APPENDIX J: NOISE STUDY

Jindal Melmoth Iron Ore Mine

Noise Study Report

SLR Consulting

J21066

Report Approval & Revision Record

Project:	Jindal Melmoth Iron Ore Mine
Document Title:	Noise Study Report
Client:	SLR Consulting
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Rev	Date	Prepared	Reviewed	Approved
01	2022-11-29	Ian Goble Consultant	Ashley Meyer Senior Consultant	Marc Blanche Partner
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Summary of Changes

Rev	Date	Nature of Revision
01	29 November 2022	Original version
02	03 March 2023	Update Based on Comments
03	22 March 2023	Jindal Comments

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Acronyms

CEMP	Construction Environmental Management Plan
DMR EDTEA	Department of Economic Development, Tourism and Environmental Affairs
EAP	Environmental Assessment Practitioner
EMPr	Environment Management Programme
ENC	Engineering Noise Control
EPC	Engineering, Procurement and Construction
ESIA	Environmental and Social Impact Assessment
ha	hectares
I&APs	Interested and Affected Parties
IEMA	Institute of Environmental Management and Assessment
IoA	Institute of Acoustics
ISO	International Organisation for Standardisation
LDV	Light Duty Vehicle
MRA	Mining Right Application
NCR	National Noise Control Regulations
NIA	Noise Impact Assessment
NSW	New South Wales
PP	Public Participation
ROM	Run-of-Mine
SANS	South African National Standard
SLM	sound level meters
SR	Sensitive Receptor
TSF	tailings storage facility
UTM	Universal Transverse Mercator
WKC	WKC Group
WRD	Waste Rock Dump

1 Introduction

1.1 Project Identification Information

SLR Consulting (South Africa) (Pty) Ltd has appointed WKC Group CC (WKC) to undertake a Noise Impact Assessment (NIA) that will form part of the Environmental and Social Impact Assessment (ESIA) being prepared for the proposed Jindal Melmoth Iron Ore Project (hereafter referred to as the "Project"). The ESIA process will be conducted in line with both the National Requirements, and, where applicable, International Requirements. The Project site is located 25 kilometres (km) southeast of Melmoth, within the Mthonjaneni Local Municipality in the KwaZulu-Natal (KZN) Province.

Jindal Iron Ore (Pty) Ltd (Jindal), is owned by Jindal Steel and Power (Mauritius) Limited (74%) and South African partner Mr. Thabang Khomo (Pty) Ltd (26%). Jindal holds two Prospecting Rights over the Project site. The prospecting rights are referred to as North Block (PR 10644) and South Block (PR 10652), with areas of 8,467 hectares (ha) and 11,703 ha, respectively.

This study details the assessments carried out in the south-eastern section of the South Block. The south block lies on the south side of Melmoth with Nkandla Municipality to the southwest and uMlalazi Municipality to the southeast.

Table 1-1 provides the Project identification details.

Table 1-1 – Project Information

Facility Identification	Jindal Melmoth Iron Ore Mine
Ownership	Jindal Iron Ore (Pty) Ltd
Property Description	Rural Residential/Subsistence Farms
Physical Address	North Block: • Reserve No.11 15831 (Ptn 3, 4); and, • Ntembeni 16921. South Block: • Kromdraai 6110; • Black Eyes 13385 (Ptn 1, 2, 3, 4, RE); • Wilderness 6107 (Ptn 3, 4, 5, 6, 7, 8,12, 13, 14, 15, 16); • Goedgeloof 6106 (Ptn 1, 2, 3, RE); • Goedertrow 89 No. 7806; • Reserve No.11 15831; and, • Vergelegen 6104.

Province	KZN
Approximate Coordinates from Site Centre Point	Universal Transverse Mercator (UTM) Co-ordinates: 350,365 m E 6,822,649 m S
Elevation above Mean Sea Level	740 meters (m)
Project Footprint	11,703 ha
Municipality	Mthonjaneni Local Muncipality

1.2 Project Background

In 2013 Jindal appointed Golder Associates Africa (Pty) Ltd. (Golder) as the independent Environmental Assessment Practitioner (EAP) responsible for managing the ESIA and the supporting Public Participation (PP) process. Golder submitted a Final Scoping Report to the Department of Economic Development, Tourism and Environmental Affairs (DMR EDTEA) under both Jindal Iron Ore (for the mining ESIA) and Jindal Processing KZN (for the Processing Plant ESIA) in March 2015.

In June 2015 both Scoping Reports (mining and processing) were returned to Jindal with comments from the EDTEA requesting more clarity on various aspects of the Project, company structure and further engagement with Interested and Affected Parties (I&APs).

In the interim the iron ore price declined from a high of $130 per tonne in January 2014 to a low of $47 per tonne in December 2015. The decline in the iron ore and steel prices worldwide resulted in reduced funding from Jindal for the Project and it was not possible to complete an amended Scoping Report.

In 2019 through 2020 the iron ore price steadily recovered and the first quarter of 2021 averaged $160 per tonne. The improved iron ore price has encouraged Jindal to increase the rate of development of the Melmoth Iron Ore Project.

In January 2021 Jindal appointed SLR Consulting South Africa as the independent EAP to undertake a new ESIA and public participation process and prepare all documentation for a Mining Right Application (MRA). In March 2021, WKC was appointed to undertake the air quality specialist study. This section details the Project activities, the study objectives, and the scope of the modelling study.

1.3 Study Objectives

The key objectives of this study were to evaluate the significance of potential impacts of Project activities on the local environment and sensitive receptors through:

- The conducting of baseline noise measurements in the vicinity of the mine during the day and night;
- The modelling of noise emissions from the mine and its associated operations, and;
- Determining the impacts that these noise emissions will have on ambient noise levels in the vicinity of the proposed mining areas.

Potential noise impacts from the Project have been modelled using SoundPLAN© Version 8.2 and compared to the applicable standards.

1.4 Scope of Modelling Study

This report presents the findings of a noise impact assessment associated with the mining operations of the Jindal Melmoth Iron Ore Project.

2 Project Description

2.1 Project Location

The Project site is located 25 km southeast of Melmoth, within the Mthonjaneni Local Municipality and the King Cetshwayo District Municipality in the KwaZulu-Natal province. The Project location in the context of its local and regional setting is illustrated in Figure 2-1 and Figure 2-2, respectively.

Figure 2-1 – Project Location, Regional Setting

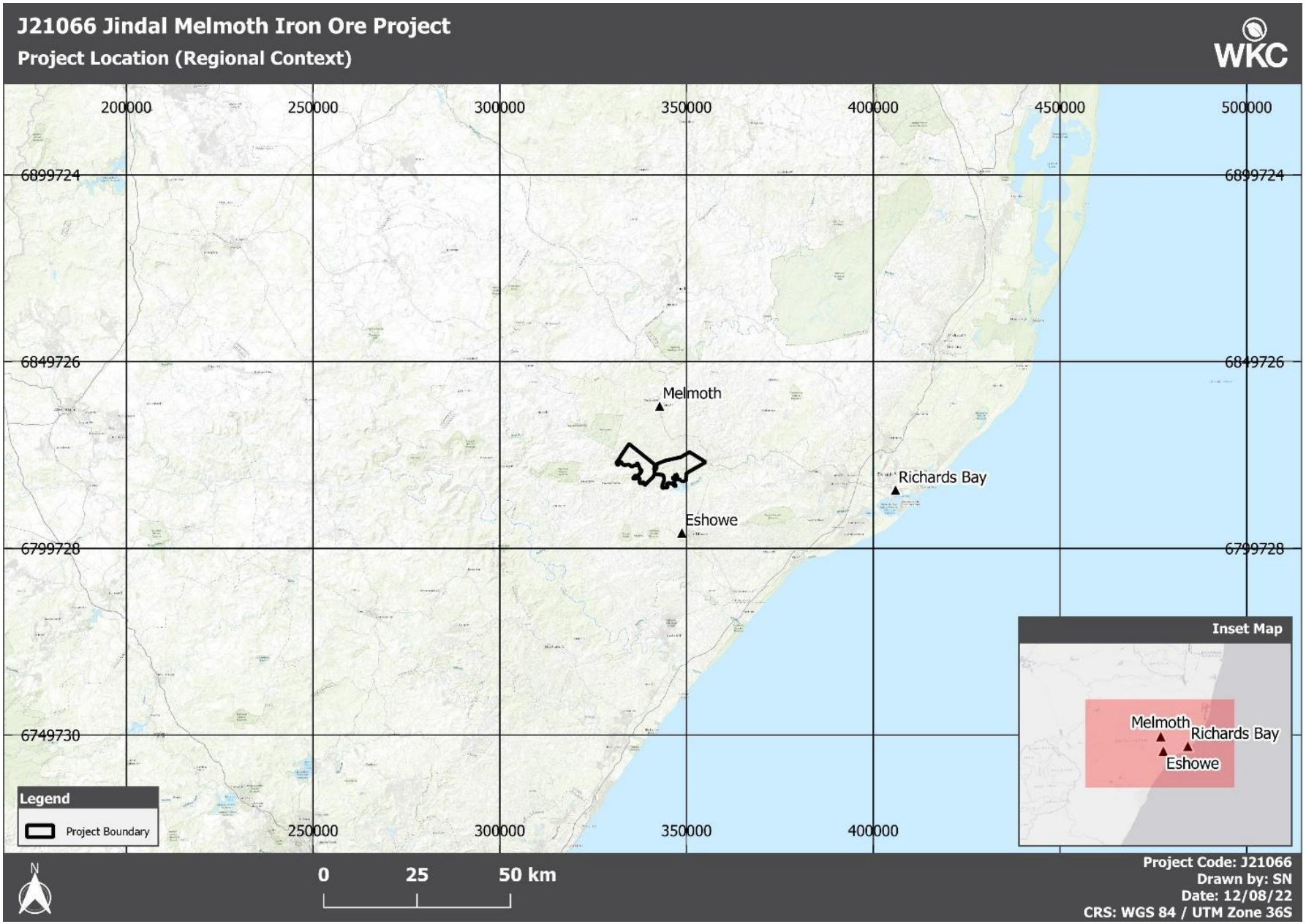
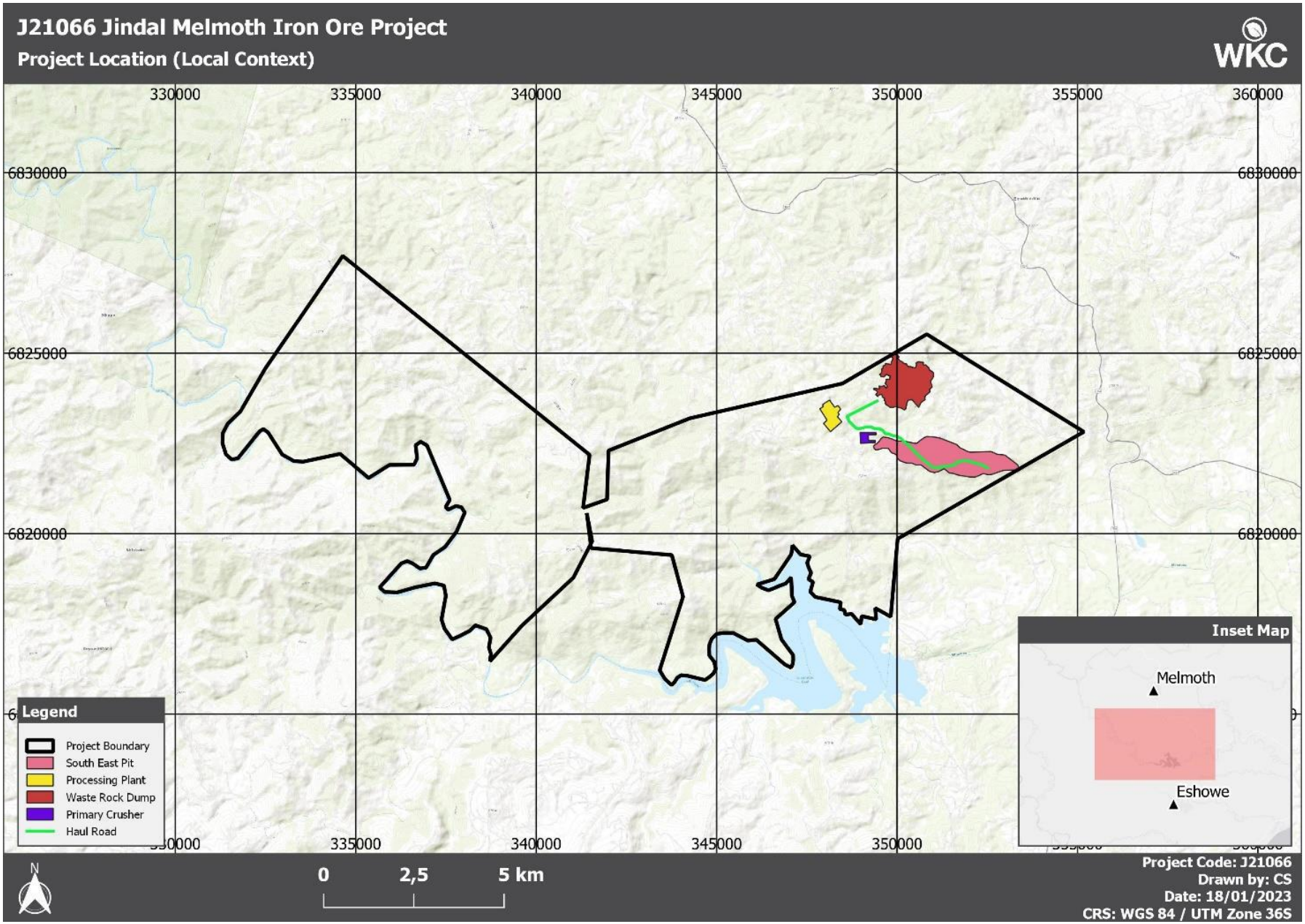


