

**Cleanergy Green Hydrogen
Demonstration Plant (GHP) Walvis Bay,
Namibia: Environmental Impact
Assessment:**

**Archaeological and Heritage Specialist
Study**

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Executive Summary

A site visit and an archaeological heritage assessment was carried out on the Cleanergy Green Hydrogen Demonstration Plant (GHDP) to be located behind the Dune 7 recreational facility at Walvis Bay, Namibia between 16-18th August 2022 as part of the overall environmental impact assessment study. This is in effort to identify, assess potential sensitive heritage resources, establish their heritage significances and devise mitigation and management measures towards their preservation. The assessment report aims to assist the client in obtaining a consent from the National Heritage Council (NHC), (**the competent Authority**) under the provisions of the National Heritage Act, (27 of 2004) for the project to proceed with the proposed development and operation of the Cleanergy GHDP project and its associated infrastructure development including access road and a water utility. The proposed area has been extensively disturbed due to a considerable legacy of damage associated with infrastructure development emanating from roads (including new alignments with bridges), railway works and associated groundworks i.e., service road, telecommunications, and utility facilities between Walvis Bay and Swakopmund. This is, in addition to an unregulated recreational activity observed in the area such as off- road driving and quad-biking.

The physically examination and assessment revealed no significant nor sensitive heritage resources relevant in terms of the National Heritage Act, (No. 27 of 2004). This is despite extensive detailed archaeological research undertaken in the Walvis Bay dunefields, which has produced a rich repertoire of archaeological sites with abundant evidence dating from the Pre-Holocene period including detailed historical data from the last 250 years (see Avery 1984; Kinahan 1991; Kinahan 2000; Morse *et al.*, 2013; Bennett *et al.*, 2014 and Detroit & Nankela 2014). None of these sources, however, suggest that the proposed GHDP site is in any way archaeologically sensitive. The data presented here is therefore deemed sufficient, as a basis of the assessment. Consequently, one can confidently assume, with a degree of confidence that the current or proposed development pose no threats to the heritage resources. Therefore, it is recommended that a consent relevant to the provisions of the National Heritage Act, (27 of 2004) is issued to the proponent to enable the project to proceed. However, the proponent is cautioned of possible significant hidden, or buried heritage remains that might be exposed during constructions as the project proceeds. Hence, a devised Chance Find Procedure must be adopted.

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1 Introduction

1.1 Background

In 2021, a joint venture was established between the Ohlthaver & List Group of Companies (Namibia's largest privately held group of companies) and CMB.TECH (a Belgian owned company working towards the development of large marine and industrial applications for hydrogen). The joint venture, Cleanergy Solutions Namibia (Pty) Ltd, aims to be the first company in Namibia to produce commercial grade hydrogen from water, utilising renewable energy sources.

Cleanergy Solutions Namibia (Pty) Ltd (henceforth referred to as either the proponent or Cleanergy) appointed SRK Consulting (South Africa) (Pty) Ltd (hereafter referred to as SRK) to facilitate the Environmental Impact Assessment (EIA) process for the proposed pilot site, also referred to as the Green Hydrogen Demonstration Plant (GHDP).

The proposed GHDP will be located outside Walvis Bay on Farm 58 (in the new industrial zone), near the Walvis Bay International Airport and Dune 7 (inland to the Dune), to the East of the new Walvis Bay-Swakopmund highway (D1984). The total size of the area to be developed will be approximately 26 hectares (ha).

Main components of the GHDP will include:

- Five (5) Megawatts-peak (MW_p) solar Photovoltaic (PV) plant, with tracker configuration covering an area of 15 ha;
- Five (5) Megawatt (MW) battery energy storage system;
- Five (5) Megawatt (MW) Polymer Electrolyte Membrane (PEM) electrolyser;
- Three (3) 45kg/hr hydrogen compressors to densify the hydrogen gas for storage;
- Hydrogen buffer tanks and storage tanks (40 bar/300 bar/500 bar);
- Two (2) 350bar hydrogen dispensers for refuelling heavy duty vehicles
- Two (2) 500bar hydrogen tube trailer filling station;
- Two (2) air compressors and Nitrogen generators installed in a 40 foot container
- Water storage tanks with a total capacity of 400 cubic-meters; and
- Information centre/building, which will also be used for training and operations.

The following secondary infrastructure will also be required:

- Access road;
- Water connection (pipeline connecting to main NamWater supply); and
- Grid connection (ErongoRed).

It should be noted that the grid connection will also require an Environmental Clearance Certificate (ECC), but that the process will be managed outside the current application due to some minor technical components which still need to be finalised and the fact that responsibility for complying with the requirements of the ECC will fall within the ambit of ErongoRed.

The demonstration project will be started at a 5 MW scale to:

- Evaluate the efficiency of current available technology within the Namibian context;

- Develop the required skills and competencies locally to operate and maintain the demonstration and possible commercial plant, as well as to share the necessary knowledge to allow for the conversion of existing equipment to allow for the utilisation of hydrogen as a fuel; and
- Develop an offtake for the green hydrogen locally (thus providing additional benefit to the country) to ensure multiple markets for the final product e.g., by converting heavy vehicles used in mining and within the port area to dual fuel vehicles.

One of the critical components of the demonstration plant will be the training centre, with course content being developed along with local vocational training and academic institutions, in order to ensure that the long-term staffing needs of the pilot and commercial facilities can be met.

SRK Consulting (Pty) Ltd has been appointed by Cleanergy as an Independent Environmental Assessment Practitioner (EAP), to compile an application for an ECC and to conduct an EIA process together with the associated stakeholder engagement in terms of the Environmental Management Act (Act No. 7 of 2007) (EMA) and the associated Regulations (GN. R 28 of 2012) for the proposed GHDP. The public participation process will be undertaken in terms of Regulation/Part 21 of EMA.

Development and operation of the proposed Cleanergy GHDP is subject to the application and granting of an ECC in terms of Regulation/Part 6 of the EMA by the Ministry of Environment, Forestry and Tourism (MEFT).

Peter Cunningham (t/a Environment & Wildlife Consulting, Namibia) was appointed to undertake a Biodiversity – i.e., Vertebrate fauna & flora specialist study of the Cleanergy GHDP project to inform the EIA process.

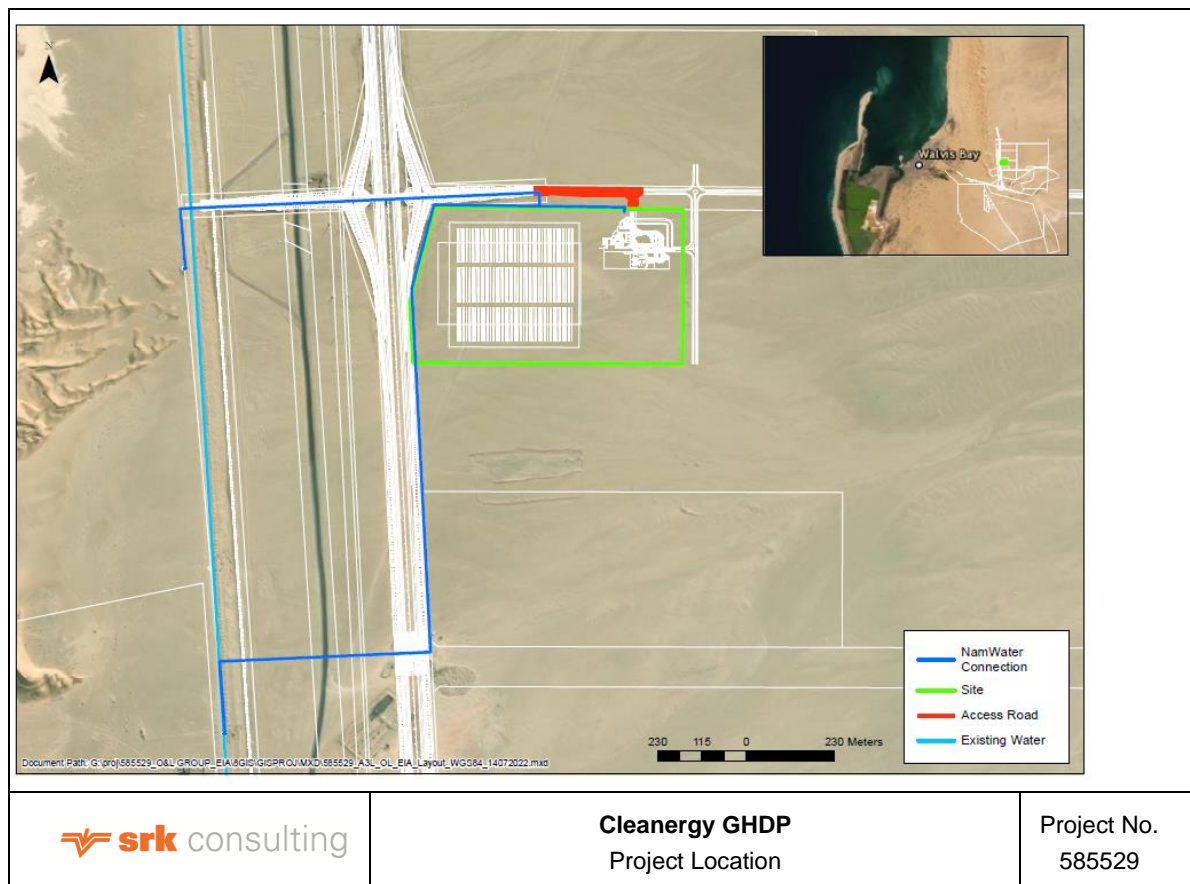


Figure 1: Location of the Cleanergy GHDP within Walvis Bay, Namibia

1.1 Project Description

Cleanergy is proposing to construct a 5 MW GHDP in Walvis Bay, Namibia. The total size of the plant will be approximately 24 ha and the extent of the different project components are as follows:

- Solar PV plant with an output of 5 MW_p, with tracker configuration covering an area of 15 ha;
- A 5 MW PEM electrolyser (electrolyser systems with a capacity of producing 90 kg of hydrogen per hour. This system will be installed in two 40 feet (12.192 m long x 2.438 m wide x 2.591 m high) containers;
- Hydrogen compressor(s) with a combined capacity of 135 kg/h (1500 Nm³/h) at 40 bar inlet pressure to densify the hydrogen gas for storage. The compressors will be installed in three (3) 10 feet containers;
- Hydrogen buffer and storage tanks:
 - Low pressure hydrogen buffer tank at 40 bar with a volume of 40 m³;
 - Medium pressure hydrogen storage tank at 300 bar; and
 - High pressure hydrogen buffer storage tank at 500 bar for distributing hydrogen for refuelling heavy duty vehicles and filling Multiple Elements Gas Container(MEGC) trailers;
- Hydrogen fuelling station covering an area of approximately 335 m²:
 - Two (2) 350bar hydrogen dispensers for refuelling heavy duty vehicles; and
 - Two (2) 500bar hydrogen tube trailer filling station;
- Five (5) Megawatt (MW) battery energy storage system;
- Two (2) air compressors and Nitrogen generators installed in a 40-foot container;
- Water storage tanks with a total capacity of 400 cubic meters; and
- Information centre/building covering an area of approximately 2 605 m².

The following secondary infrastructure will also be required:

- Access road of approximately 280 meters covering an area of approximately 4 364 m²;
- Water connection (pipeline connecting to main NamWater supply), with a length of approximately 3 392 m; and
- Grid connection (ErongoRed).

It should be noted that the grid connection will also require an ECC, but the process will be managed outside the scope of this process.

The demonstration project will be started at a 5 MW scale to:

- Evaluate the efficiency of current available technology within the Namibian context;
- Develop the required skills and competencies locally to operate and maintain the demonstration and possible commercial plant, as well as to share the necessary knowledge to allow for the conversion of existing equipment to allow for the utilisation of hydrogen as a fuel; and
- Develop an offtake for the green hydrogen locally (thus providing additional benefit to the country) to ensure multiple markets for the final product e.g., by converting heavy vehicles used in mining and within the port area to dual fuel vehicles.

One of the critical components of the demonstration plant will be the training centre, with course content being developed along with local vocational training and academic institutions, in order to ensure that the long-term staffing needs of the pilot and commercial facilities can be met. Cleanergy thus wants to commence with the construction of the training centre as soon as possible, in order to ensure that the necessary skills and competencies become available.

Please refer to Figure 2 for an illustration of the Cleanergy GHDP Project.



Figure 2: Project illustration

1.1.1 Solar Photovoltaic Plant

The solar PV plant technology as considered by Cleanergy is a high-quality, single axis, horizontal tracking, bifacial photovoltaic power plant. The power plant will be fully designed according to local and international standards. This includes Tier 1 bifacial PV modules, inverters as well as a high-quality tracking system specifically selected to withstand the local environment conditions close to the coast. Furthermore, a fully integrated monitoring system as well as a weather station will be installed for optimal plant performance and monitoring, forecasting and downtime control.

Key equipment technologies associated with the solar PV plant are described below.

Bifacial PV Modules

Cleanergy is proposing to utilize crystalline module technology due to its bankability and reliability. Compared to thin film technology, crystalline modules build up the major share (close to 90%) of all 177 GW installed PV capacity worldwide. Monocrystalline technology has a proven operational track record over the last four decades and power degradation values are well known. Therefore, the long-term performance bares significantly less risk than with the much younger thin film technology.

Based on the strong increase of bifacial installation in the last couple of years, we consider the advantages of bifacial monocrystalline modules for the respective PV Plants. Bifacial modules are further developed crystalline silicon modules, which are active on the front and the rear side. Due to ground reflection of radiation, they additionally use the light on the back side. The higher the albedo, the more irradiance reaches the rear surface of the module and the more the yield increases. CRONIMET is working with Tier 1 supplier companies for highest reliability and guarantees. The PV

modules standard is a 10-year limited product warranty and a 30-year peak power warranty. Figure 7 indicates a typical module from Canadian Solar.

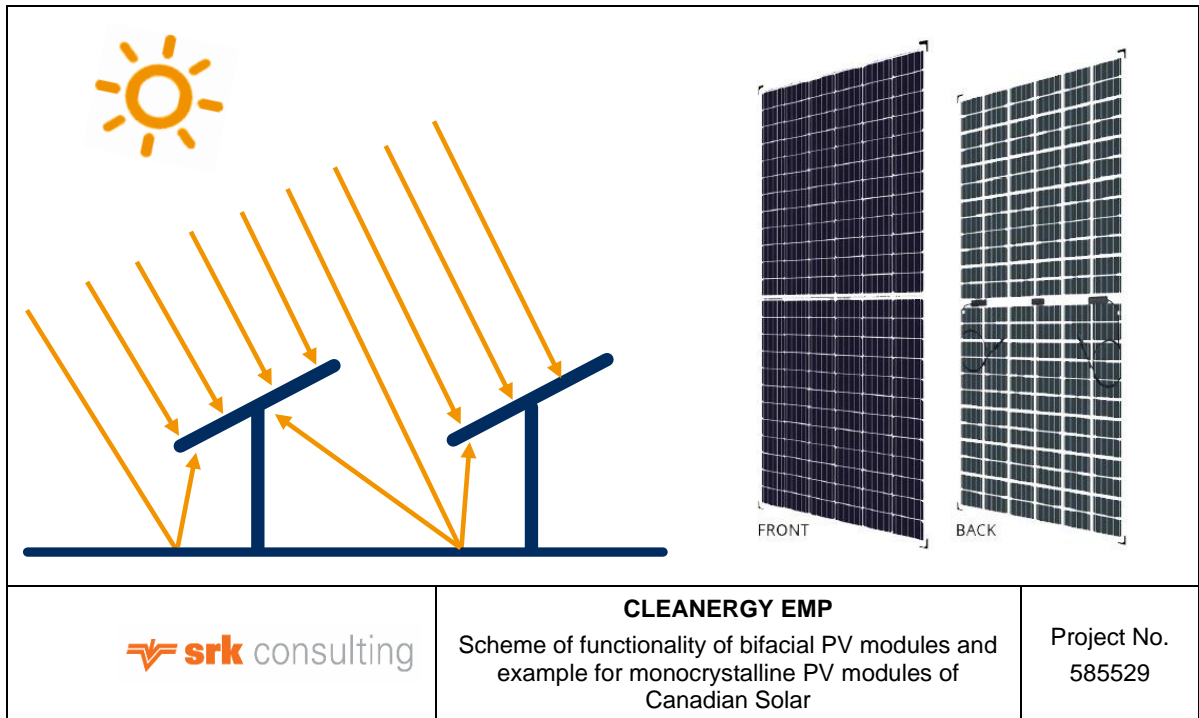


Figure 3: Scheme of functionality of bifacial PV modules and example for monocrystalline PV modules of Canadian Solar

Inverters

For the inverters, Cleanergy is proposing decentralized Tier 1 inverters for the power plant. The following figure shows decentralized inverter solutions from the top tier suppliers such as Huawei to guarantee highest performance and energy output combined with its high reliability which ensures minimum downtime and low O&M costs. The inverters come with a standard 5-year factory warranty. Our proposed inverter is the Huawei SUN2000 215kTL as illustrated in Figure 4 which has been in operation in some of the extreme conditions at our plants in Namibia.



