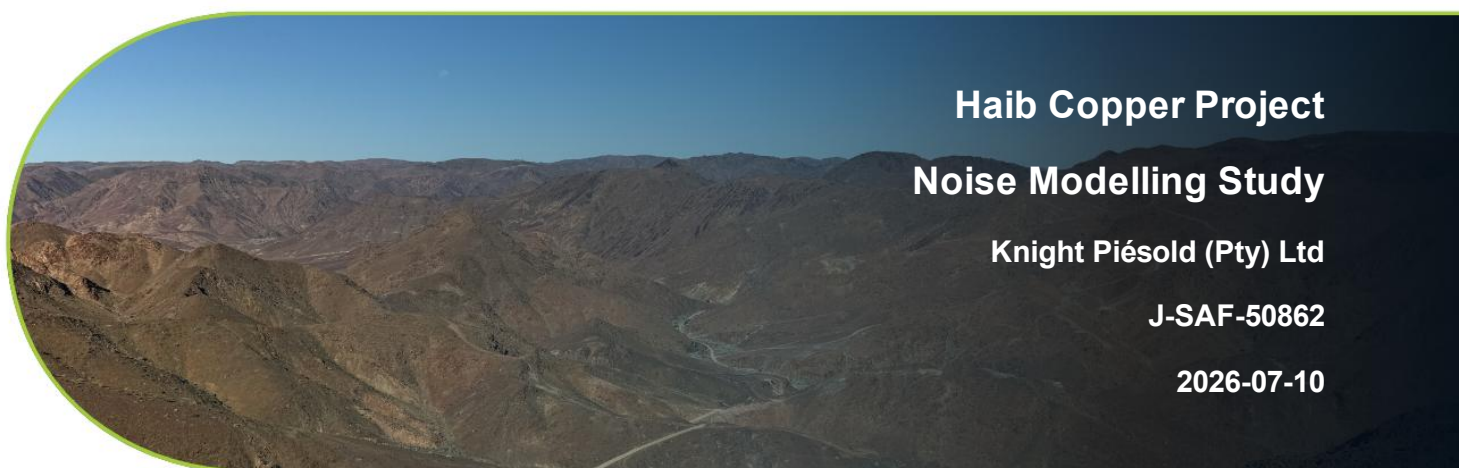




Haib Copper Project Noise Modelling Study

Knight Piésold (Pty) Ltd

J-SAF-50862

2026-07-10

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Approval & Revision Record

Project:		Haib Copper Project		
Document Title:		Noise Modelling Study		
Client:		Knight Piésold (Pty) Ltd		
Report Number:		J-SAF-50862		
Rev	Date	Prepared	Reviewed	Approved
00	09-11-2025	Ian Goble Senior Consultant	Ashley Meyer Partner	Ashley Meyer Partner
01	15-01-2026	Ian Goble Senior Consultant	Ashley Meyer Partner	Marc Blanche Senior Partner <i>Pr Sci Nat (400163/11)</i>
02	10-07-2026	Ian Goble Senior Consultant	Ashley Meyer Partner	Marc Blanche Senior Partner <i>Pr Sci Nat (400163/11)</i>
				

Summary of Changes

Rev	Date	Nature of Revision
00	09-11-2025	Original version
01	15-01-2026	Comments Addressed
02	10-07-2026	Mine Layout Updated

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Acronyms and Abbreviations

General

BS	British Standard
ECC	Environmental Clearance Certificate
EHS	Environmental Health and Safety
EPC	Engineering Procurement and Construction
EPL	Exclusive Prospecting Licence
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
GISTM	Global Industry Standard on Tailings Management
IFC	International Finance Corporation
IoA	Institute of Acoustics
ISO	International Organisation for Standardisation
KP	Knight Piésold (Pty) Ltd Consulting
MVA	Megavolt-amperes
NamPower	Namibia Power Corporation
NIA	Noise Impact Assessment
NM	Noise Monitoring
NSW	New South Wales
OHTL	Overhead transmission line
PV	photovoltaic
SLM	Sound Level Metre
SR	Sensitive Receptor
TSF	Tailings Storage Facility
WKC	WKC Group (Pty) Ltd

Units of Measurement

%	Percentage
°C	Degrees Celsius
dB	Decibel

dB(A)	Decibel (A-weighted)
GWh	Gigawatt-hour
Hz	Hertz
kHz	Kilohertz
kV	Kilovolt
km	Kilometre
m	Metre
Mm ³ /yr	Cubic Megametres per year
Mt	Megatonne
Mtpa	Megatonne per annum
MW	Megawatt
MWp	Megawatt Peak
T	Tonne

Chemical Symbols

Cu	Copper
Mo	molybdenum

1 Introduction

Knight Piésold (Pty) Ltd, hereafter referred to as the Client, has appointed WKC Group (Pty) Ltd (WKC) to undertake a Noise Impact Assessment (NIA) for the proposed Haib Copper Project (hereafter referred to as the 'Project') which is an open-cast copper mine with a total production capacity of 40 megatonne per annum (Mtpa). The Project is located in the Karas Region of southern Namibia, approximately six kilometres (km) north of the border with South Africa and between 12 km and 15 km east of the tarred B1 highway that connects Namibia with South Africa.

1.1 Study Objectives

The key objectives of the NIA assessment are to:

- Undertake a review of the relevant national noise standards, or in their absence, internationally recognised noise standards and provide a summary of the minimum standards that will need to be achieved with respect to project noise emissions;
- Identify the key noise emissions associated with the Project through the development of a noise inventory;
- Quantify and assess the potential impacts of the construction and operations phase of the Project to the ambient noise environment, and;
- Provide insight regarding mitigation options with respect to noise level reductions to minimise potential impacts arising from project operations.

Potential operational noise impacts from the Project were modelled using SoundPLAN© Version 9.1 and compared to the applicable standards.

1.2 Scope of the Modelling Study

This report presents the relevant Project information, assessment methodology, and results of the noise impact assessment. The aim of the noise impact assessment is to predict and analyse the impact of noise generated by the project at identified sensitive receptors.

1.2.1 Construction Phase Assessment

A construction phase assessment was undertaken to predict the noise levels associated with construction activities which resulted from:

- Site clearing and earthworks;

- Construction of Processing Facilities

1.2.2 Operation Phase Assessment

The operations phase assessment included the calculation and assessment of noise levels associated with mining operations and activities anticipated to arise from the continuous operation of high noise-emitting equipment, and was undertaken for both the daytime and night-time operations of the Project. These activities included:

- Open pit operations;
- Haulage of ore and waste rock;
- Operations on and around waste rock dumps;
- Operations on and around stockpiles;
- ROM pad operations; and,
- Processing Facilities.

2 Project Description

2.1 Project Background

Haib is a porphyry copper exploration Project located in the Karas Region of southern Namibia, approximately 6 km north of the border with South Africa and between 12 km and 15 km east of the tarred B1 highway that connects Namibia with South Africa.

Koryx Copper Inc. has a 100% interest in Haib Holdings (Pty) Ltd (formerly Deep South Mining Company (Pty) Ltd.), a Namibian subsidiary which holds the exploration rights to the Haib Project (the Project). Exclusive Prospecting Licence (EPL) 3140 allows for the exploration of base, rare and precious metals over an area of 36,571 hectares (ha).

Towards advancing the copper mining activities at Haib, a comprehensive Environmental and Social Impact Assessment (ESIA) with an associated Environmental and Social Management Plan (ESMP) and public consultations are currently being undertaken and developed to meet both Namibian national requirements and International Finance Corporation (IFC) standards for the Project. The ESIA is being prepared to obtain an Environmental Clearance Certificate (ECC) for the Project from Namibian authorities and to support the standards of disclosure required by the Canadian Securities Administrator in a technical report (NI 43-101) providing environmental and social compliance components.

The proposed Project comprises an open pit mine, a 40 Mtpa crushing, milling and flotation concentrator, a heap leach, solvent extraction and electrowinning plant (required for future processing), as well as infrastructure on and off site necessary to support these operations (waste rock dumps, stockpiles, tailings storage facilities, pipelines and abstraction works, power infrastructure, roads, offices etc.). The mining schedule indicates a total material movement of approximately 108 Mtpa, providing a minimum of 24 years of mining and processing of up to 33 years in addition to the construction period of about two years.

The proposed Project is currently in the exploration and studies phase, whereby the feasibility of the Project is being defined through ongoing investigations and analysis.

2.2 Project Description

The site layout has been designed around critical landform features such as topography, sensitive biodiversity areas, and heritage features. The optimisation has additionally considered the efficiencies required for the mining operation.

It must be noted that this site layout represents the results of preliminary studies, however, it is not final. The final layout will be informed by specialist impact studies and the broader environmental and social impact assessment, as well as ongoing design processes. This finalisation process will also integrate considerations received through the regulatory public consultation process. A summary of the key proposed components is provided:

Open Pit - The Haib deposit straddles the ephemeral Volstruis River and forms the basis for the open pit. The open pit consists of four target areas which will combine to form the larger pit.

The Concentrator Processing Plant - The concentrator processing plant has been laid out to the west of the pit on the gravel plain. This relatively flat area allows flexibility of the plant layout and an opportunity to minimise earthworks. The Run-of-Mine (ROM) tip pads are located close to the pit edge and are at a similar elevation to the pit rim. The crushers and ROM tip pads are located directly west of the pit edge. The typical processing plant supporting infrastructure comprises a change house, administration facility, workshop, stores, reagents stores, sewerage and water treatment facilities. The final copper and molybdenum concentrate will be dried in a filter press and exported by road.

The Concentrator design is based on a 40 Mtpa facility, executed in a single phase and comprising crushing, milling and flotation circuit modules. The Concentrator will treat higher grade primary sulphide material for recovery of copper and molybdenum (Mo) minerals and will produce separate copper and molybdenum flotation concentrates (dependent on market conditions and feed grade), which will be trucked to and shipped to international customers.

Hydrometallurgical Plant - The area in the north-west of the EPL footprint on the flatter plain has been identified as a site for potential Heap Leach and Hydrometallurgical plant. Although the Heap Leach process is not currently included in the mine's base case, it has been included in this application. Mineralised material will be crushed at the ROM pads and conveyed to the agglomeration plant before being stacked on the Heap Leach pad.

The heap leach, solvent extraction and electrowinning plant is sized to process between 3 and 7 Mtpa of ROM feed to treat lower grade sulphide mineralised material and produce Grade A copper cathode product that will be trucked, railed and shipped to international customers.

Tailings Disposal - TSF 4 has been selected as the preferred option following multicriteria analysis. It comprises a raised ring feed structure, sized to use a larger area to be self-raised with a lower rate of rise, with max storage capacity of 1,120 Mt, max footprint of 2,763 ha, max embankment of 39 Mm³, centreline facility and height of approximately 118 m.

The TSF options are currently unlined, based on the assumption that the tailings are non-acid generating, non-metal leaching, and the quality of the effluent will be above the effluent standard and waste management guidelines (as per the Namibian Water Quality Standards set out in Annexure 11 (Regulation 67) of the Water Resources Management Regulations 2023). The TSFs will have an underdrainage system and downstream seepage interception trenches/wells to maximise seepage water recovery. The TSF options are designed to Global Industry Standard on Tailings Management (GISTM) published in 2020.

Waste Rock Dumps/Stockpiles - Waste Rock Dumps were designed as close to the pit exits as possible to optimise productivity and minimise waste mining costs or environmental impacts. The WRD is placed to the east of the open pit with a capacity of 1,500 Mt.

Access and Haul Roads - The Project can be accessed from Windhoek or Noordoewer through the B1 National Highway and then via sets of farm roads and tracks developed during the various exploration programmes. Different access road options were investigated during the conceptual design stage, and the access (road) going along the Haib riverbank was rated most favourable in terms of geometrics, gradients, and cut and fill material balance. The route along the Haib Riverbanks was selected for the conceptual design. The high-level geometric parameters comply with the design speed criteria of 60 km/h. The northern access road is to be sealed with an asphalt-based pavement at the start of the mine operation. The central access road shall be constructed primarily using a gravel wearing course. The current intersection with the B1 will be shifted to maintain access during construction and upgraded according to Namibian Roads Authority standards, including 60 m acceleration and deceleration lanes and tapers, increased bellmouth radii of 20 m,

and surfacing extended approximately 50 m from the bellmouth. Based on the capital cost, maintenance costs, ease of construction, dust mitigation, and visual aesthetics, a sealed road option is recommended for the mine access road for use by commercial haulage trucks, buses, and general vehicles. A gravel wearing course and dump rock pavement layer with a dust suppressant is recommended for the haul road section between the open pit and processing stockpiles, as well as to the waste rock dumps to lower dust emission, wear, and damage to the road surface.

Bulk Water Infrastructure - The proposed Project's water demand is 20 million cubic metres per year (Mm^3/yr) of which supply is planned from the Orange River and will be sourced via NamWater through a parallel ECC application process (abstraction, supply and storage infrastructure).

