

**ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT
(ESIA) FOR THE PROPOSED SAND MINING QUARRY ON
FARM PARESIS 507, LOCATED NEAR OTJIWARONGO IN THE
OTJOZONDJUPA REGION, NAMIBIA**

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EXECUTIVE SUMMARY

Otji Bricks (hereinafter referred to as The Proponent) proposes to conduct an open cast sand mining on Farm Parises 507, on an area of 211.131 ha, the sand mining activities will be excavated from Erundu River which flows through Farm Parises 507. The mining activities will only be conducted during the non-rainy seasons, when the River is dry, to excavate the sand from the River. The intended use of the sand which will be extracted is for house-building activities, commercial housing construction, commercial road construction, and for commercial bulk sale.

Sand mining activities form part of the listed activities that may not be undertaken without an environmental clearance certificate (ECC) under the Environmental Assessment (EA) Regulations. Subsequently, to ensure that the proposed activities is compliant with the national environmental legislation, the project Proponent, appointed an independent environmental consultant, Excel Dynamic Solutions (Pty) Ltd to undertake the required Environmental Assessment (EA) process and apply for the ECC on their behalf.

The application for the ECC was compiled and submitted to the competent Authority (Ministry of Environment, Forestry and Tourism (MEFT)). Upon submission of an Environmental and Social Impact Assessment (ESIA) Report and Draft Environmental Management Plan (EMP), an ECC for the proposed project may be considered by the Environmental Commissioner at the MEFT's Department of Environmental Affairs and Forestry (DEAF).

Project Description

The proposed methods for the proposed development are divided into the following categories:

- **Site feasibility phase:** This phase involves assessing the viability of the mining project. It includes geological surveys, environmental assessment, and economic evaluation to determine whether the project should proceed.
- **Sand mining phase:** Once the feasibility is confirmed, the sand mining phase begins. This phase encompasses the actual extraction of sand from the river, including the necessary operational logistics and workforce management.
- **Site Residue & Rehabilitation phase:** After the mining sand mining activities are completed, this phase focuses on managing the leftover materials and restoring the site

to its natural state. This include cleaning up the area, and ensuring that the environment is safe for future use.

Public Consultation

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. The public consultation process assisted the Environmental Consultant in identifying all potential impacts and aided in the process of identifying possible mitigation measures and alternative to certain project activities. The communication with I&APs about the proposed project was done through the following means and in this order to ensure that the public is notified and are provided an opportunity to comment on the proposed project:

- A Background Information Document (BID) containing brief information about the proposed sand mining was compiled and sent out to all pre-identified affected parties and upon request to all new registered Interested and Affected parties (I&APs);
- Project Environmental Assessment notices were placed in The Namibian newspaper (23 august 2024 and 30 august 2024) and New Era newspapers (19 August 2024 and 27 August 2024), briefly explaining the activity and its locality, inviting members of the public to register as I&APs and submit comment;
- Public notices were placed at frequent places in Otjiwarongo and on the farm Paresis to inform members of the public of the EA process and register as I&APs as well as submit comments;
- A public meeting was scheduled and held on 04 September 2024 on farm Paresis. However, the turn up was very low and we visited the ministry of environment office in Otjiwarongo and at the Otjozondjupa Regional Council office.

Potential Impacts identified

The following potential positive and negative impacts are anticipated to occur during the project phase of the proposed development:

Positive impacts:

- Socio-economic development: employment creation and skills transfer.
- Investment opportunities or infrastructure-related development benefits,
- Produce a trained workforce and small businesses in the area.
- Boosting local economic and regional economic development.
- Increased supply of bricks for local businesses and construction industry.

Negative impacts:

- Soils and water pollution
- Surrounding soils
- Air Quality (Dust)
- Biodiversity: Fauna and flora
- Health and Safety
- Vehicular traffic safety
- Visuals impacts
- Noise and vibration
- Loss of property values
- Waste generation
- Archaeological or cultural heritage impacts

The potential negative impacts were assessed, and mitigation measures were provided accordingly in the EMP for this proposed project.

Conclusions and Recommendations

The potential positive and negative impacts stemming from the proposed sand mining activities were identified, described, and assessed. For the significant adverse (negative) impacts with a medium rating, appropriate management and mitigation measures were recommended for implementation by the Proponent, their contractors and project related employees.

The issues and concerns raised by the registered I&APs formed the basis for this Report and the Draft EMP. The issues were addressed and incorporated into this Report whereby mitigation measures have been provided thereof to avoid and/or minimize their significance on the environmental and social components. Most of the potential impacts were found to be of medium rating significance. The effective implementation of the recommended management and mitigation measures will particularly see a reduction in the significance of adverse impacts that cannot be avoided completely (from medium rating to low). To maintain the desirable rating, the implementation of management and mitigation measures should be monitored by the Proponent directly, or their Environmental Control Officer (ECO) is highly recommended. The monitoring of this implementation will not only be done to maintain the reduced impacts rating or maintain a low rating but to also ensure that all potential impacts identified in this study and other impacts that might arise during implementation are properly identified in time and addressed right away too.

Disclaimer

EDS warrants that the findings and conclusion contained herein were accomplished in accordance with the methodologies set forth in the Scope of Work and Environmental Management Act (EMA) of 2007. These methodologies are described as representing good customary practice for conducting an Environmental Assessment of a property for the purpose of identifying recognized environmental conditions. There is a possibility that even with the proper application of these methodologies there may exist on the subject property conditions that could not be identified within the scope of the assessment, or which were not reasonably identifiable from the available information. The Consultant believes that the information obtained from the record review and during the public consultation processes concerning the proposed development work is reliable. However, the Consultant cannot and does not warrant or guarantee that the information provided by the other sources is accurate or complete.



The conclusions and findings set forth in this report are strictly limited in time and scope to the date of the evaluations. No other warranties are implied or expressed. Some of the information provided in this report is based upon personal interviews, and research of available documents, records, and maps held by the appropriate government and private agencies. This report is subject to the limitations of historical documentation, availability, and accuracy of pertinent records, and the personal recollections of those persons contacted.

TABLE OF CONTENTS

EXECUTIVE SUMMARY	1
LIST OF FIGURES.....	8
LIST OF TABLES.....	10
LIST OF APPENDICES.....	11
LIST OF ABBREVIATIONS	11
1 INTRODUCTION.....	15
1.1 Project Background.....	15
1.2 Terms of Reference and Scope of Works	17
1.3 The Need for the Proposed Project.....	17
2 PROJECT DESCRIPTION.....	18
2.1 Site Feasibility Phase	18
2.2 Sand Mining Phase.....	19
2.4 Other aspects of the proposed project include:	22
3 PROJECT ALTERNATIVES.....	23
3.1 Types of Alternatives Considered.....	24
3.1.1 The "No-go" Alternative.....	24
3.1.2 Project Location	24
4 LEGAL FRAMEWORK: LEGISLATION, POLICIES AND GUIDELINES	24
4.1 The Environmental Management Act (No. 7 of 2007)	24
5 ENVIRONMENTAL BASELINE.....	29
5.1 Biophysical Environment.....	29
5.1.1 Climate.....	29
5.1.2 Climate	30

5.1.3	Topography	30
5.1.4	Soils	31
5.2	Geology	33
5.3	Hydrology	34
5.4	Hydrogeology	36
5.6	Groundwater Water quality	42
5.7	Groundwater potential	45
5.8	Fauna and Flora	47
5.9	Sand mining No-go zone area and Alternative mining area (zone)	47
5.10	Socio-Economic Condition of Otjiwarongo	49
5.11	Surrounding Land Uses	50
5.12	Heritage and Archaeology	52
6	PUBLIC CONSULTATION PROCESS	52
6.1	Pre-identified and Registered Interested & Affected Parties (I&APs)	52
6.2	Communication with I&APs	53
6.3	Public Feedback	55
7	IMPACT IDENTIFICATION, ASSESSMENT AND MITIGATION MEASURES	55
7.1	Impact Identification	55
7.2	Impact Assessment Methodology	56
7.2.1	Extent (spatial scale)	57
7.2.2	Duration	57
7.2.3	Intensity, Magnitude / severity	58
7.2.4	Probability of occurrence	59
7.2.5	Significance	59

7.3	Assessment of Potential Negative Impacts.....	61
7.3.1	Soil and water pollution	61
7.3.2	Surrounding Soils.....	62
7.3.3	Generation of Dust (Air Quality).....	62
7.3.4	Biodiversity: Fauna and Flora.....	63
7.3.5	Health and Safety.....	64
7.3.6	Vehicular Traffic Safety	64
7.3.7	Visual.....	65
7.3.8	Noise and Vibration.....	65
7.3.9	Loss of Property value.....	66
7.3.10	Waste Generation	66
7.3.11	Archaeological impact.....	67
7.3.12	Assessment of potential negative impacts: Residue & Rehabilitation phase	67
8	RECOMMENDATIONS AND CONCLUSIONS	68
9	REFERENCES	69

LIST OF FIGURES

Figure 1: Location of the riverbed section for sand mining Extension 10, Farm Paresis	16
Figure 2: Shows the schematic diagram of the project phases, (Silas, 2025)	18
Figure 3: shows the schematic diagram of the project site feasibility phase, (Silas, 2025)	19
Figure 4: shows the schematic diagram of the project sand mining phase, (Silas, 2025)	20
Figure 5: shows the schematic diagram of the project mechanized mining method, (Silas, 2025)	21
Figure 6: shows the schematic diagram of the project Site Residue & Rehabilitation phase, (Silas, 2025).....	22

Figure 7: (Otjiwarongo climate: Average Temperature, weather by month, Otjiwarongo weather averages - Climate-Data.org)	29
Figure 8: wind direction and wind speed (Simulated historical climate & weather data for Otjiwarongo - meteoblue)	30
Figure 9: Elevation map of the project site	31
Figure 10: Soils map of the project site	32
Figure 11: Top soil in the riverbed.....	33
Figure 12: Geology map for the project site.....	34
Figure 13: Drainage network for the farm paresis 507 area.....	35
Figure 14: Geological structures hosting groundwater in the project area	36
Figure 15: Yield contour lines for the project area	38
Figure 16: Depth to groundwater in and around the project area.....	39
Figure 17: Schematic cross-section through stream and alluvial aquifer during ephemeral flow (Healy et al., 2007).....	40
Figure 18: slope of ground surface towards the coastline.....	41
Figure 19: Recharge rates for farm Paresis 507 area.....	42
Figure 20: Hydrogeochemical data from coastal aquifers.....	44
Figure 21: Hydrogeochemical data from farm Paresis 507 area.....	45
Figure 22: Intrinsic aquifer potential based on geology at 1:250 000 scale.....	46
Figure 23: Sand mining No-go zone area and alternative sand mining areas.....	48
Figure 24: Otjiwarongo Population: (Otjiwarongo (Constituency, Namibia) - Population Statistics, Charts, Map and Location (citypopulation.de))	49
Figure 25: Land use surrounding the sand mining site.....	51
Figure 26: public notice placed at the entrance junction of farm Paresis	54
Figure 27: Consultation at the Otjiwarongo office of the Ministry of Environment Forestry and Tourism.....	55

LIST OF TABLES

Table 1: Applicable national and international legislations governing the proposed development	25
Table 2: Borehole information on Farm Paresis No. 507	37
Table 3: Drinking water standard in Namibia	43
Table 5: Summary of Interested and Affected Parties (I&APs)	53
Table 5: Extent or spatial impact rating	57
Table 6: Duration impact rating	57
Table 7: Intensity, magnitude or severity impact rating	58
Table 8: Probability of occurrence impact rating	59
Table 9: Significance rating scale	59
Table 10: Assessment of the impacts of the riverbed sand mining on soil water resources	62
Table 11: Assessment of the impacts of the impacts on site soils	62
Table 12: Assessment of the impacts of the riverbed mining activities on surrounding air quality	63
Table 13: Assessment of the project impact of the riverbed sand mining on biodiversity (fauna & flora)	63
Table 14: Assessment of the project impact on health and safety	64
Table 15: Assessment of the impacts of the project activities on vehicular traffic (road)	64
Table 16: Assessment of the impacts of the sand mining site on visual	65
Table 17: Assessment of the impacts of the noise from riverbed sand operations	65
Table 18: Assessment of the impacts of riverbed sand mining presence on property value	66
Table 19: Assessment of the waste generation impact	66
Table 20: Assessment of the impact of the project on archaeological or cultural sites	67
Table 21: Assessment of the impacts of riverbed sand mining closure on the community	67

LIST OF APPENDICES

Appendix A: Copy of the Environmental Clearance Certificate (ECC) Application Form 1

Appendix B: Environmental Management Plan (EMP)

Appendix C: Curriculum Vitae (CV) for the EAP

Appendix D: Proof of Public Consultations

LIST OF ABBREVIATIONS

Abbreviation	Meaning
BID	Background Information Document
CV	Curriculum Vitae
DEAF	Department of Environmental Affairs and Forestry
EA	Environmental Assessment
EAP	Environmental Assessment Practitioner
ECC	Environmental Clearance Certificate
EDS	Excel Dynamic Solutions
ESIA	Environmental and Social Impact Assessment
EMA	Environmental Management Act
EMP	Environmental Management Plan
GG	Government Gazette
GN	Government Notice
I&APs	Interested and Affected Parties
MEFT	Ministry of Environment, Tourism and Forestry
Reg	Regulation
S	Section

Abbreviation	Meaning
TOR	Terms of Reference

DEFINITION OF TERMS

Alternative	A possible course of action, in place of another that would meet the same purpose and need of the proposal.
Baseline	Work done to collect and interpret information on the condition/trends of the existing environment.
Biophysical	That part of the environment that does not originate with human activities (e.g. biological, physical and chemical processes).
Cumulative Impacts/Effects Assessment	In relation to an activity, means the impact of an activity that in it may not be significant but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.
Decision-maker	The person(s) entrusted with the responsibility for allocating resources or granting approval to a proposal.
Ecological Processes	Processes which play an essential part in maintaining ecosystem integrity. Four fundamental ecological processes are the cycling of water, the cycling of nutrients, the flow of energy and biological diversity (as an expression of evolution).

Environment	As defined in Environmental Management Act - the complex of natural and anthropogenic factors and elements that are mutually interrelated and affect the ecological equilibrium and the quality of life, including – (a) the natural environment that is land, water and air; all organic and inorganic matter and living organisms and (b) the human environment that is the landscape and natural, cultural, historical, aesthetic, economic and social heritage and values.
Environmental Management Plan	As defined in the EIA Regulations (Section 8(j)), a plan that describes how activities that may have significant environments effects are to be mitigated, controlled and monitored.
Interested and Affected Party (I&AP)	In relation to the assessment of a listed activity includes - (a) any person, group of persons or organization interested in or affected by an activity; and (b) any organ of state that may have jurisdiction over any aspect of the activity. Mitigate - practical measures to reduce adverse impacts. Proponent – as defined in the Environmental Management Act, a person who proposes to undertake a listed activity. Significant impact - means an impact that by its magnitude, duration, intensity or probability of occurrence may have a notable effect on one or more aspects of the environment.
Fauna	All of the animals found in a given area.
Flora	All of the plants found in a given area.
Mitigation	The purposeful implementation of decisions or activities that are designed to reduce the undesirable impacts of a proposed action on the affected environment.
Monitoring	Activity involving repeated observation, according to a pre-determined schedule, of one or more elements of the environment to detect their characteristics (status and trends).

Nomadic Pastoralism	Nomadic pastoralists live in societies in which the husbandry of grazing animals is viewed as an ideal way of making a living and the regular movement of all or part of the society is considered a normal and natural part of life. Pastoral nomadism is commonly found where climatic conditions produce seasonal pastures but cannot support sustained agriculture.
Proponent	Organization (private or public sector) or individual intending to implement a development proposal.
Public Consultation/Involvement	A range of techniques that can be used to inform, consult or interact with stakeholders affected by the proposed activities.
Scoping	An early and open activity to identify the impacts that are most likely to be significant and require specialized investigation during the EIA work. Can, also be used to identify alternative project designs/sites to be assessed, obtain local knowledge of site and surroundings and prepare a plan for public involvement. The results of scoping are frequently used to prepare a Terms of Reference for the specialized input into full EIA.
Terms of Reference (ToR)	Written requirements governing full EIA input and implementation, consultations to be held, data to be produced and form/contents of the EIA report. Often produced as an output from scoping.