Figure 2-2 – Project Location, Local Setting



2.2 Project Activities

The following activities pertains to the south-eastern section of the South Block, termed the ‘Southeast Pit’. Mining activities will take the form of open pit mining wherein approximately 800 million tonnes of ore are anticipated to be mined from the Southeast pit over a period of approximately 25 years.

Activities can be summarised as follows:

- Stripping of the waste rock from the put will occur at a ratio of approximately 0.5 tonnes of waste rock per 1 tonne of ore;
- Thereafter, the waste rock will be disposed of on a predetermined Waste Rock Dump (WRD) location within the Mining Right Area;
- Excavation of iron ore will be accomplished via drilling and blasting techniques;
- The excavated iron ore will then be loaded onto trucks and transported to the Run-of-Mine (ROM) ore stockpile area where it will be stored and subsequently transferred to the processing plant for milling and magnetic separation; and,
- The processing plant will produce iron ore concentrate (approximately 7.5 mtpa consisting of 67% iron) and a tailings slurry wherein the former will be exported to local markets and the latter will be disposed of to a tailings storage facility (TSF).

3 Regulations and Project Standards

3.1 South African National Standard (SANS) Guidelines

Noise impact assessment and compliance in South Africa is guided by the requirements of the Code of Practice SANS 10328:2003 (Methods for Environmental Noise Impact Assessments) [1] and the noise impact criteria as specified in SANS 10103:2004 (The Measurement and Rating of Environmental Noise with Respect to Annoyance and to Speech Communication) [2]. The measurement procedure prescribed by SANS 10103 [2] is derived from ISO 1996-1-3 (Description and Measurement of Environmental Noise) [3]. SANS 10103 defines the basic quantities to be used for the description of noise in community environments. It also describes the methods for acquisition of data that enable specific noise situations to be checked for compliance with given noise limits. SANS 10103 states that it is highly probable that the noise is annoying or otherwise intrusive to a community, or a group of persons, if the rating level of the ambient noise (including the project noise contribution) exceeds the acceptable levels indicated Table 3-1.The recommended day and night time noise limits for the various land uses described in SANS 10103 [4] is provided in Table 3-2.

Table 3-1 – Recommended Outdoor Noise Limits for Respective Land Uses [4]

Type of District	**Equivalent Continuous Rating Level for Noise (dB(A))**	**Equivalent Continuous Rating Level for Noise (dB(A))**
	Outdoors	**Outdoors**
	Daytime (L_{req},d)	**Night-time (L_{req},n)**
Residential Districts		
Rural	45	35
Suburban (with little road traffic)	50	40
Urban	55	45
Non-Residential		
Urban (some workshops, businesses and main roads)	60	50
Central Business districts	65	55
Industrial Districts	70	60

*Lreq,D is the equivalent continuous rating for daytime noise as defined in the SANS 10103:2004 methodology

Table 3-2 – Day and Night Periods Prescribed by SANS 10103 [4]

Daytime Period	Night-Time Period
06:00 – 22:00	22:00 – 06:00

The noise levels should therefore not exceed the values presented in the table above, however, it should be acknowledged that in many environments the noise levels are already above the proposed guidelines. For the purposes of this assessment, it is assumed that the surrounding land use has been classified as rural residential district given the density of informal residential housing and subsistence farming in the area surrounding the proposed mine operations.

3.2 Noise Control Regulations

The National Noise Control Regulations (NCR) (1992), forming part of the Environmental Conservation Act (Act 73 of 1989), is the primary law on noise in South Africa [5]. The procedures contained in the Noise Control Regulations (NCR) are presented in this report in addition to the SANS 10103 regulations.

3.2.1 Definitions

The NCR defines the relevant terminology (i.e. disturbing noise), which is applicable to the project, as follows:

Disturbing noise *means a noise level which exceeds the zone sound level or, if no zone sound level has been designated, a noise level which exceeds the ambient sound level at the same measuring point by 7 dBA or more.*

3.2.2 Control Procedure

Section 3 General Prohibition of the NCR states that:

3. No Person shall –

c. make changes to existing facilities or existing uses of land or buildings or erect new buildings, if these will house or cause activities that will after such changes or erection, cause a disturbing noise, unless precautionary measures to prevent the disturbing noise have been taken to the satisfaction of the local authority;

Therefore, as changes are being made to the existing land use to facilitate mine operations and as this will result in increases in noise levels in residential areas, adequate noise mitigation measures will have to be put in place.

Section 4 Prohibition of Disturbing Noise of the NCR states that:

No person shall make, produce or cause a disturbing noise, or allow it to be made, produced or caused by any person, machine, device or apparatus or any combination thereof.

A disturbing noise being a noise level greater than the zone sound level as detailed in Section 3.2.1. In the case of this project the zone limit will be defined as the SANS 10103 noise limit for rural residential areas, being 45 dB(A) for daytime and 35 dB(A) for night-time. Therefore, according to the NCR the noise from the project should not exceed noise levels of 45 dB(A) and 35 dB(A) for daytime and night-time respectively.

3.3 ISO 1996-1-3 'Description and Measurement of Environmental Noise'

International Organisation for Standardisation (ISO) 1996-1:2003 'Description and Measurement of Environmental Noise' [6] defines the basic principles to be used for the description of noise in community environments and describes the basic procedures for the determination of these principles. It also describes the methods for acquisition of data that enable specific noise situations to be checked for compliance with given noise limits.

3.4 ISO 9613-2 'Acoustics – Attenuation of Sound during Propagation Outdoors

ISO 9613 Acoustics – Attenuation of Sound During Propagation Outdoors' [7] 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.

SoundPLAN© 8.2 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.

3.5 Calculation of Construction Noise

The calculation of construction noise has been carried out in accordance with British Standard (BS) 5228:2014 'Noise and Vibration Control on Construction and Open Sites' [8]. 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.

3.6 Construction Noise Limits

The construction noise assessment has been carried out in accordance with the SANS noise limits in conjunction with the internationally recognised construction noise guidelines of the Department of Environment and Climate Change New South Wales (NSW) [9], as the SANS do not explicitly prescribe construction noise limits. The NSW construction noise guidelines define a construction noise threshold margin of 10 dB(A) above the background noise levels with a 75 dB(A) upper limit for construction operations during recommended standard hours[1].

A noise level of LAeq 75 decibel (dB) therefore represents the point above which there is 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.

[1] Recommended Standard Hours: Monday to Friday 7 am to 6 pm, Saturday 8 am to 1 pm and no work on Sundays or public holidays.

3.7 Impact Assessment Methodology

3.7.1 Construction Noise Impact Assessment Criteria

The impact assessment criteria, adapted from the joint Institute of Environmental Management and Assessment (IEMA) and the Institute of Acoustics (IoA) guidelines, relating to the contributed noise level from the construction phase are presented in Table 3-3.

Table 3-3 – Construction Noise Impact Magnitude Assessment Criteria

Impact Magnitude	Normal Working Hours (Daytime)	
	Increase in noise level above the construction noise limit	**Description of Impact**
Negligible	0 dB(A)	No Change
Minor	0.1 – 2.9 dB(A) above applicable noise limit	No discernable impact
Moderate	3 – 4.9 dB(A) above applicable noise limit	A marginal increase above the applicable noise limit. Good site practices should be enforced.
Prominent	5 – 10 dB(A) above applicable noise limit	Considerable adverse – Mitigation measure should be implemented
Severe	≥ 10 dB(A) above applicable noise limit OR exceeding the construction noise threshold of 75 dB(A)	Major adverse – Mitigation measure shall be implemented

3.7.2 Operational Noise Impact Assessment Criteria

The criteria for the impact assessment of noise changes arising at noise Sensitive Receptors (SRs) from the operation of the Project have been adapted from the joint Institute of Environmental Management and Assessment (IEMA) and the Institute of Acoustics (IoA) guidelines for noise and vibration impact assessment categories and are given in Table 3-4.

Table 3-4 – Noise Impact Assessment Criteria

Impact Category	Change in Ambient Noise Level	Description of Impact
Negligible	0 dB(A)	No Change
Minor	0.1 – 2.9 dB(A)	Not discernible – Marginal changes in noise levels of less than 3 dB(A) in residential areas, or outdoor recreational areas.
Moderate	3 to 4.9 dB(A)	Noticeable adverse – Noise levels of 3-5 dB(A) in residential areas, or at outdoor recreational areas.
Prominent	5 to <10 dB(A)	Considerable adverse – Noise levels warrant mitigation of residential properties on a widespread basis in a community, or for outdoor recreation areas.
Severe	10 dB(A) or more	Major adverse – Noise increases to a level where continued residential use of individual properties is inappropriate, or where the use of a community building could be inappropriate.

