ENVIRONMENTAL SCOPING ASSESSMENT (ESA) STUDY: CONSTRUCTION AND OPERATION OF A PIGGERY & ABATTOIR FOR THE EVARISTUS SHIKONGO CORRECTIONAL FACILITY IN THE TSUMEB DISTRICT OF THE OSHIKOTO REGION

ENVIRONMENTAL SCOPING ASSESSMENT REPORT (ESAR)

ECC APPLICATION NO.: 003411

PROPONENT: NAMIBIAN CORRECTIONAL SERVICE

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PROJECT NAME	**PROPOSED CONSTRUCTION AND OPERATION OF A PIGGERY & ABATTOIR FOR THE EVARISTUS SHIKONGO CORRECTIONAL FACILITY IN THE TSUMEB DISTRICT OF THE OSHIKOTO REGION**
DOCUMENT TITLE	**ENVIRONMENTAL SCOPING ASSESSMENT REPORT (ESAR)**
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ACRONYMS

TERMS	DEFINITION
AQI	Air Quality Index
BID	Background Information Document
CENORED	Central North Regional Electricity Distributor

TERMS	DEFINITION
DEAF	Directorate of Environmental Affairs and Forestry
EAP	Environmental Assessment Practitioners
ECC	Environmental Clearance Certificate
EIA	Environmental Impact Assessment
EMA	Environmental Management Act
EMP	Environmental Management Plan
ESA /ESAR	Environmental Scoping Assessment / Scoping Assessment Report
ESCF	Evaristus Shikongo Correctional Facility (project site)
I&APs	Interested and Affected Parties
MAWLR	Ministry of Agriculture, Water and Land Reform
mbgl	Meter below ground level
MEC	Mafuta Environmental Consultants
MEFT	Ministry of Environment, Forestry and Tourism
mg/l	Milligram per litre
NCS	Namibian Correctional Service
NHC	National Heritage Council
OML	Otavi Mountainland
PM	Particulate matter
WHO	World Health Organization

DEFINITION OF TERMS

The '**Consultant**' – this refers to the team that is conducting the ESA, compiling the ESAR and developing the Draft EMP for the proposed project (development).

The '**Proponent** – this refers to the institutions/departments that are directly involved in the implementation of the project, i.e., Namibian Correctional Service (NCS).

The '**Stakeholders**' – this refers to the people, organisations, NGOs that are directly or indirectly affected and interested by the project.

The '**Environment**' – this refers to the ecology, economy, society, and politics.

i. Purpose of this Environmental Scoping Assessment Report

This Environmental Scoping Assessment Report (ESAR) was compiled based on the regulatory requirements of the Environmental Management Act No. 7 of 2007 and its 2012 Environmental Impact Assessment (EIA) Regulations pertaining to the construction and operation of the Piggery and Abattoir. Existing information and input from authorities, Interested and Affected Parties (I&APs) as well as site observations of the Environmental Consultant were used to identify and evaluate potential environmental impacts (both social and biophysical) stemming from the proposed project activities.

Environmental flaws associated with the proposed project were identified during the environmental assessment process and presented in this document. A conscious decision was made based on the national Environmental Management Regulations, Guidelines, and best practices to assess both and less significant environmental impacts. The Draft Environmental Management Plan (EMP) developed for this proposed project will need to be effectively implemented by the Proponent (and appointed contractors), to ensure that adverse environmental impacts are avoided and minimized if avoidance is not possible.

This ESAR will also be used to motivate and define the previously identified, project alternatives (i.e., site choice, technology, etc.) based on the findings of the environmental baseline study and the suitability of the site to the type of development.

The ESAR aims to:

- Provide an overall assessment of the social, physical, and biophysical environments of the area affected by the proposed project activities.

- Undertake a concise environmental assessment, in terms of environmental criteria and impacts, and recommend a preferred location for the proposed facilities (based on environmental sensitivity), if found to be necessary.
- Identify and recommend appropriate mitigation measures for potentially significant environmental impacts.
- Undertake an inclusive Public Participation Process (PPP) – dispute limitations owing to the global pandemic (Coronavirus) at the time of the ESA process; and
- A systematic approach was adopted for the successful completion of the ESA in line with the regulated process.

ii. Assumptions and Limitations

The following assumptions and limitations underpin the approach to this EIA study:

- The information received from the stakeholders, desktop surveys and baseline assessments are current and valid at the time of the study.
- A precautionary approach was adopted in instances where baseline information was insufficient or unavailable.
- Mandatory timeframes will apply to the review and adjudication of the ECC application and ESA Report by the competent authority (Ministry of Agriculture, Water and Land Reform (MAWLR), environmental custodian (Ministry of Environment, Forestry and Tourism (MEFT) and other relevant government departments.
- It is assumed that the information provided by the Proponent is correct and that all necessary information has been disclosed.
- It is assumed that there will be no significant changes to the proposed project (please refer to Chapter 2) or the receiving environment (as presented Chapter 5) between the compilation of this Report and implementation of the proposed project that could substantially influence findings and recommendations with respect to management and mitigation measures.

NB: The EAP does not accept any responsibility if additional information comes to light at a later stage of the environmental process. All data from unpublished research utilised for the purposed of this project is valid and accurate. The scope of this investigation is limited to assessing the potential biophysical and social impacts associated with the proposed project activities.

iii. Report Summary

This document serves an Environmental Scoping Report for the proposed construction and operation of a Piggery and an Abattoir by Namibian Correctional Service (NCS) at the Evaristus Shikongo Correctional Facility near Tsumeb in the Oshikoto Region. Therefore, content revealed in this Report best describe the site conditions during the time, an environmental assessment was undertaken, and the document was compiled.

EXECUTIVE SUMMARY

The Namibian Correctional Service (NCS) or the project Proponent intends to construct and operate a Piggery & an Abattoir and associated infrastructures for the Evaristus Shikongo Correctional Facility (ESCF) about 25km northeast of Tsumeb along the M75/B15 road to Tsintsabis in the Oshikoto Region.

The two facilities will be established adjacent to the existing ESCF premises (formerly known as Farm Scott), which is owned by the NCS and therefore the project site falls under NCS land ownership. The Piggery and Abattoir facility with associated infrastructure will cover a surface area of 11-hectares, whereas the abattoir will cover 2 hectares. These two new facilities will use the existing borehole water and a new Waste and Effluent Treatment facility (small wastewater dams) is envisaged to be designed for the following slaughter phases, namely Phase 1: 700 pigs per month, Phase 2: 35 cattle per month, and Phase 3: 50 goats/sheep per month.

The need for the proposed project is to ensure that the NCS fulfil its mandate of providing safe, secure, and humane custody of offenders, rehabilitate and re-integrate them into community. This also to ensure that the operations of all NCS facilities follow the United Nations (UN) Standard Minimum Rules for the treatment of prisoners. These dictates that every prisoner shall be provided by the administration at the usual hours with food of nutritional value adequate for health and strength, of wholesome quality and well prepared and served. Hence, the NCS is managing six (6) production farms including the Evaristus Shikongo Correctional Facility which are producing maize, wheat, vegetables, beef, and pork for offenders' rations. These production farms are aimed at improving organizational self-sufficiency and reduce government expenditures in the procurement of offenders' rations.

The existence of the two facilities (Piggery & Abattoir) in the project area will create further job opportunities for the local community, by employing people from the Tsumeb, Constituency and surrounding areas during the two project phases, namely the construction

and operational & maintenance phases. This in return will also contribute to the socio-economic development of the Tsumeb Constituency and Oshikoto Region at large.

Under the Environmental Management Act No. 7 of 2007 and its 2012 Environmental Impact Assessment (EIA) Regulations, the proposed project and its associated works are listed activities that requires an Environmental Clearance Certificate (ECC) before implementation.

PUBLIC CONSULTATION AND ENGAGEMENT PROCESS

As required by Regulation 21 to 24 of the EIA Regulations on public consultation process, the public was consulted through the following means:

- **A Background Information Document (BID)** was drafted at the onset of the ESA process to act as a useful information handout about the proposed project. In addition, the BID provided details on the public consultation process with contact details for further information. This document was advertised for availability through newspaper articles and public notice posters.
- **Newspaper Advertisements** about the proposed project and related EA processes were circulated in *The Namibian Sun*, *Die Republikein* and *Allgemeine Zeitung* for two weeks on the 9th and 15th of December 2021.
- **Site Notices:** A3-sized public notice posters were placed in Tsumeb, at the Municipality office notice board (Figure 22) and Open Market notice board (Figure 23) near Tsumeb Shoprite. The notice provided information about the project and related EA while providing contact details of the project team for public communication purposes with regards to the study.
- **Public Consultation Meeting:** A notification of consultation meeting was shared with registered stakeholders/I&APs. However, some stakeholders tendered their apology due to other coinciding events. Since there was no public meeting conducted, there is no meeting minutes recorded nor available. The lack of interest and attendance by the public could be linked to the fact the proposed site is already within the Proponent

(NCS)'s land and from experience, the public had always seemed to not show much interest in such projects, especially if does not physically or directly affect them.

- **A stakeholder database** for the project was collected through a variety of means, ranging from pre-identified Interested & Affected Parties (I&APs) of the project and updated upon requests on the appearance of the ESA advert in the newspapers.
- **Comments Period and Feedback**: A comments period for the ESA Study was initially set from the 9th of December 2021 to the 31st of January 2022, and the extended to 12 February 2022. Despite this, there has been no comments from the public regarding the proposed project.
- The only comment received but from one of the Proponent' site Farm Managers and it is ''*Concern over water abstraction from a single borehole. The need to drill another borehole to supply water to the relieve the pressure off the existing borehole*''.

IMPACT IDENTIFICATION AND ASSESSMENT

The potential beneficial and adverse impacts stemming from the proposed project activities during the two vital phases (construction and operations) are listed below. These potential impacts are described and assessed further in the report.

Positive impacts: (1) Job opportunities for local communities during construction of the Piggery and Abattoir phase through appointed construction contractors and provision of other specialized services, (2) Contribution to local and regional social economic development, (3) Reduction on the national budget for offender's rations, by producing own food supply to the other NCS facilities in the country, and (4) Training for offenders on pig production as part of their rehabilitation (during the operational phase). This will help them to become productive and law-abiding citizens after serving their terms.

Negative impacts: Physical disturbance to site soils during construction, Odour, impact on groundwater resources and soils (disturbance and pollution), Air quality issues: Dust generation, Noise generated by the Piggery itself (pigs) related equipment, such as

operational pumps, and traffic from and to the site. Further potential impacts are on fauna and flora (biodiversity), Health and safety, Environmental pollution (solid waste/wastewater generation), Vehicular Traffic safety, and impact on archaeological & heritage resources from inadvertent destruction of subsurface sites and or objects during construction phase.

RECOMMENDATIONS AND CONCLUSIONS

The proposed Piggery and Abattoir and their associated infrastructures will primarily positively contribute towards the improved food security for the NCS, which may not only be for the Evaristus Shikongo Correctional Facility but also other NCS facilities in Namibia. However, the proposed project activities are potentially associated with some adverse (negative) impacts that were identified, described, and assessed during the environmental assessment process and contained in this Report. The significance rating of the impacts was found to be medium. Where it is anticipated that the potential impact cannot be practically avoided altogether, appropriate management and mitigation measures were recommended for implementation during the respective phases of the project. The effective implementation of the Draft EMP will aid in reducing the impacts' rating to low.

Furthermore, for an impact rating to remain low throughout the project life cycle, the implementation of mitigation measures needs to be monitored and reported. Implementation and monitoring will need to be done by either the Proponent or through an appointed Environmental Consultant or ECO and report to the applicable Competent and Regulatory Authority (MEFT and MAWLR, where required). Monitoring will not only be done to maintain the low significant rating but also to ensure that all potential negative impacts identified in this study and new impacts that may arise during project implementation are properly identified on time and addressed (mitigation measures provided for immediate implementation).

The effective implementation and monitoring of the mitigation measures would ensure environmental sustainability at the site and its surrounding area. Therefore, the proposed

facilities at ESCF may be granted an Environmental Clearance Certificate. The following recommendations are highly emphasized on for the Proponent:

- All mitigations provided in this Report and the management action plans in the Draft EMP are implemented as stipulated.
- All required permits, licenses and approvals for the specific project activities are obtained as required (please refer to the Permitting and Licensing Table in the Draft EMP.
- The Proponent, workers and contracted engineers, and construction contractors should comply with the legal requirements governing this type of project and its associated activities applicable to their work; and
- All the necessary environmental and social (occupational health and safety) precautions provided are adhered to.

1. INTRODUCTION

1.1. Project Background and Location

The Namibian Correctional Service (NCS), hereinafter referred to as *The project Proponent* intends to construct and operate a Piggery & an Abattoir and associated infrastructures for the Evaristus Shikongo Correctional Facility (ESCF) about 25km northeast of Tsumeb along the M75/B15 road to Tsintsabis in the Oshikoto Region - **Figure 1** and **Figure 2**.

The two facilities will be established adjacent to the existing ESCF premises (Farm), formerly known as Farm Scott, which is owned by the NCS and therefore the project site falls under NCS land ownership. The Piggery and Abattoir facility with associated infrastructures will cover a surface area of 11-hectares, whereas the abattoir will cover 2 hectares. These two new facilities will use the existing borehole water and a new Waste and Effluent Treatment facility (small wastewater dams) is envisaged to be designed for the following slaughter phases, namely Phase 1: 700 pigs per month, Phase 2: 35 cattle per month, and Phase 3: 50 goats/sheep per month.

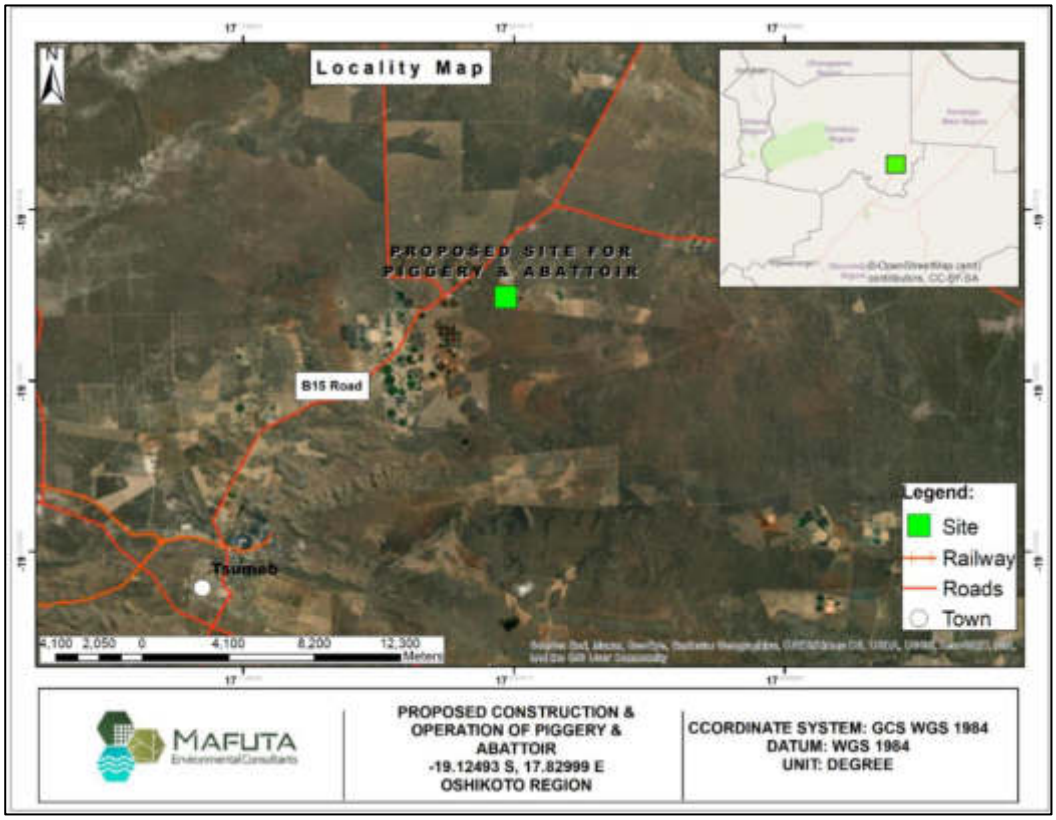

Figure 1: Locality of the proposed Piggery and Abattoir on the Evaristus Shikongo Correctional Facility near Tsumeb, Oshikoto Region

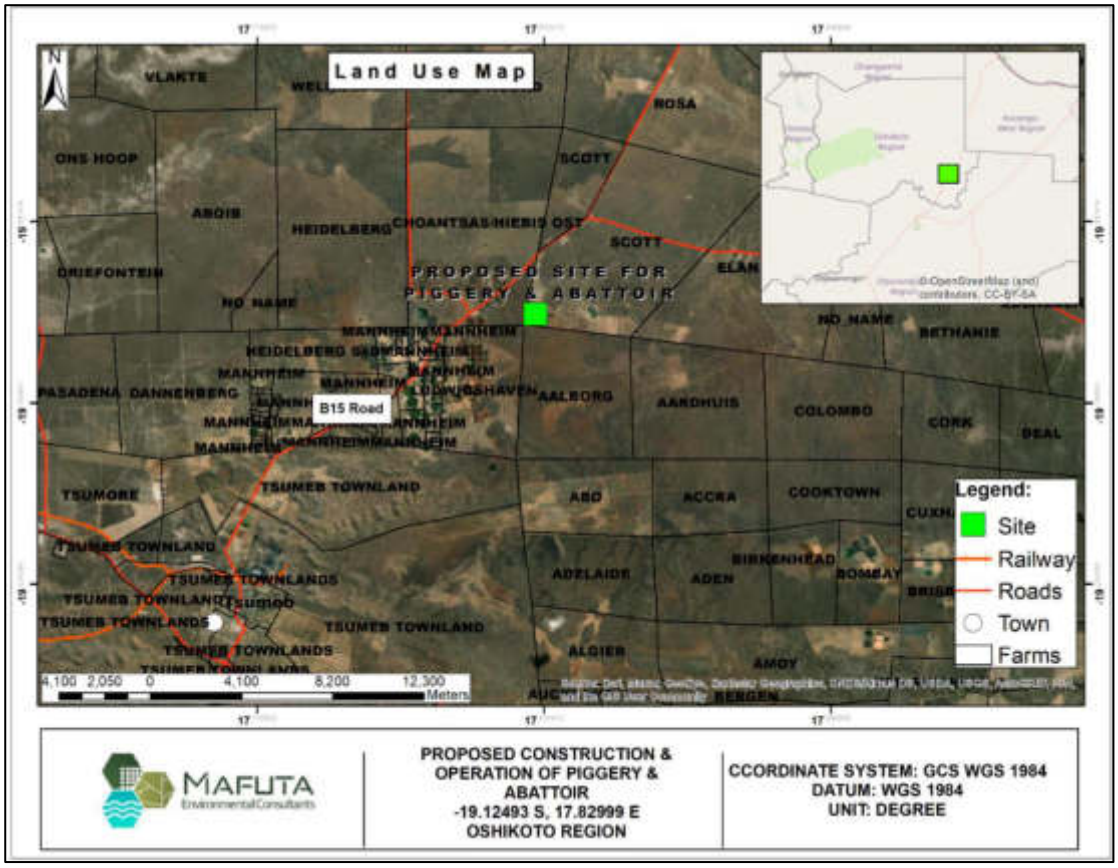

Figure 2: Map of the surrounding properties (land uses) around the proposed project site near Tsumeb, Oshikoto Region

The proposed project site is located about 1km from the existing administration building of the ESCF facility. The approximate site coordinates are presented in **Table 1**.

Table 1: Approximate site boundary coordinates

Site Point	Latitude	Longitude
Point A	19° 7'40.28"S	17°50'2.61"E
Point B	19° 7'42.34"S	17°49'50.89"E
Point C	19° 7'23.98"S	17°49'54.69"E
Point D	19° 7'25.89"S	17°49'46.45"E

1.2. Project Need and Justification

The aim of the proposed development is to contribute towards Namibian's development plans, namely: National Development Plan 5 (NDP5), Harambee Prosperity Plan (HPP) and Vision 2030. It should also be noted that the NCS has a mandate of providing safe, secure, and humane custody of

offenders, rehabilitate and re-integrate them into community. The NCS Mission is to provide exceptional correctional service that empower offenders to effectively re-integrated into society as law abiding citizen.

The operations of all NCS facilities follow the United Nations (UN) Standard Minimum Rules for the treatment of prisoners. These dictates that every prisoner shall be provided by the administration at the usual hours with food of nutritional value adequate for health and strength, of wholesome quality and well prepared and served. Hence, the NCS is managing six (6) production farms including the Evaristus Shikongo Correctional Facility which are producing maize, wheat, vegetables, beef, and pork for offenders' rations. These production farms are aimed at improving organizational self-sufficiency and reduce government expenditures in the procurement of offenders' rations.

In addition, the Piggery as well as the abattoir will help to reduce the idleness amongst offenders.

The existence of the two facilities (Piggery & Abattoir) in the project area will create further job opportunities for the local community, by employing people from the Tsumeb, Constituency and surrounding areas especially during the temporary creation of job opportunities during the construction phase. Furthermore, the construction and maintenance would also create opportunities to services providers particularly for specialized services that NCS will not have capacity on. This in return will also contribute to the socio-economic development of the Tsumeb Constituency and Oshikoto Region at large.

1.3. The Need for Environmental Scoping Assessment Study

Under the Environmental Management Act No. 7 of 2007 and its 2012 Environmental Impact Assessment (EIA) Regulations, the proposed project and its associated works are listed activities that requires an Environmental Clearance Certificate (ECC) before implementation. The relevant listed activities as per EIA regulations are:

- *''Listed Activity 2.1 Construction of facilities for waste sites, treatment of waste and disposal of waste.*
- *Listed Activity 2.2 Any activity entailing a scheduled process referred to in the Atmospheric Pollution Prevention Ordinance, 1976.*

- *Listed Activity 8.1 The abstraction of groundwater or surface water for industrial or commercial purposes.*
- *Listed Activity 8.6 Construction of industrial and domestic wastewater treatment plants and related pipeline systems.*
- *Listed Activity 9.2 any process or activity which requires a permit, license or form of authorisation, or the modification of or changes to existing facilities for any process or activity which requires an amendment of an existing permit, license or authorisation or which requires a new permit, license or authorisation in terms of a law governing the generation or release of emissions, pollution, effluent or waste.''*

1.4. Appointed Independent Environmental Consultant

Subsequently and to comply with the EMA and its 2012 EIA Regulations, the Proponent appointed Mafuta Environmental Consultants CC (MEC), independent Environmental Consultants as the Environmental Assessment Practitioner to undertake the required Environmental Scoping Assessment (ESA) Study. The ESA process includes all the required tasks for the application of the project ECC. As required by the Ministry of Environment, Forestry and Tourism (MEFT), an application for a project ECC needs to be compiled and submitted to the Competent Authority (Ministry of Agriculture, Water and Land Reform (MAWLR) and uploaded onto the MEFT ECC Portal / system for project registration purposes.

A date stamped copy of the ECC application form cover page is attached as **Appendix A** of this Report which was also uploaded on the MEFT EIA online system for project registration and proof of payment. The project ECC will then be issued upon approval of the documents produced from the ESA, i.e., Environmental Scoping Assessment Report and Draft Environmental Management Plan (EMP) developed (to avoid and or mitigate the risks).

This Environmental assessment and reporting were conducted and done by Ms. Fredrika Shagama, a qualified and experienced hydrogeologist and environmental assessment practitioner (EAP) with over 6 years of experience in environmental management consulting. Her Curriculum Vitae (CV) provided hereto.

The description of the project and its associated activities are presented under Chapter 2.

2. PROJECT DESCRIPTION AND ACTIVITIES

This chapter presents the activities, services, and infrastructure for the proposed project to be implemented upon issuance of the ECC. These processes are presented in terms of activities to be undertaken in the main project phases, namely, the planning & design, construction operational and maintenance.

The proposed project will entail the construction and operation of the two facilities (Piggery and Abattoir) and their associated infrastructure. The Abattoir will include the:

- Administration Building,
- Male/female ablution (2x), and
- Guard house.

The main associated facilities will include the following:

- Lairages, Stunning & Bleeding,
- Dressing Floor,
- Offal Processing Area,
- Sterilizing & Washing Areas,
- Chilling + Freezing Areas,
- De-boning Area,
- Packing Area,
- Palletizing Area,
- Receiving & Storage Areas,
- Loading docks,
- Wash bays, Weighbridge, Plant Room Area, Generator, and fuel storage.

The Piggery facility will comprise of:

- An Administration Building,
- Guardhouse,
- Electrical Building,
- Maintenance building,

- Feed storage building,
- Refuse area,
- Changing rooms,
- Isolation House,
- Necropsy House. Furthermore, Piggery will also include the Farming facilities such as Weaner house (2x), Finisher/ Grower (2x), Dry Sow (2x), Farrowing house (2x), Servicing house, Boar House, and Sewer ponds.

The anticipated project phases, namely planning & design, construction, and eventual operation & maintenance as well as associated required services, infrastructure and resources are presented under the following subchapters.

2.1. Planning and Design

As part of the planning phase which also accommodates an Environmental Impact Assessment ESA/(EIA) study, a preliminary site layout has been drawn by the contracted project architects (Agostinho Ferreira Architects) and the construction cost is also determined during the feasibility study by the planning and design engineers.

The planning (feasibility) study is aimed at presenting some key concepts of the project alongside a general overview of the study areas, the legal landscape to be considered, and a preliminary assessment of the main aspects affecting the feasibility of the Piggery and Abattoir. Thereafter, it will assess the technical and financial feasibility of such a project by identifying risks and proposing mitigation measures where possible and highlighting 'fatal flaws' wherever mitigation measures are unavailable or impractical with regards to the available finances and time. The technical component of the proposed project (mechanical and technical) is handled by Burmeister & Partners Consulting Engineers) and the financial component by Louis Burger Quantity Surveyors.

The preliminary site layout (drawings) for the proposed facilities drawn by Agostinho Ferreira Architects is shown in **Figure 3** below.

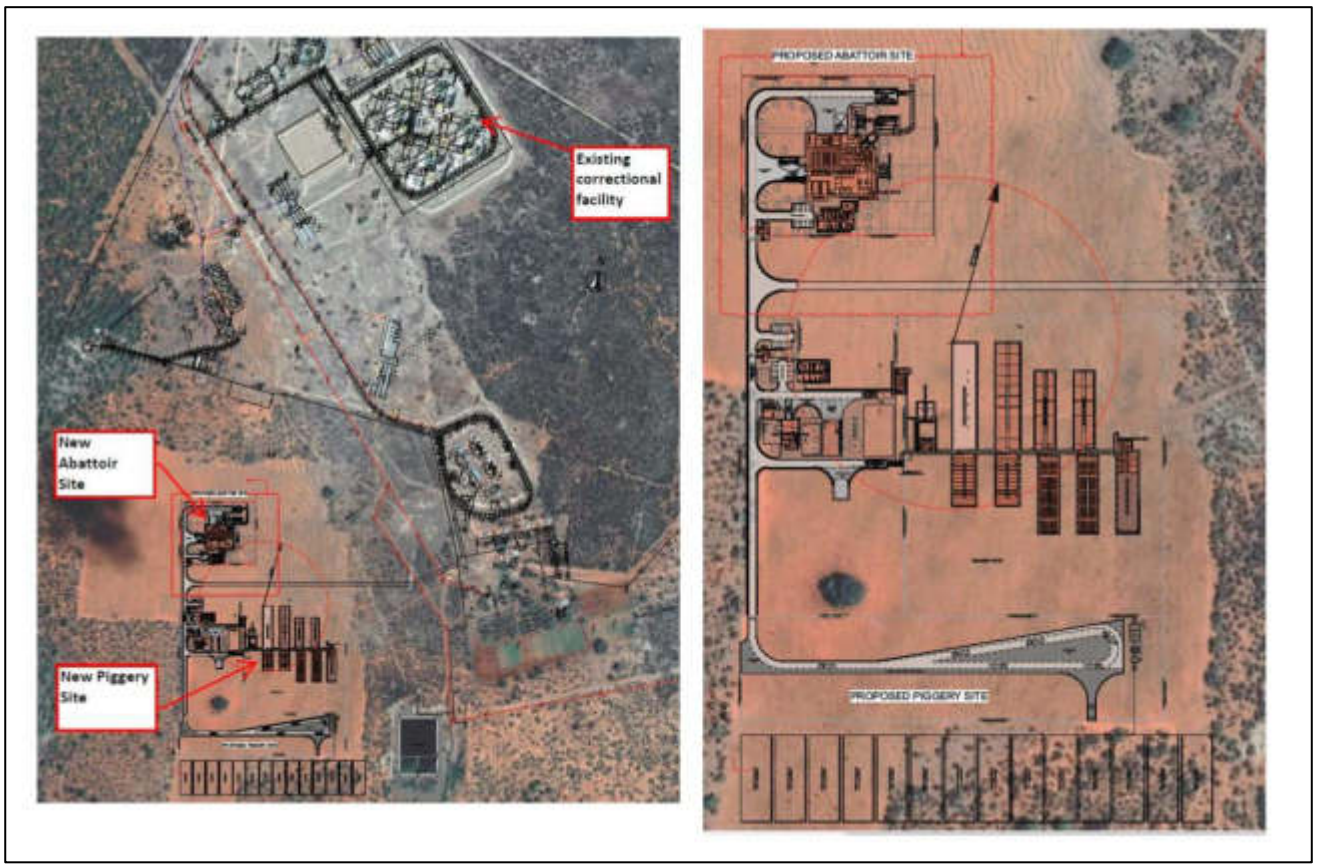

Figure 3: Preliminary drawings (layout) of the piggery and abattoir at the Evaristus Shikongo Correctional Facility (Agostinho Ferreira Architects, 2021)

Once the technical and administrative documentations of the planning and design phase are approved, construction activities will follow as planned by the project Proponent and their construction engineers/contractors.