1 INTRODUCTION

1.1 Project Background

Otji Bricks (hereinafter referred to as The Proponent) proposes to conduct an open cast sand mining on Farm Parises 507 (**Figure 1**), on an area of 211.131 ha, the sand mining activities will be excavated from Erundu River that flows through Farm Parises 507. The mining activities will only be conducted during the non-rainy seasons, when the River is dry, to excavate the sand from the River. The intended use of the sand which will be extracted is for house-building activities, commercial housing construction, commercial road construction, and for commercial bulk sale.

Sand mining activities form part of the listed activities that may not be undertaken without an Environmental Clearance Certificate (ECC). Thus, the proposed project requires an ECC to be issued by the Ministry of Environment, Forestry and Tourism (MEFT) before commencement of works on site.

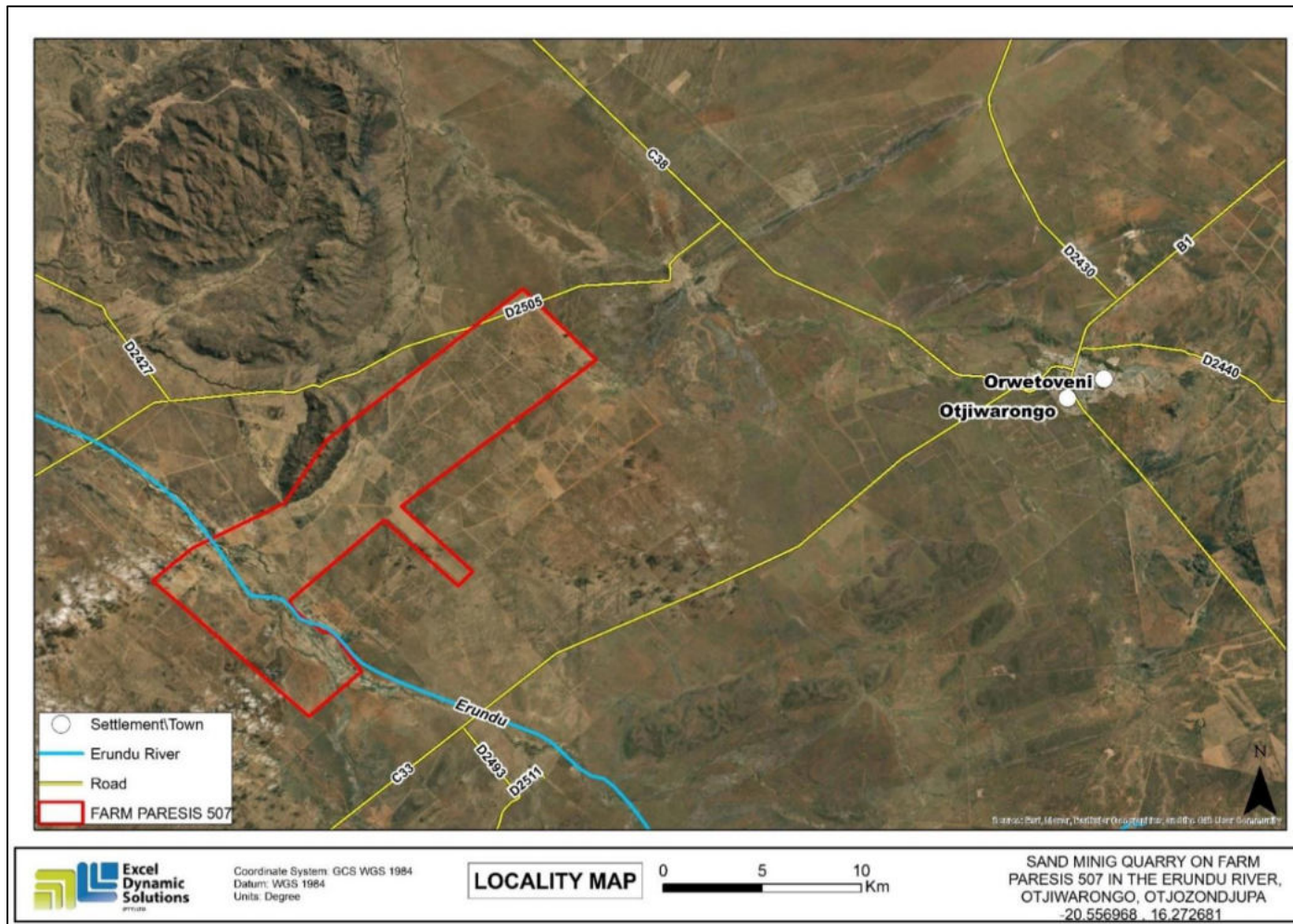


Figure 1: Location of the riverbed section for sand mining Extension 10, Farm Paresis

1.2 Terms of Reference and Scope of Works

Excel Dynamic Solutions (Pty) Ltd (EDS) has been appointed by The Proponent to undertake an environmental assessment (EA), and thereafter, apply for an ECC for the proposed project. There were no formal Terms of Reference (ToR) provided to EDS by the Proponent. The consultant, instead, relied on the requirements of the Environmental Management Act (No. 7 of 2007) (EMA) and its Environmental Impact Assessment (EIA) Regulations (GN. No. 30 of 2012) to conduct the study.

The application for the ECC was compiled and submitted to the Ministry of Environment, Forestry and Tourism (MEFT), (**Appendix A**) the environmental custodian for project registration purposes. Upon submission of an Environmental Assessment (EA) Report and Draft Environmental Management Plan (EMP), an ECC for the proposed project might be considered by the Environmental Commissioner at the MEFT's Department of Environmental Affairs and Forestry (DEAF).

1.3 The Need for the Proposed Project

The proposed sand mining project in Namibia is crucial to meeting the increasing demand for construction materials fueled by the country's rapid urbanization, economic expansion, and infrastructure development. Sand plays a key role in producing concrete, and other essential materials for constructing housing, roads, and public infrastructure. In addition, the project is expected to generate local job opportunities, stimulate regional economic growth, and support national development objectives. By adopting sustainable mining practices, the initiative seeks to balance environmental protection with the need to address Namibia's infrastructure requirements.

2 PROJECT DESCRIPTION

The proposed methods for the proposed project (**Figure 2**) are divided into the following phases, (Site feasibility, Sand mining and Site residue & rehabilitation).

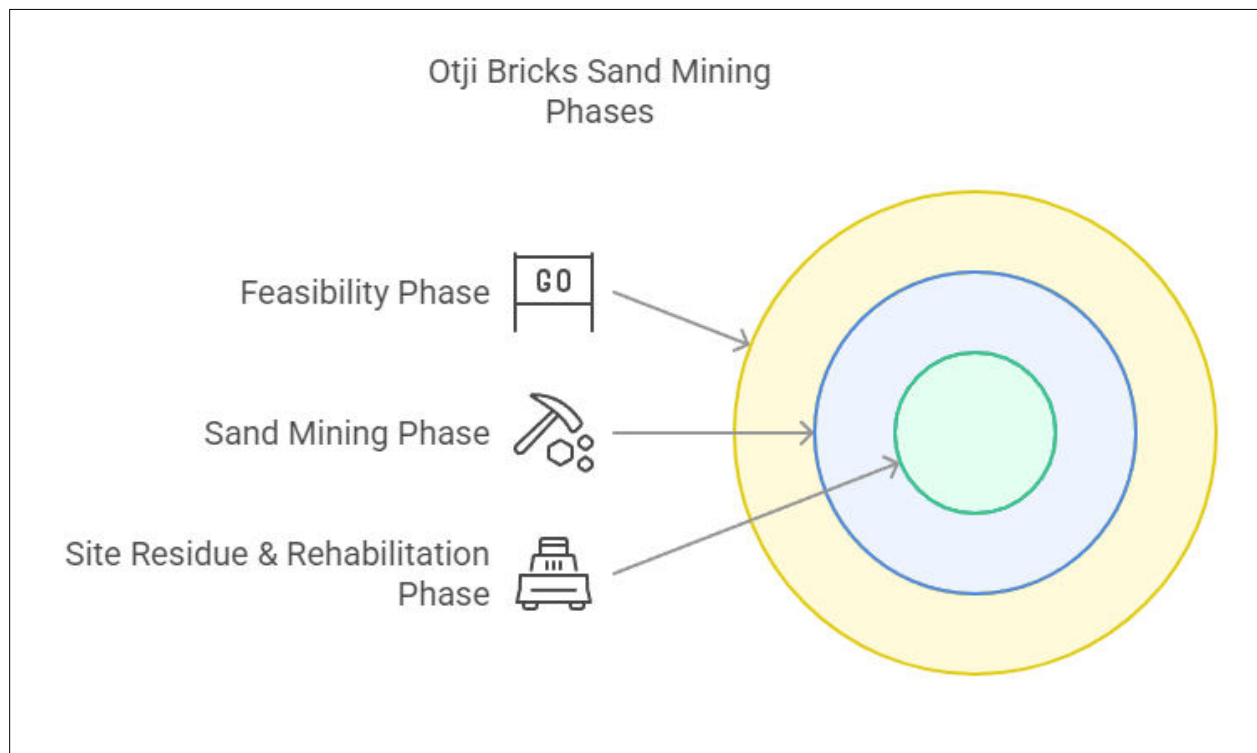


Figure 2: Shows the schematic diagram of the project phases, (Silas, 2025)

2.1 Site Feasibility Phase

This initial phase involves assessing the viability of the mining project. It includes geological surveys, environmental impact assessments, and economic evaluations to determine whether the project should proceed. **Figure 3** below shows the schematic diagram of the project site feasibility phase.

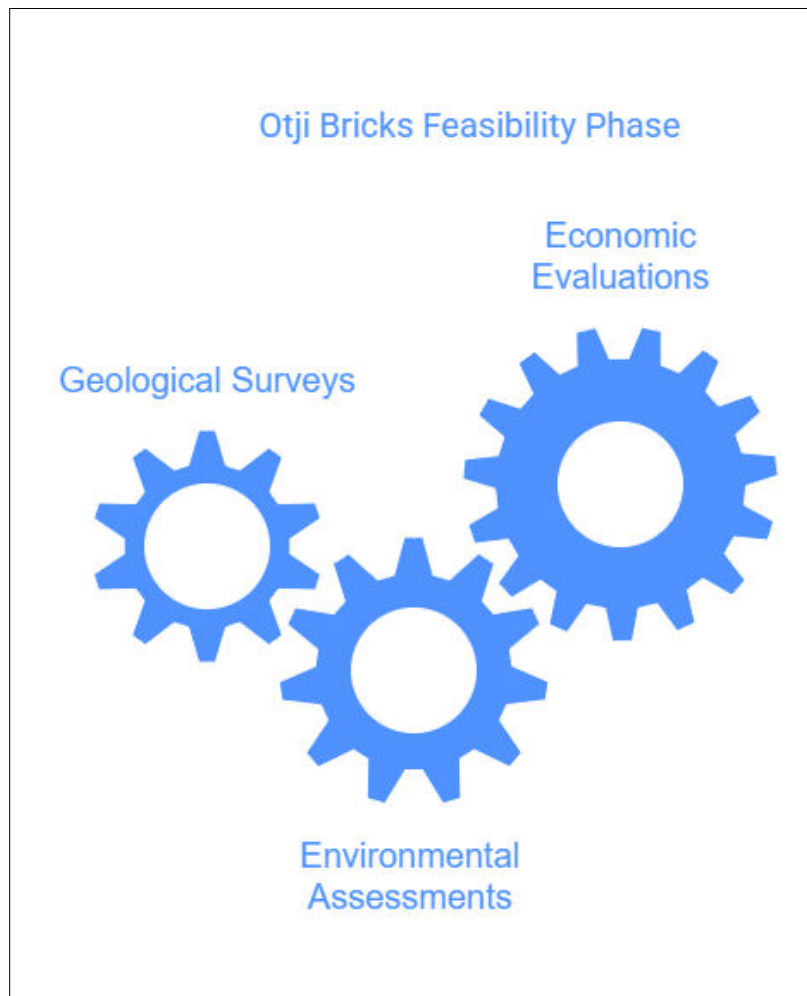


Figure 3: shows the schematic diagram of the project site feasibility phase, (Silas, 2025)

2.2 Sand Mining Phase

Once the feasibility is confirmed, the sand mining phase begins. This phase encompasses the actual extraction of sand from the river (open cast), including the necessary operational logistics and workforce management. No land clearing will be conducted during this phase. **Figure 4** below shows the schematic diagram of the project sand mining phase.

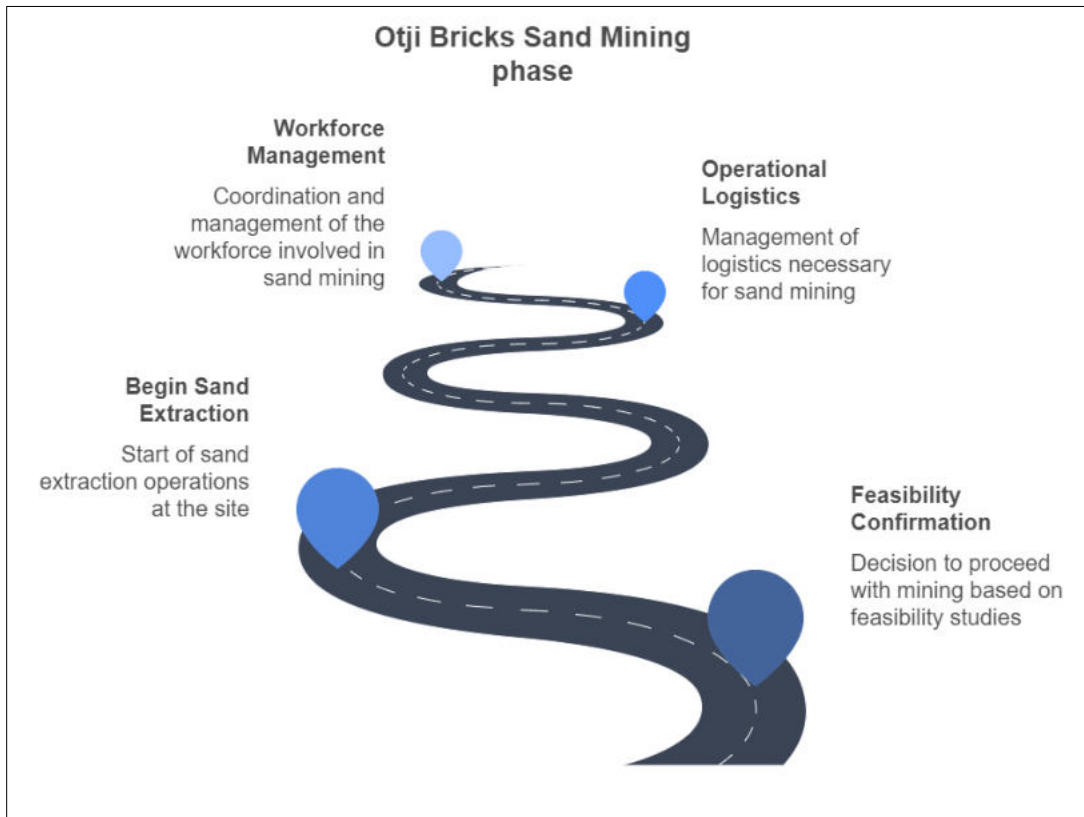


Figure 4: shows the schematic diagram of the project sand mining phase, (Silas, 2025)

During the sand mining phase, the Proponent plans to conduct sand mining at a medium size on the site, the sand will be extracted at a depth of 1.5 m from the borrow pit in the river bed. The scale and total volume of the proposed sand mining is $> 1000 \text{ m}^3$. Sand mining activities consists of different types of mining methods such as manual, semi-mechanized and mechanized. Based on site where the project will be undertaking, the Proponent intends to deploy the mechanized sand mining method. This method will involve site preparation, excavation of sands from the river, transporting (using tipper trucks and wheel loaders), processing and stockpiling the river sand from the river. In addition, this method also involves the environmental management ensuring sustainable mining on site. **Figure 4** below shows the schematic diagram of the mechanized methods for the project.