Raw water supply from the Orange River assumes seasonal reliability of supply. Off-channel storage facilities will offset the impacts of limited to nil water abstraction during the dry season or drought periods. The proposed system comprises a side intake water abstraction structure, a delivery pipeline of approximately 8 km, booster pump stations, an off-channel water storage dam of 20 Mm^3 capacity, and a flowgauging station at the existing weir. Two sites for abstraction were investigated, with Option 1 selected as the preferred option.

Mine Camp - For operations, mine housing will be situated within Noordoewer (the northern part) and is designed to accommodate 1,350 personnel. Designs for mine housing will include various types of worker accommodation, public open spaces, cafeteria, clubhouse and associated infrastructure services. Sewerage will be managed through a trickle plant treated to Namibian standard and storage in dam for reuse or discharge. Solid waste will be managed at a storage area. Water will be sourced via Noordoewer supply which is treated at NamWater water treatment facility.

For construction, the intention is to locate the bulk of construction personnel in Noordoewer in operational housing (where it can be completed in time), with the overflow living in a temporary construction camp in Noordoewer. An additional allocation for temporary construction camp on site is made to support early construction works (up to 3,500 personnel). The intention with this approach is to maximise the benefits of infrastructure development and economic growth in the Noordoewer community. Sewerage will be managed through a trickle plant treated to Namibian standard and storage in dam for reuse or discharge. Solid waste will be managed at a storage area. Water will be sourced via the off-channel storage dam and treated at a dedicated water treatment facility on site.

Bulk Power Supply - The power supply concept design includes a hybrid solution combining a solar PV plant (150 MWp) and a connection to the regional grid system from NamPower. The estimated monthly energy consumption is 123,500 MWh, of which approximately 30% is expected to be supplied by the photovoltaic (PV) farm under the Modified Single Buyer framework. The total annual energy consumption is estimated at a maximum of 1,482 GWh. The grid supply is via a 220 kV overhead transmission line (OHTL) configuration linking the Haib Substation to the existing Harib NamPower Substation, with associated upgrades to the Harib Substation and rerouting of the existing 132 kV OHTL. Site-wide electrical reticulation is primarily at 33 kV with dedicated substations. Emergency power will be supplied by high-speed diesel generator sets for critical loads. Power optimisation studies are still ongoing and expected to provide improvements through introducing efficiencies. The solar PV supply is sized at 150 MWp phase 1 to account for the 30% limitation.

All infrastructure underwent alternative assessment, which considered designing the site around critical landform features such as topography, sensitive environmental habitats/areas, and heritage features. The process additionally considered the efficiencies required for the mining operation towards identifying an optimal layout. The presented site layout is a result of these considerations.

2.3 Project Location and Site Layout

The Haib Copper Project (EPL 3140) covers an area of approximately 36,571 ha and is located in the south of Namibia, approximately 9 km (from the south-western boundary) from Noordoewer. The B1 Road forms the north-western boundary of the EPL. The Orange River runs immediately to the south of the EPL, and several farms surround the EPL. The biggest portion of EPL 3140 lies on state land.

The Haib deposit lies at elevations from a floor elevation of just under 375 meters above mean sea level to over 600 meters above mean sea level. The surrounding area is up to about 650 meters above mean sea level at the highest point. The area is rugged with steep-sided valleys and rugged local relief. Flatter topography is present in the west and north-west portions of the EPL footprint, but these areas are far away from the Haib deposit.

The site layout has been designed around critical landform features such as topography, sensitive biodiversity areas, and heritage features. The site layout has additionally been optimised considering the mining operation. The site location is shown in a regional and local context in Figure 2-1 and Figure 2-2 respectively. The conceptual site layout is provided in Figure 2-3 below.

Figure 2-1 – Project Location in a Regional Context

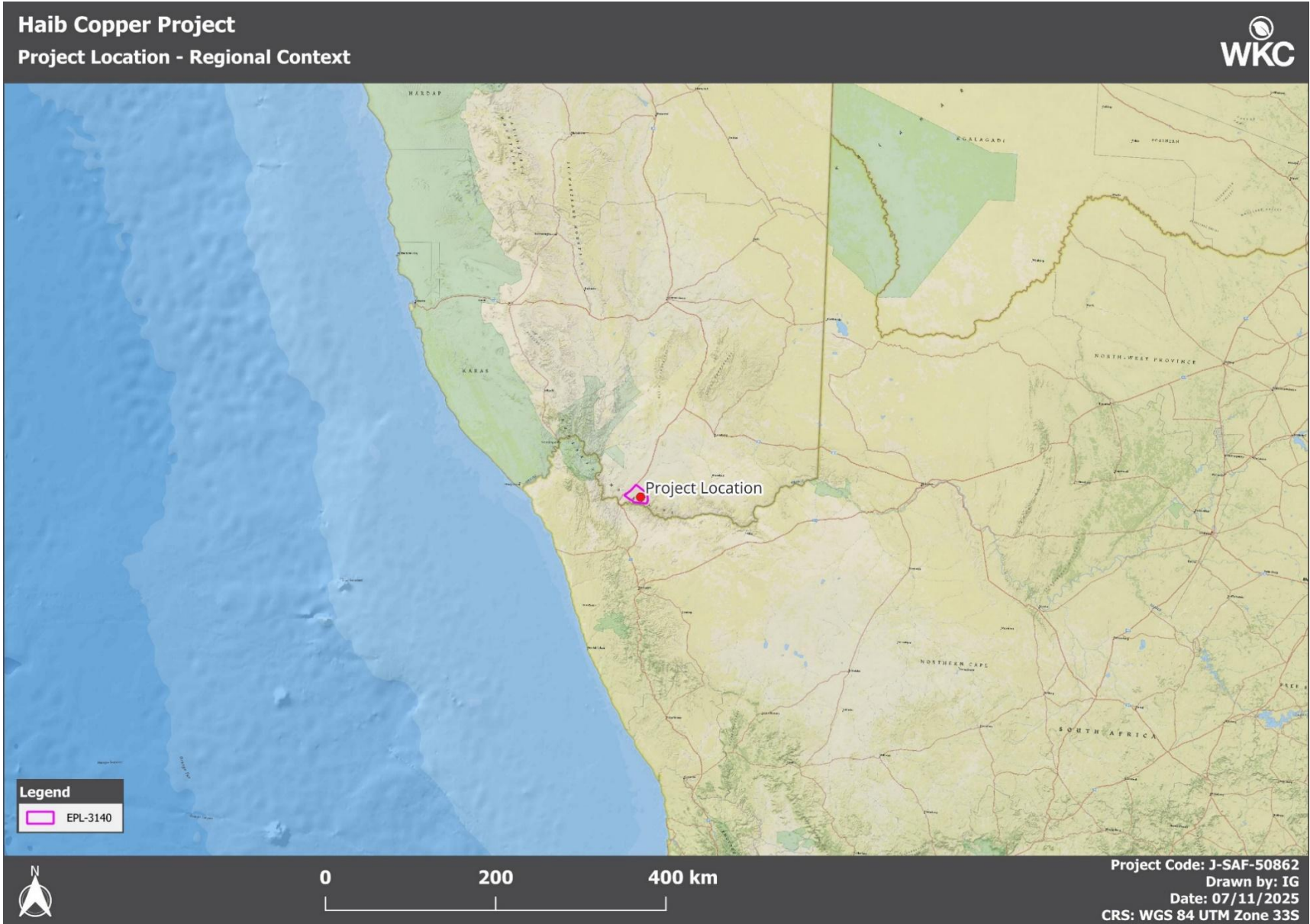


Figure 2-2 – Project Location in a Local Context

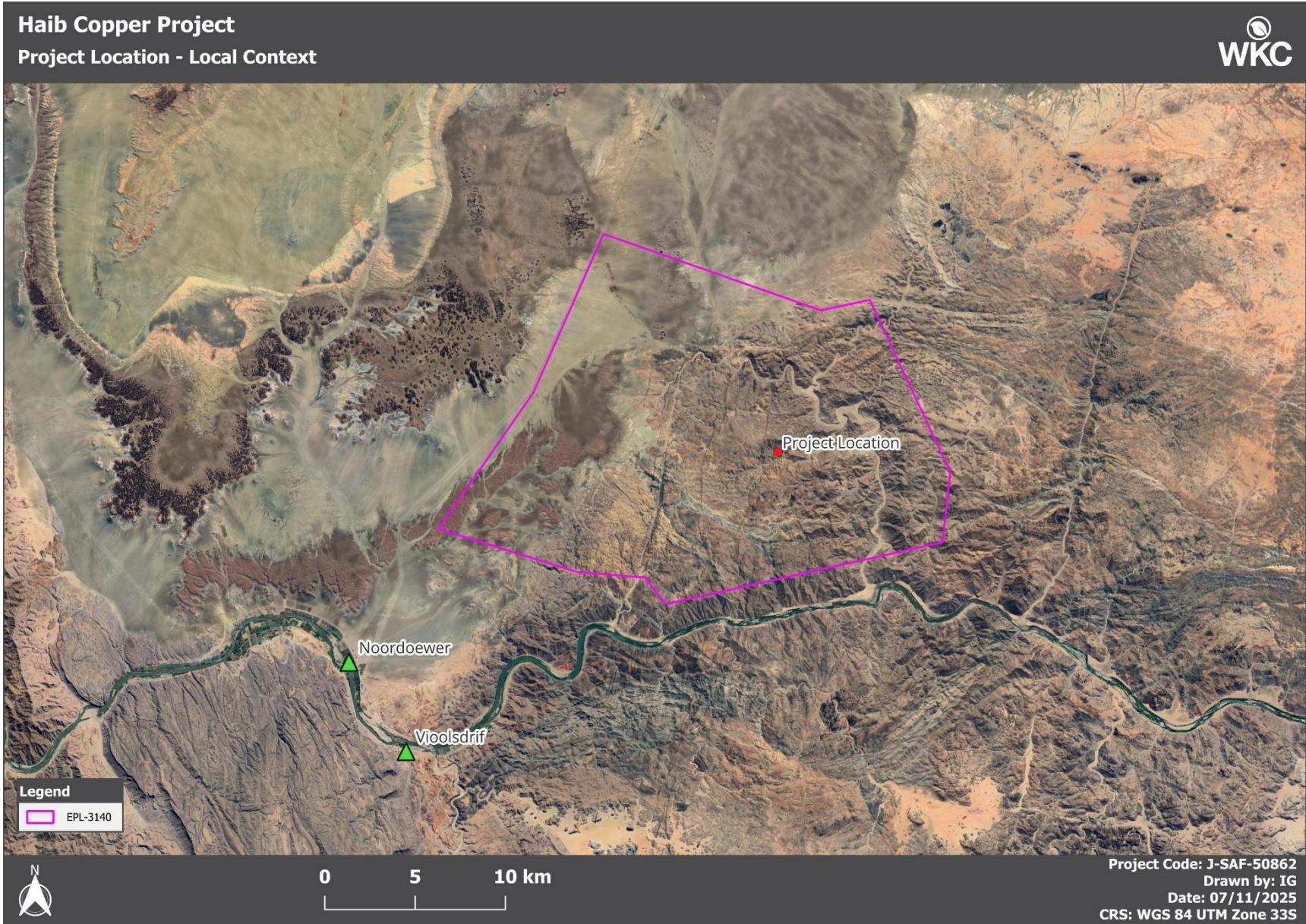
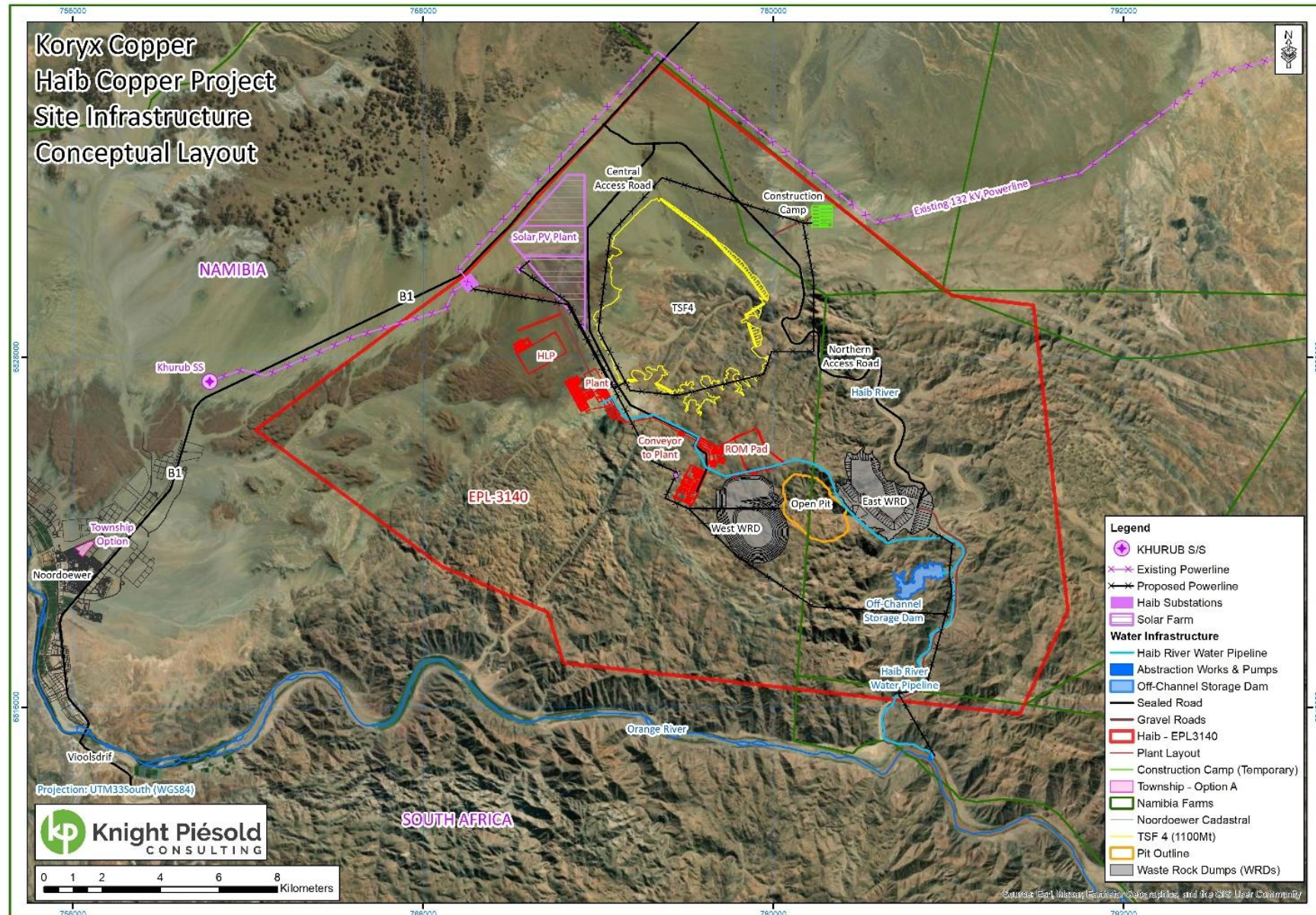


