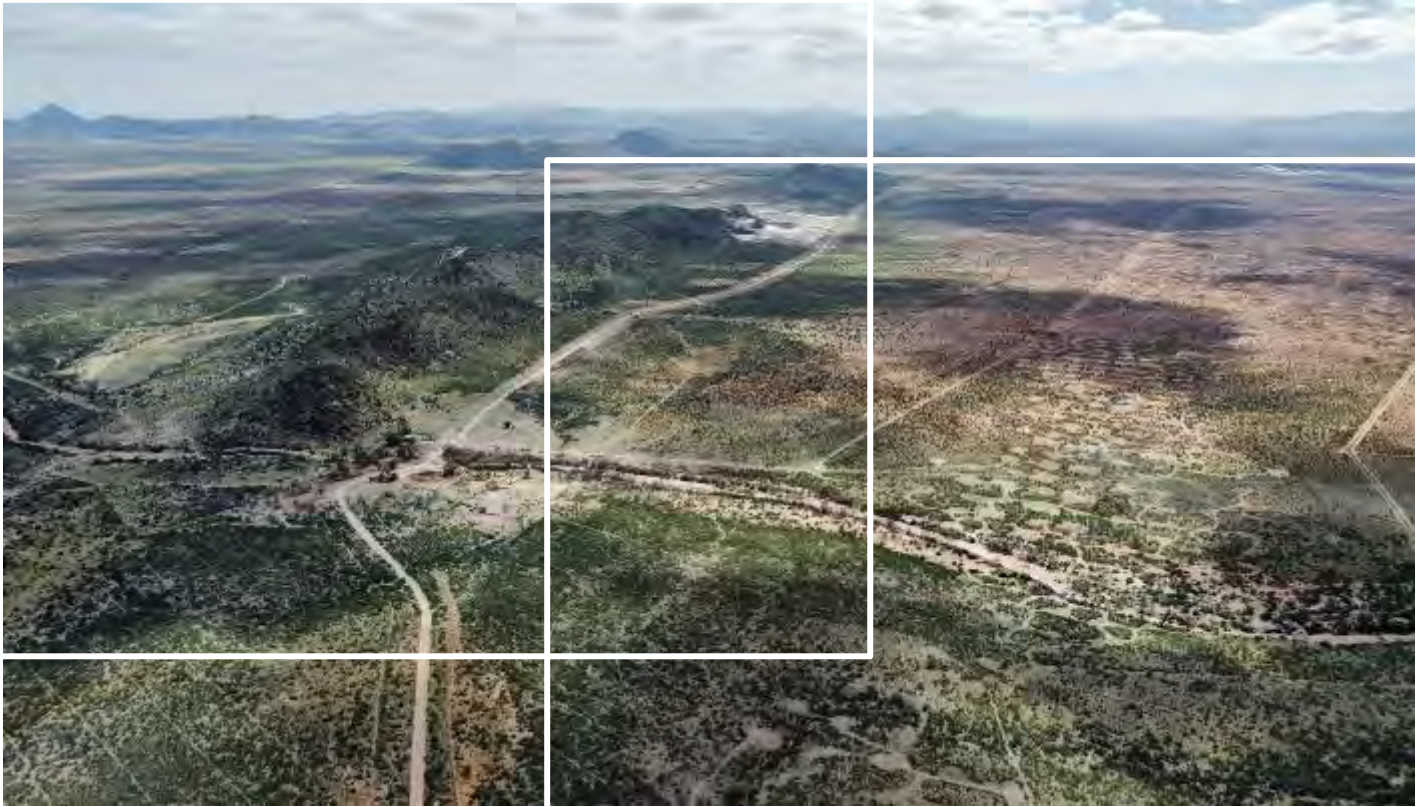




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REPORT:

TWIN HILLS GOLD PROJECT –ESIA AMENDMENT REPORT

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EXECUTIVE SUMMARY

Environmental Compliance Consultancy (ECC) has been contracted by Osino Gold Exploration and Mining (Pty) Ltd. (OGEM), a Namibian company and subsidiary of Osino Resources Corp., to undertake an environmental and social impact assessment (ESIA). OGEM manages operations in Namibia as a wholly owned Shanjin International Gold Co. ECC is conducting an ESIA for the proposed mining of precious metals on Mining Licence 238 (ML 238), located near the town of Karibib, Erongo Region, Namibia.

OGEM is the proponent for the proposed Project, referred to as “the Proponent”. The proposed Project will be a conventional open pit mine with a gold extraction process similar to those in existing gold mines in Namibia, such as the Otjikoto and Navachab mines. The proposed Project will be referred to as the “Twin Hills Gold Project” or the “Project” herein.

The proposed Project covers an area of approximately 8 000 ha, excluding linear power and water supply infrastructure. The site is accessed from the C33 road in central Namibia, between the towns of Karibib and Omaruru, Erongo Region.

In terms of the Namibian Environmental Management Act, 2007 and its regulations, the Ministry of Industry, Mines and Energy (MIME) is the competent authority for the proposed Project. Mining operations trigger listed activities in terms of the Act, and as such, require an environmental clearance certificate.

The original assessment was submitted to the Ministry of Industry, Mines and Energy (MIME) as the competent authority and the Ministry of Environment, Forestry and Tourism (MEFT) in March 2022 and RoD approval was granted on the 3rd of November 2022.

Since then, the Proponent has reviewed their operational requirements and an amendment to the original ESIA is required, as updates and changes to the site layout and proposed infrastructure has been finalised. Therefore, these noted changes, and potential related impacts have been re-assessed in this report and will be submitted to MEFT and the component authority (MIME) for a record of decision.

SCREENING PHASE

A high-level ESIA formed part of the company's preliminary economic assessment (PEA) and was incorporated into the screening phase. Alternative locations for key infrastructure, such as the processing plant and tailings storage facility (TSF), as well as potential road and river diversions, with possible mitigation measures, were considered.

The screening phase determined that the most likely potential environmental and social impacts could include:

- Surface and groundwater impacts;

- Social impacts during construction, operations, and post-closure;
- Habitat alteration and impacts on biodiversity;
- Visual impacts affecting the sense of place;
- Impacts to air quality;
- Impacts on road and land users associated with the road diversion;
- Impacts associated with the Okawayo river diversion.

SCOPING PHASE

The objective of the scoping phase was to obtain a thorough understanding of the biophysical and socioeconomic environment in which the Project is located, often using baseline and specialist studies. It also provided an opportunity for the public to have input into the scope of the assessment. The technical inputs combined with the inputs from the I&APs led to the development of the Terms of Reference (ToR) for the assessment phase. The following was considered during the preparation of the scoping report:

- Desktop and literature research;
- Site visits by ECC and specialists;
- Environmental monitoring data;
- Specialist baseline studies, including:
 - o Soil sampling and analysis;
 - o Acid-base accounting (ongoing study);
 - o Surface and groundwater studies;
 - o Biodiversity study;
 - o Noise;
 - o Air quality;
 - o Road traffic study;
 - o Visual impacts on sense of place;
 - o Socioeconomic baseline;
 - o Heritage and archaeology study.

IMPACT ASSESSMENT PHASE

The next stage of this assessment was to conduct the impact assessment. The specialist studies previously prepared for the original assessment were updated and the different impacts were reassessed where new information was provided, or new impacts were identified. A summary of those impacts and their ratings after mitigation are shown below.

On a scale from 1 to 12, low to high, the beneficial (B) and negative (N) impact significance is stated. Some variation between the sub-sections of these aspects exists so the average significance is stated for some aspects.

Socio economic environment: social		Biophysical environment	
Mining employees	B2	Surface impacts	N2
Visual impacts	N4	Groundwater impacts	N2
Sense of place	N2	Biodiversity impacts	N2
Air quality impacts	N2	Climate change impacts	N2
Traffic impacts	N2	Cumulative impacts	N2
Air traffic impacts	N6		
Blast and vibration impacts	N4		
Heritage and culture impacts	N4		
Noise impacts	N2		

The ESIA amendment report and appendices will be formally submitted to the public and the competent authority, the Ministry of Industry, Mines and Energy (MIME) and the Ministry of Environment, Forestry and Tourism (MEFT) as part of the amendment for a public review period of 7 days and renewal application for the current environmental clearance certificate for the Twin Hills Gold Project. The phases of the ESIA are provided in Figure 1.

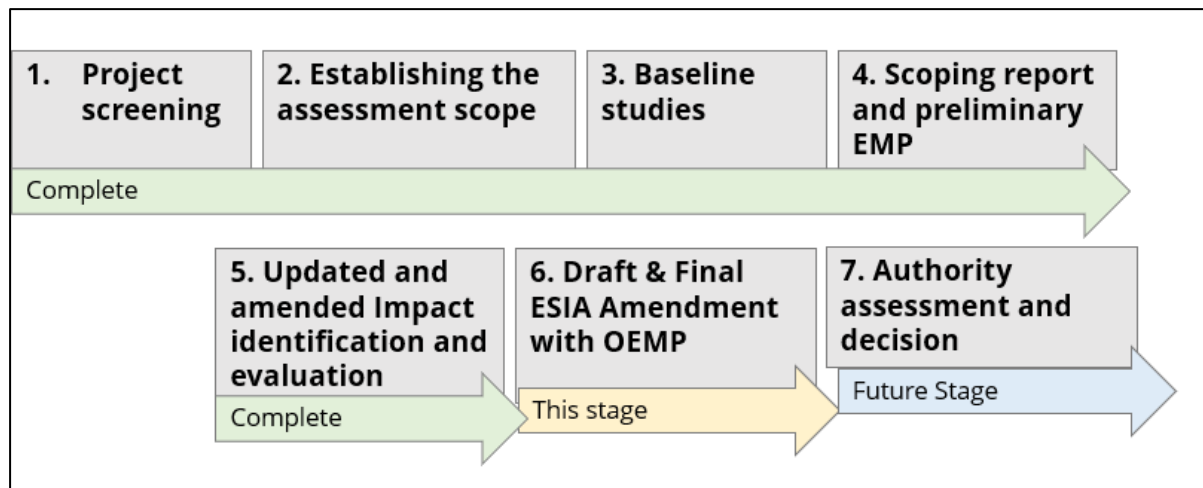


Figure 1 – Simplified Namibian ESIA process noting Twin Hills progress

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ABBREVIATIONS

ABBREVIATION	DESCRIPTION
%	percentage
~	approximately
<	less than
°C	degrees Celsius
µm	micrometre
µS/cm	micro sieverts per cm
ABA	acid-base accounting
AC	Alternating current
ADWF	average dry weather flow
AEP	annual flood exceedance probabilities
AIDS	acquired immunodeficiency syndrome
AMD	acid metalliferous drainage
ANC	acid neutralising capacity
AP	acid potential
AQSR	Air quality sensitive receptor
ARD	acid rock drainage
Au	gold
BDFs	bird flight diverters
BFS	bankable feasibility study
BID	background information document
C	carbon
CAN	Central Area of Namibia
CE	Control Efficiency
CIA	cumulative impact assessment
CIL	carbon-in-leach
CITES	The Convention on International Trade in Endangered Species
CN	cyanide
CO	carbon monoxide
CO ₂	carbon dioxide
CO ₂ e	carbon dioxide equivalent
COD	cone of drawdown
COM	Chamber of Mines
CSR	corporate social responsibility
dBa	decibels
DC	direct current
DEA	Directorate of Environmental Affairs
DFS	definitive feasibility study
E	endangered
ECC	Environmental Compliance Consultancy (Pty) Ltd
EHS	
EMA	Environmental Management Act No. 7 of 2007
EPL	exclusive prospecting licence
ErongoRED	Erongo Regional Electricity Distributor

ABBREVIATION	DESCRIPTION
ESIA	environmental and social impact assessment
ESMP	environmental and social management plan
g/m ²	grams per square meter
g/t	grams per ton
GDP	gross domestic product
GHG	greenhouse gas
GPRS	ground penetrating radar scan
GPS	global positioning system
GROWAS	GROWAS
H ₂ SO ₄	H ₂ SO ₄ /t
Ha	hectare
HCN	hydrogen cyanide
HDPE	high density polyethylene
HIV	human immunodeficiency virus
HME	heavy machinery and equipment
I&APs	interested and affected parties
ICMM	The International Council on Mining and Metals
ICR	intensive cyanidation reactor
IFC	International Finance Corporation
ITS	ITS Global - traffic engineering consultants
IUCN	The International Union for Conservation of Nature
KAFB	Karibib Air Force Base
KFZ	Karibib Fault Zone
kg	kilogram
Kg/ha	Kilograms per hectare
km	kilometre
km/h	kilometres per hour
km ²	square kilometre
kt	kilotons
KV	kilovolt
kW	kilowatt
LDPE	low density polyethylene
LDPE	Low Density Polyethylene
LoM	life of mine
m	meter
m/s	meters per second
m ³	cubic metre
m ³ /day	cubic metres per day
m ³ /h	cubic metres per hour
Ma	mega annum
mamsl	meters above sea level
MAP	Mean Annual Precipitation
MAR	Managed Aquifer Recharge

ABBREVIATION	DESCRIPTION
MAFWLR	Ministry of Agriculture, Fisheries, Water and Land Reform
MCC	motor control centre
MEFT	Ministry of Environment, Forestry and Tourism
mg/L	milligrams per litre
mg/m ² /day	milligrams per metre squared per day
MHSS	Ministry of Health and Social Services
ML	mining licence
mm	millimetre
mm/s	millimetre per second
Mm ³ /year	Million metres cubed per year
MIME	Ministry of Mines, Energy and Industry
MPA	maximum potential acidity
Mt	million tons
Mtpa	Million tons per annum
MURD	Ministry of Urban and Rural Development
MVA	mega volt amps
MW	mega watt
MW _{ac}	megawatt capacity of a solar generating station
MWT	Ministry of Works and Transport
N	nitrogen
N\$	Namibian Dollar
NaCN	Sodium cyanide
NAF	non-acid forming
NAMCATS	Namibia Civil Aviation Technical Standards
NamWater	Namibian Water Corporation (Pty) Ltd
NaOH	Sodium hydroxide
NCAA	Namibian Civil Aviation Authority
NDP	national development plan
NGO	Non-governmental organisations
NHC	National Heritage Council
NMD	neutral and metalliferous drainage
NNP	Net Neutralising Potential
NO _x	nitrogen oxide
NP	neutralising potential
NPR	Neutralising Potential Ratio
NSRs	noise sensitive receptors
NT	near threatened
nvPM	“non-volatile” particulate matter
NW	north west
OGEM	Osino Gold Exploration and Mining (Pty) Ltd
OHL	overhead power line
PAF	potentially acid forming
PCD	pollution control dam

ABBREVIATION	DESCRIPTION
PEA	preliminary economic assessment
PFS	pre-feasibility study
pH	positive hydrogens
PM ₁₀	particulate matter with a diameter of 10 micrometres of less
PM _{2.5}	particulate matter with a diameter of 2.5 micrometres of less
POI	points of interest
ppm	parts per million
PV	photovoltaic
RAB	rotary air blast
RC	reverse circulation
RMC	rubble masonry concrete
ROM	run-of-mine
rpm	revs per minute
S	Sulphur
SA NAAQS	South African National Ambient Air Quality Standards
SANCOLD	South Africa National Committee on Large Dams
SANS	South African National Standards
SAR	sodium adsorption ratio
SD	saline drainage
SE	southeast
SO ₂	sulphur dioxide
SO ₄	Sulphate
SPLP	Synthetic Precipitation Leaching Protocol
SW	southwest
t	tonnes
TB	tuberculosis
TCFD	Task Force on Climate-related Financial Disclosure
tCO _{2e}	tonnes of CO ₂ equivalents
TDS	total dissolved solids
THC	Twin Hills Central
THN	Twin Hills North
THW	Twin Hills West
TSF	tailings storage facility
USBM	United States Bureau of Mines
UV	ultraviolet
V	vulnerable
w/w	weight per weight
WAD	weak-acid dissociable
WGC	World Gold Council
WHO	World Health Organisation
WRD	waste rock dump

1 INTRODUCTION

1.1 COMPANY BACKGROUND

Environmental Compliance Consultancy (ECC) has been engaged by Osino Gold Exploration and Mining (Pty) Ltd. (OGEM), to conduct an environmental and social impact assessment (ESIA) amendment to the existing 2022 ESIA that was prepared for mining licence (ML) 238. Osino Gold Exploration and Mining (Pty) Ltd, a subsidiary of Osino Resources, has experienced notable changes in its ownership structure in recent years. Initially, Osino Resources held a 97% ownership stake in the company. In August 2022, Osino Resources acquired the remaining equity from Somerschild. This acquisition consolidated Osino Resources' ownership to 100%. Subsequently, in the first half of 2024, Osino Resources was fully acquired Shanjin International Gold Corporation.

ECC is conducting an ESIA amendment and submitting a renewal application to the original 2022 ESIA that was approved for the proposed mining of precious metals on ML 238, with the issuing of an environmental clearance certificate (Appendix M) on 03 November 2022 by the Ministry of Environment, Forestry and Tourism (MEFT). The Twin Hills Gold Project is located near the town of Karibib, Erongo Region, Namibia, see Figure 2.

The Proponent has focused on the acquisition and development of potential gold projects in Namibia through extensive exploration programmes. The advanced and successful exploration programme near Karibib has resulted in the development of the Twin Hills Gold Project, or Project. The proposed Project will be a conventional open pit mine with a gold extraction process similar to existing gold mines in Namibia, for example the Otjikoto and Navachab mines.

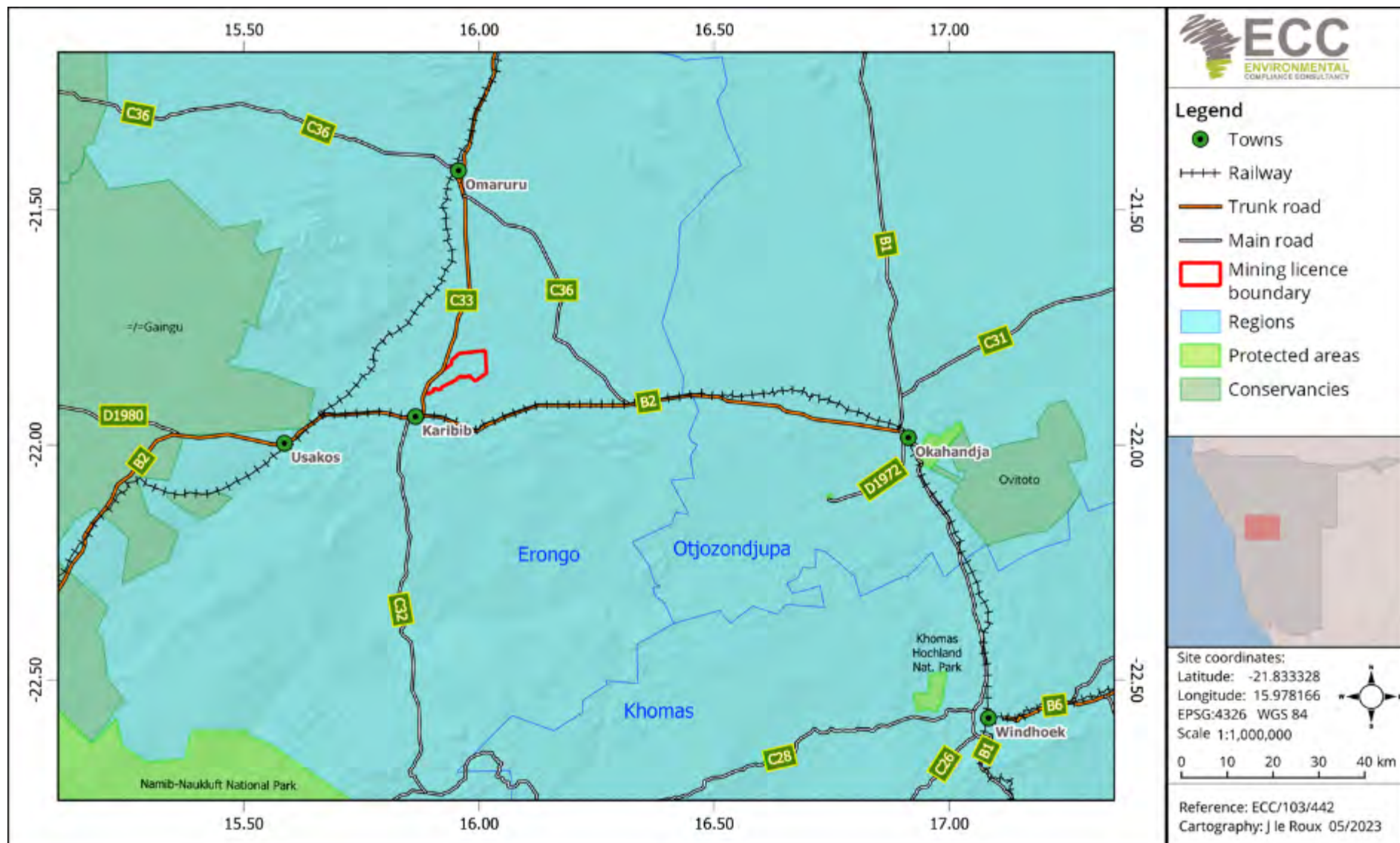


Figure 2 – Project location and regions

1.2 PURPOSE OF THE AMENDED ASSESSMENT REPORT

An environmental and social impact assessment (ESIA) has been conducted in compliance with the Namibian Environmental Management Act, No. 7 of 2007 and its Regulations. This report presents the findings of the ESIA process. In addition to describing the prescribed ESIA process, the report describes the baseline biophysical and socioeconomic environments, a Project description, findings from the assessment phase, and presents an operational environmental management plan (OEMP). The scope of the assessment was determined through undertaking a preliminary assessment of the proposed Project against the receiving environment, obtained through a desktop review, available site-specific literature, monitoring data and site reports.

The scoping report and appendices were submitted to the public for review (1 - 21 December 2021) and input on the impacts and the related ESIA terms of reference. After the public review period the final scoping report, with public input, was submitted to the Ministry of Mines and Energy (MME) as the competent authority for the Project, and to the Ministry of Environment, Forestry and Tourism (MEFT) - Directorate of Environmental Affairs (DEA) for a record of decision. A draft ESIA and ESMP were then produced and issued for public and government review, during the period of 23 February to 8 March 2022. Upon completion of the public review period of the draft ESIA and ESMP the final ESIA and ESMP were prepared for Government review and a record of decision, which was submitted on the 8 March 2022. The environmental clearance certificate (Appendix M) for the Project was approved and issued by MEFT on the 09 November 2022.

Subsequent to this approval, the Proponent reviewed their operational requirements and an amendment to the original ESIA is required, as updates and changes to the site layout and proposed infrastructure have been finalised. Therefore, these noted changes and potential related impacts have been re-assessed and the draft report was submitted to MEFT, the component authority, now the Ministry of Industry, Mines and Energy (MIME), national regulatory bodies and registered I&APs for a public review period of seven (7) days. This final report is now being submitted to MEFT and MIME for a record of decision.

The noted operational updates and changes include the following aspects:

- The 11 kV powerline route assessment;
- The new Twin Hills West pit;
- Addition of the tailing storage facility (TSF) liner facility;
- The general site layout updates;
- The new D1941 road diversion;
- The Okawayo river diversion;
- The solar (photovoltaic) PV plant;
- The airstrip.

The NamPower related 66 kV power supply infrastructure required to be constructed for mining operations is currently being managed through a separate ESIA process and will not be assessed as part of this amendment report.

Chapter 1 of the report is an introduction to the proposed Project and ESIA. Chapter 2 provides detail about the ESIA approach, including the roles of the public and specialists. Chapter 3 provides additional detail on the legal environment and requirements. Chapter 4 provides sufficient detail on the Project to identify and assess potential impacts. Chapter 5 provides an overview of the screening and scoping results and related baseline information identifying all relevant biophysical and social aspects. Chapter 6 provides an overview of the methodology for identifying and evaluating impacts. Chapter 7 provides the findings of the impact assessment. Chapter 8 and 9 cover the conclusion and bibliography, respectively.

1.3 THE PROPONENT OF THE PROPOSED PROJECT

Osino Gold Exploration and Mining (Pty) Ltd. is the Proponent for the proposed Project. The Proponent holds the rights to a mining licence and several exclusive prospecting licences (EPLs) located within the central and northern zones of Namibia's Damara gold belt, in proximity to and along strike of the operating Navachab and Otjikoto gold mines.

The Proponent has a head office in Namibia's capital, Windhoek, and a regional office based in Omaruru. The Proponents' details are provided in Table 1.

Table 1 – Proponent's details

Company Representative:	Contact Details:
Mr Ralf Schommarz	Osino Resources (Pty) Ltd.: PO Box 3489, Windhoek info@osinoresources.com +264 (61) 246 533

1.3.1 ENVIRONMENTAL AND SOCIAL ASSESSMENT PRACTITIONER

The report has been prepared by Environmental Compliance Consultancy (Pty) Ltd (ECC) (Reg. No. 2022/0593) on behalf of the Proponent. Authored by ECC employees with no material interest in the report's outcome, ECC maintains independence from the Proponent and has no financial interest in the Project apart from fair remuneration for professional fees. Payment of fees is not contingent on the report's results or any government decision. ECC members or employees are not, and do not intend to be, employed by the Proponent, nor do they hold any shareholding in the Project. Personal views expressed by the writer may not reflect ECC or its client's views. The environmental report's information is based on the best available data and professional judgment at the time of writing. However, please note that environmental conditions can change rapidly, and the accuracy, completeness, or currency of the information cannot be guaranteed.

All compliance and regulatory requirements regarding this report should be forwarded by email or posted to the following address:

Environmental Compliance Consultancy
PO Box 91193, Klein Windhoek, Namibia
Tel: +264 81 669 7608
Email: info@eccenvironmental.com

1.4 ENVIRONMENTAL REQUIREMENTS

The Environmental Management Act, No.7 of 2007, and its associated 2012 Regulations, stipulates that an environmental clearance certificate is required before undertaking any of the listed activities that are identified in the Act and its Regulations. Potential listed activities triggered by the Project are provided in Table 2.

Table 2 – Activities potentially triggered by the Twin Hills Gold Project

Source: Environmental Management Act, 2007, and its regulations

Listed activity	As defined by the regulations of Act	Relevance to the project
Energy generation, transmission, and storage activities	The construction of facilities for: (1a) The generation of electricity. (1b) The transmission and supply of electricity.	- The Twin Hills Gold Project will need to generate and or transmit electricity for its operations. - The mine will connect to the national power grid supplied by NamPower with a 66 kV overhead power line (OHL) to a main intake sub-station. - On-site power supply is managed through a 11 kV OHL infrastructure network that ties off from the main in-take sub-station. - A renewable energy plant (i.e. solar) will be constructed for the generation of supplementary power. This solar PV plant has been included in this assessment report. - Power generated will be used to supply the mine operations, and potential surplus could be redirected into the national grid. (Section4.7.2 Energy Supply)
Waste management, treatment, handling, and disposal activities	2.1 The construction of facilities for waste sites, and the treatment and disposal of waste. 2.2 Any activity entailing a scheduled process referred to in the Atmospheric Pollution Prevention Ordinance Act, 1976. 2.3 The importing, processing, use and recycling, temporary storage, transit, or exporting, of waste.	- The Project will require waste sites for the disposal of mineralised and non-mineralised waste. - Hazardous waste may be generated by the operation. - Facilities for the disposal of waste will need to be constructed. In terms of the Atmospheric Pollution Prevention Ordinance Act, the bulk storage and handling of mineralised or metallic ore on waste dumps designed to hold 100 000 metric tonnes or more, is

Listed activity	As defined by the regulations of Act	Relevance to the project
		defined as a scheduled process. (Section 4.6 Mineral and non-mineralised waste)
Mining and quarrying activities	3.1 The construction of facilities for any process or activities that require a license, right or other form of authorisation, and the renewal of a licence, right or other form of authorisation, in terms of the Minerals (Prospecting and Mining) Act, 1992. 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.	- This listed activity infers the provisions of the Minerals (Prospecting and Mining) Act 33 of 1992. The very nature of the Project is mining, which therefore triggers this listed activity. (Section 4.4 Mining infrastructure and services)
Forestry activities	4. The clearance of forest areas, deforestation, afforestation, timber harvesting, or any other related activity that requires authorisation in terms of the Forest Act, 2001 (No. 12 of 2001) or any other law.	- Vegetation clearing will be required for site construction and infrastructure establishment. - During operations, vegetation clearing will be required as the Project develops. - Clearing activities will need to align to the requirements of the Forestry Act, No. 12 of 2001 and Forest Amendment Act, No. 13 of 2005. (Sections 4.7.1 mine layout and 5.16 biodiversity)
Water resource developments	8.1 The 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 the law relating to water resources. 8.4 Construction of canals and channels, including the diversion of the normal flow of water in a riverbed, and	- Groundwater will be abstracted to support the operational activities through identified abstraction boreholes, with approved abstraction licences, from the Department of Water Affairs, as required by the Water Resources Management Act, No. 11 of 2013. - Surface water may be abstracted for operational activities.

Listed activity	As defined by the regulations of Act	Relevance to the project
	water transfer schemes between water catchments and impoundments. 8.5 Construction of dams, reservoirs, levees, and weirs. 8.6 Construction of industrial and domestic wastewater treatment plants and related pipeline systems. 8.8 Construction and other activities in watercourses within flood lines. 8.9 Construction and other activities within a catchment area.	- The mining area is within a catchment area, and an ephemeral river runs through a section of the planned Twin Hills Central pit. A diversion is required to the divert the ephemeral Okawayo tributary with a detailed design for a new channel and the occasional storm water flow would be diverted into the Cloud West pit. A dam will be constructed at the southern tip of the channel and a river diversion licence application has been submitted to the Department of Water Affairs (DWA) at the Ministry of Agriculture, Fisheries, Water and Land Reform (MAFWLR). - Process water ponds will be constructed to provide water for the process plant. - A pollution control dam (PCD) will be constructed to catch and contain dirty water on site, this is located in the processing plant. - Pipeline systems will be used to transport water or slurry within the site. - A domestic wastewater treatment plant will be constructed for operational purposes. - Septic/conservancy tanks are to be constructed for remote areas (guard houses and airstrip). - A wastewater and effluent discharge licence application has been submitted to the Department of Water Affairs (DWA) at the Ministry of Agriculture, Fisheries, Water and Land Reform (MAFWLR).

Listed activity	As defined by the regulations of Act	Relevance to the project
		(Sections 4.5.2 Water supply; 4.7 Alternatives considered and 5.15.3 Mine water supply and preliminary studies).
Hazardous substance treatment, handling, and storage	9.1 The manufacturing, storage, handling, or processing of hazardous substance defined in the Hazardous Substances Ordinance, 1974. 9.2 Any process or activity that requires a permit, licence, or other form of authorisation, or the modification of, or changes to, existing facilities for any process or activity that requires amendment of an existing permit, licence or authorisation, or which requires a new permit, licence or authorisation in terms of governing the generation or release of emissions, pollution, effluent, or waste. 9.4 The storage and handling of dangerous goods, including petrol, diesel, liquid petroleum, gas, or paraffin, in containers with the combined capacity of more than 30 cubic meters at one location. 9.5 Construction of filling stations or any other facility for the underground and above ground storage of dangerous goods, including petrol, diesel, liquid, petroleum, gas, or paraffin.	- The mining operations and proposed process plant triggers this activity, as both fuel and hazardous substances are required for mining and processing. - Bulk fuel will be required for onsite generation of electricity (generators) and for refuelling the mining fleet. - Consumer installation certificates are required for bulk fuel storage and dispensing. - Hazardous reagents will be used within the gold extraction and processing plant. - A lined tailings storage facility will be constructed. (Sections 4.4.4 Metallurgy and processing, 4.4.8.6 Fuel facility and 4.6.2 Tailings)
Infrastructure	10.1 The construction of: (b) public roads. (j) masts of any material or type, and of any height, including those used for telecommunication broadcasting and radio transmission.	- Powerlines and telemetry for operational requirements, water and tailings slurry pumping will be required. - Radio and telecommunication towers will be required for the site. - Diversion of gravel road D1941.

Listed activity	As defined by the regulations of Act	Relevance to the project
		(Sections 4.4.8.8 Communication and 4.5.1 Power supply)

2 APPROACH TO THE ASSESSMENT

2.1 PURPOSE AND SCOPE OF THE ASSESSMENT

The aim of this amendment assessment is to determine which impacts are likely to be significant; to scope the available data and identify any gaps that need to be filled; to determine the spatial and temporal scope; and to identify the assessment methodology.

2.2 THE ASSESSMENT PROCESS

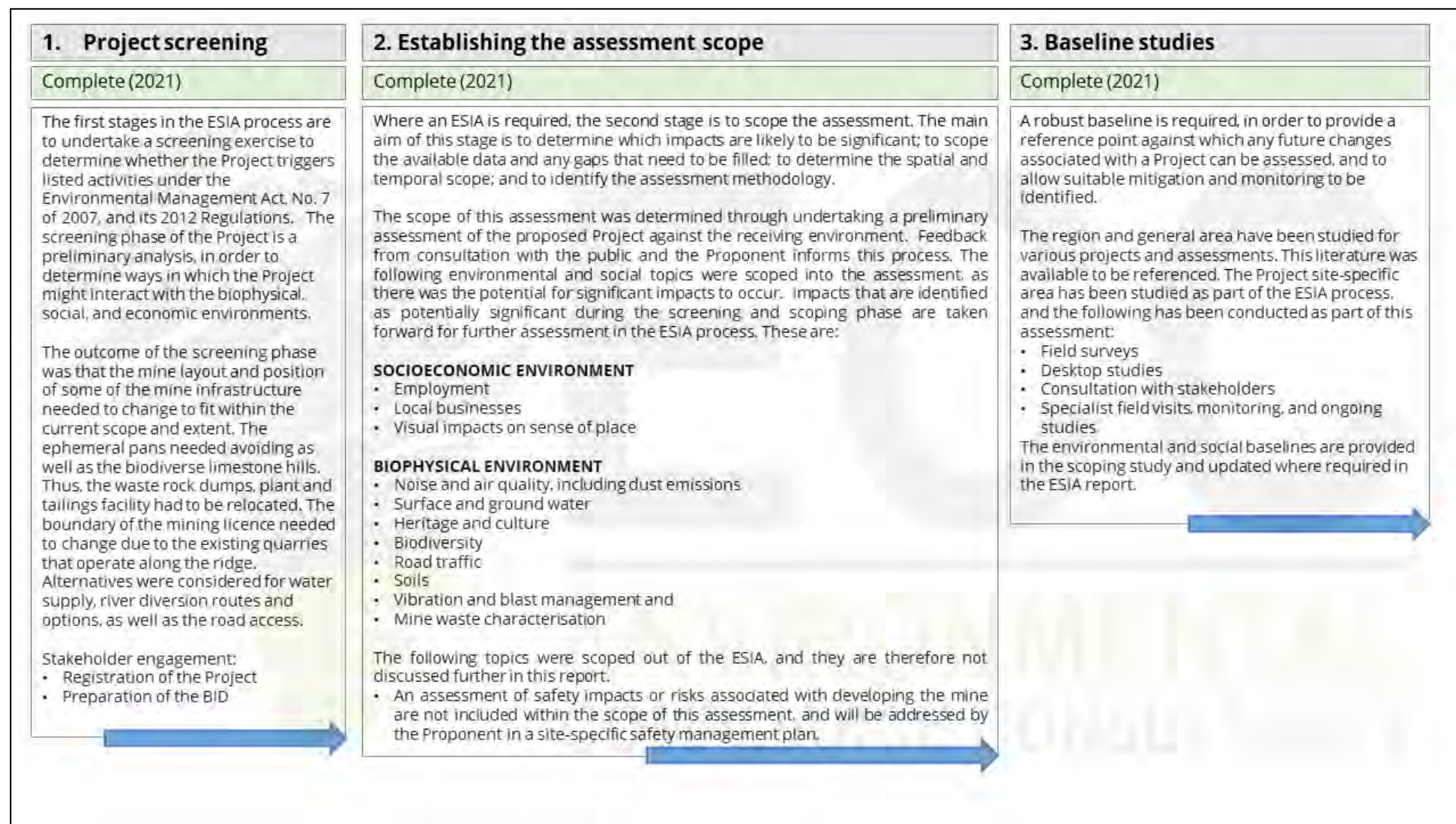
The ESIA methodology applied to this amendment assessment has been developed using the International Finance Corporation (IFC) standards and models, in particular Performance Standard 1: 'Assessment and management of environmental and social risks and impacts' (International Finance Corporation, 2012 and 2017); Namibian Draft Procedures and Guidance for EIA and EMP (Republic of Namibia, 2008); international and national best practice guidelines; and ECC's combined relevant ESIA experience.

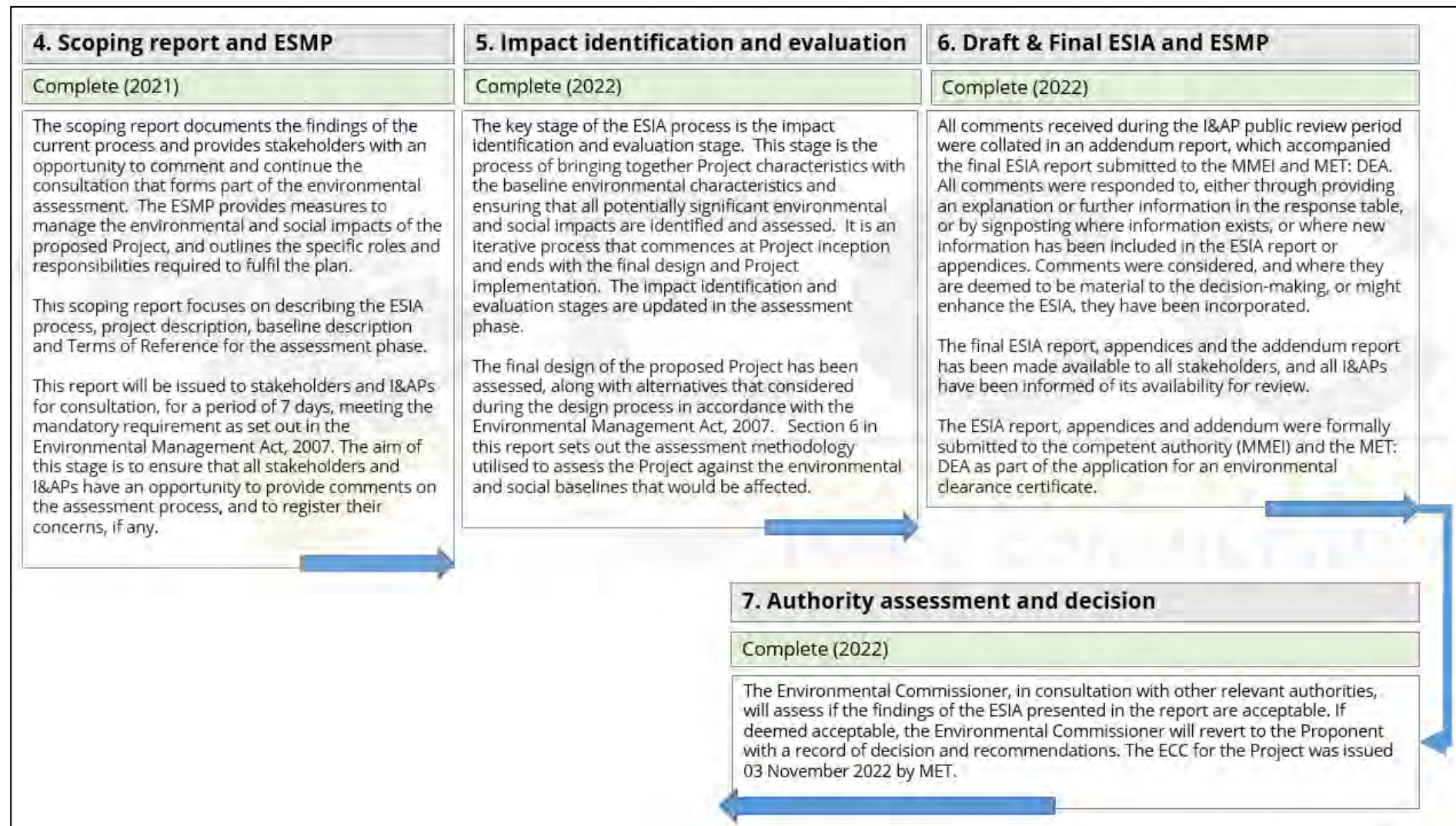
Furthermore, this amendment assessment was undertaken for the Proponent in accordance with Namibian legal requirements and where required, lender requirements (e.g. Equator Principles).

This amendment assessment is a formal process. The potential effects that the Project will have on the biophysical, social, and economic environments are identified, assessed, and reported so that the significance of potential impacts can be taken into account when considering a record of decision for the proposed Project.

Final mitigation measures and recommendations are based on the cumulative experience of the consulting team (including specialists) and the Proponent, taking into consideration the potential environmental and social impacts. The process followed, through the assessment, is illustrated in Figure 3 and is detailed further in the following sections.

It is important to note that the amendment assessment has been carried out in accordance with the updated site layout and plans received from the Proponent as of May 2023. All updated recommended mitigation measures are included in this amendment and the accompanying updated ESMP.





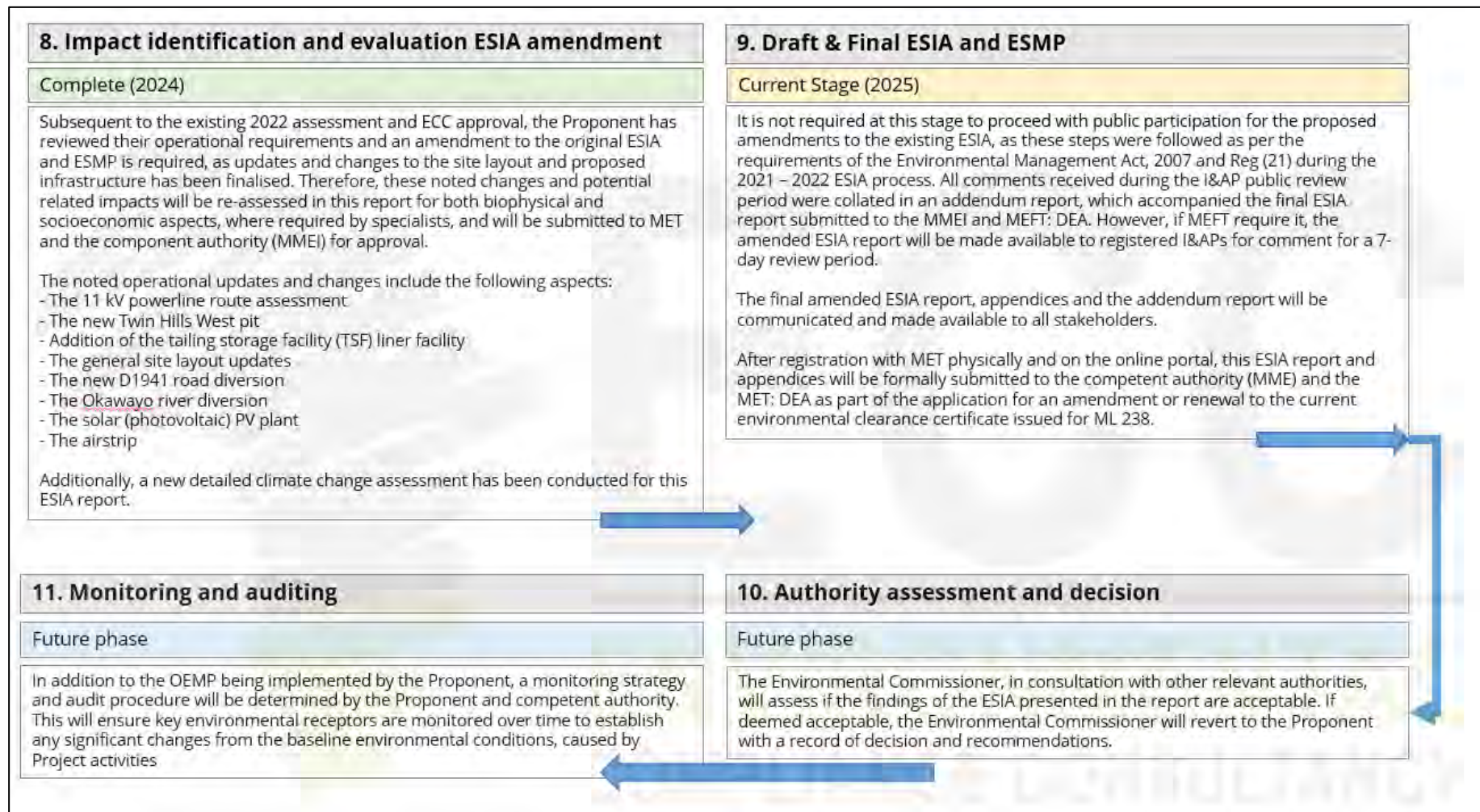


Figure 3 - ESIA process and progress of each stage

2.3 STUDY AREA

This ESIA study area has been defined according to the geographic scope of the receiving environment and potential impacts that could arise because of the proposed Project within that area. The receiving environment is a summary term for the biophysical and socioeconomic environment that is described in the baseline chapter (Chapter 5). The study area is presented in Figure 4. The study area extends beyond the mining licence boundary and includes the nearby receptors such as farmsteads and Karibib town.

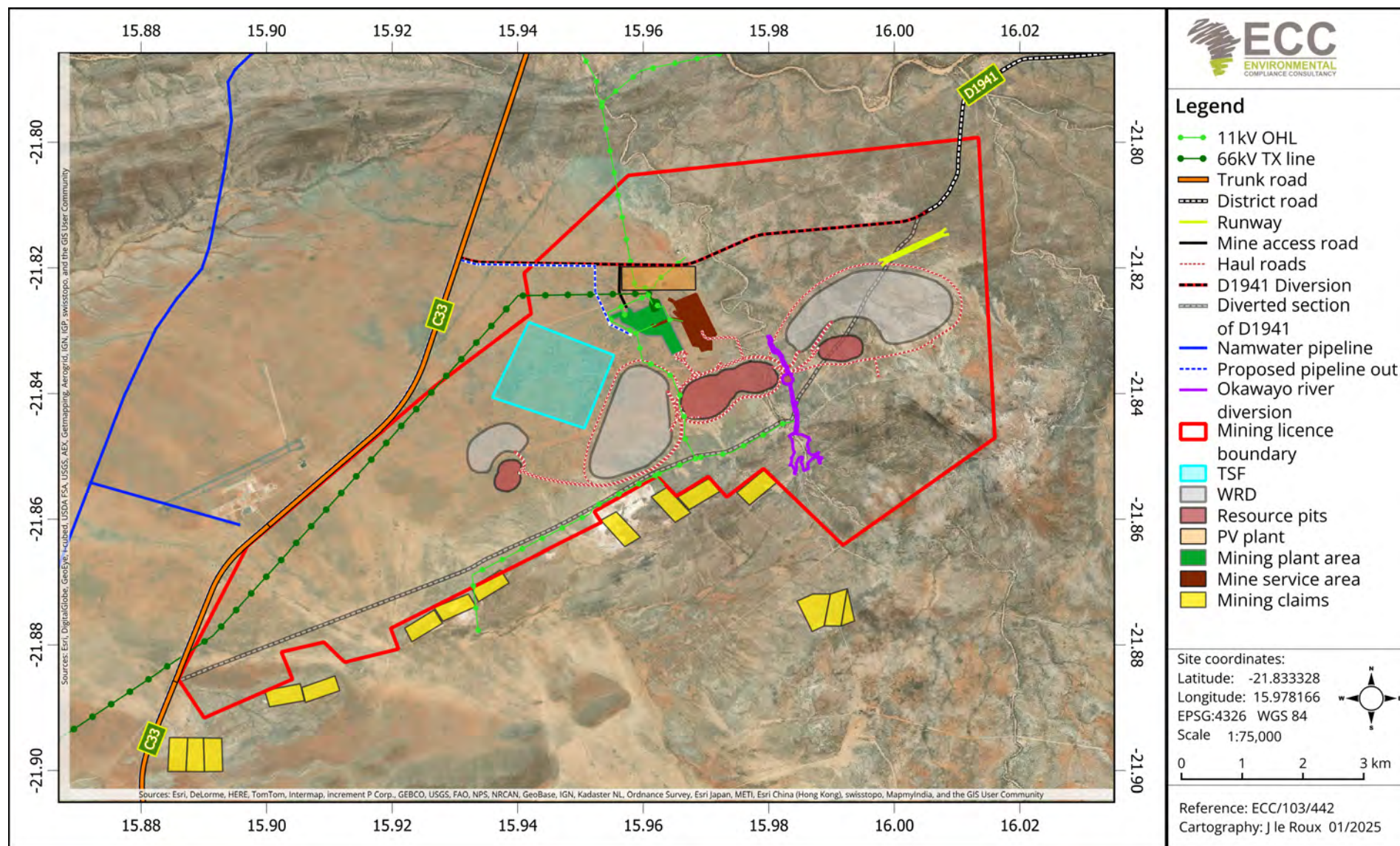


Figure 4 - ESIA study area, infrastructure, and surrounds

2.4 PUBLIC CONSULTATION

Public participation and consultation are a requirement stipulated in Section 21 of the Environmental Management Act, No. 7 of 2007 and its 2023 Regulations, for a project that requires an environmental clearance certificate. Consultation is a compulsory and critical component of the ESIA process for achieving transparent decision-making and can provide many benefits. Consultation is ongoing during the ESIA process. The objectives of the public participation and consultation process are to:

- Provide information on the Project, and introduce the overall Project concept and plan in the form of a background information document (BID) (Appendix B);
- Determine the relevant government, regional and local regulating authorities;
- Listen to and understand community issues, record concerns, and questions;
- Explain the process of the ESIA and timeframes involved; and
- Establish a platform for ongoing consultation.

The proponent is applying for this amendment in accordance with section 39 of the Environmental Management Act, 2007. As per the requirements for an amendment the Environmental Commissioner may only amend a condition of an environmental clearance certificate under this section if he or she is satisfied that the amendment will not have significant effect on the environment and interests of any other person are not adversely affected. In terms of section 44 in amending an environmental clearance certificate the amendment will be communicated and made available to all stakeholders and interested or affected parties for a public review period of 7 days.

2.4.1 IDENTIFICATION OF KEY STAKEHOLDERS AND INTERESTED AND AFFECTED PARTIES

A stakeholder mapping exercise (see Figure 5) was undertaken to identify individual or groups of stakeholders, and the method in which they will be engaged during the ESIA process. Stakeholders were approached through direct communication (letters and phone calls), the national press, site notices, or directly by email. The list of stakeholders is included in Appendix B. A summarised list of stakeholders that were engaged during the public consultation process for the 2021 – 2022 scoping and assessment stages is given below:

- Directly and indirectly affected landholders and workers;
- The general public with an interest in the Project;
- Ministry of Environment, Forestry and Tourism (MEFT);
- Ministry of Agriculture, Fisheries, Water and Land Reform (MAFWLR);
- Ministry of Industry, Mines and Energy (MIME);
- Chamber of Mines;
- Namibian Chamber of Environment;
- National Heritage Council (NHC);
- Ministry of Works and Transport (MWT) and the Roads Authority;
- Erongo Regional Council;

- Karibib and Omaruru Town Councils;
- Town residents and business owners;
- Parastatals such as NamWater and NamPower;
- Cellular network providers;
- Quarry and mineral claims holders adjacent to the Project;
- Khan River water users downstream of the Project;
- Namibian Air Force, Karibib Air Base and the Civil Aviation Authority;
- Non-governmental organisations (NGOs).

Appendix B provides a list of interested and affected parties, evidence of consultation, including notices of advertisements in national newspapers, minutes of public meetings, and a summary of the comments or questions raised by the public. A summary of the key concerns raised during the consultation process for the 2021 - 2022 scoping and ESIA reports is provided in section 2.4.2.

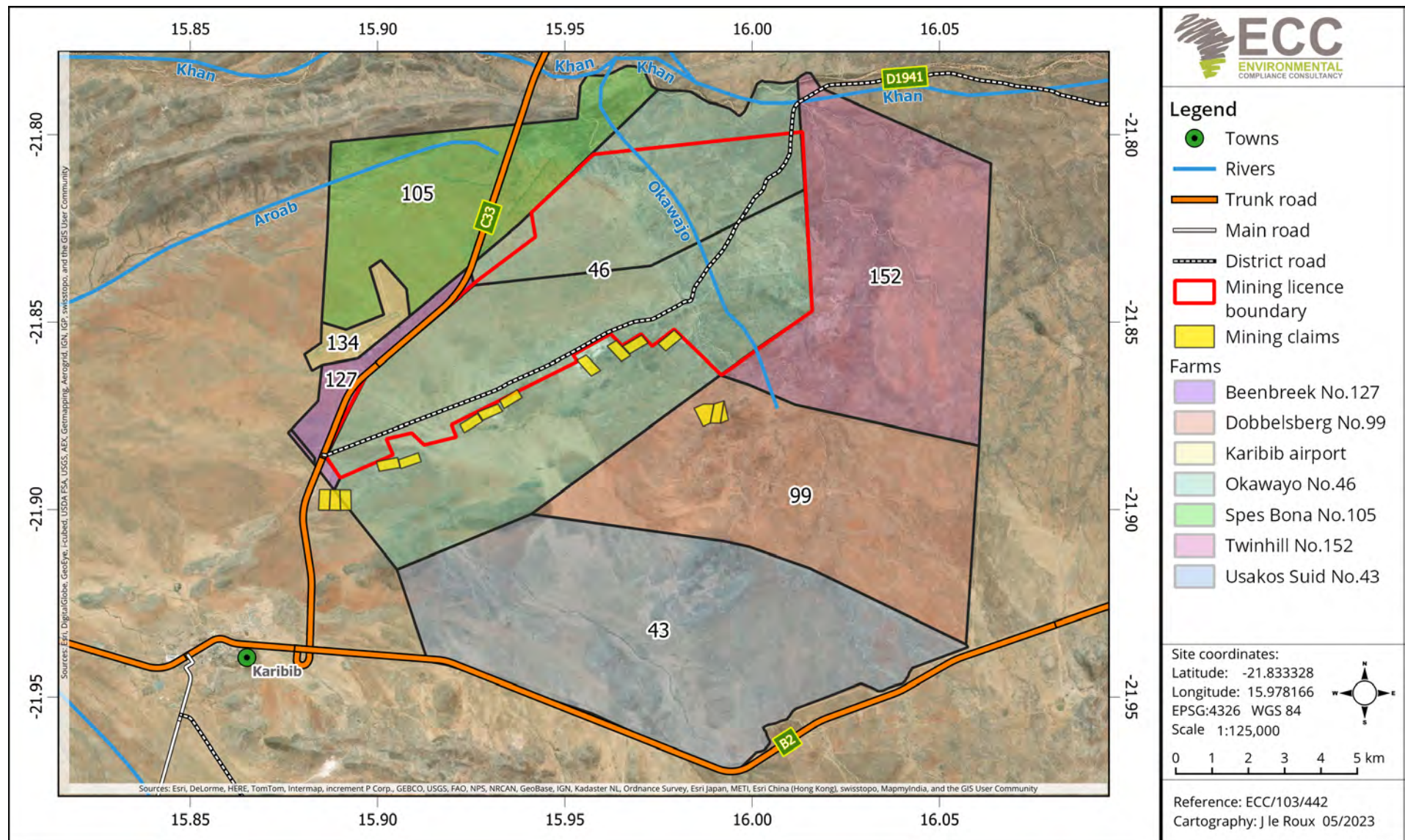


Figure 5 - Neighbouring farms to the mining licence area

2.4.2 SUMMARY OF ISSUES RAISED

During the compilation of the existing ESIA, several stakeholders were engaged for input and feedback on potential issues or concerns regarding the proposed Project. Overall, the proposed Project received positive feedback and was well received by the public. The records of the consultation meetings are provided in Appendix B of this report.

The matters raised at the public meetings and via email could be considered typical concerns for this scale of Project, and these are summarised as follows:

- Heritage impacts;
- Power and water supply;
- Waste management;
- Waste resource management;
- Visual impacts;
- Biodiversity impacts;
- Socioeconomic and social impacts, such as
 - o job creation, staff housing and accommodation, the lack of amenities in Karibib, and farmhand job loss due to purchase of nearby farms;
- Potential pollution impacts;
- Mine closure.

To ensure that interested and affected parties could comment and provide feedback during the 2021 – 2022 ESIA process, the original scoping report and assessment report was circulated to potentially interested and or affected parties, and stakeholders of the Project for a 21-day review period.

3 REVIEW OF THE LEGAL ENVIRONMENT

This chapter outlines the regulatory framework applicable to the proposed Project. As stated in Chapter 1, an environmental clearance is required for any activity listed in the Government Notice No. 29 of 2012 of the EMA. The Proponent was issued with the approved environmental clearance certificate for ML 238 on the 03 November 2023, valid for a three-year period.

The Project area is located outside of any national parks, heritage listed areas, or areas of significance. The Project area is located within a groundwater-controlled area, as regulated under the Water Resource Management Act 11 of 2013.

A thorough review of relevant legislation has been conducted for the proposed Project. Table 3 identifies relevant legal requirements specific to the Project. Table 4 provides the national policies and plan and Table 5 lists specific permits for the Project.

3.1 NATIONAL REGULATORY FRAMEWORK

Table 3 – Details of the regulatory framework as it applied to the Twin Hills Gold Project

National Regulatory Framework	Summary	Applicability to the Project
Constitution of the Republic of Namibia (1990)	The constitution defines the country's position in relation to sustainable development and environmental management. The constitution refers that the state shall actively promote and maintain the welfare of the people by adopting policies aimed at the following: “Maintenance of ecosystems, essential ecological processes and biological diversity of Namibia, and the utilisation of living, natural resources on a sustainable basis for the benefit of all Namibians, both present, and future.”	The Twin Hills Gold Project is committed to the sustainable use of the environment, and has aligned its corporate mission, vision, and objectives within the ambit of the Constitution of the Republic of Namibia (1990).
Minerals (Prospecting and Mining) Act No. 33 of 1992	The Act provides for the granting of various licences related to mining and exploration. Section 50 (i) requires: “An environmental impact assessment indicating the extent of any pollution of the environment before any prospecting operations or mining operations are being carried out, and an estimate of any pollution, if any, likely to be caused by such prospecting operations or mining operations.” The Act sets out the requirements associated with licence terms and conditions, such that the holder of a mineral licence shall comply with.	The proposed mining activity requires an ESIA to be carried out and a new assessment if changes are made to the site layout or operational requirements, as it triggers listed activities in the Environmental Management Act's regulations. Mining activities shall not commence until all conditions in the Act are met, which includes an agreement with the landowners and conditions of compensation, if applicable.

National Regulatory Framework	Summary	Applicability to the Project
	The Act also contains relevant provisions for pollution control related to mining activities and land access agreements and provides provisions that mineral licence holders are liable for any damage to land, water, plant, or animal life, caused by spilling or pollution, and must take all such steps as may be necessary to remedy such spilling, pollution, loss, or damage, at its own costs.	The Project shall be compliant with Section 76 of the Act with regard to records, maps, plans and financial statements, information, reports, and returns submitted. As the Proponent may need to access privately owned land, the Proponent will ensure Sections 50 and 52 are complied with.
Environmental Management Act, 2007 (Act No. 7 of 2007) and its Regulations, including the Environmental Impact Assessment Regulation, 2007 (No. 30 of 2011)	The Act aims to promote sustainable management of the environment and use of natural resources. The Act requires certain activities to obtain an environmental clearance certificate prior to Project development. The Act states that an EIA should be undertaken and submitted as part of the environmental clearance certificate application process. The MEFT is responsible for the protection and management of Namibia's natural environment. The Department of Environmental Affairs, under the MEFT, is responsible for the administration of the EIA process.	This report documents the findings of the scoping and assessment phases of the environmental and social impact assessment undertaken for the proposed Project. The process has been undertaken in line with the requirements under the Act and its regulations.
Water Resource Management Act 11 of 2013	The Water Resources Management Act (No. 11 of 2013) was promulgated and its regulations were also passed in August 2023.	The Act stipulates obligations to prevent the pollution of water. Measures to minimise potential surface and groundwater pollution are contained in the ESMP.

National Regulatory Framework	Summary	Applicability to the Project
	This Act provides for the control, conservation and use of water for domestic, agricultural, urban, and industrial purposes; and to make provision for the control of certain activities on or in water. The Department of Water Affairs, within the Ministry of Agriculture, Fisheries, Water and Land Reform (MAFWLR), is responsible for the administration of the Act.	The Project is obliged to have all permits relevant to its operations under this Act. Abstraction of water from boreholes requires an abstraction licence to be obtained from the Ministry of Agriculture, Fisheries, Water and Land Reform. The diversion of the Okawayo river, the location and placement of mining infrastructure, such as the tailings storage facility, and the location of industrial effluent storage ponds, require consideration in terms of the Water Resource Management Act. This has been considered in the assessment phase of the ESIA.
Soil Conservation Act, No. 76 of 1969	This Act makes provision for the prevention and control of soil erosion, and for the protection, improvement, and conservation of soil and vegetation.	Land clearing is an unavoidable necessity for the proposed Project, as large areas will be cleared for mining infrastructure. Measures have been included in the EMSP to conserve soil and vegetation that will be used as part of the rehabilitation phase of the Project.
The Forestry Act, No. 12 of 2001 as amended by the Forest Amendment Act, No. 13 of 2005	Section 22 deals with the protection of natural vegetation that is not part of the surveyed erven of a local authority area as defined.	The Project activities will require vegetation clearing. The Proponent will ensure that all required permits are in place before vegetation removal commences,

National Regulatory Framework	Summary	Applicability to the Project
	Section 21 states that no person shall cut, destroy, or remove vegetation that is growing within 100 metres of a river, stream, or watercourse. Section 23 requires a permit from the Director for the clearance of vegetation on more than 15 ha on any piece of land or several pieces of land situated in the same locality as that which has predominantly woody vegetation; or cut or remove more than 500 cubic metres of forest produce from any piece of land in a period of one year.	either as a land disturbance permit or tree harvesting permit application.
National Heritage Act, No. 27 of 2004.	The Act provides provision for the protection and conservation of places and objects with heritage significance. Section 55 compels mining companies to report any archaeological findings to the National Heritage Council. Subsection 9 allows the NHC to issue a consent, subject to any conditions that the Council deems necessary.	There is the potential for heritage related objects to be found in the mining licence area. Therefore, the relevant stipulations in the Act have been taken into consideration and incorporated into the ESMP. In cases where heritage sites are discovered, the 'chance find procedure' will be followed.
Labour Act, No. 11 of 2007	The Labour Act, No. 11 of 2007 (Regulations relating to the Occupational Health & Safety provisions of Employees at Work, promulgated in terms of Section 101 of the Labour Act, No. 6 of 1992 - GN156, GG 1617 of 1 August 1997)	The Project shall adhere to all labour provisions and guidelines, as enshrined in the Labour Act. The Project shall also develop and implement a comprehensive occupational health and safety plan to ensure adequate protection for its personnel throughout the Project lifecycle.

National Regulatory Framework	Summary	Applicability to the Project
Road Traffic and Transport Act, No. 22 of 1999	This Act makes provision for the control of traffic on public roads, the licensing of drivers, the registration and licensing of vehicles, and the control and regulation of road transport users across Namibia.	The Project will involve transportation activities in support of mining activities. The employees and support businesses shall adhere to national road regulations on public roads. The Proponent will ensure that the diversion of the D1491 road will be conducted in compliance with the Act.
Hazardous Substances Ordinance, No. 14 of 1974	This Ordinance provides for the control of toxic substances and can be applied in conjunction with the Atmospheric Pollution Prevention Ordinance, No. 11 of 1976. This applies to the manufacture, sale, use, disposal, and dumping of hazardous substances, as well as their import and export.	The planned Project will involve the handling and storage of hazardous substances such as fuels, reagents, and industrial chemicals. The Proponent shall ensure safe handling, transfer, storage, and disposal protocols are developed, implemented, and audited throughout its operations. The Proponent is obliged to ensure that all permits under this Ordinance are obtained prior to Project commencement.
Civil Aviation Act, No. 6 of 2016	Section 55 of the regulations relates to safety and security protocols near aerodromes.	The Project is located in proximity to the military air base, and as such, the Proponent will ensure that all regulations regarding safety and security near aerodromes is complied with.

National Regulatory Framework	Summary	Applicability to the Project
		This includes complying with the requirements of NAMCATS technical standards Part 139 for aerodromes (2018). Which requires; i) Permits for specific permanent and temporary infrastructure (e.g. power line infrastructure) to be applied for with the office of the Executive Director. ii) No building or object higher than 45 metres above the aerodrome elevation, may be erected within a distance of 15 kilometres measured from the aerodrome reference point without written approval of the Executive Director. iii) If the airstrip is constructed, certain requirements need to be adhered to, to register and operate this aerodrome. iv) Additionally, visual demarcation requirements are to be adhered to due to the distance with the Karibib military air base (Sub-part 13 - Visual aids for denoting obstacles).
The Atmospheric Pollution Prevention Ordinance, No. 11 of 1976	The Ordinance pertains to the prevention of air pollution, with particular focus on public health, and contains detailed provisions on air pollution matters, including the control of noxious or offensive gases, atmospheric pollution by smoke, dust control, motor vehicle emissions, and other general provisions.	The nature of mining activities generates dust. Activities within the mining operations and processing plant will generate gases, odours, and air pollution. The Proponent will ensure that all reasonably practicable measures will be implemented to reduce and mitigate impacts to air quality; this is included in the ESMP.

3.2 NATIONAL POLICES AND PLANS

Table 4 – Namibian national polices and plans applicable to the Twin Hills Gold Project

Policy Or Plan	Description	Relevance to the Project
Vision 2030	Vision 2030 sets out the nation’s development targets and strategies to achieve its national objectives. Vision 2030 states that the overall goal is to improve the quality of life of the Namibian people aligned with the developed world.	The proposed Project shall aim to meet the objectives of Vision 2030 and shall contribute to the overall development of the country through continued employment opportunities and ongoing contributions to the gross domestic product (GDP).
Fifth National Development Plan (NDP5)	The NDP5 is the fifth in a series of seven five-year national development plans that outline the objectives and aspiration of Namibia’s long-term vision. The NDP5 pillars are economic progression, social transformation, environmental sustainability, and good governance.	The planned Project supports meeting the objectives of the NDP5 through creating opportunities for continued employment.
The Harambee Prosperity Plan ii (2021 – 2025)	Second Pillar: Economic advancement – ensuring increasing productivity of priority key sectors (including mining) and the development of additional engines of growth, such as new employment opportunities.	The Project will contribute to the continued advancement of the mining industry and create an additional employment generation engine within the regional and national landscape.
Minerals Policy	The Minerals Policy was adopted in 2002 and sets guiding principles and direction for the development of the Namibian mining sector, while communicating the values of the Namibian people. The policy strives to create an enabling environment for local and foreign investments in the mining sector and seeks to	The planned Project conforms to the Policy, which has been considered through the ESIA process and the production of this report. The Proponent intends to continue to support local spending and procurement.

Policy Or Plan	Description	Relevance to the Project
	maximise the benefits for the Namibian people from the mining sector, while encouraging local participation. The objectives of the Minerals Policy are in line with the objectives of the Fifth National Development Plan that include reduction of poverty, employment creation, and economic empowerment in Namibia.	The Project will comply with the general guidelines of the Policy through the adoption of various legal mechanisms to manage all aspects of the environment effectively and sustainably from the start. The ESIA is one such mechanism to ensure environmental integrity throughout the planned Project's lifecycle.

Table 5 – Specific permits and licence requirements for the Twin Hills Gold Project

Permit or licence	Act / Regulation	Related activities requiring permits	Relevant authority
Environmental clearance certificate	Environmental Management Act, No. 7 of 2007	Required for all listed activities shown in Table 2.	Ministry of Environment, Forestry and Tourism (MEFT)
Mining licence	Section 90 (2) (A) of the Minerals Act, No. 33 of 1992	Written permission from the mining commissioner.	Ministry of Industry, Mines and Energy (MIME)
Surface rights agreements (mine, infrastructure corridors)	Section 52 (1) (A) of the Minerals Act, No. 33 of 1992	Included in the mining license application. Also required in the permit application for accessory works areas.	Ministry of Industry, Mines and Energy (MIME)
Exclusive prospecting licences	Section 68 (2) (A) of the Minerals Act, No. 33 of 1992	Written permission from the mining commissioner before prospecting can commence.	Ministry of Industry, Mines and Energy (MIME)
Accessory work permit	Section 90(3) of the Minerals Act, No. 33 of 1992	Written permission from the mining commissioner before accessory works can be erected on an EPL or mining licence area.	Ministry of Industry, Mines and Energy (MIME)

Permit or licence	Act / Regulation	Related activities requiring permits	Relevant authority
Licence for boreholes (exploration and water boreholes)	Water Resources Management Act 11 of 2013	Required before the drilling of boreholes for exploration and the abstraction of water.	Ministry of Agriculture, Fisheries, Water and Land Reform (MAFWLR)
Wastewater and effluent discharge licence	Water Resources Management Act 11 of 2013	Required for discharge of sewage, the disposal of tailings and/or management and containment of industrial or mine wastewater.	Ministry of Agriculture, Fisheries, Water and Land Reform (MAFWLR)
River diversion Licence	Water Resources Management Act 11 of 2013	Construction of canals and channels, including the diversion of the normal flow of water in a riverbed, and water transfer schemes between water catchments and impoundments. This approval was granted with the issuance of the environmental clearance certificate, as the diversion of riverbeds is considered a listed activity 8.4 of the Environmental Management Act, 2007.	Ministry of Agriculture, Fisheries, Water and Land Reform (MAFWLR)
Permit for the clearing of land	The Forest Act, 2001 (Act No. 12 of 2001)	This Act governs the removal of vegetation within 100 m of a water course, or removal of more than 15 ha of woody vegetation, or the removal of any protected plant species. The permit required is either through a land disturbance or tree harvesting application.	Ministry of Environment, Forestry and Tourism (MEFT)

Permit or licence	Act / Regulation	Related activities requiring permits	Relevant authority
Permit for the destruction of heritage objects and artefacts	The Heritage Act, No. 27 of 2004.	This Act relates to interference with heritage artefacts during the Project life. Heritage sites could potentially be located within the proposed mining licence footprint, or along proposed pipeline or powerline routes.	National Heritage Council (NHC)
Consumer installation certificate for bulk fuel storage	Petroleum Products Regulations	A consumer installation certificate is required for bulk fuel storage and dispensing.	Ministry of Industry, Mines and Energy (MIME)
Licence for explosives magazine	Minerals (Prospecting and Mining) Act, No. 33 of 1992; Mine Safety Regulations Section 22 of the Explosives Act, Act 26 of 1956 and Section 7.2.1 of the Explosives Regulations 1972	This is also covered under the accessory works application. An application for a licence is to be made to the Chief Inspector of Explosives. The permission will lapse if the magazine has not been completed within six months of the date of grant of such permission.	Ministry of Industry, Mines and Energy (MIME)
Permit for the storage and use of explosives, and the burning of packaging	Minerals (Prospecting and Mining) Act, No. 33 of 1992; Mine Safety Regulations	Part x (10), explosives and blasting. The agreement with the contractor/company to be used must first be in place before an application for a blasting permit can be made with the blasting inspector. The validity of the permit is determined by the Chief Inspector of Explosives with the information supplied.	Ministry of Industry, Mines and Energy (MIME)

Permit or licence	Act / Regulation	Related activities requiring permits	Relevant authority
		There is no permit required to burn packaging as requirement is stipulated in 10.23.7 of the Regulations.	
Emissions stack(s) and towers Temporary and permanent infrastructure (e.g. electrical infrastructure) in relation to existing aerodromes	Civil Aviation Act, No. 6 of 2016 NAMCATS technical standards Part 139 for aerodromes (2018)	Section 55 of the regulations relates to safety and security protocols near aerodromes. NAMCATS technical standards requirement's sub-part 01.34 (Land use in the vicinity of aerodrome) and sub-part 11 (Obstacle restrictions and removal) Permits to be applied for from the office of the Executive Director (FSS-AGA-FORM-032 / FSS-AGA-FORM-033).	Civil Aviation Authority
Aviation and construction/operation of an airstrip/aerodrome	Civil Aviation Act, No. 6 of 2016; Section 90 (3) of the Minerals Act, No. 33 of 1992 NAMCATS technical standards Part 139 for aerodromes (2018)	This is also covered under the accessory works application. Separate permits will be required to construct, register and operate and aerodrome.	Civil Aviation Authority

4 PROJECT DESCRIPTION

4.1 NEED FOR THE PROJECT

New mining activities could contribute to the national and local economies and may have a positive impact on the country's economy. Namibia's economy depends largely on mining. Should the Twin Hills Gold Project prove economically viable, the Namibian economy can expect benefits from revenues during the construction phase, royalties and taxes during the life of mine (LoM), and a positive contribution towards employment. Based on current mine plans, between 1000 and 1500 people will be employed during construction, and approximately 429 for the operational phase, providing jobs and livelihoods for them, and their families, for a minimum of 13 years.

4.2 EMPLOYMENT

The labour requirement for a typical gold mine the size and scale of the proposed project is expected to be approximately 1000 people during the construction phase, and approximately 880 during the operational phase. During operations it is expected that the split for the labour requirement will be: processing plant approximately 95 people; technical, administration, safety, health and environment and management 580; maintenance personnel 76 people; mining approximately 450 people. A detailed labour plan covering all operation components will be developed as the project evolves. The labour complement for the mining component at this stage comprises of the following:

- Management team;
- Mine technical service team;
- Mine support services team;
- Production crew – drill and blast;
- Production crew – load and haul;
- Mine maintenance crew.

The preferred mining contractor labour requirement for mining operations over the LoM is 879 people at maximum production.

4.1 BACKGROUND OF THE PROJECT AND EXPLORATION HISTORY

The Twin Hills Gold Project is located in central Namibia near the regional towns and settlements of Karibib, Omaruru, Wilhelmstal, and Usakos in the Erongo Region of Namibia (see Figure 6). Osino, through various locally held and majority-owned subsidiaries, holds 16 EPLs in central Namibia. The EPLs relevant to the Twin Hills Gold Project and the mining licence area are shown in Figure 7.

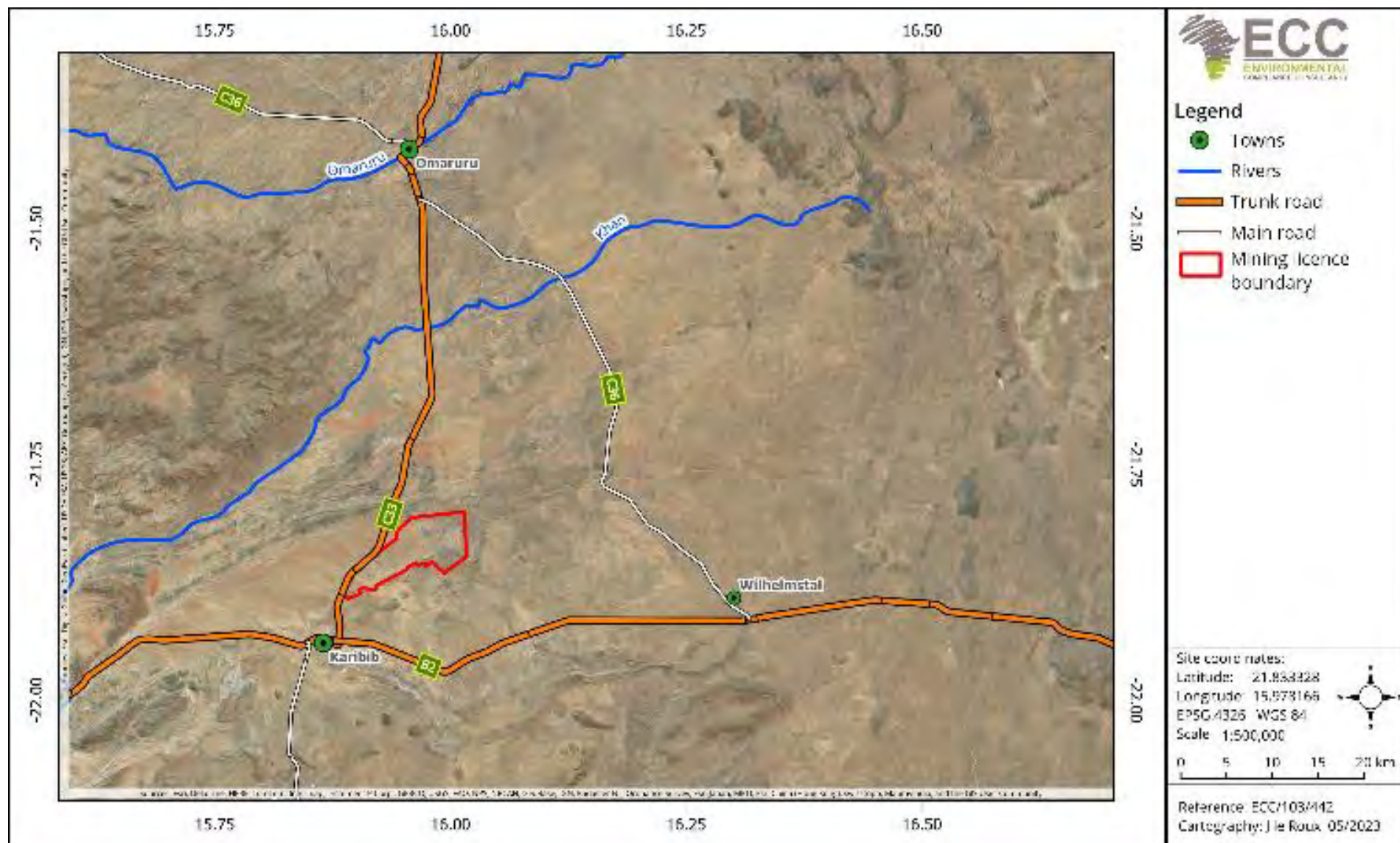


Figure 6 - Project location in proximity to towns and roads

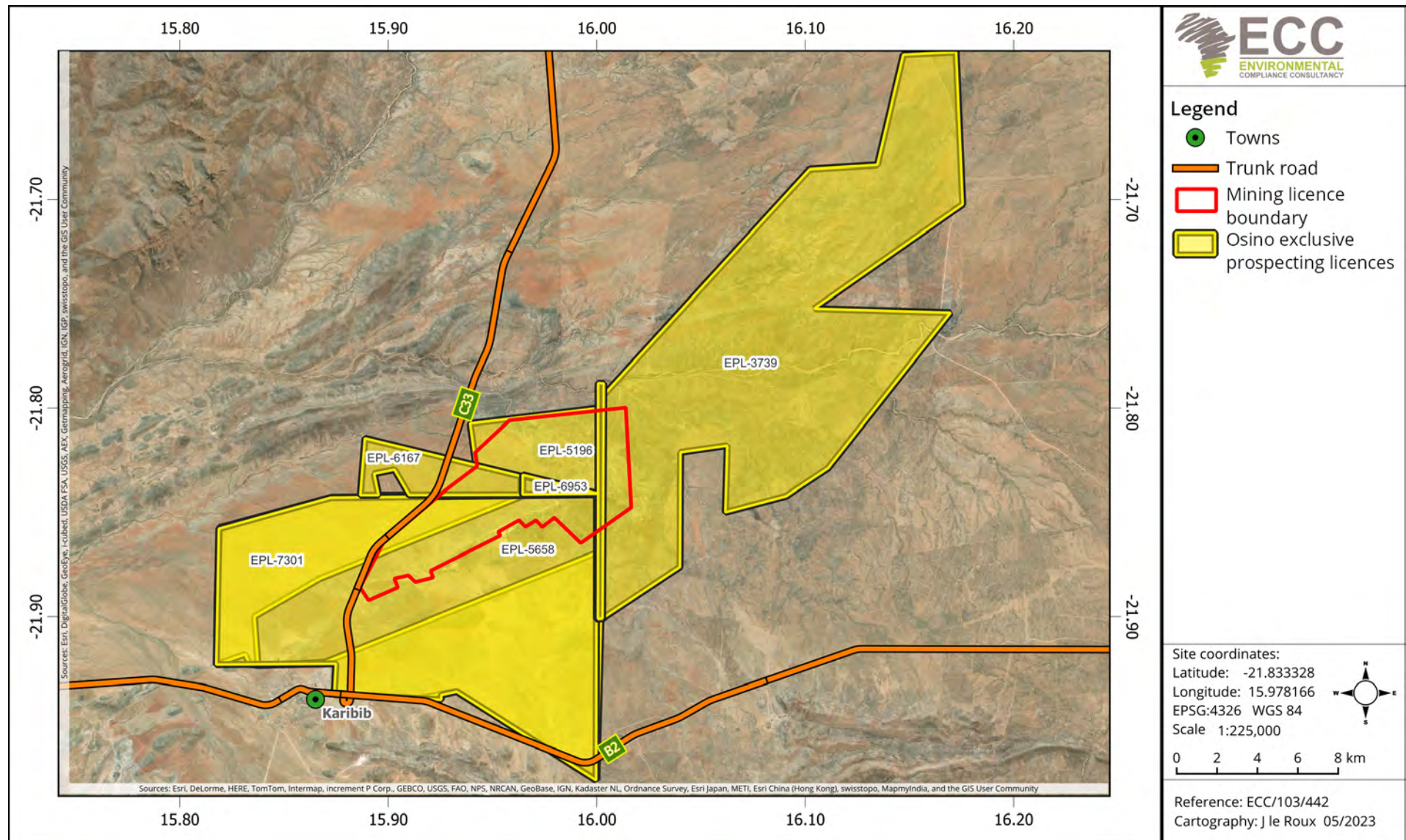


Figure 7 - Tenement boundaries showing mining licence and EPLs

Parts of the Project area were explored historically by Anglo American and Bafex Exploration as of 2008, prior to Osino. Osino has actively and systematically explored the Project area since 2016, using a variety of exploration methodologies, including, but not limited to, geochemical surveys, soil sampling, limited trenching, and drilling (RAB, RC and diamond drilling) techniques. (CSA Global, 2021).

Osino has used government regional aeromagnetic data, and carried out a detailed ground magnetic survey, as part of the exploration programme to define the Project and numerous other targets along the Karibib fault zone and related structures.

The mineral resource estimate for the Twin Hills Gold Project includes the main pit, namely Bulge, Twin Hills Central (THC), and Twin Hills North (THN) and surrounding satellite pits Clouds, Clouds West and Twin Hills West (THW). The mineral resource has an economically viable cut-off grade of 0.4 g/t Au (gold), as demonstrated in the company's published DFS (Lycopodium, 2023).

The Proponent has rapidly advanced the technical viability of the proposed Project through accelerated exploration drilling and fast-tracked development studies. The Proponent has drilled more than 225,574 drill meters with assays from the drilling that were used to support the mineral resource, as of March 2023.

4.2 GEOLOGY AND MINERALISATION

The Proponent has completed numerous in-depth studies concerning the geology and mineralisation of the Twin Hills Gold Project. The DFS NI 43-101 Technical Report dated June 2023 describes the geology and mineralisation in depth. Those descriptions are summarised in this section to provide a concise technical overview of the geology and mineralisation of the Twin Hills Gold Project. For more detailed technical descriptions, please find the DFS NI 43-101 Technical Report, 2023 on the Osino website, or as filed on SEDAR under the company's profile at www.sedar.com.

The Project is located in an area of known gold deposits hosted within the inland arm of the Pan-African Neoproterozoic Damara Belt, a northeast-striking Neoproterozoic fold, thrust, and metamorphic belt. It reflects a Neoproterozoic rifting-accretionary event between the Congo Craton to the north and the Kalahari Craton to the south. Peak deformation within the Damara Belt occurred between 500 million years ago (Ma) and 530 Ma.

The Damara Belt comprises a gently folded Northern Zone, a Central Zone, and a Southern Zone. The Central Zone consists predominantly of calcareous and pelitic sediments that were deposited in a back-arc environment. The Southern Zone is considered to represent the suture zone and was intensely deformed, at high pressures and low temperatures, by a series of southeast verging thrusts. A range of syntectonic and post-tectonic intrusions are present, and these range from

mafic to acid (i.e. gabbro to granite). Of these, the early syntectonic to late tectonic I-type Salem granites are the most abundant. These were followed by post-tectonic I-type granites. A much later Jurassic to Cretaceous event led to the emplacement of various alkaline ring complexes and granitic batholiths, as well as flood basalt provinces.

Geologically, the Project lies in the Southern Central Zone of the Damara Belt, lying to the south of a prominent regional scale lineament (the Omaruru lineament) and 20 km to 55 km east-northeast of the Navachab gold mine. The north-eastern part of the Project area is largely underlain by undifferentiated syntectonic Salem-type granite. The balance of the Project area is underlain by meta-sedimentary rocks of the Swakop Group. This group comprises the Arandis Formation (biotite schist, minor quartz schist calc-silicate rock and amphibolite), the Karibib Formation (dominantly dolomitic and calcitic marbles), and the overlying Kuiseb Formation (schistose, quartz, feldspar, mica, metagreywacke, and metapelite).

The sediments underwent polyphase deformation and metamorphism during the Damara Orogen. The larger, earlier folds have northeast-southwest striking axial planes, parallel to the Omaruru lineament. These were subsequently deformed into open basin and dome structures about fold axes with northwest-southeast orientations. Later crosscutting lineaments are also evident in the area. The Swakop Group sediments were intruded by a series of syntectonic, late-syntectonic, and post-tectonic granite and pegmatite bodies. Both generations of folds are recognised in drill core. Later, during the Damara Orogen, the crustal scale Karibib Fault Zone (KFZ) on the southern margin of the Karibib Basin was reactivated as a dextral fault with associated secondary and tertiary structures.

The structural geology of the Project area is dominated by features typical of the Southern Central Zone of the Damara Belt, namely: basement and/or basal Damara metasedimentary rocks in the cores of dome and anticlinal structures, and regional synclinal structures with thick packages of Kuiseb Formation schists “filling” these synclines.

Osino has made a series of gold discoveries along the Karibib Fault Zone, which was originally interpreted from regional magnetic data to have a strike length of over 100 km. Osino’s licences cover more than 70 km of this strike extent. The Karibib Fault Zone is manifested as a belt of very high strain, intense silicification, and partial remelting. The calcrete-covered central portion of the Karibib Fault Zone has been the most prospective to date and is where the Twin Hills deposit is located. Twin Hills is a cluster of gold mineralised zones associated with schists of the Kuiseb Formation.

Gold mineralisation is closely associated with arsenopyrite and pyrrhotite, and the deposits and occurrences are classified as orogenic. Orogenic gold deposits are generally hosted by volcanic and turbiditic sequences that have been metamorphosed to greenschist or, less commonly, amphibolite facies (CSA Global, 2021).

The deposits are generally interpreted to form late in the orogenic cycle from mid- to lower-crustal metamorphic fluids. Gold mineralisation develops syn-kinematically, with at least one stage of major deformation of the country rocks, and they inevitably have a strong structural control involving faults or shear zones, folds, and other areas of competency contrasts. Mineralisation along the Karibib Fault Zone has been located, by Osino, for over 20 km of strike to date, with the main target area at Twin Hills being associated with a structural jog along the Karibib Fault Zone. At a deposit scale, mineralisation is associated with shearing in the greywacke/turbidite sequence, parallel to the axial planes of isoclinal folds, and occurs in millimetre-scale veinlets as well as in more disseminated forms.

Osino used an orogenic gold, mineral systems approach to select and prioritise its regional exploration targets, with the Karibib Fault Zone considered the priority regional structure.

4.3 SITE LAYOUT

An optimal site layout is based on designing the site around critical landform features such as topography and sensitive areas, while considering the efficiencies required for the mining operation. The proposed site layout is provided in Figure 4.

As mentioned, it is important to note that the updated assessment has been carried out in accordance with revised plans received from the proponent. The area surrounding the Twin Hills Central and Clouds open pits has relatively flat topography to the east and west of the Okawayo River course.

The waste rock dump (WRD) locations exist in the footwall and hanging wall of the three pits, providing a flexible waste rock dumping strategy through the course of the mine life.

The plant site location is situated to the north of the Twin Hills Central open pit in an area of flat ground covered by Kalahari sands. The open area designated for the plant site is situated optimally for the transportation of most of the ore tonnes to be mined from the Twin Hills Central open pit.

The tailings storage facility (TSF) will comprise a lined facility, with the outer wall constructed using compacted tailings as well as waste rock excavated from the open pit. It is envisaged that the tailings facility will accommodate filtered tailings inside the embankments, with the transportation of tailings undertaken by a system including truck haulage or conveyors.

4.4 MINING INFRASTRUCTURE AND SERVICES

Qubeka Mining Consultants (2021) conducted a mining study as part of the definitive feasibility study (DFS). The following components are taken from their study, namely: orebody description, mining method, mine pit design, mining infrastructure, equipment and utilities, and staffing.

4.4.1 OREBODY

Sulphide-hosted gold mineralisation was interpreted and modelled from a combination of structural and assay data for each of the Twin Hills mineral resource areas [Bulge, Twin Hills Central, Clouds, Twin Hills North (THN) and Twin Hills West (THW)] as indicated in Figure 8. The mineralisation, hosted in metagreywacke, dips between 60° and 80° and ranges from a few metres to 200 m thick.

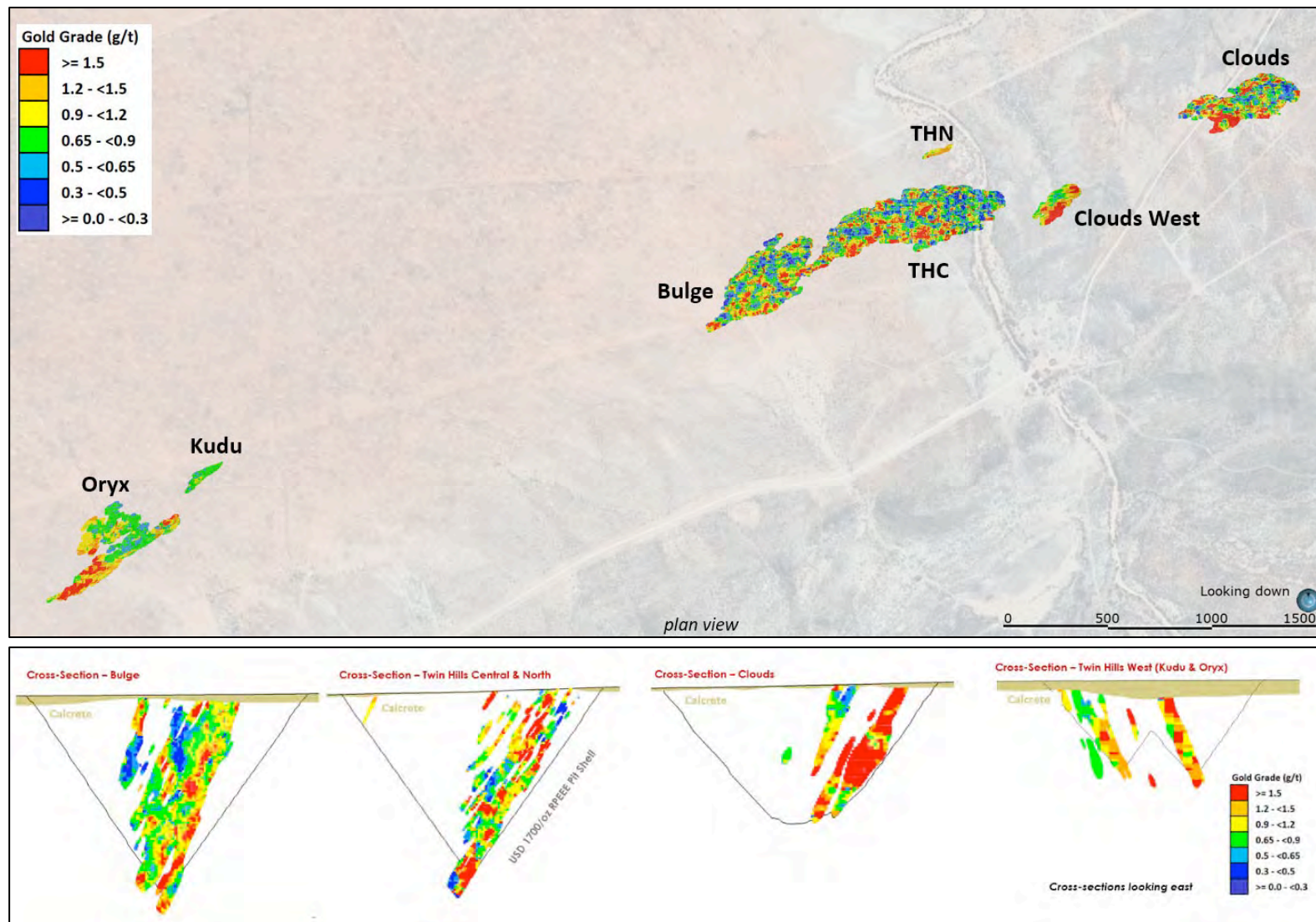


Figure 8 - Gold mineralisation and pit design (Source: (Qubeka , 2021)

The degree of stability for slopes in an open pit mine is critically important, in order to minimise the risks related to the safety of operating personnel and equipment, as well as the economic risk to the resource. Ore recovery must be maximised, and waste stripping kept to a minimum throughout the productive life of the operation. The resulting compromise is typically a balance between formulating designs that can be safely and practically implemented in the operating environment and establishing slope angles that are as steep as possible and consistent with the ore body geometry and rock conditions.

4.4.2 MINING METHOD AND EQUIPMENT

The Twin Hills Gold Project will make use of conventional open pit mining methods, with the selective ore zone and waste zone being drilled and blasted at 5 m benches, and the broad continuous areas of waste material being 10 m benches have been planned and will be loaded in two 5 m flitches. Ore and waste will be loaded with hydraulic excavators and hauled by diesel-powered trucks to the primary crusher, ROM pad stockpile, low-grade stockpile, or waste dump. At this stage it is assumed that the whole mining operation, except for the mine technical services function, will be outsourced to a reputable mining contractor company. All other mine technical services that include management, planning and grade control will be the responsibility of the Proponent.

The Project is planned as a multi-pit mining operation with seven pushbacks in the main Twin Hills Central (THC), Twin Hills North (THN) and Bulge pit design, and three satellite pit, called the Clouds pit, Clouds West and Twin Hills West (THW) to be mined in different phases throughout the LoM. It is assumed that a contractor mining model will be deployed, a 130 t hydraulic backhoe excavator to be employed for selective loading purposes, a fleet of 200 t hydraulic backhoe excavators will be employed for selective ore and waste loading, including bulk loading for entire waste benches. Off-highway rigid haul trucks of 100-t capacity will be used, and standard open-pit drilling equipment will be required. The medium-sized equipment gives increased flexibility and allows better loading selectivity, which will limit dilution. The primary equipment will be supported by an array of secondary and support equipment.

The initial management team will include a globally experienced contingent, to ensure that operation start-up is safe and efficient, and that ramp-up targets are met. An approved localisation plan will be established to train and equip the local workforce sufficiently, to enable and ensure a seamless transition of responsibilities over time. The bulk of the equipment operators are expected to be unskilled (approximately 80 %) and will require training from a basic level. The start-up strategy for mining operations takes account of this requirement.

The mine will operate 361 days per annum (allowing for lost days for public holidays and weather delays) on a 24-hour basis with three shifts rotating on an 8-hour duration.

4.4.2.1 *Blast operations*

Rock fragmentation will be undertaken by drilling and blasting, with the weathered zones requiring blasting with lower powder factors. Blasting will be a core component of the mining operation, impacting all downstream mining and comminution (crushing) processes, and also extending into the plant by way of ore recovery and dilution factors.

Blasting can substantially modify and control material flow within the mining operation, including the feed size to the primary crusher. Blast performance must be assessed in terms of the following outcomes:

- Fragmentation, relating to the feed size supplied to the primary crusher, as well as oversize material and the requirement for rehandling of material, and secondary breakage;
- Shovel productivity, including wear and maintenance costs;
- Use of track dozers to condition the bench floor and rip high bottoms;
- Grade control;
- Primary crusher power consumption, throughput, and maintenance costs;
- Disruption to material flow during digging and crushing that affects truck efficiency.

The pit configuration bench height is expected to be 5 m for ore and selective waste benches, and 10 m for bulk waste benches. The material type at the Project is suitable for a drill rig capable of drilling holes with a diameter of up to 171 mm. Drill burden, spacing and sub-drill design will be functions of the selected powder factor, which is based on the unconfined compressive strength measurement results from the geotechnical study.

A lower relative energy factor was assigned to the waste rock because the waste material needs to be efficiently and economically excavated, hauled and placed on the waste rock dump. On the other hand, with the ore material's higher relative energy factor, any finer fragmentation could benefit the downstream crushing and milling costs of the Project.

In areas where mining slopes remain intact for extended periods, it is good practice to minimise the fracturing of the high walls during blasting. In such identified areas, wall control blasting, also known as pre-splitting, can be considered. Pre-splitting was provided within the final pit boundary along the high wall, to create safe working conditions in the lower areas.

4.4.2.2 *Drilling*

Drilling is the first operation performed at most open pit mining operations. Rotary drills are predominantly used, although for smaller holes (<200 mm) down the hole hammer drills have often been employed, and would be well suited for smaller surface operations. For this Project, a 260 kW (1800 rpm) diesel crawler down hole hammer drill rig has been selected for the production holes, for ore and waste benches, and the wall control blasting holes.

4.4.2.3 *Load and haul operations*

The overall scale of mining envisaged for the Project is a medium to large-sized mine with total material movements of approximately 33-35 million tonnes per annum (Mtpa). As a result of the

limited extent of mineralisation, selective mining practices have been incorporated into the ore mining methodology.

Waste and ore mining operations will utilise medium-sized backhoe excavators – 200 t bulk mining to 120 t selective mining class range, combined with a fleet of 100 t rigid frame dump trucks, has been selected. The hydraulic face shovel, wheel loader and hydraulic excavator can fit into primary loading functions, as shown in Figure 9 and Figure 10. Multi-face loading or secondary functions do not favour hydraulic shovels or excavators, but certainly favour wheel loaders, due to speed and flexibility. Rigid frame and articulated diesel trucks have been used in the mining of small to large open pits for many years, and their mechanical capabilities are well respected. It is for this reason that diesel-powered rigid haul trucks have been selected for the Project.



Figure 9 - Example of rigid frame dump trucks (Lycopodium, 2023)

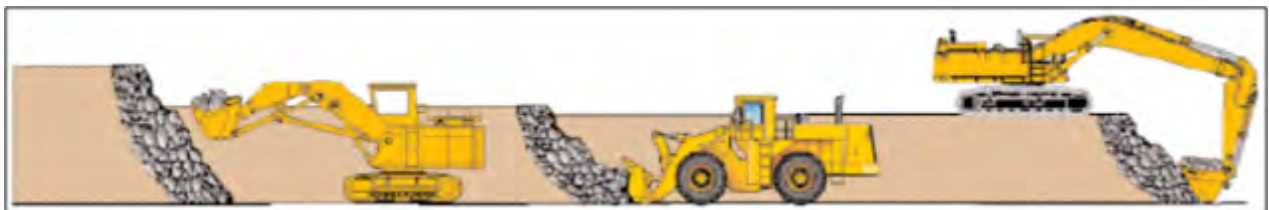


Figure 10 - Examples of equipment to be used on the Project (Lycopodium, 2023)

4.4.2.4 Ancillary equipment

Ancillary equipment that is required for functions that fall outside of the primary production equipment's scope, is also necessary for mining operations. Primary production costs are directly impacted by a number of aspects related to ancillary equipment. Support equipment is the lifeline of reliable and cost-effective mine production, and is required for the following functions or activities:

- Keeping the loading, tipping and haul road areas clean, thus prolonging tyre life and making the operation safe;
- Contributing to the mitigation and reduction of mobile equipment noise (via good road maintenance);
- Maintaining haul road conditions, thus prolonging tyre life and making the operation safe;
- Suppressing dust emissions from health, safety, environmental, and financial perspectives;
- Supporting the full equipment maintenance and diesel requirements for remote, track-propelled equipment, and breakdowns;
- Bench preparation and levelling;
- Fuelling of track-mounted equipment, and dump trucks;
- Rehabilitation.

The tertiary support equipment fleet consists of units that assist in tasks that are required, in order to make primary and secondary fleets' work easier and safer. Other functions they complete are not production-related and have no direct impact on production. The tertiary equipment fleet consists of:

- Small trucks used for maintenance activities;
- Light delivery vehicles used to transport management, technical services, and maintenance personnel around the mine;
- Buses used to transport operators from the change houses to the equipment in the field, and back;
- Lighting plant to increase visibility around the excavators during night-time;
- Pumping equipment for pit dewatering.

4.4.2.5 Other mining activities or infrastructure

Most surface haul roads, dumps and stockpiles required for the LoM will have to be constructed during the first year of mining. The waste dump will progress by the haul truck tipping on the top elevation of the dump, with the dozer pushing the waste down. These actions will cause the waste dump to progress horizontally over time. Waste dumps should be progressively rehabilitated with suitable rehabilitation materials, subsoil, and topsoil where possible. Rehabilitation must be performed as soon as possible on the external faces of the waste dump, to reduce visual and air quality impacts. Ore stockpile dumps will be constructed in close vicinity to the primary crusher tipping point, in order to minimise the reclamation costs and meet the environmental management requirements.

Waste rock will be required for the construction of mine infrastructure such as run of mine (RoM) pad and tailings storage dam walls. During normal operations, the ore feed will be achieved by a combination of ore tipped directly into the RoM bin by the haul trucks from the pit with the RoM loader adding other appropriate ore material from RoM grade control stockpiles. The assumption is that as much as 65% of direct ex-pit ore sent to the RoM pad could be stockpiled and rehandled due to ore blending and scheduling requirements, which affects mine materials handling and possibly environmental impacts and mitigation.

In-pit water management will mainly consist of run-off control around the pit perimeter and temporary sumps at the lowest elevation in the pit. Pit dewatering pumps will pump excess water to a suitable holding dam ready for use as dust suppression and plant make up water.

Haul road dust suppression is considered for the Project and will be handled through a comprehensive dust management system. A bitumen-based product may be applied during haul road construction and maintained on a customised maintenance programme.

4.4.3 PIT AND HAULAGE DESIGN

The pit design was developed from the pit optimisation study to produce a practical pit with ramps, bench and berm configurations. The ramp positioning within the overall pit design is an integral component of mine design because it influences the stripping ratio of the overall design, the performance of the equipment, as well as the operating costs. The exit positions of the ramps were determined taking into consideration the current position of the primary crusher and the waste rock dumps. Typical pit design and terminology components are rendered in Figure 11.

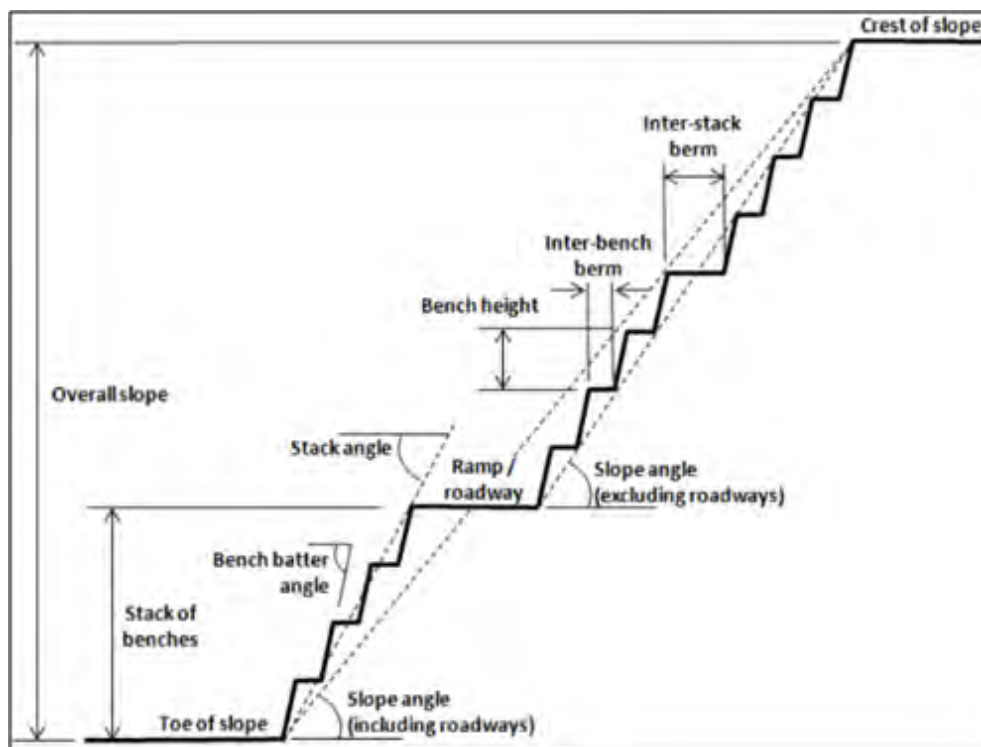


Figure 11 - Slope architecture terminology (Qubeka , 2021)

Sufficient room for manoeuvring is required to promote safety and maintain continuity in the haulage cycle. The width criterion for a haul segment will be 15 m and is based on the widest vehicle in use, which is the Komatsu 785-7 100 tonne rigid dump truck, with an operating truck width of 6.9 m. To design for anything less than this dimension would create a safety hazard due to a lack of adequate clearance. In addition, narrow lanes often create an uncomfortable and unsafe driving environment, resulting in slower traffic, and thereby impeding production.

The haul road design parameters were established taking into consideration the type and size of hauling equipment that will be used during operations. The dimensions of the haul road were based on a Komatsu 785-7 rigid truck using global standards of good practice.

A haul road gradient of 1:10 (10% or 5.71°) was selected for the Project. The selection of the haul road gradient was based on the world best practice for the type of trucks that will be utilised. A haul road gradient of 1:8 (12% or 7.1°) was selected for the single lane ramp system utilised in the lower four benches of each pushback. The practical design width for the dual ramps will be 25 m and for the single ramps will be 18 m.

The design, construction and maintenance of haul roads have a considerable impact on haulage cost, which makes up a greater percentage of the total mining cost. It is therefore important that appropriate, detailed sets of designs for haul road construction are compiled for the site.

The benefits of an improved haul road design are efficiency of haulage by reduction in cycle time, reduced fuel burn, and reduced truck component wear. It is therefore desirable to generate a minimum site-wide construction standard for both new and existing haul roads. The minimum bench operating width for the pit is limited by the size of the equipment. The pit design parameters are summarised in Table 6.

Table 6 - Pit design parameters (Qubeka , 2021)

Parameter	Unit	Value
Minimum mining width (20m + Single Ramp Width)	(m)	35.0
Minimum pushback width	(m)	60.0
Dual ramp width	(m)	25.0
Single ramp width	(m)	18.0
Minimum turning circle	(m)	10.0
Ramp gradient (short ramps < 400m)	(1: #)	8.0
Ramp gradient (short ramps < 400m)	(%)	12.0
Ramp gradient (short ramps < 400m)	(deg)	7.1
Ramp gradient (long ramps > 400m)	(1: #)	10.0
Ramp gradient (long ramps > 400m)	(%)	10.0
Ramp gradient (long ramps > 400m)	(deg)	5.7

Ramp positioning within the pit design is an integral component of mine design. It influences the stripping ratio of the overall design, the performance of the equipment, as well as the operating costs. The exit positions of the ramps were determined taking into consideration the proposed position of the primary crusher and the waste rock dumps.

Figure 12 shows the Twin Hills Central, Bulge, and Clouds, Clouds West, Twin Hills West pit design and dimensions.