Figure 4: Decentralised 215 kW Inverter from Huawei

Photovoltaic Tracking System

As there are no constraints in available area and shape, Cleanergy proposes a single axis PV tracking solution (Figure 5). The PV Power Plant's electrical output increases as the system upgrades from the fixed tilt to single tracking system and with only marginal onetime capex and yearly operating and maintenance cost increases. Depending on the site and precise characteristics of the solar irradiation, bi-facial trackers may increase the annual energy yield by up to 20% for single-axis tracker as it can be seen in the table below. Cleanergy proposes to utilize the Schletter Single Axis Tracking system designed specifically for this Class 4 environmental corrosion conditions. Cleanergy have also procured and installed trackers from major suppliers like Exosun and Lumax. Beforementioned suppliers offer very durable solutions, and long warranty periods.

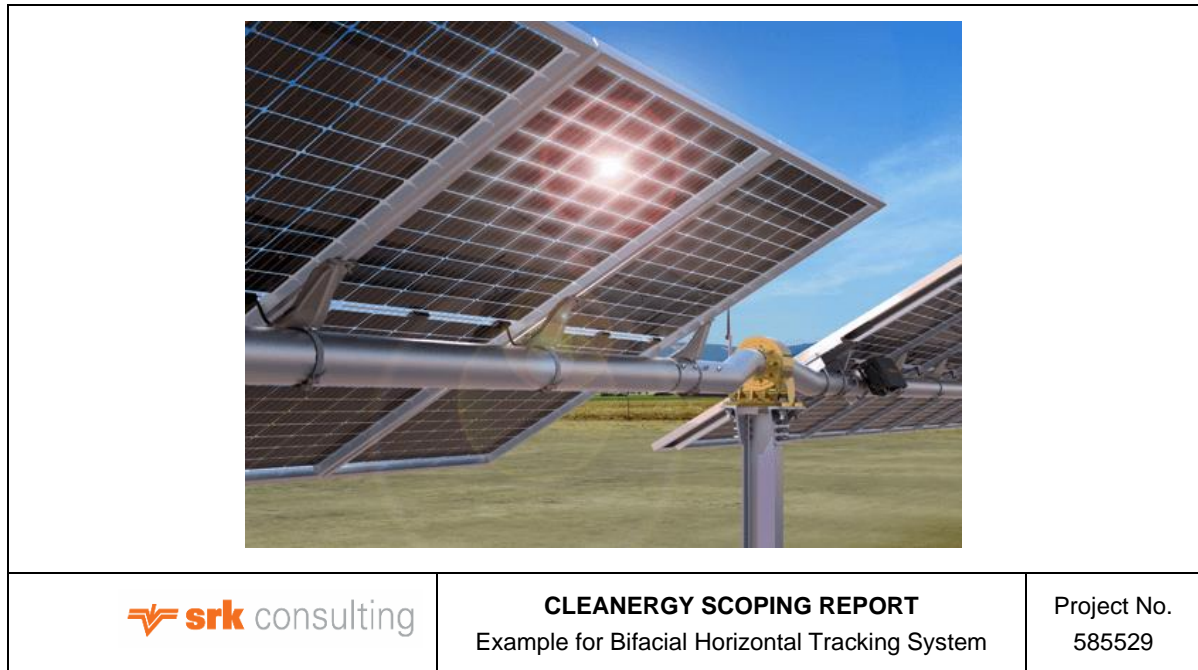


Figure 5: Example for Bifacial Horizontal Tracking System

Summary of Components Data

Table 1 summarises the offered Power Plant information data and its equipment data and ratings.

Table 1: GHDP PV Plant Technical Specifications

Technical Specifications of the PV Plant	
Plant Data	
Module Technology	Bifacial polycrystalline
Inverter Topology	Decentralized
Racking System	Horizontal Bifacial Single Axis, East-West Tracking
PV Module Data	
Supplier	Canadian Solar or Similar (Tier One)
Type	CS3U-370MB
Nominal Power	520 Wp
Efficiency	20.2 %
Warranty	10 years product warranty 30 years peak power warranty
Inverter Data	

Technical Specifications of the PV Plant	
Supplier	Huawei or Similar (Tier One)
Type	SUN2000 110kTL
Nominal Power	215 kW
Euro Efficiency	98.6 %
Output	400V 3 Phase
Warranty	5 years factory warranty
Racking System	
Supplier	Schletter or Similar (Tier One)
Type	Single Axis Tracker
Table Inclination (Both sides)	60°
Slope Gradient	10°
Wind Speed	Maximum operating wind speed of 60km/h; up to 290km/h in the security(stow) position.
Material	H4 Material Specification in order to withstand class 4 corrosion conditions.

Battery Energy Storage System (BESS)

The leading technology for stationary large-scale energy storage application are containerized Li-Ion Storage Systems (Figure 6). This solution is offered by several manufacturers such as Huawei, ABB, mtu or Tesla. The representative system comprises Li-Ion battery racks, each containing typically 480 MCN cells, combined in Battery Modules and controlled by a Battery Management System, including switchgear. The batteries cells are usually supplied by leading manufacturers like SAMSUNG, LG Chem or Panasonic and will perform at 80% of initial capacity after 4000 cycles with an assumed D.O.D (Depth of discharge) of 80%. The main advantage of Li-Ion storage compared to other technologies is its high roundtrip efficiency of around 88%, consequently PV loss due to battery charging is kept to a minimum. Operation and maintenance costs do not occur for this type of battery; however, lifetime is limited to the above discussed 4000 cycles which corresponds to about ten to fifteen years of operation.

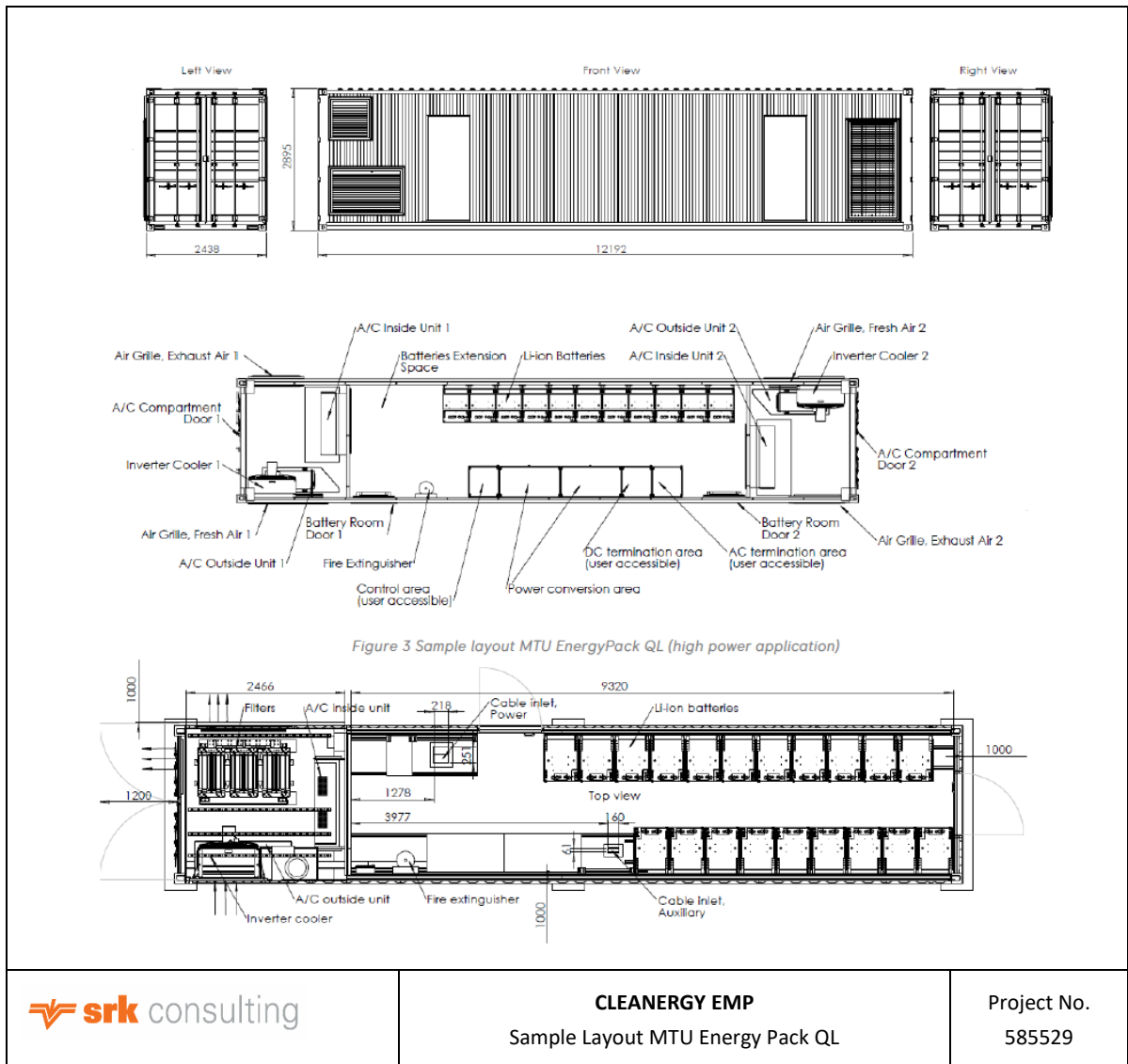


Figure 6: Sample Layout MTU EnergyPack QL

O&L Nexentury has successfully built large-scale Li-Ion battery systems in previous projects. Depending on further specifications, O&L Nexentury proposes a fixed ground-mounted bifacial layout with a state-of-the-art Li-Ion BESS.

1.1.2 Green Hydrogen Demonstration Plant

Figure 7 illustrates the key components of the 5 MW GHDP.

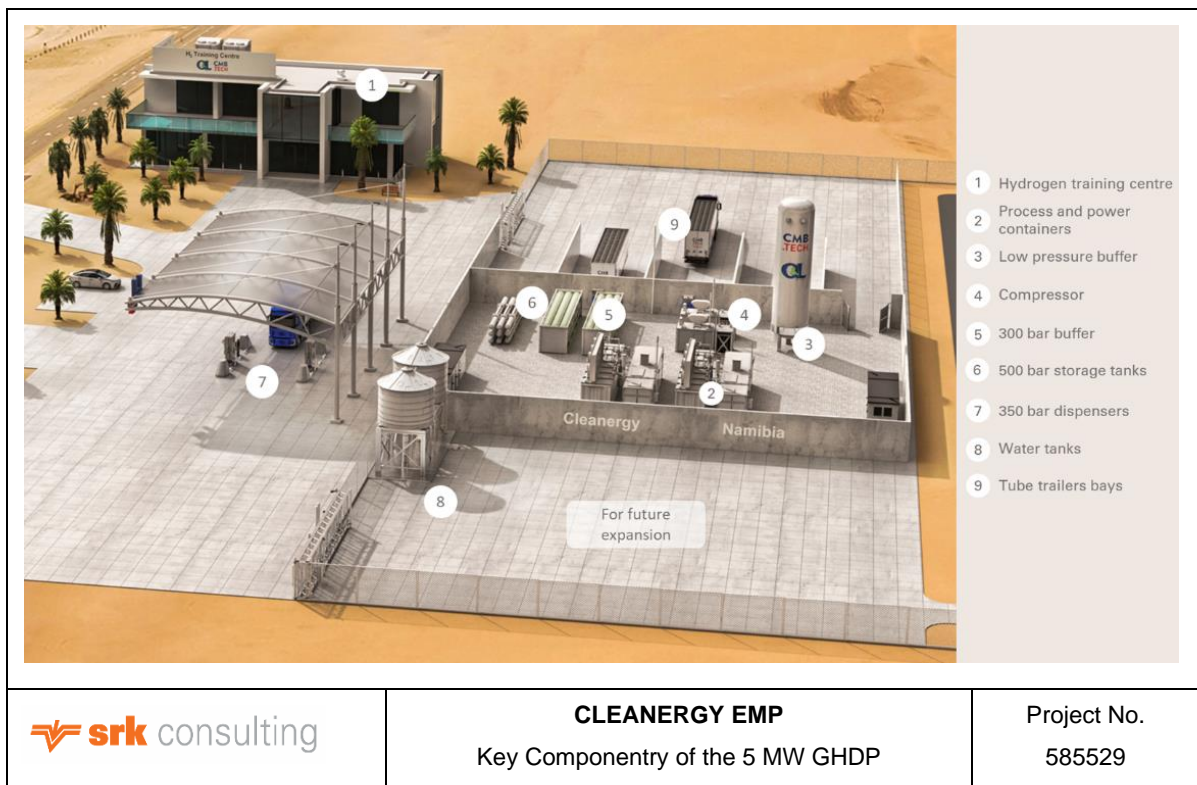


Figure 7: Key Componentry of the 5 MW GHDP

Hydrogen System

For the demonstration project, Cleanergy Solutions Namibia will be using the state-of-the-art electrolyser for the production of green hydrogen using solar panels as energy source. To deliver hydrogen to end-customers, hydrogen molecules need to be produced, then purified, compressed, and stored at the right pressure. All the equipment will be fully containerised to safely produce purified hydrogen from on-site water and power utility inputs.

Electrolyser

The site will be equipped with a 5 MW PEM electrolyser. The electrolyser is the key component for producing green hydrogen. It uses electricity to break water molecules into hydrogen and oxygen in a process called electrolysis (Figure 8).

This hydrogen production equipment called, a PEM electrolyser, consists of two electrodes, an anode and a cathode, and a semi-permeable membrane. Water molecules enter at the anode side and are split, when an electrical current is applied on the cell stack, into oxygen (O_2), hydrogen ion (H^+) (proton) and two electrons. The protons flow through the membrane and form hydrogen at the cathode side through the combination of two protons and two electrons (Figure 8).

The produced oxygen gas is released to the atmosphere or can be captured and processed for industrial processes or even medical gases in some cases.

The hydrogen gas is then purified to meet the required quality standards.

The electricity will be provided by the solar park which is located next to the hydrogen production site. As the electrolyser requires Direct Current (DC) power, a power container will be installed next to the electrolyser. This power container is equipped with transformers and rectifiers to deliver the desired voltage to the electrolyser cell stack.

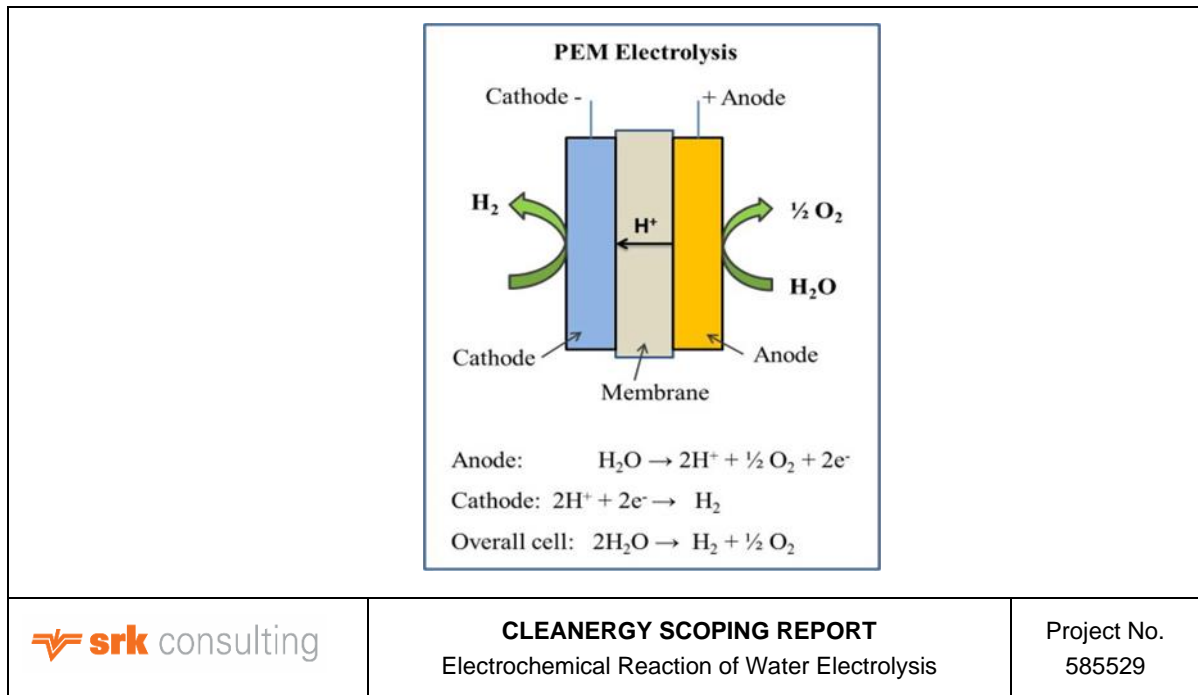


Figure 8: Electrochemical Reaction of Water Electrolysis (Kumar & Himabindu, 2019)

The electrolyser system is divided into 2 parts:

- Power container: The 40 feet container is equipped with transformers and rectifiers; and
- Process and utility containers: Two (2) 40 feet containers consist of one 5x 1 MW PEM electrolyser cell stack, water and hydrogen purification system, cooling system, instrumentation, and control system.