Figure 2-3 – Conceptual Site Layout



3 Regulatory Review

This section presents the national and international standards, guidance and Project specifications anticipated to be applicable to the assessment. In the absence of robust local noise standards, international best practice will be used to contextualise project noise impacts with respect to the ambient noise environment.

3.1 Namibian Noise Control Regulations

The Local Authorities Act, 1992 (Act No. 23 of 1992) was brought into force on the 31 August 1992 by GN 118/1992 and defines the power, duties and functions of local authority councils and provides for incidental matters regarding the setting and implementation of local regulations within the country of Namibia. As a result, the authority of setting noise limits is designated to the local authority. To date the local regulations do not provide for specific noise limits. In the absence of robust local noise standards, the quantitative assessment presented in this report was based on noise limits defined within International Finance Corporation (IFC) General Environment, Health and Safety (EHS) guidelines, which constitute the application of International Best Practice.

3.2 International Guidance

3.2.1 IFC General EHS Guidelines – Noise Management

The IFC General EHS guidelines [1] state that the noise level guidelines should either be met, or alternatively the project shall not result in a maximum increase in background levels of 3 dB(A) at the nearest receptor location. The IFC maximum permissible noise levels for general environment are presented in Table 3-1.

Table 3-1 – Maximum Permissible Noise Levels for General Environment

Classification of Receptor	Allowable Limits for Noise Levels (dB(A)(L _{eq}))	
	Day (07:00 – 22:00)	Night (22:00 – 07:00)
Residential, Institutional, Educational	55	45
Industrial, Commercial	70	70

3.2.2 Construction Noise Guidelines

The IFC Guideline values are associated with “typical noise” for a given land use zoning. Construction activities are temporary in nature and therefore it can be argued that noise associated with construction activities are not considered to be typical or continuous for an extended period; therefore, the guideline values are not specific to assessing construction noise. Due to the temporary nature of construction activities, it is not always relevant to compare noise levels generated during the construction period with allowable noise limits.

In the absence of national construction noise limits, the construction noise assessment has been carried out in accordance with internationally recognised construction noise guidelines of the Department of Environment and Climate Change New South Wales (NSW) [2]. The interim construction noise guidelines define a construction noise threshold margin of 10 dB above the background noise levels with a 75dB(A) upper limit for construction operations during standard hours. This is due to the temporary / short-term and transient nature of construction noise, as opposed to operational noise levels or conditions that are long-term (and therefore considered more significant). A noise level of L_{Aeq} 75 dB(A) represents the point above which there may be strong community reaction to noise and indicates a need to consider other feasible and reasonable ways to reduce noise, such as restricting the times of very noisy works to provide respite to affected residences.

3.2.3 ISO 1996-1-3 ‘Description and Measurement of Environmental Noise’

International Organisation for Standardisation (ISO) 1996-1-3 – ‘Description and Measurement of Environmental Noise’ [3] defines the basic quantities to be used for the description of noise in community environments and the basic procedures for the determination of these quantities. It also includes the methods for acquisition of data that enable specific noise situations to be checked for compliance with given noise limits.

3.2.4 3.2.3. ISO 9613 Acoustics – ‘Attenuation of Sound during Propagation Outdoors’

ISO 9613 Acoustics – ‘Attenuation of Sound during Propagation Outdoors’ [4] specifies an engineering method for calculating the attenuation of sound during propagation outdoors in order to predict the levels of environmental noise at a distance from a variety of sources. The method predicts the equivalent continuous A-weighted sound pressure level (L_{Aeq}) under meteorological conditions favourable to propagation from sources of known sound emission.

4 Impact Assessment Methodology

The following sections provide an overview of the calculation methodology, the impact assessment criteria for the construction and operations phase of the Project.

4.1 Calculation Methodology

4.1.1 Calculation of Construction Noise

The calculation of construction noise was carried out in accordance with British Standard (BS) 5228:2014 'Noise and Vibration Control on Construction and Open Sites' [5]. The standard provides a comprehensive construction equipment inventory with associated noise levels, a construction noise calculation method, practical information on noise reduction measures, and promotes 'Best Practice Means' approach to control noise emissions during construction.

4.1.2 Calculation of Operational Noise

ISO 9613 Acoustics – Attenuation of Sound During Propagation Outdoors' [6] specifies an engineering method for calculating the attenuation of sound during propagation outdoors in order to predict the levels of environmental noise at a distance from a variety of sources. The method predicts the equivalent continuous L_{Aeq} under meteorological conditions favourable to propagation from sources of known sound emission.

SoundPLAN® 9.1 is an internationally recognised noise modelling software that adopts ISO 9613 and has been used to estimate the operational noise levels associated with the Project. This software allows for a spatially constructed model, incorporating noise emission parameters of the Project facilities/activities, and calculates sound propagation and attenuation by recognised methods in order to predict the levels of environmental noise at a distance from the modelled sources. The method predicts the L_{Aeq} under meteorological conditions favourable to propagation from sources of known sound emission.

4.2 Impact Assessment Criteria

4.2.1 Impact Assessment Criteria for Construction Phase

The impact assessment criteria presented in Table 4-1 is based on the NSW construction noise guidelines [2] and has been adapted in accordance with the KP assessment criteria and relates to the contributed noise level from the construction phase.

Table 4-1 – Construction Noise Impact Magnitude Assessment Criteria

Impact Intensity Category	Rating of Intensity	Increase in noise level above the noise limit	Description of Impact
Minor	1	0 dB(A)	The impact causes very little change to the characteristics of the receiving environment/

Impact Intensity Category	Rating of Intensity	Increase in noise level above the noise limit	Description of Impact
			social receptor and the alteration is less than 20%
<i>Low</i>	2	0 – 5 dB(A) above applicable noise limit	The impact alters the characteristics of the receiving environment/ social receptor by a factor of 20 – 40%
<i>Moderate</i>	3	5 – 10 dB(A) above applicable noise limit	The impact alters the characteristics of the receiving environment/ social receptor by a factor of 40 – 60%
<i>High</i>	4	>10 dB(A) above applicable noise limit	The impact alters the characteristics of the receiving environment/ social receptor by a factor of 60 – 80%
<i>Very High</i>	5	≥ 10 dB(A) above applicable noise limit and exceeding 75 dB(A)	The impact causes the characteristics of the receiving environment/ social receptor to be altered by a factor of 80 – 100%

4.2.2 Impact Assessment Criteria for Operational Phase

The impact assessment criteria presented in Table 4-2 is based on the IFC General EHS Guidelines for Noise Management [1] and the Institute of Acoustics (IoA) Noise Impact Assessment Guidelines [7] and has been adapted in accordance with the KP assessment criteria and relates to the contributed noise level and resulting change in noise levels at the sensitive receptor (SR) during the operations phase.

Table 4-2 – Definition of Impact Intensity

Impact Intensity Category	Rating of Intensity	Change in Noise Level	Description
<i>Minor</i>	1	0 dB(A)	The impact causes very little change to the characteristics of the receiving environment/ social receptor and the alteration is less than 20%
<i>Low</i>	2	0.1 – 2.9 dB(A)	The impact alters the characteristics of the receiving environment/ social receptor by a factor of 20 – 40%
<i>Moderate</i>	3	3 – 4.9 dB(A)	The impact alters the characteristics of the receiving environment/ social receptor by a factor of 40 – 60%
<i>High</i>	4	5 – 10 dB(A)	The impact alters the characteristics of the receiving environment/ social receptor by a factor of 60 – 80%
<i>Very High</i>	5	> 10 dB(A)	The impact causes the characteristics of the receiving environment/ social receptor to be altered by a factor of 80 – 100%

4.2.3 Determination of Impact Significance

The impact significance arising at SRs was assessed using the KP assessment criteria, which define impact significance as the product of an impact's consequence and probability, where the consequence is the sum of the impact severity, reversibility, duration, and spatial extent.

The KP assessment criteria used to guide the approach in determining the impact significance of noise contributions from construction and operation is detailed in Appendix B.

5 Baseline Noise

A baseline noise survey was undertaken in July of 2025 in order to establish the pre-development baseline conditions at the Project site, boundary and representative off-site and sensitive receptor locations.

5.1 Noise Monitoring Methodology

The ambient noise survey was undertaken in accordance with best practice and ISO 1996-1-3 [3]. Measurements were taken at a standard height of 1.5 metres (m) and at a minimum of 3 m away from any reflecting surfaces for a minimum duration of 15 minutes.

5.2 Equipment and Calibration

A Casella CEL-490/5 type 1 integrating sound level meter, together with a CEL-110/1 type 1 field calibrator, was utilised for the measurements in the survey.

The selected sound level meter (SLM) automatically logs environmental noise measurement parameters including L_{Aeq} , L_{A90} , L_{Amax} and L_{Amin} (see Glossary).

The SLM was calibrated regularly before and after each measurement using the field calibrator, subsequently ensuring any potential drift is attributed to each measurement location rather than all locations throughout the survey period. In addition, the SLM and field calibrator are factory calibrated by a certified body on an annual basis.

5.3 Noise Measurement Locations

The baseline noise survey was conducted from the 7th to the 10th of July 2025. The survey was undertaken to measure and characterise the pre-development / baseline noise conditions at several locations, including:

- Site boundary locations;
- Selected site locations (located within the Project site); and,
- SRs (Located outside of the Project boundary).