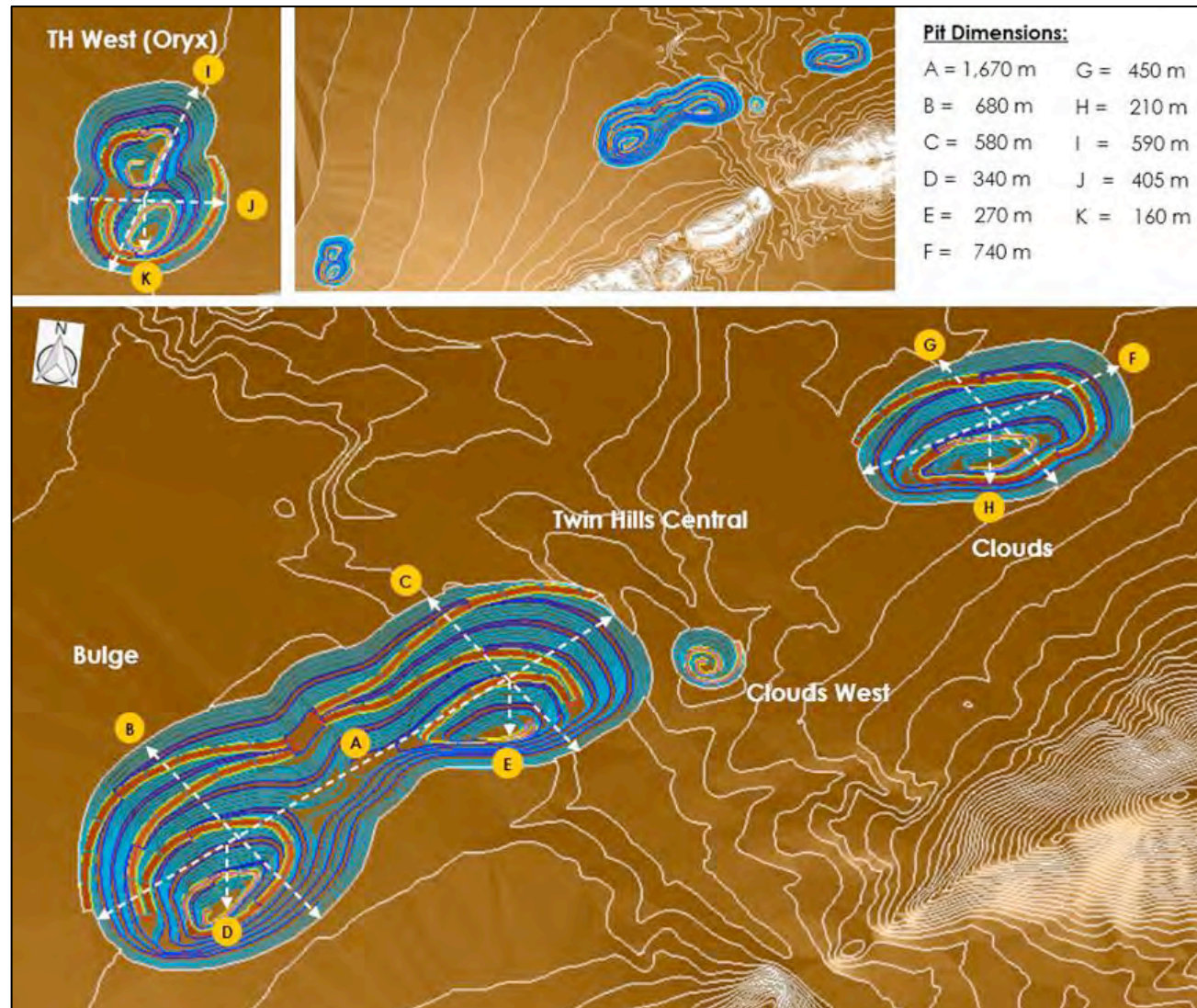


Figure 12 - Twin Hills, Bulge, and Clouds pit design and dimensions (Lycopodium, 2023)

4.4.4 METALLURGY AND PROCESSING

Gold recovery will be achieved using a conventional crushing, milling, gravity, pre-oxidation and carbon-in-leach (CIL) processing plant, as depicted in Figure 13. The process plant design is based on a robust metallurgical flowsheet developed for optimum recovery, while minimising initial capital expenditure and operating costs. The metallurgical flowsheet is based on unit operations proven in the industry, as shown in Figure 14.



As stated in the DFS (Lycopodium, 2023), pre-feasibility metallurgical test work was carried out in 2021 and 2022 with the objective of determining gold dissolution via cyanidation. The work showed the expected average gold recovery over the life of mine of 92% at an average grind of 93% passing 75 micron but also indicated significant variability in gold dissolution.

The test work showed that the samples had an average head grade of 1.19 g/t Au and 0.58 g/t Ag, with a low concentration of base metals, carbonaceous material, sulphates, and carbonates. Several samples contained appreciable amounts of arsenic. Mineralogy was found to be reasonably consistent across the deposit, and relatively high concentrations of pyrrhotite were noted in the fresh west and east sample material.

A standard set of crushing, milling, and abrasion tests was carried out. This concluded that three stages of crushing, followed by ball milling, were likely to be the optimal configuration to achieve 80 % passing 64 µm in mill cyclone overflow.

Mineralised material is considered “medium to hard” in comparison with similar material from other deposits.

The mill cyclone overflow product stream will be processed via a CIL circuit, carbon elution, electrowinning, and a gold room. CIL tails will be treated to achieve cyanide destruction before being pumped to the tailings thickener, with the underflow being filtered. Filter cake will be conveyed and disposed of as tails in the TSF. This will be a lined TSF with the impermeable lining comprising multiple layers of several different materials.

4.4.5 PROCESSING PLANT AND INFRASTRUCTURE

The processing plant infrastructure will include the following: site security and access control; change house facilities; training and induction facilities; canteen facility; administrative offices; medical and emergency response facilities; warehousing facilities including open air laydown areas; workshop facilities; ablution facilities; emergency backup generation facilities; waste management and recycling facility; reagents stores and laboratories. The remainder of plant required to be operated is further described in the sections below.

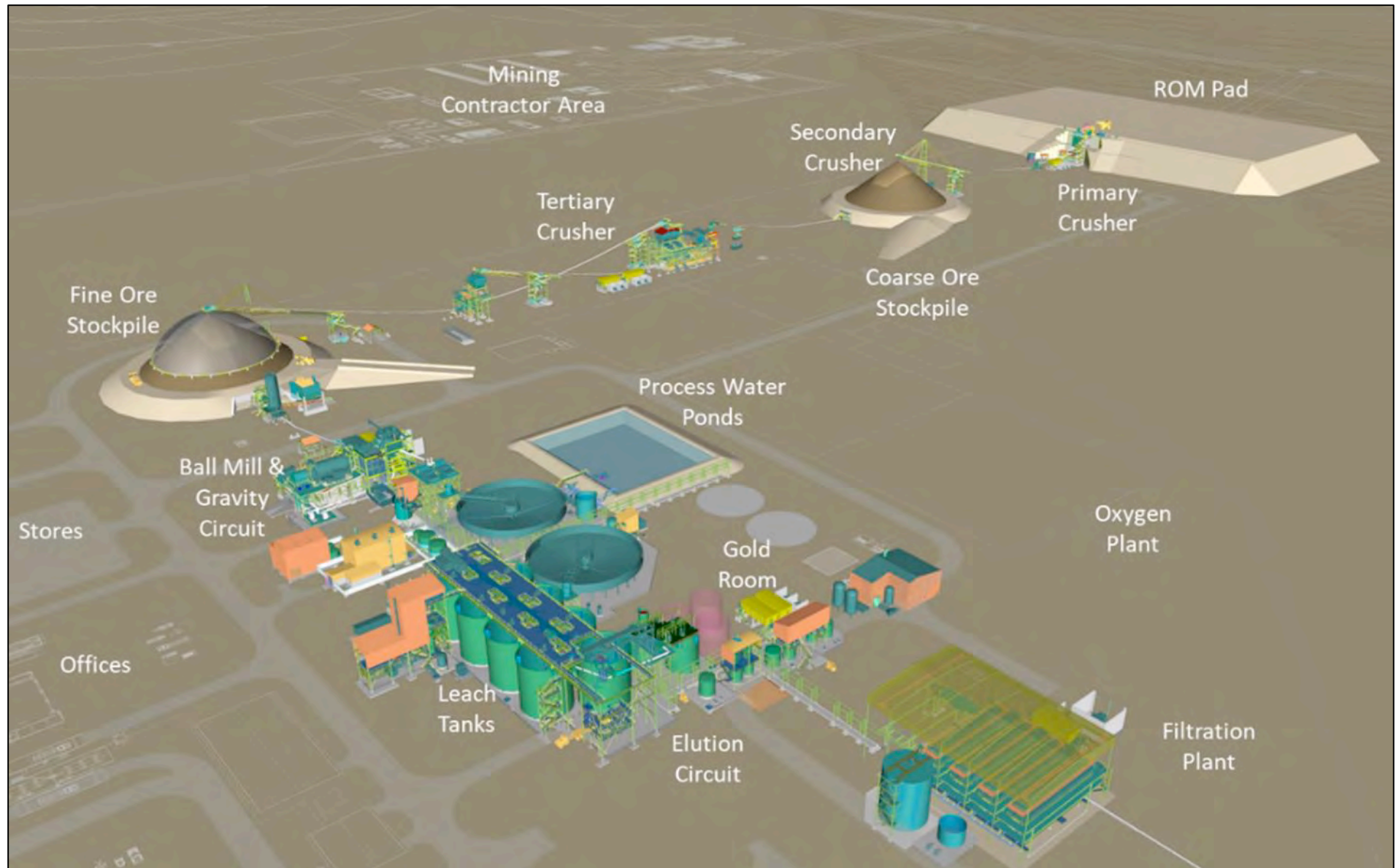


Figure 14 - Schematic Process Plant Layout (Source: (Lycopodium, 2023)).

4.4.6 PROCESS PLANT RELATED INFRASTRUCTURE

4.4.6.1 *primary crusher*

ROM material will be trucked from the pits to the primary crusher, where a rock breaker will break oversized rocks at the top of the dump pocket. The crushed rock will then be removed from the primary crusher and be transferred by a discharge conveyor to a stockpile feed conveyor and onto a coarse ore stockpile. The Primary crushing circuit includes the following:

- Gyratory crusher;
- Primary crusher discharge bin;
- Rock breaker;
- Wide primary crusher discharge conveyor and coarse ore stockpile feed conveyor;
- Coarse ore stockpile;
- Primary crushing area sump pump.

4.4.6.2 *secondary and tertiary crushers*

The coarse ore is then directed to the secondary crusher screen feed conveyor. A dry dust extraction system is used to remove dust from the secondary crusher screen feed conveyor. This conveyor is equipped with a weight meter to control throughput for secondary and tertiary crushing, as well as a metal detector to safeguard downstream cone crushers. The discharge from the secondary crusher is then sent to the tertiary crusher screen feed conveyor, where it combines with the undersize material from the secondary crusher screen and is conveyed to the tertiary crusher screen feed bin. In the crushing area, a dry dust extraction baghouse system is employed to extract dust from the extraction hoods of the tertiary crusher feed conveyor, secondary crusher screen, and tertiary crusher screen, and deposit it onto the tertiary crusher screen feed conveyor.

The combined products from the secondary and tertiary crushers, along with the undersize material from the secondary crusher screen, are conveyed by a belt feeder to a double-deck tertiary crusher screen. The oversize material from the top deck (25 mm) and the bottom deck (14 mm) is then directed onto a tertiary crusher feed conveyor. This conveyor feeds a twin tertiary crusher feed bin with double conical bottoms, each of which discharges to separate belt feeders. Variable speed belt feeders retrieve the ore and provide a controlled feed rate to the two duty tertiary crushers. The product from the tertiary crushers is discharged onto the tertiary screen feed conveyor. A dry dust extraction baghouse system is used to extract dust from the extraction hoods of the tertiary crusher screen feed bin, the tertiary crusher screen, and the extraction hood of the fine ore stockpile feed conveyor, and deposit it onto the fine ore stockpile feed conveyor. The undersize material from the tertiary crusher screen, with a P80 size of 9 mm, is discharged onto the fine ore stockpile feed conveyor, which in turn discharges onto the covered fine ore stockpile with a storage capacity of 12 hours.

The secondary and tertiary crushing circuit includes the following:

- Two coarse reclaim apron feeders;
- Secondary crusher screen feed conveyor;

- Double deck secondary crusher screen;
- Secondary crusher;
- Tertiary crusher screen feed conveyor;
- Tertiary crusher screed feed bin;;
- tertiary crusher belt feeder
- Double deck tertiary crusher screen;
- Twin tertiary crusher feeder bin;
- Two tertiary crusher belt feeders;
- Two tertiary crushers;
- Fine ore covered stockpile;
- Dust extraction and suppression;
- Coarse ore reclaim, secondary and tertiary crushing area sump pumps.

4.4.6.3 *fine ore reclaiming and conveying*

The reclaim tunnel is a structure beneath the covered stockpile where fine ore is stored, and the ore is withdrawn from this tunnel. There is then a fine ore reclaims belt feed which are two variable speed belt feeders responsible for withdrawing the fine ore from the reclaim tunnel. These feeders control the flow of the ore onto the mill feed conveyor. This conveyor then transports the fine ore from the reclaim tunnel to the ball mill feed box. A weight meter is fitted to the mill feed conveyor that measures the weight of the material being conveyed and controls the speed of the belt feeders which regulates the feed rate to the grinding circuit. The dry dust extraction system is used to extract dust from the discharge points of the belt feeders, preventing dust pollution. The fine ore reclaim tunnel ventilations fan is then responsible for displacing the air in the fine ore reclaim tunnel, helping to maintain a well-ventilated environment. The fine ore, grinding media or ball mill pebbles are stored in the fines reclaim hopper and fed into the circuit as needed. Quick lime is added directly to the mill feed conveyor via a lime silo using a rotary valve. Lime addition will be adjusted by a pH meter in the carbon-in-leach circuit and by the mill feed rate as measured by the mill feed conveyor weightometer.

The fine ore reclaim circuit includes the following:

- Two fine ore reclaim belt feeders;
- Mill feed conveyor;
- Fines reclaim hopper and belt feeder;
- Lime system;
- Fine ore reclaim area sump pump.

4.4.6.4 *grinding and classification circuit*

The material that is too large to pass through the ball mill trommel is sent to a pebble bunker, while the smaller material moves towards the mill discharge hopper, from where it is pumped to the classifying cyclones. The overflow from the cyclones flows towards two dedicated trash screens through a distribution box, positioned before the pre-leach thickener. Meanwhile, the underflow from the cyclones moves towards the ball mill feed box via a splitter box for further

grinding. Additionally, a portion of the cyclone underflow is directed to the gravity concentration circuit.

The grinding and classification circuit includes the following:

- Ball mill;
- Classification cyclones;
- Mill discharge hopper and pumps;
- Milling feed and discharge area sump pumps.

4.4.6.5 *gravity recovery circuit*

The gravity circuit consists of two centrifugal concentrators along with two gravity scalping screens. The circuit is fed by a bleed stream from the classification cyclone underflow splitter box, which flows naturally to the gravity scalping screens. Any oversize material (+2 mm) from the gravity scalping screens moves towards the ball mill feed box. The undersize material from each scalping screen gravitates to its respective dedicated gravity concentrator. The tails from the gravity concentrator then flow to the mill discharge hopper.

During batch cycles, the undersize material from the scalping screens occasionally bypasses the concentrators and is directed to the mill discharge hopper. The gravity concentrator will operate in a semi-batch mode, and the resulting gravity concentrate will be gathered in the intensive cyanidation reactor (ICR) feed storage hopper, where it will undergo leaching by the ICR circuit.

The gravity recovery circuit includes the following:

- Two gravity scalping screens;
- Two gravity concentrators.

4.4.6.6 *intensive cyanidation reactor (ICR)*

The gravity concentrator channels its concentrate to the intensive cyanidation reactor (ICR) for gold recovery through cyanide leaching. This concentrate is directed to the ICR gravity concentrate storage hopper and subsequently moved to the ICR drum once it reaches a specified weight in the storage hopper. This triggers batch processing. Water is introduced into the ICR drum. The ICR leach solution, consisting of approximately 1.2% Sodium cyanide (NaCN) and 2.0% Sodium hydroxide (NaOH), is kept in the ICR solution storage hopper and then conveyed to the ICR drum. Caustic soda solution is included to maintain the pH level above 10.5. The ICR circulating pump divides the solution between the ICR solution hopper and the ICR drum. Oxygen is infused into the circulation line through a sparger during leaching for a set duration. Flocculant is introduced into the ICR pump hopper and circulates through the ICR solution storage hopper and ICR drum. This facilitates the settling of fine flocculated solids in the ICR reactor drum. Following leaching, the ICR drum is halted, and the solution is transferred to the ICR solution storage hopper for solids to settle. Sodium hydroxide is then added to the solution storage hopper, and the clarified solution is drained to the ICR pump hopper and pumped to the ICR electrowinning feed tank in the gold room as a pregnant solution for gold sludge recovery through a dedicated electrowinning cell. The sludge can be combined with the sludge from the carbon electrowinning cells and either smelted

together or separately for metallurgical accounting purposes. Once the transfer of pregnant solution is finished, the ICR drum and ICR solution storage hopper are rinsed, and the resulting slurry is collected in the ICR pump hopper before being pumped to the mill discharge hopper.

The ICR circuit includes the following:

- ICR feed storage tank;
- ICR drum;
- ICR pump hopper;
- ICR solution storage hopper;
- ICR circulating pump;
- ICR area sump pump with imbedded gold trap.

4.4.6.7 *pre-leach thickening*

The excess material from the cyclone is divided between two screens designed to remove foreign substances before the leaching process. The removed material goes to a designated bin which will be emptied regularly. The smaller particles from the screens are directed to the pre-leach thickener to increase the concentration of solids in the leach mixture to 50%. A substance called flocculant is mixed in the static mixer of the pre-leach thickener and then added to it. The overflow from the thickener flows into a designated tank and is combined with the overflow from the tailings thickener, then circulated back as part of the plant's water processing. The thickener's denser residue is pumped into the CIL circuit through a sampling system. A self-operating slurry sampler, placed at the input of the pre-oxidation feed box distributor, collects a representative sample of the thickener's denser residue for plant monitoring and metallurgical record-keeping purposes.

The pre-leach circuit includes the following:

- Two trash screens;
- Pre-leach thickener and CIL feed pumps;
- Pre-leach thickener flocculant static mixer;
- Leach feed automatic sampler;
- Pre-leach area sump pump.

4.4.6.8 *carbon stripping*

The carbon elution process will employ the split AARL technique. To start the elution sequence, a specified volume of stripping solution containing 2.0% w/w NaOH and 2.0% w/w NaCN will be injected into the lower section of the elution column. Following an initial preheating at 95°C and a soaking period, the strip solution will be circulated through the strip solution heater to raise its temperature to 130°C before entering the elution column. The eluate exiting the elution column will pass through the recovery heat exchanger, ultimately reaching either the strip solution tank, lean eluate tank, or one of the two pregnant solution tanks, depending on the step in the sequence. The solution in the lean eluate tank will be utilised during the elution step and replenished during the rinsing and cooling steps in preparation for the next elution. Once the cooling sequence is finished, the carbon will be hydraulically transferred to the feed hopper of the

carbon regeneration kiln via a dewatering screen. An option is available for bypassing the carbon regeneration if necessary. Additionally, systems for anti-scalant dosing and sulphamic acid cleaning are included in the stripping circuit. The main equipment in the stripping circuit consists of:

- the elution column;
- strip solution heater with heat input;
- heat recovery heat exchangers;
- strip solution tank;
- lean eluate tank; and
- elution area sump pump.

4.4.6.9 *electrowinning and goldroom*

Gold is extracted from the pregnant eluate through the processes of electrowinning and smelting, resulting in the production of doré bars. The elution circuit transfers pregnant eluate to one of two tanks, allowing one tank to undergo elution while the other either recirculates through the electrowinning cells or pumps out barren solution to the CIL circuit. During an electrowinning cycle, the pregnant eluate flows through two electrowinning cells equipped with stainless steel mesh cathodes. Gold adheres to the cathodes, and the solution returns by gravity to the chosen pregnant solution tank for recirculation until it is considered barren or the designated time frame has been completed. Pregnant solution from the ICR electrowinning tank undergoes an additional step, passing through a dedicated electrowinning cell for processing. Barren ICR solution is pumped back to the leach feed distribution box in the CIL circuit. In the future, pregnant solution from the Ondundu ICR will be directed to one of two Ondundu ICR electrowinning feed tanks, allowing for eluate transfer to one tank while the other recirculates through the dedicated Ondundu ICR electrowinning cells. Barren solution will be pumped to the leach feed distribution box in the CIL circuit. The gold-enriched sludge is dislodged from the steel cathodes in the electrowinning cells using high-pressure water sprays and moves to the sludge hopper via gravity. Subsequently, the sludge is filtered in a pan filter, dried, blended with fluxes, and smelted in a diesel-fired furnace to create gold doré. This electrowinning and smelting process occurs in a secure and supervised goldroom, equipped with access control and security systems. The electrowinning circuit and goldroom are outfitted with essential equipment, including:

- Two tanks for pregnant solution;
- ICR electrowinning feed tank;
- Three electrowinning cells with dedicated rectifiers;
- Sludge hopper and sludge pan filter;
- Drying oven;
- Flux mixer;
- Diesel smelting furnace with bullion moulds;
- Bullion vault and safe;
- Fume extraction and ventilation systems;
- Goldroom crane;
- Goldroom security system;

- HCN gas monitor;
- Goldroom sump pump with imbedded gold trap;
- Ondundu ICR feed tanks, electrowinning cells with dedicated rectifiers (future).

4.4.7 SERVICES AND UTILITIES

4.4.7.1 *oxygen plant*

A specialized PSA oxygen plant is provided by a vendor as a packaged system. It delivers oxygen to the pre-oxidation tank contactors, CIL circuit, and the ICR, including the potential future Ondundu concentrate cyanidation, at the necessary pressure, flow rate, and level of purity.

4.4.7.2 *analytical and metallurgical laboratory*

The laboratory holds significance within the operations of a gold producer, primarily tasked with guaranteeing impartial sampling and meticulous preparation to achieve a satisfactory level of precision within a timeframe aligned with the Metal Accounting system's needs.

A more detailed description of the tailing's storage facility and the production of tailing process is explained in section 4.6.2.

4.4.8 SUPPORT INFRASTRUCTURE AND SERVICES

4.4.8.1 *mining office block*

The mining office block will be a modular structure installed on a mesh reinforced concrete slab. The building will provide office space to the mining personnel, including the mine manager and the technical services manager, geology personnel, surveyors, maintenance engineers, and mining support staff.

It is likely that the building will have offices, one main boardroom, two meeting rooms, male and female ablutions, a kitchen, a pit control room, a first aid room, and an open quadrant for landscaping.

4.4.8.2 *geological core shed*

The geological core shed building will be a sheeted steel portal structure. The core shed will be used by the geology section to assess and store core and geological samples. Operations will include night shift; internal ablution facilities have been provided in the building.

4.4.8.3 *mining change house*

The mining change house will provide ablution facilities to all mining employees, and production and maintenance crews, including foremen. All employees who use the change house will clock in through the change house turnstiles when they enter or exit the mining complex. A single tier locker will be allocated to each employee, either on shift or off shift, for personal belongings and clean overalls. Washing facilities will be included in the mining change house for washing overalls and clothing.

4.4.8.4 *warehouse*

The mining warehouse (or stores) will be a sheeted steel portal structure. The warehouse shall be used for the storage of all critical and operational spares, as well as office and other consumables. Goods will be received by the store's personnel in fenced receiving bays prior to storage in the main building. Access to the stores building is limited to stores personnel, and dispatch will either take place over a goods issue counter or through a fenced dispatch bay. Stores yards external to the warehouse will be used for pipes, large equipment, and tyres, etc. Acetylene gas, oil, paint, and other flammable materials will be stored in separate areas and designed accordingly if storing dangerous goods.

4.4.8.5 *Heavy mobile equipment and workshop*

The heavy equipment workshop is the main shop for maintenance and rebuilds of mining equipment. The building design is capable of handling maintenance work for 60 t ADT and Rigid Frame Dump trucks and support equipment as per the maintenance plan. The structure will be sheeted steel portal supported on concrete plinths, with double storey offices in brickwork. The workshop will be bunded with an internal drainage system into a suitable hydrocarbon collection and treatment facility. Wash bays will be required for equipment, before, during and after maintenance, and therefore settling dams/ponds will be required as part of the wastewater treatment system in the wash bay.

4.4.8.6 *fuel facility*

Diesel for mine operations will be delivered by trucks to a designated and designed site fuel facility. A site-based service provider will erect infrastructure and facilities for the storage and handling of fuel. The service provider will also be responsible for the supply, delivery, and management of stock for the life of mine. The Proponent will ensure the facility has the required installation certificates prior to commissioning the fuel facility.

A hard stand pad for maintenance and servicing of mining equipment outside the HME workshop. The hard stand will be 30 m x 30 m and will also be used for refuelling equipment from a fuel bowser.

4.4.8.7 *Explosive magazine and bulk emulsion storage facility*

The number and capacity of magazines are determined based on the defined mine production schedule and on rock mass conditions in terms of strength and moisture. A total of two explosive magazines have been determined:

- One magazine holding 100 cases of accessories
- One magazine holding 100 cases of high explosives

The designs are based on an explosive supplier's recommendation and addresses all legal requirements. There is also provision for an emulsion storage silo with a 42 tonne capacity.

An appointed contractor will be based on-site and will provide explosives and blasting services to the mine. The contractor will establish and be responsible for the explosive magazine

infrastructure, office, and workshop infrastructure. Space provision has been made for both sites, and the siting of the explosive magazine will be in conformance with the requirements of the Namibian Labour Act, Namibian Mining Legislation, and Regional Explosives Standards or regulations.

The location of the explosive magazines is southeast of the main offices, is more than 700 m in radius away from any other infrastructure and is approximately 1 km away from the open pit.

4.4.8.8 Communication

Radio, telephone, and internet connections will be required for the mining operation. Infrastructure, including communication masts, will be installed, and provisions will be made with the relevant service providers.

Additionally, there will be a training and induction facility, first aid and emergency response facility, gatehouses, and access control rooms to the site, HSE buildings, laundry facilities, analytic laboratory, refuse handling and recycle shed with office space and bus stop shelters, which will be built from brick.

While more substantial buildings such as HME workshops, boilermaker workshops, oil and flammable stores facility, bulk fuel and processing plant refuelling stations in the mining contractor laydown area and plant workshop wash bays and silt trap facility will be steel framed and sheeted structures on concrete foundations and engineered concrete floor slab, purpose designed.

Whereas, electrical MCC buildings will be containerised or prefabricated e-house units with the MCCs and related electrical equipment pre-installed to minimise site work.

Moreover, there will be:

- Administrative offices;
- Facility for training and induction;
- Gatehouses;
- Ablution facilities distributed across the site;
- Analytical laboratory;
- Shed for refuse handling and recycling with associated office space;
- Shelters at bus stops;
- Workshops for equipment and light vehicle maintenance;
- Workshops for electrical, control, and instrumentation (EC&I) and boilermaker activities;
- Primary warehouse, including a smaller facility for oil and flammable storage;
- Refuelling stations for the process plant and bulk fuel dispensing at the Mining Contractor laydown area;
- Wash bays and a silt trap facility for plant workshops; and

- Electrical Motor Control Center (MCC) buildings containerised or in prefabricated e-house units, with pre-installed MCCs and related electrical equipment to minimise on-site work.

4.5 UTILITIES

4.5.1 POWER SUPPLY

The Project's power requirement is estimated to be approximately 23.5 MW, and the current strategy is to source power for the Project from the national grid. Electrical power is readily available in the area from the national power utility, NamPower. Bulk electrical supply will be sourced from the NamPower electrical transmission network, via a new 20 km 66 kV power line that will be connected to the NamPower metering sub-station, which is connected to the Twin Hills sub-station and supplies the mine site with power through a 11 kV overhead power line.

The Twin Hills Project on-site power supply is managed through a 11 kV overhead powerline infrastructure network that ties off from the Twin Hills main in-take sub-station. The central network provides power supply to the main operational network, being the processing plant, administration offices, central open pits and solar PV plant. The northern network caters for supply to the abstraction boreholes in the vicinity of the Khan River. The southern network supports supply to the river diversion dam and the southern boreholes required for abstraction purposes. Cranes will be required to construct the 11 kV overhead powerline and for larger component installation within the processing plant.

The 11 kV overhead line infrastructure will consist of wooden pole structures with Hare aluminium conductor steel reinforced conductor. A combination of monopoles and H-pole structures will be used, with H-pole structures being utilised for cable termination and take-off structures. Pole mounted transformers shall be installed to supply power to borehole and booster pump stations. The length of the poles is 12 mm, with minimum clearance between conductors and the ground ranging from 6.5 m above ground level, 7 m above service/access roads and 15 m above haul roads. The spam length between poles is 80 m. Figure 15 shows the 11 kV line, mine substation and metering station.

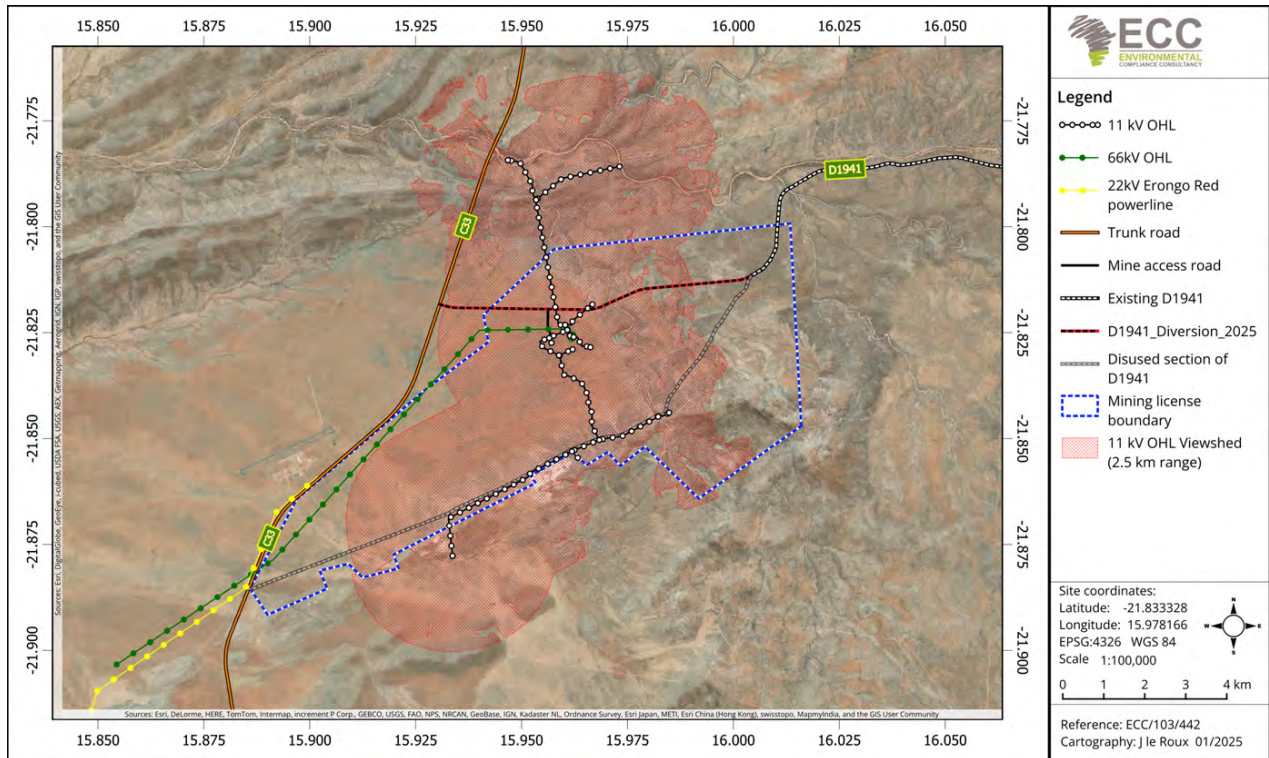


Figure 15 – 11 kV line, mine substation and metering station

4.5.1.1 switchyard and consumer station

A switchyard will be designed to accommodate the 66 kV line. The 66 kV and 11 kV switchyard, approximately 20 km of the 66 kV powerline will be constructed according to NamPower specifications, which includes steel mono poles with pelican conductor and optical ground wire. The metering station shown in Figure 16 will also be constructed according to NamPower specifications. The 66 kV/11 kV switchyard will have:

- 66 kV income feeder bay from NamPower;
- 66 kV busbar rated for 800 Amps;
- 2 x 66 kV transformer feeder bays;
- 2 x 40 MVA 66/11 kV transformers;
- 11 kV type tested indoor type switchboard rated for 40 MVA at 40 kA fault level and required feeder panels for the mines supply;
- Power factor correction equipment and control;
- 11 kV PV plant incomer feeder pane;
- All required substation control, protection, and communication requirements;
- All auxiliary AC and DC supply systems;
- 11 kV switch room and control building with smoke and fire detection systems;
- All earth mat and earthing requirements;
- All lightning protection and lighting requirements;
- Fencing, foundation, transformer plinths, oil holding dams and containment bund;
- Walls as well as yard stone as required.
- Engineered terrace to be provided by others as part of overall plant civil works package.

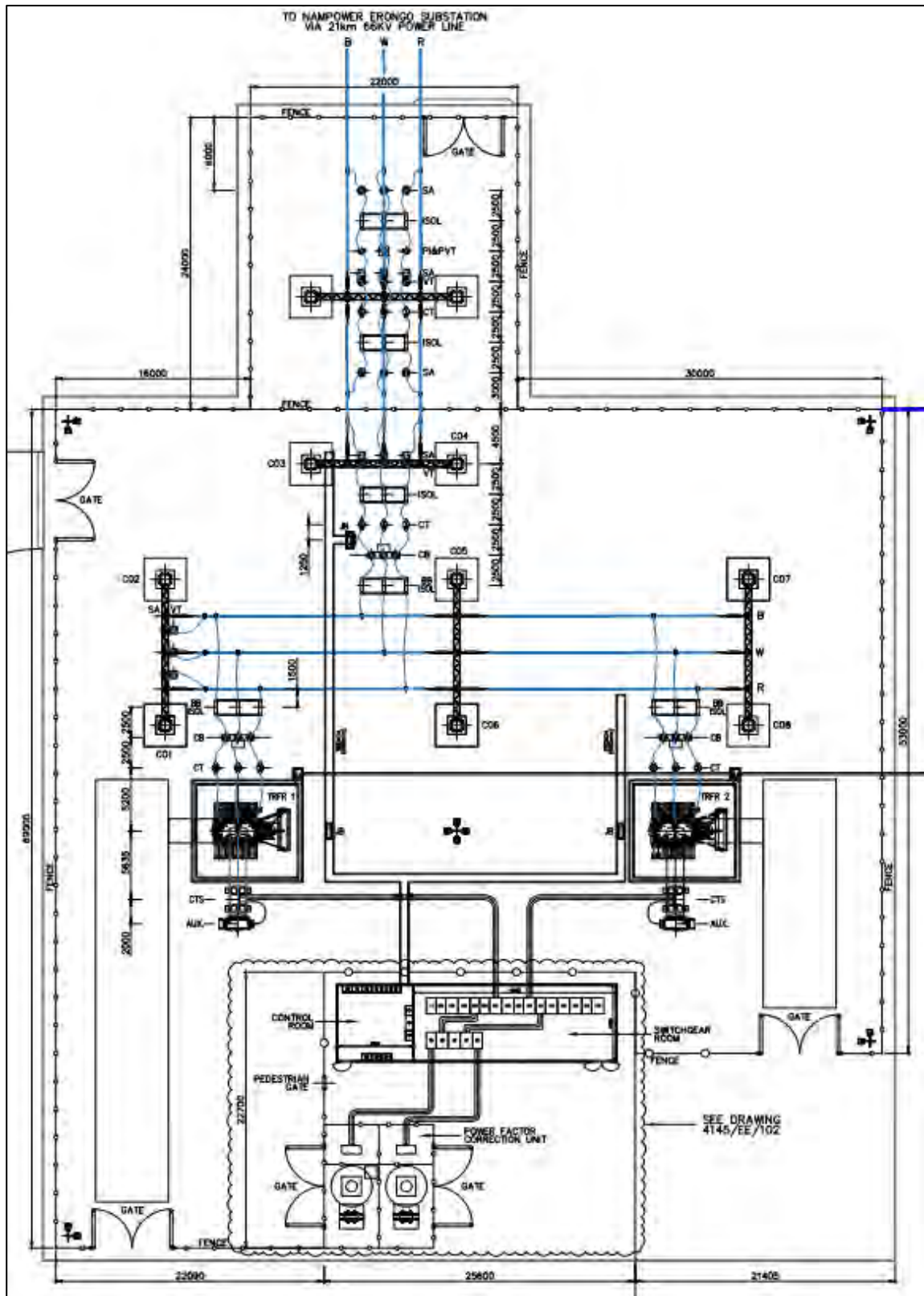


Figure 16 - Grid Connection Load Flow Confirmation (Lycopodium, 2023)

4.5.1.2 *construction power*

Prior to construction of the 66 kV and 11 kV line and substation, the mine will use diesel fuelled generators to supply power for construction activities. Contractors will also supply small generator sets for construction purposes at remote locations during the construction phase. A combination of rented generator sets, and use of the emergency generator set will be used for provision of construction power.

4.5.2 WATER SUPPLY

Long drought periods of up to seven years, typically referred to as critical periods, are common to the Namibian climate. During a long critical period, the groundwater table declines significantly due to limited recharge, causing some boreholes to become dry. Similarly, surface water sources, which are already stressed, might not be able to support priority users, resulting in water restrictions being enforced to prevent the failure of the water resource. Local dam options are typically developed over a long timeframe, in excess of 5 to 10 years, due to land acquisition, environmental and social studies, and full design and construction cycles. Developing water resources is also very costly due to the aforementioned factors (Knight Piésold, 2023).

Groundwater is localised in the schists and will likely be manageable as passive dewatering from in-pit sumps although drain holes may be needed in areas of geotechnical weakness. Based on the study the Karibib Formation (marbles) has the highest water supply potential. The shallow alluvial aquifer is also well developed along the Khan River which is currently used to supply the region shown in Figure 17.

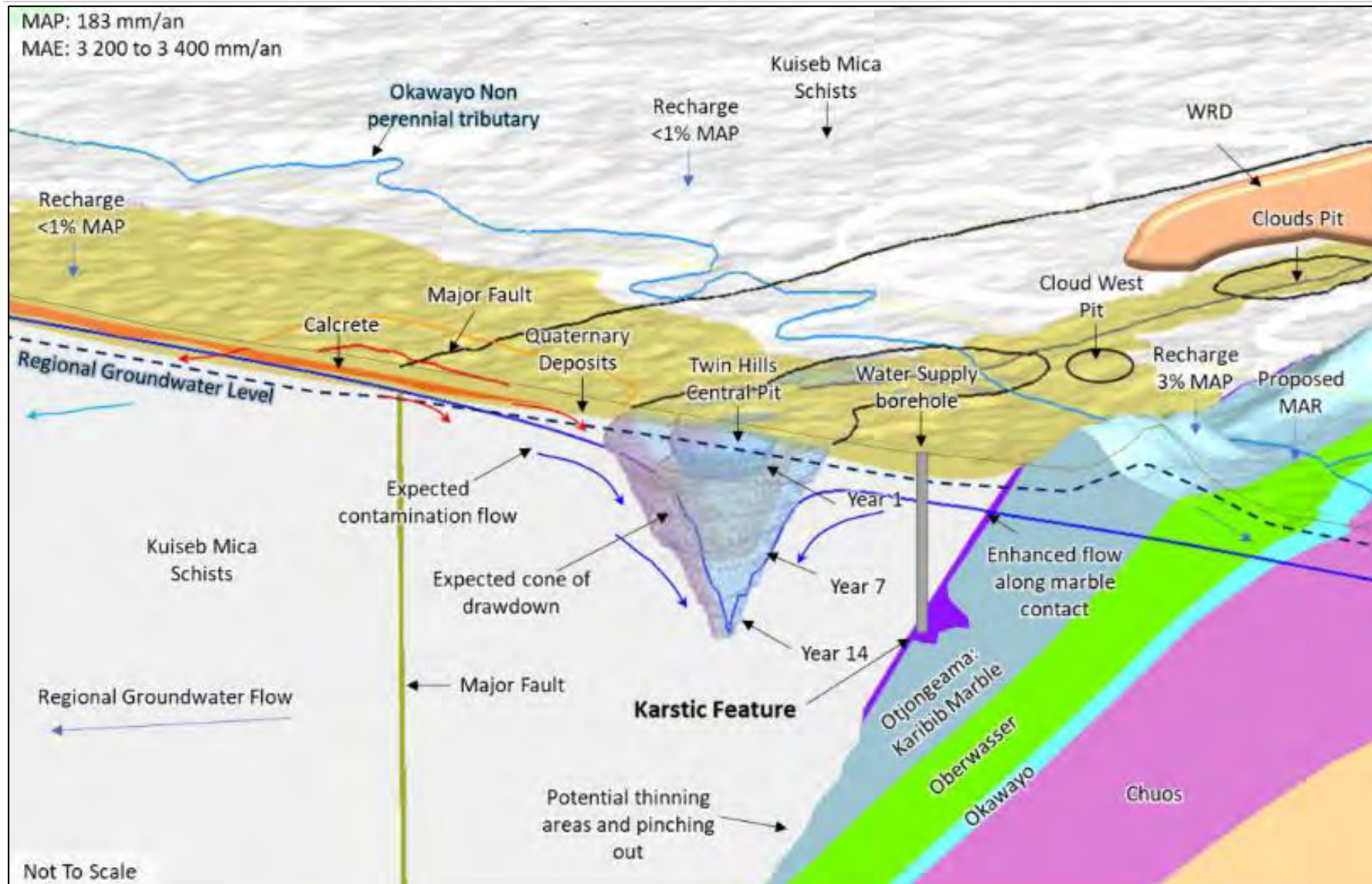


Figure 17 - Conceptual hydrological model showing a cross section from north-northwest to south-southwest, including proposed infrastructure, where the main water supply boreholes have been located (Knight Piésold, 2023)

The current mine design indicates an annual requirement of 1.112 million m³/annum for the estimated 5 Mtpa ore throughput, to sustain mining operations and related activities. Water supply options that were also addressed in the Knight Piesold Consulting (2023) report were as follows:

- Groundwater borehole pumping along the Karibib marble is estimated to supply approximately 1.2 Mm³/year (3 300 m³/day), assuming constant discharge which could be used to supplement the water supply requirements for the mining operations. Additional groundwater supply will be obtained from the pit inflows.
- Okawayo flood mitigation structure and groundwater MAR along Okawayo tributary: The potential long-term yield of this option is still to be investigated.
- NamWater scheme bulk supply: Installation of a 30 km long pipeline between Kranzberg and Karibib.
- Karibib wastewater scheme supply: this option could potentially supply the mine with between 150 000m³/year and 200 000m³/year.
- The envisioned Managed Aquifer Recharge (MAR) from the Khan Water Scheme is expected to periodically lessen stress on the local aquifers. The MAR area has higher recharge than the rest of the area due to higher head and higher permeability materials. This will significantly increase the sustainable yield and recovery of the local aquifer systems and other regional aquifers depending on the groundwater flow regime.

Therefore, water supply is proposed from a combination of surface and groundwater sources, from an onsite pipeline network. Water will be sourced from nine abstraction boreholes and from the Cloud West pit mainly during flood events, after the pit has been mined out. Raw water will be supplied externally and will be stored in a raw water storage tank for use by those requiring clean water such as gland water for pumps and reagent make-up. Water from the pre-leach thickener and tailing thickener overflow will be used to meet most of the processing water needs. Overflow from the tailings thickener will be stored in a process water pond which provides the buffer storage capacity of water required to sustain the plant production and the peak quantities of water required for starting up the milling plant.

Potable water will be supplied externally by NamWater and potable water pumps for the plant and safety showers will draw water from a dedicated potable water tank. For the elution plant raw water will be passed through a water softening system and will be stored in a softened water tank.

4.6 MINERAL AND NON-MINERALISED WASTE

4.6.1 WASTE ROCK

Waste rock dumps will be designed as close to the pit exits as possible, in order to optimise productivity and minimise waste mining costs. Rehabilitation requirements are considered in dump location and design, and all dumping areas will undergo an ore sterilisation campaign prior to waste dumping. The sterilisation drilling has already commenced. The waste rock dumping

strategy is to reduce the hauling distance and similarly enable progressive rehabilitation of the waste dumps wherever possible. In-pit dumping will also be deployed where possible.

Over the course of the operation, an estimated 299 million metric tons (or 113.6 million cubic meters) of waste will be extracted. Considering a re-compaction factor of 10% for the material in the waste rock dump, the combined capacity of the dump should be a minimum of 156.7 million cubic meters to accommodate all the mined waste.

The construction process will adhere to the guidelines outlined in the environmental management plan (EMP). Staged construction and vegetation efforts will be carried out in alignment with the EMP to minimize the visual impact from the start of the project's life. The upper surface of the dumps will be covered with soil and graded back at a ratio of approximately 1:200 to prevent water accumulation. The design parameters of the WRD have been outlined in Table 7.

Table 7 - WRD design parameters

Dump design parameters	Units	Value
Bench Angle (Angle of Repose)	deg.	35
Lift height	m	15
Berm width	m	15
Overall slop angle	deg.	20
Access ramp width	m	25
Access ramp gradient	%	10

4.6.2 TAILINGS STORAGE FACILITY

CIL tailings will be treated in a cyanide destruction circuit, followed by thickening and pressure filtration. Tailings filter cake will be transferred on an overland conveyor for stacking at the tailings storage facility (TSF). Some mine waste rock will be delivered to the TSF by dump truck and used in the construction of the outer containment berm and capping of the TSF. The TSF will be lined to prevent seepage of any acid or dissolved arsenic generated after deposition from potentially encountering groundwater.

The tailings storage facility (TSF) will comprise a lined facility, constructed from the waste rock excavated from the open pit. This design prioritizes availability, reliability, and cost-effectiveness, incorporating interchangeable spare parts. The disposal system will have six layers, with the first layer at 8 meters and subsequent layers at 5-meter intervals, resulting in a total height of 35 meters with a total area of 203 Ha. The conveying system will include streams for plant feed, emergencies, and forward stacking. Streams will alternate functions as stacking progresses. The outer edge of the storage area will be capped with material from waste rock in the pit. The TSF will be developed in three phases and will include a herringbone drainage and underdrainage system. The seepage collection pond will be lined with a 1.5 mm smooth HDPE liner and the basin will consist of 390 g/m² Bidim A6 and a flow net 700 HP drain layer. A stormwater diversion trench and

berm will be constructed around the TSF shown in Figure 18. The liner for the TSF basin and drainage systems will consists of the following material described from top to bottom:

- Geotextile Bidim A6 for liner protection
- 1.5 mm mono-textured HDPE geomembrane for seepage reduction
- 150 mm crushed compacted calcrete layer (3 mm maximum particle size) for geochemical neutralization

While water reuse is not anticipated in the standard process, provisions are in place for collecting any seepage and returning it to the plant. A specialized forward stacking conveyor system was chosen to align with the TSF dry stacking method, ensuring efficient planning, equipment movement, and safe access.

A basin underdrain system will be positioned in key areas of the facility basin to enhance consolidation of the tailings mass, and to collect leachate to the seepage pond. The seepage collection pond will be sized to maximize evaporation of the leachate water.

Table 8 - TSF design criteria (Knight Piesold, 2024)Table 8 summarises the key design criteria for the permanent storage of the tailings material.

Table 8 - TSF design criteria (Knight Piesold, 2024)

Description	Specification	Source
LoM	13 years	Lycopodium
Production rate	5 Mt	Lycopodium
Tailings product type	Filter cake	Lycopodium
Tailings dry density	1.5 t/m ³ (assumed)	Lycopodium
Waste rock bulk density	1.9t/m ³ (assumed)	Qubeka (TBC)
Tailings total production	65Mt	Osino
Tailings volume requirement	43Mt	Osino
Tailings deposition method	Forward stacking conveyor system	Lycopodium
Waste rock deposition method	Trucking and placement with excavator and dozers	KP

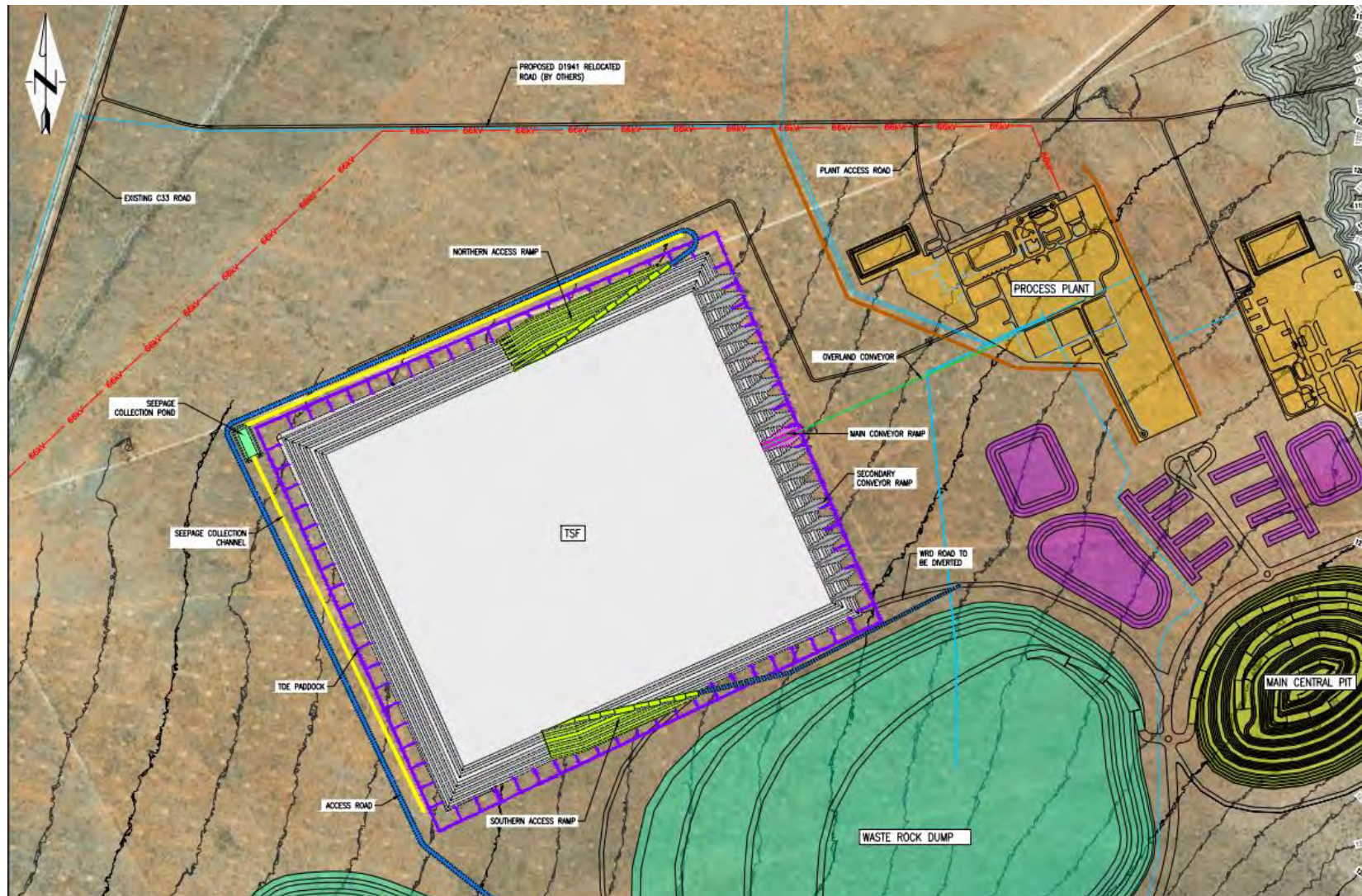


Figure 18 - Tailings Storage Facility General Arrangement at Final Elevation.

The containment walls are sequentially raised in a direction and may be developed in any number of phases or lifts, as shown in Figure 19.

The phased construction of the TSF allows for the deferral of capital expenditure and takes into account the possible limited availability of waste rock for the construction of the embankments. The embankments will be constructed continually, but the installation of the barrier will be undertaken in phases. The following summarises the proposed phasing of the TSF, a critical element of environmental and closure management to address during the LoM:

- **Phase 1:** Construction to be started in year 1, the crest elevation is 1190mamsl – 8m, the maximum embankment (NW corner) with a 1m high berm of the SE with an area of 103 Ha. The capacity at this phase will be 4Mt and will have 9 months of depositional storage.

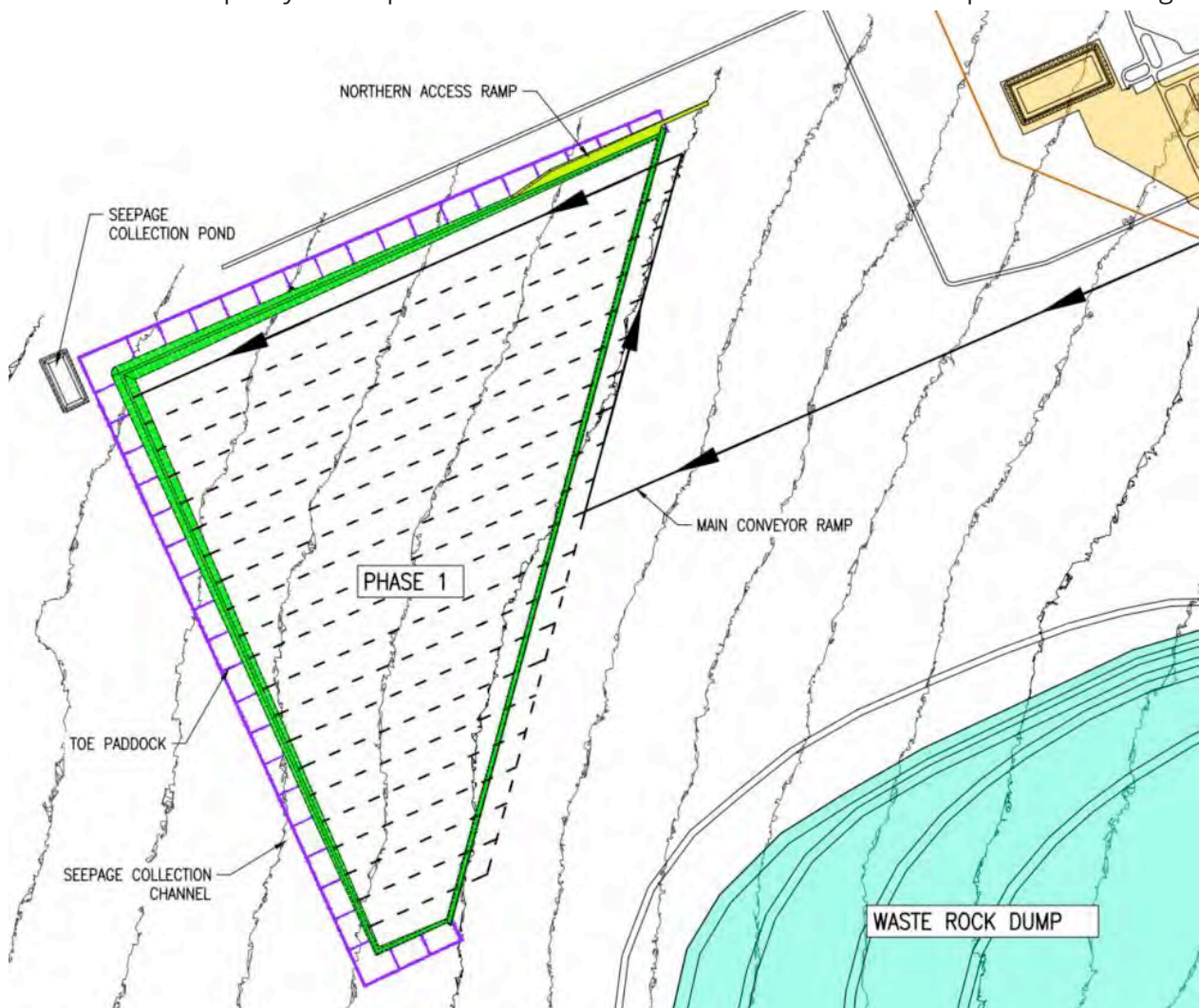


Figure 19 - TSF Design - Phase 1

- **Phase 2:** This phase will involve the construction a similar sized cell as in Phase 1, which will be constructed adjacent to Phase 1, such that the two phases share an embankment. This will be constructed in year 1. The crest elevation will be 1195mamsl – 5m high perimeter wall raise with a 1m high berm on the southeast side. Phase 2 will cover an area

of 174Ha with an extension of 71Ha to phase 1. This phase will have a capacity of 11Mt and will have 2.2 years of depositional storage capacity, shown in Figure 20.



Figure 20 - TSF design - Phase 2

- **Phase 3:** This phase includes the raising of the TSF embankments crest elevation of 1200mamsl – 5m high perimeter wall raise and 1m berm on the southeast. The internal embankment side slopes will also be lined and will cover an area of 203Ha with a 29Ha extension to phase 2. Phase 3 will accommodate tailings with a further volume of 15Mt, deposited over a period of 3 years shown in Figure 21.

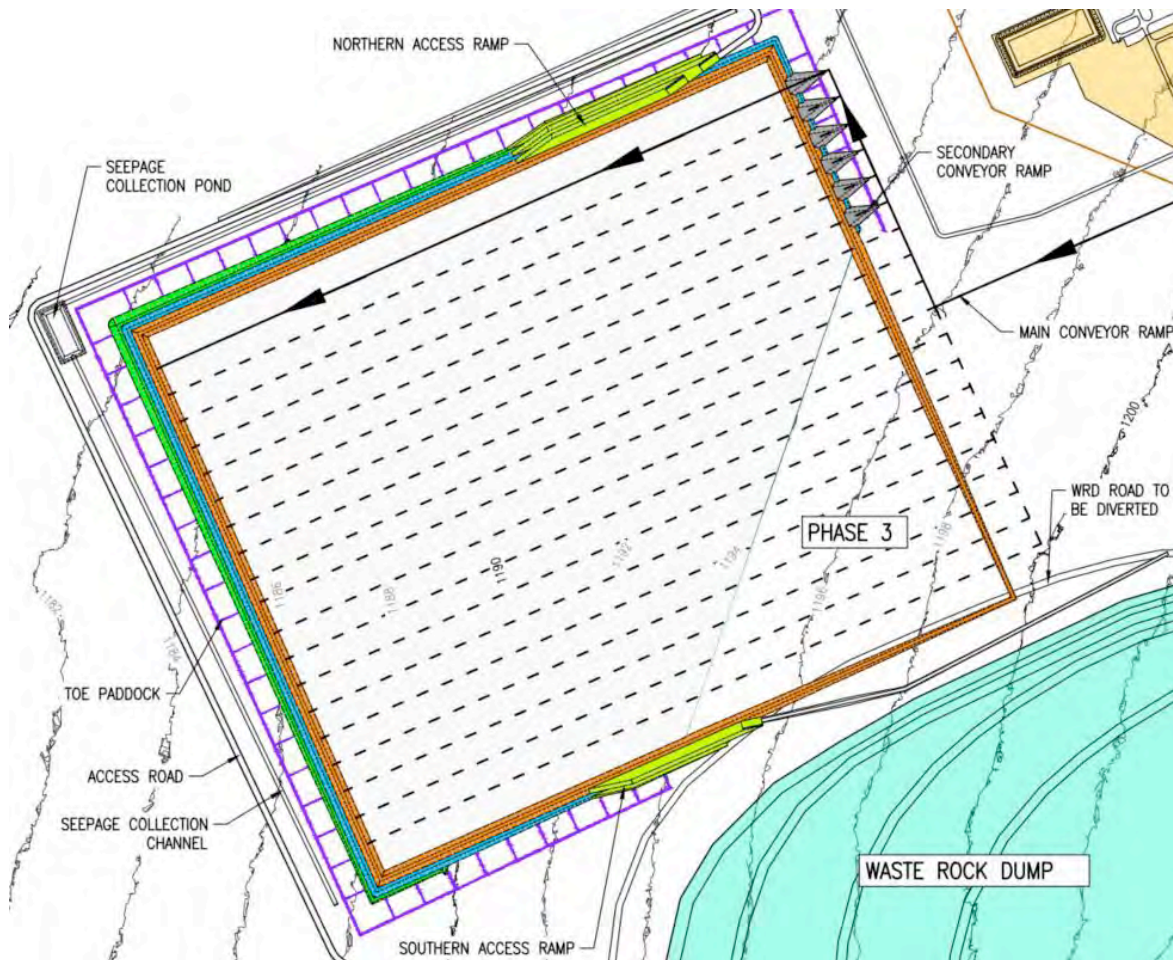


Figure 21 - TSF Design - Phase 3

The TSF can still potentially be developed beyond the proposed height and provide additional storage capacity.

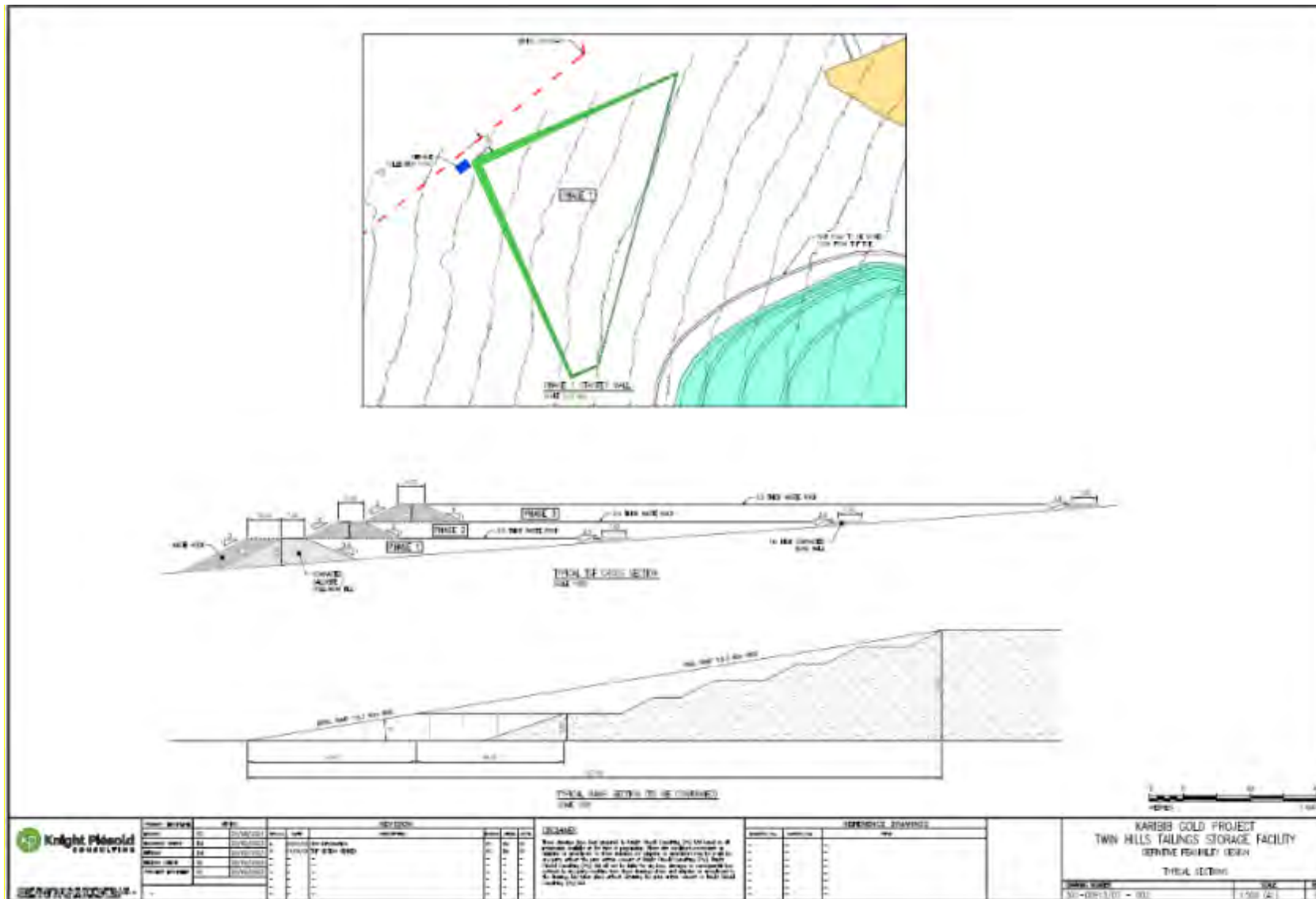


Figure 22 - Complete TSF design

The volumes of tailings and waste rock for each phase is summarised in Table 9.

Table 9 - Waste rock and tailings volumes and tonnages.

Phase	Waste rock		Tailings	
	Volume (m ³)	Tonnage (t)	Volume (m ³)	Tonnage (t)
1	179 000	340 100	2.5	3.7
2	312 000	592 800	6.1	9.7
3	157 000	298 300	9.1	13.7
4	98 000	186 200	25.3	37.9
Total	646 000	1 237 200	43	64.5

4.6.3 GENERAL WASTE

Waste will be separated at source, stored in a manner that there can be no discharge of contamination to the environment, and either recycled or reused where possible. On-site facilities will be provided at a dedicated waste storage facility for sorting and temporary storage prior to removal and disposal to appropriate recycling or disposal facilities off-site (Karibib for general waste and Walvis Bay for hazardous waste).

Industrial waste will be sorted on-site and disposed of at appropriate facilities. Hazardous waste includes, but is not limited to, the following: fuels, chemicals, lubricating oils, hydraulic and brake fluid, paints, solvents, acids, detergents, resins, brine, solids from sewage, and sludge. The waste types as set out in Table 10 will be generated by the project, a dedicated waste management and recycling facility will need to be built on site that specifically manages these waste types, and this will include an incinerator.

Table 10 - Waste specification, storage and end use.

Waste type	Waste specifics (example of waste types)	Storage facility	End use
Non-hazardous solid waste (non-mineralised)	Wooden crates, pallets, cable drums, scrap metal, general domestic waste such as food and packaging.	Dust bins in relevant work areas will be provided for different waste types. A waste management contractor will remove dust bins regularly to a dedicated waste handling and storage area.	Waste will be sorted further at a dedicated waste handling and storage area on site. Recyclable waste will be sent to a reputable recycling company. Some items may be distributed directly to the community if possible. The remainder of the waste will be transported by the waste management contractor to a permitted landfill facility

Waste type	Waste specifics (example of waste types)	Storage facility	End use
			which may be constructed on site for example within the WRD.
	Building rubble and concrete	Designated rubble collection points will be determined to which contractors will take rubble and concrete.	The waste management contractor will regularly remove the waste from the designated collection points to the footprint of the waste rock dump.
Hazardous contaminated solid waste (non-mineralised).	Treated timber crates, printer cartridges, batteries, fluorescent bulbs, paint, solvents, tar, empty hazardous material containers etc.	Hazardous waste will be separated at source and stored in designated containers in bunded work areas. The waste management contractor will remove these drums regularly to a dedicated waste handling and storage area.	Hazardous waste will be disposed of at the permitted hazardous disposal site (for example in Walvis Bay) by the waste management contractor.
	Hydrocarbons (oils, grease)	Used oil and grease will be stored in drums in bunded areas at key points in work areas. The waste management contractor will remove these drums regularly to a dedicated waste handling and storage area. The yard will have a dedicated used oil storage area which will include a concrete slab, proper bunding and an oil sump. The appointed bulk fuel supplier will collect used oil for recycling.	Used oil will be sent to a reputable recycling company for recycling.

Waste type	Waste specifics (example of waste types)	Storage facility	End use
	Sewage	Sewage will be collected and stored in a septic tank on site.	Sewage will be collected on a regular basis and transported for treatment to a dedicated sewage treatment facility which may be constructed on site.
Laboratory waste	Mineral samples, mineral assay samples, chemical fluids, glass, gloves and general laboratory waste samples	Mineral waste samples that are not required to be kept will be disposed of at the tailing storage facility and at an approved mineral disposal landfill. A mineral waste management contractor will remove the waste on a regular basis to a waste handling and storage area.	Hazardous laboratory waste will be collected regularly and transported to a hazardous disposal treatment facility (for example in Walvis Bay). Non- hazardous waste will be disposed of at an appropriate landfill which may be on site.
Medical waste	Syringes, material with blood stains, bandages, etc.	Medical waste will be stored in sealed containers. A waste management contractor will remove these drums regularly to a dedicated waste handling and storage area.	Medical waste will be transported by the waste management contractor to a permitted medical waste treatment facility.

4.6.4 EFFLUENT AND WASTEWATER

The modular packaged sewerage treatment plant s will be installed at the lowest point of the respective terraces. The process plant sewage treatment works should be designed to cater for 180m³/day average dry weather flow (ADWF), 16 m³/h at a 16 - h cycle for potable and domestic water use and 365 days per year and shall operate with an availability of 100%. The sewerage treatment plant inlet works will consist of a screen to remove solid and non-sewerage items such as plastic bags, etc., from the raw sewerage before entering the septic tank. These inlet screens size will be 1,000 x 500 mm consisting of 30 x 4 mm S 304 stainless steel plate strips placed as above with 30 x 30 x 3 SHS crossbars.). The septic tank will have a storage capacity of

approximately 180 m³ from which the sewerage would be pumped into the sewerage treatment plant. The septic tank will be a concrete tank installed underground with a concrete roof.

Sludge from the sewerage treatment plant will be disposed of into drying beds. Once the sludge has dried out, it will be mixed with wooden chips and spread onto the tailings dam or waste dump embankments which would act as fertiliser. Sludge will be removed once or twice a year.

4.7 ALTERNATIVES CONSIDERED

Alternative mine designs, processing plant options, and the types of tailing disposal methods have all been considered during the pre-feasibility and feasibility study stages of the Project. The availability of water, potential for acid mine drainage, long-term slope stability, safety, and climate change, etc. were be considered when assessing the economic, technical, and environmental suitability of alternatives. For every alternative option, trade-off studies were produced, calculating the financial or technical impact on the overall Project. The detailed baseline environmental studies in the appendices, and summarised in the environmental baseline chapter, provide further information to the decision-making process.

4.7.1 MINE LAYOUT

Several site layout alternatives were considered during the assessment phase. Layout options are currently constrained by the EPL boundaries, national roads, and the dimension stone prospecting claims held over the marble ridge. In addition, there are constraints with respect to the strike of the ore body, blue sky (possible future economic ore), a 500 m blast zone around the pits, the volumes of waste rock, and the tailings to be disposed of. Details of the alternatives for the positions, placements and designs for the waste rock dump and tailings storage facility are detailed in the assessment chapter.

4.7.2 ENERGY SUPPLY

The alternative energy source identified is predominantly solar photovoltaic (PV), with the potential for the addition of wind power generation as a prospective enhancement. The solar PV plant capacity is 25.5 – 27.1 MWac and is expected to offset approximately 35% of the Mine's total energy consumption. A battery energy storage system has not been included as part of the PV plant in the DFS. With the inclusion of the renewable energy plant, the anticipated carbon footprint of the Mine will be reduced by 19.9 kt annually of CO₂ emissions compared to a 100% Coal Generation system.

4.7.3 WATER SUPPLY

The alternatives for water supply are discussed in the utilities section above, and in more detail in the environmental baseline chapter of this report (chapter 5). Water supply optimisation strategies are in progress and continuing, current findings are included in the assessment chapter (chapter 7).

4.8 REHABILITATION AND CLOSURE

The Proponent has developed a mine rehabilitation plan as part of the mine closure plan that is consistent with the Namibian Mine Closure Framework and ICMM Integrated Mine Closure Good Practice Guide. These plans include estimated costs and are consistent with Namibian legislation and the draft Namibia Mine Closure Framework.

5 ENVIRONMENTAL AND SOCIAL BASELINE

5.1 BASELINE DATA COLLECTION

Initial desktop baseline studies relevant to the Project formed part of the initial environmental assessments conducted for the exclusive prospecting licences and mining licence area, on which the Project is situated. As part of this assessment, the baseline was studied in detail, with inputs from specialist studies commissioned as part of the environmental and social impact assessment process.

5.1.1 DESKTOP AND FIELD SURVEYS

Initial desktop baseline studies were completed between 2018 and 2020 for the EPL assessments. Additional desktop and field-based baseline studies were conducted for the mining licence ESIA between February and September 2021. These built onto the dataset of site environmental monitoring data being collected since 2010. Additional desktop and field studies have been completed following the submission of the 2022 assessment report between 2022 and 2023 and forms part of this amendment report.

This section sets out the biophysical and socioeconomic environments in which the Project is situated. It is an important part of the scoping component of the assessment, as it determines if there are any knowledge gaps that require additional information prior to the assessment phase being completed. This work has been completed.

5.1.2 SPECIALIST STUDIES

The following specialist studies as outlined in Table 11 were commissioned and completed, to determine the current state of the baseline environments. All specialist reports are available as appendices in this report.

Table 11 - Specialist studies conducted for the ESIA.

Study area	Purpose	Specialists
Terrestrial ecology	– Biodiversity, habitat and ecosystem services – Identification of species of concern and sensitive areas – Impacts of mining construction and operations on habitats and biodiversity	– Peter Cunningham (2021 a&b, 2023)
Hydrology	– Water supply – Storm protection and river diversion – Impact on heritage aspects – Clean and dirty water management systems	– SLR (2021) – Knight-Piesold (2023)
Groundwater	– Assess the potential for contamination of aquifers from TSF & WRD – Provide a model to determine impacts of drawdown and plume mobility	– SLR (2021) – Knight-Piesold (2023)

Study area	Purpose	Specialists
	– Assess the sustainability of boreholes for water supply	
Air quality	– Provide emission standards and dust suppression requirements – Assess prevailing wind directions and possible effects of emissions on the process and/or personnel – Model potential air quality impacts	– Airshed (2021 b, 2023 a)
Noise and sense of place	– Identification of possible receptors, and assess levels of noise to which they may be exposed during construction and operations	– Airshed (2021 a, 2023 b) – ECC (2021, 2023)
Soils and land use	– Assess existing land use, and potential impacts on surrounding land users – A soil study informs the quality and quantity of material available for rehabilitation to a similar state on closure	– ECC (2021)
Traffic	– The traffic impact assessment reviewed the potential traffic impacts and loading on routes associated with the mining activities – Assessing the capacity of infrastructure and safety aspects of the mine entrance – Assessing the need for an intersection upgrade at the mine entrance, and providing a concept layout plan if necessary	– ITS Global (2021, 2023)
Heritage and culture	– A heritage assessment is required, in order to comply with Namibian national legislature and gain approval from the Heritage Council	– Dr John Kinahan (2021, 2023) – Dr Alma Nankela (2022 a&b)
Visual and tourism	– Assessing the potential visual impacts of a proposed Project on the receiving environment	– ECC (2021, 2023)
Social and economic	– Includes the assessment of various recreational activities in Karibib / Omaruru / Usakos – Site-level (farms) economic impacts	– Deon Wessels (2021) – Osino/ECC (2021, 2023)
Geochemical sampling and analysis	– The geochemical analysis of waste rock, tailings, and overburden will be undertaken to assess the mineralogical composition, acid mine drainage potential, and metal concentration of the leachate of waste rock and tailings	– ECC:RGS - Mine Waste and Management Consultants (2022)
Blast vibration impact	– Assessing the impact of blasting on receptors in the area	– Blast Management and Consulting (2021, 2023)
Climate change	– Assessing and understanding requirements to adhere to the implementation of Equator	– RDJ Consulting (2023)

Study area	Purpose	Specialists
	Principles and climate-related risks guided by the Task Force on Climate-related Financial Disclosures	

5.2 LOCATION

The Twin Hills Gold Project is located approximately 180 km inland from the Atlantic coastline. The site is in a triangular area bounded by the towns of Omaruru, Karibib and Wilhelmstal. The Project area is shown in Figure 2 – Project location and regionsFigure 2 and is located northeast of Karibib (~ 15 km). The Khan River is north of the Project, with the Khan tributary directly north of the mining licence, with the Okawayo river passing through the Project area. The site is accessed from Karibib along the C33 that runs northeast to Omaruru. The B2 runs parallel to the Project area and is separated by a marble mountain ridge. Omaruru is 45 km north of the Project site.

5.3 LAND USE

The Project is situated in a commercial agricultural region and the land use is dominated by cattle, game and small stock farming. Figure 5 outlines the mining licence area map with surrounding farms. A spatial review identified that one farm has a remnant orchard, but no large-scale irrigation farming was identified. The Okawayo farm has been described as a wildlife and hunting farm. Portions of the directly impacted farms will no longer be available for farming, as the area will form part of the mining operational footprint. Farming activities on surrounding properties will be able to continue relatively undisturbed by the proposed Project.

Dimension stone quarries are located on the marble ridge that occurs on the Okawayo farm, and several mining claims are held along portions of this ridge, as shown in Figure 5.

The Project area is not part of a communal conservancy and is not situated within a freehold conservancy. The closest conservancy is ‡Gaingu, which is located in the Spitzkoppe area to the west of Karibib approximately 86 km away.

5.4 GEOLOGICAL SETTING

The local geology is summarised from a collection of reports compiled by the Proponent during exploration activities and is provided in detail in the Project description chapter of this report. The Twin Hills Gold Project is situated within the Southern Central Zone of the Damara Supergroup. It comprises continental margin carbonates and silts that grade into turbidite sequences representing continental shelf and basin deposits. The regional mapping and reinterpretation of the available aeromagnetic data undertaken by the Proponent resulted in the identification of a large deep regional structure, the Karibib Fault, which strikes east northeast and has several ‘splays’ associated with it.

The Twin Hills deposit lies in the Kuiseb Formation, which is the uppermost portion of the Swakop Group, a sequence of turbiditic marine sediments several kilometres thick, which was folded during the Neoproterozoic Damaran orogen. The gold mineralisation is hosted within a metagreywacke unit, which has been tightly folded into an overturned syncline, underlain by biotite schist and cordierite schist. The host rocks are overlain by red Kalahari sands and calcretes between 2 m and 25 m thick. Faults and lithological contacts between the marble and the greywacke/schist are considered potential targets for groundwater supply investigations. The geological setting is shown in Figure 23.

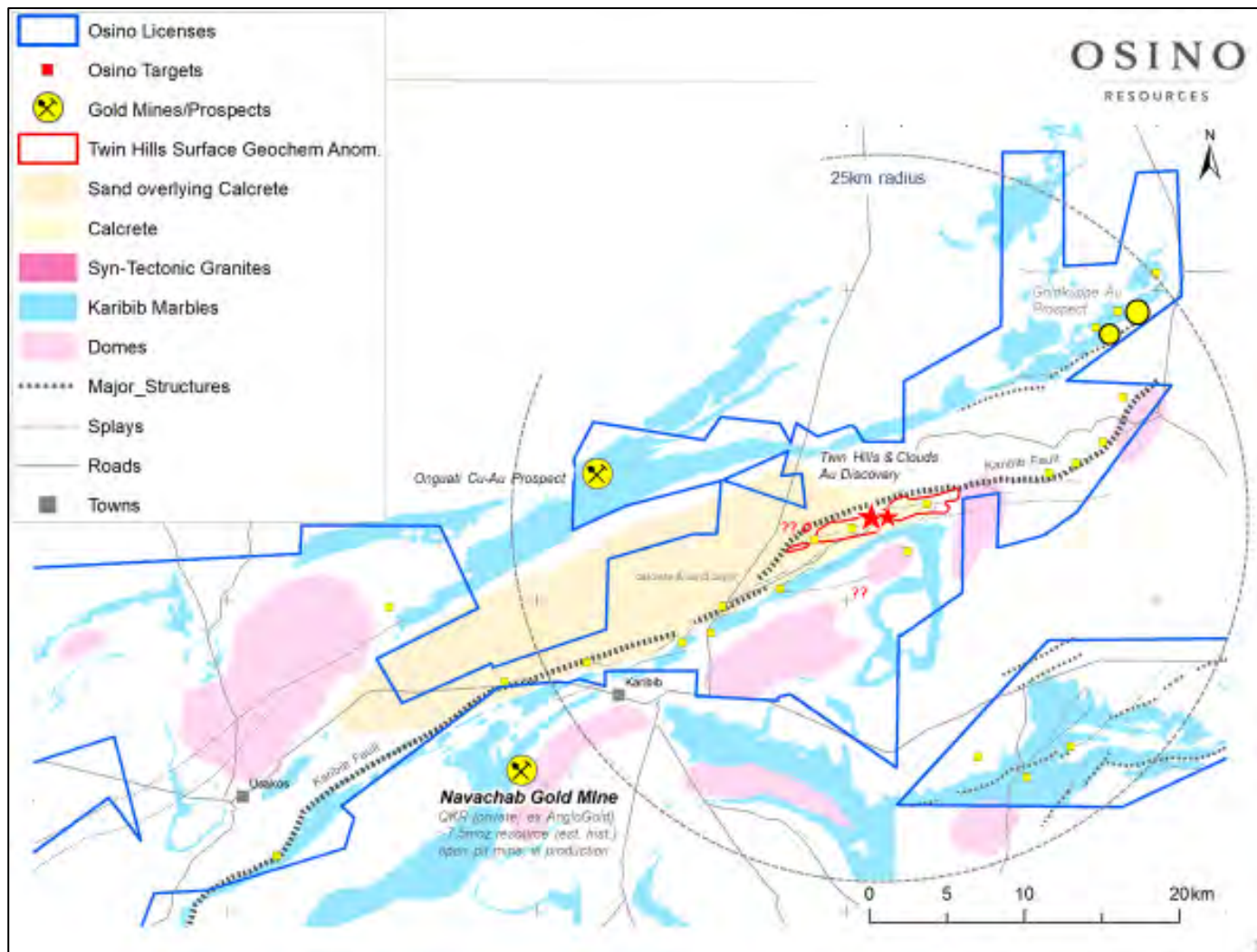


Figure 23 - Geological setting of the Project (Source: (Osino, 2020)

5.5 TOPOGRAPHY

The land in the Project area is dominated by calcisols (commonly called calcretes), regisols and rocky outcrops. The eastern portion of the Project area is moderately rough, with steep hill slopes. Conversely, the western portion of the Project area is relatively flat, covered by reddish sands and slopes gently towards the northwest.

The southern half of the Project area is traversed by a marble ridge that tends northeast southwest across the property. North of the marble ridge, the topography slopes towards the Khan River, approximately 8 km away. Figure 24 shows an image of the calcrete plain below the marble ridge. This flat plain area is where the open pits will be situated.

The marble ridge is bisected by the ephemeral Okawayo minor river, which drains northwards across the proposed main open pit to the Khan River. This water course will need to be diverted before mining can commence and is discussed in further detail within the water section of this baseline chapter.



Figure 24 - An image taken from the marble ridge overlooking the proposed Project area, with a view of the Erongo mountains in the background.

5.6 BUILT ENVIRONMENT AND INFRASTRUCTURE

5.6.1 INFRASTRUCTURE AND BULK SERVICES

The wide tarred B2 road south of the Project area, also known as the Trans-Kalahari Highway, carries large traffic volumes between Windhoek and Walvis Bay, and is considered the regional trade route. The tarred C33 road running north from Karibib to Omaruru is likely to be the primary access route to the site.

The D1941 gravel road traverses the proposed mine site, across the proposed main open pit area. This road will have to be diverted and is planned to the north of the mine, this diversion is further discussed in section 5.15. On the southwest of the site, the D1941 is used to access the marble quarries and other mining claims along the marble ridge.

The TransNamib Railway line parallels the B2 in the south, with a line branching north-eastward (at Krazenberg, west of Karibib) towards Omaruru, Otjiwarongo and on to Tsumeb. A 66-kV powerline runs loosely parallel to this railway line, but not in the same corridor (Figure 25 - Road and rail infrastructure.).

NamWater currently has an unused wellfield in the Khan River, with an associated pumpstation to the northwest of the Project. A pipeline runs south-south westwards from this location towards Karibib.

Bulk water to Karibib is pumped by NamWater from the Swakoppoort reservoir to a treatment plant in Karibib.

The town of Karibib is supplied by a 66 kV overhead powerline by ErongoRED, terminating at the Karibib 66/11 kV, 2.5 MVA substation. The power supply for the Project will be a 66 kV overhead line that will tie-off from this main sub-station to the Twin Hills tie-in sub-station on the mine site. This 66 kV powerline ESIA process is being carried out by ECC separately from this assessment for the Proponent, on behalf of NamPower. A solar PV plant will be constructed north of the operational area to provide additional power supply to the mine site. The onsite powerline infrastructure will consist of a 11 kV overhead power line, with design mitigation measures incorporated for giraffes. The PV plant and 11 kV network will be further assessed and discussed in this report as changes from the 2022 assessment layout.

The Karibib Air Base, approximately 7 km southwest of the proposed Project, is supplied by a 33 kV line from Karibib.

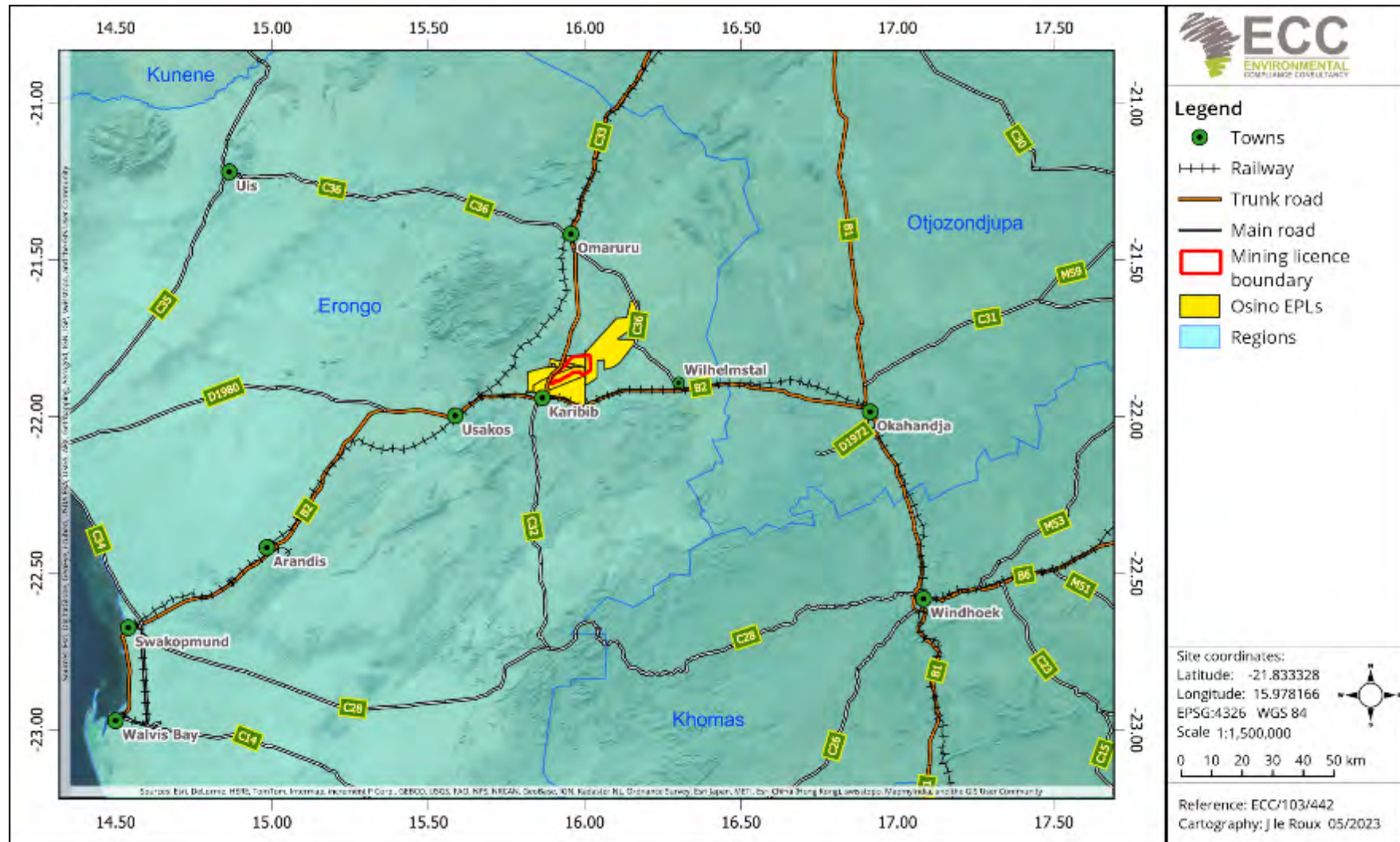


Figure 25 - Road and rail infrastructure.

5.6.2 TRAFFIC AND TRANSPORT

Innovative Transport Solutions (ITS Global) was commissioned by ECC to assess the road traffic baseline. The traffic study was completed in September 2021, at a time when there were no COVID-related travel restrictions or lockdowns, which would have affected the accuracy of the baseline study. Additionally, due to the route change with the original diversion, namely the access point change, the baseline report has been updated to reflect these layout changes. The traffic volumes have not changed and therefore remain the same. The updated 2023 traffic baseline study can be found in Appendix H. It must be noted that this study presents the current baseline conditions of the road network in proximity to the Project. Details of how the Project could impact these roads is provided in the impact assessment chapter (Chapter 7).

Four scenarios were assessed, and the 2021 baseline, 2022 baseline, 2024 total and 2040 total conditions of the roads and intersections in terms of traffic volumes, lane configuration and traffic controls are provided in Figure 26– Figure 29, respectively. The peak hourly construction and operational trips are displayed in Figure 30 and Figure 31.



Figure 26 - Baseline conditions for intersection hourly traffic volumes – >traffic vs >production
(Source: (ITS, 2023).



Figure 27 - Baseline conditions for intersection hourly traffic volumes - >traffic vs >production
(Source; ITS, 2023).



Figure 28 - 2024 Total conditions for intersection hourly traffic volumes – >traffic vs >production during the construction phase (Source: (ITS, 2023)).



Figure 29 - 2040 Total conditions for intersection hourly traffic volumes - >traffic vs >production during the operational phase (Source: (ITS, 2023).



Figure 30 - Twin Hills construction development trips per peak hourly traffic condition (Source (ITS, 2023)).



Figure 31 - Twin Hills operational development trips per peak hourly traffic condition (Source: (ITS, 2023)).

The major existing roadways in proximity to the Project area include:

- B2 Road (T0106) – Class 1 principal arterial, with a surfaced lane (approx. 3.7 meters wide) per direction. Speed limit of 120 km/h.
- C33 Road (T0203) – Class 2 major arterial, with a surfaced lane (approx. 3.5 meters wide) per direction. Gravel shoulders and a speed limit of 120 km/h.
- C36 Road (M0080) – Class 3 minor arterial, with a gravel lane per direction. Speed limit of 100 km/h. A site observation made for the C36 road is that fencing along the road is suggested to protect drivers and animals.
- D1941 Road – Class 4 distributor, with a gravel lane per direction.

(ITS, 2021) (ITS, 2023) engineers determined that all the intersections for all four scenarios currently operate with a good level of service and have spare capacity. No upgrades are required. This statement shows that the introduction of more traffic associated with the Project would be possible.

5.6.2.1 *additional traffic volumes associated with the Project*

ITS Global utilised available information associated with the Project to determine the additional traffic volumes that will be added to the road infrastructure due to the proposed Project. The trip generation for the Project was based on the number of trips required to transport the expected number of personnel, equipment and supplies to site during construction and operations.

During development this includes 333 people per shift (3 shifts, 8-hour duration) for construction purposes and 257 people per shift (3 shifts, 8-hour duration) for operational purposes. Truck development tracks is based on 10 – 20 trucks a day for construction and 5 – 10 trucks a day for operational purposes. Peak hourly traffic is determined as 74 total trips (37 in and 37 out) during construction and 52 trips (26 in and 26 out) during operations.

The additional trucks required for the different developmental phases will not significantly increase the truck usage on the surrounding network during peak hour (Figure 30 and Figure 31).

5.6.2.2 *site access*

The current district road (D1941) runs through the Project area and will intersect the planned open pits. It will therefore need to be relocated. The proposed relocation of the D1941 will require the road to be moved northwards to a point within the Okawayo farm.

The proposed realignment of D1941 would be off the C33 Road just north of Karibib Air Force Base (~5.3 km), as shown in Figure 25, and will need to meet the safety requirements set out by the Roads Authority of Namibia. The current shoulder sight distance from the re-aligned D1941 road along the C33 will be sufficient.

It is recommended to implement a separate northbound right-turn lane at the C33/D1941 intersection and to reduce the C33 speed limit upon approach to the D1941 intersection. Both

requirements are from a safety perspective Based on capacity analysis, a stop control should be installed at this intersection (ITS Global, 2023).

The D1941 re-aligned road should be surfaced, from a safety and maintenance perspective. Any damages sustained after upgrades and completion of the construction of the road should be repaired to an acceptable standard by the Proponent. The width of the re-aligned road should be 7 m (ITS, 2023) for larger vehicles to pass one another safely.

The mine entrance access should have a minimum shoulder sight distance of 200 m with a speed limit of 60 km/h. The width of the road should be a minimum of 7 m wide to allow heavy vehicles to pass one another safely (ITS, 2023)

It is further recommended that bus embayment's with sufficient bell-mouth/circulating radii (minimum 15 m), lighting and shelter be provided on site at the mine entrance (ITS, 2023).

5.7 SOCIOECONOMIC BASELINE

5.7.1 GOVERNANCE

Namibia was established in 1990 and is led by a democratically elected and stable government. The country ranked fifth out of 54 African countries in the Ibrahim Index of African Governance in 2015 for indicators that include: the quality of governance and the government's ability to support human development, sustainable economic opportunity, rule of law, and human rights.

As a result of sound governance and stable macroeconomic management, Namibia has experienced rapid socioeconomic development. Namibia has achieved the level of 'medium human development' and ranks 130th on the Human Development Index out of 189 countries (United Nations, 2021)

Namibia is divided into 14 regions, subdivided by 121 constituencies. The Erongo Region is divided into seven constituencies. The proposed Project is in the Karibib constituency of the Erongo Region. The Erongo Regional Council is responsible for the planning and development of the region in a sustainable manner for the benefit of its inhabitants by establishing, managing, and controlling settlement areas and focusing on core services. The council is accountable for an area of 63 586 km², which is about 7.7% of the total area of Namibia.

5.7.2 DEMOGRAPHICPROFILE

Namibia is one of the least densely populated countries in the world (2.8 persons per km²). Vast areas of Namibia are without people, in contrast to areas of dense concentrations, such as the central-north and along the Kavango River. Windhoek, the capital, is not only the main urban area with the largest population, but the concentration of private and public head offices attracts Namibians from all parts of the country in search for a better life.

The national population growth rate is estimated at less than 2%, which is lower than that of most African countries. Namibia's population is young – although 57% falls into the age group 15 to 59, while 37% of the total population is younger than 15 (Namibia Statistics Agency, 2018). Since 2005, there has been a steady improvement in life expectancy, which is currently estimated at 65 years. In 2018, it was estimated that 50% of all Namibians are urbanised, i.e. living in an urban settlement (retrieved from www.worldpopulationreview.com). The last national census was conducted in 2011 and counted 2.1 million Namibians (Namibian statistics Agency, 2011). An intercensal demographic survey was conducted in 2016 and estimated the total population at 2.3 million (Namibia Statistics Agency, 2018). The next national census is planned to commence from 18 September to 03 November 2023.

It is predicted that urbanisation will continue, with the urban population expected to increase from 43% in 2011, to 67% in 2041. The populations of the Khomas and Erongo regions are projected to increase the most, with over a third of Namibia's population expected to live in these two regions by 2041 (Namibia Statistics Agency, 2014).

The proposed Project is in the Karibib constituency but borders the Omaruru constituency. In this region, the gender split between males and females is almost equal, the unemployment rate is estimated to be 30%, and the average age of the population is 26 years. Figure 32 provides a pictorial representation of the initial high-level baseline and impact study conducted by Deon Wessels in relation to the Project area.

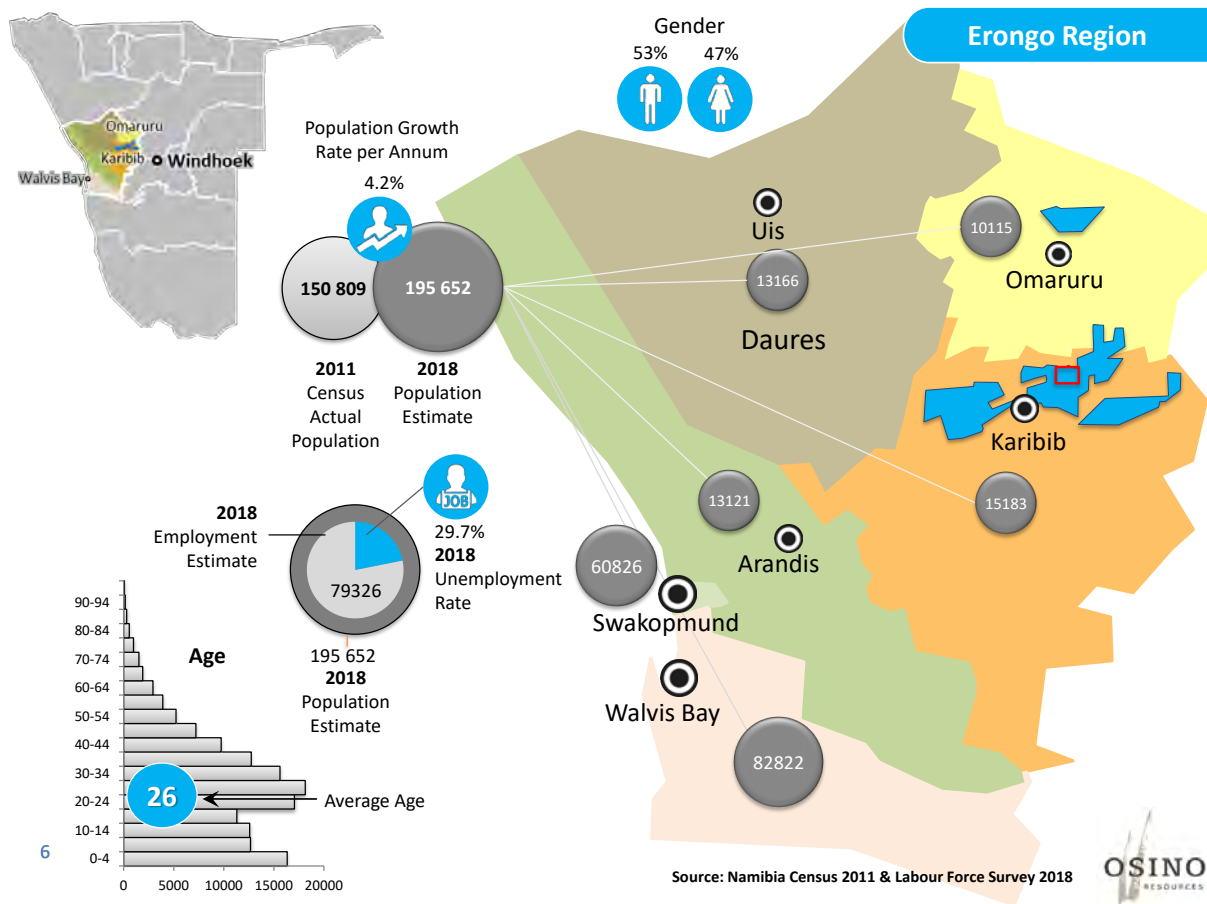


Figure 32 - An infographic showing the Erongo Region demographic profile (Source: (Wessels, 2020).

The socioeconomic baseline study has collated information from a variety of resources, including the 2018 census, Labour Force surveys and the Namibian demographic health survey, amongst others, the study is provided in Appendix I. An overview of the two towns closest to the proposed Project is presented in Table 12. These statistics have since been updated through the 2023 census.

Table 12 - Erongo Region Demographics focusing on Omaruru and Karibib.

Indictor	Erongo Region (2018)	Erongo Region (2023)	Omaruru (2018)	Omaruru (2023)	Karibib (2018)	Karibib (2023)
Population estimate 2018	195 652	240 206	10 115	10 767	15 183	8 434
Gender ratio	53% male, 47% female	51% males, 49% female	52% male, 48% female	50% male, 40% female	48% male, 52% female	51% male, 49% female
Average age	26	No current	25	No current	24	No current

Indictor	Erongo Region (2018)	Erongo Region (2023)	Omaruru (2018)	Omaruru (2023)	Karibib (2018)	Karibib (2023)
		data available		data available		data available
Number of households	57 000	No current data available	2 400	No current data available	3 500	No current data available
Formal houses	65%	No current data available	70%	No current data available	67%	No current data available
Informal houses	33%	No current data available	28%	No current data available	31%	No current data available
Schools	19	No current data available	Six schools: – 2 Government secondary and boarding – 3 Government primary – 1 private primary	No current data available	Five schools: – 2 Government secondary – 2 Government primary – 1 private primary and secondary	No current data available
Health facilities	– 4 hospitals – 2 health centres – 18 clinics	No current data available	– 1 district hospital – 2 private healthcare facilities	No current data available	– 1 district hospital – 3 clinics	No current data available

Karibib is approximately 20 km by road from the mine, whereas Omaruru is 52 km by road. Despite the further distance, a significant number of project employees, particularly the more senior ones, are likely to based themselves in Omaruru, which has better-established stores, banks, restaurants and other amenities. Karibib is known for the Navachab Gold Mine, and over 750 employees live in the town, contributing to Karibib's economy. Figure 33 renders the Erongo population with projections in relation to access to infrastructure and services.

Additionally, as confirmed in the 2023 DFS process, an estimated <10 farm workers currently residing on the existing Okawayo and Klein Okawayo farms will be employed by the Proponent during the construction and operational phase of the Twin Hills Project.

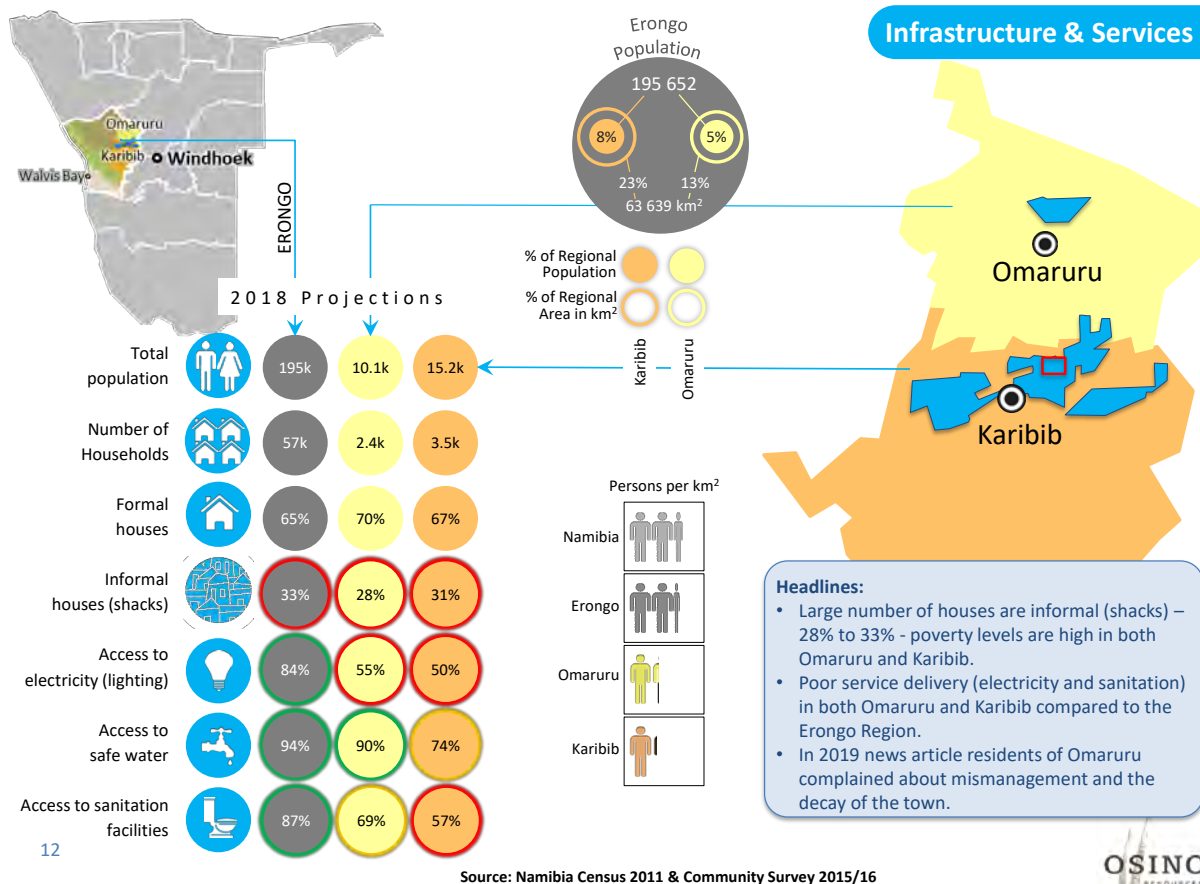


Figure 33 - An infographic showing infrastructure and services (Source: (Wessels, 2020).

5.7.3 HEALTH

Since independence in 1990, the health status of Namibia has increased steadily, with a remarkable improvement in access to primary health facilities and medical infrastructure. In 2015, the World Health Organisation (WHO) recommended strategic priorities for the health system in Namibia, which entailed improved governance, an improved health information system, emergency preparedness, risk reduction and response, preventative healthcare, and the combating of HIV/AIDS and tuberculosis (TB) (World Health Organisation, 2021)

According to the website of the Ministry of Health and Social Services (MoHSS), the Erongo Region has a total of 18 primary healthcare facilities, including two health centres, and four district hospitals. There are also private hospitals in Swakopmund and Walvis Bay. Figure 34 shows an overview of the health facilities in the two towns and region.

As elsewhere in Namibia, HIV/AIDS remains a major reason for low life expectancy and is one of the leading causes of death in the Erongo Region. HIV/AIDS remains the leading cause of death and premature mortality for all ages, killing up to half of all males and females aged 40 to 44 years in 2013 (IHME, 2016).

TB is a leading killer of people infected by HIV/AIDS, and Namibia had a high burden in 2018, with 35% of people with TB were infected with HIV. The country is included among the top 30 high-burden TB countries in the world and had an estimated incidence rate of 423 per 100 000 people, and 60 fatalities per 100 000 people in 2018 (retrieved from www.mhss.gov.na) shown in Figure 34.

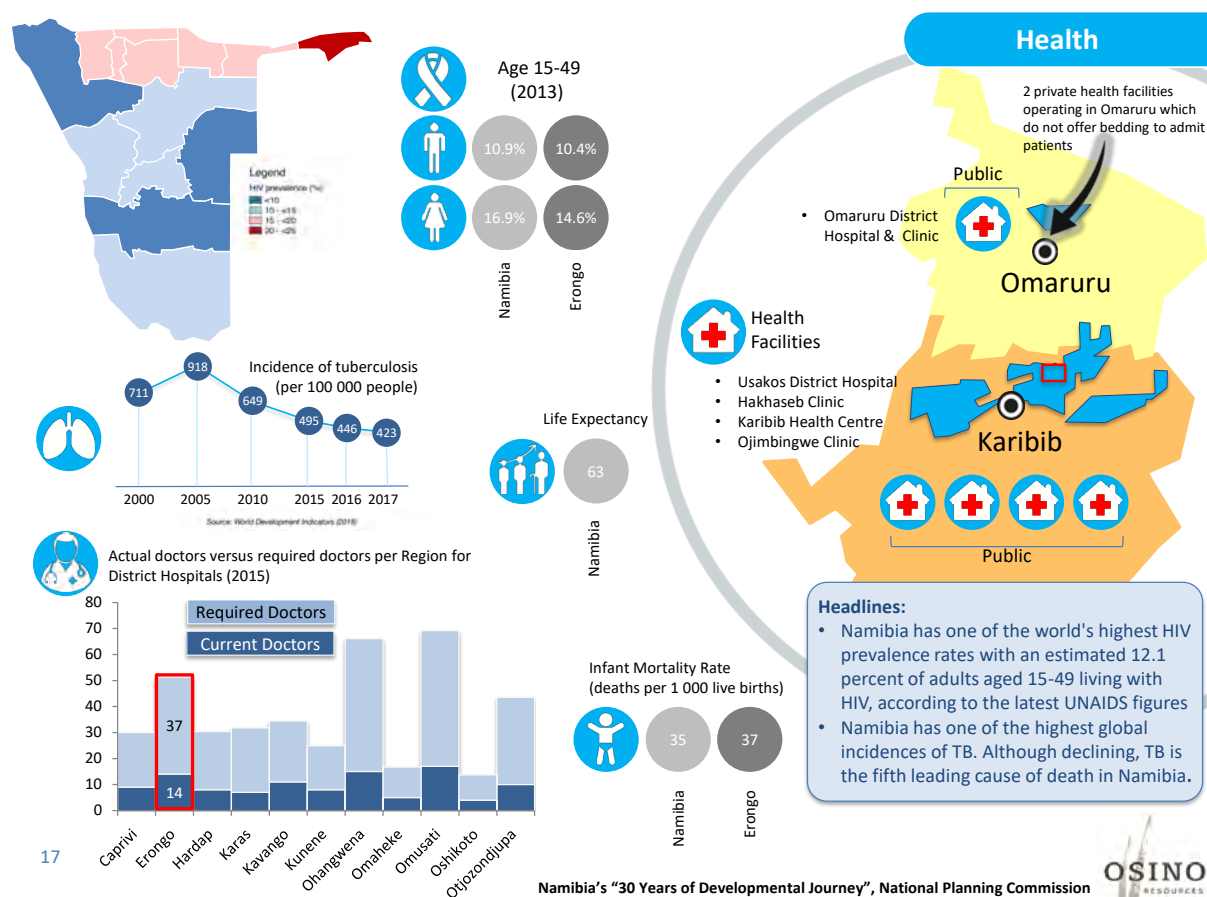


Figure 34 - An infographic showing the health profile (Source: Wessels, May 2020).

