent toxicity testing need only be undertaken for the duration and extent necessary to determine an effluent profile under all operational scenarios. Given that there are uncertainties regarding the effects and combined

effects of chlorinated or de-chlorinated water, backwash sludge and CIP chemicals on the marine environment, whole effluent toxicity tests be conducted at the plant as soon as possible after it comes on line. In this whole effluent toxicity test a range of species from different phyla are exposed to increasing dilutions of effluent from the plant for use in determining Lowest Observed Effective concentration and Predicted No Effect Concentration values for the effluent. This data can be used in conjunction with data from the dilution modelling and biological monitoring studies, to confirm if dilutions achieved in the near field are adequate to minimise impacts on the environment. Alternative mitigations relating to the discharging the backwash sludge and CIP chemicals may need to be sought if the required dilutions cannot be achieved within the near field (22 m from point discharge).

Entrainment and impingement of marine organisms on the intake screens of the intake pipe should also be assessed and recorded once a month for the first three months of operation to assess the actual magnitude of these impacts. Results should be assessed by a qualified marine biologist.

APPENDIX E: PHYSIOCHEMICAL MONITORING OF BRINE

In line, real time monitoring instruments / probes should be positioned on the seawater intake pipeline and the brine discharge pipeline. These instruments should provide data on volumes, electrical conductivity, dissolved oxygen; and temperature. Where anomalous readings are detected in these indicator readings, an investigation should be initiated, and additional water samples taken to determine the underlying cause and identify corrective actions. This system should persist for the operational life of the desalination plant.

Applicable Water Quality Guidelines

The Water Resources Management Act does not contain target values for water quality associated with brine effluent. These will form part of the regulations associated with the new Water Act and will be implemented at a future date. As far as can be established, South Africa is the only southern African country that currently has an official set of water quality guidelines for coastal marine waters. In terms of policy, legislation and practice South Africa's operational policy for the disposal of land-derived wastewater to the marine environment (DWAF 2004 a-c) is thus of relevance. Specifically, environmental quality objectives need to be set for the marine environment, based on the requirements of the site-specific marine ecosystems, as well as other designated beneficial uses (both existing and future) of the receiving environment. The identification and mapping of marine ecosystems and the beneficial uses of the receiving marine environment provide a sound basis from which to derive site-specific environmental quality objectives (Taljaard *et al*. 2006). To ensure that environmental quality objectives are practical and effective management tools, they need to be set in terms of measurable target values, or ranges for specific water column and sediment parameters, or in terms of the abundance and diversity of biotic components. The South African Water Quality Guidelines for Coastal Marine Waters (DWAF 2005) provide recommended target values (as opposed to standards) for a range of substances, but these are not exhaustive. Therefore, in setting site-specific environmental quality objectives, the information contained in the DWAF guideline document is supported by additional information obtained from published literature and best available international guidelines (e.g. BCLME 2006; ANZECC 2000; World Bank 1998; EPA 2006). Recommended target values are also reviewed and summarized in the Benguela Current Large Marine Ecosystem (BCLME) document on water quality guidelines for the BCLME region (CSIR 2006). Recommended target values extracted from these guidelines are provided in tables below.

A mixing zone is the area around an effluent discharge point where the effluent is actively undergoing dilution with the water of the receiving environment. This zone usually encompasses the near-field and mid-field regions of dilution to allow for the plume to mix throughout the water column. No water quality criteria for physical and chemical stressors are defined within the mixing zone. Instead, these water quality criteria ('trigger values') are defined at the boundary of the mixing zone to ensure the quality of nearby waters does not deteriorate as a result of the effluent discharge. The boundaries of a proposed mixing zone are typically defined according to an estimated distance from the discharge point at which point defined water quality guidelines will be met, as predicted by numerical modelling of the discharge.

According to the WSP diffusion modelling report the results of the intermediate mixing model indicate a general influence area of approximately 30m to 40m from the effluent discharge point under varying water levels and coastal processes. The required brine dilutions are achieved all of the time at a distance of 22 m from the discharge point under normal ocean conditions. Water quality standards and guidelines should therefore be applied at the edge of the mixing zone, which for practical purposes will be set at 30 m, updrift from the discharge point in the mid surf zone (this is where readings are likely to be the highest under normal conditions). The actual mixing zone should be confirmed by a marine ecologist.