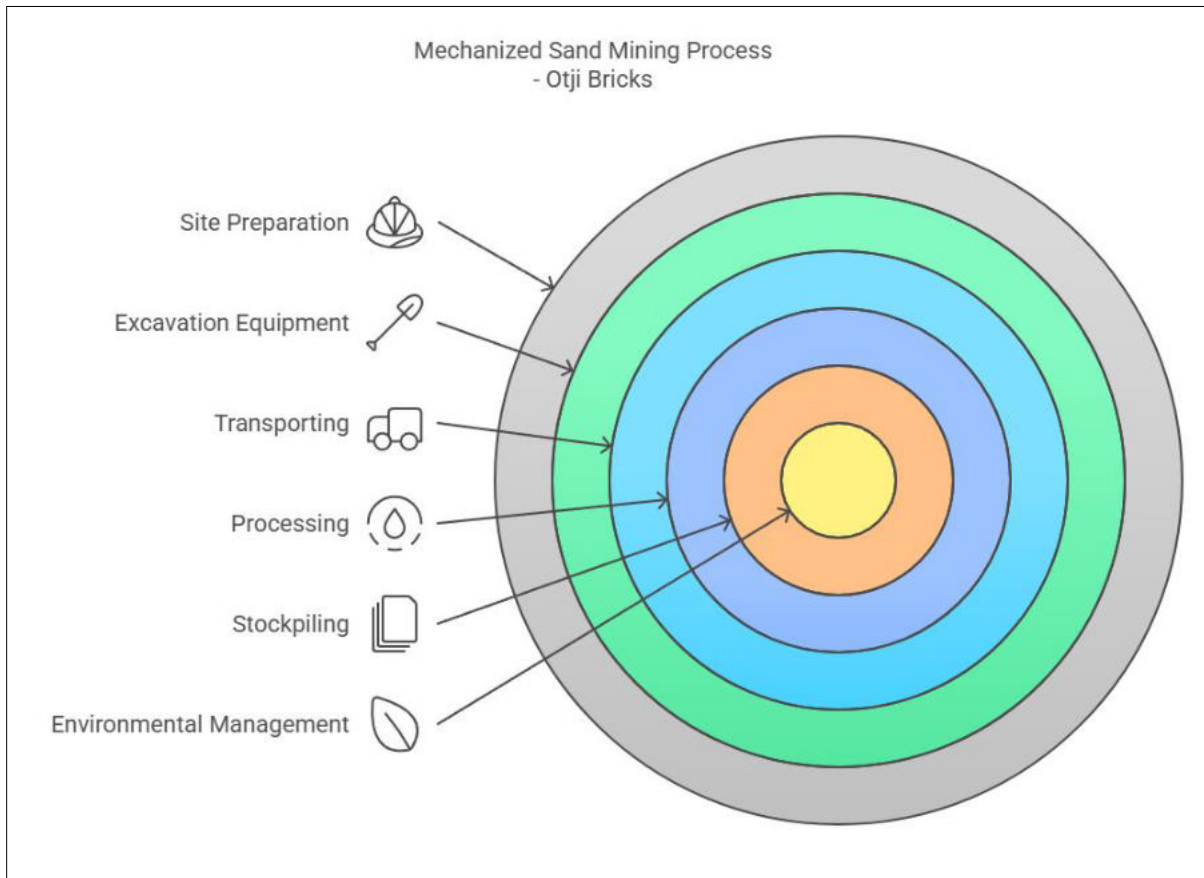


Figure 5: shows the schematic diagram of the project mechanized mining method, (Silas, 2025)

2.3 Site Residue & Rehabilitation Phase

After the mining sand mining activities are completed, this phase focuses on managing the leftover materials and restoring the site to its natural state. This include cleaning up the area, and ensuring that the environment is safe for future use. **Figure 6** below shows the schematic diagram of the project site residue & rehabilitation phase.

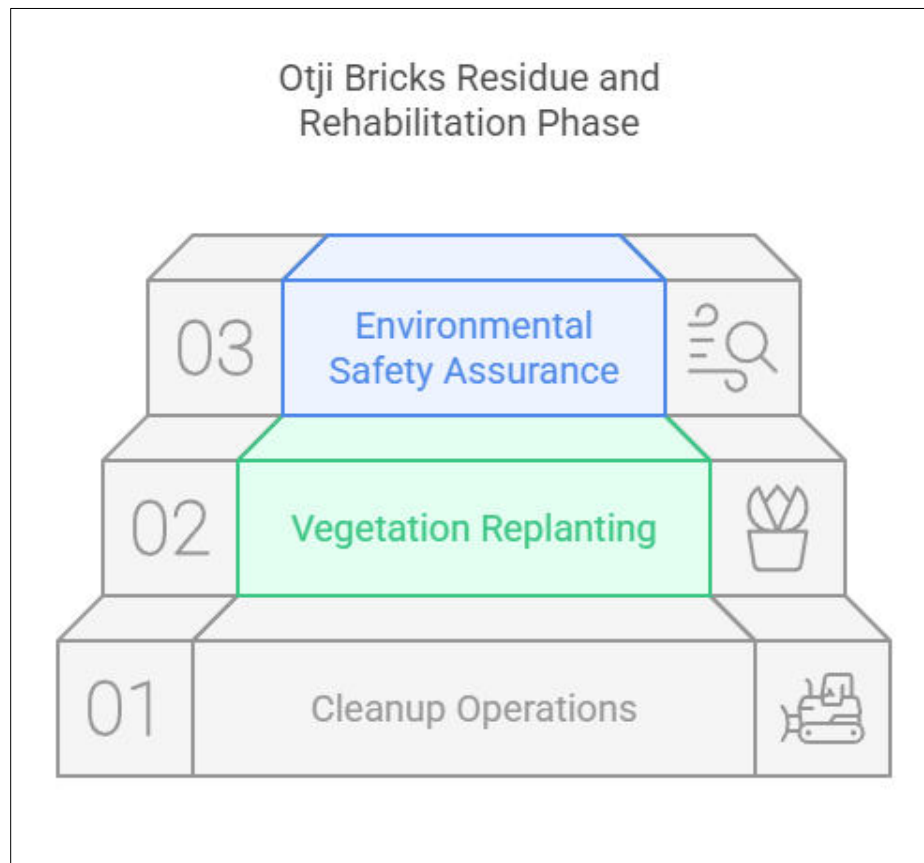


Figure 6: shows the schematic diagram of the project Site Residue & Rehabilitation phase, (Silas, 2025)

2.4 Other aspects of the proposed project include:

2.4.1 Accessibility to Site

The Proponent will make use of the already tracks which already exists within the farm, to access the project site. No new tracks will be created within the farm.

2.4.2 Water supply

No industrial water will be used during the sand mining phase, however, about 160 water may be used for human consumption per month.

2.4.3 Fuel

Diesel fuel will be used during the mining phase of the project. About 60 liters of diesel will be used for the loaders, and about 350 liters of diesel will be used for the Trucks.

2.4.4 Waste Management

The site will be equipped with secured waste bins for each waste type. Depending on the amount generated, waste will be sorted and collected on a weekly basis or monthly and taken to the Municipality landfill site in Otjiwarongo. There are existing water flushing toilets on the farm where the workers are housed.

2.4.5 Accommodation and Human Resources

The project will employ about 4 truck driver or operators, and they will be accommodated at the farm house.

2.4.6 Equipment

The Proponent intends to deploy three 20 cubic Tipper trucks, and one-wheel loader during the mining phase of the project.

3 PROJECT ALTERNATIVES

Alternatives are defined as: “*different means of meeting the general purpose and requirements of the activity*” (Environmental Management Act (2007) of Namibia (and its regulations (2012))). This chapter will highlight the different ways in which the project can be undertaken and to identify the alternative 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 the proposed development are discussed as follows:

3.1 Types of Alternatives Considered

3.1.1 The "No-go" Alternative

The "No-Go" alternative is the option of not proceeding with the activity, which typically implies a continuation of the status quo. Should the proposed sand mining plan be discontinued, there will be shortage of the sand which can cause a chain reaction of negative effects such as retrenchment, demand of sand will exceed supply and reduction in regional economic wealth.

3.1.2 Project Location

The project location was chosen by the Proponent as an alternative, based on the Quality of the Area (Suitability of the area for sand mining), accessibility, and synergy.

4 LEGAL FRAMEWORK: LEGISLATION, POLICIES AND GUIDELINES

This chapter outlines the regulatory framework applicable to the proposed project. **Table 1** provides a list of applicable and relevant framework for the project.

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

- *3.2 other forms of mining or extraction of any natural resources whether regulated by law or not.*

- 3.3 Resource extraction, manipulation, conservation, and related activities.

The legal obligations that are relevant to the sand mining and related activities are presented in **Table 1**.

Table 1: Applicable national and international legislations governing the proposed development

Legislation/Policy/ Guideline	Relevant Provisions	Implications for this project
Environmental Management Act EMA (No 7 of 2007)	Requires that projects with significant environmental impacts are subject to an environmental assessment process (Section 27). Details principles which are to guide all EAs.	The EMA and its regulations should inform and guide this EA process.
Environmental Impact Assessment (EIA) Regulations GN 28-30 (GG 4878)	Details requirements for public consultation within a given environmental assessment process (GN 30 S21). Details the requirements for what should be included in a Scoping Report (GN 30 S8) and an Assessment Report (GN 30 S15).	
The Constitution of the Republic of Namibia, 1990 as amended	The Constitution of the Republic of Namibia (1990 as amended) addresses matters relating to environmental protection and sustainable development. Article 91(c) defines the functions of the Ombudsman to include: <i>“...the duty to investigate complaints concerning the over-utilisation of living natural resources, the irrational exploitation of non-renewable resources, the degradation and destruction of ecosystems and failure to protect the beauty and character of Namibia...”</i> <i>Article 95(l) commits the state to actively promoting and maintaining the welfare of the people by adopting policies aimed at the:</i>	By implementing the environmental management plan, the establishment will be in conformant to the constitution in terms of environmental management and sustainability. Ecological sustainability will be main priority for the proposed development.

Legislation/Policy/ Guideline	Relevant Provisions	Implications for this project
	<i>"...Natural resources situated in the soil and on the subsoil, the internal waters, in the sea, in the continental shelf, and in the exclusive economic zone are property of the State."</i>	
The Regional Councils Act (No. 22 of 1992)	This Act 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 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 main objective of this Act is to initiate, supervise, manage and evaluate development.	The relevant Regional Councils are considered to be I&APs and must be consulted during the Environmental Assessment (EA) process. The project site falls under the Otjozondjupa Regional Council, therefore they should be consulted.
Water Act 54 of 1956	The Water Resources Management Act 11 of 2013 is presently without regulations; therefore, the Water Act No 54 of 1956 is still in force: - Prohibits the pollution of water and implements the principle that a person disposing of effluent or waste has a duty of care to prevent pollution (S3 (k)). - Provides for control and protection of groundwater (S66 (1), (d (ii)). Liability of clean-up costs after closure/abandonment of an activity (S3 (l)).	The protection (both quality and quantity/abstraction) of water resources should be a priority.
Water Resources Management Act (No 11 of 2013)	The Act provides for the management, protection, development, use and conservation of water resources; and provides for the regulation and monitoring of water services and to provide for incidental matters. The objects of this Act are to:	

Legislation/Policy/ Guideline	Relevant Provisions	Implications for this project
	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 in Section 66 - protection of aquifers, Subsection 1 (d) (iii) provide for preventing the contamination of the aquifer and water pollution control (Section 68).	
National Heritage Act No. 27 of 2004	To provide for the protection and conservation of places and objects of heritage significance and the registration of such places and objects; to establish a National Heritage Council; to establish a National Heritage Register; and to provide for incidental matters	The Proponent should ensure compliance with this Acts' requirements. The necessary management measures and related permitting requirements must be taken. This done by consulting with the National Heritage Council of Namibia.
The National Monuments Act (No. 28 of 1969)	The Act enables the proclamation of national monuments and protects archaeological sites.	
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.	Duty of care must be applied to soil conservation and management measures must be included in the EMP.
Public Health Act (No. 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."	The Proponent and all its employees should ensure compliance with the provisions of these legal instruments.
Health and Safety Regulations GN 156/1997 (GG 1617)	Details various requirements regarding health and safety of labourers.	

Legislation/Policy/ Guideline	Relevant Provisions	Implications for this project
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. Should the Proponent wish to undertake activities involving road transportation or access onto existing roads, the relevant permits will be required.	Mitigation measures should be provided for, if the roads and traffic impact cannot be avoided. The relevant permits must therefore be applied for.
Labour Act (No. 6 of 1992)	Ministry of Labour (MOL) is aimed at ensuring harmonious labour relations through promoting social justice, occupational health and safety and enhanced labour market services for the benefit of all Namibians. This ministry insures effective implementation of the Labour Act no. 6 of 1992.	The Proponent should ensure that the sand mining operation, do not compromise the safety and welfare of workers.

5 ENVIRONMENTAL BASELINE

The baseline information presented below has been sourced from different reports of studies conducted in Otjozondjupa Region (at large) as well those done for the Town of Otjiwarongo town. The rest of the information has then been obtained by the Environmental Consultant upon site visit conducted on 04 September 2024.

5.1 Biophysical Environment

5.1.1 Climate

The variation in the precipitation between the driest and wettest months is 128 mm. The highest amount of rainfall in the area is usually experienced in January. The month with the highest relative humidity is March (56 %). The month with the lowest relative humidity is September (16%). Namibia has a low humidity in general, and the lack of moisture in the air has a major impact on its climate by reducing cloud cover and rain increases the rate of evaporation (Mendelsohn, 2002).

Figure 7 below shows climate condition of the project area.

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature °C	23.5 °C	22.8 °C	21.9 °C	20.7 °C	18.6 °C	15.7 °C	15.6 °C	18.7 °C	22.4 °C	24.7 °C	24.5 °C	24.2 °C
(°F)	(74.3) °F	(73) °F	(71.5) °F	(69.2) °F	(65.5) °F	(60.3) °F	(60.1) °F	(65.6) °F	(72.3) °F	(76.5) °F	(76.1) °F	(75.5) °F
Min. Temperature °C (°F)	17.6 °C (63.7) °F	17.3 °C (63.1) °F	16.8 °C (62.3) °F	15.1 °C (59.1) °F	12.3 °C (54.1) °F	9.1 °C (48.4) °F	8.9 °C (47.9) °F	11 °C (51.7) °F	14.3 °C (57.7) °F	17 °C (62.6) °F	17.1 °C (62.8) °F	17.3 °C (63.2) °F
Max. Temperature °C	29.9 °C	28.9 °C	27.8 °C	26.9 °C	25.6 °C	23.4 °C	23.4 °C	26.9 °C	30.8 °C	32.6 °C	32 °C	31.3 °C
(°F)	(85.9) °F	(84) °F	(82.1) °F	(80.4) °F	(78) °F	(74.1) °F	(74) °F	(80.5) °F	(87.4) °F	(90.6) °F	(89.6) °F	(88.3) °F
Precipitation / Rainfall	128	118	90	31	2	0	0	0	5	20	45	84
mm (in)	(5)	(4)	(3)	(1)	(0)	(0)	(0)	(0)	(0)	(0)	(1)	(3)
Humidity(%)	49%	54%	56%	47%	34%	30%	27%	20%	16%	20%	29%	37%
Rainy days (d)	11	10	10	5	0	0	0	0	1	3	6	8
avg. Sun hours (hours)	10.6	9.9	9.4	9.7	10.0	9.8	9.9	10.3	10.8	11.2	11.5	11.4

Figure 7: (Otjiwarongo climate: Average Temperature, weather by month, Otjiwarongo weather averages - Climate-Data.org)

The wind rose for Otjiwarongo area (**Figure 8**) shows, how many hours per year the wind blows from the indicated direction. In the area of Otjiwarongo, wind are more dominant in the east direction reaching speeds of 28 km/h. The prevailing wind direction or occurrence in the site area is said to be in the east, and this may be a major concern in terms of dust when in full operation (excavating).