5.7.4 EMPLOYMENT

The Erongo Region is one of the most affluent regions in Namibia, with the second highest per capita income in Namibia at N\$ 16 819 per annum (EniroDynamics, 2010). In Walvis Bay, most employment is through the harbour, fishing industry and the processing of sea salt (Walvis Bay Municipality, 2008).

The labour force participation rate is the proportion of the economically active population, given as a percentage of the working age portion of the population (i.e. older than 15 years of age). The

rate of labour force participation for the Erongo Region was 80.9% compared to the average of 71.2% for Namibia in 2018 (Namibia Statistics Agency, 2018).

In 2018, 53.4% of all working Namibians were employed in the private sector and 21.5% by the state. State-owned enterprises employ a further 7.6% and private individuals 16.6%. Agriculture (combined with forestry and fishing) is the economic sector with the most employees, 23% of all employed persons in Namibia work in this sector. Wages and salaries represented the main income source of 47.4% of households in Namibia (Namibia Statistics Agency, 2018).

Low education levels affect employability and prevent many households from earning a decent income. Of all employed people in Namibia, 63.5% do not have more than a junior secondary level qualification (Grade 10 and lower), and 11.8 % of all employed people have no formal education. In total, 29.1% of those employed are in the category of “elementary occupation”, and 15.2% in the category of “skilled agriculture”.

Overall, the rate of unemployment is estimated at 33.4% for Namibia, using the broad definition of unemployment. The unemployment rate in rural and urban areas is almost the same, 33.4% in urban areas and 33.5% in rural areas. The highest unemployment rates are found amongst persons with education levels lower than junior secondary. The unemployment rate of persons with no formal education is 28.6%, with primary education at 34.6% and junior secondary education at 32.7% (Namibia Statistics Agency, 2018).

According to the Namibian Chamber of Mines (COM) 2022 annual review report, the mining industry employed 16 147 people directly in the industry, which is an increase from the 15 426 reported figure in 2021 (increase of 6.9%). This employment consisted of 8 391 permanent employees, 742 temporary employees and 7014 contractors. The mining industry spent 196 million Namibian dollars on skills expenditure, with 184 million Namibian dollars spent on CSR expenditure and 964.9 million Namibian dollars on exploration. These figures include developing and operational mines, such as Osino.

Figure 35 shows the employment profile of Karibib and Omaruru and the Erongo region.

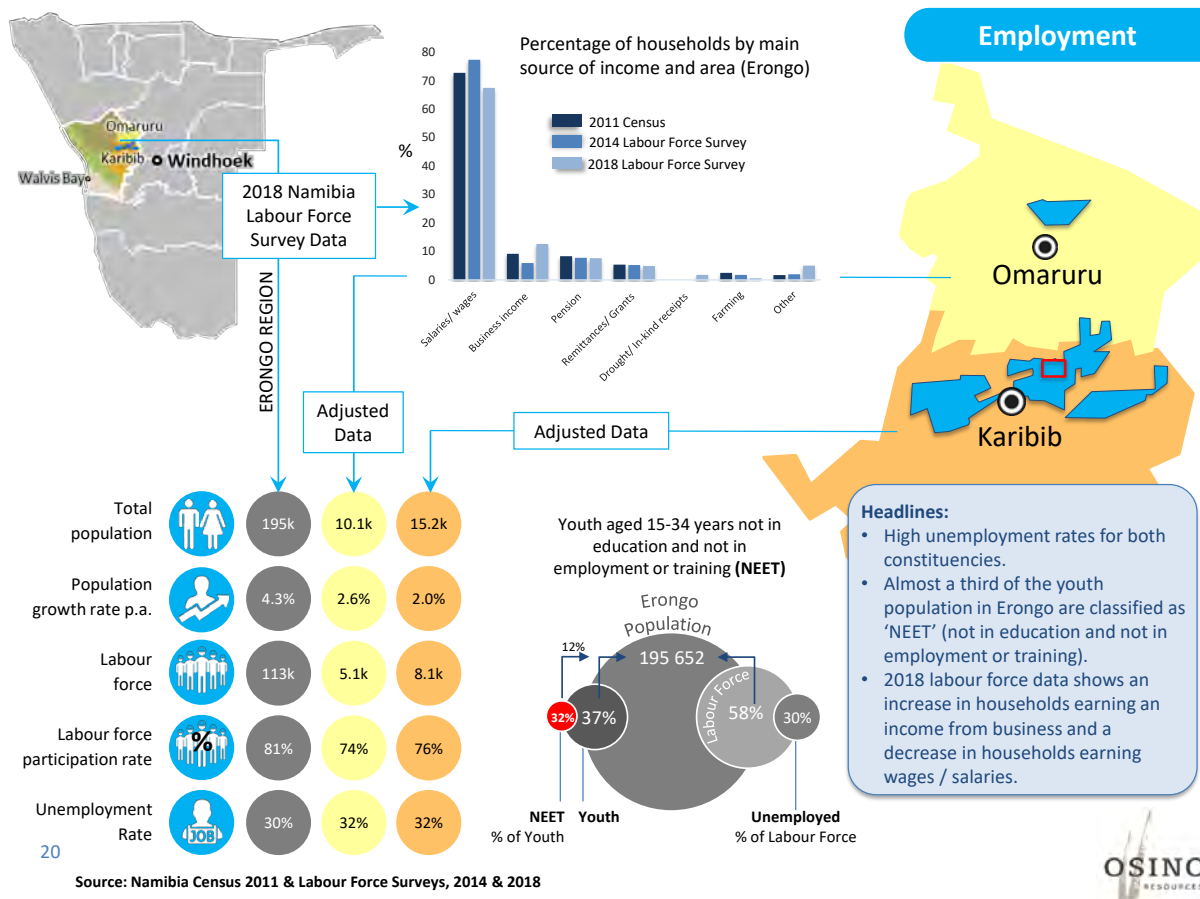


Figure 35 - An infographic showing the employment profile (Source: (Wessels, 2020).

Additionally, as confirmed in the 2023 DFS process, an estimated <10 farm workers currently residing on the existing Okawayo and Klein Okawayo farms will be employed by the Proponent during the construction and operational phase of the Twin Hills Project.

5.7.5 CRIME

Namibia's crime rate has been on the decline, in general and in the Erongo Region, since 2011. Namibia's crime index is 65.49 as at October 2021 and 64.64 as of May 2023. The town of Omaruru has a police station with 41 police officers, and compared with other towns, it is classified as having a below average rate of crime as shown in Figure 36. Anecdotally, a rising trend of substance abuse in Karibib has been reported during public consultation. The reason for this increasing trend is associated with the limited recreational and entertainment facilities in the Karibib area and is fuelled by the increase in disposal income from those working in the mining and quarrying industry in the area.

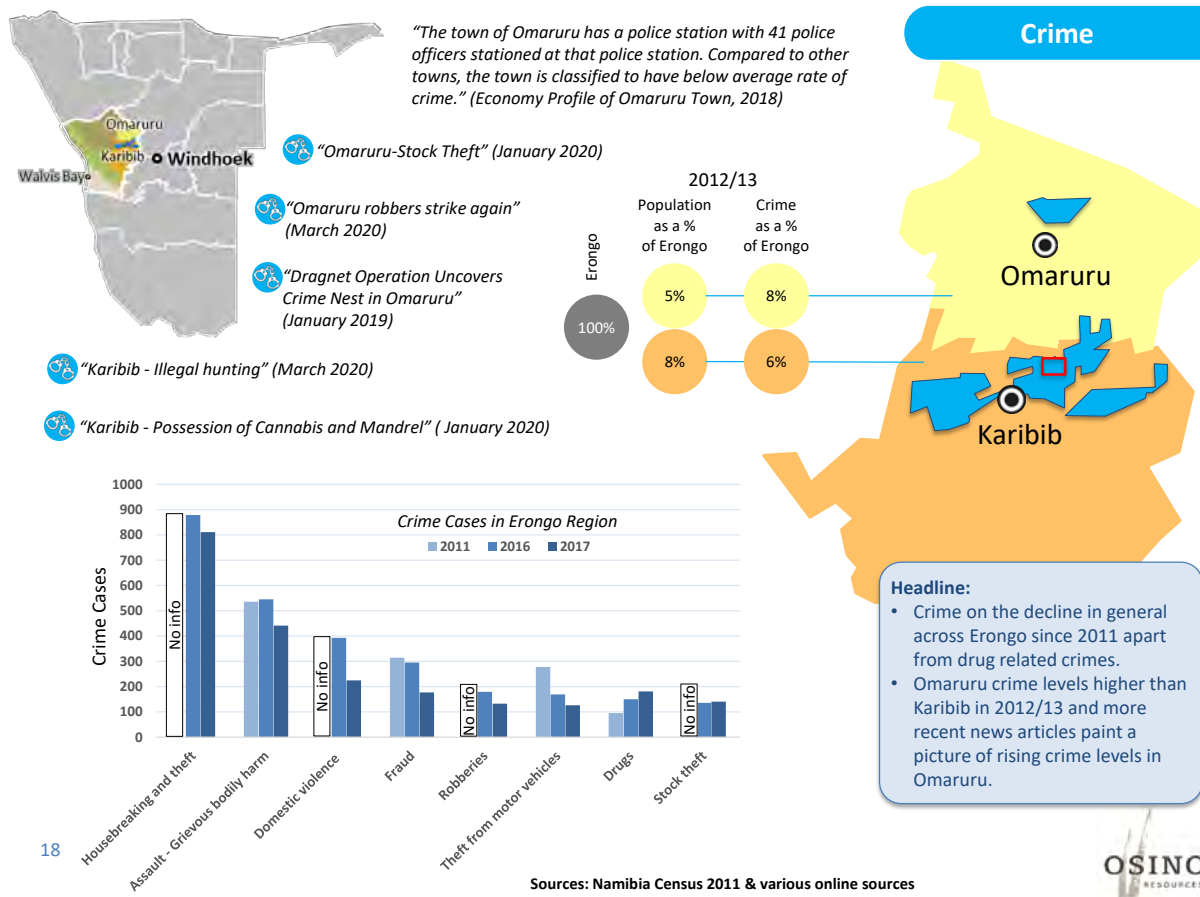


Figure 36 - An infographic showing the crime profile (Source: (Wessels, 2020).

5.7.6 ECONOMIC AND BUSINESS ACTIVITIES

Key economic activities of the Erongo region include agriculture, forestry, fishing, mining and quarrying, manufacturing, tourism and retail, as shown in Figure 37.

Mining plays a pivotal role in the economy of Namibia. Since independence, it has consistently been the biggest contributor to Namibia's economy in terms of revenue (29.6% in 2022) and accounts for 12.2% of the country's GDP (COM, 2022). Mining is one of the main contributors to GDP, and one of the largest economic sectors of Namibia. Mining is a pronounced industry in the Erongo region, and the main commodities are uranium, gold, salt and dimension stones.

In addition to the sectors mentioned, the economy of the Erongo region is dominated by the local economies of Swakopmund and Walvis Bay. In the rural parts of the region, extensive livestock farming is a common activity, but intensive farming is also practiced along the lower part of the Swakop river and at Omaruru. Several fresh crops are produced, mainly for local consumption. In the Erongo region, 67.5% of all households depend on salaries and wages as the main income (Namibia Statistics Agency, 2018). Exact figures do not exist, but this high percentage can be ascribed to the dominance of the mining, fishing, and manufacturing and processing sectors, together with the prominence of state departments and the administrative sectors in the Erongo

Region. A total of 12.6% of households receive their income from business activities (Namibia Statistics Agency, 2018).

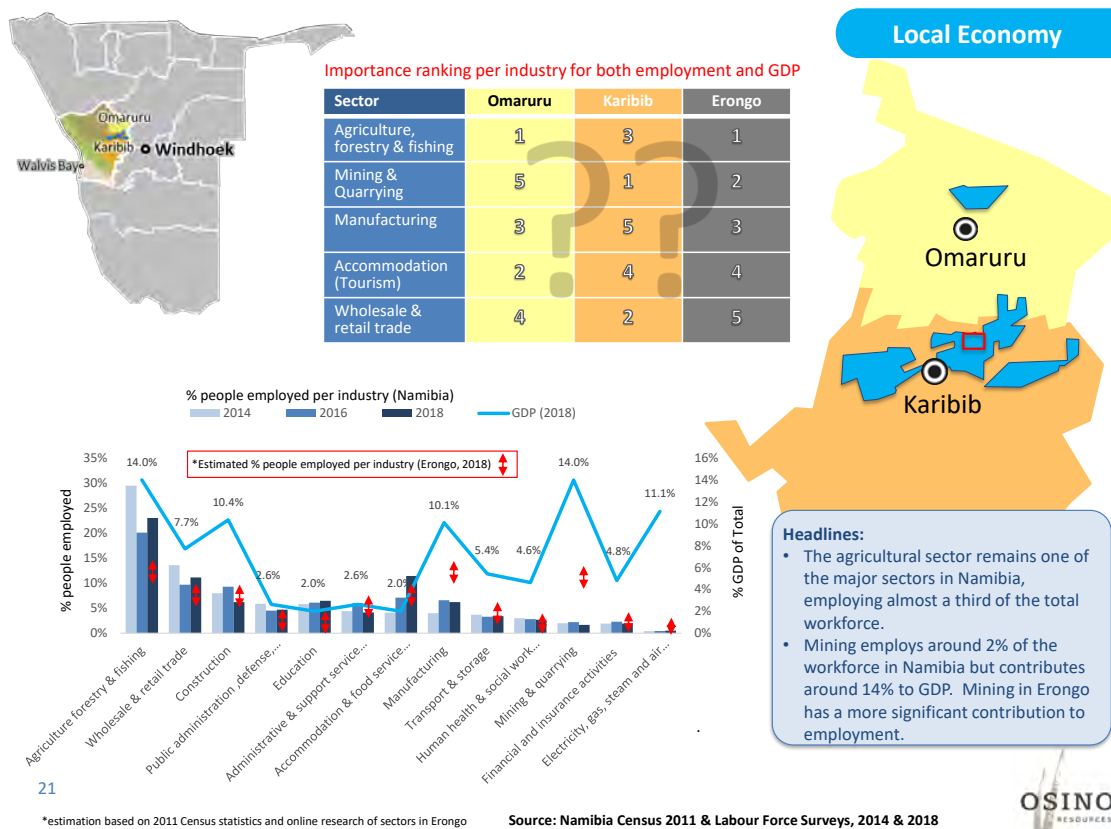


Figure 37 - An infographic showing the local economic profile (Source: (Wessels, 2020).

5.8 HERITAGE AND CULTURE

The initial baseline archaeological field survey and assessment was carried out on the proposed Twin Hills Gold Project site in early February 2021. Several minor archaeological sites were located (Figure 38) and colonial era structures (Figure 39), that might merit protection under the National Heritage Act, No. 27 of 2004, were assessed by (Kinahan, 2021). Subsequent to this baseline assessment, additional field work was conducted on discovered grave sites on farm Okawayo and the potential for new heritage sites along the Okawayo River tributary, which was carried out by Dr Alma Nankela, in October and November 2022, respectively (Nankela, 2022). Additionally, a ground penetrating radar scan (GPRS) was conducted in August 2023 by Dr Klaus Knupp to confirm if the suspected graves observed during Nankela and Kinahans field surveys were confirmed graves. These results are further discussed in Kinahan amended baseline report in the section below.

The National Heritage Council issued consent (No. 117/2022) to the Proponent for the old ruined colonial farm building and suspected burials to be demolished or relocated in lines with Section 55 (9) of the National Heritage Act, No. 27 of 2004, on the 09 August 2022 for the Project, which was valid for 1 year and expired on 10 August 2023. However, upon discovery of additional graves

this consent was withdrawn pending further investigations which were then conducted by Nankela in 2022. Heritage consent was then reapplied for and granted in 2023 for the Project, including the relocation of graves and the demolition buildings which are located within the project area. The heritage assessment reports are provided in Appendix G.

The ruined colonial farm building appears to be vulnerable, as is the well-constructed Okawayo farmstead, which was established in the late 19th century and is in relatively good condition. Both may potentially be affected by vibrations from mine blasting that will take place nearby (Kinahan, 2021). Further research from the national archives is required to determine the history of these buildings and is presented in the assessment chapter. Additionally, a suspected grave cairn was also observed during the survey (Okawayo 478).

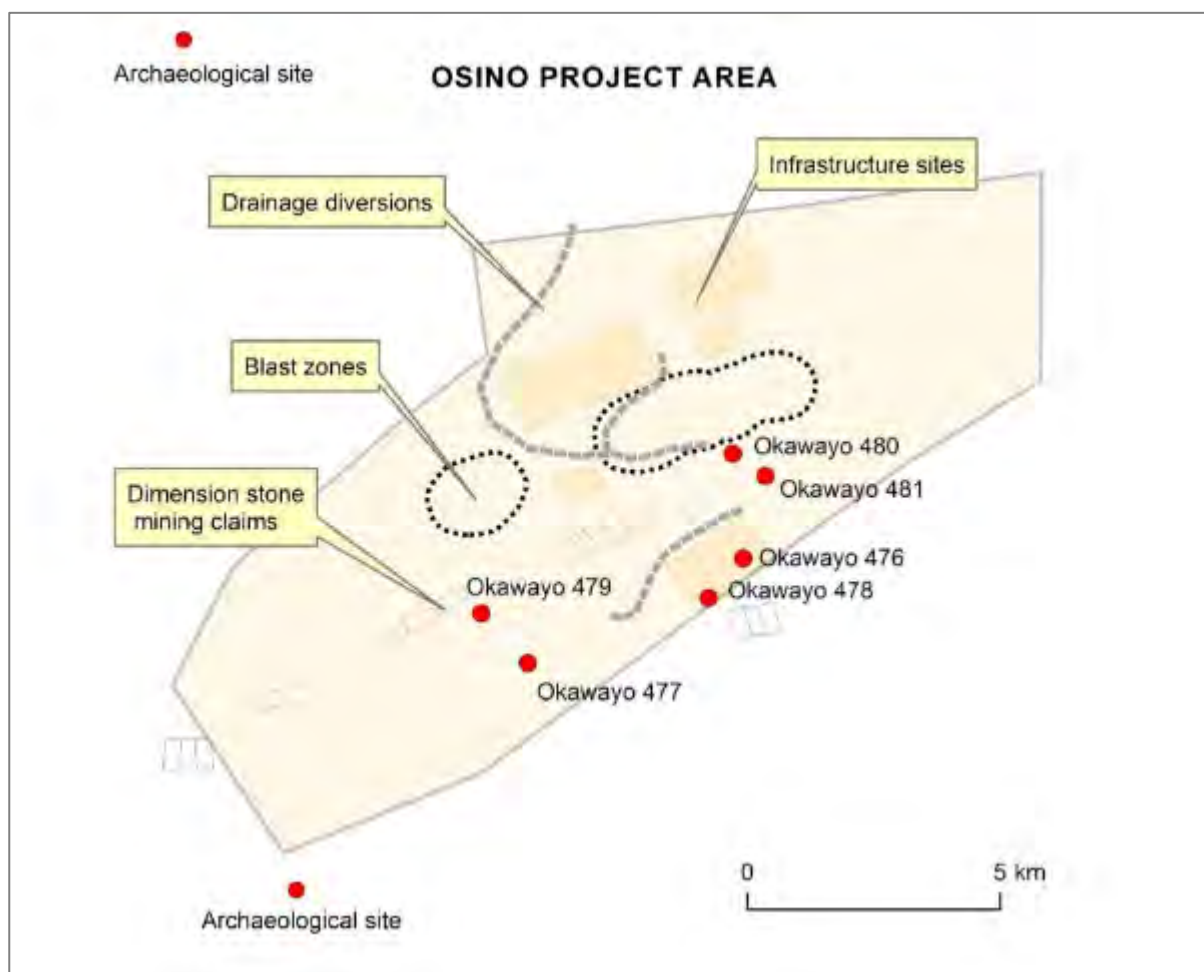


Figure 38 - A map showing the location of archaeological sites (Kinahan, 2021).



Figure 39 - A photo of the 19th Century German buildings on the Okawayo farm (Kinahan, 2021).

Archaeology has been studied in the areas surrounding the Erongo mountains, 20 km to the northwest of the site, but no previous work has been completed at Okawayo itself. The field survey by Kinahan (2021) discovered several precolonial sites resembling historical Ovaherero settlements on the southern side of the marble ridge, outside of the proposed Project area, but in proximity to the current dimension stone quarrying activities.

The 2021 baseline archaeological report (Kinahan, 2021) indicates that the Project area is considered moderately archaeologically sensitive. The assessment determined that a blast vibration assessment would be required, in order to determine the effects of mining activities on these buildings Figure 39). This is presented in the assessment chapter (chapter 7).

The field work conducted by Nankela (2022 a) was done in a collaboration between the National Heritage council, ECC, the Proponent and family members related to the grave sites. This was to ensure proper assessment of the grave sites and to locate, identify and engage on appropriate cultural procedures for the exhumation, relocation and reburial of the grave sites, since they will be impacted on by mining operations.

A total of four graves were determined (Figure 40), two representing adult individuals (with one grave site bearing a marked headstone with legible inscriptions) and two representing children (an infant and a toddler), as confirmed by the family members (Figure 41). A potential grave was also observed to the immediate west of the family grave site (Figure 42).



Figure 40 - A Google Earth Map showing the location of the grave site on farm Okawayo (Source: (Nankela, 2022).



Figure 41 - Images of the respective graves on farm Okawayo (Source: (Nankela, 2022).



Figure 42 - Image of the first potential grave observed to the west of the family Auxub graves (Source: (Nankela, 2022)).

The National Heritage Council provides oversight for the consent and practical mitigation measures since the graves will be impacted by mining operations. The graves are planned to undergo exhumation, relocation and reburial in line with the requirements and approvals of Burial Places Ordinance. No. 27 of 1966 (Nankela, 2022). Approvals have been granted by the President's office and Ministry of Urban and Rural Development for the relocation of these four graves to the designated cemetery within the jurisdiction of the Karibib Local Authority (Appendix G). This will be actioned before operational activities commence in the areas of the grave sites. This additional impact has been assessed in chapter 7 and mitigation measures included in the ESMP (Appendix A).

A second field survey was conducted in November 2022 and report compiled by Nankela (2022 b) to supplement the Twin Hills baseline archaeological assessment (Kinahan, 2021). This was as a result of recommendations made in the (Nankela, 2022) report, that a comprehensive field survey should be conducted along the Okawayo River tributary (within river course and banks) and dolomite marble ridges to ensure that any new or suspected graves, burial grounds or other heritage remains are recorded, assessed and/or rescued before operational activities commence. Additionally, the Auxub graves were revisited to obtain contextual information on the area. No additional obvious graves or heritage artefact were observed. However, a potential grave was observed 15 - 20 m from the Auxub grave site and surveyed, with only a calcite bolder observed

as anthropogenically placed as a grave marker (Figure 43). This is the second potential grave within the burial area observed. The findings of the GPRS survey in terms of this potential grave site is discussed below (Section 5.8.1).



Figure 43 - Images of the second potential grave, located 15 – 20 m from Auxub family graves (Source: (Nankela, 2022)).

The field survey also observed four potential suspected burials on the west bank of the Okawayo River (Figure 44). These graves are in addition to the suspected grave observed by Kinahan (2021) (Figure 45). GPS coordinates of all suspected or potential grave sites can be viewed in the specialist reports in Appendix G.



Figure 44 - Images of the suspected graves on the west bank of the Okawayo River tributary (Source: (Nankela, 2022)).



Figure 45 - Images of the suspected grave cairn Okawayo 478 (Source: (Kinahan, 2021).

5.8.1 GPRS

(Nankela, 2022) further recommended that all potential or suspected graves be surveyed and scanned through a ground penetrating radar scan to determine if these sites are in fact graves. This method is preferred as it is non-invasive and provides high spatial resolution data, through by using high frequency radio waves (200 – 300 mega Hertz (MHz)). A Pulse EKKO PRO GPR system with a shielded 250 MHz antenna was used to survey three profiles at the known and suspected grave sites. In August 2023 Dr Klaus Knupp (Earthmaps Consulting CC) conducting a GPR survey of the known and potential/suspected grave sites and findings updated in the baseline archaeological report (see Kinahan, 2023). A summary of the results is further discussed below:

- Of the four known demarcated graves, it was obvious that two graves have either coffins or remains therein by identifiable GPR signatures (indicated as grave 1 and 2). Graves 3 and 4 have no clear signatures and this could potentially be due to the fact that no coffins were used during the burial or the length of the graves, representing children.
- The potential grave located to the west of the Auxub burial ground (~5 m), covered by a partially fallen bush, shows no indication of a buried void. However, even though no evidence of a coffin signature is present, based on the following evidence, it is concluded that this is in fact a grave:
 - The truncated soil profile on the on side of the site, below the framing stone line;
 - The mound measuring 1.8 m x 0.9 m, which is clearly evident; and

- The surrounding, framing stone line, including an upright “headstone”, all in the same orientation and alignment as the Auxub family graves.
- The potential grave sites located 15 – 20 m from the Auxub family grave and potential grave sites in and around the Okawayo River tributary are confirmed to not be graves.
- Site Okawayo 478 had three potential mounds, mounds 1 and 2 show evidence to indicate a burial site and that these mounds are in fact graves. Mound 3 results were inconclusive, no obvious ground disturbance was detected and therefore it cannot be confirmed if this is a grave or not.

Figure 46 provides an overview of the graves surveyed, conditions and allocated numbers.



Figure 46 - Southwest view of the Auxub family grave site utilising GPR survey (Source: Knupp in (Kinahan, 2021)).

Figure 47 provides an overview of the GPR survey conducted on site Okawayo 478 at the potential grave cairns, indicating mounds surveyed and equipment in use.



Figure 47 - Site Okawayo site 478 view to the east, indicating mounds, utilising GPR survey (Source: Knupp in (Kinahan, 2021)).

Additionally, with the proposed operational layout changes, Dr Nankela was approached to confirm if a reassessment is required for the Twin Hills Project for this ESIA amendment. It was confirmed that all potential or suspected graves identified and mapped remain within the mining licence area and therefore there is no need for further mitigation or assessment, apart from the recommended mitigation measures discussed as per (Kinahan, 2021) and (Nankela, 2022) for implementation (personal comms. Dr Alma Nankela, 14 July 2023).

5.9 NOISE

Noise is generally defined as unwanted sound transmitted through a compressible medium such as air. Sound, in turn, is defined as any pressure variation that the ear can detect. Human response to noise is complex and highly variable, as it is subjective rather than objective. The IFC General Environmental Health and Safety Guidelines on noise addresses the impacts of noise beyond the property boundary of the facility under consideration and provides noise level guidelines. The IFC states that noise impacts should not exceed levels or result in a maximum increase above background levels of 3 dBA at the nearest receptor location off-site (IFC, 2007). For a person with average hearing acuity, an increase of less than 3 dBA in the general ambient noise level is not detectable. 3 dBA is, therefore, a useful significance indicator for a noise impact.

A noise baseline survey was conducted on 07 and 08 April 2021, at designated points as shown in Figure 28 for the Twin Hills Gold Project site. Airshed Planning Professionals (Pty) Ltd., a firm that specialises in all aspects of air quality, ranging from neighbourhood concerns to regional air pollution impacts, was appointed to conduct the modelling and assessment process. Due to

design and operational changes as part of the definite feasibility study (DFS) conducted for the Project, the 2021 assessment was re-assessed in 2023 (Airshed, 2023) through a desktop study approach and is discussed further in the sections below. Both reports are provided in Appendix C. During the 2021 assessment (AirShed, 2021), Airshed identified sites to be monitored for day and night-time noise level measurements, for the noise baseline report. Survey sites were selected after careful consideration of future activities, accessibility, potential noise sensitive receptors, and safety restrictions. A total of seven survey sites were selected.

These sites were chosen based on the sensitivity of the areas in terms of proximity to properties within the Project site. Noise sensitive receptors (NSRs) generally include private residences, community buildings such as schools and hospitals, and any publicly accessible areas. The 2023 assessment has additionally taken the Karibib airforce base into account. The ability of the environment to attenuate noise as it travels through the air was studied by considering land use and terrain. The same map shows the sensitive receptors near and at the proposed Project site (Figure 48).

The baseline acoustic environment was described in terms of the location of NSRs, that is, the ability of the environment to attenuate noise over long distances, as well as existing background and baseline noise levels.

For the assessment (Airshed, 2023), noise emissions from mobile and non-mobile equipment were estimated using LW predictions for industrial machinery (Bruce & Moritz, 1998), where LW estimates are a function of the power rating of the equipment engine. Numerous noise source LW's for operations were obtained from a database for similar operations. Values from the database are based on source measurements carried out in accordance with the procedures specified in SANS 10103. The source inventory, local meteorological conditions and information on local land use were used to populate the noise propagation model (CadnaA, ISO 9613). The outcomes of the noise assessment are reported on in the assessment chapter (chapter 7) and mitigation measures included in the operational ESMP (Appendix A).

The noise sources of the proposed Project are typical of opencast mining and ore processing facilities. Sources of noise at the Project site will include the following:

- Drilling;
- Blasting – although not assessed as part of this study, the character of noise generated by blasting is mentioned. Blasting can cause noise and vibration, which can have an impact upon neighbouring noise receptors. Blasting usually results in both ground and airborne vibration;
- Ore and waste handling (loading, unloading, dozing) in open pits, on waste dumps, and in crusher/plant areas;
- Crushing and screening of ore;
- Haul truck traffic;
- Diesel mobile equipment use (including reverse warnings); and

- Ore processing activities such as crushing, screening and milling.

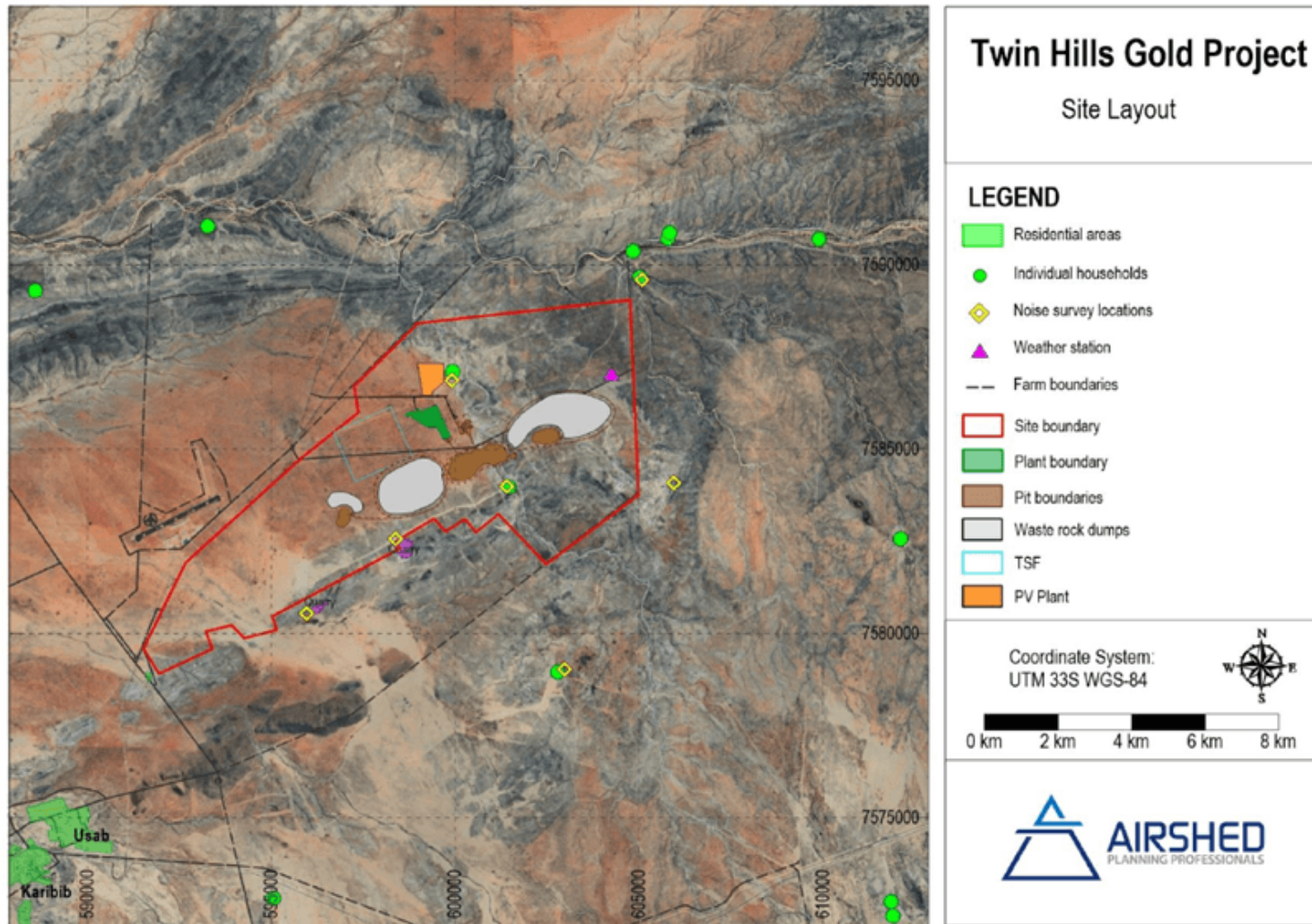


Figure 48 - Baseline noise survey and sensitive receptors, with updated site infrastructure layout map (Airshed, 2023).

5.9.1 ATMOSPHERIC ABSORPTION AND METEROLOGY

Meteorological data from an on-site station, for the period 23 July 2020 to 22 July 2021, was used for the 2021 baseline study, which was amended for the 2023 assessment with the data for a span of two years, from 01 January 2021 to 31 December 2023. The measured data set indicates wind flow primarily from the southwest. At night, the predominant wind direction shifts to the southeast. On average, noise impacts are expected to be more notable to the northwest and northeast of the Project activities.

Aircraft noise factors must also be considered during development to ensure that activities do not interfere with the Karibib air force base aerodrome aircraft operations. However, based on the dominant wind direction experienced (southwest and southeast), construction and operational activities are not expected to interfere with the safe operations of the aerodrome.

Temperature gradients in the atmosphere create effects that are uniform in all directions from a source. On a sunny day with no wind, temperature decreases with altitude and creates a 'shadowing' effect for sounds. On a clear night, temperatures may increase with altitude, thereby 'focusing' sound on the ground surface. Noise impacts are therefore generally more notable during the night.

5.9.2 TERRAIN, GROUND ABSORPTION AND REFLECTION

Noise reduction caused by a barrier (i.e. natural terrain, installed acoustic barriers, buildings) feature depends on two factors, namely: the path difference of a sound wave as it travels over the barrier compared with direct transmission to the receiver, and the frequency content of the noise (Bruël & Kjær, 2011). Readily available terrain data was obtained from the United States Geological Survey (USGS) website (<https://earthexplorer.usgs.gov/>) accessed in July 2021. A study was made of Shuttle Radar Topography Mission (STRM) 1 arc-sec data.

Sound reflected by the ground interferes with the directly propagated sound. The effect of the ground is different for acoustically hard (e.g. concrete or water), soft (e.g. grass, trees or vegetation), and mixed surfaces. Ground attenuation is often calculated in frequency bands, to take into account the frequency content of the noise source and the type of ground between the source and the receiver (AirShed, 2021) . Based on observations, ground cover was found to be acoustically hard.

The main findings from the 2021 baseline study were as follows:

- The flow field is dominated by winds from the southwest (daytime) and southeast (night-time);
- Sensitive receptors in the study area consist of industrial sites, individual households, and residential areas (i.e. Usab and Karibib); and

- The baseline noise levels (LAeq) for the area surrounding the Project range between 28.6 dBA to 54.8 dBA for daytime, and 29.4 dBA to 50.2 dBA for night-time, as shown in Figure 49 and Figure 50.

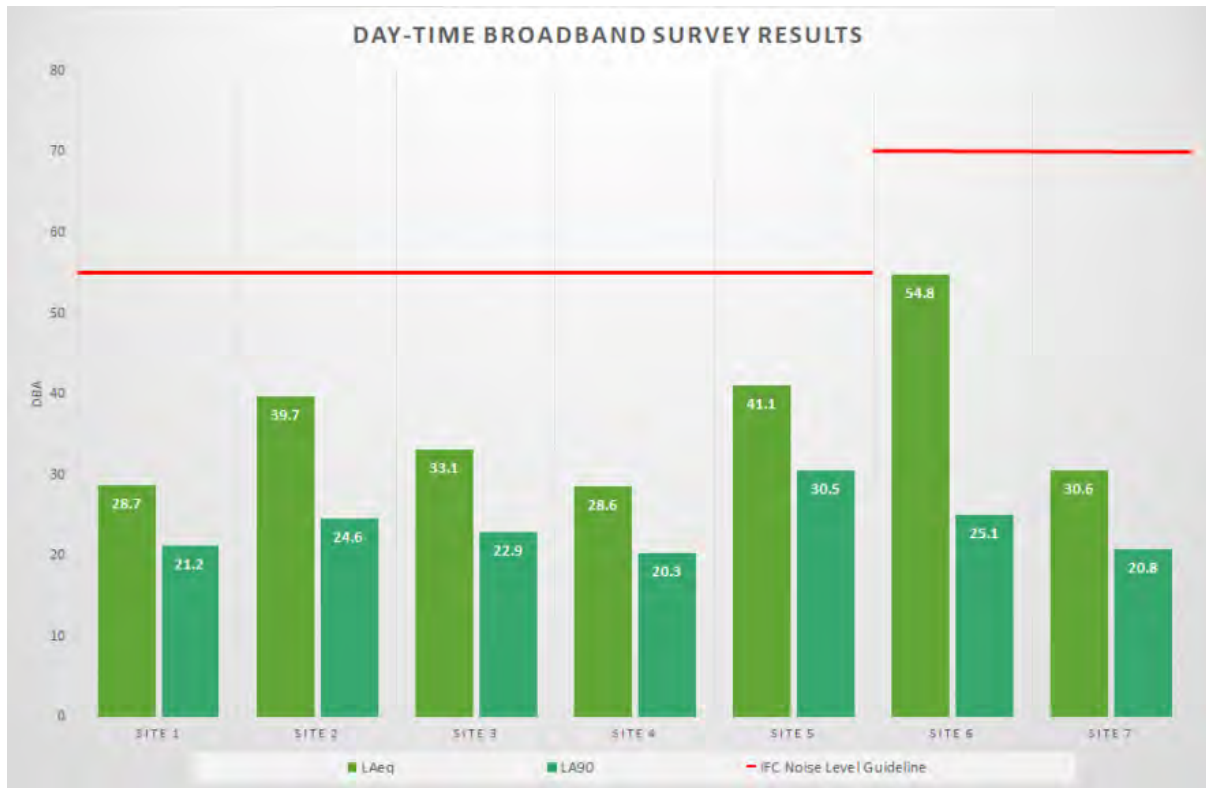


Figure 49 - A graph showing daytime broadband survey results (AirShed, 2021).

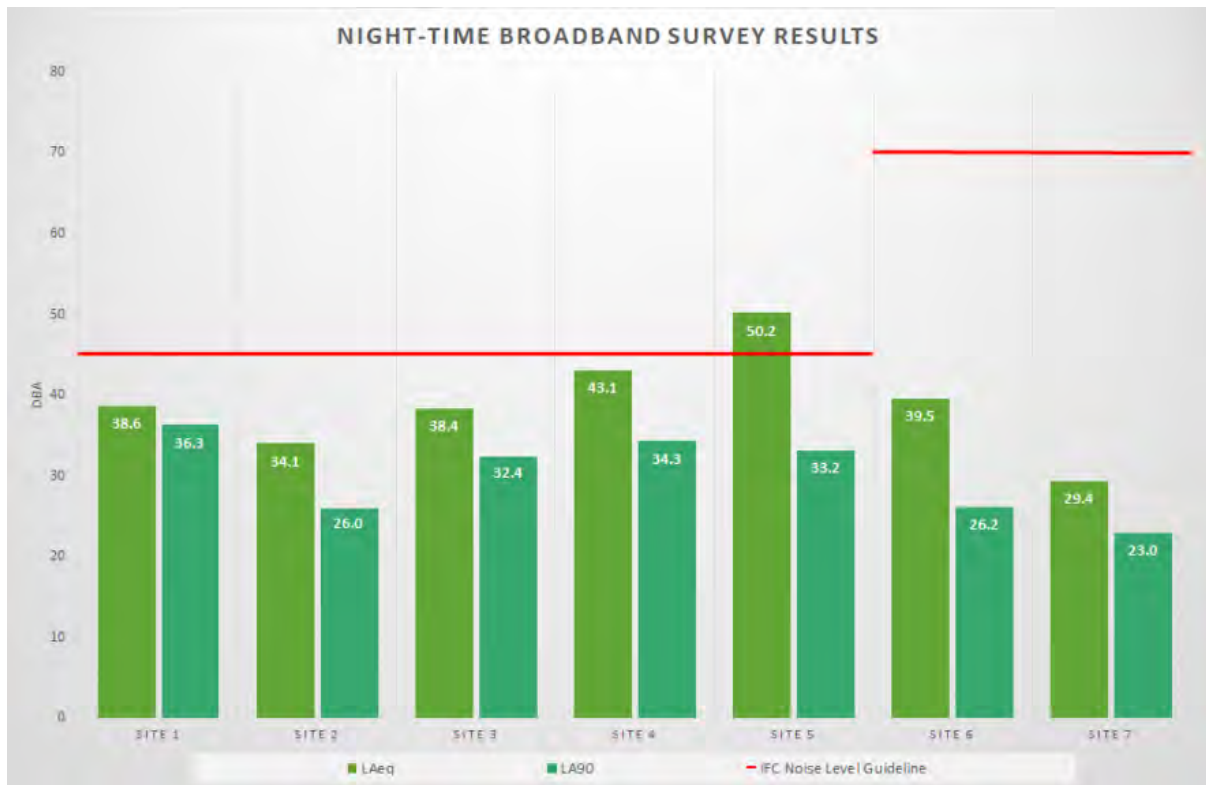


Figure 50 - A graph showing night-time broadband survey result (AirShed, 2021)

The aim of this investigation was to provide the basis for the environmental noise impact assessment plan to be conducted for the proposed Project. The following has been included in the environmental noise impact assessment study (AirShed, 2021):

- Compilation of Project source term;
- Attenuation modelling of all potential noise sources due to Project operations;
- Evaluation of potential noise impacts on human receptors due to Project activities; and
- Recommendation of mitigation and management measures

5.10 GROUND VIBRATION, AIR BLAST AND FLY ROCK

Blast Management and Consulting (BMC) conducted a baseline assessment in 2021 of the site layouts for the Twin Hills Project to assess the potential ground vibration, air blast and fly rock impacts from the proposed blasting activities on the surrounding receptors and infrastructure. This assessment has been updated in 2023 based on the finalised DFS pit and site infrastructure layouts, and mining drill and blast methodology. Fumes as a results of blasting activities have also been addressed. Proposed blasting operations were assessed over an area of 3500 m from the mining area considered, which in each scenario is from the edge of each pit, specified distances and/or the minimum and maximum charge outputs, following the conservative approach. The range of structures observed includes roads (tar and gravel), low-cost houses, corrugated iron structures, industrial buildings, brick and mortar houses, power lines/pylons.

Blasting operations are required to break rock for excavation to access targeted ore material. Explosives in blast holes provide the required energy to conduct this work. Ground vibration, air blast and fly rock are a result of the blasting process. Based on the regulations of the different acts consulted and international accepted standards, these effects are required to be within certain limits. As indicated, there are no specific South African ground vibration and air blast limit standard (BMC, 2023).

In the context of the evaluation of the Twin Hills Project, the specialists report focused on the drilling and blasting of overburden material to determine possible impacts from mining blasting operations. Ore blasts requires significantly less explosives per unit than the overburden. The overburden blasts are then considered as a worst-case scenario and is used as indicator of possible influence (BMC, 2023).

The evaluation of ground vibration, air blasts, fly rock per pit design (and resultant noxious fumes) and impact assessment outcomes are further discussed in chapter 7 of this report and recommended mitigation measures have been included in the ESMP (Appendix A).

5.10.1 PROJECT SENSITIVITY

A sensitivities map was created by BMC (Figure 51), based on distances normally associated with potential impacts or where an impacts is expected to be very low or none, in relation to identified points of interest (POI) from each pit. The different areas were identified and are discussed further below:

- A highly sensitive area of 500 m around the mining area. This is the typical area to be cleared of all blasting activities before a blast can proceed. Levels of ground vibration and air blast are expected to be higher closer to the pit area.
- A medium sensitive area of 500 m to 1500 m. The possibility of an impact is expected but to a lesser extent. The expected level of influence may be low but there is still a potential for concern, due to structural damage or complaints from the public/people.
- A low sensitive area greater than 1500 m. It is almost certain that impacts will be low, with low possibility of damages and limited complaints from the public/people.

A list was prepared of all the structures identified to be potential POI's in the 3500 m radius and classified per type according to BMC classification systems. See Table 13 and Table 14 below for the POI classification used and list of POI's linked to their respective classification.

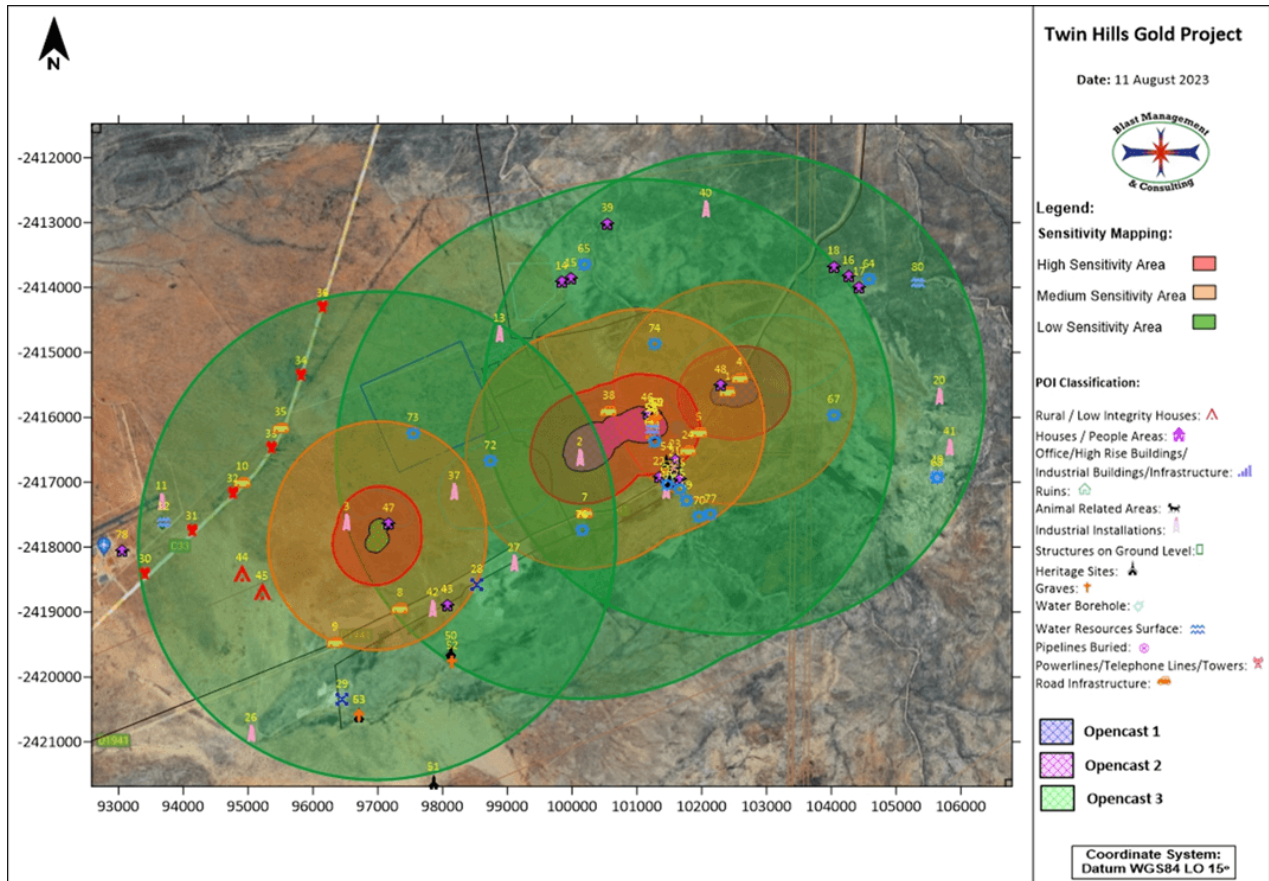


Figure 51 - Identified sensitive areas and points of interest, in relation to each pit (BMC, 2023).

Table 13 - Classification used for points of interest (BMC, 2023)

Class	Description
1	Rural building and structures of poor construction
2	Private houses and people sensitive areas
3	Office, high-rise buildings and industrial buildings / infrastructure
4	Ruins
5	Animal related installations and animal sensitive areas
6	Industrial installations
7	Earth like structures – no surface structure
8	Heritage sites (buildings, infrastructure, activity)
9	Graves
10	Water borehole
11	Water resources surface

Class	Description
12	Pipelines buried
13	Powerlines / telephone lines / towers
14	Road infrastructure
15	Infrastructure inside pit

Table 14 - List of points of interested identified in WGS84 - LO 15° (BMC, 2023)

Tag	Description	Classification	Y	X
1	Road (D1941) - inside pit 1 area	14	-102404.42	2415611.95
2	Cement dam - inside pit 2 area	6	-100118.70	2416619.50
3	Cement dam	6	-96523.84	2417617.63
4	Road (D1941)	14	-102583.08	2415393.85
5	Road (D1941)	14	-101960.09	2416234.07
6	Road (D1941)	14	-101550.22	2416898.78
7	Road (D1941)	14	-100195.83	2417481.64
8	Road (D1941)	14	-97345.46	2418947.35
9	Road (D1941)	14	-96342.90	2419468.57
10	Road (C33)	14	-94911.53	2417001.53
11	Landing strip	6	-93666.02	2417297.78
12	Water reservoir	11	-93700.32	2417616.39
13	Cement dam	6	-98879.36	2414717.94
14	Buildings/structures	2	-99837.52	2413910.82
15	Farmstead	2	-99983.74	2413864.91
16	Farmstead	2	-104263.34	2413823.69
17	Buildings/structures	2	-104429.44	2413995.66
18	Structure	2	-104037.45	2413678.32
19	Dam/dam wall	11	-105638.70	2416896.62
20	Cement dam	6	-105665.09	2415675.12

Tag	Description	Classification	Y	X
21	Buildings/structures	2	-101581.01	2416782.55
22	Buildings/structures	2	-101345.61	2416922.10
23	Buildings/structures	2	-101590.11	2416653.33
24	Road (D1941)	14	-101786.98	2416519.52
25	Buildings/structures	2	-101660.72	2416946.97
26	Cement dam	6	-95047.21	2420869.54
27	Mine activity	6	-99101.76	2418253.72
28	Mine buildings/structures	3	-98530.87	2418583.56
29	Mine buildings/structures	3	-96453.68	2420352.51
30	Power lines/pylons	13	-93411.81	2418396.61
31	Power lines/pylons	13	-94131.72	2417738.99
32	Power lines/pylons	13	-94763.58	2417162.32
33	Power lines/pylons	13	-95359.79	2416470.71
34	Power lines/pylons	13	-95820.03	2415345.98
35	Road (C33)	14	-95503.62	2416158.34
36	Power lines/pylons	13	-96151.41	2414298.93
37	Cement dam	6	-98181.29	2417144.84
38	Gravel road	14	-100567.93	2415907.12
39	Structure	2	-100544.73	2413016.47
40	Cement dam	6	-102062.78	2412787.23
41	Cement dam	6	-105830.75	2416463.10
42	Cement dam	6	-97851.34	2418941.38
43	Structure	2	-98073.91	2418892.69
44	Rural village/house	1	-94911.83	2418404.07
45	Rural village/houses	1	-95216.81	2418688.66
46	Structures - inside pit 2 area	2	-101164.98	2415942.56

Tag	Description	Classification	Y	X
47	Structure	2	-97173.42	2417642.20
48	Structures - inside pit 1 area	2	-102294.63	2415509.11
49	Cement dam	6	-101446.92	2417134.17
50	Heritage site (anchor stones - Okawayo 476)	8	-98131.11	2419608.88
51	Heritage site (quartzite schist outcrop - Okawayo 477)	8	-97861.27	2421629.40
52	Heritage site (graves - Okawayo 478)	9	-98153.96	2419759.63
53	Heritage site (marble quern stone - Okawayo 479)	8	-96717.21	2420593.58
54	Heritage site (farm building - Okawayo 480)	8	-101460.69	2416693.94
55	Heritage site (historical farmstead - Okawayo 481)	8	-101497.11	2416981.00
56	Heritage site (graves) - inside pit 2 area	9	-101229.44	2416098.01
57	Heritage site (potential burial ground) - inside pit 2 area	9	-101215.31	2416097.31
58	Heritage site (potential burial ground) - inside pit 2 area	9	-101218.22	2416100.46
59	Heritage site (potential burial ground) - inside pit 2 area	9	-101319.56	2416017.13
60	Heritage site (potential burial ground) - inside pit 2 area	9	-101215.08	2416323.04
61	Heritage site (potential burial ground) - inside pit 2 area	9	-101276.52	2416010.02
62	Heritage site (potential burial ground) - inside pit 2 area	9	-101320.74	2416021.01
63	Heritage site (potential burial ground) - inside pit 2 area	9	-96717.09	2420593.82
64	Hydrocensus borehole (Klein Oka 1)	10	-104581.83	2413881.56

Tag	Description	Classification	Y	X
65	Hydrocensus borehole (Klein Oka 2)	10	-100189.09	2413643.47
66	Hydrocensus borehole (Oka 7)	10	-101466.60	2417040.83
67	Hydrocensus borehole (Oka12)	10	-104040.62	2415967.40
68	Hydrocensus borehole (Twin 6)	10	-105630.25	2416941.79
69	Hydrocensus borehole (BH3)	10	-101764.72	2417292.93
70	Hydrocensus borehole (OKP040)	10	-101965.80	2417530.02
71	Hydrocensus borehole (OKP045)	10	-101278.52	2416370.56
72	Hydrocensus borehole (OKP008)	10	-98740.51	2416677.68
73	Hydrocensus borehole (OKP015)	10	-97546.03	2416246.51
74	Hydrocensus borehole (OKP004)	10	-101275.52	2414873.96
75	Hydrocensus borehole (deep injection well)	10	-101654.67	2417108.85
76	Hydrocensus borehole (OKP013)	10	-100152.07	2417742.11
77	Hydrocensus borehole (OKP056)	10	-102137.87	2417503.01
78	Buildings (airport)	2	-93057.94	2418053.66
79	Okawayo river - inside pit 2 area	11	-101246.66	2416181.23
80	River	11	-105334.38	2413931.12

5.10.2 BLASTING OPERATIONS

Planned blast design technical information was provided and used for defining expected outcomes by utilising a software referred to as JKSimblast to simulate the blast. Table 15 below provides an overview of the technical blasting information for the Twin Hills Project.

Evaluation of the blasting operations considered a minimum charge and a maximum charge. The minimum charge was derived from the 102 mm diameter single blast hole and the maximum charge was based on typical 4 blastholes detonating using shock tube initiation. The minimum charge relates to 90 kg and the maximum charge relates to 361 kg. These values were applied in all predictions for ground vibration and air blast (BMC, 2023)

Table 15 - List of points of interested identified in WGS84 – LO 15° (Source: (BMC, 2023)

Parameters	Units	Ore Blasts	Waste Blasts
Hole diameter	mm	102	102
Bench height	m	10	10
Explosive Type		Emulsion	Blend
Angle of the hole (90° is vertical)	°	90	90
Burden	m	2.9	2.9
Spacing	m	3.2	3.2
Stemming length	m	1.9	2
Sub-drill	m	0.7	0.7
Length of hole	m	10.7	10.7
Actual powder factor	kg/m ³	1	0.9
Mass of Explosive per hole	kg	90.82	83.23
Cubic metres blasted per hole	m ³	90.09	91.3
Mean fragmentation	cm	20	19

5.10.2.1 Ground vibration calculations

In order to predict ground vibration and possible decay, the specialist utilised a standard accepted mathematical process of scaled distance. The equation applied utilises charge mass and distance with two site constants. These site constants are specific to a site where blasting is to be done. In absence of measured values an acceptable standard set of constants is applied. Allowable levels for specific limits and expected ground vibration levels can then be calculated for various distances (BMC, 2023).

Equation utilised:

$$PPV = a \left(\frac{D}{\sqrt{E}} \right)^{-b}$$

PPV = Predicted ground vibration (mm/s)

a = Site constant

b = Site constant

D = Distance (m)

E = Explosive mass (kg)

Factors: a = 1143; b = -1.65 (applicable and accepted factors a and b for new operations)

As a result of the varying types of structures located within the potential influence zones, it is proposed that different limiting levels of ground vibration will be required. The proposed limits to be considered are as follows: 6 mm/s, 12.5 mm/s levels and 25 mm/s. Based on the designs presented on expected drilling and charging design, the following Table 16 shows expected ground vibration levels (PPV) for various distances calculated at the two different charge masses. The charge masses are 90 kg and 361 kg for the pit areas (BMC, 2023)

Table 16 - Expected ground vibration at various distances from charges applied (Source: (BMC, 2023)).

No.	Distance (m)	Expected PPV (mm/s) for 90 kg charge	Expected PPV (mm/s) for 361 kg charge
1	50.0	73.6	231.6
2	100.0	37.7	118.6
3	150.0	12.0	37.8
4	200.0	7.5	23.5
5	250.0	5.2	16.3
6	300.0	3.8	12.0
7	400.0	2.4	7.5
8	500.0	1.6	5.2
9	600.0	1.2	3.8
10	700.0	0.9	3.0
11	800.0	0.8	2.4
12	900.0	0.6	2.0
13	1000.0	0.5	1.7
14	1250.0	0.4	1.1
15	1500.0	0.3	0.8
16	1750.0	0.2	0.7
17	2000.0	0.2	0.5
18	2500.0	0.1	0.4
19	3000.0	0.1	0.3
20	3500.0	0.1	0.2
21	4000.0	0.1	0.2
22	4500.0	0.0	0.1
23	5000.0	0.0	0.1
24	5500.0	0.0	0.1

5.10.2.2 air blast calculations

The prediction of air blast as a pre-operational effect is difficult to define as there are many variables that have influence on the outcome of air blast. Air blast is the direct result from the blast process, although influenced by meteorological conditions, wind strength and direction, the

final blast layout, timing, stemming, accessories used, covered or not covered etc., all these factors have an influence on the outcome of the result. Air blast is also an aspect that can be controlled to a great degree by applying basic rules. In most cases mainly an indication of typical levels can be obtained. A standard cube root scaling prediction formula is applied for air blast predictions to calculate possible air blast values in millibar. This equation does not take temperature or any weather conditions into account (BMC, 2023)

Equation utilised:

$$P = A \times \left(\frac{D}{1}\right)^{-B} E^3$$

P = Air blast level (mB)

D = Distance from source (m)

E = Maximum charge mass per delay (kg)

A = Constant - (14.3)

B = Constant - (-0.71)

The constants for A and B were selected according to the air overpressure prediction equations utilised by the USBM RI 8485 for a metal mine (see (BMC, 2023) report for further detail). Various types of mining operations are expected to yield different results.

The air pressure calculated is further converted to decibels in the below equation. The reporting of air blast in the decibel scale is more readily accepted in the mining industry.

Equation utilised:

$$p_s = 20 \times \log \frac{P}{P_o}$$

p_s = Air blast level (dB)

P = Air blast level (Pa (mB x 100))

P_o = Reference Pressure (2×10^{-5} Pa)

Although the above equation was applied for prediction of air blast levels, additional measures are also recommended to ensure that air blast and associated fly-rock possibilities are minimised as best possible. In the Table 17 below is a summary of values predicted according to air blast equation per maximum and minimum charge values. Initial limits for evaluating conditions have been set at 120 dB, 120 dB to 134 dB and greater than 134 dB. The USBM limits for nuisance are 134 dB. All attempts should be made to keep air blast levels from blasting operations well below 120 dB where the public is of concern (BMC, 2023)

Table 17 - Expected air blasts at various distances from charges applied (Source: (BMC, 2023).

No.	Distance (m)	Air blast (dB) for 90 kg charge	Air blast (dB) for 361 kg charge
1	50.0	142.2	145.0
2	100.0	139.7	142.5
3	150.0	135.4	138.2
4	200.0	133.6	136.5
5	250.0	132.2	135.1
6	300.0	131.1	134.0
7	400.0	129.3	132.2
8	500.0	128.0	130.8
9	600.0	126.8	129.7
10	700.0	125.9	128.8
11	800.0	125.1	127.9
12	900.0	124.4	127.2
13	1000.0	123.7	126.6
14	1250.0	122.3	125.2
15	1500.0	121.2	124.1
16	1750.0	120.2	123.1
17	2000.0	119.4	122.3
18	2500.0	118.1	120.9
19	3000.0	116.9	119.8
20	3500.0	116.0	118.8
21	4000.0	115.1	118.0
22	4500.0	114.4	117.3
23	5000.0	113.8	116.7
24	5500.0	113.2	116.1

5.10.3 FLY ROCK

Blasting practices require some movement of rock to facilitate the excavation process. The movement should be in the direction of the free face, and therefore the orientation of the blast is important. Material or elements travelling outside of this expected range is considered fly rock. The occurrence of fly rock in any form will have an impact if found to travel outside the safe boundary. This safe boundary is determined by the appointed blaster or as per mine code of practice (BMC, 2023).

- Fly rock from blasting can result under the following conditions (BMC, 2023):
- When burdens are too small, rock elements can be propelled out of the free face area of the blast;
- When burdens are too large and movement of blast material is restricted and stemming length is not correct, rock elements can be forced upwards creating a crater forming fly rock;

- If the stemming material is of poor quality or too little stemming material is applied, the stemming is ejected out of the blast hole, which can result in fly rock; and
- Stemming of correct type and length is required to ensure that explosive energy is efficiently used to its maximum and to control fly rock.

5.10.4 NOXIUS FUMES

Explosives used in the mining environment are required to be oxygen balanced. This refers to the stoichiometry of the chemical reaction and the nature of gases produced from the detonation of explosives. The creation of poisonous fumes, such as nitrous oxides and carbon monoxide, are a concern. It has been reported that 10 ppm to 20 ppm can be mildly irritating. Exposure to 150 ppm or more (no time period given) has been reported to cause death from pulmonary oedema. It has been predicted that 50% lethality would occur following exposure to 174 ppm for 1 hour. Anybody exposed must be taken to hospital for treatment (BMC, 2023).

Factors contributing to undesirable fumes are typically (BMC, 2023):

- Poor quality control on explosive manufacture;
- Damage to explosive, lack of confinement;
- Insufficient charge diameter;
- Excessive sleep time;
- Water in blast holes;
- Incorrect product used;
- Product not loaded properly; and
- Specific types of rock/geology can also contribute to fumes

5.10.5 GENERAL IMPACTS TO STRUCTURES/BUILDINGS FROM BLASTING ACTIVITIES

Houses in general have cracks, which is mainly influenced from construction related materials and workmanship, however, is also influenced from environmental factors such as temperature, wind, water etc. Ground vibration will be mostly responsible for cracks in structures if high enough and at continued high levels. Visual results of actual damage due to blasting operations are limited. There are cases where it has occurred, and a result is shown in Figure 52 below, a typical X crack formation is observed as a result (BMC, 2023).



Figure 52 - Example of a typical blast induced damage to a building marked with an X (Source: BMC, 2023).

The presence of general vertical cracks or horizontal cracks that are found in all structures does not need to indicate devaluation due to blasting operations but rather devaluation due to construction, building material, age, standards of building applied. Exact costing of devaluation for normal cracks observed is difficult to estimate and a property valuator will be required for this work. However typically the property value includes the entire property and not the structure alone. Therefore, mining operations may not have influence to change the status quo of any property (BMC, 2023). Monitoring of structures is however proposed and is included in the monitoring programme discussed in the ESMP (Appendix A).

5.11 VISUAL AND SENSE OF PLACE

The proposed Twin Hills Gold Project is situated in a sparsely populated area, with few farmsteads or other possible receptors. Apart from the hunting farm, Okawayo, no other tourist sites are known in the immediate vicinity of the Project. The sense of place of the Project area has already been disturbed by farming activities and the many quarries, as well as the presence of the nearby airfield.

The marble ridge running northeast southwest across the property may block the view of the mine from Karibib and the B2, but it will be visible from sections of the C33. The Project's mining landforms will be seen from sections along the C33 road and from the airfield. Project construction

and operational processes may lead to excessive dust, and the waste rock dump and tailings storage facility will alter the landscape in perpetuity. The visual assessment to be undertaken will include the viewsheds for several receptors. Figure 53 to Figure 57 render the expected viewsheds for waste rock dumps (~40 m height) and the 11 kV overhead power line route (~15 m height).

From the viewshed maps created for the waste rock dumps, the residents of Karibib, the road users on the C33, diverted D1941 road, marble quarry employees/contractors and the Karibib air force base will be able to see the central and western waste rock dump features. Only road users along the C33 and D1941 road will be able to see the eastern waste rock dump and 11 kV overhead powerline features. However, these features should not disturb the sense of place and might not even be perceived by individuals commuting or going about their daily activities. From the viewshed maps it appears that no private residents in and around the mining licence area will be able to see the waste rock dumps or 11 kV overhead powerline routes. The Proponent is the landowner of farms Okawayo and Klein Okawayo, and therefore no private residents will reside on these farms during construction and operational activities.

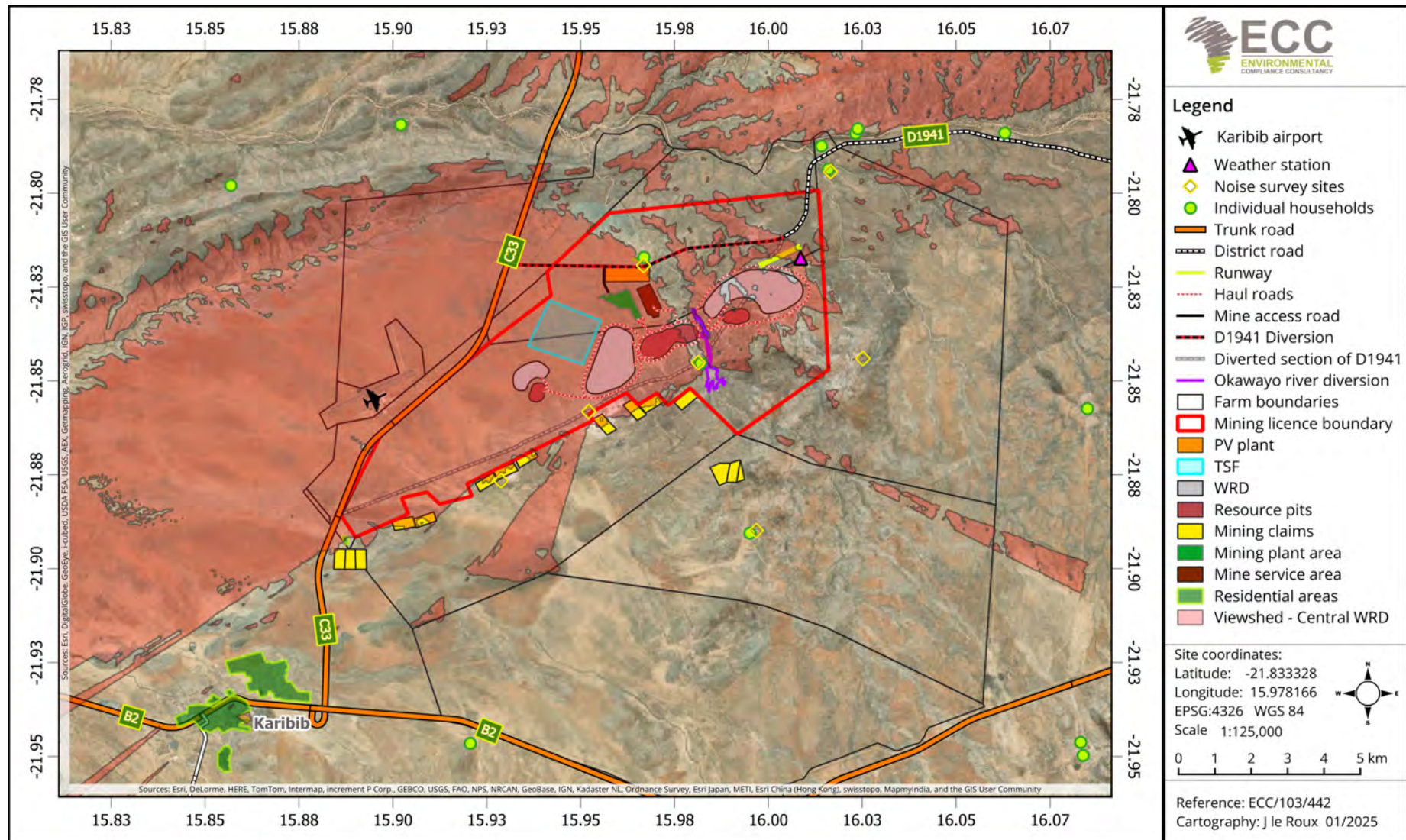


Figure 53 - Viewshed model from the central waste rock dump.

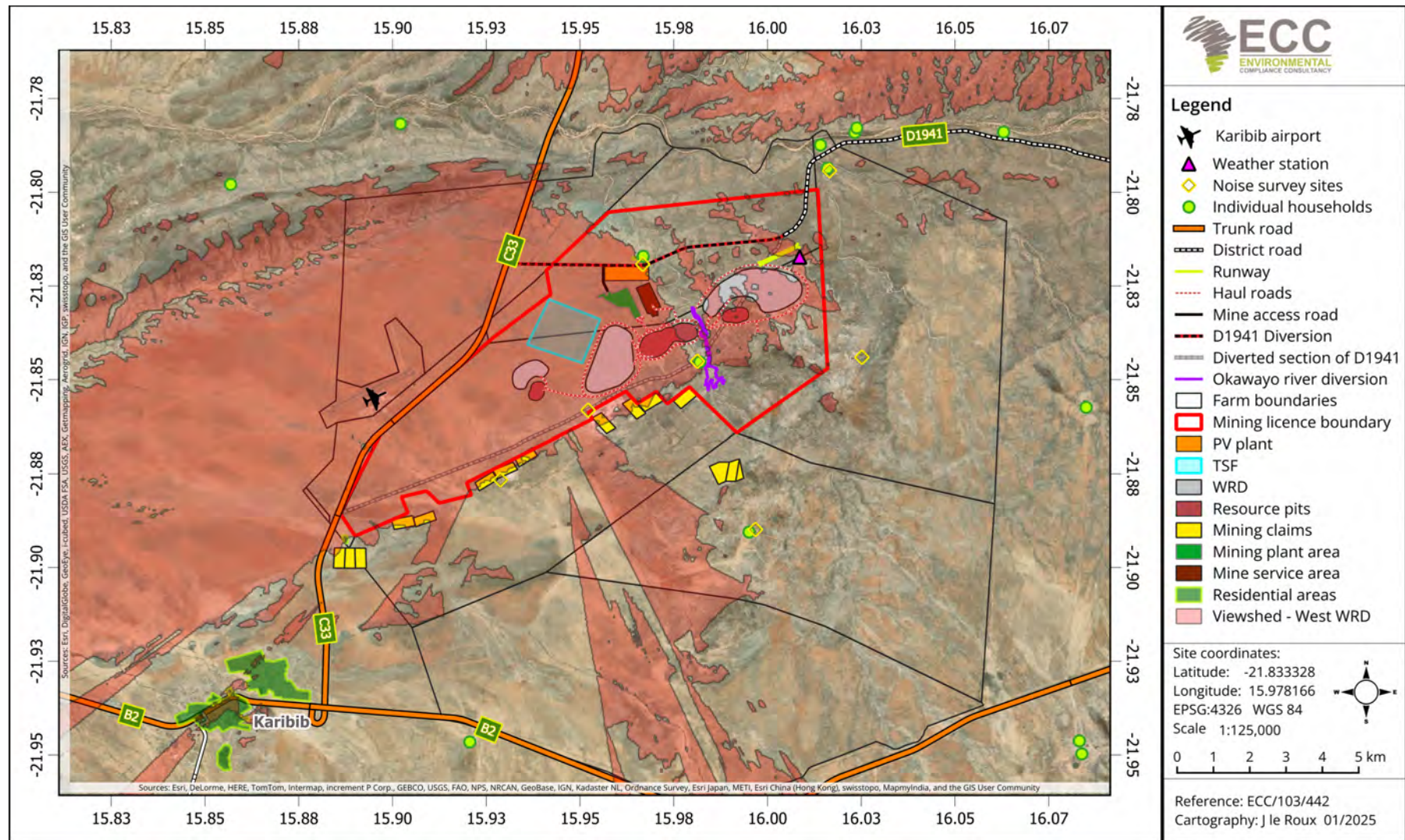


Figure 54 - Viewshed model from the western waste rock dump.

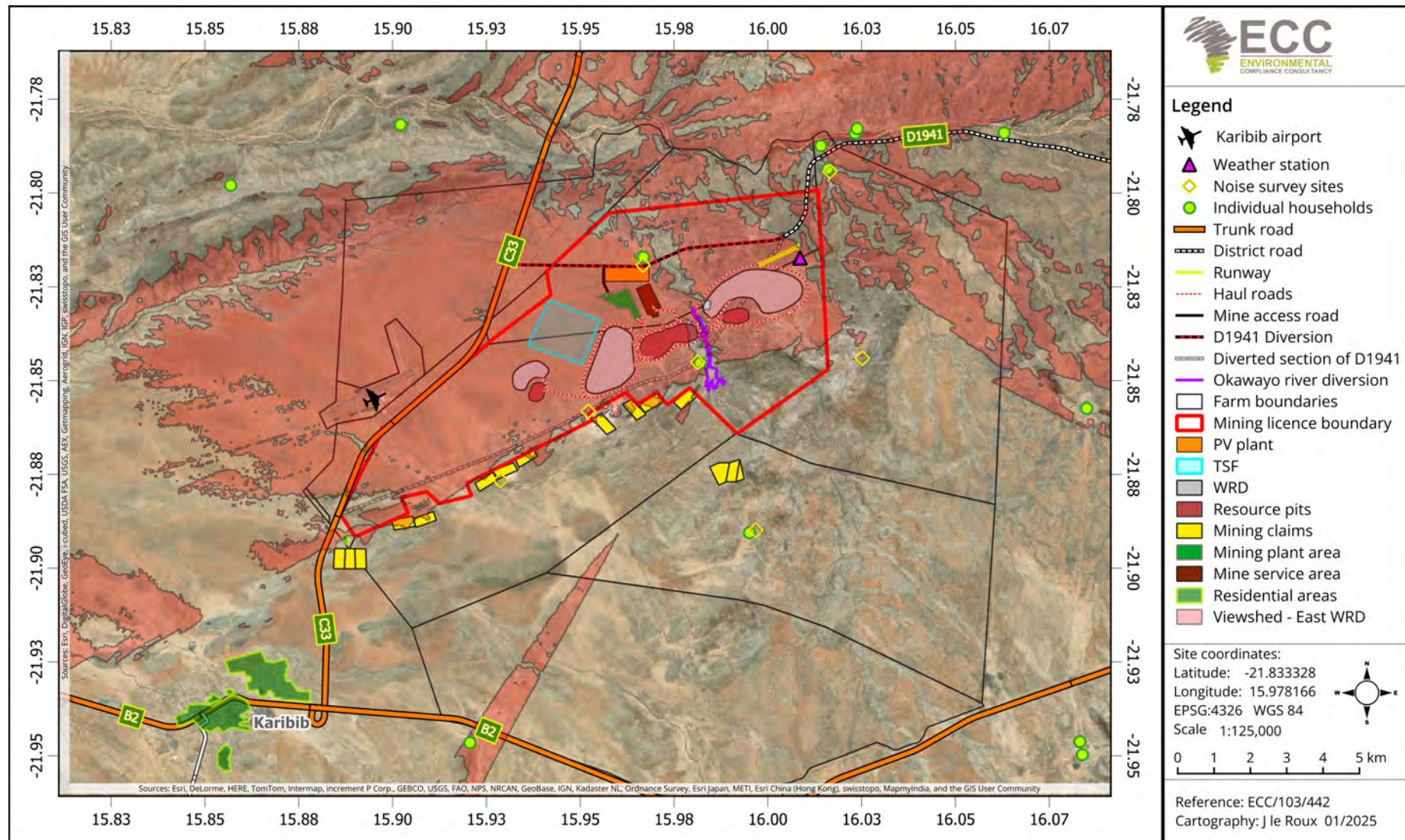


Figure 55 - Viewshed model from the eastern waste rock dump.

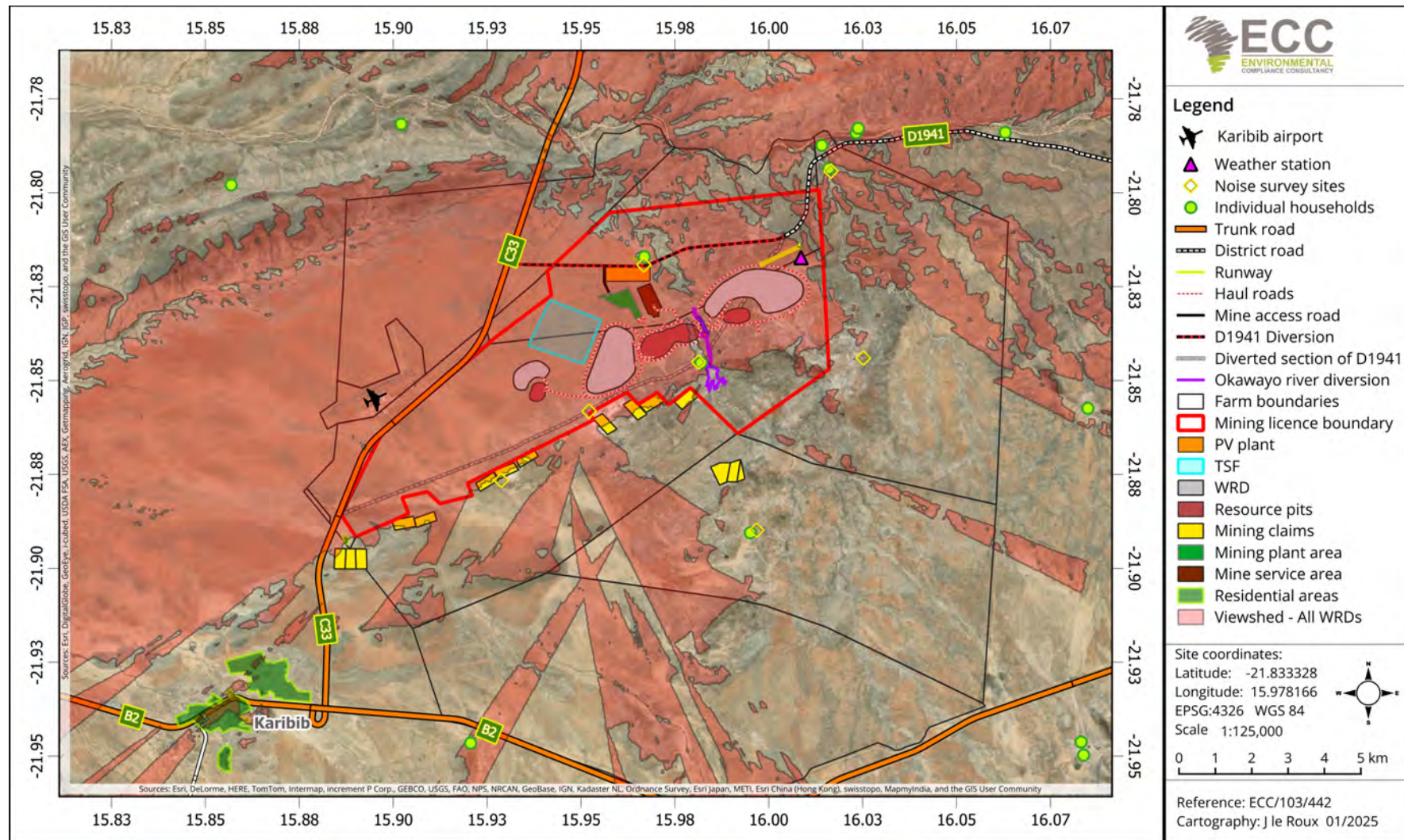


Figure 56 - Viewshed model from all waste rock dumps.

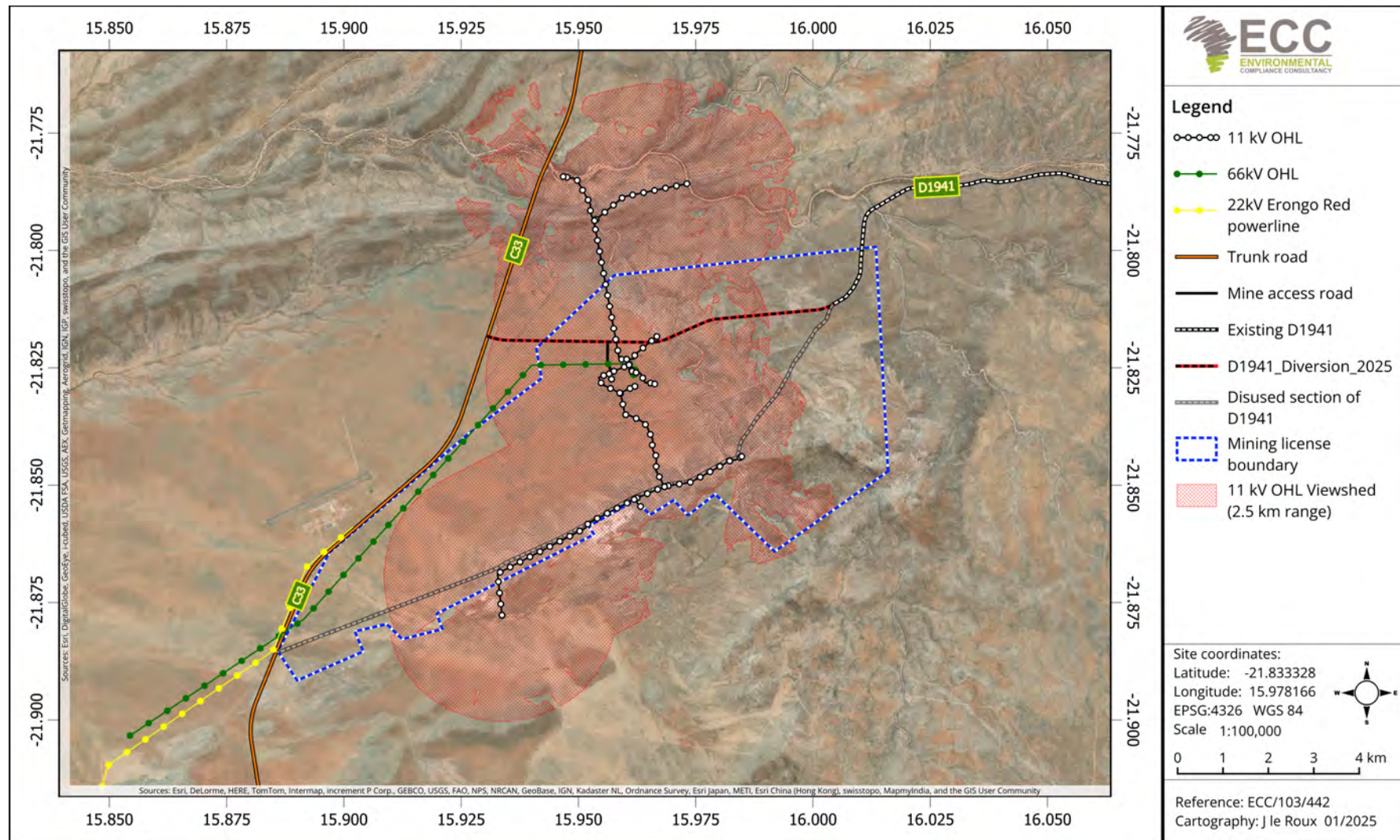


Figure 57 - Combined viewsheds from the 11 kV overhead powerline routes.

5.12 LIGHTING AND VISUAL MARKERS

The night sky in the area is undisturbed, apart from lights from the adjacent Karibib air force base, mining quarry activities and farmsteads on the adjacent farms. Namibia is known for its clear night skies and excellent stargazing settings. Artificial lighting, floodlights and lighting for night shift mining activities is expected to be visible from the Project site. The baseline of undisturbed night skies from lights will be altered during construction and operations of the Project.

The Karibib air base aerodrome is a 24-hour operation, that allows for night flying for military and commercial purposes. Lighting and potential obstacle obstructions from the Twin Hills construction and mining activities must adhere to the requirements of obstacles and lighting within 10 km of the Karibib air base, as per the specific technical requirements of the aerodrome and as per NAMCATS part 139. The marking and/or lighting of obstacles that could pose a hazard is intended to reduce hazards to aircrafts by indicating the obstacles presence. Lighting that could cause confusion must be altered or removed.

Lighting in the case of this Project makes reference to the requirements for the lighting of objects with a height less than 45 m above ground level and for visual markers on towers, antenna's, chimneys, structures above/crossing roads and water ways and/or overhead cables, as required. See Figure 58 below for the requirements of lighting as per part NAMCATS part 139.13.3.

General requirements for visual markers are that a marker displayed on an overhead wire, cable, etc. must be spherical and have a diameter of not less than 60 cm, spacing must be appropriate to the diameter of the marker used and the use of colour as per the specifications. Markers must be of one colour only, that must be in contrast to the natural environmental background. When installed, white and red or white and orange markers are to be displayed alternately. When it has been determined that an overhead wire, cable, etc. practically cannot have a marker installed, then a high intensity obstacle light, Type B, must be provided on the supporting tower structure. These lights are intended for use during the day and night. When these lights are used, they must be located at three levels: top of the tower, lowest level of the catenary of the wires or cables and midway between the two levels. These lights must flash sequentially, first the middle, then top light and last the bottom light. Intervals between flashes must adhere to the required ratios. Middle and top light (1/13), top and bottom light (2/13) and bottom and middle lights (10/13). These lights must be installed at the required angles (see Table 13.5 in Figure 58). If high or medium intensity light cause dazzling effects to the aircrafts or aerodrome operator, then a dual obstacle lighting may be preferred.

Impacts associated with lights are further assessed in chapter 7, and the management and mitigation measures are included in the ESMP (Appendix A).

Table 13. 1: Characteristics of obstacle lights

1	2	3	4	5	6	7
Light Type	Colour	Signal type/ (flash rate)	Peak intensity (cd) at given Background Luminance (b)			Light Distribution Table
			Day (Above 500 cd/m ²)	Twilight (50-500 cd/m ²)	Night (Below 50 cd/m ²)	
Low-intensity, Type A (fixed obstacle)	Red	Fixed	N/A	N/A	10	Table 13.2
Low-intensity, Type B (fixed obstacle)	Red	Fixed	N/A	N/A	32	Table 13.2
Low-intensity, Type C (mobile obstacle)	Yellow/Blue (a)	Flashing (60-90 fpm)	N/A	40	40	Table 13.2
Low-intensity, Type D (follow-me vehicle)	Yellow	Flashing (60-90 fpm)	N/A	200	200	Table 13.2
Low-intensity, Type E	Red	Flashing (c)	N/A	N/A	32	Table 13.2 (Type B)
Medium-intensity, Type A	White	Flashing (20–60 fpm)	200,00	20,000	2,000	Table 13.3
Medium-intensity, Type B	Red	Flashing (20–60 fpm)	N/A	N/A	2,000	Table 13.3
Medium-intensity, Type C	Red	Fixed	N/A	N/A	2,000	Table 13.3
High-intensity, Type A	White	Flashing (40–60 fpm)	200,000	200,00	2,000	Table 13.3
High-intensity, Type B	White	Flashing (40–60 fpm)	100,000	20,000	2,000	Table 13.3
a. See 2.6 b. For wind turbine application, to flash at the same rate as the lighting on the nacelle.						

Table 13. 2:Light distribution for low-intensity obstacle lights

	Minimum intensi ty (a)	Maximum intensity (a)	Vertical beam spread (f)	
			Minimum beam spread	Intensity
Type A	10 cd (b)	N/A	10°	5 cd
Type B	32 cd (b)	N/A	10°	16 cd
Type C	40 cd (b)	400 cd	12° (d)	20 cd
Type D	200 cd (c)	400 cd	N/A (e)	N/A

Table 13. 3:Light distribution for medium- and high-intensity obstacle lights according to benchmark intensities of Table 13.1

Benchmar k intensity	Minimum requirements					Recommendations				
	Vertical elevation angle (b)			Vertical beam spread (c)		Vertical elevation angle (b)			Vertical beam spread (c)	
	0°		-1°			0°	-1°	-10°		
	Minimum average intensity (a)	Minimum intensity (a)	Minimum intensity (a)	Minimum beam spread	Intensity (a)	Maximum intensity (a)	Maximum intensity (a)	Maximum intensity (a)	Maximum beam spread	Intensity (a)
200 000	200 000	150 000	75 000	3°	75 000	250 000	112 500	7 500	7°	75 000
100 000	100 000	75 000	37 500	3°	37 500	125 000	56 250	3 750	7°	37 500
20 000	20 000	15 000	7 500	3°	7 500	25 000	11 250	750	N/A	N/A
2 000	2 000	1 500	750	3°	750	2 500	1 125	75	N/A	N/A

Table 13. 5: Installation setting angles for high-intensity obstacle lights

Height of light unit above terrain (AGL)		Angle of the peak of the beam above the horizontal
Greater than	Not exceeding	
151 m		0°
122 m	151 m	1 °
92 m	122 m	2 °
	92 m	3 °

Figure 58 - Lighting requirement specification for as per NAMCATS part 139 for obstacles operating in the vicinity of aerodromes (Source: NCAA NAMCATS part 139).

5.13 BIOPHYSICAL ENVIRONMENT BASELINE

5.13.1 CLIMATE AND METEROLOGY

Namibia is a hyper-arid country. Regionally, there is a growing demand for water due to climate change, population growth, economic development and urbanisation, which increases pressure on existing water sources. The Twin Hills Gold Project is located in central Namibia in an area that experiences generally hot daytime temperatures throughout the year, while the nights are mild to cool in winter.

The mean annual rainfall is highly variable, ranging between 200 mm to 300 mm. Generally, evaporation exceeds precipitation, especially during the winter months of May to August, when there is little to no rainfall. The hot and dry season from September to December is dry with high daytime temperatures. Namibia's central rains tend to fall between January and April, but cognisance should be taken of potential changes in weather patterns because of climate change, whereby rainfall can be received in November and December. Runoff in the ephemeral streams can be expected when the water deficit ratio is near neutral in January through April.

Figure 59 below renders the wind roses for the period of July 2020 to July 2021 (AirShed, 2021) and Figure 60 renders the wind roses for the period 01 January 2021 – 31 December 2023 (AirShed, 2023). The dominant wind direction from 2020 – 2021 was from the southwest, followed by winds between the east and southeast. Day time winds tend to be from the east, whereby this changes to southwest winds during the night (AirShed, 2021).

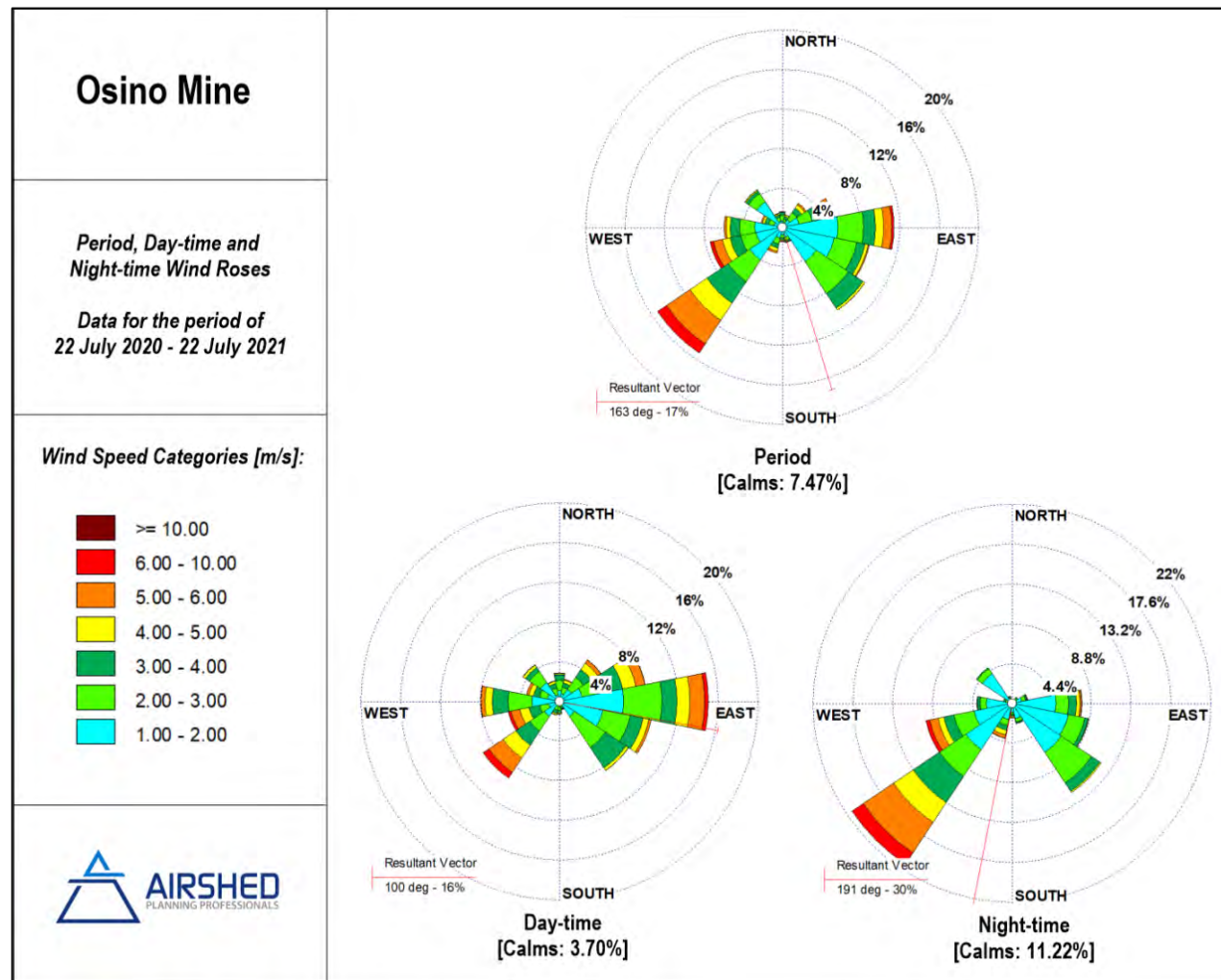


Figure 59 -Wind roses for the period 23 July 2020 – 22 July 2021 from data gathered from the on-site weather station (Source: (AirShed, 2021)

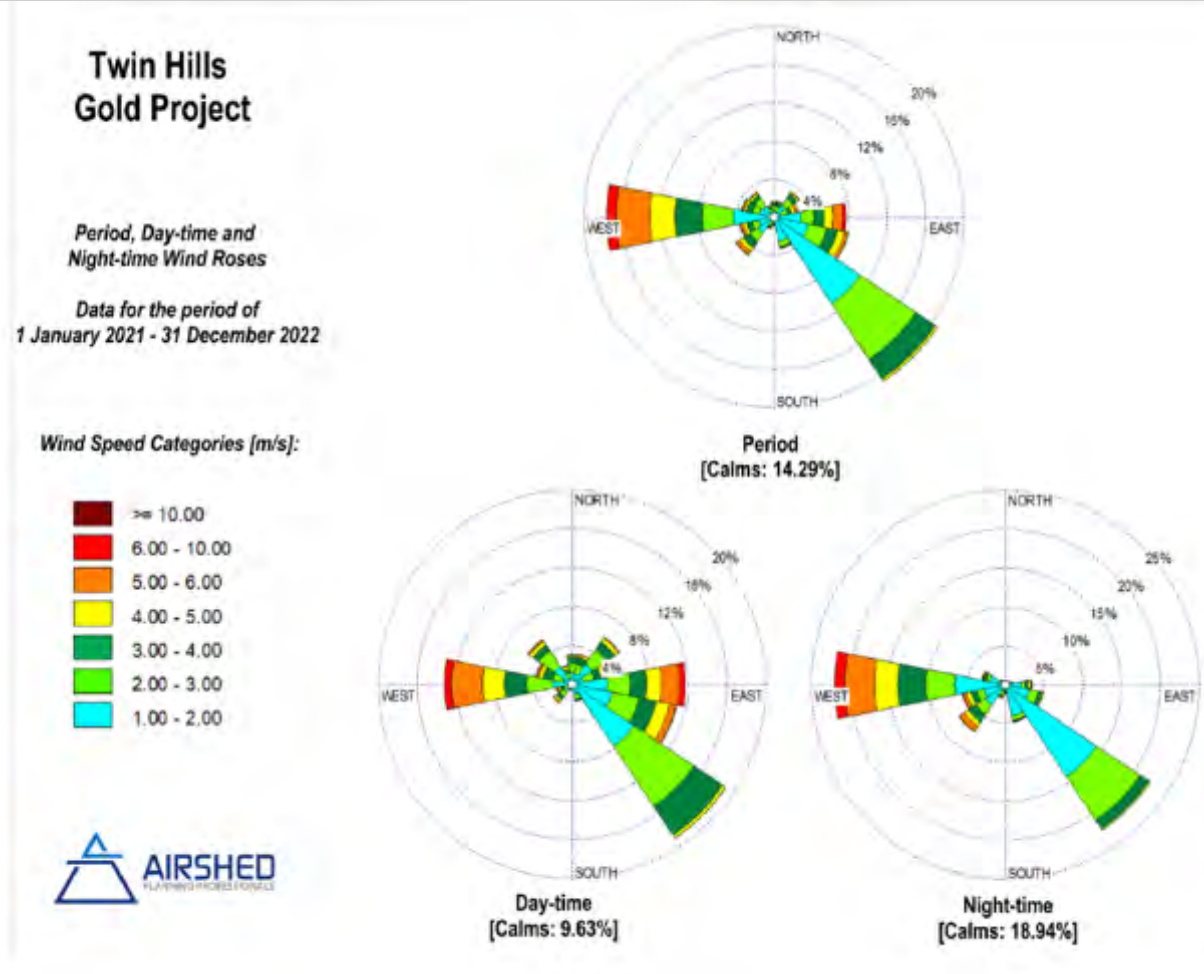


Figure 60 - Wind roses for the period 01 January 2021 – 31 December 2023 from data gathered from the on-site weather station (Source: (AirShed, 2023))

5.13.2 SOIL

The soil in the Project area is dominated by calcisols (commonly called calcretes), regisols and rocky outcrops, based on mapping in the Atlas of Namibia. The mapping from the Atlas of Namibia is considered high level, and sampling done during this investigation can be used to improve the mapping of soils in the area.

A soil analysis baseline provides a description of the environment specifically related to soils that occur in the study area. It summarises the soil composition, fertility, land use potential and erodibility. This information will contribute to the material balance, which could be used for cover material of selected mining landforms.

Eight (8) soil sampling locations were determined by the visible soil differences found on satellite imagery and the planned footprint areas, as depicted in the preliminary economic assessment report (PEA). The 2021 baseline soil types in the Project area are presented in Table 18.

Table 18 - Classification of soil type.

Sample photo	Type of soil	Reasoning
 Photo - Soil 1	Gypsic / Neocarbonate	Soft and hardened gypsum accumulation in alluvial material. Calcareous (though soil material dominates horizon); apedal to weak structure; colour variegation; absence of gleying.
 Photo - Soil 2	Gypsic / Neocarbonate	Soft and hardened gypsum accumulation in alluvial material. Calcareous (though soil material dominates horizon); apedal to weak structure; colour variegation; absence of gleying.
 Photo - Soil 3	Gypsic / Neocarbonate	Soft and hardened gypsum accumulation in alluvial material. Calcareous (though soil material dominates horizon); apedal to weak structure; colour variegation; absence of gleying.

Sample photo	Type of soil	Reasoning
 Photo - Soil 4	Gypsic / Neocarbonate	Soft and hardened gypsum accumulation in alluvial material. Calcareous (though soil material dominates horizon); apedal to weak structure; colour variegation; absence of gleying.
 Photo - Soil 5	Red apedal / Red Structured	Uniform red colouring; apedal to weak structure; non-calcareous. Uniform red colouring; moderate to strong structure; red cutans.
 Photo - Soil 6	Red apedal / Red Structured	Uniform red colouring; apedal to weak structure; non-calcareous. Uniform red colouring; moderate to strong structure; red cutans.

Sample photo	Type of soil	Reasoning
 Photo - Soil 7	Red apedal	Uniform red colouring; apedal to weak structure; non-calcareous. Quartz stone fragments within a red apedal horizon.
 Photo - Soil 8	Neocarbonate	Calcareous (though soil material dominates horizon); apedal to weak structure; colour variegation; absence of gleying.

5.13.3 K-FACTOR

The soil erodibility factor (K-factor) is a quantitative depiction of the characteristic of a particular soil's erodibility; it is the extent to which soil particles detach and are washed away by rainwater and runoff. The soil erodibility factor can in some cases be described as the rate of erosion per unit index from a specific area. The erodibility factor reflects the susceptibility between different soils when all other impacting factors (infiltration rate, permeability rate, dispersion and total water capacity, abrasion, and rain splash) are all kept constant. The soil erodibility factor (K- factor) ranges in value from 0.02 to 0.69, which is highly influenced by soil texture, although other factors such as permeability, organic matter content, and structure could play a contributing factor (Pacific Northwest National Laboratory, 2021).

$$K_{fact} = (1.292)[2.1 \times \left(\frac{10}{f_p} \right)^{-6} f_p^{1.14} (12 - P_{om}) + 0.0325(S_{struc} - 2) + 0.025(f_{perm} - 3)]$$

In which:

$$f_p = P_{silt} (100 - P_{clay})$$

Where:

f_p is the particle size parameter (unitless)

Pom is the percent organic matter (unitless)

Sstruc is the soil structure index (unitless)

fperm is the profile-permeability class factor (unitless)

Soil infiltration rate is the most important factor because it determines how fast the transfer and distribution of water from surface to soil profile happens (Patle, Sikar, Rawat, & Singh, 2018). The infiltration rate was calculated by means of a literature analysis, as it was not conducted on-site.

The infiltration rate was determined by making use of the sand, silt, and clay percentages, and the results are shown in Table 19. It was observed that sand content varies from 89% to 97%, with a mean value of 92.8%; silt content varies from 1% to 3%, with a mean value of 1.69%; and clay content varies from 2% to 9%, with a mean value of 5.63%. Table 20 to Table 21 provide details into the factors used in this assessment. The analysis from the first-class method (Patle, Sikar, Rawat, & Singh, 2018) was used to determine the infiltration rate of the 8 soil samples, and thus is represented by the following formulae:

$$EIR = 14,195.35 - 141.75(sand\%) - 142.10(silt\%) - 142.56(clay\%)$$

Table 19 -The profile permeability class factor table.

The profile-permeability class factor, fperm	
1	for very slow infiltration
2	for slow infiltration
3	for slow to moderate infiltration
4	for moderate infiltration
5	for moderate to rapid infiltration
6	for rapid infiltration

Table 20 - Soil structure index.

The soil structure index	
1	for very fine granular soil
2	for fine granular soil
3	for medium or coarse granular soil
4	for blocky, platy, or massive soil

Table 21 - Table of K-Factor calculation.

Sample	Fp	EIR (cm/H)	Kfact ((t ha h)· (ha MJ mm)–1)	Sand (%)	Fperm	Sstruc
Topsoil 1	182	3087.634	0.074457	89	5	2
Subsoil 1	182	3150.383	0.07462	89	5	2
Topsoil 2	93	2267.078	0.144082	92	6	3
Subsoil 2	186	2565.331	0.149459	91	6	3
Topsoil 3	184	2833.253	0.106936	90	6	2
Subsoil 3	276	3123.506	0.079819	89	5	2
Topsoil 4	98	870.4121	0.102726	97	6	2
Subsoil 4	96	1474.12	0.102639	95	6	2
Topsoil 5	96	1508.773	0.144754	95	6	3
Subsoil 5	94	2076.692	0.144624	93	6	3
Topsoil 6	180	1580.933	0.149901	95	6	3
Subsoil 6	192	1695.493	0.150637	94	6	3
Topsoil 7	97	1090.751	0.102707	96	6	2
Subsoil 7	192	1775.687	0.108282	94	6	2
Topsoil 8	192	1709.169	0.150368	94	6	3
Subsoil 8	186	2525.336	0.14996	91	6	3

Table 22 - Laboratory results for the element and organic matter (Geolab, 2021).

Sample no	PH (KCL)	P (OLSEN) MG KG ⁻¹	K MG KG ⁻¹	CA MG KG ⁻¹	MG MG KG ⁻¹	NA MG KG ⁻¹	ORG-C %
Topsoil 1	7.5	4	238	2893	166	7	1.38
Subsoil 1	7.5	3	221	2978	165	10	1.21
Topsoil 2	7.7	1	91	2773	162	6	1.09
Subsoil 2	7.8	1	72	2756	167	4	0.90
Topsoil 3	7.6	2	217	2906	163	11	1.33
Subsoil 3	7.6	7	170	2935	264	63	1.21
Topsoil 4	7.4	2	226	1024	160	6	0.47
Subsoil 4	7.6	1	216	1074	152	4	0.37

Sample no	PH (KCL)	P (OLSEN) MG KG ⁻¹	K MG KG ⁻¹	CA MG KG ⁻¹	MG MG KG ⁻¹	NA MG KG ⁻¹	ORG-C %
Topsoil 5	6.9	1	144	792	224	7	0.12
Subsoil 5	7.1	0	112	951	283	6	0.10
Topsoil 6	7.1	2	182	775	196	3	0.08
Subsoil 6	7.7	1	137	2399	281	9	0.10
Topsoil 7	7.6	0	162	2839	214	22	0.37
Subsoil 7	7.7	1	138	2805	255	44	0.47
Topsoil 8	7.6	4	199	2377	115	5	0.37
Subsoil 8	7.7	3	169	2899	124	7	0.37

Table 23 - Soil erodibility factor (after Stewart et al. 1975 as cited by PNNL, 2021).

P _{OM} (%)			
Textural class	<0.5	2	4
Sand	0.05	0.03	0.02
Fine sand	0.16	0.14	0.10
Very fine sand	0.42	0.36	0.28
Loamy sand	0.12	0.10	0.08
Loamy fine sand	0.24	0.20	0.16
Loamy very fine sand	0.44	0.38	0.30
Sandy loam	0.27	0.24	0.19
Fine sandy loam	0.35	0.30	0.24
Very fine sandy loam	0.47	0.41	0.33
Loam	0.38	0.34	0.29
Silt loam	0.48	0.42	0.33
Silt	0.60	0.52	0.42
Sandy clay loam	0.27	0.25	0.21
Clay loam	0.28	0.25	0.21
Silty clay loam	0.37	0.32	0.26
Sandy clay	0.14	0.13	0.12

P_{OM} (%)			
Textural class	<0.5	2	4
Silty clay	0.25	0.23	0.19

5.13.3.1 Soil fertility potential

Table 22 provides the laboratory results from the soil samples and Table 23 the soil erodibility factor. According to the laboratory results, soils 1, 3, 4, 5 and 6 have a high pH and do not require any lime application. The soil sodium adsorption ratio (SAR) is low and does not require gypsum application.

