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HERITAGE IMPACT ASSESSMENT REPORT FOR

PROPOSED CONSTRUCTION OF AN AMMONIA PIPELINES FROM FARM 58 TO WALVIS BAY PORT TERMINAL AREA ERONGO REGION, NAMIBIA

FINAL REPORT

25 July 2024

PREPARED FOR:

Environmental Compliance Consultancy (ECC)

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For attention: Kelly Ochs, Environmental Assessment Practitioner

QUALIFICATIONS AND EXPERTISE OF THE CONSULTANT

NAME	Dr Alma Nankela, PhDs
RESPONSIBILITY ON THE PROJECT	Archaeological Field Survey and impact assessment for the proposed construction of an ammonia pipeline from Farm 58 to Walvis Bay Port terminal area as part of EIA by the Environmental Compliance Consultancy (ECC) on behalf of Cleanergy Solutions Namibia (Pty) Ltd (the Proponent).
QUALIFICATIONS	PhDs & Masters Degrees in Quaternary and Prehistory (MNHN and UNIFE) & Bachelor Degree in History and Geography (UNAM).
PROFESSIONAL REGISTRATION	Association of Southern African Professional Archaeologists (ASAPA); Namibia Scientific Society (NSS); the Society of Africanist Archaeologists (SafA).
EXPERIENCE IN YEARS	17 (Field and laboratory)
EXPERIENCE	Dr Nankela worked as an Archaeologist at the NHC for more than a decade where she has conducted extensive archaeological, anthropological and historical research, carried out extensive assessments across Namibia developed and developed heritage policies and systems.
HERITAGE PERMIT NO.	06/2024
REPORTING REQUIREMENT	National Heritage Act, (No. 27 of 2004) and the National Guidelines for Heritage Impact Assessment in Namibia (2021) by the National Heritage Council.

DECLARATION

I, a duly authorised representative of Research Culture Heritage Services (RCHS), hereby confirm my independence as a specialist and declare that:

1. Neither I nor the RCHS CC have any financial or any other personal interests in the construction of an ammonia pipelines infrastructure development project other than consultation fees for work performed on the project.
2. The RCHS specialist was appointed on a strictly professional basis to conduct an archaeological field survey and impact assessment in line with the National Heritage Act (No. 27 of 2004) and its Regulations (Government Notice 106 of 2005), guided by the “Guidelines for Heritage Impact Assessment (HIA) of 2021” from the Heritage Council as well as the Environmental Management Act (No. 7 of 2007) and its Regulations (Government Notice 30 of February 6, 2012).



Dr. Alma Nankela,
Archaeologist & Heritage Management Specialist

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EXECUTIVE SUMMARY

Desk research and archaeological field surveys and impact assessments were carried out between May 26 and 28, 2024, and June 6, 2024, along the 12.7 km proposed ammonia pipeline from farm 58 to the Walvis Bay port terminal area in the Erongo Region of Namibia. This report therefore presents a baseline description of potential heritage features located within and around the proposed. The field survey located a total of ten ($n = 10$) heritage features, including *five* potential historic sites that are neither sensitive nor vulnerable to the proposed ammonia pipelines (hot and cold), as they are located between 180 and 200 metres apart. Furthermore, their relevance in terms of the National Heritage Act (27 of 2004) is very low, as it is rated 1 due to the degree of disturbances as a result of anthropogenic and natural impacts. Furthermore, at least *one* wayside monument belonging to Maxuilili G.I. Nathaniel was recorded. This wayside monument is neither vulnerable nor sensitive, as it is located over 800 m from the proposed construction of the ammonia pipeline (hot), but it is deemed sacred in terms of the National Heritage Act (27 of 2004) as it is linked to his remains buried at the declared Heroes' Acre in Windhoek. A further *two* wayside crosses likely belonging to the Walvis Bay/Swakopmund road accident victims (no human remains) have been recorded. However, these are not relevant in terms of the National Heritage Act (27 of 2004), but they are worth mentioning. Lastly, at least *two* superficial shell-midden accumulations likely linked to the extinct mid-Holocene tidal lagoon have been recorded. These sites are relevant in terms of the National Heritage Act (27 of 2004), but they are neither sensitive nor vulnerable to the proposed ammonia pipeline (cold), as they are located between 127 and 129 metres away. As a result, no further mitigation is required for these sites; however, adopting the chance-find procedure appended to this report to facilitate future discovery of potential heritage features within and along the footprint of the project is recommended.

1. PROJECT BACKGROUND

Cleanergy Solutions Namibia (Pty) Ltd., a joint venture between Ohlthaver & List (O&L) Group and CMB.TECH (“**Proponent**”), intends to construct an ammonia pipeline from farm 58 to the Walvis Bay port terminal area in the Erongo Region of Namibia **Figure 1**. The proposed ammonia pipeline project runs 12.7 km from Farm 58, an industrial property east of the highway, to Walvis Bay Airport (near Dune 7), to the Walvis Bay port area. The first ammonia pipeline route (hot pipeline) ends at the ammonia terminal, while the second ammonia pipeline route (cold pipeline) begins from the ammonia terminal to the Walvis Bay terminal **Figure 2**. Its purpose is to connect the green ammonia production plant to the ammonia terminal. The pipeline will be made of carbon steel and will transport at least 800 metric tonnes of green ammonia daily from the ammonia production plant on Farm 58 to the storage unit at the port of Walvis Bay (ECC, 2024). It is anticipated that the green ammonia will be supplied to various marine and industrial applications and promote sustainable energy practices in Namibia, while the liquid ammonia will be transported from the ammonia production plant via the ammonia pipeline to the terminal for storage and exporting purposes (ECC, 2024).



Figure 1: The location of the project site Ammonia Terminal (four square shape in blue) surrounded by green in relation to the pipelines (warm and cold) from Farm 58 (orange dot).. Map Credit: (Cleanergy Solution, 2024: 16).

The construction of the pipeline and its associated infrastructure within the route layout has the potential to cause a significant negative impact on the receiving physical, biological, socioeconomic, and cultural environment. Such activities cannot be undertaken without an Environmental Clearance Certificate (ECC) as per the Environmental Management Act (No. 7 of 2007) and the Environmental Impact Assessment (EIA) and its Regulations (Government Notice 30 of February 6, 2012). To obtain an ECC, the proponent appointed Environmental Compliance Consultancy (Pty) Ltd., as the independent Environmental Assessment Practitioner (EAP) to conduct an Environmental Impact Assessment (EIA) in terms of the environmental legislation for the proposed ammonia pipeline from farm 58 to the Walvis Bay port terminal area and all its associated infrastructure within the route layout.

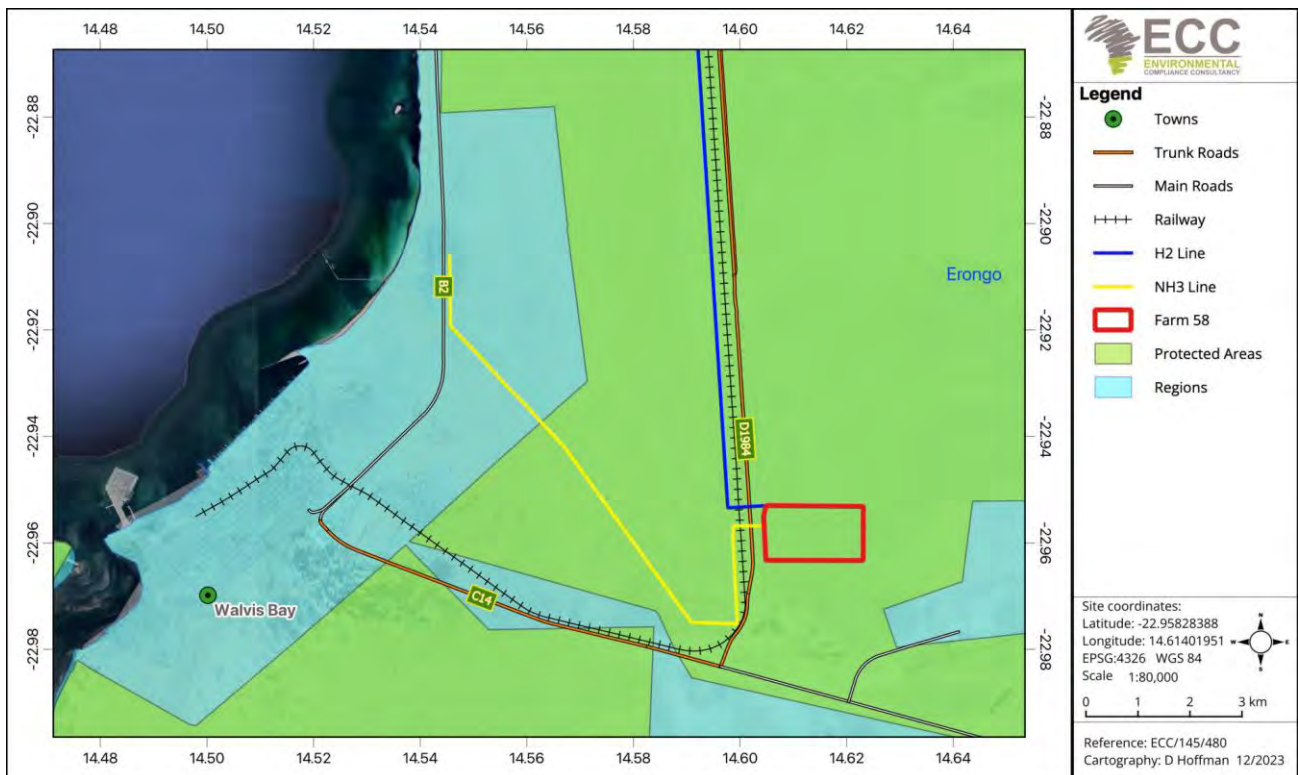


Figure 2: The locality of Farm 58 in relations to the proposed warm Ammonia pipeline (NH3 Line). Source: (ECC, 2024:7).