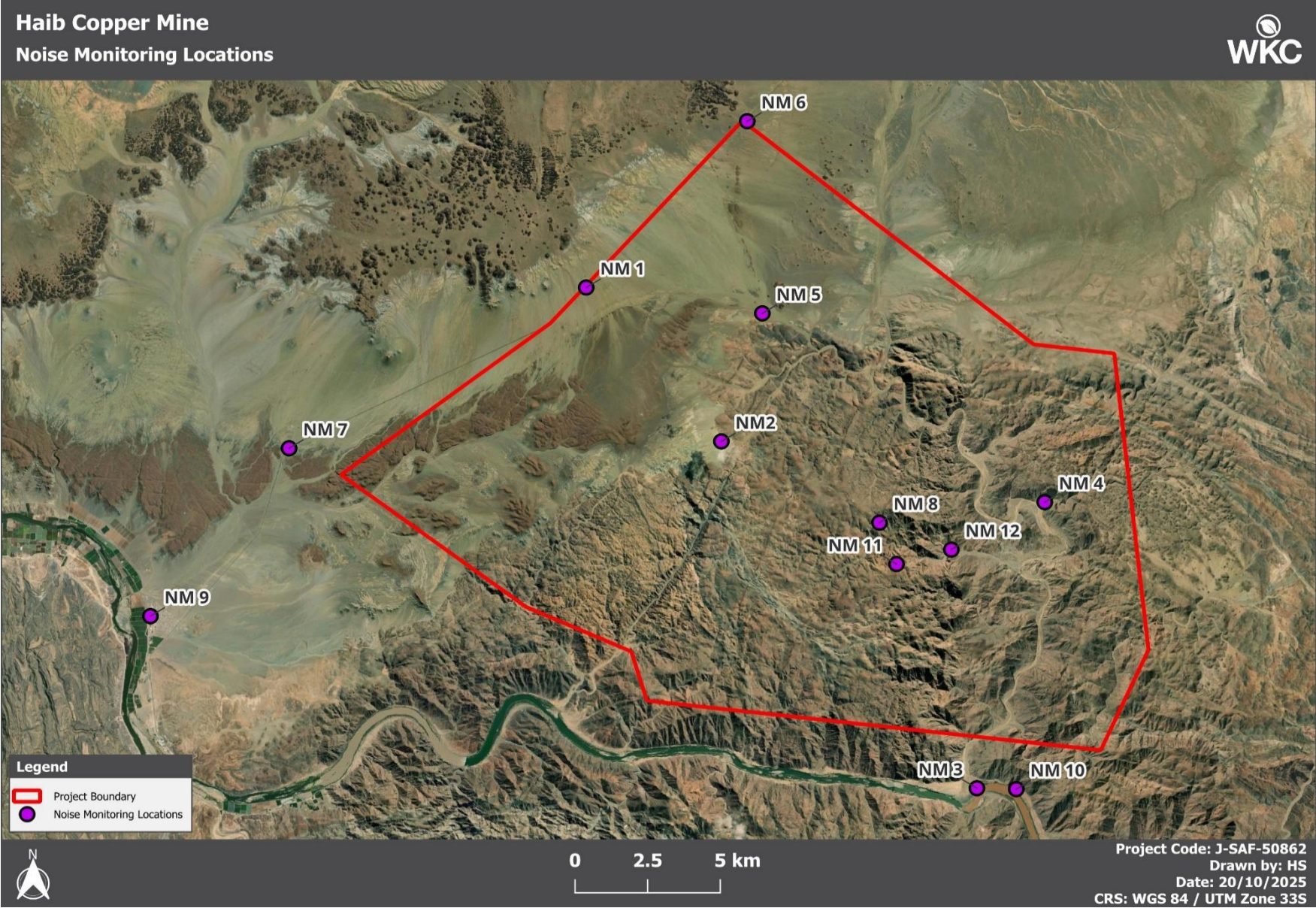
Details of the NM locations are summarised in Table 5-1, and the NM locations are illustrated in Figure 5-1.

Table 5-1 – July 2025 Noise Monitoring Locations and Applicable Noise Limits

Site ID	Site Description	Land Use Type	UTM Coordinates		IFC Daytime Noise Limit (dB(A))	IFC Night-time Noise Limit (dB(A))
			(m E)	(m S)		
NM1	Access Gate	Residential / Rural	770,618	6,832,152	55	45
NM2	Southern Route – Access Road	Residential / Rural	775,276	6,826,713	55	45
NM3	Southern Boundary – Orange River	Residential / Rural	784,081	6,814,454	55	45
NM4	East Boundary	Residential / Rural	786,421	6,824,565	55	45
NM5	Northern Route – Access Road	Residential / Rural	776,688	6,831,240	55	45
NM6	Northern Boundary	Residential / Rural	776,168	6,838,031	55	45
NM7	Western Boundary	Residential / Rural	760,378	6,826,470	55	45
NM8	Weather Station	Residential / Rural	780,724	6,823,841	55	45
NM9	Noordoewer Town	Residential / Rural	755,602	6,820,537	55	45
NM10	South Village	Residential / Rural	785,438	6,814,421	55	45
NM11	South Central – Directors Perch	Residential / Rural	781,313	6,822,379	55	45
NM12	Central – Access Road	Residential / Rural	783,200	6,822,888	55	45

Daytime noise measurements were undertaken at all locations as listed in Table 5-1, whereas night-time noise measurements were limited to accessible boundary locations (i.e., NM1 – NM7, NM9 and NM12).

Figure 5-1 – Baseline Noise Monitoring Locations



5.4 Survey Timing, Frequency and Duration

The date, start and end time of each measurement recorded during the daytime and night-time periods are detailed in Table 5-2 and Table 5-3 respectively.

Table 5-2 – Daytime Survey Timing and Schedule

Site ID	Site Description	Daytime Measurements		
		Date	Start Time	End Time
NM1	Access Gate	07/07/2025	12:58	13:13
NM2	Southern Route – Access Road	07/07/2025	14:40	14:55
NM3	Southern Boundary – Orange River	08/07/2025	13:16	13:31
NM4	East Boundary	07/07/2025	16:56	17:11
NM5	Northern Route – Access Road	07/07/2025	14:02	14:17
NM6	Northern Boundary	07/07/2025	12:17	12:32
NM7	Western Boundary	08/07/2025	16:28	16:43
NM8	Weather Station	07/07/2025	15:28	15:43
NM9	Noordoewer Town	07/07/2025	09:44	09:59
NM10	South Village	08/07/2025	14:22	14:37
NM11	South Central – Directors Perch	08/07/2025	11:58	12:13
NM12	Central – Access Road	08/07/2025	10:46	11:01

Table 5-3 – Night-time Survey Timing and Schedule

Site ID	Site Description	Night-time Measurements		
		Date	Start Time	End Time
NM1	Access Gate	09/07/2025	23:01	23:16
NM2	Southern Route – Access Road	09/07/2025	23:44	23:59
NM3	Southern Boundary – Orange River	09/07/2025	20:02	20:17
NM4	East Boundary	09/07/2025	21:30	21:45
NM5	Northern Route – Access Road	09/07/2025	22:30	22:45
NM6	Northern Boundary	10/07/2025	00:16	00:31
NM7	Western Boundary	10/07/2025	00:52	01:07
NM9	Noordoewer Town	10/07/2025	01:23	01:38
NM12	Central – Access Road	09/07/2025	20:49	21:04

5.5 Baseline Noise Monitoring Results

5.5.1 Daytime Noise Monitoring Survey Results

Overall, the noise levels recorded at all the NM locations were below the applicable IFC noise limits. The daytime noise levels results are summarised in Table 5-4.

Table 5-4 – Daytime Baseline Noise Monitoring Survey Results

Site ID	Site Description	Land Use Type	IFC Daytime Noise Limit (dB(A))	L _{Aeq} (dB(A))
NM 1	Access Gate	Residential / Rural	55	44.1
NM 2	Southern Route – Access Road	Residential / Rural	55	42.3
NM 3	Southern Boundary – Orange River	Residential / Rural	55	40.7
NM 4	East Boundary	Residential / Rural	55	41.1
NM 5	Northern Route – Access Road	Residential / Rural	55	48.8
NM 6	Northern Boundary	Residential / Rural	55	48.8
NM 7	Western Boundary	Residential / Rural	55	48.1
NM 8	Weather Station	Residential / Rural	55	47.2
NM 9	Noordoewer Town	Residential / Rural	55	46.3
NM 10	South Village	Residential / Rural	55	29.8
NM 11	South Central – Directors Perch	Residential / Rural	55	35.3
NM 12	Central – Access Road	Residential / Rural	55	33.1

5.5.2 Night-time Noise Monitoring Survey Results

The noise levels recorded at NM 2, NM 3, NM 4, NM 5 and NM 12 were below with the applicable IFC noise night-time noise limit of 45 dB(A). The noise levels recorded at NM 1, NM 6, NM 7, and NM 9 exceeded the night-time noise limit, ranging from levels 46.0 dB(A) to a maximum of 62.6 dB(A). The night-time noise level results are summarised in Table 5-5.

Table 5-5 – Night-time baseline Noise Monitoring Survey Results

Site ID	Site Description	Land Use Type	IFC Night-time Noise Limit (dB(A))	L _{Aeq} (dB(A))
NM 1	Access Gate	Residential / Rural	45	46.0
NM 2	Southern Route – Access Road	Residential / Rural	45	27.6
NM 3	Southern Boundary – Orange River	Residential / Rural	45	30.9
NM 4	East Boundary	Residential / Rural	45	35.9
NM 5	Northern Route – Access Road	Residential / Rural	45	27.8
NM 6	Northern Boundary	Residential / Rural	45	57.6
NM 7	Western Boundary	Residential / Rural	45	62.6
NM 9	Noordoewer Town	Residential / Rural	45	52.6
NM 12	Central – Access Road	Residential / Rural	45	34.2

Overall, the results of the survey indicate that baseline levels are typical of rural residential areas, where day-time noise levels are generally below the day-time noise limits, and night-time noise levels fluctuate between levels below and exceeding the limit, with significant contributions from both local natural sources (such as insects) and anthropogenic sources (including community activity) which contribute to exceedances of the night-time noise limit.

Noting exceedances of the night-time noise limits as a result of local community sources and natural sources prior to the development of the Project is important. In consideration of this point, the assessment considered both the potential change in noise levels at receptors, as well as the Project's contribution in terms of the applicable limits to establish the potential impact as a result of the Project activities.

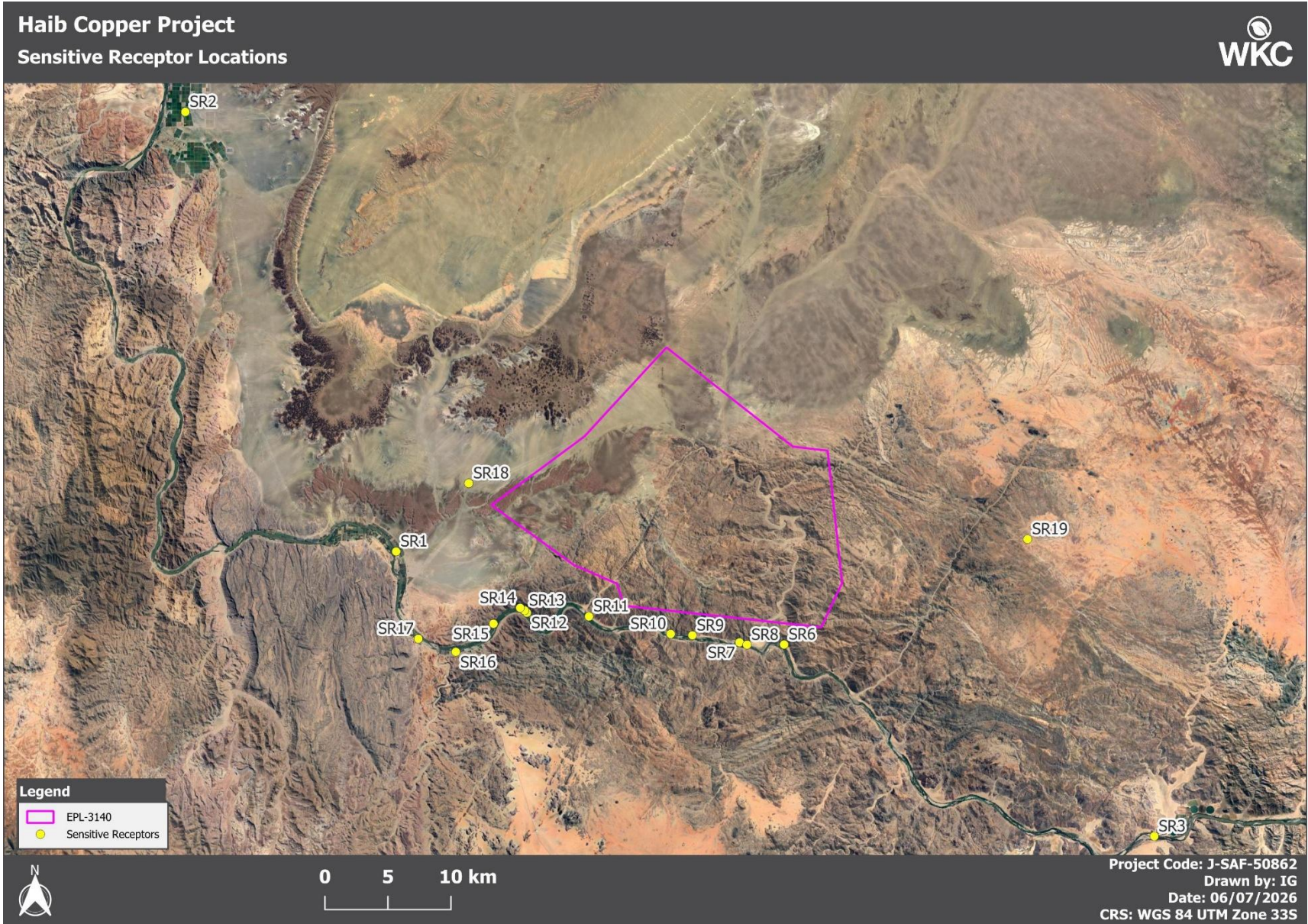
6 Sensitive Receptors

The project site is located in a remote area with few anthropogenic receptors located in close proximity to the project activities. Identified sensitive receptors include Noordoewer which is located to the west of the project site, which is the closest town to the project, and a number of formal and informal farmers. Details of the identified SR locations are provided in Table 6-1, and the SR locations in relation to the Project site are illustrated in the map shown in Figure 6-1.