In relation to understanding the soil material for closure and rehabilitation purposes, to improve the fertility potential of the soil from samples 1, 3, 4, 5 and 6 for planting pasture grasses, broadcast 300 Kg/ha in a ratio of 1:1:0 (32), add Zn immediately before planting, and work within 10cm. Top-dress 200 Kg/ha of limestone ammonium nitrate (LAN) six weeks after planting (Geolab, 2021).

Soil 2 also has a high pH and does not require any lime application. The soil sodium ratio is low and does not require gypsum application. In order to improve the fertility potential of this soil for the establishment of pasture grasses, broadcast 500 Kg/ha in a ratio of 2:3:4 (30), add Zn immediately before planting, and work within 10 cm. The top-dress is the same as the other soils and has a requirement of 200 Kg/ha LAN six weeks after planting (Geolab, 2021).

In conclusion, the soil analysis survey has determined that the soils have calcrete and marble that can act as a neutralising agent. The topsoil must be kept for rehabilitation, as it is fertile enough to produce grasslands. There will be no need to add lime or gypsum to any of the soils if it gets used for cover material, as the soils have a high pH and low Na and SAR values. The soils have a low erodibility in general.

It is suggested that a detailed soil map depicting stripping depths and available cover soil volumes be created once the final site layout plans are available. These maps should be used to start the stripping and topsoil stockpiling plan, as well as inform the active topsoil balance for life of mine.

5.13.4 AIR QUALITY

Since June 2020, Environmental Compliance Consultancy has been conducting environmental monitoring and assessments for the Twin Hills Gold Project, for the purpose of reporting on depositional dust, at eight dust monitoring stations located on the Project site. Air quality monitoring is crucial for determining the potential impacts that planned mining operations may have in an environment.

The potential expected sources of dust particulate matter resulting from the operational activities include but are not limited to: construction activities; mineral material handling and processing; and mining activities like drilling, blasting and hauling. Therefore, depositional dust monitoring station locations were based on the proposed infrastructure locations likely to generate dust, taking into account prevailing wind, in line with the requirements of the Standard Test Method for Collection and Measurement of dust fall (ASTM D1739-98) and South African National Standards (SANS) standards and target actions. Baseline particulate matter (PM) 10/2.5 measurements have also commenced to be taken on a monthly basis from August 2023 by utilising a handheld monitoring device, taking into account the World Health Organisation (WHO) IT3 targets for particulate matter.

Figure 61 shows the locations of the dust fall sampling locations.

Natural environments are complex systems that can be affected by anthropogenic interference such as mining activities, including mineral exploration. To understand the confounding factors and interpret the findings based on the baseline of the receiving environment, deductive and inductive approaches can be used. The wind vectors, topography (e.g. mountains and valleys), seasonal rainfall, and drought are identified as the potential factors that are likely to influence air quality. Wind direction and speed are the primary factors determining the distance of travel of a dust particle and the distribution of particles falling out.

As the ESIA for the proposed gold mining activities at the Project site commenced in 2021, an air quality specialist study was deemed necessary to determine the potential impacts of atmospheric pollution to air quality for this Project. Airshed Planning Professionals were engaged to model and provide a technical report for the air quality baseline environment (AirShed, 2021). Subsequently, as the DFS for the Project progressed, site layout and design changes were confirmed in 2023 and therefore a reassessment of the baseline environment, taking into account these changes, has been conducted by (AirShed, 2023). The ambient air quality guidelines, as contained within the IFC and EHS guidelines of 2007, were applied to the assessment. Both these reports can be viewed in Appendix D.

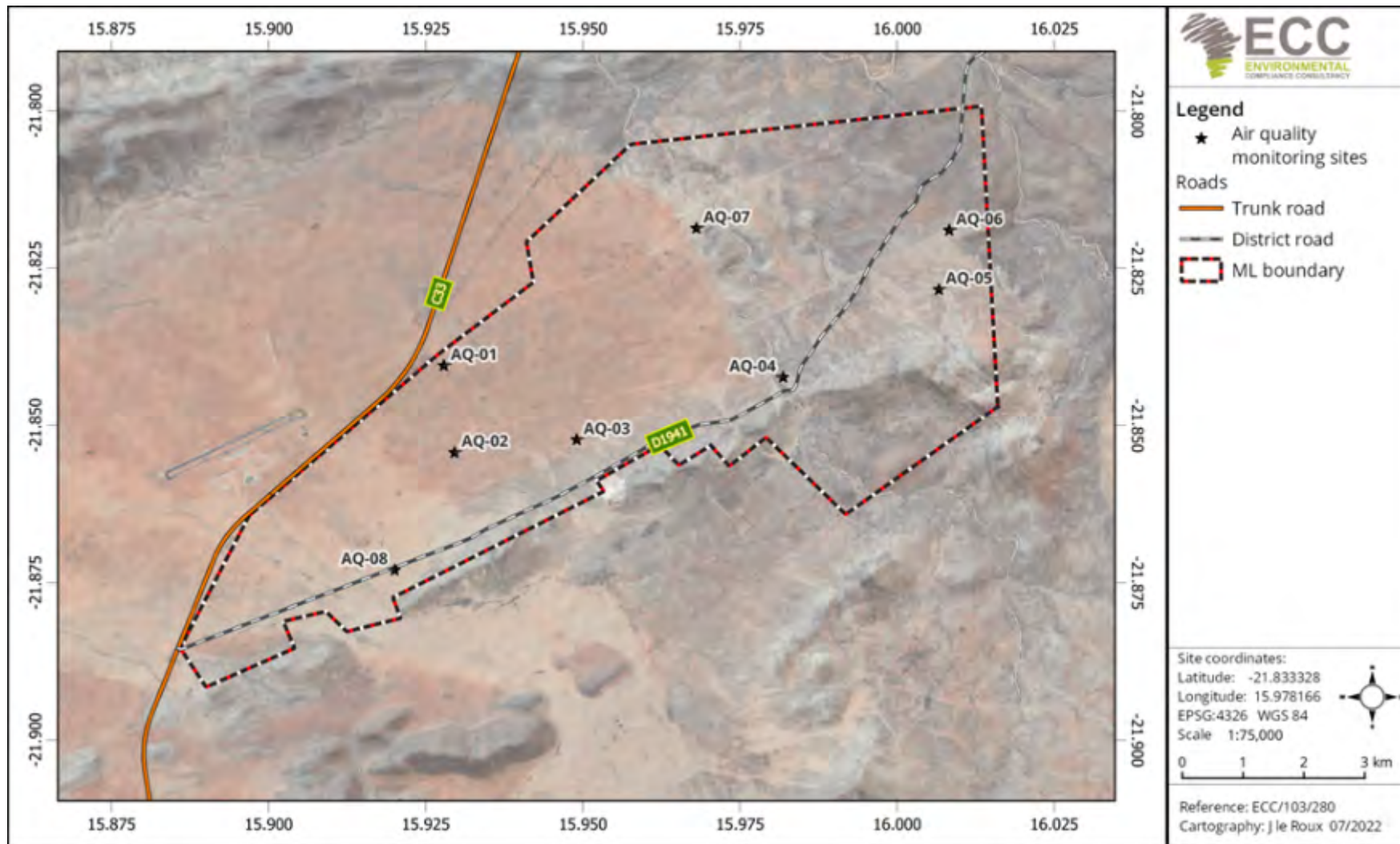


Figure 61 - Dustfall monitoring locations.

The findings, recommendations, and the way forward, as described in the baseline reports, are described hereafter. The main findings from the Airshed (2021b) baseline study can be summarised as follows:

- The terrain is hilly, with a ridge to the north and northwest, and a ridge on the southern side;
- On-site weather data is available for the period 23 July 2020 to 22 July 2021. The wind field is dominated by winds from the southwest and the east to southeast, with the strongest winds from the southwest. During the day, easterly winds prevailed with strong but less frequent winds from the southwest, and at night the wind field shifted to the southwest. Calm conditions were recorded for 7.5% of the time with a period average wind speed of 2.3 m/s. Higher wind speeds occurred during the night, with the strongest winds recorded from the southwest. A maximum wind speed of 8.9 m/s was recorded;
- Monthly variation in the wind field showed more frequent south-westerly winds during the summer months and a shift to easterly winds in May, and then to the southeast during April to July – the so called “east-winds”. In August, winds from the northwest prevailed, whereafter it shifted to the southwest in September with a remaining easterly component. The winter months were dominated by high velocity north-easterly winds;
- Maximum, minimum and mean temperatures were given as 42°C, -3°C and 23°C, respectively, from the Twin Hills Gold Project on-site weather station for the period July 2020 to July 2021;
- Rainfall over the 12-month period totalled 254 mm, with the highest rainfall month being January 2021 (115 mm);
- The main pollutant of concern in the region is particulate matter (TSP; PM10 and PM2.5) resulting from vehicle entrainment on the roads (paved, unpaved, and treated surfaces), windblown dust, and mining and exploration activities; and
- Gaseous pollutants such as SO₂, NO_x, CO and CO₂, would result from vehicles and combustion sources, but these are expected to be at low concentrations due to the few sources in the region.

The main findings from the (AirShed, 2023) baseline study can be summarised as follows:

- On-site weather data was reviewed over a two-year period, from 01 January 2021 to 31 December 2023, this was found to be sufficient for the model for the assessment;
- The wind field is dominated by winds from the southeast to east and from the west, with the strongest winds from the west. During the day, southeasterly winds prevailed with strong but less frequent winds from the west, and at night the wind field shifted to the west (Figure 62);
- Calm conditions were recorded for 14.3% of the time with a period average wind speed of 2.4 m/s; with August displaying the calmest conditions (25.07%) and June the least calm conditions (4.24%);

- Higher wind speeds occurred during the night, with the strongest winds recorded from the southwest. A maximum wind speed of 8 m/s were recorded;
- Monthly variation in the wind field showed more frequent westerly winds during the summer months and a shift to southeasterly winds in April until July. Winds shifted to the west in September with a remaining southeasterly component;
- Maximum, minimum, and mean temperatures were given as 38°C, -2°C and 21°C respectively from the Twin Hills weather station for the period; and
- Rainfall recorded 241 mm in 2021 and 128 mm in 2022, with the highest rainfall month January 2021 (115 mm); and

Sources of atmospheric emissions in the vicinity of the proposed Twin Hills Gold Project include (AirShed, 2021) (AirShed, 2023):

- Vehicle entrainment from roads: The national road to the south (B2) of the Project is the main road between Windhoek and Swakopmund, and one of the roads in the region with the highest traffic counts. It is a paved road with vehicle entrainment calculated to be a significant contributor to the regional paved road PM_{2.5} and PM₁₀ emissions. The C33 is a paved road connecting the Karibib Airport to the B2, and although no information was available for this road, it is expected to have very low traffic counts and low PM_{2.5} and PM₁₀ emissions;
- Windblown dust: Windblown particulates from natural exposed surfaces, mine waste facilities, and product stockpiles can result in significant dust emissions with high particulate concentrations near the source locations, potentially affecting both the environment and human health. Windblown dust from natural exposed surfaces in and at the Twin Hills Gold Project is only likely to result in particulate matter emissions under high wind speed conditions (>10 m/s), and since recorded wind speeds did not exceed 10 m/s, this source is likely to be of low significance;
- Mines and exploration operations: Pollutants typically emitted from mining and quarrying activities are particulates, with smaller quantities associated with vehicle exhaust emissions. Mining and quarrying activities, especially open-cast mining methods, emit pollutants near ground level over (potentially) large areas. Mines in proximity to the proposed Project are Navachab Gold Mine, located approximately 20 km west-southwest of Karibib, and a number of marble quarries – Capra Hill, Dreamland and Savanna Marble, etc.; and
- Regional transport of pollutants: Regional-scale transport of mineral dust and ozone (due to vegetation burning) from the north of Namibia is a significant contributing source to background PM concentrations.

Figure 63 provides the results of the baseline dust fallout conditions from June 2020 to 2023 (AirShed, 2021) and the threshold limits are included in the legend. Dust fall rates were generally low for the sampling period, and well within the dust fall limit of 600 mg/m²/day (adopted limit for residential areas) and 1 200 mg/m²/day (adopted limit for non-residential areas). Dust fall rates were the lowest during the autumn and winter months. The residential

dust fall limit of 600 mg/m²/day was exceeded at AQ-07 during January 2023 and at AQ-03 during February 2023.

Air quality assessment impacts are further discussed in the assessment chapter (chapter 7) of this report and the mitigation measures are included in the ESMP (Appendix A). This chapter discussed in detail the modelling outcomes for dust fall out, PM_{10/2.5} and gaseous emissions impacts in response to the predetermined sensitive receptors. However, the below map (Figure 64) provides an overview of the air quality sensitive receptors.

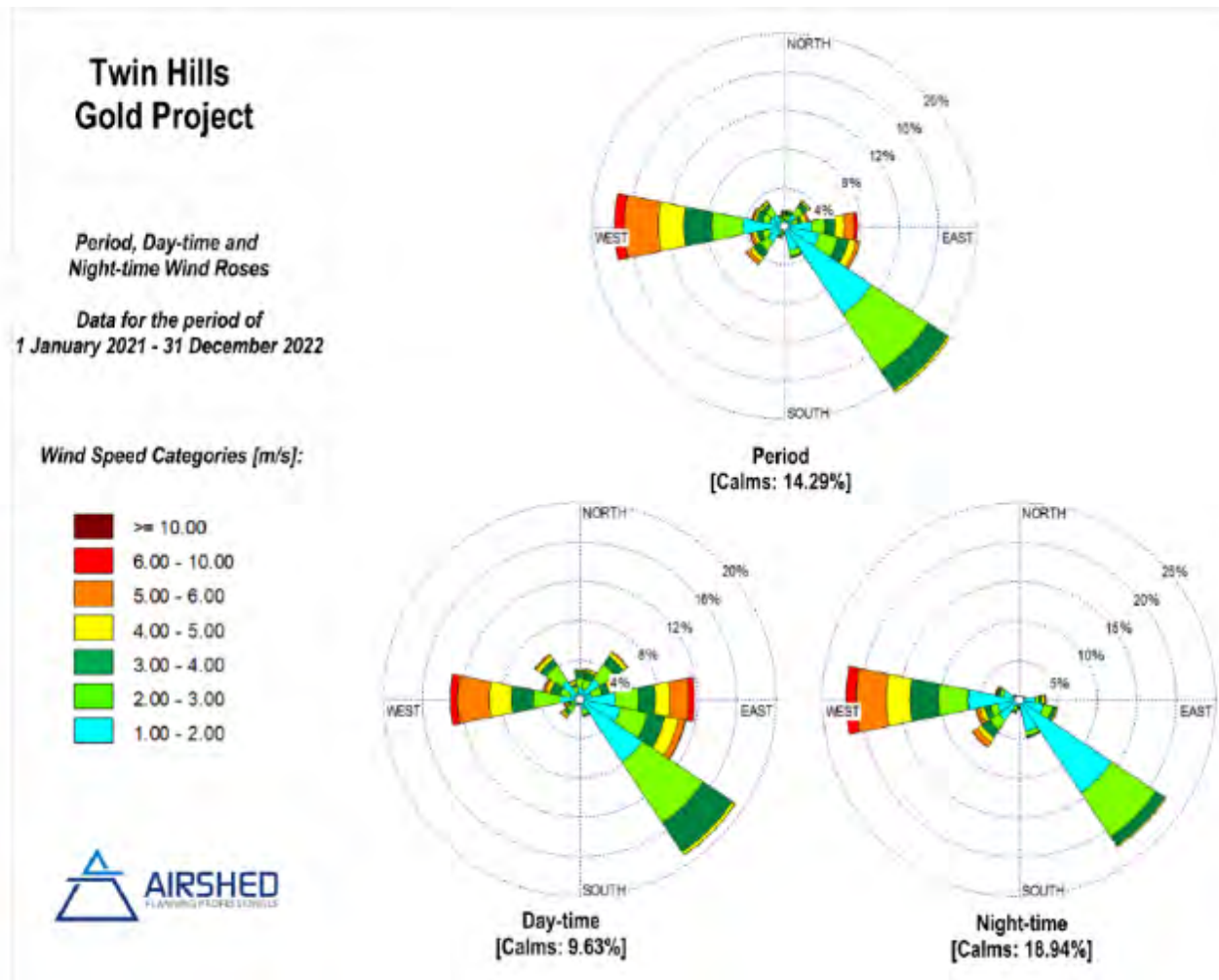


Figure 62 - Period, day and night time wind roses based on the Twin Hills weather data for 01 January 2021 – 31 December 2023 (AirShed, 2023).

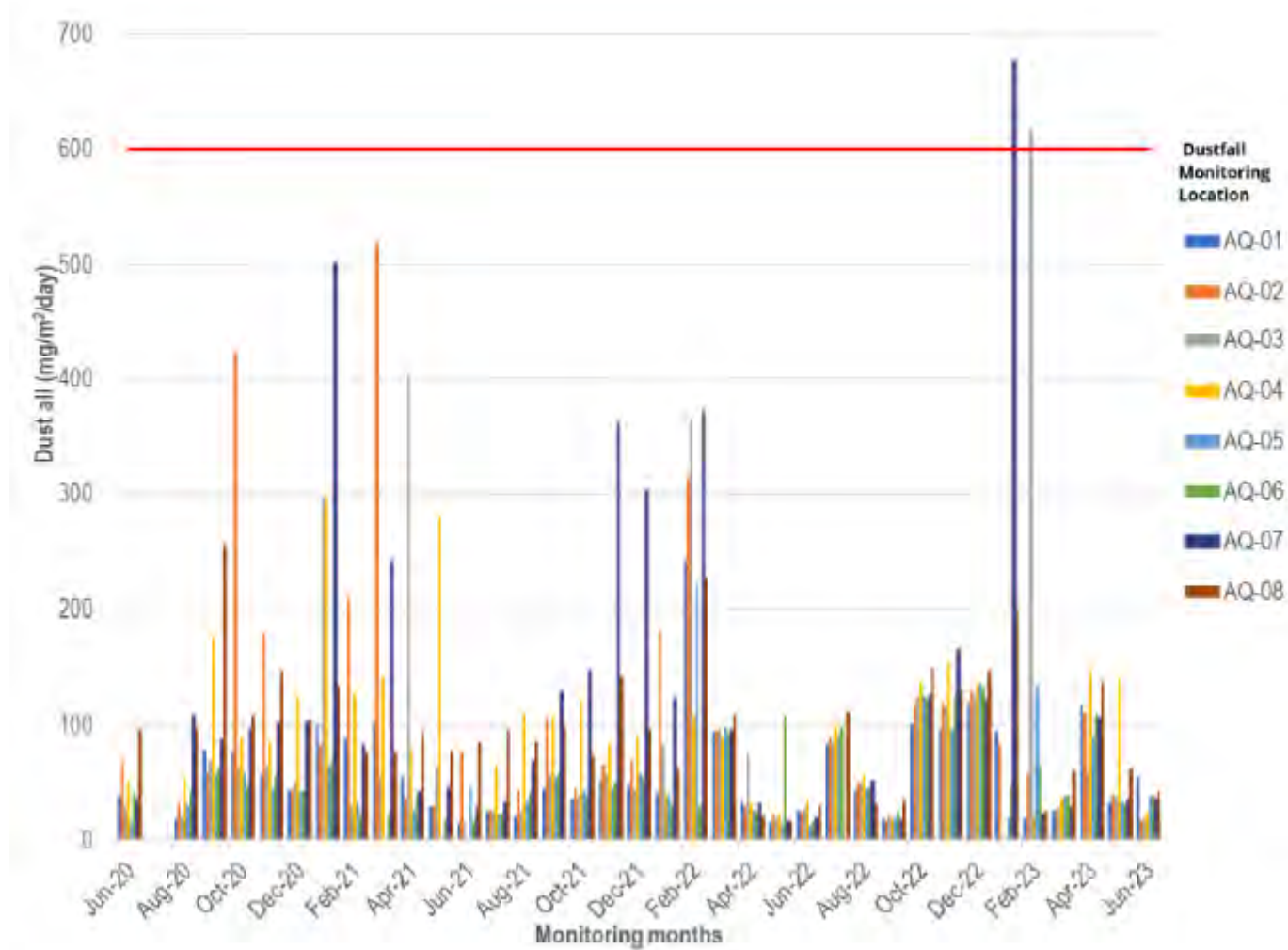


Figure 63 - Dust fall out monitoring results June 2020 to June 2023, red line indicates the residential threshold (600 mg/m²/day) (AirShed, 2023).

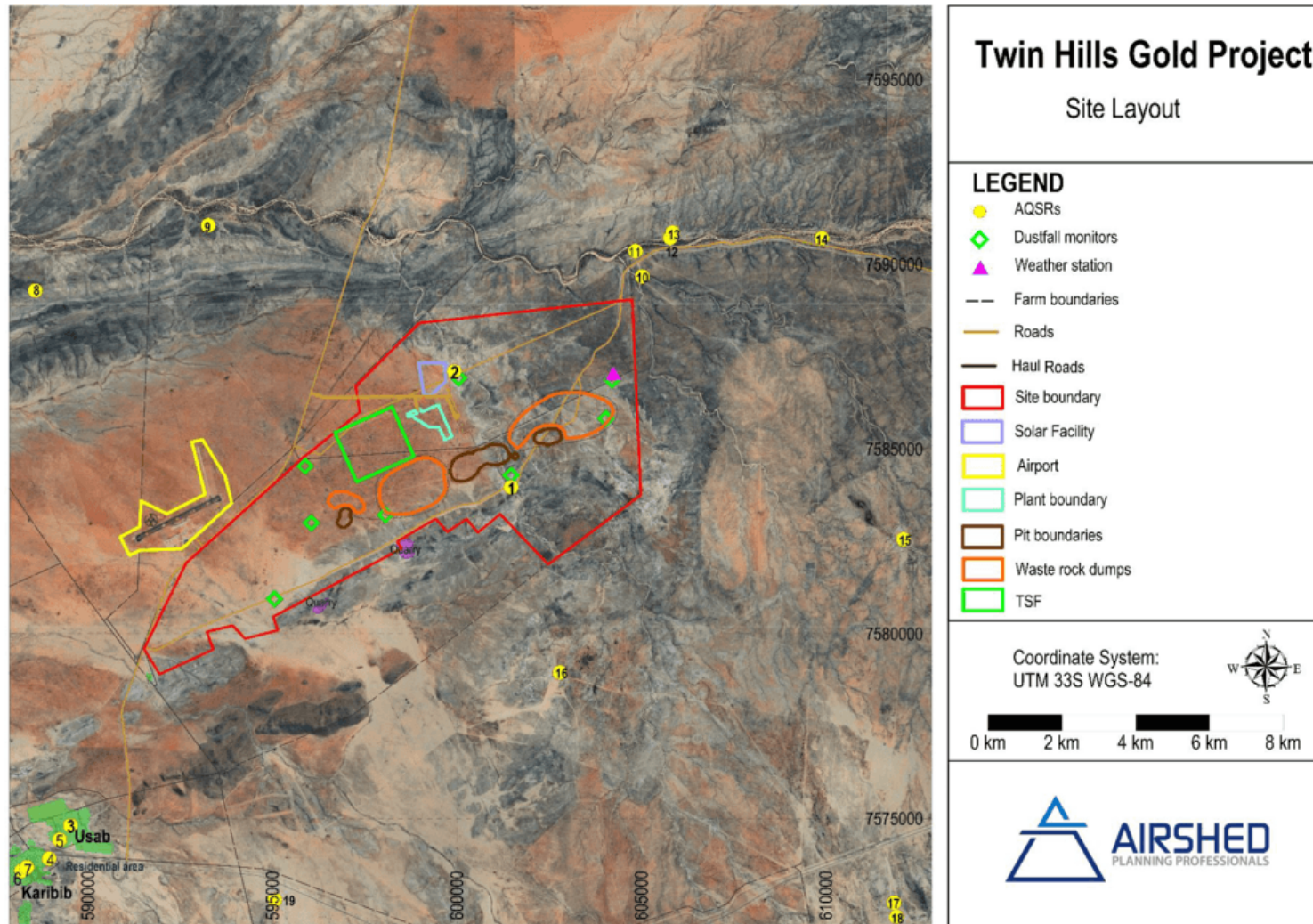


Figure 64 - Twin Hills Gold Project layout, monitoring network and identified air quality sensitive receptors (AirShed, 2023).

5.14 GEOCHEMICAL

RGS-ECC is completing a geochemical assessment of mining materials for the Twin Hills Gold Project using relevant legislation, guidelines, and policies to inform the assessment (AMIRA, 2002). A geochemical analysis of the mine material (waste rock, low-grade and high-grade ore) was conducted to assess the mineralogical composition and potential for the generation of acid and metalliferous drainage (AMD), neutral and metalliferous drainage (NMD), saline drainage (SD), or dispersive issues from these materials.

A strategy was developed to collect and geochemically characterise representative samples of mining materials from drill core representing waste rock, low-grade ore and high-grade ore materials. The strategy was developed to align with Australian and international (The International Network for Acid Prevention , 2020) technical guidelines for the geochemical assessment of mine waste materials.

Representative waste rock, low-grade and high-grade ore samples for the assessment were collected as set out in the RGS-ECC Geochemical Sampling and Analysis Plan (RGS, 2021). A total of 131 samples from six drill holes from the Project were crushed and sub-sampled, pulverised to pass 75 µm sieve size, bagged, labelled, sealed, and then transferred to a commercial laboratory (Analytical Laboratory Services in Windhoek and SGS in South Africa) for static geochemical testing as shown in Table 24.

Table 24 - Sample materials used for geochemical testing.

Sample Description	Number of Samples
Twin Hills Central Waste Rock – no alteration, mineralisation	65
Clouds Waste Rock – no alteration, mineralisation	5
Twin Hills Central Waste Rock – alteration, mineralisation	28
Clouds Waste Rock – alteration, mineralisation	16
Twin Hills Central Ore – oxidised	3
Clouds Ore – oxidised	3
Twin Hills Central Ore – alteration, mineralisation	9
Clouds Ore – alteration, mineralisation	2
Total	131

The geochemical test program was designed to assess the degree of risk from the presence and potential oxidation of sulphides, acid generation and the presence/leaching of soluble metals/metalloids and salts. The results from the ABA data trends are presented below.

pH: The pH of the samples tested ranges from 6.1 - 10.2 (i.e. in the neutral to moderately alkaline range) and has a median value of 9.4 (Figure 65). The only samples with a pH value less than 8 are

three waste rock samples with phyllic alteration and pyrrhotite mineralisation from the Clouds deposit. Hence, the majority of the samples have moderately alkaline pH values greater than the deionised water used in the tests, suggesting that, at least initially, the addition of alkalinity to water in contact with these materials is likely.

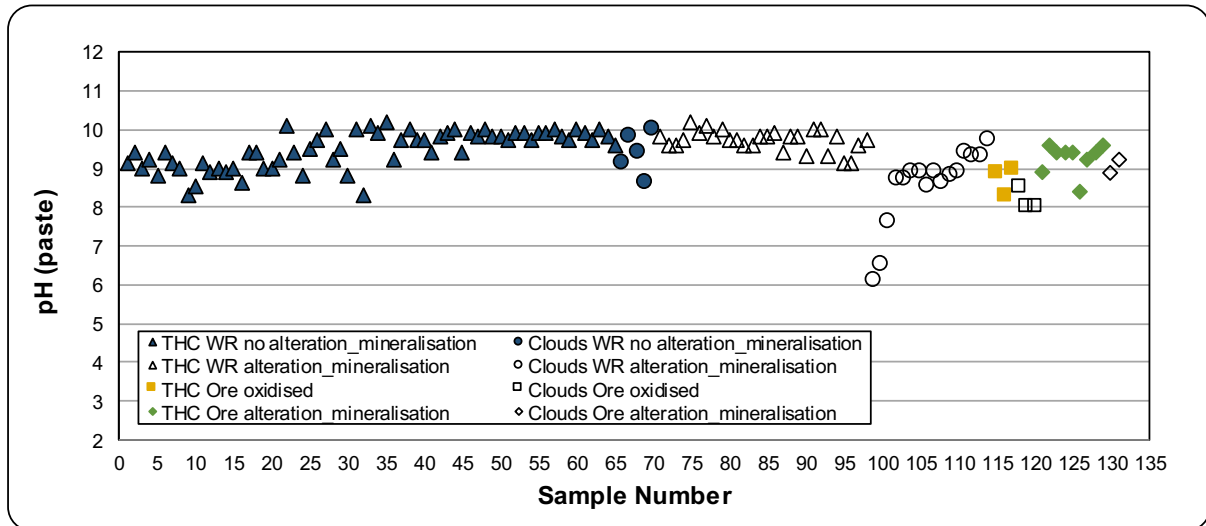


Figure 65 - pH values for waste rock and ore (Source: (RGS, 2021).

Electrical conductivity (EC): The EC value of the 51 samples ranges from 19 to 272 $\mu\text{S}/\text{cm}$ and is generally low (median 58 $\mu\text{S}/\text{cm}$) (Figure 66). The only samples with an EC value greater than 200 $\mu\text{S}/\text{cm}$ are two waste rock samples with phyllic alteration and pyrrhotite mineralisation from the Clouds deposit. Hence, at least initially, waste rock and ore materials are likely to have a low salinity value.

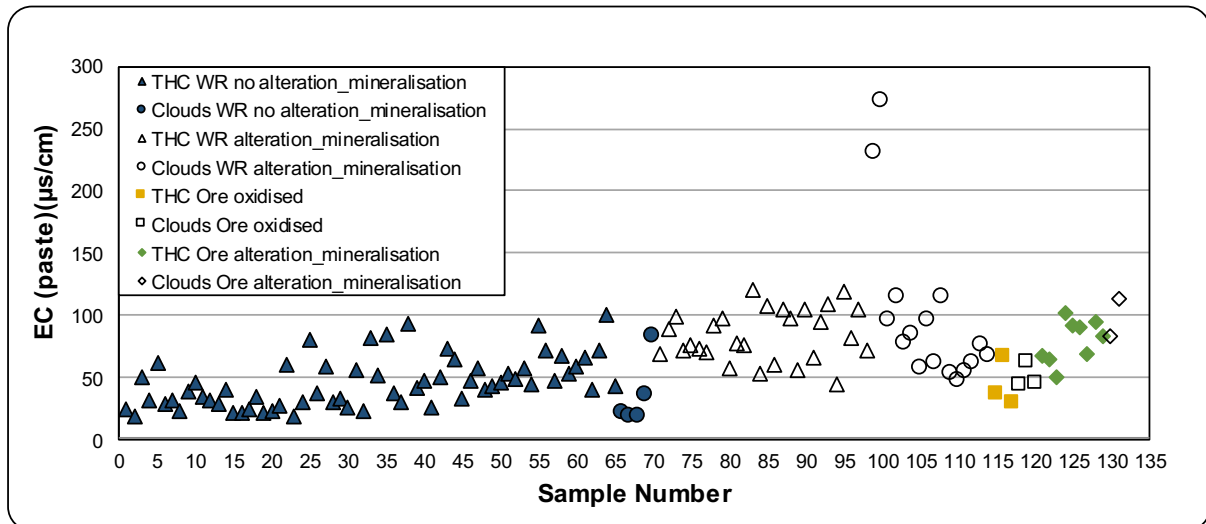


Figure 66 - EC values for waste rock and ore (Source: ECC: (RGS, 2021).

Total sulfur: The total sulfur content of the 131 waste rock and ore samples range from 0.005 to 3.08%S and has a low median value of 0.11%S. Most of the waste rock and ore samples that have not been altered, or are without mineralisation, have a very low total sulfur concentration below

the median crustal abundance (0.1%S) for this element in unmineralised soils (The International Network for Acid Prevention , 2020)

In contrast, most of the waste rock and ore samples that are altered, and/or contain mineralisation, have elevated total sulfur concentrations that are likely to be present in the form of pyrrhotite and/or pyrite (Figure 67).

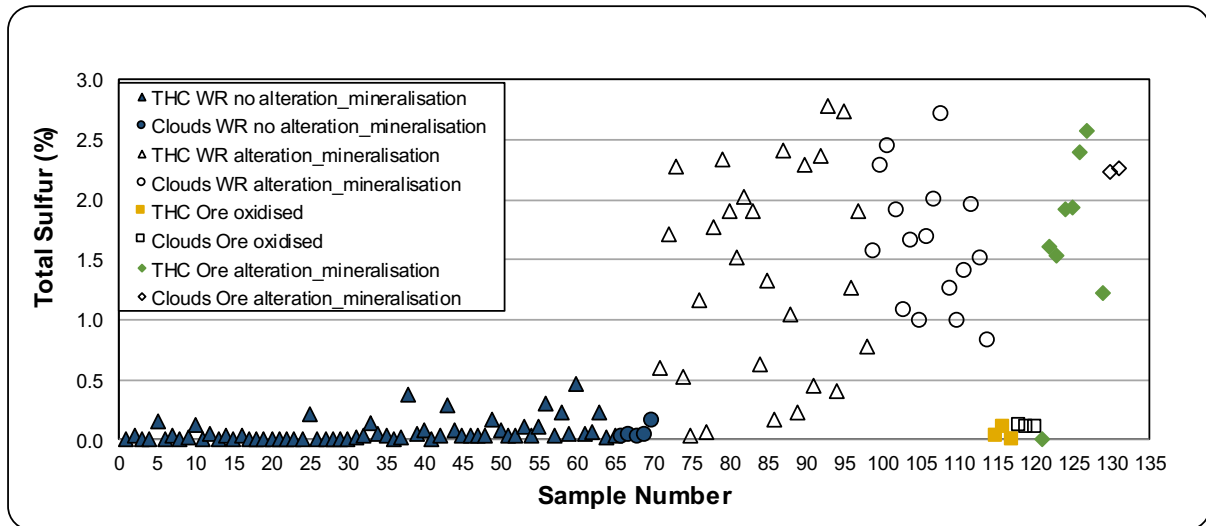


Figure 67 - Total sulfur concentrations for waste rock and ore (Source: (RGS, 2021).

Maximum potential acidity (MPA): Based on the total sulfur content, the maximum potential acidity (MPA) that could be generated by the 131-waste rock and ore samples ranges from 0.2 to 94.3 kg H₂SO₄/t with a low median value of 3.4 kg H₂SO₄/t. The altered and/or mineralised waste rock and ore samples have a much higher potential for generation of acidity through sulfide oxidation than the waste rock and ore with no alteration and/or mineralisation.

Acid neutralising capacity (ANC): The ANC value for the 131-waste rock and ore samples ranges from below the laboratory limit of reporting (0.5 kg H₂SO₄/t) to 680 kg H₂SO₄/t, and has a median value of 16 kg H₂SO₄/t. The highest ANC values were recorded for the calcrete waste rock samples and is generally more than an order of magnitude greater than the median ANC value.

Net acid producing potential (NAPP): The NAPP is the balance between the capacity of a sample to generate acidity (MPA) minus its capacity to neutralise acidity (ANC). The calculated NAPP values for the 131 waste rock and ore samples ranges from -679.1 to +85.8 kg H₂SO₄/t with a negative median value of -10.5 kg H₂SO₄/t. The most negative NAPP values were generally recorded for the calcrete waste rock samples, and the most positive NAPP values were recorded for some of the altered and mineralised waste rock and ore samples.

The results of the information review and static geochemical test program have been used to provide some conclusions as to whether the exposed waste rock and ore materials at the Project will present environmental risks that will need to be managed.

The Twin Hills deposit contains iron sulphide minerals. The mine rock characterisation study (RGS, 2021) identified that unaltered and unmineralized waste rock is not acid generating, has neutral to alkaline pH, and could be used for construction and rehabilitation activities. Altered and mineralised rock contains pyrrhotite, in concentration up to 2 to 5% and if left unmanaged is likely to be a source of acid and metalliferous drainage (AMD). Groundwater resources at the site are highly sensitive to potential impacts from AMD, and there is a risk that potential impacts to groundwater could be regional and irreversible, making this a moderate to high impact. Identifying the risks and potential impacts to groundwater resources from altered and mineralised waste rock materials helps to mitigate these risks prior to mining and facilitates the appropriate design of management systems and storage facilities. This is further discussed in assessment chapter of this report (chapter 7).

5.14.1 WASTE ROCK GEOCHEMICAL ANALYSIS FOR ACID ROCK DRAINAGE POTENTIAL

Representative samples of the waste rock materials during operations will be collected on a regular basis by the Twin Hills Geology team, up to two months in advance of mining operations, using a site standard operating procedure for acid rock drainage (ARD) pit and waste rock monitoring and the geochemical characteristics of the waste rock samples will be tested by Project laboratory personnel using a metallurgy ARD standard operating procedure. A visual assessment of the acid potential of a sample will be completed in the field and any samples with visual sulphides and a gold grade below the cut-off grade (plus 50%) (i.e. 0.3 g/t) will be identified, tagged and logged for ARD analysis at the metallurgical laboratory.

The waste rock sampling and testing program will also include exploration drill core materials further in advance of mining (i.e. greater than 2 months) and use existing and future geochemical data to produce an ARD block model. This could simply be an extension of the existing ore block model and introduce geochemical source terms to delineate non-acid forming (NAF) and potentially acid forming (PAF) waste rock materials.

The ARD pit and waste rock monitoring procedure will determine that baseline sampling and testing of PAF material occurring outside the broad ore-zone and that any PAF material will most likely report to a low-grade ore or ore material streams.

Any waste rock materials identified as PAF will be encapsulated within NAF waste rock at a designated area in the WRD.

5.14.2 TAILINGS STORAGE FACILITY GEOCHEMICAL ANALYSIS FOR ACID ROCK DRAINAGE POTENTIAL

Tailings also contain pyrrhotite and the tailings are potentially acid forming and have a significant risk for acid generation with a neutralisation potential ratio below 1. Short-term leaching

experiments identified arsenic, aluminium and iron as potential pollutants of concern in high water to rock leaching ratios.

As a result of the findings of the test work on the tailings material and based on a review of the existing geochemical data, the TSF design now includes a geosynthetic lining and underdrainage systems. The liner will include a composite geosynthetic barrier/liner system over the tailings basin footprint to reduce seepage that has the potential for acid generation and metal leaching. The geosynthetic lining system will be installed during the initial construction of each phase. It will comprise the following material from top to bottom; a geotextile bidim A6 for liner protection; 1.5mm mono-textured HDPE geomembrane for seepage reduction; and 150 mm crushed compacted calcrete layer (3 mm maximum particle size) for geochemical neutralisation. The underdrainage system will comprise of a basin underdrain system positioned in key areas of the facility to enhance consolidation of the tailings mass, and to collect leachate to the seepage pond. The seepage collection pond is sized to maximise evaporation of the leachate water.

These systems will protect the environment from the tailings' geochemistry, reduce seepage from the facility and help maintain drained conditions in the tailings mass. The TSF slope will need to be clad progressively during operation with hauled and placed selected waste rock to mitigate dust generation. Additional dust suppressant polymer will be required on the tailings surface following tailings placement. Compaction of tailings and potential wind rowing will also improve control dust generation.

5.15 WATER

The Project area falls in the Okawayo River catchment, within the larger Khan River catchment, and a tributary of the Khan River, which is in turn a sub-catchment of the Swakop River. Drainage in the area is dendritic with ephemeral streams, often steeply incised, forming small tributaries of the ephemeral Khan River, which flows south-westwards towards the Swakop River (Figure 68).

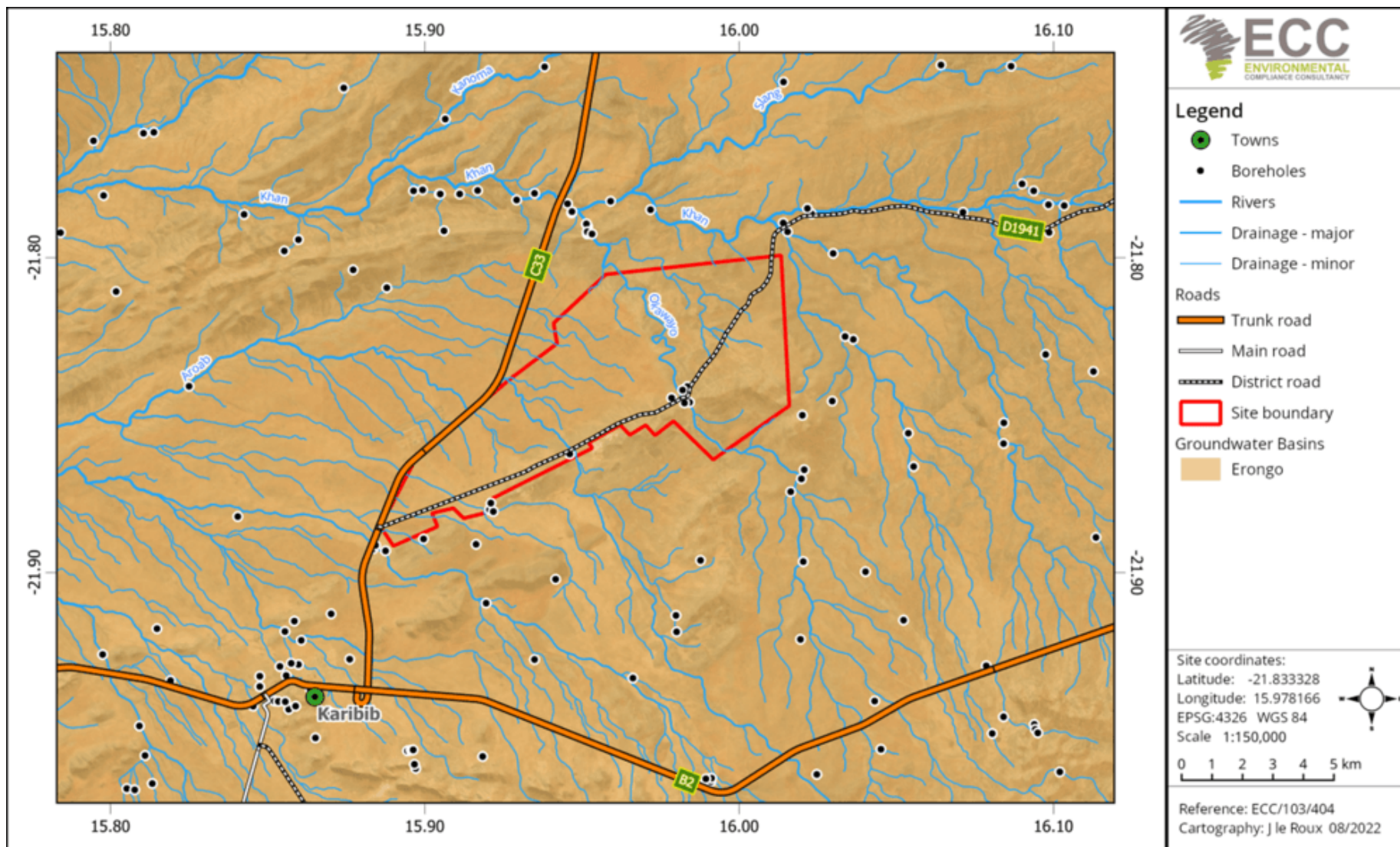


Figure 68 - Surface water flow showing ephemeral rivers, drainage lines, groundwater boreholes and the Project area.

Major surface drainage lines in the Project area include the Aroab Minor in the west, the Okawayo Minor in the centre, and the Slang Minor River in the east. The catchment area (Figure 69) upstream of the planned mining pit is approximately 92 km², which is roughly 1% of the Khan River catchment area, with a watercourse length of roughly 28.3 km upstream of the pit (Knight Piésold, 2023). Small streams also flow southwards off the marble ridge into a stream that flows parallel to the ridge, before turning north-westwards to dissipate in the red sands south of the airfield. The proposed mining operations occurs towards the lower end of the catchment area.

The local surface water resources have not been significantly impacted by the current farming land use, although small dams and boreholes are expected to have supplied the farmsteads. There is also no urbanisation or industrial development in the larger catchment areas south of the proposed mine, so the local surface water resources are unlikely to be significantly polluted (SLR, 2020).

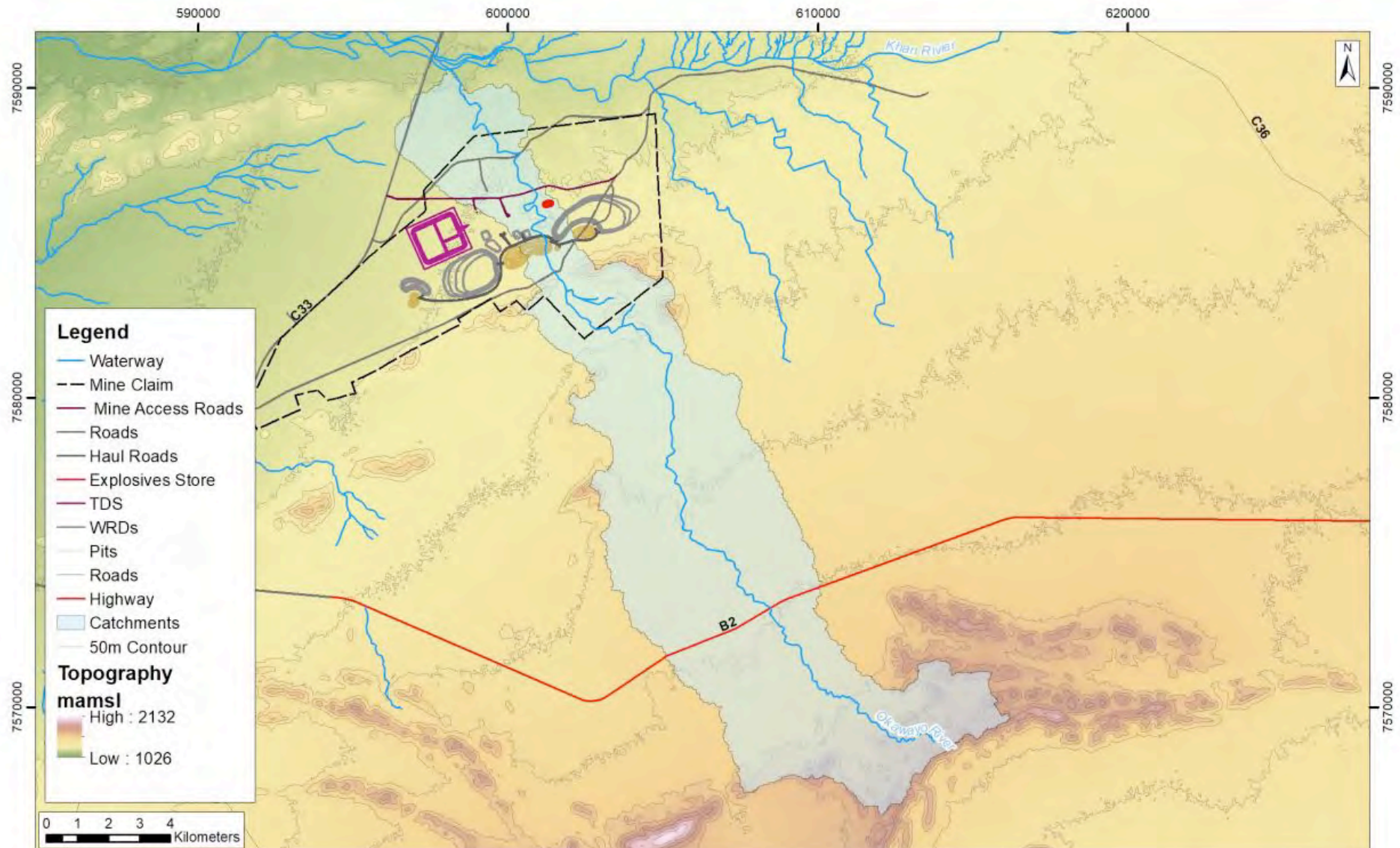


Figure 69 - Okawayo River catchment area (Source: (Knight Piésold, 2023))

5.15.1 STORMWATER CONTROL

Runoff generated within the planned mining area, processing plant, handling, haul, and waste management areas should be managed by adding stormwater infrastructure, consisting of diversion channels, silt traps, berms gutters, pollution control reservoirs, and other components. The infrastructure is required to prevent dirty water, which was in contact with the mining-related activities, to pollute the surrounding areas, and to allow for storage and retention of polluted water on-site (Knight Piésold, 2021).

(Knight Piésold, 2021) proposed that an attenuation dam be constructed upstream of the pit on the main catchment tributary, to prevent potential damage to infrastructure and pollution of the environment as result of a major flood event. During the DFS work conducted in 2023 by Knight-Piesold, this plan subsequently changed, mainly due to CAPEX related restrictions and a newly planned diversion with a Category 1 rubble masonry concrete (RMC) weir dam (8.8 m) and spillway channel was proposed. This updated 2023 report can be viewed in Appendix E. Details related to this new design is discussed further in the section below.

The main pit will be developed across the natural flow path of the Okawayo River (Figure 49), which is an ephemeral river that is prone to flash flooding during rainfall events. Without the implementation of a diversion system, large floods will impact significantly on mining operational activities and pose a safety hazard to employees operating on the mine, by flooding the main pit during storm events. The flood peaks were measured by (Knight Piésold, 2023) to determine various flood exceedance probabilities (AEP) and the anticipated flood line level that could arise if the main pit was flooded (Figure 70). It is clear that the main pit could be flooded up to a depth of 50 m originating from a 2-year AEP flood event ($\sim 0.6 \text{ Mm}^3$ from 42 mm rainfall-runoff generating over the entire catchment) and up to 140 mm depth in the event of a 200-year AEP flood event occurring ($\sim 5.8 \text{ Mm}^3$ from 118 mm rainfall-runoff generating over the entire catchment).

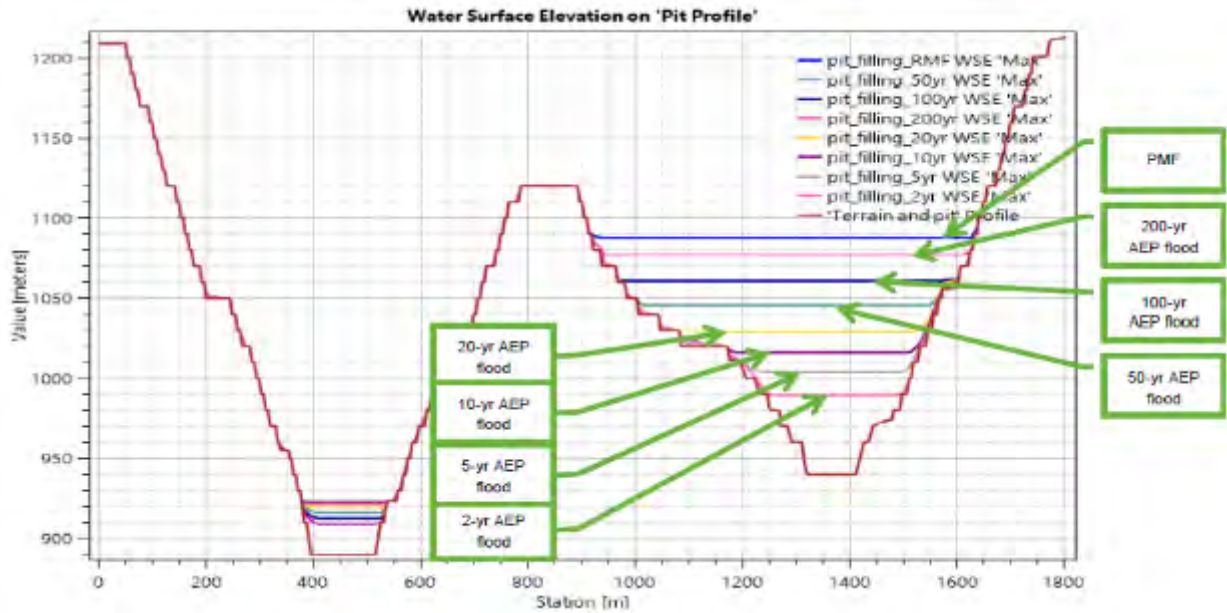


Figure 70 - Okawayo River catchment area (Source: (Knight Piésold, 2023)).

The RMC (Figure 71) and associated flood infrastructure (Figure 72) have been designed and sized to capture 50-year AEP peak flow events at the Main Central pit, that will discharge into the Cloud West pit. During period of greater flood events, the dam wall will overtop, and water will be routed to the Main Pit. Provision has been made in the pit to capture this water, whereby the Proponent will dewater the pit and utilise the water in the processing plant for operational activities. The dam structure is therefore being designed to account for safe overtopping during extreme flood events without compromising the structure integrity and the spillway channel must always be fully operational and maintained accordingly by the Proponent.

It is expected that the small reservoir formed upstream of the dam structure will fill with sand sediment transported during flood events over time and that little to no flood attenuation can be assumed once this happens. The spillway and discharge channel capacity are therefore sized to accommodate (20 m wide, 3 m deep) the unrouted design flood peaks (without allowing for attenuation), which is appropriately conservative. The length of the spillway is approximately 1.1 km downstream of the diversion structure. The flow velocity is expected to be 1.2 m/s based on results of the mild slope of the channel. A secondary benefit of upstream sedimentation is that the diversion structure will then essentially act as a sub-surface recharge dam that will provide a higher, beneficial, head for groundwater recharge (Knight Piésold, 2023).

Stored water in the Cloud West pit during normal 50-year flood events will be used as additional storage for the mine's operational requirements over the life of mine, especially in the first couple of years of operations when the focus will not be directly to mine this pit. The pit capacity is adequate to store up to approximately one fifth of 50-year AEP and will overtop for larger duration storm events to the Main Pit. Water flowing from the pit must be routed back into the downstream watercourse and the detail of this design is still to be confirmed.

The construction of the spillway and channel is expected to require excavation in medium to hard rock and would require little to no additional lining to protect the structure against erosion during operations. However, this assumption will need to be reviewed once additional geotechnical investigations are conducted along the spillway before construction commences (Knight Piésold, 2023).

The RMC weir is considered a small wall size and will be designed as a gravity monolith with the majority of its length assumed to be an emergency spillway. Considering the flat catchment and ephemeral flow regime, effective early flood warning systems should be considered by the Proponent as part of their emergency response and preparedness during flood events. The selected spillway design (1 in 50-year flood event) for a dam with a low hazard risk rating is in accordance with the South Africa National Committee on Large Dams (SANCOLD) guidelines (1991).

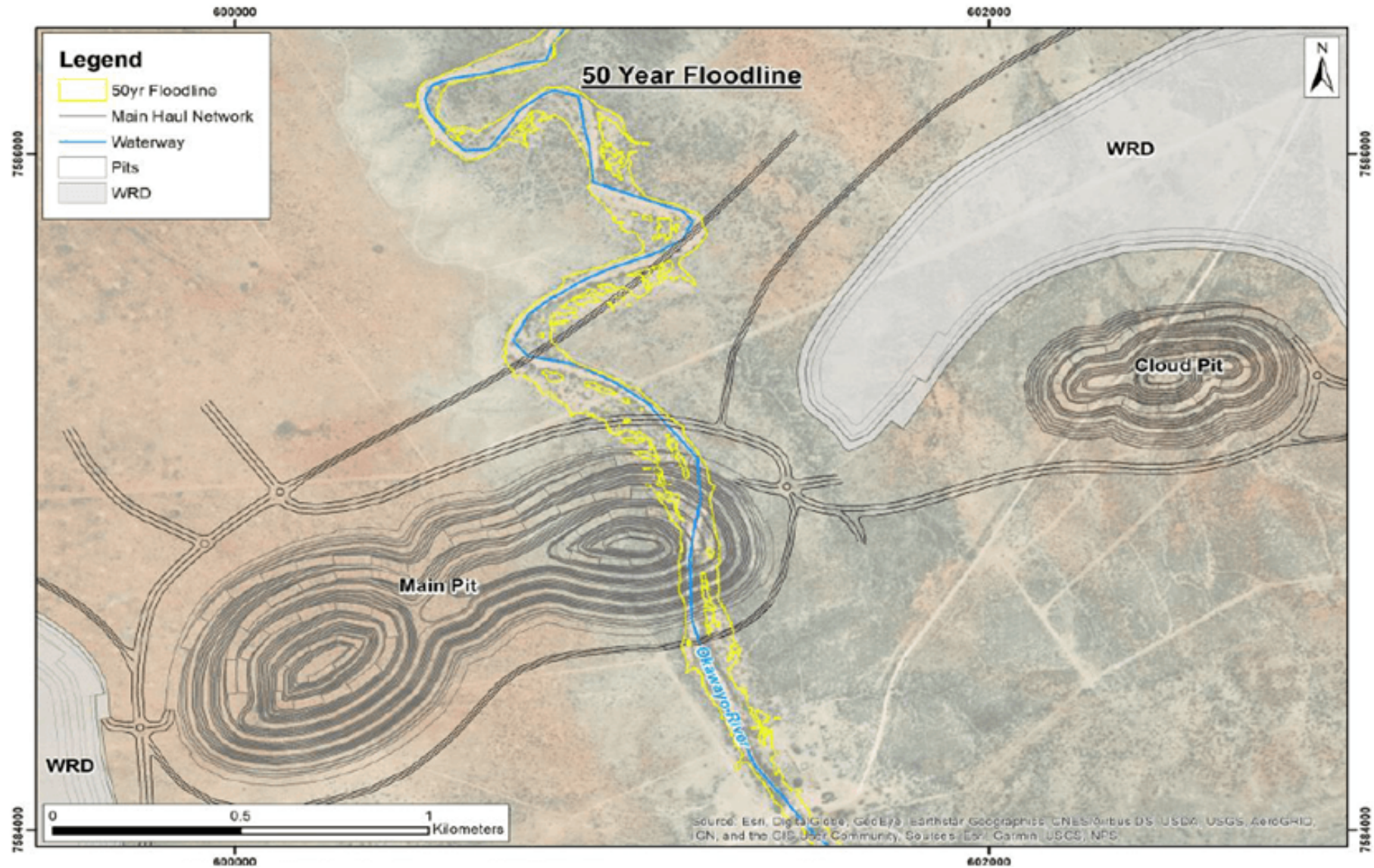


Figure 71 - The 50-year AEP floodline of the Okawayo River (Source: (Knight Piésold, 2023).

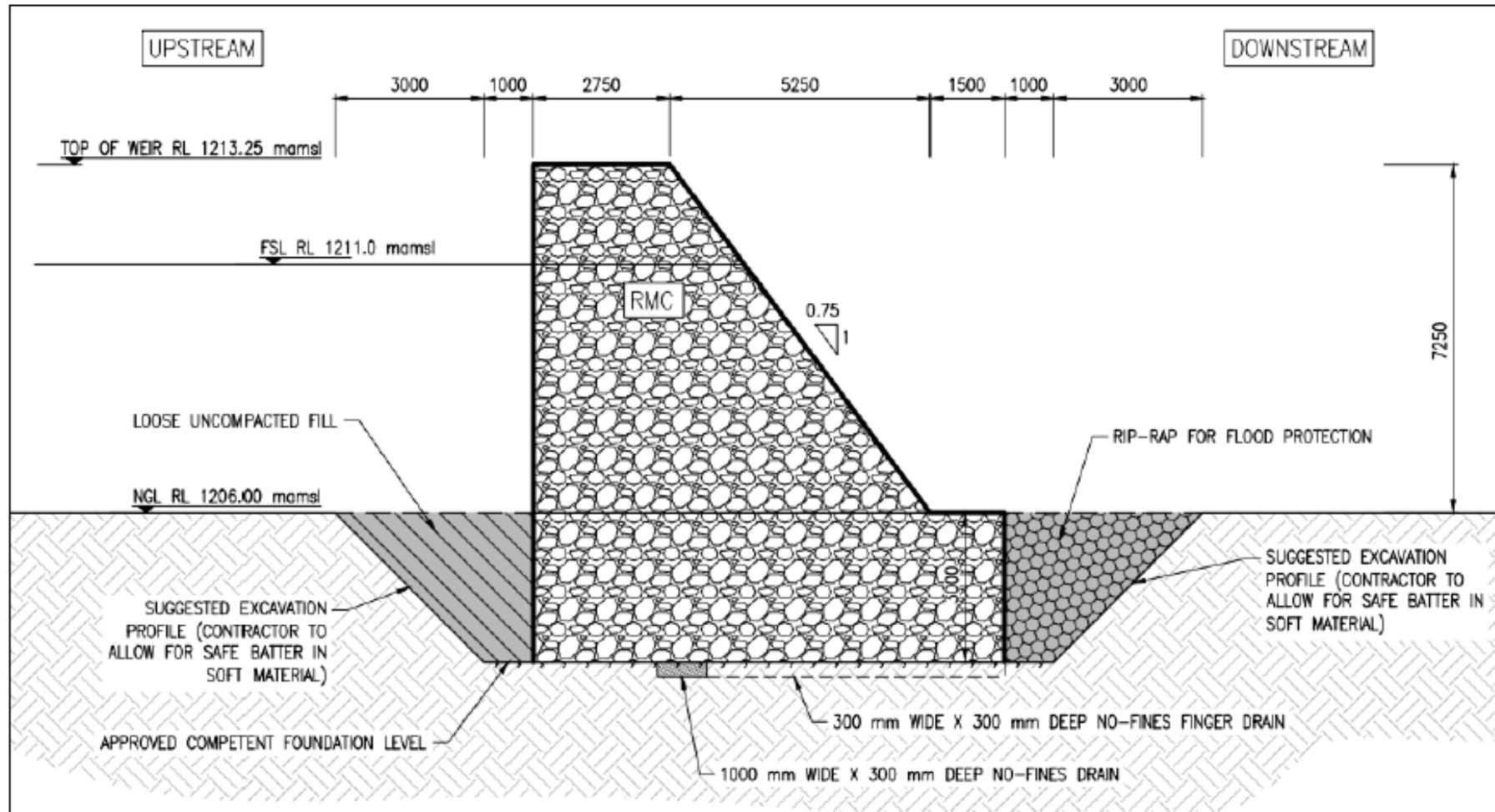


Figure 72 - Cross section of the Category 1 rubble masonry concrete (RMC) weir dam (Source: (Knight Piésold, 2023))



Figure 73 - The river diversion layout, southern structure indicates RMC, spillway channel is indicated in yellow, small pit indicates Cloud West pit (green), large pit indicates Main Central pit (Green) (Source: (Knight Piésold, 2023))

5.15.2 SITE WIDE WATER BALANCE

The Twin Hills Project site has a net water deficit and therefore various investigations were undertaken by (Knight Piésold, 2023) to investigate supplementary water sources to meet operational water demand requirements. This report can be viewed in Appendix E. These include assessing groundwater supply through borehole pumping and surface water run-off through pit dewatering options. Evaporation estimates from water storage in the open pit(s), groundwater inflows and rainfall are considered in the water balance model by Knight-Piesold.

The key component that contribute to water supply for the Twin Hills Project are:

- Sub-surface water supply through abstraction boreholes;
- Seasonal run-off generated from the upstream catchment, stored in the reservoir created by the diversion structure and mined out pits;
- Groundwater seepage into the pits through recharge events; and
- TSF seepage collection pond return (to be determined).

The current operational process methodology is designed to maximise water reuse on site through water recycling initiatives, with a focus on the process plant water reuse through filtration systems throughout the processing plant. It is expected that approximately 77% of water contained in the tailings material is recycled in the plant before the tailings waste material is sent to the tailings storage facility. The remaining water in the tailings material will be lost, mainly due to evaporation. Other water losses expected include losses to the processing plant operations and gland water. Details from the TSF are still to be refined and the surface water collection potential from this facility should be incorporated into the overall site water balance.

Seven scenarios were run by (Knight Piésold, 2023) to determine the site water balance requirements from on-site water sources (Figure 74 to Figure 80).

These scenarios are summarised as the following:

Scenario 1: Full groundwater supplies available for plant supply (abstraction and pit dewatering through seepage). Diversion structure applied in year 4 of operation with the Cloud West pit used as an additional storage reservoir. Plant demand is 1.112 Mm³/a.

Scenario 2: No groundwater supply through abstraction. Diversion structure applied in year 4 of operation with the Cloud West pit used as an additional storage reservoir. Plant demand is 1.112 Mm³/a.

Scenario 3: No groundwater supply through abstraction. Cloud West pit supply ignored when constraints in place. Diversion structure is applied in year 4 of operation. Plant demand is 1.112 Mm³/a.

Scenario 4: Full groundwater supplies available for plant supply. Cloud West pit supply ignored when constraints not in place. Diversion structure is applied in year 4 of operation. Plant demand is 1.112 Mm³/a.

Scenario 5: Full groundwater supplies available for plant supply, however a drought condition is applied, 7 years of drought over the first 7 years of operation, after which average climatic

conditions apply. Diversion structure applied in year 4 of operation with the Cloud West pit used as additional storage reservoir. Plant demand is 1.112 Mm³/a.

Scenario 6: Increase in plant demand to 1.5 Mm³/a when full groundwater supply available for plant supply. Diversion structure applied in year 4 of operation with the Cloud West pit used as additional storage reservoir.

Scenario 7: Increase in plant demand to 1.5 Mm³/a when full groundwater supply available for plant supply, however not utilising the Cloud West pit as additional water supply. Diversion structure applied in year 4 of operation.

Modelling has determined that the operational demand of the processing plant can be met by water supplied by groundwater abstraction boreholes and pit dewatering through the life of mine (Scenario 1). The use of groundwater as the main source of water is essential for operations. Occasional surface water runoff will be diverted from the Okawayo River to the Cloud West pit, after the pit is fully mined. The use of surface water runoff for life of mine is uncertain, as flood and rainfall events cannot be predicted. The impacts of the Cloud West pit as a storage reservoir on the overall groundwater recharge still needs to be evaluated in greater detail.

The water balance modelling also considered the sensitivity of supply based on increased plant demands, the exclusion of the abstraction boreholes supply, extended drought periods and the exclusion of the Cloud West pit as a storage reservoir. It was determined that the security of water supply is extremely sensitive to borehole supply (Knight Piésold, 2023), with deficits expected in the initial years of the Project and in the dry seasons of the latter years if borehole supply is ignored. These deficits would thus require additional sources of water supply.

If boreholes supply is considered, then the impact of drought is negligible. Additionally, if the borehole supply is met for operational requirements, then the use of the Cloud West pit for storage is not required. However, the modelling results should be a clear benefit to utilise surface water from storage on the Cloud West pit.

The maximum pit dewatering abstraction rate from the main pit is estimated to be 292 m³/hr. The maximum dewatering rates for the Cloud, Cloud West and West pit(s) are 65 m³/h, 127 m³/h and 35 m³/h, respectively.

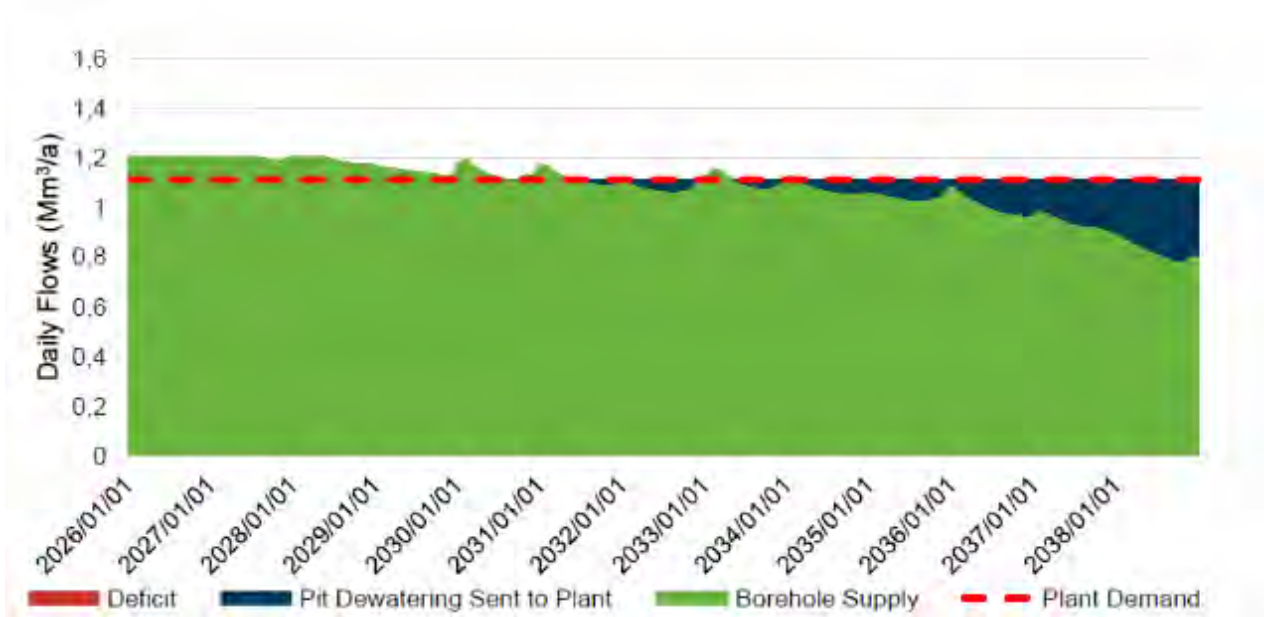


Figure 74 - Water supply/deficit for Scenario 1 (Source: (Knight Piésold, 2023)).

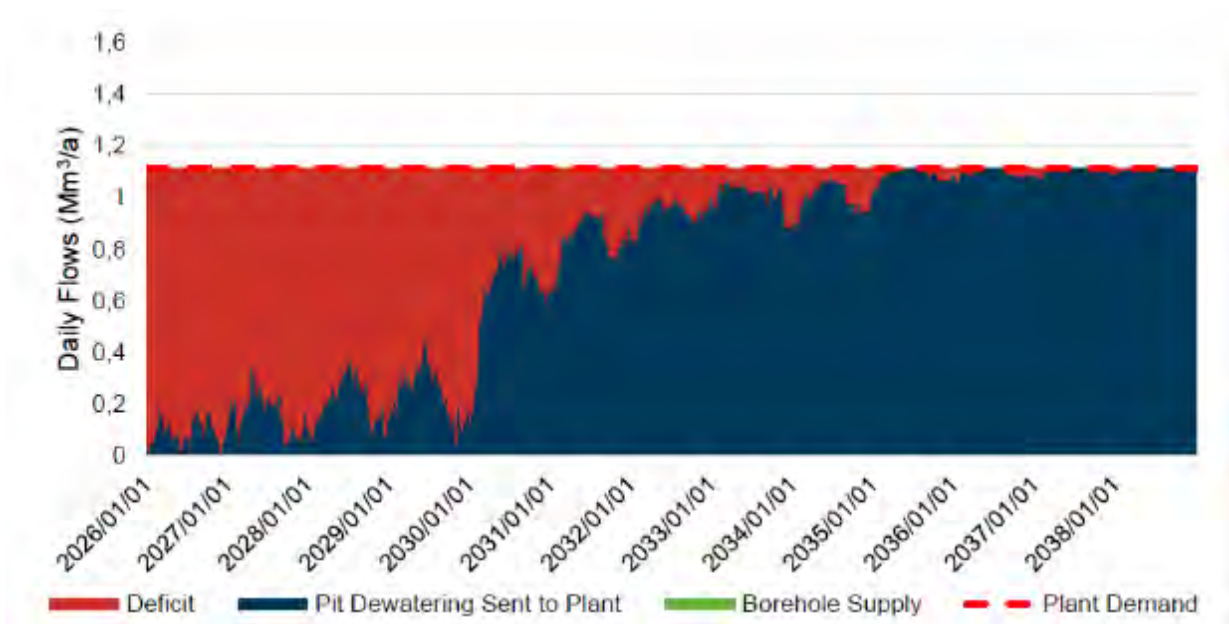


Figure 75 - Water supply/deficit for Scenario 2 (Source: (Knight Piésold, 2023))

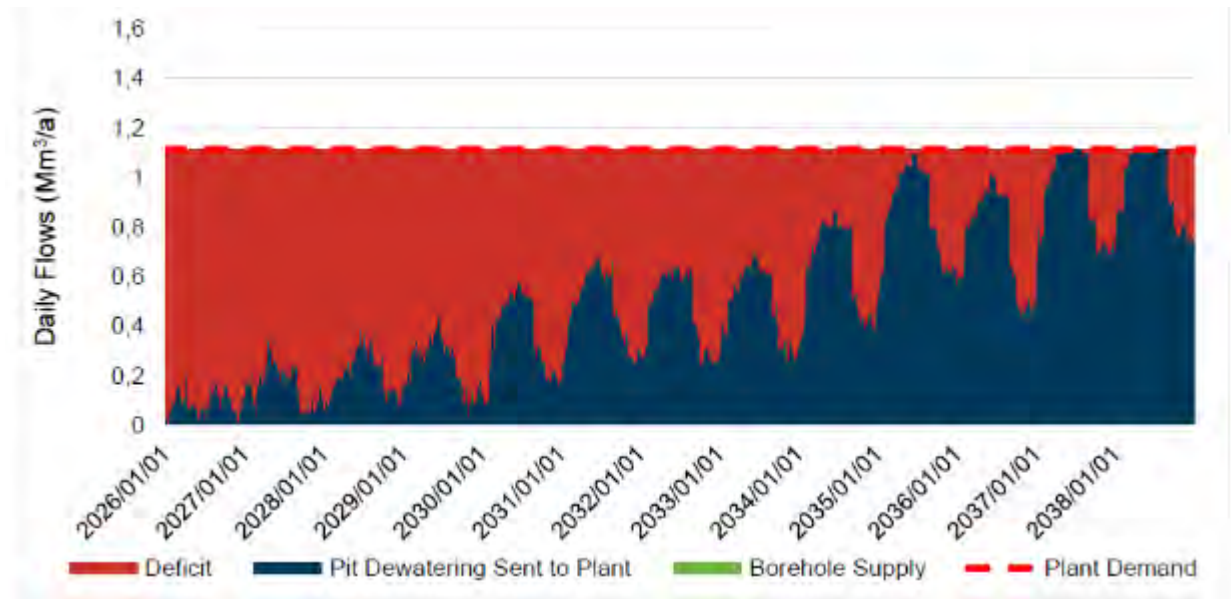


Figure 76 - Water supply/deficit for Scenario 3 (Source: (Knight Piésold, 2023))

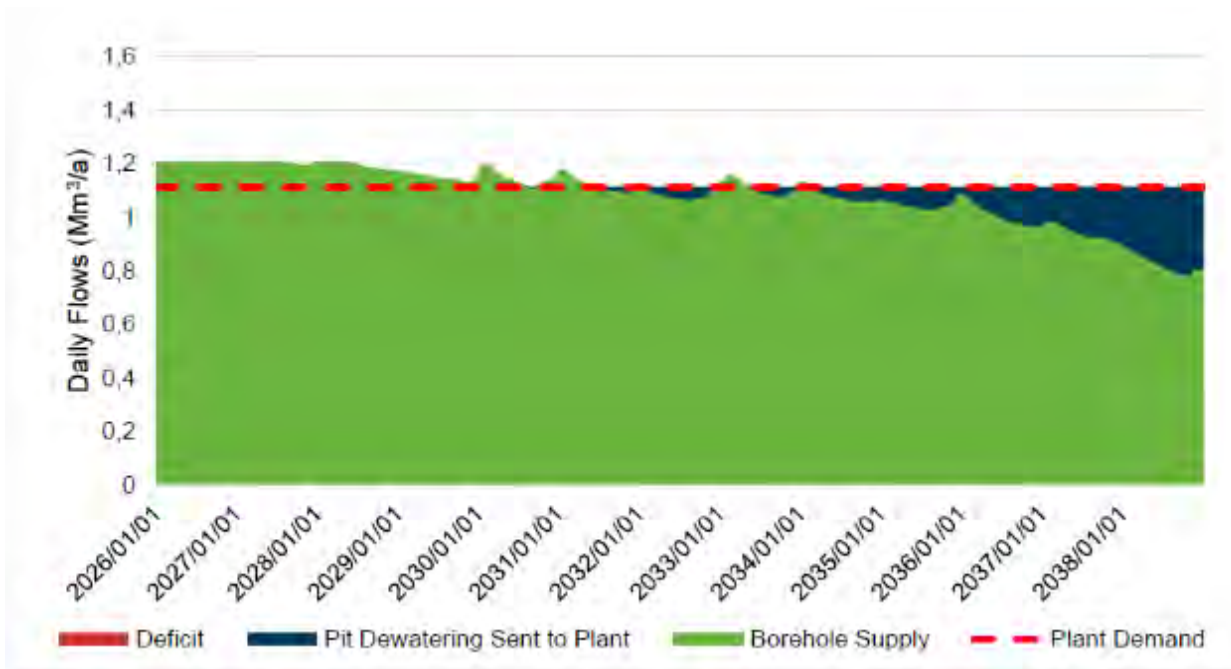


Figure 77 - Water supply/deficit for Scenario 4 (Source: (Knight Piésold, 2023))

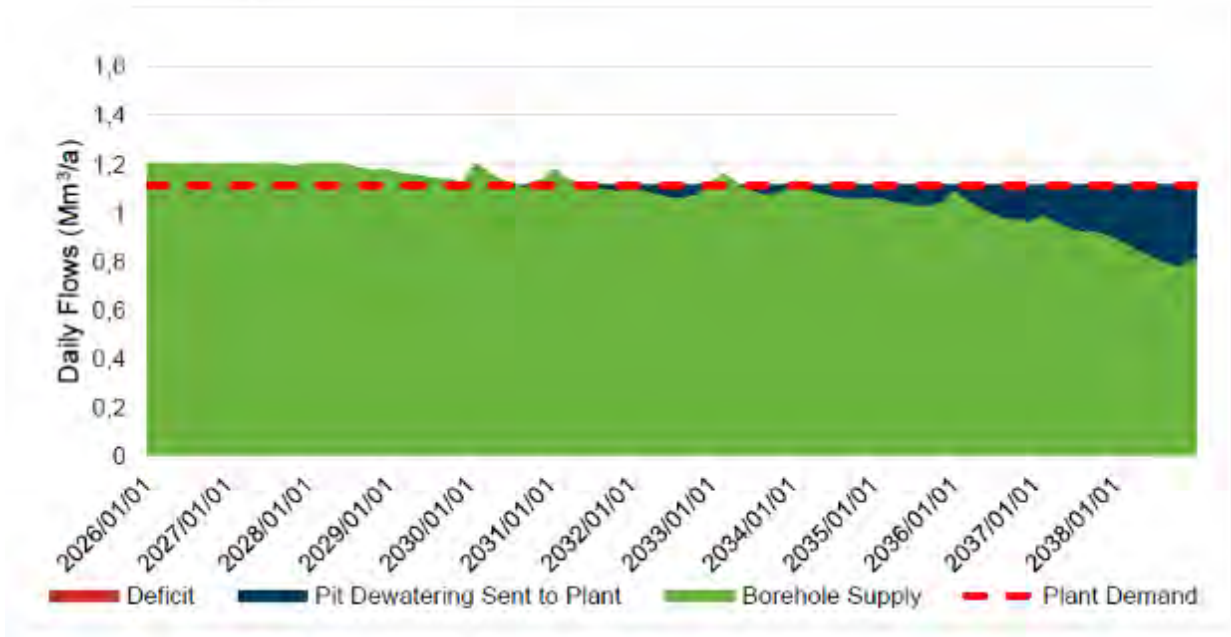


Figure 78 - Water supply/deficit for Scenario 5 (Source: (Knight Piésold, 2023))

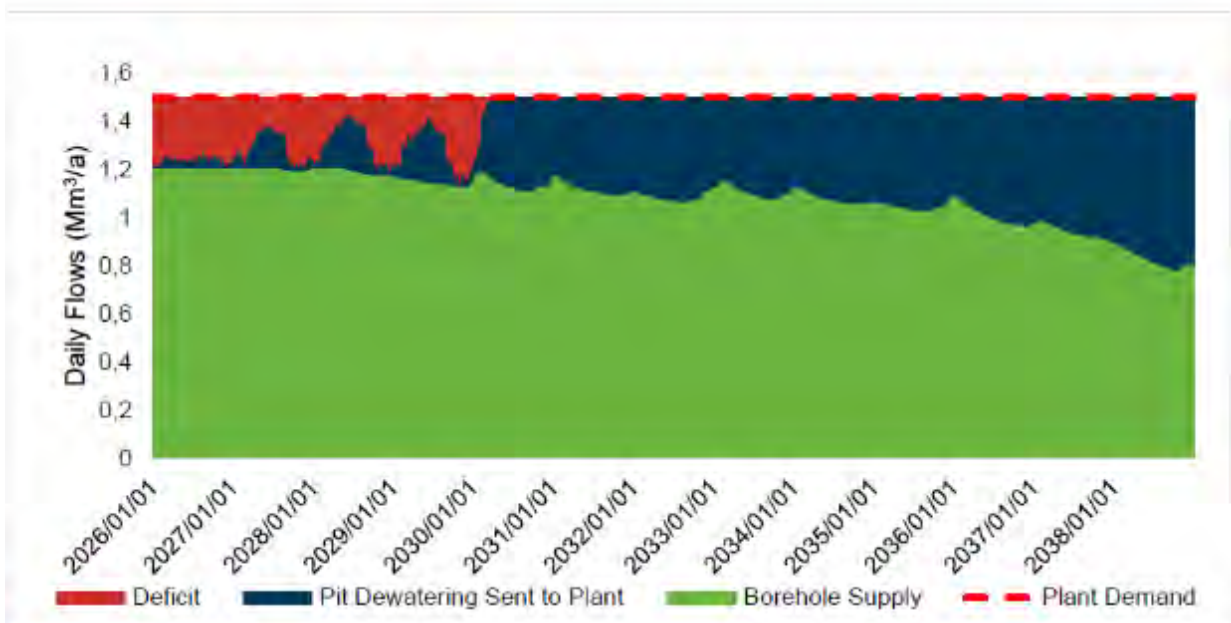


Figure 79 - Water supply/deficit for Scenario 6 (Source: (Knight Piésold, 2023))

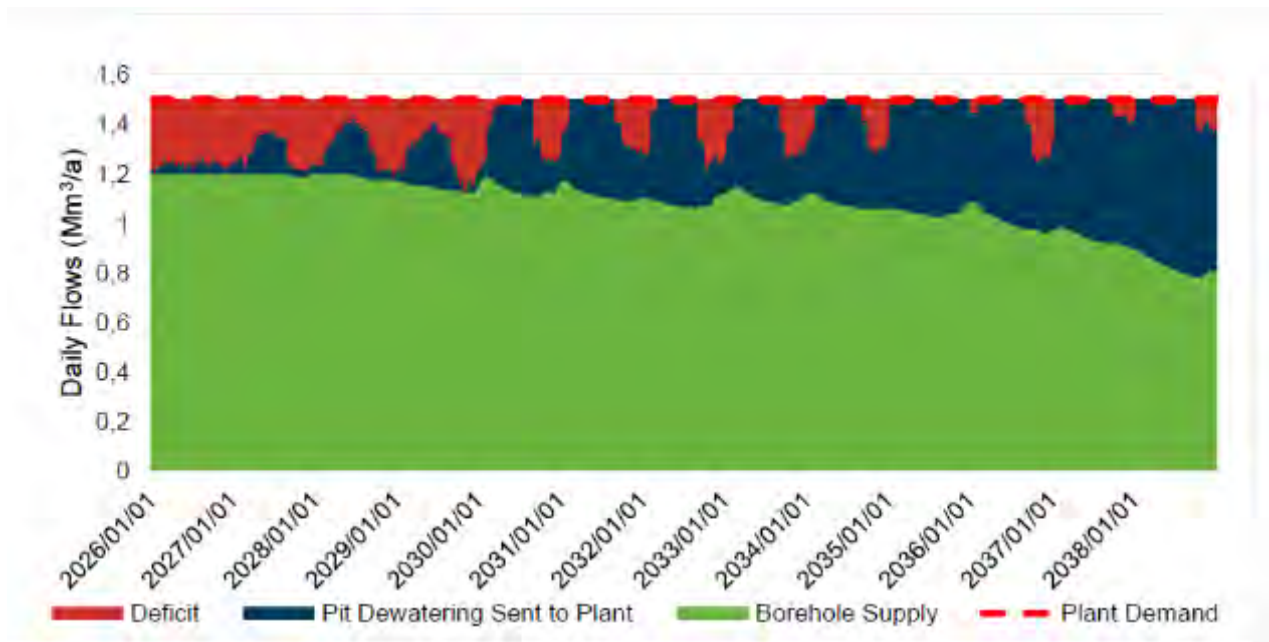


Figure 80 - Water supply/deficit for Scenario 7 (Source: (Knight Piésold, 2023))

5.15.3 MINE WATER SUPPLY AND RELATED STUDIES

The current mine design indicates a daily requirement of approximately 3013.7 m³/day (1.112 million m³/annum) for the estimated 5.2 million tons per annum (mtpa) ore throughput, to sustain mining operations and related activities.

Water supply options that were addressed in the (SLR, 2020) Report, were as follows:

- Three potential local dam sites on the Khan River, with catchment areas ranging from approximately 2 100 km² to 2 400 km² (Figure 81);
- Obtaining a water use license from the existing NamWater Swakoppoort to Karibib Pipeline, provided that there is sufficient capacity for mining activity;
- Planned desalination pipeline, which will primarily be used to support the Central Area of Namibia (CAN). According to the CAN Surface Water Augmentation Report, the desalination pipeline will supply water at the earliest in 10 years; and
- Groundwater supply from boreholes.

Long drought periods of up to seven years, typically referred to as critical periods, are common to the Namibian climate. During a long critical period, the groundwater table drops significantly due to limited recharge, causing some boreholes to dry up. Similarly, surface water sources, which are already stressed, might not be able to support priority users, resulting in water restrictions being enforced to prevent the failure of the water resource. Local dam options are typically developed over a long timeframe, in excess of 5 to 10 years, due to land acquisition, environmental and social studies, and full design and construction cycles. Developing water resources is also very costly due to the aforementioned factors (Knight Piésold, 2021).

The pipeline route for the desalination support to the CAN will follow the B2 Road from Swakopmund to Okahandja, adjacent to the mining operation. Water supply from the desalination pipeline will be costly due to the high pumping costs and the expensive desalination process itself. The desalination plant and pipeline are planned to be implemented in 2031, and it is estimated that one cubic meter of water is going to cost more than N\$ 45 at 2020 infrastructure costs. The unit cost is likely going to increase significantly, due to the inflation of electricity and general costs (Knight Piésold, 2021).

As of 2023 through the BFS investigations, it is confirmed that the main water supply to be provided for operational purposes is through nine (9) groundwater abstraction boreholes, with water being supplemented by the Cloud West pit. Alternative water supply from NamWater, Karibib Town wastewater treatment works and an augmentation scheme on the Khan River are currently being investigated and will not form part of this assessment report. A memorandum of understanding and agreement has been signed between NamWater and Osino in August 2023 to commence investigations to upgrade the Uakos Kranzberg scheme to supply additional water to the mine site for contingency planning.

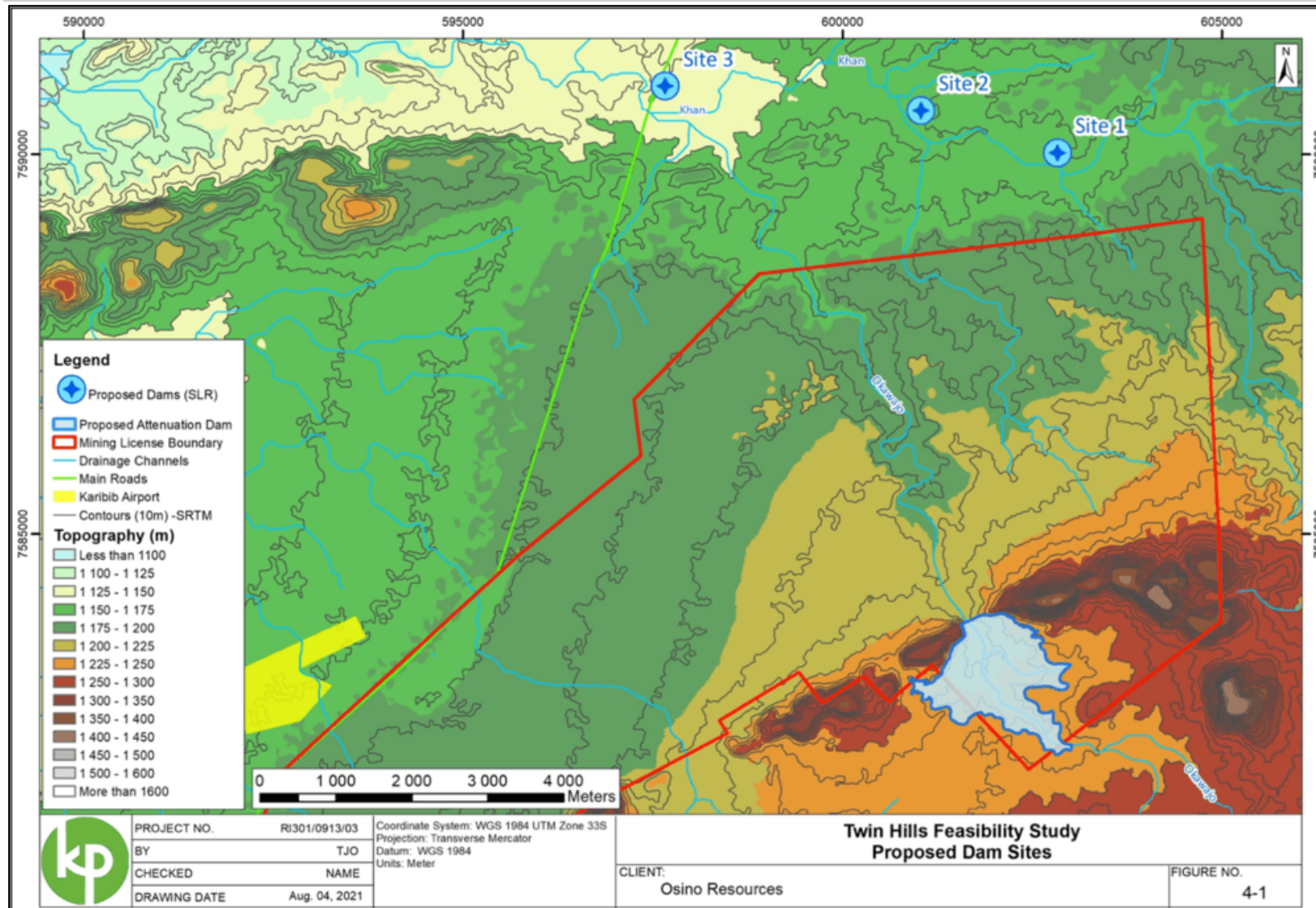


Figure 81 - Proposed dam constructions by SLR (2020) for surface water supply (Source: (Knight Piésold, 2021).

5.15.4 GROUNDWATER AND GEOLOGY

A desktop regional hydrocensus was conducted in 2020 (SLR, 2020) as part of the baseline studies, and a summary of the findings is presented here. Figure 82 provides a map of the classification of the aquifers and the hydrocensus results.

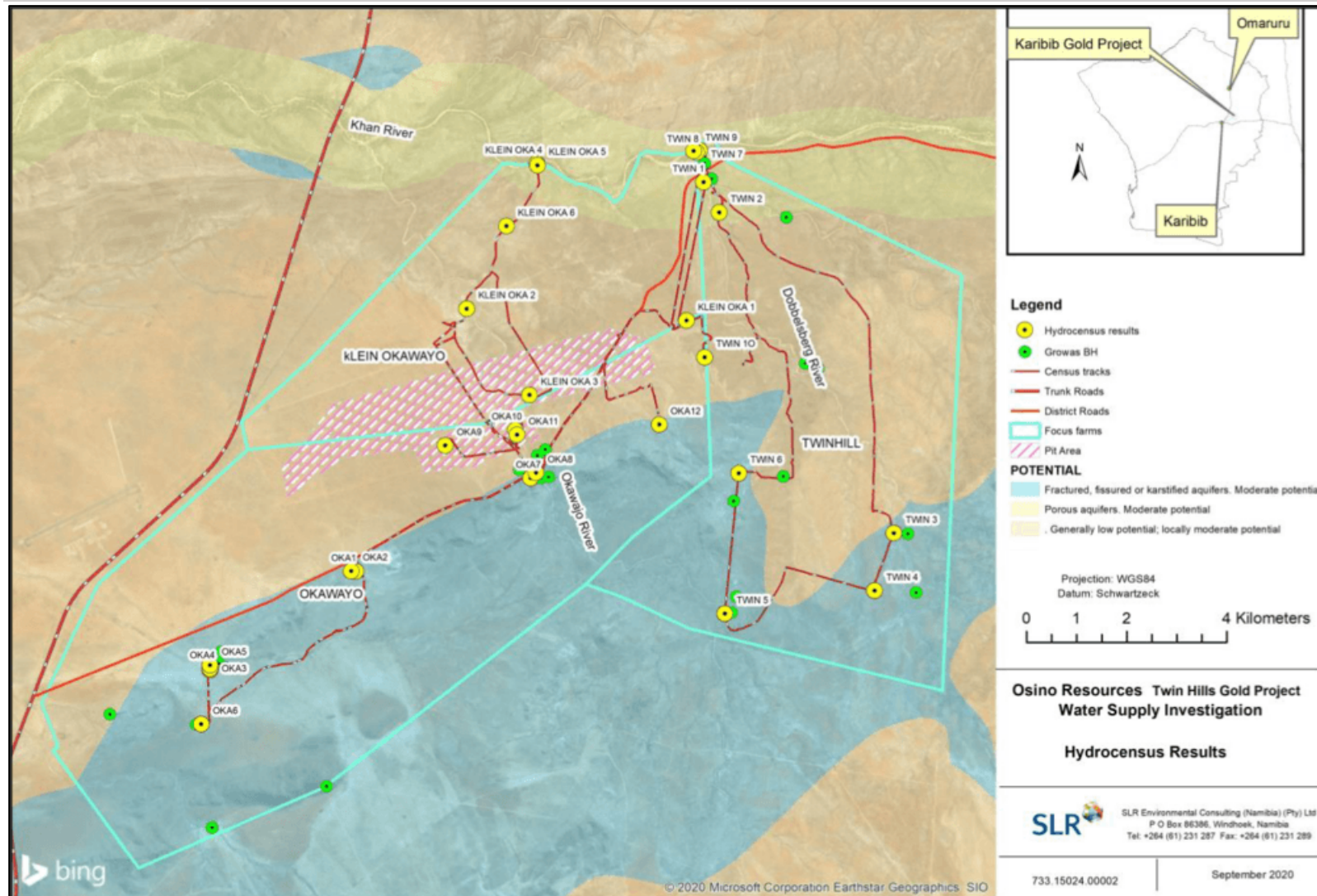


Figure 82 - Classification of aquifers and hydrocensus results (Source: (SLR, 2020).

The Project site falls within the Erongo groundwater basin. Twenty-four active boreholes were found in the Project area and show that the local groundwater table is relatively shallow, with water levels ranging from 6 m to 57 m below ground level. Groundwater is supplied from local boreholes to the farmers and quarry operations in the area. Borehole yields in the area are variable, and generally low, and the water quality is variable (SLR, 2020).

The regional general groundwater flow, interpolated from the GROWAS database produced by (SLR, 2020), flows in a north-westerly direction from the high ground of the Otjipatera Mountains, southeast of the B2, across the proposed mine pit zone and towards the Khan River.

Knight-Piesold have undertaken various drilling programmes to determine the groundwater resource potential and have conducted drilling and aquifer test pumping. Figure 83 indicates the distribution of boreholes that have been pump tested in 2021 (including those from the SLR, Nov 2020 report), with the associated individual yields. the accumulated indicative yield is indicated as 70 m³/hr (Knight Piésold, 2021).

Three aquifer types may occur in the area based on their geology and perceived groundwater potential. The first type is a porous aquifer of moderate groundwater potential that will be confined to the Khan River channel. The second type in the area is the fractured aquifer that occurs in the Kuiseb Formation greywacke and shales, and which generally has low to locally moderate groundwater potential. The third type is a fractured aquifer confined to the marbles in the southwestern part of the project site. Water in the latter two types generally occurs in faults and fractures.

Groundwater is the main source of water supply to the farmers and quarry operations in the area and is supplied from local boreholes. During the hydro-census conducted in 2020, 24 active boreholes were found in the Project area (SLR, 2020).

The 2021 investigation has shown that the main aquifer and likely water supply for the Project is the silicified marble contact of the Karibib Formation, which forms the high topography in the area. Due to the high porosity of this unit, the main recharge to the aquifer occurs along this marble ridge during rainfall events. To date, the focus for groundwater supply is from this domain.

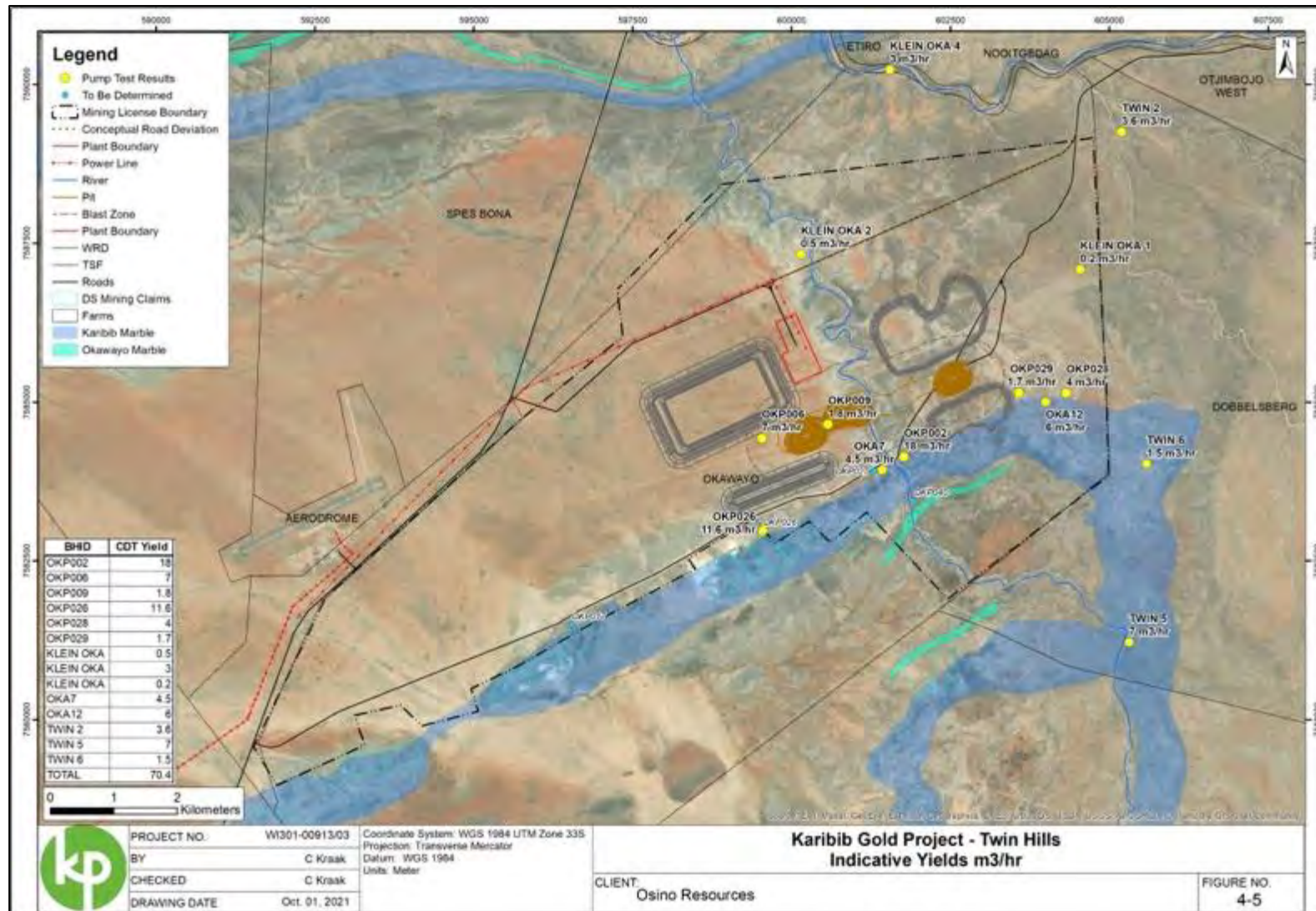


Figure 83 - Groundwater boreholes showing hourly yields (Source: (Knight Piésold, 2021))

Based on the (Knight Piésold, 2021) study, the following conclusions were made:

- The mean annual runoff volume for the catchment is expected to be 650 000m³, based on a unit runoff of 7 mm per annum over the catchment upstream of storm water control Option 1;
- The flood attenuation model captures multiple day events, indicating that a dam size of 17.9 million m³ is required to absorb a flood without any spills;
- The attenuated floodwater, in conjunction with a NamWater connection and/or groundwater resources, indicate that they can likely support the mining activities;
- The following recommendations were made:
 - The final dam and spillway capacity depends on a detailed financial and risk assessment, with detailed design;
 - A more detailed topographical survey upstream of the mine pit should be conducted to determine a more accurate inundation boundary near the existing farmhouse and other relevant structures;
 - Once the final mine layout is available, internal stormwater infrastructure and management should be assessed and stormwater intervention designed;
 - Review the proposed water supply options with the updated mine layout plan, as well as including the groundwater resource options; and
 - Evaluate the option of artificially recharging the marble contact aquifer by way of a subsurface dam/attenuation dam.

The hydrogeological site investigation from 2020 to 2023 conducted by Knight-Piesold, included geophysical surveying, drilling and test pumping to target potentially water-bearing structures and lithologies to determine aquifer hydraulic properties and evaluate groundwater resources as a potential water supply to the Project. This specialist report (Knight Piésold, 2023) can be viewed in Appendix E.

The conceptual hydrogeological model (Knight Piésold, 2023) (Figure 84) is shown below in a cross-section from north-northwest to south-southeast below and includes the proposed mine infrastructure (Central Pit and waste rock dumps) located on the Kuiseb Schists with the south limb of Karibib Marble syncline to the south of the Twin Hills, where the main water supply boreholes have been located.

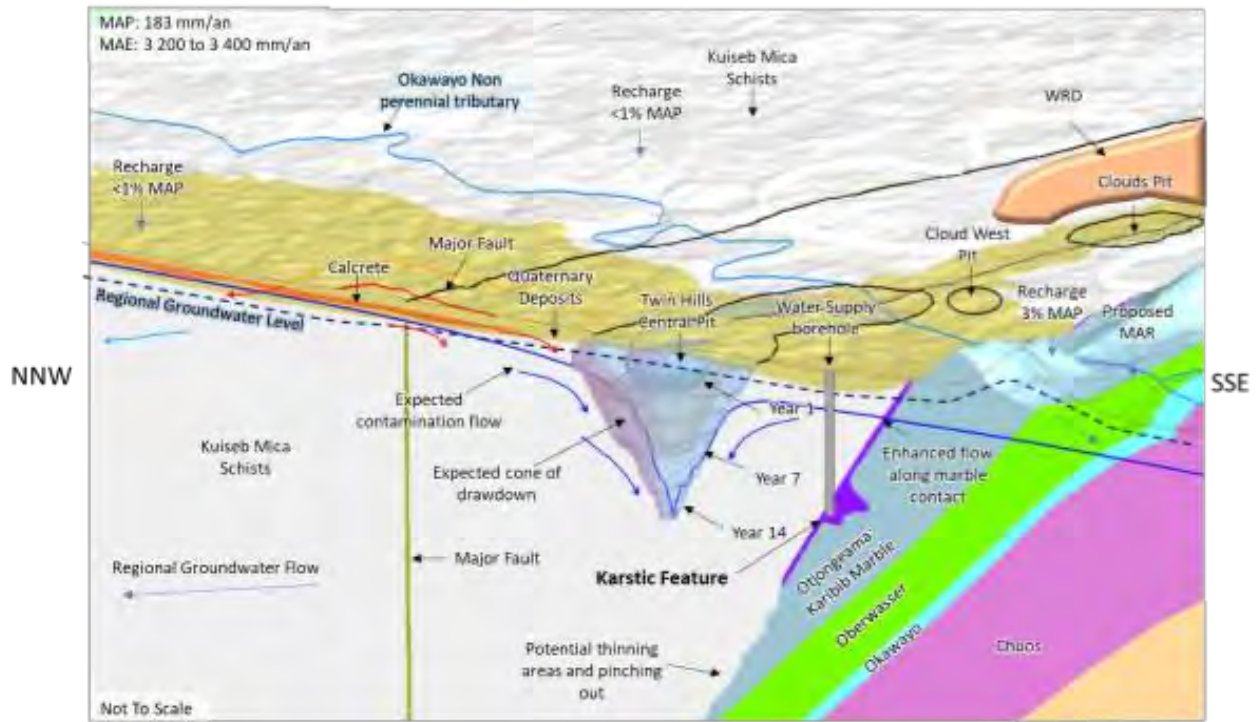


Figure 84 - Groundwater boreholes showing hourly yields (Source: (Knight Piésold, 2021).

Groundwater flow is towards the northwest and the Khan River is the receiving water body from an elevation of 1400 mamsl in the Karibib Marbles to the south of the mine pits and 1000 mamsl at the Khan River.

Groundwater levels are deeper in the Kuiseb mica schists (40 to 70 meters below the surface (mbs)) to 4 mbs in the alluvial aquifers associated with the Khan River. Static water levels in the marble are shallower than when intersected during drilling, indicating confined conditions in the karstic features. This means there is a poor correlation (60%) between topography and measured water levels across the site. The seasonal fluctuation of the water table is up to 2.5 m in the marble and 0.5 m to 1 m in the schists due to the higher recharge to the marbles (particularly where exposed as the calcsilicate ridges) (Knight Piésold, 2023).

In total the 26 boreholes drilled into the Kuiseb mica schists around/within the planned open pits confirms the low water permeability of the Project site, with minor secondary permeability developed in faults and fractures and associated with the northeast-southwest foliation. The bulk hydraulic conductivity is 0.01 to 0.03 m/day, with low maximum pumping yields of < 200 m³/day. Groundwater is localised in the schists and will likely be manageable as passive dewatering from in-pit sumps, although localised sub-horizontal drain holes may be required in zones of geotechnical weakness (Knight Piésold, 2023).

Based on the drilling of 58 groundwater exploration boreholes in the Karibib Marbles, this formation has the highest water supply potential. The test pumping yields of boreholes in the marbles varied from >2000 m³/day to seepage, consistent with the heterogeneity of the marble.

The weathered and exposed upper contact of the Karibib Marbles (hills to the south as the recharge zone) and minor karstification developed where late brittle faults orientated NNW to SSE crosscut through the marbles, have localised hydraulic conductivity of more than 20 m/day. The bulk marble matrix has lower water permeability (0.08 m/day) to impermeable, resulting in an effective hydraulic conductivity of 0.01 m/day for the Karibib Marbles due to the dual porosity (Knight Piésold, 2023).

A shallow alluvial aquifer is well developed along the Khan River, which is used as a water supply to the Erongo region and has been characterised through testing of 12 boreholes by (Knight Piésold, 2023).

Result from the groundwater quality assessment is summarised as the following:

- The total dissolved solids (TDS) ranges from 300 mg/l in the Karibib marble aquifer to 900 - 3000 mg/l in the Kuiseb mica schists.
- Active recharge from precipitation occurs in the karstic and silicified marble hills, with bicarbonate as the main anion and calcium as the major cation.
- There is less recharge and longer residence time in the mica schists due to the low permeability, resulting in higher concentrations of chloride, sodium and sulphate with elevated iron and aluminium in the groundwater samples.
- The alluvial aquifer has a mixed water quality type due to the interaction of surface water runoff and groundwater from the different lithologies.

Static and kinetic leach testing was also conducted of the altered and mineralised waste rock and tailings materials. Test results confirm that these materials are potentially acid generating (PAG), with higher sulphates resulting from the oxidation of sulphides. Aluminium and iron are flagged as potential metals of concern from the waste rock and arsenic from the tailings that could result in a deterioration in groundwater quality. The waste storage facilities such as the waste rock dumps (WRDs) and the tailings storage facility (TSF) could potentially impact the groundwater quality once mining operations commence and post-closure and this is further assessed and discussed in chapter 7 of the report.