4 Baseline Conditions

4.1 Noise Baseline Monitoring

The baseline noise survey was undertaken in accordance with best practice and SANS 10103 [4]. The measurements were taken at a standard height of 1.5 metres (m) and minimum of 3 m away from any reflecting surfaces for a duration of 48 hours, at each of the established seven monitoring locations.

4.2 Equipment and Calibration

Three class 1 integrating sound level meters (SLMs) (one Cirrus and two Rion SLMs), together with a type 1 field calibrator, was utilised for all measurements. Additional equipment used compromised of a field-free microphone, tripod, anemometer, and microphone windscreen. The selected SLMs automatically logged environmental noise measurement parameters including LA_{eq}, LA_{10}, LA_{90}, L_{Amax} and L_{Amin}.

Each SLM was calibrated 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 SLMs and field calibrator are factory calibrated by the certified bodies on an annual basis. Calibration certificates can be located in Appendix B. Noise measurements were recorded under appropriate weather conditions with any prevailing conditions noted in the measurement field sheet.

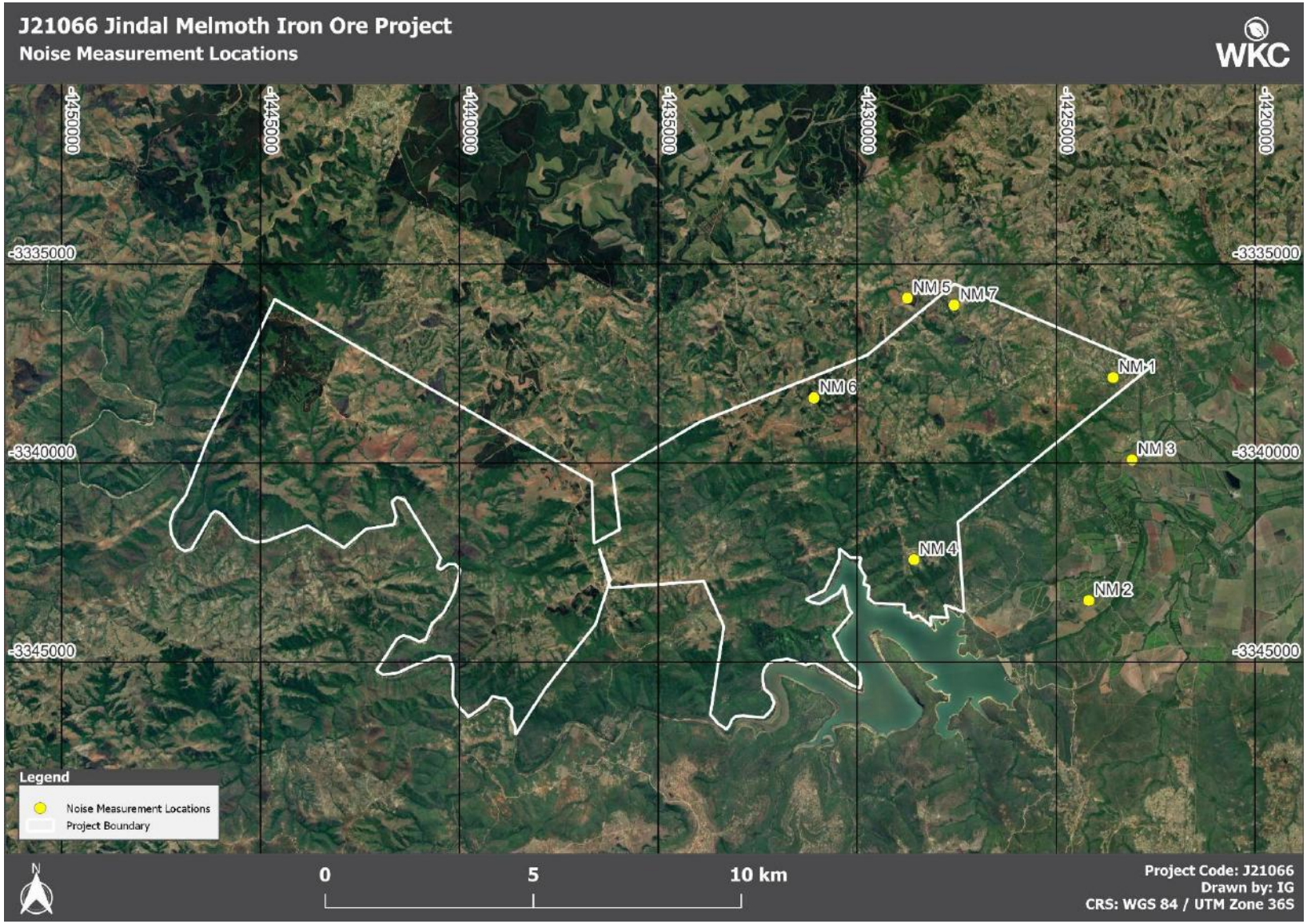
4.3 Noise Monitoring Locations

The baseline noise assessment was conducted from the 17th to 21st November 2021, in order to determine the environmental noise characteristics at several locations of interest in and around the proposed Project area. Details of the measurement locations are summarised in Table 4-1 and the measurement locations are illustrated in Figure 4-1. Visual reference of the equipment set-up at each location can be found in Appendix D. These locations were selected based on site inspection to ensure that the SLMs were deployed in locations that would be representative of the surrounding areas' acoustic environmental conditions.

Table 4-1 – Noise Monitoring Locations and Applicable Noise Limits

Site ID	Site Description	Site Classification	UTM Coordinates		Daytime Applicable Noise Limit [4] (dB(A))	Night-time Applicable Noise Limit [4] (dB(A))
			m E	m S		
NM 1	Chennells Farm – Venture Compound	Rural	354,243	6,822,708	45	35
NM 2	Chennells Farm – Hillcrest 40 Block	Rural	352,830	6,817,505	45	35
NM 3	Siyavuna Primary School	Rural	354,385	6,820,682	45	35
NM 4	Ngobese Homestead	Rural	348,834	6,819,130	45	35
NM 5	Mxosheni Combined School	Rural	349,655	6,825,364	45	35
NM 6	Nogajuka Primary School	Rural	347,065	6,823,343	45	35
NM 7	Mehlamasha Combined School	Rural	350,738	6,825,024	45	35

Figure 4-1 – Noise Measurement Location



4.4 Survey Timing, Frequency and Duration

The following measurements were taken at each location identified above in the noise monitoring location section. Table 4-2 summarises the measurement timing and duration including the date, start time and end time.

Table 4-2 – November 2021 Survey Timing and Schedule

Site ID	Site Description	48-Hour Measurements			
		Start Date	Start Time	End Date	End Time
NM 1	Chennells Farm – Venture Compound	15/11/2021	09:40	17/11/2021	09:41
NM 2	Chennells Farm – Hillcrest 40 Block	15/11/2021	10:12	17/11/2021	10:12
NM 3	Siyavuna Primary School	15/11/2021	11:09	17/11/2021	11:09
NM 4	Ngobese Homestead	17/11/2021	11:51	19/11/2021	11:51
NM 5	Mxosheni Combined School	17/11/2021	12:21	19/11/2021	12:21
NM 6	Nogajuka Primary School	17/11/2021	13:29	19/11/2021	13:30
NM 7	Mehlamasha Combined School	19/11/2021	16:57	21/11/2021	17:13

4.5 Results and Analysis

The ambient noise measurements recorded at all locations during the daytime and night-time periods are summarised below in Table 4-3 and Table 4-4, respectively.

Table 4-3 – Ambient Noise Survey Results: Daytime Noise Levels

Site ID	Site Description	Land Use Type	SANS Noise Limit [4] (dB(A))	Recorded Noise Level (dB(A))	Noise Level Exceeded?
NM 1	Chennells Farm – Venture Compound	Rural	45	49.4	Yes
NM 2	Chennells Farm – Hillcrest 40 Block	Rural	45	49.6	Yes
NM 3	Siyavuna Primary School	Rural	45	52.1	Yes
NM 4	Ngobese Homestead	Rural	45	48.1	Yes
NM 5	Mxosheni Combined School	Rural	45	56.7	Yes
NM 6	Nogajuka Primary School	Rural	45	51.8	Yes
NM 7	Mehlamasha Combined School	Rural	45	40.3	No

Table 4-4 – Ambient Noise Survey Results: Night-time Noise Levels

Site ID	Site Description	Land Use Type	SANS Noise Limit [4] (dB(A))	Recorded Noise Level (dB(A))	Noise Level Exceeded?
NM 1	Chennells Farm – Venture Compound	Rural	35	46.3	Yes
NM 2	Chennells Farm – Hillcrest 40 Block	Rural	35	46.9	Yes

Site ID	Site Description	Land Use Type	SANS Noise Limit [4] (dB(A))	Recorded Noise Level (dB(A))	Noise Level Exceeded?
NM 3	Siyavuna Primary School	Rural	35	48.5	Yes
NM 4	Ngobese Homestead	Rural	35	44.2	Yes
NM 5	Mxosheni Combined School	Rural	35	52.8	Yes
NM 6	Nogajuka Primary School	Rural	35	45.9	Yes
NM 7	Mehlamasha Combined School	Rural	35	37.1	Yes

As it can be seen from the results of the baseline monitoring presented above, all the daytime and night-time recorded noise measurements were above the relevant SANS 10103 [4] limit values prescribed for rural land use types with the exception of the recorded daytime noise level of 40.3 dB(A) at noise monitoring location NM 7, which was found to be in compliance with the daytime limit of 45 dB(A). Based on the results of the measurements the average daytime noise level is 51.7 dB(A) and the average night-time noise level is 47.8 dB(A).

Table 4-5 summarises the description of the noise sources within the respective measurement locations.

Table 4-5 – Description of Noise Sources at Measurement Locations

Site ID	Site Description	Description of Noise Source
NM 1	Chennells Farm – Venture Compound	Cirrus SLM deployed in the Venture Compound. The Chennells New Venture Farm is a working citrus farm. A few residential dwellings observed are inhabited by farm employees. Noise sources noted include: • Driven machinery (tractors and other associated machinery), Light Duty Vehicle (LDV), motorcycles; • Hooting and reverse sirens may also be presented on an intermittent basis; • Chickens, goats, birds and sun beetles; • People talking and children playing are also anticipated within the compound area; and, • The weather, in particular, the wind, would have resulted in noise from rustling leaves etc.
NM 2	Chennells Farm – Hillcrest 40 Block	Rion SLM deployed at the Hillcrest / 40 Block. The Chennells New Venture farm is a working citrus farm. An irrigation holding dam was observed, with associated pump house and few residential dwellings for farm employees. The unit was deployed behind the compound dwelling to eliminate possible noise contribution from the pump house. Noise sources noted include: • Driven machinery (tractors and other associated machinery), LDV, motorcycles; • Hooting and reverse sirens may also be presented on an intermittent basis; • Chickens, goats, birds and sun beetles; • People talking and children playing are also anticipated within the compound area; and, • The weather, in particular, the wind, would have resulted in noise from rustling leaves etc.
NM 3	Siyavuna Primary School	Rion SLM deployed on the Liquefied Petroleum Gas cage to avoid tampering by school children. Noise sources include:

Site ID	Site Description	Description of Noise Source
		• Children talking, shouting, singing (general play), adults talking, and general noise from nearby classrooms; • Noise from neighbours; • Chickens (including roosters growing), goats, birds and sun beetles include nature sounds; and, • Vehicles passing on the gravel road ion the distance.
NM 4	Ngobese Homestead	Rion SLM deployed adjacent to a homestead. Noise sources noted include: • Dogs barking, chickens and roosters crowing, goats, cattle, sun beetles; • Kids talking and shouting, people talking and shouting; and, • Vehicles passing on the adjacent gravel road.
NM 5	Mxosheni Combined School	Rion SLM deployed on the water storage tank stand, to avoid tampering by school children. Noise sources include: • Children talking, shouting, singing, and general play; • Vehicles passing on the adjacent gravel road; and, • Goats, dogs barking and distant roosters crowing.
NM 6	Nogajuka Primary School	Cirrus SLM deployed on the water storage tank structure to avoid tampering by school children. Primary noise sources include: • Children talking, shouting, singing and general play; • Vehicles passing on the adjacent gravel road; • Distant dogs barking; and, • Chainsaw activity in the distance, with log loading and offloading operations and activities occurring at a nearby plot.
NM 7	Mehlamasha Combined School	Cirrus SLM deployed at the school, along one of the walkways to avoid excessive exposure to rain. Noise sources noted include: • The school was closed over the weekend; however, a religious gathering occurred on the Sunday morning; • Goats, roosters, dogs barking, and sun beetles were noted; and, • Vehicle activity in the area was also noted.