Table 2: PEM Electrolyser Specifications

Capacity	5 MW
H ₂ production at max. power	90 kg/h
Outlet pressure	40 bar
Total anticipated water consumption	1.2 m ³ /h
Footprint	Global footprint of 200 m ² divided into: One (1) 40 feet container: power container Two (2) 40 feet containers stacked on each other for the hydrogen production

Compressor

Once the hydrogen molecules are produced and purified, these are compressed to increase their energy density in order to facilitate the storage thereof. The site will be equipped with three compressors to increase the pressure of the hydrogen gas up to 500 bar.

The Piston technology is chosen for the project, a piston compressor is mainly composed of one hydraulic cylinder and two gas cylinders (Figure 9). A steel rod connects the oil piston with two gas pistons. The pressure of the oil on the oil piston moves the connecting rod and gas is compressed in the gas cylinders by the gas pistons. The only moving part is the connecting rod. With this simple construction all forces are applied towards the same direction and are balanced by the hydraulic oil. Two sets of seals (one on the gas and one on the oil side) ensure that the hydrogen molecules are not contaminated by other fluids.

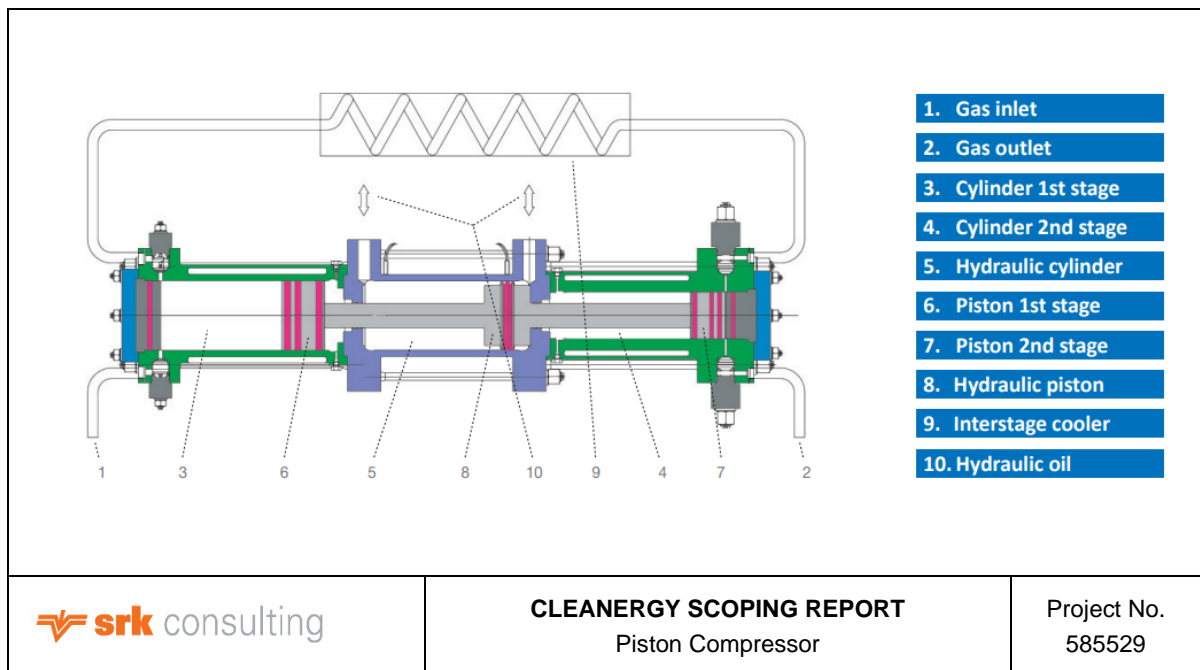


Figure 9: Piston Compressor (Hofer, n.d.)

To ensure redundancy, three compressors will be installed. Each compressor has the capacity of 50% of the total required capacity, thus three times 50%. During normal operations, two systems will be in use whilst one system serves as a spare. Each compressor will have a maximal hydrogen flow of 45 kg/h.

Storage

A 40-bar buffer is placed between the electrolyser and the compressors to overcome the time to start the electrolyser and the possibility to run the compressor in partial mode. This buffer consists of one big, Type I, steel cylinder placed vertically. The capacity of the 40-bar buffer is 40 cubic-meters.

Hydrogen will be stored at 300 bar and 500 bar. To ensure safe and continuous delivery of hydrogen, the site will have a capacity of about 2 days of production distributed between 300 bar and 500 bar. The total capacity of the 300-bar buffer is 60 cubic-meters installed in two standard 40 foot MEGC containers composed of horizontally aligned Type IV cylinders. Type IV cylinders are made of a polymer liner wrapped in carbon fibres or glass fibres. This technology ensures a low weight and high storage pressure.

The total capacity of the 500bar storage is 12.6 cubic meters, composed of vertically aligned Type IV cylinders installed in stillages.

Hydrogen Refuelling Station

One dual dispenser (1x TK16 & 1x TK16 HF) for heavy duty vehicles will be installed. The discharge pressure for fuelling equals 350 bar (Figure 10). This dual dispenser is designed according to the safety and operation protocols specified in SAE hydrogen refuelling standards.

The demonstration plant will also have a 500-bar mobile refueller for transporting hydrogen from the production site to locations where it will be needed for refuelling heavy duty applications. Following are the potential CMB.TECH projects in Namibia which will require refuelling in the field.

- Tugboat for Namport;
- Heavy duty mining dump truck;
- Port equipment;

- Locomotive for TransNamib/Traxtion;
- Trucks for long distance road transport; and
- Gensets.

Table 3: Fuelling Base Case

Number of vehicles	10 per day
Maximum per vehicle	30 kg (heavy duty truck)
Average fill per vehicle	20 kg
Throughput per day	200 kg
Maximum fuelling time	Max. 15 minutes
Maximal fuelling in sequence	Two parallel fuelling possible

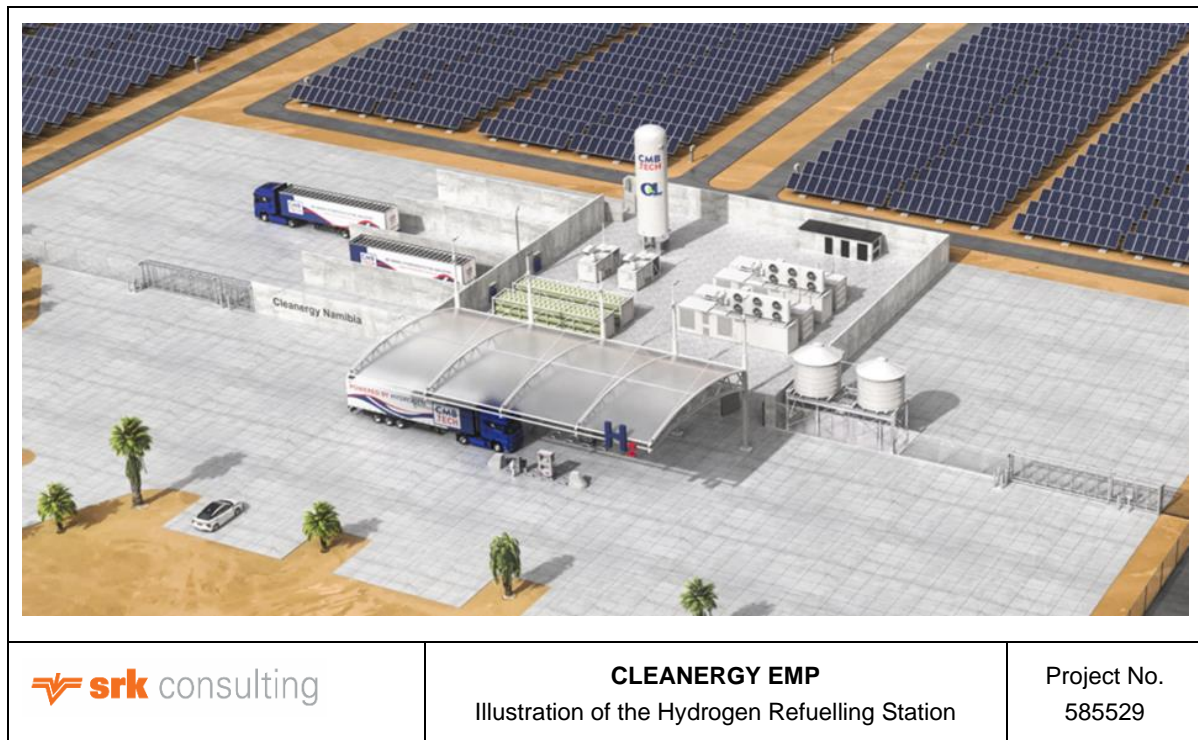


Figure 10: Illustration of the Hydrogen Refuelling Station

Effluents/Emissions from the GHDP Electrolyser

Effluent from the GHDP electrolyser should be suited to run into the sewer without requiring additional treatment. These effluents will be generated from the following sources:

- Water purification;
- Condensate from condensate trapes, chiller and the dryer;
- Air compressor (oil free type) and dryer; and
- Other sources not specified.

Emissions to air include:

- Gaseous hydrogen releases routed out to atmosphere at a safe location by means of a central vent stack;
- Gaseous oxygen released to atmosphere; and

1.1.3 Access Road

It is noted that the Dune 7 interchange and service road to the heavy industrial zone needs to be completed in order to gain access site (Figure 12). Figure 13 illustrate the site entrance road proposed for the Cleanergy GHDP Project.

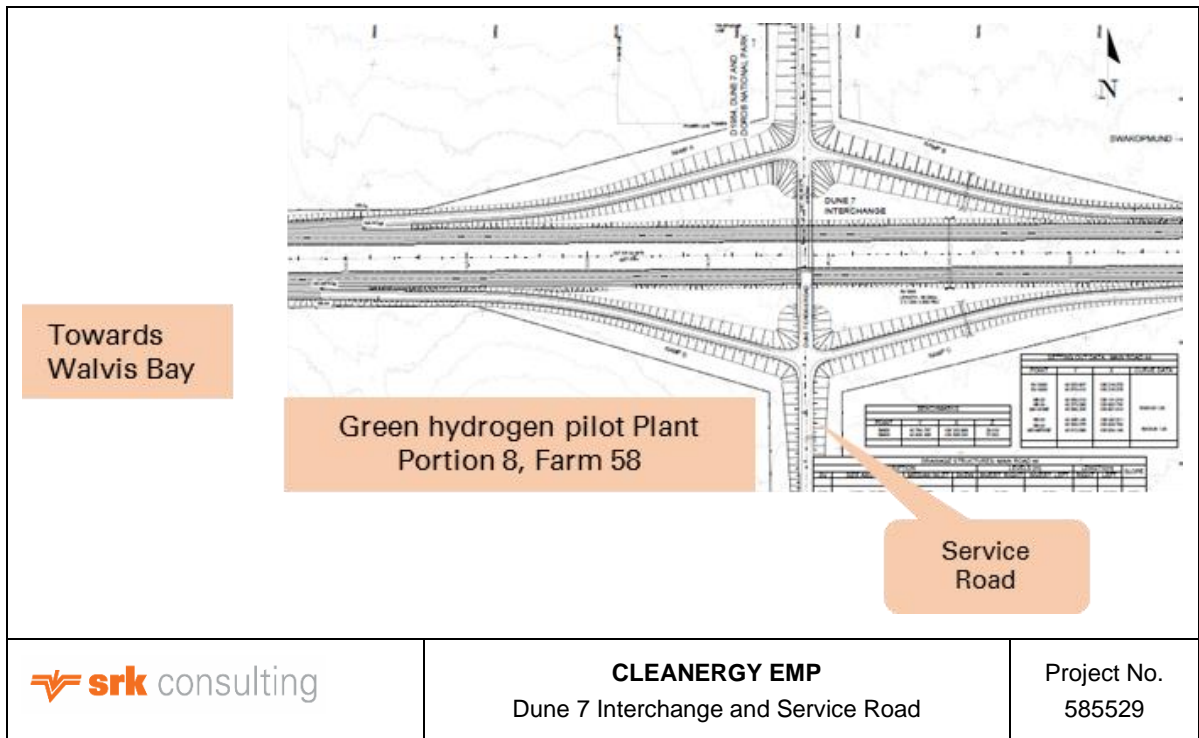


Figure 12: Dune 7 Interchange and Service Road

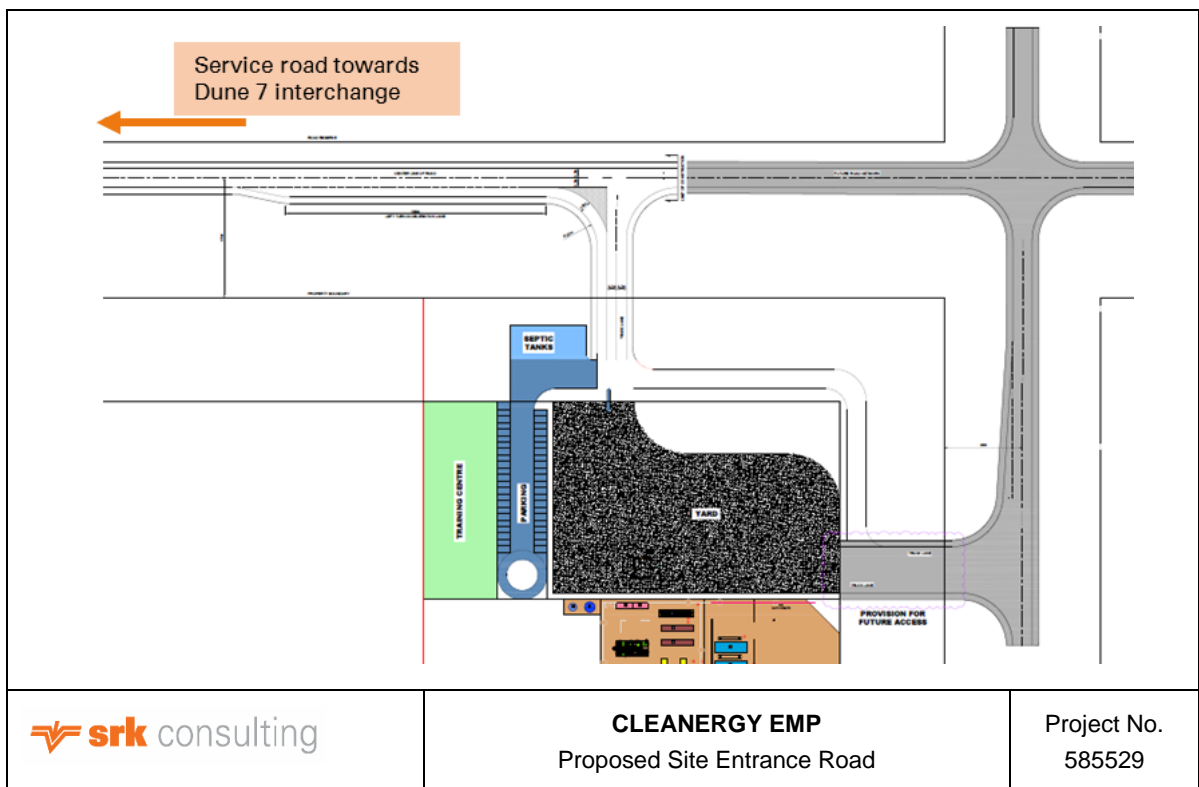


Figure 13: Proposed Site Entrance Road

1.1.4 Potable Water Pipeline Connection

At full load, the electrolyser requires 1200 litres (1.2 m³) per hour to produce 90 kg of hydrogen. Of this, 200 litres per hour will be rejected by the electrolyser's water treatment system. From this volume, 1 000 litres are effectively split into hydrogen and oxygen, while the rest is used as cooling water.

Depending on the season, Cleanergy will require between 10 and 14 m³ of potable water per day for hydrogen production. The extra water, can be used for different purposes including:

- Domestic/Sanitation;
- Growing plants on site; and
- Cleaning the solar panels.

The water which will be used in the process, is potable water to be supplied directly to site from municipality with a direct connection to the main water pipelines. The closest municipal water access point is approximately 1.5 km from the site. A new pipeline connection has to be established to have water access. To ensure safe operations and sustainable water usage, the option of a 400 m³ to 500 m³ water buffer tank will be envisaged.

1.1.5 Electrical Transmission

The Cleanergy GHDP Project requires grid connection to support night time operation and/or production. To kick-start the pilot project a minimum of 600 kiloVolt Ampere (kVA) grid power during night hours to support auxiliary system demands & training/office building.