Mitigations that are under further investigation to reduce impacts on groundwater include:

- The unaltered and unmineralised waste rock that is non-acid generating can be used to encapsulate the altered and mineralised PAG waste rocks;
- The TSF will be lined and subsurface drainage materials to neutralise any leakage or breach from the tailings; and
- The waste facilities are underlain by a thick unit of calcrete that will be subjected to kinetic column testing to determine the long-term neutralising potential of the *in-situ* subsurface.

Once the exploration program was completed from 2020 to 2023, the test pumping results were integrated into a FEFLOW numerical model to determine and evaluate groundwater resources to

meet the mines water demand, the abstraction boreholes sustainable yields and evaluate key risks and opportunities (Knight Piésold, 2023).

Conclusions and results from the modelling are discussed further below:

- Estimates of groundwater inflows to the pits were calculated over the life of mine (LOM). These estimates range from 0.21 Mm³/year in Year 1, increasing to a cumulative maximum of 1.71 m³/year in Year 10 when all pits (Central main pit, Cloud, Cloud West and West) are in operation. This indicates that during the commencement of mining, there will be a water supply deficit from pit dewatering activities until Year 7 in terms of meeting the mine's water demand of 1.112 Mm³/year.
- Pit inflows can be managed from in-pit sumping, provided the dewatering infrastructure is sized appropriately to include direct precipitation as well as predicted groundwater inflows.
- Active dewatering boreholes have not been included, as the passive inflows can be managed from in-pit sumps and the pore pressures remain at least 50 m behind the pit walls due to passive dewatering but may require localised depressurisation by sub horizontal drain holes behind disconnected structures or due to transient higher inflows following rainfall events.
- As makeup water to mine water supply, the groundwater exploration boreholes with the highest yields were included in the model, taking into consideration the overlapping impacts between adjacent boreholes being pumped simultaneously and the developing cone of drawdown of the water table induced by passive dewatering from the mine pits. The cumulative total yield of 6 boreholes is 1.2 Mm³/year, with an additional 3 in reserve.

The nine boreholes with sufficient sustainable yields are noted as: WW 206163, WW 206161, WW 205787, WW 206114, WW 206662, WW 206664, WW 206666, WW 206665, WW 206663 (Figure 84).

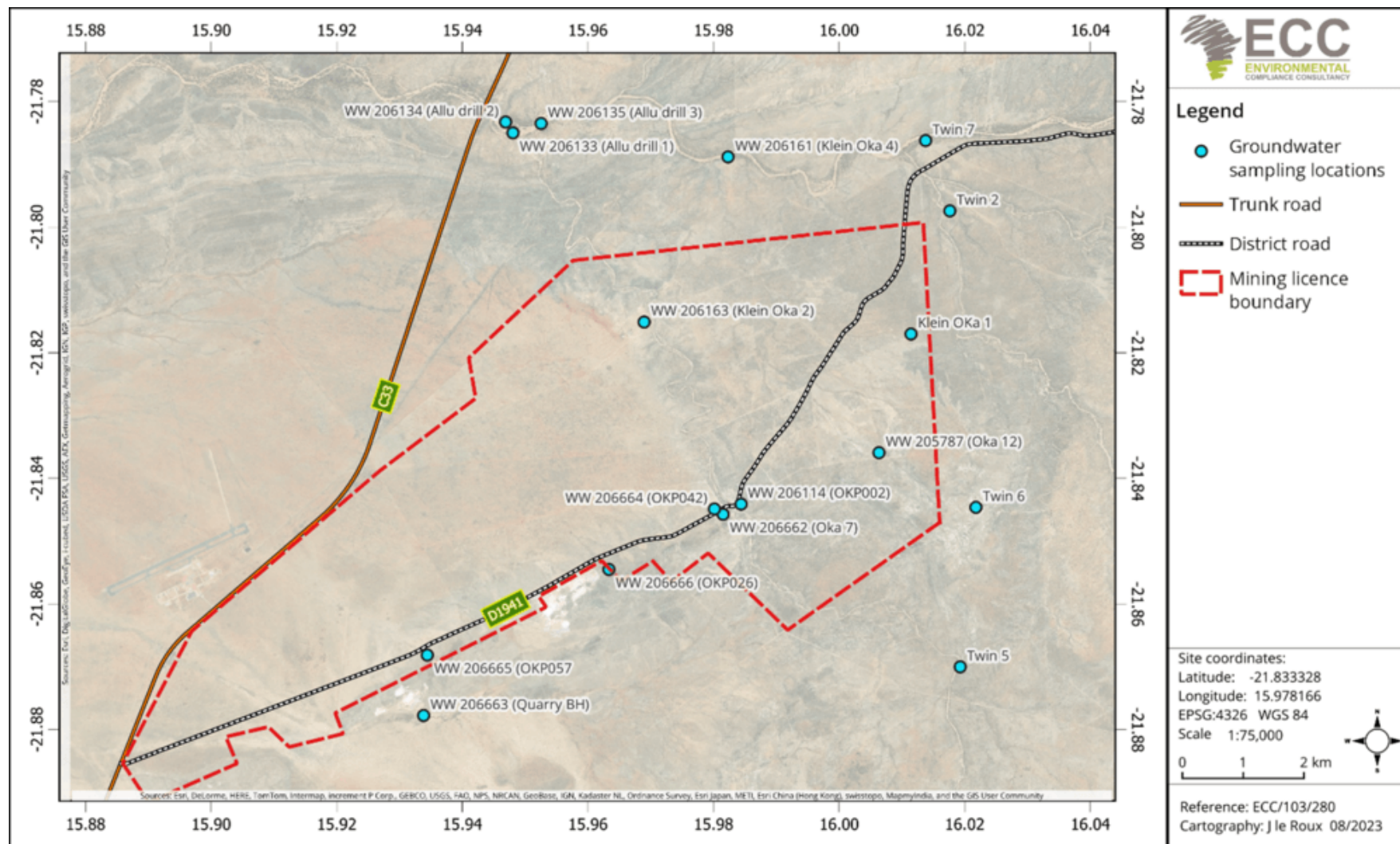


Figure 85 - Monitoring groundwater boreholes and nine abstraction boreholes indicated with sustainable yields for operational water supply as indicated by the pump test results and modelling by Knight-Piesold

- The mine water requirement of 1.112 Mm³/year is met from Year 1 to the end of LOM in Year 13, through a combination of the groundwater supply boreholes in the Karibib Marbles and the pit inflows which increase with the deepening pits.
- Most of the successful water supply boreholes are along the northeast-southwest striking the south limb of the Karibib marble contact, some of which are hydraulically interconnected based on test pumping results.
- The opportunity to recharge this aquifer via managed aquifer recharge (MAR) upstream along the Okawayo sub-tributary is conceptually under consideration as a mitigation to ensure the long-term sustainability of this aquifer. The model results indicate that MAR could provide an additional 0.2 Mm³/year, that would offset the gradual depletion of aquifer resources from the water supply boreholes towards the end of LOM, due to the developing cone of drawdown around the mine.
- The conceptual management of the Okawayo seasonal flows in a flood mitigation structure/sub-surface sand dam upgradient of the mine pits, will have the dual purpose of recharging the marble contact aquifer (MAR for mine water supply) and minimise ingress to the pits.
- The geotechnical rock mass ratings for the pits are generally high and the risk of excess pore pressures in weak rock mass has not been flagged as a requirement for depressurisation design work. As the foliation along the southern side of the pits dips into the pits, and there is a possible structure along the Okawayo valley which runs through the Central Pit, the pore pressures with the increased head of the flood mitigation structure/sub-surface sand dam upgradient along the Okawayo was modelled to simulate pore pressures that may develop along this face (Figure 86). The model outputs indicate a seepage face could develop, which may require localised depressurisation by sub-horizontal drain holes. The data collected from vibrating wire transducers being installed in boreholes will be used to quantify the risk and evaluate management opportunities.

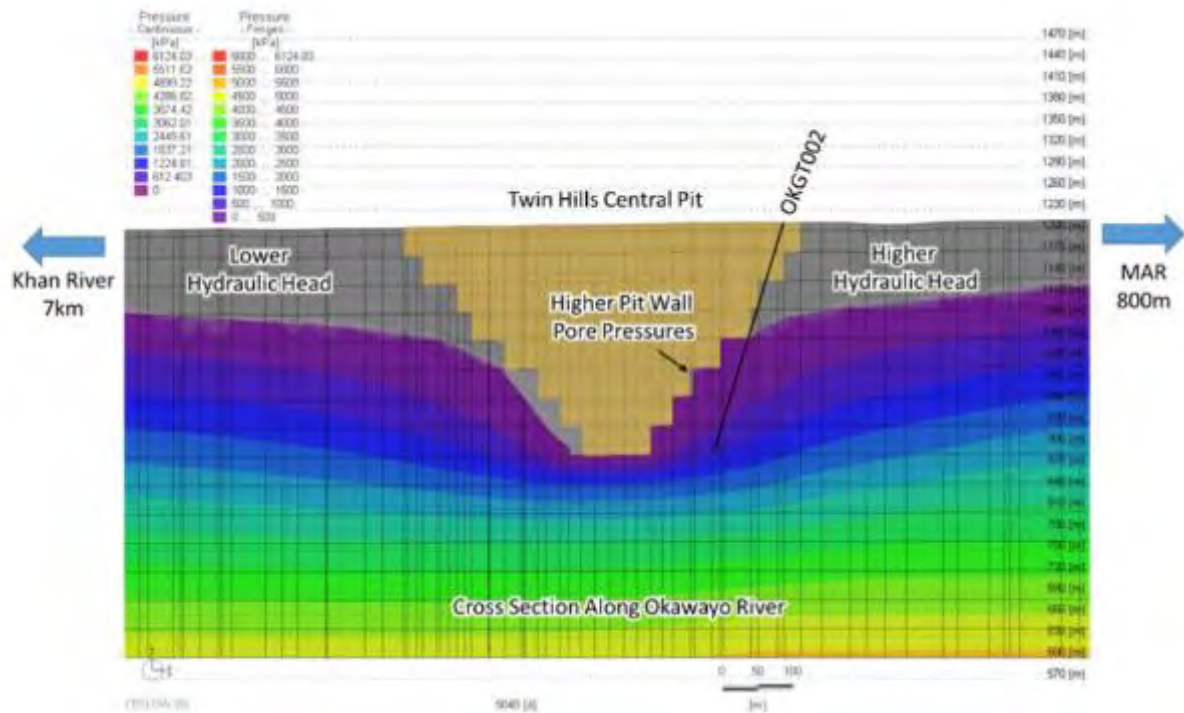


Figure 86 - Cross section along the Okawayo River indicating the Central main pit pore pressures from hydraulic head pressures (Source: (Knight Piésold, 2023).

- The cumulative cone of drawdown due to passive dewatering of the open pits and the water supply boreholes will be elongated towards the northeast-southwest along the strike of the orebody and parallel to the southern limb of the Karibib Marble. Two of the water supply boreholes are located on the northern limb of the Karibib Marble anticline and close to the Khan River.
- Managed aquifer recharge (MAR) of the water supply boreholes is under consideration to increase the sustainability of the aquifers due to the cone of drawdown but there are no boreholes used by farmers that will be impacted as shown in Figure 87.

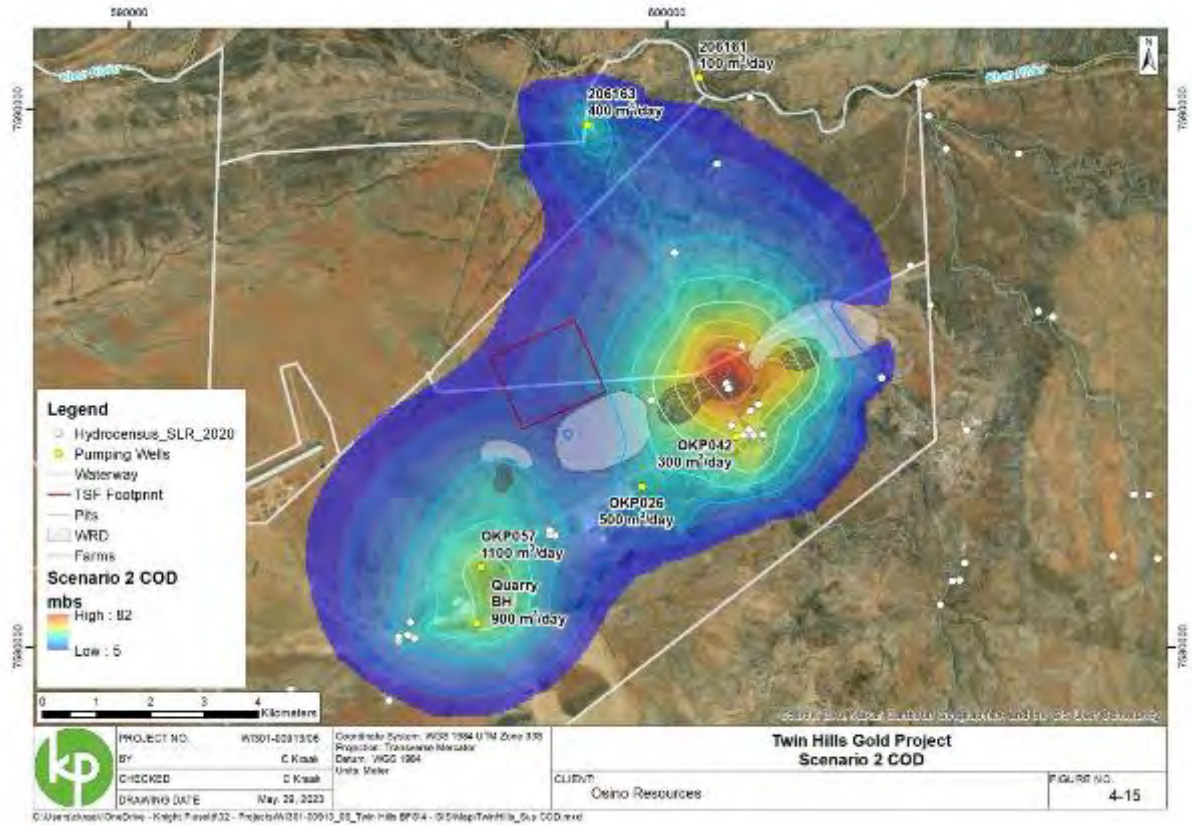


Figure 87 - The Osino Twin Hills Gold Project cumulative cone of drawdown (Source: (Knight Piésold, 2023)).

- Contaminant transport modelling of sulphate representing possible plume migration from the lined tailings storage facility (TSF) and waste rock dumps (WRDs) indicates the drawdown cone development around the pits effectively captures the plume during operations and post-closure due to the pits being terminal sumps (meaning that due to the low rainfall, high evaporation rate and the low permeability of the pit rock types, the static groundwater table will not fully recover to pre-mining level and groundwater will continue to flow towards the pits).
- The plume extent from all the WRDs over LoM extends less than 180 m from the WRD footprints. Following 50 years post-operation, the plume will have migrated less than 250 m from the WRD footprints and the simulated seepage from the lined TSF is within 35 m from the footprint as shown in Figure 88.

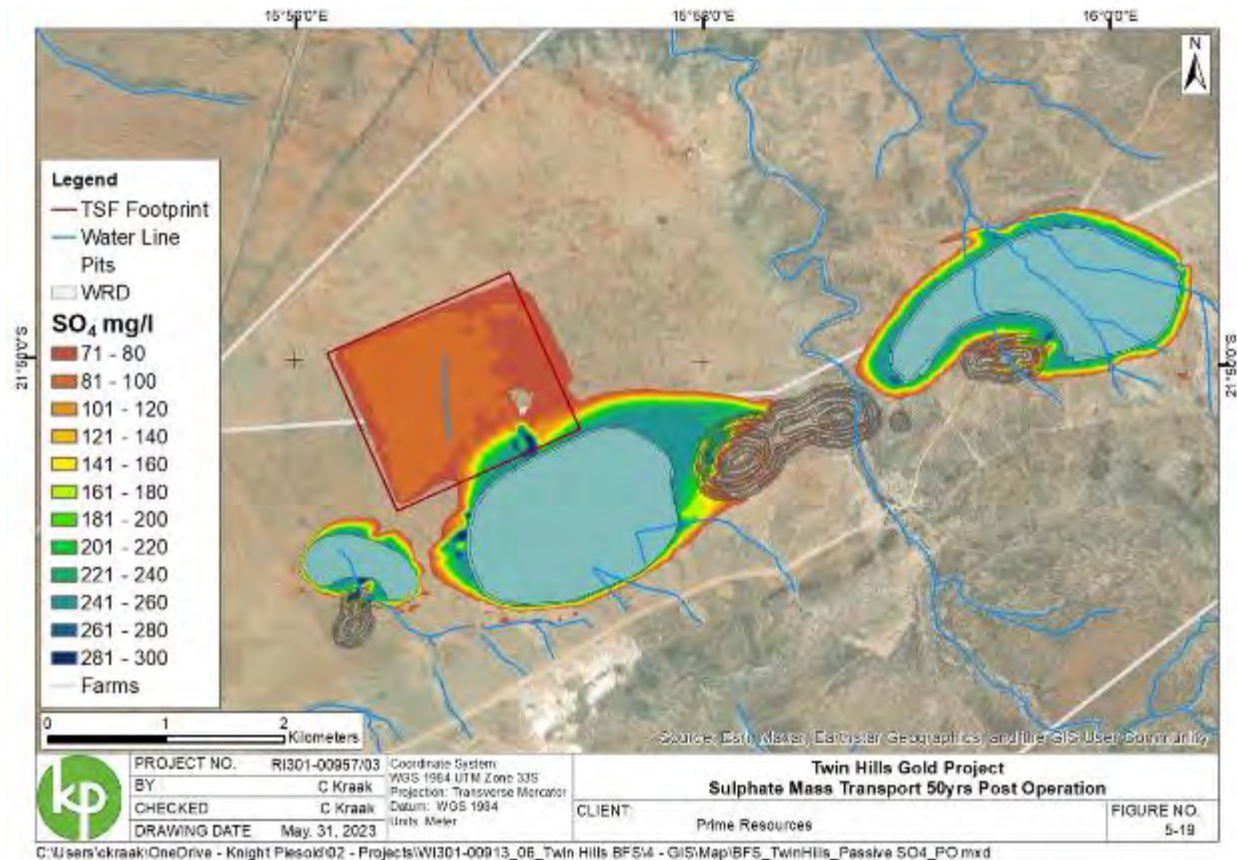


Figure 88 - The Osino Twin Hills Gold Project sulphate mass transport model (Source: (Knight Piésold, 2023).

5.16 BIODIVERSITY

The farmland of Twin Hills Properties is located approximately 12 km northeast of the town of Karibib and about 25 km south of the Erongo inselberg mountains in the Erongo region of central Namibia. The farm is located within the Central-Western Plain Landscape and the Western Highlands Acacia vegetation type of the Tree-and-Shrub Savanna biome dominated by low shrubby Acacia species. The rocky hills to the south have elements of the Central-Western Escarpment and Inselbergs vegetation type of the Nama Karoo biome. The area has an expected plant diversity of about 200 species of which about 40 are endemic to Namibia; about 70 mammal species, 190 bird species with 10 endemics, and about 55 reptile species of which 15 are endemic.

The average annual rainfall in the area is about 200 mm per annum and falls mainly between January and March. On average there are just 25 days each year with more than 1 mm of rain. The rainfall is both unpredictable and highly variable, with a coefficient of variance of about 60%. There have been years when the area received less than 70 mm. Hours of sunshine and solar irradiance are both high in national and international terms, with an average of more than 10 hours of sunshine per day over the year, and an average of over 8 kilowatt-hours per square meter per day, respectively. As a result, average maximum summer temperatures are high at about 36° C, while average minimum winter temperatures are about 6-8° C. Evaporation rates are also high at about

2,500 – 2,600 mm per year, giving an annual water deficit of about 2,300 – 2,400 mm per year and a Global Aridity Index of 0.08 - 0.10, which classifies the area as “arid”. Over the period 2040 to 2060, the temperature is expected to rise by about 3° C and the rainfall to decline by 20 – 30 mm per year, or about 12.5%. These changing parameters resulting from climate change have a compounding negative impact on soil moisture which in turn leads to a reduction in soil cover. As a result, the present average agricultural carrying capacity for the area is likely to decrease from the present 15-20 kg per ha to about 10 kg per ha.

(Cunningham, 2021) undertook a rapid assessment study (screening initial Project options, including winter and summer biodiversity surveys) and a baseline study (fixed project scope) of the vertebrate fauna and flora. Subsequently due to the Project layout changes in 2023, a desktop reassessment was conducted (Cunningham, 2023) looking at the areas of vegetation and faunal habitats that would be impacted by the new/altered infrastructure, within the Project site. The reports are provided in Appendix F. The potential impacts are assessed and discussed in the assessment chapter of this report (chapter 7) and the mitigation measures are included in the ESMP (Appendix A).

5.16.1 ECOSYSTEM SERVICES

Ecosystem services are services that provide benefits to humans and influence human wellbeing. The Project falls within an ecosystem zone known as the Western Highlands. The broad drivers of change in this zone, with ecosystem related specific pressures are:

- Habitat change through overgrazing,
- Exploitation by groundwater abstraction and increase in livestock numbers,
- Pollution,
- Invasive species,
- Climate change (particularly drought) and
- Illegal use through poaching.

Whilst the Project is not expected to negatively impact these systems within the Western Highlands zone, some could potentially be affected if not addressed adequately during the Project lifetime (Cunningham, 2023).

The following provisional services could be affected (Cunningham, 2023):

- Livestock habitat change by converting farming area to non-farming areas;
- Wild animals habitat change by increased disturbance and potential for poaching;
- Flora utilised for material and energy use (e.g. firewood, charcoal etc.);
- Surface water changes due to damming and soil disturbance influencing runoff and downstream ecological processes; and
- Ground water through abstraction and potential contamination.

These services would influence local populations and the change in flow over the past 50 years has increased due to an increase in human population and exploitation. Services related to food, surface water and groundwater are expected to increase as the human population increases.

Rangeland degradation due to overgrazing is expected to increase, whilst the carrying capacity decreases. Farmland becomes more arid due to climate change influences. Wood required for fuel and building materials is expected to continue.

The following regulation and maintenance services could be affected (Cunningham, 2023):

- Soil formation and composition through land clearing and erosion;
- Ground water recharge (erosion, dams, increased abstraction, increased runoff);
- Mediation of waste and pollution (usage of chemicals);
- Global and regional climate regulation (erosion, land clearing); and
- Ventilation and transportation (vegetation clearing).

The population expected to be affected is local (e.g. soil formation/composition), regional (e.g. waste, toxins, rainfall, temperature) and global (carbon sequestration), dependent on scale. The change in flow over the past 50 years has resulted in rangeland deterioration, erosion and soil fertility issues due to overgrazing, this is expected to increase especially with desertification. Absorption and dilution of pollutants in ecosystems has increased due to an increase in human populations due to rapid rural and urban population growth. The most significant increases in flow relate to the provision of water, particularly for urban residents, irrigation and livestock (Harper-Simmonds et al., 2016). No significant groundwater recharge and carbon sequestration in this zone.

The following cultural services could be affected (Cunningham, 2023):

- Physical interactions, for example interactions dependent on workforce; and
- Spiritual, symbolic and intellectual interactions, for example tribal interactions dependent on workforce.

Tourists to the zone are mainly associated with services related to wildlife and recreational tourism has increased over the past 50 years significantly, this is still expected to increase with improved access and facilities. Poaching of wildlife could also influence tourism.

In conclusion, certain ecosystem services may be affected as large areas would be cleared of vegetation and/or covered by rock with potential negative erosion and groundwater impacts (mainly provisioning, but also regulation and maintenance services) (Cunningham, 2023). Ecosystem impacts are further assessed and discussed in the assessment chapter of this report (chapter 7). Mitigation measures related to construction, operations and decommissioning has been incorporated into the ESMP.

5.16.2 FLORA

A literature review of the vegetation done by (Cunningham, 2021) (Cunningham, 2023), the ecologist undertaking the baseline study and site visits, determined that the area around Karibib is commonly referred to as the Semi-desert Savannah and Transition Zone (Giess, 1971) (Van der Merwe, 1983) or as the Western Highlands, as described by Mendelsohn *et al.* (2002). This semi-desert and savannah transition zone, as referred to by (Giess, 1971) is typified by shrubs such as

Blepharis pruinosa, *Leucosphaera bainesii*, and *Monechma genistifolia*. Larger woody species such as *Acacia erioloba* are confined to the drainage lines.

It has been estimated that at least 74 to 101 larger tree and shrub species, and up to 80 grass species occur in the general Karibib area, of which a high proportion are endemics.

Summer field studies have been undertaken for the Twin Hills Gold Project. Vegetation was lush following exceptional rains during December 2020 and January 2021. Three zones of vegetation were defined, the plains, hills and rivers. Protected tree species that occur within these zones include: *Acacia erioloba*, *Albizia anthelmintica*, *Aloe littoralis*, *Boscia albitrunca*, *Cyphostemma currorii*, *Faidherbia albida*, *Ziziphus mucronata*, *Commiphora glaucescens*, *Commiphora virgata*, *Euphorbia guerichiana*, *Euphorbia avasmontana*, *Ficus cordata*, *Maerua schinzii*, *Moringa ovalifolia*, *Sterculia africana*, *Combretum imberbe*, and *Euclea pseudebenus*. These trees provide habitat or food for much of the fauna that is found in the area. Large trees are found along the drainage lines and should be protected.

The greatest biodiversity will be found on the marble ridge, and although some of its length is excluded from the gold mining activity, potential cumulative impacts associated with the dimension stone quarrying activities of the neighbours are likely.

Seventeen grass species were identified during the field study, as were several invasive and alien vegetation types, mainly in the vicinity of the farmhouses. The invasive species will need to be removed, particularly where they are invading along drainage lines.

The most important areas identified were the following:

- The limestone/marble hills and ridges (Figure 89);
- The ephemeral watercourses (Figure 90); and
- The ephemeral pans (Figure 91)



Figure 89 - An image showing the vegetation on the marble ridge during the rainy season (Source: (Cunningham, 2021))



Figure 90 - An image showing the vegetation on the Project area during the dry season (Source: (Cunningham, 2021)).



Figure 91 - An image showing vegetation within an ephemeral riverbed (Source: (Cunningham, 2021).



Figure 92 - An image of a pan with large trees creating a habitat for unique vertebrate species (Source: (Cunningham, 2021).

5.16.3 FAUNA

The Twin Hills Gold Project is located in an area of high biodiversity according to The Atlas of Namibia (Mendelsohn et al. 2002). Distribution maps show a high probability for the occurrence of leopard, brown hyena and African rock python. Various endemic reptiles and scorpions are also expected to potentially occur in the area. The area is also known for high levels of endemism for birds. Figure 93 renders an image of a rodent and lizard species.

The variety of geomorphological units (hill slopes, marble ridge, grasslands and streams) provides a number of diverse habitats, making it likely that there will be an equally high level of faunal diversity in the area. It is estimated that at least 75 species of reptile, 7 amphibian, 88 mammal, and 217 birds occur in the general/immediate Karibib area, of which a high proportion are endemics (e.g. reptiles ~45.3%).

The summer field investigation and results of surveys undertaken by the specialist in the same area confirmed that at least 34 species of mammals are present, including leopard and African wildcat. Another 3 species that were observed are: impala, Burchell's zebra, and eland but these were not included in the count as they were probably introduced to the game/hunting farm Okawayo.



Figure 93 - Photos from the field biodiversity survey (Cunningham, 2021).

Of the reptiles, only 12 species were confirmed from the area, which included 1 terrapin, 4 skinks, 3 Old World lizards, 2 agamas and 2 geckos. The farm manager confirmed another 8 species, which include: tortoise, python, 4 typical snakes (including black mamba), monitor lizard and a chameleon. Thus 20 species are confirmed from the area. A total of ± 26 species are confirmed if one includes species identified by the ecologist on other studies in the surrounding area.

The recent 2021 rains contributed to standing bodies of water on the farm and in the drainage lines. Most were unfortunately muddy and *Phrynomantis annectens* tadpoles were only seen in one drinking trough. Seven species of amphibians, of which 2 are endemic, are expected to occur in the area.

Field work confirmed the existence of 56 bird species of the 217 expected from the literature reviews. A total of at least 108 species are confirmed from the general area, with the inclusion of the farmer's sightings and other studies by the ecologist. The most important species confirmed from the area during the field work are Monteiro's hornbill (endemic), Kori bustard (NT), white-backed vulture (E), lappet-faced vulture (V), and secretary bird (V).

5.16.4 INITIAL BIODIVERSITY BASELINE ASSESSMENT OUTCOMES

As an introduction to scoping out the potential impacts that could result from the Project, the specialist (Cunningham, 2021) stated the following:

All developments change or are destructive to the local fauna and flora to some or other degree. Assessing potential impacts is occasionally obvious, but more often difficult to predict accurately. Such predictions may change depending on the scope of the development, i.e. development, once initiated, may have a different effect on the fauna and flora than originally predicted. Thus, continuing monitoring of such impacts during the Project's phase(s) is imperative.

5.16.5 UPDATED 2021 BASELINE ASSESSMENT OUTCOMES

The initial baseline study included an earlier high-level assessment of the various alternatives that were presented during the screening phase of the ESIA (Cunningham, 2021). Thereafter, some aspects of the Project changed, and certain alternatives were discarded. The baseline study was updated to consider the fixed options for the assessment phase Cunningham (2021b). In light of these initial scope and layout changes of the Project, the following potential infrastructure impacts were assessed and are further discussed below.

Vertebrate fauna species most likely to be adversely affected by the proposed mining/prospecting in the Twin Hills Gold Project areas would be sedentary species (i.e. species with limited mobility), such as unique reptiles (i.e. tortoises *Stigmochelys pardalis* and *Psammobates oculiferus*; pythons – *P. anchietae* and *P. natalensis*; Namibian wolf snake (*Lycophidion namibianum*) – *Varanus albigularis*; some of the endemic and little-known gecko species, e.g. *Pachydactylus* species; and species viewed as "rare", i.e. *Rhinotyphlops lalandei*, *Mehelya vernayi*, and *Afroedura africana* (although very little is known about these species). Amphibians are not viewed as important in the area and mammals are more mobile. Although important species are known to occur and/or pass through the area, none are expected to be specifically associated and/or expected to be negatively affected by the developments. Although general disturbances could affect bird species of concern, i.e. species classified as endangered (violet wood-hoopoe, Ludwig's bustard, white-backed vulture, black harrier, tawny eagle, booted eagle, martial eagle, black stork), vulnerable (lappet-faced vulture, secretary bird), and near threatened (Rüppel's parrot, kori bustard, Verreaux's eagle, peregrine falcon, marabou stork), birds are also mobile and not limited to the area.

Flora species most likely to be adversely affected by mining/prospecting would be the various protected species, although these species are not specifically associated with the development sites. Important areas in the general vicinity are viewed as hills (limestone/marble hills), ephemeral drainage lines, ground dams and pans, and bird flight paths.

The WRD 2 would cover parts of the northern tributaries of the Okawayo River and should be avoided. The proposed water pipeline should not be placed above ground, as this would act as a barrier to ungulates and ostrich and should be buried.

Bird flight diverters (BDFs) should be attached to the proposed 66 kV transmission line from the tarmac road to the mine plant area, to minimise/prevent avifauna mortalities. These requirements have further been assessed through a different ESIA process for the 66 kV overhead line.

Although the proposed Okawayo River diversion would affect vertebrate fauna and flora directly associated with the loss of habitat and thoroughfare, the diversion would eventually be vegetated again and serve the same purpose. This proposed diversion is viewed as the best option for the river diversion compared to other alternatives discussed in (Cunningham, 2021).

(Cunningham, 2021) determined that the Twin Hills Gold Project areas are unlikely to experience negative impacts on distinct vertebrate fauna and flora due to mining/prospecting developments. This is particularly true when considering the incorporation of suggested recommendations (mitigation measures) as potential offset measures.

5.16.6 UPDATED 2023 BASELINE ASSESSMENT OUTCOMES

After the updated 2021 assessment report, due to final layout and design changes for the Project, impacts have been reassessed by (Cunningham, 2023). Baseline conditions and potential impacts are further discussed below and assessed in chapter 7. Where observations and findings have not changed from the previous assessment reports, these are not repeated in this section. Changes to the design include the following: waste rock dumps location and size, tailings storage facility location and size, installation of a solar PV plant, 11 kV overhead line network(s), main mine access route, pit locations and size, airstrip, Okawayo River diversion and D1941 diversion.

(Cunningham, 2023) identified that the northern most waste dump would cover parts of the northern turbaries of the Okawayo River, this should be avoided where possible (Figure 94). See Figure 95 for the updated 2023 site sensitivities map, indicating sensitivities buffer zones.



Figure 94 - 2023 Waste rock dump outlines. White dashed arrow through northern waste rock dump indicates tributary to be avoided (Source: (Cunningham, 2023)).

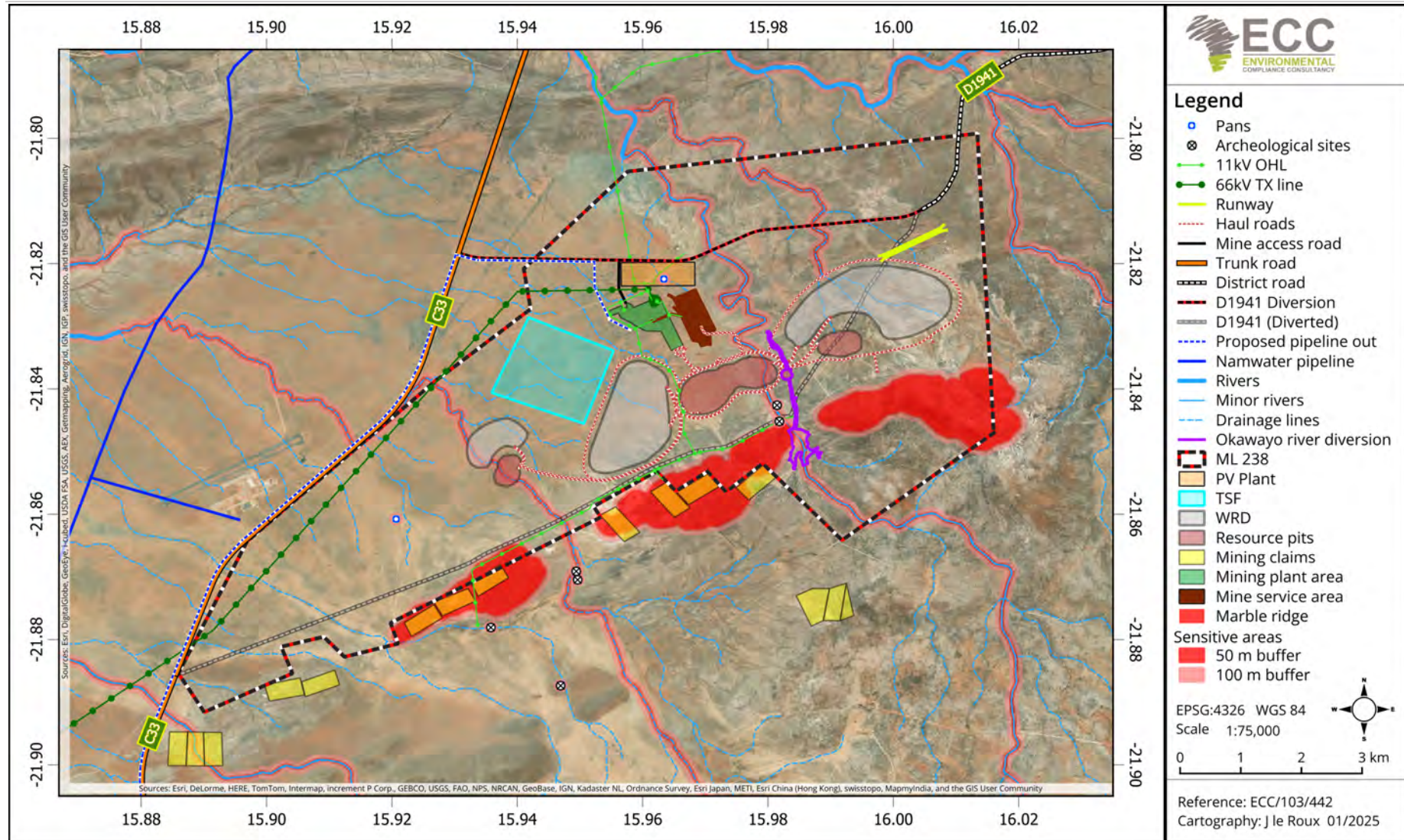


Figure 95 - 2024 Updated site sensitivities map

5.16.6.1 *reptiles*

The Twin Hills Project area has been heavily impacted due to current/past mining (e.g., marble quarrying) and farming activities and none of the unique reptiles are expected to be exclusively associated with this area (Cunningham, 2023). Artificial habitats could be created during construction and operational activities attracting reptiles, open holes could act as pitfall traps and tarmac roads could attract reptiles for basking. Small lacertid and gecko species which would probably use the pit(s) as part of their habitat and/or rather be attracted to the rocky waste dumps as more suitable habitat. Changes to riparian vegetation as a result of the Okawayo River diversion and embankment dam, could influence reptiles associated with this habitat.

5.16.6.2 *amphibians*

The Twin Hills Project area has been heavily impacted due to current/past mining (e.g., marble quarrying) and farming activities and none of the unique amphibians are expected to be exclusively associated with this area (Cunningham, 2023). Artificial habitats could be created during construction and operational activities attracting amphibians, particularly along the access route with the installation of culverts and drainage pipes and potentially in the open pits when water accumulates/collects. Changes to riparian vegetation as a result of the Okawayo River diversion and embankment dam, could influence amphibians associated with this habitat.

5.16.6.3 *mammals*

The Twin Hills Project area has been heavily impacted due to current/past mining (e.g., marble quarrying) and farming activities and none of the unique mammals are expected to be exclusively associated with this area (Cunningham, 2023). Artificial habitats could be created during construction and operational activities attracting mammals, for example certain small carnivores and rodents (waste rock dumps), certain carnivores and ungulates (TSF) and smaller mammals (pits). Open holes for the 11 kV powerline could act as pitfall traps and some species (mongoose, small-spotted genet) could be attracted to sub-stations and on-pole-mounted switching gear for foraging and heat. This could cause issues to the structures. Baboons could potentially climb these infrastructures once operational and clearing heights are required for giraffes in order to avoid electrocutions. Tarmac roads could attract mammals for basking (nocturnal species) and for foraging (small carnivores). Pits could potentially act as a pitfall trap. Grass on the airstrip should be kept short in order not to attract herbivores.

5.16.6.4 *Avifauna*

The Twin Hills Project area has been heavily impacted due to current/past mining and farming activities (e.g., marble quarrying) and none of the unique birds are expected to be exclusively associated with this area (Cunningham, 2023). Although white-backed vulture, lappet-faced vulture and secretary bird are not known to breed in the area (Eddie Nederlof pers. com. (Cunningham, 2023), such nesting sites, should these be established and/or located in future, are viewed as extremely important and should be avoided at all costs.

Artificial habitats could be created during construction and operational activities attracting avifauna, for example chats, crows, owls and smaller raptors to the waste rock dumps and crows, smaller

raptors and various aquatic species to the TSF and smaller birds to the pits. Certain species could be attracted to tarmacs for foraging purposes (crows, smaller raptors and owls). Grass on the airstrip should be kept short in order not to attract various species.

The solar PV plant could cause issues with reflective surfaces and mirror collisions; however, this is not expected with a PV plant compared to concentrated solar power however collisions could be underestimated. Long term monitoring is important to determine collisions with these structures and nesting potential of smaller local species.

Regarding the 11 kV overhead powerlines, open holes could act as pitfall traps for ostriches and should be covered when not in use. Pylon sensitive species could be negatively associated with the aboveground transmission lines (electrocutions/collisions) and include the following:

- Birds flying at pylon height (bustards, swifts, sandgrouse, ravens, raptors, aquatic and marine species);
- Birds with nocturnal transients (Palearctic migrants and wetland birds (coastal areas);
- Birds following geological and/or landscape features (rivers, mountains), whilst foraging or migrating (aquatic/marine species and raptors); and
- Birds attracted to the area during rainfall events (bustards) and temporary water source in ephemeral rivers/drainage lines (aquatic/marine species).

Pylon sensitive species typically in the Project area include the following species: black stork, booted eagle, kori bustard, lappet-faced vulture, Ludwig's bustard, marabou stork, martial eagle, Peregrine falcon, tawny eagle, Verreaux's eagle and white-backed vulture. Black-chested snake-eagles are also known to be affected by transmission lines in the Husab mine area (Baufeldt pers. com.).

Certain species also have the potential to nest on transmission structures and are listed as the following: cape crow, pied crow, sociable weaver, red-billed buffalo-weaver, eagles (large) and vultures.

Factors that influence collision risk include the following: voltage levels, body size and flight behaviour, flight height and habitat use, age, residents versus migratory birds, weather conditions, time of the day, land use and topography.

As many of the pylon sensitive species occur in the general area, it is recommended that Bird Flight Diverters (BDF) (coils, flappers) are installed along the most important portions of the transmission line to minimise/prevent mortalities (see Figure 96). Covering conductors with low density polyethylene (LDPE) pipe would further minimise risk to a variety of raptors on or associated with the 11 kV power lines.



Figure 96 - Various 11 kV overhead transmission lines and areas indicated (white dashed) where flight diverters are to be installed (Source: (Cunningham, 2023)).

Most birds would be able to adapt to disturbances from vehicle and construction/operational activities of the pits and associated haul roads, however raptor breeding trees (especially vultures) should be avoided, especially during the breeding season, as these species might abandon nests when regularly disturbed (Cunningham, 2023).

Changes to riparian vegetation as a result of the Okawayo River diversion and embankment dam, could influence amphibians associated with this habitat. Artificial water bodies could be created, especially as a result of standing open water bodies in the embankment dam, and this could attract aquatic species.

5.16.6.5 trees and shrubs

The most important protected species (including endemic/near endemic, etc.) are viewed as:

- Plains: *Acacia erioloba*, *Albizia anthelmintica*, *Aloe litoralis*, *Boscia albitrunca*, *Cyphostemma currorii*, *Faidherbia albida* and *Ziziphus mucronata*
- Hills: *Acacia erioloba*, *Albizia anthelmintica*, *Boscia albitrunca*, *Commiphora glaucescens*, *Commiphora virgata*, *Cyphostemma currorii*, *Euphorbia guerichiana*, *Euphorbia avasmontana*, *Ficus cordata*, *Maerua schinzii*, *Moringa ovalifolia* and *Sterculia africana*

-
- Rivers: *Acacia erioloba*, *Albizia anthelmintica*, *Boscia albitrunca*, *Combretum imberbe*, *Euclea pseudebenus*, *Faidherbia albida* and *Ziziphus mucronata*

The Twin Hills Project area has been heavily impacted due to current/past mining (e.g., marble quarrying) and farming activities and none of the unique larger trees/shrubs are expected to be exclusively associated with this area (Cunningham, 2023). Some individual larger trees (e.g. *Acacia erioloba*, *Aloe litoralis*, *Boscia albitrunca*) may have to be removed (infrastructures) and/or pruned (transmission lines) for construction and development purposes. Tarmac roads would assist to minimise associated dust impacts. Herbicides should not be used to control grass on the airstrip runway verges or to control tree/shrub regrowth on road verges of the D1941 and access road, as these could have long lasting and/or widespread implications affecting flora in adjacent areas. The diversion and embankment dam are expected to affect the downstream riparian vegetation, probably even the Khan River riparian vegetation due to reduced flow, and consequently large and protected tree species, especially *Acacia erioloba* and *Ziziphus mucronata*, associated with this habitat (Cunningham, 2023).

5.16.6.6 Grass

The Twin Hills Project area has been heavily impacted due to current/past mining (e.g., marble quarrying) and farming activities and none of the unique grasses are expected to be exclusively associated with this area (Cunningham, 2023). All impacts are expected to be localised to the clearing/disturbed area and not influence grasses adjacent to these areas. Herbicides should not be used to control grass on the airstrip runway verges or to control regrowth on road verges of the D1941 and access road, as these could have long lasting and/or widespread implications affecting flora in adjacent areas. The diversion and embankment dam are expected to affect the downstream riparian vegetation, probably even the Khan River riparian vegetation due to reduced flow, and consequently grasses, associated with this habitat (Cunningham, 2023).

5.16.6.7 other species

Other species confirmed by (Cunningham, 2021) throughout the proposed development area included herbs and bulbs. However, many more species are known and/or expected to occur in the area that what was observed during field surveys. The most important species are viewed as the endemic species (*Barleria lanceolata* and *Lantana dinteri*) and near endemic species (*Emilia marlothina* and *Oxalis purpurascens*) (Mannheimer 2012). Fewer herbs were observed during the winter months and the majority of herbs during this season were located in the rivers, due to this habitat retaining moisture for longer and riparian vegetation providing shade and protection from herbivores (Cunningham, 2023).

Alien species observed (Cunningham, 2021) included the following:

- *Cryptostegia grandiflora* (rubber vine);
- *Datura ferox* (thorn apple species
- *Datura innoxia* (thorn apple species.);
- *Eucalyptus* spp. (Australian gum species);

- *Flaveria bidentis* (smelter's bush);
- *Leucaena leucocephala* (giant wattle);
- *Opuntia* spp. (prickly pear species); and
- *Prosopis* spp. (mesquite species).

Some of these above-mentioned species have already started invading the area, especially along the drainage lines, close to the farmstead (*Opuntia* and *Prosopis* species) and should be eradicated where/when encountered. Furthermore, mine related soil disturbances could favour some of the invasive alien species (*Datura* species increase in disturbed areas) and/or increase their range throughout the area (Cunningham, 2023).

Other important species to be protected and/or relocated during construction and operational activities include aloes, commiphora species, lithops species, ferns and lichens.

Other species with commercial potential that could occur in the general Karibib area include *Harpagophytum procumbens* (Devil's claw) harvested for medicinal purposes and often over-exploited, *Citrullus lanatus* (Tsamma melon) which potentially has a huge economic benefit and *Ximenia americana* (sour plum) for its oil (Cunningham, 2023).

5.16.6.8 Twin Hills important areas

The most important areas for the Project based on the (Cunningham, 2023) assessment are described below:

- Limestone/marble hills: rocky areas generally have high biodiversity and consequently viewed as important habitat for all vertebrate fauna and flora in the general Karibib area. Protected species associated with and confirmed from the hills in the Project area include unique species such as *Commiphora glaucescens*, *Commiphora virgata*, *Cyphostemma currorii*, *Euphorbia avasmontana*, *Ficus cordata*, *Moringa ovalifolia* and *Sterculia africana*.

Ephemeral drainage lines: the various ephemeral drainage lines are important habitat to larger trees, especially *Acacia erioloba*, *Euclea pseudebenus*, *Faidherbia albida* and *Ziziphus mucronate*. The most important drainage line is the Okawayo River bisecting the Project area. It is recommended that the Okawayo River not be channelled into an embankment dam or pit but rather bisect the adjacent WRD and pit and rejoin the river downstream (Figure 97). This would ensure continued flow with the least impact on the riparian vegetation and downstream ecological processes and associated and/or dependent vertebrate fauna.



Figure 97 - Okawayo River diversion and embankment dam site. The white dashed arrow indicates the proposed direction of flow of the Okawayo River rather than damming it into the proposed holding dam (Source: (Cunningham, 2023)).

- Ephemeral dams and pans: the various ephemeral ground dams, albeit artificial, and pans are important habitat, mainly for amphibians, although the larger trees associated with such features serve as habitat to a variety of vertebrate fauna.
- Bird flyways: Although very little is known regarding bird flight paths in Namibia, most birds seem to follow the shortest routes between selected habitats. However, unpredictable rainfall events may lure species into areas not normally frequented and storm may also force birds into areas not regularly visited. Species potentially affected by the proposed overhead transmission line once operational and at greatest risk would be those larger species flying at pylon height (bustards, eagles, vultures); nocturnal travellers (flamingos and Palearctic species) and species potentially visiting the area for roosting/foraging (bustards, crows). Figure 98 and Figure 99 indicates important areas, such as potential flight paths for the Project site and documented known mortalities as a result of interactions with power lines within Namibia and adjacent to the Project area. As vultures are known to breed in the general area; located between known bird mortality “hotspot” areas and known to be negatively affected by transmission lines, anti-perching devices should be placed on pylons and anti-collision mechanisms should be attached to the transmission lines. Other important

species that would also benefit from BFD's and known to frequent the area after localised rainfall events, are kori and Lüdwig's bustards.



Figure 98- Expected bird flight paths along ephemeral drainage lines (white dashed arrows) and between mountainous areas (yellow dashed arrows) in the general area. The 11 kV power lines are indicated by the solid red lines (Source: (Cunningham, 2023).

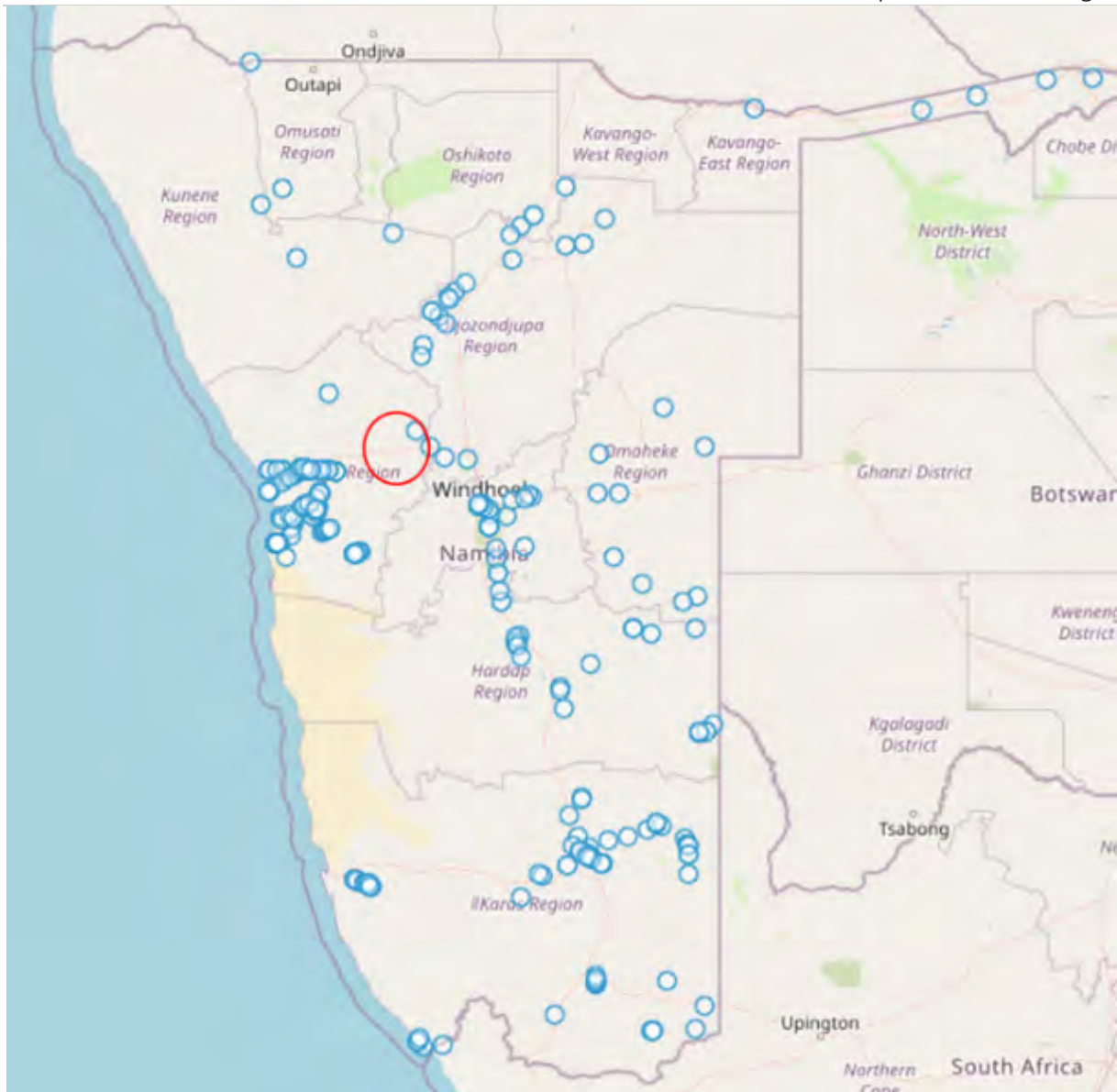


Figure 99 - Known bird mortalities caused by power lines throughout Namibia (March 2021) are indicated by blue circles. The general Karibib area (indicated by a red circle) although not currently a known hotspot bird collision risk area, is located between such sites to the west and east, and new overhead transmission line(s) undoubtedly would increase bird collision/electrocution risks (Source: www.the-eis.com in (Cunningham, 2023).

(Cunningham, 2023) concluded the following, except for the 11 kV overhead lines and Okawayo River diversion, it is not expected that most of the mine infrastructure amendments will adversely affect any unique vertebrate fauna and flora in the Twin Hills Project areas, especially if the proposed recommendations (mitigation measures) are incorporated (see ESMP – Appendix A).

5.17 CLIMATE CHANGE

A predictive climate change assessment was conducted by (RDJ, 2023) and this section summarises their findings. Their brief was to conduct climate-related scenario analysis, estimate future

operational emissions, assess project impacts on society and the environment, and assess risks of climate and related impacts on the project.

Namibia's climate vulnerability, proneness to prolonged periods of drought, desertification, land and water resource degradation, and loss of biodiversity pose a risk to the economy. It is the driest country in Sub-Saharan Africa and severe droughts are a persistent threat to agricultural outputs, farm owners and general economic performance. The frequency and severity of droughts are predicted to worsen. As a positive however, Namibia has an abundance of sunlight as a renewable energy source and the Project plans to significantly utilise this resource for its future operations to mitigate the Project's carbon footprint.

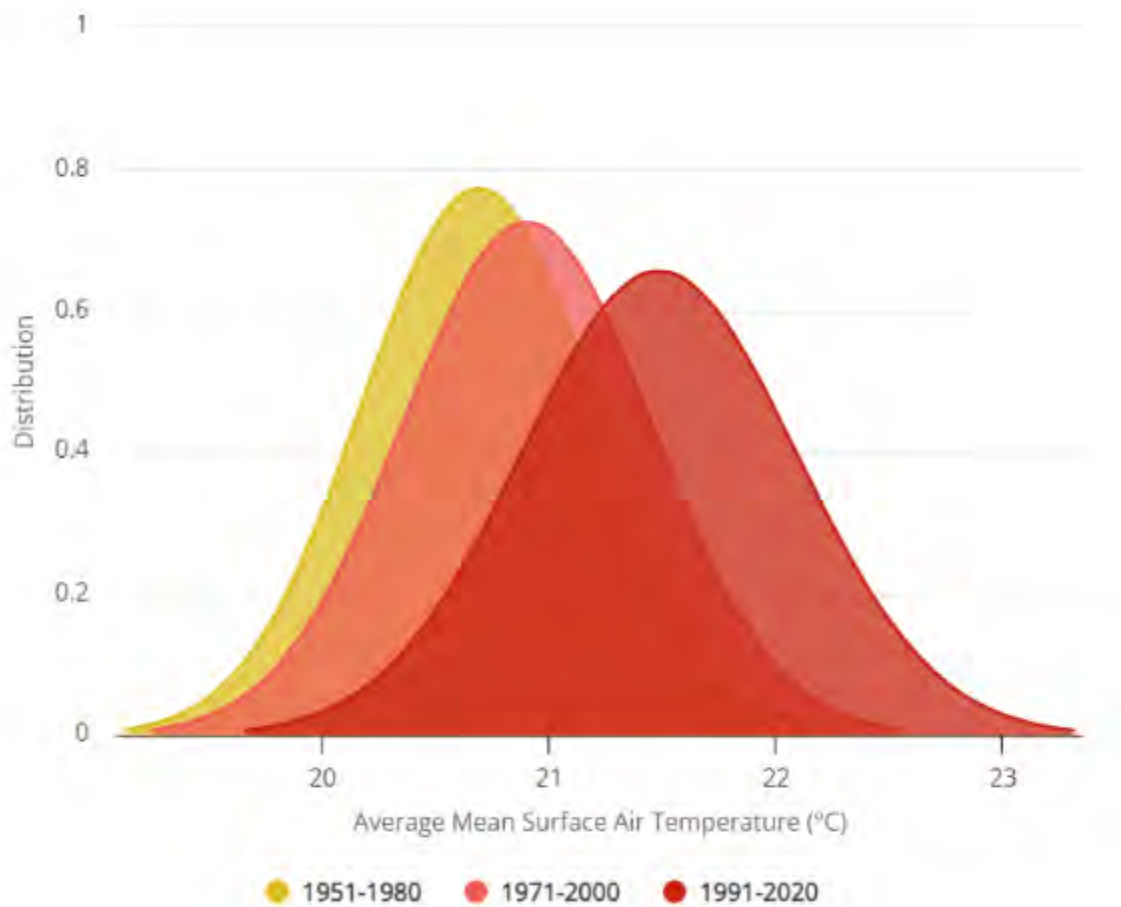


Figure 100 - Change in the distribution of average mean surface air temperature form 1951 – 2020 in Namibia (Source: World Bank Climate Change Knowledge Portal).

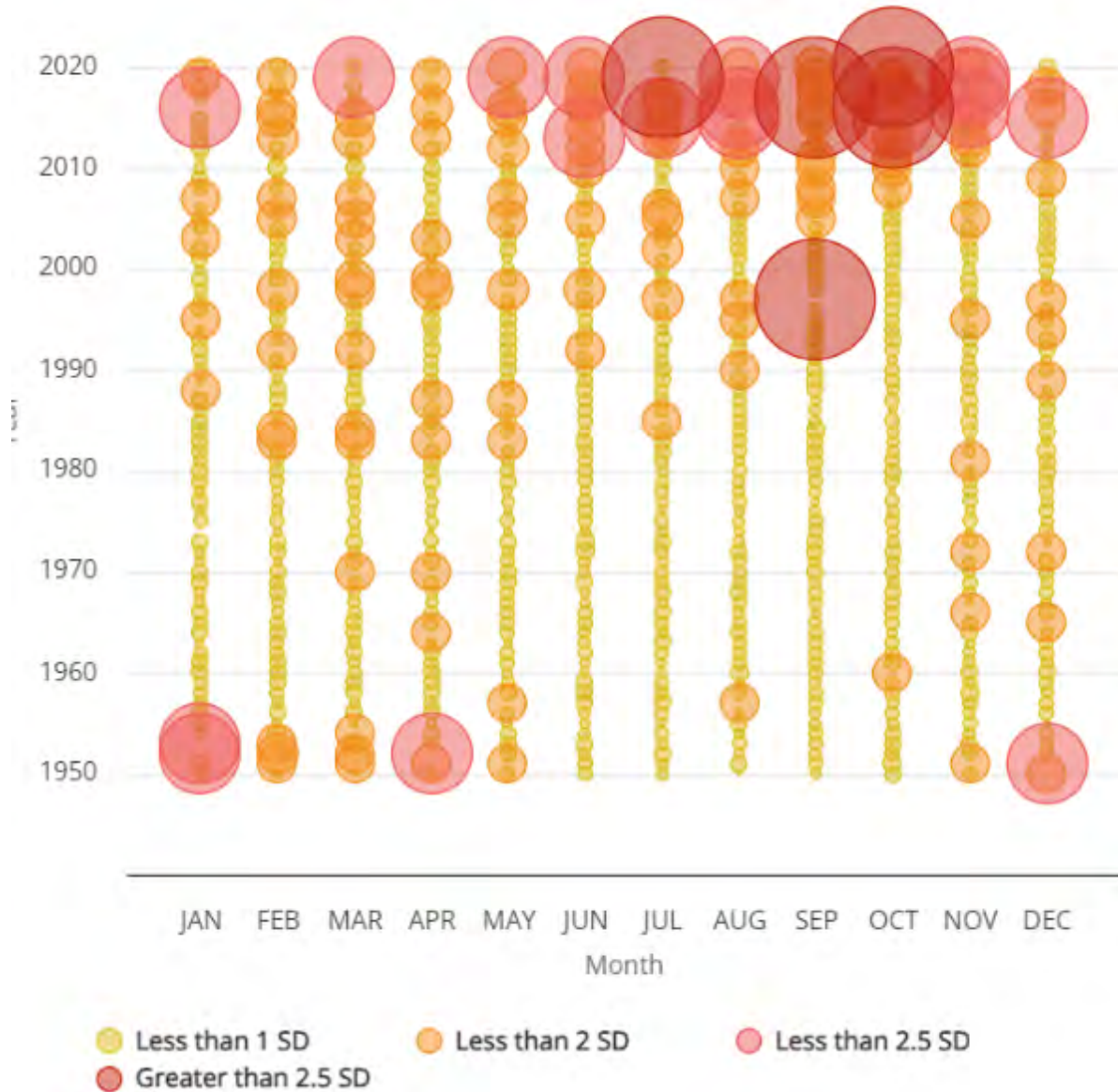


Figure 101 - Change in event intensity of maximum daily temperatures from 1951-2020 in Namibia
(Source: World Bank Climate Change Knowledge Portal).

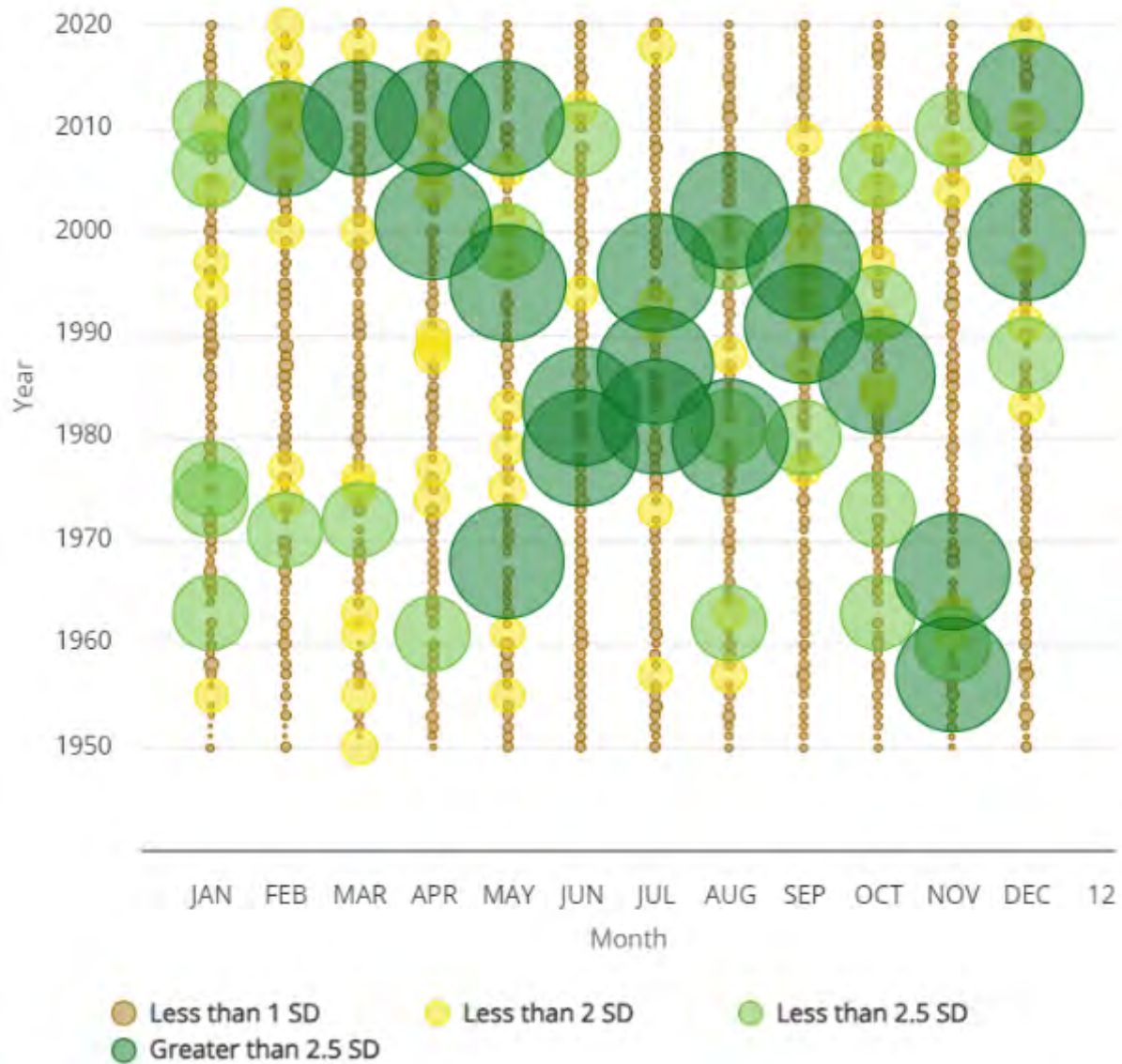


Figure 102- Change in event intensity of precipitation in Namibia between 1951 and 2020.

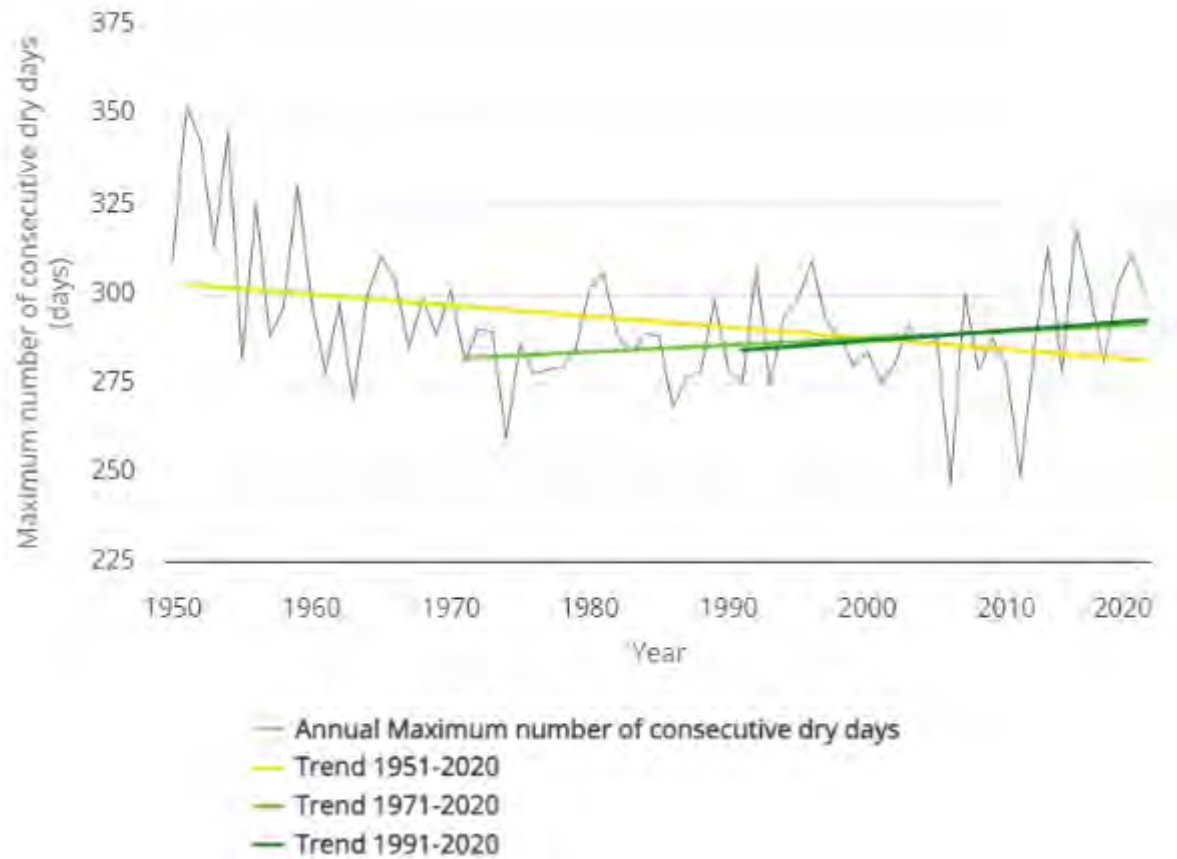


Figure 103 - Maximum number of consecutive dry days annual trends with significant trends per decade from 1951-2020, in Namibia.

Climate change-related extreme weather events, specifically droughts and flooding events – e.g. prolonged droughts and erratic heavy rainfall, severe winds accompanied by extreme temperature fluctuations – are expected to affect the mining and plant operations of Twin Hills and surrounding communities through the disruption of supply chains, mining operations, and water and energy supply. The growth in the number and ambitiousness of policies aimed at stemming greenhouse gas (GHG) emissions and managing climate impacts, are likely to further impact businesses. These could take the form of increased carbon taxes, stringent water regulations, the impact of new technologies, and changing investor perceptions.

Mining activities have significant environmental impacts, including greenhouse gas emissions, deforestation, habitat destruction, and water pollution. Common climate change policy goals and measures for the mining sector include sustainable mining practices, energy efficiency, water management, community engagement and climate and broader resilience actions. Increasingly, companies strive to reduce their carbon footprint using a range of plans, including the use of renewable energy. Setting emissions reduction targets and implementing carbon pricing and trading mechanisms are also key strategies.

The associated impacts of rising temperatures not only likely to affect the Project operations but also the health and well-being of Twin Hills workers, contractors and surrounding communities.

Rainfall levels are expected to decline and the regularity of rainfall less predictable. Based on the research of various climate specialists, the chances of flooding in the Erongo Region will increase by 20% in the coming decade, which is likely to impact project operations.

5.17.1 PRINCIPLES AND GUIDELINES

The Project plans to adopt the following principles and guidelines:

- Equator Principles (Principle 2): this requires an alternatives analysis to be conducted when there is an “expectation” that Scope 1 and 2 CO₂e emissions will exceed 100 000 tonnes of CO₂e per annum during any stage of the project.
- International Finance Corporation (IFC) Principles: the IFC started their Performance Standards in 2006 and have since updated it so that projects with significant emissions (namely those that are expected to or currently produce more than 100 000 tonnes of CO₂e annually) will quantify direct emissions from the facilities owned or controlled within the physical project boundary, as well as indirect emissions associated with the off-site production of energy used by the project. Quantification of GHG emissions will be conducted by the proponent annually in accordance with internationally recognised methodologies and good practice.
- Task Force on Climate-related Financial Disclosure (TCFD): The TCFD framework enhances the disclosure of climate-related risks and opportunities for public companies and other organizations within their current reporting procedures. Provide information on the organization's governance concerning climate-related risks and opportunities.
- World Gold Council (WGC): In relation to this sector, the WGC seeks to provide a platform for responsible gold mining, inclusive of carbonization, net zero approaches, and ultimately societal progress.

5.17.2 EMISSIONS

Contributions of mining-sector greenhouse gas emissions are typically due to either direct (demand-side or Scope 1 sources) CO₂ emissions, or indirect (supply-side or Scope 2 sources) CO₂ emissions.

Scope 1 (direct) GHG emissions stem from sources owned or controlled by the organisation. These include, for example, emissions from combustion owned or controlled boilers, furnaces, vehicles, or emergency generators, and emissions from chemical production in owned or controlled process equipment.

Scope 2 (indirect) emissions stem from the GHG emissions emitted by generation facilities providing purchased electricity consumed by the organisation. This is power that is purchased or otherwise brought into the organisational boundary. Scope 2 emissions physically occur at the facility where electricity is generated.

Scope 3 emissions stem from the activities not owned or controlled by the organisation, but that are emitted at the behest of the organisation. Scope 3 is an optional reporting category that allows for

the treatment of all other indirect emissions. Scope 3 emission examples include extraction, processing, production, transportation and / or delivery of purchased materials, products, fuels and services, and also includes employee business and private travel. Scope 3 emissions were not reviewed as part of this assessment.

5.17.3 GREENHOUSE GAS EMISSIONS

The Project's cumulative Scope 1 emissions (derived from various construction and operational activities such as the loading and hauling of ore and waste rock, drilling, crushing and milling, processing, air conditioning in the admin building and the general admin fleet) are estimated to peak at about 56 600 tCO₂e in year eight (Figure 104).

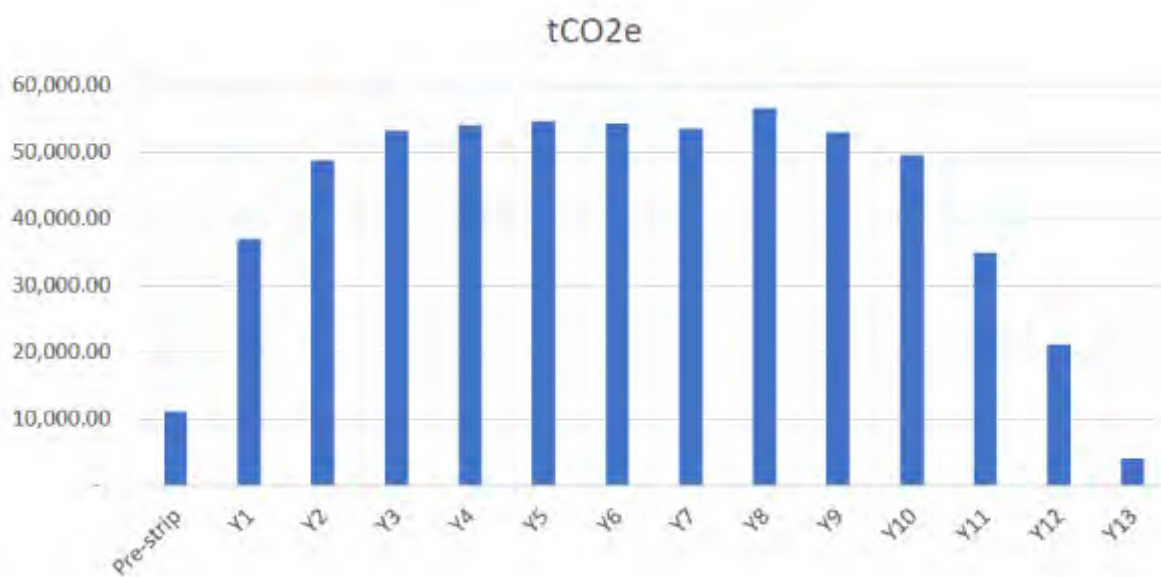


Figure 104 - Estimated Scope 1 emissions

The Project's Scope 2 emissions from electricity usage are estimated to reach a maximum total emission of 187 000 tCO₂e (Figure 105) throughout LoM. Annual Scope 2-related emissions, factoring in the effects of the planned on-site solar plant, are expected to remain largely constant throughout the life of mine at about 117 000 tCO₂e per annum.

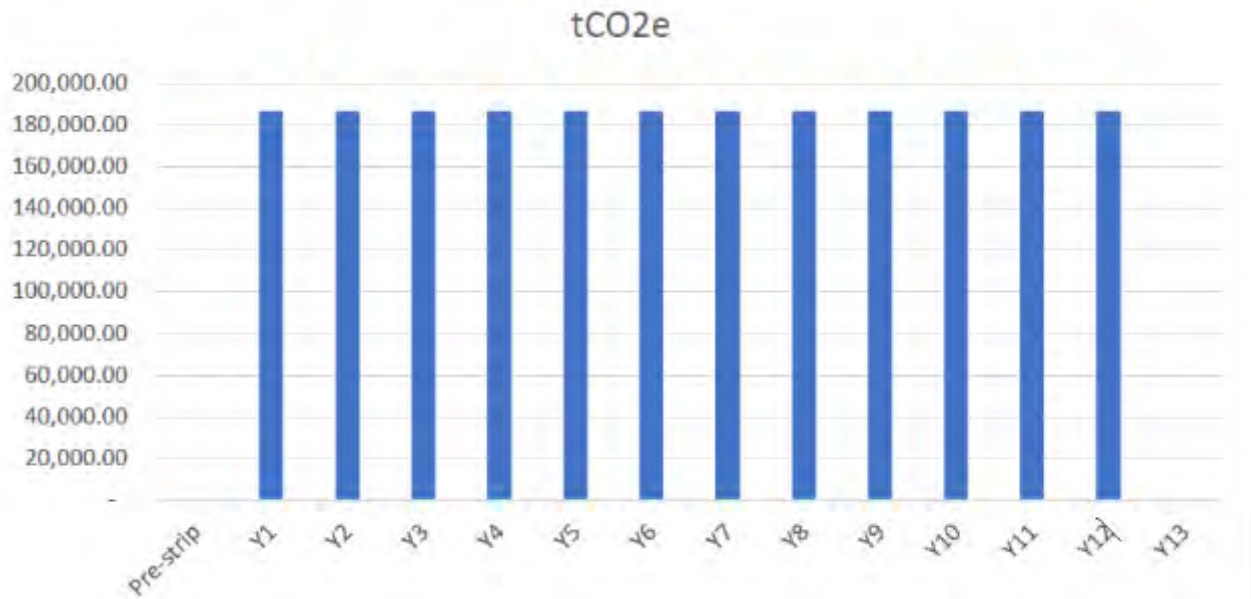


Figure 105 - Estimated Scope 2 emissions

Processing plant operations are the largest contributor to the GHG emission of this project, based on its electricity needs, accounting for 87% of electricity demand and peak at 142 796.72 tCO₂e per annum of the overall emissions accounted for of 186 529.27 tCO₂e per annum. The benefits of the on-site solar power plan become more apparent, etc. to help mitigate this is even more apparent in the overall reduction of 37%.

In comparison to other major global carbon and GHG emitters in Namibia, the impact of the Project on the nation's contribution to climate change is expected to be minor (see chapter 7). Since Namibia is a net sink, which means that more CO₂ is removed from the atmosphere, and stored in plants and trees, than is emitted, combined with the implementation of mitigation measures such as the use of renewable energy and flood risk management by having strong stormwater management procedures in place, the Project is not likely to pose a contribute significantly national or international GHG emissions and is better prepared to manage physical climate change risks. Recommendations (year 0 to year 14) to be implemented for the Project and further actions required have been included in the ESMP (Appendix A).

6 IMPACT IDENTIFICATION & EVALUATION METHODOLOGY

6.1 INTRODUCTION

Chapter 2 provides an overview of the approach used in this ESIA process, and details each of the steps undertaken to date. Predication and evaluation of impacts is a key step in the ESIA process. This chapter outlines the methods followed, to identify and evaluate the impacts arising from the proposed Project. The findings of the assessment are presented in chapter 7.

This chapter provides comprehensive details of the following:

- The assessment guidance used to assess impacts;
- The limitations, uncertainties, and assumptions with regards to the assessment methodology;
- How impacts are identified and evaluated, and how the level of significance derived;
- How mitigation is applied in the assessment, and how additional mitigation will be identified; and
- The cumulative impact assessment (CIA) method used.
- The aims of this assessment are to determine which impacts are likely to be significant; to scope the available data and identify any gaps that need to be filled; to determine the spatial and temporal scope; and to identify the assessment methodology.

The scope of the assessment was determined through undertaking a preliminary assessment of the proposed Project against the receiving environment, and was obtained through a desktop review, available site-specific literature, monitoring data, and site reports, as set out in the existing 2021 scoping report and 2022 ESIA report,

6.2 ASSESSMENT GUIDANCE

The following principal documents were used to inform the assessment method:

- International Finance Corporation standards and models, in particular performance standard 1: 'Assessment and management of environmental and social risks and impacts (International Finance Corporation, 2012)
- International Finance Corporation Cumulative Impact Assessment (CIA) and Management Good Practice Handbook (International Finance Corporation, 2013);
- Namibian Draft Procedures and Guidance for EIA and EMP (Republic of Namibia, 2008); and
- Requirements encapsulated in IFC Performance Standard 3 (PS 3)
- Equator Principles 4 (ep 4) - Guidance on environmental and social impact assessment.

6.3 LIMITATIONS, UNCERTAINTIES AND ASSUMPTIONS

The following limitations and uncertainties associated with the assessment methodology were considered in the assessment phase:

- Topic specific assessment guidance has not been developed in Namibia. A generic assessment methodology will be applied to all topics using IFC guidance and professional judgement;
- Guidance for CIA has not been developed in Namibia, but a single accepted state of global practice has been established. The IFC's guidance document (International Finance Corporation, 2013) will be used for the CIA; and
- The climate change methodology was determined by an external specialist in this field in order to comply with international, national and lender reporting requirements.

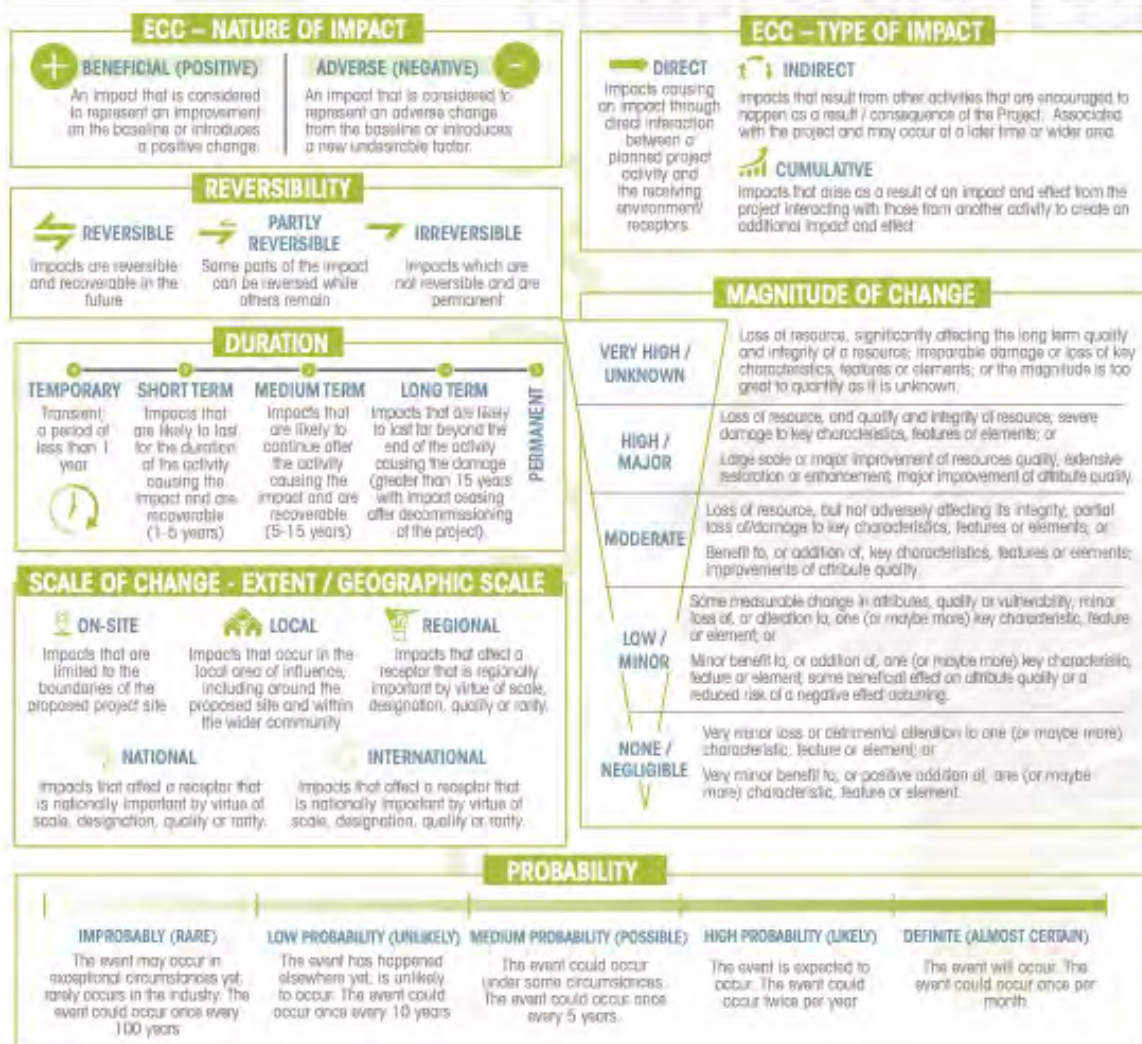
6.4 ASSESSMENT METHODOLOGY

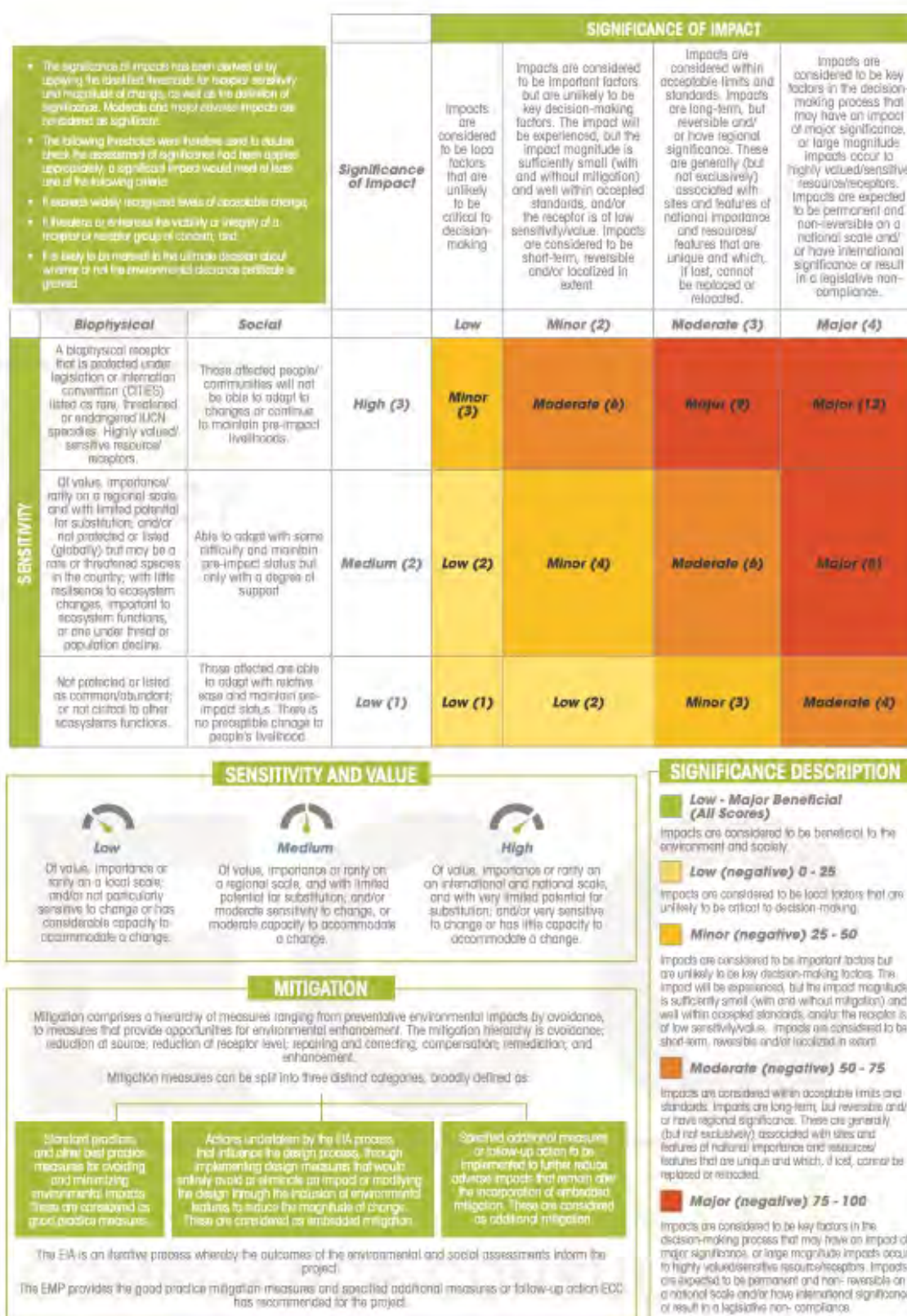
The ESIA methodology applied to this assessment has been developed by ECC using the International Finance Corporation (IFC) standards and models, in particular performance standard 1: 'Assessment and management of environmental and social risks and impacts' (International Finance Corporation, 2017); Namibian Draft Procedures and Guidance for EIA and EMP (Republic of Namibia, 2008); international and national best practice; and over 25 years of combined ESIA experience. The methodology is set out in Figure 106.

The methodology utilised for the climate change assessment was developed by the specialist conducting this assessment to adhere to the requirements of IFC Performance Standard 3 (PS 3) and Equator Principles 4 (ep 4) (Appendix K). ECC will not amend this methodology used, however impact significance will be scored.

The evaluation and identification of the environmental and social impacts require the assessment of the Project characteristics against the baseline characteristics, ensuring that all potentially significant impacts are identified and assessed. The significance of an impact is determined by taking into consideration the combination of the sensitivity and importance/value of environmental and social receptors that may be affected by the proposed Project, the nature and characteristics of the impact, and the magnitude of any potential change. The magnitude of change (the impact) is the identifiable changes to the existing environment that may be negligible, low, minor, moderate, high, or very high; temporary/short-term, long-term or permanent; and either beneficial or adverse.

ECC IMPACT PREDICTION AND EVALUATION METHODOLOGY





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Figure 106 - ECC ESIA methodology based on IFC standards

6.5 MITIGATION

Mitigation comprises a hierarchy of measures ranging from preventative environmental impacts by avoidance, to measures that provide opportunities for environmental enhancement. The mitigation hierarchy is: avoidance; reduction at source; reduction at receptor level; repairing and correcting; compensation; remediation; and enhancement.

Mitigation measures can be split into three distinct categories, broadly defined as:

1. Actions undertaken by the ESIA process influence the design process, through implementing design measures that would entirely avoid or eliminate an impact or modifying the design through the inclusion of environmental features to reduce the magnitude of change. These are considered as embedded mitigation.
2. Standard practices and other best practice measures for avoiding and minimising environmental impacts. These are considered as good practice measures.
3. Specified additional measures or follow-up action to be implemented, in order to further reduce adverse impacts that remain after the incorporation of embedded mitigation. These are considered as additional mitigation.

The ESIA is an iterative process whereby the outcomes of the environmental assessments inform the Project.

The ESMP (Appendix A) provides the good practice measures and specified additional measures or follow-up action.

Embedded mitigation and good practice mitigation was taken into account in the assessment. Additional mitigation measures will be identified when the significance of impact requires it and causes the impact to be further reduced. Where additional mitigation is identified, a final assessment of the significance of impacts (residual impacts) will be carried out, taking into consideration the additional mitigation.

7 IMPACT ASSESSMENT FINDINGS AND MITIGATION

This impact assessment was completed taking into consideration the input received from stakeholders during the public participation phase. Specialist studies that had previously been conducted were reviewed and reassessed based on the input from the public participation phase. As part of the final impact assessment, a final environmental management plan (EMP) was produced to manage residual impacts that cannot be mitigated through the project evolution process.

This chapter presents the findings of the ESIA for the proposed project as per the ESIA process, scope and methodology set out in Chapters 2 and 6. The aim of this ESIA report is to focus on the significant impacts that may arise as a result of the proposed project. This chapter therefore only considers the significant impacts and or those that may have specific interest to the community and stakeholders. A summary of impacts that are not considered significant is discussed in section 7.1. The list of high level and likely impacts that are considered significant or of interest to the community and stakeholders are as follows:

- Socio-economic: employment and employee occupational health and safety
- Socio-economic: road diversion, traffic, and potential housing related impacts
- Socio-economic: nearby heritage site
- Environment: river diversion and related ecological functioning impacts
- Environment: surface and ground water quality and quantity
- Environment: soil, air quality, and noise impacts.

For each potential significant or sensitive impact, a summary is provided which includes the activity that would cause an impact; the potential impacts; embedded or best practice mitigation (stated where required / available); the sensitivity of receptor that would be impacted; the severity, duration, and probability of impacts; the significance of impacts before mitigation and after mitigation measures are applied.

7.1 IMPACTS CONSIDERED NOT SIGNIFICANT

As a result of an iterative project evolution process, mitigation has been incorporated and embedded into the project plan, thereby designing out potential environmental and social impacts or reducing the potential impact so that it is not significant. The EMP provides best practice measures, management and monitoring for identified impacts. Impacts that have been assessed as not being significant are summarised in Table 25 and are not discussed further, unless otherwise indicated.

Table 25 - non-significant impacts

Environment or social topic	Potential impact	Summary of assessment findings
Noise and Vibration	Potential for vibrations from construction and operations of the mine and mineral processing	The potential for the mine to generate noise that will impact neighbours is unlikely given the

Environment or social topic	Potential impact	Summary of assessment findings
	plant could cause vibration on surface. Noise impacts to neighbours are described below. A heritage site is within the high blast sensitivity zone and is therefore exposed to possible blast impact. It is described further under vibration and heritage	distance from the operations to the nearest sensitive receptor. Vibrations from mining are variable, depending on the blast size, location within the site (depth), and blasting and mining methods. With mining there is the potential for vibration to follow fault lines and sometimes vibrations can be felt some distance away from the operation. The site will monitor vibrations and ensure vibrations are below allowable limits. A second heritage site and two boreholes are within the medium sensitivity zone and mitigation is described below.
Dust	Suspended dust plumes over the Karibib Air Force Base (KAFB) during construction and operation. Other dust impacts are described below.	The KAFB lies southwest of ML and not within the prevailing wind direction. It is not expected that dust plumes generated from construction and operation activities will cover the airspace over the KAFB. Furthermore, waste rock dump 1 the TSF would lie between the mine site and the KAFB effectively screening it from on-site dust nuisances
Land ownership	Displacement of the inhabitants of Farm Okawayo.	This impact is considered non-significant because farms Okawayo and Klein Okawayo are in the process of being acquired by the Proponent and the existing housing infrastructure will be incorporated into the mine's operational plan.
Noise	Noise impacts to sensitive receptors within range of active mining activities	It is not expected that light pollution from sources within the ML will affect human receptors surrounding the ML on an

Environment or social topic	Potential impact	Summary of assessment findings
		extended basis (i.e. every night). Users of the new diverted D1941 road will experience some measure of light presence beside the road, but this will not constitute a hazard or nuisance
Light disturbance	Light disturbance on surrounding neighbours. Light impact on fauna is described below	It is not expected that light pollution from sources within the ML will affect human receptors surrounding the ML on an extended basis (i.e. every night). Users of the new diverted D1941 road will experience some measure of light presence beside the road, but this will not constitute a hazard or nuisance.
Temporary road closure of the D1941	Inaccessibility of the D1941 gravel road to the public running through the ML toward Omaruru	Approximately 10 km of the D1941 gravel road that traverse the ML will be closed off temporarily while construction of the new gravel road takes place on the northern periphery of the ML (See Chapter 4) The C33 bitumen road between Karibib and Omaruru will not be affected and remain open for public use, therefore the daily movement between the two towns will not be negatively impacted on. Although the temporary road closure may be experienced as significant to some farmers in the direct vicinity of the ML, it can at best be described as a short-lived inconvenience that will not affect livelihoods.

7.2 SOCIO ECONOMIC: ECONOMIC

Social impacts include the consequences to local communities based on their livelihoods, comfort, occupational safety and interactions in the workplace. The social impacts that are of interest to the community and stakeholders before mitigations are summarised in the following section and are illustrated in Figure 107.



Figure 107 - economic impacts

7.2.1 IMPACTS ON MINING EMPLOYEES

The mining sector in Namibia is defined as the backbone of the country due to its average annually contribution of approximately 11 % economic growth, contribution to GDP, job creation, income generation and foreign exchange earnings in 2021 (Victoria Nambinga & Lydia Mubita, 2021). The sector has also identified areas that require intervention and established nationwide goals such as poverty reduction, employment creation for Namibian citizens and increased opportunity for skills development and mining training programs for unskilled to skilled workers (National Planning Commission, 2021).

Health and safety risk management forms a key aspect for the Twin Hills Gold Project and any mining project. Permanent and partial disabilities and injuries may hinder workers' job opportunities in the future, changing their way of life drastically. Health and safety risks include occupational diseases or illnesses that are easily spread among workers and communities, traffic or vehicle incidents and the general fitness of workers. Table 26 shows the impacts of the Project on mining employees.

7.2.1.1 impacts on the development of trained workforce

Approximately 19 000 jobs were created between 2011 and 2015 by the mining industry, and it is projected that the mining industry will continue to grow (BDO, 2023). Gold was primarily mined at Navachab mine, however the Otjikoto gold mine began production in 2015 which resulted in a major increase in Namibia's gold output (Mining Africa, 2017).

The Twin Hill Gold Mine is located close to Navachab and Osino estimates it will provide approximately 750 new jobs for Namibian citizens, many of whom will be from local communities (Lycopodium, 2023). Developmental skills and experience acquired from the mining project will

allow employees to improve on a wide range of work-related skills such as equipment operation, health and safety practices and technical knowledge thus ensuring the continued growth of skills in the mining sector and similar industries.

This impact is direct, irreversible and permanent, increasing opportunities for individuals in the future. The sensitivity of the impact is low due to the scale of the impact as it influences local employees, and the magnitude of change is moderate due to the measurable importance of the added benefit.

7.2.1.2 impacts on employee occupational health and safety

Occupational health and safety may be impacted due to the spread of communicable diseases due to working near each other and/or possible injuries sustained during active mining activities. These impacts will be direct and could have lasting effects depending on the severity of the disease or injury. In 2021, Osino significantly expanded its occupational health and safety systems in preparation for the increase in employee intake during the operational phase as reported on in their sustainability report (Osino Resources Corp., 2022).

The following mitigation measures already adopted by Osino Resources at their other sites will be adopted and improved on for the Twin Hills Project. These mitigation measures may include but are not limited to:

- The implementation of an injury or incident register as part of an online system to keep track of incidents. It is important that protocols are in place should an incident occur to review the actions that led to the incident and make sure that preventative measures are in place.
- Toolbox safety briefings, continued safety training, as well as the distribution of proper PPE to staff, are important components of health and safety in the workplace. It should be mentioned in the company policy that should an employee feel ill or sick, they should see a health practitioner and recover before entering the workplace.

The sensitivity of this impact is low because it is focused on incidents that may occur on-site. The magnitude of change after mitigation is low due to the unlikelihood of the impact occurring due to the mitigation measures in place.

7.2.1.3 impacts on Okawayo farm employees

Klein Okawayo and Okawayo farm located on the Project area have been characterised as wildlife and hunting farms dominated by cattle, game and small-stock farming activities. Sections of the directly impacted farms will cease farming activities, however Okawayo employees will remain employed and accommodated on the farm. The Okawayo farm currently has approximately 6 employees. The surrounding properties will continue relatively undisturbed by mining activities. The impact will be beneficially direct, partly reversible and occur over the long term.

The magnitude of change is negligible as very minor benefits are provided to the 6 farm employees, and the sensitivity of receptor is low due to the scale of the impact. Overall, the significance of the impact is low.

Table 26 - Impacts on mining employees.

Activity	Receptor	Impact	Nature of impact	Value & Sensitivity	Magnitude of change	Significance of impact
Operational phase	Community	Skills and development through the training of workforce and safety training received on-site	Beneficial Direct Irreversible Permanent On-site Likely	Low	Moderate	Beneficial Minor (3)
	Community, health, safety and security (on site)	Possible incidents during blasting, drilling or any other mining activity during operations while on site	Adverse Direct Irreversible Permanent On-site Possible	Low	Major	Minor (3)
		Workplace health may be affected due to the easy spread of illness. Safety and competence during construction and operation may be at risk	Adverse Direct Irreversible Permanent On-site Possible	Low	Major	Minor (3)
	Community	Okawayo farm employees remain employed during the Project and are provided with	Beneficial Direct Partly reversible Long term On-site Likely	Low	Negligible	Beneficial Low (2)

Activity	Receptor	Impact	Nature of impact	Value & Sensitivity	Magnitude of change	Significance of impact
		accommodati on				

7.3 SOCIO ECONOMIC: SOCIAL

7.3.1 VISUAL AND SENSE OF PLACE IMPACTS

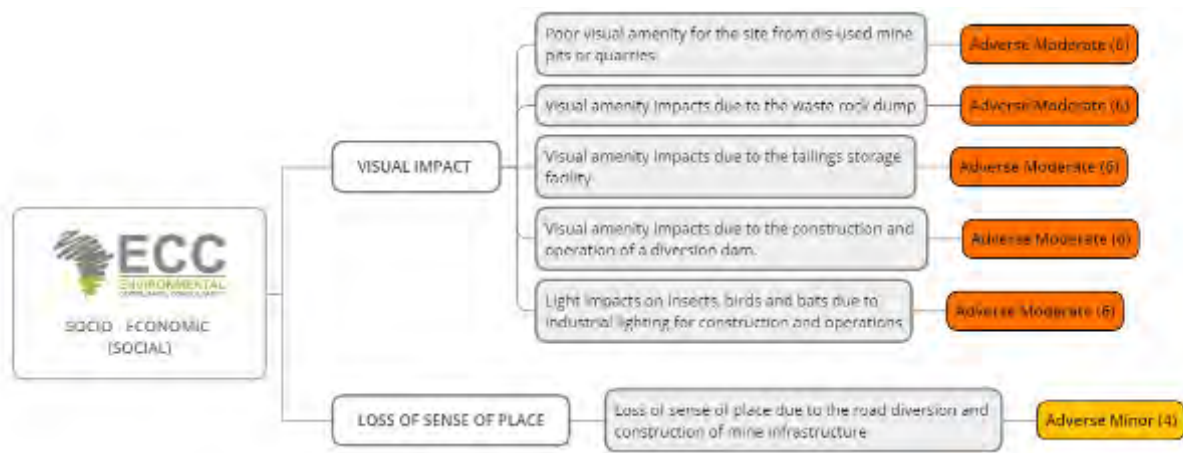


Figure 108 - visual and sense of place impacts

Farmers adjacent to the site, motorists and tourists will be affected by visual amenity impacts from the construction and operation of the large open pit and waste dump facilities at the mine, as well as the borrow pits and quarries used to build the metallurgical plant. Progressive rehabilitation can lessen the impacts; however, the anthropogenic earthworks are obvious especially in the relatively flat expanse of the mine area. The entire site and its open pits and quarries are in the proximity of nearby farms, three national roads, and an airforce base and within view of their respective receptors. Progressive rehabilitation will help to lessen the visual amenity impacts and ensure the project-related earthworks become integrated into the local landscape thereby reducing their visual impact on receptors.

The following visual impacts were identified:

- Poor visual amenity for the site from dis-used borrow pits or quarry
- Visual amenity impacts due to the waste rock dump
- Visual amenity impacts due to the tailings storage facility
- Visual amenity impacts due to the construction and operation of a dam
- Light impacts on insects, birds, and bats

The nature of these impacts is adverse and direct, these impacts are irreversible, the duration of these impacts are permanent, the extent is local, and the possibility is likely. The sensitivity is

medium, and the magnitude of change is high. Therefore, the significance of these impacts has all been rated adverse moderate.

Mitigation includes limiting the height of the earthworks, with a trade-off that the larger footprint would have a greater spatial impact on environmental receptors such as flora, fauna, habitat, and water resources. Progressive and effective rehabilitation is the best mitigation and a critical part of the Namibia Mine Closure Framework.

7.3.2 SENSE OF PLACE

The Project is classified as a greenfield project that will permanently change the physical landscape and character of the area. Therefore, the magnitude of change on the social environment is considered moderate and the sensitivity of the receptor is deemed low during the construction phase. However, during the operational phase of the Project the magnitude of change may decrease as road users get accustomed to the new man-made features modifying the horizon. The sensitivity of road users may increase as the waste rock dumps (height and width), increase in size. Commuters along the C33 and members of the Namibian Airforce at the military airbase would be able to see these features. Progressive rehabilitation on the waste rock dumps is required to lower this impact.

Industrial lighting required for construction and operations will attract flying insects which in turn attracts birds and bats. The disturbance and impact, although reversible will occur at a local level with a moderate magnitude of change. Birds migrating at night will be affected by lighting, and nocturnal bats are likely to be affected by lights as well.

Reducing and managing lighting and reducing stray light while using lights that minimize the attraction of insects will help to minimize the impacts to birds and bats that feed on them. Regardless, the extent of the impact could remain regional on migrating bird species, and the sensitivity remains moderate. The nature of the impact is adverse, the type of impact is direct, reversibility of the impact is irreversible, the duration of the impact is medium term, the extent of the impact is local and the probability of the impact occurring is likely. The sensitivity of the impact is medium, and the magnitude of change is minor. Therefore, this impact has been rated adverse minor.

The impacts are shown in Table 27.

Table 27 - Visual and sense of place impacts

Activity	Receptor	Impact	Nature of impact	Value & Sensitivity	Magnitude of change	Significance of impact
Construction and operations	Farmers Motorists Tourists	Poor visual amenity for the site from dis-used mine pits or quarries	Adverse Direct Irreversible Permanent Local Definite	Medium	High/ Major	Adverse Moderate (6)
Construction and operations	Farmers Motorists Tourists	Visual amenity impacts due to the waste rock dump	Adverse Direct Irreversible Permanent Local Definite	Medium	High/ Major	Adverse Moderate (6)
Construction and operations	Farmers Motorists Tourists	Visual amenity impacts due to the tailings storage facility	Adverse Direct Irreversible Permanent Local Definite	Medium	High/ Major	Adverse Moderate (6)
Construction and operations	Farmers Motorists Tourists	Visual amenity impacts due to the construction and operation of a diversion dam	Adverse Direct Irreversible Permanent Local Possible	Medium	High/ Major	Adverse Moderate (6)
Open pit mine and plant construction and operation	Road users of the D1941 gravel road driving past the mine	loss of sense of place due to the road diversion and construction of mine	Adverse Direct Local Medium term Irreversible	Medium	Minor	Adverse Minor (4)

Activity	Receptor	Impact	Nature of impact	Value & Sensitivity	Magnitude of change	Significance of impact
	infrastructure	infrastructure				
Lighting for construction and operations	Insects, birds, and bats	Light impacts on insects, birds and bats due to industrial lighting for construction and operations	Adverse Direct Reversible Short term Local to regional High Probability	Medium	Moderate	Adverse Moderate (6)

7.3.3 AIR QUALITY IMPACTS

Different types of air pollutants are generated during mining construction and operation. The most common air pollutants observed from most mining sites and assessed in this assessment are TSP, PM₁₀ and PM_{2.5}. Pollutants are generated in the form of dust (TSP, PM₁₀ and PM_{2.5}) from vehicle entrainment on the roads, and gaseous pollutants SO₂, NO_x, CO and CO₂ from vehicles and combustion sources.