In Namibia, the heritage and culture component forms part of the required specialist studies to be considered in the overall EIA in an effort to examine whether possible heritage features within the footprint of the project are correctly identified, accurately recorded, reported, interpreted and their significances appropriately estimated in order to fulfil the requirements of the following legislations –the National Heritage Act No. 27 (2004) and the National Heritage Regulation of 106 of 2005 as well as the Environmental Management Act (2007) and Environmental Impact Assessment (EIA) Regulations (2012), in which the process of review, verification and consent will be required to clear the project. The significance of heritage resources (sites, structures, and artefacts) is determined by means of assessing their archaeological, palaeontological, historical, aesthetic, technological, and scientific value in relation to their uniqueness, condition of preservation, and research potential.

These aspects are not mutually exclusive, and the evaluation of each resource is done following the significance criterion ratio outlined in the “National Guidelines for Heritage Impact Assessment in Namibia (2021)” from the Heritage Council. Consequently, Environmental Compliance Consultancy (Pty) Ltd., subcontracted the services of the Research Culture Heritage Services (RCHS) to carry out the heritage surveys and impact assessments.

2. TERMS OF REFERENCE (TOR)

This heritage survey and impacts assessment study aimed for the specialist to:

- a) Assess the nature and degree of significance of heritage resources within the area and immediate surroundings.
- b) Demarcate sensitive heritage sites that will likely be found to guide the development process through establishing thresholds of impact significance.
- c) Determine the nature and degree of significance, sensitivity, and vulnerability of the heritage resources.
- d) Assess and rate any possible impact on the archaeological and other heritage resources within the area emanating from the proposed development activities.
- e) Devise heritage management measures actions for the project to be considered by the authorities for the issuance of Heritage Consent and thereafter the issuance of an Environmental Clearance Certificate.

3. PROJECT DESCRIPTION

According to ECC (2024), Cleanergy Solutions Namibia (Pty) Ltd. is a registered Namibian company and a joint venture 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) with the latter holding 49% of the of the shares and the former holding 51%. The company is already in the process of constructing a hydrogen demonstration plant on Farm 58 outside Walvis Bay. Apart from the proposed 12.7 km green ammonia pipeline (the subject of this assessment), the organisation also intends to construct an ammonia terminal at Walvis Bay and an 80 km green hydrogen pipeline from Farm 58 to Arandis as part of the overall components of this project **Figure 3**. The Ammonia pipeline design including the type of materials and size of pipelines will consist of: (a) ammonia: o 6" - 300LB (Assumed) – based on Pre feed docs, (b) insulation layer of 75 mm (assumed) (c) painting of the pipe according IM3 (marine specification for the saline environment); and (d) wrapping with Polyken tape (anti corrosion) – TBC. It is yet to be established by the proponent whether the ammonia pipeline will be constructed above or underground, but the

underground option is preferred to minimise impacts on the receiving environment. Its layout will connect two sites where the ammonia is produced (farm 58 plant) and the Northport where the storage lies for the import and export to take place as shown in **Figure 1**.

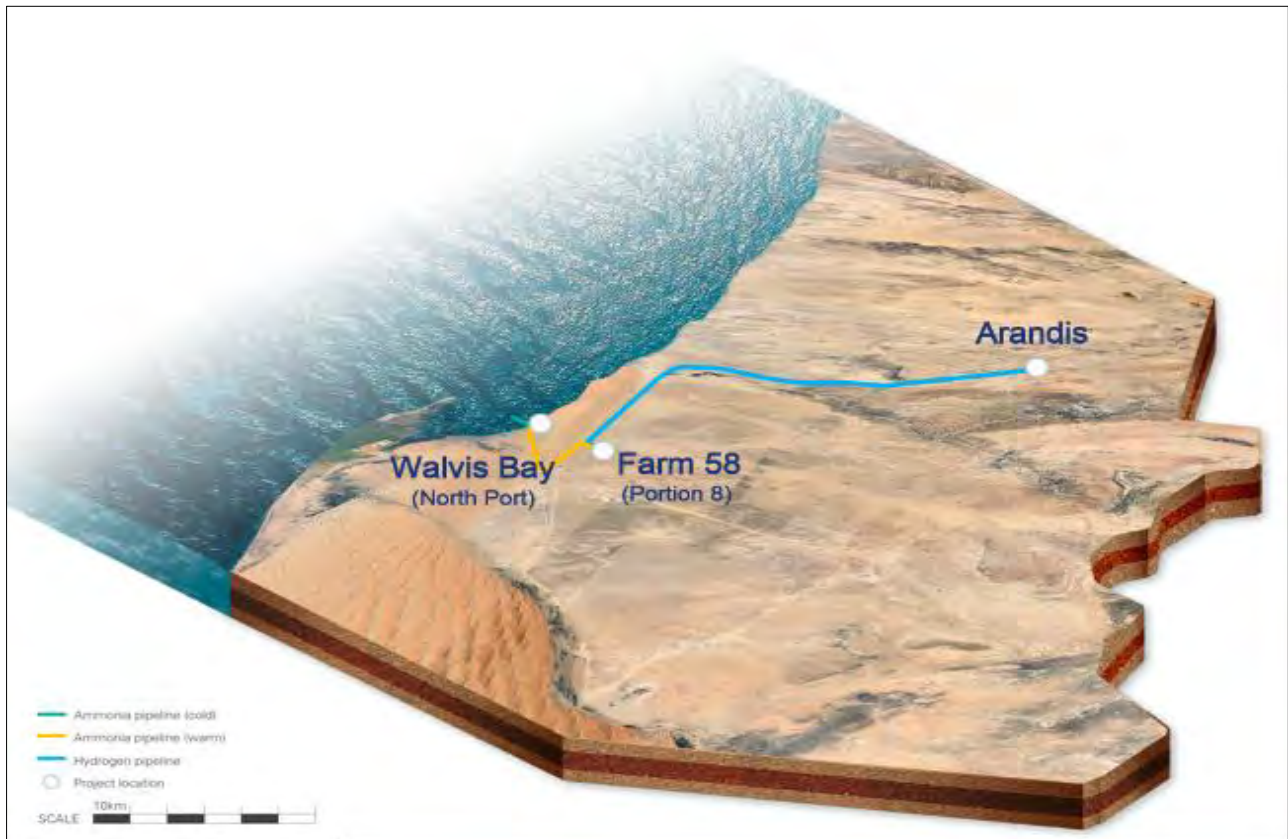


Figure 3: The layout of all three infrastructure development associated with the proposed green hydrogen project. Source: (Cleanenergy Solution, 2024:8).

The proposed construction and operational phases of the ammonia pipeline and associated infrastructure within the route layout shown in **Figure 4** and Error! Reference source not found. will include the following:

- a) During the construction phase, the proposed construction phase will include low-impact and non-intrusive activities where the ammonia pipeline will be constructed out of a carbon steel pipeline for daily transportation of green ammonia from the ammonia production plant to the ammonia terminal.
- b) Crews flag of the boundaries of all locations where construction activities will take place. The flags will mark the extent of the temporary construction zone surrounding the pipeline right-of-way (ROW), as well as the staging and storage areas. The width of the right-of-way is determined based on the diameter of the pipe, with widths ranging from 50m until a few 100m. While existing roads are used when possible, temporary access roads are also constructed to be create direct paths from staging areas to the pipeline ROW while observing the following steps:
 - o Step 1: Construction Staging Areas & Storage Yards In order to construct a pipeline, staging

areas and storage yards are cleared, strategically located along the planned right-of-way. These areas are used to stockpile pipe and to store fuel tanks, sand bags, silt fencing, stakes, and equipment parts. They provide parking for construction equipment, employee trucks, and locations for office trailers.