To future proof the plant, it is necessary to have a 5 MVA grid connection, where surplus electricity from the PV could potentially be injected into the grid whilst off takers for the hydrogen are being developed. Once the hydrogen off-take base has been established, the 5 MVA grid connection can be used for producing hydrogen during night hours (by using surplus electricity).

As the connection to the grid will ultimately be the responsibility of ErongoRed, a separate EIA process will be undertaken to obtain an ECC for the connection to the ErongoRed grid.

1.1.6 Project Activities

Activities associated with the development and operation of the proposed Cleanergy GHDP Project is described in the following sections.

Site Preparation Phase

Site preparation activities will commence following the granting of the ECC. This Phase would include limited clearance of vegetation present on site, the installation of perimeter fencing, site levelling and preliminary earthworks. Thereafter the project site will be marked out, construction site offices set up and a temporary access road to site constructed.

Construction Phase

Once site preparation activities have been completed, the Construction Phase of the proposed Cleanergy GHDP Project will commence. Construction phase activities will include:

- Bulk earthworks;
- Layer works and surfacing of roads and hardstand areas;
- Installation of sub surface civil services such as water, sewer, fire and electrical networks;
- Construction of general storage facilities for water and sewage (complete);

- Excavation of cable and pipeline trenches;
- Ramming or drilling of the mounting structure frames;
- Installation of the PV modules onto the frames;
- Installation of measuring equipment;
- Laying of cables between the module rows to the inverter stations;
- Optionally laying of gravel or aggregate from nearby quarries placed in the rows between the PV panel array for enhanced reflection onto the panels, assisting in vegetation control and drainage;
- Construction of foundations for the inverter stations and installation of the inverters;
- Construction of the foundations for the hydrogen production electrolyzers, compressors, storage vessels, power container and hydrogen dispensing station;
- Construction of the substation and BESS foundations and installation of the substation components and placement of BESS;
- Construction of operations and maintenance buildings;
- Construction of refuelling station;
- Piping structure installation and piping interconnections between components;
- Cable structure installation and cabling interconnections between components;
- Undertaking of rehabilitation on cleared areas where required;
- Testing and commissioning;
- General fencing; and
- Removal of equipment and disassembly of construction camp.

It is noted that where possible, Cleanergy will source materials, plant and equipment from suppliers within the vicinity of the project area. The bulk of the specialist equipment, i.e., PV modules, inverters, BESS, substation components and BESS, etc, will be imported from China, Europe and/or South Africa and be shipped to Walvis Bay.

The construction phase of the proposed Cleanergy GHDP Project is estimated to take approximately 6-12 months.

Operational Phase

The proposed project will be operated on a 24-hour, 7 days a week basis. The operation phase of the proposed project will comprise the following activities:

- Operating of Training Centre which will include classrooms and workshops facility from where basic hydrogen knowledge to hands on experience can be delivered to various parties;
- Installation and testing of different green hydrogen technologies;
- Regular cleaning of the PV modules by trained personnel;
- Vegetation management under and around the PV modules to allow maintenance and operation at full capacity;
- Maintenance of all components including PV modules, mounting structures, trackers, inverters, substation transformers, BESS, and equipment;

- Office management and maintenance of operations and maintenance of buildings;
- Supervision of the solar PV facility operations;
- Supervision of the hydrogen production, storage and dispensing facilities;
- Site security monitoring;
- Executing storm water management plan;
- Managing sewage disposal; and
- General road/site maintenance.

Decommissioning Phase

Whilst the solar PV plant itself will have an anticipated life cycle of 25 years, the GHDP will only be in operation for as long as it is feasible. If decommissioned, the necessary approvals will be obtained before all components are to be removed and the site rehabilitated. Materials will be recycled where possible and where it is not possible to recycle the materials, these will be disposed of in accordance with local regulations and international best practice.

1.2 Terms of Reference (TOR)

This project functioned according to the following terms of reference for heritage specialist input:

1. Provide a detailed description of all archaeological materials and other heritage resources which may be affected by the project, if any.
2. Assess the nature and degree of significance of such resources within the area and immediate landscape.
3. Demarcate sensitive archaeological/heritage sites that will likely be found to guide the development process through establishing thresholds of impact significance.
4. Assess and rate any possible impact on the archaeological and other heritage resources within the area emanating from the proposed development activities.
5. Propose possible heritage management measures actions for the project to be considered by the authorities for the issuance of consent and thereafter clearance certificate.

1.3 Assumptions and Limitations

The archaeological heritage assessment is largely depended on the indicative of surface finds value recorded during the site visit and intensive field survey. These are supplemented by information yielded from available records harvested from a series of published materials, reports from similar projects undertaken in the surrounding areas and a cumulative database of all previous surveys. The records are further augmented by information obtained from local heritage and museum databases to establish a valid baseline against which to assess potential impacts. Therefore, field survey is a critical component that helps to establish the nature and extent of the visible remains to enhanced suite of interpretations.

The general lack of vegetation in the proposed GHDP site contributed to the greater visibility of the surface area which allowed intensive survey to identify possible surface remains on the terrain. The survey primarily focused on the site and its surrounding areas tentatively identified as sensitive and of heritage probability (i.e. those noted during the mapping and satellite survey through use of available satellite imagery - Google Earth). In terms of on-site limitations during the survey, the following should

be noted: (1) the project area is accessed via a C14 road due to the current upgrades of the D1984 road that connects Walvis Bay and Swakopmund or through the D1984 two bridges (also recently completed) (**Figure 4**). Access control is therefore applied to the area for safety. No access restrictions onto the GHDP site were encountered during the site visit and field survey (August 2022). (2) the proposed GHDP site is a highly dynamic environment, with very strong prevailing winds, morning fogs which not only reduce visibility of the surface artefacts but also dislocate them (if they exist), making it difficult to preserve, locate and or to document them. Although all possible care is taken to identify sites of heritage significance during the investigation of the area, it is always possible that hidden or subsurface remains could be overlooked during the survey.

Therefore, the Chance Find Procedure Guidelines from the National Heritage Council (2017) must be adopted.



Figure 14: An access route through two bridges. Image credits: (RCHS, August 2022).

1.4 Guidelines

1.4.1 Guideline 1: Guidelines Heritage Permits in Namibia, NHC.

All heritage impact assessment studies in Namibia conducted on public and private land whether declared or undeclared areas are subjected to a Heritage Permit as set out in section 48 of the National Heritage Act (Act No. 27 of 2004) with procedures for application and granting of permits outlined in section 55 of the Act. Therefore, unless authorized by a permit under section 52, a person must not, without a consent issued under subsection (8) carryout any heritage research and assessment in Namibia without a permit. It is for this reason that the undersigned has been granted a Heritage Research Permit 02/2022 from the National Heritage Council (**Competent Authority**) for this assessment to further enable the proponent to apply for a heritage consent referred to in section 53 (7).

1.4.2 Guideline 2: Guidelines for Heritage Impact Assessment in Namibia (2021).

The implementation of the National Heritage Act, (Act No. 27 Of 2004), its Regulations (Government Notice 106 of 2005) in relation to the Heritage Impact Assessment (HIA) section 51 (3) in Namibia

follows standards procedures in the devised “National Guidelines for Heritage Impact Assessment in Namibia (2021)”, in which the processes of reporting, review and verification of heritage resources is required to clear the project. The Guidelines covers all aspects of heritage resources, types of heritage impact assessments, significance ratings, methodology for reporting, requirements for appropriate professional qualifications or experience of heritage consultants, and what should be contained in the report. The guidance further details reasons why the HIA studies are critical parts of the EIA processes in ensuring effective identification; accurate recording, reporting, interpretation, and appropriate estimation of the sensitive and significant heritage resources that could be negatively affected by the developments. The assessment needs to address cumulative impacts on the heritage resources, map out and demarcate sensitive areas, provide practical mitigation to avoid or reduce negative impacts, and set out associated long-term monitoring requirements for managing and conserving heritage resources in the project area so that they are appropriately managed, protected and preserved in their original settings.

1.4.3 Protocols Applicable to the Study

Applicable laws and policies relevant to the study towards the protection of heritage resources globally are the international standards and protocols expected to be followed to ensure best practice during development activities. For instance, the Performance Standard 8 of the International Finance Corporation’s (IFC) Performance Standards on Environmental and Social Sustainability (2012) addresses both national and World Cultural and Natural Heritage. Therefore, the requirement 7 states “where the risk and identification process determine that there is a chance of impacts to cultural heritage, the client will retain competent professionals to assist in the identification and protection of cultural heritage.” The standards apply whether the heritage material is protected, and irrespective of whether it may have been previously disturbed. To comply with these standards, a baseline survey and assessment is required. The European Investment Bank’s Environmental and Social Handbook (2013) includes cultural heritage impact assessment amongst its list of requirements. The details of this requirement are contained within Section 5, which specifies the scope of impact assessment for Cultural Heritage as “screening for risks... assessing and mitigating the impact” on cultural heritage employing techniques to establish baseline conditions such as “field surveys and expert assessment of the significance of cultural heritage”. Relevant standards for impact assessment in relation to fieldwork and data dissemination, standard methodologies are recommended to follow the Standards and Guidance set within the Chartered Institute for Archaeologists (CIfA) where both field survey and desk-based assessments are universally recognized. The ICOMOS Principles Guidelines for Conservation of Industrial Heritage sites, Structures, Areas, and Landscapes is equally critical to this study in assessing the built heritage. Additionally, the African Development Bank (AfDB) Guidelines to the environmental and social assessment procedures (ESAP) of 2001 further guide this assessment. Its guidance is integrated in addressing all crosscutting themes promoting sustainable development.

1.5 Methodology

This archaeological survey followed a basic three-phase process of evaluation – the desk study - *Phase I* (current report) where a baseline report is produced followed by assessment based on field survey. Field investigations included extensive examination of the site surfaces through field transects approaches such as walking across the landscape in parallel lines and grid patterns of about 10 m intervals whilst recording surface artefacts using conventional criteria of physical setting and archaeological affinity through photography, general description and their GPS locations using a handheld Garmin GPS and GIS maps to aid field survey. However, it is important to point it out that no surface collections were made for analysis during this systematic survey. Additional data were obtained through available records on historical, geological, and archaeological data in the project

areas. Such data were generated from a series of publications harvested from multidisciplinary research. *Phase II* usually involves detailed field investigation including management plans in the likely event that heritage resources are discovered while *Phase III* involves archaeological excavations, collection, scientific analysis, and interpretation of heritage materials to establish the cultural affinities.

1.6 Impact Assessment

The objectives of the impact assessment are to identify potential archaeological and other heritage resources within the footprints of the project and its immediate surrounding and to find best practice measures to enhance positive impacts and avoid, minimise, or mitigate the negative impacts, either by record or preservation. If possible, any form of impact is to be avoided by finding alternatives to damage or destruction. Actions which cannot be avoided or minimized ought to be mitigated in effort to reduce the impact as much as possible. This procedure is dependent on the size of the site, its state of preservation and its values and significances. The principle behind the mitigation is that no final decision on the site’s future can be made until it has been demonstrated that all measures to avoid, minimize and mitigate has been fully explored. Baseline information was obtained by undertaking the following activities:

- a) Pre-fieldwork assessment to identify high impact risk and sensitive areas within the footprints of the project and its surrounding areas such as the terrain features i.e., natural outcrops formed by the lateral erosion of the flood deposits, hill saddles etc. This is to ensure that these potential sensitive features may be designated as “No-Go” if they contain significant finds.
- b) Literature and desktop review of available data concerning the distribution and typologies of heritage resources both at the regional and local levels and the surrounding areas; and
- c) The site visit and reconnaissance survey of the site to identify potentially-significant impacts that could be identified to have “direct and indirect impacts” arising from possible preparation/clearing of the proposed GHDP site and its associated infrastructure development.

1.7 Impact Assessment Methodology

In Namibia, the significance and vulnerability rating of heritage impact assessment follow standardized methodology devised by the National Heritage Council (the competent authority) within its “Guidelines for Heritage Impact Assessment of the National Heritage Council (2021)” shown in (Table 1 & 2) and those adopted by the Council on the basis evaluation developed by the Quaternary Research Services (Kinahan 2012).

Table 1: Heritage significance rating table with key attributes defined by the National Heritage Council, (2021).

Level of significance	Grading	Description
Exceptional/upper higher	5	<ul style="list-style-type: none"> ● Major national heritage resources. ● Rare & outstanding example. ● Containing unique evidence of high regional & national significance.
Considerable high	4	<ul style="list-style-type: none"> ● Very important to the heritage of the region. ● High degree of integrity/ authenticity. ● Multi-component site and objects. ● High research potential.
Moderate	3	<ul style="list-style-type: none"> ● Contributes to the heritage of the locality and region. ● Has some altered or modified elements, not necessarily detracting from the overall significance of the place. ● Forming part of an identifiable local distribution or group. ● Research potential.

Low	2	<ul style="list-style-type: none"> Isolated minor find in undisturbed primary context, with diagnostic materials. Makes some contribution to the heritage of the locality, usually in the combination with similar places or objects.
Little	1	<ul style="list-style-type: none"> Makes little contribution to the heritage resources of the locality. Heritage resources in a disturbed or secondary context, without diagnostic or associated heritage.
Zero/ no significance	0	<ul style="list-style-type: none"> Absence of heritage resources. Highly disturbed or secondary context, without diagnostic or associated heritage.

Table 2: Is the vulnerability rating table with key attributes defined by the National Heritage Council, (2021).

Vulnerability Rating
<ol style="list-style-type: none"> Not Vulnerable No threat posed by current or proposed development activities Low or indirect threat from possible consequences of development (e.g. soil erosion) Probable threat from inadvertent disturbance due to proximity of development High likelihood of partial disturbance or destruction due to close proximity of development Direct and certain threat of major disturbance or total destruction

In effort to measure the sensitivity of archaeological sites considering their significance and vulnerability rating in Table 1 & 2, the assessment also estimated the extent of possible impact, the magnitude of impact, and the duration of these impacts to sensitive heritage resources. The scales of estimation developed by Quaternary Research Services (Kinahan 2012) is replicated below in Table 3.

Table 3: Assessment criteria for the evaluation of cumulative impacts on archaeological sites developed by QRS (Kinahan 2012).

CRITERIA	CATEGORY	DESCRIPTION
Extent or spatial influence of impact	National Regional Local	Within Namibia Within the Region On site or within 200m of the site impact
Magnitude of impact (at the indicated spatial scale)	High Medium Low Very Low Zero	Social and/or natural functions and/ or processes are severely altered Social and/or natural functions and/ or processes are notably altered Social and/or natural functions and/ or processes are slightly altered Social and/or natural functions and/ or processes are negligibly altered Social and/or natural functions and/ or processes remain unaltered
Duration of impact	Short Term Medium Term Long Term	Up to 3 years 4 to 10 years after construction More than 10 years after construction

1.8 Legislation Context

In Namibia, the legal instrument for the protection of heritage resources is set out within the National Heritage Act, (Act No. 27 of 2004). As defined in Part 1 of the Act, 'heritage resources' implies places and objects of archaeological, palaeontological and rare geological objects including meteorites, cultural, historical, anthropological, ethnographical, scientific and social significance or "any remains

of human habitation or occupation that are 50 or more years old found on or beneath the surface". The legal protection extends beyond the tangible heritage resources to include "the natural or existing condition or topography of land", as well as the "trees, vegetation or topsoil". Moreover, the newly developed "Guidelines for Heritage Impact Assessment in Namibia of 2021" considers aspects of intangible heritage such as sacred sites "places to which oral traditions are attached or which are associated with living heritage, graves and burials, historic settlements and military sites by means of a building, garden or a tree" are considered to be of heritage significance. Part IV of the Heritage Act indicates that the Council maintains a register which lists 'significant heritage' places and objects.

The register allows new approved entries to be added based on an assessment of their heritage significance and thereafter publication of the sites in the Government Gazette. As a result, Part V applies immediate legal protection to heritage sites added on the register to prevent disturbance or damage, unless a permit is issued by the Council permitting activities to take place at the site. Before issuing a permit, section 48 empowered Council to grant permits such as might be required in the event of damage to a protected site occurring as an inevitable result of development. Apart from the Heritage Act, Heritage impact assessment in Namibia also takes place under the provisions of the Environmental Management Act, (Act No. 7 of 2007) which includes man-made features in its definition of the environment as "anthropogenic factors" such as archaeological remains or any other evidence of human activity. The need for Environmental Impact Assessment forms part of the Act, and this requires that "Namibia's cultural heritage must be protected and respected for the benefit of present and future generations".