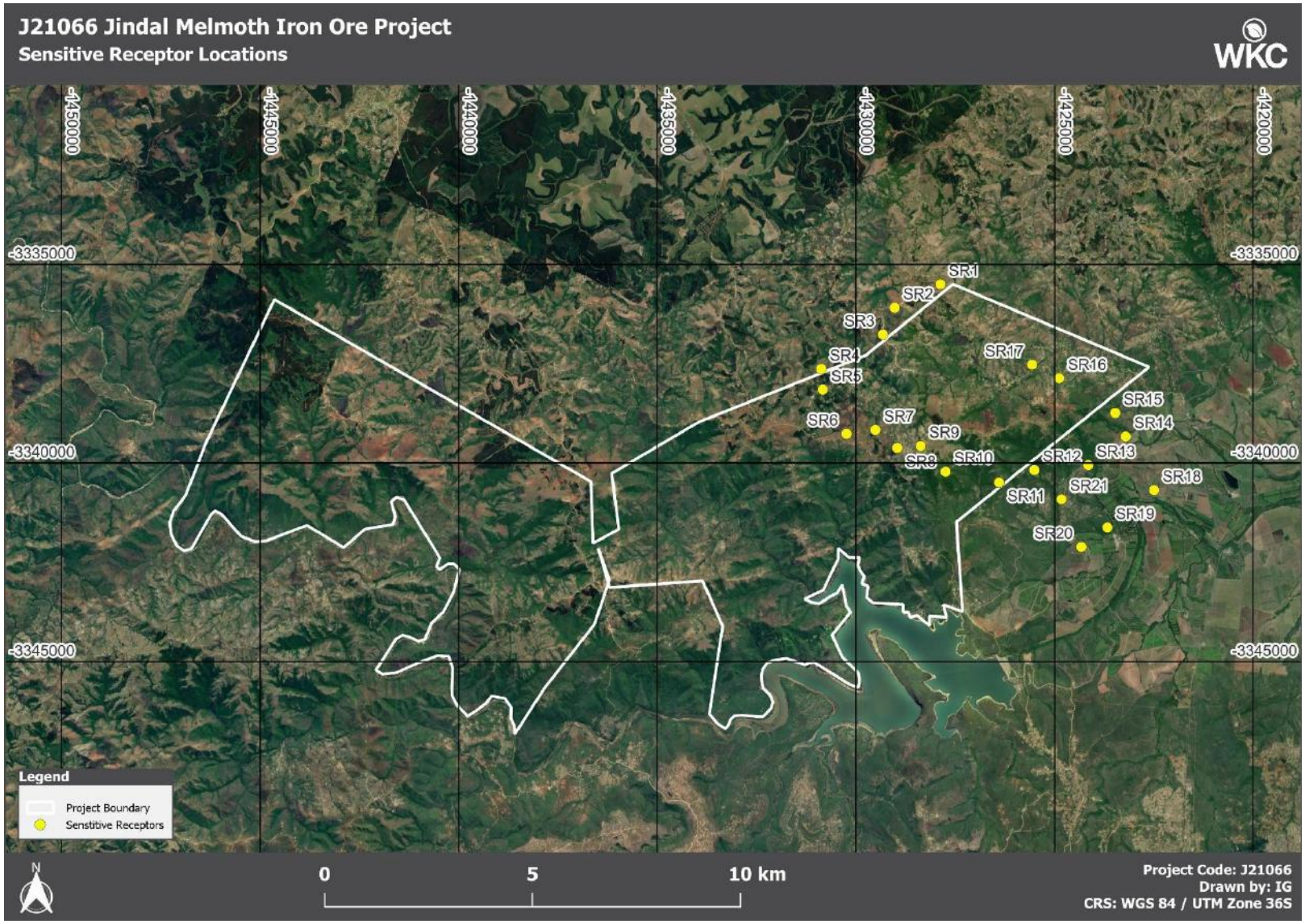
5 Noise Sensitive Receptors

Sensitive receptors have been identified within and around the mining area and were included in the assessment to determine the potential impact to areas of high receptor sensitivity. The sensitive receptors are listed below in Table 5-1 and are presented in Figure 5-1.

Table 5-1 – Sensitive Receptors

Site ID	Site Description	SANS Zone Classification	SANS Noise Limit dB(A)		UTM Coordinates	
			Day	Night	m E	m N
SR 1	Community House	Rural	45	35	350,520	6,825,570
SR 2	Community House	Rural	45	35	349,352	6,825,184
SR 3	Community House	Rural	45	35	348,972	6,824,590
SR 4	Community House	Rural	45	35	347,376	6,824,004
SR 5	Community House	Rural	45	35	347,335	6,823,502
SR 6	Community House	Rural	45	35	347,736	6,822,365
SR 7	Community House	Rural	45	35	348,433	6,822,352
SR 8	Community House	Rural	45	35	348,890	6,821,841
SR 9	Community House	Rural	45	35	349,455	6,821,798
SR 10	Community House	Rural	45	35	349,949	6,821,097
SR 11	Community House	Rural	45	35	351,180	6,820,644
SR 12	Community House	Rural	45	35	352,064	6,820,804
SR 13	Community House	Rural	45	35	353,367	6,820,720
SR 14	Farmland	Rural	45	35	354,363	6,821,255
SR 15	Community House	Rural	45	35	354,204	6,821,858
SR 16	Community House	Rural	45	35	352,998	6,822,891
SR 17	Community House	Rural	45	35	352,405	6,823,312
SR 18	Farmland	Rural	45	35	354,840	6,819,875
SR 19	Farmland	Rural	45	35	353,588	6,819,160
SR 20	Farmland	Rural	45	35	352,896	6,818,795
SR 21	Community House	Rural	45	35	352,603	6,820,002

Figure 5-1 – Sensitive Receptors



6 Construction Assessment

Construction activities for the project are to be conducted during the day (daytime period as per SANS is 06:00 – 22:00) therefore, this study will assess the construction noise against daytime construction noise limits only.

Noise emissions will be generated from equipment used during the construction of the Project facilities (Processing Plant and Crushing Area). The following activities are anticipated to lead to noise emissions during the construction phase:

- Earth-moving operations (associated with land clearing and site preparation); and,
- Construction and delivery vehicle emissions (diesel powered equipment, cranes and trucks).

An assessment of predicted noise emissions from construction activities in the area surrounding the proposed Project was carried out in accordance with BS5228 [8].

6.1 Equipment Inventory

The construction equipment list was approved by the Client and is detailed in Table 6-1 below. The table gives the total number of equipment items along with the representative equipment noise levels from the BS 5228 construction equipment noise tables and SoundPLAN library.

Table 6-1 – Construction Equipment Inventory

No.	Equipment Item	Total No. of Units	Sound Pressure Level @ 10 m, LA_{eq} (dB)	Reference
1	Concrete Pavers	1	83	SoundPLAN Library
2	Rollers	1	73	BS5228 C.2, Ref No. 37
3	Scrapers	1	95	BS5228 D.9, Ref No. 12
4	Trenchers	1	77	BS5228 C.4, Ref No. 63
5	Excavators	2	77	BS5228 C.4, Ref No. 63
6	Cement and Mortar Mixers	1	76	BS5228 D.5, Ref No. 7
7	Cranes	2	77	BS5228 C.4, Ref No. 49
8	Graders	2	86	BS5228 C.6, Ref No. 31
9	Off-highway Trucks	10	86	BS5228 C.6, Ref No. 24
10	Rubber Tyred Loaders	2	76	BS5228 C.6, Ref No. 34

No.	Equipment Item	Total No. of Units	Sound Pressure Level @ 10 m, LA_{eq} (dB)	Reference
11	Rubber Tyred Dozers	6	75	BS5228 C.2, Ref No. 1
12	Tractors/Loaders/Backhoes	2	68	BS5228 C.2, Ref No. 8
13	Skid Steer Loaders	1	79	BS5228 C.2, Ref No. 26
14	Off-highway Tractors	1	79	BS5228 C.4, Ref No. 74
15	Dumpers/Tenders	2	80	BS5228 C.2, Ref No. 11
16	Other Construction Equipment	10	60	SoundPLAN Library
17	Welders <50hp	2	73	BS5228 C.3, Ref No. 11
18	Forklifts	1	88	BS5228 D.7, Ref No. 12
19	4 x 4 Petrol	3	44	SoundPLAN Library
20	4 x 4 Diesel	3	44	SoundPLAN Library

6.2 Assumptions

The following assumptions were applied when conducting the construction phase impact assessment:

- To represent a conservative worst-case scenario, construction activities occur at the plant boundary nearest to the receptor;
- Partial screening adjustment was considered;
- Reflection adjustment was considered;
- All equipment was assumed to be operating for 100% of the construction hours (daytime only); and,
- A single occurrence of each item in the inventory is assumed to be operating at a single location.

6.3 Construction Noise Impact Assessment

The construction noise levels have been calculated in accordance with BS5228:2014 [8] and have been assessed in terms of the assessment criteria detailed in Section 3.7.1.

It is not possible to identify an exact location from which to measure the edge of the construction site, as a result, construction noise was assessed by assuming construction occurs at the plant boundary nearest to the closest receptor. The construction site boundary adopted for the assessment is limited to the perimeter of the plant boundary. To represent a conservative worst-case scenario, a single incidence of each equipment item detailed in the inventory has been assumed to be operating concurrently at a single location.

The impact of the noise from construction activities will be assessed at the closest Sensitive Receptor (SR5) as this would represent the worst-case impact. Based on the noise measurement closest to SR5 a representative baseline noise level of 51.8 dB(A) has been used, therefore the noise limit at this location based on the NSW criteria would be 61.8dB(A).

The predicted noise levels in the area surrounding the Project site are detailed in Table 6-2 and have been evaluated against the standards detailed in Section 3. Table 6-2 presents the predicted noise levels at specific intervals from 50 m to 1,000 m.