- Step 2: Clear Cutting the ROW After the equipment is accessible in the staging area, work will begin to clear cut the pipeline right-of-way.
 - Step 3: Excavating the Trench The trench for the pipeline is dug after the ROW is cleared of trees. If rocks or ledges are encountered, track hoes with jack hammers are brought in to create the trench. Sandbags are placed within the trench to restrict water flow and to support the pipe.
 - Step 4: Pipe Transport, Stringing, & Assembly When the trench is completed, segments of pipe, usually 12 m in length, are transported from stockpiles in the staging area to the right-of-way. Pipes are laid above ground beside the trench, or within the trench on top of supportive sandbags in steep terrain. Certain pipe sections are bent using a pipe bending tool to allow the pipeline to follow the planned route and the terrain. The pipe sections will then be welded together, sand blasted (TBD), and the weld joints coated to prevent corrosion. Finally, the weld joints are inspected with x-ray to ensure their quality. Connected lengths of pipe can then be lowered into the trench.
 - Step 5: Obstacles: Roads & Streams Pipelines cross existing roads, highways, streams, rivers, and wetlands. Typically, pipelines are constructed underneath these obstacles by either boring for shallow depth or using horizontal directional drilling (HDD) for deeper placement. Other obstacles include abandoned mines, karst topography, and densely populated areas. Each obstacle requires a unique method and order of operations.
 - Step 6: Testing & Restoration: After the pipe is inspected, the trench is filled in. Before completing the project, the pipeline integrity must be verified using hydrostatic testing. Water is sent through the pipeline and the pressure is increased to above the maximum operational level. If the pipeline remains intact during this test, it is deemed operational. After this, the surface of the ROW is seeded and fertilized, and above-ground markers are placed along the pipeline path.
- c) Additional Infrastructures for the underground pipeline will employ several types of supporting infrastructure that are constructed during a pipeline project. Compressor stations, valve stations are built above the right-of-way along the pipeline, allowing operators to shut off sections of the line for maintenance or in an emergency. Metering stations are built along the length of pipelines, providing a measure of the flow of gas throughout the line. To ensure pipeline integrity, welds must be x-rayed and the pipe hydrotested. This process involves pumping in clean water, pressured above the expected MAOP — maximum average operating pressure. Then, all water is removed, and “pigs” are inserted into the pipe to clean it out. When the pigs eventually exit the

far end of the pipe clean, then the line will be filled with dry air. Air compressors pump up the air, and the air is run thru a drier. The air will be sampled and tested for moisture content. When those parameters get low enough, the complete pipeline is filled with nitrogen to absorb more of the remaining moisture. Only then is the pipeline ready to transport the purposed medium. In this step-by-step overview as described above is assumed that we position the pipe underground. The aboveground workflow is quietly the same, except for the excavation part. Also, more security mitigations have to be in place i.e. fencing and CCTV.

- d) During the operational phase, the ammonia pipeline will transport 800 metrics tons of green ammonia from the ammonia production plant on Farm 58 to the ammonia terminal at the port of Walvis Bay.



Figure 4: A typical example of the ammonia pipeline above the ground. Image credit: (ECC, 2024).

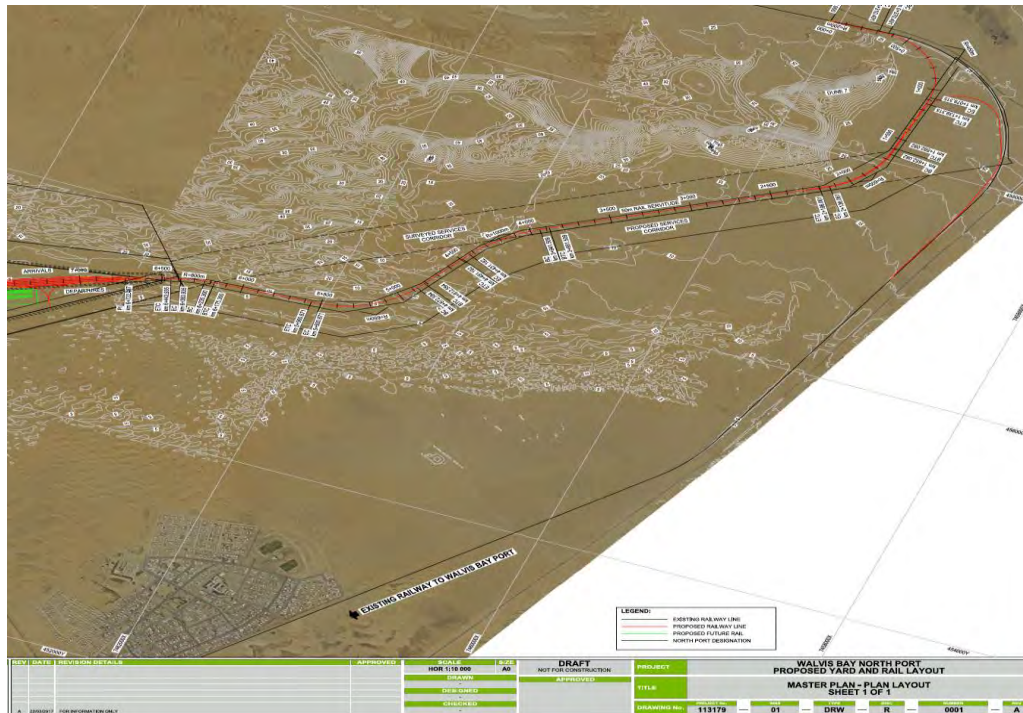


Figure 5: Layout route of the ammonia pipeline and associated North Port infrastructures. Source: (ECC, 2024).

4. ASSUMPTIONS AND LIMITATIONS

This archaeological heritage study assumes that all background information and layout plans provided by the proponent are accurate and up-to-date. The assessment therefore focused mainly on the proposed ammonia pipeline routes (hot and cold) and the immediate vicinity (100 m) of the project. It does not apply to and may not be used for any other future developments and expansions of the project outside the assessed areas. The available heritage records from previous studies of similar projects undertaken in the same general area were used in this study. These records were augmented by a recent comprehensive field survey and assessment carried out in three days between May 26 and 28, 2024, and June 6, 2024.

Only one heritage feature was identified through interviews with affected local communities in the vicinity of the project as part of the community consultations to record possible unknown heritage resources, in particular historic graves or burial grounds and other intangible or sacred sites of community value. However, since archaeological and or palaeontological heritage surveys largely depend on the indicative value of surface finds recorded during the field surveys, it is always possible that hidden or subsurface remains could be overlooked; therefore, the appended Chance Find Procedure Guidelines should be adopted. Since the proposed ammonia pipeline route (hot) falls within Dorob Park, an access permit from the Ministry of Environment, Forestry, and Tourism was granted to the RCHS researcher, while permission to access the propopsed ammonia pipeline route (cold) was granted by Namcor to access the jetty terminal area where the project ends **Figure 6**.



Figure 6: RCHS researchers wearing frame resistant attires by Namcor while accessing the jetty terminal. Source: (RCHS, 2024e).

Other limitation experienced was due to the prevailing eastwinds, morning fogs and gradual aeolian erosion process which reduced the visibility of archaeological remains including possible buried remains which might be preserved and protected under shallow sedimentary deposits making it difficult to locate and or document them.

5. LEGAL REQUIREMENT

The National Heritage Act (No. 27 of 2004) is the regulatory authority for the identification, protection, preservation, management, and promotion of Namibia's heritage resources. Part 1 of the Heritage Act defines 'heritage resources' as both *places* and *objects* of archaeological, palaeontological, and rare geological objects, including meteorites, cultural, historical, ethnographical, scientific, technological, and social significance. The significant places also include "the natural or existing condition or topography of land", as well as "trees, vegetation, topsoil, or bodies of water" that maintain the ecological functioning and integrity of the specific area. In these aspects, the Act provides legal protection for both tangible and intangible heritage resources. The newly developed "Guidelines for Heritage Impact Assessment in Namibia of 2021" have been formulated for the implementation of the National Heritage Act, especially Section 51 (3), which outlines requirements for heritage impact assessment in Namibia. The aspect of intangible heritage may include sacred sites: "places to which oral traditions are attached to or which are associated with living heritage, graves and burials, historic settlements, and military sites by means of a

building, garden, or tree” which are considered to have heritage significance in Namibia. The significance of the heritage resources (sites, structures, and artefacts) is determined by means of their typological classifications defined in Part 1 of the Act in relation to their uniqueness, condition of preservation, and research potential. Therefore, these aspects are not mutually exclusive, and the evaluation of each resource is achieved following the significance criterion ratio entrenched in the ‘Guidelines for Heritage Impact Assessment (HIA) in Namibia of 2021’.

NHC maintains a heritage register in accordance with Part IV of the Heritage Act. The register lists ‘significant heritage’ places and objects of national importance. The register allows new approved entries to be added based on the assessment of their heritage significance and, thereafter, publication of the sites in the Government Gazette. Consequently, Part V applies immediate legal protection to heritage sites added to the register to prevent unnecessary disturbances or damages to heritage resources as an inevitable result of infrastructure development, unless permitted in terms of Section 48 of the Act. Moreover, aspects concerning the conservation, management, and impact assessment studies of cultural heritage resources for projects such as the proposed ammonia pipelines are also addressed in the Environmental Management Act, 2007 (No. 7 of 2007).