Water Quality Guidelines for the Discharge of Brine into the Marine Environment

Variable	South Africa (DWAF 2005)	Benguela Current Large Marine Ecosystem (BCLME 2006)	Australia/New Zealand (ANZECC 2000)	World Bank (World Bank 1998)	US Environmental Protection Agency (EPA 2006)
Zone of impact/mixing zone	To be kept to a minimum, the acceptable dimensions of this zone informed by the EIA and requirements of licensing authorities, based on scientific evidence.			100 m radius from point of discharge for temperature.	
Temperature	The maximum acceptable variation in ambient temperature is ± 1°C.	Where an appropriate reference system(s) is available, and there are sufficient data for the reference system, the guideline value should be determined as the range defined by the 20%ile and 80%ile of the seasonal distribution for the reference system. Test data: Median concentration for the period.	Where an appropriate reference system is available, and there are sufficient resources to collect the necessary information for the reference system, the median, (or mean) temperature should lie within the range defined by the 20%ile and 80%ile of the seasonal distribution of the ambient temperature for the reference system.	< 3°C above ambient at the edge of the zone where initial mixing and dilution take place. Where the zone is not defined, use 100 meters from the point of discharge when there are no sensitive aquatic ecosystems within this distance.	

Variable	South Africa (DWAF 2005)	Benguela Current Large Marine Ecosystem (BCLME 2006)	Australia/New Zealand (ANZECC 2000)	World Bank (World Bank 1998)	US Environmental Protection Agency (EPA 2006)
pH		Where an appropriate reference system(s) is available, and there are sufficient data for the reference system, the guideline value range should be determined as the range defined by the 20%ile and 80%ile of the seasonal distribution for the reference system. pH changes of more than 0.5 pH unit from the seasonal maximum or minimum defined by the reference systems should be fully investigated.			
Salinity	33 – 36 psu	Where an appropriate reference system(s) is available, and there are sufficient data for the reference system, the guideline value should be determined as the 20%ile or 80%ile of the reference system(s) distribution, depending upon whether low salinity or high salinity effects are being considered. Test data: Median concentration for the period.	Low-risk trigger concentrations for salinity are that the median (or mean) salinity should lie within the 20%ile and 80%ile of the ambient salinity distribution in the reference system(s). The old salinity guideline (ANZECC 1992) was that the salinity change should be <5% of the ambient salinity.		

Variable	South Africa (DWAF 2005)	Benguela Current Large Marine Ecosystem (BCLME 2006)	Australia/New Zealand (ANZECC 2000)	World Bank (World Bank 1998)	US Environmental Protection Agency (EPA 2006)
Total Residual Chlorine	No guideline, however, deleterious effects recorded for concentrations as low as 2 – 20 µg/ ℓ. A conservative trigger value is <2 µg/ℓ.	3 µg Cl/ℓ measured as total residual chlorine.	3 µg Cl/ℓ measured as total residual chlorine (low reliability trigger value at 95% protection level, to be used only as an indicative interim working level) (ANZECC 2000).	0.2 mg/ℓ at the point of discharge prior to dilution.	Long-term and short-term water quality criteria for chlorine in seawater are 7.5 µg/l and13 µg/l, respectively.
Dissolved Oxygen	For the west coast, the dissolved oxygen should not fall below 10 % of the established natural variation. For the south and east coast the dissolved oxygen should not fall below 5 mg/ℓ (99 % of the time) and below 6 mg/ℓ (95 % of the time).	Where an appropriate reference system(s) is available, and there are sufficient data for the reference system, the guideline value should be determined as the 20%ile of the reference system(s) distribution. Where possible, the guideline value should be obtained during low flow and high temperature periods when DO concentrations are likely to be at their lowest.	Where an appropriate reference system is available, and there are sufficient resources to collect the necessary information for the reference system, the median lowest diurnal DO concentration for the period for DO should be >20%ile of the ambient dissolved oxygen concentration in the reference system(s) distribution. The trigger value should be obtained during low flow and high temperature periods when DO concentrations are likely to be at their lowest.		

Variable	South Africa (DWAF 2005)	Benguela Current Large Marine Ecosystem (BCLME 2006)	Australia/New Zealand (ANZECC 2000)	World Bank (World Bank 1998)	US Environmental Protection Agency (EPA 2006)
Nutrients	Waters should not contain concentrations of dissolved nutrients that are capable of causing excessive or nuisance growth of algae or other aquatic plants or reducing dissolved oxygen concentrations below the target range indicated for dissolved oxygen (see above)	Nutrient concentrations in the water column should not result in chlorophyll a, turbidity and/or dissolved oxygen levels that are outside the recommended water quality guideline range (see above). This range should be established by using either suitable statistical or mathematical modelling techniques. Alternatively, where a modelling approach may be difficult to implement, nutrient concentrations can be derived using the Reference system data approach: Where an appropriate reference system(s) is available and there are sufficient data for the reference system, the guideline value should be determined as the 80%ile of the reference system(s) distribution.	Default trigger values of PO4-P: 100 µg/ℓ NOx-N: 50 µg/ℓ NH4+-N: 50 µg/ℓ for the low rainfall southern Australian region (Table 3.3.8 in ANZECC 2000)		