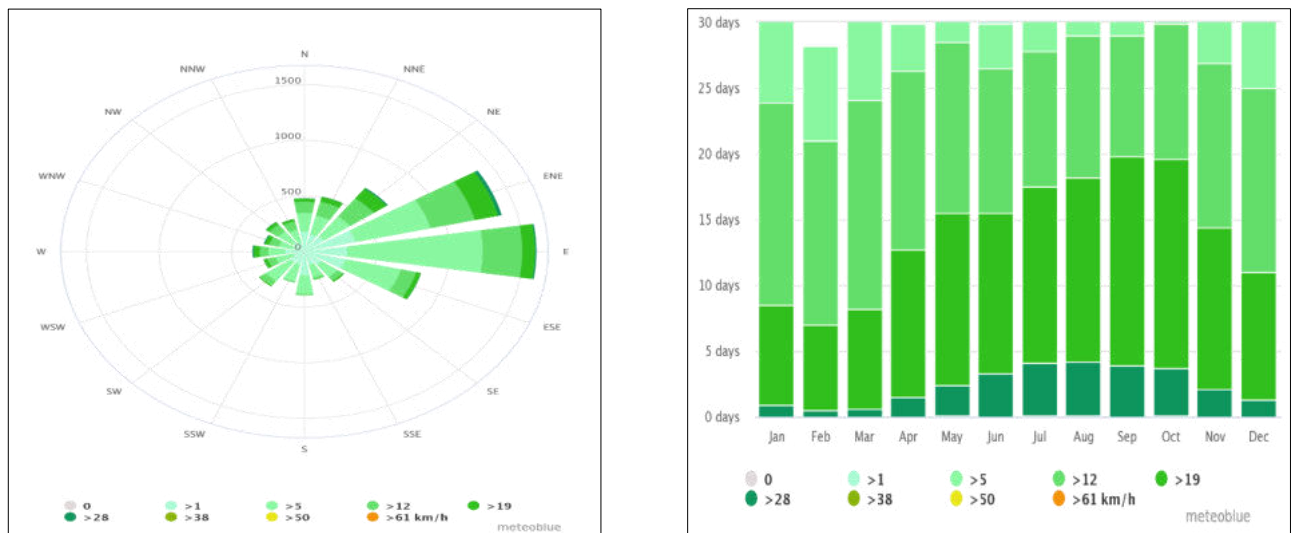


Figure 8: wind direction and wind speed (Simulated historical climate & weather data for Otjiwarongo - meteoblue)

5.1.3 Topography

The project site is located within the Central Western Plain which consist of areas of dissection and erosional cutbacks. The project site area is located between approximately 1,216 – 1,453 meters above sea level. **Figures 9** shows the elevation map of the project area.

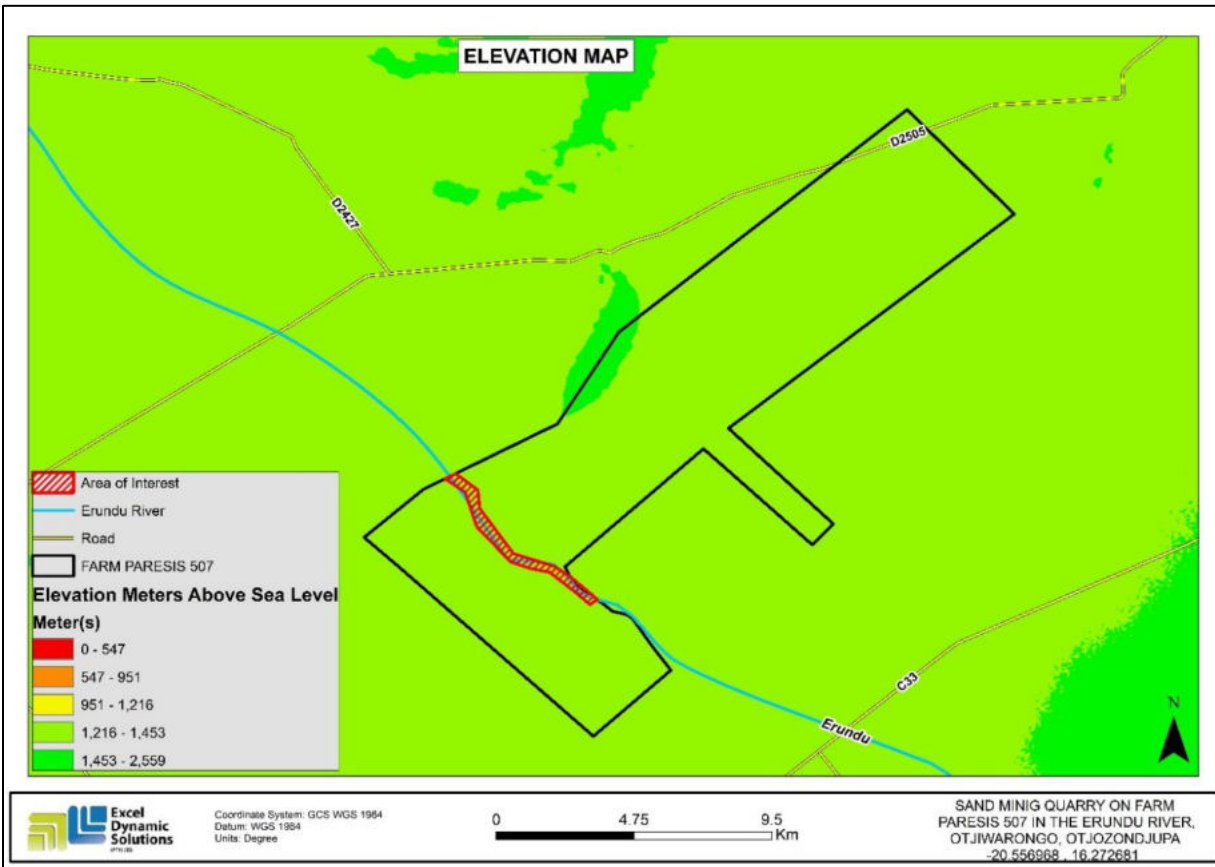


Figure 9: Elevation map of the project site

5.1.4 Soils

The project site lies within the chromic Cambisols soils. The Cambisols soils are young soils that show the first signs of differentiating into distinct horizons. They form in recently deposited or exposed colluvial, alluvial and aeolian parent materials, or where aridity or low temperatures slow down processes of soil formation. Cambisols are found in a variety of climates, but are particularly prevalent in arid and semi-arid areas, (Mondelsohn,2003). **Figure 10** below shows the soil map for the project, and **Figure 11** shows the picture representation of the Cambisols soils which was captured during the site visit which was conducted on 04 September 2024.

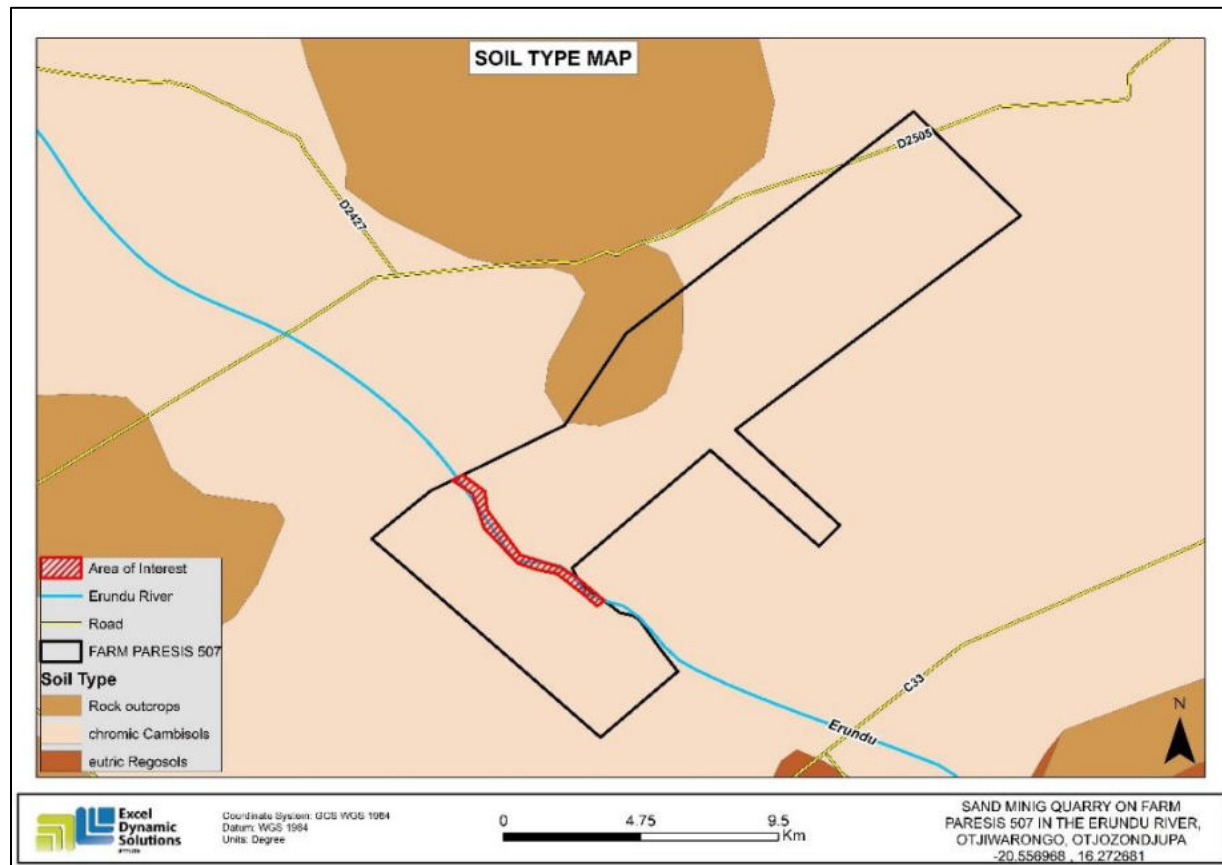


Figure 10: Soils map of the project site



Figure 11: Top soil in the riverbed

5.2 Geology

Geologically, the project site area falls within the swakop group of the Damara supergroup and gariiep complex (Speiser, 2012). The characteristic feature of the zone is the basement zone structures, which elongates in a north-eastern direction and possesses numerous post-tectonic granite plutons. A series of regional scale antiforms and synforms which trend in a northeast direction, dominates the project area. The Damara Sequence is dominated by the Swakop and Nossib groups, with the Swakop group being the dominated type within the area of the project. The Chuos and Karibib formations of the Swakop group, creating a composition of mixture and pebbly quartzite as well as marble and quartz-biotite schist (Speiser, 2012). **Figure 12** below shows the general map of geology for the project.

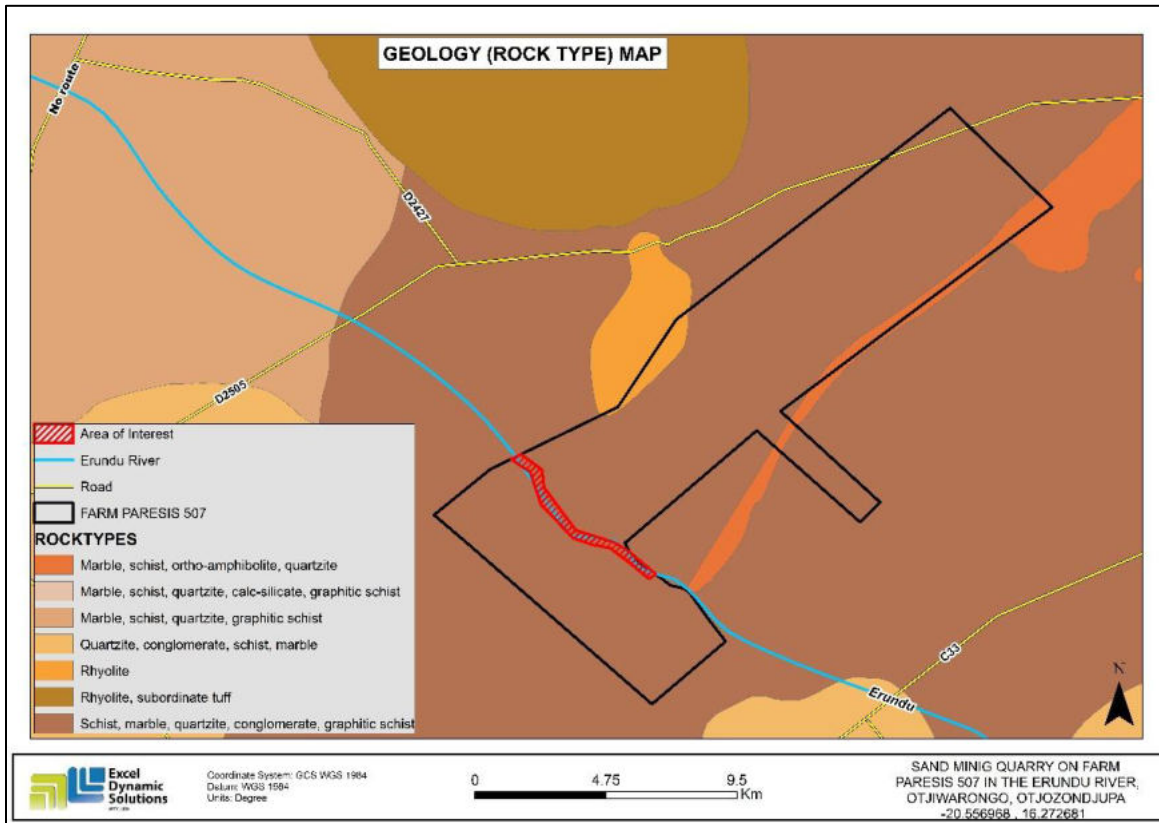


Figure 12: Geology map for the project site

5.3 Hydrology

The project area is north-westwards by the Erundu River and its tributaries. The Erundu River is part of the stream network that forms the upper catchment for the ephemeral Ugab River (**Figure 13**), which is one of the few ephemeral rivers such as, Hoarusib, Khumib, Hoanib, Huab, Koigab and Uniab, which reach the Atlantic Ocean through regions of increasing aridity (Jacobson, 2012).

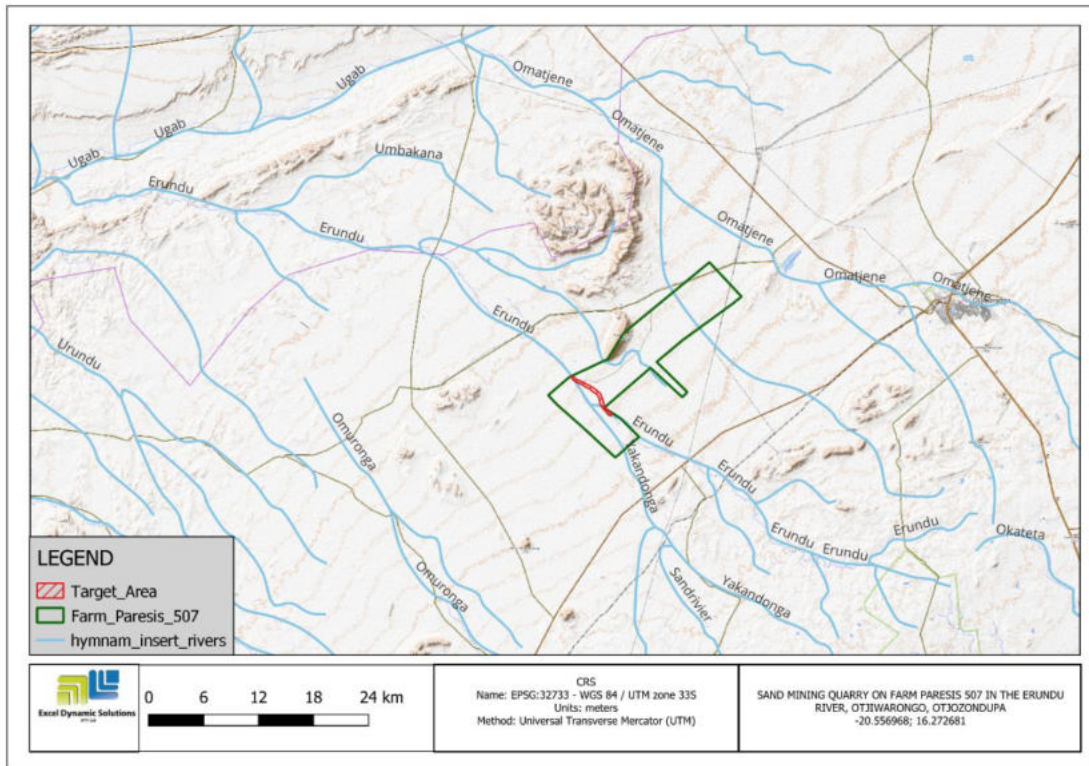


Figure 13: Drainage network for the farm paresis 507 area

To the east and southeast of the study area is a drainage divide that separates westward flowing Ugab catchment from the south-eastward flowing towards the Omatako River catchment. The divide is part of the regional water divide, that coincides with the Great Escarpment of southern Africa.