2.2. Construction Phase

The proposed project will involve the construction of the piggery and abattoir and associated infrastructure. Construction works will be outsourced to an appointed and experienced construction contractor(s). The facilities and anticipated related infrastructure will cover the footprint of 11-hectares for the piggery and 2 hectares for the abattoir.

Based on site observation during the site visit, the planned site is covered by grass cover and about 5 big trees within the project footprints. Although there may be removal of some shrubs mainly to the area planned for the wastewater treatment dams, the big trees will be left alone. With that said, minimal disturbance to vegetation is expected and advocated during this phase.

During construction phase, earth works will be carried out in certain areas of the project site to erect the buildings and for the installation of the necessary services infrastructure. This will require soil excavation within the construction sites. There will be heavy construction vehicles and equipment moving around the site.

2.2.1. Construction Equipment, Materials, Services and Duration

Construction materials will be sourced from the local building materials suppliers in Tsumeb and if necessary, and as required, materials will need to be sourced from elsewhere in the country and as per the required and approved standards.

In terms of construction materials such as sand and aggregate for concrete and site surfacing will be obtained from commercial sources or crushing suitable sources, as approved by the Construction Engineer

The following activities will be done in terms of infrastructure and service provision, that is, the installation of:

- Power supply cables,
- Potable water pipelines,
- Wastewater disposal pipelines, and
- Domestic waste and sewage removal.

The estimated time for construction works will be determined by the contractor, however a duration of eighteen (18) months can be expected. Construction works will be carried on weekdays only and during the day between 08h00 and 17h00.

2.3. Operational and maintenance Phase

During this phase, the Piggery and Abattoir will be operated and managed by a responsible unit within NCS. The maintenance of the facilities will be done by NCS maintenance team. It is during this phase when the pigs will be kept on site under the care of designated workers and the monthly processing of 700 pigs (phase 1), 35 cattle (phase 2) and 50 goats/sheep (phase 3). The food for pigs will be obtained from local suppliers in Tsumeb with some of the feed produced by NCS. The re-location of the piggery from Oluno Correctional Facility will be the source of pig supply to the Piggery. In-house pig bleeding will be the source of pigs to sustain the Piggery.

Upon a determined time, frequency and possibly depending on the demand, some pigs will be slaughtered and processed in the abattoir, whereby it will be distributed to other NCS facilities throughout the country as well as to some of the Namibian Police holding cells, as a source of meat supply for the inmates / offenders.

It is anticipated that the facilities' will be operated daily, except for animal slaughtering that is likely to be done at a determined frequency and as required.

2.3.1. Stormwater Management

Given the nature of the area in terms of good rainfalls, there will be a need to manage stormwater. This water from paved areas (i.e., potentially contaminated by pigs) will be directed to the purpose-built effluent dam. Stormwater from roofs will be clean water and will therefore be directed to open lawned areas or contours which will direct it to the nearest natural water resource. The stormwater drainage systems will be made of rock-lined drains and velocity dissipaters to ensure that erosion is prevented along the stormwater route and at its endpoints.

2.3.2. Waste Management

A. <u>Construction and Operational Phase Waste (Solid Waste)</u>

Construction waste such as domestic refuse, scrap metals, woods and other non-hazardous solid waste generated on site will be kept at site, sorted accordingly and regularly, transported to the NCS' solid waste management site. If needed, the solid waste can also be transported for disposal at the Tsumeb Municipal waste management site.

The appointed construction contractor will have to arrange with the Municipality for the permission to dispose of the waste. Domestic waste generated on site will be collected in bins to be deployed on site, thereafter, it will be transported to the waste site, twice a week or depending on the capacity of the temporary waste storage containers onsite.

For the operational and maintenance phase, different wastes generated onsite will be stored in designated waste bins, collected, and transported to the existing NCS waste site on a weekly basis. If NCS would prefer that the waste or some of it is disposed at the Tsumeb Municipality waste site, then arrangements will need to be made.

B. Wastewater (Effluent)

The liquid waste or effluent from the facility growers will be managed by using about three to four purpose-built effluent dams. The effluent dams will serve the breeding unit and abattoir section. However, the management of the solids and liquid may change according to the specifications.

C. Sewage

During construction, the appointed construction contractor will be required to have a portable chemical toilet system for the employees on-site. The operational phase.

For operational phase, canteen, the workers will be using the associated constructed ablution facilities (septic tank system). The tank will be maintained on a regular basis by the NCS maintenance team, as and when required.

D. Hazardous waste (used oil and grease)

As it is a current practice for the facility, for the proposed project phases, hazardous waste such as used oils and grease will be carefully stored onsite in designated containers awaiting removal and disposal the Tsumeb Municipal hazardous waste facilities for further handling and disposal, i.e., the Municipality has the capacity to handle and deal with such waste.

E. Veterinary waste

Veterinary medicine containers, for vaccines, antibiotics, and supplemental iron, equates to approximately 700 bottles (100 cc) annually. Syringes varying in size from 2 cc – 20 cc amount to 1,000 circa per annum. Veterinary medicine containers, for vaccines, antibiotics, and supplemental iron, equates to approximately 700 bottles (100 cc) annually. Syringes varying in size from 2 cc – 20 cc amount to 1,000 circa per annum (Mafuta Environmental Consultants, 2018) A maintenance contractor with a Medical Waste Collection Permit will be appointed to collect, manage, and discard such waste. All veterinary waste dealt with on site will be recorded in the Waste Register.

2.4. Services, Infrastructure and Requirements

The following services infrastructure will be required for the construction and operation of the proposed facilities:

- **Water:** The water required for both project phases will be sourced from the onsite existing boreholes. The water will be required for concrete mixing, ablution, pig feed and watering, drinking purposes, and other operational water needs.
- **Electricity** –during the construction, the contractor will use diesel powered generators to enable the operation of construction machinery and equipment. For the operational phase, the two facilities will be connected to the existing power grind that supply the Correctional Facility, upon consulting with the local electricity supplier (CENORED).
- **Fuel** – fuel or firewood that may be required by onsite personnel to prepare food will be provided by the contractor through the proper channels of sourcing firewood (from registered firewood suppliers), but not by cutting down site vegetation without permission from relevant authorities.
- **Road:** The construction works will follow the existing road network from the surrounding to site. The site is accessible from the M75 road (Tsumeb-Tsintsabis) via a single-track unpaved road D3039 connecting the Evaristus Shikongo Correctional Facility and its proposed project site to M75. It is anticipated that upon some upgrading, the existing access road will be utilized for all project related vehicles and activities in the area.
- **Personnel** – About fifty (50) temporary employment opportunities will be created during the construction of the facilities. It should be noted that the figure has been estimated as the exact number of workers will be determined by the appointed contractor (at a later stage) and actual site requirements (workload). The employment of locals for works that can be done by locals will have to be prioritized, i.e., preference of locals for site jobs (both unskilled, semi-skilled and skilled).
- **Accommodation of project personnel (workers):** The construction workers will be housed on site in temporary camps. The reason for construction workers camping within proximity of the site instead of them staying in the nearest town (like Tsuen) will be to minimize the pressure exerted on the local roads by buses transporting workers to and from site daily throughout this phase. Not only that but also to make sure that the site works commences on time daily. About eighty-three (83) officers / workers will be required for the operational phase. However, the number could be depending on the actual situation on the ground during the operational phase. Only workers required to be on standby for the administration of the

facilities and premises security guards will be housed on site. The workers that will be sourced from the neighbouring houses/farms will be commuting from their homes.

- **Sanitation –** The appointed construction contractor will be required to have a portable chemical toilet system for the employees on-site during the construction period. The operational phase workers will be using the associated constructed ablution facilities.
- **Worker's health and safety:** project workers (employees) during the construction and operational phases will be provided with necessary and sufficient personal protective equipment (PPE). In addition, to ensure safety throughout the project's operations, all workers that will be assigned in high to medium risk working areas, will be provided with Personal Protective Equipment (PPE).
- **Construction and operational (maintenance) waste:** all waste generated from the project activities will be sorted, stored on site in designated waste containers and carted to the approved local landfill site in Tsumeb. The generation of liquid waste such as hydrocarbons or wastewater will be carefully handled and disposed of at the nearest hazardous waste facility in Tsumeb.

2.5. Decommissioning of Works and Services

2.5.1. Construction

Decommissioning referred to herein is for the decommissioning of the construction works and sites at the end of the construction phase.

The decommissioning phase will particularly entail the following:

- Dismantling and removal of all infrastructures and structures that will no longer be required for the operational and maintenance phase. These structures include temporary camping sites, storage tanks, onsite temporary offices, ablution facilities and other supporting structures erected for construction. These will be transported to designated storage facilities offsite.
- Removal of all project related vehicles, machinery, and equipment from site to designated parking and storage sites off site, respectively.

- Carrying away the waste storage containers and disposal of waste to designated and approved waste management sites.
- Closure of all access roads/tracks that may have been temporary created for the construction phase and no longer required for the operational phase.
- Levelling of stockpiled topsoil and where possible, backfilling of all construction excavated pits and trenches.

2.5.2. Piggery and Abattoir facilities (if considered)

At this stage, it is not anticipated that the facilities will close because there will always be a need to provide food for the prisoners. However, should it come to light that the need to be decommissioned; it would be converted into a training centre for the NCS. The centre would then be focusing on agricultural skills transfer and giving trainees hands-on farming experience.

The proposed project has been evaluated based on different aspects. These aspects have been evaluated in terms of considered alternatives to ensure that the proposed project and its associated activities are environmentally friendly while maintaining the intended purpose, technical side, and efficiency of the project. The alternatives weighed for the proposed project are presented in the following chapter.

3. PROJECT ALTERNATIVES ANALYSIS

Alternatives in relation to a proposed activity, is defined (as per Environmental Management Act No. 7 of 2007 and its 2012 EIA Regulations) as "*different means of meeting the general purpose and requirements of the activity, which may include alternatives to -*

a) the property on which or location where it is proposed to undertake the activity
b) the type of activity to be undertaken
c) the design or layout of the activity
d) the technology to be used in the activity; and
e) the operational aspects of the activity"

This chapter will highlight the different ways in which the project can be undertaken and to identify the alternatives that will be the most practical but least damaging to the environment. Once the alternatives have been established, these are examined by asking the following three questions:

- What alternatives are technically and economically feasible?
- What are the environmental effects associated with the feasible alternatives?
- What is the rationale for selecting the preferred alternative?

The alternatives considered for this project were in terms of; locality (two options considered), alternative project type, services infrastructure as well as the no-go alternative.

3.1. No-Go Alternative vs. Continuation of the Project

The "No-Go" alternative is the option of not proceeding with the proposed activity, which typically implies a continuation of the status quo. Should the proposed project be discontinued, the bare land proposed for the project on the NCS farm would continue to maintain its status. This would also mean that the anticipated positive and negative impacts would not occur. Furthermore, the need for offenders' food supply will continue put some pressure on the national budget, which would mean continued heavy reliance on the national budget to supply food for the prisons.

Added to that, without the proposed development, there will be no job opportunities for the local community, and eventual contribution to the local and regional economic development.

For these reasons and by considering the proposed project, the 'no-go' option is not considered the preferred alternative.

3.2. Alternative Project Type

This type of alternative is weighed in terms of what other development could have been considered for the site. The Proponent did not consider any other project alternative on the site nor a different type of farming, such as poultry or any other. Other alternatives have not been considered because the Proponent already have sufficient area on their Farm Scott (where the Evaristus Shikongo Correctional Facility (ESCF) is). Having the similar project near Oluno in the Oshana Region, means that the NCS already has project-handling experience for this type of farming, thus setting up a similar project at their ESCF near Tsumeb would be a perfect project type.

In other words, this would mean that the Proponent would need to research new farming technology and practices, had they proposed to practice a different type of farming such as poultry, for instance. Furthermore, this would also mean that the Proponent would have to research about completely new farm operational techniques, suitable animal breed type, and sensitivity of such animals to certain areas / conditions, and other requirements that would be associated with a different type of farming. For this reason, the proposed Piggery and associated Abattoir would be the viable project option for the site and befitting some of the mandate of the NCS.

3.3. Site Location

The NCS had not investigated other alternative locations because they already have ample space on the Farm which would make a perfect location for the proposed Piggery and Abattoir. The site would also be well-within the target end consumers of the products from the two proposed facilities. For instance, the site is also strategically located in terms of distribution of meat products to other NCS facilities and correctional training college such as the one in Omaruru. The factors that have been considered in this decision-making process included:

- Topography,
- Orientation,
- Location,
- Land suitability (i.e., disturbed land versus pristine land), and
- Electricity, water availability and site accessibility.

The proposed site location has been considered as a feasible location in terms of it being within the consumers of the products from the Piggery and Abattoir, open, lowly vegetated (not need to remove vegetation) and within proximity of the electricity line and road. Furthermore, the vastness of the land, remoteness from towns and the fact that it is located within farming area where almost similar activities are undertaken makes the project location ideal for pig farming. For this reason, the proposed site location is considered more feasible for the project.

3.4. Services and Infrastructure

3.4.1. Site Accessibility: Road

The site can be easily accessed by the unpaved single-track road connecting the Evaristus Shikongo Correctional Facility to M75 road (Tsumeb-Tsintsabis). The same access road will be utilized for the proposed Piggery and Abattoir project works.

3.4.2. Water Supply

The main source of water supply planned for the project will be groundwater to be sourced from the existing borehole onsite. During the site visit, the ESCF Farm Manager suggested a drilling of an additional borehole to relieve pressure off the existing borehole that is currently supplying all the ESCF projects onsite).

3.4.3. Power Supply

The Proponent will negotiate with CENORED for the project's power supply by increasing their supply for the operational phase of the project. It is envisaged that during the construction phase, solar energy and generators will be used as a source of power supply. During the operational phase, the current power grid at the ESCF will supply electricity to the project. As power supply backup, generators and solar may be utilized for some project operations during the operational phase.

3.4.4. Wastewater (Effluent) Discharge Disposal

The preferred method for effluent disposal is to channel all effluent into the designed purpose-built effluent dams on-site. The dams will be covered with a specifically designed impermeable membrane or 'digester' which will capture the methane gas (CH4). The technicalities and details of the process at this stage are still being investigated and will be made available to the construction contractor.

3.4.5. Other Infrastructures

In addition, the site is relatively flat, which will make the construction of structures like buildings and waste / effluent dams much easier, compared to uneven locations. In addition, constructing the site elsewhere where re-working or levelling of the site to accommodate the infrastructure, would be required. The re-working or levelling of a site to desirable shapes would be more costly to perform.

The two proposed facilities and their associated activities, including analysed alternatives are governed by certain national legislations and policies and these are given under Chapter 4.

4. APPLICABLE LEGAL, POLICY AND ADMINISTRATIVE FRAMEWORK

4.1. Introduction

A review of applicable Namibian (and international) legislation, policies and guidelines and their implications on the proposed project are presented under this chapter. This is to ensure that the proposed project activities comply with the legal requirements for good practice and preservation of the environment. This review serves to inform the project Proponent, Interested and Affected Parties and the decision makers at the DEAF of the requirements and expectations, as laid out in terms of these instruments, to be fulfilled with regards to the development. The construction and operation of the Piggery and Abattoir triggers the legislations, policies and legal framework outlined in **Table 2**.

4.2. Environmental Management Act No. 7 of 2007

This EIA was carried out according to the Environmental Management Act (EMA) and its Environmental Impact Assessment (EIA) Regulations (GG No. 4878 GN No. 30).

The Act details requirements for public consultation within a given environmental assessment process (GN No 30 S21). It further details the requirements for what should be included in an Environmental Scoping Report (GN No 30 S8) and an EIA report (GN No 30 S15).

The EMA has stipulated requirements to complete the required documentation to obtain an Environmental Clearance Certificate (ECC) for permission to undertake certain listed activities. These activities are listed under the following Regulations:

- *'Listed Activity 2.1 Construction of facilities for waste sites, treatment of waste and disposal of waste.*
- *Listed Activity 2.2 Any activity entailing a scheduled process referred to in the Atmospheric Pollution Prevention Ordinance, 1976.*
- *Listed Activity 8.1 The abstraction of groundwater or surface water for industrial or commercial purposes.*
- *Listed Activity 8.6 Construction of industrial and domestic wastewater treatment plants and related pipeline systems.*

- *Listed Activity 9.2 any process or activity which requires a permit, license or form of authorization, or the modification of or changes to existing facilities for any process or activity which requires an amendment of an existing permit, license, or authorization or which requires a new permit, license or authorization in terms of a law governing the generation or release of emissions, pollution, effluent or waste.''*

Implication (applicability) to the proposed project: The nature of the proposed facilities operation activities potentially causes environmental impacts to the surrounding environment. Certain construction of project infrastructure such as the of growers, weaner houses, manure lagoons, drainage system, water network, etc. can potentially cause significant environmental impacts with some impacts revisable and avoided. Therefore, prior to project implementation, proper assessments of all possible environmental and social impacts to avoid, minimise or compensate environmental damage associated with the project activities.

The implementation of the proposed project triggers the need for consultation of all affected and interested stakeholders regarding the development at all project development phases from planning to operational stage of the facilities. The full list and description of all the legislations (policies, guidelines, Acts, Regulations and Conventions) are presented under **Table 2.**

Table 2: Applicable legislation, policies, and guidelines to the proposed Piggery and Abattoir

LEGISLATION/POLICY	PROVISION/SUMMARY	PROJECT APPLICABILITY
The Constitution of the Republic of Namibia (1990)	The articles 91(c) and 95 (i) commits the state to actively promote and sustain environmental welfare of the nation by formulating and institutionalising policies to accomplish the Sustainable objectives which include: • Guarding against overutilization of biological natural resources, • Limiting over-exploitation of non-renewable resources, • Ensuring ecosystem functionality, • Maintain biological diversity.	The construction and operation of the Piggery and Abattoir can interfere with the ecosystem and overutilization of natural resources like water. Attention should be given to the state of water and other natural resources to avoid over exploitation. By developing and implementing the Environment Management Plan, NCS is ensuring sustainable development. Ecological sustainability should guide construction and operational activities of the ESCF project.
Environmental Assessment Policy of Namibia 1994	The Environmental Assessment Policy of Namibia states Schedule 1: Screening list of policies/ plans/ programmes/ projects subject to environment must be accompanied by environmental assessments. "The Proposed facilities' activities" are on that list.	The establishment of the Piggery and Abattoir project triggers the need for environmental assessments prior commencement of civil works particularly the construction of weaners and growers, drainage facilities, management of waste and manure during operations as they alter the

LEGISLATION/POLICY	PROVISION/SUMMARY	PROJECT APPLICABILITY
		environment which could result on the damage of the environment.
	The policy provides a definition to the term "Environment" broadly interpreted to include biophysical, social, economic, cultural, historical and political components and provides reference to the inclusion of alternatives in all projects, policies, programmes and plans.	The establishment of the two facilities requires the assessment of all possible environmental and social impacts to avoid, minimise or compensate environmental damage associated with the activities.
EIA Regulations GN 57/2007 (GG 3812)	Details requirements for public consultation within a given environmental assessment process (GN No 30 S21). Details the requirements for what should be included in an Environmental Scoping Report (GN No 30 S8) and an EIA report (GN No 30 S15).	The implementation of the proposed project triggers the need for consultation of all affected and interested stakeholders regarding the development at all project development phases from planning to operation of the facilities.
The Regional Councils Act (No. 22 of 1992)	It sets out the conditions under which Regional Councils must be elected and administer each delineated region. From a land use and project planning point of view, their duties include, as described in	The relevant Regional Councils are I&APs/Stakeholders and must be consulted during the Environmental Assessment

LEGISLATION/POLICY	PROVISION/SUMMARY	PROJECT APPLICABILITY
	section 28 "to undertake the planning of the development of the region for which it has been established with a view to physical, social and economic characteristics, urbanisation patterns, natural resources, economic development potential, infrastructure, land utilisation pattern and sensitivity of the natural environment." The objective is to initiate, supervise, manage, and evaluate development.	(EA) process. The Oshikoto Regional Council is the applicable regional authority for this project
Animal Health Act No. 1 of 2011	To provide for the prevention, detection, and control of animal disease; to provide for the maintenance and improvement of animal health; and to provide for incidental matters	The Proponent should ensure that the establishment and subsequent operations of the Piggery and Abattoir adhere to the requirements of this Act.
Fertilizers Farm Feeds and Agricultural Remedies Act No. 36 of 1947	To provide for the appointment of a Registrar of Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies; for the registration of fertilizers, farm feeds, agricultural remedies, and stock remedies; to regulate or prohibit the importation, sale, acquisition, disposal or	The Proponent should ensure compliance with the Regulations of this Act. If required, the necessary permits should be obtained from the relevant Directorate of the Ministry of Agriculture, Water and Land Reform.

LEGISLATION/POLICY	PROVISION/SUMMARY	PROJECT APPLICABILITY
Regulations on the Registration of Fertilizers, Farm Feeds, Sterilising Plants and Agricultural Remedies Government Notice 112 of 2007	use of fertilizers, farm feeds, agricultural remedies and stock remedies; to provide for the designation of technical advisers and analysts; and to provide for matters incidental thereto.	
The Water Act 54 of 1956	The Act was formulated to consolidate and amend the laws relating to the control, conservation and use of water for domestic, agricultural, urban and industrial purposes; to make provision for the control, in certain respects, of the use of sea water for certain purposes; for the control of certain activities on or in water in certain areas.	The establishment of the two facilities uses significant amount of agriculture water. The activities directly affect water conservation, management and use therefore, requires the implementation of water conservation techniques.

LEGISLATION/POLICY	PROVISION/SUMMARY	PROJECT APPLICABILITY
The Water Resources Management Act No. 11 of 2013	Equitable improvement of water and sanitation services should be achieved by the combined efforts of the government and the beneficiaries, based on community involvement and participation, the acceptance of a mutual responsibility and by outsourcing services where necessary and appropriate, under the control and supervision of government.	
Pollution Control and Waste Management Bill	The bill aims to "prevent and regulate the discharge of pollutants to the air, water and land" Of particular reference to the Project is: Section 21 "(1) Subject to sub-section (4) and section 22, no person shall cause or permit the discharge of pollutants or waste into any water or watercourse."	The construction and operation of the Piggery and Abattoir trigger section 21 and 22 of the Bill, activities like the construction of the Piggery and Abattoir infrastructure and the manure from the Piggery generates a lot of waste that require good management practices.
	Section 55 "(1) No person may produce, collect, transport, sort, recover, treat, store, dispose of or otherwise manage waste in a manner that results in or creates a significant risk of harm to human health or the environment."	Contractors of the civil works of the project should make it mandatory that they manage their waste in a manner that do not cause environmental threat and risk both to the surroundings and the local communities.

LEGISLATION/POLICY	PROVISION/SUMMARY	PROJECT APPLICABILITY
Atmospheric Pollution Prevention Ordinance 11 of 1976	The law act to provide for the prevention of the pollution of the atmosphere, and for matters incidental thereto. The law regulates and prohibit pollution from industries particularly smoke and dust from various activities.	The construction and operation of the two facilities is highly unlikely to produce significant amounts of smoke, but dust during activities like excavations and backfilling infrastructure development and from the pig pens. Efforts to suppress dust should be adopted as recommended in the EMP.
National Solid Waste Management Strategy	The Strategy ensures that the future directions, regulations, funding and action plans to improve solid waste management are properly co-ordinated and consistent with national policy, and to facilitate co-operation between stakeholders The Strategy listed priorities for the strategy to address for effective solid waste management, the priorities given below are the most relevant to the WSSP:	The construction and operation activities can potentially generate significant amount of solid waste (stockpiles, soil remains, pig manure) that might need proper management by contractors to avoid pollution. Waste management plans should be generated and implemented prior the commencement of civil works and during project operation.

LEGISLATION/POLICY	PROVISION/SUMMARY	PROJECT APPLICABILITY
	Waste disposal is the main problem with the current solid waste management in Namibia. The top priority is to reduce risks to the environment and public health from current waste disposal sites and illegal dumping in many areas of Namibia.	Contractors for the construction of the Piggery and Abattoir should reduce the risk of solid waste to the environment and surroundings of the sites they are working at by applying safe waste management measures particularly on civil works for bulk water infrastructures, wastewater, and water purification projects. Including the team responsible for the management of the operations of the facilities, proper handling of manure waste and wastewater is required as advised in the EMP.
Soil Conservation Act 76 of 1969	The Act established to consolidate and amend the law relating to the combating and prevention of soil erosion, the conservation, improvement, and manner of use of the soil and vegetation and the protection of the water sources in the Republic of Namibia.	The construction of infrastructure related to drainage system should prevent soil erosion, mitigation measures proposed in the EMP to conserve and prevent erosion during construction and operation of the facilities should be implemented.

LEGISLATION/POLICY	PROVISION/SUMMARY	PROJECT APPLICABILITY
Road Traffic and Transport Act, No. 22 of 1999	The Act provides for the establishment of the Transportation Commission of Namibia; for the control of traffic on public roads, the licensing of drivers, the registration and licensing of vehicles, the control and regulation of road transport across Namibia's borders; and for matters incidental thereto.	Mitigation measures should be provided for if the roads and traffic impact cannot be avoided. Should the Proponent wish to undertake activities involving road transportation or access onto existing roads, the relevant permits will be required from the Ministry of Works and Transport.
Forest Act 12 of 2001	Section 10 (1) set out the aim of the forest management as to: The purpose for which forest resources are managed and developed, including the planting of trees where necessary in Namibia is to conserve soil and water resources, maintain biological diversity and to use forest produce in a way which is compatible with the forest's primary role as the protector and enhancer of the natural environment.	The construction of the facilities' infrastructure at the proposed site may minimally trigger the removal of vegetation. Therefore, necessary measures should be taken to ensure minimum vegetation removal. However, since the dedicated project site is already cleared from previous farming activities that used to be carried out on the farm, there will be minimal to no additional vegetation clearing.

LEGISLATION/POLICY	PROVISION/SUMMARY	PROJECT APPLICABILITY
	Section 22. (1) (Protection of Natural vegetation) Unless otherwise authorised by this Act, or by a licence issued under subsection (3), no person shall on any land which is not part of a surveyed erven of a local authority area as defined in section 1 of the Local Authorities Act, 1992 (Act No. 23 of 1992) cut, destroy, or remove - Republic of Namibia 20 Annotated Statutes Forest Act 12 of 2001	The proposed location of the project is not located on areas that are surveyed as erven by any local authority.
	(a) vegetation which is on a sand dune or drifting sand or on a gully unless the cutting, destruction or removal is done for the purpose of stabilising the sand or gully; or (b) any living tree, bush or shrub growing within 100 metres of a river, stream or watercourse.	It is not anticipated that the construction and operation activities will result in the removal of living trees, bushes and shrubs growing within 100m of a river, stream, or watercourse. However, if the need arises, necessary measures should be implemented.
	(2) A person who wishes to obtain a licence to cut and remove the vegetation referred to in subsection (1) shall, in the prescribed form and manner, apply for the licence to a licensing officer who has been designated or appointed for the area where the protected area is situated.	The removal of trees in the above instances would require the contractors or sub-contractors to acquire necessary permits first.

LEGISLATION/POLICY	PROVISION/SUMMARY	PROJECT APPLICABILITY
National Policy on Climate Change for Namibia (2011)	The National Policy on Climate Change pursues constitutional obligations of the Government of the Republic of Namibia, namely for "the state to promote the welfare of its people and protection of Namibia's environment for both present and future generation."	The proposed project by virtue of providing highly quality meet with less water used for pig production, it enhances and improve the welfare of the people of Namibia particularly those living in remote and marginalised communities.
	The goal of the National Policy on Climate Change is to contribute to the attainment of sustainable development in line with Namibia's Vision 2030 through strengthening of national capacities to reduce climate change risk and build resilience for any climate change shocks.	Through the implementation of projects that utilize dry regions of Namibia using available resources, the program contributes towards sustainable development. The various initiatives directly and indirectly reduce the climate risk for several communities.
	The policy reckons that Namibia has limited capacity to adapt to climate change impacts. The policy projected that Namibia would become drier with more variability in rainfall.	Implementation of the proposed project initiative helps to address climate change mitigation and adaptation in the Northern region of Namibia.
	The Policy seeks to promote primary government objectives, which include job creation, provision of basic services and infrastructure development, alleviation of poverty and provision of housing.	By implementing the proposed project, NCS are promoting meat production that improve the food security of the country.