Table 6-1 – Sensitive Receptor Details

SR ID	SR Description	UTM Co-ordinates*		Site Classification	IFC Noise Limits (dB(A))	
		m E	m S		Daytime	Night-Time
SR1	Noordoewer	754670.4	6821806.7	Residential	55	45
SR2	Aussenkehr	737917.9	6856723.7	Residential	55	45
SR3	Haklesdoorn	814904.9	6799190.7	Residential	55	45
SR6	OR Livestock Farmers	785495.3	6814418.8	Residential	55	45
SR7	OR Livestock Farmers 2	781954.0	6814584.9	Residential	55	45
SR8	OR Livestock Farmers 3	782549.3	6814405.8	Residential	55	45
SR9	OR Livestock Farmers 4	778211.7	6815149.4	Residential	55	45
SR10	OR Livestock Farmers 5	776481.6	6815258.7	Residential	55	45
SR11	OR Livestock Farmers 6	769989.5	6816646.9	Residential	55	45
SR12	OR Farmers 7	765055.5	6816946.3	Residential	55	45
SR13	OR Farmers 8	764879.2	6817129.9	Residential	55	45
SR14	OR Farmers 9	764520.2	6817330.5	Residential	55	45
SR15	OR Farmers 10	762402.4	6816066.5	Residential	55	45
SR16	Irrigation Agriculture Area	759409.2	6813834.8	Residential	55	45
SR17	Border Post	756435.2	6814874.0	Commercial	70	70
SR18	Police Compound	760437.8	6827222.8	Commercial	70	70
SR19	Farmer	804836.6	6822785.3	Residential	55	45
*UTM Co-Ordinates in ref system: WGS84 33S						

Figure 6-1 – Sensitive Receptor Locations



7 Construction Phase Noise Impact Assessment

7.1 Construction Phase Overview

Noise emissions are expected during the construction of the Project due to the operation of various equipment and machinery. Key construction phases and activities that may result in significant noise generation during this phase include:

- Site preparation; and,
- General construction of processing facilities and supporting infrastructure.

Due to the remote location of the project, such as the processing plant and TSF infrastructure, most construction activities will be far away from any SR's with significant terrain screening, and are therefore expected to have a negligible impact on SR's. The assessment of construction activities therefore focused on construction activity with the potential to impact on nearby SRs.

Based on a review of the Project footprint and infrastructure in the vicinity of the identified SRs, the construction of the pump station was identified as the only infrastructure close enough with the potential to impact on SRs, which is located approximately 350m from SR6 (Livestock farmer along the Orange River).

The types of equipment anticipated for use throughout the different stages of construction were estimated based on the scale of construction and type of construction activities. As construction activities are expected to take place during daytime hours, the assessment was carried out against the applicable daytime noise limits and construction noise thresholds.

7.2 Equipment Noise Levels

Equipment noise levels for the various construction equipment items included in the assessment were obtained from BS 5228:2014 'Noise and Vibration Control on Construction and Open Sites' [5]. The noise levels used in the predictive assessment are summarised for each equipment item, and for each of the phases of construction in Table 7-1.

Table 7-1 – Estimated Construction Equipment Inventory

No.	Equipment Item	Sound Level @ 10m (dB) – LA _{eq}	Reference
Site Preparation			
1	Wheeled backhoe loader	68	Table C.2, No. 8
2	Dozer	79	Table C.2, No. 11
3	Tracked excavator	71	Table C.2, No. 21
4	Articulated dump truck (tipping fill)	74	Table C.2, No. 32
5	Roller	73	Table C.2, No. 38
General construction site activities			
6	Dumper	76	Table C.4, No. 3
7	Wheeled backhoe loader	67	Table C.4, No. 14
8	Small cement mixer	61	Table C.4, No. 23
9	Concrete mixer truck (discharging) & concrete pump (pumping)	75	Table C.4, No. 28
10	Vibratory tamper	63	Table C.4, No. 35
11	Mobile telescopic crane	71	Table C.4, No. 41
12	Tracked excavator	71	Table C.4, No. 65
13	Diesel generator	66	Table C.4, No. 85
14	Pump	68	Table C.4, No. 88

7.3 Determination of Impact Intensity

Construction noise levels were calculated at specific distance intervals ranging from the edge of the pump station area to 1,000 m. The calculated noise levels for the “site preparation” phase are presented in Table 7-2 and the noise levels of the “general construction” phase are presented in Table 7-3.

The predicted construction noise levels were calculated under the conservative assumption that one of each equipment item will be operating at full capacity at a singular point on the Project boundary closest to the SR, resulting in the highest potential construction noise level estimate.

Table 7-2 – Predicted Noise Emissions from Site Preparation

Distance from Project Boundary (m)	Noise Levels dB(A)
50	67.6
100	61.6
150	58.0
200	55.5
500	47.6
1000	41.6

Table 7-3 – Predicted Noise Emissions from General Construction Activities

Distance from Project Boundary (m)	Noise Levels dB(A)
50	66.6
100	60.6
150	57.1
200	54.6
500	46.6
1000	40.6

Based on the assessment, the noise levels due to the site preparation (resulting in the highest noise levels) will be below the construction noise threshold of 65 dB(A) at approximately 70m from the construction activities under worst-case construction activities. As there are no receptors within this distance from the construction activities the construction phase activities are not expected to generate noise levels that exceed the applicable construction noise threshold.

7.4 Construction Impact Magnitude Assessment

Based on the highest construction noise level contribution at the SR (anticipated during site preparation), the resulting impact magnitude at the assessed SR is presented in Table 7-4.

Table 7-4 – Construction Impact Magnitude at SRs

SR ID	Minimum Distance from Construction (km)	Total L_{Aeq} Contribution at Sensitive Receptor (dB(A))	Construction Noise Limit L_{Aeq} (dB(A)) ^(a)	Increase above Limit (dB(A))	Impact Magnitude
SR6	350	50.7	65.0	0.0	Minor
Note a: the construction noise limit is set at 10dB above the applicable day-time noise limit for the area.					

Table 7-4 shows that the construction noise contribution at the closest SR is expected to be more than 10 dB below the applicable construction noise threshold, therefore the impact magnitude for the construction phase of the project is *Minor*.

7.5 Determination of Impact Significance

Based on the construction impact assessment, the Impact magnitude is predicted to be *Minor*, corresponding to a rating of '1'. The Reversibility, Duration and Spatial Extent have a rating of '1', '2' and '2' respectively, which results in an overall Consequence of '6'. A Probability rating of '2' results in an Impact Significance of 'Low'.

Table 7-5 – Construction Phase Impact Assessment Summary

								Nature of Impact	
		Severity / Magnitude (M)	Reversibility (R)	Duration	Spatial Extent	Probability	Significance	+ / -	D / I / C
Construction Impacts Prior to Mitigation									
Increase in noise potentially disturbing levels at SRs due to construction activities (i.e. site preparation and construction activities)	Without Mitigation	1	1	2	2	2	Low	(-)	D
Recommendations:									
Based on the construction phase noise impact assessment, the Project noise contributions are unlikely to result in impacts. However, best practice construction noise control measures have been provided and should be implemented where possible.									
Noise Control Guidelines – Controlling Noise Sources									
Relevant construction noise control guidelines from the BS 5228 [8] are provided below.									
General Mitigation Measures									
- Avoid unnecessary revving of engines and switch off equipment when not required. - Keep internal access routes well maintained and avoid steep gradients. - Use rubber linings in, for example, chutes and dumpers to reduce impact noise. - Minimise drop height of materials. - Start-up plant and vehicles sequentially rather than all together. - The movement of plant equipment onto and around the site should have regard to the normal operating hours of the site or surrounding environment.									

	Severity / Magnitude (M)	Reversibility (R)	Duration	Spatial Extent	Probability	Significance	Nature of Impact	
							+ / -	D / I / C
Audible reversing warning systems on mobile plant and vehicles should be of a type which, whilst ensuring that they give proper warning, have a minimum noise impact on persons outside sites. When reversing, mobile plant and vehicles should travel in a direction away from sensitive receptors whenever possible. Where practicable, alternative reversing warning systems should be employed to reduce the impact of noise outside sites.								
Modification of Equipment								
- Noise from equipment can often be reduced by modification or by the application of improved sound reduction methods, but this should only be carried out after consultation with the manufacturer (i.e., fitting a more effective exhaust silencer system or by designing an acoustic canopy to replace the normal engine cover). - It might be possible in certain circumstances to substitute diesel engines with electric motors, thereby resulting in noise reduction. - On-site generators supplying electricity for electric motors should be suitably enclosed and appropriately located. - Noise caused by resonance of body panels and cover plates can be reduced by stiffening with additional ribs or by increasing the damping effect with a surface coating of special resonance damping material. Rattling noises can be controlled by tightening loose parts and by fixing resilient materials between the surfaces in contact; this is generally a maintenance issue. Impact noise during steel construction can be a nuisance. Direct metal-to-metal contact should be minimised.								
Enclosures								
As far as reasonably practicable, sources of significant noise should be enclosed. The extent to which this can be done depends on the nature of the machine or process to be enclosed and their ventilation requirements.								
Use and Siting Equipment								
- Equipment should always be used in accordance with manufacturers' instructions. Where possible, loading and unloading should also be carried out away from such areas. - Machines such as cranes that might be in intermittent use should be shut down between work periods or should be throttled down to a minimum.								

	Severity / Magnitude (M)	Reversibility (R)	Duration	Spatial Extent	Probability	Significance	Nature of Impact		
							+ / -	D / I / C	
- Equipment from which the noise generated is known to be particularly directional should, wherever practicable, be orientated so that the noise is directed away from noise-sensitive areas. - Acoustic covers to engines should be kept closed when the engines are in use and idling. If compressors are used, they should have effective acoustic enclosures and be designed to operate when their access panels are closed. - Materials should be lowered whenever practicable and should not be dropped. The surfaces onto which the materials are being moved should be covered by resilient material.									
Maintenance									
Provide regular and effective maintenance by trained personnel.									
Other									
- Conduct site inductions to cover the importance of noise control and available noise reduction measures. - Establish and enforce site speed limits. - Designate a grievance officer who is able to deal with concerns and establish a complaints response programme (this can form part of the grievance mechanism) to enable the identification and resolution of any noise related concerns at an early stage of the construction operations, as well as throughout the different phases of project development.									
Construction Noise Impacts Post-Mitigation									
Increase in noise potentially disturbing levels at SRs due to construction activities (i.e. site preparation and construction activities)	With Mitigation	1	1	2	2	2	Low	(-)	D

7.6 Typical Noise Management Measures

Based on the construction phase noise impact assessment, the Project noise contributions are unlikely to result in significant impacts. However, in order to minimise the potential impact from the construction phase of the project, key noise control measures have been provided. Best practice construction noise control measures, as they are applicable to the construction phase, are provided to minimise noise from overall constructions activities and should be implemented where possible.

Noise Control Guidelines – Controlling Noise Sources

Relevant construction noise control guidelines from the BS 5228 [8] are provided below.

General Mitigation Measures

- Avoid unnecessary revving of engines and switch off equipment when not required.
- Keep internal access routes well maintained and avoid steep gradients.
- Use rubber linings in, for example, chutes and dumpers to reduce impact noise.
- Minimise drop height of materials.
- Start-up plant and vehicles sequentially rather than all together.
- The movement of plant equipment onto and around the site should have regard to the normal operating hours of the site or surrounding environment.
- Audible reversing warning systems on mobile plant and vehicles should be of a type which, whilst ensuring that they give proper warning, have a minimum noise impact on persons outside sites. When reversing, mobile plant and vehicles should travel in a direction away from sensitive receptors whenever possible. Where practicable, alternative reversing warning systems should be employed to reduce the impact of noise outside sites.

Modification of Equipment

- Noise from equipment can often be reduced by modification or by the application of improved sound reduction methods, but this should only be carried out after consultation with the manufacturer (i.e., fitting a more effective exhaust silencer system or by designing an acoustic canopy to replace the normal engine cover).
- It might be possible in certain circumstances to substitute diesel engines with electric motors, thereby resulting in noise reduction.
- On-site generators supplying electricity for electric motors should be suitably enclosed and appropriately located.
- Noise caused by resonance of body panels and cover plates can be reduced by stiffening with additional ribs or by increasing the damping effect with a surface coating of special resonance damping material. Rattling noises can be controlled by tightening loose parts and by fixing resilient materials between the surfaces in contact; this is generally a maintenance issue. Impact noise during steel construction can be a nuisance. Direct metal-to-metal contact should be minimised.

Enclosures

- As far as reasonably practicable, sources of significant noise should be enclosed. The extent to which this can be done depends on the nature of the machine or process to be enclosed and their ventilation requirements.