The river flow dynamics in the area are strongly controlled by rainfall events, causing fast discharge peaks with rapid recessions. This reduces base flow to the river discharges during dry periods, hence all rivers in the area are ephemeral. Moreover, river discharges represent a quite low fraction of the water precipitated into the catchment, which indicates that most of rainfall evaporates or infiltrates. In summary, the ephemeral rivers in the area show the following characteristics:

1. Only rainfall run-off contributes to their flow – no baseflow
2. Runoff reaches the ocean only under exceptionally high rainfall events

3. Due to steep slopes in up gradient areas river discharges transport high volumes of sediments, which get sorted in gently sloping areas such as the target area on Erundu River.

5.4 Hydrogeology

As described under geology section, the project area is underlain by basement rocks belonging to the Damara Group. Due to various degrees of metamorphism, the basement rocks do possess primary porosity, and hence groundwater in the project area occurs in geologic structures, such as faults that resulted from tectonic processes and evidenced by the existence of the springs in the region. Due to the aridity of the region, all the springs in the area are ephemeral and hence do not sustain river flows during dry seasons. Apart from the basement fractured aquifers groundwater also occurs in the alluvial deposits along the flow channels of the current rivers (**Figure 14**) as well as in the paleo-channels that have been incised into the basement by ancient river systems, and where alluvial in-fill sediments were later deposited.

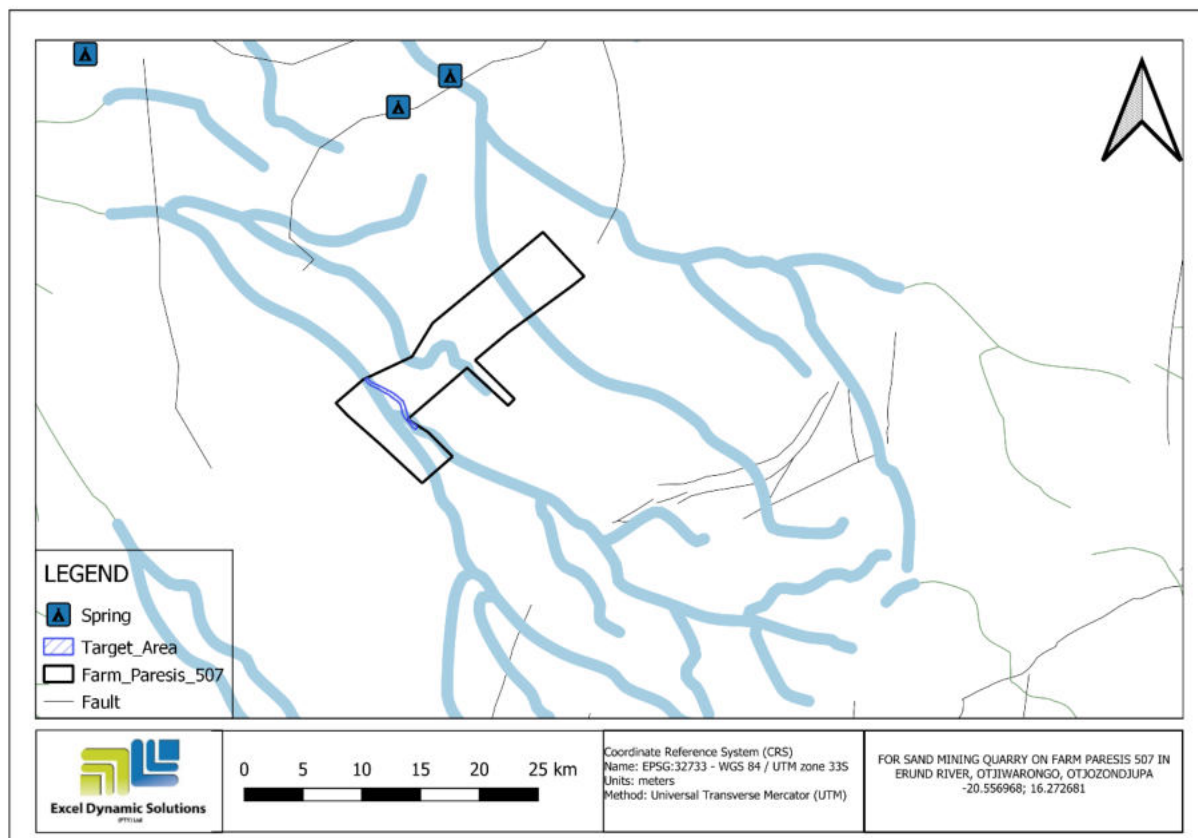


Figure 14: Geological structures hosting groundwater in the project area

The storage capacity of alluvial aquifers depends on the nature of the sediments (specific yield) and thickness. The Erundu River and other larger rivers (such as the Ugab river), to the northwest of the study area have greater sediment thickness (in excess of 15 m) in the productive sections. Bedrock highs usually dissect the sediment fill into 'compartments' that are replenished by vertical leakage from surface flows.

Typically, groundwater flow rates in the alluvium are slow under normal circumstances, however, in the study area the elevations drop rapidly west of the Great Escarpment (Goudie and Viles, 2015), resulting in steep gradients in the headwaters. The boreholes in the proximity of the target area and within farm Paresis No. 507 have been drilled to average depth of 72.75 mbgl and bearing yields ranging between 2 to 18m³/h (**Table 2**).

Table 2: Borehole information on Farm Paresis No. 507

WW No.	Latitude	Longitude	Elevation	Drill Date	Yield	RWL	Depth	Diameter
WW12709	20.4464 ⁻	16.4192	1440	24/05/1905	18			
WW17790	20.4712 ⁻	16.3547	1226	01/01/1974	10.9		61	
80547	20.4912 ⁻	16.3296	1340					
WW9446	20.4464 ⁻	16.4192	1440	22/11/1971	11.7	470	94	200
78568	20.5425 ⁻	16.2653	1335	01/01/1921	4.3	30	49	150
78569	20.5218 ⁻	16.3425	1340	01/01/1955	2	49	87	150
78570	20.5741 ⁻	16.3027	1390					
WW24021	20.5865 ⁻	16.3197	1341	01/03/1980				

The boreholes have been drilled into different aquifer types, and hence there is no relationship between depths and borehole yields. Higher yields have been encountered at shallower depths in alluvial (and paleo-channel) aquifers and lower yields in deeper fractured basement aquifers (**Figure 15**).

These are yields sufficient for both domestic, stock watering and small-scale industrial and irrigation activities. In essence, the yields are sufficient to support developments at small scale basis. To improve borehole yields and drilling success rate, geophysical approach to drill site

identification should be prioritize to target both the alluvial aquifers and fractured basement aquifers of the area.

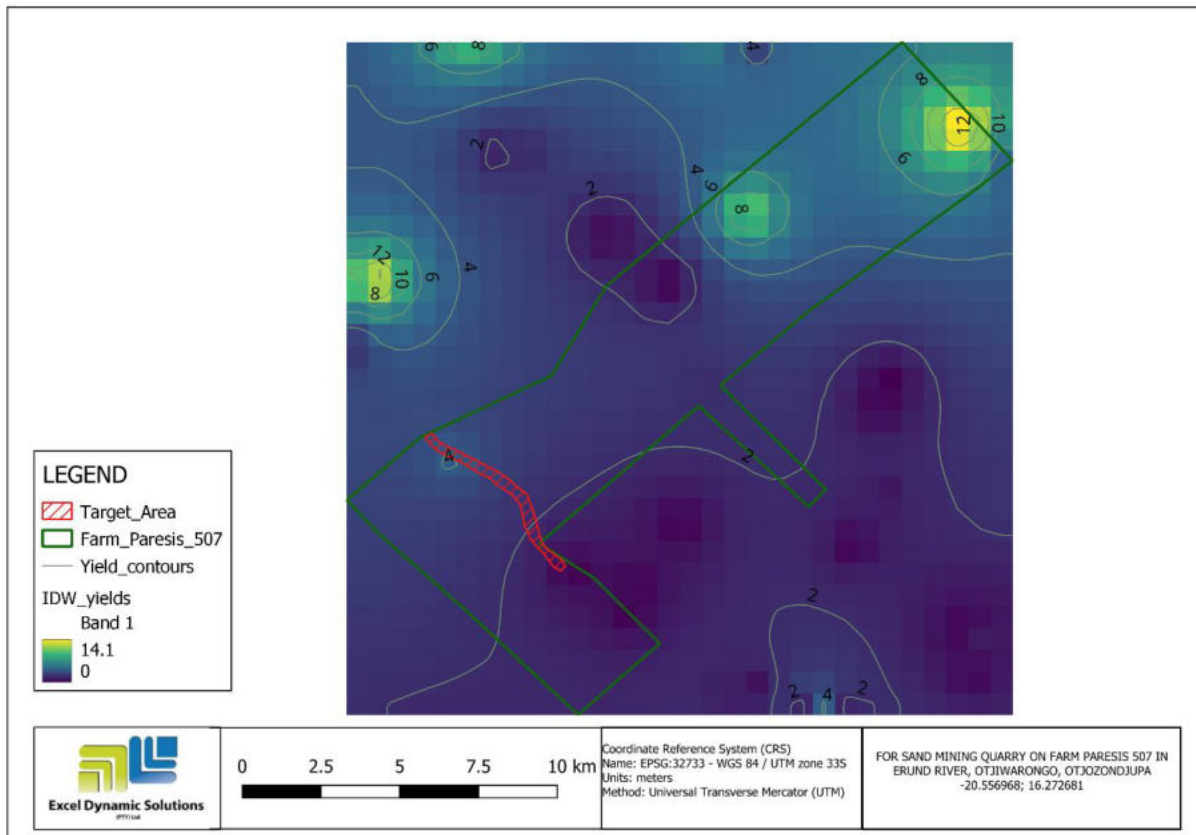


Figure 15: Yield contour lines for the project area

The borehole yields were observed to be varying within short distances, which indicates that the yields were more dependent on secondary structures in the bedrock than on the primary porosity in surficial deposits and alluvial sediments. Very few boreholes have been archived in the national database, several of which have been entered with questionable yield values. Most of the boreholes have not been test pumped and hence the yields indicated as “initial yields” are merely blow yields estimated during borehole development.

Lower depths to groundwater are associated with alluvial and paleo-channel aquifers and higher depths to groundwater are associated with deeper fractured basement aquifers (**Figure 16**). There is also a correlation between depths to groundwater and borehole yields in that the

boreholes in alluvial and/or in paleo-channel aquifers, with lower depth to groundwater are associated with higher yields.

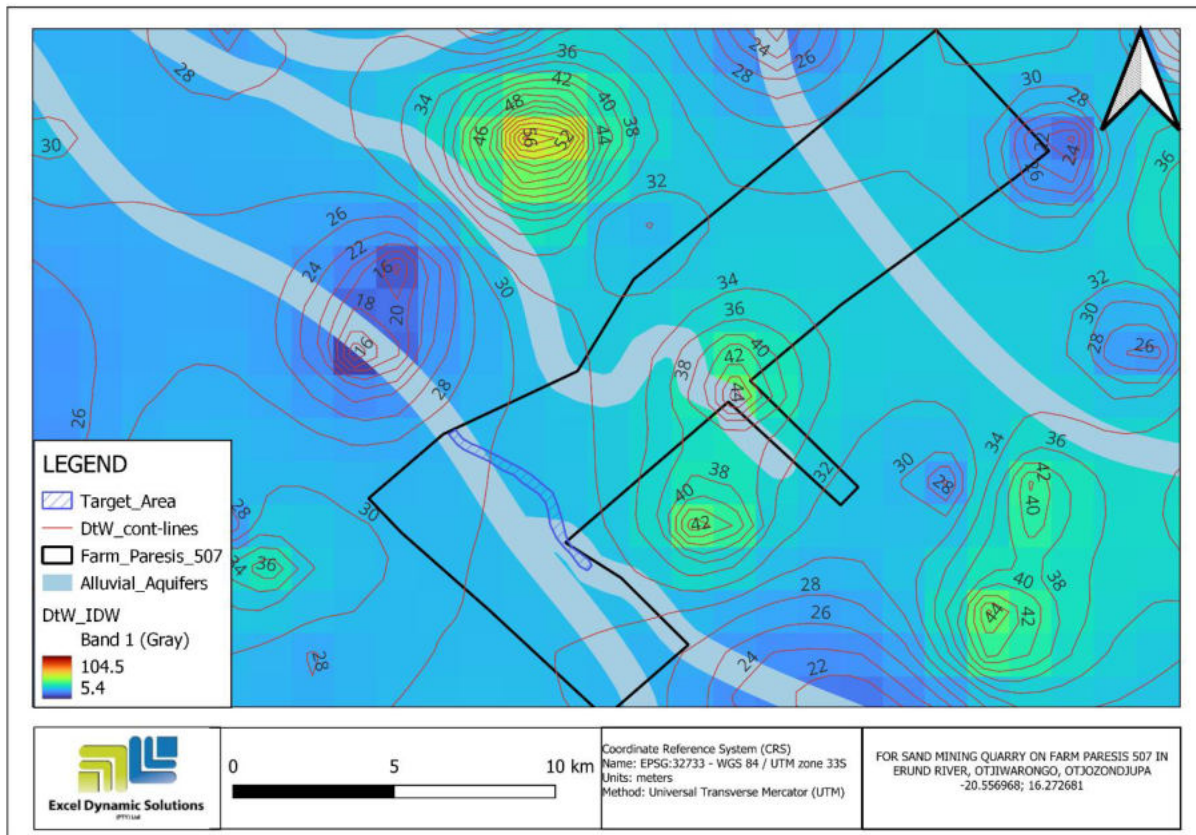


Figure 16: Depth to groundwater in and around the project area

5.5 Recharge mechanisms

The rivers have incised valleys into impervious Damara basement rocks, and deposited the sediments along flow channels, forming alluvial aquifers of variable thicknesses. Recharge into the alluvial aquifers occurs only after rainfall events with capacity to cause runoff and river discharges. However, smaller rivers with thin alluvial sediment deposits do not form viable aquifers but function as transitional storage (perched aquifers) that are only important for the recharge of underlying fractured aquifers in the basement (Caballero et al., 2023).

Recharge is infiltration of water from the ground surface (such as river) through the unsaturated zone to the zone of saturation, causing an increase in aquifer storage. The interaction between

the river and the aquifer is based on the difference between the elevation of the river stage and the elevation of the groundwater level in the aquifer (Barlow and Leaky, 2012; Healy et al., 2007). In this arid region rivers are mostly dry with ephemeral flows occurring only after exceptionally high rainfall events with very long return periods. The ephemeral flows cause occasional recharge events, during which water infiltrates vertically through a thick unsaturated zone separating the river stage and the aquifer (**Figure 17**).