LEGISLATION/POLICY	PROVISION/SUMMARY	PROJECT APPLICABILITY
National Climate Change Strategy & Action Plan 2013 - 2020	The Strategy outlines Namibia's response to climate change. The strategy aims to address and plan for action against climate change, both through mitigation and adaptation actions. In its adaptation strategy, the Strategy recognises the role of a **sustainable water resource base**.	The proposed project should adopt measures that strengthen sustainable water resource base development of the country. The implementation should be very careful on not to cause harm to the available water resources but improve the management through various conservation technics.
	The Strategy proposed strategies that aim to: - Strategic Aim 1: Further improve the overall climate change understanding and related policy responses in water resources sector. - Strategic Aim 2: Monitoring and data collecting technologies of surface and underground water are developed and implemented at basin/watershed level.	NCS should invest capital on strengthening the understanding of climate change and its related policies through various training of the officers responsible for management of the various project aspects.
Nature Conservation Ordinance (1996)	This ordinance relates to the conservation of nature; the establishment of game, parks and nature reserves; the control of problem animals; and highlights matters incidental thereto.	The activities of the project are highly localized therefore, there is no potential to interfere with parks, games, and nature reserves. However, there is need for proper

LEGISLATION/POLICY	PROVISION/SUMMARY	PROJECT APPLICABILITY
		designing and planning of the drainage and water network of the project to make sure that the infrastructure will not interfere with facilities listed in the Nature Conservation Ordinance.
National Biodiversity Strategy and Action Plan (NBSAP2) 2013 – 2022	The action plan was operationalised in a bid to make aware the critical importance of biodiversity conservation in Namibia, putting together management of matters to do with ecosystems protection, biosafety, and biosystematics protection on both terrestrial and aquatic systems.	The proposed construction and operation activities potentially triggers the ecosystem threatening.
Labour Act 11 of 2007.	Empowers the minister responsible for labour to publish regulations pertaining to health and safety of labourers (S135). Details requirements regarding minimum wage and working conditions (S39-47).	The construction and operation of the project will invite significant amount of laborious work. Therefore, there is need to make sure that the workers participate are protected and that they are from the local area especially unskilled labour.
Health and Safety Regulations GN	Details various requirements regarding health and safety of labourers to be involved in the construction and operation of the two facilities.	Contractors involved in the construction of various units and facilities should complying with this Act and its

LEGISLATION/POLICY	PROVISION/SUMMARY	PROJECT APPLICABILITY
156/1997 (GG 1617)		regulations
Public Health Act 36 of 1919	Section 119 states that "no person shall cause a nuisance or shall suffer to exist on any land or premises owned or occupied by him or of which he is in charge any nuisance or other condition liable to be injurious or dangerous to health."	Provision of community labour, the input of the local communities is usually in the form of labour for the construction and operation of the Piggery and Abattoir. The safety of these people is crucial particularly women, who do not knowledge of handling dangerous, risk and strenuous jobs.
Public and Environmental Health Act 1 of 2015.	To provide a framework for a structured uniform public and environmental health system in Namibia; and to provide for incidental matters.	
National Heritage Act 27 of 2004	Section 48(1) states that "A person may apply to the (Heritage) Council for a permit to carry out works or activities in relation to a protected place or protected object" Protects and conserves cultural heritage and cultural resources with special emphasis on places and sources of National heritage including graves, artefacts, and any objects older than 50 years.	The project construction works the two facilities will be limited to the 11ha and 2ha. however, if heritage resources (e.g., human remains etc.) discovered during constructions, it will require NCS to obtain a permit from the National Heritage Council of Namibia for relocation.

The proposed project will be undertaken in specific biophysical and social environment. Understanding the pre-existing environmental settings will assist in identifying sensitive components as well as understanding how the project environment was before and would be after project's operations. The pre-existing environmental features of the project area and site are therefore presented under Chapter 5.

5. THE RECEIVING (BASELINE) ENVIRONMENT

For an Environmental Assessment Study, it is crucial to understand the current environmental and social conditions (baseline) of the proposed project site. This information plays a role in aiding Environmental Consultants to identify the sensitive environmental and social features that may require protection through the recommendation and effective implementation of appropriate management and mitigation measures. The baseline information of the project area presented below has been sourced from a site visit undertaken by the Mafuta Consultants on the 2nd of February 2022. Other baseline information has been obtained from different reports of studies conducted near the project area and/or the Oshikoto Region areas close to Tsumeb.

The considered environmental and social features are presented under the following subchapters/headings.

5.1. Physical and Biological Environment

5.1.1. Climate: Rainfall and Temperature

The Tsumeb area is one of the few areas in Namibia that receive some good rains and according to Lohe *et al,* (2021), Tsumeb receives an average annual rainfall of between 550 to 600 mm.

The rainiest months of the year are from November to March. The highest recorded rainfall event from the year 2009 to 2021 was 708.7 mm in January 2021, followed by 699.2 mm in December 2011 and 690.69 mm in January 2011. The graphs of the rainfall and rain days as well as for monthly average rainfall for the period of 2009 to early 2022 are shown in **Figure 4** and **Figure 5.**

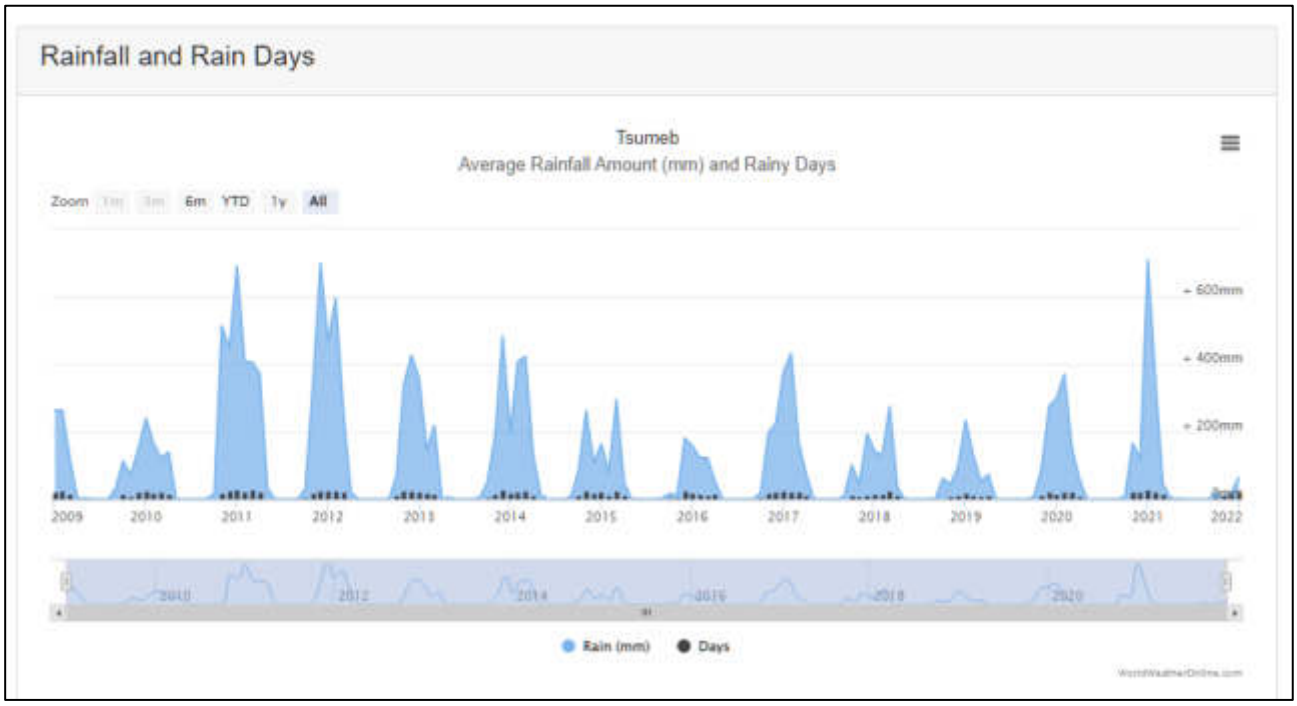

Figure 4: The rainfall and rain days chart for Tsumeb area (source: World Weather Online, 2022)

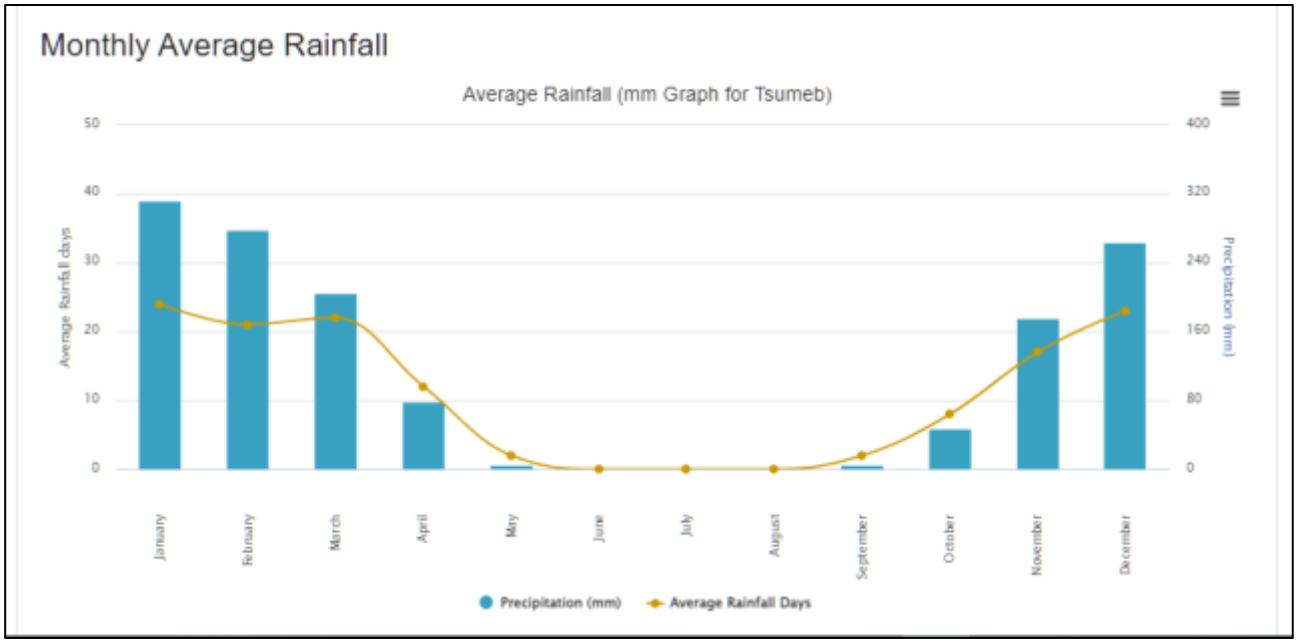

Figure 5: The monthly average rainfall chart for Tsumeb area (source: World Weather Online, 2022)

In terms of temperatures, the maximum values recorded for the Tsumeb area which is hosting the project site for the period of 2009 and 2022 range between 20°C and 36°C whereas the minimum temperatures range between 5°C and 21°C. The average low and high temperatures are 7°C in July and 32°C in September. These temperature components are shown in **Figure 6** and **Figure 7**.

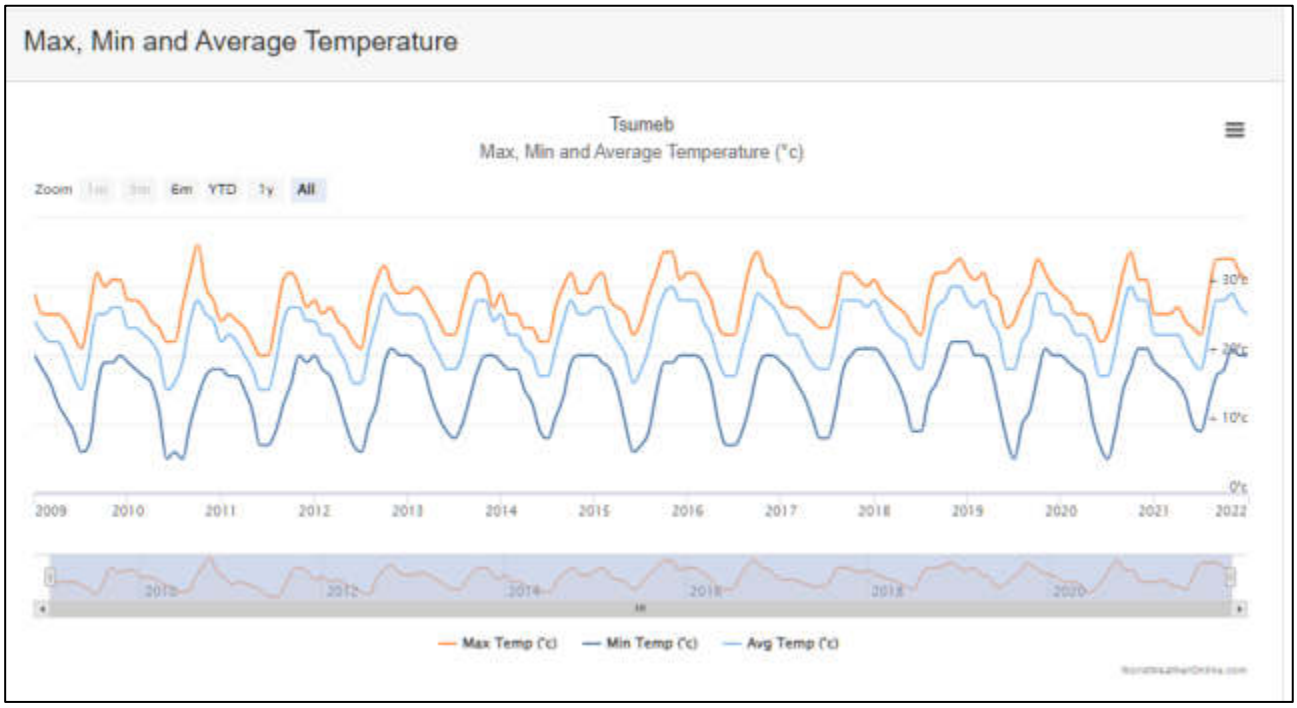

Figure 6: The maximum, minimum and average temperature of the Tsumeb area (source: World Weather Online, 2022)

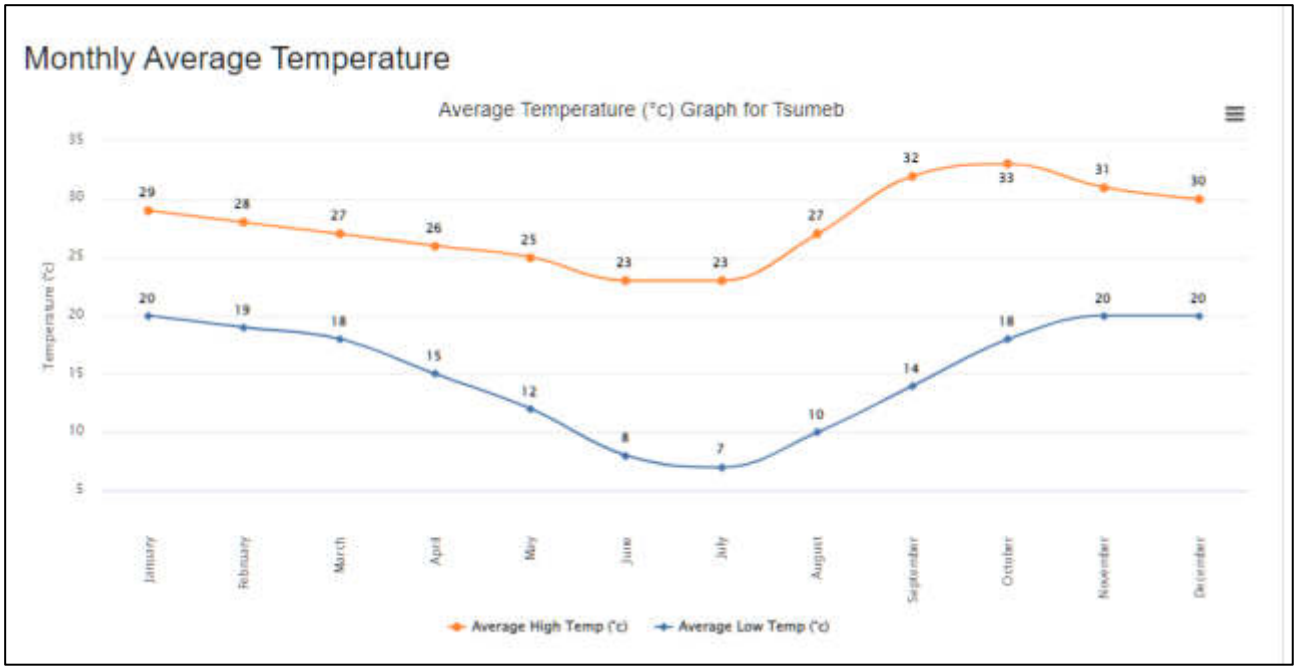

Figure 7: The monthly average temperatures of the Tsumeb area (source: World Weather Online, 2022)

5.1.2. Air Quality and Wind Direction

The potential current known sources of air pollution around the project site are dust emissions from unpaved access roads, and emissions from heavy vehicles such as trucks that may be travelling into and through the area.

According to IQ Air (2022), the current air pollution level around Tsumeb is good. The air quality index (AQI) is 25 US AQI. The main pollutant is the atmospheric particulate matter (PM) 2.5. PM, which are microscopic solid or liquid matter suspended in the air with a diameter of 2.5 micrometres (µm) or less. The PM2.5 concentrate of Tsumeb is 6.1 µg/m3.

The PM2.5 concentration in Tsumeb air is currently 1.2 times above the World Health Organization (WHO) annual air quality guideline value (IQ Air, 2022).

Wind direction and speed: according to the wind rose for Tsumeb in **Figure 8**, the wind is blowing from the indicated direction (Southwest (SW) to Northeast (NE) at a speed of 12 and 19 kilometres per hour (km/h).

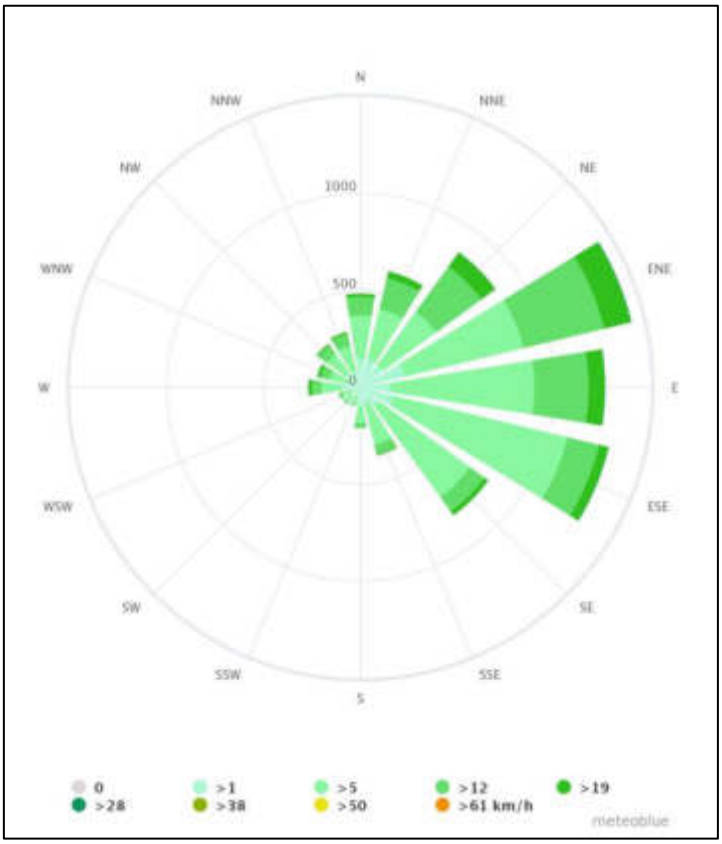

Figure 8: Wind rose for the Tsumeb area (Meteoblue, 2022)

The diagram/chart for Tsumeb in **Figure 9** below shows the days per month, during which the wind reaches a certain speed. For instance, there was recording of 15, 16 and 17 days of wind with speeds of more than 19 km/h in July, October and September, respectively.

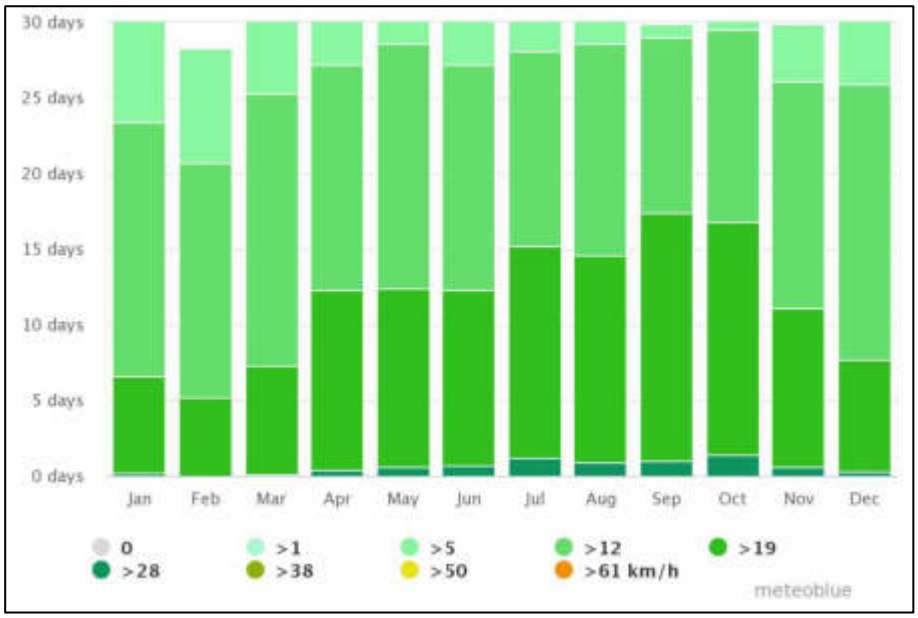

Figure 9: Wind speed chart for the Tsumeb area with the number of days per month (Meteoblue, 2022)

5.1.3. Soils and Topography

The soil around Tsumeb varies in quality from very fertile red loam through black turf to chalky clay and loam. This makes the area suitable for intensified farming and crop production. The site soils are sandy loamy with a light brown colour, overlain by short and medium grass as shown in Figure below. The soil map of the area is shown in **Figure 10**.

Figure 10: Typical soils (light brown loam soil) on the project site area

The soil map of the site area is shown in **Figure 11**, where it is indicated that the western edge of the site is underlain by rock outcrops (dolomites) and most of the site to its eastern side is overlain by Mollic Leptosols (loam soils).

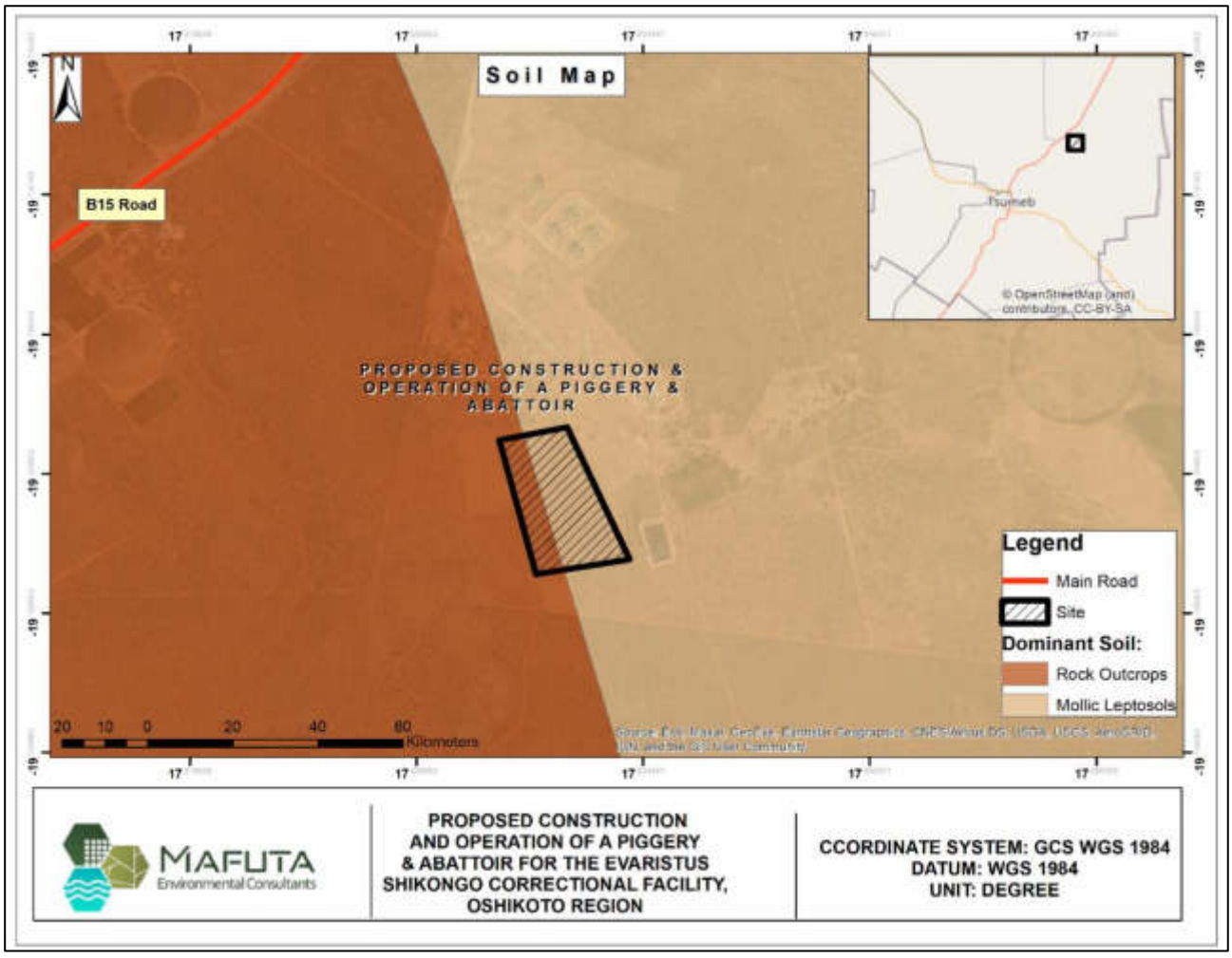

Figure 11: The soil map of the project site area

The project site is relatively flat, with two mountains on the southwestern side of the site.

5.1.4. Geology

The geology of the Tsumeb area is characterized by the members of the Nosib group that are directly overlain by a thick sequence of shelf carbonates of the Otavi group. The Otavi group is stratigraphically subdivided into two subgroups, namely the:

- Abenab sub-group consists mostly of laminated dolomites in the lower part, and of intercalating bedded limestone and shale with massive dolomites in the upper part.

- Tsumeb sub-group is composed mostly of limestones and dolomites with horizons of spectacular diagenetic chert in the uppermost part of the unit (Shagama 2015 after Kribek, 2005).

Towards the north of Tsumeb (where the project site is) is the Karo Sequence which was deposited in the basin throughout the Permian and the Mesozoicperious periods. The Karoo is overlain by the Tertiary and Quaternary sediments of the Kalahari Sequence. The thickness of the Kalahari Sequence forms an extensive cover of terrestrial origin and amounts to some tens of metres and seldom exceeds 200m in the northern part of the basin (Shagama, 2015).

The local geology of the site shown in **Figure 12** shows that the project site is overlain by surficial deposits (sandy loamy soils of the Kalahari Sequence). Underlying the sediments/surficial deposits are dolomites.

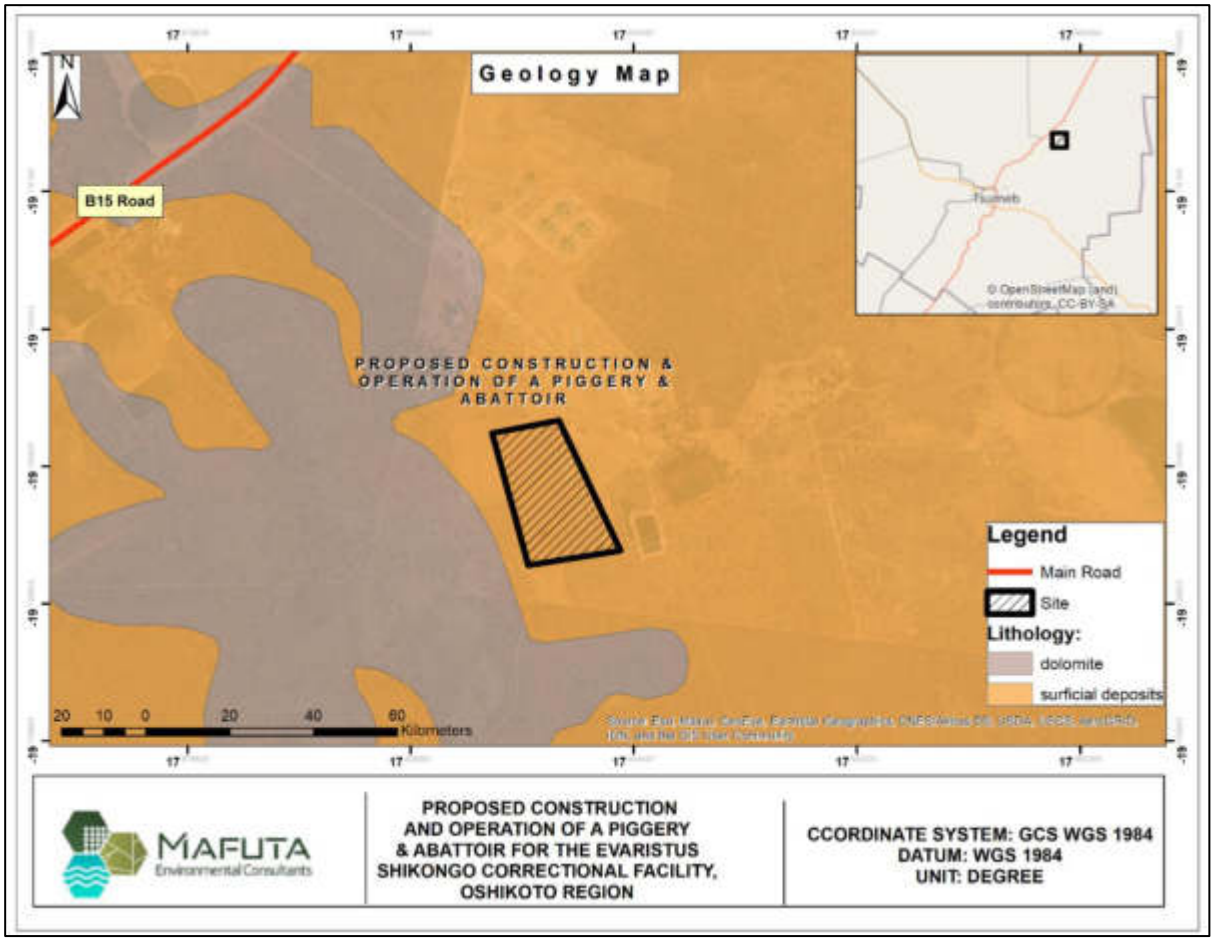

Figure 12: The geology map of the project site and surrounding area

5.1.5. Water Resources: Hydrology and Hydrogeology

In terms of hydrology (surface water), the Oshikoto Region like the rest of inland of Namibia does not have any perennial rivers. There are also no ephemeral rivers within the project site or its vicinity.