2 Baseline environment

The proposed GHDP site is an area between Walvis Bay and Swakopmund in close proximity to the D1984 road network. It is a designated light/heavy industrial area that has been also subject to intensive recreational pressure associated with the Dune 7. Other activities in the area, such as quad-biking, off-road driving and sightseeing appear to be operating. However, these are not regulated. The topography of the proposed GHDP site is relatively flat and on level ground with an altitude of 50m above sea level. Its weather is largely influenced by arid coastal conditions that are maintained by the cold Benguela Current that flows northwards from the South Atlantic Ocean, driven by strong south-westerly winds. Its geology is characterised by two distinct geomorphological units. The largest by far being the gravel coastal plain and dry disappeared river beds with lateral erosion of previous floods barely visible (**Figure 15**). During the site visit, no animals were observed in the area, but multiple fresh footprints belonging to carnivores- hyena or jackal (not confirmed) were visible on the ground (**Figure 16**) and these differs in size and morphological appearance. One plant species was registered in the project - isolated patches of *Arthroa leubnitziae* hummocks (**Figure 17**).

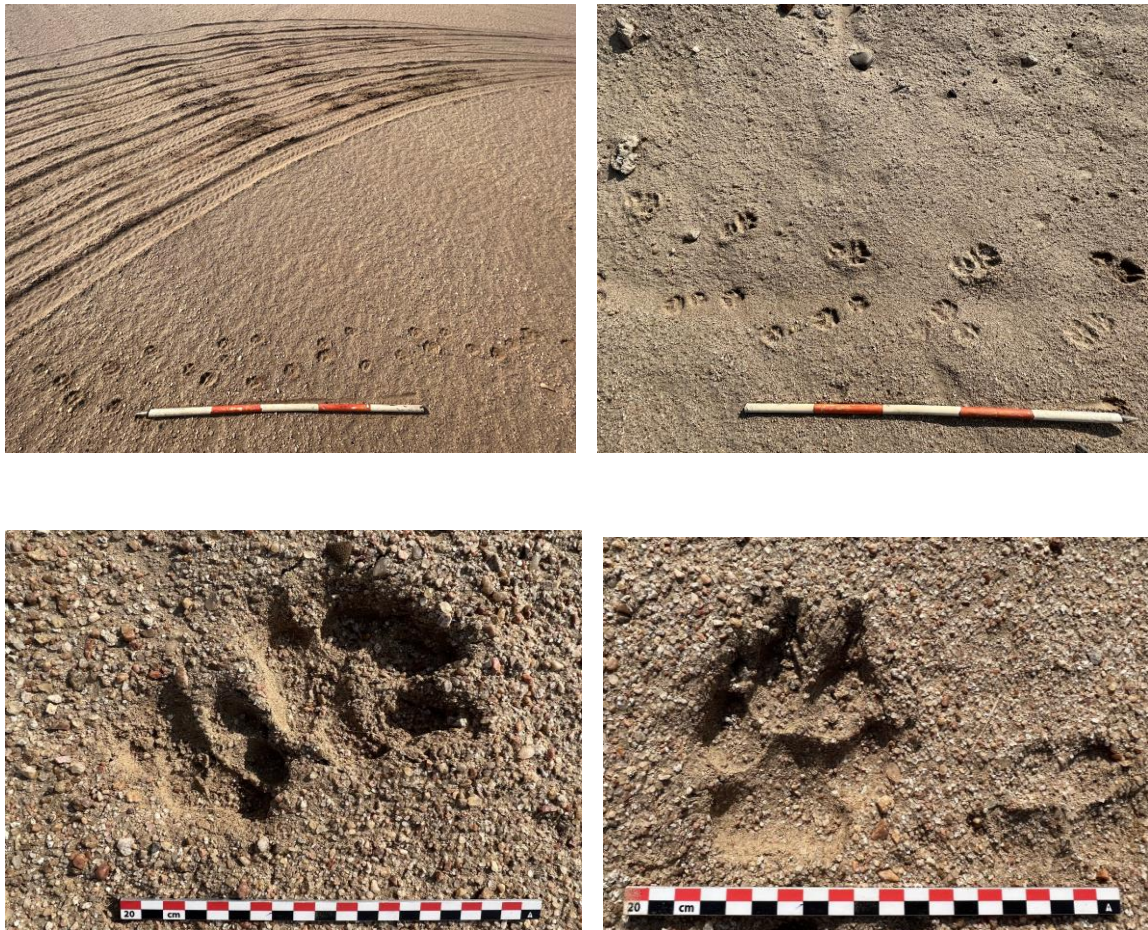


Figure 15: Animal tracks registered within the GHDP. Images credits: (RCHS, August 2022).



Figure 16: The endemic *Arthroerua leubnitziae* recorded in the footprint of the project. Images credits: (RCHS, August 2022).

2.1 Fieldwork

Site visits and a detailed field investigation were carried out from the 16th to the 18th August 2022 by the cultural heritage team. The walkover survey (**Figure 19**) covered an entire combined area of 24 hectares of the proposed sites. In total, this area stretches from the new road D1984 extension which lies just before the western margin of the High Dune Belt overlooking the Dune 7 fields (**Figure 17A**) to the eastern small escarpment formed by the lateral erosion of the flood deposits (**Figure 17B**). A systematic visual inspection was undertaken and photographs taken to record ground conditions and any surface archaeological/cultural heritage sites encountered. The locations of surface features were included in the survey and objects were recorded using a handheld Garmin GPS with an accuracy of +/-2 m horizontally and elevation. The site beacon (**Figure 18**) has been marked for the project.

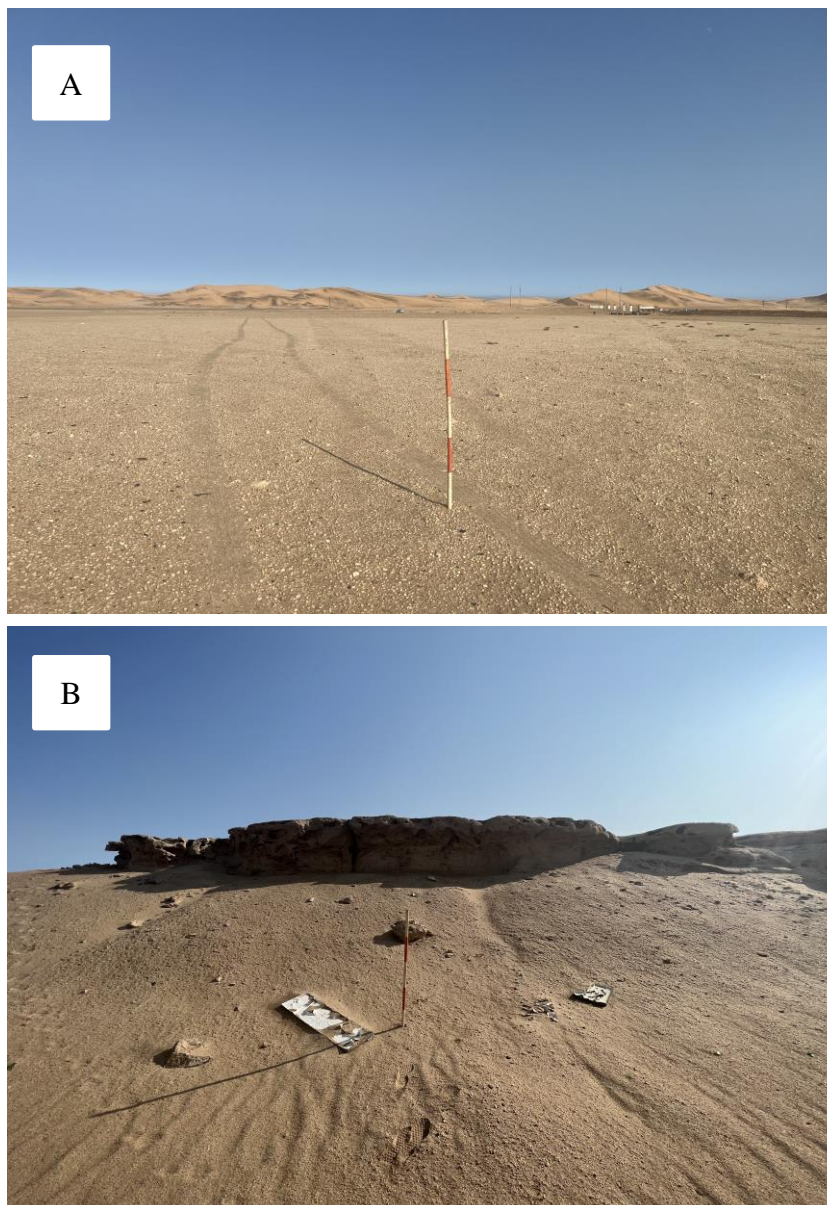


Figure 17: Top image shows the distance of the site from Dune 7 dune fields in the foreground while the bottom image is the periphery bordering the site. Images credits: (RCHS, August 2022).

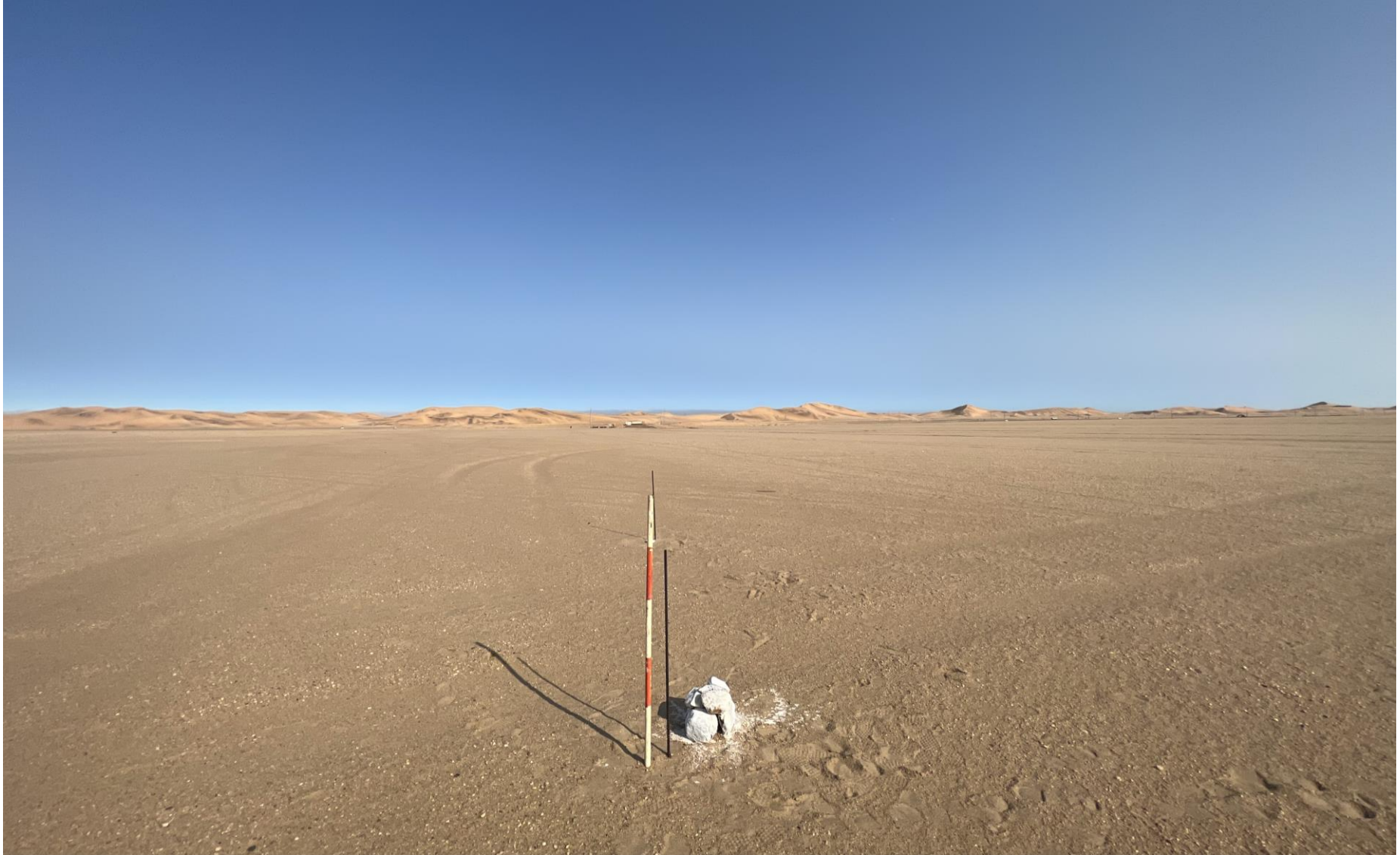


Figure 18: Site beacon (white stones) scaled at local level. Image credits: (RCHS, August 2022).



Figure 19: Walkover survey within the proposed GHDP site. Image Credits: (RCHS, August 2022)

2.2 Literature Review

Available heritage literature indicates that the area covering the GHDP project falls under the Namib Naukluft Park in Erongo Region (**Figure 20**). It was proclaimed in August 1979 under the Nature Conservation Ordinance No. (4 of 1975).

According to several researchers, the Erongo Region, including the central Namib Desert is recognized as a major archaeological landscape in Namibia (see Wendt 1972; Kinahan 1990, 1984, 2020, 2012 2021; Richter 1991, Lenssen-Erz 1997, 2004; Breunig 2003; Pleurdeau et al. 2012 and Nankela 2013, 2017, 2020 etc.) (**Figure 10**). However, a considerable and large part of the region remains archaeologically unregistered because research has concentrated mostly on key major granite landforms which helped to establish the sequence of human occupations and determined the relationship between archaeological sites and the particular types of terrain across the landscape. It is for this reason that the region's archaeological wealth is evidenced in a substantial number of prehistoric human settlements dating from the Early through Middle to Late Stone Age periods (Kinahan 2012). The earliest evidence of human activity is traced back from 800 000 years Before Present (BP) according to (Kinahan 2011). Multiple sources further attest that abundance of significant archaeological sites have been recorded within the last 12 000 to 10 000 years, during Holocene period which coincides with the onset of warmer and moist conditions after the retreat of the Last Ice Age period which led to sudden expansion of human occupation as aridity intensified in the entire Namib Desert and hinterland (Stuut et al 2000; Kinahan 1991, 2012; 2021; Pleurdeau et al. 2012; Nankela 2007; Lenssen-Erz 2007). Such changes eventually prompted the Hunter-Gatherers to find refuge in mountainous localities such as the Brandberg, Erongo and Spitzkoppe Mountains where food and shelter was available. Chronologically, records yielded from a series of excavations carried out in these areas roughly over the last 6000 BP to 50 years BP when the rock art tradition was likely abandoned. These archaeological data are attributed to the Hunter-Gatherers and later pastoralists communities.

The coastal region is another crucial archaeological landscape in Erongo. The rich oceanic and coastal biodiversity and its resources has afforded a favorable living environment for the indigenous pastoralists' community as evidenced by Pre-Holocene records including detailed historical records from the last 250 years (Avery 1984; Kinahan 1991, 2000, 2001, 2005; Kinahan and Kinahan 2009; Morse et al., 2013; Bennett et al., 2014 and Detroit & Nankela 2014; Nankela 2017). These are harvested through a series of detailed archaeological research and surveys assessments. Walvis Bay, a natural harbour, and the largest anchorage on the coast that stretches about 500 km to the north is the first site of contacts between the indigenous communities and Europeans during the late seventeenth century (Kinahan and Kinahan 2009). To date, Walvis Bay and its surrounding environment i.e. Kuiseb Delta and Dune Belt Areas *also* !Kuisseb Delta Conservation Areas (KDCA) has registered approximately 235 archaeological sites of which 75% dates from prehistoric period linked to the indigenous communities such as the Topnaar (±Aonin). They were purportedly wealthy pastoralist that controlled extensive grazing lands around in the interior of the country and exploited the coastal resources (Kinahan 2001; Kinahan and Kinahan 2009). Such sites are generally characterized by shell middens of various extensions, accumulations of skeletal remains of marine and terrestrial (wild and domestic) vertebrates, pottery, beads, human footprints, and various artifacts including human remains buried under silt deposits with some largely exposed by natural erosion corresponding to the flood deposits of !Kuisseb River (Detroit and Nankela 2014).

As Walvis Bay became the gateway to the interior for traders, explorers, missionaries, and settlers; evidence of contact with the Western world has been registered in the episodic river delta at Walvis Bay, with over 58 sites (Ibid 2009). Here, the pastoralists reportedly traded (bartered) cattle, sheep, hides, and feathers were traded (Kinahan 2000; 2001) for the European exotic goods such as glass

beads, porcelain, gin bottles and tins food among other things (Kinahan and Kinahan 2009). However, during the first half of the nineteenth century importation of traded goods intensified around Walvis Bay coastline which encouraged movements further inland where merchants settled and established themselves further (Kinahan 2000; Kinahan and Kinahan 2009; Nankela 2017; 2021). Although material evidence of these historical settlements is less documented and poorly preserved, debris of what is left is visible in the landscape today and can easily be mistaken for trash. The genetic character of artefacts found in these sites comprised of material trace of the European community of the time. They include remnant of building materials, broken bottles inclusive of square case gin bottles, tins, rusted copper wires and drums, old post (indicative of settlement), old clothing, fishing nets, charcoal, animal bones fragments, decorated porcelains, cups, trade beads, used bullets and consumed products i.e., shell maddens all dating from the 17th to 19th Century during intense trading economy between the European merchants and indigenous traders. Possible historic graves and skeletal remains of animals (mainly horses) might also be expected at such sites (Kinahan 2000; Nankela 2017 and 2020).