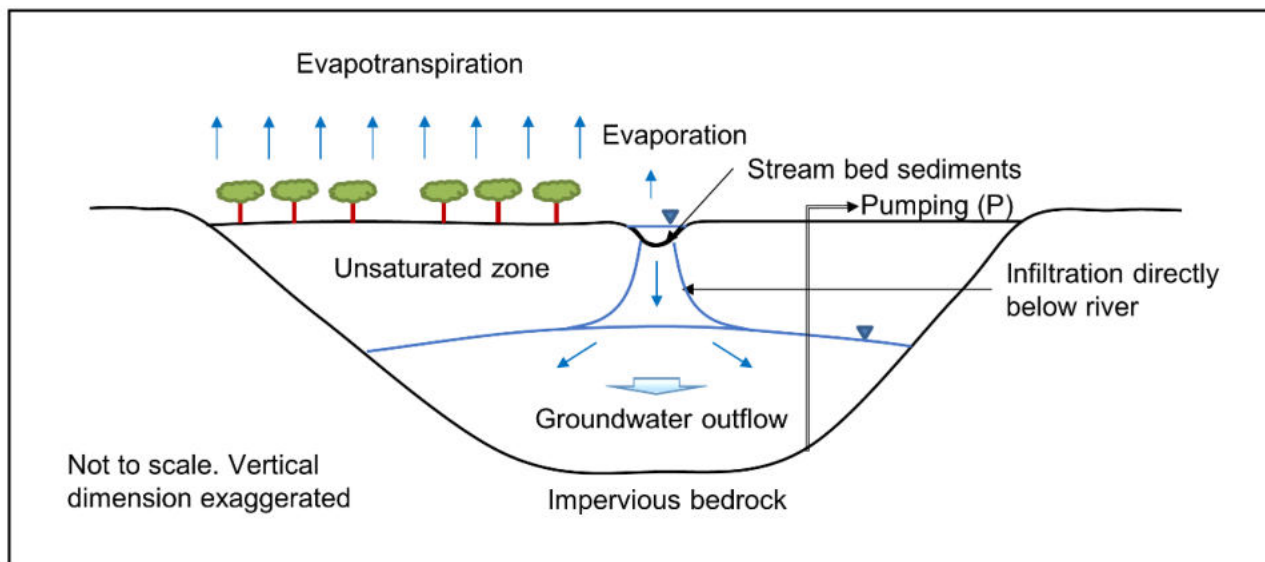


Figure 17: Schematic cross-section through stream and alluvial aquifer during ephemeral flow (Healy et al., 2007)

The project area is characterized locally by low relief, with topographic slopes ranging between 0.25 in low-lying areas and 0.5 down from the hill tops. The topographic relief was observed using a profile line stretching from point A to point B in **figure 18**.

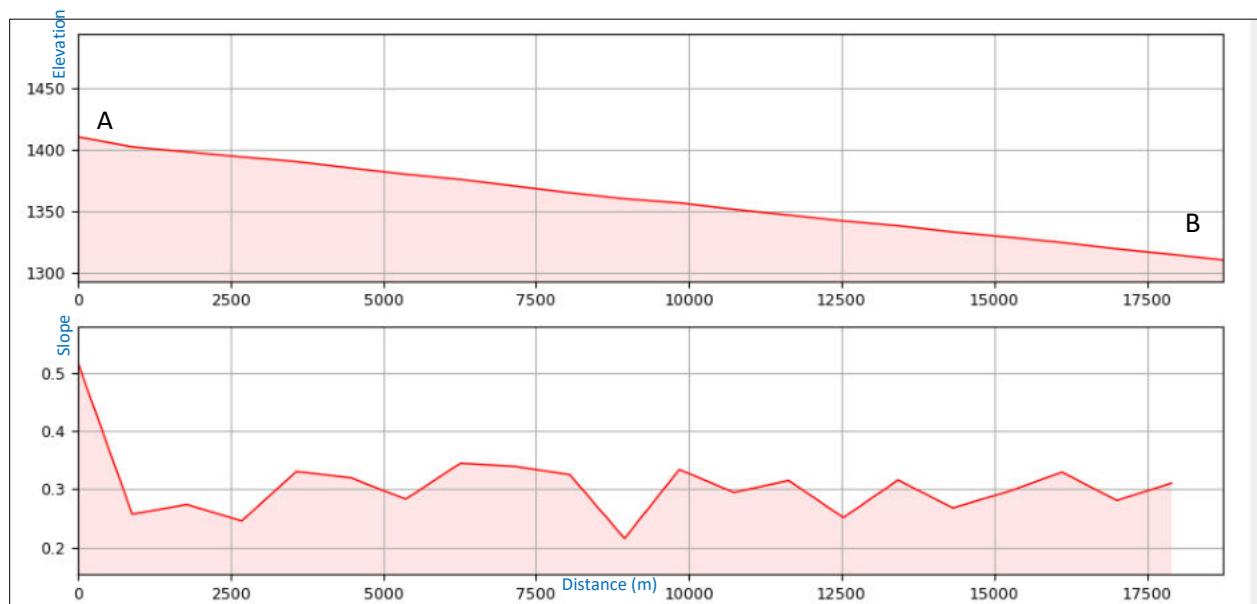


Figure 18: slope of ground surface towards the coastline

Although the topographic slopes are low, the aquifer recharge has been estimated at 0 mm/a for basement outcrops areas, <0.5 mm/a for the general area covered by Kalahari sand, 1.5 mm/a for the main river channels, and 5 m/a (Christelis and Struckmeier, 2001) for the highly fractured basement (**Figure 19**). Where slopes are steeper the recharge is reduced especially near the headwaters.

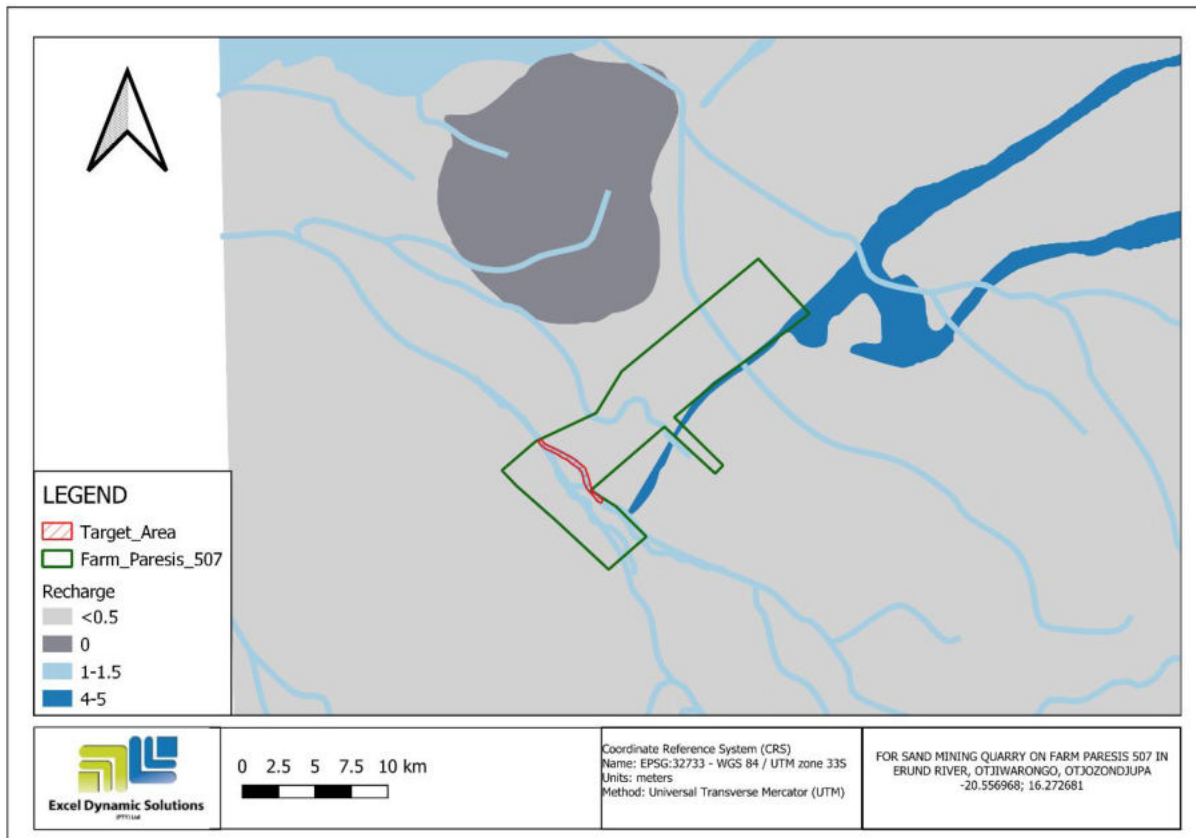


Figure 19: Recharge rates for farm Paresis 507 area

The silt content of the floodwaters, hydraulic conductivity of the alluvial sediments, topographic relief, and climate change are the main factors that determine the recharge to the aquifer (Sarma and Xu, 2016). Where fine river bed sediments occur at the base of the river cross-section, infiltration rates are often low.

5.6 Groundwater Water quality

The water chemistry data water extracted from the GROWAS database indicates that groundwater within and around the project area fall under all categories/types of the Namibian standards for drinking water. Type A is excellent quality water, Type B is good quality water, Type C is low-risk water and Type D is high-risk or water (**Table 3**).

The Type D, C, and B water was due to the elevated concentrations of Total Dissolved Solids (TDS), which is boreholes drilled into the fractured basement aquifers while Type A water is associated with boreholes drilled into the alluvial deposits along the Erundu River (**Figure 20**).

Table 3: Drinking water standard in Namibia

	Classification	Limits				
		EC	TDS *	Sulphate	Nitrate – N	Fluoride
		[mS/m]	[mg/l]	[mg/l]	[mg/l]	[mg/l]
Type A	Excellent quality water	150	1,000	200	10	1.5
Type B	Good quality water	300	2,000	600	20	2
Type C	Low risk water	400	2,600	1,200	40	3
Type D	High risk or water unsuitable for human consumption	> 400	> 2,600	> 1,200	> 40	> 3.0
Source: DWA, 1991: Guidelines for the evaluation of drinking water for human consumption						
with reference to the chemical, physical and bacteriological quality, Windhoek.						
(* Calculated from EC with multiplication factor 6.6)						
Salinity ranges	Classification	TDS [mg/l]	EC [mS/m]			
	fresh:	< 1,000	< 150			
	brackish:	1,000 to 10,000	150 to 1,500			
	saline:	> 10,000	> 1,500			

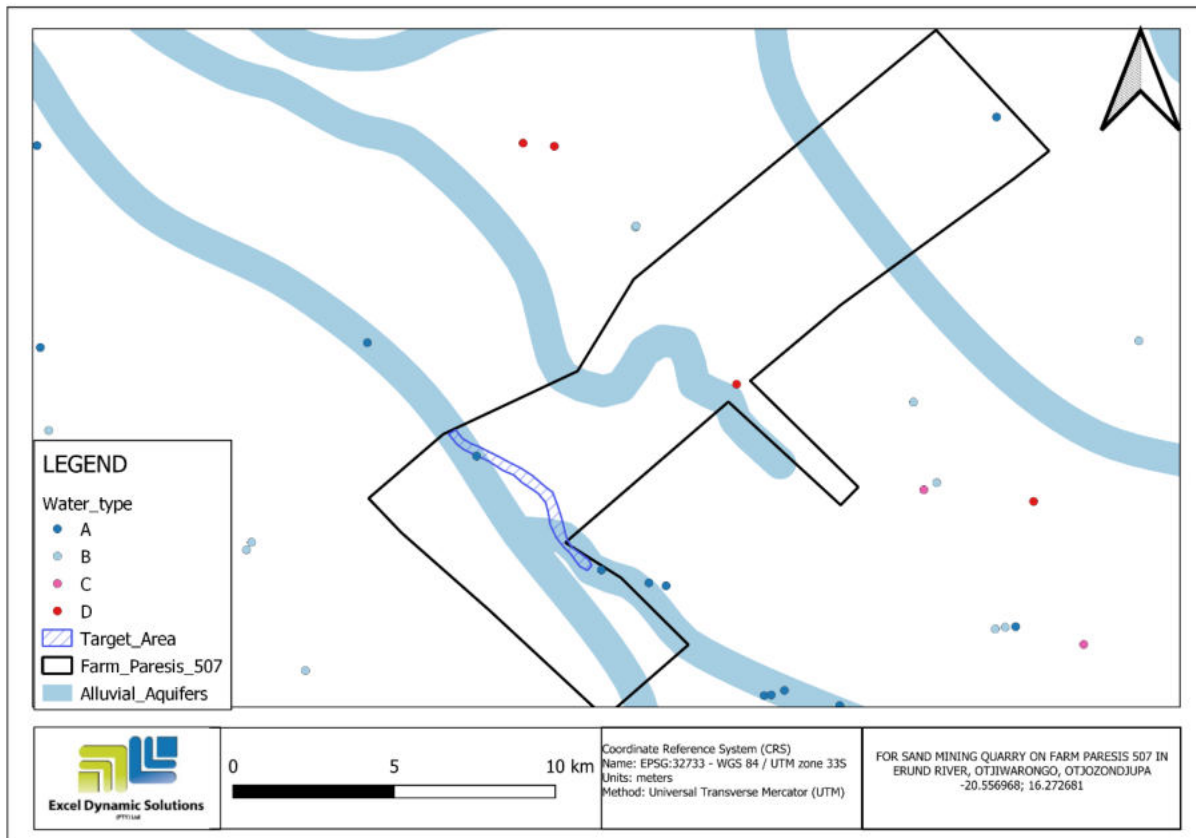
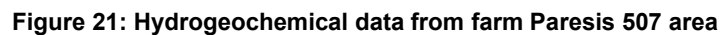


Figure 20: Hydrogeochemical data from coastal aquifers

Due to the contrast in the data as observed in **Figure 20**, the data was divided into alluvial (boreholes drilled into alluvial deposits) and non-Alluvium (boreholes drilled into fractured basement aquifer) datasets (**Figure 21**). At least 15% of the samples were alluvium and the remaining 85% were non-alluvium.



Groundwater potential in the area is relatively of low to moderate according to the hydrogeological map of Namibia, which is a delineation of mapped rock bodies and their potential to hold groundwater across the country. The potential of any aquifer to sustain the stress of pumping depends on but is not limited to the aspects described above such as geology, hydrology/hydrogeology, and water quality. The sustainable yield of the aquifer must be considerably less than recharge and aquifer storage (water the aquifer can intrinsically provide).

As it depends largely on specific hydrodynamics of the aquifer, which are variable in time and space, there is no standard percentage of recharge that should be considered as a safe or sustainable aquifer yield (Gutierrez, A., et al., 2023).

The groundwater potential was extracted from the hydrogeological map of Namibia at 1:1 000 000 scale and revised based on 1:250 000 scale geology of Namibia map to produce a revised local groundwater potential map for the project area (**Figure 22**). The revised groundwater potential can then be used to evaluate various hydrogeological aspects which are beyond the scope of the current study, such as the potential yields of different lithologies and safe yields of aquifers.

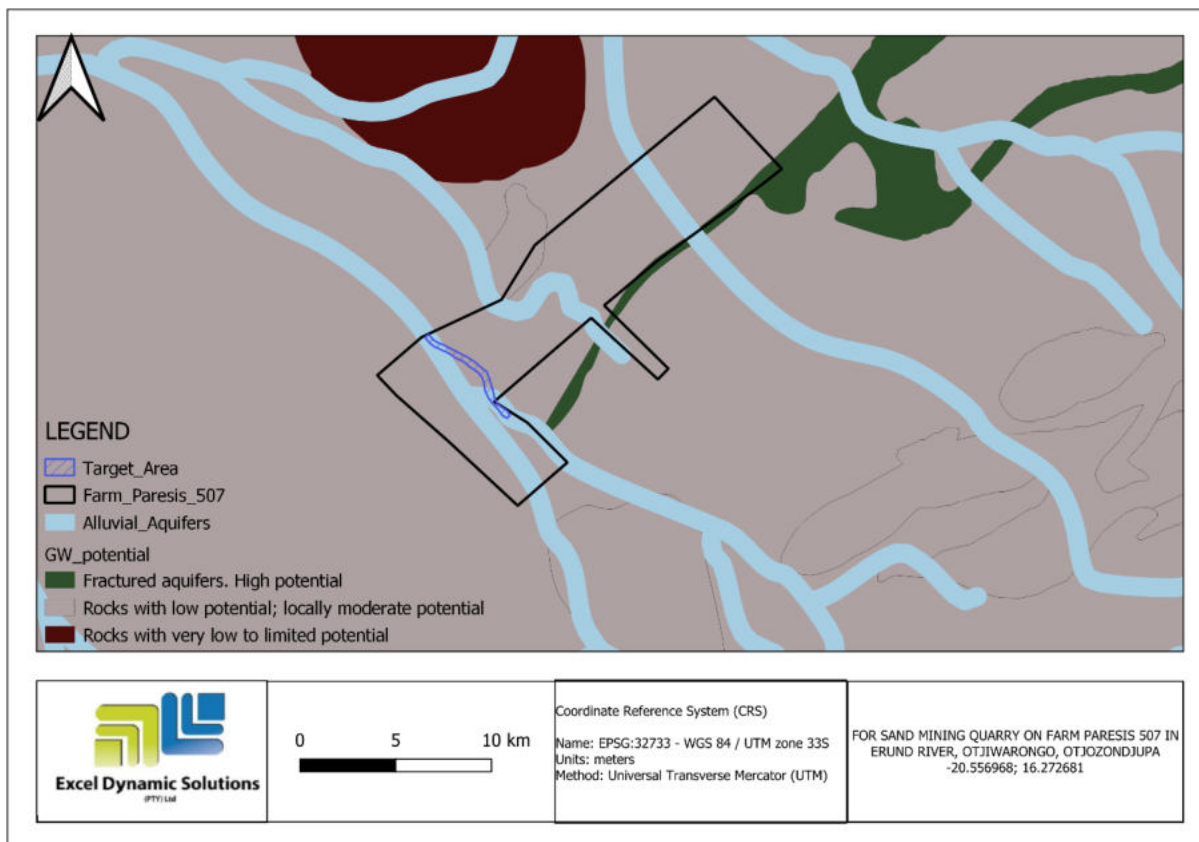


Figure 22: Intrinsic aquifer potential based on geology at 1:250 000 scale

The alluvial aquifers fall under the category of moderate groundwater potential for alluvial aquifers, whilst for fractured basement aquifers a stretch of high groundwater potential extends

into the area from the northeast- and most of the country rock body is of low potential, although when appropriate geophysical techniques are applied for borehole siting it can be of moderate potential locally. The rest of the basement outcrops are of very low to limited groundwater potential, actually constituting aquicludes and aquitards.