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. Other applicable laws and policies relevant to 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, 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. The standards apply whether or not the heritage material is protected, irrespective of whether it may have been previously disturbed. Furthermore, Namibia being a state party to the World Heritage Convention, the country strictly follows and adopts the operational guidelines for the implementation of the convention that aim at facilitating the implementation of the convention concerning the protection of the inscribed world cultural and natural heritage properties on the World Heritage List against any deterioration or disappearance of these most prized assets because of their exceptional qualities, which have been considered to be of “outstanding universal values”.

6. METHODOLOGY AND IMPACT ASSESSMENT

This archaeological survey followed a basic two-phase process of evaluation: the desk study, followed by an assessment based on the field survey. Field investigations included extensive examination of the site surfaces through field transect approaches such as walking across the landscape in parallel lines of about 20 m intervals from the limit of the project **Figure 7** while recording surface artefacts using conventional

criteria of physical setting and archaeological affinity through photography, general description, and GPS locations to aid the field survey. However, it is important to point out that no surface collections were made for analysis during this survey. Additional data were obtained through available records on palaeontological and archaeological data in the project areas. Such data were generated from a series of publications from multidisciplinary research.

The objectives of the impact assessment are to identify potential archaeological and other heritage resources within the footprints of the project and its immediate surroundings and to find best practice measures to enhance positive impacts and avoid, minimise, or mitigate the negative impacts, either by recording or preservation. If possible, any form of impact is to be avoided by finding alternatives to damage or destruction. Actions that cannot be avoided or minimised ought to be mitigated in an 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 significance. 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, minimise, and mitigate have been fully explored.



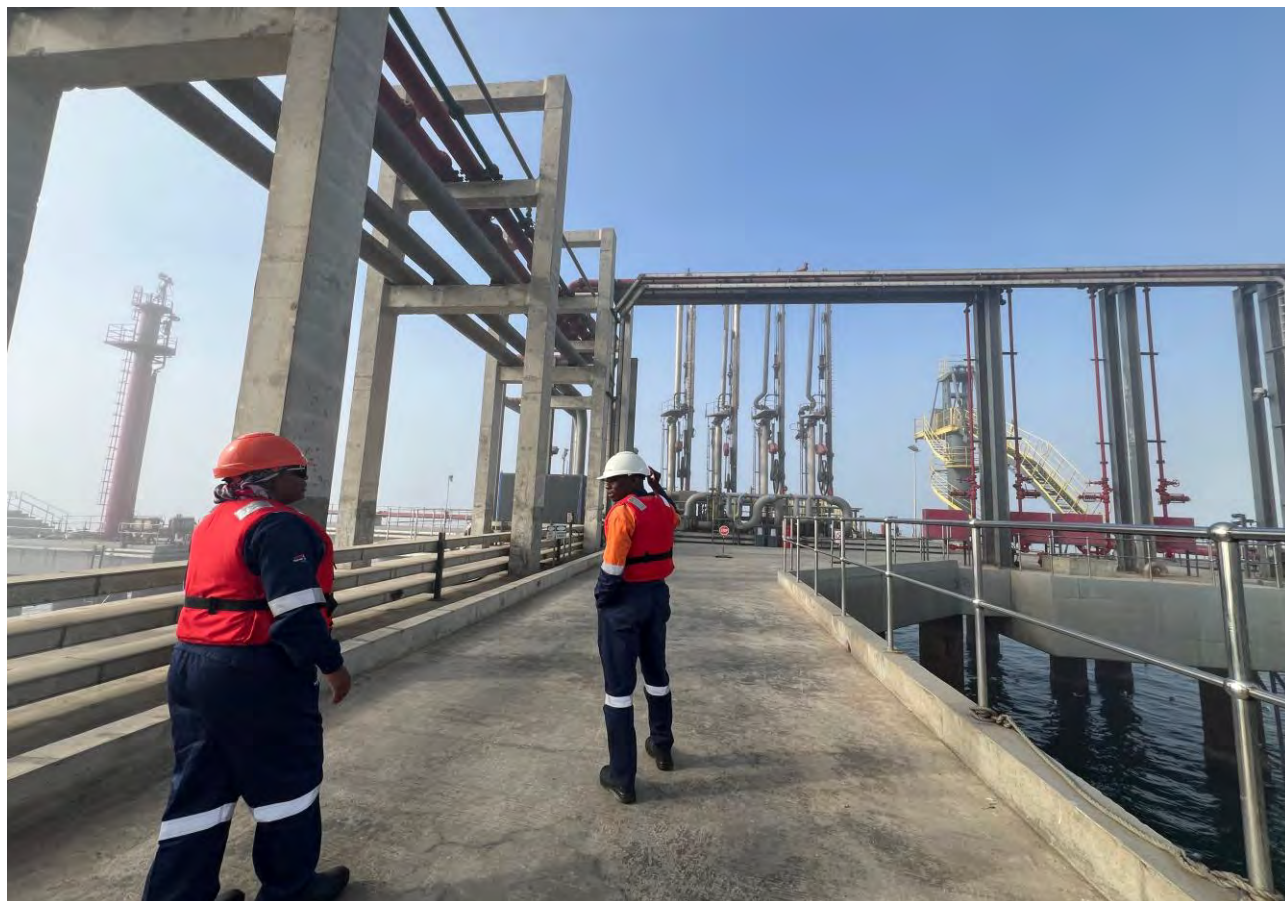


Figure 7: Archaeological field surveys along the proposed ammonia pipelines (cold and hot). Source: (RCHS, 2024e).

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

Table 1: Heritage Significance rating table with key attributes adopted by the National Heritage Council, 2021.

LEVEL OF SIGNIFICANCE	GRADING	DESCRIPTION
Exceptional/upper higher	5	- Major national heritage resources. - Rare & outstanding example. - Containing unique evidence of high regional & national significance.
Considerable high	4	- Very important to the heritage of the region. - High degree of integrity/ authenticity. - Multi-component site and objects - High research potential
Moderate	3	- 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	- 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	- 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	- Absence of heritage resources - Highly disturbed or secondary context, without diagnostic or associated heritage

Table 2: The vulnerability rating table with key attributes adopted by the National Heritage Council, 2021.

VULNERABILITY RATING	
0. Not Vulnerable	
1. No threat posed by current or proposed development activities	
2. Low or indirect threat from possible consequences of development (e.g. soil erosion)	
3. Probable threat from inadvertent disturbance due to proximity of development	
4. High likelihood of partial disturbance or destruction due to close proximity of development	
5. Direct and certain threat of major disturbance or total destruction	

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

Table 3: Assessment criteria for the evaluation of cumulative impacts on archaeological heritage sites adopted by the National Heritage Council, 2021

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	Up to 3 years 4 to 10 years after construction

	Long Term	More than 10 years after construction
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7. COMMUNITY CONSULTATION

The public participation process is a critical and integral part of the HIA process, and it was deemed necessary that affected local communities, authorities, and interest groups in Walvis Bay are engaged on heritage matters with respect to the proposed ammonia pipeline routes (warm and cold) to provide their input into the planned development as the impacts may directly or indirectly affect them. These consultations provide stakeholders with the opportunity to provide input on issues related to the project on matters of heritage in an effort to supplement secondary data and bridge gaps in heritage knowledge of the area by identifying key heritage features, elements, or aspects that the present-day communities living near the proposed development value, such as tangible and intangible heritage resources, in an effort to safeguard them.

The EIA public consultation on the proposed ammonia pipeline routes (warm and cold) and other related infrastructure development was commissioned by ECC and commenced in March 2024 with the community directly affected and/or interested and key stakeholders. Public meetings and focus group meetings were held in Walvis Bay, Swakopmund, and Arandis. Additional notices advertising the public meetings were also published in national newspapers and in the media. For heritage aspects, the Ministry of Environment, Forestry, and Tourism office in Swakopmund, which manages Dorob National Park, was engaged on May 27, 2024, while the National Petroleum Corporation of Namibia (NAMCOR) was engaged on May 28, 2024, and on June 6, 2024. However, the only heritage data provided was the known monument of Nathaniel Maxuilili **Figure 8**, unveiled on June 23, 2000, built along the C14/M36 road and located approximately 904 metres from the proposed ammonia pipeline route (warm). Therefore, although significant, the site is not vulnerable; hence, it will not be directly affected by this development.



Figure 8: Nathanael Maxuilili monument along the C14/M36 road behind dune 7 in Walvis Bay. Source: (Author, 2017).

8. BASELINE ENVIRONMENT

A large section of the project area is gravel plains within the Dune Belt area. Although a unique biodiversity of local fauna occurs, it is extremely sparse vegetation, and common plants found include the cushion-like plant *Trianthema hereroensis* (**Figure 9** left) and a number of hummocks (vegetated mounds of sand that act as sand and detritus traps), which are important shelters for various species of beetles and reptiles. The hummocks are mainly caused by *Arthroa leubnitziae* (**Figure 9** right), *Zygophyllum* species, and *Salsola* species (Walvis Bay Council, 2008). However, due to the increased infrastructure development around this area, such as tourism activities surrounding the dune 7 and associated activities like quad biking and off-road driving, transportation infrastructure (roads, railways, and airports), and utility service infrastructure (installation of water pipelines, electricity lines, and renewable energy facility), a large part of the gravel plains is highly disturbed (**Figure 9** bottom images), hence few plant species are observed today.