Use and Siting Equipment

- Equipment should always be used in accordance with manufacturers' instructions. Where possible, loading and unloading should also be carried out away from such areas.
- Machines such as cranes that might be in intermittent use should be shut down between work periods or should be throttled down to a minimum.
- Equipment from which the noise generated is known to be particularly directional should, wherever practicable, be orientated so that the noise is directed away from noise-sensitive areas.
- Acoustic covers to engines should be kept closed when the engines are in use and idling. If compressors are used, they should have effective acoustic enclosures and be designed to operate when their access panels are closed.
- Materials should be lowered whenever practicable and should not be dropped. The surfaces onto which the materials are being moved should be covered by resilient material.

Maintenance

- Provide regular and effective maintenance by trained personnel.

Other

- Conduct site inductions to cover the importance of noise control and available noise reduction measures.
- Establish and enforce site speed limits.

Designate a grievance officer who is able to deal with concerns and establish a complaints response programme (this can form part of the grievance mechanism) to enable the identification and resolution of any noise related concerns at an early stage of the construction operations, as well as throughout the different phases of project development.

8 Noise Model

In order to estimate the operational noise level, the internationally recognised noise modelling software 'SoundPLAN' was utilised.

The propagation methodology adopted, and the equations used within the SoundPLAN model are based on the ISO 9613 'Acoustics – Attenuation of Sound during Propagation Outdoors' (ISO, 1996) [9]. This document can be referred to for an in-depth description of the methodology SoundPLAN utilises for attenuation of sound and propagation outdoors.

ISO 9613 specifies an engineering method for calculating the attenuation of sound during propagation outdoors in order to predict the levels of environmental noise at a distance from a variety of sources. The method predicts the equivalent continuous L_{Aeq} under meteorological conditions favourable to propagation from sources of known sound emission. The source (or sources) may be moving or stationary and the model takes account of the following physical effects:

- Geometrical divergence.
- Atmospheric absorption.
- Ground effect.
- Reflection from surfaces; and,
- Screening by obstacles.

This method is applicable in practice to a great variety of noise sources and environments. It is applicable, directly or indirectly, to most situations concerning: industrial noise sources, and many other ground-based noise sources. A summary of noise model settings and standards are detailed in Table 8-1.

Table 8-1 – Model Settings

Model Parameter	Parameter Setting / Standard
Calculation Standard	(ISO) 9613 'Acoustics – Attenuation of Sound during Propagation Outdoors' (ISO, 1996)
Ground Absorption Coefficient	0.6
Maximum Order of Reflection	1
Reflection Loss by Obstacles and Barriers	Default: 1 dB
Calculation Grid Size	Project area calculations: 5 m resolution

8.1 Propagation of Sound Outdoors

The variables that affect sound propagation over ground away from a source have been the subject of much detailed investigation over the years. The principal factors influencing sound attenuation with distance from the source are:

- Geometrical spreading (this is the standard spherical wave divergence term which gives 6 dB reduction in noise level for each doubling of distance from point sources e.g. small motor, 3 dB for a line source e.g. piping);
- Source directivity;
- Atmospheric (molecular) absorption;
- Ground effects (different for hard/soft ground, and type of ground cover);
- Atmospheric wind temperature gradients (refraction);
- Source height;
- Atmospheric turbulence; and,
- Barrier effects (diffraction). A brief description of the above is given as follows.

The total attenuation due to all these factors except geometrical spreading and directivity is generally referred to as 'excess attenuation' and will vary with frequency. Because of these effects, a significant noise source may not be significant at, and beyond, the boundary and vice-versa. A noise source dominated by low frequency noise (with a long wavelength) is likely to travel a greater distance under the same excess attenuation factors to that of a noise source dominated with high frequency noise (with a shorter wavelength).

8.2 Meteorological and Ground Conditions

The most influential environmental condition on noise propagation is distance, the greater the distance between the noise source and the receiver the greater the noise reduction achieved. Typically for stationary sources (such as a refinery), a reduction of 6 dB(A) per doubling of distance is considered the norm.

The type of ground cover also influences noise propagation. Soft ground such as sand or agricultural land absorbs sound energy shortening the propagation path whereas hard ground such as compact soil or tarmac reflects the sound energy and thereby noise travels further. It has been assumed for this assessment that the ground cover will be hard.

For noise propagation over short distances, climatic conditions do not have a significant effect, however over longer distance over 50 m wind becomes more influential. Downwind the level may increase by a few dB, depending on wind speed whereas on the upwind or side-wind the level can drop by 10 dB.

Temperature gradients create effects similar to those of wind gradients, except that they are uniform in all directions from the source. On a sunny day with no wind, temperature decreases with altitude, giving a noise shadow. (The result is the noise is taken up and away from the source and the ground). On a clear night, temperature may increase with altitude (temperature inversion) focusing sound towards the ground surface.

8.3 Summary of Modelling Methodology and Key Assumptions

The following sections provide an overview of the modelling methodology and some key assumptions applied to the modelling assessment. Wherever possible, a conservative approach has been taken.

8.3.1 Model Environment:

- Ground absorption has been modelled at 0.6 (approximately 60% soft ground, and 40% hard ground);
- Environmental objects that are deemed to be of significant influence on the screening of noise (including large tanks and buildings) were included in the noise model. Environmental object dimensions were based upon dimensions specified on the plot plans;
- Reasonable worst-case meteorological conditions are implicitly applied in accordance with ISO 9613-2, i.e., steady wind conditions blowing in each direction;
- SRTM1 terrain data was used to calculate the digital ground model (i.e. terrain in the model).

8.3.2 Source Layout and Geometry

- Mobile equipment was modelled in the open pit working areas as discrete sources concentrated in one area of the pit in order to represent a conservative scenario.
- Haul roads and dumping pads were modelled as discrete moving/line-equivalent sources (SoundPLAN road source objects) with speed-dependent corrections.
- Crushing and screening were modelled as discrete sources (e.g., primary crusher, transfer points).
- Processing plant equipment were modelled as aggregated area sources per process area with typical equipment spectra and duty factors.
- Waste rock dump (WRD) and ore stockpile dumping were modelled as discrete sources at active tipping faces;

8.3.3 Equipment and Noise Levels

- Included sources: in-pit operations (drilling, loading, dozing, grading), haulage (pit-to-crusher, to WRD), dumping (ore stockpiles and WRD), primary/secondary crushing, and processing plant (mills, pumps, mixers, transformers).
- No significant noise sources were identified at the Tailings Storage Facility (TSF) and Solar Plant areas. Consequently, no noise sources from these locations were included in the noise model.
- Noise modelling calculations has been carried out for the eight octave bands centred between 63 hertz (Hz) and 8 kilo hertz (kHz);
- Equipment has been modelled at a reasonable worst-case equipment noise level limits or based on the noise levels from the BS5228 and SoundPLAN library.
- Noise emission spectra were taken from the BS 5228, SoundPLAN library or Engineering Noise Control [10].
- The corresponding sound power level has been estimated based on equipment dimensions in accordance with the ISO 3744 standard [11].

- Calculations are as per a steady-state operation with continuous duty cycles.

8.3.4 Noise Assessment

- A single, worst-case scenario was modelled based on the peak mining operations, and the preferred mining layout. Alternatives were assessed qualitatively based on the assessed scenario and expected area of influence.
- Noise contour plots have been generated at a height of 1.5 m.
- Project noise contributions at the identified SR locations have been assessed against the applicable IFC residential, institutional, educational limits of 55 dB(A) and 45 dB(A), or industrial and commercial limits of 70 dB(A) where applicable.
- The potential change in background noise levels at receptors due to project operations were assessed in order to determine an operational impact magnitude.

9 Operations Phase Noise Impact Assessment

9.1 Noise Contour Maps

A series of noise contour maps were produced to illustrate the potential “area of influence” and assess the noise levels within and around the Project study area. Calculations have been carried out under normal operating conditions to determine the level of compliance with environmental standards. The contours are shown below and are as follows:

- Figure A-1 – Mine Area
- Figure A-2 – Surrounding Area

It must be noted that the terrain in the area is expected to influence the propagation of noise around the project site significantly, with the elevated and undulating terrain having a screening effect on the noise propagation.

9.2 Overview of Expected Noise Levels

The noise contour plots for the Project (Figure 9-1 and Figure 9-2) show that noise emissions from the open-pit, haulage and processing areas are localised around the mine footprint. Elevated noise levels (typically >55–60 dB(A)) are confined to the immediate pit and plant area, with noise contours decreasing significantly in extent away from the operational zone.

At the nearest identified SRs, predominantly located along the Orange River corridor to the south of the mine, the modelling indicates that project-related noise levels drop below contour bands (<35 dB(A)). This is primarily due to:

- Large separation distances between the source area and the SRs, resulting in substantial geometric attenuation; and
- Rugged/undulating terrain providing effective acoustic screening.

Overall, the results demonstrate that, under the assessed operating scenario, noise propagation from mining operations are expected to be contained within the mine area, with limited contributions predicted at the nearest SRs and a low potential for significant off-site noise impacts. This is assessed in more detail in the following sections.

Figure 9-1 – Noise Contour: Mine Area

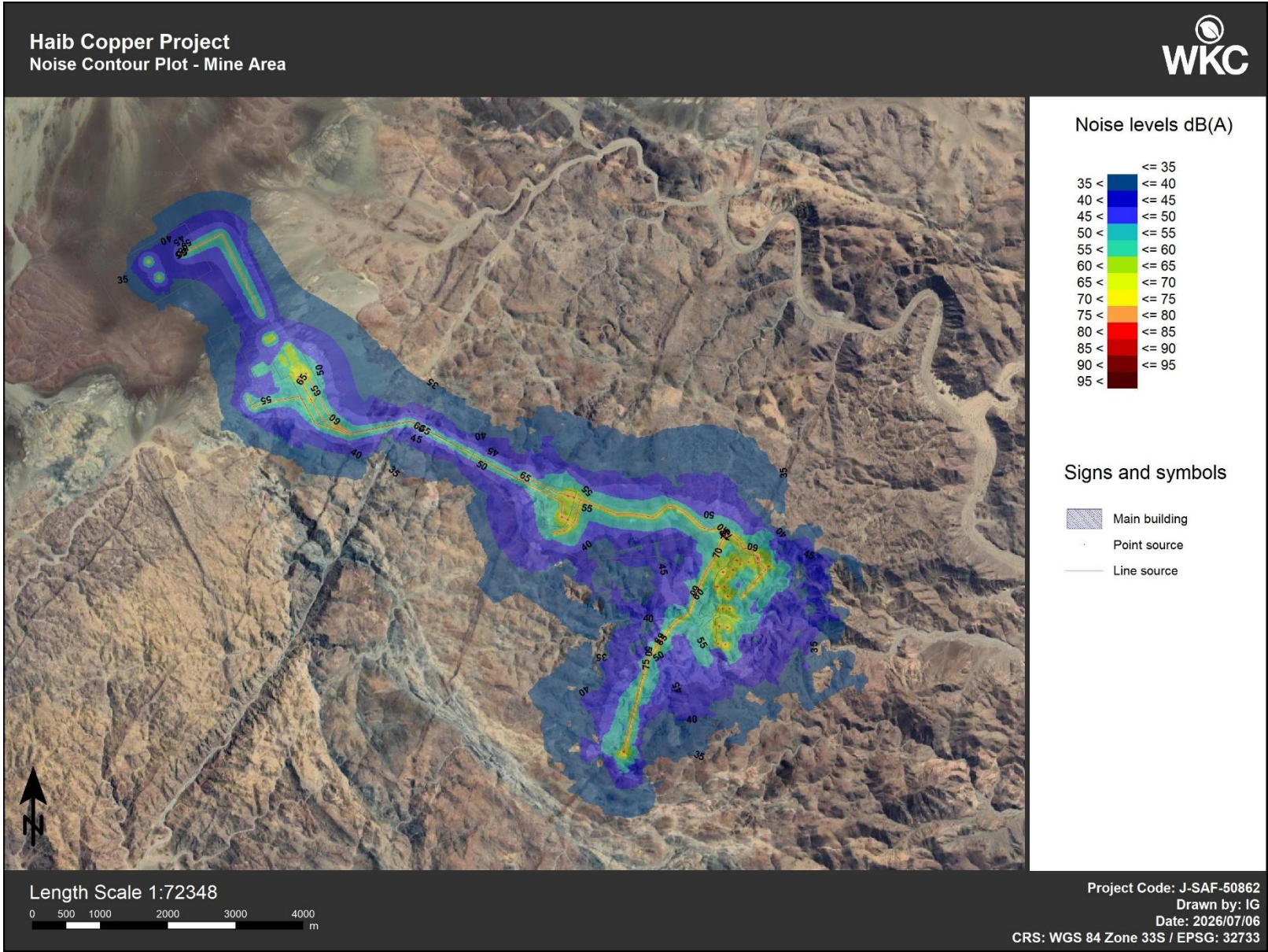
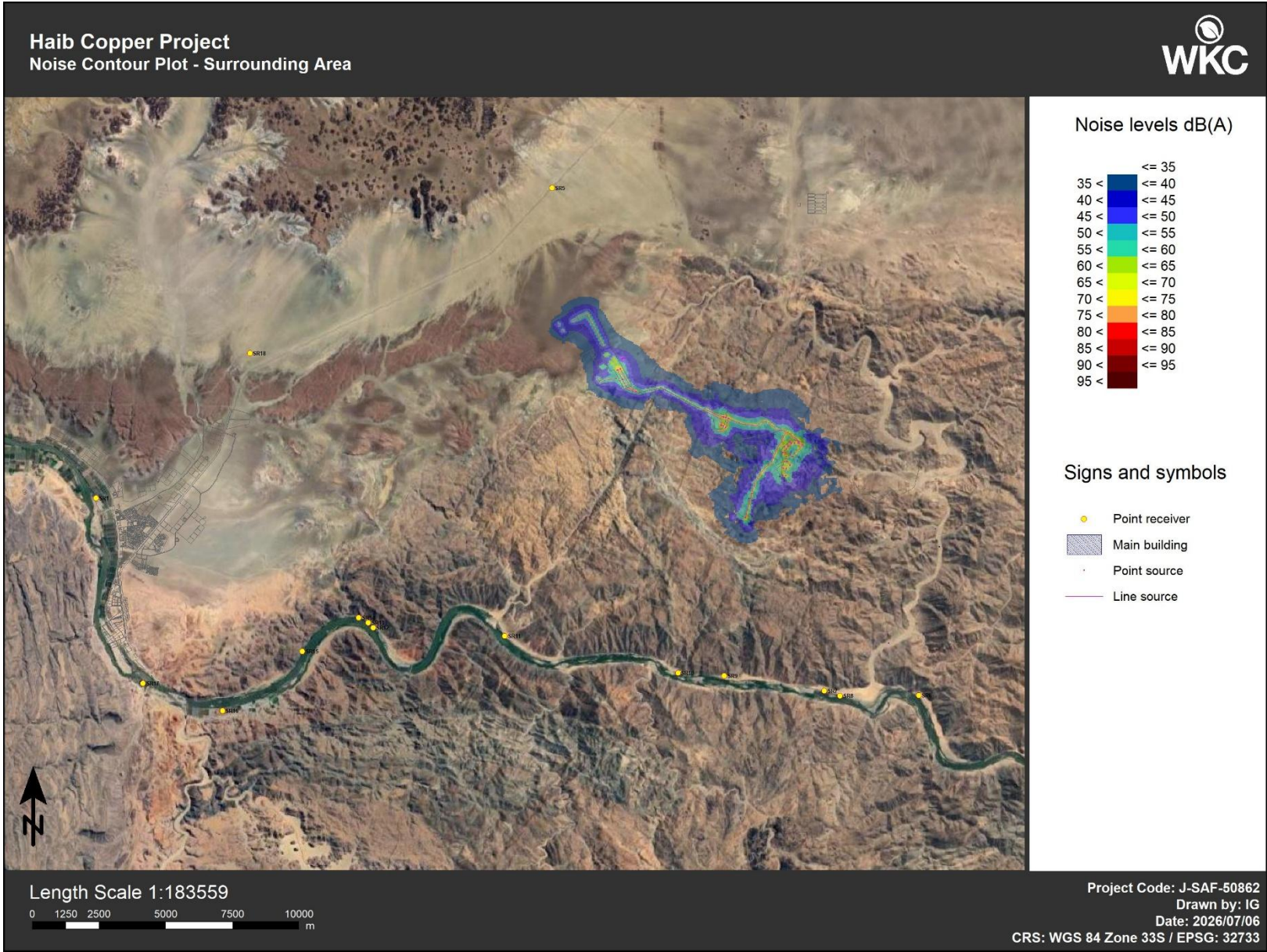