From the hydrogeology (groundwater) perspective, the project site area falls under the Otavi Mountainland groundwater basin. Located in the Central Northern Namibia, the Otavi Mountainland comprises a series of dolomite units that have been subjected to an erosion process of carbonate dissolution to form karstified landforms. The Mountainland region is a major groundwater resource known as the "Karst Area" or "Karstland" which comprises the mountainous landscapes of Otavi, Tsumeb and Grootfontein.

Groundwater recharge: Tsumeb receives an average annual rainfall of between 550 to 600 mm and given the high infiltration rates typical in this Karst area, groundwater recharge is therefore high (Lohe *et al*., 2021).

Groundwater flow: the local groundwater flow pattern follows the regional northerly flow direction from the Otavi Mountain Land (OML) in the south, beneath Tsumeb towards the north. said that groundwater flow is reported to occur primarily within the upper 150 m below surface although flow is reported to occur as deep as 900 mbgl (Shagama 2015 after Van Rooyen and Nel, 2013). It was also stated that a 'slightly southern dipping water table' even though regional groundwater flow directions are reportedly to the north, this may, therefore, be indicative of a localized, complex flow regime in the vicinity of the site, although overall groundwater elevations have not been taken into consideration (Van Rooyen and Nel, 2013).

Groundwater Potential: given the high rainfall (as mentioned above) and nature of the rocks, the area has high groundwater potential as also shown on the map in **Figure 13**. There are also about eleven boreholes, including the ESCF borehole found within the proximity of the project site.

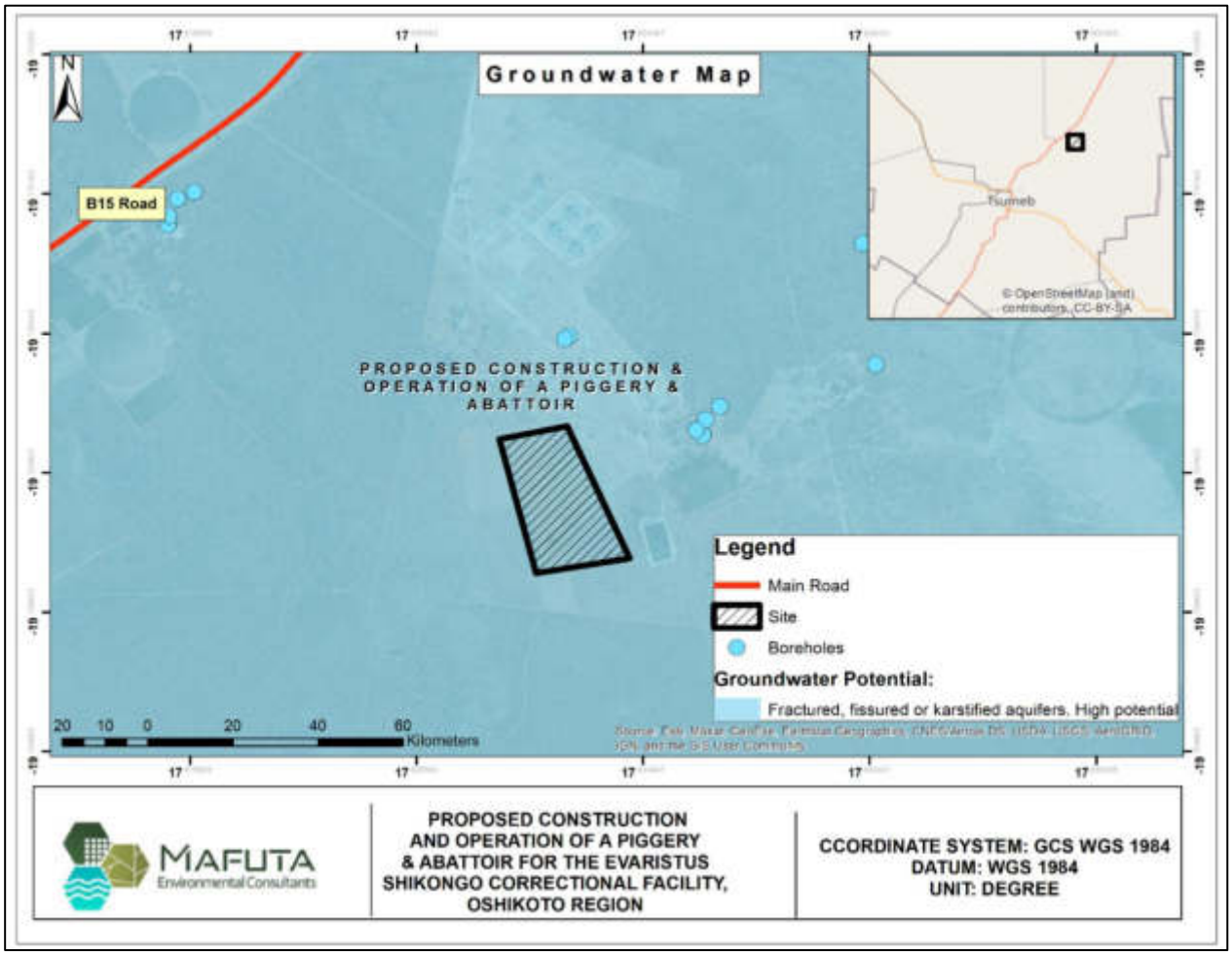

Figure 13: Groundwater map of the site

Groundwater quality: The groundwater in the Nosib anticline is predominantly characterised by a Mg/Ca-HCO3 water type where the (Total dissolved solids ranges from 150 to 1 200 mg/l. Locally, higher sodium, chloride and nitrate concentrations can occur in the vicinity of boreholes used for livestock watering. The dolomitic groundwater may be characterised as a low mineralised (with average TDS of 500 mg/l in the range of 150 to 1 300 mg/l), very hard and near-neutral Ca/Mg-HCO3 water (Lohe *et al.,* 2021).

5.1.6. Fauna and Flora

A. Fauna

The project site area is dedicated to farming. There is said to be wildlife on and around the project site area (Farm Scott). The wild animals within the site area known to the ESCF personnel include warthogs, rabbits, kudus and small birds such as guinea fowls.

In terms of livestock, there are sheep, goats (**Figure 14**), and cattle that belong to the ESCF. However, the cattle are condoned off in camps, and that was the reason they were not seen on site during the site visit.

Figure 14: some goats and sheep spotted at the middle of the project site

According to the livestock distribution map of the area (**Figure 15**), the project site area has a distribution density of 20 to 39 livestock per square kilometres.

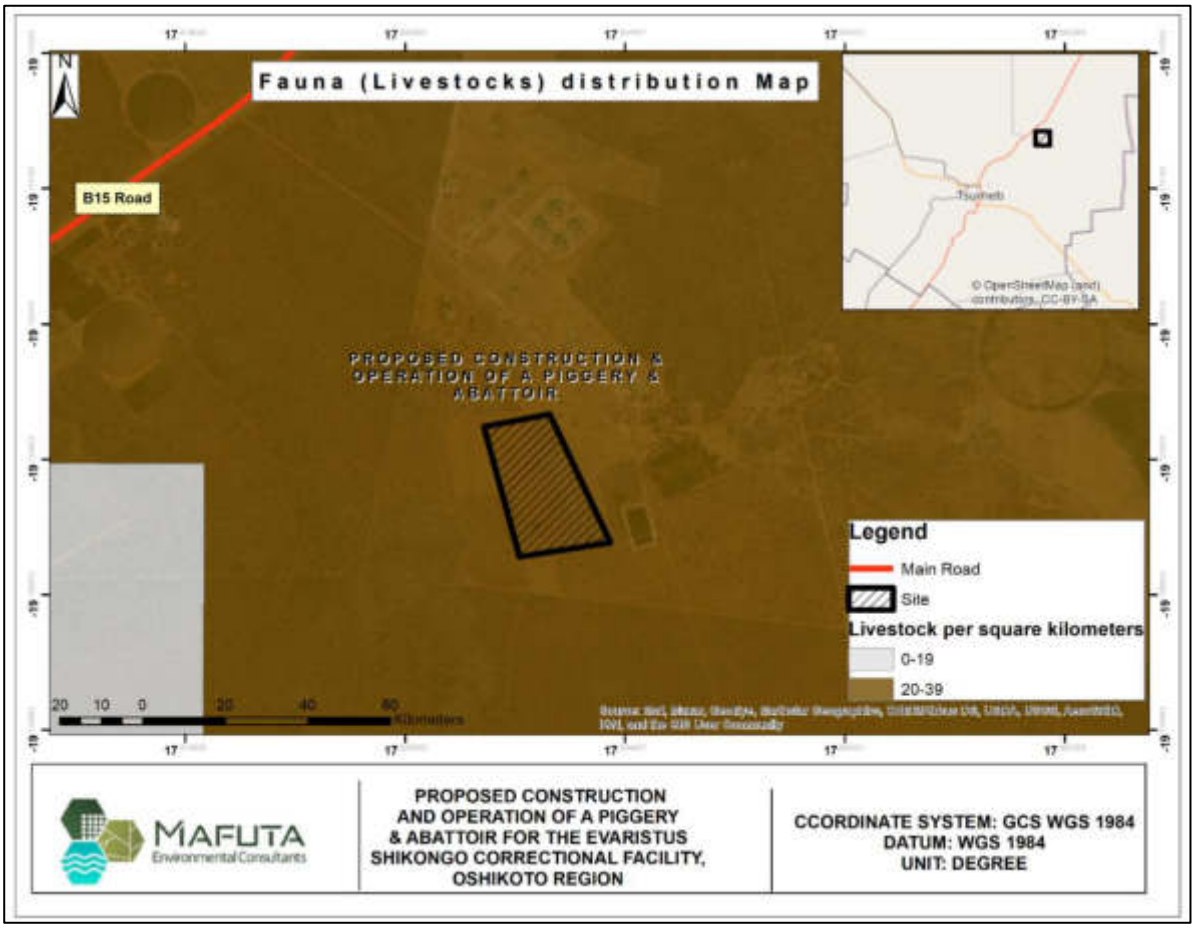

Figure 15: Livestock distribution map of the site and surrounding area

B. Flora

The Tsumeb falls in the dry woodland, savanna vegetation zone. The typical vegetation observed on and around the site are camelthorn (*Vachellia erioloba*), purple-pod cluster-leaf (*Terminalia prunioides*), mopane and marula (*Sclerocarya birrea*) shrubs and trees -**Figure 16**. There were also some young shrubs of bitterbrush.

Due to its rich groundwater, and regular rainfall in the summer month, the area is very productive when it comes to irrigation. The typical crops that are grown on the farmers in the area are citrus fruits with the main crops grown being maize, sorghum, and sunflowers

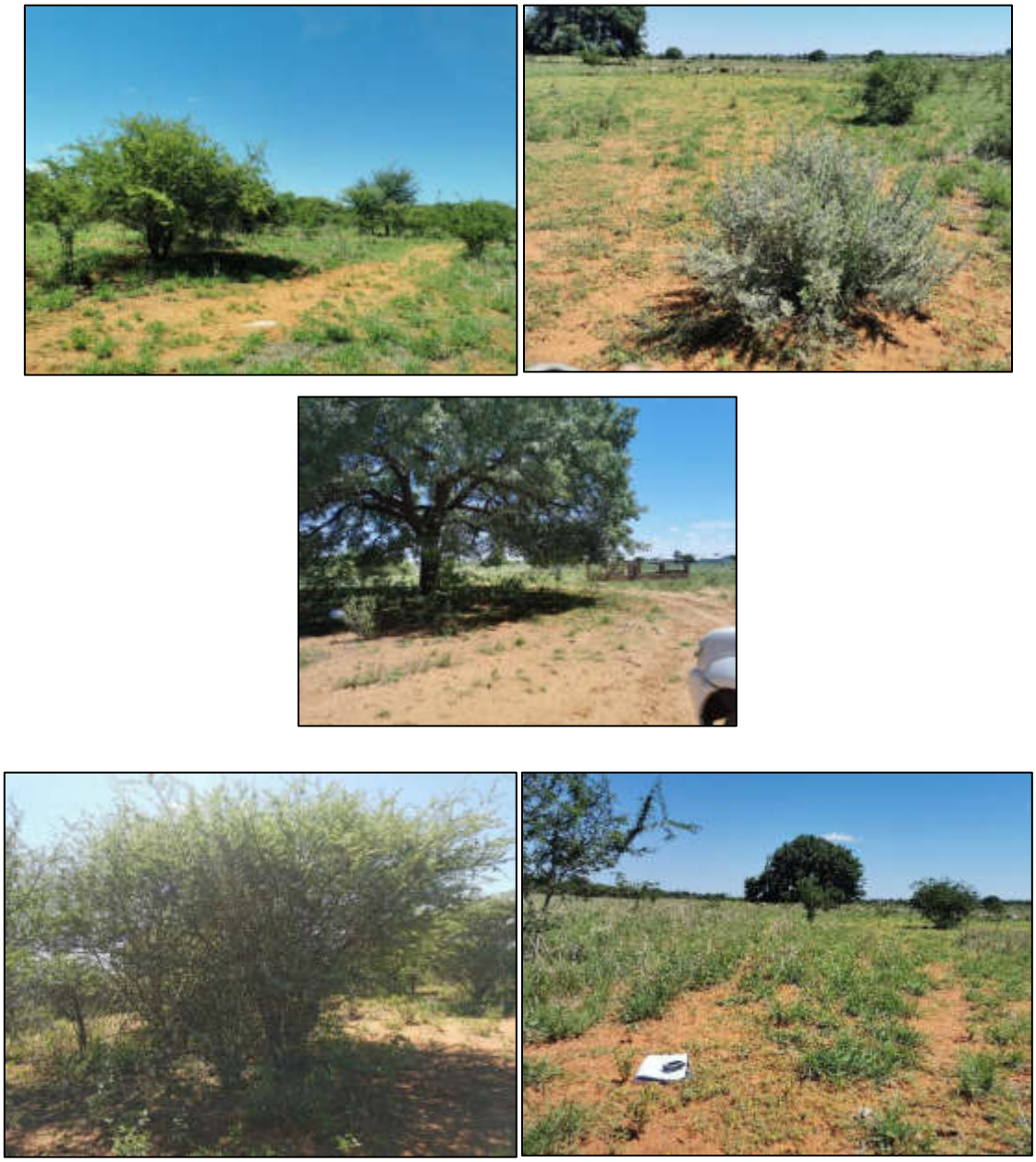

Figure 16: shrubs of camelthorn and mopane as well as some big marula tree on site

The important plant species in the area is Colophospermum mopane, commonly called mopane, butterfly, or turpentine tree as shown on the map in **Figure 17**.

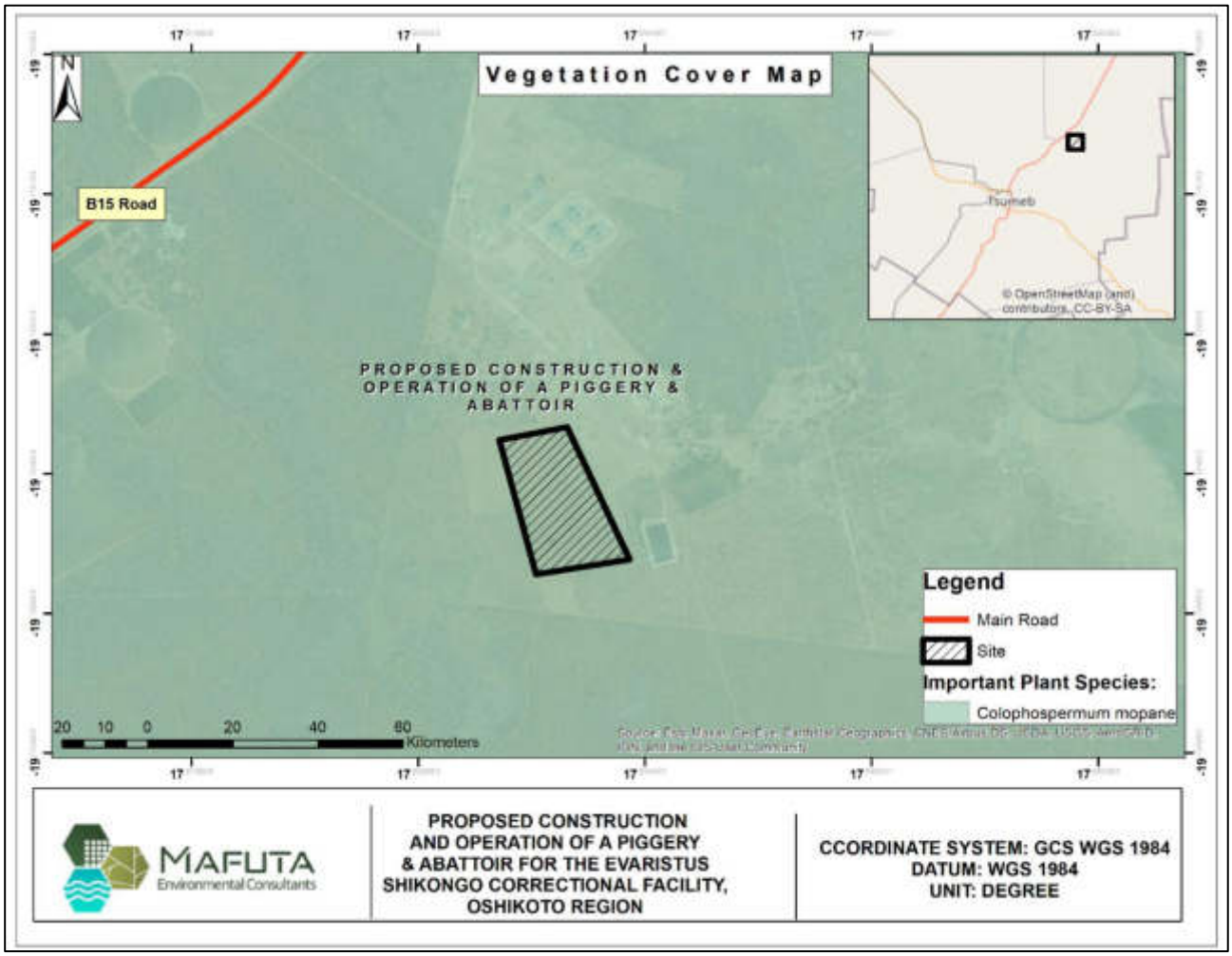

Figure 17: Vegetation cover and common plant species map of the site

5.2. Socio-Economic Environment

5.2.1. Population Census of the Oshikoto and Project (Tsumeb) Constituency

The population Oshikoto Region was 181 973 (94 907 females and 87 066 males) according to National Housing and Population Census conducted in 2011 (2011), with the Tsumeb constituency population recorded at 19 840. According to van Zyl and Kinghorn (2017) after Yarmoshuk 2015, Tsumeb's population has grown by at least 25% since 2011 to over 25,000 inhabitants driven primarily by the growth of informal settlements.

2015).

5.2.2. Economic Development

The Regional main sources of income are farming (33%), wages and salaries (30%), cash remittance (5%), business, non-farming at 9% and old-age pensions at 19% (Namibia Statistics Agency, 2011).

Oshikoto Region has four main tourist destinations, namely Etosha National Park, Otjikoto Lake, King Nehale Conservancy and Okashana RDC.

According to van Zyl and Kinghorn (2017), as with occupation categories, Census 2011 data on the main industries within which workers are employed reveals that Oshikoto is heavily reliant on agriculture where 49% of jobs are to be found. According to Lohe *et al.*, (2021), cash crops are irrigated within the so-called maize triangle between Grootfontein, Otavi and Tsumeb. The next most prominent employer is administrative and support service activities (7% of jobs), followed by education and activities of private households (6% of jobs each). The manufacturing sector only contributes 1,123 (or 3%) to total direct employment in Oshikoto. This serves to emphasise the importance of plants such as Dundee Precious Metals Tsumeb Smelter, which employs 457 people, in providing diversification (van Zyl and Kinghorn, 2017).

Due its good groundwater potential, the Tsumeb area relies on commercial farming and according to van Zyl and Kinghorn (2017), for Oshikoto's employed population, agriculture is the most common occupation (47%), followed by elementary occupations (13%), service workers (11%), craft and related trades workers (8%) and professionals (8%). Various occupation categories make up the remaining 13%.

5.2.3. Current Land Use

The Farm Scott which is currently owned by the NCS' Evaristus Shikongo Correctional Facility is used as a rehabilitation centre for offenders. The Farm consists of administration offices, employees' housing, prison cells/blocks, workshop and other associated buildings required to execute the NCS' mandate. Some of the buildings are shown in **Figure 18**.

The site is also home to some livestock (goats, sheep and goats) that belongs to the NCS. There also wild animals in the area but are condoned off in camps, not on the project site.

Figure 18: The ESCF Workshop with new buildings and small livestock grazing on open site land

5.2.4. Surrounding Land Users

The project site is within commercial farming area, and therefore surrounded by farms on both directions.

To the site level, the proposed site is bordered to the west by the administration buildings, staff houses and a solid waste management site within proximity of the project site. To the north is the ESCF Workshop and to the northeast is the Minimum-Security Rehabilitation building (under construction).

5.2.5. Services and Infrastructure

The Region of Oshikoto is well-equipped with services infrastructure ranging from road networks, railways, airport (in Tsumeb), telecommunication and radio services, health care, shopping centres, water, and power supply, etc.

From a local perspective, the Tsumeb area has the following services and infrastructure and the maps with some of the services and infrastructure is shown in **Figure 19.**

- **Roads:** The Tsumeb town is connected to the rest of the country by the B1 road. The proposed project site area is then accessed from the B1 in Tsumeb via B15 / M75 and access road D3039. The surrounding areas to the site are then accessed by the local access roads.
- **Railway:** There is a railway line connecting Tsumeb to the northwestern and southern part of the country.
- **Power Supply:** Tsumeb area and surrounding is supplied with electricity by the Central North Regional Electricity Distributor Company (CENORED), which also supplies the ECSF where the proposed project site is (the electricity line supplying the ESCF is named HLPCD 22kV). Some residences and business may be using generators as well as solar power for electricity.
- **Water Supply:** The Tsumeb area has good groundwater potential that urban areas are supplied by the municipality through water boreholes and farms around the town have their own boreholes. The project site is equipped with its own boreholes where the ESCF's current operations abstract water from.
- **Aerodromes (airports/strips):** There is a private airport located on the easter side of Tsumeb Town.
- **Health care services:** Tsumeb District has a District Hospital and Tsumeb Primary Health Care (PHC) Clinic in Tsumeb, Lombard PHC Clinic, Oshivelo PHC Clinic, and Tsintsabis PHC Clinic.
- **Telecommunication and radio (broadcasting) services:** The Region and the project site area are well connected to the rest of the country and world via local network service providers.

The main providers of this service in the area are Mobile Telecommunications Company (MTC Namibia).and in some instance, Telecom Namibia with landlines.

- There is also good radio coverage, and this service is important for most rural communities in deep rural areas as this is how they get some of the information, such as constituency councillors' public announcements as well as old-age pension monthly schedules and local community gatherings/meetings

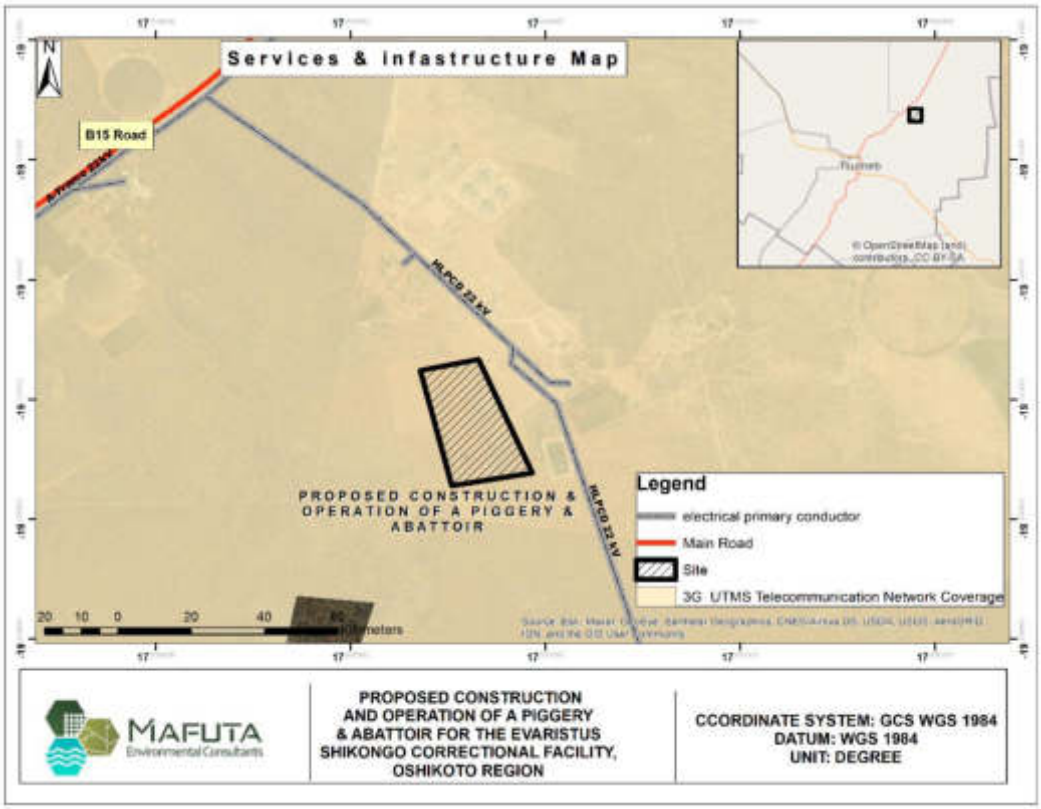

Figure 19: Services and infrastructure around the project site

5.2.6. Heritage and Archaeology

There are no known or observed archaeological sites on the Farm (NCS site) during the site visit and personal interview with site personnel. However, according to information from one of the Farm Managers onsite, there are some old graves for the San people located far north of the Farm Scott, therefore outside of the project site and will not be impacted by the proposed project activities.

5.2.7. Waste Management

The proposed project site is in a rural/farming set up where domestic waste is managed per household and dumped in small hand dug pits or selected open area within the farms. However, this does not imply that such waste management practises have no environmental impact. The ESCF is currently managing its own solid waste at a fenced site on the farm, located just to the immediate west of the proposed project site – **Figure 20**. For wastewater management, there is an existing fenced off wastewater dam with a pumping station located to its west- **Figure 21.**

Figure 20: Solid waste management site of the Evaristus Shikongo

Figure 21: The existing wastewater treatment dam, east of the project site

Public Participation (Consultation) is a crucial requirement of any ESA/EIA process. The public consultation process followed for this ESA is presented under the next chapter.

6. PUBLIC CONSULTATION AND ENGAGEMENT

Public and Stakeholder Public is an important aspect of an Environmental Assessment (EA) process. This process entails the sharing of information through the recommended means by the EMA as well as other means that are considered efficient to get the notifications to the public. The consultation provides potential Interested and Affected Parties (I&APs) with an opportunity to comment on and raise any issues relevant to the project for consideration as part of the assessment process.

The consultation process has been undertaken in accordance with the Environmental Management Act No. 7 of 2007 and its 2012 Environmental Impact Assessment (EIA) Regulations: Section 21 to 24 (Public Consultation).

The public consultation process assisted the Environmental Consultant in identifying all potential impacts and aided in the process of identifying possible mitigation measures. Potential impacts that may stem from the proposed project activities were pre-identified prior to the consultation process and additional impacts were identified upon public feedback. Public Consultation with Interested

and Affected Parties (I&APs) allows for a transparent decision-making with regards to the ECC. The consultation was conducted as per the following sections.

6.1. Registration of Interested and Affected Parties (I&APs)

The relevant and applicable national, regional, and local authorities and other interested members of the public were identified and consulted by the Consultant. The (pre-identified) I&APs were contacted directly, and some were registered as I&APs upon their request. The list of registered I&APs had been updated throughout the ESA process and attached under **Appendix B**.

6.2. Public Consultation Activities

Regulation 21 of the EIA Regulations details steps to be taken during a public consultation process and these have been used in guiding this process. Communication with I&APs about the proposed Piggery and Abattoir was done through the following means and in this order:

6.2.1. Background Information Document

A Background Information Document (BID) was drafted at the onset of the ESA process to act as a useful information handout about the proposed project- **Appendix C**. In addition, the BID provided details on the public consultation process with contact details for further information. This document was advertised for availability through newspaper articles and public notice posters.