During the field survey, no living animals or their footprints could be observed within and around the proposed ammonia pipeline route from farm 58 to the dune belts; however, the only remains observed were the skeletal remains of what appear to be a small antelope species **Figure 10** around the project route. The baseline biodiversity report by the Walvis Bay Council (2008) indicates that the gravel plains within the Dune Belt area support a high diversity of tenebrionid beetles, reptiles, and endemic rodent species such as *Eremitalpa granti namibensis* (Golden mole) and *Gerbilurus tytonis* (Namib dune gerbil). These

shelters are mainly in cushion-like plants and hummocks, as well as in the dune sand. Large wild animals such as ostriches, antelopes such as springbok and oryxes, and brown hyenas can also occasionally be seen, according to the information from MEFT. However, due to the excessive noise pollution and surface disturbances of the area, such fauna species are less frequently seen.



Figure 9: Top image shows the observed plant adopted species within the proposed ammonia pipeline route while bottom images show an extensive surface disturbances in form of existing infrastructure development. Source: (RCHS, 2024e).



Figure 10: Left and right images are the skeletal remains of a small antelope species behind dune 7 in proximity to the proposed ammonia pipeline route (warm). Source: (RCHS, 2024e).

9. GEOLOGICAL SETTING

According to the geological map (**Figure 11**), the main superficial lithological sequences that characterise the footprint of the project are gravel plains and aeolin sand, which form part of the important Dune Belt System that falls within Dorob National Park between Walvis Bay and Swakopmund. The Kuisese River in Walvis Bay is probably the most important geomorphic feature due to its capacity to produce sediment that is being carried by the wind and transported onto the shoreline, control the transportation of sand inland from the beach, and control the patterns and forms of sand dunes. For the aeolian sand to accumulate, the system requires a source of sand, sufficient wind energy to transport the sand, and conditions that promote the deposition of the sand to form an accumulation (Havholm & Kocurek, 1994).

The Dune system is then sourced from sands that have been transported to the coast by fluvial processes and reworked by waves and nearshore currents to a series of entry points where the coast lies at an angle that allows transport onshore by the prevailing winds (Lancaster, 2014). The size of the sandy gravel, or aeolin sand, largely depends on the available accommodation space, the length of time over which the accumulation has occurred, and the width of the coastal platform (ibid., 2014). Although sand redeposition continues, the largest accumulation of sand was reported to be more rapid during Quaternary periods due to increased wind speed and lower sea levels (ibid., 2014). The gravel and aeolin sand is underlined by regional geology of this area consists mainly of the Kalahari Group with the rock type characterised as Kalahari and Namib Sands belonging to the Kalahari Group and covers a large part of Namibia.



Figure 11: The geological settings of the ammonia pipelines project. Images source: (RCHS,2024e).

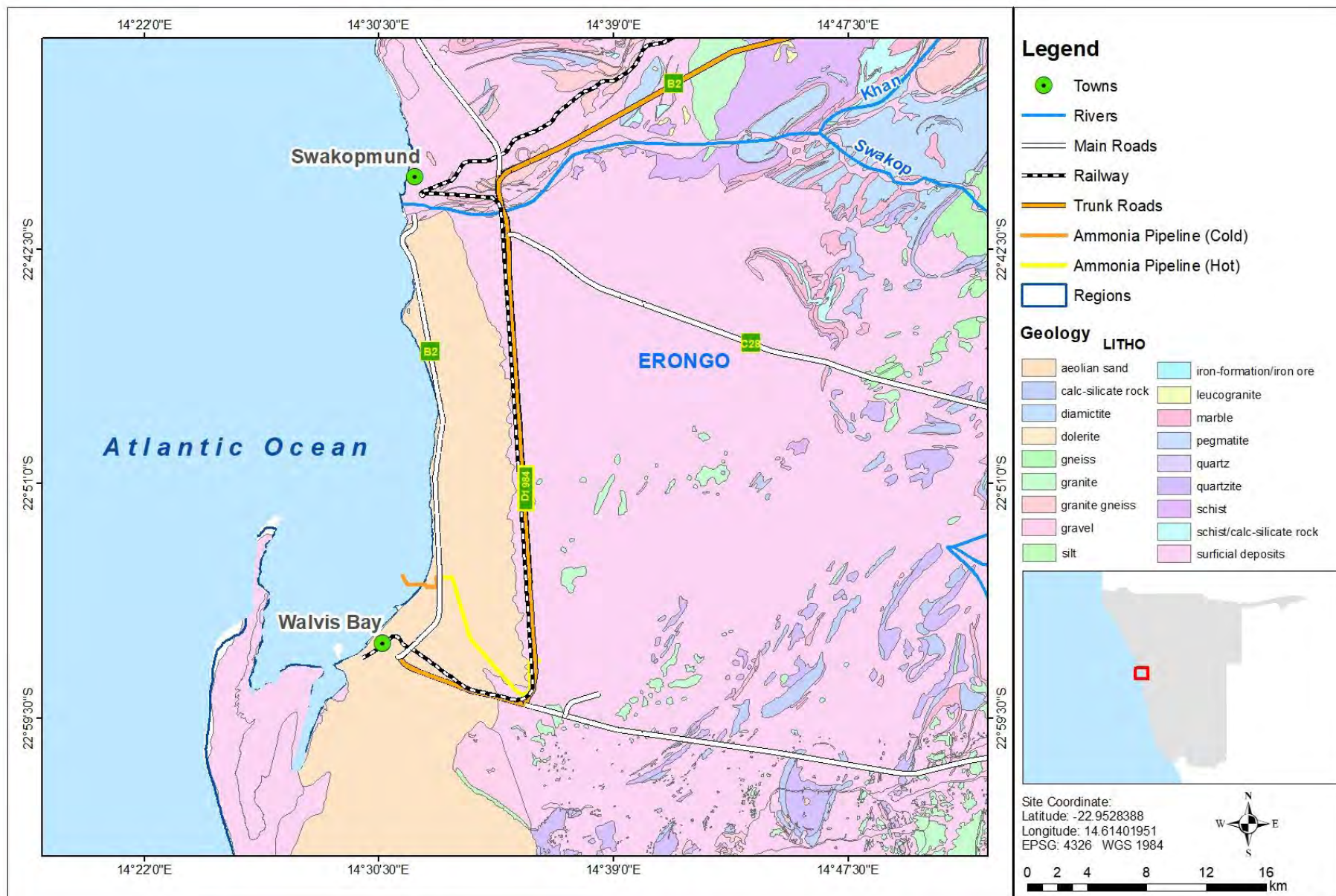


Figure 12: The geological setting of the proposed ammonia pipelines (cold-orange) and warm (yellow). Cartographer: (Maria Sigopi, RCHS, 2024e).

10. HERITAGE SETTING

A series of detailed archaeological, palaeo-environmental research and heritage survey assessments carried out along the coastal region and in the vicinity of the project footprint (see Mitchell 2002; Kinahan 2014; Morse et al., 2013; Detroit & Nankela 2014; and Nankela 2017; 2022) has revealed a wealth of archaeological data considered to be of great significance due to their state of preservation. Accordingly, these archaeological features manifest themselves in the form of a group of shell-middens, accumulations of skeletal remains of marine and terrestrial (wild and domestic) vertebrates, pottery, beads, human footprints, and various artefacts, including human remains buried under silt deposits, with some largely exposed by natural erosion corresponding to the flood deposits.

More recently, palaeoarchaeological assessment in vicinity of the project area by Kinahan (2014), in relation to the Port of Walvis Bay SADC Gateway project **Figure 13** revealed evidences of molluscan fauna remains dated to $40\,830 \pm 480$ BP and representing the tidal flood from the Pleistocene lagoon; extensive shell-midden accumulations along the extinct Tumas River mouth, archaeological evidence related to the coastal conditions of Namibia during associated with human occupations over the last 0.8 million years appearing extensively during the mid-Holocene Optimum—over the last 6,500 years ago at the northern extremity of the Khuseb Delta as well as pottery vessel recovered from the shell-midden sites at the extinct Tumas River mouth and dated to the 7th century AD. This is the area in proximity to where the proposed ammonia terminal is envisioned to be constructed.

Well-preserved evidence of early trading contact between indigenous Namibian communities and sea-faring traders that developed around Walvis Bay in the 1700s, evidenced by historical materials such as temporary camps, tins, broken glass bottles, gin bottles, and corrugated iron drums, has also been recorded (Kinahan and Kinahan 2009; Kinahan 2001, 2005; Bennett et al., 2014; Nankela 2017 and 2022). In the area around the High Dune Belt, a number of historic sites associated with the usage of this area have been documented, including old posts (indicative of settlements or animal enclosures), skeletal remains of wild horses, remnants of building materials such as rusted drums and copper wires, old clothing, fishing nets, charcoal, decorated porcelains, traded beads, empty bullet casings, and square case gin bottles and tins (Nankela 2017). These appear to be related to the 17th to 19th centuries trading activities between European merchants and indigenous traders and/or military training exercises conducted in the 1960s associated with ‘bokkop soldiers’ **Figure 14** who trained for the second South African Infantry Battalion (2 SAI) of the South African Defence Force (Dickens 2017¹).