Figure 9-2 – Noise Contour: Surrounding Area



9.3 Sensitive Receptor Assessment

9.3.1 Environmental Noise Assessment (Project Contribution in Isolation)

The noise contributions of the project at the SRs were assessed against the applicable IFC noise limits; the assessment is summarised in Table 9-1 below. The noise modelling results indicate that the Project noise contributions at all SR's are unlikely to exceed the relevant noise limits (55 dB(A) and 45 dB(A)) when assessed in isolation, with maximum contributions from the Project expected to be less than 20 dB(A).

Table 9-1 – Model Results at Sensitive Receptors in Isolation

SR ID	Project Noise Contribution at SR (dB(A))	IFC Daytime Noise Limits (dB(A))	IFC Night-time Noise Limits (dB(A))	Exceedance of Daytime Limit?	Exceedance of Night-time Limit?
SR1	0.0	55	45	No	No
SR2	0.0	55	45	No	No
SR3	0.0	55	45	No	No
SR6	13.2	55	45	No	No
SR7	13.6	55	45	No	No
SR8	14.1	55	45	No	No
SR9	14.3	55	45	No	No
SR10	14.8	55	45	No	No
SR11	14.0	55	45	No	No
SR12	8.8	55	45	No	No
SR13	8.0	55	45	No	No
SR14	7.3	55	45	No	No
SR15	8.2	55	45	No	No
SR16	0.0	55	45	No	No
SR17	3.9	70	70	No	No
SR18	5.4	70	70	No	No
SR19	0.0	55	45	No	No

9.3.2 Cumulative Impact Assessment at Sensitive Receptors

An impact assessment was carried out in order to determine the impact magnitude of the project at the SR's based on the predicted change in ambient noise levels. The results of the assessment of the predicted change in daytime and night-time ambient noise levels are presented in Table 9-2 and Table 9-3 respectively below.

Table 9-2 – Cumulative Noise and Change in Ambient Noise Level Assessment Results (Daytime)

SR ID	Project Noise Contribution at SR (dB(A))	Baseline Noise Level (dB(A))	Cumulative Noise Level (dB(A))	Change in Noise Level (dB(A))	Impact
SR1	0.0	46.3	46.3	0.0	Minor

SR ID	Project Noise Contribution at SR (dB(A))	Baseline Noise Level (dB(A))	Cumulative Noise Level (dB(A))	Change in Noise Level (dB(A))	Impact
SR2	0.0	46.3	46.3	0.0	Minor
SR3	0.0	46.3	46.3	0.0	Minor
SR6	13.2	38.0	38.0	0.0	Minor
SR7	13.6	38.0	38.0	0.0	Minor
SR8	14.1	38.0	38.0	0.0	Minor
SR9	14.3	38.0	38.0	0.0	Minor
SR10	14.8	38.0	38.0	0.0	Minor
SR11	14.0	38.0	38.0	0.0	Minor
SR12	8.8	38.0	38.0	0.0	Minor
SR13	8.0	38.0	38.0	0.0	Minor
SR14	7.3	38.0	38.0	0.0	Minor
SR15	8.2	38.0	38.0	0.0	Minor
SR16	0.0	46.3	46.3	0.0	Minor
SR17	3.9	46.3	46.3	0.0	Minor
SR18	5.4	48.1	48.1	0.0	Minor
SR19	0.0	41.1	41.1	0.0	Minor

Table 9-3 – Cumulative Noise and Change in Ambient Noise Level Assessment Results (Night-time)

SR ID	Project Noise Contribution at SR (dB(A))	Baseline Noise Level (dB(A))	Cumulative Noise Level (dB(A))	Change in Noise Level (dB(A))	Impact
SR1	0.0	52.6	52.6	0.0	Minor
SR2	0.0	52.6	52.6	0.0	Minor
SR3	0.0	52.6	52.6	0.0	Minor
SR6	13.2	30.9	31.0	0.1	Low
SR7	13.6	30.9	31.0	0.1	Low
SR8	14.1	30.9	31.0	0.1	Low
SR9	14.3	30.9	31.0	0.1	Low
SR10	14.8	30.9	31.0	0.1	Low
SR11	14.0	30.9	31.0	0.1	Low
SR12	8.8	30.9	30.9	0.0	Minor
SR13	8.0	30.9	30.9	0.0	Minor
SR14	7.3	30.9	30.9	0.0	Minor
SR15	8.2	30.9	30.9	0.0	Minor
SR16	0.0	52.6	52.6	0.0	Minor

SR ID	Project Noise Contribution at SR (dB(A))	Baseline Noise Level (dB(A))	Cumulative Noise Level (dB(A))	Change in Noise Level (dB(A))	Impact
SR17	3.9	52.6	52.6	0.0	Minor
SR18	5.4	62.6	62.6	0.0	Minor
SR19	0.0	35.9	35.9	0.0	Minor

Based on the cumulative assessment, no change or a negligible change in background noise levels is anticipated at the assessed sensitive receptors due to the low project noise contribution at these locations. These low noise level contributions are expected due to the large distances between the project site and the receptors, as well as some screening afforded by the terrain. Therefore, the impact magnitude for the operations phase of the project is 'Low'.

9.3.3 Determination of Impact Significance

Based on the results of the cumulative assessment the Impact magnitude for the operations phase of the project is '**Low**' which corresponds to a rating of '**2**'. The Reversibility, Duration and Spatial Extent are allocated ratings of '**1**', '**4**' and '**2**' respectively, which leads to a Consequence of '**9**'. A Probability rating of '**2**' results in an Impact Significance of '**Low**'.

Table 9-4 – Operations Phase Impact Assessment Summary

		Severity / Magnitude (M)	Reversibility (R)	Duration	Spatial Extant	Probability	Significance	Nature of Impact	
								+ / -	D / I / C
Operations Impacts									
Operational Noise Impacts Prior to Mitigation									
Increase in noise potentially disturbing levels at SRs due to mining operational activities (i.e. haulage, heavy machinery, processing facilities and utilities)	Without Mitigation	2	1	4	2	2	Low	(-)	D
Recommendations: - A comments and complaints register, accessible to members of public, should be implemented and maintained. Such a register would provide a formal framework within which to record any comments and complaints received, as well as to identify and action appropriate mitigation and/or remediation measures and allow for active dissemination regarding potential operational noise issues. The register should also include a means of recording and communicating the close-out of issues; - Investigate noise complaints immediately and where warranted undertake monitoring and investigate corrective actions; - Preference for low noise equipment during procurement and use of low noise equipment; - All equipment to be maintained in good working order and regularly inspected for unnecessarily loud noise emissions and replaced or repaired in such cases.									
Operational Noise Impacts Post-Mitigation									
Increase in noise potentially disturbing levels at SRs due to mining operational activities (i.e. haulage, heavy machinery, processing facilities and utilities)	With Mitigation	2	1	4	2	2	Low	(-)	D

9.4 Typical Noise Management Measures

Several conservative assumptions were implicit in the modelling study and have resulted in a 'Low' impact significance. Despite the low impact rating a number of mitigation measures have been provided below and should be considered where possible:

- A comments and complaints register, accessible to members of public, should be implemented and maintained. Such a register would provide a formal framework within which to record any comments and complaints received, as well as to identify and action appropriate mitigation and/or remediation measures and allow for active dissemination regarding potential operational noise issues. The register should also include a means of recording and communicating the close-out of issues;
- Investigate noise complaints immediately and where warranted undertake monitoring and investigate corrective actions;
- Preference for low noise equipment during procurement and use of low noise equipment; and,
- All equipment to be maintained in good working order and regularly inspected for unnecessarily loud noise emissions and replaced or repaired in such cases.

10 Conclusion and Recommendations

A noise impact assessment was conducted for the Haib Copper Mine Project to determine the significance of likely operational and construction phase impacts at nearby sensitive receptors.

10.1 Construction Noise Assessment

A construction noise impact assessment was conducted to determine the noise contribution anticipated from the following phases:

- Site preparation, and;
- General construction site activities.

Equipment noise levels for the various construction equipment items were obtained from BS-5228:2014 'Noise and Vibration Control on Construction and Open Sites' [5]. The assessment was used to determine the impact significance based on the impact assessment criteria detailed in Appendix B.

Based on the construction impact assessment, the impact magnitude is predicted to be Minor, corresponding to a rating of '1'. The Reversibility, Duration and Spatial Extent have a rating of '1', '2' and '2' respectively, which results in an overall Consequence of '6'. A Probability rating of '2' results in an Impact Significance of 'Low'.

10.2 Operations Noise Assessment

In order to estimate the operational noise level, the internationally recognised noise modelling software 'SoundPLAN' was utilised for the determination of Project noise contributions at both the Project boundary and offsite sensitive receptors.

10.2.1 Sensitive Receptors Assessment

The operational noise assessment showed that noise contributions from the Project in isolation are not likely to exceed the IFC General EHS Noise Guideline levels for both the daytime and night-time periods, primarily due to the distance between SRs and the mining operational footprint.

Based on the results of the cumulative assessment the Impact magnitude for the operations phase of the project is 'Low' which corresponds to a rating of '2'. The Reversibility, Duration and Spatial Extent are allocated ratings of '1', '4' and '2' respectively, which leads to a Consequence of '9'. A Probability rating of '2' results in an Impact Significance of 'Low'.