5.8 Fauna and Flora

The project site is located within farm Paresis, in terms of flora the project site lies within the tree and shrubs savannah, and is widely covered by camel thorn. The faunal observed on site was different types of bird species. Wildlife animals such as springbok, graph, antelope, warthogs, wilder beast, jackals, rabbits and kudus are mainly found on site; domestic animals such as goats, sheep and cattle are found around the site.

5.9 Sand mining No-go zone area and Alternative mining area (zone)

The Namibian sand mining guidelines, outlines that sand mining shall not be extracted within 200 to 500m from any infrastructures, and sand mining shall also not be allowed to be extracted where erosion may occur. It is on this basis that no sand mining activities must be conducted within 500m of the infrastructure which is indicated in **figure 23**. If sand mining occurs within this radius, the mining activities will alter the river channel morphology which will directly results in erosion of the riverbanks, channel incision, channel instability and infrastructural damages, which will affect the natural flow of the water into the river and causes the river flow directions to change. The figure below shows the sand mining no-go zone area, and the alternative sand mining area which the Proponent may conduct mining activities through employing the Namibia sand mining guideline:

- Sand mining activities should be concentrated or localized to an area rather than spread out over many areas. This localization of sand extraction will minimize the areas of disturbance.
- Mining should be conducted systematically from one side along the length of the mining area.
- Sand may be extracted across the entire channel during the dry seasons; however, the stream must not be diverted to form inactive channel.

- Demarcation of sand mining areas with pillars and geo-referencing should be done prior to start of mining.
- A safe distance between the sand mining sites must be maintained and shall depend on the replenishment rate of the river.
- The sand mining depth should be restricted to 3m and distance from the bank should be 20m or 10 percent of the river width whichever less.

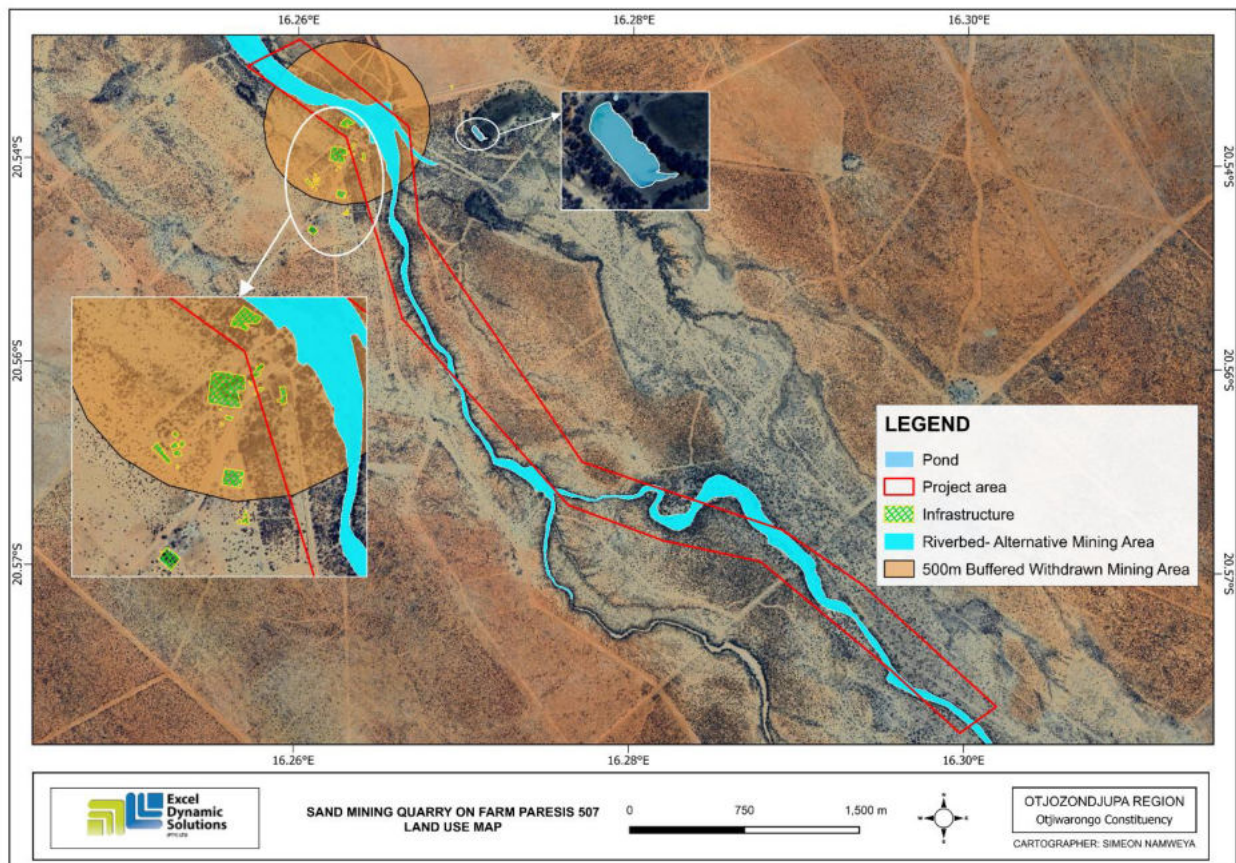


Figure 23: Sand mining No-go zone area and alternative sand mining areas

5.10 Socio-Economic Condition of Otjiwarongo

The population of otjiwarongo recorded in the National Census in 2011 was 32 144 (16 425 females and 15 719 males) with population density of 5.015 Km per square meter. **Figure 24** shows the demographic condition for the project area.

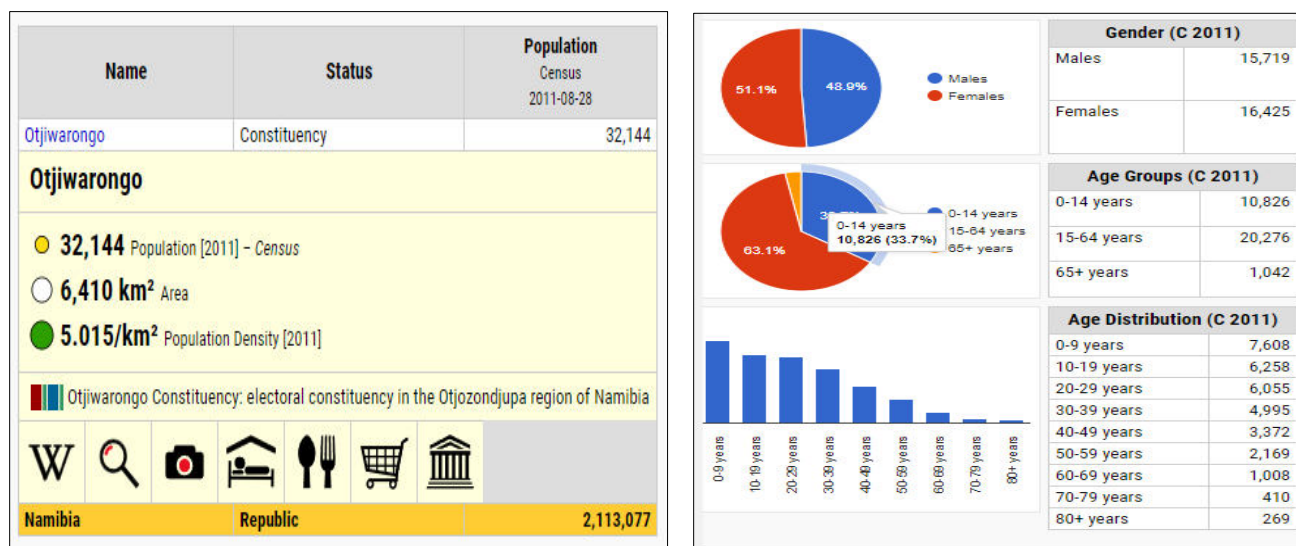


Figure 24: Otjiwarongo Population: (Otjiwarongo (Constituency, Namibia) - Population Statistics, Charts, Map and Location (citypopulation.de))

5.9.1 Economic Development

The economy of the Otjozondjupa Region depends on three components, namely; mining, farming, agriculture and tourism. The mining sector in the Otjozondjupa Region has been characterized by the establishment of large scale mines that provide employment for many Otjiwarongo residents, the likes of B2 gold, Ohorongo cement and cheetah cement. The Region accommodates the mining of commodities such as gold, marble, semi-precious stones. The farming industry is the one of the significant sector that contributed directly to the Gross Domestic Product (GDP). The region provides good grazing land for cattle farming as a result, farming for cattle sale commercially and communally it became a source of income for most residing residents in the region. The Otjozondjupa Region offers some of the most spectacular and popular



tourist destinations as well as a variety eco-, wildlife, cultural and adventure tourism opportunities (Otjozondjupa Regional Council, 2013).

5.9.2 Services Infrastructure

The Otjozondjupa Region has good services infrastructures such as tarred and good-graded gravel road links, a railway line, health centers, educational institutions, malls and shops (in towns and settlements), fuel stations and hospitality facilities, etc. These services are well-placed within the respective areas/locations of the Otjiwarongo Town as well.

5.11 Surrounding Land Uses

The site falls within Commercial farms as shown in **Figure 25**. The Proponent is required to secure a signed agreement from the affected farm owners for operational purposes.

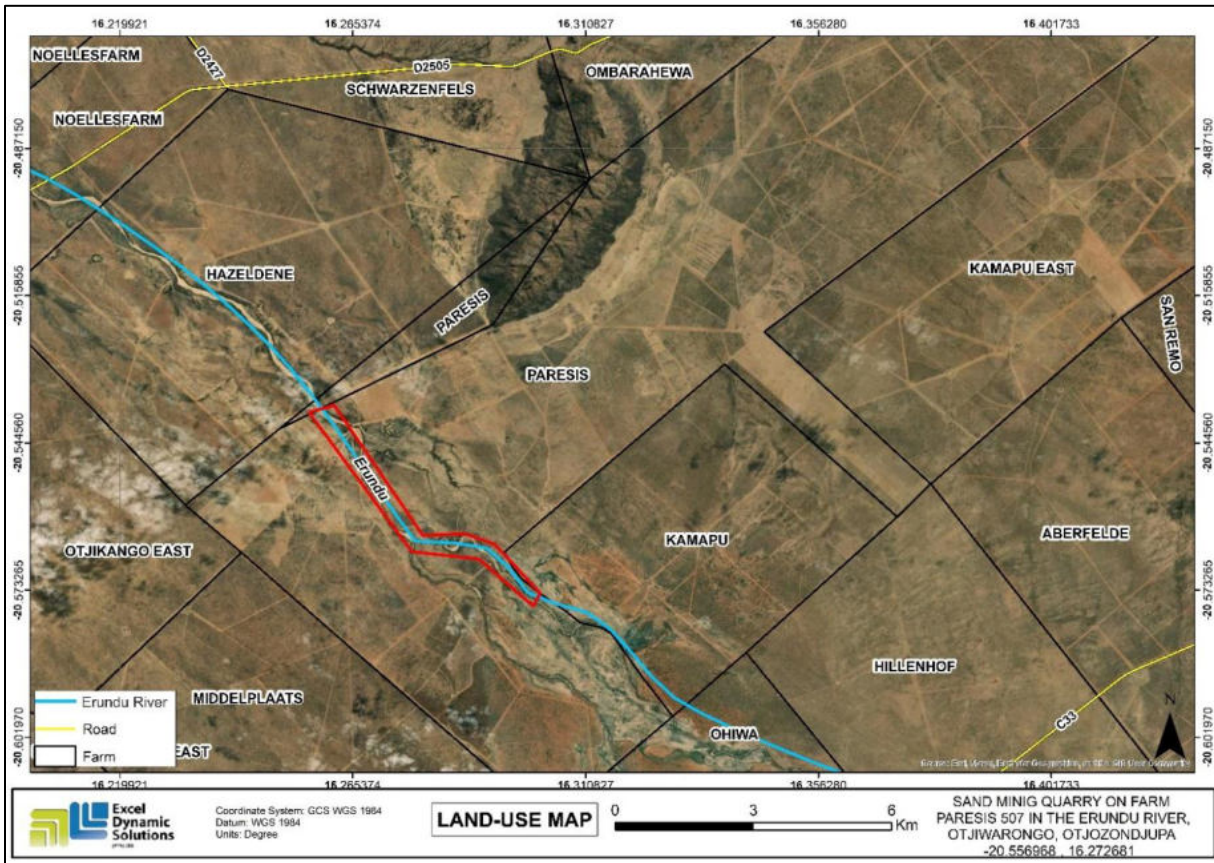


Figure 25: Land use surrounding the sand mining site

5.12 Heritage and Archaeology

There are no known archeological sites or object noted or seen on site or within close proximity of the proposed site.

6 PUBLIC CONSULTATION PROCESS

Public consultation forms an important component of an Environmental Assessment (EA) process. Public 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. Public consultation has been done in accordance with both the EMA and its EA Regulations.

The public consultation process assists the Environmental Assessment Practitioner (EAP) in identifying all potential impacts and to what extent further investigations are needed. Public consultation can also aid in the process of identifying possible mitigation measures.

6.1 Pre-identified and Registered Interested & Affected Parties (I&APs)

Relevant and applicable national, regional and local authorities, and other interested members of the public. The pre-identified I&APs were contacted directly and some were registered as I&APs upon their request (those that were registered after the EA notification in the newspapers). Newspaper adverts of the proposed project were placed in two widely-read national newspapers in the region (*The Namibian* and *New Era* newspapers). The project advertisement/announcement ran for two consecutive weeks inviting members of the public to register as I&APs and submit their comments. The summary of pre-identified and registered I&APs is listed in **Table 5** below.

Table 4: Summary of Interested and Affected Parties (I&APs)

National (Ministries and State Owned Enterprises)
Ministry of Agriculture, Water and Land Reform
Ministry of Environment, Forestry and Tourism (Department of Environmental Affairs and Forestry)
Regional & Local
Otjozondjupa Regional Council
General Public
Interested members of the public

6.2 Communication with I&APs

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 development was facilitated through the following means and in this order:

- A Background Information Document (BID) containing brief information about the proposed facility was compiled and sent out to all pre-identified affected parties and upon request to all new registered Interested and Affected parties (I&APs);
- Project Environmental Assessment notices were placed in *The Namibian newspaper* (**23 august 2024 and 30 august 2024**) and *New Era* newspapers (**19 August 2024 and 27 August 2024**), briefly explaining the activity and its locality, inviting members of the public to register as I&APs and submit comment;
- Public notices were placed at frequented places (**Figure 26**) in Otjiwarongo to inform members of the public of the EA process and register as I&APs as well as submit comments;
- A public meeting was scheduled on 04 September 2024 in on farm paresis No.507. However, no one turned up.



Figure 26: public notice placed at the entrance junction of farm Paresis



Figure 27: Consultation at the Otjiwarongo office of the Ministry of Environment Forestry and Tourism

6.3 Public Feedback

No comments or concerns have been received during the public consultation processes.