For instance, the new Wastewater Treatment Works located about 10 km near Farm No. 60 just behind Dune 7 recreational area has produced similar materials finds (Nankela 2017). Another site near Swakop River 25km from Walvis Bay also yielded similar finds (Nankela 2021). A further 40 km south of Walvis Bay, a commercial fishing establishment at Sandwich Harbour reportedly existing alongside the indigenous settlements from 1860 to the late 1880s who largely dependent upon wage labour and European charity” (Kinahan 1991).

The overall distribution of heritage sites beyond KDCA decreases towards the hinterland where the proposed GHDP site lies. This is largely attributed to increased footprints of anthropogenic impacts on the environment with clear visible damages and disturbances from earlier and current constructions of infrastructure development i.e., railway line and service road, roads networks, telecommunication lines, town expansions, sewerage, and water utilities as well as increased tourism activities associated with the recreational area of Dune 7. Natural impacts such as erosion (mainly by the wind and sand movements) related to coastal dynamic environment also threatens the integrity of many archaeological and historic sites in this area.

This erosion process aggravates archaeological remains including possible buried remains which might be preserved and protected under shallow sedimentary deposits. Further, coastal fogs and other form of moisture degrade artefacts and reduces the visibility of the sites. The unregulated tourism activities such as off-road driving and quad biking within the area can easily damage heritage resources unintentionally through trampling and crashing. As a result, their historical value is compromised, and its significance rating is therefore relatively very low to 0.



Figure 20: An edited satellite map of the Dorob National Park, indicating its geographical boundaries and GHDP site location. Source- NASA, 2006. Accessed from: <https://upload.wikimedia.org/wikipedia/commons/4/42/Namib-Naukluft-Park-Borders-Sat.jpg> on the 8th September 2022.

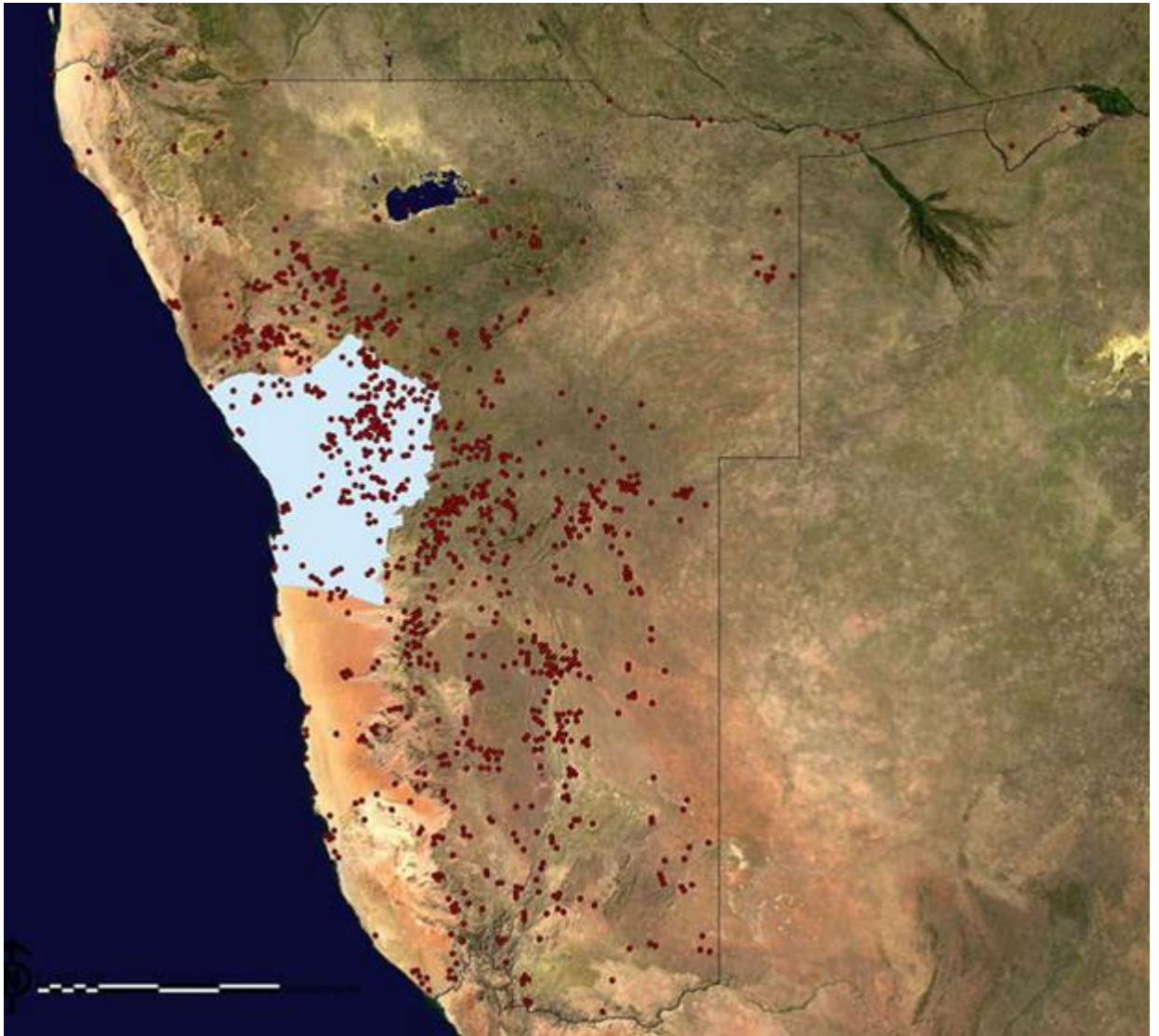


Figure 21: Erongo Region (blue highlight) in relation to the distribution of archaeological sites in Namibia. Image Credits: (John Kinahan 2012:15)

2.3 Data Analysis & Results

Due to relative homogeneity of the site's topography and its geomorphology, no traces of significant archaeological and historical evidence relevant under the provisions of the National Heritage Act (Act. No. 27 of 2004) were found. This is attributed to the surface disturbances related to the rehabilitations (**Figure 22A&B**), constructions, and erections of infrastructure related development i.e., roads, telecommunication lines and service roads in vicinity to the proposed site. The present off-roads vehicle prints (**Figure 23A&B**) and possible recreational activities carried out in the area has also disturbed the site context. However, typical few surface finds in form of rusted tins, broken glass, and animal bones fragments (mandible) were recoded (**Figure 24**). The contexts of majority co suggests that such surface deposits might be a result of gradual aeolian erosion and natural erosion of the surface of the flood deposit rather than a secondary context by prehistoric nomads. However, if they are associated with the materials linked to the 17th to 19th Century during trading economy between the European merchants and indigenous traders, their significance is reduced considerably due to surface disturbances and the fact that these surface materials are seemingly in secondary deposition. However, one feature that stood out (**Figure 24D**) is an industrial plastic pole cut off a concrete foundation with legible numbers that reads "RWK 227". A quick internet search revealed that it's a most probably a "screw compressor" which may attest to the previous industrial use of this area.

However, this find was recorded in the immediate surrounding of the site limit and not within the project area.

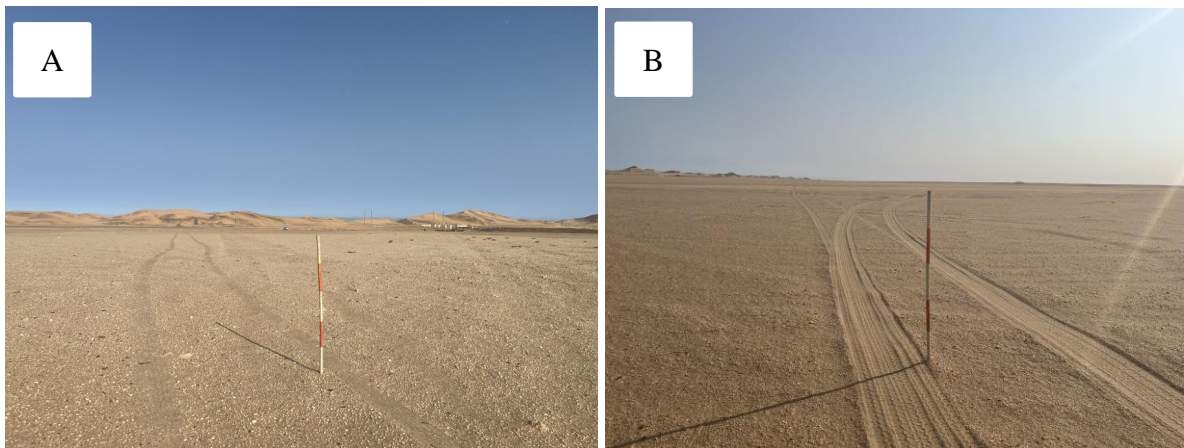


Figure 22: Off-road vehicle tracks found in the project site. Images Credits: (RCHS, 2022).

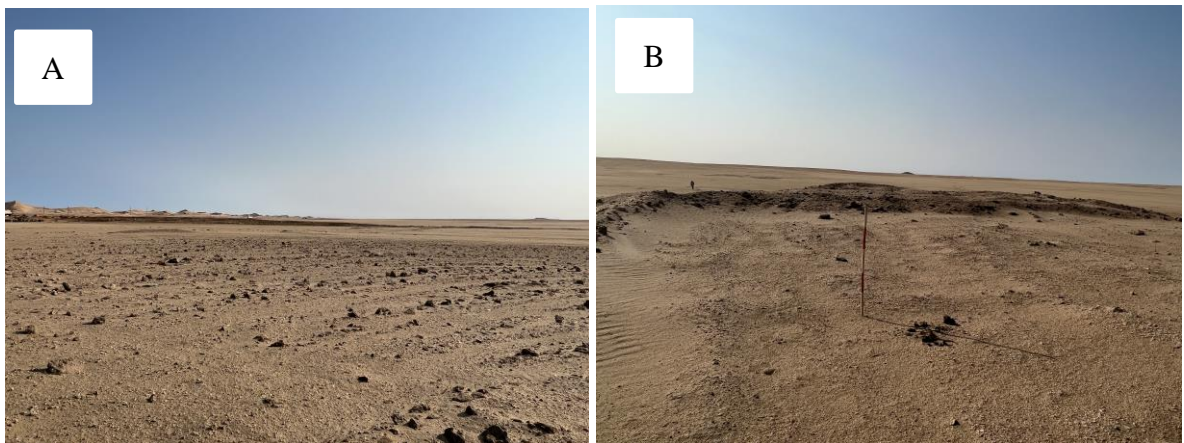


Figure 23: Rehabilitated surface land of the project site. Images credits: (RCHS, August 2022).

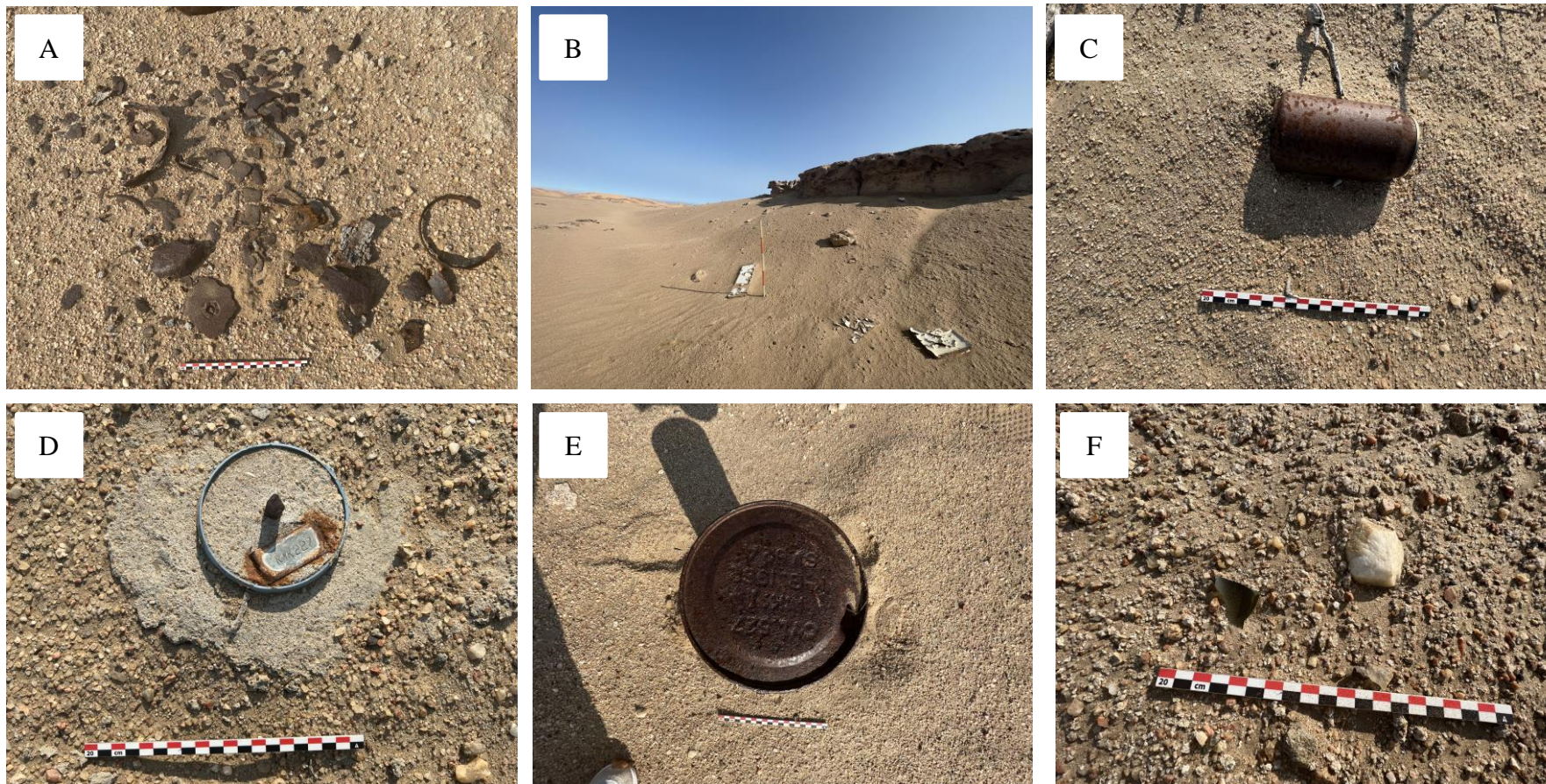


Figure 24: The site repertoire: surface finds with DFHP project site. From A, C & E is the debris of rusted cans and broken glass while B and D are indeterminate objects. Image Credits: (RCHS, August 2022).

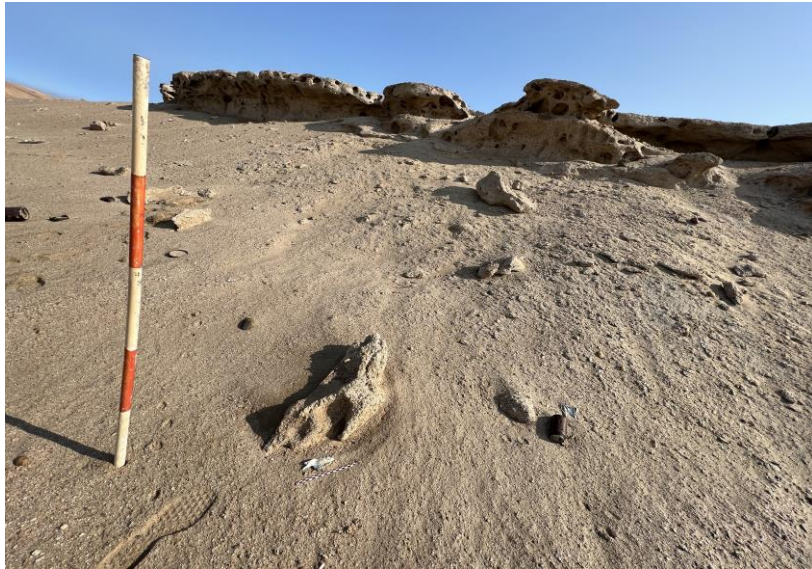


Figure 25: A fragment mandible of upper maxillary cheek dental of an unidentified animal / probably a horse. Image Credits: (RCHS, August 2022).