¹ Peter Dickens (2017). The ‘Dune’ that forged men. Accessed on: <https://samilhistory.com/2017/03/21/the-dune-that-forged-men/>

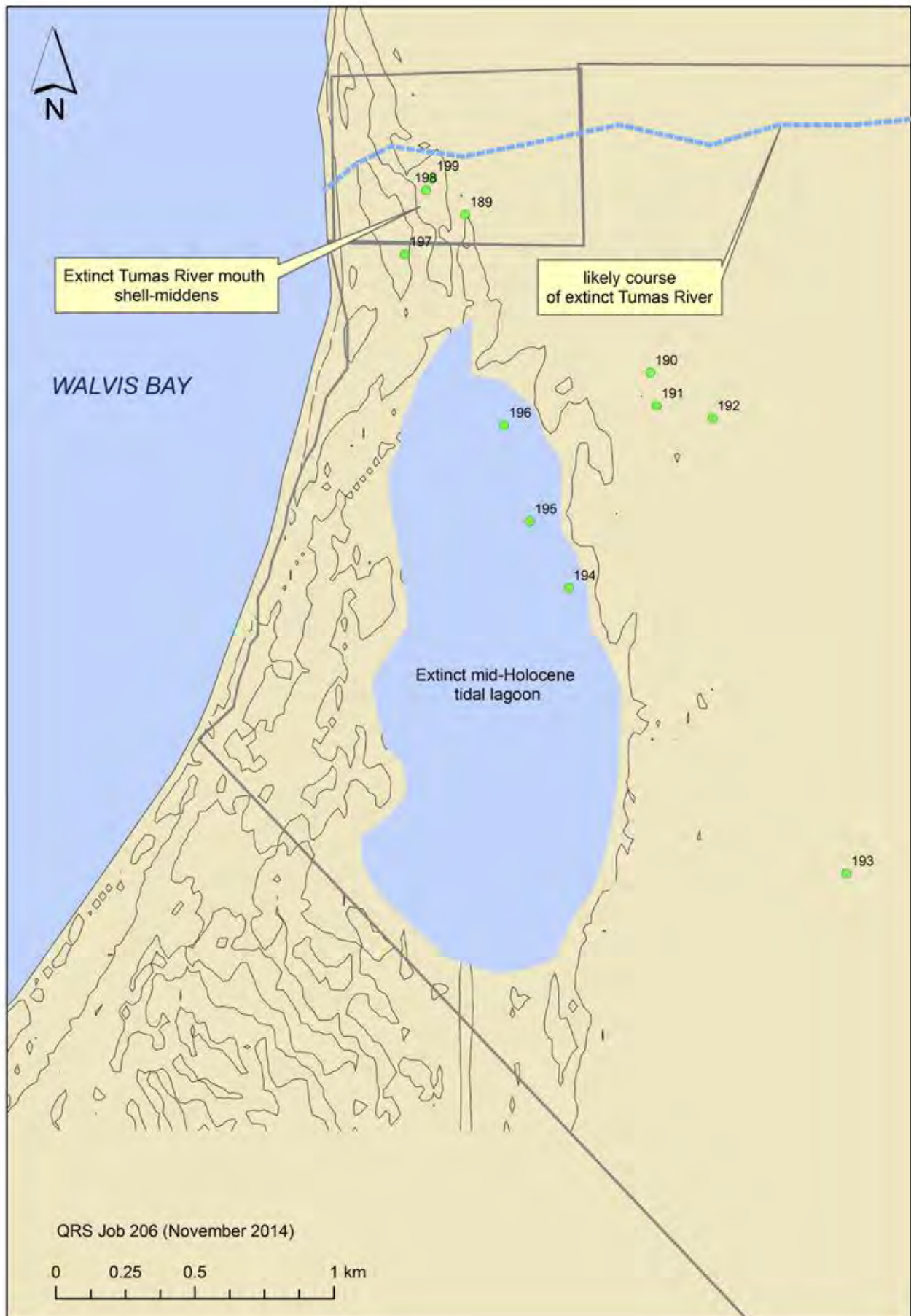


Figure 13: A localised map of Walvis Bay area indicating a number of palaeoarchaeological features near the port of Walvis Bay SADC Gateway Development project site (grey polygon) in vicinity of the Dunes Belt Area. Source: (Kinahan 2014:14).



Figure 14: Above and below are images shows the SADF SAI military training exercise on and around Dune 7 area in Walvis Bay.
 Source: <https://samilhistory.com/2017/03/21/the-dune-that-forged-men/> accessed on the 8th July 2024.

11. ASSESSMENT FINDINGS

The field survey and assessment have located ten potential heritage features ($n = 10$) in the vicinity of the 12.7 km proposed route of the ammonia pipeline from farm 58 (hot) to the ammonia pipeline terminal (cold) area presented in Table 4 and in Figures 15, 16, 17, and 18, respectively. None of these sites are vulnerable or sensitive, as shown in **Table 4**, as they are located over 100 metres from the project. These comprised five ($n = 5$) potential historic sites with an isolated heap of discarded debris of broken bottles, rusted canned beef cans, and other debris of unidentified corrugated metal materials probably associated with the temporary post likely used by the 'bokkop soldiers' during military training exercises in this area **Figure 17**, as well as historic fishing activities evidenced by buried and surface corrugated asbestos structures with fishing nets, baskets, and probably whale bones. These sites are neither sensitive nor vulnerable to the proposed ammonia pipelines (hot or cold), as they are located between 180 and 200 metres apart. Furthermore, their relevance in terms of the National Heritage Act (27 of 2004) is very low, as it is rated 1 due to the degree of disturbances as a result of anthropogenic impacts such as off-road vehicles, surface trampling, and increased infrastructure development around this area, such as utility service infrastructure and fencing. Natural impacts in the form of wind erosion processes have also redeposited these surface materials out of their primary contexts, with no research potential.

A wayside monument ($n = 1$) belonging to Maxuilili G.I. Nathaniel **Figure 8**, born on October 10, 1927, in Tsumeb, Oshikoto Region, and who was a resident of Walvis Bay, has been recorded. Maxuilili passed away on June 23, 1999, at this spot, reportedly when the ambulance that was taking him to the airport collided with another vehicle. Maxuilili was a member of SWAPO, a veteran of the struggle for independence in Namibia, served as the ruling party's acting president in Namibia between 1960 and 1989, was deputy defence minister in the Namibian government in the 1990s, and was instrumental in the negotiations for the return of Walvis Bay to Namibia². However, Maxuilili's remains are currently reburied at Heroes Acre in Windhoek from Walvis Bay Cemetery. This wayside monument is neither vulnerable nor sensitive to the proposed ammonia pipelines (hot or cold), as it is located over 800 m from the proposed construction of the ammonia pipeline (hot), but it is deemed sacred in terms of the National Heritage Act (27 of 2004) as it is linked to his remains buried at the declared Heroes' Acre in Windhoek.

Further two ($n = 2$) wayside crosses likely belonging to the Walvis Bay/Swakopmund road accident victims (no human remains), as shown in **Figure 1**, have been recorded. Finally, at least two ($n = 2$) significant but superficial shell-midden accumulations are probably linked to the extinct mid-Holocene tidal lagoon **Figure 19**. All these heritage features are presented in the following table:

² https://www.parliament.na/dt_team/maxuilili-g-i-nathaniel-3/

Table 4: Present the list of potential archaeological sites and historic heritage resources within and around the proposed project.