Table 6-2 – Predicted Construction Noise Emissions Surrounding the Project Site

Distance from boundary	Construction Noise	Noise Limit at SR5 dB(A), L_{10}	Exceedance of Noise Limit?
m	dB(A)	dB(A)	
50	83.3	61.8	Yes
100	77.2		Yes
150	73.7		Yes
200	71.2		Yes
250	69.3		Yes
500	63.3		Yes
600	61.7		No
1000	57.2		No

The predicted noise levels generated by the construction activities are expected to be below the noise limit of 61.8 dB(A) at distances greater than 600 m from the Project boundary.

The area around the project site is made up of rural residences. Construction will take place at the processing plant and crushing area with the closest sensitive receptor to these areas being approximately 533 m away. The noise level at this location is calculated to be 62.7 dB(A), exceeding the noise limit by 1.1dB(A). Based on the construction noise assessment, the construction noise level contributions at the nearest sensitive receptors are expected to be 0.9dB(A) above 61.8 dB(A) and therefore Minor impacts associated with construction noise are anticipated.

It should be noted that the calculated construction noise levels represent a conservative worst-case scenario, where a single occurrence of each item in the general construction equipment list has been assumed to be operating concurrently at a single location closest to the receptor. Furthermore, construction activities and associated noise levels will be temporary as construction noise activities are transient and temporary in nature. Based on the results of the assessment it is recommended that noise control measures be implemented, as outlined in the following section in order to minimise construction noise where possible.

6.3.1 Potential Mitigation Measures for Construction Noise

Noise and vibration from construction activities can be controlled through the Health, Safety and Environmental (HSE) Management Plans and the Environment Management Programme (EMPr). The following general mitigation measures should be considered and commitments should incorporated into the relevant plans:

- Site inductions to cover the importance of noise control and available noise reduction measures.
- Construction contractors should be required to use equipment that is in good working order, is properly maintained according to the equipment's manufacturer requirements and that meets current best practice noise emission levels. This should be achieved by making it a component of contractual agreements with the construction contractors.

- 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 machines to be enclosed and their ventilation requirements.
- Construction site speed limits should be established and enforced during the construction period, typical speed limits are 40km/hr on paved site roads and 20km/hr on unpaved haul routes.
- A gradual start to noisy activities and as far as it is feasible, establish a schedule for noisy activities to reduce overlapping of works.
- The on-site construction supervisor should have the responsibility and authority to receive and resolve noise complaints (this can be part of the grievance mechanism). A clear appeal process to the owner should be established prior to construction commencement that will allow for resolution of noise problems that cannot be immediately solved by the site supervisor.
- The Engineering, Procurement and Construction (EPC) contractor should develop a Project Construction Noise Control Plan, which should be approved and implemented prior to commencement of any construction activity.
- Implement a community complaints and grievance procedure.
- Contract incentives may be offered to the construction contractor to minimise or eliminate noise complaints resulting from Project activities where Project construction would result in significant noise impacts.

6.4 Impact Significance Table – Construction

Based on the results of the construction assessment the impact significance can be determined and is shown in the figure below.

Table 6-3 – Construction Phase Impact Significance

Increase in Noise Levels at SR's due to Construction phase		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Minor change (Low)	Negligible change (Very low)
Duration	Very Short-term (< 1 year)	Very Short-term (< 1 year)
Extent	Beyond site	Beyond site
Consequence	Low	Very low
Probability	Probable	Probable
Significance	**Low -**	**Very low -**
Degree to which impact can be reversed	*fully reversable: Once the construction is complete the source of the impact will be gone*	

Degree to which impact may cause irreplaceable loss of resources	*None*	
Degree to which impact can be avoided	*Medium: Exceedances of the limits may be able to be avoided should good site practice be followed and mitigations implemented.*	
Degree to which impact can be mitigated	*Medium: Impacts can be mitigated to a medium degree although due to the nature of construction some impacts may be experienced despite careful consideration of mitigation measures*	
Cumulative impact		
Nature of cumulative impacts	*Slight increase in noise levels above baseline*	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Insignificant	Insignificant
Residual impact		
Residual impact discussion	*None*	

7 Operational Noise Impact Assessment

The following section details the assessment of the operations phase of the Project including the project noise sources considered, the assessment methodology followed, and the impact assessment results.

7.1 Project Noise Sources

As no formal equipment list was available at the time of modelling, an equipment list was developed based on the available equipment documentation[2]. The following equipment items were identified as major noise emitting sources for the Project as provided in the above-mentioned documents. A total of 162 equipment items across 13 equipment categories were included in the noise model as listed below:

- Agitators;
- Breakers;
- Compressors;
- Conveyors;
- Crushers;
- Feeders;
- Mills;
- Mobile Mine Equipment;
- Packages;
- Pumps;
- Samplers;
- Screens; and,
- Thickeners.

[2] The equipment list was based on two documents including *Amec Equipment List* and *Amec Opex Details Power etc* as provided by Jindal. The equipment list was approved by Jindal prior to modelling.

A detailed noise logbook including all the sources considered in the study and their associated modelling parameters is provided in Appendix A.

7.2 Equipment Noise Levels

Where technical data was available for equipment items (eg. kW ratings) Noise levels for equipment were calculated using Engineering Noise Control (ENC) [10].

Noise levels for various equipment items were also determined from various resources such as BS 5228 and SoundPLAN's noise emission library. Where no noise level could be determined from any of these sources a conservative noise level of 85 dB(A) at 1m was used. Details of the method used per equipment item can be seen in the noise log in Appendix A.

Noise Spectrums for equipment items were either determined based on ENC or the SoundPLAN emission library which comprises of a collection of international databases, was used to calculate and apply an appropriate 1/1 octave spectrum profile from 63 Hz to 8000 Hz for each equipment type. In the absence of any data a central frequency at 500Hz was used.

7.3 Noise Model

In order to estimate the operational noise levels, the internationally recognised noise modelling software SoundPLAN© 8.1 has been utilised.

The propagation methodology adopted within the SoundPLAN© model is the ISO 9613 'Acoustics – Attenuation of Sound during Propagation Outdoors' (ISO, 1996) [7]. 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 L_{Aeq} under meteorological conditions favourable to propagation from sources of known sound emission. The source/s may be moving or stationary and 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, road, construction activities, and many other ground-based noise sources.

7.4 Propagation of Sound

The variables which 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 source 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).

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. For example, 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).

7.5 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, 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 conservatively assumed for this assessment that the ground cover will be partially hard with an associated absorption coefficient of 0.6.

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.

7.6 Modelling Assumptions

The following assumptions have been made for the modelling assessment, and wherever possible, a conservative approach has been taken:

- Normal operations have been modelled;
- Equipment list was derived from the following documents "Amec Equipment List" and "Amec Opex Details Power etc.";

- 100% of equipment items have been assumed to be operating at any given point in time to ensure a conservative assessment;
- All noisy equipment operating in the processing plant area will be enclosed within a building, therefore transmission loss has been applied to the overall sound power level;
- All modelled equipment sound power levels were summed to establish total sound power levels for each of the areas (South East Pit, Crusher, Processing Plant and Waste Rock Dump). The resulting sound power level was spread across the various operational footprint areas. Therefore, all equipment has been modelled as aggregated areas sources with the exception of haul routes, haul routes / trucks were modelled as moving points sources and the access road has been modelled as a road source;
- Truck traffic noise along routes for hauling to the processing plant and waste rock dump were modelled as moving points sources based on the number of trips per hour;
- All equipment items have had spectrum and noise levels applied based on the SoundPLAN Library, BS5228 [8] or ENC [10];
- Terrain contours were included in the model from USGS Earth Open source library;
- All sources across the areas have been modelled at surface level in-line with a worst-case operating scenario;
- The model does not incorporate features which might provide partial screening (e.g., columns, pipe racks, structural steelwork, small equipment, overburden dumps, topsoil berms, pit bench walls etc.);
- Ground absorption has been modelled as medium ground (having an absorption coefficient of 0.6) to maintain a conservative assessment;
- Transmission loss for “sheet-steel, trapeze profile” was applied to the Operation Plant noise level, with and Rw = 25dB;
- Reasonable worst-case meteorological conditions have been applied, i.e. steady wind conditions blowing in each direction.

7.7 Operational Noise Model Assessment

A series of noise contour maps have been produced to depict predicted 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 7-1: Overall Project Area – Daytime; and,
- Figure 7-2: Overall Project Area – Night-time.

It must be noted that the terrain in the area has influenced the propagation of noise levels around the project site, this is evident when looking at the area south of the project area where elevated terrain has had a screening effect on the noise propagation.