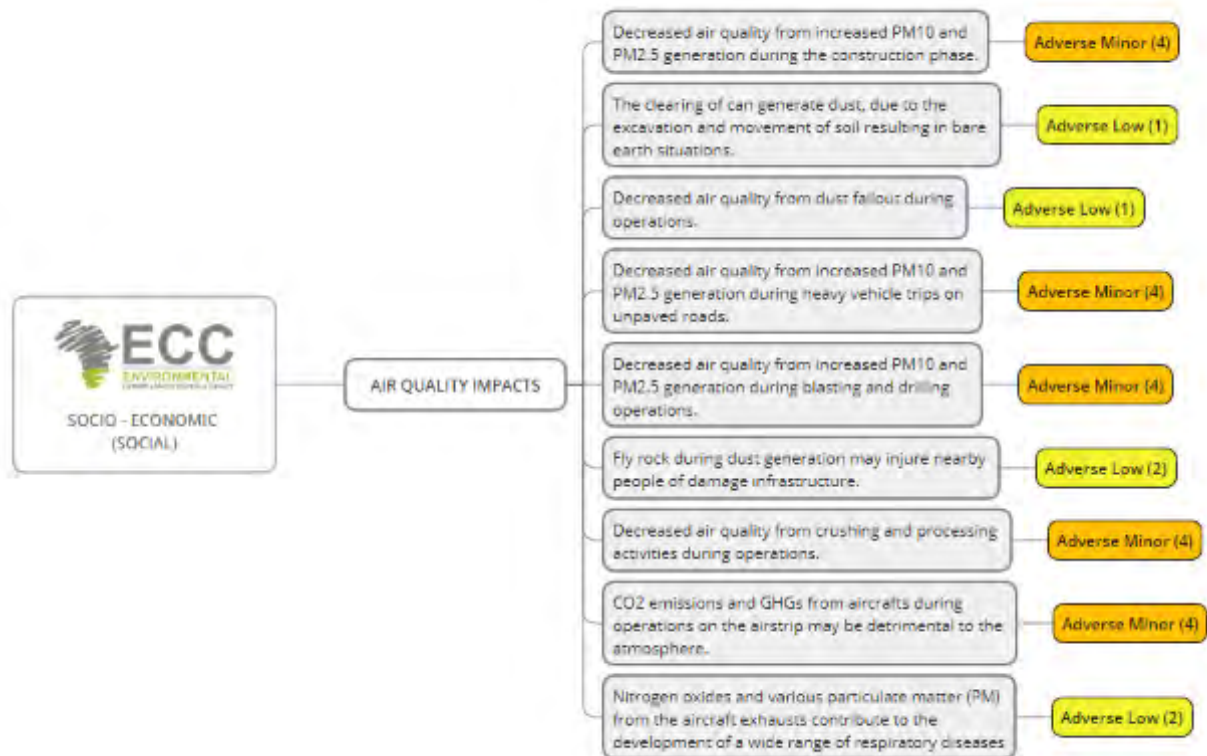


Figure 109 - Air quality impacts

7.3.3.1 decreased air quality due to PM 10 and PM 2.5 generation during construction activities

During construction activities such as land clearing, topsoil removal, road grading, material loading and hauling, stockpiling etc. PM is predominantly produced. The level of emissions and pollutants depends on the number of activities taking place at a specific period of construction. There are expected to be increased PM10 and PM2.5 generation which impacts two sensitive receptors (farmhouses) closest to the open pits and processing plant as shown in Figure 110 and Figure 111. The nature of the construction impact of site infrastructure will be adverse negative and direct, the impact however will be reversible and recoverable over time as illustrated in Table 28. The magnitude of the impact will contribute to minor loss or alteration to the environment's overall air quality. The impact of the dust generated by construction will be temporary and only affect the employees on-site. The impact is going to be short term, and the scale of the impact will be local and is likely to occur.

Mitigation measures include limiting the speed of haul trucks to minimize dust generation, limiting unnecessary travelling of vehicles on untreated roads and reducing the area of construction close to receptors. Water sprays should be applied on regularly travelled, unpaved sections. The significance of this impact has been rated as adverse minor after mitigation.

7.3.3.2 decreased air quality due to dust generation during the construction of the PV plant

The clearing of land for the construction of solar plants can generate dust, primarily due to the excavation and movement of soil resulting in bare earth situations. Before the actual installation of

solar panels, the construction site typically requires significant preparation. This may involve clearing vegetation, grading the land, and sometimes even excavating trenches for cable installation. The process of excavating and moving soil can generate dust, especially if the soil is dry and fine-grained. This is particularly true in arid regions where the soil is naturally prone to dustiness.

This can be prevented through planning and phased approach towards land clearing and only clearing areas just prior to the land being needed.

For ground-mounted solar arrays, concrete foundations are often constructed to support the solar panels. Additionally mixing and pouring concrete can generate dust. High levels of dust can reduce air quality resulting in lead to a wide range of diseases such as respiratory diseases (lung cancer, TB, bronchitis, COPD etc.). In plants dust can block stomata, affecting the growth of plants and metabolism by destroying chlorophyll and disrupting photosynthesis.

The nature of this impact will be adverse and direct. The impacts of these activities are reversible and are likely to be temporary. The magnitude of change from this impact is going to be low, however, the extent of the impact is only on-site. While the negative impacts of dust are likely to occur. Therefore, this impact has been rated adverse low.

7.3.3.3 decreased air quality from dust fallout during operation

During construction and operation potential dustfall out was modelled and the daily dustfall out limits are not expected to exceed the national air quality limits (SA NDCR residential limit of 600 mg/m²/day) at any of the air quality monitoring stations or outside of the ML boundary. The nature of this impact is adverse and direct. The magnitude of the impact is low, while the impact is reversible. The impact is expected to be short term, and the scale of the impact will be on-site and is possible to occur. Therefore, the significance of this impact has been rated adversely low.

7.3.3.4 decreased air quality due to PM10 and PM2.5 generation during transportation, blasting and crushing operations

During operations, the main contribution to emissions will be vehicle entrainment from unpaved haul roads, crushing, screening, drilling, and blasting. The worst-case scenario (Year 6) was assessed in which the highest tonnage of ore will be mined from THC, Bulge and Clouds, thus resulting in an increase in crushing and screening activities. TSP, PM2.5 and PM10 ground-level concentrations are likely to exceed WHO IT-3 and SA NAAQS limits daily near the mine especially closest to the pits, stock ore piles, haul roads and crushing plant. At the same time, the levels of PM10 and PM2.5 are likely to exceed the WHO IT-3 and SA NAAQS limits daily northwest and east of the site boundary (AQSR 1 & 2) if mitigation measures are not implemented. PM10 and PM2.5 levels would exceed WHO IT-3 and SA NAAQS annually at the farmhouse (AQSR 1) closest to the pits. The nature of the impact is adverse and direct, and the magnitude of change is high. The impact is going to be short term, and the scale of the impact will be local and is likely to occur. Therefore, the significance of this impact has been rated as adverse minor.

For the control of vehicle-entrained dust the following is recommended to minimise impacts:

- Applying water to the hauls roads in the pit would reduce the amount of windblown dust blowing towards sensitive receptors; and
- Surface haul roads (to the WRDs and ROM SP) – use chemical suppressants such as dust-a-side.

In minimising dust from crushing and screening operations, water should be sprayed to keep the ore wet. Hooding with cyclones would achieve 65% Control Efficiency (CE), whereas scrubbers will achieve 75% and fabric filters would result in 83% CE. Minimising dust from materials transfer points, excluding the dried concentrate, could be done using water sprays at the tip points. In minimising windblown dust from stockpile areas, water sprays should be used to keep surface material moist. The TSF slope should be clad progressively during operation using waste rock and a dust-suppressing polymer is sprayed on the TSF surface following tailings placement.

7.3.3.5 *Decreased air quality because of operations of aircraft on the airstrip*

The operation of the airstrip and the movement of the planes will emit CO₂ emissions and GHGs which are more detrimental to the atmosphere as these gases are released into higher levels of the atmosphere. The nature of this impact will be adverse, and direct but partly reversible. The magnitude of change is high, the duration is long term, and the extent is regional. This impact is likely to occur, and the sensitivity of this impact is medium. Therefore, the significance of this impact is expected to be adverse minor.

The release of nitrogen oxides and various particulate matter (PM) from the aircraft exhausts such as (PM 0.1µm) contribute to ambient concentrations of ultrafine particles in and around airports. This can contribute to the development of a wide range of respiratory diseases (e.g., chronic obstructive pulmonary disease (COPD) and asthma; occupational lung diseases, such as byssinosis, asbestosis etc.) which could constitute a health hazard. Additionally, aircraft gas turbine engines result in direct emissions of “non-volatile” particulate matter (nvPM), also described as black carbon (BC) “soot” emissions.

The nature of this impact will be adverse, and direct but reversible. The magnitude of change is moderate, the duration is short-term, and the extent is local. This impact is likely to occur, and the sensitivity of this impact is low. Therefore, the significance of this impact is expected to be adverse low.

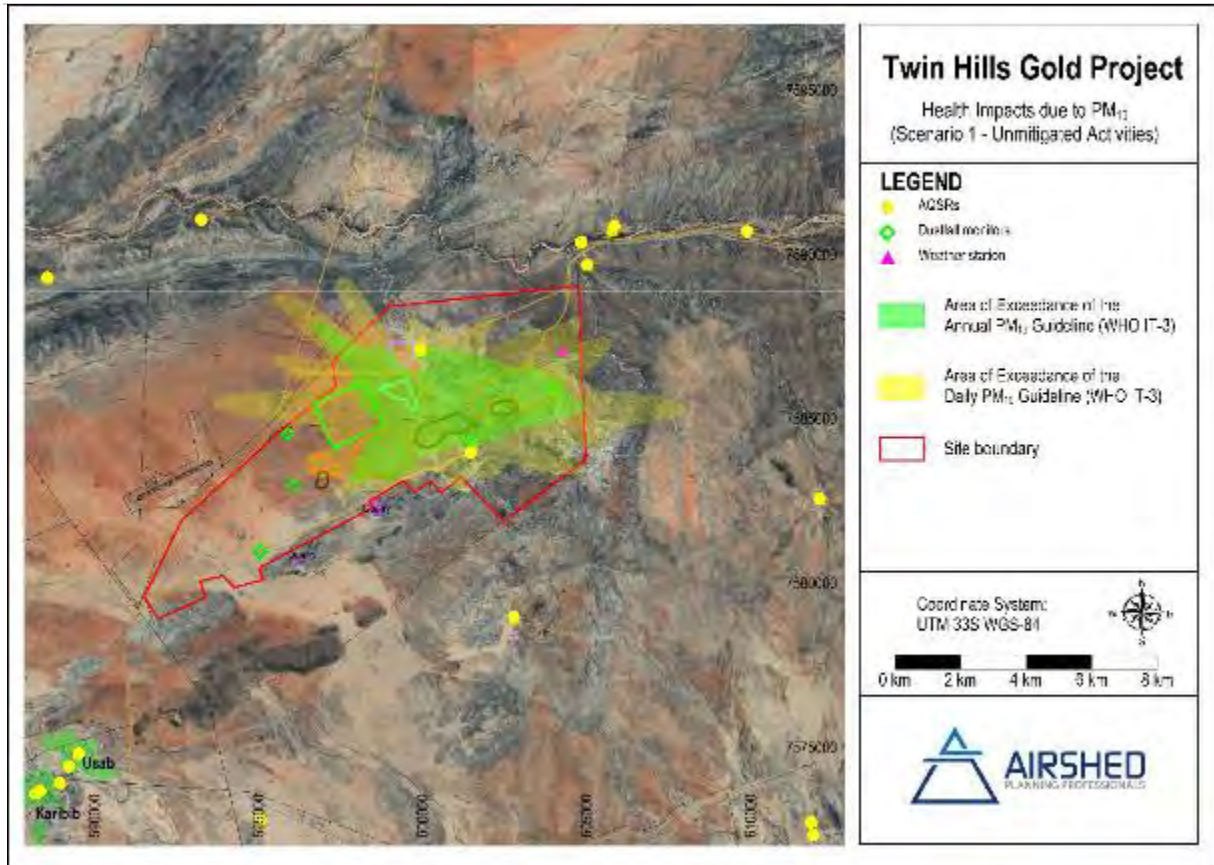


Figure 110 - Area of daily and annual PM10 AQO non-compliance for unmitigated Year 6 operations.

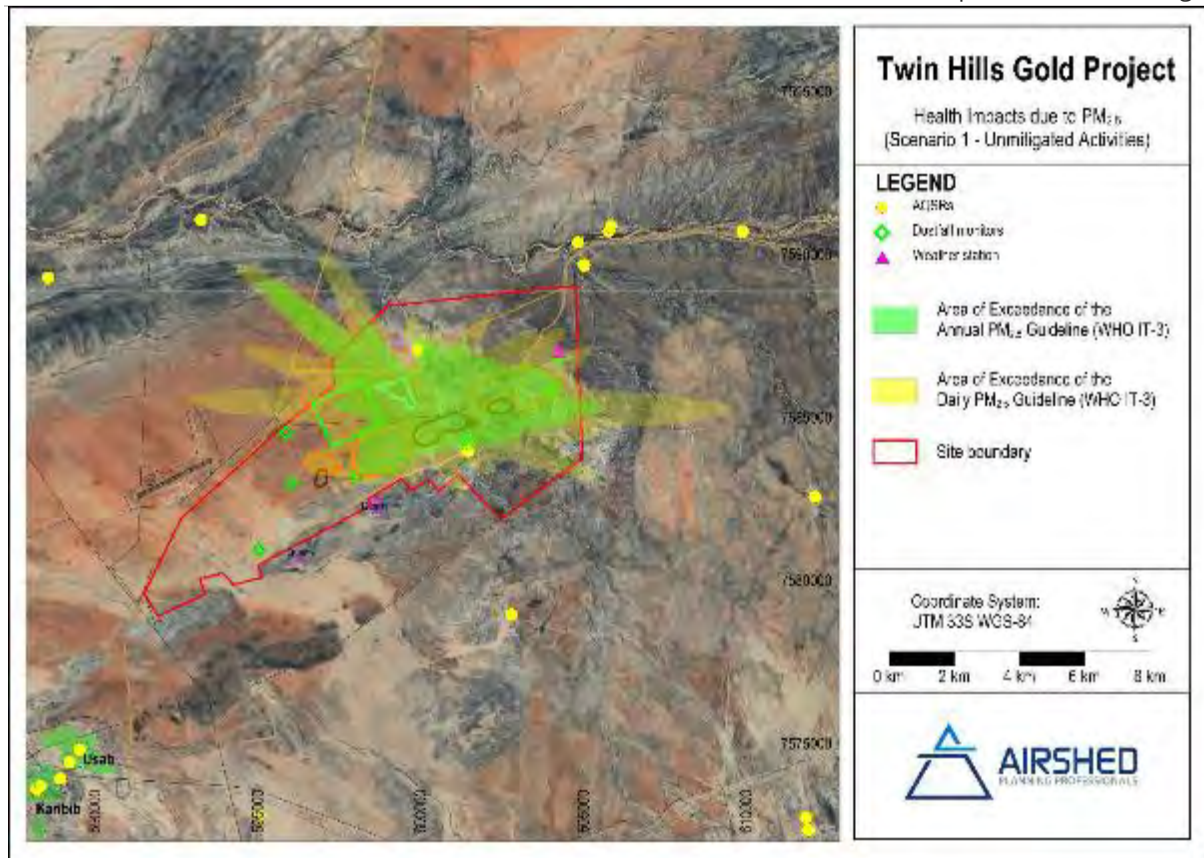


Figure 111 - Area of daily and annual PM_{2.5} AQO non-compliance for unmitigated Year 6 operations.

Table 28 - Impacts of Project on air quality

Activity	Receptor	Impact	Nature of impact	Value & Sensitivity	Magnitude of change	Significance of impact
Construction	Air quality Employees Community	Decreased air quality from increased PM ₁₀ and PM _{2.5} generation	Adverse Direct Reversible Moderate Short Term Local Likely	Medium	Moderate	Minor (4)
Construction and installation of the solar plant.	Air quality Employees Community	The clearing of can generate dust, due to the excavation and movement of soil resulting	Adverse Direct Reversible Low Temporary On-site Likely	Low	Low	Low (1)

Activity	Receptor	Impact	Nature of impact	Value & Sensitivity	Magnitude of change	Significance of impact
		in bare earth situations				
Operations	Air quality Employees Community	Decreased air quality from dust fallout	Adverse Direct Reversible Low Short Term Local Possible	Low	Low	Low (1)
Access and roads	Air quality Employees Community	Decreased air quality from increased PM10 and PM2.5 generation	Adverse Direct Reversible Moderate Short Term Local Likely	Medium	Moderate	Minor (4)
Blasting	Air quality Employees Community	Decreased air quality from increased PM10 and PM2.5 generation	Adverse Direct Reversible High Short Term Local Likely	Medium	High	Minor (4)
Blasting	Employees Infrastructure	Fly rock may injure people or damage infrastructure	Adverse Direct Partly Reversible Moderate Short Term Onsite Possible	Low	Moderate	Low (2)
Crusher and processing	Air quality Employees Community	Decreased air quality from emissions	Adverse Direct Partly Reversible Moderate Short Term Local Likely	Medium	Moderate	Minor (4)

Activity	Receptor	Impact	Nature of impact	Value & Sensitivity	Magnitude of change	Significance of impact
Operation of an airstrip	Air quality	CO ₂ emissions and GHGs from aircrafts during operations on the airstrip may be detrimental to the atmosphere.	Adverse Direct Partly reversible High Long term Regional Likely	Medium	High	Minor (4)
		Nitrogen oxides and various particulate matter (PM) from the aircraft exhausts contribute to the development of a wide range of respiratory diseases	Adverse Direct Reversible Moderate Short term Local Likely	Low	Moderate	Low (2)

7.3.4 TRAFFIC IMPACTS

Traffic impact study determines the potential impacts of a proposed Project on the existing road systems. This may include potential alteration to normal traffic volumes, potential degradation of existing freeways and district roads. The significant traffic impacts that have specific interest to the community and stakeholders (before mitigation measures) are summarised in Figure 112. Impacts are discussed further in detail in the section below.

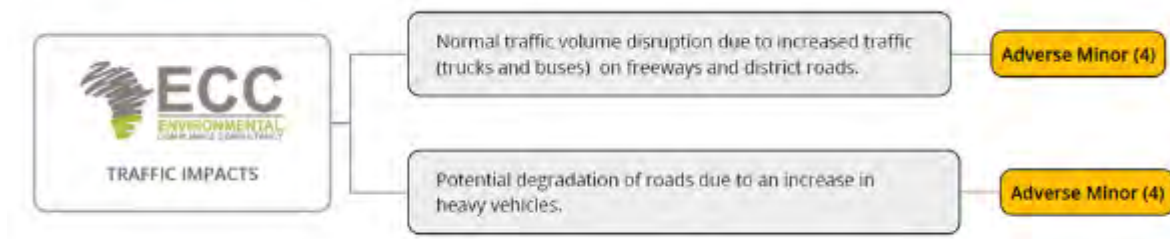


Figure 112 - Impacts of the Project on traffic in the area.

7.3.4.1 Probable alteration and disruption of normal traffic flow

Traffic and transport related impacts aligned with the Twin Hills Project were assessed by Innovative Transport Solution in 2023. The traffic count study surveyed a total volume of 170 vehicles (53 were heavy duty vehicles) along the C33 Karibib - Omaruru national road (ITS, 2023). It is likely and expected that traffic volume will increase during both construction and operation phase, with 74 hourly trips projected on the C33 road and the D1941 district road during the project development phase and 52 hourly trips are expected during the operation phase (ITS, 2023). This as a result will potentially cause alterations to normal traffic flow between Karibib and Omaruru.

The potential increase in traffic volume and potential disruption to normal traffic flow is adverse and direct. Receptors are regarded as commuters and road users between Karibib and Omaruru, hence the extent of the impact is regarded as local. According to (ITS, 2023), all intersections would continue to operate acceptably and would have sufficient capacity until 2040 (LoM). The impact has a medium probability and moderate magnitude of change as road users would enduringly adapt to increase in traffic levels as the project transition through different phases. Therefore, the significance of the impact is expected to be adverse minor as shown in Table 29.

Table 29- Impacts related to traffic flow disruption

Activity	Receptor	Impact	Nature of impact	Value & sensitivity	Magnitude of change	Significance of impact
Frequent traffic movements between Karibib, Omaruru and the mine site.	- Commuters - Visitors to the area - New workforce	Increased traffic volumes on district roads and buses and trucks travelling to and from the mine site will disrupt normal	Adverse Direct Local Reversible Possible	Medium	Moderate	Adverse Minor (4)

Activity	Receptor	Impact	Nature of impact	Value & sensitivity	Magnitude of change	Significance of impact
		traffic flow.				

7.3.4.2 Potential road degradation due to an increase in heavy vehicles on national and district roads

Heavy load vehicles on roads could fairly pressurise and degrade roads. A total of 53 heavy vehicles were survey on the C33 national during the traffic count conducted by Innovative Transport Solution in 2023. As the project transition through the different developmental phases, an increase in delivery heavy vehicles to and from the mine site is expected which potentially could lead to creation of road potholes, degradation of dirt roads and wearing out of tar road structures, if such roadways are not timely maintained.

The existing D1941 road will be re-aligned 8.5 km north of the C33-D1941 road intersection as the current D1941 district road cuts across the mine site. This shields D1941 from excessive traffic volumes and thus brings the impact within acceptable levels. The road diversion is predicted to be able to accommodate traffic levels up until 2040 (ITS, 2023). As per the specialist study, additional complementary mitigation measures that will ensure good conditions of roadways are such as surfacing the re-aligned D1941 road, imposing a speed limit of 60 km/h towards the entrance of the mine, designing and maintaining the width of the road at the site access point at a width of at least 7m and bell-mouth radii of at least 15 m to allow heavy vehicles such as buses and trucks to pass each other safely. Additionally, it is recommended that a northbound right-turn lane be constructed at the realigned D1941 intersection onto the C33 road, and the speed should be reduced from 120 km/h to 80 km/h on the C33 road leading towards the D1941 turn-off.

With the implementation of the abovementioned feasible mitigation management measures, the significance of the impact is expected to be adverse minor (Table 30). The impact is therefore not discussed further in this chapter.

Table 30 - Impact of the Project on the main and district road quality

Activity	Receptor	Impact	Nature of impact	Value & Sensitivity	Magnitude of change	Significance of impact
Road degradation	C33 road and D1941	Increased heavy vehicles on the road will lead to more potholes and degradation of the road	Adverse Direct Regional reversible Moderate Medium term Possible	Medium	Moderate	Adverse Minor (4)

7.3.5 AVIATION RELATED AIRTRAFFIC IMPACTS ON THE KARIBIB AIR FORCE BASE AND AERODOME

The Karibib air force base aerodrome is a 24-hour operation, that allows for night flying for military and commercial purposes. Lighting and potential obstacle obstructions from the Twin Hills Project construction and mining activities could have impacts on the safe operation of this aerodrome and aircrafts. The potential significant impacts or impacts that have specific interest to the community and stakeholders, before mitigation, are summarised in Figure 113 for illustrative purposes only. Details related to each specific impact is discussed further in this section.

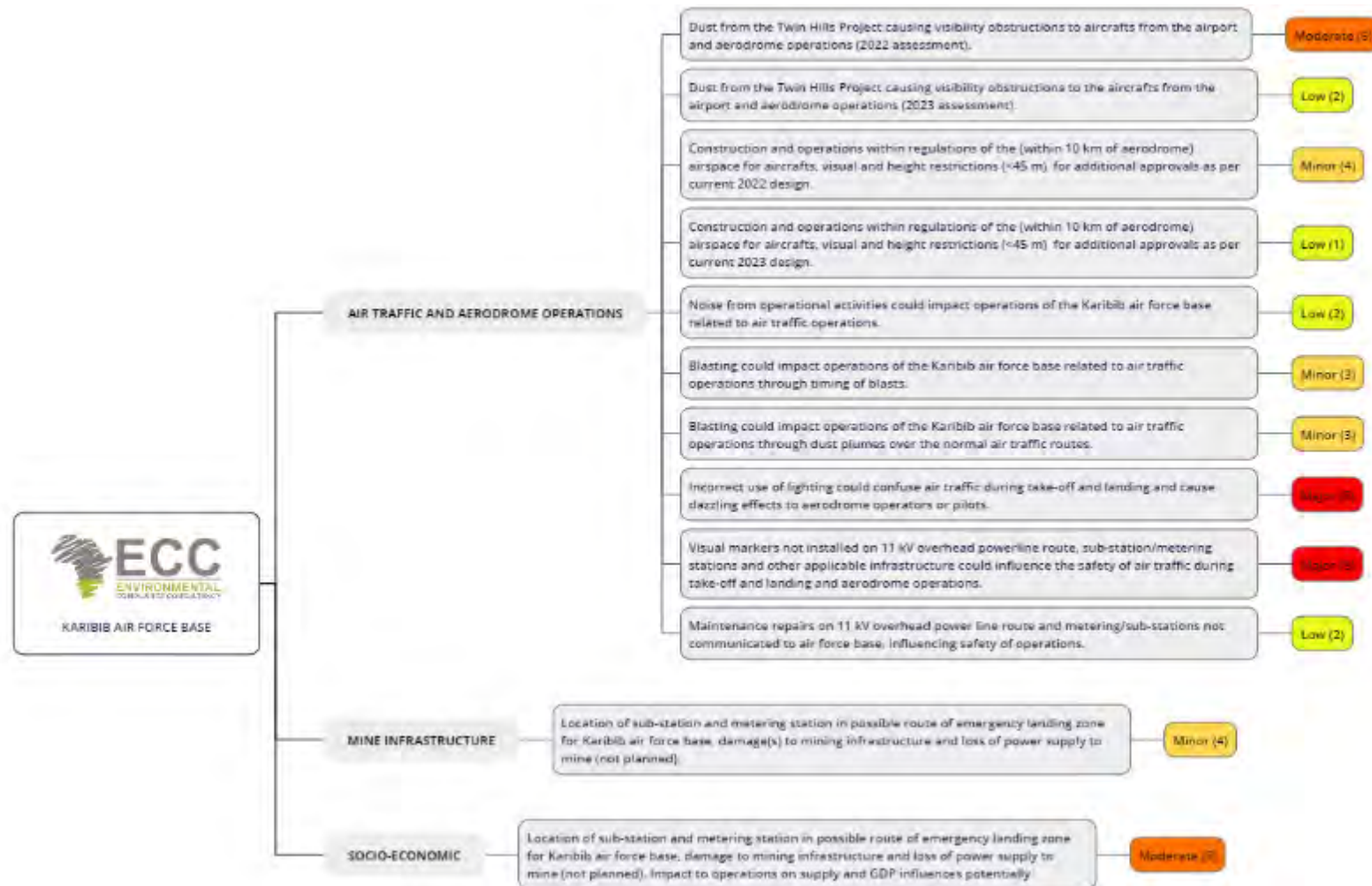


Figure 113 - Air traffic related impacts

7.3.5.1 *Dust from the Twin Hills Project activities causing visibility obstructions to aircrafts from the airport – 2022 assessment*

Previously during the 2022 ESIA this potential impact was determined to be a non-significant impact and was thus not assessed further in the 2022 assessment. However, the 2023 ESIA has determined that this potential impact should have been assessed and scored, to determine the differences between the 2022 and 2023 assessments, taking the air quality baseline updates into account, as the Karibib air force base has been included as a specific air quality sensitive receptor for the 2023 assessment.

Based on the 2022 baseline assessment and modelling, dust from operational activities causing visibility obstructions to aircrafts taking off and landing from Karibib air force base and related impacts on aerodrome operators could have an adverse impact. These impacts will be direct, long term for the duration of the Project (life of mine) and reversible. The scale of the impact is local, as activities extend to the aerodrome (within 5 nautical miles) and direct flight path surroundings around the Project site. The probability of this impact occurring is expected to be likely, as dust will be emitted during construction and operation activities. The value of sensitivity is expected to be medium and magnitude of change very high/major, due to the impacts on the aerodrome operations if pilots are not able to take off or land. The overall significance of the impact is expected to be moderate. Mitigation measures through dust suppression requirements are further discussed in the ESMP (Appendix A).

7.3.5.2 *Dust from the Twin Hills Project activities causing visibility obstructions to aircrafts from the airport – 2022 assessment*

Modelling from 2023 air quality impact assessment by Airshed (2023 a) for total dust fall and PM10/2.5 dust emissions on site demonstrated that source dust emitted will not reach the Karibib air force base as a receptor and will not influence operations at the air force base/aerodrome self in the unmitigated and mitigated scenarios for the year 6 operations scenario (Figure 114 to Figure 116). During the year 8 scenario of operations assessment, only the unmitigated PM10 was assessed to reach the Karibib air force base (Figure 117) however, this is not the case in the mitigated scenario (Figure 118) or for the dust fall out and PM2.5 in the mitigates and unmitigated scenarios (Figure 119 to Figure 120).

PM10 and PM2.5 dust cannot be seen by the naked eye, as with fallout dust or nuisance dust. Dust will be concentrated over operational activities and roads, with an extension off site to the northwest, west and east of the site boundary, which will be mitigated by using water sprays, chemical binding agents and other dust suppressant methodologies.

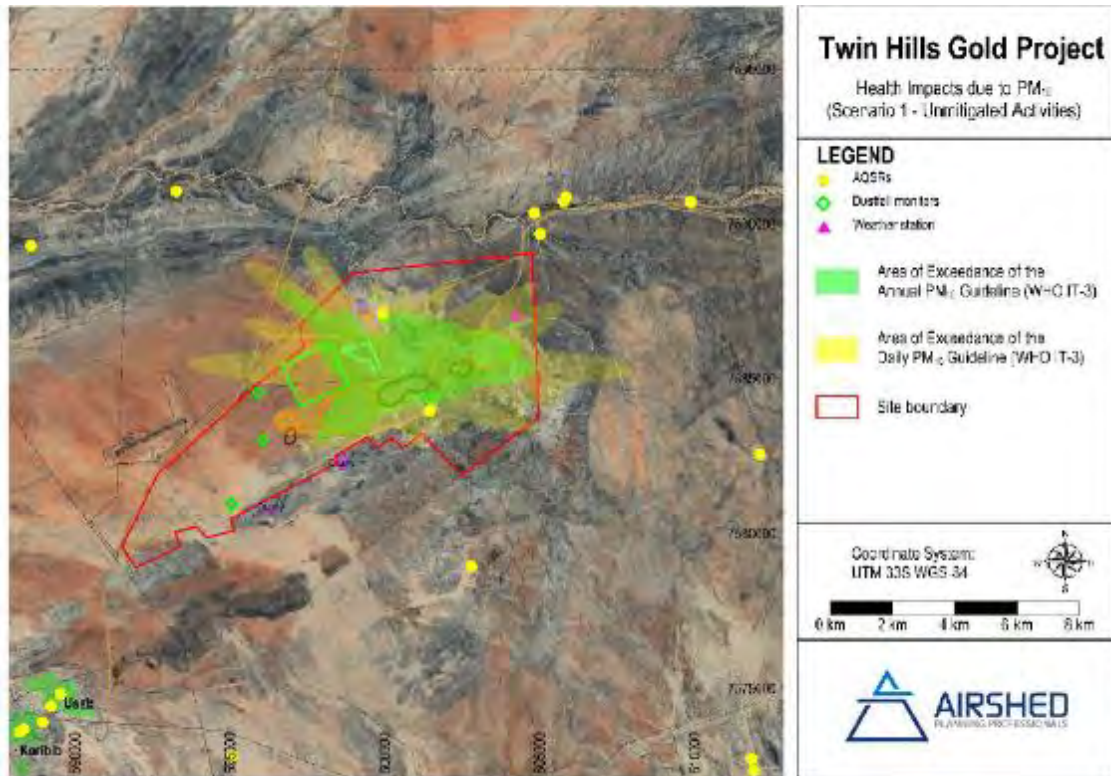


Figure 114 - Area of non-compliance of daily and annual PM10 for the unmitigated scenario for year 6 of operations (Source: AirShed, 2023 a) (AirShed, 2023).

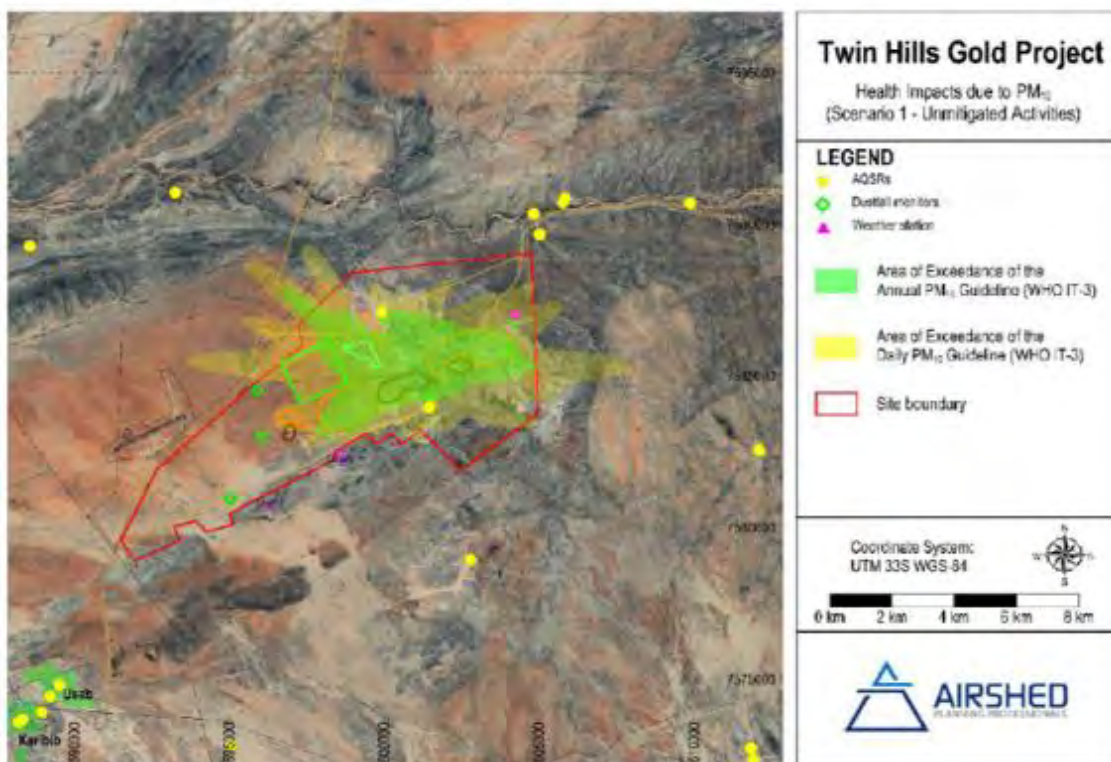


Figure 115 - Area of non-compliance of daily and annual PM2.5 for the unmitigated scenario for year 6 of operations (Source: (AirShed, 2023)

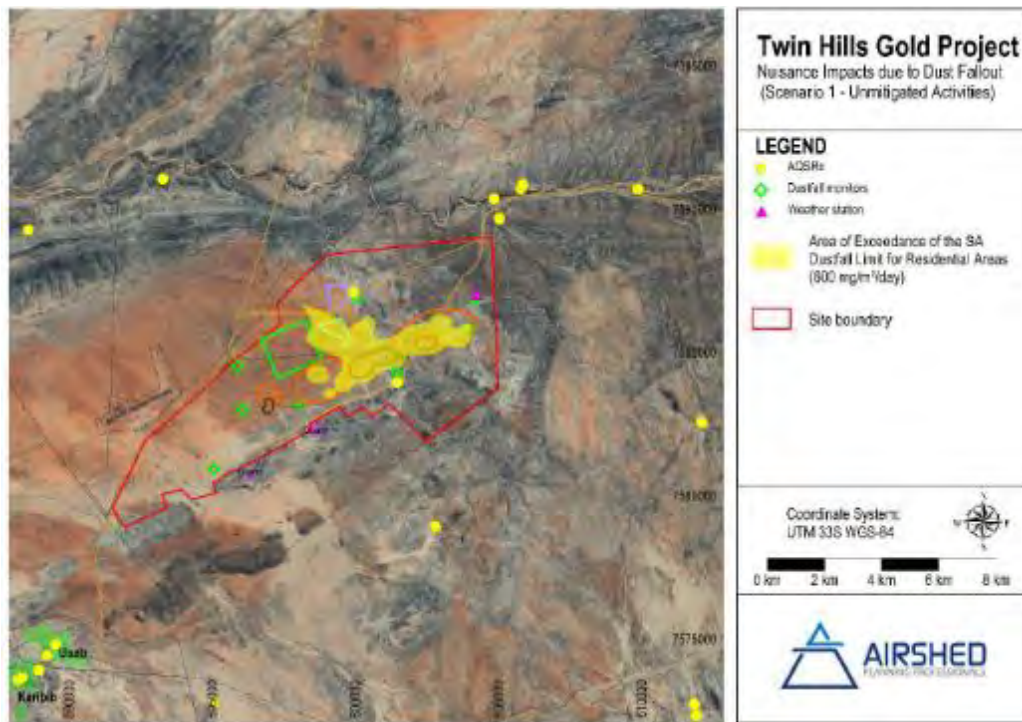


Figure 116 - Area of non-compliance of dustfall limit values for the unmitigated scenario for year 6 of operations (Source: (AirShed, 2023))

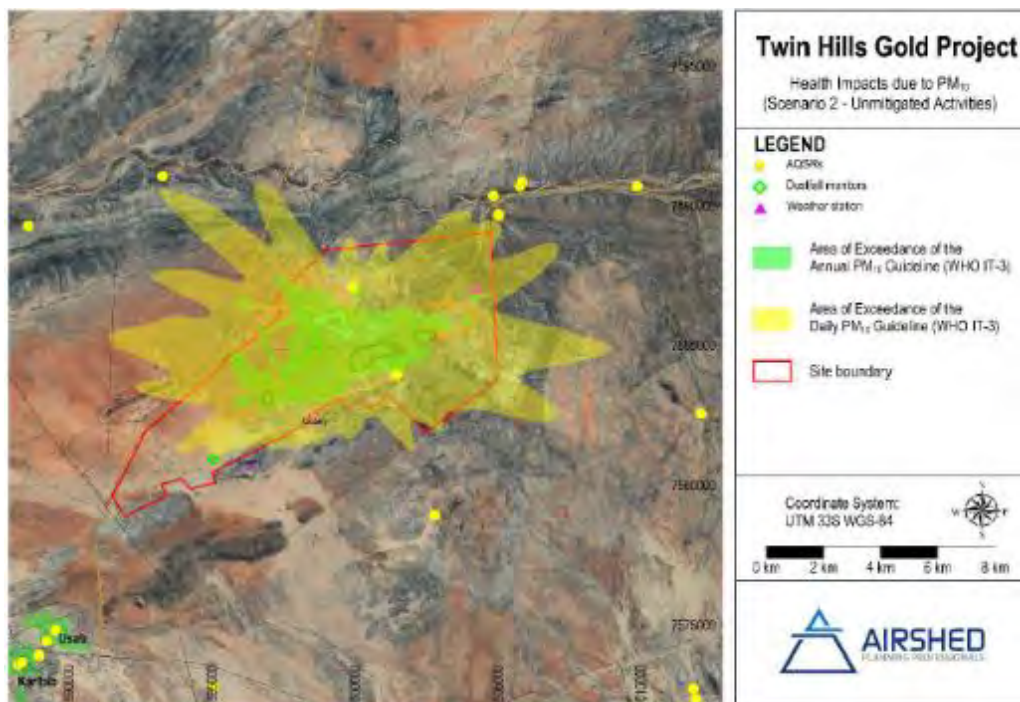


Figure 117 - Area of non-compliance of daily and annual PM10 for the unmitigated scenario for year 8 of operations (Source: (Airshed, 2023)).

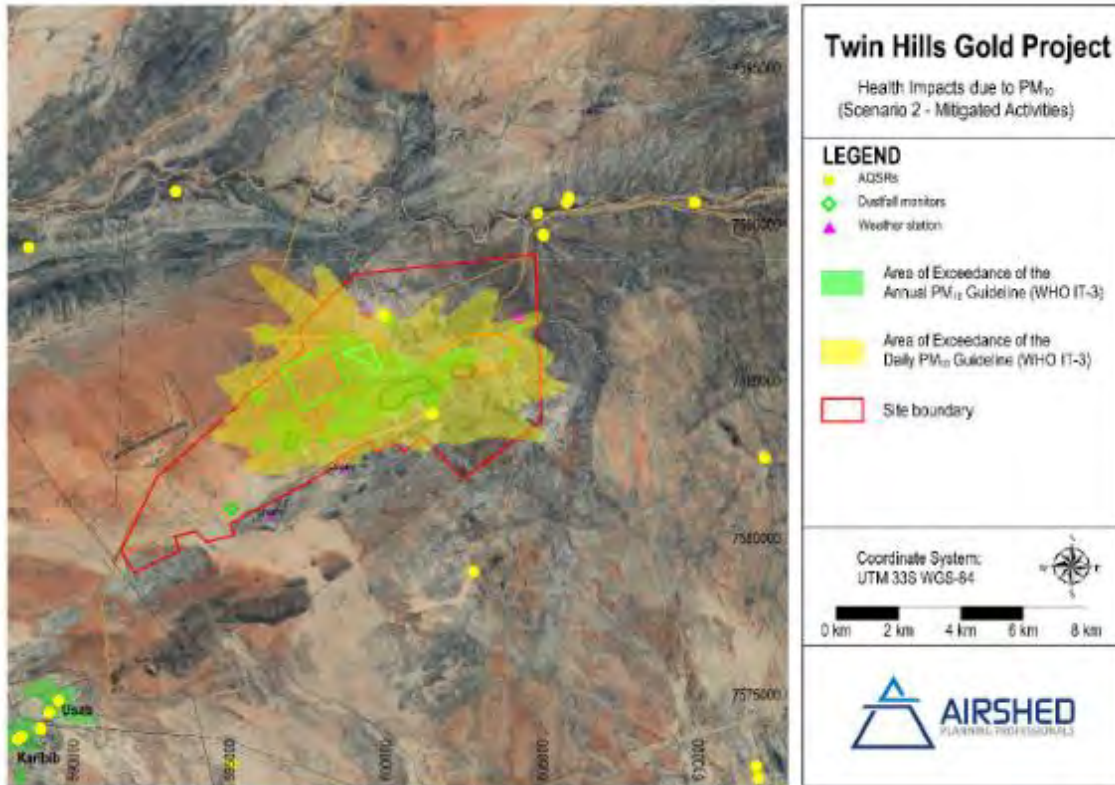


Figure 118 - Area of non-compliance of daily and annual PM₁₀ for the mitigated scenario for year 8 of operations (Source: (AirShed, 2023)).

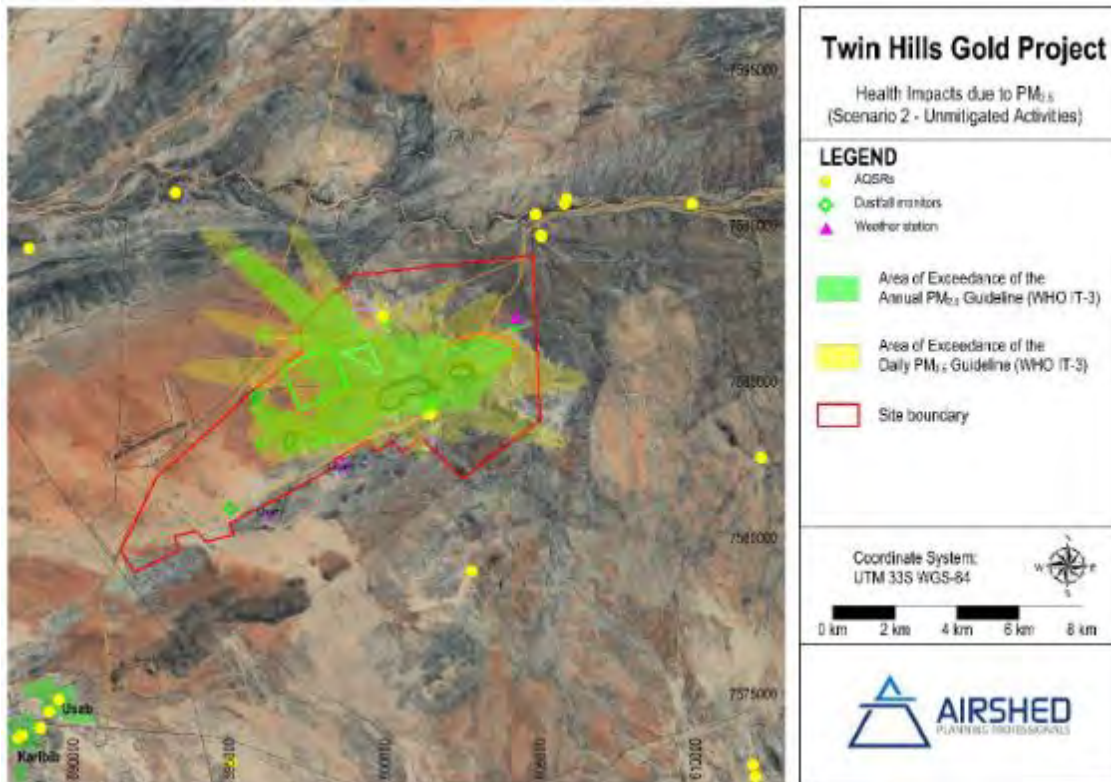


Figure 119 - Area of non-compliance of daily and annual PM_{2.5} for the unmitigated scenario for year 8 of operations (Source: (AirShed, 2023)).

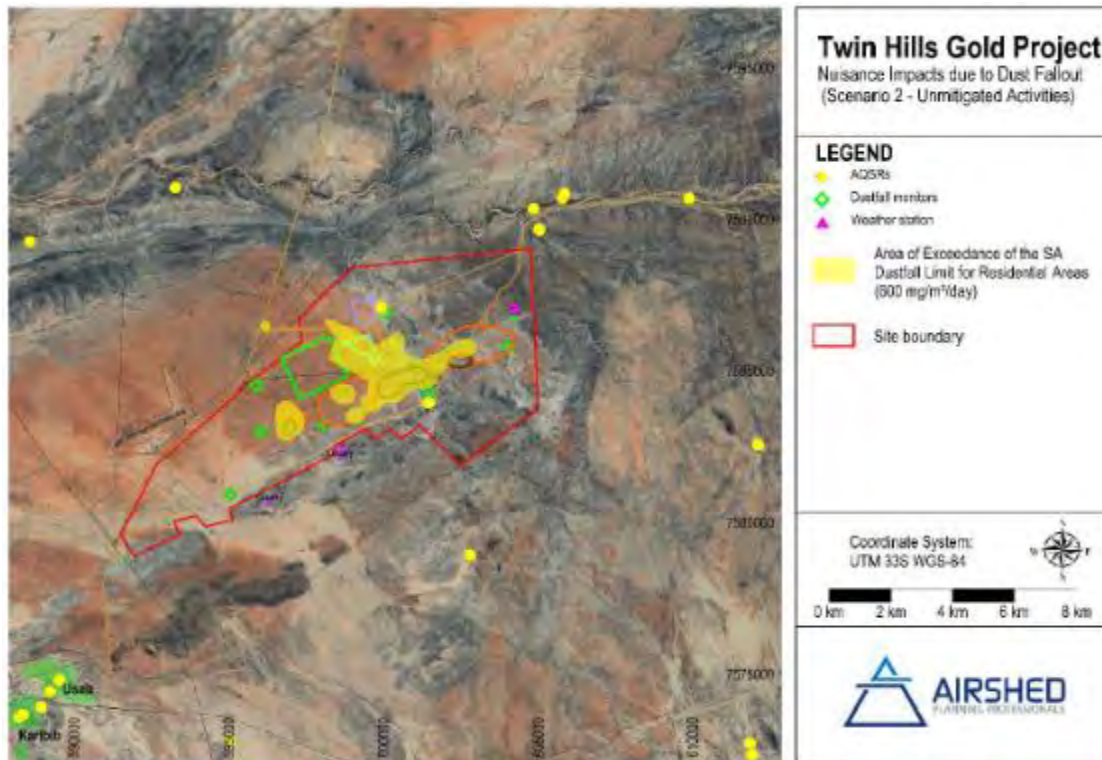


Figure 120 - Area of non-compliance of dustfall limit values for the unmitigated scenario for year 8 of operations (Source: (AirShed, 2023)).

Based on the 2023 baseline assessment and modelling, dust from operational activities causing visibility obstructions to aircrafts taking off and landing from Karibib air force base and related impacts on aerodrome operators could have an adverse impact. These impacts will be direct, long term for the duration of the Project (life of mine) and reversible. The scale of the impact is local, as activities extend to the aerodrome (within 5 nautical miles) and direct flight path surroundings around the Project site. The probability of this impact occurring is expected to be likely, as dust will be emitted during construction and operation activities. The value of sensitivity is expected to be low and magnitude of change very low/minor, due to the reassessed modelling of potential impacts for the Project and Karibib air force base as a sensitive receptor. The overall significance of the impact is expected to be low. Mitigation measures through dust suppression requirements and further environmental monitoring are further discussed in the ESMP (Appendix A).

7.3.5.3 Construction and operations within regulations of the (within 10km of aerodrome) airspace for aircrafts, visual and height restrictions (<45m) airspace for aircrafts, visual and height restrictions (<45) for additional approvals as per current 2022 design.

Previously during the 2022 ESIA this potential impact was determined to be a non-significant impact and was thus not assessed further in the 2022 assessment. However, the 2023 ESIA has determined that this potential impact should have been assessed and scored, to determine and quantify the differences between final design requirements between the 2022 and 2023 assessments. The height restrictions of infrastructure in relation to the NAMCATS part 139 requirements were not looked at in detail for the 2022 assessment (<45 m within 10 km of an aerodrome).

Based on the 2022 design requirements, infrastructure layout and heights of structures from construction and operational activities could have adverse impacts and cause visibility obstructions, that do not align with NCAA requirements due to distance of the Project site from the aerodrome, for aircrafts taking off and landing from Karibib air force base and related impacts on aerodrome operators. These impacts will be direct, long term for the duration of the Project (life of mine) and reversible. The scale of the impact is on-site, as the construction and operational infrastructure and activities are located in the Project boundaries. The probability of this impact occurring is expected to be possible. The value of sensitivity is expected to be medium and magnitude of change very high/major, due to the impacts on the aerodrome operations and pilots if height restrictions exceed 45 m and markers are not installed as required by the NCAA. The overall significance of the impact is expected to be minor.

7.3.5.4 Construction and operations within regulations of the (within 10 km of aerodrome) airspace for aircrafts, visual and height restrictions (<45 m) for additional approvals as per current 2025 design

As per the NAMCATS part 139, the 2023 design requirements fall within the required height restrictions of less than 45 m for all facilities, stockpiles and infrastructure on site, including use of cranes and do not warrant any additional approvals or mitigation in this regard.

Based on the 2025 design requirements, infrastructure layout and heights of structures from construction and operational activities could have adverse impacts and cause visibility obstructions for aircrafts taking off and landing from Karibib air force base and related impacts on aerodrome operators. These impacts will be direct, long term for the duration of the Project (life of mine) and reversible. The scale of the impact is on-site, as the construction and operational infrastructure and activities are located in the Project boundaries. The probability of this impact occurring is expected to be unlikely. The value of sensitivity is expected to be low and magnitude of change none/negligible, as height restrictions will not exceed 45 m and no additional approvals are required from the NCAA. The overall significance of the impact is expected to be low.

7.3.5.5 Noise from operational activities could impact operations of the Karibib air force base related to air traffic operations

Potential noise impacts from operational activities of the Twin Hills Project were re-assessed and re-modelled in 2023 by Airshed (2023, b) (AirShed, 2023), taking into account updated design information for the site for various noise sources and reviewing the noise sensitive receptors. The noise impact assessment determined that there will be no impacts as per the IFC guidelines in the mitigated or unmitigated scenarios on the Karibib air force base as a sensitive receptor during the daytime or nighttime activities in operational year 7 (Figure 121 to Figure 122).

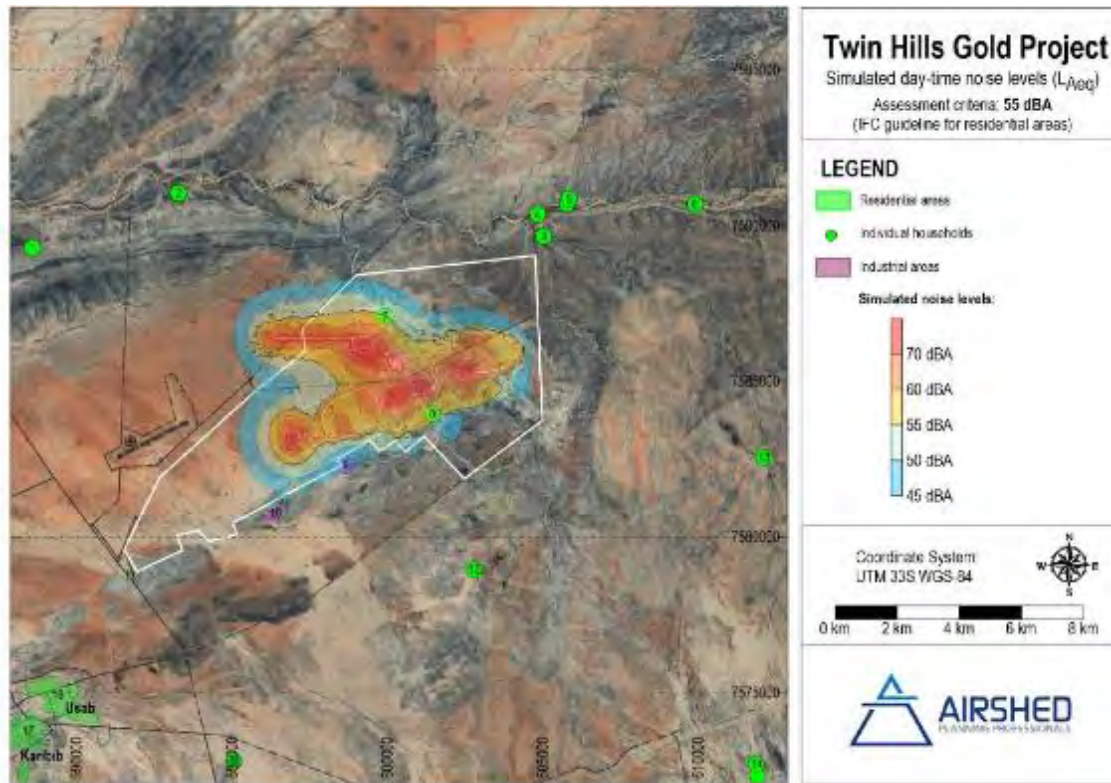


Figure 121- Simulated day-time noise levels for year 7 of operations (Source: (AirShed, 2023))

Therefore, noise impacts from the Project site could have an adverse impact on operational activities of the Karibib air force base, however these impacts will be direct, long term for the duration of the Project (life of mine) and reversible. The scale of the impact is on-site, as the noise impacts will not extend off site. The probability of this impact occurring is expected to be likely as noise will be generated on site from various identified sources. The value of sensitivity is expected to be low and magnitude of change low/minor to the Karibib air force base operations. The overall significance of the impact is expected to be low. Noise levels to be maintained on site as required by recommendations made by (AirShed, 2023) and these requirements are further described in the ESMP (Appendix A).

7.3.5.6 *Blasting could impact operations of the Karibib air force base related to air traffic operations through timing of blasts*

Blasting operations is a normal mining activity to remove overburden material to expose ore for open pit mining operations. Additionally, when ore in hard rock is too hard to excavate with ancillary equipment, blasting is further required to loosen the ore. During an operational mine, blasting can take place on a minimum 2 to 3 times a week, which increases in frequency depending on the hardness of the rock at specific depths as the pit deepens. The Twin Hills Project has determined four open pits, that will be mined as per the mine planning strategy over the life of mine of the Project. The identified blaster will determine specific site requirements for blasting activities but generally, the blast zone (500 m) must be cleared of all mobile equipment/fleet and persons 30 minutes prior to the blast, whereby the blast zone is sealed off. Warning signs of the blast details should be placed within 24 hours at locations around the mine site. An audible

warning such as a siren is played until the blast goes off. Following a blast the blaster inspects the site that was blasted, ensures there are no miss fires and provides the all clear once operational activities can commence and entry is allowed back into the pit. This usually takes a minimum of 30 minutes.

During planning of blast, the Proponent and blaster will need to communicate with the Karibib air force base, as aircrafts should not operate during an active blast. Times would need to be communicated in advance and found appropriate by the air force base in order not to interfere with operations from the military or commercial flight requirements. Delays with blasts are expected to be 30 min before a blast and 30 min following a blast, therefore this is not a long interference. However, if misfires would occur, this would delay providing the all clear. A standard no-fly time period should be agreed upon with the Karibib air force base per planned blast.

Therefore, time of blasting operations could adversely impact the Karibib air force base normal operations. These impacts will be direct, long term for the duration of the Project (life of mine) and reversible. The scale of the impact is local, as the extent includes the aerodrome and related off site air space operations. The probability of this impact occurring is expected to be definite as blasting is part and parcel of open pit mining activities. The value of sensitivity is expected to be low and magnitude of change moderate to the Karibib air force base operations. Operations of the air force will be slightly affected, and the aerodrome operations will need to work together with the Proponent and blaster to find suitable blast times that least influences flight schedules. The overall significance of the impact is expected to be minor.

Proactive communication with Karibib air force base is required to determine air traffic schedules and schedule blast events to avoid interference where possible from blasting. Additionally, inform air force well in advance (24 hours of planned blast activities) and timing. These mitigation requirements are further described in the ESMP (Appendix A).

7.3.5.7 Blasting could impact operations of the Karibib air force base related to air traffic operations through dust plumes over the normal air traffic routes

During a blast, dependent on the stemming material used, a dust cloud is emitted and there is the possibility of fly rick being projected. A standard no-fly time period should be agreed upon with the Karibib air force base per planned blast to avoid potential damages to aircrafts entering the airspace above the mine for landing or take-off during planned blasting activities.

Therefore, dusty plumes created during blasting operations could adversely impact the Karibib air force base normal operations and aircrafts in the aerodrome airspace. These impacts will be direct, long term for the duration of the Project (life of mine) and reversible. The scale of the impact is local, as the extent includes the aerodrome and related air space operations. The probability of this impact occurring is expected to be definite as blasting is part and parcel of open pit mining activities. The value of sensitivity is expected to be low and magnitude of change moderate to the Karibib air force base operations. Operations of the air force base will be slightly affected, and the

aerodrome operations will need to work together with the Proponent and blaster to find suitable blast times that least influences flight schedules as aircrafts will not be able to fly with reduced visibility. The overall significance of the impact is expected to be minor.

Mitigation requirements are further described above in 7.3.5.11 and in the ESMP (Appendix A).

7.3.5.8 Incorrect use of lighting could confuse air traffic during take-off and landing and cause dazzling effects to aerodrome operators or pilots

As stated previously, the Twin Hills Project is located within the aerodrome air space of the Karibib air force base. As the Project is a 24-hour operation, lighting will be utilised during daytime where required for safety reasons and night-time for normal operations to visibly proceed. Currently the air force base is also a 24-hour operation. As per the NAMCATS part 139, there are specific requirements for the use of lighting on infrastructure as not to confuse pilots during take-off and landing and to prevent dazzling effects for the pilots and for the aerodrome operators. Additionally, each aerodrome might have specific requirements that need to be adhered too for structures and infrastructure that fall within the specific aerodrome to prevent interference to operations. Night-time flying should not be hindered by the operational use of lights for the Project.

Therefore, there was a need to assess the potential adverse impacts that lighting could have on the operations of the aerodrome. This impact will be direct, long term for the duration of the Project (life of mine) and partly reversible. The scale of the impact is National, as this air force base is main air force base utilised in Namibia by the military (The Namibian, 2016). Additionally, the air force base is also open to commercial flights. The probability of this impact occurring is expected to be definite as lighting will be required to be used by the Project in order for normal operations to proceed. The value of sensitivity is expected to be medium and magnitude of change very high/unknown to the Karibib air force base operations without mitigation measures being enforced, as operations of the air force base will be affected, and this could prevent night flying operations to proceed or dazzling effects to pilots/aerodrome operators during the day. The overall significance of the impact is expected to be major.

Mitigation measures are further discussed below and described in the ESMP (Appendix A):

- Lighting in the case of this Project makes reference to the requirements for the lighting of objects with a height less than 45 m above ground level;
- Requirements of lighting to confirm to NAMCATS part 139.13.3 (Table 13.1, 13.2, 13.3, 13.5); and
- If high or medium intensity light cause dazzling effects to the aircrafts or aerodrome operator, then a dual obstacle lighting may be preferred

7.3.5.9 *Visual markers not installed on 11 kV overhead powerline route, sub-station/metering stations and other applicable infrastructure could influence the safety of air traffic during take-off and landing and aerodrome operations*

As stated previously, the Twin Hills Project is located within the aerodrome air space of the Karibib air force base. As per the NAMCATS part 139, there are specific requirements for structures and infrastructure than fall within the aerodrome airspace to ensure obstacles do not interfere with the safety requirements and safe operations of aerodrome operations and air traffic/pilots; for examples cause dazzling effects, aircrafts fly too low into powerlines or other infrastructure e.g with chimneys/antennas/road crossings.

Therefore, there was a need to assess the potential adverse impacts that a lack of visual markers on obstacles could have on the safe operations of the aerodrome and pilots. This impact will be direct, long term for the duration of the Project (life of mine) and partly reversible. The scale of the impact is National, as this air force base is main air force base utilised in Namibia by the military. Additionally, the air force base is also open to commercial flights. The probability of this impact occurring is expected to be definite as there will be permanent infrastructure constructed by the Project that would require visual markers to be installed. The value of sensitivity is expected to be medium and magnitude of change very high/unknown to the Karibib air force base operations without mitigation measures being enforced, as safe operations of the air force base could be affected. The overall significance of the impact is expected to be major (The Namibian, 2016).

Mitigation measures are further discussed below and described in the ESMP (Appendix A):

- Visual markers to be installed on towers, antenna's, chimneys, structures above/crossing roads and water ways and/or overhead cables, as required;
- General requirements for visual markers are that a marker displayed on an overhead wire, cable, etc. must be spherical and have a diameter of not less than 60 cm, spacing must be appropriate to the diameter of the marker used and the use of colour as per the specifications;
- Markers must be of one colour only, that must be in contrast to the natural environmental background. When installed, white and red or white and orange markers are to be displayed alternately;
- When it has been determined that an overhead wire, cable, etc. practically cannot have a marker installed, then a high intensity obstacle light, Type B, must be provided on the supporting tower structure. These lights are intended for use during the day and night. When these lights are used, they must be located at three levels: top of the tower, lowest level of the catenary of the wires or cables and midway between the two levels. These lights must flash sequentially, first the middle, then top light and last the bottom light. Intervals between flashes must adhere to the required ratios. Middle and top light (1/13), top and bottom light (2/13) and bottom and middle lights (10/13). These lights must be installed at the required angle; and

- If high or medium intensity light cause dazzling effects to the aircrafts or aerodrome operator, then a dual obstacle lighting may be preferred.

7.3.5.10 Maintenance repairs on 11 kV overhead power line route and metering/sub-stations not communicated to air force base, influencing safety of operations

It may be required from time to time to switch off the overhead power line network on site, due to scheduled or unplanned on-site maintenance requirements or NamPower scheduled or unplanned maintenance on the 66 kV overhead line and related electrical support infrastructure. Even when electricity is switched off, the source must be treated as live and could be unpredictable. It will therefore be required to communicate and inform the Karibib air force base of planned or unplanned power shuts to avoid potential safety concerns for the operations of the aerodrome or aircrafts. Additionally, the air force base is to be informed when power is successfully returned.

Therefore, maintenance repairs on the electrical infrastructure could have an adverse impact and this impact will be direct, long term for the duration of the Project (life of mine) and reversible. The scale of the impact is local, as this will influence the air force base operations and aircrafts in the aerodrome airspace. The probability of this impact occurring is expected to be possible, as maintenance will be required on a scheduled basis and unplanned shuts cannot be accounted for. The value of sensitivity is expected to be low and magnitude of change moderate for the Karibib air force base safe operations and should have little interference in their operations. The overall significance of the impact is expected to be low.

Table 31 below provides a summary of the impacts on air traffic and aerodrome operations, before mitigation.

Table 31 - Impact assessment for direct and indirect impacts on the Karibib air force base.

Activity	Receptor/s	Impact	Nature of impact	Value & sensitivity	Magnitude of change	Significance of impact
Construction and operations	Air traffic operations of the Karibib air force base	Dust from the Twin Hills Project causing visibility obstructions to aircrafts from the airport and aerodrome operations (2022 assessment)	Adverse Direct Reversible Long term Local	Medium	High/major	Moderate (6)

Activity	Receptor/s	Impact	Nature of impact	Value & sensitivity	Magnitude of change	Significance of impact
		Dust from the Twin Hills Project causing visibility obstructions to the aircrafts from the airport and aerodrome operations (2023 assessment)	Adverse Direct Reversible Long term Local	Low	Low/minor	Low (2)
		Construction and operations within regulations of the aerodrome airspace for aircrafts, visual and height restrictions for additional approvals (2022 assessment)	Adverse Direct Reversible Long term On-site	Medium	High/major	Minor (4)
		Construction and operations within regulations of the (within 10 km) airspace for the aircrafts, visual and height restrictions	Adverse Direct Reversible Long term On-site	Low	None/negligible	Low (1)

Activity	Receptor/s	Impact	Nature of impact	Value & sensitivity	Magnitude of change	Significance of impact
		for additional approvals as per current design (2023 assessment)				
		Noise from activities could impact operations of the Karibib air force base related to air traffic operations	Adverse Direct Reversible Long term Local	Low	Low/Minor	Low (2)
Blasting		Blasting could impact operations of the Karibib air force base related to air traffic operations through timing of blasts	Adverse Direct Reversible Long term Local	Low	Moderate	Minor (3)
		Blasting could impact operations of the Karibib air force base related to air traffic operations through dust plumes over the normal air traffic	Adverse Direct Reversible Long term Local	Low	Moderate	Minor (3)

Activity	Receptor/s	Impact	Nature of impact	Value & sensitivity	Magnitude of change	Significance of impact
		routes. This impact is expected to last for 30 - 60 min max following a blast event.				
Lighting		Incorrect use of lighting could confuse air traffic during take-off and landing, if not in line with NCAA and air force base requirements	Adverse Direct Partly reversible Long term National	Medium	Very high/unknown	Major (8)
Construction and operation of a powerline		Visual markers not installed on 11 kV OHL route and sub-station/metering stations and other relevant infrastructure could influence air traffic during take-off and landing as per NCAA and air force base safety requirements	Adverse Direct Partly reversible Long term National	Medium	Very high/unknown	Major (8)

Activity	Receptor/s	Impact	Nature of impact	Value & sensitivity	Magnitude of change	Significance of impact
		Maintenance repairs on 11 kV OHL route and metering/sub-stations not communicated to air force base, influencing safety of operations	Adverse Direct Reversible Long term Local	Low	Moderate	Low (2)

7.3.5.11 Impact on mine infrastructure from Karibib Air Force Base operations

The NCAA has discussed with the EAP through personal communication (10 August 2023) that the current position of the NamPower metering station and Twin Hills main station sub-station may be in the route of potential emergency landing zones in line with the main runway from the Karibib air force base (northeast to southwest direction) (Figure 122). This has been discussed with the relevant Project engineering team and the positions of these stations cannot be changed. Therefore, the potential risk of damages that could be sustained to the relevant mining infrastructure was assessed during operations, in line with power supply requirements for the Twin Hills Project. Damages sustained could include partial or complete destruction of these stations, including fire related incidents associated with emergency landings and power related infrastructure and supply, due to the voltages and infrastructure involved.

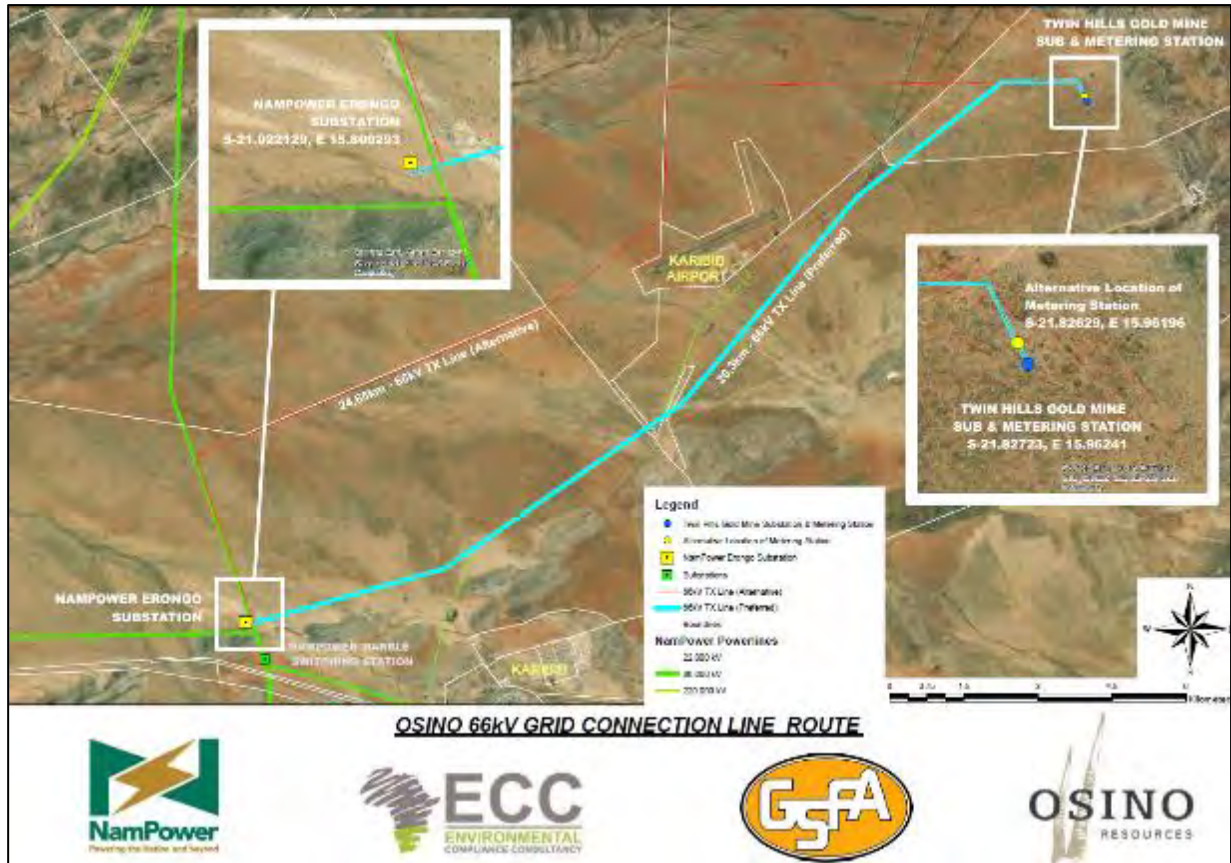


Figure 122 - Twin Hills associated 66 kV overhead powerline route with indicated NamPower metering station and Twin Hills sub-station, with Karibib air force base highlighted (Source: (GSFA Consulting Engineers, 2023)).

Emergency landings of aircrafts could have an adverse impact on mine infrastructure through potential damages. These impacts will be indirect, long term for the duration of the Project (life of mine) and partly reversible. The scale of the impact is on-site, as physical damages will occur directly on site. The probability of this impact occurring given the amount of air traffic and the that the sample size is one airfield, it is expected to be possible, as emergency landings do occur on a regular basis world-wide but exact figure for the Karibib air force base are not known or available. The value of sensitivity is expected to be medium and magnitude of change very high/major, due to the impacts on the Proponent if damages were to occur to their on-site power supply during operations. The Proponent would need to act quickly to rectify the situation and rely on their back-up power supply for the interim until the damages have been rectified to infrastructure and the overhead power line and metering station/Twin Hills sub-station is in good running order. The overall significance of the impact is expected to be minor. No specific mitigation measures are required to be implemented however, it is recommended to discuss with air force base to re-route emergency landings to the new diverted D1941 road where possible, to avoid infrastructure damages to electrical infrastructure.

Table 32 below provides a summary of the impacts on mine infrastructure from Karibib air force base operations, before mitigation.

Table 32 - Impact assessment for direct and indirect impacts on the mine infrastructure.

Activity	Receptor/s	Impact	Nature of impact	Value & sensitivity	Magnitude of change	Significance of impact
Construction and operation of a powerline	Mine infrastructure	Location of sub-station and metering station in possible route of emergency landing zone for Karibib air force base, damage(s) to mining infrastructure and loss of power supply to mine (not planned)	Adverse Indirect Partly reversible Long term On-site	Medium	Very high/unknown	Minor (4)

The potential socio-economic impacts related to emergency landings interfering with operational activities has also been assessed if damages were to occur to the main power line infrastructure. Partial or complete damage(s) sustained to permanent power supply infrastructure could take weeks or months to rectify, dependent on the damage(s) sustained. This will put strain on the backup power supply for operations and could incur additional costs, that might not have been properly budgeted for. This could in turn put strain on operational activities and reduce mining and processing plant activities to cater for the reduction in power supply. Supply of gold bars for sale could be reduced, which in turn will impact the Twin Hills Project overall contribution to the Namibian GDP for the mining sector, due to a reduction in sales and on-site spending.

Emergency landings of aircrafts could have an adverse socio-economic impact through potential damages. These impacts will be indirect, long term for the duration of the Project (life of mine) and partly reversible. The scale of the impact is National, due to the potential impacts on reduced sales, spending and contribution to the Namibian GDP. The probability of this impact occurring is expected to be possible, as emergency landings do occur on a regular basis world-wide but exact figure for the Karibib air force base are not known or available. The value of sensitivity is expected to be medium and magnitude of change very high/major, due to the impacts on the Proponent if damages were to occur to their on-site power supply during operations and contingency planning required. The overall significance of the impact is expected to be moderate. No specific mitigation measures are required to be implemented however, it is recommended to discuss with air force base to re-route emergency landings to the new diverted D1941 road where possible, to avoid infrastructure damages to electrical infrastructure.

Table 33 below provides a summary of the socio-economic impacts on mine infrastructure from Karibib air force base operations, before mitigation.

Table 33- Impact assessment for direct and indirect impacts on socio-economic aspects

Activity	Receptor/s	Impact	Nature of impact	Value & sensitivity	Magnitude of change	Significance of impact
Construction and operation of a powerline	Twin Hills Project Socio-economic	Location of sub-station and metering station in possible route of emergency landing zone for Karibib air force base, damage to mining infrastructure and loss of power supply to mine (not planned). Impact to operations on supply and GDP influences potentially.	Adverse Indirect Partly reversible Long term National	Medium	Very high/unknown	Moderate (6)

7.3.6 MINE BLAST AND VIBRATION IMPACTS

The blast impact assessment embraces the potential impacts that are associated with open cast operations such as ground vibrations, air blasts and fly rock. The blast impact study for the project was undertaken by Blast Management Consulting in 2023. Moreover, the points of interest susceptible to blast impacts were identified as those within 3500 m radius from the three proposed open pits edges are shown by the sensitivity map in Figure 123. Impacts related to blast and vibrations are discussed further in the section below.

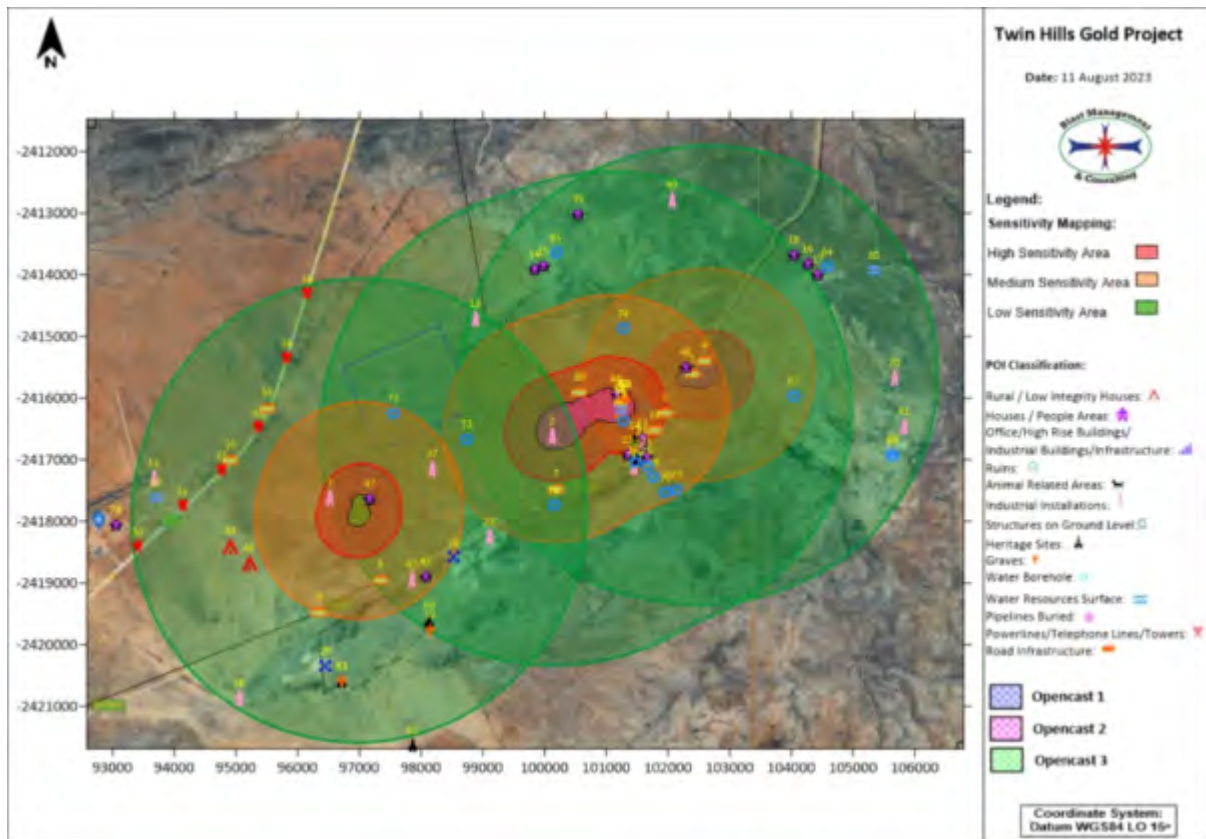


Figure 123 - Blast sensitivity map with identified points of interest (Source: (BMC, 2023).

Ground vibrations impacts are generally known to cause structural damage to properties within close range of the blast zones (ground vibration and air blast are expected to be higher closer to the pit area). Additionally, the magnitude and ground vibrations levels would adversely vary depending on the nature of the blast event i.e., minimum (90 kg) and maximum (361 kg) charge mass per delay.

Highly sensitive man-made infrastructure most susceptible to high level ground vibrations were identified by the specialist and include: the D1941 district road, the hydrocensus boreholes, cement dams, the historical colonial farm building, the well-constructed Farm Okawayo 480 and the cultural burial sites. These architectural, cultural and heritage areas will have to be cleared of all blasting activities as they are highly susceptible to high blast ground vibration levels which primarily could lead to permanent structural damage or cracks formations. The specific ground vibration impacts with (out) mitigation are presented in Figure 124, for illustrative purposes only. The impacts are discussed in detail in the sections below.

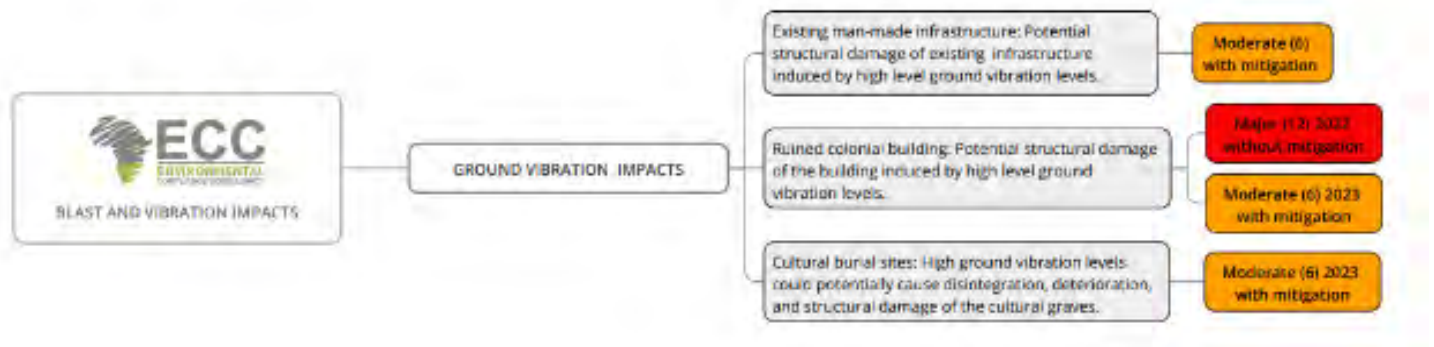


Figure 124 - Impacts from mine blasts and vibrations

7.3.6.1 Blast ground vibration levels could potentially cause structural damage of existing man-made infrastructure

According to BMC (2023), ground vibrations will be mostly accounted for cracks in structures if high enough and at prolonged high levels. The specialist study further indicated that private houses and industrial installations found across the three proposed open pit areas are subject to ground vibration impacts. A summary of the highly sensitive structures as identified by MBC (2023) is provided in Table 34. Each sensitive receptor is discussed in the section below and a summary of the overall impact assessment is provided in Table 35.

Table 34 - A list of highly sensitive structures across three proposed open pit areas (Source: BMC, 2023).

Type of structure	Location	Distance from open pit edge (m)	coordinates
Hydrocensus borehole (OKP045)	Proposed open pit 2 area	30	-21.839681, 15.979658
D1941 district road	Proposed open pit 1 area	-	-21.832765, 15.990501
Private house and people sensitive area	Inside the proposed open pit 1 area	-	-21.831843, 15.989432
Cement dam	Inside the proposed open pit 2 area	-	-21.41995, 15.968456
Private house and people sensitive area	Inside the proposed open pit 2 area	-	-21.835822, 15.978534
Private house and people sensitive area	Proposed open pit 3 area	14	-21.851394, 15.940029
Okawayo River	Inside pit 2 area	-	-21.837973, 15.979338

Hydrocensus borehole (OKP045): The specialist study determined that the hydrocensus borehole (OKP045) is within 30 meters of the open pit 2 edge (Figure 125). Therefore, the borehole

is susceptible to ground vibrations levels of 17.4 mm/s and 548.4 mm/s at minimum and maximum charge. These figures surpass the permissible ground vibration limit of 50 mm/s and structural damage to the boreholes is anticipated. OKP045 is 361 meters and 4309 meters from open pit 1 and open pit 3 areas. Therefore, OKP045 is expected to be less vulnerable to ground vibration impacts from these opencast operations. As per future plan of the mine, it is unlikely that this will be an abstraction borehole, therefore the significance of the impact is regarded to be within acceptable limits.

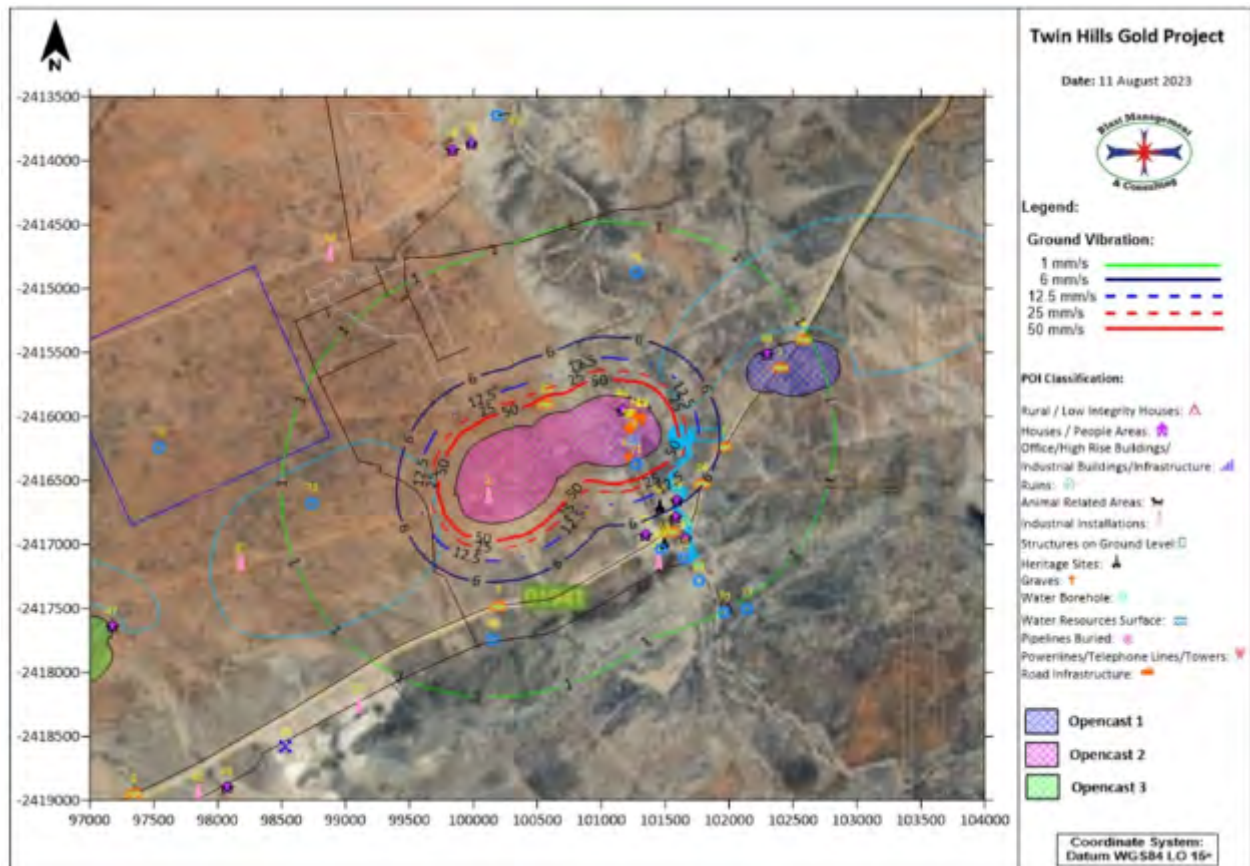


Figure 125 - Open pit 2 ground vibration influence from maximum charge per delay (Source: (BMC, 2023)).

D1941 district road: The D1941 currently provides access to the dimension stone quarries to the south of the mining licence area. The road passes through the mining licence area and across the future mine pit area. A section of the D1941 district road is underlain by the proposed open pit 1 area and is certainly vulnerable to ground vibrations and structural damage during both minimum and maximum charge delay as shown in Figure 126 and Figure 127. At a radius of 17 meters from the open pit 1 edge, the D1941 road will be susceptible to ground vibration levels of close to 1441.8 mm/s at maximum charge which surpasses the 150 mm/s ground vibration limit (BMC, 2023) (Figure 127).

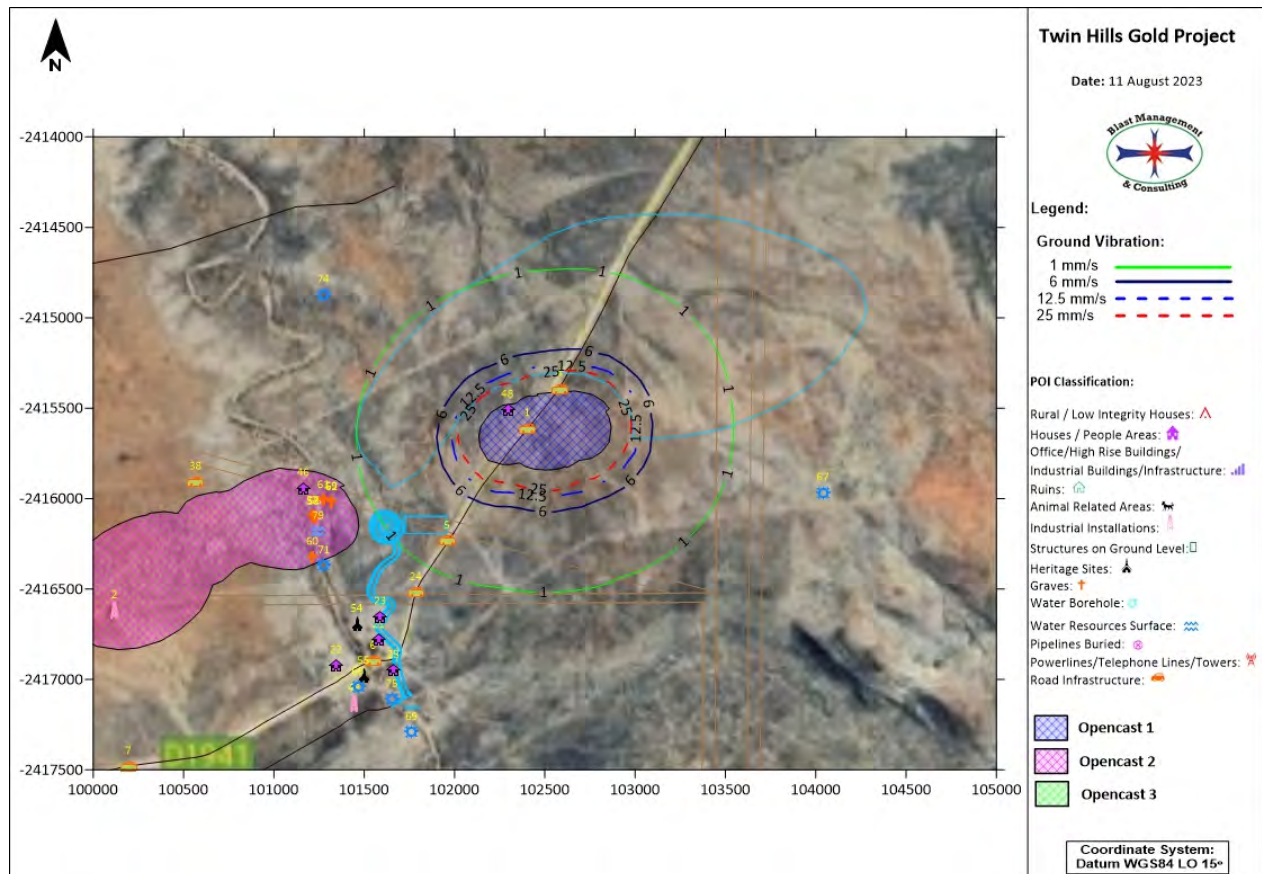


Figure 126 - Open pit 1 ground vibration influence at maximum charge (Source: (BMC, 2023)).

Ground vibrations and structural damage of the D1941 road section is inevitable in this instance as the mine open pit is designed primarily based on mineral orebody. The significance of the impact is, however, mitigated by the planned diversion of the D1941 road. The alternative that is proposed is the truncation of the D1941 road at the Okawayo farmstead and construction of a new section of the D1941 that will join the C33 road 8.5 km north of the existing C33 road intersection with the D1941 road. The new road will provide access to the mine and does not fall within the open pit 1 footprint.

Private houses: The construction of the proposed open pits 1 and 3 will certainly induce ground vibration impacts to private houses and the cement dam as these structures are underlain by the proposed open pits footprints shown in Figure 126 and Figure 127. In particular, the private house located 14 meters from the proposed open pit 3 edge is vulnerable and subject to 572.7 mm/s and 1801.4 mm/s ground vibration levels during minimum and maximum charge per delay (MBC, 2023) (Figure 6). These levels are significantly more than the 12.5 mm/s ground vibration permissible levels for structures (BMC, 2023).

The Proponent is the landowner of farms Okawayo and Klein Okawayo, and therefore no private residents will reside on these farms during construction and operational activities, therefore an acceptable impact can be expected if blasting activities are conducted with precautions and strictly guided by good blasting practices and guidelines.

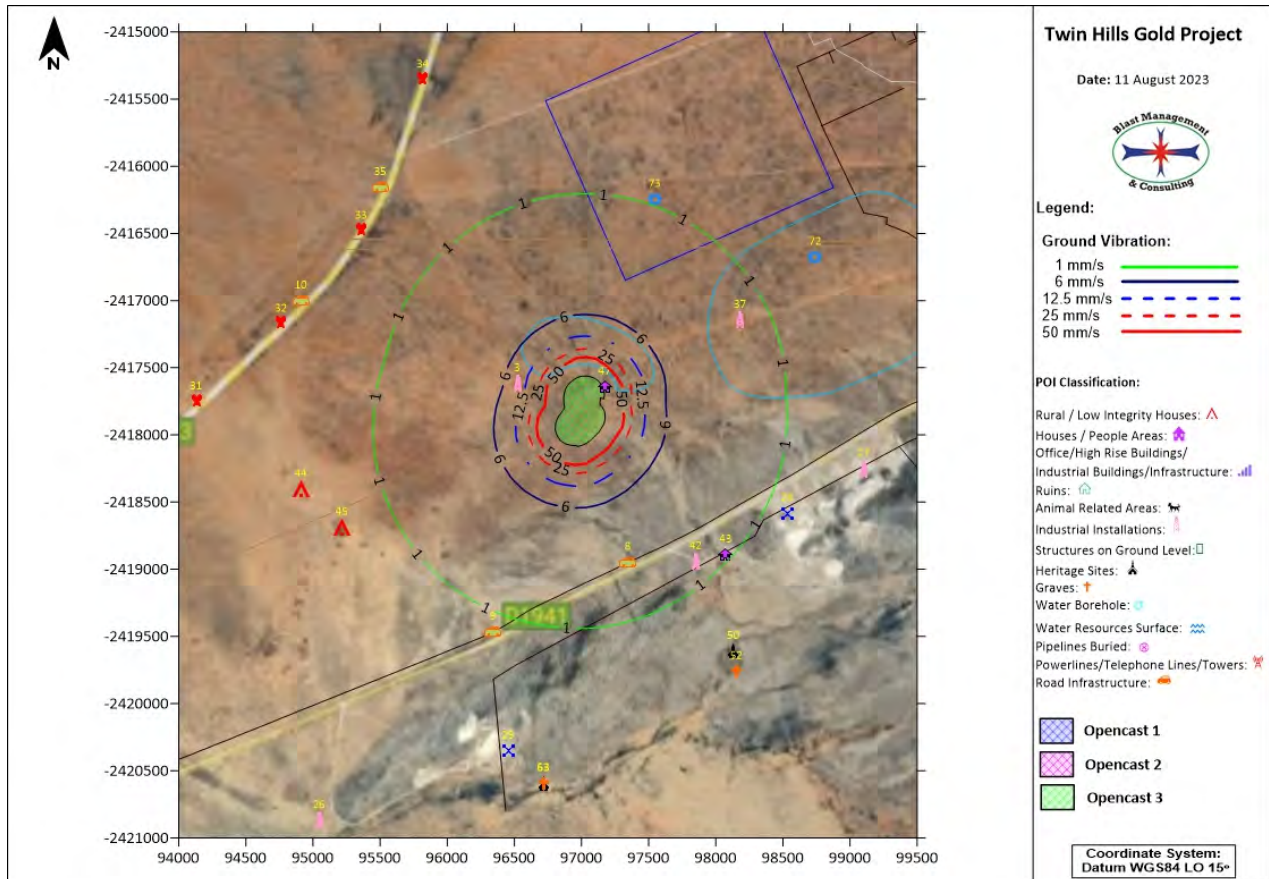


Figure 127 - Open pit 3 ground vibration influence from maximum charge (Source: (BMC, 2023).

Blast and ground vibrations will have adverse, direct and irreversible impacts on man- made infrastructure. The duration of the impact is expected to be short term due to the infrequent nature of blast activities. The magnitude of change and probability of the impact are ranked high as permanent damage to structure could be expected. The Proponent is however the landowner of farm Okawayo and Klein Okawayo which lessen the level of blast intolerance and complaints. Overall, the significance of the impact is expected to be adverse moderate (Table 35).

Table 35 - Ground vibration impacts on the man- made infrastructure.

Activity	Receptor	Impact	Nature of impact	Value & sensitivity	Magnitude of change	Significance of impact
Blasting	Built environment	Ground vibration may cause structural damage to existing man-structures	Adverse Direct Irreversible High Short term On-site Likely	Medium	High	Adverse Moderate (6)

7.3.6.2 *Blasting and ground vibration impacts could potentially cause structural damage of the ruined colonial buildings of heritage significance.*

The initial baseline archaeological field study and assessment undertaken by Dr John Kinahan in early 2021 confirmed the presence of archaeological and colonial era structures that may merit protection under the National Heritage Act, No.27 of 2004. The historic colonial ruin (historical farmstead – Okawayo 480) and the well-constructed Okawayo farmstead (farm building- Okawayo 481) identified in the initial archaeological field survey are presented in Figure 128, Figure 129 and Figure 130.

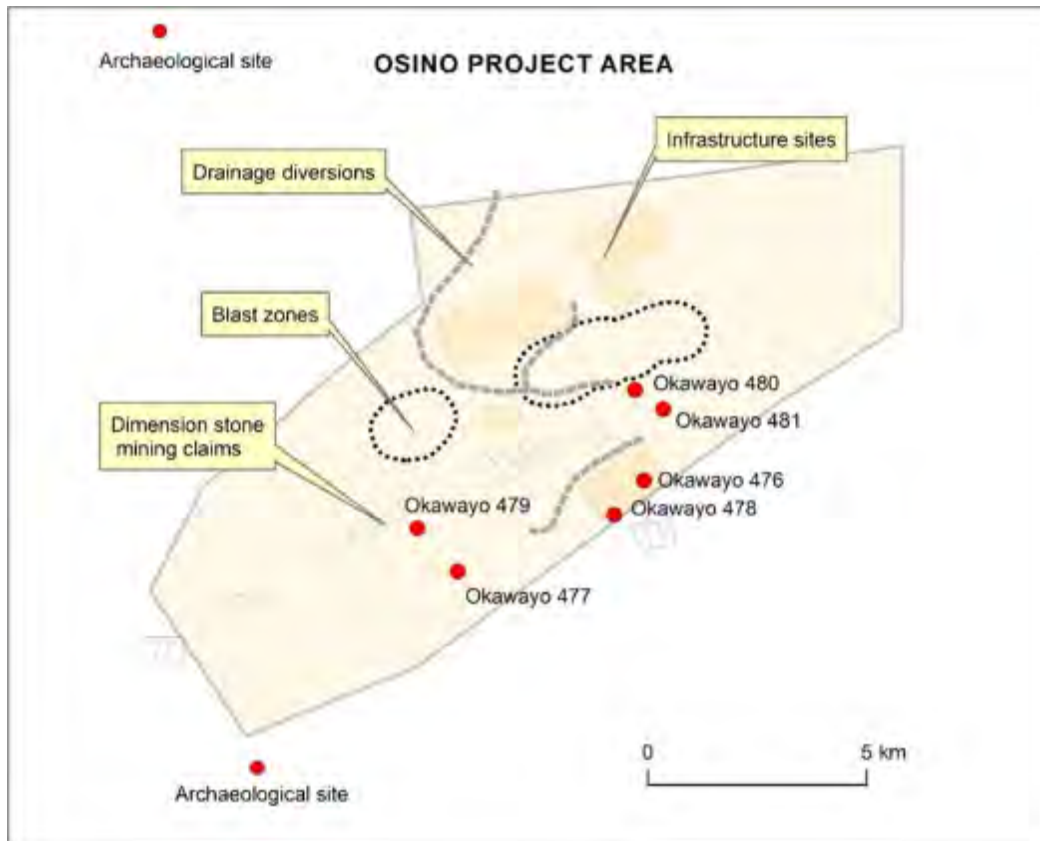


Figure 128 - A map showing the location of archaeological sites at Twin Hills (Kinahan, 2021).



Figure 129 - Southeast view of the Okawayo 480 colonial ruin (Kinahan, 2021).



Figure 130 - Back view of the well- constructed historical Okawayo 481 farmstead (Kinahan, 2021).

Opencast pit locations are primarily designed based on the mineral orebody deposit; therefore, it has been established that open pit operations will have adverse impacts on the ruined colonial buildings at Twin Hills. The proximate distances of the two historical buildings from the three proposed open pits edges are presented in Table 36. These archaeological buildings were assessed as vulnerable to blasting impacts in the initial assessment and are re- assessed in detail

in this section taking into consideration inputs from the blast impact specialist study that was undertaken by BMC in August 2023.

Table 36 - Radius of the ruined colonial buildings from the edge of three proposed opencast pits (BMC, 2023).

	Open pit 1 (m)	Open pit 2 (m)	Open pit 3 (m)
Farm building 480	1162	398	4401
Farmstead 481	1378	678	4382

The historic buildings are in close proximity to the proposed open pit 2 as opposed to the proposed open pit 1 and 3 (Table 37). In light of the above-mentioned, severe ground vibration impacts are expected, and potential structural damages of these properties could be expected. At maximum charge, the ruined colonial building 480 is expected to be susceptible to ground vibration levels of close to 7.5 mm/s which potentially will lead to structural damage and intolerant or unpleasant to humans (BMC, 2023). The well- constructed farmstead building 481 is however expected to be susceptible to an acceptable 3.1 mm/s ground vibration impact from the same blast event. However, at minimum charge, the ground vibration levels are expected to be relatively low at less than 2.5 mm/s at both locations (BMC, 2023). The relative ground vibration levels at maximum charge at the proposed open pit 2 is provided Figure 125 in Ground vibration impacts from the opencast pit 1 and 3 operations are unlikely expected (between 0.0 mm/s and 0.1 mm/s) as the buildings are far-off from the two pits (BMC, 2023) (Table 37).

In the initial assessment, ground vibration influences from operations of the opencast pit 2 will cause permanent destruction of the ruined colonial buildings, therefore the impact was regarded as irreversible, direct and permanent. The magnitude of change is regarded to be high as the colonial buildings will be destroyed and the sensitivity is regarded as high due to the heritage significance status of the buildings. The overall blast impacts are thus expected to be adverse major, before mitigation (Table 38).

The location and overall design of the proposed open pit 2, which in this instance pose major blast and vibration concerns, was based on the mineral orebody deposit, therefore no other alternative location was considered. The Proponent, however, acknowledged in the initial assessment the vulnerability of the ruined colonial buildings in relation to the mine operations and had engaged the National Heritage Council (the competent authority in relation to heritage and archaeological sites) for consent. The National Heritage Council consent (No. 117/2022) was issued for the colonial building, in line with Section 55 (9) of the National Heritage Act, No. 27 of 2004 in August 2022. Approval to relocate partial heritage building granted to Twin Hills Gold Project in July 2022, however, is now on hold pending resolution on an approval to follow due process for relocation of existing grave sites, as this will form one permit for the site. The Proponent proposed in the consent application to assist in the recovery, relocation and safekeeping of valuable artefacts of the building structures as representative of its historical era (i.e., where possible preserve the

building's remnants such as window frames that could be moved to a visitor's information station or to a museum). Furthermore, the Proponent proposed to make available the documented research findings of the building's origin since 1900's, which could be used by scholars as the basis for further academic studies.

In the current assessment, an acceptable or reduced impact can be expected as the Proponent is the landowner of farms Okawayo and Klein Okawayo, and therefore no private residents will reside on these farms during construction and operational activities. With the implementation of the abovementioned preservation management mitigation measures, the magnitude of the impact is regarded moderate and overall significance of the impact is regarded as moderate - major.

The initial and amended impact ratings are shown in Table 37.

Table 37 - Summary of the initial and amended assessment regarding blast impacts on the ruined colonial buildings.

Initial ground vibration impact assessment – Ruined colonial buildings						
Activity		Impact			Significance of impact (2022)	
Open pit construction and mining operations		Loss of heritage objects or place from mine blasting operations and related ground vibrations.			Adverse Major (12)	
Amended ground vibration impact assessment – Ruined colonial buildings (2025)						
Activity	Receptor	Impact	Nature of impact	Value & sensitivity	Magnitude of change	Significance of impact
Open pit 2 construction and mining operations	Ruined colonial buildings	Loss of heritage objects or place	Adverse Direct Partly reversible Permanent On-site Likely	High	Moderate	Adverse Moderate (6)

7.3.6.3 Air blast impacts

Air blast impacts are directly aligned with the blasting processes and severity of the impact entirely influenced by meteorological conditions such as wind strength, direction and blasting design aspects such as stemming, final blast layout, timing and accessories used (BMC, 20223). Air blast records are compared to the general recommended limit of 134 (decibels) dB, set based on the United States Bureau of Mines guidelines (USBM) (BMC, 2023). The specific impacts are presented in Figure 131 below for illustrative purposes only. The impacts are discussed in detail in the section below.

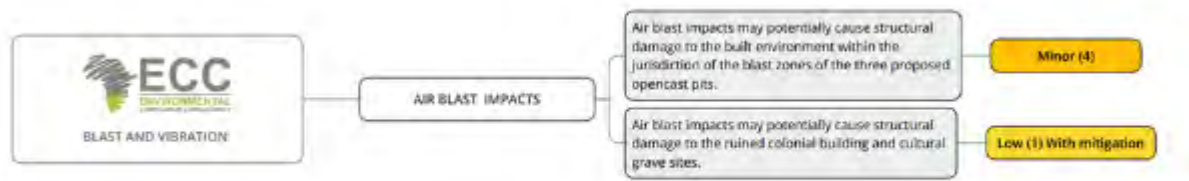


Figure 131 - Impacts of air blasts on nearby infrastructure.

7.3.6.3.1 *air blasts could potentially cause structural damage to existing man-made infrastructure*

BMC (2023) predicted that farmsteads, rural village houses, mine industrial buildings located within or beyond 300 m radius from a blast zone would likely be susceptible to air blast impacts. Powerlines and pylons are however resistant to air blast impacts. The structures likely susceptible to air blast impacts are discussed below. The impact ratings are provided in Table 38.

Farmsteads and private houses: The expected air blast levels across private houses and farmsteads located ± 1000 meters from all the proposed pit edges is expected to range between 121.6 dB to 130.5 dB at minimum charge mass per delay (BMC, 2023). These figures are below the air blast damage causing levels (150 dB -180 dB), therefore no severe air blast induced damages are expected. This is however with the exception of the private house located 14 meters from the proposed open pit 3 edge which will be susceptible to 153 dB air blast levels and theoretically could cause window breaks and cracks to structures.

Industrial buildings: Marbel quarry offices and industrial buildings located on the southwest of the site, along the D1941 are approximately 1500 meters to 2000 meters from the proposed open pit 3 edge. It is predicted that at maximum charge mass, these buildings could be subject to air blast levels of 121.6 dB and 123.4 dB, respectively. With the implementation of operational management mitigation measures, the impact is expected to fall within acceptable levels.

7.3.6.3.2 *air blasts could cause structural damage to structures of historical and cultural significance*

The Proponent has been granted consent for the exhumation, relocation and reburial of the confirmed graves; therefore, air blast impacts on the four graves are not assessed further as the graves will be relocated before mining operation commence. However, air blast levels are predicted to reach a peak level of 132.2 dB which would pose some degree of concern for the ruined colonial buildings (BMC, 2023) (Figure 132). The relocation of the ruined colonial buildings remnants would lessen the impact to acceptable levels. A summary of the impact rating is provided in Table 38.

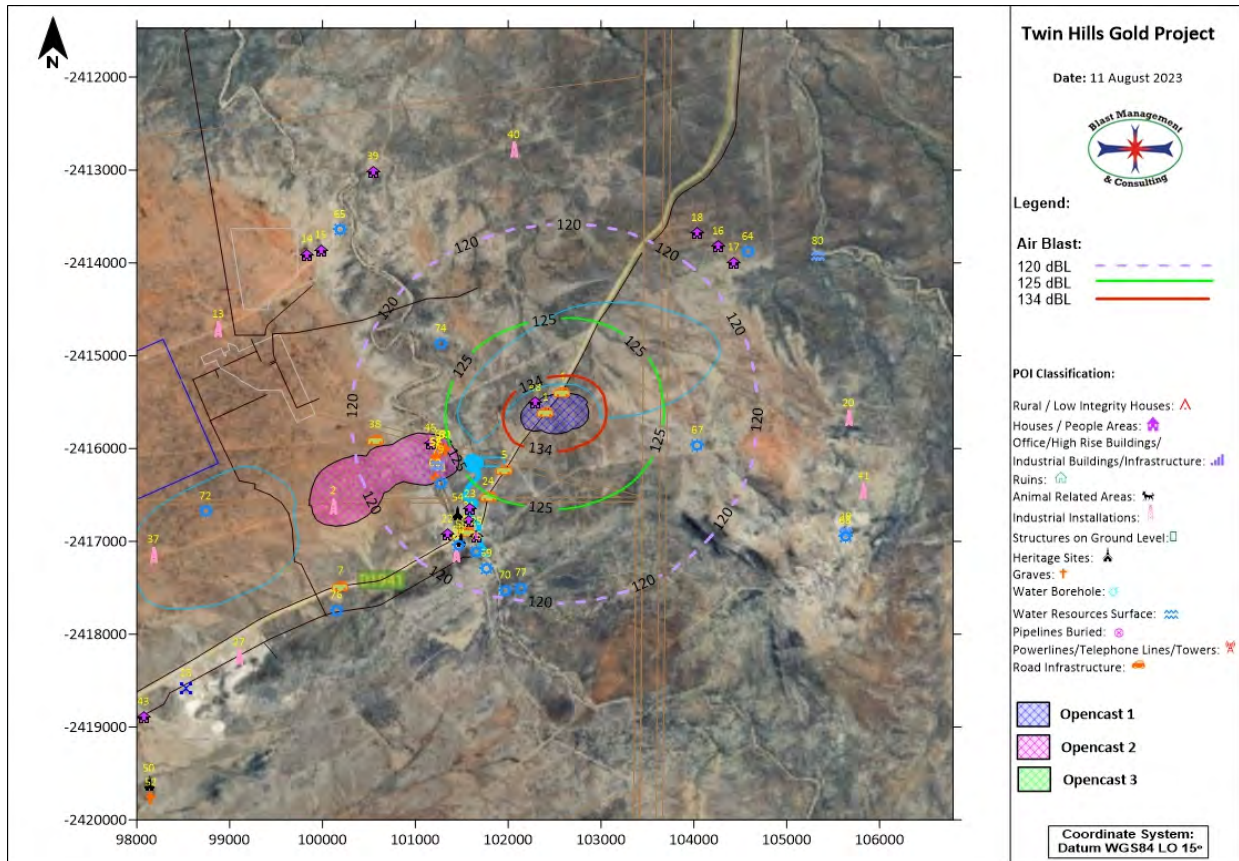


Figure 132 - Open pit 2 air blast influence from maximum charge (Source: (BMC, 2023).