Site Coordinates	Description	Artefacts	Typology	Distance from the proposed Ammonia pipeline (hot/cold)	Sensitivity Rating	Vulnerability Rating	Significance Rating	Recommendation
22°57'47.21"S / 14°35'49.35"E Site 01	Isolated heap of discarded debris materials	Rusted tins and broken glass bottles	Potential Historic Site (waste dump)	181.97m (hot)	0	0	1	No further mitigations required
22°58' 18.45" S 14°35' 37.842" E Site 02	Isolated heap of discarded debris materials	Old post with toilet remnant and an oval stone feature	Potential Historic Site	470.92m (hot)	0	0	1	No further mitigations required
22°58'45.71"S/ 14°35'0.66"E	Nathanael Maxuilili monument	Wayside monument	Sacred Site	896.69m (hot)	0	0	4	No-Go Zone
22°58'20.02"S/ 14°35'6.39"E Site 03	Isolated heap of discarded debris materials	Old settlement post with animal enclosure with many remnants	Potential Historic Site	237.10m (hot)	0	0	1	No further mitigations required
22°57'26.922" S/ 14°34' 43. 752" E Site 04	Isolated heap of discarded debris materials	Old settlement post with animal enclosure	Potential Historic Site	251.41m (hot)	0	0	1	No further mitigations required
22°54'45.89"S/ 14°32'37.96"E Site 05	Remembrance monument (Not a grave)	Wayside Cross	Sacred Site	120.38m (hot)	0	0	0	No further mitigations required
22°54'4.46"S/ 14°32'40.99"E Site 06	Remembrance monument (Not a grave)	Wayside Cross	Sacred Site	546.46m (hot)	0	0	0	No further mitigations required
22°54'31.76"S 14°32'21.19"E Site 07	Old fishing post	Buried and surface post with fishing nets and baskets	Potential Historic Site	216.54m (hot)	0	0	0	No further mitigations required
22°54'47.652" S/ 14°32' 21.378" E Site 09	Surface scatter of shell-midden	shell-midden	Archaeo - palaeontological	127.41m (cold)	0	0	3	No-Go Zone
22°54'47.622"S / 14°32'26.418" E Site 10	Surface scatter of shell-midden	shell-midden	Archaeo - palaeontological	129.28 (cold)	0	0	3	No-Go Zone

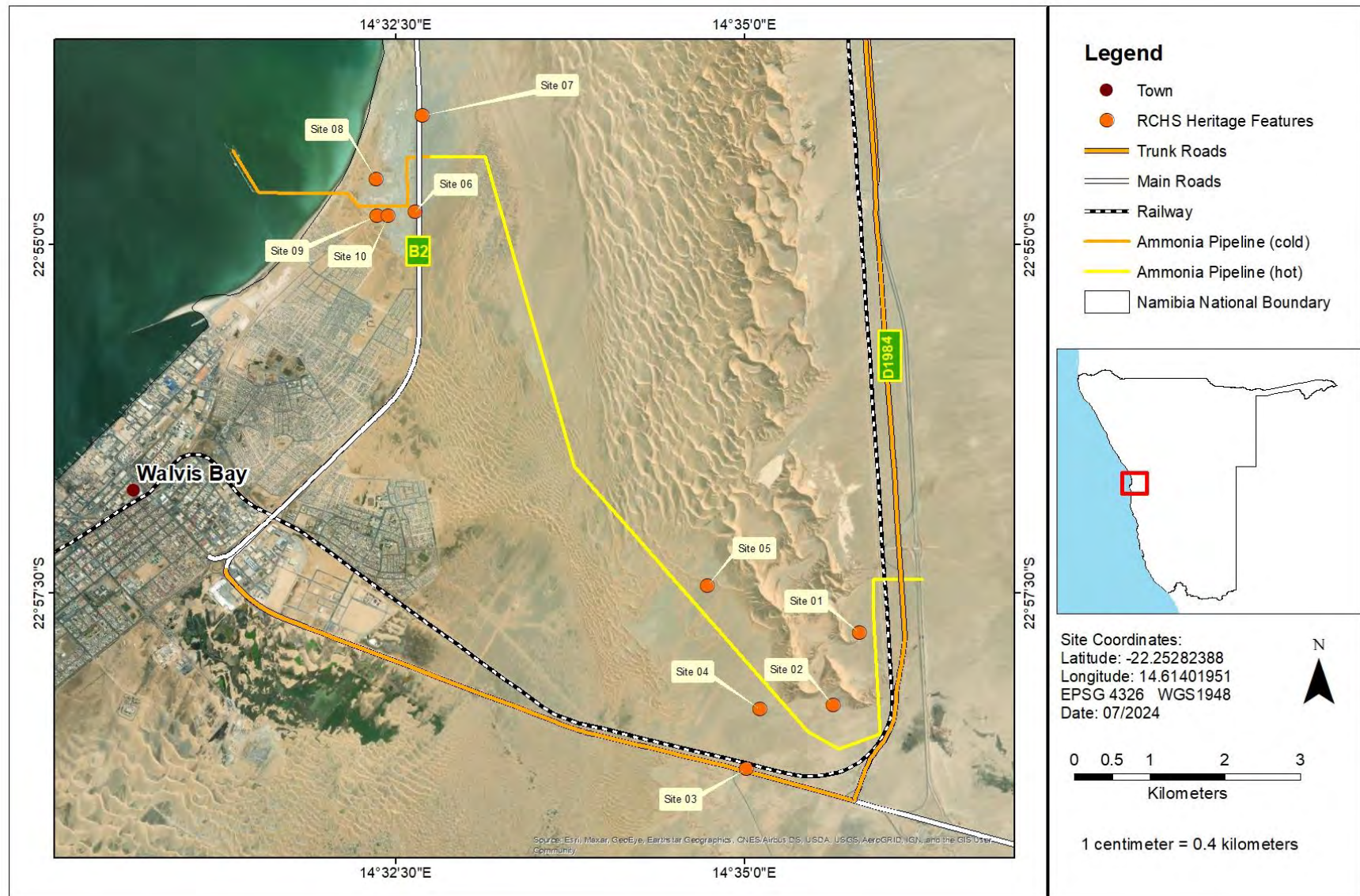


Figure 15: The distribution of all heritage resources located within and around the project footprint of the proposed ammonia pipelines (hot and cold). Cartographer: (Maria Sigopi at RCHS, 2024e).

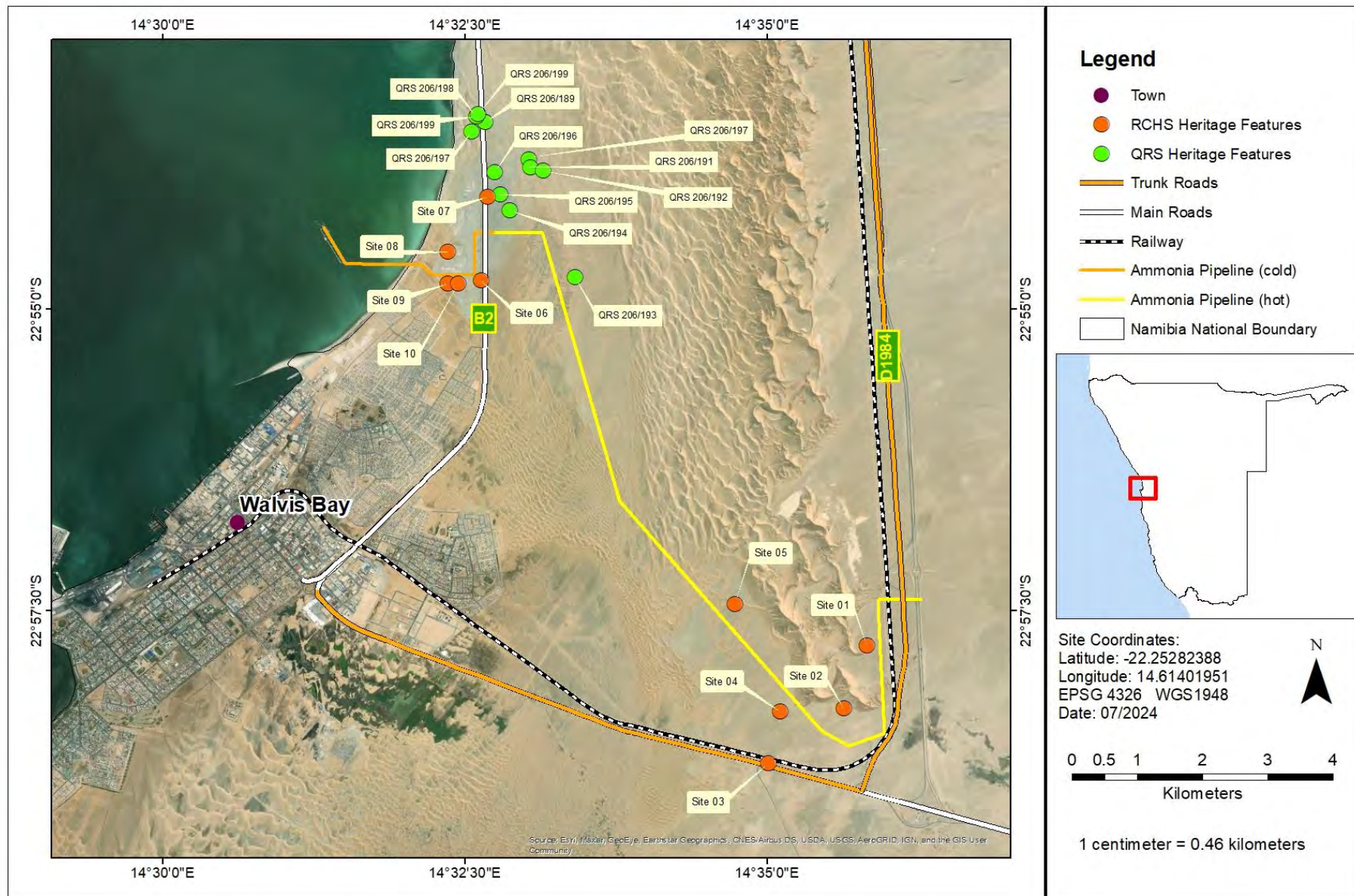


Figure 16: A consolidated map with the distribution of all heritage resources by RCHS and QRS located within and around the proposed ammonia pipelines (hot and cold). Cartographer: (Maria Sigopi at RCHS, 2024e).