Variable	South Africa (DWAF 2005)	Benguela Current Large Marine Ecosystem (BCLME 2006)	Australia/New Zealand (ANZECC 2000)	World Bank (World Bank 1998)	US Environmental Protection Agency (EPA 2006)
Chromium	8 µg/ℓ (as total Cr)	Marine moderate reliability trigger value for chromium (III) of 10 µg./ℓ with 95% protection Marine high reliability trigger value for chromium (VI) of 4.4 µg/ℓ at 95% protection.	Marine moderate reliability trigger value for chromium (III) of 10 µg./ℓ with 95% protection Marine high reliability trigger value for chromium (VI) of 4.4 µg/ℓ at 95% protection.	0.5 mg/ℓ (total Cr) for effluents from thermal power plants	1 100 µg/ℓ for highest concentration at brief exposure without unacceptable effect 50 µg/ℓ highest concentration at continuous exposure without unacceptable effect
Iron			Insufficient data to derive a reliable trigger value. The current Canadian guideline level is 300 µg/ℓ	1.0 mg/ℓ for effluents from thermal power plants	
Molybdenum			Insufficient data to derive a marine trigger value for molybdenum. A low reliability trigger value of 23 µg/ℓ was adopted to be used as indicative interim working levels.		
Nickel	25 µg/ℓ (as total Ni)	<70 µg/ℓ	7 µg/ℓ at a 99% protection level is recommended for slightly-moderately disturbed marine systems.		74 µg/ℓ for highest concentration at brief exposure without unacceptable effect

Variable	South Africa (DWAF 2005)	Benguela Current Large Marine Ecosystem (BCLME 2006)	Australia/New Zealand (ANZECC 2000)	World Bank (World Bank 1998)	US Environmental Protection Agency (EPA 2006)
					8.2 µg/ℓ highest concentration at continuous exposure without unacceptable effect

a The World Bank guidelines are based on maximum permissible concentrations at the point of discharge and do not explicitly take into account the receiving environment, i.e. no cognisance is taken of the fact of the differences in transport and fate of pollutants between, for example, a surf zone, estuary or coastal embayment with poor flushing characteristics and an open and exposed coastline. It is for this reason that we include in this study other generally accepted Water Quality guidelines that take the nature of the receiving environment into account.

b The ANZECC (2000) Water Quality guideline for salinity is less stringent than, but roughly approximates, the South African Water Quality guideline that requires that salinity should remain within the range of 33 psu to 36 psu (=ΔS of approximately 1 psu). Scientific studies have shown that effects on marine biota are primarily observed for increases of >4 psu above ambient level. ΔS 1 psu and 4 psu have been chosen for assessment purposes.

c In case of chlorine "shocking", which involves using high chlorine levels for a short period of time rather than a continuous low-level release, the target value is a maximum value of 2 mg/ℓ for up to 2 hours, not to be repeated more frequently than once in 24 hours, with a 24-hour average of 0.2 mg/ℓ (The same limits would apply to bromine and fluorine.).

Every six months, laboratory samples should be taken from the intake pipeline, the brine discharge pipeline and the brine sampling point at the edge of the predicted mixing zone and sent for testing and analysis to confirm that the plant is operating within its expected design parameters and to confirm that the chemical profile of the discharge roughly match the expected values and that the rate of dilution is occurring as predicted. These results should be communicated to the Ministry of Fisheries and Marine Resource. The following provisional water quality standards for Namibia have been provided. The laboratory should test for all criteria contained in the guidelines in the tables to follow.

The water quality at the edge of the mixing zone should comply with the guidelines and the provisional standards provided below.

Special Water Quality Standards for Effluents

Criteria	Proposed Special Water Quality Standards for Effluents
Turbidity	<5 NTU
Colour	<10%
Suspended solids	<25 mg/l
TDS	<500 mg/l above the intake potable water quality
pH	6.5- 9.5
Temp	± 1ºC of ambient
Nitrate as N	< 15 mg/l (as N)
Nitrite as N	<2 mg/l
Fluoride (F)	< 1 mg/l
Na	<50mg/l above the intake potable water quality
Ca	-
Mg	-
K	-
Chloride as Cl	<40mg/l above the intake potable water quality
Alkalinity as CaCO3	Not specified
Hardness as CaCO3	Not specified
Sulphate as SO4	<20mg/l above the intake potable water quality
Iron as Fe	<200 µg/l

The O&M Contractor shall monitor and report changes in shoreline dynamics around the seawater intake or brine discharge structures. Should these changes persist for more than a few months or appear to be rapidly changing, the O&M Contractor shall inform HDF Energy, who should consult with a specialist and determine if the change is associated with the structures and secondly if an intervention is required. Where interventions are required that may require earthworks or other construction activities, the provision made under the construction phase of this EMP shall apply.

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