2.4 Interpretation of impact assessment

The entire proposed project site including its surrounding areas (300m) have been subjected to the detailed assessment. This detailed heritage impact assessment has therefore not located any significant, sensitive and or vulnerable archaeological, paleontological, ethnographical, or historic remains in terms of National Heritage Act, (Act No. 27 of 2004) within the proposed GHDP project area. The study is therefore considered to be sufficient as a basis for these assessments. However, in the unlikely event that archaeological and or paleontological traces are exposed during site works, the expected nature of impact would be in the form of direct physical disturbance or destruction. The expected magnitude of this impact would be low. Since impacts on archaeological and palaeontological sites are irreversible, these would be high, at local spatial level. The consequence of the impact would be localized, and its significance would be low. The interpretation of this assessment would indicate a low significance, indicating that the risk of archaeological, palaeontological, and historical impact is so low as to have no influence on the project decision. From the cumulative impact perspective and given the disturbed nature of the entire site and zero sensitivity and vulnerability of archaeological and paleontological sites, it is expected that the project will have no negligible cumulative impact on Namibia's archaeology resource base. As a result, there were no significant impacts identified and or arising from site clearance / preparation of the proposed GHDP site.

However, in relation to the possible direct impacts from groundwork outside and immediate surrounding of the proposed GHDP site boundary prior to development, contractors involved in construction work should be made aware of the small crop formed by the lateral erosion of the flood deposits (**Figure 9**) as it may contain in situ significant historic materials which should be avoided, included in their EMP, and designated as a "No Go" The assessment of **direct impacts** is a product of the heritage significance of the resources combined with the magnitude of impact formed by the proposed development of the GHDP site and associated activities is placed on a scale of very low – very low – very low, with no effects. Assessment of **indirect impacts** such as setting has been carried out using the following considerations (1) Initial consideration of intervisibility between the proposed site and cultural heritage leading to identification of potentially affected heritage (2) the assessment of heritage significance of potentially-affected heritage values, (3) the assessment of the contribution of setting to heritage significance (4) the assessment of the magnitude of impacts of the relevant aspects of the proposed scheme affecting the setting and (5) the assessment of significance of impacts. Potential Impact: Impact

3 Conclusions and management procedures

This baseline study has not identified significant archaeological and historic heritage sites within the footprints of proposed GHDP site that are worth preserving in terms of National Heritage Act, (Act. No. 27 of 2004). Therefore, there are no sensitive heritage resources expected to be directly impacted by the project. However, it is possible that unknown sub-surface archaeological, paleontological and or historic resources that could fall within the footprints of proposed ground disturbing activities (during site preparation/ construction phases) for the GHDP site including access roads; borrow pits, utilities; and other ancillary project infrastructure. The following chance find procedure will need to be adopted to address this uncertainty in all project phases.

CHANCE FIND PROCEDURES

The “chance finds” procedure covers the actions to be taken from the discovery of a heritage site or item to its investigation and assessment by a trained archaeologist or other appropriately qualified person. The “chance finds” procedure is intended to ensure compliance with the relevant provisions of the National Heritage Act (Act No.27 of 2004), especially Section 55 (4): “a person who discovers any archaeological objects must as soon as practicable report the discovery to the Council”. The procedure of reporting set out below must be observed so that heritage remains reported to the NHC are correctly identified in the field (Kinahan 2012) and replicated below:

RESPONSIBILITIES

Operator:	To exercise due caution if archaeological remains are found
Foreman:	To secure site and advise management timeously
Superintendent:	To determine safe working boundary and request inspection
Archaeologist :	To inspect, identify, advise management, and recover remains

PROCEDURE

Action by person identifying archaeological or heritage material:

- If operating machinery or equipment stop work
- Identify the site with flag tape
- Determine GPS position if possible
- Report findings to foreman
Action by foreman a) Report findings, site location and actions taken to superintendent
b) Cease any works in immediate vicinity
Action by superintendent a) Visit site and determine whether work can proceed without damage to findings

Action by **foreman**:

- a) Report findings, site location and actions taken to superintendent;
- b) Cease any works in immediate vicinity
Action by superintendent;
- c) Visit site and determine whether work can proceed without damage to findings
- d) Determine and mark exclusion boundary;

- e) Site location and details to be added to GIS for field confirmation by archaeologist

Action by **archaeologist**:

- a) Inspect site and confirm addition to GIS;
- b) Advise NHC and request written permission to remove findings from work area;
- c) Recovery, packaging and labeling of findings for transfer to National Museum
In the event of discovering human remains
- d) Actions as above
- e) Field inspection by archaeologist to confirm that remains are human
- f) Advise and liaise with NHC and Police
- g) Recovery of remains and removal to National Museum or National Forensic Laboratory, as directed.

4 References

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3. Kinahan John (1984). The importance of Walvis Bay and !Kuseb Delta area in the archaeology of Namib Coast. Unpublished report to the National Monuments Council, Cape Town, 29 March 1984.
4. Kinahan Jill (2000). Cattle for beads: the archaeology of historical contact and trade on the Namib Coast. Namibia Archaeological Trust & Department of Archaeology & Ancient History, Uppsala, Sweden.
5. Kinahan, John (1990.) Four thousand years at the Spitzkoppe: change in settlement and land use on the edge of the Namib Desert, *Cimbebasia*, 12:1-4.
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8. Kinahan John (2021). *Namib: the archaeology of an African desert*, Windhoek, UNAM Press.
9. Lenssen-Erz Tilman (1997). Metaphors of Intactness of Environments of Rock Art Paintings of Namibia. In *Rock-art as visual ecology*, by P. Faulstich (Editor), pp. 43-54, AZ American, Tucson, 2004 Landscape Setting of rock painting sites in the Brandberg (Namibia): Infrastructure, Gestaltung, use and meaning, Cambridge University Press: Cambridge.
10. Lenssen-Erz Tilman (2004). The landscape setting of rock painting sites in the Brandberg (Namibia): Infrastructure, Gestaltung, use and meaning. In "The figured landscapes of rock-art. Looking at pictures in place", ed. C. Chippindale and G. Nash. Cambridge: Cambridge University Press.
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12. Nankela Alma (2013). Archaeological research (Phase I) in farm Eurasiro, Etendero, Immenhof, Okosongoro and communal areas surrounding Erongo Mountains, report for the National Heritage Council of Namibia.
13. Richter Jurgen (1991). Studien zur Urgeschichte Namibias, *Africa Prehistorica*, 3, Köln.
14. Wendt, W. E. (1972). Preliminary report on an archaeological research programme in South West Africa, *Cimbebasia*, (B), 2, pp.1-6.
15. Ekinetix. (2022). *Basis of Design: Hydrogen Production, Fuelling and Loading Station*. Walvis Bay: Ekinetix.

Appendices

Appendix A: Specialist CV

Name of Consultant: Dr. Alma Mekondjo Nankela
Profession: Archaeologist and Heritage Specialist
Nationality: Namibian
Contact Number: +264 81 88 9 5856
Emails: ahamulo@gmail.com / rcheritageservices@gmail.com
Postal Address: 22972, Windhoek, Namibia
Drivers' License: Code 08
Social Media: <https://mnhn.academia.edu/AlmaNankela>
<https://www.researchgate.net/profile/Alma-Nankela>

PROFESSIONAL PROFILE, CORE SKILLS AND EXPERTISE

Dr Nankela is a Quaternary and Prehistory Specialist with over 14 years progressive experience in archaeological and heritage research in Namibia. Her greatest strength is conducting scientific research in archaeology, history, ethnoarchaeology and geoheritage. She has conducted extensive specialist heritage assessments including conditions, risks evaluations, inspections, and verifications and monitoring of both cultural and natural heritage properties in Namibia. Dr Nankela has experience in reviewing Environmental Impact Assessments (EIAs) reports and compilation of Heritage Management Plans (HMPs), facilitating Public meetings (engagement). Over a decade, Dr Nankela is well known for transforming Namibia's heritage sector through developing heritage policies, operational guidelines and advising the Namibian Government in relation to research, management and quality conservation treatment activities for all heritage resources in Namibia while working at the National Heritage Council from 2011 until 2021. She is a diligent, efficient, focused, ethical, hardworking professional, either as an individual or in a team. She also has very good Project Management skills.

Through her specialized Archaeosciences & Consulting Firm - Research Culture Heritage Services (RCHS)

<https://sites.google.com/view/rcheritage-services/home?authuser=0> she provides independent and professional consultancy services to local communities, proponents, environmental science community and cultural heritage sector; government and non-governmental agencies and the global community with the following services Archaeosciences, heritage impact assessments, heritage management and valorization as well as all services related to repatriation and restitution of human remains and heritage objects of Namibian origin held in foreign institutions. The Heritage Impact Assessment Programmes at RCHS supports the infrastructure-led developments e.g., renewable energy and power, mining, construction, oil and gas explorations, communication, transport (rail, road, aviation, and shipping), water utilities and wastewater etc. in effort to meet their planning process requirements swiftly and expertly.

EDUCATIONAL QUALIFICATIONS

Degree Obtained: Doctor of Philosophy in Quaternary and Prehistory (double Title)

Names of institutions: University of Ferrara (UNIFE), Ferrara, Italy

Muséum National d'Histoire Naturelle de Paris, (MNHN), Paris, France

Years attended: January 2014 – March 2017

Degrees Awarded: 2018 & 2020

Degree Obtained: Masters Degrees in Quaternary and Prehistory (Double Title)

Names of institutions: University of Ferrara (UNIFE) Ferrara, Italy

Muséum National d'Histoire Naturelle de Paris (MNHN), Paris France

Years attended: 2009 – 2011

Degrees Awarded: 2012

Degree Obtained: Bachelor's Degree in education: History & Geography

Names of institution: University of Namibia (UNAM)

Years attended: 2005 – 2008

Degree Awarded: 2009

LANGUAGES

Language	Speaking	Reading	Writing
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English	Excellent	Excellent	Excellent
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Oshiwambo	Excellent	Excellent	Excellent
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French:	Good	Good	Good
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PROFESSIONAL MEMBERSHIPS (AFFILIATIONS)

1. Namibia Scientific Society (NSS) since 2017; <https://www.namscience.com/>
2. Associations of Southern African Professional Archaeologists (ASAPA) since 2013, <https://asapa.co.za/>
3. The Society of Africanist Archaeologists (SafA) since 2020 <https://www.africanistarchaeology.net/>
4. International Council on Monuments and Sites (ICOMOS) since 2011. <https://www.icomos.org/en>

EMPLOYMENT RECORD

Dr Nankela began her professional career 16 years ago, in the museum and heritage sector firstly as an intern responsible for projects coordination and digital cataloging of heritage sites and objects in Namibia in the Museums Association of Namibia. After obtaining her Bachelor Degree in Education majoring in History & Geography, she taught high school learners at a German prestigious school, Delta Secondary School Windhoek. Thereafter, her scientific career in Archaeology began 14 years later at the National Heritage Council where she was responsible for *inter alia*, commissioning scientific research, reviewing, developing and implementing heritage policies, operational guidelines and systems; conservation plans; integration UNESCO Conventions & guidelines; providing management, technical and supervisory support to the Secretariat and advising Government on the appropriate measures towards research, conservation, management, education and promotion of Namibia's heritage resources base and their implementations thereof. Dr Nankela also liaised and collaborated with regional, international heritage professionals and worked closely with local communities to strengthen, encourage and promote their involvement in the preservation and management of their heritage properties. Between 2018 to 2021 Dr Nankela provided technical assistance to the National

Museum of Namibia with repatriation and restitution efforts, policy and guidelines development for managing museum collections. Dr Nankela has also independently assisted Government projects and environmental communities in relation to Heritage Impact Assessment as part of Strategic and Environmental Impact Assessment projects and compilations of Heritage Management Plans.

Dr Nankela has been employed as per order of employment record below:

2022- Present: Research Culture Heritage Services CC

Position: Quaternary and Prehistorian Specialist

Job Description: Founder and Principal Consultant

2011 – 2021: National Heritage Council of Namibia

Position: Heritage Specialist

Job Descriptions: Technical management and Supervisory responsibilities

2009 Delta Secondary School Windhoek, Olympia

Position: Secondary School Teacher

Subject Taught: History, Geography and Development Studies for Grade 8-12

2006 – 2007 Museums Association of Namibia -MAN

Position: Projects Co-coordinator (Intern)

Projects: Schools Club and Museum Exhibition Project (SCAMEX) and Digital cataloging of Heritage Sites & Objects in Namibia.

2003 – 2004 Electoral Commission of Namibia

Positions: Registration and Polling Officer

Region: Oshana

SOME KEY PROJECT (EXPERIENCE) UNDERTAKEN AND RESPONSIBILITIES

Projects Undertaken as an Independent Consultant

YEAR	PROJECT NAME AND CLIENT	RESPONSIBILITIES
2022 (completed)	The review of the Draft Common African Position (CAP) on Restitution of Heritage Resources and the Draft Study on Promoting Decent Work in the African Cultural and Creative Economy workshop for consideration, endorsement and approval by AU Policy organs including the 4th Specialised Technical Committee on Youth, Culture and Sport (STC-YCS4), the Executive Council and the AU Assembly. Proponent: African Union Commission	Workshop Rapporteur and Facilitator.

2022 (In preparation)	Environmental Impact Assessment for the Cleanergy GHDP EIA Project) in Walvis Bay by the SRK Consulting (South Africa) (Pty) Ltd. Proponent: The Namibian Government	Baseline archaeological impact assessment and reporting.
2022 (completed)	Archeological survey within EPL 5445, in Erongo and Kunene Regions by Environmental Compliance Consultancy (ECC). Proponent: AfriTin Mining Namibia (PTY) LTD	Detailed archaeological survey and management plans.
2022 (completed)	Strategic Environmental Impact Assessment for the Kranzberg-Tsumeb Railway Upgrade by Urban Green CC. Proponent: The Namibian Government	Baseline and Detailed archaeological impact assessment: reporting and management plan.
2022 (completed)	Environmental Impact Assessment for Oil and Gas Explorations in PEL 93, North and East of Oshivelo (440km) in Oshikoto Region by Risk Based Solutions CC and Consulting Arm of Foresight Group Namibia (FGN) (PTY) Ltd. Proponent: MEL Oil and Gas Exploration (Namibia) (Pty) Ltd.	Desktop Assessment: Heritage and Archaeological Impact Assessment and Heritage Management Plan.
2022 (Completed)	Heritage and Archaeological Impact Assessment on Farm Jackalswater 220. Karibib District, Erongo Region in relation to EPL 7547. Proponent: Valeries Goldhuys	Detailed Heritage Impact Assessment and Heritage Management Plan.
2022 (Completed)	Specialist Review of Environmental Impact Assessment reports and Environmental IManagement Reports for Elbe Farm in relation to ML 224 in Otjozondjupa District, Namibia. Proponent: Sonja Thieme	Detailed Specialist Review of EIAs and EMP reports.
2022 (Completed)	The development of the Heritage Management Plan for Omandumba East & West Farm, Erongo Mountains, with funding from the French Foreign Affairs Ministry. Proponent: Harald and Deike Rust	The development of the Heritage Management Plan
2021	Environmental Impact Assessment for the seismic survey in Kavango East and West for oil and gas exploration by Risk Based Solutions CC and Consulting Arm of Foresight Group Namibia (FGN) (PTY) Ltd. Proponent: Rencon Africa	Scoping Assessment: Heritage and Archaeological Impact Assessment and Heritage Management Plan.
2020	Environmental Impact Assessment for the proposed powerline and acid plant between Gobabis and Leonard Ville, Omaheke region, Namibia by Risk Based Solutions CC and	Desktop Assessment: Heritage and Archaeological Impact

	<p>Consulting Arm of Foresight Group Namibia (FGN) (PTY) Ltd.</p> <p>Proponent: Namibia Power Corporation (Nampower)</p>	<p>Assessment and Heritage Management Plan.</p>
	<p>Environmental Impact Assessment for the Proposed Leonard Ville potential mining site, Omaheke region, Namibia. Risk-Based Solutions (RBS) CC and Consulting Arm of Foresight Group Namibia (FGN) (PTY) Ltd.</p> <p>Proponent: Headspring Investments (Pty) Ltd</p>	<p>Desktop Assessment: Heritage and Archaeological Impact Assessment and Heritage Management Plan.</p>
	<p>Environmental Impact Assessment for the proposed oil explorations in Kavango East and West in relation to the new 2D Seismic Survey Lines. Risk-Based Solutions (RBS) CC and Consulting Arm of Foresight Group Namibia (FGN) (PTY) Ltd.</p> <p>Proponent: Rencon Africa</p>	<p>Scoping Assessment: Heritage and Archaeological Impact Assessment and Heritage Management Plan.</p>
	<p>Environmental Impact Assessment for the Proposed mining development of base and rare metals in Farm No: 504 Mesopotamia, Khorixas, Kunene Region by Healthy Earthy Environmental Consultant CC.</p> <p>Proponent: Mr. Gerhardt Kariseb</p>	<p>Desktop Assessment: Heritage and Archaeological Impact Assessment and Heritage Management Plan.</p>
	<p>Environmental Impact Assessment for the Proposed construction of the Desalination plants at Granue and Bethanie in the Karas region.</p> <p>Proponent: Namibia Water Corporation (Namwater)</p>	<p>Desktop Assessment: Heritage and Archaeological Impact Assessment and Heritage Management Plan.</p>
2019	<p>Environmental Impact Assessment for the construction of wells drill of 2-3 wells in Kavango East for Oil Explorations project in Namibia. Risk-Based Solutions (RBS) CC and Consulting Arm of Foresight Group Namibia (FGN) (PTY) Ltd.</p> <p>Proponent: Rencon Africa</p>	<p>Desktop Assessment: Heritage and Archaeological Impact Assessment and Heritage Management Plan.</p>
2018	<p>Environmental Impact Assessment for the construction of the Omuthiya – Ongwediva road project in Oshikoto and Oshana Regions, Section B also known as the Oshakati Bypass, Namibia Project for the Roads Authority of Namibia by Aurecon Namibia (PTY) LTD</p> <p>Proponent: Road Authority Namibia</p>	<p>Desktop Assessment: Heritage and Archaeological Impact Assessment and Heritage Management Plan</p>
2017	<p>Environmental Impact Assessment for the Walvis Bay Wastewater Treatment Works (WWTW) in Erongo Region, Namibia by Aurecon Namibia (PTY) LTD.</p>	<p>Desktop Assessment: Heritage and Archaeological Impact Assessment and Heritage</p>