Figure 7-1 – Overall Project Area – Daytime

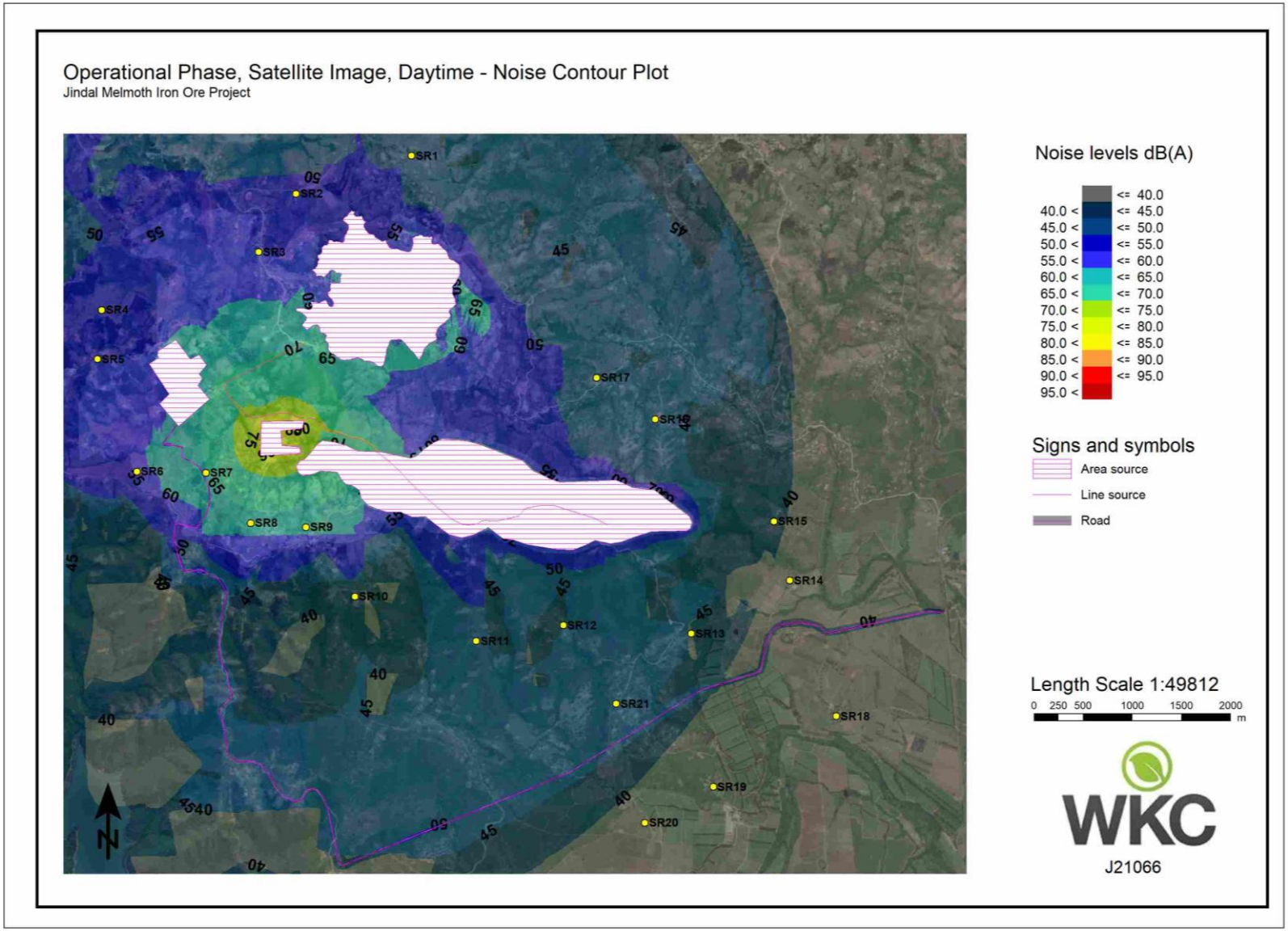
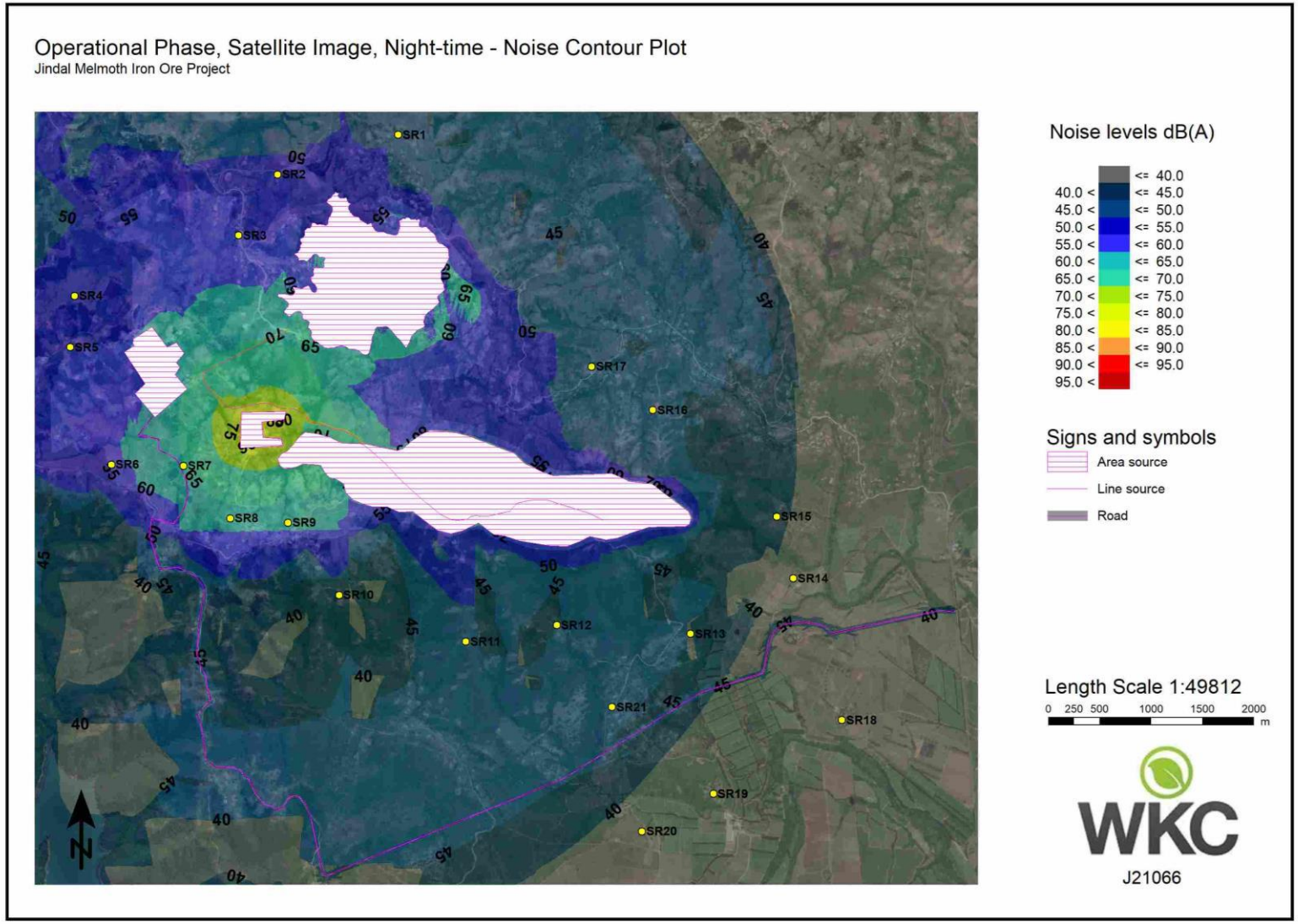


Figure 7-2 – Overall Project Area – Night-time



7.7.1 Environmental Noise Assessment (Project Contribution in Isolation)

The environmental noise assessment takes into account all identified noise sources within the Project scope. In terms of national noise regulations, the noise level limits are set at 45 dB(A) during the daytime and 35 dB(A) at night-time in rural areas according to SANS 10103:2004 [4]. The assessment of the Project noise level contribution in isolation at identified sensitive receptors are presented in the Table 7-1.

Table 7-1 – Project Noise Contribution in isolation as Sensitive Receptors

ID	Model Results (dB(A))		SANS Noise Limits (dB(A))		Exceedance?	
	Daytime	Night-time	Daytime	Night-time	Daytime	Night-time
SR1	48.3	48.3	45	35	Yes	Yes
SR2	50.7	50.7	45	35	Yes	Yes
SR3	56.7	56.7	45	35	Yes	Yes
SR4	51.8	51.8	45	35	Yes	Yes
SR5	55.2	55.2	45	35	Yes	Yes
SR6	55.2	55.2	45	35	Yes	Yes
SR7	64.8	64.8	45	35	Yes	Yes
SR8	63.6	63.6	45	35	Yes	Yes
SR9	63.9	63.9	45	35	Yes	Yes
SR10	41.6	41.5	45	35	No	Yes
SR11	47.0	46.9	45	35	Yes	Yes
SR12	42.8	42.7	45	35	No	Yes
SR13	39.8	39.6	45	35	No	Yes
SR14	33.3	32.8	45	35	No	No
SR15	41.8	41.8	45	35	No	Yes
SR16	46.5	46.5	45	35	Yes	Yes
SR17	47.5	47.5	45	35	Yes	Yes
SR18	28.5	27.5	45	35	No	No
SR19	29.4	28.5	45	35	No	No
SR20	29.7	28.5	45	35	No	No

ID	Model Results (dB(A))		SANS Noise Limits (dB(A))		Exceedance?	
	Daytime	Night-time	Daytime	Night-time	Daytime	Night-time
SR21	45.5	45.4	45	35	Yes	Yes

The noise modelling results indicate that the Project noise contributions at sensitive receptors are likely to exceed the relevant SANS noise limits when assessed in isolation at a number of locations. This is expected due to the proximity of the new mining operations to certain assessed sensitive receptors (the closest being approximately 530m away), as well as the relatively low SANS noise limit for zones or areas classified as “rural”.

To contextualise the result in terms of potential impacts to sensitive receptors, the predicted change and potential increases in ambient noise levels at sensitive receptors were calculated. The cumulative assessment is detailed in the following section.

7.7.2 Cumulative Impact Assessment

An impact assessment was carried out in order to determine the severity of the potential impact of the project at the nearest SRs based on the predicted change in ambient noise levels. The results of the assessment of the predicted change in daytime ambient noise levels are presented in Table 7-2.

Table 7-2 – Cumulative Noise and Change in Ambient Noise Level Assessment Results (Daytime)

ID	Model Results (dB(A))	Baseline Noise Level (dB(A))	Cumulative Noise Level (dB(A))	Change in Ambient Noise Level (dB(A))	Impact Severity (dB(A))
SR1	48.3	56.7	57.3	0.6	Minor
SR2	50.7	56.7	57.7	1.0	Minor
SR3	56.7	56.7	59.7	3.0	Moderate
SR4	51.8	51.8	54.8	3.0	Moderate
SR5	55.2	51.8	56.8	5.0	Prominent
SR6	55.2	51.8	56.8	5.0	Prominent
SR7	64.8	51.8	65.0	13.2	Severe
SR8	63.6	51.8	63.9	12.1	Severe
SR9	63.9	51.8	64.2	12.4	Severe
SR10	41.6	48.1	49.0	0.9	Minor
SR11	47.0	48.1	50.6	2.5	Minor
SR12	42.8	52.1	52.6	0.5	Minor
SR13	39.8	52.1	52.3	0.2	Minor
SR14	33.3	52.1	52.2	0.1	Minor
SR15	41.8	49.4	50.1	0.7	Minor
SR16	46.5	49.4	51.2	1.8	Minor

ID	Model Results (dB(A))	Baseline Noise Level (dB(A))	Cumulative Noise Level (dB(A))	Change in Ambient Noise Level (dB(A))	Impact Severity (dB(A))
SR17	47.5	49.4	51.6	2.2	Minor
SR18	28.5	52.1	52.1	0.0	Negligible
SR19	29.4	52.1	52.1	0.0	Negligible
SR20	29.7	52.1	52.1	0.0	Negligible
SR21	45.5	52.1	53.0	0.9	Minor

The results of the assessment of the predicted change in night-time ambient noise levels are presented in Table 7-3.

Table 7-3 – Cumulative Noise and Change in Ambient Noise Level Assessment Results (Night-time)

ID	Model Results (dB(A))	Baseline Noise Level (dB(A))	Cumulative Noise Level (dB(A))	Change in Ambient Noise Level (dB(A))	Impact Severity (dB(A))
SR1	48.3	52.8	54.1	1.3	Minor
SR2	50.7	52.8	54.9	2.1	Minor
SR3	56.7	52.8	58.2	5.4	Prominent
SR4	51.8	45.9	52.8	6.9	Prominent
SR5	55.2	45.9	55.7	9.8	Prominent
SR6	55.2	45.9	55.7	9.8	Prominent
SR7	64.8	45.9	64.9	19.0	Severe
SR8	63.6	45.9	63.7	17.8	Severe
SR9	63.9	45.9	64.0	18.1	Severe
SR10	41.5	44.2	46.1	1.9	Minor
SR11	46.9	44.2	48.8	4.6	Moderate
SR12	42.7	48.5	49.5	1.0	Minor
SR13	39.6	48.5	49.0	0.5	Minor
SR14	32.8	48.5	48.6	0.1	Minor
SR15	41.8	46.3	47.6	1.3	Minor
SR16	46.5	46.3	49.4	3.1	Moderate
SR17	47.5	46.3	50.0	3.7	Moderate
SR18	27.5	48.5	48.5	0.0	Negligible
SR19	28.5	48.5	48.5	0.0	Negligible
SR20	28.5	48.5	48.5	0.0	Negligible
SR21	45.4	48.5	50.2	1.7	Minor

The cumulative noise assessment in terms of the IEMA and IoA criteria indicate that the cumulative noise levels are currently in the range of 65.0 dB(A) to 49.0 dB(A) during the daytime and between 64.9 dB(A) and 46.1 dB(A) during the night. The table above shows that the Project noise contribution is anticipated to result in impacts ranging from Negligible to Severe impacts, which is similar for both daytime and night-time periods due to the 24-hour operation of the mining activities.