6.2.2. Newspaper Advertisements

Newspaper adverts about the proposed project and related EA processes were placed in the Namibia Media Holdings' Market Watch comprising three newspapers, namely *The Namibian Sun*, *Die Republikein* and *Allgemeine Zeitung* (**Appendix D).** The project advertisement / announcement ran for two consecutive weeks for two weeks (on the 9th and 15th of December 2021) as per the requirements of the EIA Regulations.

6.2.3. Site Notices

The A3-sized public notice posters were placed in Tsumeb, at the Municipality office notice board (**Figure 22**) and Open Market notice board (**Figure 23**) near Tsumeb Shoprite. The notice provided

information about the project and related EA while providing contact details of the project team for public communication purposes with regards to the study.

Figure 22: Public notices at the Tsumeb Municipality

Figure 23: Public notices at the Tsumeb Open Market near Shoprite

6.2.4. Public Consultation Meeting

A notification of consultation meeting was shared with registered stakeholders/I&APs. However, some stakeholders tendered their apology due to other coinciding events. Since there was no public meeting conducted, there is no meeting minutes recorded nor available.

The lack of interest and attendance by the public could be linked to the fact the proposed site is already within the Proponent (NCS)'s land and from experience, the public had always seemed to not show much interest in such projects, especially if does not physically or directly affect them.

6.2.5. Comments Period and Feedback

A comments period for the ESA Study was initially set from the 9th of December 2021 to the 31st of January 2022, and the extended to the 12th of February 2022. Despite this, there has been no comments from the public regarding the proposed project.

The only comment received but from one of the Proponent's site Farm Managers and this is summarized below:

- **Concern over water abstraction from a single borehole:** There is a need to drill another borehole to supply water to the Piggery & Abattoir and possibly other nearby ESCF operations that side and relieve the pressure off the existing borehole. This is because there are other ESCF operations/projects that are relying on the same single borehole that is currently on site.

7. ENVIRONMENTAL AND SOCIO-ECONOMIC IMPACTS

7.1. Overview

Agriculture-related projects are associated with different environmental impacts, whether positive or negative. The positive impacts are assessed to ascertain the significance of their extent and magnitude. The potential negative impacts are assessed to ensure that their significance on the biophysical and social environments are adequately addressed so that they are brought under control, while maximizing the positive impacts.

The potential positive and negative impacts that have been identified from the proposed project activities are as follows:

7.2. Impact Identification (Positive and Negative) and Asessment Methodology

The potential beneficial (positive) and adverse (negative) impacts stemming from the proposed project activities are listed below and assessed under the subsequent subchapters.

Positive impacts

- Job opportunities for local communities during construction of the Piggery and Abattoir phase through appointed construction contractors and provision of other specialized services.
- Contribution to local and regional social economic development.
- Reduction on the national budget for offender's rations, by producing own food supply to the other NCS facilities in the country.
- The operational phase of the facilities will serve as a training for offenders on pig production as part of their rehabilitation. This will help them to become productive and law-abiding citizens after serving their terms.
- Helping at the two facilities will keep the inmates (offenders) busy to reduce idleness amongst them.
-

Potential negative impacts

- **Physical disturbance to site soils**/land during construction and pollution.
- **Odour**: Piggeries are associated with odour that comes from pig manure, decaying feed, and carcasses. This odour is a potential nuisance for nearby receptors (farmers in the vicinity). According to the Queensland State's Department of Agriculture & Fisheries (2018), the rate at which dust is generated, is influenced by shed design, effluent collection and disposal systems, and the overall piggery management.
- **Impact on groundwater resources (pollution and over-abstraction)**- the uncontrolled abstraction (over-abstraction) of groundwater resources may negatively affect the local aquifer. Improper handling of construction waste and eventual wastewater/ effluent (slurry) from the Piggery and Abattoir operations may pollute soils and water resources (ground and surface water).
- **Air quality issues:** Dust generated by traffic travelling on the gravel road to site during construction and operational phases.

- **Noise** generated by the Piggery itself (pigs), related vehicle and equipment, such as operational pumps, and traffic from and to the site.
- **Impact on fauna and flora (biodiversity)** due to the potential removal of site vegetation and habitat destruction to enable construction works.
- **Health and safety** – Workers involved in the construction as well as when handling waste, machinery and equipment during the operations phase may be exposed to health and safety risks. Health concerns are potentially associated with the operational and maintenance phase.
- **Environmental pollution (solid waste generation)** – mishandling of wastes generated during the project phases may lead to environmental degradation/pollution.
- **Vehicular Traffic safety** – the construction works may potentially put pressure on the existing roads when construction materials and operational phase goods are delivered to and from site as well as the transportation of waste from site to respective waste management facilities.
- **Impact on archaeological and heritage resources** from inadvertent destruction of subsurface sites and or objects during earthworks for construction phase.

7.2.1. Impact Assessment Methodology

The methodology employed for this project was adopted from environmental reports compiled by the Environmental Consultant based on research and analysis of other consultants' reports on the suitable project assessment methodology.

The proposed project activities will likely to some scale/extent (spatial scale), magnitude (severity) and duration (temporal scale) have impacts on certain biophysical and social components. The potential impacts were assessed as per methodology presented in **Table 3**.

To enable a scientific approach to the determination of the environmental significance, a numerical value is linked to each rating scale. This methodology ensures uniformity and that potential impacts can be addressed in a standard manner so that a wide range of impacts are comparable.

It is assumed that an assessment of the significance of a potential impact is a good indicator of the risk associated with such an impact. The following process will be applied to each potential impact:

- Provision of a brief explanation of the impact.
- Assessment of the pre-mitigation significance of the impact; and
- Description of recommended mitigation measures.

The recommended mitigation measures prescribed for each of the potential impacts contribute towards the attainment of environmentally sustainable operational conditions of the project for various features of the biophysical and social environment. The impact assessment criteria used is presented in **Table 3**.

Table 3: The criteria for impacts assessment

Nature	Description	Rating
Extent (Spatial scale)	An indication of the physical and spatial scale of the impact.	**Low (1)**: Impact is localized within the site boundary: Site only. **Low/Medium (2)**: Impact is beyond the site boundary: Local. **Medium (3)**: Impacts felt within adjacent biophysical and social environments: Regional. **Medium/High (4)**: Impact widespread far beyond site boundary: Regional **High (5)**: Impact extend National or over international boundaries.
Duration	The timeframe, over which the impact is expected to occur, measured in relation to the lifetime of the project.	**Low (1)**: Immediate mitigating measures, immediate progress

Nature	Description	Rating
		Low/Medium (2): Impact is quickly reversible, short-term impacts (0-5 years) **Medium (3)**: Reversible over time; medium term (5-15 years). **Medium/High (4)**: Impact is long-term. **High (5):** Long term; beyond closure; permanent; irreplaceable or irretrievable commitment of resources
Intensity, Magnitude / Severity (Qualitative criteria)	The degree or magnitude to which the impact alters the functioning of an element of the environment. The magnitude of alteration can either be positive or negative	**Medium/low (4)**: Low deterioration, slight noticeable alteration in habitat and biodiversity. Little loss in species numbers. **Low (2)**: Minor deterioration, nuisance or irritation, minor change in species / habitat / diversity or resource, no or very little quality deterioration.
Probability of occurrence	Probability describes the likelihood of the impacts occurring. This determination is based on previous experience with similar projects and/or based on professional judgment	**Low (1)**: Improbable; low likelihood; seldom. No known risk or vulnerability to natural or induced hazards. **Medium/low (2):** Likely to occur from time to time. Low risk or vulnerability to natural or induced hazards. **Medium (3)**: Possible, distinct possibility, frequent. Low to

Nature	Description	Rating
		medium risk or vulnerability to natural or induced hazards. **Medium/High (4)**: Probable if mitigating measures are not implemented. Medium risk of vulnerability to natural or induced hazards. **High (5)**: Definite (regardless of preventative measures), highly likely, continuous. High risk or vulnerability to natural or induced hazards.

7.2.1. Impact Significance

This is determined through a synthesis of the above impact characteristics (in **Table 3** above). The significance of the impact "without mitigation" is the main determinant of the nature and degree of mitigation required. As stated in the introduction to this chapter, for this assessment, the significance of the impact without prescribed mitigation actions was measured.

Once the above factors (**Table 3**) have been ranked for each potential impact, the impact significance of each is assessed using the following formula:

SP = (magnitude + duration + scale) x probability

The maximum value per potential impact is 100 significance points (SP). Potential impacts were rated as high, moderate, or low significance, based on the following significance rating scale (**Table 4).**

Table 4:Impact significance rating scale

Significance	*Environmental Significance Points*	*Colour Code*
High (positive)	>60	H
Medium (positive)	30 to 60	M
Low (positive)	<30	L
Neutral	0	N
Low (negative)	>-30	L
Medium (negative)	-30 to -60	M
High (negative)	>-60	H

For an impact with a significance rating of high, mitigation measures are recommended to reduce the impact to a low or medium significance rating, provided that the impact with a medium significance rating can be sufficiently controlled with the recommended mitigation measures. To maintain a low or medium significance rating, monitoring is recommended for a period to enable the confirmation of the significance of the impact as low or medium and under control.

The assessment of the project impacts is done for both pre-mitigation (before implementing any mitigation) and post-mitigation (after mitigations are implemented).

The risk/impact assessment is driven by three factors, and these are:

- **Source:** The cause or source of the contamination.
- **Pathway:** The route taken by the source to reach a given receptor
- **Receptor:** A person, animal, plant, eco-system, property, or a controlled water source. If contamination is to cause harm or impact, it must reach a receptor.

A pollutant linkage occurs when a source, pathway and receptor exist together (Booth, 2011). The objective with the mitigation measures is to firstly avoid the risk and if the risk cannot be avoided, mitigation measures to minimize the impact are then recommended. Once the mitigation measures have been applied, the identified risk will be of low significance, provided there is sufficient monitoring of measures' implementation.

The description of potential impacts identified for the construction and operational and maintenance phases of the Piggery and Abattoir are given under section 7.3. The assessment of these impacts and where necessary, mitigation measures to avoid or minimize the impacts are provided in the respective tables and as management action plans in the Draft EMP.

7.3. Description and Assessment of Potential Negative (Adverse) Impacts

Some of the potential negative impacts are anticipated to only occur in one phase, while others occur in both phases. To avoid repetition, impacts that occur in both phases will be described and assessed once. In other words, an impact will only be described and assessed once under the construction phase (since construction phase precedes the operational and maintenance phase) and mitigation measures clearly provided.

7.3.1. Soil Disturbance and Pollution

Physical impact of surrounding soils would be from disturbance during site excavations. The valuable topsoil may also be lost during the construction process. The loss of topsoil can however be minimised through the storage of topsoil in designated small stockpiles on site and then re-used for backfilling.

The soil disturbance impact is considered medium and short term as this is likely to occur during the construction phase where earthworks will be carried to install and erect services and building infrastructures, respectively. Therefore, it is considered of low to medium significance and upon implementation of management and mitigation measures, it can be reduced to low rating.

Potential soil pollution during the construction works would be caused by spills and leaks of hydrocarbons and other materials from project vehicles and machinery and then during the operational phase by potential wastewater/effluent from the Piggery and Abattoir facilities. Given the nature of the project activities, the potential impact of soil pollution is considered medium as it is likely to span from the construction phase throughout the operational phase of the project, if there is no implementation of any mitigation measures. The impact assessment is shown in **Table 5**.

Table 5: Assessment of the project impact on site soils

Mitigation Status	Extent	Duration	Intensity	Probability	Significance
Pre mitigation	L/M - 2	L/M - 2	L/M - 4	M - 3	L – 24
Post mitigation	L - 1	L - 1	L - 2	L - 1	L - 4

Physical disturbance Management and Mitigation measures

- Site areas that have been excavated but not used for construction activities should be rehabilitated to their pre-excavation state to avoid erosion.
- Soils around the site should not be disturbed.

Pollution management and mitigation measures

- Where hydrocarbons and other chemicals are used during the project activities on site, impermeable liners should be laid on such sites to capture possible spills and prevent these substances from reaching the site soils.
- In an event that any of the substances mentioned above, spill on the soil, the contaminated soil should be cleaned up immediately and dispose of in a designated hazardous waste bin and transported to the nearest approved landfill site. The contaminated and removed soil should be replaced with clean soil.
- No waste, of any form should be disposed of on the soils but in designated waste containers.

7.3.2. Impact on Groundwater Resources: Quantity (Abstraction) and Quality (Wastewater)

Water resources is impacted by project developments in two ways. This is either through pollution (water quality) or over-abstraction (water quantity) or at times both.

The impact of developments on water resources quantity is when the required volume of water abstracted for the operations is more than what the water resource (surface or aquifer) can provide. In other words, when the water volume abstracted from a source is more than what can be replenished by natural processes (recharge). This practise could lead to depleting of a water resource which will not affect people relying on the same water resource, but the surrounding ecosystems, animals, and plants.

Groundwater Abstraction: The Tsumeb area has abundant groundwater resources due to the good rains and nature of the aquifers. Therefore, the project will have sufficient water supply. However,

this statement does not substantiate that the water should be used without managing it. The impact on water resources (abstraction) will be medium if no measure is implemented, but upon implementation of the provided water management measures, the impact will be low.

In terms of pollution (quality), improper handling of construction waste and eventual wastewater/ effluent and slurry from the Piggery and Abattoir operations may be washed into the soil and eventually infiltrate into the ground and pollute groundwater. This would be a concern because according to Lohe *et al.,* (2021), Tsumeb receives an average annual rainfall of between 550 to 600 mm and given the high infiltration rates typical in this Karst area, groundwater recharge is high. Thus, the risk of groundwater pollution/contamination is also high, especially at areas of concentrated pollution source. The groundwater sensitivity of the site (**Figure 24**) is therefore determined by the nature of the rock formations (fractured and karstified to provide ready pathways for polluted groundwater) and surface land use.

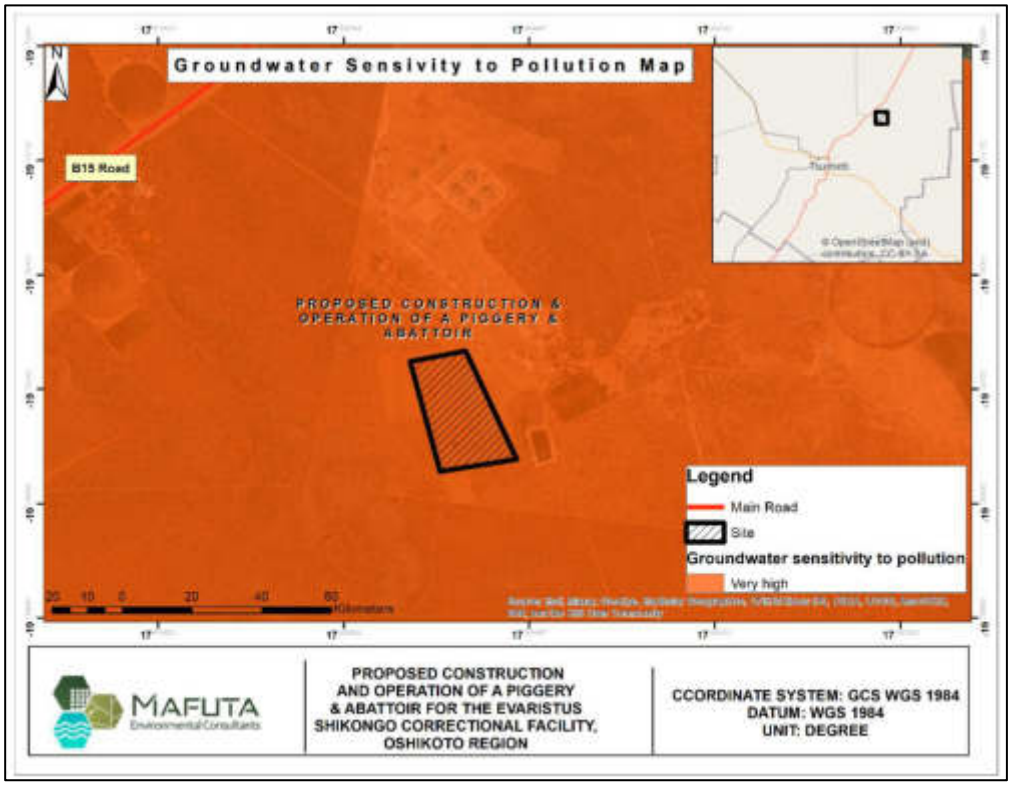

Figure 24: Groundwater sensitivity map of the ESCF site and surrounding

The way in which the Piggery and Abattoir waste, wastewater/effluent (slurry) is handled (improperly) from the two facilities' operations may pollute soils and groundwater resources on and around the site. Animal processing industry results from the discharge of wastewater. Most processes in slaughterhouses require the use of water and the water used for general cleaning purposes will produce wastewater that would potentially end up in the environment to pollute soils and eventually water resources such as aquifers if proper care is not taken or wastewater management is not put in place.

The following sources are considered the main cause of water pollution in piggery (and abattoir) projects as per Mafuta Environmental Consultants (2018) after several authors indicated therein:

A. Chemical products

Pesticides used to control pests (e.g., parasites and disease vectors) have been reported to cause pollution when they enter groundwater and surface water. Active molecules or their degradation products enter ecosystems in solution, in emulsion or bound to soil particles, and may, in some instances, impair the uses of surface waters and groundwater. Not only pesticides, but fuel products utilized on site could lead to the pollution of water (both surface and groundwater).

B. Carcass disposal

Improper disposal of pig carcasses can contribute to water-quality problems especially in areas prone to flooding or where there is a shallow water table. Disposal methods of carcasses may include burial, incineration, composting and rendering.

C. Slaughterhouse

The most significant environmental issue resulting from slaughterhouse operations is the discharge of wastewater into the environment. Like many other food-processing activities, the necessity for hygiene and quality control in meat processing results in high water usage and consequently high levels of wastewater generation.

D. Pig manure and slurry

The nitrogen and phosphorus compounds in the manure contaminate the soil and bodies of water. The chemical composition of pig manure depends on many factors, including the type and age of

the animals and the feeding method, manure may contain pathogens which may potentially affect soil and water resources, particularly if poorly managed. Leaching and runoff of these substances has the potential to result in the pollution of surface water and groundwater resources. The impact of manure on the environment also depends on Manure Handling Procedures at the facilities.

Pig slurry from indoor production units is often sprayed onto land as a fertilizer. Outdoor, free-range pig rearing can also result in water pollution problems, but farmers can undertake measures that ensure that waterways are protected from pollution caused by soil contaminated with pig manure running off from fields in which pigs are being kept.

The main problem comes from the nitrates contained in the pig manure. When these enter the surface water system, it leads to an algae bloom that uses up most of the oxygen in the water, leading eventually to the mortality of water organisms (Wanninger, 2011).

E. Site septic tanks

Subsurface sewage disposal systems are said to be the largest sources of wastewater to the ground, are most frequently reported causes of groundwater contamination (Hanchar, 1991). This impact occurs in the case that there are leakages in the tanks, either from improper installation or poor to no maintenance. Domestic septic tanks effluent typically contains elevated concentrations of chloride, sulfate, nitrite plus nitrate, ammonia, fecal streptococci bacteria, etc. The infiltration of this effluent will lead to pollution of surrounding subsoils and eventual groundwater, resulting in a decrease in water quality. The rate at which the sewage effluent moves into the ground depends on the site geology. The project site is overlain by sediments (sand and gravel) that are vulnerable to pollution. **A Desktop Groundwater Impact Assessment Report is attached as Appendix E of this ESA document.** Without any mitigations, the impact is rated as of medium to slightly high significance. To change the significance from the pre-mitigation significance to low rating, the mitigation measures given under the impact assessment table below should be implemented. This impact is assessed in **Table 6**.

Table 6: Assessment of the project impact on groundwater (abstraction and pollution)

Mitigation Status	Extent	Duration	Intensity	Probability	Significance
Pre mitigation	M - 3	L/M - 2	M - 6	M/H - 4	M – 44
Post mitigation	L/M - 2	L/M - 2	L/M - 4	L/M - 2	L - 16
Management and Mitigation Measures (Groundwater Abstraction and Use)					

- The water resources impact awareness training should be provided to the employees involved in all the project phases (construction and operational).
- If an additional borehole is considered, it should be sited, and their sustainable yields determined during the aquifer test (pumping test) by a qualified and experienced hydrogeologist who will then recommend a safe abstraction yield for the project site. This is to ensure that the local aquifers are not stressed, i.e., negatively impacted due to over abstraction.
- If there is an existing Groundwater Water Abstraction & Use Permit, this should be revised to include the water volumes proposed for the Piggery and Abattoir project. This should be done by applying for amendment to the national Department of Water Affairs (DWA) at the Ministry of Agriculture, Water and Land Reform (MAWLR). The aim is to regulate and manage water abstracted from the borehole(s). In the Permit, the Water Regulatory Authority would set objectives (abstraction targets), conditions, annual abstraction threshold, monitoring requirements and enforce compliance by the Proponent**. If there is no Permit, this should be applied for, given that the proposed project is an agricultural related activity that is known to be water consuming.**
- Monthly groundwater monitoring to record water levels in both the NCS production boreholes and drilled monitoring boreholes within 1km north of the project and monitoring boreholes of neighboring boreholes in farms (to the north and south) and any other borehole water user within a 5 km radius of the project site.
- Water should be used sparingly, by ensuring water re-use, and recycling for different suitable activities of the project.
- The borehole(s) should only be pumped for a specified period in a week and water stored in water storage tanks or reservoirs. This will allow the boreholes(s) to recover from previous day pumping (abstraction).

Mitigation Status	Extent	Duration	Intensity	Probability	Significance
Pre mitigation	M/H- 4	M/H - 4	M - 6	M/H - 4	M – 56
Post mitigation	L/M - 2	L/M - 2	M - 6	L/M - 2	L - 20

Management and Mitigation Measures (Groundwater Pollution)

- All run off materials such as hydrocarbons, wastewater and other potential contaminants should be contained on site and disposed of in accordance with

municipal wastewater discharge standards, so that they do not reach to water systems.

- The new wastewater management ponds (dams) associated with the Piggery and Abattoir should be properly lined with geomembrane lining to prevent seepage through the dams to groundwater systems.
- At least two monitoring boreholes should be drilled and installed within 1km upstream (south) and downstream (north) of the facilities. These boreholes will be used to detect and monitor possible pollution from the site operations.
- Stormwater management plans (discharge points) should be designed and implemented on site to prevent the potentially contaminated run-off from reaching groundwater resources.
- Wastewater and hazardous used substance such as oils and grease should be properly disposed of in the appropriate management pipelines and waste containers, respectively and disposed of in the designated wastewater containment dams onsite and at the hazardous disposal facilities in Tsumeb, respectively.

7.3.3. Impact on Biodiversity: Fauna and Flora

The project site is already cleared, due to past use of the farm for irrigation purposes. The only major vegetation within the actual footprint of the site are five big marula trees that are likely to be left alone. Unnecessary clearing of the existing vegetation, especially outside the footprint of the project site may lead to loss of biodiversity on site.

The only major fauna that may be found around the site, are the Proponents' goats and sheep grazing close within the site footprint. There were also some faeces of cattle on the site that are kept in grazing camps on the farm. There is also wildlife in the area, and their illegal hunting (poaching) by project related workers would lead to the decrease or loss of such species in the area.

The impact is considered medium if no measures are implemented. With the implementation of recommended measures, the rating will significantly be reduced to low. The assessment of this impact is presented in

Table 7**.**

Mitigation Status	Extent	Duration	Intensity	Probability	Significance
Pre mitigation	M - 3	M - 3	M - 6	M - 3	M – 36
Post mitigation	L/M - 2	L/M- 2	L/M - 4	L/M -2	L - 16

Table 7:

Mitigation Status	Extent	Duration	Intensity	Probability	Significance
Pre mitigation	M - 3	M - 3	M - 6	M - 3	M – 36
Post mitigation	L/M - 2	L/M- 2	L/M - 4	L/M -2	L - 16

Management and Mitigation Measures

- Vegetation found on the site, but not on the site infrastructure footprint should not be removed nor disturbed in any way, and thus, should be left to preserve biodiversity on the sites.
- Workers should refrain from killing or snaring livestock found on site.
- Illegal hunting (poaching) of wildlife in the area is strictly prohibited.
- Environmental awareness on the importance of biodiversity preservation should be provided to the workers.

Management and Mitigation Measures

- Vegetation found on the site, but not on the site infrastructure footprint should not be removed nor disturbed in any way, and thus, should be left to preserve biodiversity on the sites.
- Workers should refrain from killing or snaring livestock found on site.
- Illegal hunting (poaching) of wildlife in the area is strictly prohibited.
- Environmental awareness on the importance of biodiversity preservation should be provided to the workers.

Assessment of project activities on biodiversity

7.3.4. Environmental Pollution (Solid waste generation)

Projects of such magnitude are associated with the generating of waste such as domestic refuse, scrap metals, woods, etc. during the construction and operational phases. Improper handling, storage and disposal of wastes may lead to environmental degradation/pollution. Waste generation is an ongoing activity for any development, and this can be rated as medium significant if no mitigation measures are implemented. However, upon implementation of waste management measures, the impact will be of low significance. This impact is assessed in **Table 8** below.

Table 8: Assessment of project activities on the environment (solid waste)

Mitigation Status	Extent	Duration	Intensity	Probability	Significance
Pre mitigation	M - 3	L/M - 2	M - 6	M/H - 4	M – 44
Post mitigation	L/M - 2	L/M - 2	L/M - 4	L/M - 2	L - 16

Management and Mitigation Measures

- Workers should be sensitized to dispose of waste in a responsible manner and not to litter.
- After each daily works, the Proponent should ensure that there is no waste scattered on site.

- All domestic and general construction waste produced daily should be contained until such that time it will be transported to designated waste sites on a bi-weekly basis during construction and on a weekly basis during operations.
- No waste may be buried or burned on site or anywhere else throughout the project lifecycle.
- The sites should be equipped with separate waste bins for hazardous and general waste/domestic.
- Scrap metals and wood should be packaged at one area and disposed of by an appointed off taker for recycling.
- A penalty system for irresponsible disposal of waste on site and anywhere in the area should implemented.

7.3.5. Vehiular Traffic Safety

The project works may potentially put pressure on the existing roads when construction materials and operational phase goods are delivered to and from the site. The construction of the facilities and their eventual presence will potentially increase traffic in the area. An increase in traffic would potentially lead to road accidents, especially by slow moving heavy trucks that will be frequenting the area during the construction phase. Vehicular traffic safety is also a concern during operational phase when pig feed and other supplies are delivered to site and when transporting waste.

This is impact is rated medium if no mitigation measure is implemented. For the significance to be rated low, the mitigation measures given under the impact assessment table below (**Table 9**) should be implemented.

Table 9: Assessment of project activities on vehicular traffic and roads

Mitigation Status	Extent	Duration	Intensity	Probability	Significance
Pre mitigation	M - 3	L/M - 2	M - 6	M/H - 4	M – 44
Post mitigation	L/M - 2	L/M - 2	L/M - 4	L/M - 2	L - 16

Management and Mitigation Measures

- Drivers of the project vehicles should be in possession of valid and appropriate driving licenses.
- Vehicle drivers should only use the site access roads provided.

- Vehicle drivers should not be allowed to operate vehicles while under the influence of alcohol.
- Sufficient parking bays for all project vehicles should be constructed on site.
- The Proponent should make provision for safe offloading and loading zones on site.
- No heavy trucks or project related vehicles should be parked outside the project site boundary.
- To control traffic movement on site, deliveries and collection of goods and waste to and from the site should be carefully scheduled. This should optimally be during weekdays and between the hours of 08h00 and 17h00.

7.3.6. Health and Safety

Workers involved in the construction as well as when handling construction machinery and equipment during the operations phase may be exposed to health and safety risks. The health and safety risk are not only for the workers, but the local community too. Health concerns are potentially associated with the operational phase of the piggery and abattoir as well, especially when the workers are exposed to dust and several toxins that are present due to the manure. Further health and safety risks are associated with the mishandling operational equipment and machines. The impact can be rated as medium significant if no mitigation measures are implemented, but upon implementation, the impact will be of low significance. This impact is assessed in **Table 10** below.

Table 10: Assessment of project activities on health and safety

Mitigation Status	Extent	Duration	Intensity	Probability	Significance
Pre mitigation	M - 3	L/M - 2	M - 6	M/H - 4	M – 44
Post mitigation	L/M - 2	L/M - 2	L/M - 4	L/M - 2	L - 16

Management and Mitigation Measures

- During construction phase, a temporary enclosed fence should be constructed around the site. This is done to control access to the site, in such a way that the public, especially children (that may be living at staff houses) do not access the site and play with equipment and machinery on days when work is not undertaken.
- The site should be equipped with security control gate, once in operation. This is to limit restrict access to authorized personnel only.
- As part of their induction, the workers should be provided with an awareness training of the risks of mishandling equipment and materials on site.

- When working on site, employees should be properly equipped with appropriate and adequate personal protective equipment (PPE) such as coveralls, gloves, safety boots, earplugs, safety glasses, etc.
- No employee should be allowed to drink alcohol prior to and during working hours as this may lead to mishandling of equipment which may lead to injuries and other health and safety risks.
- Employees should not be allowed on site if under the influence of alcohol.

7.3.7. Air Quality: Dust generation

Dust emanating from traffic travelling on the gravel road to site during construction and operational phases will lead to decrease in the air quality around the site. The potential sources of dust generation for this project will be from unsealed access roads (and the main gravel road), bare soil, solid effluent stockpiles, feed milling and delivery.

The assessment of this impact needs to consider the general climate, wind directions and strengths. However, in this case, there is no air quality data available from the immediate vicinity of the Piggery site. Nevertheless, the site is in a farming area at a distance from urban areas and the absence of indicative local information such as tree decline indicates that air quality is excellent and virtually free from pollutants.