Table 38 - Impacts related to air blast.

Activity	Receptor	Impact	Nature of impact	Value & sensitivity	Magnitude of change	Significance of impact
Blasting	Built environment	Air blasts may cause structural damage to farmstead homes	Adverse Direct Irreversible Moderate Short term On-site Likely	Medium	Moderate	Minor (4)
		Air blasts may cause structural damage to rural villages/houses	Adverse Direct Irreversible Moderate Short term On-site Likely	Medium	Moderate	Minor (4)
		Air blast may cause structural damage to mine industrial buildings	Adverse Direct Irreversible Moderate On-site	Medium	Moderate	Minor (4)

Activity	Receptor	Impact	Nature of impact	Value & sensitivity	Magnitude of change	Significance of impact
			Likely			
	Cultural heritage	Air blasts may cause structural damage to heritage sites	Adverse Direct Irreversible Not applicable Short term On-site Unlikely	Low	Low	Low (1)

7.3.6.3.3 impacts of fly rock on nearby infrastructure

Fly rock will have a negative impact if found to travel outside the unsafe zone (BMC, 2023). Furthermore, (BMC, 2023) predicted a minimum unsafe zone radius of 356 m for the Project, although a 500 m unsafe zone is generally applied across most mines. An overview of the areas within the 356 m unsafe buffer zone across the three proposed pits is provided in Figure 134 below. A summary of the points of interest to fly rock impacts is presented in Table 39. Specific impacts are presented in Figure 133 below and are discussed further in chapter.

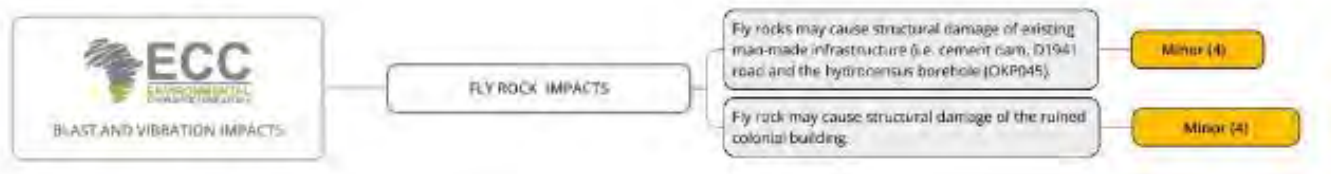


Figure 133 - impacts of fly rock on nearby infrastructures.

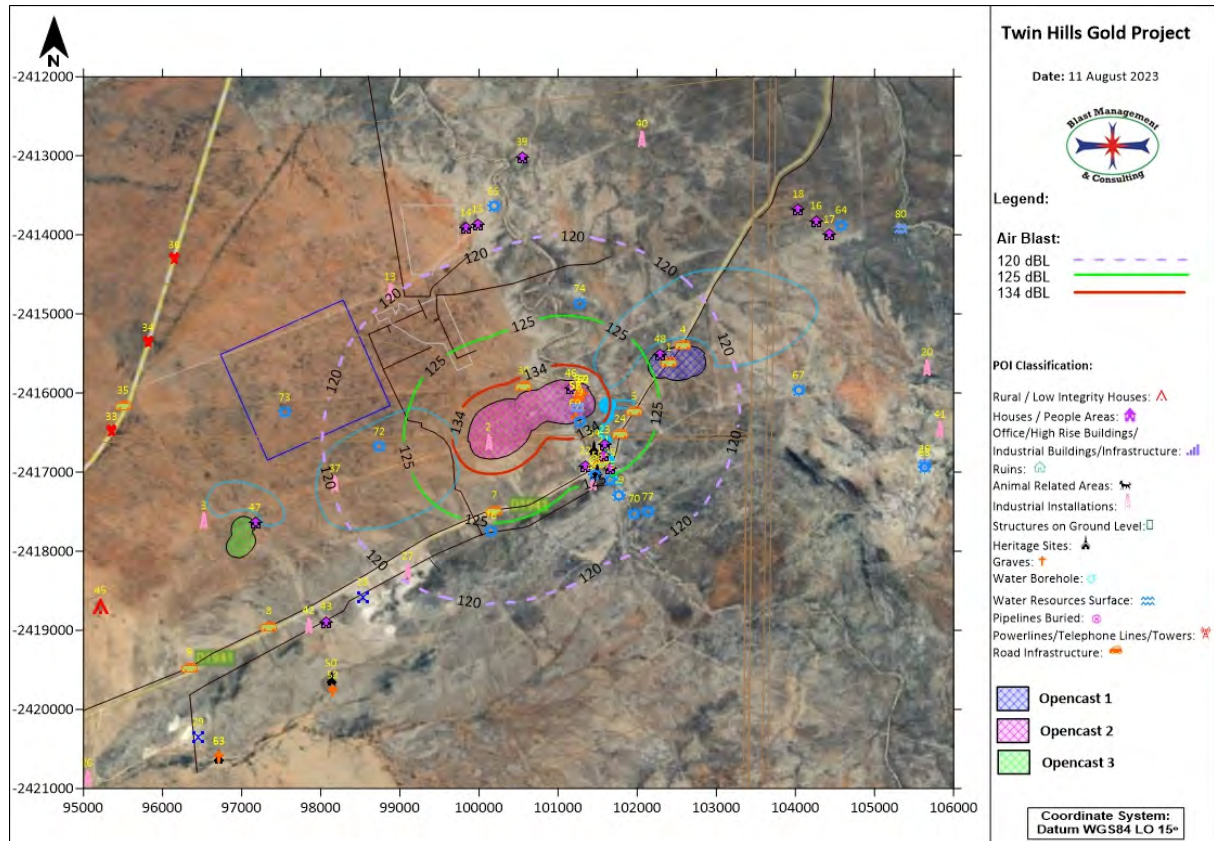


Figure 134 - Unsafe buffer zone for the proposed opencast pit areas (Source: BMC, 2023) (BMC, 2023).

Table 39 - Fly rock sensitive receptors across three proposed operational opencast pits (Source: BMC, 2023) (BMC, 2023).

Description	X	Y
Opencast 1		
Road (D1941) - Inside pit 1 area	-21.832765	15.990501
Road (D1941)	-21.830786	15.992215
Structures - Inside pit 1 area	-21.831843	15.989432
Opencast 2		
Cement dam - Inside pit 2 area	-21.41995	15.968456
Structures - Inside pit 2 area	-21.835822	15.978534
Heritage site (Farm building - Okawayo 480)	-21.84259	15.98144
Heritage site (Graves) - Inside pit 2 area	-21.837222	15.979167
Heritage site (potential burial ground) - Inside pit 2 area	-21.837217	15.97903
Heritage site (potential burial ground) - Inside pit 2 area	-21.837245	15.979058
Heritage site (potential burial ground) - Inside pit 2 area	-21.836487	15.980033
Heritage site (potential burial ground) - Inside pit 2 area	-21.839255	15.979042

Description	X	Y
Heritage site (potential burial ground) - Inside pit 2 area	-21.836425	15.979042
Heritage site (potential burial ground) - Inside pit 2 area	-21.836522	15.980045
Heritage site (potential burial ground) - Inside pit 2 area	-21.878072	15.935789
Hydro census borehole (OKP045)	-21.839681	15.979658
Okawayo River - Inside pit 2 area	-21.837973	15.979338
Opencast 3		
Structure	-21.851394	15.940029

7.3.6.3.3.1 fly rock from blasting activities may cause structural damage to existing man-made infrastructure

Man-made Infrastructure most susceptible to fly rock impacts were identified as being the hydrocensus borehole (OKP045), cement dam and the D1941 district road (Figure 13). The nature of the impact of fly rock on the abovementioned is adverse, direct as these structures falls within the unsafe blast zone. The impact is further regarded as partly reversible on condition that probable and safe blasting mitigation measures are taken into consideration before blasting activities. The duration of the impact is deemed short-term as blast events are occasional events. The magnitude of change is expected to be moderate, and the impact probability is likely considering the proximity of these areas to the operational opencast pits. Therefore, the significance of this impact has been rated adverse minor across all three proposed operational pits.

7.3.6.3.3.2 Fly rock may cause structural damages to ruins and colonial buildings

The ruined colonial building falls within the footprint of the proposed opencast pit 2. The building is certainly susceptible to fly- rock impacts and associated structural damage from the open cast pit operation. The significance of the impact is however reduced to acceptable levels as the Proponent has been granted consent for the relocation of the building remnants. The heritage consent makes provision for the relocation of the ruined colonial building remnants; therefore, the overall impact is expected to be adverse minor, as shown in Table 40.

Table 40 - Impact on fly rock nearby infrastructures.

Activity	Receptor	Impact	Nature of impact	Value & sensitivity	Magnitude of change	Significance of impact
Blasting	Built environment	Fly rock may cause structural damage of existing man-made infrastructure (cement dam,	Adverse Direct Partly reversible Moderate Short term On-site	Medium	Moderate	Minor (4)

Activity	Receptor	Impact	Nature of impact	Value & sensitivity	Magnitude of change	Significance of impact
		D1941 road and hydrocensus borehole)	Likely			
		Fly rock may cause structural damage of the ruined colonial building	Adverse Direct Partly reversible Moderate Short term On-site Likely	Medium	Moderate	Minor (4)

7.3.7 HERITAGE AND CULTURE IMPACTS

Heritage and cultural impacts address project-related impacts on archaeological, heritage and cultural sites that merit protection, preservation, and management under the National Heritage Act, No. 27 of 2004.

As stated in chapter 5, the Twin Hills Gold Project initial baseline archaeological field survey and assessment was carried out by Dr John Kinahan in early February 2021. Several archaeological sites were located and colonial-era structures that merit protection under the National Heritage Act, No. 27 of 2004. Furthermore, additional field work was conducted on the discovered grave sites on farm Okawayo and the potential for new heritage sites along the Okawayo River tributary by Dr Alma Nankela in October and November 2022 (Nankela, 2022). A ground penetrating radar scan (GPRS) was conducted in August 2023 by Dr Klaus Knupp to confirm whether the suspected graves observed during Dr Kinahan and Dr Nankela's field surveys were graves.

The specific Project impacts related to the discovered archaeological and cultural graves are presented in Figure 135, for illustrative purposes only, before and after mitigation. The impacts are discussed further in the section below.

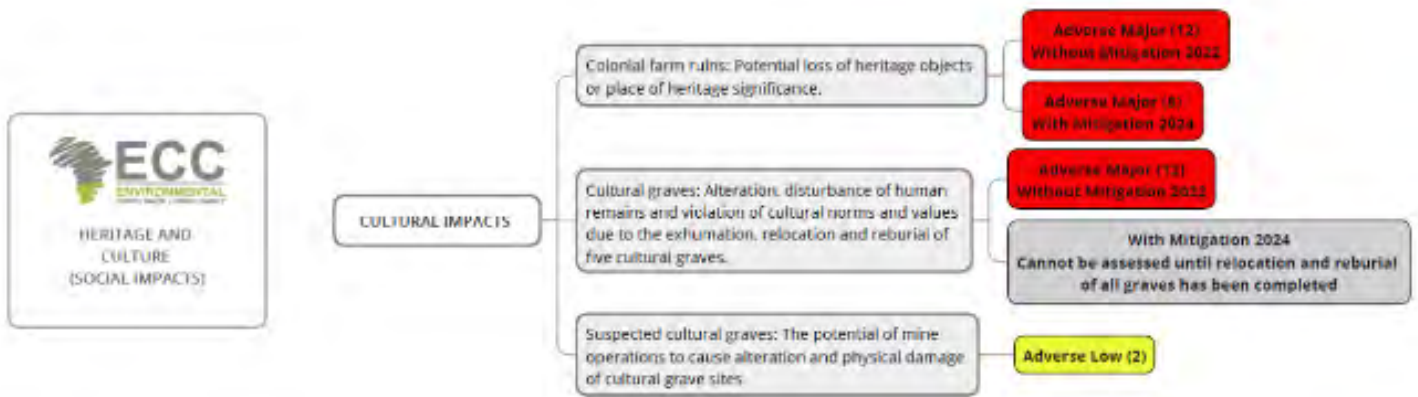


Figure 135 - Impact of the Project on cultural and heritage artifacts

7.3.7.1 potential loss of heritage and cultural objects or place of heritage significance

The 2021 baseline archaeological report indicated that the Twin Hills Gold Project area is moderately archaeologically sensitive (Kinahan, 2021). The study located the historic colonial farm building (Figure 136) and the well-constructed Okawayo farmstead, both related to German occupancy during the 19th century.



Figure 136 - The 19th century German ruins on Okawayo farm (Kinahan, 2021).

The earliest recorded history of the building remains, dates to the earliest occupation of Namibia by Germany (1884 - 1920), where the property was used as a military station by the colonial

regime. From 1920, farm Okawayo was consistently leased to colonial settlers for agricultural use because of its favourable natural conditions (water and good grazing potential). Therefore, the infrastructure can be deemed as constructed by the colonial regime and used for the purpose of military operations.

The historic colonial farmstead is in proximity to the open pit and thus appears to be vulnerable to the central open pit operations, with specific consideration of earthworks and blast impacts. The building's vulnerability to mine operations were initially assessed in 2022 with no consideration of probable mitigation measures such as the safe removal and relocation of the buildings remains prior to mine operations (Table 41). The Proponent had however acknowledged the vulnerability of the colonial ruin building in the initial assessment and engaged the competent authority (National Heritage Council) for consent.

The Proponent has progressed exceptionally with acquiring permits required for different project activities. Approval to relocate the heritage building granted to Twin Hills Gold Project in July 2022 is currently on hold pending resolution on an approval to follow due process for the relocation of existing grave sites as this will form one permit for the site.

The location and design of the proposed central open pit is based on the mineral orebody deposit, therefore there was no alternative location considered that will best safeguard and preserve the colonial building ruin.

The Proponent throughout the application-for-consent process has taken the following management mitigation measures to best preserve the colonial building remnants:

- Offered to assist in the recovery, relocation and safekeeping of valuable artefacts of the building structures as representative of its historical era;
- Where possible, preserve the building's remnants such as window frames by moving them to a visitor's information station or to a museum;
- To make available the documented research findings of the building pertaining to the early 1900s, which could be used by scholars as the basis for further academic research/studies; and
- Commit to the implementation of the mitigation measures prior to commencement of mine operations.

The impact is regarded as partially reversible as the Proponent would commit to the safe removal and relocation of the building remnants. The building will be dismantled subject to recovery of some the building remnants, the impact is considered direct and permanent. The magnitude of change is ranked from high in the initial assessment to moderate in the current assessment, as Osino is the landowner of farm Okawayo and Klein Okawayo and no private residencies are expected on these farms during construction and operational activities. This therefore reduces the community social cohesion in relation to the colonial building. Regardless, the overall

archaeological state of the area will be disturbed, therefore the sensitivity is regarded high. With the implementation of the management mitigation measure the significance of the impact is expected to be adverse – moderate as shown in Table 42.

Table 41 - Heritage impact assessment (2022).

Activity	Impact	Significance of impact
Open pit construction and mining operations	Loss of heritage objects or place	Adverse Major (12)

Table 42 - Amended heritage impacts related to the loss of heritage objects (2025).

Activity	Receptor	Impact	Nature of impact	Value & sensitivity	Magnitude of change	Significance of impact with mitigation
Central open pit construction and mining operations	Cultural heritage	Loss of heritage objects or place	Adverse Direct Partly reversible Permanent On-site Possible	High	Moderate	Adverse Major (9)

7.3.7.2 *Potential alteration, disturbance of human remains and violation of cultural norms, customs and values due to the exhumation, relocation and reburial of cultural graves: Auchab family members*

The cultural graves and potential new graves reported as modern graves by Dr John Kinahan were unintentionally not assessed during the initial assessment. Additional heritage field studies at Twin Hills were then undertaken by Dr Alma Nankela in October and November 2022. These studies confirmed the existence of grave sites underlain by the proposed central open pit (THC). On Dr Nankela's recommendation, a ground penetration radar scan (GPRS) study on the graves was conducted by Dr Knupp in August 2023, which confirmed the graves. A total of five graves were identified: two representing adult individuals (with one grave site bearing a marked headstone with legible inscriptions) and two representing children (an infant and a toddler), as confirmed by the Auchab family members as shown in Figure 137. The sixth suspected grave located approximately 5 meters to the west of the Auchab burial ground showed no indication of a buried void and given there was no evidence of a 'coffin signature' this mound was not regarded as a grave (Knupp, 2023).



Figure 137 - The four graves of the Auchab family members (Source: (Nankela, 2022)).

The five graves are older than 50 years of age and fall within the jurisdiction of the National Heritage Act of 2004, in which the National Heritage Council is the competent authority. The five graves encrust over the proposed central open pit footprint and are therefore susceptible to disturbance and will subsequently be unearthed by earthwork activities, and blast and ground vibration impacts. Based on these findings, (Nankela, 2022) determined that the National Heritage Council should consent to the Proponent's practical mitigation measures as the graves will be impacted should the Project advance to the construction and operational phase. On 07 August 2023, Osino obtained permission to exhume, relocate and rebury the identified graves as per the terms of the Burial Place Ordinance No. 27 of 1966.

To these recommendations, the Proponent pro-actively engaged the National Heritage Council and consulted the Auchab family members for the exhumation, relocation, and reburial of the graves in the same manner, closely fulfilling the family's cultural burial requirements.

The Proponent further engaged various regulatory and local authorities for legal, technical, and professional advice, this included the following:

- Completed a site visit to the grave site accompanied by the appointed project archaeologist (Dr Nankela), ECC and the Auchab family members. This ensured proper assessment of the grave sites, identifying and engaging on the appropriate cultural procedures for the exhumation, relocation and reburial of the grave site;

- Recognised the extended Auchab family as the affected party and subsequently held intensive engagement meetings with family representatives aimed at reaching an amicable agreement regarding the relocation and reburial of the grave sites;
- As guided by the Burial Place Ordinance No. 27 of 1966, engaged the Office of the President for professional advice in relation to the relocation of modern graves;
- Engaged the Ministry of Urban and Rural Development to seek approval for the relocation of the graves; and
- As per the formal directive from the Office of the President, engaged the Karibib Town Council to request formal approval for the relocation of the graves, which was subsequently granted in August 2023.

Subsequent to the abovementioned, the Proponent was granted consent by the National Heritage Council in October 2023, in terms of Section 55 (9) of the National Heritage Council Act No. 27 of 2004, to relocate the graves. The consent is valid for one year and therefore expires in October 2024. Additionally, the Karibib Town Council issued the Proponent with written approval to commence the reburial process.

After securing approval from the appropriate government authorities, the Proponent took the required steps from 12 – 25 January 2024 to coordinate the exhumation, relocation and reburial of the graves. This was done in collaboration with the Nambob Funeral Home in Swakopmund, to bury the graves in the Karibib cemetery, following the guidance outlined in the permit conditions to ensure strict compliance.

The excavation process utilised heavy machinery to carefully uncover the graves in layers, preserving remains and associated materials. Special care was taken when encountering human remains, leaving skeletons intact. Loose stones were collected, recorded and packed for placement in Karibib cemetery. For specific graves, soil sieving and careful removal of remains occurred, followed by sealing in coffins for transportation (Dr Alma Nankela, 2024).

Five graves were exhumed, with four having identified next of kin from the Auxab family. The fifth grave, lacking confirmed next of kin, was reburied in Karibib on 25 January 2024, with support from Nambob and the Proponent's team. The remaining four graves are stored at Nambob Funeral Home in Swakopmund, requiring immediate reburial due to temperature fluctuations and a noted foul odour. Preservation of human remains is a priority, presenting potential conservation challenges. The Proponent is urged to set a reburial deadline amid compensation discussions with the Auxab family. Upon completion, the report will be updated and submitted to NHC for monitoring and record-keeping (Dr Alma Nankela, 2024).

All recommended mitigation management measures proposed by the various archaeological specialists and government authorities have been carried out by the Proponent. Despite several attempts by the Proponent to encourage the Auxab family to be involved in these processes, they did not indicate any interest in these propositions. The Proponent assumed responsibility for the

costs of the process and offered compensation, which the family rejected. As these ongoing consultations have not yielded any progress on these matters, the matter was still unresolved at the time of completion of this assessment. Consequently, this impact cannot be assessed until this matter has been resolved (Dr Alma Nankela, 2024).

7.3.7.3 The potential of mine operations to cause alteration to or physical damages to grave sites: site Okawayo 478

Potential graves (with unmarked headstones) were discovered 15 - 20 m from the Auchab family burial ground on the west bank of the Okawayo tributary during Dr Nankela's field survey. These graves are in addition to the suspected graves observed on site Okawayo 478 in the initial baseline heritage study conducted by Kinahan in 2021.

In August 2023, Dr. Knupp performed ground-penetrating radar scans on the newly identified potential burial locations near the Okawayo tributary. The findings indicated that the features initially suspected to be graves along the Okawayo Riverbank were, in fact, not graves. Site Okawayo 478 had three mounds and Dr Knupp's field study concluded that two of the three mounds were graves whilst the third mound had no obvious evidence of ground disturbance and was therefore confirmed not to be a grave (Figure 138).

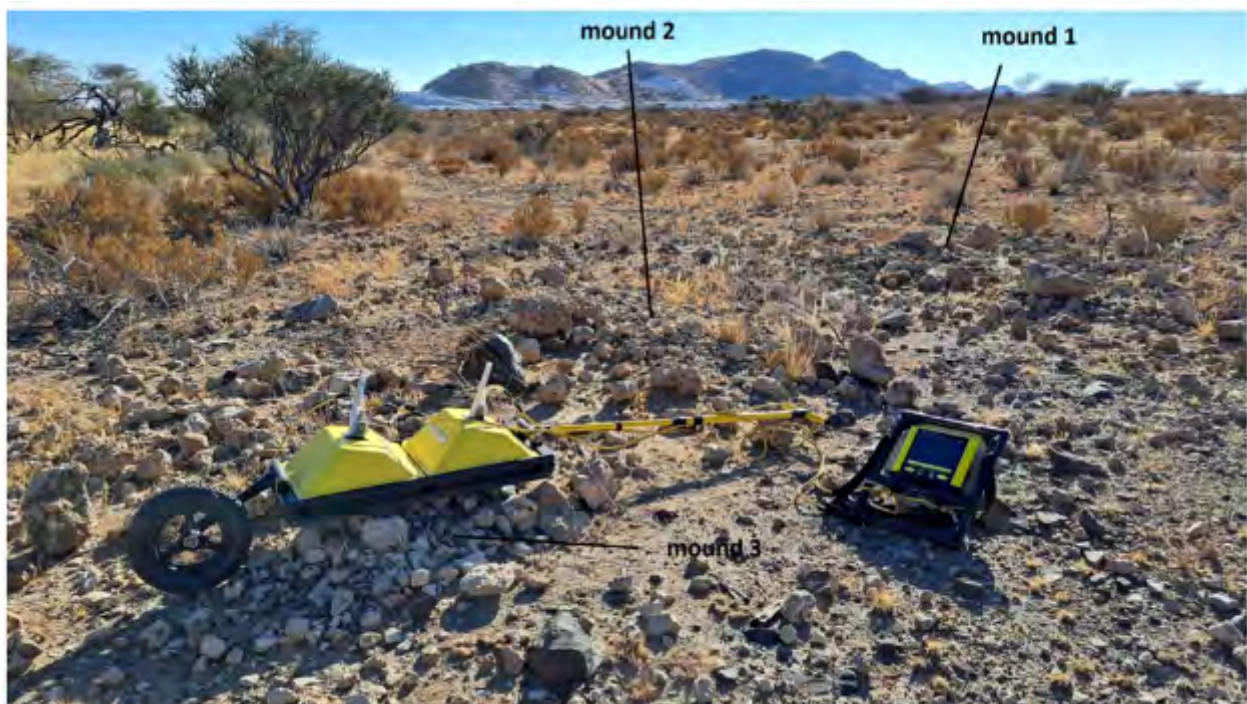


Figure 138 - Okawayo site 478, indicating the three mounds surveyed by Dr Knupp (Source: (Knupp, 2023)).

The potential graves along the Okawayo tributary were confirmed not to be graves. These grounds are rated with a low significance and sensitivity; therefore, the impacts are not discussed further in this section. Additionally, the five graves that have already been exhumed as explained in the

section above have either been reburied or are being housed at the Nambob Funeral Home in Swakopmund and are therefore no longer at risk of being altered or damaged due to mine operations. Therefore, these impacts are also not discussed further in this section.

The two confirmed graves on site Okawayo 478 are located approximately 2033 meters from the closest mine operational area, i.e., open pit 3 (BMC, 2023) (BMC, 2023). The confirmed cultural graves are located on a portion currently mined for dimension stones, marble quarries and several mining claims along the marble ridge. The graves are less vulnerable to alterations or disturbances considering that the graves are further away from the mine footprint. The magnitude of change regarding possible interaction or disturbance to the confirmed cultural graves is considered low as Osino has made no provision for the relocation and reburial of these grave sites. Furthermore, the sensitivity map developed by the contracted Project blast impact assessment specialists indicate that the grave sites fall within the low sensitivity buffer zone, therefore relatively low ground vibrations (approximately 1 mm/s) are expected. The graves are highly sensitive, however the probability of mine operations causing direct disturbance to these burial grounds is low as mine contractors or employees will only operate within their areas of interest. The impact is expected to be adverse low.

Table 43 - Impacts related to alteration and disturbance to cultural graves: Site Okawayo 478 (2024).

Activity	Receptor	Impact	Nature of impact	Value & sensitivity	Magnitude of change	Significance of impact
Mine construction and operations	Cultural heritage	Potential interaction or disturbance of suspected grave sites and confirmed cultural graves	Adverse Direct Partly Irreversible On-site Low probability	Low	Minor	Adverse Low (1)

7.3.8 NOISE IMPACTS

The construction and operation of mines can often produce noise pollution, which is defined as the propagation of noise or sound that has a range of impacts on the activity of human or animal life. Various activities such as drilling, loading, hauling, ore processing and mobile diesel equipment use (including reverse warnings) generate noise. Additionally, mobile and non-mobile equipment generate noise which may be excessive and disturbing to sensitive receptors. The potential significant impacts or impacts that have specific interest to the community and stakeholders, before mitigation, are summarised in Figure 139 for illustrative purposes only. Details related to each specific impact is discussed further in this section and outlined in Table 44.

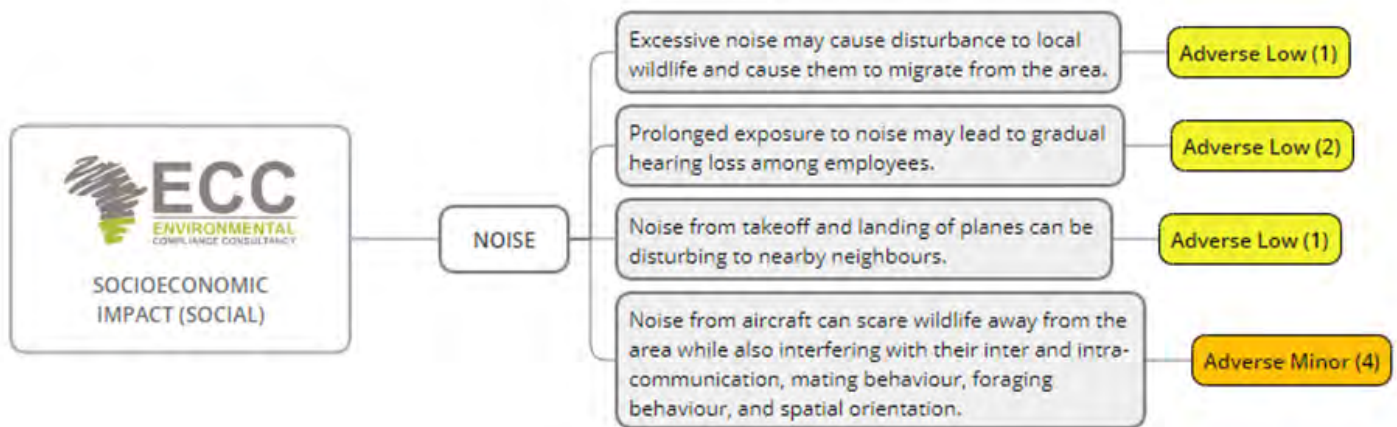


Figure 139 - Impact of the noise from Project on the surrounding environment.

7.3.8.1 impact of noise on local fauna

Excessive noise from the Project construction and operational activities such as blasting may disturb local wildlife but is not expected to be detrimental to local fauna. Local wildlife is likely to migrate from the area to seek an area with limited activity. The impact will be direct and reversible, over the short term and will only occur on-site.

Mitigation measures may include regular equipment maintenance to prevent the production of noise from machinery and equipment due to not being regularly serviced and maintained. Minimising the need for trucks/equipment to reverse will reduce the duration the reversing warnings are being sounded. Noise generation, where possible, should be restricted to the daytime.

The magnitude of change and sensitivity of the impact is expected to be low due to the low presence of local wildlife that will be found on-site, while all noise levels as modelled by airshed will be within international guidelines.

7.3.8.2 impact of noise on the health and safety of employees

Prolonged excessive noise could negatively affect the health of employees and lead to temporary, partial, or permanent hearing loss. The nature of the impact will be direct, adverse, irreversible and over a long period time as the impacts are likely to last long after the operations of the mine have ceased.

The magnitude of change will be low as there may be minor loss or alteration to hearing however there is no loss of resource/life. The sensitivity of the impact is low because the extent of the impact will be on-site not stretching beyond the boundary of the ML.

Mitigation measures would involve the provision of proper PPE to employees to prevent damage to their hearing. A noise complaint register should be maintained, and noise complaints should be addressed as soon as possible.

7.3.8.3 Impact of noise from the project on nearby communities due to movement of airplanes.

During the takeoff and landing of planes, aircraft noise and vibrations are generated. The average noise level generated by planes during takeoff and landing is between 65 dB(A) and 95 dB(A). This is unlikely to be detrimental to nearby communities. The nature of this impact will be adverse and direct, but reversible.

Mitigation measures involve excessive noise to be restricted to daytime hours (7 am to 5 pm weekdays and 7 am until 1 pm on Saturdays). No aircraft activities should be carried out between dusk and dawn.

The magnitude of change is minor, the duration is short term, and the extent is local. This impact may possibly occur, and the sensitivity of this impact is low. Therefore, the significance of this impact is expected to be adversely low.

7.3.8.4 Noise impacts on wildlife due to movement of airplanes

Excessive noise can scare wildlife away from the area while also interfering with their inter and intra-communication, mating behaviour, foraging behaviour, and spatial orientation. The nature of this impact will be adverse and direct, but reversible.

The mitigation measures are shown in the section above and will be further elaborated in the Project ESMP.

The magnitude of change is moderate, the duration is short-term, and the extent is local. This impact may possibly occur, and the sensitivity of this impact is medium. Therefore, the significance of this impact is expected to be adverse minor.

Table 44 - Noise related impacts

Activity	Receptor	Impact	Nature of impact	Value & Sensitivity	Magnitude of change	Significance of impact
Excessive noise from construction and operations	Fauna (Wildlife)	This may cause disturbance to local wildlife and cause them to migrate from the area	Adverse Direct Reversible Low Short term On-site Possible	Low	Low	Low (1)

Activity	Receptor	Impact	Nature of impact	Value & Sensitivity	Magnitude of change	Significance of impact
Excessive noise from construction and operations	Occupational health and safety (Employees)	Prolonged exposure may lead to hearing loss	Adverse Direct Irreversible Low Long term On-site Possible	Low	Low	Low (2)
Operation of an airstrip	Community	Noise from takeoff and landing of planes can be disturbing to nearby neighbours	Adverse Direct Reversible Minor Short term Local Possible	Low	Low	Low (1)
	Fauna	Noise from aircraft can scare wildlife away from the area while also interfering with their inter and intra-communication, mating behaviour, foraging behaviour, and spatial orientation	Adverse Direct Reversible Moderate Short term Local Possible	Medium	Moderate	Minor (4)

7.4 BIOPHYSICAL ENVIRONMENT

7.4.1 SURFACE AND GROUNDWATER IMPACTS

The Karibib region is characterised by arid conditions, with warm to hot daytime temperatures in summer averaging 35 °C and cold winters with temperatures often dropping below 0 °C. Mean Annual Precipitation (MAP) is reported as 184 mm, predominantly occurring between December

– April as intense thunderstorms. The gross potential evaporation exceeds the MAP (3200 – 3400 mm per annum) and results in the area being a water stressed region.

The Twin Hills Project area occurs in the lower reaches of the Okawayo River catchment, a sub catchment of the Khan River within the greater Swakop River Basin. Drainage in the region is dendritic with ephemeral streams, often steeply incised, forming small tributaries of the ephemeral Khan River, flowing south-westwards to the confluence with the Swakop River that discharges to the Atlantic Ocean (Figure 140) The Okawayo River bisects the mining licence area, requiring a diversion of the natural flow path.

Three distinct geological formations with varied groundwater potential underly the project area (Figure 140). These are the Khan River alluvium (porous material), Kuiseb schists (rock bodies with little groundwater potential) and Karibib marbles (fracture, karstic). The ore deposit and mine pits are associated with the schists, while the adjacent marbles offer increased groundwater potential for water supply. High surface run-off potential and flash flood events result in episodic groundwater recharge with the alluvial material providing important recharge potential to the underlying fractured and karstic aquifers.

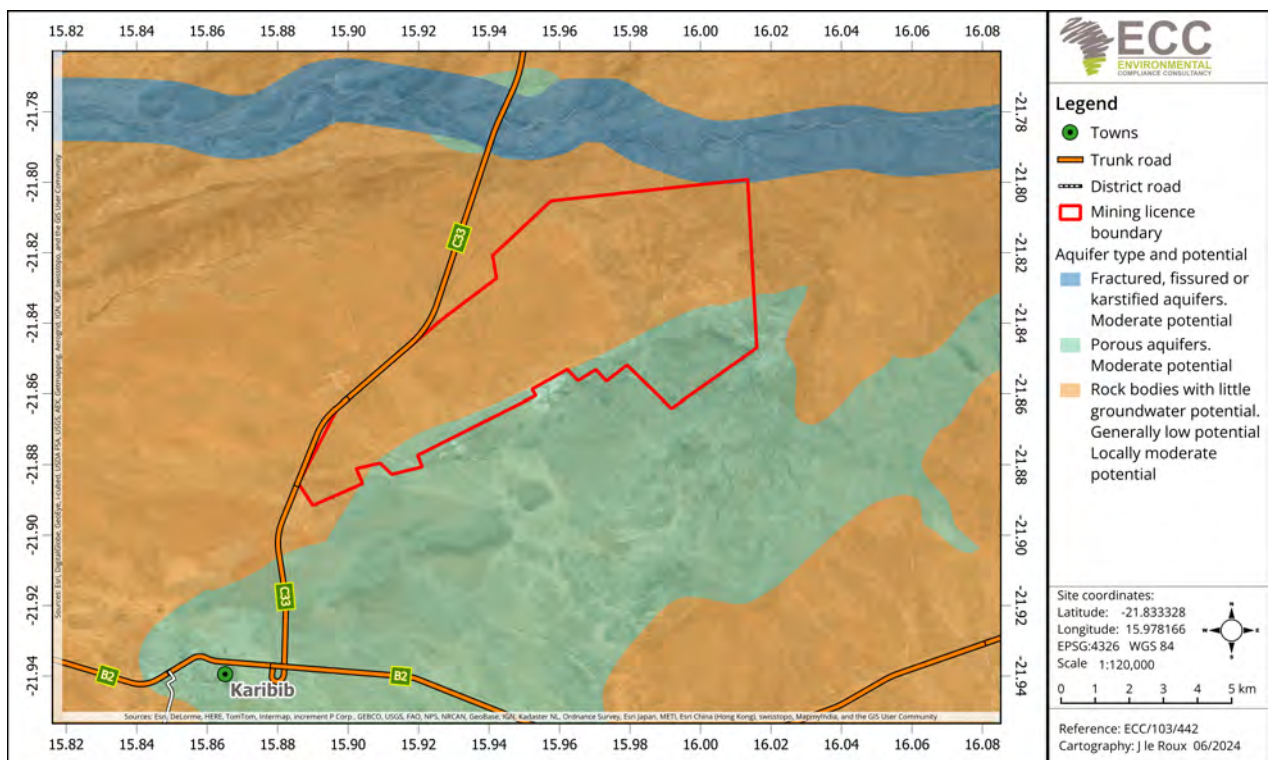


Figure 140 - Hydrogeological map of the project area showing the various rock types of varied groundwater potential. Fractured and karstic aquifer of the Karibib marbles is targeted for local water supply.

This section describes potential impacts to groundwater (hydrogeology) and surface water (hydrology) resources in the Project area as a result of mining activities. The specific impacts are

discussed independently in the sections below. To conclude the section, mitigation measures to manage and where possible, reduce the impacts are provided.

7.4.1.1 *groundwater impacts*

Identified impacts to groundwater resources due to operational mining operational activities are provided in Figure 141 (for illustrative purposes only). Where possible, a comparison is made between the 2022 and 2025 assessments.

The impacts are discussed in detail in the section below.

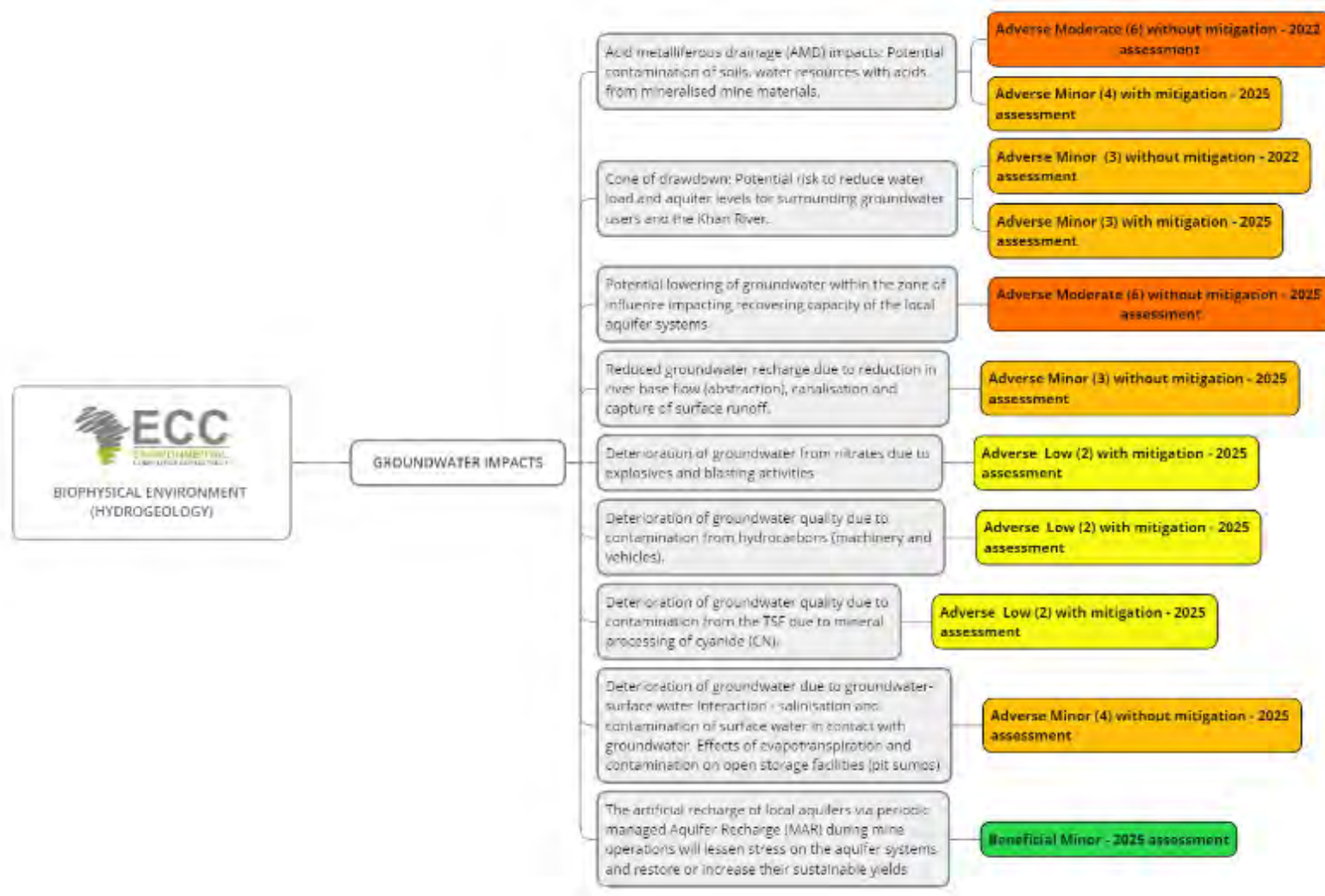


Figure 141 - Identified impacts to groundwater resources.

7.4.1.1.1

acid metalliferous drainage (AMD) may contaminate soils and water resources with acids from mineralised mine materials

In 2022 Prime Resources undertook studies relating to the tailings disposal methodology and design as part of the pre-feasibility study (PFS). Tailings samples were found to be enriched in arsenic, molybdenum, nickel and selenium. Acid-Base accounting (ABA) showed the tailings material and slurry samples to be potentially acid generating (PAG). The samples had a low abundance of total carbon and low calcite and although pH of the tailings paste was alkaline, the sulphide bearing minerals resulted in an Acid Potential (AP) of up to 88 kilograms per ton (kg/t) of sulphuric acid. The neutralising potential (NP) was less than 15kg/t and the Net Acid Generating (NAG) pH was 2.6. While the Net Neutralising Potential (NNP) was in an uncertain range, it was ultimately determined to be PAG with the Neutralising Potential Ratio (NPR = NP/AP) of ~0.5 indicating a significant risk for acid generation, shown in Figure 142.

The Synthetic Precipitation Leaching Protocol (SPLP) was applied and the static leach test of the tailings was compared to the IFC Effluent Standard for Mining, the Namibian Effluent Guideline and the Namibian Drinking Water Guidelines (Ministry of Agriculture, Fisheries, Water and Land Reform, 2023). Arsenic, aluminium and iron were identified as potential contaminants of concern and high concentrations of arsenic were released in the short-term leach tests (2.5 and 1.5 mg/l).

To simulate the weathering of the tailings, dry tailings and slurry underwent humidity cell testing for a period of 20 weeks and found that pH values of the leach tests remained circum-neutral and based on the consumption of the neutralisation potential, the tailings slurry would generate acidity within 4-7 years (bacterial influence could result in acidity being generated sooner). The acidic conditions would further increase the concentration of sulphates, and arsenic, resulting in potential metal contamination and increased total dissolved salts.

The results from the PFS provided initial recommendations for a composite liner and drainage system beneath the tailings storage facility. As part of the definitive feasibility study (DFS) by Knight Piesold (2022), a revised liner design was proposed to include the underlying in-situ but compacted calcrete, providing it could be shown that this geological formation could provide sufficient neutralisation potential should there be seepage through the TSF and underdrainage system. The XRD results from Knight Piesold (2023) confirmed the calcretes and marbles to have high compositions of carbonate minerals, making them suitable to provide effective neutralisation to acids generated.

Further geochemical testing undertaken by Knight Piesold (2023) included trickle down column leaching through the laboratory scaled TSF and underlying calcrete layer using a mild acid solution (distilled water) to simulate rainfall and infiltration through the TSF. The static test results for the tailings material sample indicated that the sample was classified as “uncertain” due to the NPR being slightly higher than 2 and lower acid generating potential of 4 kg/t sulfuric acid compared with the 2022 tailings sample of 88 kg/t.

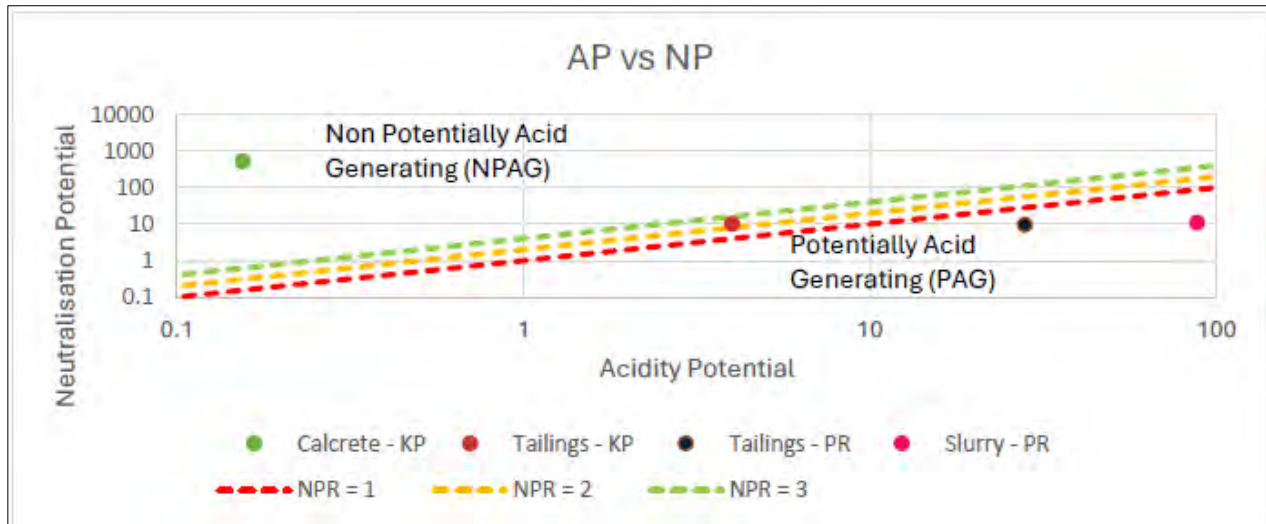


Figure 142 - Acid Potential vs Neutralisation Potential of Twin Hills samples (Knight Piésold, 2023).

This could be due to different test trial laboratories and processing of the tailings material, and due to heterogeneity of the ore that was processed in the tailings trials. However, the Prime Resources PAG outcome remains valid.

The leach testing confirmed that after the initial flush in the first week, the sulphate in the leachate dropped accompanied by a rapid decrease in metal concentrations due to the neutralisation provided by the underlying calcrete layer, through which the tailings seepage passed. However, low concentration of arsenic that spiked in week 5 before dropping to undetected, confirmed that there is a potential short-term risk of contamination to the groundwater once scaled up and assuming the TSF to be unlined. The planned liner above the calcrete is therefore considered necessary in the TSF design with the compacted calcrete providing assurance that if there is deterioration and tears in the liner, risks to the underlying groundwater will be further minimised.

The leach results were then used in a PHREEQC mixing model, with the background brackish groundwater concentrations from routine monitoring results. Background results showed elevated chloride, sodium and sulphate concentrations. The results of the mixing model determined that heavy metals would be sufficiently neutralised by the ambient groundwater with pH also remaining neutral.

Findings of the geochemical testing on tailings material thus concluded that the TSF be lined with locally sourced materials comprising a 150 mm crushed calcrete layer (ripped and recompact in-situ calcrete or imported where required), overlain by an A6 bidim geotextile and a 1.5mm mono-textured High-Density Polyethylene (HDPE) geomembrane and an over liner drainage system.

Work by RGS in 2022 as part of the definitive feasibility study (DFS) assessed waste rock and ore materials (waste rock, low-grade and high-grade ore) from different pit areas. The aim of these

assessments was to assess the mineralogical composition and potential for the generation of acid and metalliferous drainage (AMD), neutral and metalliferous drainage (NMD), saline drainage (SD), or dispersive issues from these materials. For this purpose, a total of 131 waste rock, low grade and high-grade ore representative samples were collected. Results concluded that some waste rock, particularly that from near the fringes of the ore body would be PAG (see Table 45).

Table 45 - Initial Kinetic Leach Column (KLC) test results for composite waste and ore rock samples.

Sample Description	Classification	KLC Number	pH	EC (µS/cm)
Bulge Waste Rock	Potentially Acid Forming	KLC2	5.28	158
Twin Hills Central Waste Rock	Non-Acid Forming	KLC4	6.76	114
Twin Hills Central Waste Rock	Potentially Acid Forming	KLC5	4.29	166
Bulge Waste Rock	Non-Acid Forming	KLC6	7.13	29
Bulge Waste Rock	Non-Acid Forming	KLC7	6.90	31
Twin Hills Central Waste Rock	Non-Acid Forming	KLC8	8.40	112
Clouds Waste Rock	Potentially Acid Forming	KLC11	3.65	864
Twin Hills Central Ore	Potentially Acid Forming	KLC12	6.31	39
Clouds Ore	Non-Acid Forming	KLC14	7.81	145

Soluble trace metals in the leachate included cobalt, iron, manganese, zinc and arsenic. Unaltered and unmineralised waste rock was determined not to be acid-generating, with neutral to alkaline pH, and fit for use of construction and rehabilitation activities. However, altered and mineralised rock (from the Cloud deposit) was determined to contain a concentration of 2-5% pyrrhotite; accounting for elevated sulphur concentrations (~3.08 % S) (Figure 143). The geochemical assessment determined further that based on the sulphur content, altered or mineralised waste rock would have a much higher maximum potential acidity (MPA) (through sulphide oxidation) ranging from 0.2 to 94.3 kg/t sulphuric acid. If left unmanaged, it is likely to be a source of acid and metalliferous drainage.

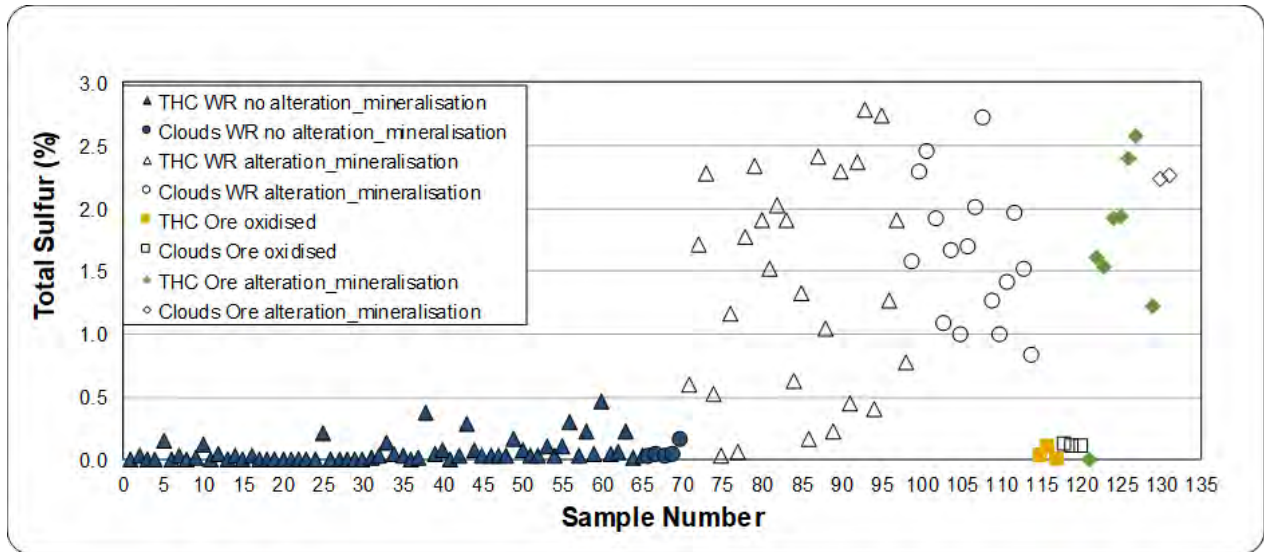


Figure 143 - Total sulphur concentration for waste rock and ore (Source: (RGS, 2021).

Additional work was undertaken by Knight Piesold in 2023 to 2024 and concluded that altered waste rock contain pyrrhotite and are potential acid-forming agents (Figure 144).

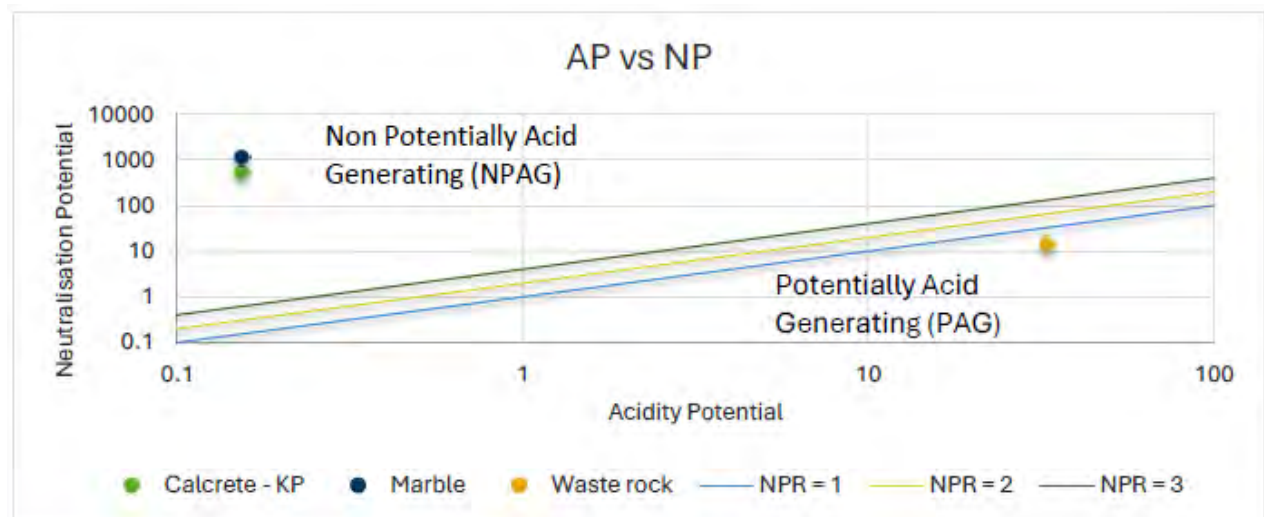


Figure 144 - Acid Potential vs Neutralisation Potential of PAG waste rock, calcrete and marble.

To represent the worst-case scenario kinetic test results for the PAG waste rock results (RGS, 2021) were used in the equilibrium mix model as inputs together with the background groundwater and minerals from the calcrete were allowed to dissolve so as to provide additional buffering capacity. The results of the model were compared to the Namibian discharge limits and the IFC effluent standards. The pH increased to 7.4 due to the higher alkalinity (increased from 40 to 561 mg/L). The sulphate concentrations were elevated above the Namibian effluent limits (340 mg/L) due to the background groundwater concentrations. Aluminium, iron, nickel, and arsenic were above the Namibian limits for the PAG waste rock leachate but when mixed with background groundwater and an addition of calcrete these parameters were then below the effluent limits. Based on the results of the mix model, there is no requirement to line the Waste Rock Dumps

(WRDs) as the seepage from the low volume of PAG waste rock that will be deposited, will be effectively neutralised by the underlying calcrete and groundwater. It was further concluded that the high carbonate mineralogy of the marbles (98%) can be used to encapsulate or be mixed with zones of waste rock and the low-grade stockpile if required.

Regional groundwater resources are identified as sensitive receptors to potential AMD impacts, therefore potential AMD impact on groundwater systems and resources are considered to be regional in scale and partly reversible due to the slow rate of groundwater movement. Groundwater resources are the main water supply for the farming community within the Project area, hence seepage from tailings due to tailings lining failure (worst-case scenario) at some point in the life of mine or post-closure (active or passive) could lead to contamination of these groundwater resources. The magnitude of change is therefore regarded as moderate. Should there be seepage from the TSF lining and the buffering capacity of underlying calcrete be exceeded, a permanent deterioration of groundwater resources upon which other users rely may be expected considering the natural groundwater flow patterns.

The TSF lining will enhance the collection of leachates to the seepage pond which will be sized to maximise evaporation of the leachate. Additionally, the underlying calcrete will offer the buffering capacity to the acids generated. These measures reduce the impact to acceptable levels as the concentration of the tailing's geochemistry will be low, thereby protecting the surrounding environment from such contaminants and associated impacts thereof. Deep groundwater levels and carbonaceous in situ formations further offer mitigation should acids formed at the TSF or WRD reach the sub surface environment. The sulphate plume migration model from the TSF and WRDs during life of mine (LOM) is shown in Figure 145. From the mine onset, SO_4 solutes migrate towards the Okawayo tributary (100 mg/l solute migration within 290 m in the unsaturated zone), however, the solute will be captured by the open pit drawdown (i.e. captured by the pumping wells - OK042 and OKP049) after year five (5) (Knight Piesold, 2024). This implies that the solutes will be captured within the zone of influence and not migrate toward other users.

The nature of the impact adverse and the type of impact is direct. The impact is irreversible, the duration of the impact is permanent, and the extent of the impact is regional. Sensitivity for receptors (other users) is regarded as medium due to the communal and economic value of the groundwater sources. The probability of the impact occurring is possible provided that the TSF operations and WRDs management systems are fully monitored by the Twin Hills team. Should leachate management through the TSF lining system fail, the impact is expected to be reduced further due to the buffering capacity of calcrete. The lining of the TSF will ensure improved control of the contaminants and would lessen the impact to acceptable levels. Furthermore, the proponent should develop a groundwater monitoring network around the TSF and WRDs to understand the plume migration extent and potential groundwater contamination in the project area. With management mitigation measures, the impact is expected to be adverse minor, as shown in Table 46.

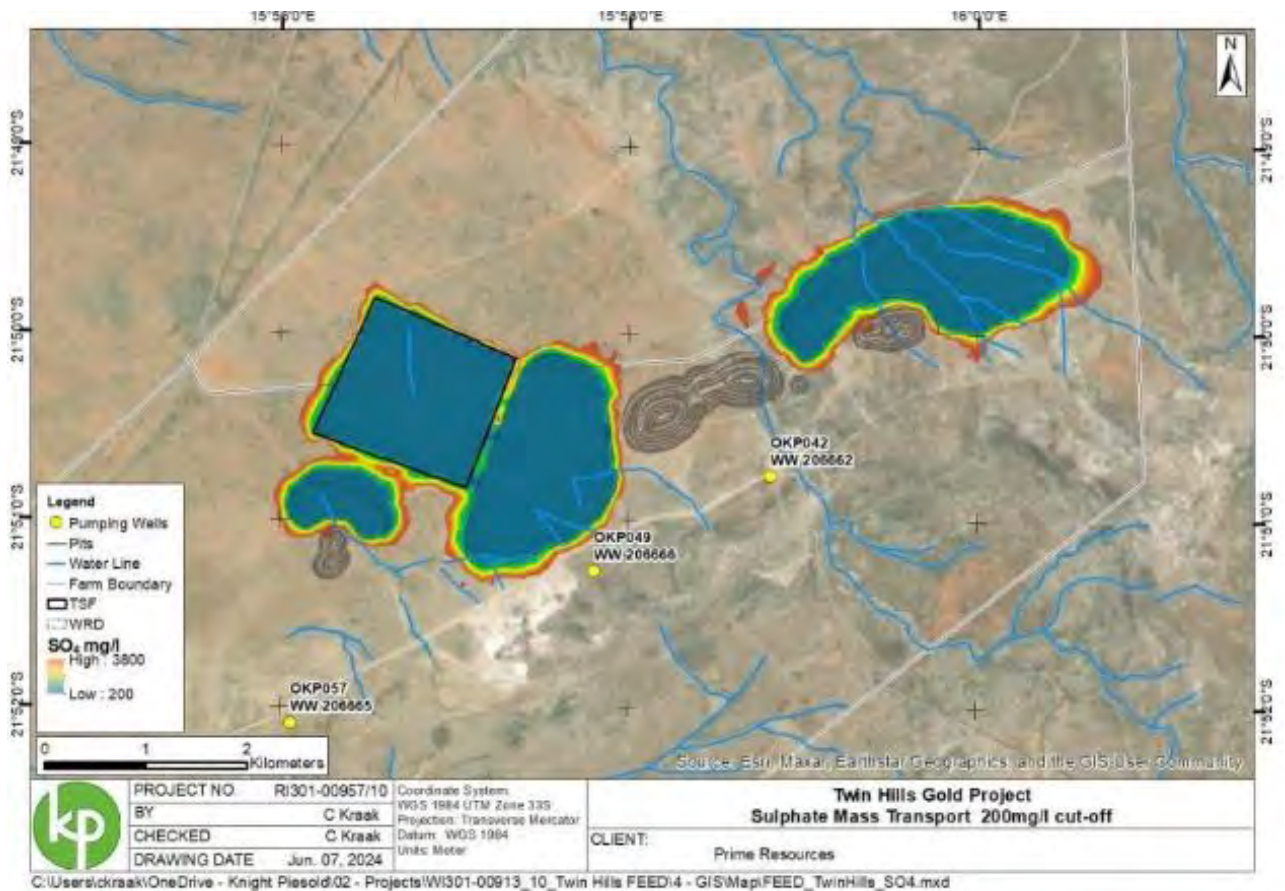


Figure 145 - Solute concentration map in the unsaturated zone during LOM (Source: (Knight Piésold, 2023)).

A summary of the initial impact assessment is presented in Table 47.

Table 46 - Summary of the initial assessment related to acid mine drainage (2022).

Activity	Impact	Significance of impact
Groundwater contamination from unlined TSF and WRD	Contamination of soils, groundwater resources with leachate from altered waste rock and seepage from TSF (without a liner).	Adverse Moderate (6)

Table 47 - Amended impact related to acid mine drainage (2025).

Activity	Receptor	Impact	Nature of impact	Value & sensitivity	Magnitude of change	Significance of impact
Operation of TSF and WRDs	Soils and groundwater	Acid metalliferous drainage (AMD)	Adverse Direct Irreversible Permanent	Medium	High	Adverse Moderate (6)

Activity	Receptor	Impact	Nature of impact	Value & sensitivity	Magnitude of change	Significance of impact
		impacts: Potential contamination of soils, water resources with acids from mineralised mine materials.	Regional Possible			

7.4.1.1.2 cone of drawdown: potential risk to reduce water load and aquifer levels for surrounding groundwater users and the Khan River

Abstraction from boreholes during mine construction and operations may potentially lower the groundwater levels in the aquifers that other users depend on. Abstraction from boreholes needs to be managed correctly to prevent over-abstraction and reduce overall stress on the aquifers. Groundwater recharge in the Karibib area has been defined as sporadic/episodic and is dependent on heavy periods of rainfall to recharge the local aquifers. As drought impacts are significant, extensive drought periods could further increase pressure on the aquifer systems as unpredictable rainfall patterns would mean limited aquifer recharge. This may have negative impacts on the water supply to the mine that is needed for processing, tailings and dust suppression.

The duration of the impact is long-term considering the duration of the mine operation and low rate of recharge. Rainfall patterns are unpredictable however, the ongoing investigation into Managed Aquifer Recharge (MAR) and subsequent implementation of the MAR plan will lessen pressure on some aquifer systems. Therefore, the impact is regarded as partially reversible after LoM. The impact probability can be expected to be medium (possible) as mine abstraction will occur concurrently with the marble quarry operations. Pressure and severity on the aquifer system could be expected.

Lowering of groundwater tables in the local aquifer could result in the water level drop of many boreholes of other users within the same aquifer. The nature of the impact is adverse, and the type of impact is direct. The reversibility of the impact is partly reversible, and the duration of the impact is long term. The scale of impact is expected to be local, with a moderate magnitude of change as the envisioned MAR would periodically recharge the aquifer system. The probability of the impact occurring is possible and the sensitivity of the impact is medium. The impact prior to mitigation is expected to be adverse minor, as shown in Table 48.

7.4.1.1.3 *potential lowering of groundwater within zone of influence impacting recovering capacity of the local aquifer systems*

The Twin Hills Project site has a net water deficit, hence various bulk supply water options were investigated by Knight-Piesold in 2023 to establish the most convenient and applicable options to sustainably meet the project water requirements (~1.1 Mm³/a). The water study undertaken by Knight-Piesold (2023) determined that the mine will be supplied with water from boreholes drilled into the locally occurring Karibib Marble Aquifer, north and south of the site, which will supply a sustainable yield of 3 300 m³ daily throughout the life of mine.

Although the marble aquifer is envisioned as the primary supply to the Mine site, a diversified water supply strategy is in place to augment the utilisation of resources from the Karibib Marble Aquifer. In this regard, options such as the Khan Water Scheme with Managed Aquifer Recharge (MAR), Kranzberg Water Supply Scheme and treatment of wastewater from Karibib Town are being investigated to alleviate reliance on a single source supply (groundwater resources). The mine water balance model by Knight-Piesold also includes Cloud West pit dewatering as a supplementary water supply option (Figure 146).

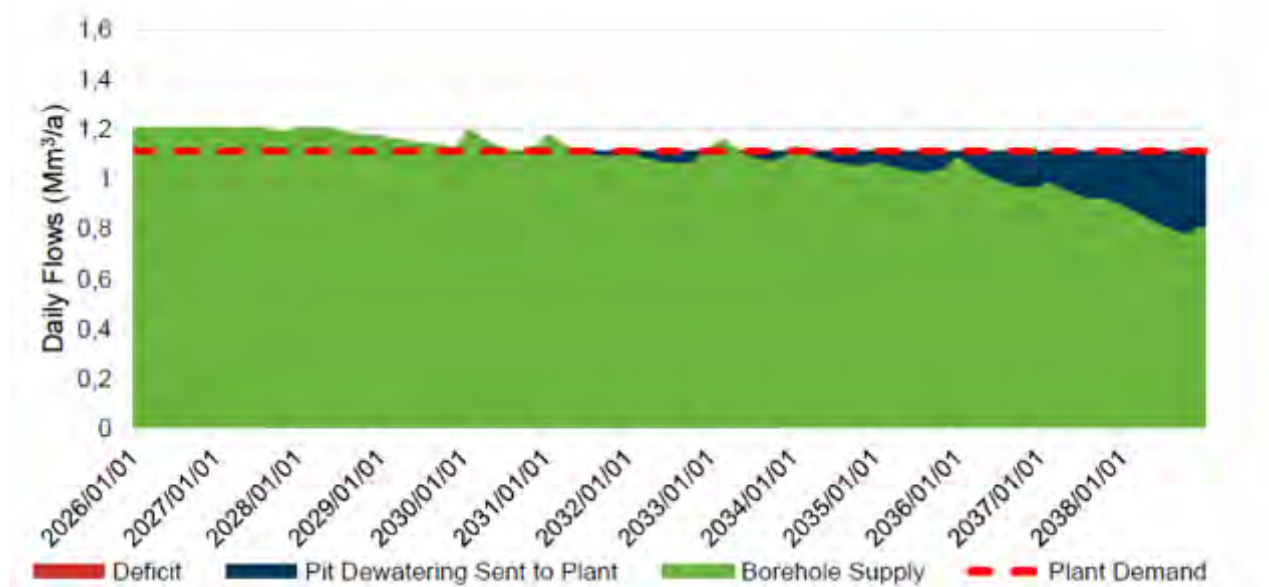


Figure 146 - Water supply model for Twin Hills Gold Project (Source: (Knight Piésold, 2023).

Over 20 active boreholes were found in the Project area and show that the local groundwater table is relatively shallow, with water levels ranging from 6 m to 57 m below ground level. Groundwater is supplied from local boreholes to the farmers and quarry operations in the area.

The updated Cone of Depression (COD) model by Knight Piesold (2024) indicates that passive dewatering of the open pits and pumping boreholes at recommended pumping rates will create an elongated cone of drawdown in a SW-NE strike from the open pits, covering a total length of ~10 % (~1.5 km SW of the west pit and ~2 km NE of the cloud pit) (Figure 147). Pumping along the northern marble limb would create a COD and merge with the pits COD (Knight Piesold, 2024). However, the COD does not extend significantly to the south. Passive dewatering of the open pit

operations and pumping from boreholes simultaneously will ultimately create a cone of depression, leading to the lowering of the water table in the surrounding area. In the case that groundwater resources are utilised unsustainably and poorly managed (excessive pump rates leading to mineralisation and annealing of strikes, dewatering of main water strikes), there may be limited recharge capacity of the local aquifer systems with limited recovery of local boreholes. This may ultimately impede marble ridge operations and water shortage for domestic and commercial farming in the surrounding farming community.

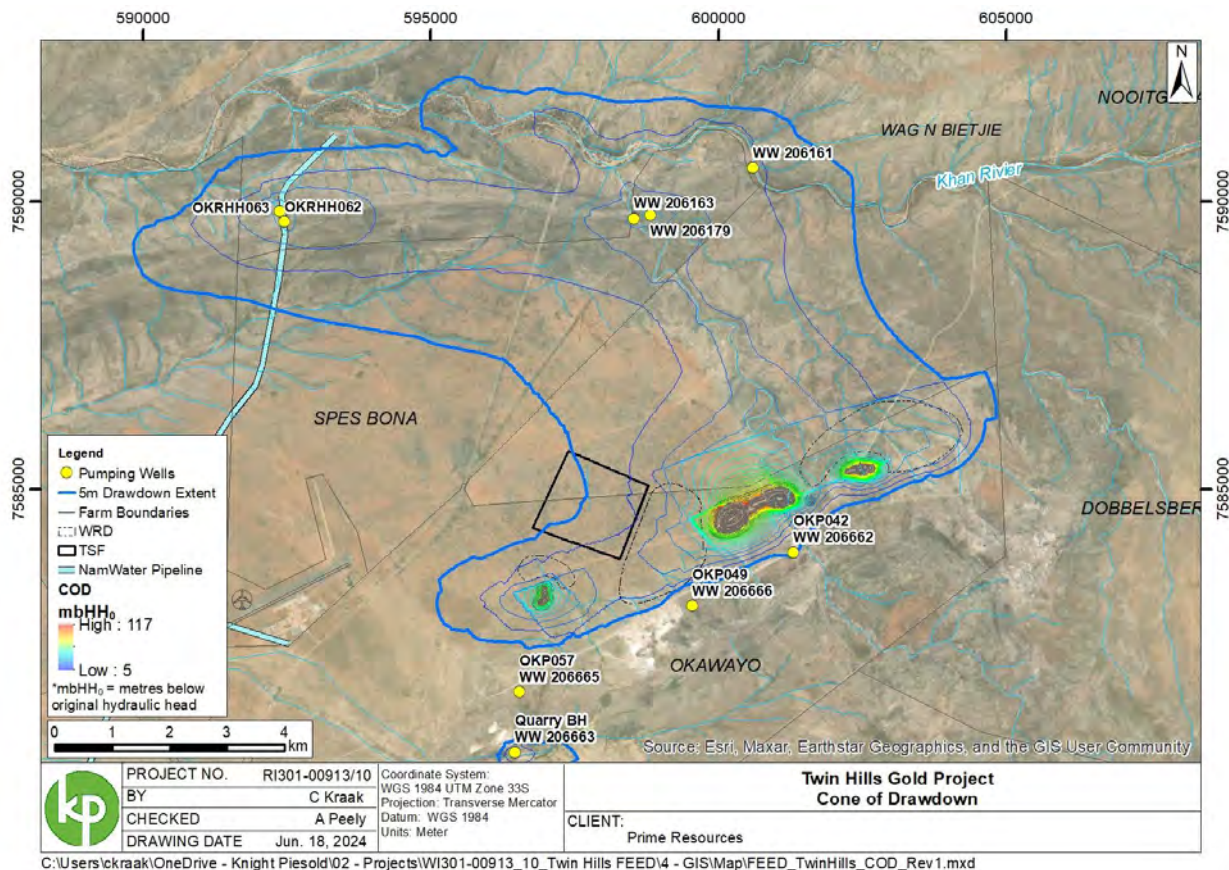


Figure 147 - Osino Twin Hills Gold Project cumulative cone of drawdown (Source: (Knight Piésold, 2023)).

Generally, the cone of drawdown extends outward from the pit and potentially impact boreholes by decreasing flow rates or drying up of boreholes with limited recovery capacity. As shown in Figure 147, the cone of drawdown does not significantly extend to the south or reach the adjacent Dobbelsberg farm, although, the drawdown will be elongated towards the northeast-southwest along the strike of the orebody, hosted within Kuiseb Schist, and parallel to the southern limb of the Karibib Marbles.

Over pumping and abstraction of groundwater can lead to annealing, which occurs when water-bearing rocks to become compressed or the fractured rocks seal up. This is more likely to happen in the Project area due to the fact that the aquifer underlying the Project is karstic or due to lack of hydrostatic pressure or precipitation in the flow path

The nature of this aquifer is characterized by “double porosity” and formed by the dissolution of soluble rocks, primarily limestone and dolomite. Due to the rapid flow of water through the system, water levels can fluctuate significantly in response to pumping or changes in recharge. As water is pumped out, the reduced hydrostatic pressure can cause overlying rock layers to compress the aquifer, potentially leading to subsidence. Additionally, increased mineral concentration in the remaining water can result in precipitation, clogging pores and reducing permeability. The fractures within the aquifer may also become compressed or less permeable due to the decreased pressure. Over time, repeated compression and relaxation can cause the aquifer material to anneal, losing elasticity and reducing its ability to recover from deformation. This damage can impede the flow of water through the ground, reducing its permeability and making water more difficult to extract.

Therefore, the nature of this impact is adverse and direct. The sensitivity of the impact is medium. The impact is expected to be localised on-site. The duration of impact is regarded as long-term considering the life of mine and slow recharge rates and probability is high as the event is likely expected to occur. The impact is partially reversible with a minor magnitude of change. Therefore, this impact has been rated adverse moderate.

7.4.1.1.4 *the impact of reduced groundwater recharge on other users due to reduction in river base flow (abstraction), canalisation and capture of surface runoff*

As discussed in the section above the canalisation and damming of the diverted Okawayo River into the Clouds West Pit will result in a reduction groundwater recharge, decrease river baseflow and increase evaporation losses. River base flow is the portion of a river's flow that is sustained between precipitation events. It is essentially groundwater flowing in the river channel, providing a steady flow even during dry periods. Abstraction from boreholes close to the river will reduce the amount of water seeping through from underground to the base of the river, thus decreasing the overall river base flow. Furthermore, this may be exacerbated in the coming years because of an increase in evaporation rates due to climate change. These two activities will result in a decrease in the amount of groundwater available for other users. Therefore, the nature of this impact has been rated adverse and direct. The reversibility of the impact is partially reversible, and magnitude of change is moderate. The duration of the impact is long term, and the extent of the impact is local. The probability of the impact occurring is likely and the sensitivity is medium. Therefore, this impact has been rated adverse minor.

7.4.1.1.5 *the impact of the deterioration of groundwater quality from nitrates due to explosives and blasting activities*

When explosives decompose or are not fully detonated, harmful chemicals like nitrates, ammonium, and heavy metals can leach into the groundwater, while the salts used in explosives can increase the salinity of groundwater. Furthermore, the vibrations from blasting can either cause fractures in the aquifer or can cause some fractures to close up. This may change the flow paths within the aquifer and nitrates could seep into the groundwater. However, any nitrate

solutes are expected to be captured by the open pit drawdown, specifically by the pumping wells OK042 and OKP049 (Knight Piesold, 2024). This suggests that the solutes will be contained within the zone of influence of these wells. Therefore, this impact has been rated adverse and direct, the reversibility of the impact is irreversible, and the magnitude of change is low. The duration of the impact is long term, and the extent of the impact is local. The probability of the impact occurring is possible and the sensitivity of the impact is low. Therefore, this impact has been rated adverse low.

7.4.1.1.6 *the impact of the deterioration of groundwater quality due to contamination from hydrocarbons (machinery and vehicles)*

Accidents and improper handling can lead to leaks and spills of fuel products, such as diesel, gasoline, and lubricants. These contaminants can infiltrate the soil and eventually reach the groundwater. However, any hydrocarbon solutes are expected to be captured by the open pit drawdown, specifically by the pumping wells OK042 and OKP049 (Knight Piesold, 2024). This suggests that the solutes will be contained within the zone of influence of these wells. Therefore, this impact has been rated adverse and direct, the reversibility of the impact is irreversible, and the magnitude of change is low. The duration of the impact is long term, and the extent of the impact is local. The probability of the impact occurring is possible and the sensitivity of the impact is low. Therefore, this impact has been rated adverse low.

7.4.1.1.7 *the impact of the deterioration of groundwater quality due to contamination from the TSF due to mineral processing of cyanide (CN)*

During the ore processing phase, cyanide will be utilized to create a cyanide solution. This solution will undergo a treatment process to extract gold. Subsequently, the remaining solution will be subjected to a cyanide destruction process. Additionally, the CIL tailings, containing an initial cyanide concentration of 150 g CN WAD/m³, will be reduced to less than 50 g CN WAD/m³ following the cyanide destruction process. Residual cyanide and other processing waste will then be transported to the Tailings Storage Facility (TSF) as a slurry. The cyanide within the slurry solution will undergo further degradation into its carbon (C) and nitrogen (N) components due to the combined effects of ultraviolet (UV) radiation from sunlight and gaseous oxygen in the air. However, in the event of a TSF failure or seepage, any residual cyanide could potentially infiltrate into the groundwater. However, the solute is expected to be captured by the open pit drawdown, specifically by the pumping wells OK042 and OKP049 (Knight Piesold, 2024). This suggests that the solutes will be contained within the zone of influence of these wells. Therefore, this impact has been rated adverse and direct, the reversibility of the impact is irreversible, and the magnitude of change is low. The duration of the impact is long term, and the extent of the impact is local. The probability of the impact occurring is possible and the sensitivity of the impact is low. Therefore, this impact has been rated adverse low.

- 7.4.1.1.8 *the impact of the deterioration of groundwater quality due to groundwater-surface water interaction – salination and contamination of surface water in contact with groundwater along with effects of evapotranspiration and contamination and open storage facilities (pit sumps)*

As the open body of water in the pits are exposed to evaporation, the salt load in the pits may increase. If the salt load in the water in the pit increases, this water may recharge the aquifer resulting in groundwater contamination. If the salt load in surface water increases, this water with elevated salinity may recharge the aquifer especially in the open pits. This could result in the contamination of low salinity groundwater with high salinity surface water. The nature of the impact is adverse and the type is direct. This impact is irreversible and the duration of the impact is long term. The extent of the impact is regional and it is possible for this impact to occur. The sensitivity of the impact is medium and the magnitude of change is high. Therefore, the significance of this impact has been rated adverse minor.

- 7.4.1.1.9 *the impact of groundwater availability due to managed aquifer recharge system (MAR)*

The envisioned Managed Aquifer Recharge from the Khan Water Scheme is expected to periodically lessen stress on the local aquifers. This will significantly increase the sustainable yield and recovery of the local aquifer systems and other regional aquifers depending on the groundwater flow regime. The planned Managed Aquifer Recharge (MAR) system is shown in Figure 148.

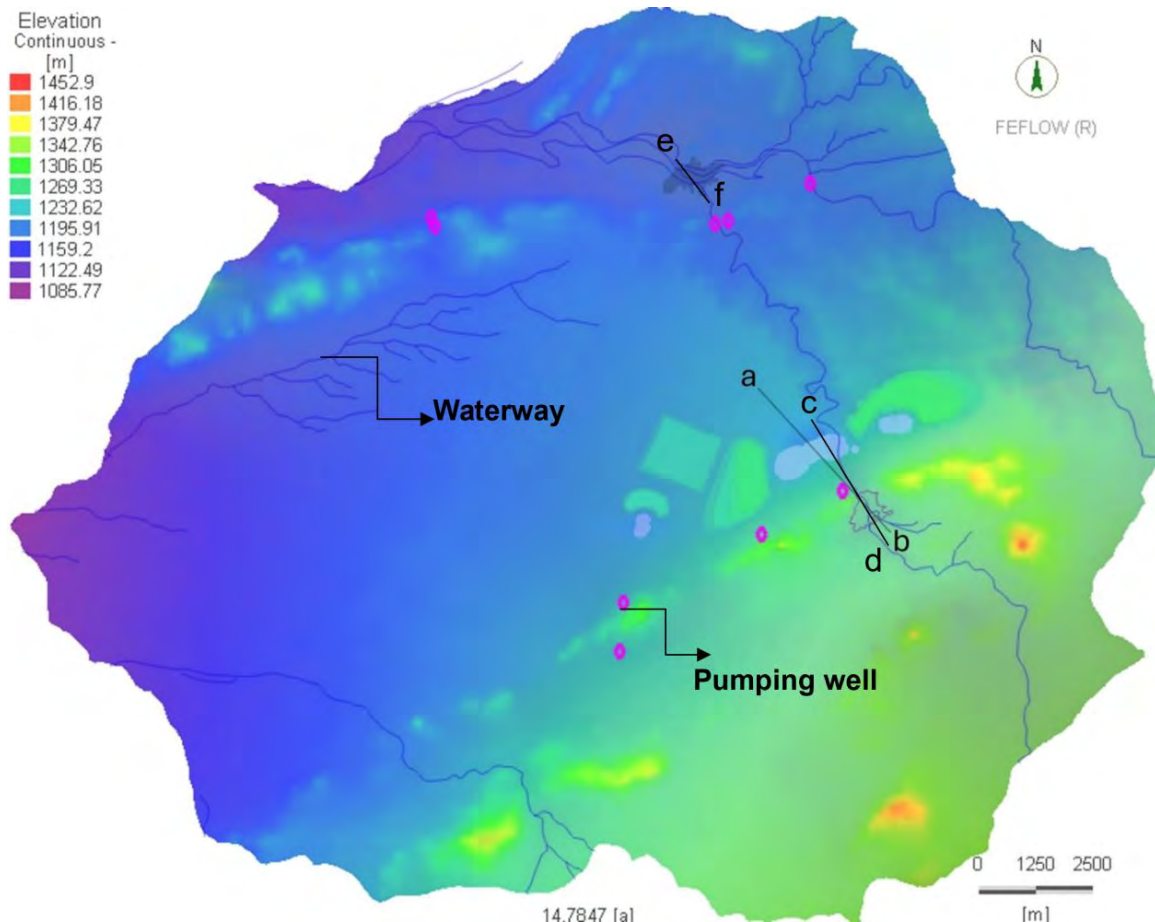


Figure 148 - The Managed Aquifer Recharge (Source: (Knight Piésold, 2023)).

The envisioned MAR area has higher recharge than the rest of the area due to higher head and higher permeability materials. The following benefits are credited to the MAR initiative (Knight Piésold, 2023):

- Enhanced recharge from the MAR area may increase groundwater to more than 6 m;
- The induced recharge from the MAR would increase the groundwater hydraulic head in the marble aquifers;
- Induced recharge will result in increased pore pressure. However, this will be manageable and would not significantly impact the pits walls stability;
- The induced recharge would result in pit inflows, from 2.20 to 22 m³/day from year 3 to year 14;
- The marble aquifer and particularly OKP042 would be recharged; and
- The greater Khan River north of the project area would be recharged, and the Spes Bona aquifer would have a lesser drawdown from abstraction.

The type of the impact is direct. The impact is reversible, and the duration of the impact is long term. The probability of this impact occurring is likely. The abovementioned attributes will have a high magnitude of change on the long-term availability of water which will ensure the groundwater resources are utilised equitably by the farming and mining sector in the local area. The magnitude of change of impact is rated high as induced recharge will extend to a regional scale (i.e. expected

to recharge the greater Khan River north of the project area). The integration of periodic Managed Aquifer Recharge during the LoM is deemed beneficial, therefore the overall project impacts on the local aquifers is expected to be beneficial - minor. The impact ratings are shown in Table 48.

A summary of the initial assessment on the project's impacts on water availability is shown in Table 49

Table 48 - Initial assessment on water availability (2022).

Activity	Impact	Significance of impact
Water levels in neighbouring boreholes are used for water supply.	During pre-mining, groundwater is impacted due to water abstraction for use in exploration drilling, as well as test pumping of groundwater exploration holes. The temporary lowering of the groundwater will occur and may impact boreholes that are located along the marble contact.	Adverse low (2)
Groundwater cone of depression	Lowering the groundwater within the zone of influence may impact groundwater users and their water supply.	Adverse Minor (3)
Impact on the Khan River Catchment quantities	Abstraction of the groundwater and catchment of the surface runoff for use in the mining process will reduce the water load to the Kahn River Catchment	Adverse Minor (3)

Table 49 - Amended impacts related to water availability (2025).

Activity	Receptor	Impact	Nature of impact	Value & Sensitivity	Magnitude of change	Significance of impact
Over-abstraction	Water Availability for neighbouring boreholes and ML boreholes	Cone of drawdown: Potential risk to reduce water load and aquifer levels for surrounding groundwater users and the Khan River.	Adverse Direct Partly Reversible Long Term Local Possible	Medium	Moderate	Adverse Minor (4)
Open pit excavation and over-abstraction (cone of drawdown)	Water levels in Neighbouring boreholes used for water supply	Potential lowering of groundwater within the zone of influence impacting recovering capacity of the local aquifer systems.	Adverse Direct Irreversible Long term Local Possible	Medium	High	Adverse Moderate (6)
Water storage in open reservoirs	Water availability for groundwater recharge	Reduced groundwater recharge due to reduction in river base flow (abstraction), canalisation and capture of surface runoff.	Adverse Direct Partly reversible long Term Local Likely	Medium	moderate	Adverse Minor (3)
Blasting	Groundwater quality	Deterioration of groundwater quality from nitrates due to explosives and blasting activities	Adverse Direct Irreversible Long term Local Possible	Low	Low	Adverse Low (2)

Activity	Receptor	Impact	Nature of impact	Value & Sensitivity	Magnitude of change	Significance of impact
Mine construction and operation	Groundwater quality	Deterioration of groundwater quality due to hydrocarbon spills	Adverse Direct Irreversible Long term Local Possible	Low	Low	Adverse Low (2)
Leakage from the TSF	Groundwater quality	Deterioration of groundwater due to contamination from the TSF due to the mineral processing of CN	Adverse Direct Irreversible Long term Regional Possible	Low	Low	Adverse Low (2)
Open pit excavation	Groundwater quality	The impact of the Deterioration of groundwater quality due to groundwater-surface water interaction - salinisation and contamination of surface water in contact with groundwater along with Effects of evapotranspiration and contamination on open	Adverse Direct Irreversible Long term Regional Possible	Medium	High	Adverse Minor (4)

Activity	Receptor	Impact	Nature of impact	Value & Sensitivity	Magnitude of change	Significance of impact
		storage facilities (pit sumps).				
Artificial recharge of groundwater resources via Managed Aquifer Recharge during mine operations.	Groundwater resources	The artificial recharge of local aquifer systems during mine operations will lessen stress on the aquifer systems and restore or increase their sustainable yields.	Beneficial Direct Reversible Medium term Regional ¹ Likely	Medium	Moderate	Beneficial Minor (4)

¹ Local impact due to the recharge of aquifers in the immediate project area and regional impact as the groundwater flow patterns will recharge the Khan River that flows towards the greater Swakop River.

7.4.1.1.10 bulk water supply mitigation measures

Based on the findings in the initial assessment, the Proponent proposed to commit to the following supplementary water supply sources to alleviate reliance on a single water supply (groundwater supply), and are provided in the ESMP (Appendix A):

- Build a Category 1 rubble masonry concrete (RMC) weir dam (8.8 m) and spillway channel designed and sized to capture 50-year flood flow events at the Main Central pit and discharge into the Cloud west pit. The pit will therefore be de-watered and stored water will be used for the mine's operational requirements over the life of mine.
- The current operational process methodology is designed to maximise water reuse on-site through water recycling initiatives with a focus on the process plant water reuse through filtration systems throughout the processing plant. It is expected that ~77% of the water contained in the tailings materials will be recycled in the plant before tailings materials are disposed of at the TSF.
- A desalination pipeline to the Central Area of Namibia (CAN) is proposed and is planned to be implemented in 2031.
- The opportunity to recharge the aquifer via managed aquifer recharge (MAR) upstream along the Okawayo sub-tributary and from the Khan Water Scheme option is conceptually under consideration to ensure the long-term sustainability of the aquifer. The model results indicate that MAR could provide an additional 0.3 Mm³/a from the KRWS, which would offset the gradual depletion of aquifer resources from the water supply boreholes towards the end of LoM, due to the developing cone of drawdown around the mine.
- Investigated the alternative water supply from NamWater, Karibib Town wastewater treatment works and an augmentation scheme on the Khan River.
- Bulk water supply from the Kranzberg Water Supply Scheme. Supply from this option would also reduce stress on local water sources.
- The Proponent through an independent third party has developed a groundwater level baseline database, which essentially will be used to analyse future trends and aquifer performances and other associated impacts triggered by mining operations should they occur.

The abovementioned management/mitigation measures will limit reliance on a single water source throughout the LOM, and thereon a low significance rating can be expected.

7.4.1.2 surface water impacts

Surface water impacts envisaged with the mine operational activities are provided in Figure 149, for illustrative purposes only, where possible comparison has been made to the 2022 assessment. The impacts are discussed in detail in the section below.

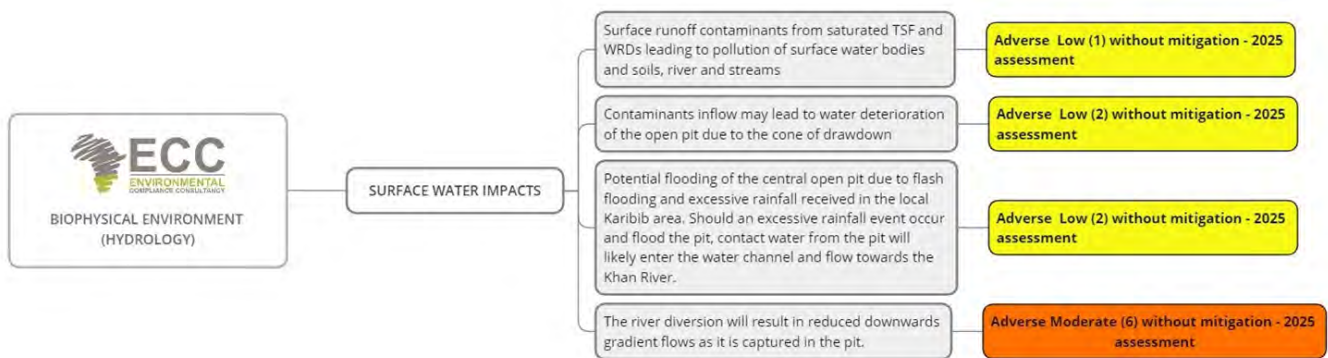


Figure 149 - Surface water impacts.

7.4.1.2.1 *Surface water runoff of contaminants from saturated TSF and WRDs may lead to pollution of surface water bodies, soils, streams and the Khan River*

Static and kinetic leach testing programs confirmed both WRD and TSF contain pyrrhotite which is potentially acid-forming and has a significant risk for acid generation. Short-term leaching experiments identified arsenic, aluminium and iron as potential pollutants of concern in high water-to-rock leaching ratios. Evaporation from the TSF and WRD would result in the precipitation of salts, which could be washed off the facilities, down gradient during intense rainfall and flood events onto surrounding surface water sources, soils, surrounding rivers, and streams. Infrequent monitoring post-closure or tailings design failure could potentially result in contaminants seepage into the surrounding environment (e.g. rivers and streams).

This impact was initially assessed and did not consider the TSF geosynthetic lining and underdrainage systems.

The current mine methodology includes lining the TSF, underlying the WRD with a thick layer of calcrete and building stormwater management infrastructure to aid in the control of contaminants. This will lessen the magnitude of the impact. The scale of impact is considered local as rainfall intensity will dictate the flow rate and travel distance of contaminant surface runoff. The impact is expected to have a long-term impact post-closure due to reduced monitoring of both facilities. The probability of the impact occurring is regarded as low. The bathtub effect post closure will however have a moderate magnitude of change, as the standing contaminants at the base of the TSF could attract foraging birds such as crows, owls, smaller raptors and various aquatic species (e.g. migrants). Overall, the impact is expected to be adverse low with the implementation of management mitigation measures (Table 50).

7.4.1.2.2 *contaminants surface runoff mitigation/management measures*

Management mitigation measures have been proposed by the Proponent to lessen the impact to acceptable levels. The current TSF design includes a geosynthetic lining and underdrainage systems. The geosynthetic lining system will be installed during the construction phase over the tailings basin footprint to reduce seepage that has the potential for acid generation and metal

leaching. The underdrainage system will comprise a basin underdrain system positioned in key areas to enhance consolidation of the tailings and collect leachate to the settling seepage pond which will be sized to maximize evaporation of the leachate water. Waste rock facilities will further be underlain by a thick unit of calcrete that will act as neutralising agent and will be subject to frequent kinetic column testing to determine the long-term neutralising potential of the in-situ subsurface. Additionally, a site wide monitoring program that include precipitation and runoff in rivers at the site will be developed. This will ensure an improved understanding of local climatic conditions of the site and its associated influence on surface water resources.

To further reduce the significance of the impact, the following mitigation measures are proposed:

- Implementation of a sitewide monitoring that includes precipitation and runoff in rivers at the site, this will ensure an improved understanding of local climatic conditions and influence on surface water.
- Implementation of a site wide storm water management plan that also includes inspection of storm water infrastructure etc.
- Continued groundwater quality and level monitoring post-closure;
- Rehabilitate the TSF and WRDs post closure to reduce penetration of water into the tailings materials and thus mitigating the potential for seepage or the bathtub effect;
- Implementation of a TSF surveillance and management program throughout LoM and management measures post closure to include continuous inspection of the TSF geosynthetic lining, underdrainage systems and settling seepage pond for leakages;
- The unaltered and unmineralised waste rock that is non-acid generating can be used to encapsulate the altered and mineralised PAG waste rocks; and

Ensure suitable stormwater design and slope benches to capture and reduce runoff from these facilities or channel the runoffs to the settling bottom dam.

7.4.1.2.3 *contaminant inflow may potentially lead to the deterioration of water in the open pits*

The water quality of the pit will potentially deteriorate over time due to pit wall exposure to the elements, the inflow of contaminants from the remaining TSF, as well as concentrated salts drawn into the pit through the cone of depression. In the event of excessive rainfall, which may flood the pit, decanting from the pit will likely enter the water channel and flow towards the Khan River.

(Knight Piésold, 2023) modelled the plume migration from the lined tailings storage facility (TSF) and waste rock dumps (WRDs) (Figure 145) and indicated that the drawdown cone development around the pits will effectively capture the plume during operations due to the pits being terminal sumps. The solute migration simulated model indicates that during operation, 100 mg/l SO₄ solute will migrate covering a distance of 290 m in the unsaturated zone from the Cloud pit WRD towards the Okawayo River. The plume is not expected to migrate further down the river as the pumping wells (i.e. OKP042 and OKP049) would potentially capture solutes. This implies that the solutes will be captured within the zone of influence and pit inflows with contaminants will potentially deteriorate the water quality captured within the open pits (Figure 145).

The impact will be direct, irreversible, and long-term as pit inflows are expected post-closure. The water quality of the pit will deteriorate over time and any flood event will potentially wash off surface and subsurface contaminants in the project area downgradient towards the Khan River. The extent of the impact could thus be deemed as regional. This is only expected to occur during flash flood events. The mine has however proposed stormwater management infrastructure to capture, manage and guide stormwater and flood flows towards the Khan River catchment. The implementation of proposed stormwater management measures and controlled operational activities of the TSF and WRDs will lessen the significance of the impact. The significance of the impact is adverse minor pre-mitigation and adverse low post-mitigation (Table 50).

7.4.1.2.4 *potential flooding of the central open pit and work areas of the mine thereby disrupting mining operations*

The main pit will be developed across the natural flow path of the Okawayo River, which is an ephemeral river that is prone to flash flooding during rainfall events. Without a diversion system in place, large floods will significantly impact the mine operations and pose a safety hazard to employees operating on the mine. The flood peaks were measured by (Knight Piésold, 2023) to determine various annual flood exceedance probabilities (AEP) and the anticipated flood line level that could arise if the main pit was flooded. The various flood events modelled by Knight-Piesold indicate that the main pit could be flooded up to a depth of 50 m originating from a 2-year AEP flood event (~ 0.6 Mm³ from 42 mm rainfall-runoff generating over the entire catchment) and up to 140 mm depth in the event of a 200-year AEP flood event occurring (~ 5.8 Mm³ from 118 mm rainfall-runoff generating over the entire catchment).

A river diversion with a category 1 rubble masonry concrete (RMC) 8.8 m weir dam and spillway channel is proposed. This infrastructure will be designed and sized to capture 50-year AEP peak flow events at the Main Central pit and discharge it into the Cloud West pit (Figure 148). During significant floods events, the weir dam wall will overtop, and water will be routed to the Main Pit. Water inflow will demand considerate management by the Twin Hills hydrology department. The current provision proposed is to capture this water, dewater the pit and utilise the water in the processing plant for operational activities. Furthermore, the addition of stormwater management infrastructure such as diversion channel, slit traps, berms gutters and pollution control reservoirs will channel the flow of water from the mine sensitive areas and allow for storage and retention of polluted water on-site. Therefore, an adverse major impact may be expected. However, with the precautionary river diversion system in place and other stormwater management practices, the event is unlikely to occur and therefore an adverse low impact could be expected. Therefore, a worst-case scenario has been considered in the assessment. (Table 50).

7.4.1.2.5 *the river diversion will result in reduced down gradient flows as it is captured in the pit*

The proposed river diversion will attenuate flood flows into the clouds pit shown in Figure 150. Down gradient flows will be reduced as it is captured in the pit - this may reduce water availability for environmental flow requirements in the Okawayo River, while also reducing the amount of

water is likely to reach the Khan River. The nature of this impact has been rated adverse and direct. This impact is reversible, and the duration of the impact is permanent. The magnitude of change of the impact is high and the scale of the impact is regional. The probability of this impact occurring is definite. The sensitivity of the impact is medium. Therefore, the nature of the impact has been rated adverse moderate.



Figure 150 - The river diversion layout, southern structure indicates RMC, spillway channel is indicated in yellow, small pit indicates Cloud West pit (green), and large pit indicates Main Central pit (Green) (Source: (Knight Piésold, 2023)).

Table 50 - Surface water impacts (2025)

Activity	Receptor	Impact	Nature of impact	Value & Sensitivity	Magnitude of change	Significance of impact
WRDs and TSF operations (Contaminants load surface runoff)	Water quality, soils	Surface runoff contaminants from saturated TSF and WRDs leading to pollution of surface water bodies and soils, river and streams	Adverse Direct Partly reversible Long term Unlikely	Low	Moderate	Adverse Low (1)
Flooding and decanting of pit lake post-closure due to excessive rainfall events	Water quality	Contaminants inflow may lead to water deterioration of the open pit due to the cone of drawdown	Adverse Direct Partly reversible Long term On-site	Low	Minor	Adverse Low (2)
Flooding and excessive rainfall	Central open pit	Potential flooding of the central open pit due to flash flooding and excessive rainfall received in the local Karibib area. Should an excessive rainfall event occur and flood the pit, contact water from the pit will likely enter the water channel and flow towards the Khan River.	Adverse Direct Partial reversible Local Temporary	Medium	Moderate	Adverse Low (2)

Activity	Receptor	Impact	Nature of impact	Value & Sensitivity	Magnitude of change	Significance of impact
Okawayo River Diversion	Surface water	The river diversion will result in reduced downwards gradient flows as it is captured in the pit.	Adverse Direct Irreversible Permanent Regional Likely	Medium	High	Adverse moderate (6)

7.4.2 BIODIVERSITY IMPACTS

The Klein Okawayo Farm falls within the Central-Western Plain Landscape and the Western Highlands Acacia vegetation type of the Tree-and-Shrub Savanna biome dominated by low shrubby Acacia species. The rocky hills to the south have elements of the Central-Western Escarpment and Inselbergs vegetation type of the Nama Karoo biome. The area has an expected plant diversity of about 200 species of which about 40 are endemic to Namibia; about 70 mammal species, 190 bird species with 10 endemics, and about 55 reptile species of which 15 are endemic. There have been some changes and alterations to the mine site layout from the initial 2021 assessment and these changes are illustrated in Figure 95. These changes include amendments to the locations of the waste rock dumps, an addition of Twin Hills West Pit, the decision to line the TSF, the addition of an 11 kV powerline, aircraft runway, solar PV plant, the diversion of the Okawayo River and diversion of the D1941 road.

The additional infrastructure developments of site layout changes will consequently have further impacted on the biodiversity found in the Project area. The Project area is known for having a moderate level of species diversity with relatively high terrestrial endemism and the diversity, abundance and density of herbivores consisting of big game such as kudu, mountain zebra and springbok and carnivores such as leopard, cheetah, spotted and brown hyena with a moderate diversity, abundance and density (Cunningham, 2023). This revised assessment (Cunningham, 2023) determines how the alterations mentioned above or additions to the mine site layout/footprint may affect biodiversity (reptiles, amphibians, mammals, birds, trees, shrubs, and grasses) and various ecosystem services.

7.4.2.1 Reptiles

The area over which the mining license falls is home to reptiles such as the *Stigmochelys pardalis*, *Psammobates oculiferus*, *Pelomedusa subruf*, *Python anchietae*, *Python natalensis*, *Heliobolus lugubris*, *Meroles suborbitalis*, *Agama achuleata*, *Afroedura Africana*, *Chondrodactylus angulifer* and many more which are listed in (Cunningham, 2023). Of all the species that are found in the area 34 are endemic, 3 are rare, 4 vulnerable and 5 protected. The overall impact on reptiles during construction and operation other than habitat alteration or injury is not expected to be detrimental, however, the construction and operation of certain infrastructure may have some negative effects on reptiles that reside in the area. The specific impacts to reptiles in the Project area before mitigation are presented in Figure 151, for illustrative purposes only and outlined in Table 51.

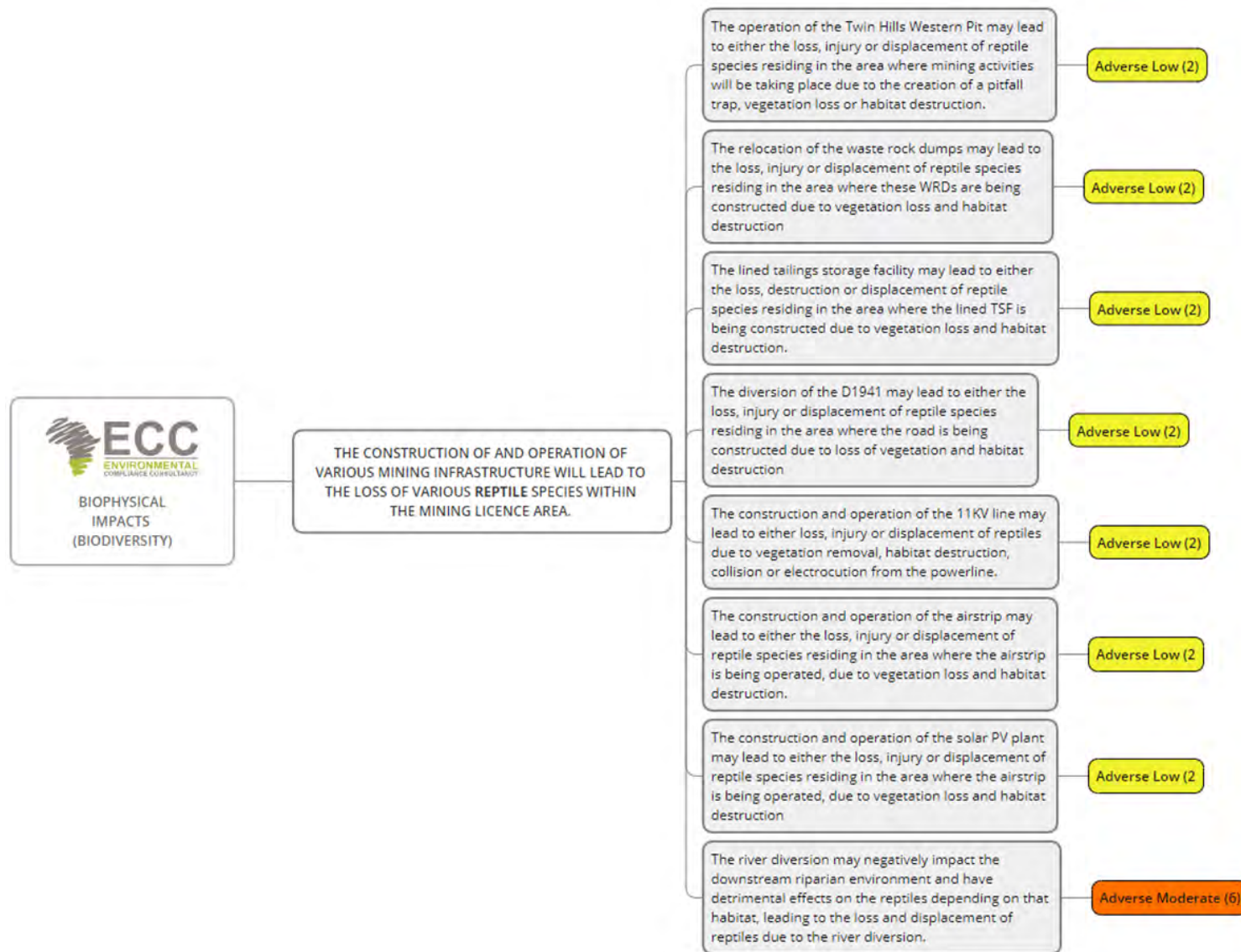


Figure 151 - Impacts to reptiles in the Project area.

- 7.4.2.1.1 *The operation of the Project may result in the loss, injury or displacement of reptile species residing in the area where activities will be conducted due to the creation of pitfall traps, vegetation loss or habitat destruction.*

Due to the large amounts of soil and rock that will be removed, there are various reptiles such as tortoises, snakes, lizards, agamas, chameleons etc whose habitats will be destroyed due to the excavation of the twin hill western pit. Reptiles rely on these habitats for shelter, breeding, and foraging. Therefore, the removal of these habitats will result in the loss of their homes and nesting sites, which will lead to the displacement of these reptiles in this area and may affect their overall population in that area. Additionally, the open pit may create a massive pitfall trap for reptiles, leading to either injury or death. Therefore, the nature of this impact is adverse (negative) and direct. The reversibility of this impact is irreversible, while the duration of this impact is long-term as the impact is likely to last long after the activity has ceased and after mine closure. The magnitude of change for this impact is moderate as there is a loss of resource (reptiles) but not affect the quality and integrity of the resource. The scale of this impact is limited onsite to the boundaries of the Project site, while the probability of this impact occurring is likely. The sensitivity of this impact is low as it is of importance on a local scale and the significance of the impact is adverse low.

- 7.4.2.1.2 *The relocation of the waste rock dumps may result in the loss, injury or displacement of reptile species in the area where these WRDs are being constructed due to vegetation loss and habitat destruction.*

The relocation and construction of the waste rock dumps may lead to habitat loss of reptiles in those areas thus leading to either the loss or displacement of reptiles in the areas where these WRDs are initially being constructed. However, once these infrastructures have been constructed, they may form an artificial habitat for reptiles thus attracting various reptile species to the WRDs. Therefore, the nature of this impact is adverse (negative) and direct. The reversibility of this impact is irreversible, while the duration of this impact is short term as the impact is only likely to last throughout the duration of the Project or Life of Mine. The magnitude of change for this impact is moderate as there is a loss of resources (reptiles) and but not changing quality and integrity of the resource. The scale of this impact is limited to the boundaries of the Project site, while the probability of this impact occurring is likely. The sensitivity of this impact is low as it is of importance on a local scale and the significance of the impact is adverse low.

- 7.4.2.1.3 *the lined tailings storage facility may lead to the loss, injury or displacement of reptile species residing in the area where the lined TSF is being constructed due to vegetation loss and habitat destruction*

The construction of the lined tailings storage facility is likely to lead to habitat loss of reptiles in those areas thus leading to either the loss or displacement of reptiles in the areas where these lined TSF is being constructed. However, once these infrastructures have been constructed, the lined TSF may form an artificial habitat for reptiles thus attracting various reptile species to the lined TSF. However, the lining helps prevent the release of toxic substances into nearby water

sources, which can directly affect aquatic reptiles and indirectly impact reptiles that rely on these water sources for drinking. Therefore, the nature of this impact is adverse (negative) and direct. The reversibility of this impact is irreversible, while the duration of this impact is long term as the impact is likely to last long after the activity has ceased and after mine closure. The magnitude of change for this impact is moderate as there is a loss of resource (reptiles) but not changing the quality and integrity of the resource. The scale of this impact is limited to the boundaries of the Project site, while the probability of this impact occurring is likely. The sensitivity of this impact is low as it is of importance on a local scale and the significance of the impact is adverse low.