Severe impacts are anticipated for SR7, SR8 and SR9 with changes in ambient noise levels of up to 13.2dB(A) during the day and 19.0 dB(A) during the night. These SR's are located within the project concession boundary and within close proximity to the crushing area which is a major source of noise for the project.

During the daytime period there are also Moderate and Prominent impacts at SR3, SR4, SR5 and SR6 with SR3 and SR4 having an increase of 3 dB(A) and SR5 and SR6 having an increase of 5 dB(A). During the night-time period Prominent impacts are expected at SR3, SR4, SR5 and SR6, additionally there are Moderate impacts at SR11, SR16 and SR17.

A series of noise contour plots for the daytime and night-time periods are shown in Section 7.

7.7.3 Noise Control Regulations

In terms of the noise control regulations, no person shall make changes to existing facilities or existing uses of land if these will cause activities that will after such change, cause a disturbing noise, unless precautionary measures to prevent the disturbing noise have been taken to the satisfaction of the local authority.

A disturbing noise is defined as a noise level which exceeds the zone sound level or, if no zone sound level has been designated, a noise level which exceeds the ambient sound level at the same measuring point by 7 dBA or more.

Based on the predicted changes in ambient noise level, the mining activities are anticipated to result in increases in ambient noise levels that are greater than 7 dB(A) at SR7, SR8 and SR9 during the daytime and night-time periods and SR5 and SR6 during the night-time periods.

7.8 Impact Significance Table – Operational Phase

Based on the results of the operational assessment the impact significance can be determined and is shown in the figure below.

Increase in Noise Levels at SR's due to operations phase		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operational	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Severe change (Very high)	Prominent change (High)
Duration	Long-term (10 and 20 years	Long-term (10 and 20 years
Extent	Beyond site	Beyond site
Consequence	High	High
Probability	Definite / Continuous	Conceivable
Significance	**High -**	**Medium -**

Degree to which impact can be reversed	*Fully reversable: Once the mining activities end the impact will be gone*	
Degree to which impact may cause irreplaceable loss of resources	*None*	
Degree to which impact can be avoided	*Medium: Exceedances of the limits may be able to be avoided should good site practice be followed and mitigations implemented.*	
Degree to which impact can be mitigated	*High: Mitigation measures can reduce the impacts significantly*	
Cumulative impact		
Nature of cumulative impacts	*The Project noise contributions will result in a direct and cumulative increase of ambient noise levels as a result of existing background noise and the contribution of Project noise.*	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	High -	**Medium -**
Residual impact		
Residual impact discussion	*The implementation of mitigation measures such as relocation of the most severely impacted SR's along with implementation of other general mitigation measures described in section 7.8.1 below can reduce the impacts to medium. These measures should be enough to reduce the noise level increase to below the NCR limit of 7 dB, this would however still be a noticeable increase in noise levels.*	

7.8.1 General Operational Mitigation Measures

The following measures should be considered for detailed Project design, and, where applicable, adoption into an Environmental Management Plan (EMPr) for the Project operations.

Due to the nature of mining activities being closely related to construction (earthworks) certain mitigation measures from the construction mitigation can implemented for the effective noise control of both construction and operational phase activities. The following mitigation measures are proposed:

- Develop overburden dumps in such a way that the dumps act as a noise berm for closest receptors;
- Use of noise barrier walls or berms, especially around crushing area location;
- Site inductions for all employees that operate machinery with the potential to generate significant noise should cover the importance of noise control and available noise reduction measures;
- Plant operations should always be carried out using equipment that is in good working order and that meets current best practice noise emission levels;
- The designation of a community liaison officer who is able to deal with the concerns of residents and the establishment of a complaint response programme (this can form part of the grievance mechanism) would enable the identification and resolution of any noise related concerns at an early stage of the plant operation, as well as throughout the different phases of project development;

- Noise monitoring should be undertaken in order to determine the operational noise emission levels and to aid the selection of additional noise controls where necessary. These locations should be determined based on the closest SR's to the site once plans have been finalised and should be chosen to determine the noise levels in all directions around the site (eg locations to the North, South, East and West of the site) Additional noise controls such as portable screening can be employed if monitoring indicates the need or in response to concerns;

- 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 machines to be enclosed and their ventilations requirements. Enclosures are specifically recommended for pumps and compressors;

- Minimise reversing of equipment to prevent nuisance caused by reversing alarms;

- Driver practices when approaching and leaving the site should minimise noise emissions created through activities such as unnecessary acceleration and breaking noise;

- Material stockpiles and mobile equipment staging, parking, and maintenance areas shall be located as far as practicable from SRs;

- Permanent haul-road speed limits shall be established and enforced, especially where SRs are located close to the roads, typical speed limits are 40km/hr on paved site roads and 20km/hr on unpaved haul routes;

- The use of noise-producing signals, including horns, whistles, alarms, and bells shall be for safety warning purposes only;

- Ensure that all haul roads are maintained and kept free of potholes, ruts and bumps in order to reduce vehicle noise;

- Relocation of residences that are within close proximity to the mining areas or within the project boundary, primarily as a function of the minimum blast safety distance recommendation.

7.9 Ground Vibration and Air Blast Overpressure

Ground vibration and air blast overpressure have been assessed in a separate blast impact assessment report for this project [11]. The report details the methodology, assessment and impacts associated with blasting at the project site, additionally it provides detailed mitigation measures on how to reduce the impacts.

In summary the report finds that during operation the unmitigated impacts associated with the Ground Vibration and Air Blast Overpressure are 'High' however after implementation of the mitigation measures the impacts are reduced to 'Low'. One of the main recommendations of the blasting report is the establishment of a 500m safety zone around the pit that contains no persons or animals.

8 Conclusion and Recommendations

A noise impact assessment was conducted for the Jindal Melmoth Iron Ore Mine to determine the significance of likely operational phase impacts at nearby sensitive receptors.

The construction noise assessment shows that there is expected to be an exceedance of the construction noise limit at SR's located within approximately 600m of the processing plant and crushing area. The closest assessed SR is located approximately 533m away resulting in an exceedance of the limit of 0.9 dB(A). A number of general mitigation measures have been provided in section 6.3.1. It must, however, also be noted that the construction assessment represents an unlikely worst-case scenario and the construction phase is transient and temporary in nature.

The operational noise impact assessment of the project found that operation of all project related activities is anticipated to have a Severe impact at three sensitive receptor locations, a number of other locations also had Prominent and Moderate impacts. These impacts would warrant noise mitigation measures being required in order to reduce the impacts to acceptable levels. These impacts can be attributed to the close proximity of the sensitive receptors to the project area, with some being within the project boundary, and the rural nature of the area with low baseline noise levels and low noise limits.

When looking at the Noise Control Regulations the mining activities are anticipated to result in increases in ambient noise levels that are greater than 7 dB(A) at SR7, SR8 and SR9 during the daytime and night-time periods and SR5 and SR6 during the night-time periods. Therefore as per the regulations mitigation would be required.

In order to minimise the potential impacts to sensitive receptors, a number of noise mitigation measures have been proposed.

It should, however, be noted that the assessment was conducted in a conservative manner for a reasonable worst-case scenario, with equipment lists being determined from other project documents, limited technical specifications and no detailed plot plans to indicate specific equipment locations. It is recommended that the assessment be updated once more data is available, such as detailed plot plans, equipment vendor specifications and detailed equipment specifications.

9 References

[1] South African Bureau of Standards, *SANS 10328:2003,* Pretoria: Standards South Africa, 2003.

[2] South African Bureau of Standards, *SANS 10103:2008,* Pretoria: Standards South Africa, 2008.

[3] International Standards Organisation (ISO), *ISO 1996-1:2016 Description and Measurement of Environmental Noise,* Geneva: International Standards Organisation (ISO), 2016.

[4] SANS 10103: 2004, *The measurement and rating of environmental noise with respect to land use, health, annoyance and to speech communication,* Edition 5.1 ed.

[5] "NOISE CONTROL REGULATIONS IN TERMS OF SECTION 25 OF THE ENVIRONMENT CONSERVATION ACT, 1989 (ACT NO. 73 OF 1989)," Government Notice R154, 1992.

[6] International Organisation for Standardisation, *Description and Measurement of Environmental Noise 1996-1:2003,* 2003.

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[9] Department of Environmental & Climate Change NSW, Interim Construction Noise Guideline, Sydney, 2009.

[10] D. A. Bies and C. H. Hansen, Engineering Noise Control, London: Spon Press, 2009.

[11] Blast Management & Consulting, "Blast Impact Assessment Proposed Jindal Melmoth Iron Ore Project," 2022.

Glossary

LAeq T: This is the continuous equivalent sound level. It is a widely used noise parameter that calculates a constant level of noise with the same energy content as the varying acoustic noise signal being measured. The letter “A” denotes that the A-weighting has been included and “eq” indicates that an equivalent level has been calculated. Hence, LAeq is the A-weighted equivalent continuous noise level. A-weighting is a filter incorporated into a sound level meter which when measuring noise replicates the sensitivity of human hearing.

LASN, T percentile levels: The level of A-weighted noise exceeded for N% of the measurement time. LAS90, T is often used as a measure of background noise in many standards and guidelines. The LAS90, T parameter would therefore represent the level exceeded for 90% of the measurement period, T. Likewise the LAS10, T would indicate the level exceeded for 10% of the measurement period, T indicating the higher noise levels measured.

Octave Band Analysis: To identify frequency components of a sound, there is octave band analysis in which frequencies are segmented into proportionate widths (octave bands) and analysed. The sound pressure level of a single octave band is called the "octave band level", while that analysed for 1/3 of the octave band is called a "1/3 octave band level". The frequency band in the octave band and 1/3 octave band is expressed as the centre frequency of that band. Using f1 and f2 as the upper and lower end frequencies of the band.

Sound Pressure Level (Lp): An acoustic measurement for the ratios of sound energy. Rated in decibels.

Sound Power Level (Lw): The Lw is a measure of the total airborne acoustic power generated by a noise source, expressed on a decibel scale referenced to a common standard (10-12 watts).

Decibel (dB): dB is a logarithmic unit of measurement that expresses the magnitude of a physical quantity (usually power or intensity) relative to a specified or implied reference level. Since it expresses a ratio of two quantities with the same unit, it is a dimensionless unit.

dB(A): The ‘A’ weighting network is very similar to the way in which the human ear responds to variations in sound pressure level as it places higher attenuation on the lower frequencies than on the mid to upper frequencies. It is applied to the decibel scale in order to account for how the human ear responds to changes in sound levels.