While the wind direction of the area is predominantly from the southwestern side to the northeast, The Piggery will be located on the south-eastern side of the main ESCF administration buildings, staff housing and south of the offenders' cells and Workshop. Therefore, the potential odour and dust generated on site will be towards the northeast of the site and will not affect people on the west to northwest.

Pre-mitigation measures, the impact is of medium significance, but upon implementation, the impact will be of low significance. This impact is assessed in **Table 11** below.

Table 11: Assessment of project activities on air quality (dust)

Mitigation Status	Extent	Duration	Intensity	Probability	Significance
Pre mitigation	M - 3	L/M - 2	M - 6	M/H - 4	M – 44
Post mitigation	L/M - 2	L/M - 2	L/M - 4	L/M - 2	L - 16

Management and Mitigation Measures

- It is advised that in extremely windy days, a reasonable amount of water should be used to suppress the dust that may be emanating from certain construction areas on the site, access roads and on the gravel in proximity to the site.
- Project vehicles should not be left idling when not in use.
- During windy months and days, solid effluent stockpiles should be covered with plastic covers or any viable cover to prevent dry effluent particles from blown away by wind and generating dust.
- During operations, the air ventilation points on the building are to be placed as high as possible so that exhaust air and gases enter the air column as high as possible.
- The separation distance of the piggery from nearby dwelling houses is done in such a way that the exhaust air and gases is well dispersed and diluted in the air mass.

7.3.8. Noise

Noise generated by the piggery itself (the pigs themselves), piggery operations related vehicles and equipment, such as operational pumps, and traffic from and to the facilities can be nuisance to the neighbours. According to Dunne (2011), the duration between pigs' feeds coupled with the Pavlovian response to the appearance of a feed cart and operative trigger much excitement in the pigs. This excitement manifested itself in much noise from the animals. Naturally this noise could be a source of nuisance in circumstances where there is a potential poor insulation and nearby neighbours.

With regards to noise from the facilities construction and operations, this impact will be unlikely because the Piggery and Abattoir will be established far from human dwellings (ESCF buildings). Therefore, it is rated low to medium significant if no mitigation measures are implemented, but upon implementation, the impact will be completely of low significance to avoidable. This impact is assessed in **Table 12.**

Table 12: Assessment of noise from project activities

Mitigation Status	Extent	Duration	Intensity	Probability	Significance
Pre mitigation	M - 3	M- 3	M - 6	M - 3	M – 36
Post mitigation	L/M - 2	L/M - 2	L/M - 4	L/M - 2	L - 16

Management and Mitigation Measures

- Noise from vehicles and equipment on site should be reduced to acceptable levels.
- The site construction and operational activities' times should be set such that, no activity is carried out during the night or very early in the mornings.
- Construction and operational hours should be restricted to between 08h00 and 17h00 to avoid noise generated by equipment and the movement of vehicles.
- **Pig noise: No specific mitigation measure, however, the Piggery location on the site (based on the site drawings) is far enough from people, i.e., ESCF staff housing, administration buildings, and offenders' accommodation).**
- When operating noise equipment or working in noisy environments on site, workers should be equipped with personal protective equipment (PPE) such as earplugs to reduce noise exposure.

7.3.9. Impact on Archaeology and Heritage Resources

Although there are no known or visible heritage sites or objects on the surface, there are reported historical graves north of the ESCF Farm. Therefore, despite the absence of such sites on or around the project site, potential impact on unknown archaeological objects can still be expected. This could be discovered during the construction works (excavation and earthworks), whereby historical resources may be impacted through inadvertent destruction or damage. This may include the excavation of subsurface graves or other archaeological objects. There was no information provided about neither known heritage nor site of cultural values within the site. However, this does not mean rule out the possibility of finding some of these objects during the construction phase as mentioned above. The assessment of the impact is presented in **Table 13** below.

Table 13: Assessment of the project impacts on archaeological resources

Mitigation Status	Extent	Duration	Intensity	Probability	Significance
Pre mitigation	M - 3	M - 3	M - 6	M - 3	M – 36
Post mitigation	L/M - 2	L/M - 2	L/M - 4	L/M - 2	L - 16

Management and Mitigation Measures

- -Caution should be exercised when carrying out excavations associated with the road construction activities if archaeological/heritage remains are discovered

- -Identification of any archaeological significant objects on the site should not be disturbed but are to be reported to the project SHE officer who then reports it to National Heritage Council (NHC) offices for further instructions and actions.
- -Workers should be educated to not destroy or throw away but report (to the environmental/Safety officer) of any unknown object found/discovered on site.
- -The worksite manager should familiarize themselves with the NHC's Chance Find Procedure (please refer to Appendix 1 of the Draft EMP) and if uncertain about the procedure should receive training by a suitably qualified archaeologist with respect to the identification of archaeological/heritage remains and the procedures to follow if such remains are discovered throughout the project activities' duration.

8. CONCLUSIONS AND RECOMMENDATIONS

The proposed Piggery and Abattoir and their associated infrastructures will primarily positively contribute towards the improved food security for the NCS, which may not only be for the Evaristus Shikongo Correctional Facility but also other NCS facilities in Namibia. However, the proposed project activities are potentially associated with some adverse (negative) impacts that were identified, described, and assessed during the environmental assessment process and contained in this Report. The significance rating of the impacts was found to be medium. Where it is anticipated that the potential impact cannot be practically avoided altogether, appropriate management and mitigation measures were recommended for implementation during the respective phases of the project. Should the recommendations included in this report and the Draft EMP be implemented, the significance of these impacts can be reduced to low rating.

For this scoping assessment, only one Desktop Specialist Study (Hydrogeological Impact Assessment) and Report was done and compiled, respectively.

Furthermore, for an impact rating to remain low throughout the project life cycle, the implementation of mitigation measures needs to be monitored and reported. Implementation and monitoring will need to be done by either the Proponent themselves or through an appointed Environmental Consultant or Environmental Control Officer (ECO)) and report to the applicable Competent Authority (MEFT) and MAWLR (where required). Monitoring will not only be done to maintain the low significant rating but also to ensure that all potential negative impacts identified in this study and new impacts that may arise during project implementation are properly identified on time and addressed (mitigation measures provided for immediate implementation).

The effective implementation and monitoring of the mitigation measures would ensure environmental sustainability at the site and its surrounding area. Therefore, the proposed facilities at ESCF may be granted an Environmental Clearance Certificate on condition that the Proponent:

- Implements all mitigations provided in this Report and the management action plans in the Draft EMP as recommended.
- Obtain all the required permits, licenses and approvals for the specific project activities as required (please refer to the Permitting and Licensing Table in the Draft EMP.
- Together with their workers, and contracted engineers, and construction contractors comply with the legal requirements governing this type of project and its associated activities applicable to their work; and
- Adhere to all the necessary environmental and social (occupational health and safety) precautions provided.

9. LIST OF REFERENCES

This chapter is presentation of the data source and literature consulted for the compilation of this Report. These sources are listed below.

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DATE STAMPED COPY OF THE ECC APPLICATION

ANNEXURE 1

FORMS

Form 1

REPUBLIC OF NAMIBIA

ENVIRONMENTAL MANAGEMENT ACT (No. 7 of 2007)

(Section 32)

APPLICATION FOR ENVIRONMENTAL CLEARANCE CERTIFICATE – APP NO. 003411

PART A: DETAILS OF APPLICATION

1.	Name:	Namibian Correctional Service
2.	Business Registration:	N/A
3.	Correspondence Address:	Private Bag 13281 Windhoek, Namibia
4.	Name of Contact Person:	Mr. Immanuel T. Ngolo (Commissioner)
5.	Position of Contact Person:	Commissioner
6.	Telephone No.:	+264 (0) 61 284 6921
7.	Fax No:	N/A
8.	E-mail Address:	Immanuel.Ngolo@ncs.gov.na

PART B: SCOPE OF THE ENVIRONMENTAL CLEARANCE CERTIFICATE

1. THE ENVIRONMENTAL CLEARANCE CERTIFICATE IS FOR:

The 'listed activities' that might be affected are listed below:

AGRICULTURE AND AQUACULTURE ACTIVITIES

WASTE MANAGEMENT, TREATMENT, HANDLING AND DISPOSAL ACTIVITIES

Listed Activity 2.1 Construction of facilities for waste sites, treatment of waste and disposal of waste.

Listed Activity 2.2 Any activity entailing a scheduled process referred to in the Atmospheric Pollution Prevention Ordinance, 1976.

WATER RESOURCES DEVELOPMENTS

Listed Activity 8.1 The abstraction of ground or surface water for industrial or commercial purposes.

MAFUTA
Environmental Consultants

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08 February 2022

RECEIVED
2022 -02- 08
EXECUTIVE DIRECTOR'S OFFICE
MAWLR

The Office of the Executive Director

Ministry of Agriculture, Water and Land Reform (MAWLR)

Private Bag 13184 Windhoek

Namibia

Attention: Mr. Percy Misika

Dear Sir,

Re: Environmental Scoping Assessment (ESA) and Environmental Management Plan (EMP) for the Proposed Construction and Operation of a Piggery & an Abattoir and associated infrastructures for the Evaristus Shikongo Correctional Facility on the Namibian Correctional Service (NCS) Farm) near Tsumeb in the Oshikoto Region – Application for the Environmental Clearance Certificate (ECC), Application No. 003411

Mafuta Environmental Consultants cc (the Independent Environmental Consultant) has been appointed by the Namibian Correctional Services (NCS or the Proponent) of the Ministry of Home Affairs, Immigration, Safety & Security to apply for the Environmental Clearance Certificate (ECC) for the proposed construction and Operation of a Piggery & an Abattoir and associated infrastructures for the Evaristus Shikongo Correctional Facility near Tsumeb. The ECC application is done as required by section 56(1 (e)) of the Environmental Management Act (EMA) (No. 7 of 2007) and the corresponding list of activities requiring an ECC (GN No. 29 GG No. 4878).

In accordance with Section 32 of the EMA the relevant Competent Authority identified for this project is the Ministry of Agriculture, Water and Land Reform and the reason your office is receiving this communication. The Environmental Consultant herewith applies for an ECC for the above-mentioned proposed project on behalf of the Proponent according to Regulation 6 of the EIA Regulations (GN. No. 30 of 2012).

Accompanying this cover letter are **Form 1 - Application for Environmental Clearance Certificate, project Background Information Document (BID) and Preliminary Site Drawings**.

Should you require further information and/or have additions that you would like us to consider and include in the Environmental Scoping Assessment Report (ESAR), kindly send us your inputs and

HYDROGEOLOGICAL IMPACT ASSESSMENT REPORT

Hydrogeological Impact Assessment (DHIA) Report: Construction and Operation of a Piggery & Abattoir for the Evaristus Shikongo Correctional Facility in the Tsumeb District of the Oshikoto Region

Document Version: **Final**

Date: **21 February 2022**

Prepared by: **Fredrika N. Shagama for Mafuta Environmental Consultants cc**

Private Bag 97009 Maerua Mall, Windhoek

Prepared for: **Namibian Correctional Service (NCS)**

Private Bag 13281 Windhoek, Namibia

Email: Immanuel.Ngolo@ncs.gov.na

February 2022

DOCUMENT INFORMATION

Title: Hydrogeological Impact Assessment (DHIA): Construction and Operation of a Piggery & Abattoir for the Evaristus Shikongo Correctional Facility in the Tsumeb District of the Oshikoto Region

Prepared by:

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Date:	21 February 2022

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1 INTRODUCTION

Groundwater is one of the most valuable yet vulnerable natural resources that play a vital role in societies and the general environment. It is, therefore, very crucial to value water resources' presence and accessibility and understand the mismanagement impacts on these resources in terms of over-abstraction, pollution (quality) or both.

Water demand is largely driven by population and related economic activities and the high abstraction of groundwater leads to water scarcity, whereby there is insufficient water resources to satisfy long-term average requirements. The water scarcity impacts are mostly felt in areas with low rainfalls resulting in poor groundwater recharge. Water scarcity is referred to long-term water imbalances, combining low water availability with a level of water demand exceeding the supply capacity of the natural system (European Environmental Agency (EEA), 2019). Water scarcity is driven primarily by two factors: climate, which controls the availability of renewable freshwater resources and seasonality in water supply and water demand, which is largely driven by population and related economic activities.

Although water scarcity often happens in areas with low rainfall, human activities aggravate the problem particularly in areas with high population density, tourist inflow, intensive agriculture and other water demanding industries.

Agricultural activities are mostly practised in arid to semi-arid zones (also referred to dry lands) but also known as humid areas. Dry lands are poor in precipitation and suffer tremendous climate variability from year to year, thus increasing the vulnerability of cultivated ecosystems.

The inland parts of Namibia heavily rely on groundwater for development and human consumption. This is the case with the Tsumeb area and surrounding, where the Namibian Correctional Service (NCS)'s Evaristus Shikongo Correctional Facility (ESCF) is located. The NCS intends to establish (construct) and operate a Piggery & an Abattoir and associated infrastructures for the ESCF situated about 25km northeast of Tsumeb along the M75/B15 road to Tsintsabis in the Oshikoto Region.

In Namibia, for water abstraction used for commercial purposes and in water-controlled areas, a permit to abstract and use that water should be obtained from the Department of Water Affairs (DWA) of the Ministry of Agriculture, Water and Land Reform (MAWLR). The abstraction and use of water resources is also listed under the Environmental Management Act No. 7 of 2007 and its 2012 Environmental Impact Assessment (EIA) Regulations as one of the activities that may not be undertaken without an environmental clearance certificate.

As part of fulfilling the requirements by the legislation that protects water resources in Namibia, an environmental assessment needs to be conducted to understand, assess and mitigate the potential impacts of the proposed development or activity on the environmental components/features and this includes local water resource. It is for this reason, that this water resources risk / impact assessment report was compiled. The aim of the report was to determine and assess the proposed project impacts on groundwater resources in the project area. The amount of water required for the project activities is not known at this stage.

1.1 Project Background and Location

The NCS has a mandate of providing safe, secure, and humane custody of offenders, rehabilitate and re-integrate them into community. The NCS Mission is to provide exceptional correctional service that empower offenders to effectively re-integrated into society as law abiding citizen.

The operations of all NCS facilities follow the United Nations (UN) Standard Minimum Rules for the treatment of prisoners. These dictates that every prisoner shall be provided by the administration at the usual hours with food of nutritional value adequate for health and strength, of wholesome quality and well prepared and served. Hence, the NCS is managing six (6) production farms including the Evaristus Shikongo Correctional Facility which are producing maize, wheat, vegetables, beef, and pork for offenders' rations. These production farms are aimed at improving organizational self-sufficiency and reduce government expenditures in the procurement of offenders' rations.

In Namibia, the abstraction and use of water resources for commercial purposes and in water-controlled areas are protected by the old Water Act No. 54 of 1956 and the new Water Resources Management Act No. 11 of 2013. As mentioned earlier, water abstraction and use are also listed under the Environmental Management Act No. 7 of 2007 and its 2012 Environmental Impact Assessment (EIA) Regulations as one of the activities that may not be undertaken without an Environmental Clearance Certificate (ECC). The ECC has been applied for, the EIA process undertaken and Environmental Management Plan (EMP) to be developed by Mafuta Environmental Consultants cc (hereinafter referred to as Mafuta Consultants).

It is for these legal reasons stated above that Mafuta Consultants, as part of the Environmental Scoping Assessment (ESA) study prepared this hydrogeological (groundwater) assessment for the proposed project. The groundwater assessment covers both groundwater resources in terms of quantity (abstraction and use) and quality (pollution).

The two proposed facilities will be established adjacent to the existing ESCF premises (Farm) - **Figure 1** and **Figure 2.** The Piggery and Abattoir facility with associated infrastructures will cover a surface area of 11-hectares, whereas the abattoir will cover 2 hectares. These two new facilities will use the existing borehole water and a new Waste and Effluent Treatment facility (small wastewater dams) is envisaged to be designed for the following slaughter phases, namely Phase 1: 700 pigs per month, Phase 2: 35 cattle per month, and Phase 3: 50 goats/sheep per month.

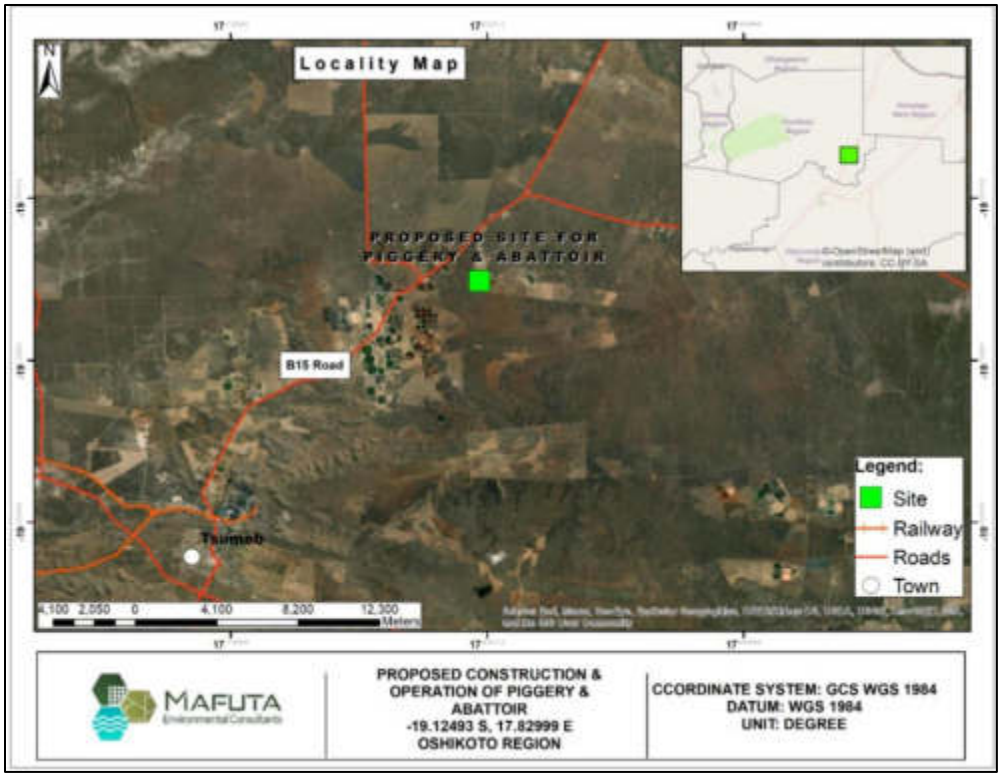

Figure 1: Locality of the proposed Piggery and Abattoir on the Evaristus Shikongo Correctional Facility near Tsumeb, Oshikoto Region

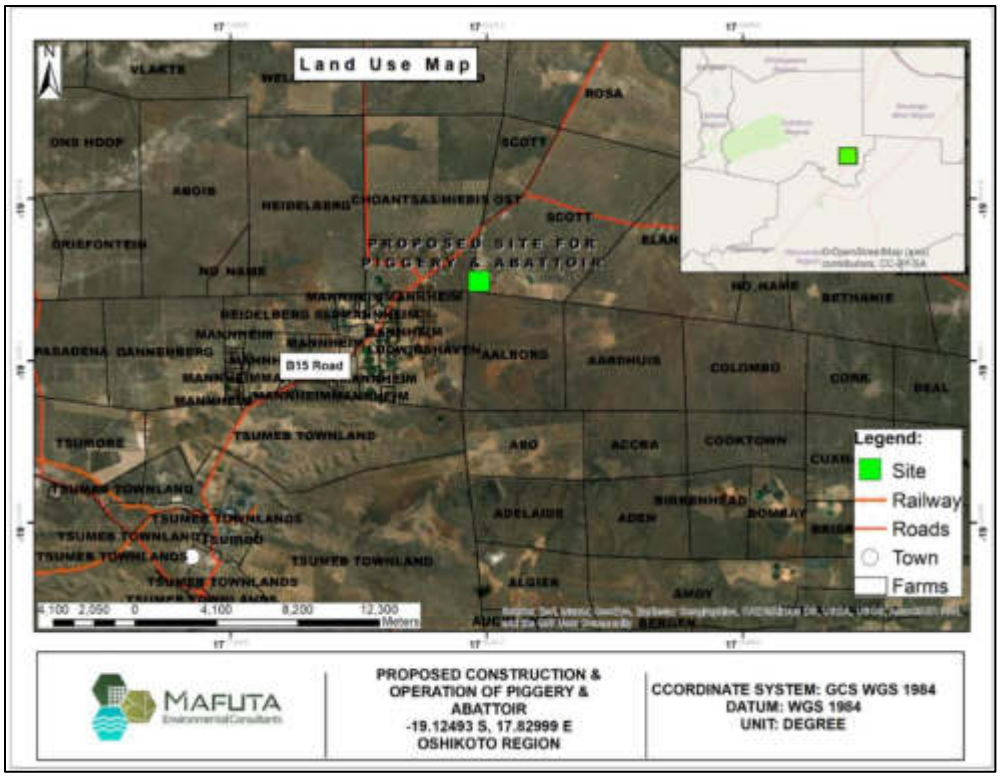

Figure 2: Map of the surrounding properties (land uses) around the proposed project site near Tsumeb, Oshikoto Region

2 TERMS OF REFERENCE, SCOPE OF WORKS AND METHODOLOGY

2.1 Terms of Reference

The Terms of Reference (TOR) for the preparation of this Report has been based on one of the crucial environmental components (water), i.e., assessing the impact of the project activities on groundwater resources. Since groundwater resources impact assessment is impacted by developments through over-abstraction or pollution, and in most cases both, it is vital that the risk is assessed, and management measures provided thereto.

2.2 Scope of Works

The scope of work for this study is limited to the groundwater resource impact assessment with a cursory look at groundwater supply, but more especially groundwater quality (pollution). The scope of works for this study is presented below:

- Baseline assessment (desktop study) of existing site information and general literature on the site and broader area in relation to the proposed project.
- A review of legislation that governs water resources management and protection in Namibia.
- A description of the physical conditions; climatic, geological, hydrogeological, and hydrological conditions of the project area.
- The proposed agricultural activities (Piggery and Abattoir) water uses and its impacts on surrounding water resources quantity (abstraction) and quality (pollution); and
- Water resources impact assessment and recommendations on management.

2.3 Limitations of the Study

The following assumptions apply to this assessment:

- This Report has been compiled on a desktop level with a one-day site walkover conducted for the environmental assessment. The project specific information in this Report has been used as provided by NCS representatives.
- It is assumed that the project information and data provided by NCS is correct and accurate and that all necessary information has been disclosed.
- It is also assumed that the relevant information obtained from different literature consulted is accurate; and

- It is assumed that there will be no significant changes to the proposed activity or the affected water environment between the compilation of this report and implementation of the proposed project that could substantially influence findings of this document. It is also assumed that there will be no significant changes to the project activities that could substantially influence the mitigation measures given and recommendations made for the management and protection of groundwater resources.

2.4 Methodology Employed

The methodology for this study was derived from some projects of similar nature that have been conducted by the author. The following tasks were undertaken:

- Task 1: Desktop study and basic field/site assessment - Reviewing of literature and legislation relevant to the study (baseline assessment). The data source for this project stage comprised of reports containing information on the site area geology, climatic conditions, and hydrology. Hydrogeological maps and other existing reports of similar or related studies conducted in the area were also reviewed.
- Task 2: Impact assessment - The potential impacts of the project on the groundwater resources (in terms of water over-abstraction and pollution), impact/risk assessed, and practical mitigation measures recommended.
- Task 3: Reporting - Consolidation of all the information obtained from NCS and literature review that have been analysed. This includes physical settings/conditions of the area, relevant maps, water availability and quality, impact assessment, and recommendations on groundwater resources management and protection. The recommendations have been incorporated into Mafuta Consultants' main documents (Environmental Assessment Report and Management Plan (EMP)).

The abstraction and use of water resources is governed by certain legal framework. The applicable legal requirements to this assessment are presented under the next chapter.

3 LEGAL FRAMEWORK FOR WATER RESOURCES USE, MANAGEMENT AND PROTECTION

The project will be supplied with groundwater from site sources. It is therefore vital that the legislations and legal requirements governing the abstraction and use of groundwater are considered. The applicable legislations to the project water use are presented in the section below.

3.1 General National Water Legislations

3.1.1 Namibia Water Act No. 54 of 1956

To consolidate and amend the laws relating to the control, conservation and use of water for domestic, agricultural, urban and industrial purposes; to make provision for the control, in certain respects, of the use of sea water for certain purposes; for the control of certain activities on or in water in certain areas; for the control of activities which may alter the natural occurrence of certain types of atmospheric precipitation; for the control, in certain respects, of the establishment or the extension of townships in certain areas; and for incidental matters.

- "*Section 26 Regulations as to permits and control of pollution of water to (c) the prevention of wastage or pollution of public or private water, including underground water, and the powers and duties of persons appointed to exercise control in respect thereof;"*
- *"Section 28 (1) The Governor General may from time to time by proclamation in the Gazette declare any area defined in the proclamation to be a subterranean water control area if the Minister is of the opinion that such area is a dolomite or artesian geological area or that the abstraction of water naturally existing underground in such area may result in undue depletion of its underground water resources, and may in like manner withdraw or amend such proclamation".*

3.1.2 Water Resources Management Act No.11 of 2013

This Act (Government Gazette 5367) has been passed by Parliament, but it has not yet been brought into force. The Regulations have been passed in December 2016 but have not yet been promulgated. Therefore, the Regulations of the 1956 Water Act still apply.

The objectives of this Act are to ensure that the water resources of Namibia are managed, developed, used, conserved, and protected in a manner consistent with, or conducive to, the fundamental principles set out under the following Sections:

- *75 (1) In considering an application for a license to discharge effluent or operate a wastewater treatment facility or a waste disposal site, the Minister must, in addition to any submissions made in relation to the application, have regard also to the following matters -*

  (j) the application of cleaner production techniques in industrial, agricultural and mining activities designed to improve efficiency in the use of resources by reducing or preventing pollution and waste generation at the source thereof; and

- *(3) A license to discharge effluent or to construct or operate a wastewater treatment facility or a waste disposal site -a) must be issued in the form determined by the Minister; (b) must specify the activities authorized by the license; and (c) is subject to the conditions.*

The Act further provides for control and protection of groundwater, section 66, subsection 1 (d) (ii), water pollution control (Section 68) and water related emergency or pollution threats (Section 81).

3.2 Environmental Management Act No. 7 of 2007

The Act aims at promoting sustainable management of the environment and use of natural resources. The Environmental Management Act (EMA) is broad; it regulates land use development through environmental clearance certification and/or Environmental Impact Assessments. The Act provides for the clearance certification for surface or groundwater abstractions for industrial or commercial purposes to protect water resources. It further stipulates requirements to complete the required documentation to obtain an Environmental Clearance Certificate (ECC) for permission to undertake this activity. The following Sections of the EIA Regulations that are relevant to this project are:

- *"8.1 Abstraction of ground or surface water for industrial or commercial purposes*
- *8.2 The abstraction of groundwater at a volume exceeding the threshold authorised in terms of a law relating to water resources."*

3.3 Soil Conservation Act No. 76 of 1969

The Act makes provision for the prevention and control of soil erosion and the protection, improvement and conservation of soil, vegetation and water supply sources and resources, through directives declared by the Minister.

The physical conditions (baseline environment) of the site area and surrounding are presented under the following chapter.

4 PHYSICAL CONDITIONS OF THE SITE AREA AND SURROUNDING

The baseline information of a project area is crucial to understand when undertaking an assessment and make informed conclusions on the impact of the project on environmental components, such as water resources. The baseline conditions relevant to this assessment are for the site area and Tsumeb area where the proposed agricultural activities (Piggery and Abattoir) will be undertaken. These are briefly described below.

4.1 Climate and Topography

The Tsumeb area is one of the few areas in Namibia that receive some good rains and according to Lohe et al, (2021), Tsumeb receives an average annual rainfall of between 550 to 600 mm.

The rainiest months of the year are from November to March. The highest recorded rainfall event from the year 2009 to 2021 was 708.7 mm in January 2021, followed by 699.2 mm in December 2011 and 690.69 mm in January 2011. The graphs of the rainfall and rain days as well as for monthly average rainfall for the period of 2009 to early 2022 are shown **Figure 3** and **Figure 4**.