11 References

- [1] International Finance Corporation (IFC), “Environmental, Health, and Safety (EHS) Guidelines - Noise Management,” 2007.
- [2] Department of Environmental & Climate Change NSW, Interim Construction Noise Guideline, Sydney, 2009.
- [3] International Organisation for Standardisation (ISO), *ISO1996-1-3 ‘Description and Measurement of Environmental Noise’*, 2003.
- [4] International Organisation for Standardisation (ISO), *ISO9613-2 ‘Acoustics – Attenuation of Sound During Propagation Outdoors’*, 1996.
- [5] British Standards Institute (BSI), BS5228 - Noise and Vibration Control on Construction and Open Sites, London: BSI, 2014.
- [6] International Organisation of Standards (ISO), *ISO 9613-2 Acoustics - Attenuation of Sound During Propagation Outdoors*, International Organisation of Standards (ISO), 1993.
- [7] Institute of Acoustics (IoA), “IEMA/IoA Noise Impact Assessment Guidelines - Update,” IoA, 2005.
- [8] BSI British Standards, *BS 5228: 2009+A1: 2014 Code of practice for noise and vibration control on construction and open sites*, BSI British Standards, 2014.
- [9] “International Organisation for Standardisation (ISO) 9613 ‘Acoustics - Attenuation of Sound During Propagation Outdoors’ (ISO, 1996)”.
- [10] C. Q. Howard, H. C. Hansen and A. D. Bies, “Engineering Noise Control, 5th Edition,” CRC Press, 2017.
- [11] International Organisation for Standardisation (ISO), *ISO 3744:2010 Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Engineering methods for an essentially free field over a reflecting plane*, ISO.

Appendix A – Noise Logbook

No	Equipment Type / Package	Description	Lp at 1m (dB(A))	Lw (dB(A))	Frequency Spectrum Hz (dB(A))								Comment
					63	125	250	500	1k	2k	4k	8k	
1	Conveyors	Conveyor Belts	73.4	78.4	57.7	61.8	69.3	65.7	68.9	69.1	73.9	71.8	Lw/m, Spectrum from SoundPlan Library, Lp from "Analysis and Distribution of Conveyor Belt Noise Sources under Laboratory Conditions, Bortnowski et al, 2021"
2	Mobile Equipment	Haul Truck	86.0	114.5	80.8	95.9	100.4	108.8	109.0	109.2	104.0	94.9	Noise Level and Spectrum from BS5228
3	Mobile Equipment	Hydraulic Face Shovel	85.0	113.3	92.8	97.9	99.4	105.8	108.0	107.2	106.0	96.9	Noise Level and Spectrum from BS5229
4	Mobile Equipment	FEL - Front End Loader	76.0	103.5	83.8	93.9	90.4	97.8	97.0	96.2	95.0	84.9	Noise Level and Spectrum from BS5230
5	Mobile Equipment	Drill Rig	86.0	113.7	86.8	104.9	97.4	103.8	108.0	108.2	105.0	100.9	Noise Level and Spectrum from BS5231
6	Crusher, Grind, Mill	High-Pressure Grinding Rolls (HPGR)	-	105.0	72.0	82.0	89.0	95.0	98.0	99.0	99.0	97.0	Noise Level and Spectrum from BS5232
7	Crusher, Grind, Mill	Primary & Secondary Crushing	-	112.0	79.0	89.0	96.1	102.1	105.0	106.0	106.1	104.0	Noise Level and Spectrum from SoundPLAN Library
8	Crusher, Grind, Mill	Milling	-	112.0	79.0	89.0	96.1	102.1	105.0	106.0	106.1	104.0	Noise Level and Spectrum from SoundPLAN Library
9	Regrind and Cleaner Flotation	- Regrind Milling	-	105.0	72.0	82.0	89.0	95.0	98.0	99.0	99.0	97.0	Noise Level and Spectrum from SoundPLAN Library
10		- Mixer 1	75.0	84.9	49.1	60.2	69.7	75.1	81.3	79.5	75.3	67.2	Assumed Lp 75dB(A) at 1m, Spectrum from ENC Ch11
11		- Mixer 2	75.0	84.9	49.1	60.2	69.7	75.1	81.3	79.5	75.3	67.2	Assumed Lp 75dB(A) at 1m, Spectrum from ENC Ch11
12		- Pump 1	85.0	94.9	59.1	70.2	79.7	85.1	91.3	89.5	85.3	77.2	Assumed Lp 85dB(A) at 1m, Spectrum from ENC Ch11
13		- Pump 2	85.0	94.9	59.1	70.2	79.7	85.1	91.3	89.5	85.3	77.2	Assumed Lp 85dB(A) at 1m, Spectrum from ENC Ch11
14		- Air Compressor	85.0	100.2	66.0	75.1	80.6	86.0	91.2	96.4	95.2	89.1	Assumed Lp 85dB(A) at 1m, Spectrum from ENC Ch11
15	Tailings Thickening and Pump	- Mixer 1	75.0	84.9	49.1	60.2	69.7	75.1	81.3	79.5	75.3	67.2	Assumed Lp 75dB(A) at 1m, Spectrum from ENC Ch11
16		- Mixer 2	75.0	84.9	49.1	60.2	69.7	75.1	81.3	79.5	75.3	67.2	Assumed Lp 75dB(A) at 1m, Spectrum from ENC Ch11
17		- Pump 1	85.0	94.9	59.1	70.2	79.7	85.1	91.3	89.5	85.3	77.2	Assumed Lp 85dB(A) at 1m, Spectrum from ENC Ch11
18		- Pump 2	85.0	94.9	59.1	70.2	79.7	85.1	91.3	89.5	85.3	77.2	Assumed Lp 85dB(A) at 1m, Spectrum from ENC Ch11
19	Concentrate Thickener	- Mixer 1	75.0	84.9	49.1	60.2	69.7	75.1	81.3	79.5	75.3	67.2	Assumed Lp 75dB(A) at 1m, Spectrum from ENC Ch11
20		- Pump 1	85.0	94.9	59.1	70.2	79.7	85.1	91.3	89.5	85.3	77.2	Assumed Lp 85dB(A) at 1m, Spectrum from ENC Ch11
21	Moly Flotation	- Mixer	75.0	84.9	49.1	60.2	69.7	75.1	81.3	79.5	75.3	67.2	Assumed Lp 75dB(A) at 1m, Spectrum from ENC Ch11
22		- Pump	85.0	94.9	59.1	70.2	79.7	85.1	91.3	89.5	85.3	77.2	Assumed Lp 85dB(A) at 1m, Spectrum from ENC Ch11
23		- Air Compressor	85.0	100.2	66.0	75.1	80.6	86.0	91.2	96.4	95.2	89.1	Assumed Lp 85dB(A) at 1m, Spectrum from ENC Ch11
24	Reagent	- Mixer	75.0	84.9	49.1	60.2	69.7	75.1	81.3	79.5	75.3	67.2	Assumed Lp 75dB(A) at 1m, Spectrum from ENC Ch11
25		- Pump	85.0	94.9	59.1	70.2	79.7	85.1	91.3	89.5	85.3	77.2	Assumed Lp 85dB(A) at 1m, Spectrum from ENC Ch11
26		- Air Compressor	85.0	100.2	66.0	75.1	80.6	86.0	91.2	96.4	95.2	89.1	Assumed Lp 85dB(A) at 1m, Spectrum from ENC Ch11
27	Water Treatment	- Pump	85.0	94.9	59.1	70.2	79.7	85.1	91.3	89.5	85.3	77.2	Assumed Lp 85dB(A) at 1m, Spectrum from ENC Ch11
28		- Pump	85.0	94.9	59.1	70.2	79.7	85.1	91.3	89.5	85.3	77.2	Assumed Lp 85dB(A) at 1m, Spectrum from ENC Ch11
29		- Mixer	75.0	84.9	49.1	60.2	69.7	75.1	81.3	79.5	75.3	67.2	Assumed Lp 75dB(A) at 1m, Spectrum from ENC Ch11
30	Power Infrastructure	Transformer	70.0	79.9	56.3	68.4	70.9	76.3	73.5	69.7	64.5	55.4	Lp and Spectrum from ENC Ch11

Appendix B – KP Impact Assessment Criteria

Nature of impact	
Term	Definition
Positive (+)	An impact that is considered to represent an improvement on the baseline or introduces a positive change.
Negative (-)	An impact that is considered to represent an adverse change from the baseline or introduces a new undesirable factor.
Direct impact (D)	Impacts that result from a direct interaction between a planned project activity and the receiving environment/receptors (e.g. between occupation of a site and the pre-existing habitats or between an effluent discharge and receiving water quality).
Indirect impact (I)	Impacts that result from other activities that are encouraged to happen as a consequence of the Project (e.g. in-migration for employment placing a demand on resources).
Cumulative impact (C)	Impacts that act together with other impacts (including those from concurrent or planned future third party activities) to affect the same resources and/or receptors as the Project.

Ranking criteria				
Severity / magnitude (M)	Reversibility (R)	Duration (D)	Spatial extent (S)	Probability (P)
5 – Very high – The impact causes the characteristics of the receiving environment/ social receptor to be altered by a factor of 80 – 100 %	5 – Irreversible – <u>Environmental</u> - where natural functions or ecological processes are altered to the extent that it will permanently cease.	5 – Permanent - Impacts that cause a permanent change in the affected receptor or resource (e.g. removal or destruction of ecological habitat) that endures substantially beyond the Project lifetime.	5 – International - Impacts that affect internationally important resources such as areas protected by international conventions, international waters etc.	5 – Definite - The impact will occur.
	<u>Social</u> - Those affected will not be able to adapt to changes and continue to maintain-pre impact livelihoods.			
4 – High – The impact alters the characteristics of the receiving environment/ social receptor by a factor of 60 – 80 %		4 – Long term - impacts that will continue for the life of the Project, but ceases when the Project stops operating.	4 – National - Impacts that affect nationally important environmental resources or affect an area that is nationally important/ or have macro-economic consequences.	4 – High probability – 80% likelihood that the impact will occur
3 – Moderate – The impact alters the characteristics of the receiving environment/ social receptor by a factor of 40 – 60 %	3 – Recoverable <u>Environmental</u> - where the affected environment is altered but natural functions and ecological processes may continue or recover with human input.	3 – Medium term - Impacts are predicted to be of medium duration (5 – 15 years)	3 – Regional - Impacts that affect regionally important environmental resources or are experienced at a regional scale as determined by administrative boundaries, habitat type/ecosystem.	3 – Medium probability – 60% likelihood that the impact will occur
	<u>Social</u> - Able to adapt with some difficulty and maintain pre-impact livelihoods but only with a degree of support or intervention.			
2 – Low – The impact alters the characteristics of the receiving environment/ social receptor by a factor of 20 – 40 %		2 – Short term - Impacts are predicted to be of short duration (0 – 5 years)	2 – Local - Impacts that affect an area in a radius of 2 km around the site.	2 – Low probability - 40% likelihood that the impact will occur
1 – Minor – The impact causes very little change to the characteristics of the receiving environment/ social receptor and the alteration is less than 20 %	1 – Reversible <u>Environmental</u> - The impact affects the environment in such a way that natural functions and ecological processes are able to regenerate naturally.	1 – Temporary - Impacts are predicted to intermittent/ occasional over a short period.	1 – Site only - Impacts that are limited to the site boundaries.	1 – Improbable - 20% likelihood that the impact will occur
	<u>Social</u> - People/ communities are able to adapt with relative ease and maintain pre-impact livelihoods.			

Consequence (severity + reversibility + duration + spatial scale) x Probability = Significance

Significance		
Score According to Impact Assessment Matrix	Colour Scale Ratings	
	Negative Ratings	Positive Ratings
Between 0 and 29 significance points indicate Low Significance	Low	Low
Between 30 and 59 significance points indicate Moderate Significance	Moderate	Moderate
60 to 100 significance points indicate High Significance	High	High

Appendix C – Independence Declaration

10 July 2026

Re: INDEPENDENCE DECLARATION

I, the undersigned, declare the following in respect to the above-mentioned client:

- I acted as the independent specialist for this assessment
- I have expertise in conducting specialist assessments and reporting relevant to this report, including relevant legislation and any guidelines that have relevance to the proposed activity
- I performed the work relating to the assessment in an objective manner, even if this results in views and findings that are not favourable to the applicant
- I do not hold any financial interest, business and personal relationships or provision of other services, which would impair my independence and objectivity (e.g. shares held by a trust where I am trustee and a beneficiary etc.)
- The fees relating to the specialist work performed is of a fixed nature and are not contingent on the results of your report.
- I acted independently from the above mentioned client during my performance of the specialist services and can confirm that the following threats did not impair my objectivity in performance of the service:
 - Self-interest
 - Advocacy
 - Familiarity
 - Self-review
 - Intimidation

Yours sincerely



Ian Goble

Senior Consultant

For WKC Group (PTY) Ltd