	Proponent: Walvis Bay, Namibia	Management Plan
2017/2018	Strategic Environmental Impact Assessment for Mobile Telecommunications Ltd (MTC) Namibia by GCS Water Environmental Engineering Namibia (GCS Namibia). Proponent: MTC Namibia	Desktop, Scoping and Detailed Archaeological impact assessment and Heritage Management Plan.
RESEARCH AND ASSESSMENTS UNDERTAKEN FOR NATIONAL HERITAGE COUNCIL		
2020	Joint archaeological studies at Otjohorongo and Gross- Okandjou Farm, Erongo region, Namibia	Monitoring and compilation of technical report
2019 & 2018	Archaeological research at Klein Spitzkoppe, Erongo region, Namibia.	Scientific Research
2018	Archaeological monitoring Assessment of heritage resources within the Neckartal Dam area, Karas region, Namibia	Monitoring and compilation of technical report
2018	Condition Assessments of archaeological heritage sites in Namibia: Brandberg, Twyfelfontein, Piet Alberts Rock Engraving and Spitzkoppe Mountains.	Condition Assessments and compilation of technical report
2018	Archaeological investigations of rock art sites at Daberas Mine, in the Sperrgebiet National Park. Report for the Ministry of Environment and Tourism and the National Heritage Council of Namibia.	Scientific Research
2017	Condition Assessments of rock art sites in the Brandberg Mountain and Twyfelfontein World Heritage Site, for the National Heritage Council of Namibia.	Condition Assessments and compilation of technical report
2016	Archaeological research in Omandumba Farms, Erongo Mountains Namibia, for the European Union and the National Heritage Council of Namibia.	Scientific Research
2014	Archaeological Excavations in the upper Brandberg Mountains	Scientific Research
2015	Rescue Excavation and relocation of graves in Elizabeth Bay, Luderitz, Namibia for the National Heritage Council of Namibia.	Scientific Research
2013	A monitoring Impact Assessment of tourism activities within the Tsisab Ravine, Lower Brandberg Heritage Site for the National Heritage Council of Namibia.	Monitoring Assessment
2013	Preliminary Investigation of Human Remains in the Kuiseb Delta, Walvis Bay, Erongo region for the National Museum of Namibia.	Scientific Research
2012	Archaeological Investigations of Earth Tremors at	Scientific Research

	Twyfelfontein World Heritage Site for National Heritage Council of Namibia	
2012	Archeological Impact Assessment of Husab Project of Heritage Sites in Swakop Uranium, for National Heritage Council of Namibia	Detailed Archaeological Impact Assessment.
2012	Heritage Impact Assessment of Klein Windhoek Extension 4, for the National Heritage Council of Namibia and City of Windhoek.	Detailed Archaeological Impact Assessment.
2012	Archaeological Impact Assessment of the Late Stone Age Graves, Sendelingsdrift, Oranjemund for the National Heritage Council of Namibia and Namdeb.	Detailed Archaeological Impact Assessment.
2008	Rescue excavation of the oranjemund Shipwreck, Namibia. For the National Museum of Namibia, National Heritage Council.	Scientific Research

SOME SELECTED PUBLISHED PAPERS

- Nankela, A.M** (2012): the Landscape Setting of the Rock Arts Sites in Kunene Region, Namibia, pp. 73-82, in *"Landscape within rock art"*, by Luiz Oosterbeek and George Nash (eds.), Tomar, CEIPHAR, *série ARKEOS* vol. 29.
- Nankela, A.M** (2014): Rock Art and cultural Identity formation in Namibia: reference to Twyfelfontein World Heritage Site (pp. 143-174), in *"Identidades e diversidade cultural. Etnia e género"*, by Lins, M.; Borges, S.; Oosterbeek, L.; Mendes, A.; Leite, D.; Lima, A. (eds.) Teresina: Fundação Quixote- CEIPHAR/ITM.
- Nankela, A.M** (2015): Rock Art Research in Namibia: A synopsis, in *Symbols in the Landscape: Rock Art and its Context* XIX International Rock Art Conference IFRAO 2015, by Hipólito Collado Giraldo and José Julio García Arranz (eds.), *Série ARKEOS 37*. Mação: Instituto Terra e Memória, *série ARKEOS 37* Mação: Instituto Terra e Memória, Tomar.
- Nankela, A.M** (2015): A new Discovered rock-engraving site on Omandumba East Farm, Erongo Mountains, Namibia" in *"Symbols in the Landscape: Rock Art and its Context"* XIX International Rock Art Conference IFRAO 2015, by Hipólito Collado Giraldo and José Julio García Arranz (eds.), *Série ARKEOS 37*. Mação: Instituto Terra e Memória, Tomar.
- Nankela, A.M** (2015): Rock art and landscape of Erongo region, Namibia, in *"Styles, techniques et expression graphique dans l'art sur paroi rocheuse (Styles, Techniques and Graphic Expression in Rock Art)"*, edited by Marc Groenen and Marie-Christine Groenen. British Archaeological Reports Ltd. Proceedings of Session A11d of the 17th World Congress of the IUPPS (Actes de la session A11d du 17e Congrès mondial de IUISPP) (Burgos 1-7 Septembre 2014).
- Nankela, A.M** (2015): Rock Art: When, Why, and to Whom? Rock art of Omandumba Farm on Erongo Mountain, pp. 72-77, in *"Expression N°9 quarterly e-journal of atelier in cooperation with uispp-cisnep, international scientific commission on the intellectual and spiritual expressions of non-literate people"* by Emmanuel Anati (ed.), Capo di Ponte, (Atelier), September 2015.
- Nankela AM** (2017). Rock art and landscape: an empirical analysis in the content, context and distribution of the rock art sites in Omandumba East and West, Erongo Region Namibia. PhD dissertation. Museum National d'Histoire Naturelle de Paris, France.

8. **Nankela AM** and Silvester J (2021). 2021. A Namibian Experience: The contentious Politics of repatriation of human remains and sacred objects. <https://www.museumbund.de/wp-content/uploads/2021/07/dmb-leitfaden-umgang-menschl-ueberr-en-web-20210625.pdf>
9. **Nankela, A.M.**, Mocke, H., Pickford, M. and Schneider, U.M (2016): Fossil Freshwater Mollusc from Simanya in the Kalahari System, northern Namibia, in *Communication of the Geological Survey of Namibia, Vol. 17*.
10. Mauran G, Lebon. M, Détróit. F, Caron. B, **Nankela A**, Pleurdeau D, Bahain J-J, (2019). First in situ pXRF analyses of rock paintings in Erongo, Namibia: results, current limits, and prospects. *Archaeological and Anthropological Sciences*, Springer-Verlag GmbH Germany, part of Springer Nature.

Dumoulin, J., Lebon, M., Caffy, I., Mauran, G., **Nankela, A.**, Pleurdeau, D, Beck, L. (2020). Calcium Oxalate Radiocarbon Dating: Preliminary tests to date rock art of the decorated open-air caves, Erongo Mountains, Namibia. *Radiocarbon*, 1-12. doi:10.1017/RDC.2020.81.
11. **Nankela, Alma** and Lenssen-Erz, Tilman (2020). Rock art in Namibia. In 'Encyclopedia of global archaeology', Smith (ed.), Springer Nature Switzerland AG.
12. Louise Le Meillour, Séverine Zirah, Antoine Zazzo, Sophie Cersoy, **Alma Nankela**, Florent Détróit, Emma Imalwa, Matthieu Lebon, Olivier Tombret, David Pleurdeau & Joséphine Lesur (2020). Palaeoproteomics gives new insight into early southern African pastoralism. *Science Rep*: 10, 14427 (2020). <https://doi.org/10.1038/s41598-020-71374-3>
13. Mauran Guilhem, Caron Benoît, Detroit Florent, **Nankela Alma**, Bahain Jean-Jacques, Pleurdeau David and Lebon Matthieu (2021). Data pretreatment and multivariate analyses for ochre sourcing: Application to Leopard Cave (Erongo, Namibia). *Journal of Archaeological Science: Reports*. Volume 35, February 2021, 102757. Accessed on: <https://doi.org/10.1016/j.jasrep.2020.102757>

OUTLINE OF EXPERIENCES, TRAINING AND PAPERS DELIVERED

- 2022:** Workshop facilitator and rapporteur for the review of the Draft Common African Position (CAP) on Restitution of Heritage Resources and the Draft Study on Promoting Decent Work in the African Cultural and Creative Economy workshop for consideration, endorsement and approval by AU Policy organs including the 4th Specialised Technical Committee on Youth, Culture and Sport (STC-YCS4), the Executive Council and the AU Assembly. African Union Commission, **20 – 26th August 2022, Dakar, Senegal**.
- 2021:** 2001 Convention Regional Meeting on the Protection of Underwater Cultural Heritage in Africa organized by Namibian Ministry of Education, Arts and Culture in partnership with the UNESCO Windhoek Office on the Ratification and Implementation of the 2001 UNESCO Convention on the Protection of the Underwater Cultural Heritage, 10 March and Thursday 11 March 2021, **Windhoek, Namibia**. Paper delivered: The state of Namibian Underwater Heritage.
- 2021:** Restitution and Human Remains, Online Workshop, 9 December 2021, part of The Hunterian at the **University of Glasgow**, Part of the Devolving Restitution Project, this is the third webinar in the series sponsored by the Pitt Rivers Museum and the Open Society Foundation, organized by AFFORD. **University of Glasgow, Scotland**.
- 2020:** Returning Home: The challenges of developing a Namibian policy for the return and reunion of human remains and heritage objects. Paper presented at the workshop on collections management and preventive conservation of human remains and sacred

belongings in **Cape Town, South Africa**, March 10th, 2020.

- 2019:** The state of Namibian archaeological research: paper presented at the Université Savoie Mont Blanc in November 2019, **Chambery, France**.
- 2019:** The violence of quarrying and mining on the Namibian archaeological landscape: The case of Spitzkoppe and other Erongo Sites. Paper presented at the **Namibia Scientific Society**, 04th November 2020.
- 2019:** First in situ XRF analyses of rock paintings in Namibia: The feasibility of radiocarbon C14 dating of rock paintings in Namibia? A collaborative paper presented on the 16th April 2019 at the **Namibia Scientific Society**.
- 2019:** Remembering and Respecting Tshū!Kō and! Kai: “Namibian Practices and Policy Regarding the Return of Human Remains” a collaborative paper presented at workshop on Human Remains Management: Extending the Conversation throughout Southern Africa - **Gaborone, University of Botswana**, 11th -13th March 2019.
- 2018:** Current State of Rock Art Research in Namibia: Paper presented at Origin Centre Museum as part of the Public lecture Series Rock Art & Symbolic Expression. A Southern African – France Dialogue, 25th October 2018. Organized by the French Institute of South Africa’s Research (IFAS), **Johannesburg, South Africa**.
- 2018:** Rock Art Research in Namibia: An overview. Paper presented to the public at Franco Namibian Cultural Center (FNCC) on the 14th May 2018, **Windhoek, Namibia**.
- 2018:** Human Remains: What are they, where do they come from, how are they discovered? Paper presented at the Human Remains Management and Policy Development in Southern Africa, at the **University of Namibia** on March 22-23rd 2018.
- 2017:** Attended and presented a paper at the African Humanities Conference (AHC) held in **Bamako, Mali** from 28 June to 1st of July 2017 on the theme "Languages, Cultures, History and Territories" following the UNESCO 36th General Conference in October 2009 and the ICPHS General Assembly in December 2010 in Nagoya, Japan. The Conference drew on the ICPHS and UNESCO guidelines of the content within a comprehensive thinking on the humanities and their role in a polycentric world, elaborated in a cross-cultural perspective.
- 2016:** Resource Person and a curriculum developer for the Risk Preparedness workshop for the Anglophone African countries in **Brandberg, Namibia** organized by the UNESCO World Heritage Center, in collaboration with the African World Heritage Fund (AWHF), the National Heritage Council of Namibia and the Ministry of Education, Arts and Culture.
- 2015:** Conservation and Management of Namibia’s rock art sites, at the Namibia’s Arts, Culture and Heritage Seminar for Cultural Policy conference in (May) organized by the Ministry of Education, Arts and Culture, **Windhoek, Namibia**.
- 2014:** Represented Namibia at First extraordinary session of the General Assembly of States Parties to the 1972 Convention held at UNESCO Headquarters in Paris from 13 to 14 November 2014 to revise the Rules of Procedures on the equitable distribution of the 21 seats on the World Heritage Committee. During this session, the General Assembly determined the uniform percentage of contribution to the World Heritage Fund applicable to all State Parties and elected members to the World Heritage Committee, **Paris, France**.

- 2014:** “The history of Namibian heritage research: a synthesis” presented at the XIV International seminar on prehistoric rock art, Mação in Portugal organized by the European Union, Erasmus Mundus Consortium and the Instituto Politécnico de **Tomar, Portugal**.
- 2013:** “Risks and disasters affecting the Twyfelfontein World Heritage Sites, Namibia” presented at the World Heritage sites “Risk Preparedness field workshop for the Anglophone African countries in Mauritius organized by the UNESCO World Heritage Center, in collaboration with the African World Heritage Fund (AWHF), the Center for Heritage Development in Africa (CHDA) and the Le Morne Heritage Trust Fund of **Mauritius** (02-27 September 2013).
- 2013:** “Earthquake Tremors at Twyfelfontein World heritage Site” paper presented at the Risk Preparedness workshop for the Anglophone African countries in Zimbabwe organized by the UNESCO World Heritage Center, in collaboration with the African World Heritage Fund (AWHF), the Center for Heritage Development in Africa (CHDA) and the National Museums and Monuments of **Zimbabwe** (04-28 May 2013)

REFERENCES

Ms. Helvi Inotila Elago, National Programme Culture Office, UNESCO Office, Windhoek, UN House 38 -44 Stein Street 2nd floor, P.O. Box 24519. Windhoek Namibia, Emails:
h.elago@unesco.org / inotila@gmail.com

CERTIFICATION



I certify that to the best of my knowledge and belief, these data correctly describe qualifications, my experience and me.

Appendix B: Declaration of Independence

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

Application for authorization in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

Archaeological Heritage Impact Assessment for the Proposed Cleanergy Green Hydrogen Demonstration Plant in Walvis Bay, Namibia: Environmental Impact Assessment

SPECIALIST INFORMATION

Specialist Name:	Company	RESEARCH CULTURE HERITAGE SERVICES (RCHS) CC	
Specialist Name:	Dr Alma Mekondjo Nankela		
Specialist Qualifications:	PhD IN Quaternary & Prehistory		
Professional Affiliation/Registration:	Association of Southern African Professional Archaeologists (ASAPA); Namibia Scientific Society (NSS); The Society of Africanist Archaeologists (SafA) and the International Council on Monuments and Sites (ICOMOS).		
Physical Address:	ERF 4779, Meass Street, Khomasdal, Windhoek		
Postal Address:	Po Box: 22972, Windhoek, Namibia		
Postal Code:	9000	Cell:	+264 81 88 9 5856
Telephone:		Fax:	
Email:	rheritageservices@gmail.com / ahamulo@gmail.com		

DECLARATION BY THE SPECIALIST

I, Dr. AM Nankela, declare that –

- I act as the independent specialist in this application.
- I will perform the work relating to the application objectively, even if this results in views and findings that are not favourable to the applicant.
- I declare that there are no circumstances that may compromise my objectivity in performing such work.
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity.
- I will comply with the Act, Regulations, and all other applicable legislation.
- I have no, and will not engage in, conflicting interests in the undertaking of the activity.
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken concerning the application by the competent authority; and - the objectivity of any report, plan, or document to be prepared by myself for submission to the competent authority.
- All the particulars furnished by me in this form are true and correct.
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.



Signature of the Specialist

Research Culture Heritage Services cc (RCHS)

Name of Company

11 September 2022

Date