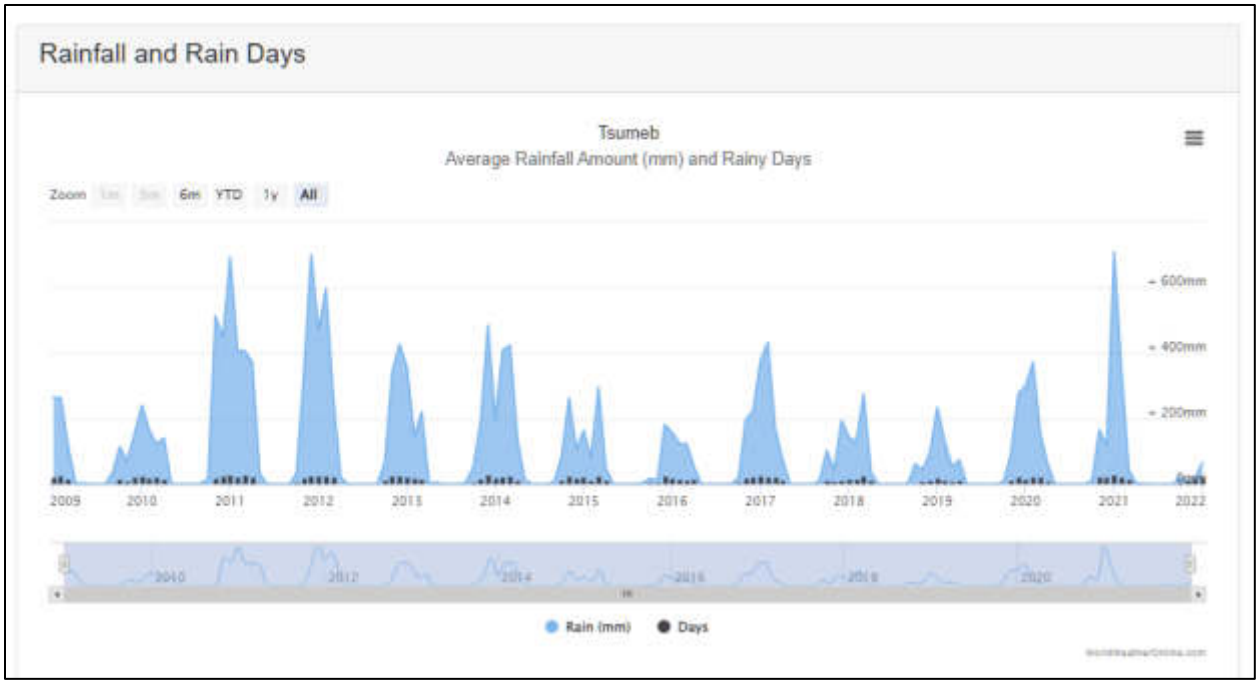

Figure 3: The rainfall and rain days chart for Tsumeb area (source: World Weather Online, 2022)

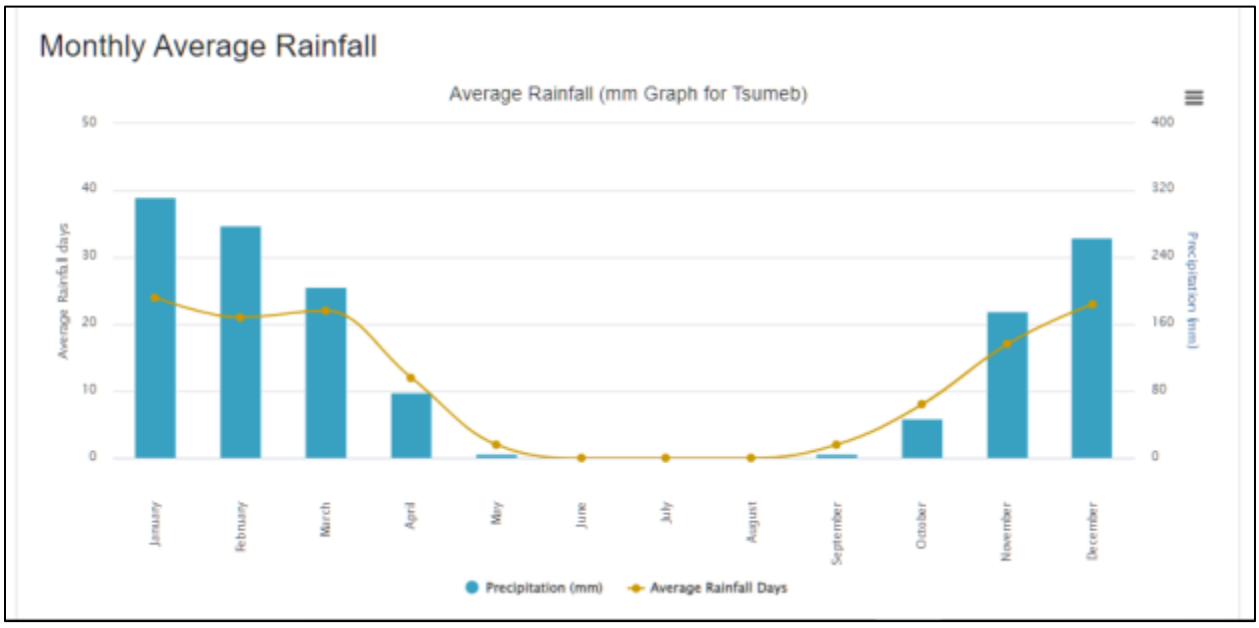

Figure 4: The monthly average rainfall chart for Tsumeb area (source: World Weather Online, 2022)

In terms of temperatures, the maximum values recorded for the Tsumeb area which is hosting the project site for the period of 2009 and 2022 range between 20°C and 36°C whereas the minimum temperatures range between 5°C and 21°C. The average low and high temperatures are 7°C in July and 32°C in September. These temperature components are shown in **Figure 5** and **Figure 6**.

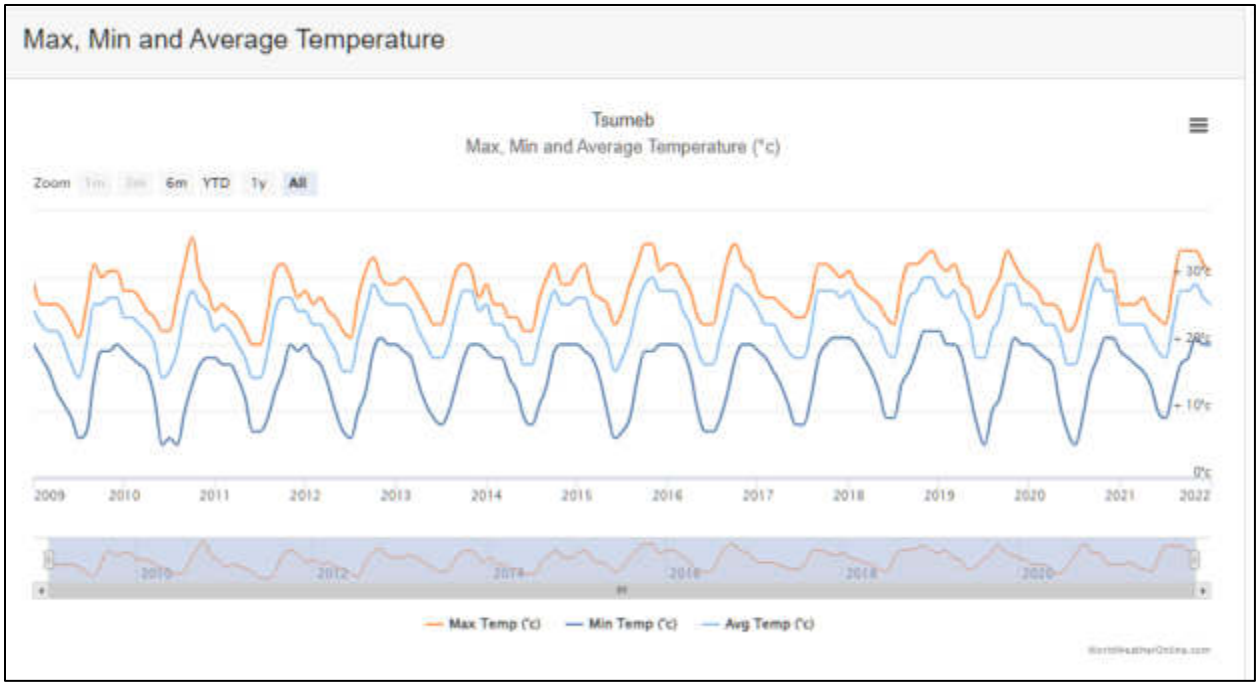

Figure 5: The maximum, minimum and average temperature of the Tsumeb area (source: World Weather Online, 2022)

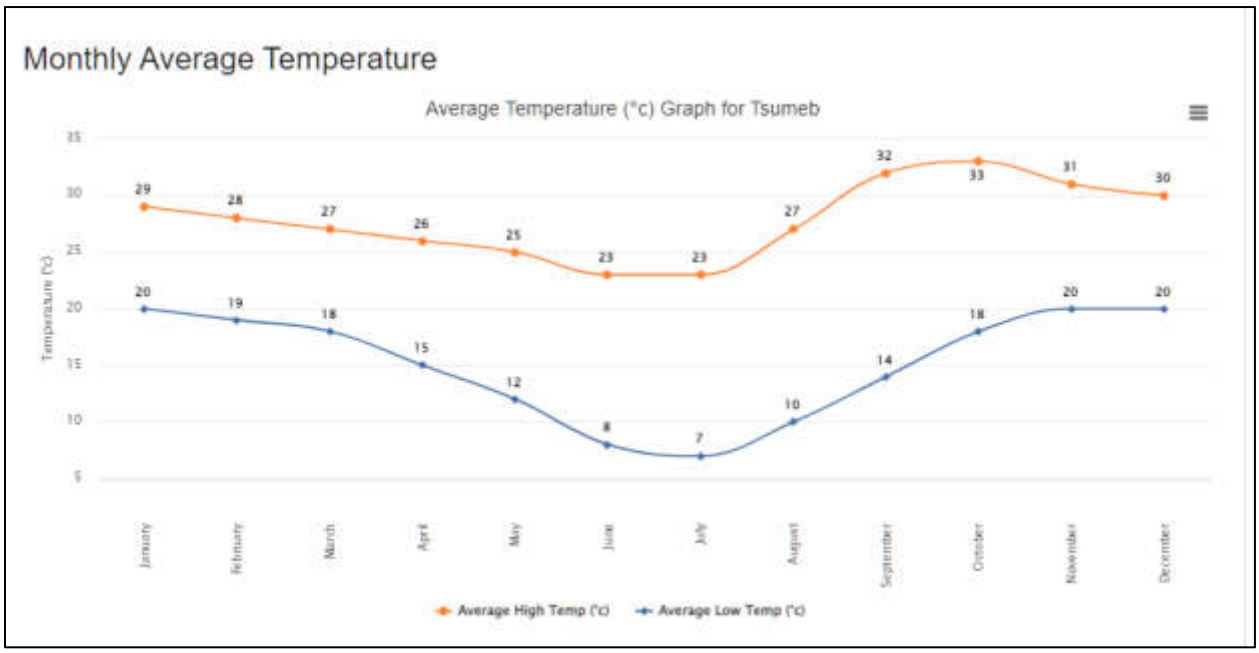

Figure 6: The monthly average temperatures of the Tsumeb area (source: World Weather Online, 2022)

In terms of topography, the project site is relatively flat, with two mountains on the southwestern side of the site.

4.2 Soils and Geology

The soil around Tsumeb varies in quality from very fertile red loam through black turf to chalky clay and loam. This makes the area suitable for intensified farming and crop production. The soil map of the site area is shown in **Figure 7**, where it is indicated that the western edge of the site is underlain by rock outcrops (dolomites) and most of the site to its eastern side is overlain by Mollic Leptosols (loam soils).

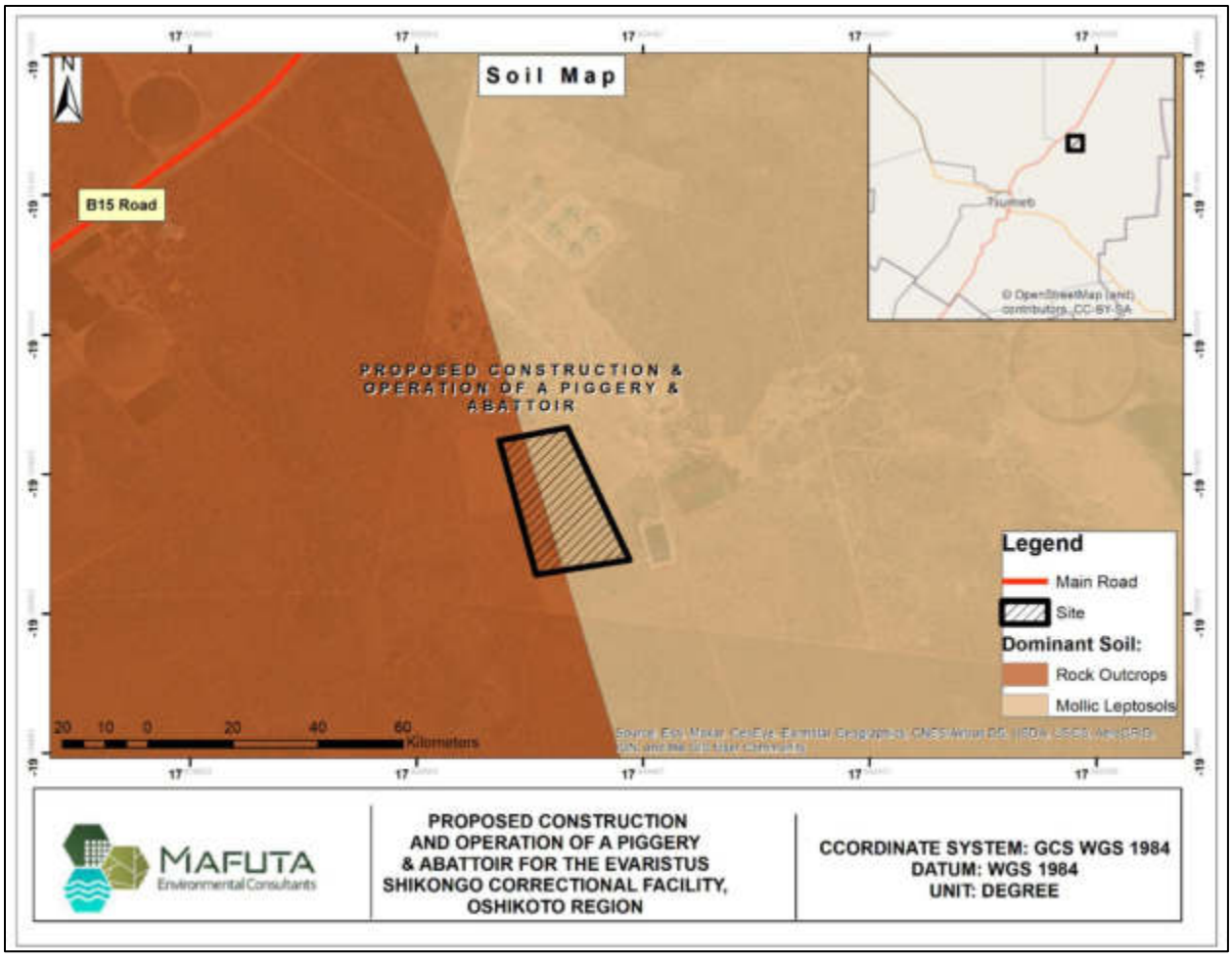

Figure 7: The soil map of the project site area

The site soils are sandy loamy with a light brown colour, overlain by short and medium grass as shown in **Figure 8.**

Figure 8: Typical soils (light brown loam soil) observed on the project site area

4.3 Site Geology

The Tsumeb area geology is characterized by the members of the Nosib group that are directly overlain by a thick sequence of shelf carbonates of the Otavi group. The Otavi group is stratigraphically subdivided into two subgroups, namely the:

- Abenab sub-group consists mostly of laminated dolomites in the lower part, and of intercalating bedded limestone and shale with massive dolomites in the upper part.
- Tsumeb sub-group is composed mostly of limestones and dolomites with horizons of spectacular diagenetic chert in the uppermost part of the unit (Shagama 2015 after Kribek, 2005).

Towards the north of Tsumeb (where the project site is) is the Karo Sequence which was deposited in the basin throughout the Permian and the Mesozoicperious periods. The Karoo is overlain by the Tertiary and Quaternary sediments of the Kalahari Sequence. The thickness of the Kalahari Sequence forms an extensive cover of terrestrial origin and amounts to some tens of metres and seldom exceeds 200m in the northern part of the basin (Shagama, 2015).

The local geology of the site shown in **Figure 9** shows that the project site is overlain by surficial deposits (sandy loamy soils of the Kalahari Sequence). Underlying the sediments/surficial deposits are dolomites.

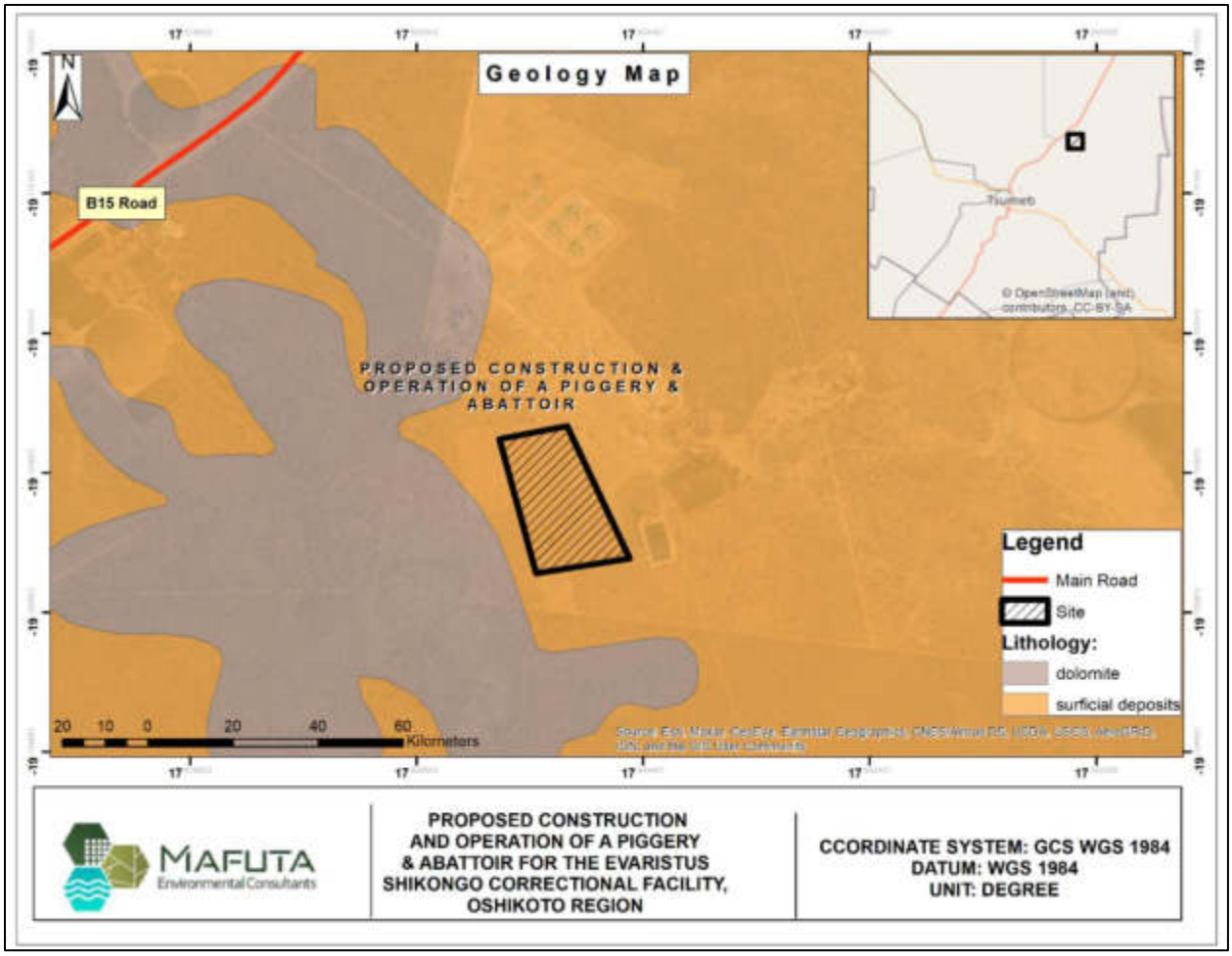

Figure 9: The geology map of the project site and surrounding area

4.4 Hydrogeology

The project site area falls under the Otavi Mountainland groundwater basin. Located in the Central Northern Namibia, the Otavi Mountainland comprises a series of dolomite units that have been subjected to an erosion process of carbonate dissolution to form karstified landforms. The Mountainland region is a major groundwater resource known as the “Karst Area” or “Karstland” which comprises the mountainous landscapes of Otavi, Tsumeb and Grootfontein.

The groundwater map shown in **Figure 10** shows that in the project site area (Tsumeb), groundwater potential is high to moderate and hoested in fractured, fissured or karstified aquifers.

A. Groundwater Recharge

Tsumeb receives an average annual rainfall of between 550 to 600 mm and given the high infiltration rates typical in this Karst area, groundwater recharge is therefore high (Lohe *et al.*, 2021).

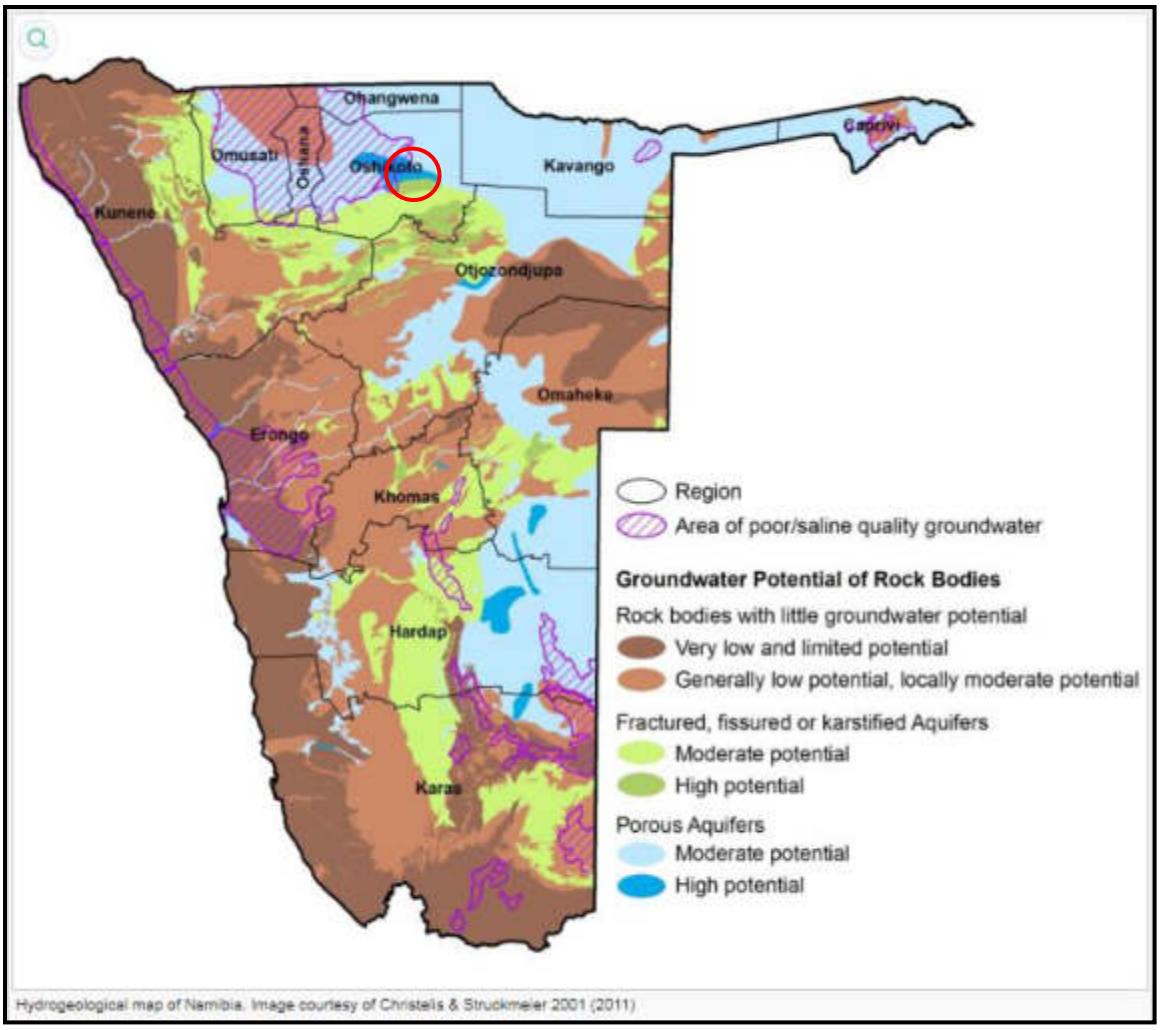

Figure 10: Hydrogeological map of Namibia with rock bodies groundwater potential (with the approximate location of Tsumeb area (red circle))

4.4.1 Groundwater Flow

The local groundwater flow pattern follows the regional northerly flow direction from the Otavi Mountain Land (OML) in the south, beneath Tsumeb towards the north. said that groundwater flow is reported to occur primarily within the upper 150 m below surface although flow is reported to occur as deep as 900 meters below ground level (mbgl) (Shagama 2015 after Van Rooyen and Nel, 2013). It was also stated that a 'slightly southern dipping water table' even though regional groundwater flow directions are reportedly to the north, this may, therefore, be indicative of a localized, complex flow regime in the vicinity of the site, although overall groundwater elevations have not been taken into consideration (Van Rooyen and Nel, 2013).

4.4.2 Groundwater Potential

Given the high rainfall (as mentioned above) and nature of the rocks, the site area has high groundwater potential as also shown on the map in **Figure 11**. There are also about eleven boreholes, including the ESCF borehole found within the proximity of the project site. All these boreholes are said to have very good yield.

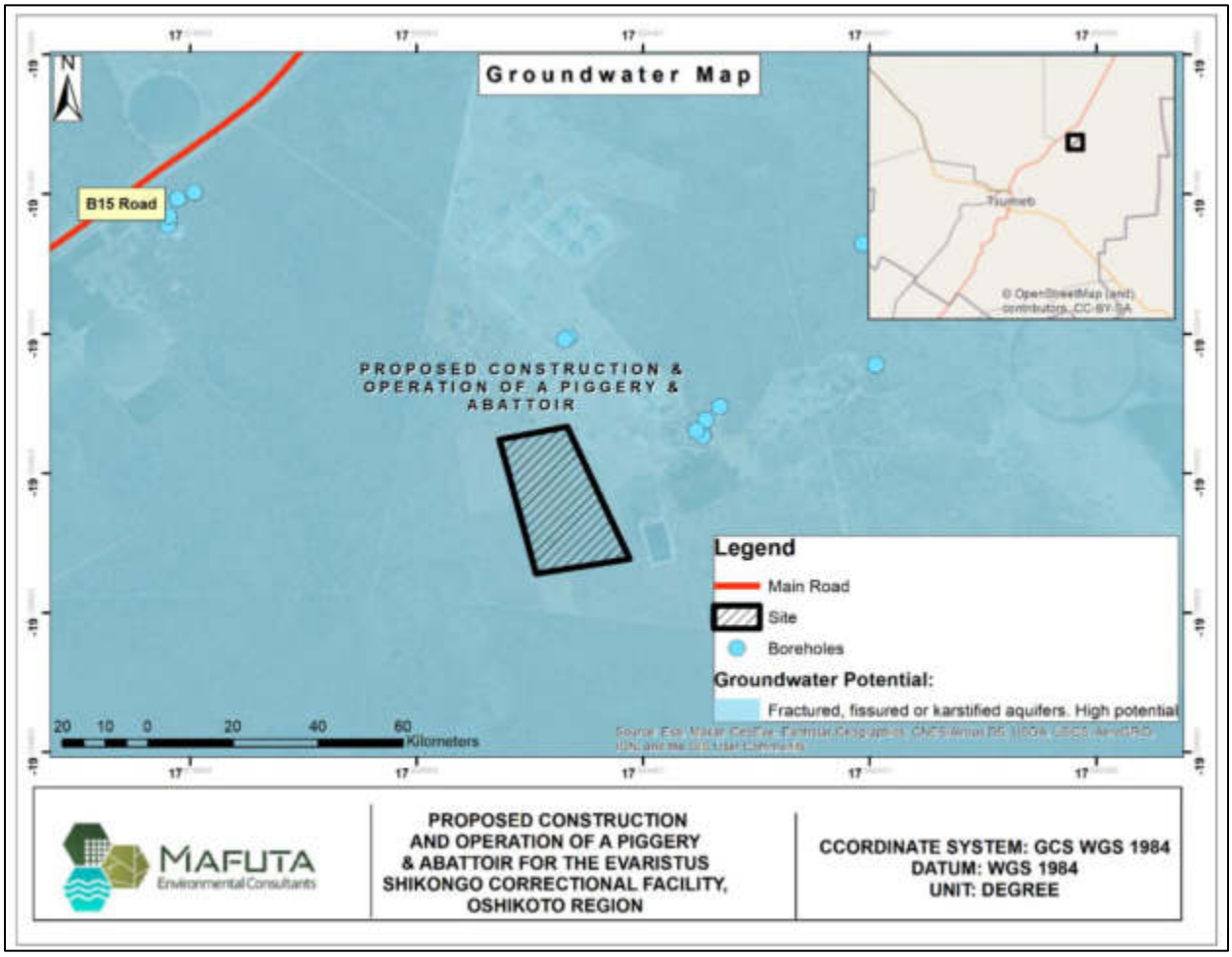

Figure 11: Groundwater map of the site

4.4.3 Groundwater Quality

The groundwater in the Nosib anticline is predominantly characterized by a magnesium/calcium carbonate (Mg/Ca-HCO3 water) type where the (Total dissolved solids (TDS) ranges from 150 to 1 200 milligram per liter (mg/l_. Locally, higher sodium, chloride and nitrate concentrations can occur in the vicinity of boreholes used for livestock watering. The dolomitic groundwater may be characterised as a low mineralised (with average TDS of 500 mg/l in the range of 150 to 1 300 mg/l), very hard and near-neutral Ca/Mg-HCO3 water (Lohe *et al*., 2021).

4.4.4 Vulnerability of Groundwater to Over-abstraction

The over-abstraction of groundwater in any aquifer does not only affect the surrounding human populations, but the general environment too that rely depend on the same water resource. The lowering of the water table would mean a decrease in borehole water levels for downstream water users. A decrease in water level in the surrounding (downstream) users' boreholes increases pumping costs because advanced pumping equipment will be required to reach the new borehole water levels.