7 IMPACT IDENTIFICATION, ASSESSMENT AND MITIGATION MEASURES

7.1 Impact Identification

The sand mining activities are usually associated with different potential impacts, be it positive or negative. For an environmental assessment, the focus is placed mainly on the negative impacts. This is done to ensure that these impacts are addressed by providing adequate mitigation measures such that an impact's significance is brought under control, while maximizing the positive impacts of the development. The potential positive and negative impacts that have been identified from the sand mining activities are listed as follow:

Positive impacts:

- Socio-economic development: employment creation and skills transfer.
- Investment opportunities or infrastructure-related development benefits,

- Produce a trained workforce and small businesses in the area.
- Boosting local economic and regional economic development.
- Increased supply of bricks for local businesses and construction industry.

Negative impacts:

- Soils and water pollution
- Surrounding soils
- Air Quality (Dust)
- Biodiversity: Fauna and flora
- Health and Safety
- Vehicular traffic safety
- Visuals impacts
- Noise and vibration
- Loss of property values
- Waste generation
- Archaeological or cultural heritage impacts

7.2 Impact Assessment Methodology

The impact assessment method used for this project was adopted from previous environmental reports that were compiled by the author and as well as published reports online through research on the suitable project assessment methodology.

The identified impacts were assessed in terms of probability (likelihood of occurring), scale/extent (spatial scale), magnitude (severity) and duration (temporal scale) as presented in **Table 5, Table 6, Table 7** and **Table 8**.

In order 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 following criteria were applied in this impact assessment:

7.2.1 Extent (spatial scale)

Extent is an indication of the physical and spatial scale of the impact. **Table 5** shows rating of impact in terms of extent of spatial scale.

Table 5: Extent or spatial impact rating

Low (1)	Low/Medium (2)	Medium (3)	Medium/High (4)	High (5)
Impact is localised within the site boundary: Site only	Impact is beyond the site boundary: Local	Impacts felt within adjacent biophysical and social environments: Regional	Impact widespread far beyond site boundary: Regional	Impact extend National or over international boundaries

7.2.2 Duration

Duration refers to the timeframe over which the impact is expected to occur, measured in relation to the lifetime of the project. **Table 6** shows the rating of impact in terms of duration.

Table 6: Duration impact rating

Low (1)	Low/Medium (2)	Medium (3)	Medium/High (4)	High (5)
Immediate mitigating measures, immediate progress	Impact is quickly reversible, short term impacts (0-5 years)	Reversible over time; medium term (5-15 years)	Impact is long-term	Long term; beyond closure; permanent; irreplaceable or irretrievable commitment of resources

7.2.3 Intensity, Magnitude / severity

Intensity refers to 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. These were also taken into consideration during the assessment of severity. **Table 7** shows the rating of impact in terms of intensity, magnitude or severity.

Table 7: Intensity, magnitude or severity impact rating

Type of criteria	Negative				
	H- (10)	M/H- (8)	M- (6)	M/L- (4)	L- (2)
Qualitative	Very high deterioration, high quantity of deaths, injury of illness / total loss of habitat, total alteration of ecological processes, extinction of rare species	Substantial deterioration, death, illness or injury, loss of habitat / diversity or resource, severe alteration or disturbance of important processes	Moderate deterioration, discomfort, partial loss of habitat / biodiversity or resource, moderate alteration	Low deterioration, slight noticeable alteration in habitat and biodiversity. Little loss in species numbers	Minor deterioration, nuisance or irritation, minor change in species / habitat / diversity or resource, no or very little quality deterioration.

7.2.4 Probability of occurrence

Probability describes the likelihood of the impacts actually occurring. This determination is based on previous experience with similar projects and/or based on professional judgment. See **Table 8** for impact rating in terms of probability of occurrence.

Table 8: Probability of occurrence impact rating

Low (1)	Medium/Low (2)	Medium (3)	Medium/High (4)	High (5)
Improbable; low likelihood; seldom. No known risk or vulnerability to natural or induced hazards.	Likely to occur from time to time. Low risk or vulnerability to natural or induced hazards	Possible, distinct possibility, frequent. Low to medium risk or vulnerability to natural or induced hazards.	Probable if mitigating measures are not implemented. Medium risk of vulnerability to natural or induced hazards.	Definite (regardless of preventative measures), highly likely, continuous. High risk or vulnerability to natural or induced hazards.

7.2.5 Significance

Impact significance is determined through a synthesis of the above impact characteristics. 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 5**, **Table 6**, **Table 7** and **Table 8**) have been ranked for each potential impact, the impact significance of each is assessed using the following formula:

$$\text{SP} = (\text{magnitude} + \text{duration} + \text{scale}) \times \text{probability}$$

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 9**).

Table 9: Significance rating scale

<i>Significance</i>	<i>Environmental Significance Points</i>	<i>Colour Code</i>
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 of time to enable the confirmation of the significance of the impact as low or medium and under control.

The assessment of the project phases 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.*

According to Booth (2011), a pollutant linkage occurs when a source, pathway and receptor exist together. 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 recommended. Once the mitigation measures have been applied, the identified risk will be of low significance.

The impact assessment for this EA focuses on the three project phases namely; operational & maintenance and decommissioning. The potential negative impacts stemming from the project site are described, assessed and mitigation measures provided thereof. Further mitigation measures in a form of management action plans will be provided in the Draft Environmental Management Plan.

7.3 Assessment of Potential Negative Impacts

7.3.1 Soil and water pollution

The site is located within the catchment of the Ugab River, an ephemeral river, draining in western direction. Any pollutants or contaminated soil must be removed from site and disposed of in an appropriate manner. Flash floods could be a threat during high rainfall events, if the project site is situated on a river bed.

Groundwater is utilized in the area and such users would be at risk in possible cases of groundwater contamination. Permeable soil and shallow groundwater levels renders the groundwater more vulnerable to contamination. Heavy rainfall events may result in the leaching of pollutants or hazardous substances into groundwater or its transport to receptors downstream of the mine. Servicing of vehicles may not occur at the sand mine.

The alluvial deposits are sand and gravel-dominated and as such, the project area is prone to high levels of leaching. The groundwater is shallower in the Erundu River alluvial sediments than in the fractured basement aquifers. Therefore, groundwater at the proposed project site is vulnerable to:

1. Pollution due to spilling of fuel, oil or hydraulic fluids when earthmoving equipment are refueled or repaired on site
2. Salinization due to continuous evaporation of stagnant water in quarries

Carelessly disposal or poor handling of waste such as hydrocarbon spills from the vehicles and machinery on site may lead the contamination of soil and eventual surface water systems, especially when the river starts running. Soil contamination by liquid hazardous substances may also lead to groundwater contamination by infiltration. The impact of the mining to groundwater is minimal due to the fact that mining activities will only be done till a certain depth, but not close to or below groundwater table. Regardless, care will need to be taken by effectively implementing

the mitigation measures. With nothing done to prevent this, the impact can be rated as medium to high, but post-mitigation measures, the rating will be of medium to low significance. The impact assessment and mitigation measures are given in the table below. The impact is assessed in **Table 10** below.

Table 10: Assessment of the impacts of the riverbed sand mining on soil water resources

Mitigation Status	Extent	Duration	Intensity	Probability	Significance
Pre mitigation	M: -4	M: -3	M: -4	M/H: -5	M: -55
Post mitigation	L/M: -2	L/M: -2	L/M: -4	L/M: -3	L: -24

7.3.2 Surrounding Soils

During sand mining activities, soils will be disturbed through the excavation of the topsoil. Excessive disturbance of soil to more than the natural processes can generate the material (soil) may lead to soil erosion during rainy seasons. If there are no measures put in place and eventual implementation, the impact can be rated as medium, but after implementing the measures, the rating will significantly reduce to low. The impact is assessed in **Table 11** below.

Table 11: Assessment of the impacts of the impacts on site soils

Mitigation Status	Extent	Duration	Intensity	Probability	Significance
Pre mitigation	M: -2	M: -2	M: -6	M/H: -3	M: -30
Post mitigation	L/M: -1	L/M: -2	L/M: -2	L/M: -3	L: -10

7.3.3 Generation of Dust (Air Quality)

Given the fact the soils in this area are exposed (very little to no cover), dust emanating from site works when transporting sand to the Otji bricks factory may compromise the air quality in the site area. Since sand mining works will only be done five days a week and sand is only transported on a time-to-time basis, the generation of dust by can be considered moderate. The medium

significance of this impact can be reduced to a low significance rating by properly implementing mitigation measure. The impact is assessed in **Table 12** below.

Table 12: Assessment of the impacts of the riverbed mining activities on surrounding air quality

Mitigation Status	Extent	Duration	Intensity	Probability	Significance
Pre mitigation	M: -3	M: -3	M/L: -4	M/H: 4	M: -40
Post mitigation	L - 2	L - 2	L - 2	L - 1	L - 6

7.3.4 Biodiversity: Fauna and Flora

Operation of sand mining works may potentially result in land degradation, thus destroying habitats of small animal species that may be encountered within the site soils, thus resulting in the loss of such species. In the operational phase the movement of trucks and other sounds produced by machinery can scare off animals leaving their origin of inheritance. During the site visit, there were cattle observed and birds but no (small) animal species were observed on the site however rabbit holes and bird nests were visual observed. This indicate sufficient proof of presence of fauna within and around the project site. The level of impact is of low significance with mitigation as the sand mining will only happen within the riverbed and on request when there is a demand of sand from the factory.

In terms of Flora, most of the areas are surrounded by shrubs spatially distributed along the river and camel thorn tree are barley found within the riverbed but densely populated around the river vicinity. However, the shrubs found in the river will be cleared in order to collect the sand. Regardless of clearing the path the impact significance is low. Under the current status, the impact on flora can be considered to be of low significance rating. With the implementation of appropriate mitigation measure and monitoring, the low significance rating will be maintained throughout the project life cycle, the impact significance would be reduced to low as presented in **table 13** below.

Table 13: Assessment of the project impact of the riverbed sand mining on biodiversity (fauna & flora)

Mitigation Status	Extent	Duration	Intensity	Probability	Significance
Pre mitigation	M - 3	M/H - 3	L/M - 4	M/H - 4	M - 40
Post mitigation	L/M - 1	L/M - 1	L - 2	L/M - 3	L - 12

7.3.5 Health and Safety

Improper handling of onsite materials and equipment may cause health and safety risks (injuries and possible fatalities). The potential health and safety risks may not only to the workers, but other the people and animals on the farm. Without any mitigation measures, the impact can be rated as medium, but with effective implementation of the measures, the impact will significantly be reduced to low significance. The impact is assessed in **table 14** below.

Table 14: Assessment of the project impact on health and safety

Mitigation Status	Extent	Duration	Intensity	Probability	Significance
Pre mitigation	M - 5	M/L - 3	M/L - 3	M - 4	M - 44
Post mitigation	L - 3	M - 3	L - 3	L/M - 3	L - 27

7.3.6 Vehicular Traffic Safety

The presence of heavy vehicles on days when sand needs to be loaded and transported from site, will potentially increase traffic around the project site. Heavy vehicles will exert pressure on local roads and given their slow speeds, this may potentially result in road accidents. Without any mitigation measures, the impact can be rated as medium, but with the effective implementation of the measures, the impact will significantly be reduced to low significance. The impact will reduce to low significance, upon implementing the mitigation measures. The assessment of this impact is given in **table 15** below.

Table 15: Assessment of the impacts of the project activities on vehicular traffic (road)

Mitigation Status	Extent	Duration	Intensity	Probability	Significance
Pre mitigation	L/M - 2	L/M - 2	M - 6	M - 5	M - 50
Post mitigation	L - 1	L - 1	L - 2	L/M - 2	L - 8

7.3.7 Visual

The sand mining are isolated from residence with about 39 km, posing no impact visual impact on residence. The activities happening on the project site are not of morally visual sensitive to people (sand mining). In regards that the site is a mining environmentally looking and might pose a harsh visual impact. However due to the number of people that come in visual contact with the site are relatively few if not people from farm Paresis or visitors, the visual significance impact is low with no mitigation plan in place. However, with adequate mitigation measures, the impact rating will be reduced to low. This impact is assessed in **table 16** below and mitigation measures are provided.

Table 16: Assessment of the impacts of the sand mining site on visual

Mitigation Status	Extent	Duration	Intensity	Probability	Significance
Pre mitigation	M - 3	M/L - 2	M - 6	M/H - 4	M - 44
Post mitigation	L/M - 2	L/M - 2	L - 2	L/M - 2	L - 12

7.3.8 Noise and Vibration

The operation of the sand mining may be a nuisance to surrounding, but due to that the closest neighbour is the farm Paresis farm house. Excessive noise can also be a health risk to site workers. The machinery noise will be limited to a certain extent and project site only. The sand mining activities will only last for so long during working hours and five days in a week. Therefore, the noise level is bound to be limited to the site only, and therefore, the impact likelihood is minimal. Without any mitigation, the impact is rated as medium to low significance. In order to change the impact significance from the pre-mitigation significance to low rating, the mitigation measures provided below should be implemented, the significance will be low as assessed in **table 17** below.

Table 17: Assessment of the impacts of the noise from riverbed sand operations

Mitigation Status	Extent	Duration	Intensity	Probability	Significance
Pre mitigation	M - 4	M/H - 3	L/M - 4	M/H - 5	M - 55

Post mitigation	L/M - 2	L/M - 2	L - 2	L/M - 2	L - 12
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7.3.9 Loss of Property value

The location of the project site is about more than 39 Kilometers away from the Otjiwarongo townlands which is the only nearby residential area. This will have no effect at all due to the distance away from site. In terms of property valuation for purchasing or resale, the project site have no effect on the value of the property. With such a distance away the impact is of low significance with no mitigation measures in place. This impact is assessed in **Table 18** below. No mitigation measures required.

Table 18: Assessment of the impacts of riverbed sand mining presence on property value

Mitigation Status	Extent	Duration	Intensity	Probability	Significance
Pre mitigation	L/M - 2	L/M - 2	M - 4	M/H - 2	M - 16
Post mitigation	L - 1	L/M - 1	L - 2	L/M - 1	L - 4

7.3.10 Waste Generation

All works and their eventual operations are usually associated with generation of waste of all kinds (domestic and general). If these are not disposed of in a responsible manner, it will result in the pollution of the site and the surrounding environment. Without any mitigation measure, the impact has a medium significance. The impact will be of low significance from medium, upon implementing the provided mitigation measures. The impact is assessed in **Table 19**.

Table 19: Assessment of the waste generation impact

Mitigation Status	Extent	Duration	Intensity	Probability	Significance
Pre mitigation	M - 3	M/H - 4	M - 6	M/H - 3	M - 39
Post mitigation	L/M - 1	L/M - 1	L - 2	L/M - 2	L - 8

7.3.11 Archaeological impact

During operational works, 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 herigate nor site of cultural values within the site nor in the vicinity of the project site area. Therefore, this impact can be rated medium to low, if there are no mitigation measures in place. Upon implementation of the necessary measyres, the impact significance will be low. The assessment of this impact is presented in **Table 20**.

Table 20: Assessment of the impact of the project on archaeological or cultural sites

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

7.3.12 Assessment of potential negative impacts: Residue & Rehabilitation phase

Riverbed sand mining is necessarily requiring residue and rehabilitation when excavation of the topsoil reaches a clay soil depth. Therefore, when the excavation reaches an un-mineable depth in the future, Otji Bricks will have to close the site and look for a new site. The impact is assessed below (**Table 21**)

Table 21: Assessment of the impacts of riverbed sand mining closure on the community

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

8 RECOMMENDATIONS AND CONCLUSIONS

The potential impacts anticipated from the proposed project activities were identified and assessed. For the significant adverse (negative) impacts with a medium rating, appropriate management and mitigation measures were recommended for implementation by the Proponent, their contractors and project related employees.

The concerns raised by the registered I&APs were put into consideration, addressed and incorporated into this Report, and mitigation measures have been provided accordingly, to avoid and/or minimize their significance on the environmental and social components. Most of the potential impacts were found to be of medium rating significance. The effective implementation of the recommended management and mitigation measures will particularly see a reduction in the significance of adverse impacts that cannot be avoided completely (from medium rating to low). To maintain the desirable rating, the implementation of management and mitigation measures should be monitored by the Proponent directly, or their Environmental Control Officer (ECO). The monitoring of this implementation will not only be done to maintain the reduced impacts' rating or maintain a low rating but to also ensure that all potential impacts identified in this study and other impacts that might arise during implementation are properly identified in time and addressed right away too.

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