Figure 17: Top left image present the potential historic waste dump sites with discarded heap debris materials of rusted tins, drums and broken glass bottles south of dune 7. Top right image is an old post with toilet remnant and oval shaped stone feature and other waste materials behind dune 7. Middle left image is the old settlement post with animal enclosure with many historic remnants of materials. Middle right image is an old settlement post with various discarded materials and animal enclosure. Bottom image is animal remains (horses), at another potential historic post. Source: (RCHS, 2024e).

The two wayside crosses likely belonging to the Walvis Bay/Swakopmund road accident victims (no human remains), as shown in **Figure 18**, have been recorded. These are located at these GPS locations: 22° 5445.89 S and 14° 3237.96 E, as well as 22° 544.46 S and 14° 3240.99 E. The sites are also not relevant in terms of the National Heritage Act (27 of 2004) but are deemed sacred features. Equally, the sites are neither sensitive nor vulnerable to the proposed ammonia pipelines (hot or cold), as they are located between 120 and 500 metres away.



Figure 18: Wayside crosses belonging to the road accident victims along Walvis Bay/Swakopmund road. Source: (RCHS, 2024e).

The two superficial shell-midden accumulations are most likely similar to those found and documented by Kinahan (2014) at the extinct mouth of the Tumas River and undescribed tidal lagoon with an approximate age of 1,600 years. The typology of these shell middens is unknown, but molluscan fauna like *Bullia digitalis* and *Dosina lupines* has been reported at the tidal lagoon and dated to be $40,830 \pm 480$ years old (Kinahan 2014). Evidence of human occupation at this locality is dated to $1,370 \pm 30$ years ago based on analysis of a pottery vessel found at the shell-midden sites. Such remains are associated with more recent human activity, as evidenced by shuttered concrete structures that may have been used during the construction of the coastal railway line and coastal defence installations at Rand Rifles (Kinahan 2014). The sites are relevant in terms of the National Heritage Act (27 of 2004), but they are neither sensitive nor vulnerable to the proposed ammonia pipeline (cold), as they are located between 127 and 129 metres away from the proposed project.

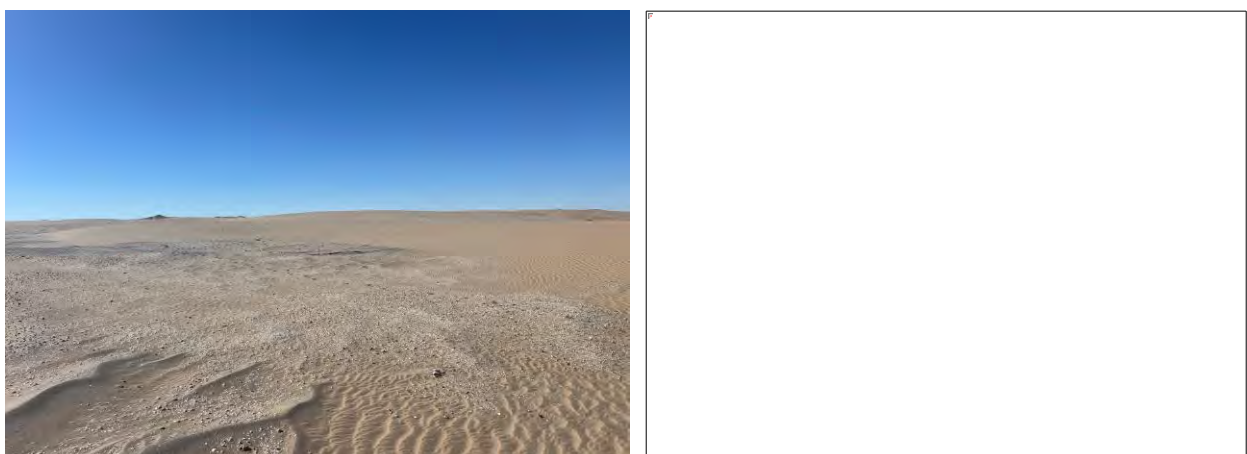




Figure 19 Left, right and below images shows the significant but superficial shell midden accumulations near the extinct mid-Holocene tidal lagoon. Source: (RCHS, 2024e).

12. INTERPRETATION OF ASSESSMENT

All heritage resources recorded in the course of the proposed construction of ammonia pipelines (hot and cold) and associated infrastructures were assessed as to their significance (0–5) and vulnerability (0–5) (see

Further two ($n = 2$) wayside crosses likely belonging to the Walvis Bay/Swakopmund road accident victims (no human remains), as shown in **Figure 1**, have been recorded. Finally, at least two ($n = 2$) significant but superficial shell-midden accumulations are probably linked to the extinct mid-Holocene tidal lagoon **Figure 19**. All these heritage features are presented in the following table:

Table 4), and recommended measures deemed necessary for mitigation were devised. In the case of potential historic sites and wayside cross sites, these resources have zero to very low significance ranking ($1/<$) because they are not significant sites in terms of the National Heritage Act (27 of 2004).

These potential historic sites are currently in extensively disturbed settings as a result of existing anthropogenic impacts associated with the industrial development in this area therefore, no further mitigation is required. Particular attention is required to the shell-midden sites located at 22°54'47.652" S/ and 14°32' 21.378" E as well as 22°54'47.622"S / 14°32'26.418" E whose significance is rating is ranked at 3. Although significant in terms of Heritage Act (No. 27 of 2004), fortunately such sites are not vulnerable nor sensitive to the proposed project as they lie between 127.41 and 129.28 meters away from the project. However, their locations are treated as No-Go Zones.

13. IMPACT ASSESSMENT

There is no likely impact of the proposed construction of ammonia pipelines (hot and cold) and associated infrastructures on the potential heritage features or archaeo-palaeontological sites identified around the footprint of the project. As a result, no further mitigation measures are to be implemented other than sensitising heritage data to the operator and fieldwork personnel. Significant sites in terms of the National Heritage Act (27 of 2004) should not be damaged through inadvertent encroachment or disturbance of their immediate area; otherwise, the consequences of such disturbance will impact the sites in a local area. However, the extent of this impact would be low in that its direct effect would be confined within the area itself. As with all impacts on archaeological sites, the duration is considered to be permanent. Given the far distance the sites are from the proposed surface works associated with the construction of ammonia pipelines, the probability of the impact is considered to be low. The extent or spatial influence of impact, magnitude of impact, and duration of impact on the heritage resources are non-existent, as all these sites are located beyond 100 m from the proposed project, as shown in

Further two (n = 2) wayside crosses likely belonging to the Walvis Bay/Swakopmund road accident victims (no human remains), as shown in **Figure 1**, have been recorded. Finally, at least two (n = 2) significant but superficial shell-midden accumulations are probably linked to the extinct mid-Holocene tidal lagoon **Figure 19**. All these heritage features are presented in the following table:

Table 4.

14. SPECIFIC RECOMMENDATION

- a) The proponent is to submit this HIA report to the competent authority, the National Heritage Council of Namibia, in an effort to secure heritage consent.
- b) The proponent is implored to incorporate the GIS data of the archaeopalaeontological heritage resources in their sensitivity mapping of the project layout so that these flagged sites can be avoided

as a management measure to avoid any possible encroachment and disturbance.

- c) The proponent is implored to sensitise heritage data to the operator and fieldwork personnel and to exercise due caution when working in close proximity to where the heritage features are found.
- d) The proponent is equally implored to sensitise operators and fieldwork personnel working around the Dune 7 area that it was a military training area; therefore, cautions should be exercised in the unlikely event that military explosives are encountered.

15. CONCLUSION AND MANAGEMENT PROCEDURES

This baseline study has identified some potential heritage features with very low significance that are neither vulnerable nor significant, as well as significant but not vulnerable archaeopalaeontological heritage sites outside the footprints of the proposed project that are worth preserving in terms of the National Heritage Act (No. 27 of 2004). Therefore, no further mitigation measures should be implemented prior to the construction of the proposed ammonia pipelines (hot and cold) as associated infrastructure. However, since this field survey relied only on surface finds, it is possible that buried sub-surface archaeological, paleontological, or historic resources could fall within the footprints of the project during site preparation and construction phases. The following chance-finding procedure, devised by Kinahan (2012) and replicated hereto, is applicable to address these uncertainties in the project phases.

16. APPENDIX 1: CHANCE FIND PROCEDURES

The ‘chance finds’ procedure covers 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 find’ procedure intends to ensure compliance with the relevant provisions of the National Heritage Act (27 of 2004), especially Section 55 (“a person who discovers any archaeological object must as soon as practicable report the discovery to the Council”). The procedure for reporting set out below, developed by Kinahan (2021) and replicated hereto, is to be observed.

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.
- 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 **Superintendent**

1. Visit the site and determine whether work can proceed without damage to findings.
2. Determine and mark exclusion boundaries.
3. Site location and details to be added to Archaeological Heritage Geographical Information System (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.

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