Furthermore, over-pumping of groundwater in areas with poor recharge will also increase salt concentrations in the aquifer, leading to poor water quality.

With regards to the proposed project, the water volume required is undetermined at this stage. **However, the water potential of the project area is moderate to high. Therefore, continued abstraction of water from the site borehole(s) at a sustainable yield would probably not make the aquifers vulnerable to over-abstraction. The existing borehole on the ESCF will be able to supply water to the additional project (Piggery and Abattoir). Although, an additional borehole is drilled (to relieve pressure off the existing borehole)**, the vulnerability of the aquifer to over-abstraction will be low (insignificant), provided that the abstraction is controlled and managed.

4.4.5 Vulnerability of groundwater to Pollution

In areas where extensive agricultural and industrial activities are practised with poor prior planning and waste management, the aspects of water pollution and water protection have increasingly become an issue in most parts of the world. However, poor water quality does not only come from direct pollution from the ground surface, but from over-abstraction of water from aquifers that are poorly recharged. This would be the case with some aquifers in the southern parts of Namibia, where if abstraction exceeds effective recharge, the salt concentrations increase leading to poor quality water. In other words, the lowering of water levels from intensive abstraction in areas with poor rainfall may lead to the salinization of groundwater.

Typically, the vulnerability risk to pollution is assessed based on the vulnerability of groundwater resources to pollution as per parameters on the vulnerability map is shown in **Figure 12**, with the project area enclosed in the dark blue circle.

Based on the Groundwater Resources Vulnerability Map of Namibia below (**Figure 12)**, the vulnerability of groundwater to pollution in the project area is **very high around Tsumeb and high north of Tsumeb where the project is located**. The geology and secondary nature of the bedrocks ''encourage'' the transport of pollutants in the groundwater. In other words, the fractured and karstified nature of the dolomites in the area would provide ready passage for pollutants into groundwater.

The vulnerability of groundwater to pollution at the site would be promoted by the fractured/karstified rock units therefore high to very high.

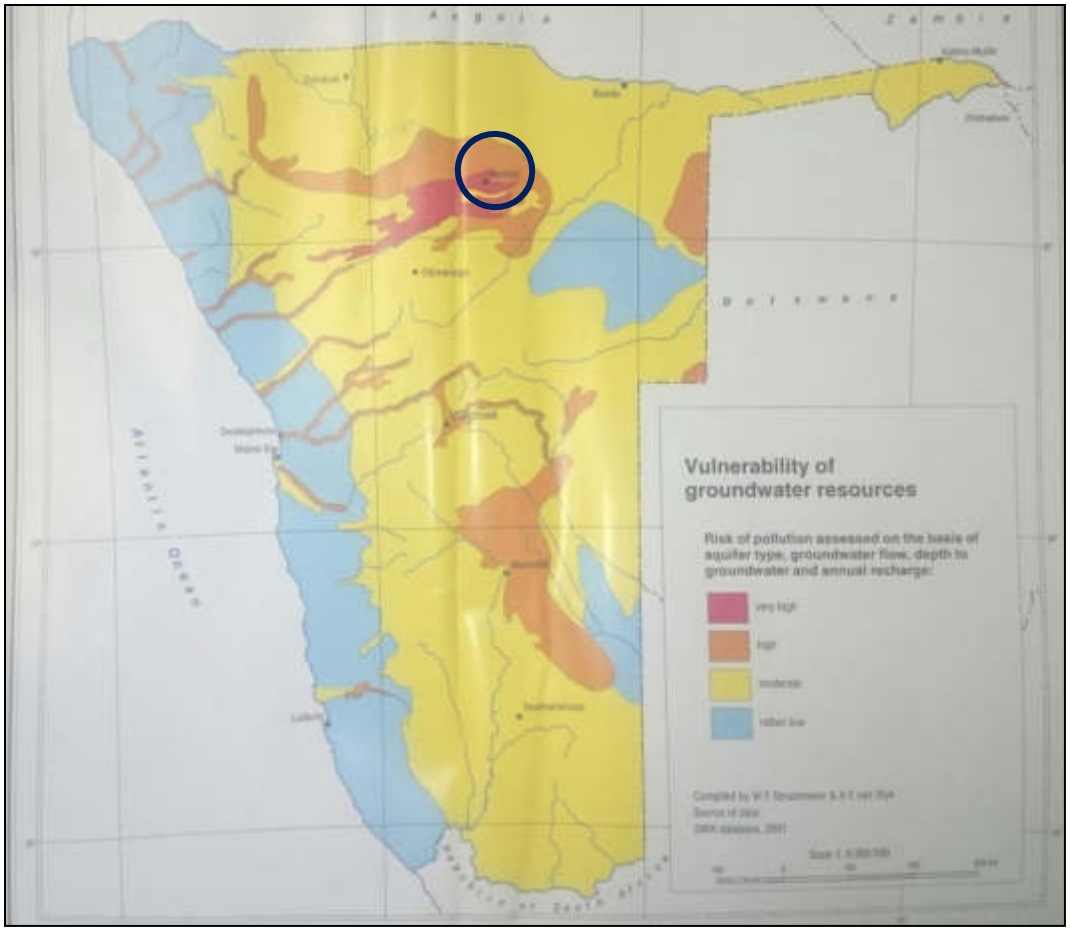

Figure 12: Vulnerability of groundwater resources to Pollution (source: Van Wyk *et.al*, 2001)

Since the purpose of this report is to assess the impact of the proposed Piggery and Abattoir activities on the groundwater resources (quantity but particularly groundwater quality given the vulnerability status), the following chapter covers this. The assessment of these impacts is presented under chapter 5 (section 5.2 and 5.3)

4.4.6 NA-MIS Namibian Monitoring Information System & Hydrogeological Map of Namibia

This is a new online National Monitoring Information System developed by Water Associates Namibia Pty Ltd, Ministry of Agriculture, Water & Land Reform and Groundwater Management Institute (**Figure 13**). The system is still being developed and only contains some of the following data and available here https://na-mis.com/:

- Hymnam Rock Bodies Potential, Groundwater Abstraction, Groundwater Vulnerability, Effective Groundwater Recharge, Monitoring Boreholes, Groundwater Quality, and Monitoring Stations.

The Monitoring Information System gives an overview of the baseline groundwater information of the area, whereby some information also covers the project site. The only monitoring boreholes in the vicinity of the project site borehole WW200207 west of the ESCF facility with a water level of 30 m.

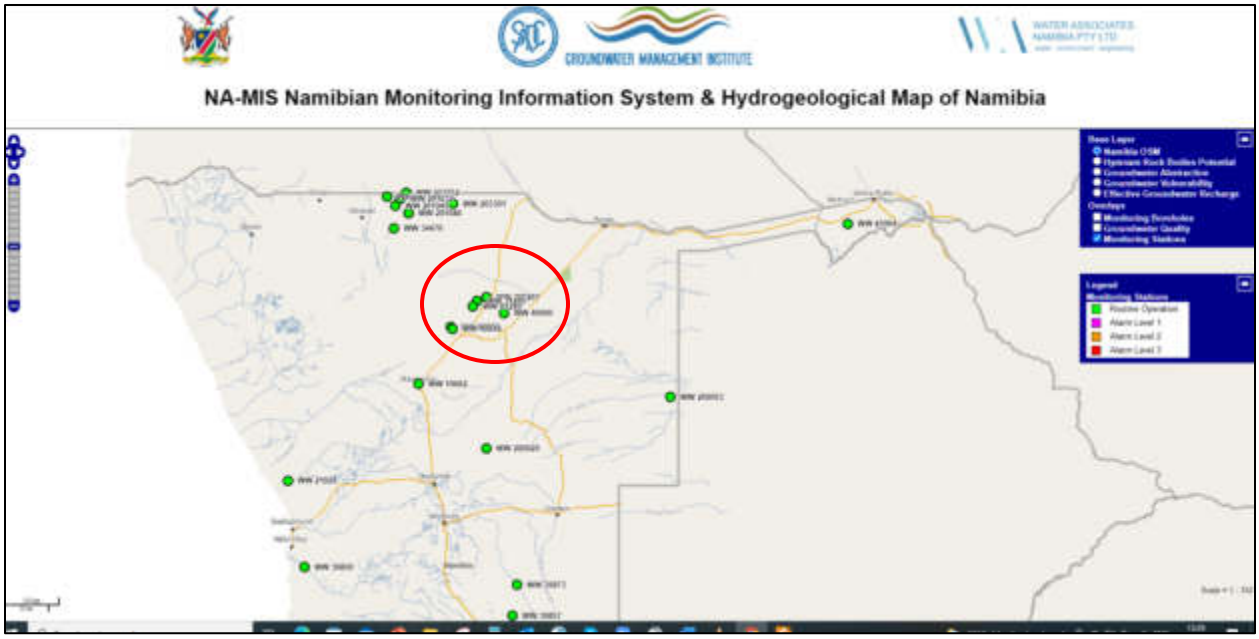

Figure 13: The groundwater monitoring information system with a close look at Tsumeb (source: NA-MIS https://na-mis.com/)

The available groundwater information of the site area is shown in **Figure 15** and **Figure 15. The annual groundwater abstraction of the site area is in the range of 500 to 100 000 m^3.**

According to the NA-MIS information in the next two Figures, the general site groundwater quality is classified as Group A: water with excellent quality.

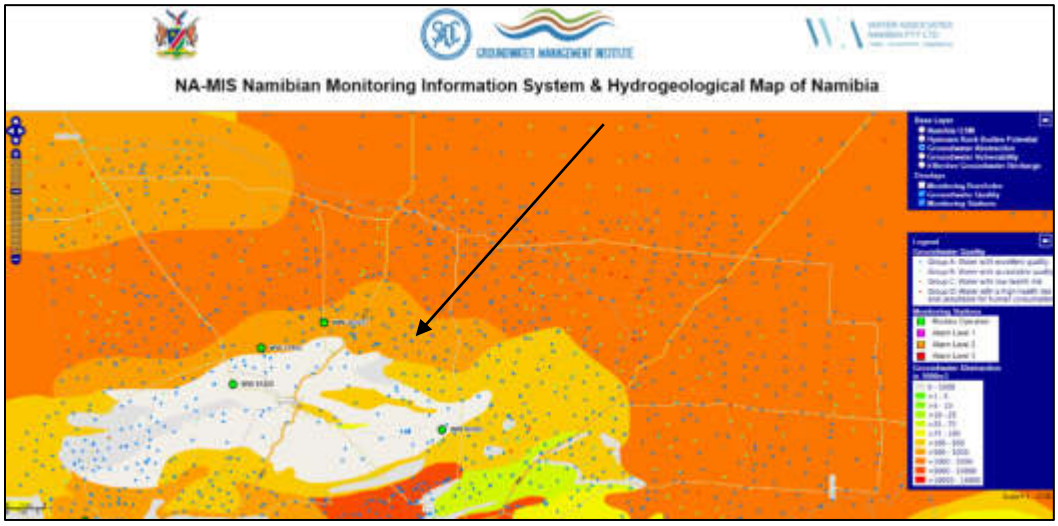

Figure 14: The groundwater monitoring information system with a close look at the project site area (source: NA-MIS https://na-mis.com/)

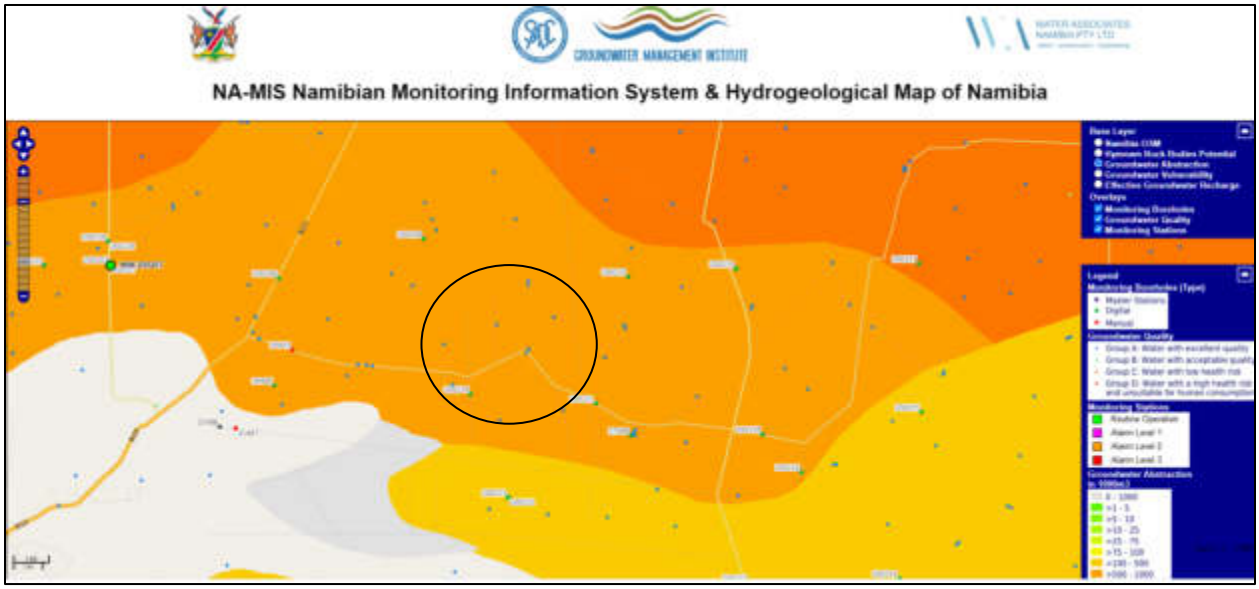

Figure 15: The groundwater monitoring information system with a close look at the site area (source: NA-MIS https://na-mis.com/)

5 GROUNDWATER IMPACT ASSESSMENT AND MANAGEMENT MEASURES

5.1 General Concept of Impact (Risk) Assessment

Generally, an environmental risk occurs when there is a hazard (e.g., process, activity, or substance) that can result in a harmful impact on the surrounding environment. The part of the environment which is, or could be, affected is known as a receptor. Receptors include humans, flora and fauna, the built environment and water resources (controlled waters).

The presence of a hazard alone does not constitute a risk; a risk is only present if there is a means by which the hazard can impact on sensitive receptor(s). The connection between the hazard and receptor is known as a pathway, and all three elements together constitute a source-pathway-receptor (S-P-R) linkage (SRK, 2006). The three elements are briefly defined as follows:

- **Source (or hazard)**: a substance capable of causing pollution or harm.
- **Receptor (or target)**: something which could be adversely affected by the contaminant.
- **Pathway**: a route by which contaminants can reach the receptor.

Environmental risk assessment is the process whereby S-P-R linkages are identified and evaluated. If any of the three elements are absent, then there is no complete linkage and thus no unacceptable risk. The magnitude of a risk is a function of the consequences of risk and the likelihood that such rick will occur.

The risk assessment for the two issues (over-abstraction and pollution) that may impact the water resources for the duration of the project activities on site is presented below.

5.2 Water Impact Assessment (Over-abstraction)

5.2.1 Source

The sources in this aspect will be the over-abstraction of borehole water to meet the project water needs. If there is no water management plans or management is not done properly, over-abstraction of groundwater may occur. With regards to the proposed project, the water volume required is undetermined at this stage. However, the water potential of the project area is moderate to high. Therefore, continued abstraction of water from the site borehole(s) at a sustainable yield would probably not make the aquifers vulnerable to over-abstraction. The existing borehole on the ESCF will be able to supply water to the additional project (Piggery and Abattoir). Although, an additional borehole is drilled (to relieve pressure off the existing borehole), the vulnerability of the aquifer to over-abstraction will be low (insignificant), provided that the abstraction is controlled and managed.

5.2.2 Pathway

The pathway of this impact would be determined by the amount of water abstracted and water flow direction. Groundwater within the project area is mostly in the secondary (fractured or karstified dolomites) aquifers that are overlain by unconsolidated sediments (surficial deposits of sandy loamy soils). Due to the high permeability of the sediments and fractured or karstified rocks, water can enter the groundwater system easily and rapidly. The nature of these sediments would cause rapid a drawdown in boreholes during excessive pumping and leading it to extend over a large area and interfere with nearby borehole yields. However, this impact is moderate to low because groundwater in the project area is mainly hosted in the above-mentioned fractured rock units and boreholes are located far from each other, therefore, rapid drawdown possibility is low.

5.2.3 Receptor

The neighbouring boreholes (downstream water users) and surrounding environment to the north of the ESCF and project site can be considered potential receptors in this regard. A sudden decrease in groundwater levels downstream during the project operations could be linked its water abstraction. **Establishing a good groundwater level monitoring database, prior to project implementation, a hydrocensus would need to be undertaken. This is aimed at identifying all the existing boreholes on the ESCF facility and within a 2 to 5 km radius of the project sites to obtain information such as borehole location, water levels and water quality, etc. The sudden change/decrease of water levels in downstream boreholes over time would be a good indicator of over-abstraction related to the project activities.**

With the above-said, the potential impact on the groundwater resources (abstraction) in the area can be considered low to moderate. The implementation of groundwater monitoring plan and adherence to the water permitting conditions and legislations are essential to manage groundwater and prevent over-abstraction.

5.3 Water Impact Assessment (Pollution)

5.3.1 Source

In terms of pollution (quality), improper handling of construction waste and eventual wastewater/ effluent and slurry from the Piggery and Abattoir operations may be washed into the soil and eventually infiltrate into the ground and pollute groundwater. This would be a concern because according to Lohe *et al*., (2021), Tsumeb receives an average annual rainfall of between 550 to 600 mm and given the high infiltration rates typical in this Karst area, groundwater recharge is high. Thus, the risk of groundwater pollution/contamination is also high, especially at areas of concentrated pollution source. The groundwater sensitivity of the site **(Figure 16**) is therefore determined by the nature of the rock formations (fractured and karstified to provide ready pathways for polluted groundwater) and surface land use.

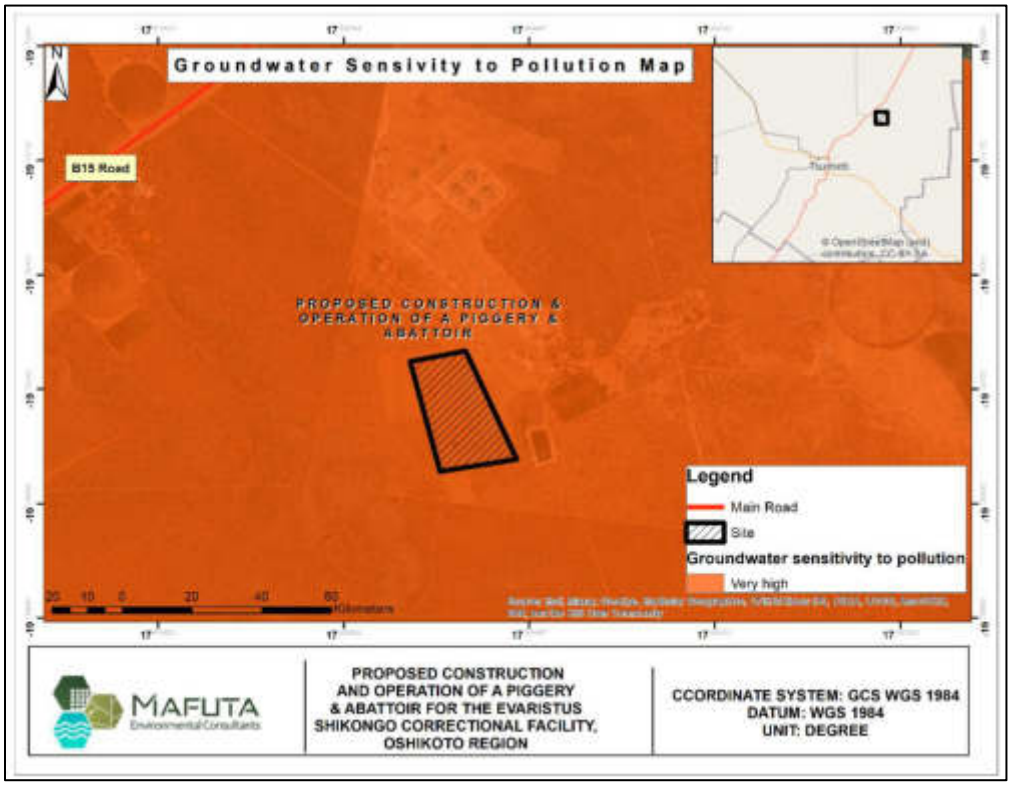

Figure 16: Groundwater sensitivity map of the ESCF site and surrounding

5.3.2 Pathway

Polluted or poor-quality water would travel from the potential sources to downstream water users. Pollution can be transported to nearby receptors via the unconsolidated surficial deposits (sediments) overlaying the project site and fractured and faulted aquifers (dolomites) that would act as ready pathways for polluted water (pollution) to spread fast and to a large area. The extent of the pollution will however depend on the amount of pollutant infiltrating from the ground surface into the aquifers. **Therefore, without proper planning on the handling and management of hazardous and wastewater on the ground (site surface), pollution of groundwater would be high**.

5.3.3 Receptor

The downstream groundwater users such as farm boreholes, settlements, and surrounding environments (north of the project site) are considered potential receptors. A sudden decrease in groundwater quality would be linked to new contributors (pollution sources from the project) to poor groundwater quality.

The implementation of groundwater monitoring plan and adherence to the water permitting conditions and legislations are essential for the prevention and management of groundwater pollution. **After assessing the hydrogeological regime of the area based on the available information, the impact of pollution on the groundwater resources is considered high to very high. However, this rating could be reduced by ensuring effective implementation of management and mitigation measures, accompanied by monitoring of borehole water.**

5.4 Water Abstraction & Demand (Use) and Pollution Management Plans

The following management plans are recommended and should be effectively implemented and monitored by the NCS to mitigate and properly manage the potential risks on water resources.

5.4.1 Groundwater Abstraction Management Plans

Over-abstraction of water resources can have severe impacts on water users and the general environment (biodiversity) supported by the same groundwater resource. Therefore, it is very important to manage water abstraction. If too much of it is abstracted, the water source may become depleted, especially during the years of little to no rainfall in the country. The depletion of water sources would also have adverse impacts such as deterioration of water quality due to potential decrease in groundwater levels. It is therefore very important to manage the water abstraction for the project activities.

The management action plans provided below are to be implemented to mitigate the impacts of the project on water quantity (over-abstraction):

- If an additional borehole is considered, it should be sited, and their sustainable yields determined during the aquifer test (pumping test) by a qualified and experienced hydrogeologist who will then recommend a safe abstraction yield for the project site. This is to ensure that the local aquifers are not stressed, i.e., negatively impacted due to over abstraction.

- If there is an existing Groundwater Water Abstraction & Use Permit, this should be revised to include the water volumes proposed for the Piggery and Abattoir project. This should be done by applying for amendment to the national Department of Water Affairs (DWA) at the Ministry of Agriculture, Water and Land Reform (MAWLR). The aim is to regulate and manage water abstracted from the borehole(s). In the Permit, the Water Regulatory Authority would set objectives (abstraction targets), conditions, annual abstraction threshold, monitoring requirements and enforce compliance by the Proponent. **If there is no Permit, this should be applied for, given that the proposed project is an agricultural related activity that is known to be water consuming.**
- Once the permit is issued or amended and obtained, it will be very crucial that the Proponent strictly adheres to the abstraction volumes given in their permit, and when possible, use less water than the allocated volume in the water permit.
- As part of the commercial water user's responsibilities, an annual report that includes water returns and any new changes to the water use should be prepared and submitted to the responsible unit of the DWA. Reporting will be used as a tool by the Regulatory Authority to ensure that monitoring implementation is effective, the Proponent commits and complies with the legislation. This action also enables the Authority to make further informed decisions on groundwater management and protection.
- The Proponent should raise awareness to their project workers on water saving measures and include the reality of climate change and its impacts on groundwater recharge, and eventual effect on the water supply in the area.
- The lack of a comprehensive groundwater monitoring programme precludes getting an overall and clear presentation of groundwater data in the area. It is for this reason that monitoring of water level in boreholes should be undertaken. **The monitoring will entail monthly recording of water levels in both the NCS production boreholes and drilled monitoring boreholes within 1km north of the project and monitoring boreholes of neighbouring boreholes in farms (to the north and south) and any other borehole water user within a 5 km radius of the project site.**
- The re-use of the water used on some of the projects' activities should be encouraged.

5.4.2 Pollution Management Plans

The the water quality in this area is mainly controlled by the local geological (fractured and karstified).

Therefore, to avoid and or minimize the potential impact of pollution stemming from project activities, the following measures are recommended for implementation:

- All run off materials such as hydrocarbons, wastewater and other potential contaminants should be contained in appropriate containers on site and disposed of in accordance with municipal wastewater discharge standards, so that they do not reach to water systems.
- The new wastewater management ponds (dams) associated with the Piggery and Abattoir should be properly lined with geomembrane lining to prevent seepage through the dams to groundwater systems.
- At least two monitoring boreholes should be drilled and installed within 1km upstream (south) and downstream (north) of the facilities. These boreholes will be used to detect and monitor possible pollution from the site operations.
- Stormwater management plans (discharge points) should be designed and implemented on site to prevent the potentially contaminated run-off from reaching groundwater resources.
- Wastewater and hazardous used substance such as oils and grease should be properly disposed of in the appropriate management pipelines and waste containers, respectively and disposed of in the designated wastewater containment dams onsite and at the hazardous disposal facilities in Tsumeb, respectively.

The recommendations and conclusions made for the overall assessment are as presented under chapter below.

6 RECOMMENDATIONS AND CONCLUSIONS

The aim of this report was to assess the potential risk/impact of the proposed Piggery and Abattoir on the groundwater resources, primarily water quality. The assessment has been undertaken on a desktop level, i.e., based on the site walkover and information provided by NCS and author's review of previous different studies done on the project area.

The recommendations provided to the assessment and conclusions made are presented under the following sections (6.1 and 6.2):

6.1 Recommendations

Given the assessment results, to protect and manage the water resources, the following management measures should be implemented (to mitigate over-abstraction):

- If an additional borehole is considered, it should be sited, and their sustainable yields determined during the aquifer test (pumping test) by a qualified and experienced hydrogeologist who will then recommend a safe abstraction yield for the project site. This is to ensure that the local aquifers are not stressed, i.e., negatively impacted due to over abstraction.

- If there is an existing Groundwater Water Abstraction & Use Permit, this should be revised to include the water volumes proposed for the Piggery and Abattoir project. This should be done by applying for amendment to the national Department of Water Affairs (DWA) at the Ministry of Agriculture, Water and Land Reform (MAWLR). The aim is to regulate and manage water abstracted from the borehole(s). **If there is no Permit, this should be applied for, given that the proposed project is an agricultural related activity that is known to be water consuming.**
- Once the permit is issued or amended and obtained, it will be very crucial that the Proponent strictly adheres to the abstraction volumes given in their permit, and when possible, use less water than the allocated volume in the water permit.
- As part of the commercial water user's responsibilities, an annual report that includes water returns and any new changes to the water use should be prepared and submitted to the responsible unit of the DWA. Reporting will be used as a tool by the Regulatory Authority to ensure that monitoring implementation is effective, the Proponent commits and complies with the legislation. This action also enables the Authority to make further informed decisions on groundwater management and protection.
- The Proponent should raise awareness to their project workers on water saving measures and include the reality of climate change and its impacts on groundwater recharge, and eventual effect on the water supply in the area.
- The lack of a comprehensive groundwater monitoring programme precludes getting an overall and clear presentation of groundwater data in the area. It is for this reason that monitoring of water level in boreholes should be undertaken. **The monitoring will entail monthly recording of water levels in both the NCS production boreholes and drilled monitoring boreholes within 1km north of the project and monitoring boreholes of neighbouring boreholes in farms (to the north and south) and any other borehole water user within a 5 km radius of the project site.**

<u>Pollution measures that will need to be implemented and monitored are as follow:</u>

- All run off materials such as hydrocarbons, wastewater and other potential contaminants should be contained in appropriate containers on site and disposed of in accordance with municipal wastewater discharge standards, so that they do not reach to water systems.
- The new wastewater management ponds (dams) associated with the Piggery and Abattoir should be properly lined with geomembrane lining to prevent seepage through the dams to groundwater systems.

- At least two monitoring boreholes should be drilled and installed within 1km upstream (south) and downstream (north) of the facilities. These boreholes will be used to detect and monitor possible pollution from the site operations.
- Stormwater management plans (discharge points) should be designed and implemented on site to prevent the potentially contaminated run-off from reaching groundwater resources.
- Wastewater and hazardous used substance such as oils and grease should be properly disposed of in the appropriate management pipelines and waste containers, respectively and disposed of in the designated wastewater containment dams onsite and at the hazardous disposal facilities in Tsumeb, respectively.

6.2 Conclusions

Based on the analyzed information from site and baseline literature consulted, **it can be concluded that** groundwater although groundwater volume for the Piggery and Abattoir activities required is undetermined (unknown) at this stage, the water potential of the project area is moderate to high. Therefore, continued abstraction of water from the site borehole(s) at a sustainable yield to supply the project would probably not make the aquifers vulnerable to over-abstraction. The existing borehole on the ESCF will be able to supply water to the additional project (Piggery and Abattoir). Although, an additional borehole is drilled (to relieve pressure off the existing borehole), the vulnerability of the aquifer to over-abstraction will be low (insignificant), provided that the abstraction is controlled and managed.

In terms of pollution, after assessing the hydrogeological regime of the area based on the available information and knowledge of the project area's groundwater sensitivity, the potential impact of pollution on the groundwater resources is considered high to very high. However, this rating could be reduced by ensuring effective implementation of management and mitigation measures, accompanied by monitoring of borehole water (water quality sampling in downstream boreholes).

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