7.4.2.1.4 *The diversion of D1941 may result in the loss, injury and displacement of reptile species residing in the area where the road is being constructed due to the loss of vegetation and habitat destruction*

Additional access routes such as the diversion of the D1941 road are not foreseen to have negative impacts on reptiles because there are several access routes already present on site. However, should any of these access routes be tarred they may attract reptiles to them, who are attracted to the tarmac to bask in the sun. This may increase their risk of being run over by vehicles. Therefore, the nature of this impact is adverse (negative) and direct. The reversibility of this impact is irreversible, while the duration of this impact is permanent as the impact is likely to last long after the activity has ceased and after mine closure. The magnitude of change for this impact is minor as there is a loss of resources (reptiles) but no changes to the quality and integrity of the resource. The scale of this impact is limited onsite to the boundaries of the Project site, while the probability of this impact occurring is possible. The sensitivity of this impact is low as it is of importance on a local scale and the significance of the impact is adverse low.

7.4.2.1.5 *The construction and operation of the airstrip may lead to either the loss, injury or displacement of reptile species residing in the area where the airstrip is being operated due to vegetation loss and habitat destruction.*

The removal of vegetation to accommodate the airstrip and the machinery used during the construction may have harmful effects on the reptile species in the area. Constructing an airstrip involves land clearance, leading to habitat fragmentation and depriving reptiles of essential resources. This fragmentation disrupts migration patterns and gene flow, while aircraft noise disturbs reptiles, affecting their behaviour, communication, and feeding. The airstrip's tarmac may attract reptiles for sunbathing, increasing the risk of accidental collisions with planes during take-off and landing. However, the construction and operation of the airstrip is not expected to have major detrimental effects on the reptiles inhabiting the area. Therefore, the nature of this impact is adverse (negative) and direct. The reversibility of this impact is partly irreversible, while the duration of this impact is permanent as the impact is likely to last long after the activity has ceased and after mine closure. The magnitude of change for this impact is minor as there is a very minor loss of resources (reptiles) and changes to the quality and integrity of the resource. The scale of this impact is limited onsite only while the probability of this impact occurring is possible. The

sensitivity of this impact is low as it is of importance on a local scale and the significance of the impact is adverse low.

7.4.2.1.6 *The construction and operation of the solar PV plant may lead to the loss, injury or displacement of reptile species residing in the area where the PV plant is being operated due to vegetation loss and habitat destruction.*

Construction activities during solar plant development can disturb reptile habitats by removing vegetation and disrupting the ground. This may lead to the loss of crucial nesting and foraging sites, potentially displacing reptiles. Additionally, the installation of fencing and other infrastructure may impede reptile movement, disrupting their natural behaviour, migration patterns, or access to essential habitats. The presence of solar facilities may attract small mammals and insects, subsequently attracting predators like snakes, potentially impacting local predator-prey dynamics and reptile populations. On the positive side, solar panels create shaded areas that offer cooler microhabitats for reptiles, allowing activities like basking or seeking refuge from high temperatures. However, excessive shading could adversely affect species dependent on direct sunlight for thermoregulation.

Therefore, the nature of this impact is adverse (negative) and direct. The reversibility of this impact is partly reversible, while the duration of this impact is long term as the impact is likely to last long after the activity has ceased and after mine closure. The magnitude of change for this impact is minor as there is a very minor loss of resources (reptiles) and changes to the quality and integrity of the resource. The scale of this impact is limited onsite only limited to the Project site while the probability of this impact occurring is Possible. The sensitivity of this impact is low as it is of importance on a local scale and the significance of the impact is adverse low.

7.4.2.1.7 *the river diversion may negatively impact the downstream riparian environment and have detrimental effects on the reptiles residing in that habitat, leading to the loss and displacement of reptiles in the area due to the river diversion*

The modification of river courses, as seen in the diversion described, can have significant ecological impacts on reptiles. Changes in the environment, including alterations to nesting sites, basking areas, and food sources, can occur. The diversion's influence on downstream riparian vegetation, particularly the reduced flow toward the Khan River, is expected to affect reptile habitats, potentially leading to a decline in populations. Disruptions to migration patterns and movement corridors, along with shifts in temperature and microclimate, may impact reptiles sensitive to such changes, affecting their behaviour, reproductive success, and overall well-being. Additionally, the creation of obstacles to reptile movement within their habitat adds to the anticipated adverse effects of the river diversion on the affected reptile species. Therefore, the nature of this impact is adverse (negative) and direct. The reversibility of this impact is irreversible, while the duration of this impact is permanent as the impact is likely to last long after the activity has ceased and after mine closure. The magnitude of change for this impact is high as there is an expected to be loss of resources (reptiles) and significant changes to the quality, characteristics and integrity of the resource. The scale of this impact may be regional, while the probability of

this impact occurring is Possible. The sensitivity of this impact is medium as it is of importance on a local scale and the significance of the impact is adverse moderate.

Table 51 - Impact of habitat loss and the removal of terrestrial biodiversity on reptiles.

Receptor	Impact	Activity	Nature of impact	Value & sensitivity	Magnitude of change	Significance of impact
Reptiles	The operation of the Twin Hills Western Pit may lead to either the loss, injury or displacement of reptile species residing in the area where mining activities will be taking place due to the creation of a pitfall trap, vegetation loss or habitat destruction.	Development of the Twin Hills Western pit	Adverse Direct Irreversible Long term Moderate On site Likely	Low	Moderate	Low (2)
	The relocation of the waste rock dumps may lead to the loss, injury or displacement of reptile species residing in the area where these WRDs are being constructed due to vegetation loss and habitat destruction.	Development and relocation of the waste rock dumps	Adverse Direct Irreversible Short term Moderate Onsite Likely	Low	Moderate	Low (2)
	The lined tailings storage facility may lead to either the loss, injury or displacement of reptile species residing in the area where the lined TSF is being constructed due to vegetation loss and habitat destruction	Construction and operation of the TSF	Adverse Direct Irreversible Long term Moderate Onsite Likely	Low	Moderate	Low (2)
	The diversion of the D1941 may lead to either the loss, injury or displacement of reptile species residing in the	Construction and operation	Adverse Direct Irreversible	Low	Minor	Low (2)

Receptor	Impact	Activity	Nature of impact	Value & sensitivity	Magnitude of change	Significance of impact
	area where the road is being constructed due to loss of vegetation and habitat destruction	of D1941 road diversion	Permanent Minor Onsite Possible			
	The construction and operation of the 11 kV line may lead to either loss, injury or displacement of reptiles due to vegetation removal, habitat destruction, collision or electrocution from the powerline.	Construction and operation of the 11 kV powerline	Adverse Direct Irreversible Permanent Minor Onsite Possible	Low	Minor	Low (2)
	The construction and operation of the airstrip may lead to either the loss, injury or displacement of reptile species residing in the area where the airstrip is being operated, due to vegetation loss and habitat destruction.	Construction and operation of the airstrip	Adverse Direct Irreversible Permanent Minor Onsite Possible	Low	Minor	Low (2)
	The construction and operation of the solar PV plant may lead to either the loss, injury or displacement of reptile species residing in the area where the airstrip is being operated, due to vegetation loss and habitat destruction.	Construction and operation of the solar PV plant	Adverse Direct Partly reversible Long term Minor Onsite Possible	Low	Minor	Low (2)
	The river diversion may negatively impact the downstream riparian environment and have detrimental effects on the reptiles depending on that habitat, leading to the loss and displacement of reptiles due to the river diversion.	The Okawayo River diversion	Adverse Direct Irreversible Permanent	Medium	High	Moderate (6)

Receptor	Impact	Activity	Nature of impact	Value & sensitivity	Magnitude of change	Significance of impact
			High Regional Possible			

7.4.2.2 *Amphibians*

Amphibian species are experiencing a global decline, primarily attributed to habitat destruction. There are a total of 7 different species of amphibians found in the Project area, with 2 of these species being endemic and one of them is classified as near threatened. The following amphibian species can be found in the area *Amietophrynus poweri*, *Poyntonophrynus hoeschi*, *Phrynomantis annectens* and more which can be found in (Cunningham, 2023). The overall impact on amphibians during construction and operation other than habitat alteration or injury is not expected to be detrimental, however, the construction and operation of specific infrastructure may have some adverse effects on amphibians that reside in the area. The specific impacts to amphibians in the Project area before mitigation are presented in Figure 152, for illustrative purposes only and outlined in Table 52.

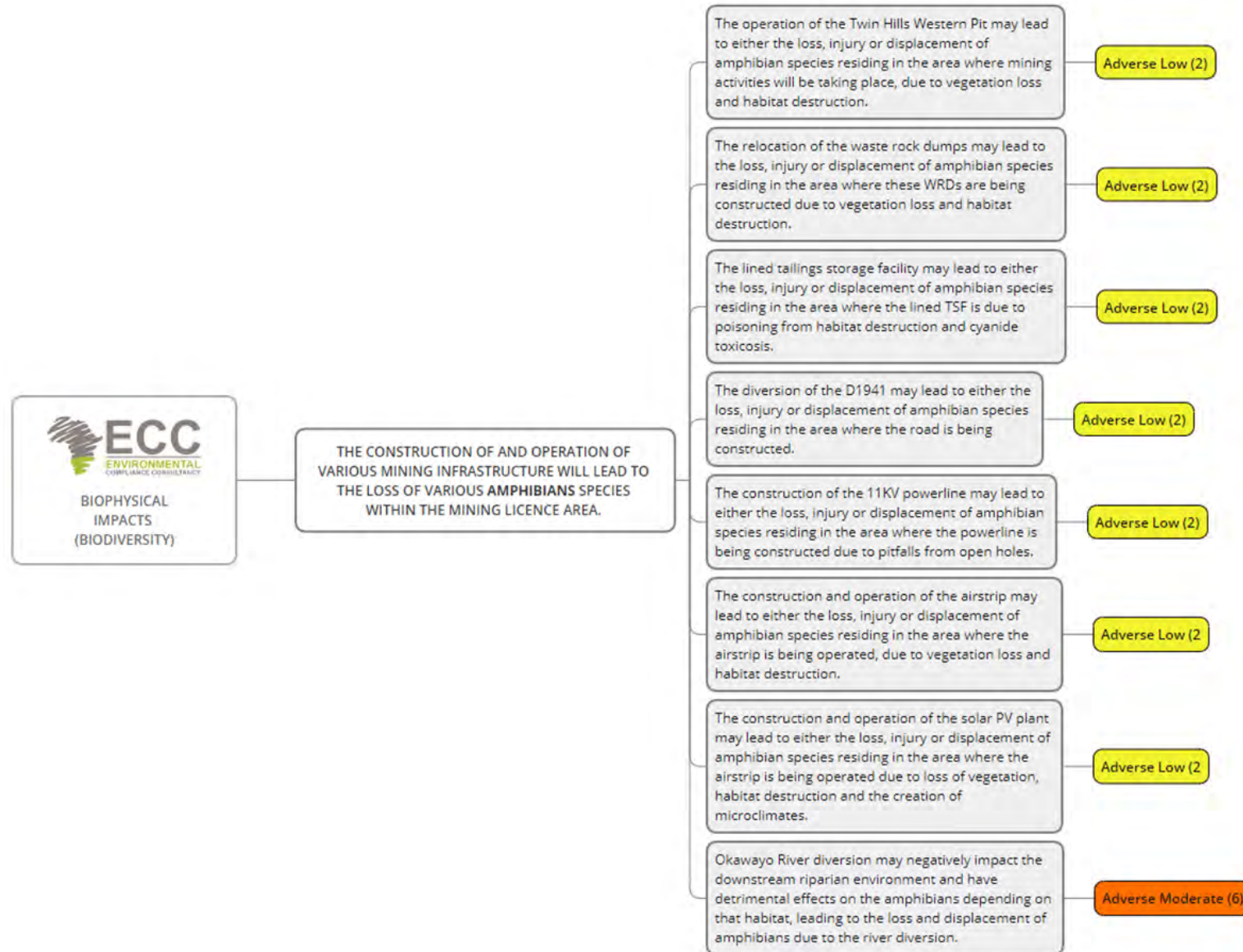


Figure 152 - Impacts to amphibians in the Project area.

7.4.2.2.1

The Project may result in the loss, injury or displacement of amphibian species residing in the Project area due to vegetation loss and habitat destruction.

The impact of open pits on amphibians is influenced by factors such as pit size, proximity to amphibian habitats, and the characteristics of local amphibian species. While open pits may attract various amphibian species, they can also lead to changes in water quality, affecting pH, temperature, and pollutant levels. Amphibians, sensitive to water quality alterations, may experience adverse effects on health and reproductive success. Additionally, the open pit may create a massive pitfall trap for amphibians, leading to either injury or death. Open pits can serve as breeding grounds for amphibian diseases, potentially spreading pathogens within local populations. Additionally, these pits may harbor harmful chemicals, posing risks through direct contact with pit water or consumption of contaminated prey. The cumulative effect of habitat destruction, water quality changes, migration barriers, disease transmission, predator presence, and other factors can contribute to a decline in amphibian populations in areas with open pits. Therefore, the nature of this impact is adverse (negative) and direct. The reversibility of this impact is irreversible, while the duration of this impact is long term as the impact is likely to last long after the activity has ceased and after mine closure. The magnitude of change for this impact is moderate as there is a loss of resources (amphibians) but not changing the quality and integrity of the resource. The scale of this impact is limited to the boundaries of the Project site, while the probability of this impact occurring is likely. The sensitivity of this impact is low as it is of importance on a local scale and the significance of the impact is adverse low.

7.4.2.2.2

The relocation of the WRDs may lead to the loss, injury or displacement of amphibian species residing in the area where the WRDs are being constructed due to vegetation

The relocation and construction of the waste rock dumps may lead to habitat loss of amphibians in those areas thus leading to either the loss or displacement of amphibians in the areas where these WRDs are initially being constructed. However, the WRDs are not expected to impede the movement of any amphibians but may act as an artificial habitat and may attract certain amphibians to the area or WRDs. Therefore, the nature of this impact is adverse (negative) and direct. The reversibility of this impact is irreversible, while the duration of this impact is long term as the impact is likely to last long after the activity has ceased and after mine closure. The magnitude of change for this impact is moderate as there is a loss of resources (amphibians) and but not changing the quality and integrity of the resource. The scale of this impact is limited onsite to the boundaries of the Project site, while the probability of this impact occurring is likely. The sensitivity of this impact is low as it is of importance on a local scale and the significance of the impact is adverse low.

- 7.4.2.2.3 *The lined TSF may lead to the loss, injury or displacement of amphibian species residing in the area where the TSF will be constructed and operated due to habitat destruction, vegetation loss and potential poisoning from cyanide toxicosis*

The construction of the lined tailings storage facility is likely to lead to habitat loss of amphibians in those areas thus leading to either the loss or displacement of amphibians in the areas where these lined TSF is being constructed. However, once these infrastructures have been constructed, the lined TSF may form an artificial habitat for amphibians thus attracting various amphibian species to the lined TSF. However, the lining helps prevent the release of toxic substances into nearby water sources, which can directly affect amphibians, such as the cyanide used in the gold process which if ingested by the amphibians could lead to cyanide toxicosis. However, cyanide concentrations below 50 mg/L weak-acid dissociable (WAD) is deemed safe to wildlife (D B Donato et al., 2007). Therefore, the nature of this impact is adverse (negative) and direct. The reversibility of this impact is irreversible, while the duration of this impact is long term as the impact is likely to last long after the activity has ceased and after mine closure. The magnitude of change for this impact is high as there is a loss of resources (amphibians) and changing the quality and integrity of the resource. The scale of this impact is limited to the boundaries of the Project site, while the probability of this impact occurring is likely. The sensitivity of this impact is low as it is of importance on a local scale and the significance of the impact is adverse low.

- 7.4.2.2.4 *The diversion of the D1941 road may result in the loss, injury or displacement of amphibian species in the area where the road is to be diverted.*

Additional access routes such as the diversion of the D1941 road are not foreseen to have negative impacts on amphibians because there are several access routes already present on site. However, should any of these access routes be tarred they may attract amphibians to them, who are attracted to the tarmac to bask in the sun. Additionally, culverts and drainage pipes could retain water and serve as artificial habitat luring amphibians to the road with potentially more mortality. This may increase their risk of being run over by vehicles. Therefore, the nature of this impact is adverse (negative) and direct. The reversibility of this impact is reversible, while the duration of this impact is permanent as the impact is likely to last long after the activity has ceased and after mine closure. The magnitude of change for this impact is moderate as there is a loss of resources (amphibians) but not changing the quality and integrity of the resource. The scale of this impact is limited to the boundaries of the Project site, while the probability of this impact occurring is possible. The sensitivity of this impact is low as it is of importance on a local scale and the significance of the impact is adverse low.

- 7.4.2.2.5 *The construction of the 11kv powerline may lead to either loss, injury or placement of amphibians residing in the area where the powerline is being constructed due to pitfalls from open holes*

Open holes made for the placement of poles for the transmission lines for the 11 kV line and they could act as pitfalls for amphibians, leading to injury or death. This is particularly true for species that move across the ground or near it. Therefore, the nature of this impact is adverse (negative) and direct. The reversibility of this impact is reversible, while the duration of this impact is temporary as the impact is likely to last only during construction. The magnitude of change for this impact is minor as there is a very minor loss of resources (amphibians) and changes to the quality and integrity of the resource. The scale of this impact is local extending beyond the boundaries of the Project site while the probability of this impact occurring is possible. The sensitivity of this impact is low as it is of importance on a local scale and the significance of the impact is adverse low.

- 7.4.2.2.6 *The construction and operation of the airstrip may lead to the loss, injury or displacement of amphibian species residing in the area of the airstrip due to vegetation loss and habitat destruction.*

The construction and operation of an airstrip or runway can significantly impact amphibians by altering their habitats and behaviours. The physical development of the airstrip, involving vegetation removal and changes to the landscape, directly affects amphibians that depend on specific environments for breeding, feeding, and shelter. The substantial noise from aircraft take-offs and landings, particularly disruptive to amphibians using vocalizations for communication and mating, can alter their behaviour and communication patterns. Roads and runways may serve as obstacles, hindering amphibian movement and increasing the risk of road mortality. Airstrip lighting, potentially contributing to light pollution, has the potential to disturb amphibians' nocturnal or crepuscular behaviours, disrupting natural activities, including breeding. Therefore, the nature of this impact is adverse (negative) and direct. The reversibility of this impact is irreversible, while the duration of this impact is permanent as the impact is likely to last long after the activity has ceased and after mine closure. The magnitude of change for this impact is minor as there is a very minor loss of resources (amphibians) and changes to the quality and integrity of the resource. The scale of this impact is limited onsite only limited to the Project site while the probability of this impact occurring is likely. The sensitivity of this impact is low as it is of importance on a local scale and the significance of the impact is adverse low.

- 7.4.2.2.7 *The construction and operation of the solar PV plant may lead to either the loss, injury or displacement of amphibian species residing in the area where the PV plant is being operated due to loss of vegetation, habitat destruction and the creation of microclimates*

Construction activities can disrupt habitats, and the use of chemicals in solar panel manufacturing poses a potential threat to amphibians if not managed carefully. Solar PV panels can alter local temperatures, creating both advantageous warmer microhabitats and potentially detrimental temperature extremes for amphibians. The installation of fencing and infrastructure may fragment habitats, impeding amphibian movement and leading to population isolation. Noise and vibrations from solar PV plant activities can disturb amphibians, particularly during critical life stages like breeding. Therefore, the nature of this impact is adverse (negative) and direct. The reversibility of this impact is partly reversible, while the duration of this impact is long term as the impact is likely to last long after the activity has ceased and after mine closure. The magnitude of change for this impact is minor as there is a very minor loss of resources (amphibians) and changes to the quality and integrity of the resource. The scale of this impact is limited onsite only limited to the Project site while the probability of this impact occurring is Possible. The sensitivity of this impact is low as it is of importance on a local scale and the significance of the impact is adverse low.

- 7.4.2.2.8 *Okawayo River diversion may negatively impact downstream riparian environment and have detrimental effects on the local amphibians leading to loss, injury or displacement due to the river diversion*

The river diversion's impact on downstream riparian vegetation, diminishing flow to the Khan River, directly affects amphibian habitats, potentially leading to a population decline. Changes in riparian vegetation may alter available food resources. Amphibians, reliant on specific water conditions for breeding, face disruption due to altered water flow, temperature, and substrate. Breeding-season migrations may be hindered, isolating populations, and limiting genetic exchange, reducing diversity and adaptability. Altered river flow influences water quality, affecting amphibians directly through physiology and development or indirectly through food sources. Changes in habitat structure can disrupt predator-prey dynamics, exposing amphibians to increased predation or food availability changes. River diversions also impact water temperature, crucial for amphibian eggs and larvae, affecting developmental rates and life cycle events. Changes in water flow and conditions resulting from river diversions may facilitate the spread of invasive species. Invasive species can outcompete native species for resources, leading to shifts in amphibian communities. The nature of this impact is adverse and direct, while this impact is irreversible. The duration of this impact is permanent and is likely to have an impact on the regional environment. The magnitude of change is high as there may be a loss of resource along with a decrease in the quality and integrity of the receiving environment and receptor. The probability of this impact occurring is possible and the sensitivity of this impact is medium. Therefore, the significance of this impact has been rated adverse moderate.

Table 52 - Impact of habitat loss and the removal of terrestrial biodiversity on amphibians.

Receptor	Impact	Activity	Nature of impact	Value & sensitivity	Magnitude of change	Significance of impact
Amphibians	The operation of the Twin Hills Western Pit may lead to either the loss, injury or displacement of amphibian species residing in the area where mining activities will be taking place, due to vegetation loss and habitat destruction.	Development of the twin hills western pit	Adverse Direct Irreversible Long term Moderate Onsite Likely	Low	Moderate	Low (2)
	The relocation of the waste rock dumps may lead to the loss, injury or displacement of amphibian species residing in the area where these WRDs are being constructed due to vegetation loss and habitat destruction.	Development and relocation of the waste rock dumps	Adverse Direct Irreversible Long term Moderate Onsite Likely	Low	Moderate	Low (2)
	The lined tailings storage facility may lead to either the loss, injury or displacement of amphibian species residing in the area where the lined TSF is due to poisoning from habitat destruction and cyanide toxicosis.	Construction and operation of the TSF	Adverse Direct Irreversible High Onsite Likely	Low	High	Low (2)
	The diversion of the D1941 may lead to either the loss, injury or displacement of amphibian species residing in the area where the road is being constructed.	Construction and operation of D1941 road diversion	Adverse Direct Permanent Moderate Onsite Possible	Low	Moderate	Low (2)

Receptor	Impact	Activity	Nature of impact	Value & sensitivity	Magnitude of change	Significance of impact
	The construction of the 11 kV powerline may lead to either the loss, injury or displacement of amphibian species residing in the area where the powerline is being constructed due to pitfalls from open holes.	Construction and operation of the 11KV powerline	Adverse Direct Temporary Minor Local Possible	Low	Minor	Low (2)
	The construction and operation of the airstrip may lead to either the loss, injury or displacement of amphibian species residing in the area where the airstrip is being operated due to vegetation loss and habitat destruction.	Construction and operation of the airstrip	Adverse Direct Partly Irreversible Permanent Minor Onsite Possible	Low	Minor	Low (2)
	The construction and operation of the solar PV plant may lead to either the loss, injury or displacement of amphibian species residing in the area where the airstrip is being operated due to loss of vegetation, habitat destruction and the creation of microclimates.	Construction and operation of the solar PV plant	Adverse Direct Partly reversible Long term Minor Onsite Possible	Low	Minor	Low (2)
	Okawayo River diversion may negatively impact the downstream riparian environment and have detrimental effects on the amphibians depending on that habitat, leading to the loss and displacement of amphibians due to the river diversion.	Development of the Okawayo River diversion	Adverse Direct Irreversible Permanent Regional High Possible	Medium	High	Moderate (6)

7.4.2.3 Mammals

In the Karibib area there are about 87 mammal species, and of those 87 species 10 are classified as endemic, 2 are rare, 5 vulnerable and 12 are protected game. The area has an overall high terrestrial diversity and endemism of mammals. A few examples of mammals that can be found in the area are *Macroscelides proboscideus* (endemic), *Orycteropus afer* (protected), *Crocidura cyanea*, *Eidolon helvum*, *Procavia capensis*, *Lepus capensis*, *Hystrix africaeaustralis*, *Petromys typicus* (endemic), *Galago moholi* (vulnerable and protected), *Papio ursinus*, *Parahyaena (Hyaena) brunnea*, *Acinonyx jubatus* (protected), *Panthera pardus*. Additional information about the mammal species and their IUCN and CITES ratings can be found in the biodiversity assessment. The specific impacts to mammals in the Project area before mitigation are presented in Figure 153, for illustrative purposes only and outlined in Table 53.



Figure 153 - Impacts to mammals in the Project site.

- 7.4.2.3.1 *Development of the western pit may lead to either loss, injury or displacement of mammal species in the area where the pit will be developed due to vegetation loss and habitat destruction*

Due to the large amounts of soil and rock that will be removed, there are various reptiles whose habitats will be destroyed due to the excavation of the twin hill western pit. Reptiles rely on these habitats for shelter, breeding, and foraging. Therefore, the removal of these habitats will result in the loss of their homes and will lead to the displacement of these mammals in this area and may affect their overall population in that area. Additionally, the open pit may create a massive pitfall trap for mammals, leading to either injury or death. Therefore, the nature of this impact is adverse (negative) and direct. The reversibility of this impact is irreversible, while the duration of this impact is long term as the impact is likely to last long after the activity has ceased and after mine closure. The magnitude of change for this impact is High as there is a loss of resource (mammals) and affects the quality and integrity of the resource. The scale of this impact is limited to the boundaries of the Project site, while the probability of this impact occurring is likely. The sensitivity of this impact is low as it is of importance on a local scale and the significance of the impact is adverse low.

- 7.4.2.3.2 *The relocation of the WRDs may lead to the loss, injury or displacement of mammals.*

The overall impact on mammals during construction and operation other than habitat alteration or injury is not expected to be detrimental, however, the construction and operation of specific infrastructure may have some adverse effects on mammals that reside in the area. However, this impedes the movement of wildlife, especially larger mammals and can create fragmented habitats. Nevertheless, many of the WRDs are expected to attract certain mammals to these areas or infrastructure, resulting in these mammals utilizing the WRDs as an artificial habitat and may even be attracted to these WRDs. Therefore, the nature of this impact is adverse (negative) and direct. The reversibility of this impact is irreversible, while the duration of this impact is long term as the impact is likely to last long after the activity has ceased and after mine closure. The magnitude of change for this impact is moderate as there is a loss of resource (mammals) and but not affecting the quality and integrity of the resource. The scale of this impact is limited to the boundaries of the Project site, while the probability of this impact occurring is likely. The sensitivity of this impact is low as it is of importance on a local scale and the significance of the impact is adverse low.

- 7.4.2.3.3 *The lined TSF may lead to either the loss, injury or displacement of mammal species residing in the area where the lined TSF is being constructed due to vegetation loss and habitat destruction*

The construction and operation of tailings storage facilities can lead to habitat disruption. This may affect the local mammal populations by altering their access to food, water, and shelter. If not properly managed, the chemicals in tailings can pose a risk to mammals through direct contact, ingestion, or inhalation. Lining is intended to reduce the risk of such exposure. However, the lining helps prevent the release of toxic substances into nearby water sources, which can directly affect aquatic mammals and indirectly impact mammals that rely on these water sources for drinking. Therefore, the nature of this impact is adverse (negative) and direct. The reversibility of this impact is irreversible, while the duration of this impact is long term as the impact is likely to last long after the activity has ceased and after mine closure. The magnitude of change for this impact is moderate as there is a loss of resource (mammals) and but not affecting the quality and integrity of the resource. The scale of this impact is limited to the boundaries of the Project site, while the probability of this impact occurring is likely. The sensitivity of this impact is low as it is of importance on a local scale and the significance of the impact is adverse low.

- 7.4.2.3.4 *The diversion of the D1941 road may lead to either the loss, injury or displacement of mammal species residing in the area where the road is being constructed due to vegetation loss and collisions between mammals and vehicles.*

The diversion of the D1941 road and the development of additional access and haul routes are not foreseen to have negative impacts on mammals since there are several access routes already present on site. However, should any of these access routes be tarred they may attract mammals to them to it for basking due to its retention and slow release of heat and foraging (e.g., small carnivores) resulting in potentially more mortalities. This may increase their risk of being run over by vehicles. Therefore, the nature of this impact is adverse and direct. The reversibility of this impact is irreversible, while the duration of this impact is permanent as the impact is likely to last long after the activity has ceased and after mine closure. The magnitude of change for this impact is moderate as there is a loss of resources (mammals) but no changes to the quality and integrity of the resource. The scale of this impact is limited to the boundaries of the Project site, while the probability of this impact occurring is possible. The sensitivity of this impact is low as it is of importance on a local scale and the significance of the impact is adverse low.

- 7.4.2.3.5 *The construction of the 11KV powerline may lead to either the loss, injury or displacement of mammal species residing in the area where the powerline is being constructed due to vegetation loss, pit fall traps and electrocution from powerline and switch gear*

Open holes made for the placement of poles for the transmission lines and the open pits could act as pitfalls for small mammals. With regards to the open mine pits, may also act as pitfall traps, however, certain species may utilize the pits as part of their habitats. Additionally, some small

animals are attracted to substations and pole mounted switching gear which may pose a threat to them causing either injury or death should they get electrocuted. Therefore, the nature of this impact is adverse and direct. The reversibility of this impact is irreversible, while the duration of this impact is long term as the impact is likely to last long after the activity has ceased and after mine closure. The magnitude of change for this impact is minor due to the loss of resources (mammals) and but minimal changes to the quality and integrity of the resource. The scale of this impact is limited onsite to the boundaries of the Project site, while the probability of this impact occurring is possible. The sensitivity of this impact is low as it is of importance on a local scale and the significance of the impact is adverse low.

7.4.2.3.6 *The construction and operation of the airstrip may lead to either the loss, injury or displacement of mammal species residing in the area where the airstrip is being operated due to vegetation loss and habitat destruction*

Clearing land for airstrip construction can lead to habitat fragmentation, isolating mammal populations and disrupting their natural behaviours. This may reduce genetic diversity, impede mating, foraging, and habitat location for mammals. Therefore, the nature of this impact is adverse (negative) and direct. The reversibility of this impact is irreversible, while the duration of this impact is long term as the impact is likely to last long after the activity has ceased and after mine closure. The magnitude of change for this impact is minor as there is a very minor loss of resources (amphibians) and changes to the quality and integrity of the resource. The scale of this impact is limited onsite while the probability of this impact occurring is possible. The sensitivity of this impact is low as it is of importance on a local scale and the significance of the impact is adverse low.

7.4.2.3.7 *The construction and operation of the solar PV plant may lead to either the loss, injury or displacement of mammal species residing in the area where the PV plant is being operated due to habitat destruction*

Construction activities for solar panels can disrupt habitats, displacing mammals and causing noise pollution during the construction and operation of photovoltaic (PV) plants. Large solar installations pose collision risks for flying species like bats act as physical barriers, potentially isolating mammal populations. Additionally, the installation of solar panels can alter local microclimates, affecting vegetation and food availability for mammals. While the improper handling of chemicals in the production, maintenance, and disposal of solar panels can contaminate soil, water, and food sources, posing risks to mammalian populations. Despite these challenges, solar PV plants can create new green spaces that attract specific species, contributing positively to local biodiversity. Therefore, the nature of this impact is adverse (negative) and direct. The reversibility of this impact is partly reversible, while the duration of this impact is long term as the impact is likely to last long after the activity has ceased and after mine closure. The magnitude of change for this impact is minor as there is a very minor loss of resources (mammals) and changes to the quality and integrity of the resource.

The scale of this impact is limited onsite while the probability of this impact occurring is likely. The sensitivity of this impact is low as it is of importance on a local scale and the significance of the impact is adverse low.

7.4.2.3.8 *The Okawayo River diversion may negatively impact the downstream riparian environment and have detrimental effects on the mammals depending on that habitat, leading to the loss and displacement of mammals due to the river diversion*

The river diversion will negatively impact downstream riparian vegetation, reducing flow to the Khan River and affecting mammal habitats, potentially causing a loss of mammalian populations. Conversely, the creation of a new waterbody downstream could attract different mammal species. River diversions alter natural water flow, impacting the accessibility and quality of habitats for mammals adapted to specific riverine environments. Migration patterns of mammals relying on river systems, aquatic mammals, may be hindered, affecting reproductive success. Changes in water flow, temperature, and sediment transport due to diversions can impact water quality, affecting mammals relying on specific conditions for drinking or foraging. Altered river dynamics can affect food resource availability for mammals in the river ecosystem, disrupting the aquatic food chain and impacting higher trophic levels. River diversions may exacerbate drought or flooding events, directly impacting mammalian populations through disruptions to breeding and nesting sites. Additionally, changes in water flow may facilitate the spread of invasive species, leading to competition with native species and shifts in mammalian communities. Therefore, the nature of this impact is adverse (negative) and direct. The reversibility of this impact is irreversible, while the duration of this impact is permanent as the impact is likely to last long after the activity has ceased and after mine closure. The magnitude of change for this impact is high as there is a very significant loss of resources (mammals) and changes to the quality, characteristics, and integrity of the resource. The scale of this impact is regional while the probability of this impact occurring is likely. The sensitivity of this impact is medium as it is of importance on a regional scale and the significance of the impact is adverse moderate.

Table 53 - Impact of habitat loss and the removal of terrestrial biodiversity on mammals.

Receptor	Impact	Activity	Nature of impact	Value sensitivity	& Magnitude of change	Significance of impact
Mammals	The operation of the Twin Hills Western Pit may lead to either the loss, injury or displacement of mammal species residing in the area where mining activities will be taking place, due to vegetation loss and habitat destruction.	Development of the twin hills western pit	Adverse Direct Irreversible Permanent High Onsite Likely	Low	High	Low (2)
	The relocation of the waste rock dumps may lead to the loss, injury or displacement of mammal species residing in the area where these WRDs are being constructed due to vegetation loss and habitat destruction.	Development and relocation of the waste rock dumps	Adverse Direct Irreversible Long term Moderate Onsite likely	Low	Moderate	Low (2)
	The lined tailings storage facility may lead to either the loss, injury or displacement of mammal species residing in the area where the lined TSF is being constructed due to vegetation loss and habitat destruction.	Construction and operation of the TSF	Adverse Direct Irreversible Long term Moderate Onsite Likely	Low	Moderate	Low (2)
	The diversion of the D1941 may lead to either the loss, injury or displacement of mammal species residing in the area where the road is being constructed due to vegetation loss and collisions between mammals and vehicles.	Construction and operation of D1941 road diversion	Adverse Direct Irreversible Moderate Onsite Possible	Low	Moderate	Low (2)

Receptor	Impact	Activity	Nature of impact	Value sensitivity &	Magnitude of change	Significance of impact
	The construction of the 11 kV powerline may lead to either the loss, injury or displacement of mammal species residing in the area where the powerline is being constructed due to vegetation loss and electrocution from powerline and switch gear.	Construction and operation of the 11 kV powerline	Adverse Direct Irreversible Long term Minor Onsite Possible	Low	Minor	Low (2)
	The construction and operation of the airstrip may lead to either the loss, injury or displacement of mammal species residing in the area where the airstrip is being operated due vegetation loss and habitat destruction.	Construction and operation of the airstrip	Adverse Direct Irreversible Long term Minor Onsite Possible	Low	Minor	Low (2)
	The construction and operation of the solar PV plant may lead to either the loss, injury or displacement of mammal species residing in the area where the airstrip is being operated due to habitat destruction.	Construction and operation of the solar PV plant	Adverse Direct Partly reversible Long term Minor Onsite Likely	Low	Minor	Low (2)
	The river diversion may negatively impact the downstream riparian environment and have detrimental effects on the mammals depending on that habitat, leading to the loss and displacement of mammals due to the river diversion.	Development of the Okawayo River diversion	Adverse Direct Irreversible Permanent High Regional Likely	Medium	High	Moderate (6)

7.4.2.4 Avian

The diversity of birds in the Karibib area is high, with between 171 and 200 species, 8 of those being endemic. Of those species 8 species are endangered those being the violet wood-hoopoe, Ludwig's bustard, white-backed vulture, black harrier, tawny eagle, booted eagle, martial eagle, black stork. Two of the overall species found in the area are vulnerable namely lappet-faced vulture, secretary bird and 5 are near threatened; Rüppel's parrot, Kori bustard, Verreaux's eagle, peregrine falcon, marabou stork.

The removal of trees and other associated biodiversity leads to habitat loss, nesting sites, and sources of food for birds. Habitat loss can lead to a decrease availability of nesting sites and food resources, which may result in lower breeding rates and increased difficulty raising healthy offspring. Raptors may be significantly affected by mining activities during breeding season should their breeding trees be disturbed. This may consequently lead to them abandoning their nests. The specific impacts to avian in the Project area before mitigation are presented in Figure 154, for illustrative purposes only and outlined in Table 54.



Figure 154 - Impacts to avian species in the Project area

7.4.2.4.1 *Operation of the Project may lead to either loss, injury or displacement of avian species due to loss of vegetation or habitat destruction*

The addition of an extra open pit is not expected to harm birds, but the development process involves removing significant vegetation and soil, potentially degrading crucial bird habitats. Species relying on specific vegetation for nesting may be especially affected. Noise and vibrations from pit development may displace birds, disrupting their breeding and nesting behaviors, possibly leading to population declines. Direct harm is possible, including collisions with mining equipment, structures, or vehicles, and exposure to toxic substances used in mining processes poses a poisoning risk. The altered landscape resulting from open-pit mining may impact plant communities, affecting bird food resources and overall abundance and distribution. Therefore, the nature of this impact is adverse (negative) and indirect. The reversibility of this impact is irreversible, while the duration of this impact is long term as the impact is likely to last long after the activity has ceased and after mine closure. The magnitude of change for this impact is high as there is a loss of resources (birds) and affecting the quality, characteristic and integrity of the resource. The scale of this impact is limited to the boundaries of the Project site, while the probability of this impact occurring is likely. The sensitivity of this impact is low as it is of importance on a local scale and the significance of the impact is adverse minor.

7.4.2.4.2 *The relocation of the WRDs may lead to the loss, injury or displacement of avian species residing in the area where these WRDs are being constructed due to the loss of vegetation and habitat destruction*

The construction and relocation of the WRDs are not expected to have any detrimental effects on any avian species. However, the development process involves removing significant vegetation and soil, potentially degrading crucial bird habitats. Species relying on specific vegetation for nesting may be especially affected. On the contrary, once these WRDs have been constructed, they may form an artificial habitat for birds thus attracting various bird species to the WRDs such as crows and small raptors. Therefore, the nature of this impact is adverse (negative) and indirect. The reversibility of this impact is partly reversible, while the duration of this impact is long term as the impact is likely to last long after the activity has ceased and after mine closure. The magnitude of change for this impact is moderate as there is a loss of resources (birds) and but not changing the quality and integrity of the resource. The scale of this impact is limited to the boundaries of the Project site, while the probability of this impact occurring is likely. The sensitivity of this impact is low as it is of importance on a local scale and the significance of the impact is adverse low.

7.4.2.4.3 *The lined TSF may lead to either the loss, injury or displacement of avian species residing in the area where the lined TSF is due to poisoning from cyanide toxicosis*

The development of the lined TSF may attract aquatic birds in search of food and they may use the infrastructure as their habitat. However, the tailings contained in the lined TSF may have detrimental impacts on birds because the tailings from gold mines that use cyanide in the extraction process can pose a significant hazard to birds if not managed properly. Birds can be affected if they drink or encounter water contaminated with cyanide, this is known as cyanide toxicosis. Cyanide interferes with the ability of cells to utilise oxygen, which can lead to rapid respiratory distress and death (Donato et al., 2007). Therefore, the nature of this impact is adverse (negative) and direct. The reversibility of this impact is irreversible, while the duration of this impact is long term as the impact is likely to last long after the activity has ceased and after mine closure. The magnitude of change for this impact is high as there is a loss of resource (birds) and changes to the quality and integrity of the resource. The scale of this impact is limited to the boundaries of the Project site, while the probability of this impact occurring is possible. The sensitivity of this impact is low as it is of importance on a local scale and the significance of the impact is adverse low.

7.4.2.4.4 *The construction of the 11 kV powerline may lead to either the loss, injury or displacement of avian species residing in the area due to electrocution and collisions with powerline*

Transmission or powerlines have long been known to have detrimental effects on birds. The aboveground transmission lines are expected to be particularly detrimental to “pylon-sensitive species”. A few examples of pylon-sensitive birds that can be found in the area are the Black stork, the Booted eagle, the Kori bustard and the rest can be found in (Cunningham, 2023).

Birds may be negatively impacted by the powerlines in the following ways:

- Electrocution by the powerlines
- Birds following certain geological and or landscape features whilst foraging and or migrating may collide with the new powerline
- Birds attracted to the area during rainfall events may collide with the new powerline
- Nesting on powerlines which may also lead to electrocution
- High voltage levels in the line have a greater impact on smaller birds with increase mortality rates.
- Birds with heavier body sizes and smaller wings, birds who fly shorter distances at lower altitudes, older birds, migratory birds, times of lower visibility e.g., rainy weather and mountainous, wetland areas are at a higher risk of colliding with power lines.

Additionally, migrating bird species migrate between different habitats, removal or alteration of habitats and the introduction of new infrastructure will interrupt their migration routes and make it more difficult for them to find suitable resting and feeding areas during their migration journeys. Migratory birds' current flight patterns are shown in Figure 155.



Figure 155 - Expected bird flight paths along ephemeral drainage lines (white dashed arrows) and between mountainous areas (yellow dashed arrows) in the general area. The 11 kV TL's are indicated by the solid red lines (Source: Cunningham, 2023) (Cunningham, 2023).

The above-mentioned factors are extremely important factors to take into consideration when constructing powerlines and should be considered when and developing mitigation and management measures.

Therefore, the nature of this impact is adverse and direct. The reversibility of this impact is irreversible, while the duration of this impact is long term as the impact is likely to last long after the activity has ceased and after mine closure. The magnitude of change for this impact is high due to a loss of resources (birds) and changing the quality and integrity of the ecosystem. The scale of this impact is international as it extends outside the local boundaries of the Project and the country, while the probability of this impact occurring is highly likely.

The sensitivity of this impact is high as it is of importance on an international scale and the significance of the impact is adverse high.

7.4.2.4.5 *The diversion of the D1941 road may lead to either the loss, injury or displacement of avian species residing in the area where the road is due to collisions between cars and birds.*

Additional access routes are not expected to be detrimental to birds, however, should any of these roads be tarred this may increase the chances of birds being attracted to the roads for foraging which may increase their chances of injury or death due to collisions with vehicles. Therefore, the nature of this impact is adverse and direct. The reversibility of this impact is irreversible, while the duration of this impact is permanent as the impact is likely to last long after the activity has ceased and after mine closure. The magnitude of change for this impact is moderate as there is a loss of resources (bird) and but not changing the quality and integrity of the resource (ecosystem). The scale of this impact is limited onsite to the boundaries of the Project site, while the probability of this impact occurring is likely. The sensitivity of this impact is low as it is of importance on a local scale and the significance of the impact is adverse low.

7.4.2.4.6 *The construction and operation of the airstrip may lead to either the loss, injury due to collisions between birds and aircrafts or displacement of avian species residing in the area where the airstrip is being operated*

The increase in the presence of planes in the area may increase the chances of collisions between birds and planes. Collisions between birds and planes are estimated to account for a small percentage of bird deaths per year. Sensitivity to aircraft is shown by breeding colonies, especially those of larger bird species. Plane and bird collisions also pose a safety threat to the passengers of the planes as birds may fly into the fan blades of an airplane and damage the fan blades. This could potentially lead to an engine malfunction, possibly resulting in a crucial loss of thrust, leading to plane crashes (Kempf & Ommo, n.d.). Therefore, the nature of this impact is adverse and direct. The reversibility of this impact is irreversible, while the duration of this impact is long term as the impact is likely to last long after the activity has ceased and after mine closure. The magnitude of change for this impact is moderate as there is a loss of resources (bird) and but not changing the quality and integrity of the resource (ecosystem). The scale of this impact is limited onsite to the boundaries of the Project site, while the probability of this impact occurring is likely. The sensitivity of this impact is low as it is of importance on a local scale and the significance of the impact is adverse low.

- 7.4.2.4.7 *The construction and operation of a solar PV plant may lead to either the loss, injury, or displacement of avian species due to the blinding of birds from the reflection from solar panels*

The reflective nature of the solar panels has also been known to blind various animals specifically birds, changes in apparent colour and texture, scintillation, glinting, and geometric patterns of star-like points of reflected light associated with the collector arrays and lead to bird collisions with solar panels (Cunningham, 2023). Therefore, the nature of this impact is adverse and direct. The reversibility of this impact is partly reversible, while the duration of this impact is long term as the impact is likely to last long after the activity has ceased and after mine closure. The magnitude of change for this impact is moderate as there is a loss of resources (bird) and but not changing the quality and integrity of the resource (ecosystem). The scale of this impact is limited onsite to the boundaries of the Project site, while the probability of this impact occurring is possible. The sensitivity of this impact is low as it is of importance on a local scale and the significance of the impact is adverse low.

- 7.4.2.4.8 *The Okawayo River diversion may negatively impact the downstream riparian environment and have detrimental effects on the avian species depending on that habitat, leading to the loss and displacement of avian species due to the river diversion*

The diversion of the Okawayo River may negatively impact its associated avifauna, particularly affecting downstream habitats and ecosystems. Alterations in water flow can have significant consequences, affecting nesting sites, feeding areas, and shelter for birds, especially those dependent on specific riverine environments. The redirection of the river can disrupt crucial migration routes, posing challenges for species relying on specific river corridors. Changes in water flow may also impact the abundance of aquatic organisms crucial for bird sustenance, affecting foraging behaviour and success. River diversion can influence water quality, potentially jeopardizing the well-being of birds' dependent on affected ecosystems. Wetland habitats, vital for bird breeding and feeding, may face loss or degradation due to the river diversion. The adaptability of bird species to these changes varies, with some capable of adjusting while others may struggle. Despite potential adverse effects, the area around the redirected river is expected to undergo revegetation, attracting birds to the regenerated habitat. Additionally, the creation of a new dam resulting from the diversion could attract aquatic birds. Birds might even colonize newly formed habitats resulting from diversions, depending on ecological flexibility, reproductive strategies, and habitat availability. Therefore, the nature of this impact is adverse (negative) and direct. The reversibility of this impact is irreversible, while the duration of this impact is permanent as the impact is likely to last long after the activity has ceased and after mine closure. The magnitude of change for this impact is high as there is a very significant loss of resources (mammals) and changes to the quality, characteristics, and integrity of the resource. The scale of this impact is regional while the probability of this impact occurring is likely. The sensitivity of this impact is medium as it is of importance on a regional scale and the significance of the impact is adverse moderate.

Table 54 - Impact of habitat loss and the removal of terrestrial biodiversity on avian species.

Receptor	Impact	Activity	Nature of impact	Value & sensitivity	Magnitude of change	Significance of impact
Birds	The operation of the Twin Hills Western Pit may lead to either loss, injury, or displacement of avian species due to the loss of vegetation and habitat destruction.	Development of the twin hills western pit	Adverse Indirect Irreversible Long term High Onsite Likely	Low	High	Minor (3)
	The relocation of the waste rock dumps may lead to the loss, injury or displacement of avian species residing in the area where these WRDs are being constructed due to the loss of vegetation and habitat destruction.	Development and relocation of the waste rock dumps	Adverse Indirect Partly reversible Long term Moderate Onsite Likely	Low	Moderate	Low (2)
	The lined tailings storage facility may lead to either the loss, injury or displacement of avian species residing in the area where the lined TSF is due to poisoning from habitat destruction and cyanide toxicosis.	Construction and operation of the TSF	Adverse Direct Irreversible Long term High Onsite Possible	Low	High	Low (2)
	The construction of the 11 kV powerline may lead to either the loss, injury or displacement of avian species residing in the area due to electrocution and collisions with powerline.	Construction and operation of the 11 kV powerline	Adverse Direct Irreversible Long term High International	High	High	Major (9)

Receptor	Impact	Activity	Nature of impact	Value & sensitivity	Magnitude of change	Significance of impact
			Highly Likely			
	The diversion of the D1941 may lead to either the loss, injury or displacement of avian species residing in the area where the road is due to collisions between cars and birds	Construction and use of the diverted D1941 road	Adverse Direct Irreversible Long term Moderate Onsite Likely	Low	Moderate	Low (2)
	The construction and operation of the airstrip may lead to either the loss, injury due to collisions between birds and aircrafts or displacement of avian species residing in the area where the airstrip is being operated.	Construction and operation of the airstrip	Adverse Direct Irreversible Long term Moderate Onsite Likely	Low	Moderate	Low (2)
	The construction and operation of a solar PV plant may lead to either the loss, injury, or displacement of avian species due to the blinding of birds from the reflection from solar panels.	Construction and operation of the solar PV plant	Adverse Direct Partly reversible Long term Moderate Onsite Possible	Low	Moderate	Low (2)
	River diversion may negatively impact the downstream riparian environment and have detrimental effects on the avian species depending on that habitat, leading to the loss and displacement of avian species due to the river diversion.	Development of the Okawayo River diversion	Adverse Direct Irreversible Permanent High Regional Likely	Medium	High	Moderate (6)

7.4.2.4.9 *Mitigation measures for the loss of bird species due to collision and electrocution from the 11 kV powerline.*

There are various measures that can be taken to reduce the number of cases of birds colliding with the powerline, being electrocuted by it or nesting on it. These include:

- BFD's (Bird Flight Diverters – e.g., coils, flappers, etc.) are installed along the most important portions of the transmission line to minimise/prevent mortalities.
- Covering conductors with LDPE (Low Density Polyethylene) pipe would further minimise risk to a variety of raptors on 11kV lines.
- Dummy poles, placed adjacent to problem areas, could be used to attract nesting birds

7.4.2.5 *Loss of Flora (trees, shrubs and grasses)*

There are approximately between 58 species of large trees and shrubs in the area where the Project falls. The most important protected (endemic and near endemic) species found in the plains, hills and rivers were *Acacia erioloba*, *Albizia anthelmintica*, *Aloe littoralis*, *Boscia albitrunca*, *Commiphora glaucescens*, *Combretum imberbe*, *Euclea pseudebenus*, *Faidherbia albida* and *Ziziphus mucrona* just to name a few. Furthermore, there are a total of 30 species with one of these species being endemic namely the *Eragrostis omahekensis*. The specific impacts to flora in the Project area before mitigation are presented in Figure 156 for illustrative purposes only and outlined in Table 55.



Figure 156 - Impacts to flora present in the Project area

7.4.2.5.1

The development of the Western Pit will result in the removal of flora leading to vegetation loss and habitat destruction

The development of open pits involves removing significant amounts of soil and rock, leading to the direct injury of plant habitats. This can result in the loss of adapted flora, including both common and rare species. Uncovering topsoil during mining exposes the soil to erosion, compaction, and disruptions in nutrient cycling, hindering plant establishment. Habitat destruction in open pits can lead to biodiversity loss, affecting animal species dependent on specific plants. The disruption of plant communities can have cascading effects on ecosystems. Abandoned open pit areas may be susceptible to non-native plant invasions, altering the composition of the flora. Large open pits can fragment natural habitats, isolating plant populations and impeding species migration and seed dispersal, leading to a reduction in genetic diversity and hindering natural. Therefore, the nature of this impact is adverse (negative) and direct. The reversibility of this impact is irreversible, while the duration of this impact is permanent as the impact is likely to last long after the activity has ceased and after mine closure. The magnitude of change for this impact is high as there is a very significant loss of resources (flora) and changes to the quality, characteristics, and integrity of the resource. The scale of this impact is on site while the probability of this impact occurring is highly likely. The sensitivity of this impact is low as it is of importance on a local scale and the significance of the impact is moderate.

7.4.2.5.2

The development and relocation of the WRDs will result in the removal of flora leading to vegetation loss and habitat destruction.

The northernmost WRD site would cover parts of the northern tributaries of the Okawayo River and should be avoided. The construction of waste rock dumps can lead to the loss of natural plant habitats, as vegetation displacement and soil alteration create challenges for certain plant species. This disturbance fosters conditions favourable for invasive plants, potentially displacing native flora and altering the overall plant community composition. The exposed surfaces of waste rock dumps generate dust, negatively affecting nearby vegetation by disrupting photosynthesis and compromising overall plant health. Additionally, the dumping process and subsequent erosion contribute to topsoil loss, further impacting plant growth. Cumulatively, these factors may result in long-term changes to plant communities in affected areas, with some species declining or disappearing, while others adapted to the modified conditions may become more prevalent. The various protected and endemic species observed in the plains on site which may be adversely affected are the *Acacia erioloba*, *Albizia anthelmintica*, *Aloe litoralis*, *Boscia albitrunca*, *Cyphostemma currorii*, *Faidherbia albida* and *Ziziphus mucronate*. Therefore, the nature of this impact is adverse (negative) and direct. The reversibility of this impact is irreversible, while the duration of this impact is permanent as the impact is likely to last long after the activity has ceased and after mine closure. The magnitude of change for this impact is high as there is a very significant loss of resources (flora) and changes to the quality, characteristics, and integrity of the resource. The scale of this impact is on site while the probability of this impact occurring is Highly likely. The sensitivity of this impact is low as it is of importance on a local scale and the significance of the impact is adverse moderate.

7.4.2.5.3 *The construction of the lined TSF will result in the removal of flora leading to vegetation loss and habitat destruction*

The purpose of lining tailings storage facilities is to prevent the release of harmful substances into the environment, including heavy metals and contaminants. However, despite the presence of a liner, ecological consequences can still occur. The construction and maintenance of these facilities can disrupt habitats, directly impacting floral communities by causing the loss of plant species and changes in distribution patterns. Additionally, the storage of tailings may generate dust with contaminants, influencing plant health and floral communities. Despite the lining, there is a continued risk of soil contamination from potential leaks or breaches, altering soil composition and impacting plant growth. The disturbance from facility construction and operation can create conditions favourable for invasive plant species, leading to changes in overall floral composition. The impact on floral communities may persist long after mining activities cease, even with proper closure and reclamation, affecting the recovery of native plant species. Therefore, the nature of this impact is adverse (negative) and direct. The reversibility of this impact is irreversible, while the duration of this impact is permanent as the impact is highly likely to last long after the activity has ceased and after mine closure. The magnitude of change for this impact is high as there is a loss of resources (flora) and significant changes to the quality, characteristics, and integrity of the resource. The scale of this impact is on site while the probability of this impact occurring is likely. The sensitivity of this impact is low as it is of importance on a local scale and the significance of the impact is adverse minor.

7.4.2.5.4 *The development and diversion of the D1941 road will result in the removal of flora and will lead to vegetation loss and habitat destruction.*

Roads cause habitat fragmentation, creating isolated patches of vegetation and disrupting the natural flow of seeds, pollen, and species movement. This impacts the genetic diversity of plant populations and promotes the establishment of invasive species, altering floral communities. Construction activities and increased traffic release pollutants, negatively affecting plant growth and survival. Additionally, the construction process itself may introduce non-native plants. Herbicides used to control grass on road verges as these could have long lasting and/or widespread implications affecting ecosystem services throughout the local environment. Roads serve as pathways for the spread of invasive species, altering fire regimes and potentially favouring fire-adapted species, leading to shifts in floral community composition. Moreover, road edges, exposed to different environmental conditions, can facilitate the invasion of pioneer species, altering the structure of floral communities along roads. Therefore, the nature of this impact is adverse (negative) and direct. The reversibility of this impact is partly reversible, while the duration of this impact is long term as the impact is likely to last long after the activity has ceased and after mine closure. The magnitude of change for this impact is moderate as there is a loss of resources (flora) and but not significant changes to the quality, characteristics, and integrity of the resource. The scale of this impact is on site while the probability of this impact occurring is possible. The sensitivity of this impact is low as it is of importance on a local scale and the significance of the impact is adverse low.

7.4.2.5.5 *The development of the 11 kV transmission line will result in the removal of flora and will lead to vegetation loss*

The construction of powerlines involves vegetation removal, leading to habitat fragmentation. This can isolate plant populations, disrupt ecological connections, and potentially reduce genetic diversity in floral communities. Additionally, powerlines can alter the microclimate, affecting the types of plants that thrive. Ongoing maintenance, using herbicides or mechanical clearing, further influences floral communities. Powerline construction disturbances create opportunities for invasive species, potentially outcompeting native flora. Moreover, powerlines also increase wildfire risk, especially with machinery or herbicide use, significantly impacting floral communities by altering plant composition and hindering regeneration. Therefore, the nature of this impact is adverse (negative) and direct. The reversibility of this impact is partly reversible, while the duration of this impact is long term as the impact is likely to last long after the activity has ceased and after mine closure. The magnitude of change for this impact is minor as there is a loss of resources (flora) and but not significant changes to the quality, characteristics, and integrity of the resource. The scale of this impact is on site while the probability of this impact occurring is possible. The sensitivity of this impact is low as it is of importance on a local scale and the significance of the impact is adverse low.

7.4.2.5.6 *The development of the airstrip will result in the loss of flora due to vegetation loss and habitat destruction*

The construction of airstrips involves clearing extensive land, destroying natural habitats and depleting diverse floral communities, including native plants. Airstrips can introduce invasive plant species, leading to reduced biodiversity and changes in the floral community. Additionally, they fragment natural habitats, hindering plant movement and disrupting ecological processes such as gene flow and pollinator mobility. The use of herbicides and pesticides around airstrips can directly and indirectly impact floral communities. Therefore, the nature of this impact is adverse (negative) and direct. The reversibility of this impact is partly reversible, while the duration of this impact is long term as the impact is likely to last long after the activity has ceased and after mine closure. The magnitude of change for this impact is minor as there is a loss of resources (flora) and but not significant changes to the quality, characteristics, and integrity of the resource. The scale of this impact is on site while the probability of this impact occurring is possible. The sensitivity of this impact is low as it is of importance on a local scale and the significance of the impact is adverse low.

7.4.2.5.7 *The development of the solar PV plant will result in the removal of flora and will result in vegetation loss and habitat destruction*

The construction of solar installations can disrupt local ecosystems by removing vegetation and fragmenting habitats, potentially harming flora and fauna. Additionally, the presence of solar panels can alter microclimates, affecting temperature and humidity, which may negatively impact the growth and reproduction of certain plant species. Furthermore, solar installations can create

barriers that impede plant movement, limiting gene flow and disrupting ecological processes. Therefore, the nature of this impact is adverse (negative) and direct. The reversibility of this impact is partly reversible, while the duration of this impact is long term as the impact is likely to last long after the activity has ceased and after mine closure. The magnitude of change for this impact is moderate as there is a loss of resources (flora) and but not significant changes to the quality, characteristics, and integrity of the resource. The scale of this impact is on site while the probability of this impact occurring is likely. The sensitivity of this impact is low as it is of importance on a local scale and the significance of the impact is adverse low.

7.4.2.5.8 *The Okawayo River diversion may negatively impact the downstream riparian environment and have detrimental effects on the floral community depending on that habitat, leading to the loss and displacement of floral communities due to the river diversion*

The river diversion is expected to influence the downstream riparian vegetation due to the reduced flow and could consequently even impact the Khan River riparian vegetation further downstream by affecting the physical structure and composition of that habitat. Altered flow regimes and sediment transport can lead to shifts in the types of vegetation that can thrive in the riparian zone. For example, species adapted to periodic flooding may be replaced by plants that are better adapted to stable water levels. Furthermore, changes in flow regimes and water quality can create conditions that are more favourable for certain invasive plant and animal species, which can outcompete native species in the riparian zone. Therefore, the nature of this impact is adverse (negative) and direct. The reversibility of this impact is irreversible, while the duration of this impact is long term as the impact is likely to last long after the activity has ceased and after mine closure. The magnitude of change for this impact is high as there is a loss of resources (flora) and significant changes to the quality, characteristics, and integrity of the resource. The scale of this impact is regional while the probability of this impact occurring is likely. The sensitivity of this impact is medium as it is of importance on a regional scale and the significance of the impact is adverse moderate.

Table 55 - Impact of habitat loss on terrestrial flora biodiversity

Receptor	Impact	Activity	Nature of impact	Value & sensitivity	Magnitude of change	Significance of impact
Terrestrial floral community	The development of the Twin Hills Western Pit will result in the removal of flora leading to vegetation loss and habitat destruction	Development of the twin hills western pit	Adverse Direct Irreversible Permanent High Onsite Highly Likely	Low	High	Moderate (4)
	The development and relocation of the WRDs will result in the removal of flora leading to vegetation loss and habitat destruction.	Development and relocation of the waste rock dumps	Adverse Direct Irreversible Permanent High Onsite Highly likely	Low	High	Moderate (4)
	The construction of the lined TSF will result in the removal of flora leading to vegetation loss and habitat destruction.	Construction and operation of the TSF	Adverse Direct Irreversible Permanent High Onsite Highly likely	Low	High	Moderate (4)
	The development and diversion of the D1941 road will result in the removal of flora and will lead to vegetation loss and habitat destruction.	Construction and operation of D1941 road diversion	Adverse Direct Partly reversible Long term Moderate Onsite	Low	Moderate	Low (2)

Receptor	Impact	Activity	Nature of impact	Value & sensitivity	Magnitude of change	Significance of impact
			Possible			
	The development of the 11 kV transmission line will result in the removal of flora and will lead to vegetation loss	Construction and operation of the 11 kV powerline	Adverse Direct Partly reversible Minor Onsite Possible	Low	Minor	Low (2)
	The development of the airstrip will result in the loss of flora due to vegetation loss and habitat destruction	Construction and operation of the airstrip	Adverse Direct Irreversible Long term Minor Onsite Possible	Low	Minor	Low (2)
	The development of the solar PV plant will result in the removal of flora and will result in vegetation loss and habitat destruction	Construction and operation of the solar PV plant	Adverse Direct Partly reversible Long term Moderate Onsite Likely	Low	Moderate	Low (2)
	River diversion may negatively impact the downstream riparian environment and alter the floral community downstream	Development of the Okawayo River diversion	Adverse Direct Irreversible Long term High Regional Likely	Medium	High	Moderate (6)

Although it has not been rated adverse high, it is vital to ensure that the alteration of floral community downstream due to the Okawayo River diversion is mitigated. The removal of larger trees and shrubs coupled with the river diversion may have an adverse high impact of ecological processes downstream. To mitigate this impact, it has been recommended that excessive removal of vegetation along the Okawayo river should be avoided. Any important or protected species that can survive relocation should be removed and relocated to the diversion route. Special attention should be given to the flow conditions and volume of the river diversion. The flow should be able to move sediment effectively but not cause severe damage to aquatic habitats and riverine vegetation or accelerating erosion.

7.4.2.5.9 Impact of infrastructure development and the Okawayo River diversion on the ecosystem services that are provided by the natural environment within the Project area.

Various ecosystem services such as provisioning, regulation, maintenance, and cultural services may be negatively affected by the activities of the construction and operation of this Project. The specific impacts to ecosystem services in the Project area before mitigation are shown in Figure 157, for illustrative purposes only and Table 56.

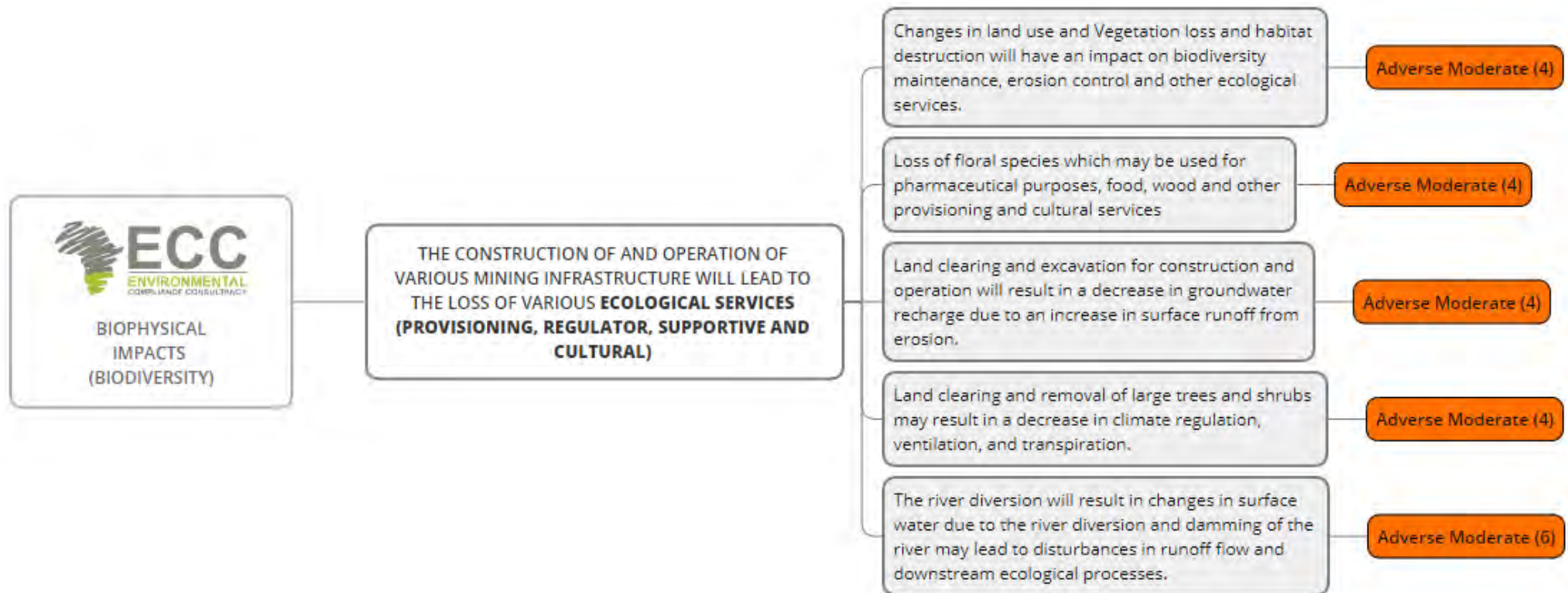


Figure 157 - Impact of the Project on ecological services.

- 7.4.2.5.10 *Changes in land use and vegetation loss and habitat destruction will have an impact on biodiversity maintenance, erosion control and other ecological services*

Open-pit mining entails the extraction of substantial amounts of soil and rock, resulting in the devastation of natural habitats. This process can directly lead to the loss of plant and animal species, thereby contributing to a decline in biodiversity. The reduction in biodiversity can disrupt the functioning of ecosystems and diminish their ability to offer supportive and regulatory services such as pollination, pest control, and nutrient cycling. The extraction and processing of gold typically involves the utilization of chemicals like cyanide and the establishment of tailings ponds, leading to potential water pollution. Therefore, the nature of this impact is adverse (negative) and direct. The reversibility of this impact is partly reversible, while the duration of this impact is long term as the impact is likely to last long after the activity has ceased and after mine closure. The magnitude of change for this impact is high as there is a loss of resources (ecosystem service) and significant changes to the quality, characteristics, and integrity of the resource. The scale of this impact is local while the probability of this impact occurring is likely. The sensitivity of this impact is low as it is of importance on a local scale and the significance of the impact is rated adverse moderate.

- 7.4.2.5.11 *Loss of floral species which may be used for pharmaceutical purposes, food, wood and other provisioning and cultural services.*

The loss of various floral species may have an impact on the Project environment to sustain the growth of certain floral species that could potentially be used for pharmaceutical purposes, food, wood, biofuels, or biomass etc. which decreased the provisioning services offered by the environment encompassed in the Project footprint. Alterations in landscape aesthetics and cultural values, such as the removal of protected trees have the potential to impact the cultural services provided by the ecosystem. Therefore, the nature of this impact is adverse (negative) and direct. The reversibility of this impact is partly reversible, while the duration of this impact is long term as the impact is likely to last long after the activity has ceased and after mine closure. The magnitude of change for this impact is high as there is a loss of resources (ecosystem service) and significant changes to the quality, characteristics, and integrity of the resource. The scale of this impact is local while the probability of this impact occurring is likely. The sensitivity of this impact is low as it is of importance on a local scale and the significance of the impact is rated adverse moderate.

- 7.4.2.5.12 *Land clearing and excavation for construction and operation will result in a decrease in groundwater recharge due to an increase in surface runoff from erosion*

The removal of vegetation and topsoil can result in soil erosion and degradation. The exposure of bare soil may lead to increased sedimentation in nearby water bodies. Given that healthy soils are essential for supporting plant growth and sustaining nutrient cycling, soil degradation can diminish the ecosystem's capacity to provide crucial services. Therefore, the nature of this impact

is adverse (negative) and direct. The reversibility of this impact is partly reversible, while the duration of this impact is permanent as the impact is likely to last long after the activity has ceased and after mine closure. The magnitude of change for this impact is high as there is a loss of resources (ecosystem service) and significant changes to the quality, characteristics, and integrity of the resource. The scale of this impact is local while the probability of this impact occurring is possible. The sensitivity of this impact is low as it is of importance on a local scale and the significance of the impact is rated adverse moderate.

7.4.2.5.13 *Land clearing and removal of large trees and shrubs may result in a decrease in climate regulation, ventilation and transpiration*

Deforestation linked to open-pit mining contributes to the release of stored carbon in vegetation and soils. Trees play a pivotal role in sequestering carbon dioxide, aiding in the mitigation of climate change. The removal of trees in mining areas can therefore contribute to an increase in greenhouse gas emissions affecting this environment's ability to offer essential regulatory services. Therefore, the nature of this impact is adverse (negative) and direct. The reversibility of this impact is partly reversible, while the duration of this impact is permanent as the impact is likely to last long after the activity has ceased and after mine closure. The magnitude of change for this impact is high as there is a loss of resources (ecosystem service) and significant changes to the quality, characteristics, and integrity of the resource. The scale of this impact is local while the probability of this impact occurring is likely. The sensitivity of this impact is low as it is of importance on a local scale and the significance of the impact is rated adverse moderate.

7.4.2.5.14 *The Okawayo River diversion will result in changes in surface water due to the river diversion and damming of the river may lead to disturbances in runoff flow and downstream ecological processes*

Modifications to landscapes can interfere with the natural flow of water, causing harm to aquatic ecosystems and impacting the quality and availability of clean water for both aquatic and terrestrial organisms. Changes in surface water due to river diversion and damming of the river may lead to disturbances downstream ecological processes such as changing the natural flow patterns. This can lead to altered seasonal flows, which can affect the timing of events like floods and droughts. These changes can disrupt the life cycles of many aquatic species and the availability of habitat for various organisms. Altered flow regimes can impact nutrient cycling in river ecosystems. Changes in nutrient availability can influence the composition of plant and algal communities, which in turn could affect the entire food web. This may in turn also promote a perfect environment for the spread of alien invasive species which out-compete and displace native species. Therefore, the nature of this impact is adverse (negative) and direct. The reversibility of this impact is partly reversible, while the duration of this impact is long term as the impact is likely to last long after the activity has ceased and after mine closure. The magnitude of change for this impact is high as there is a loss of resources (ecosystem service) and significant changes to the quality, characteristics, and integrity of the resource. The scale of this impact is

regional while the probability of this impact occurring is possible. The sensitivity of this impact is medium as it is of importance on a regional scale and the significance of the impact is rated adverse moderate.

Table 56 - Impact of habitat loss and the removal of terrestrial biodiversity on ecosystem services.

Receptor	Impact	Activity	Nature of impact	Value & sensitivity	Magnitude of change	Significance of impact
Ecological services (provisioning, regulator, supportive and cultural)	Changes in land use and Vegetation loss and habitat destruction will have an impact on biodiversity maintenance, erosion control and other ecological services.	Land clearing	Adverse Direct Partly reversible Long term High Onsite Possible	Low	High	Moderate (4)
	Loss of floral species which may be used for pharmaceutical purposes, food, wood and other provisioning and cultural services		Adverse Direct Partly reversible Long term High Onsite Possible	Low	High	Moderate (4)
	Land clearing and excavation for construction and operation will result in a decrease in groundwater recharge due to an increase in surface runoff from erosion.		Adverse Direct Partly reversible Long term High Onsite Possible	Low	High	Moderate (4)
	Land clearing and removal of large trees and shrubs may result in a decrease in climate regulation, ventilation, and transpiration.		Adverse Direct Partly reversible Long term	Low	High	Moderate (4)

Receptor	Impact	Activity	Nature of impact	Value & sensitivity	Magnitude of change	Significance of impact
			High Onsite Possible			
	The river diversion will result in changes in surface water due to the river diversion and damming of the river may lead to disturbances in runoff flow and downstream ecological processes.	Okawayo River diversion	Adverse Direct Irreversible Long term High Regional Likely	Medium	High	Moderate (6)

7.4.2.6 *Biologically sensitive areas or receptors*

Four areas have been pointed out as extremely sensitive areas that may be drastically negatively affected by the mining activities and precautions should be taken when operating in these areas or should be avoided if possible. These areas are limestone or marble hills, ephemeral drainage lines, ephemeral dams or pans and bird flyways. Rocky areas such as the limestone or marble hills are known to have high levels of diversity specifically for vertebrate fauna and flora such as *Commiphora glaucescent*, *Commiphora virgata*, *Cyphostemma currorii*, *Euphorbia avasmontana*, *Ficus cordata* etc. The specific impacts to sensitive receptors in the Project area before mitigation are shown in Figure 158, for illustrative purposes only and are outlined in Table 57.

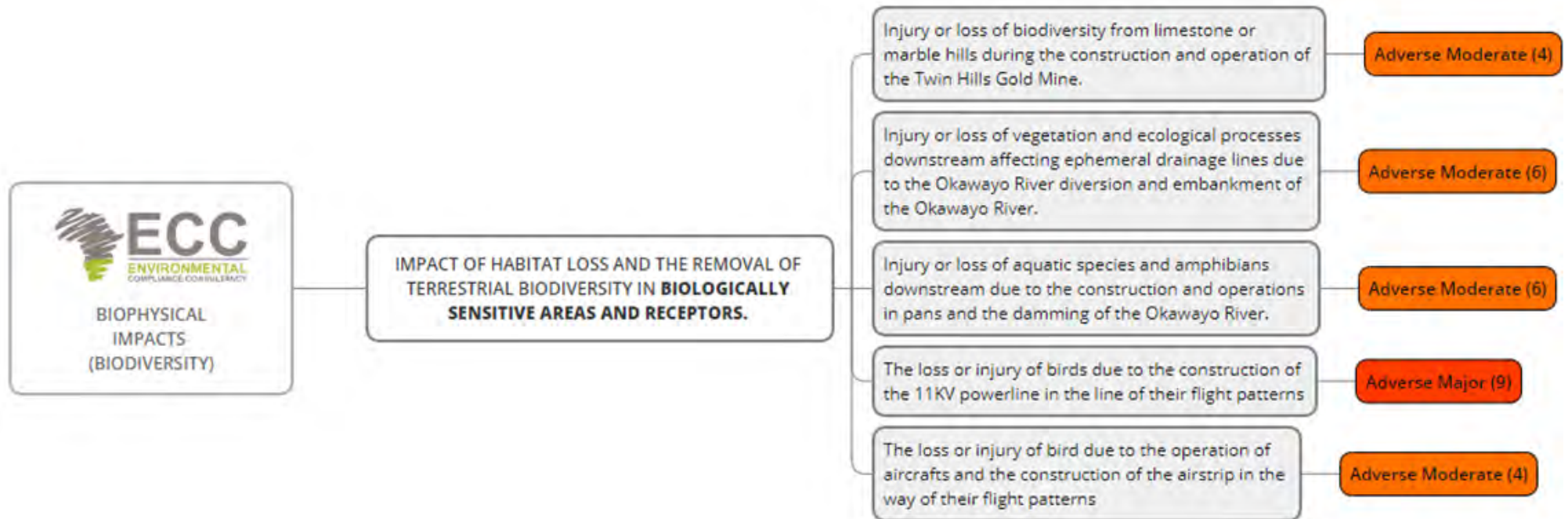


Figure 158 - Impacts to sensitive areas and receptors

7.4.2.6.1 *Injury or loss of biodiversity from limestone or marble hills during the construction and operation of the Project.*

Harm or degradation of limestone and marble ridges in mining areas poses a significant threat to biodiversity, particularly in the Twin Hills project, which hosts protected species such as *Commiphora glaucescens*, *Commiphora virgata*, *Cyphostemma currorii*, *Euphorbia avasmontana*, *Ficus cordata*, *Moringa ovalifolia* and *Sterculia africana* adapted to the specific geological conditions. Removal of these plant species can disrupt ecosystems, causing local extinction and impacting herbivores. The injury of ridges contributes to heightened soil erosion, affecting the mining site and nearby water bodies, impacting aquatic ecosystems. Karst landscapes, associated with limestone ridges, face disruptions in features like caves and drainage systems, affecting local hydrology and organisms adapted to such environments. The injury also has cultural and aesthetic consequences, diminishing the value of geological formations and landscapes, and may lead to long-term changes in soil structure, hindering natural regeneration. Therefore, the nature of this impact is adverse (negative) and direct. The reversibility of this impact is irreversible, while the duration of this impact is permanent as the impact is likely to last long after the activity has ceased and after mine closure. The magnitude of change for this impact is high as there is a loss of resources (ecosystem service) and significant changes to the quality, characteristics, and integrity of the resource. The scale of this impact is on site while the probability of this impact occurring is possible. The sensitivity of this impact is low as it is of importance on a local scale and the significance of the impact is rated adverse moderate.

7.4.2.6.2 *Injury or loss of vegetation and ecological processes downstream affecting ephemeral drainage lines due to the Okawayo River diversion and embankment of the Okawayo River*

The ephemeral drainage lines downstream of the Okawayo River are vital habitats for larger trees, including *Acacia erioloba*, *Euclea pseudobenus*, *Faidherbia albida*, and *Ziziphus mucronata*. However, the construction of a dam and river diversion could significantly alter natural flow patterns, disrupting hydrological cycles in terms of timing, frequency, and magnitude downstream. Dams trapping sediment reduce downstream transport, impacting essential processes like nutrient cycling and habitat creation, with potential consequences for trees downstream. This diminished sediment supply could lead to nutrient deficiencies, affecting plant growth and the adaptation of floral communities. Changes in flow patterns and sediment transport could also modify riparian habitats and impact floral community composition. Ephemeral rivers, supporting wetland areas during flow periods, could face habitat loss due to altered water availability from dam construction. This could affect plants adapted to wetland conditions, causing shifts in floral community composition. Certain plant species may decline, impacting biodiversity. Dams further induce changes in downstream erosion and sedimentation, affecting the physical structure of the riverbed and habitats supporting floral communities. Cumulatively, river diversion and dam construction could lead to long-term degradation of ephemeral rivers, jeopardizing ecosystem services such as water filtration, flood regulation, and habitat provision. Therefore, the nature of this impact is adverse (negative) and direct. The reversibility of this impact is irreversible, while the

duration of this impact is permanent as the impact is likely to last long after the activity has ceased and after mine closure. The magnitude of change for this impact is high as there is a loss of resources (ecosystem service) and significant changes to the quality, characteristics, and integrity of the resource. The scale of this impact is regional while the probability of this impact occurring is likely. The sensitivity of this impact is medium as it is of importance on a regional scale and the significance of the impact is rated adverse moderate.

7.4.2.6.3 *Injury or loss of aquatic species and amphibians downstream due to the construction and operations in pans and the damming of the Okawayo River*

The construction of dams alters aquatic habitats, causing the loss of critical environments for fish, amphibians, and other aquatic species. This modification disrupts reproduction, feeding, and migration patterns, especially for migratory fish, as dams obstruct essential routes, potentially leading to population declines and impacting overall ecosystem health. The impoundment of water behind dams induces changes in water quality, including sedimentation and alterations in nutrient levels. Dam-controlled water flow negatively affects aquatic ecosystems, influencing spawning and feeding behaviour. Sediment trapped by dams leads to erosion, affecting habitat and disrupting the vital role of sediment in maintaining riverbed structure and providing suitable substrate for fish spawning. Changes in flow patterns can disrupt these activities, impacting the survival of organisms. Dams also affect water temperature downstream, potentially harming species adapted to specific temperature ranges. Moreover, the decomposition of organic matter in stagnant reservoirs reduces oxygen levels, negatively impacting fish and aquatic organism's dependent on well-oxygenated water. Therefore, the nature of this impact is adverse (negative) and direct. The reversibility of this impact is irreversible, while the duration of this impact is permanent as the impact is likely to last long after the activity has ceased and after mine closure. The magnitude of change for this impact is high as there is a loss of resources (ecosystem service) and significant changes to the quality, characteristics, and integrity of the resource. The scale of this impact is regional while the probability of this impact occurring is possible. The sensitivity of this impact is medium as it is of importance on a regional scale. Therefore, this impact has been rated adverse moderate.

7.4.2.6.4 *The loss or injury of birds due to the construction of the 11 kV powerline in the line of their flight patterns*

The construction of the 11 kV line in the path of migratory birds' flight path may increase the possibility of collision and electrocution of birds with the powerline as shown in Figure 155. This can affect their ability to find food, breeding sites, or suitable habitats, leading to disruptions in migratory routes or local movements. Birds may avoid nesting near powerlines due to the associated risks. This can limit the availability of suitable nesting sites, potentially affecting breeding success and population dynamics. Additionally due to the decrease in the abundance of trees from the removal of trees for the mine site preparation birds may use the powerlines to perch on as there is a reduced amount of elevates structures for perching thus increasing the likelihood of collisions and electrocution. Additionally, the aboveground transmission line infrastructure is expected to harm specific bird species, especially those sensitive to pylons like bustards, eagles, and vultures. Once operational, the transmission line poses a significant risk to these larger species as well as nocturnal travellers (e.g., flamingos), Palearctic species, and birds visiting the area for roosting/foraging. Figure 155 provide information on important areas, potential flight paths, and documented bird mortalities caused by transmission lines in Namibia. Vultures, recognized as "pylon-sensitive" and critically endangered, face increased vulnerability due to their breeding proximity to known bird mortality hotspots and the negative impact of

transmission lines. Therefore, the nature of this impact is adverse (negative) and direct. The reversibility of this impact is irreversible, while the duration of this impact is long term as the impact is likely to last long after the activity has ceased and after mine closure. The magnitude of change for this impact is moderate as there is a loss of resources (ecosystem service) but no changes to the quality, characteristics, and integrity of the resource. The scale of this impact is local while the probability of this impact occurring is possible. The sensitivity of this impact is high as it is of importance on a international scale and the significance of the impact is adverse high.

7.4.2.6.5 *The loss or injury of birds due to the operation of aircrafts and the construction of the airstrip in the way of their flight patterns*

The construction of airstrips and increased air traffic associated with airport operations can disrupt bird flight patterns, forcing changes in migration routes, breeding locations, and foraging areas. This disturbance may impact bird behaviour and survival. Additionally, the heightened aircraft presence in migratory bird flight paths increases the risk of collisions, potentially causing harm or fatality to the birds and, in some cases, damage to aircraft. Therefore, the nature of this impact is adverse (negative) and direct. The reversibility of this impact is irreversible, while the duration of this impact is long term as the impact is likely to last long after the activity has ceased and after mine closure. The magnitude of change for this impact is high as there is a loss of resources (birds) and changes to the quality, characteristics, and integrity of the resource. The scale of this impact is local while the probability of this impact occurring is possible. The sensitivity of this impact is low as it is of importance on a local scale and the significance of the impact is adverse moderate.

Table 57 - Impact of habitat loss and the removal of terrestrial biodiversity in biologically sensitive areas and receptors

Receptor	Impact	Activity	Nature of impact	Value sensitivity	Magnitude of change	Significance of impact
Limestone or marble ridges	Injury or loss of biodiversity from limestone or marble hills during the construction and operation of the Twin Hills Gold Mine.	Excavation or injury of limestone/marble hills	Adverse Direct Irreversible Permanent High Onsite Possible	Low	High	Moderate (4)
Floral communities and ecological processes	Injury or loss of vegetation and ecological processes downstream affecting ephemeral drainage lines due to the Okawayo River diversion and embankment of the Okawayo River.	Okawayo River diversion	Adverse Direct Irreversible Permanent High Onsite Likely	Medium	High	Moderate (6)
Aquatic species and amphibians,	Injury or loss of aquatic species and amphibians downstream due to the construction and operations in pans and the damming of the Okawayo River.		Adverse Direct Irreversible Permanent High Onsite Likely	Medium	High	Moderate (6)
Birds	The loss or injury of birds due to the construction of the 11 kV powerline in the line of their flight patterns	Construction and operation of the 11 kV powerline	Adverse Direct Irreversible Permanent	High	High	High (9)

Receptor	Impact	Activity	Nature of impact	Value sensitivity &	Magnitude of change	Significance of impact
			High Onsite Likely			
	The loss or injury of bird due to the operation of aircrafts and the construction of the airstrip in the way of their flight patterns	Construction and operation of the airstrip	Adverse Direct Irreversible Long term High Onsite Likely	Low	High	Moderate (4)

7.4.2.7 *Mitigation measures*

7.4.2.7.1 *Mitigation measure aimed at reducing the potential adverse effects stemming from the diversion of the Okawayo River, which may otherwise negatively impact riparian vegetation and aquatic fauna*

It is recommended to avoid redirecting the Okawayo River into an embankment dam or the pit; instead, it is recommended to let the river traverse through the adjacent WRD and pit before rejoining downstream. This approach ensures a sustained flow with minimal impact on riparian vegetation, downstream ecological processes, and the vertebrate fauna associated with or dependent on these ecosystems.

7.4.2.7.2 *Mitigation measures that could be implemented to prevent the interruption of ephemeral drainage lines, preserving downstream habitats from adverse impacts*

Proposing to split the river into two parts along the waste rock dump (WRD) and then reconnect it downstream aims to avoid the infringement of ephemeral drainage lines by the WRD. This strategy ensures the uninterrupted flow of water and sediment downstream. Furthermore, it is advised not to dam the river to prevent adverse effects on riparian vegetation, downstream ecological processes, and the fauna reliant on these processes and vegetation.

7.4.2.8 *A mitigation measure designed to safeguard aquatic species from the adverse impacts of river diversion, as well as to minimize the downstream transmission of reduced water flow and sediment.*

Avoiding the damming of the river is advised, as it would have detrimental effects on downstream vegetation, ecological processes, and the fauna relying on that vegetation. Furthermore, it is cautioned against placing infrastructure in pans, as they play a crucial role for aquatic species and amphibians.

7.4.2.8.1 *Mitigation measures to prevent the disturbance of avian flight paths and perching on transmission lines of the 11kV powerline*

Assess the powerline routes for potential raptor perches. Modify or relocate powerlines as needed to minimize the impact on raptor flight paths. Marker balls or flight diverters can be installed on the powerlines to increase their visibility to birds, making them more likely to avoid collisions. Additionally anti-perching devices should be placed on pylons and anti-collision mechanisms – BFD's (bird flight diverters) such as coils, flappers, etc. – should be attached to the transmission lines. Other important species that would also benefit from BFD's and known to frequent the area after localised rainfall events, are kori and Lüdwig's bustards. The proponent should explore emerging technologies, such as bird-friendly sensors or deterrent systems, that can automatically detect bird presence and activate deterrent measures.

7.4.3 GHG EMISSIONS AND CLIMATE CHANGE

Internationally, mining has been known to contribute a significant amount of carbon and greenhouse gas (GHG) emissions to the atmosphere, which is a direct contributing factor to climate change. As with many industrial and energy-intensive activities, this is to be expected.

According to IFC PS 3, projects that are expected to or are currently producing more than 25 000 tonnes of CO₂ equivalent annually, will be required to quantify and report on direct (Scope 1) emissions, this included emissions from the facilities owned or controlled within the physical project boundary, as well as indirect (Scope 2) emissions associated with the off-site production of energy used by the Project.

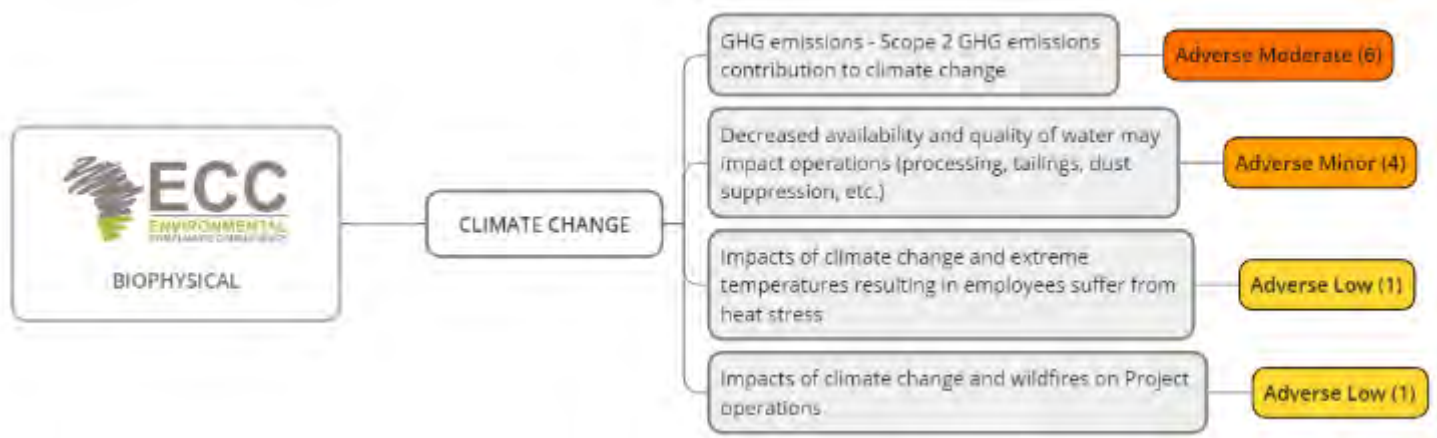


Figure 159 - climate change impacts

7.4.3.1 Contribution of the Project on climate change locally and internationally

Mining operations conducted throughout the construction and operational phases of the Twin Hills Gold Project will generate varying quantities of greenhouse gas (GHG) emissions. The anticipated emissions for the project's entire Life of Mine (LoM) were computed in the climate change assessment report. CO₂ and other Scope 1 greenhouse gas emissions resulting from diverse construction and operational activities, including ore and waste rock transportation, drilling, crushing, and processing, are estimated to peak at approximately 55 000 tCO₂e around year 8 during the LoM. Concurrently, the Project's Scope 2 emissions from electricity generation are predicted to reach a maximum of 187 000 tCO₂e in year 1 of the LoM as shown in Figure 104 and Figure 105 in 5.17.2. While the isolated Scope 1 emissions from the project do not exceed the 25,000 tCO₂e threshold, the combined Scope 1 and 2 emissions are expected to surpass this limit, necessitating quantification and reporting in accordance with IFC guidelines. The nature of this impact is adverse and direct, the impact is partly reversible, and the magnitude of change is high. The duration of the impact is long-term, and the scale of the impact is international. The probability of the impact however is rare, and the sensitivity of the impact is high. The significance of the impact has therefore been rated adverse minor.

7.4.3.2 *Impacts climate change may have on the project operations and resource availability*

7.4.3.2.1 *impacts of climate change on water availability and quality for Project.*

Climate change can exert diverse effects on mining activities, encompassing elevated temperatures, shifts in water availability and quality, as well as increased risks of flooding and high winds, among other consequences. The Karibib region is already grappling with water scarcity, a situation that could intensify due to anticipated prolonged and more severe drought episodes. Such circumstances may adversely influence the mine's water resources, crucial for tasks like processing, managing tailings, and suppressing dust. Alterations in precipitation patterns could also result in changes to water quality, potentially impacting mineral processing. The nature of this is adverse and direct, the impact is partly reversible, and the magnitude of change is High. The duration of the impact is short-term, and the scale of the impact is on-site. The probability of the impact however is Possible, and the sensitivity of the impact is medium. The significance of the impact has therefore been rated adverse minor.

7.4.3.2.2 *impacts of climate change and extreme temperatures on Project operations*

Climate change could result in heightened temperatures, potentially causing various detrimental effects. Among these consequences is the increased risk of heat stress among workers, impacting both their productivity and safety. This situation may necessitate additional efforts from the Project and the Proponent to implement measures ensuring the well-being of their employees, such as elevated provisions for cool water and air conditioning. The nature of this is adverse and direct, the impact is reversible, and the magnitude of change is low. The duration of the impact is temporary, and the scale of the impact is on-site. The probability of the impact however is rare, and the sensitivity of the impact is low. The significance of the impact has therefore been rated low.

7.4.3.2.3 *impacts of climate change and wildfires on Project operations*

Increased temperatures may also lead to an increased probability of wildfires, which poses a threat to both operations and the safety of employees and infrastructure. The nature of this is adverse and direct, the impact is reversible, and the magnitude of change is low. The duration of the impact is temporary, and the scale of the impact is on-site. The probability of the impact however is rare, and the sensitivity of the impact is low. The significance of the impact has therefore been rated low.

In comparison to other major global carbon and GHG emitters, and the fact that Namibia is an overall carbon sink, the impact of the Project on the nation's contribution to climate change has been rated as minor. The table below (Table 58) shows the impact rating before mitigation.

Table 58 - GHG emissions and climate change impact on the Project

Activity	Receptor	Impact	Nature of impact	Value & Sensitivity	Magnitude of change	Significance of impact
Construction and operations	Air quality, fauna and flora, habitats, and people	GHG emissions - Scope 2 GHG emissions contribution to climate change	Adverse Direct Partly reversible High Long term Local Possible	Medium	High	Moderate (6)
Operations	Operations, employees, community, and air quality	Decreased availability and quality of water may impact operations (processing, tailings, dust suppression, etc.)	Adverse Direct Partly reversible High Temporary Short-term On-site Possible Medium	Medium	High	Minor (4)
Extreme temperatures	Employees	Employees suffer from heat stress	Adverse Direct Reversible Low Temporary On-site Possible Low	Low	Low	Low (1)

Activity	Receptor	Impact	Nature of impact	Value & Sensitivity	Magnitude of change	Significance of impact
Wildfires	Operations, employees and air quality	Wildfires may pose a threat to employees and infrastructure	Adverse Direct Reversible Moderate Temporary On-site Possible Low	Low	Moderate	Low (1)

7.5 CUMULATIVE IMPACTS

The EIA regulations clearly states that cumulative impacts should be considered as part of the ESIA for a proposed project. Good practice requires that, as a minimum, cumulative impacts are assessed during the ESIA process. Cumulative impacts can arise when a single resource or receptor is affected by more than one impact from the proposed project. For example, a local resident could be affected by noise from construction vehicles and dust from ground excavation during the construction stage. In isolation, the impacts of noise and dust may be insignificant, however when combined, the impacts on the receptor (if present) may result in a significant impact. This is termed 'Intra-Project Cumulative Impacts'.

Cumulative impacts may also arise as a result of the combination of two or more projects. A receptor could be impacted by similar types of impact from different developments, or a receptor could be impacted by different types of impact from different developments. This could occur at the same time or at different times. This is termed Inter-Project Cumulative Impacts.

Cumulative impacts have a wide temporal and spatial scope and are not restricted to a local area nor need to happen at the same time. It is, therefore, crucial to identify a suitable study and assessment area, as well as a timeframe to assess. Cumulative impacts can also be vast and complicated; therefore, it is important to focus on the significant impacts.

The six-step rapid CIA process has been followed:

- Step 1: Scoping - determine spatial and temporal boundaries
- Step 2: Scoping - identify valued environmental and social receptors and identify reasonably foreseeable developments
- Step 3: Determine present condition of valued environmental and social receptors (the baseline)
- Step 4: Assessment of cumulative impacts and evaluation of the significance of the cumulative impacts
- Step 5: Identification of mitigation measures to avoid or reduce cumulative impacts.

The cumulative impacts that may arise because of the project are provided in Table 59 and Table 60.

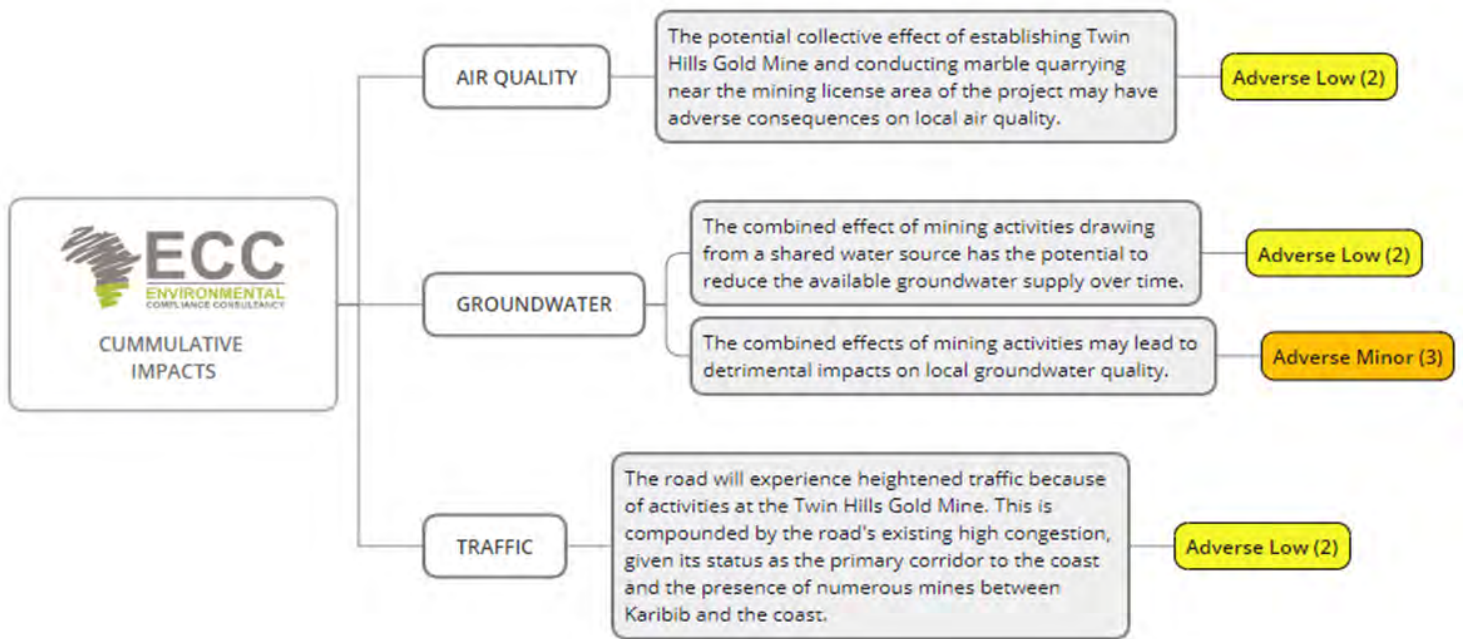


Figure 160 - The cumulative interspecific impacts of the Project on the social and biophysical environment.

7.5.1 POTENTIAL COLLECTIVE EFFECT OF ESTABLISHING TWIN HILLS GOLD MINE AND CONDUCTING MARBLE QUARRYING NEAR THE MINING LICENCE AREA OF THE PROJECT MAY HAVE ADVERSE CONSEQUENCES ON LOCAL AIR QUALITY.

On its own, marble quarrying produces elevated dust emissions as part of its operations, which contains various particulate matter, which can be suspended in the air for long periods of time and transported from the area of operation to surrounding areas by wind. This coupled with the excavation of the open pit and emissions from the crusher and processing plant may further decrease the air quality in the Project area. Additionally, the increase in the presence of dust from both activities may reduce the air quality of the surrounding environment and local region. Therefore, the nature of this impact is adverse and cumulative. The impact is reversible, while the magnitude of change is minor with some measurable changes in attribute. The duration of impact is short term as it will only last for the LoM and the extent is local. The probability of this impact occurring is likely while the sensitivity of the impact is low as it only affects the local area. Therefore, this impact has been rated adverse low.

7.5.2 COMBINED EFFECT OF MINING ACTIVITIES DRAWING FROM A SHARED WATER SOURCE HAS THE POTENTIAL TO REDUCE THE AVAILABLE GROUNDWATER SUPPLY OVER TIME

When multiple mining operations draw water from the same source, they collectively contribute to the lowering of the water table. The excessive withdrawal of groundwater by multiple mining activities can exceed the natural recharge rate of the aquifer. This results in a decline in the water table over time. Groundwater depletion is often a slow and long-term process. Once aquifers are

overexploited, natural recharge processes may not be sufficient to replenish them, leading to persistent water scarcity. Therefore, this impact has been rated adverse and cumulative. The impact of this activity is partly reversible while the magnitude of this impact is moderate. The duration of the impact could be long-term, and the extent of the impact would be local. The probability of this impact occurring is possible. Therefore, this impact has been rated adverse low.

7.5.3 COMBINED EFFECTS OF MINING ACTIVITIES MAY LEAD TO DETRIMENTAL IMPACTS ON LOCAL GROUNDWATER QUALITY

Both mining and quarrying activities entail the excavation and manipulation of the Earth's surface, potentially introducing diverse pollutants and disrupting natural hydrological processes. Moreover, the concurrent application of chemicals in mineral extraction and processing may introduce contaminants into the local groundwater, thereby diminishing its quality. The removal of natural vegetation and soil cover, intrinsic filters for groundwater, is a common outcome of both activities. This loss of natural filters can expedite the movement of pollutants into the groundwater. Therefore, this impact has been rated adverse and cumulative. The impact of this activity is irreversible while the magnitude of this impact is high. The duration of the impact could be long-term, and the extent of the impact would be local. The probability of this impact occurring is possible and the sensitivity is low. Therefore, this impact has been rated adverse minor.

7.5.4 C33 ROAD WILL EXPERIENCE HEIGHTENED TRAFFIC BECAUSE OF ACTIVITIES AT THE TWIN HILLS GOLD MINE. THIS IS COMPOUNDED BY THE ROAD'S EXISTING HIGH CONGESTION, GIVEN ITS STATUS AS THE PRIMARY CORRIDOR TO THE COAST AND THE PRESENCE OF NUMEROUS MINES BETWEEN KARIBIB AND THE COAST

Increased mining traffic will worsen existing traffic congestion, causing delays and extending travel times for all road users. These delays can have widespread effects on businesses, commuters, and overall transportation system efficiency. The influx of heavy mining vehicles can accelerate road infrastructure deterioration, leading to higher maintenance costs and more frequent repairs. Congested roads are associated with increased accident rates, raising safety concerns, especially if the road wasn't designed for intense and frequent mining traffic. Efficient transportation is crucial for the mining industry and other businesses relying on the road, and delays can result in higher costs, impacting the region's economic sustainability. If the road is the primary route to the coast, congestion may have broader economic implications, affecting trade, logistics, and regional development strategies. Therefore, this impact has been rated adverse and cumulative. The impact of this activity is reversible while the magnitude of this impact is minor. The duration of the impact could be short term as it will only last for the LoM and the extent is regional, and the extent of the impact would be local. The probability of this impact occurring is possible and the sensitivity is medium. Therefore, this impact has been rated adverse low.

Table 59 - The cumulative interspecific impacts of the Project with mitigation measures

Receptor	Impacts	Significance of impact	Impact management
Air quality	Activity: Construction of the mine and commencement of operations at the mine coupled with the mining operations at the marble quarry south of the project site Impact: Increased dust in the air reducing the quality of the air in that area	Low (2)	– Regular air quality monitoring – Dust suppression measures (Applying chemical and water dust suppressants to roads and stockpiles can help to control dust) – Constructing physical barriers like berms or windbreaks to shield sensitive areas from prevailing winds – Ensure that international air quality standards and best practices are adhered to – Continuous engagement between the two mining operations (mining and processing?)
Groundwater availability	Activity: The additional use of the groundwater sources in the area Impact: This may put extra pressure on the already stressed groundwater sources which may further exacerbate the scarce water available for operations	Low (2)	– Regular water audits and monitoring of groundwater levels to ensure that mining activities do not negatively impact local aquifers. (Install monitoring systems to track water usage in different processes and areas of the mine) – Implement water recycling systems to treat and reuse water from processes like mineral processing, dust suppression, and vehicle washdown. – Use treated wastewater for non-potable purposes, such as dust control or irrigation – Ensure compliance with permitting requirements and report water usage and conservation efforts as required. – Ensure compliance with permitting requirements and report water usage and conservation efforts as required – Continuous engagement between the two mining operations
Groundwater quality	Activity: Toxic chemicals from slurry produced from tailings and the dewatering of the pits	Minor (3)	– Ensure that international groundwater quality standards and best practices are adhered to – Regular water audits and monitoring of groundwater quality to ensure that mining activities do not negatively impact local aquifers

Receptor	Impacts	Significance of impact	Impact management
	Impact: Potential increase of groundwater contamination from multiple mining activities in close proximity to one another		– Continuous engagement between the two mining operations (mining and processing)
Traffic (Road users and road quality)	Activity: Transport of people and goods to and from the site Impact: Increased traffic and heavy loads on the C33 and D1941 may cause an increase in traffic congestion, resulting in longer travel times, fuel wastage and increased emissions. There will be an increase in potholes, cracks, and surface degradation increasing the need for maintenance and repair of roads to keep them in good condition	Low (2)	– Implement a structured maintenance schedule to address wear and tear, including resurfacing, grading, and drainage improvements – Continuous engagement between the two mining operations

The combined adverse inter-project impacts on the identified receptors cannot be easily quantified mainly due to the lack of other project schedule information. A qualitative approach was then used to assess the possible combined effects that may arise should the Project coincide with the other project identified (Marble Quarriers). The combined beneficial socio-economic cumulative impact will be experienced by the shared receptor base for both projects. Should the two projects develop simultaneously, the local economy will experience an increase in downstream spending from both personnel and business aspects.

8 CONCLUSION

A full and comprehensive amendment and update of the 2021 Environmental and Social Impact Assessment (ESIA) has been undertaken for the Twin Hills Gold Project. All aspects have been considered in the impact assessment. These aspects have been thoroughly investigated against planned activities. Public participation has been positive with all issues raised considered in the report for the decision making and impact assessment. All specialist input has been considered, and the recommended mitigations have been incorporated into the operational environmental and social management plan (OESMP).

The scoping phase of the ESIA described the receiving environment adequately. The Proponent adjusted the layout after the screening phase and the project description and plan was fixed for the assessment phase, however the plan was updated as details were refined in which case an amendment to the original assessment was prepared. Alternatives provided in terms of mineral dump sites, water management and water sourcing, have also been assessed by the specialists.

Table 60 below summarises the impacts after mitigation. On a scale from 1 to 12, low to high, the beneficial (B) and negative (N) impact significance is stated. Some variation between the sub-sections of these aspects exists so the average significance is stated for some aspects.

Table 60 - Summary of the significance ratings after mitigations for the expected impacts (B=beneficial impact; N=negative impact; scale of 1-12 from low to high).

Socio economic environment: social		Biophysical environment	
Mining employees	B2	Surface impacts	N2
Visual impacts	N4	Groundwater impacts	N2
Sense of place	N2	Biodiversity impacts	N2
Air quality impacts	N2	Climate change impacts	N2
Traffic impacts	N2	Cumulative impacts	N2
Air traffic impacts	N6		
Blast and vibration impacts	N4		
Heritage and culture impacts	N4		
Noise impacts	N2		

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APPENDIX A – ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

APPENDIX B – PUBLIC CONSULTATION RECORDS

APPENDIX C – NOISE ASSESSMENT REPORT

APPENDIX D – AIR QUALITY ASSESSMENT REPORT

APPENDIX E – GEOHYDROLOGY ASSESSMENT REPORT

APPENDIX F – BIODIVERSITY ASSESSMENT REPORT

APPENDIX G – ARCHAEOLOGICAL ASSESSMENT REPORT

APPENDIX H – TRAFFIC ASSESSMENT REPORT

APPENDIX I – SOCIOECONOMIC ASSESSMENT REPORT

APPENDIX J – CLIMATE CHANGE ASSESSMENT REPORT

APPENDIX K – BLAST MANAGEMENT ASSESSMENT REPORT

APPENDIX L – EAP CVS

APPENDIX M – APPROVED ECC