Appendix A – Noise Logbook

- Table A1: Noise Logbook

Table A1: Noise Logbook

No.	Equipment Tag	Equipment Type	Equipment Description	No. Items	LP (dB(A)) @ 1m	Lw (dB(A))	Octave Band Central Frequency Spectrum Hz (dB(A))								Comment
1	3170-PP-0001	Pump	Raw Water Supply Pump 1 & 2	1	87.5	97.4	61.6	72.7	82.2	87.6	93.8	92.0	87.8	79.7	Noise Level Calculated from ENC Ch11, Pump Spectrum from ENC Ch11
2	3170-PP-0003	Pump	Haul Road Dust Suppression Fill Pump	1	78.6	88.5	52.8	63.9	73.4	78.8	85.0	83.2	79.0	70.9	Noise Level Calculated from ENC Ch11, Pump Spectrum from ENC Ch11
3	3170-PP-0004	Pump	Process Water Dam Pump 1 & 2	1	88.7	98.6	62.8	73.9	83.4	88.8	95.0	93.2	89.0	80.9	Noise Level Calculated from ENC Ch11, Pump Spectrum from ENC Ch11
4	3170-PP-0006	Pump	Process Water Dam Pump 3 & 4	1	88.7	98.6	62.8	73.9	83.4	88.8	95.0	93.2	89.0	80.9	Noise Level Calculated from ENC Ch11, Pump Spectrum from ENC Ch11
5	3170-PP-0008	Pump	Storm Water Dam Pump	1	83.4	93.3	57.5	68.6	78.1	83.5	89.7	87.9	83.7	75.6	Noise Level Calculated from ENC Ch11, Pump Spectrum from ENC Ch11
6	3170-PP-0009	Pump	Potable Water Pump 1 & 2	1	70.3	80.2	44.5	55.6	65.1	70.5	76.7	74.9	70.7	62.6	Noise Level Calculated from ENC Ch11, Pump Spectrum from ENC Ch11
7	3170-PP-0011	Pump	Filtered Water Pump 1 & 2	1	87.5	97.4	61.6	72.7	82.2	87.6	93.8	92.0	87.8	79.7	Noise Level Calculated from ENC Ch11, Pump Spectrum from ENC Ch11
8	3170-PP-0013	Pump	LP Gland Seal Water Pump 1 & 2	1	78.6	88.5	52.8	63.9	73.4	78.8	85.0	83.2	79.0	70.9	Noise Level Calculated from ENC Ch11, Pump Spectrum from ENC Ch11
9	3170-PP-0015	Pump	HP Gland Seal Water Pump 1 & 2	1	75.6	85.5	49.8	60.9	70.4	75.8	82.0	80.2	76.0	67.9	Noise Level Calculated from ENC Ch11, Pump Spectrum from ENC Ch11
10	3170-PP-0017	Pump	Fire Water Pump - electric	1	84.3	94.2	58.4	69.5	79.0	84.4	90.6	88.8	84.6	76.5	Noise Level Calculated from ENC Ch11, Pump Spectrum from ENC Ch11
11	3170-PP-0018	Pump	Fire Water Pump - jockey	1	77.3	87.2	51.4	62.5	72.0	77.4	83.6	81.8	77.6	69.5	Noise Level Calculated from ENC Ch11, Pump Spectrum from ENC Ch11
12	3170-PP-0019	Pump	Fire Water Pump - diesel	1	67.1	77.0	41.2	52.3	61.8	67.2	73.4	71.6	67.4	59.3	Noise Level Calculated from ENC Ch11, Pump Spectrum from ENC Ch11
13	3170-PP-0020	Pump	Goedetrouw Dam pump 1 & 2	1	91.4	101.3	65.6	76.7	86.2	91.6	97.8	96.0	91.8	83.7	Noise Level Calculated from ENC Ch11, Pump Spectrum from ENC Ch11
14	3200-PP-0001	Pump	Primary Crushing Area Spillage Sump Pump	1	79.5	89.4	53.7	64.8	74.3	79.7	85.9	84.1	79.9	71.8	Noise Level Calculated from ENC Ch11, Pump Spectrum from ENC Ch11
15	3200-PP-0002	Pump	Crushed Ore Stockpile Spillage Sump Pump	1	79.5	89.4	53.7	64.8	74.3	79.7	85.9	84.1	79.9	71.8	Noise Level Calculated from ENC Ch11, Pump Spectrum from ENC Ch11

No.	Equipment Tag	Equipment Type	Equipment Description	No. Items	LP (dB(A)) @ 1m	Lw (dB(A))	Octave Band Central Frequency Spectrum Hz (dB(A))								Comment
16	3200-PP-0003	Pump	Pebble Stockpile Spillage Sump Pump	1	79.5	89.4	53.7	64.8	74.3	79.7	85.9	84.1	79.9	71.8	Noise Level Calculated from ENC Ch11, Pump Spectrum from ENC Ch11
17	3210-PP-0001	Pump	AG Mill 1 Screen Feed Pump 1 & 2	1	89.0	98.9	63.2	74.3	83.8	89.2	95.4	93.6	89.4	81.3	Noise Level Calculated from ENC Ch11, Pump Spectrum from ENC Ch11
18	3210-PP-0003	Pump	AG Mill 2 Screen Feed Pump 1 & 2	1	89.0	98.9	63.2	74.3	83.8	89.2	95.4	93.6	89.4	81.3	Noise Level Calculated from ENC Ch11, Pump Spectrum from ENC Ch11
19	3210-PP-0005	Pump	AG Mill 3 Screen Feed Pump 1 & 2	1	89.0	98.9	63.2	74.3	83.8	89.2	95.4	93.6	89.4	81.3	Noise Level Calculated from ENC Ch11, Pump Spectrum from ENC Ch11
20	3210-PP-0007	Pump	Mill Area Sump Pump	1	80.3	90.2	54.4	65.5	75.0	80.4	86.6	84.8	80.6	72.5	Noise Level Calculated from ENC Ch11, Pump Spectrum from ENC Ch11
21	3210-PP-0008	Pump	HPGR 1 Product Transfer Pump 1 & 2	1	85.6	95.5	59.7	70.8	80.3	85.7	91.9	90.1	85.9	77.8	Noise Level Calculated from ENC Ch11, Pump Spectrum from ENC Ch11
22	3210-PP-0010	Pump	HPGR 2 Product Transfer Pump 1 & 2	1	85.6	95.5	59.7	70.8	80.3	85.7	91.9	90.1	85.9	77.8	Noise Level Calculated from ENC Ch11, Pump Spectrum from ENC Ch11
23	3210-PP-0012	Pump	HPGR 3 Product Transfer Pump 1 & 2	1	85.6	95.5	59.7	70.8	80.3	85.7	91.9	90.1	85.9	77.8	Noise Level Calculated from ENC Ch11, Pump Spectrum from ENC Ch11
24	3210-PP-0014	Pump	AG Mill 1 Screen Discharge Pump 1 & 2	1	85.6	95.5	59.7	70.8	80.3	85.7	91.9	90.1	85.9	77.8	Noise Level Calculated from ENC Ch11, Pump Spectrum from ENC Ch11
25	3210-PP-0016	Pump	AG Mill 2 Screen Discharge Pump 1 & 2	1	85.6	95.5	59.7	70.8	80.3	85.7	91.9	90.1	85.9	77.8	Noise Level Calculated from ENC Ch11, Pump Spectrum from ENC Ch11
26	3210-PP-0018	Pump	AG Mill 3 Screen Discharge Pump 1 & 2	1	85.6	95.5	59.7	70.8	80.3	85.7	91.9	90.1	85.9	77.8	Noise Level Calculated from ENC Ch11, Pump Spectrum from ENC Ch11
27	3250-PP-0001	Pump	Regrind Pebble Mill 1 Cyclone Feed Pump 1 & 2	1	88.5	98.4	62.7	73.8	83.3	88.7	94.9	93.1	88.9	80.8	Noise Level Calculated from ENC Ch11, Pump Spectrum from ENC Ch11
28	3250-PP-0003	Pump	Regrind Pebble Mill 2 Cyclone Feed Pump 1 & 2	1	88.5	98.4	62.7	73.8	83.3	88.7	94.9	93.1	88.9	80.8	Noise Level Calculated from ENC Ch11, Pump Spectrum from ENC Ch11
29	3250-PP-0005	Pump	Regrind Pebble Mill 3 Cyclone Feed Pump 1 & 2	1	88.5	98.4	62.7	73.8	83.3	88.7	94.9	93.1	88.9	80.8	Noise Level Calculated from ENC Ch11, Pump Spectrum from ENC Ch11

No.	Equipment Tag	Equipment Type	Equipment Description	No. Items	LP (dB(A)) @ 1m	Lw (dB(A))	Octave Band Central Frequency Spectrum Hz (dB(A))								Comment
30	3250-PP-0007	Pump	Secondary Regrind Mill Cyclone 1 Feed Pump 1 & 2	1	88.5	98.4	62.7	73.8	83.3	88.7	94.9	93.1	88.9	80.8	Noise Level Calculated from ENC Ch11, Pump Spectrum from ENC Ch11
31	3250-PP-0009	Pump	Secondary Regrind Mill Cyclone 2 Feed Pump 1 & 2	1	88.5	98.4	62.7	73.8	83.3	88.7	94.9	93.1	88.9	80.8	Noise Level Calculated from ENC Ch11, Pump Spectrum from ENC Ch11
32	3250-PP-0011	Pump	Secondary Regrind Mill Cyclone 3 Feed Pump 1 & 2	1	88.5	98.4	62.7	73.8	83.3	88.7	94.9	93.1	88.9	80.8	Noise Level Calculated from ENC Ch11, Pump Spectrum from ENC Ch11
33	3250-PP-0013	Pump	Magnetic Separation Area Sump Pump	1	80.3	90.2	54.4	65.5	75.0	80.4	86.6	84.8	80.6	72.5	Noise Level Calculated from ENC Ch11, Pump Spectrum from ENC Ch11
34	3400-PP-0001	Pump	Concentrate Thickener U/F Pump 1 & 2	1	85.6	95.5	59.7	70.8	80.3	85.7	91.9	90.1	85.9	77.8	Noise Level Calculated from ENC Ch11, Pump Spectrum from ENC Ch11
35	3400-PP-0003	Pump	Concentrate Thickener U/F Pump 3 & 4	1	85.6	95.5	59.7	70.8	80.3	85.7	91.9	90.1	85.9	77.8	Noise Level Calculated from ENC Ch11, Pump Spectrum from ENC Ch11
36	3400-PP-0005	Pump	Concentrate Thickener O/F Pump 1 & 2	1	84.3	94.2	58.4	69.5	79.0	84.4	90.6	88.8	84.6	76.5	Noise Level Calculated from ENC Ch11, Pump Spectrum from ENC Ch11
37	3400-PP-0007	Pump	Concentrate Transfer Pump 1 & 4	1	88.5	98.4	62.7	73.8	83.3	88.7	94.9	93.1	88.9	80.8	Noise Level Calculated from ENC Ch11, Pump Spectrum from ENC Ch11
38	3400-PP-0008	Pump	Concentrate Transfer Pump 2 & 5	1	88.5	98.4	62.7	73.8	83.3	88.7	94.9	93.1	88.9	80.8	Noise Level Calculated from ENC Ch11, Pump Spectrum from ENC Ch11
39	3400-PP-0009	Pump	Concentrate Transfer Pump 3 & 6	1	88.5	98.4	62.7	73.8	83.3	88.7	94.9	93.1	88.9	80.8	Noise Level Calculated from ENC Ch11, Pump Spectrum from ENC Ch11
40	3400-PP-0013	Pump	Concentrate Thickener Area Sump Pump	1	80.3	90.2	54.4	65.5	75.0	80.4	86.6	84.8	80.6	72.5	Noise Level Calculated from ENC Ch11, Pump Spectrum from ENC Ch11
41	3900-PP-0005	Pump	Collector Dosing Pump 1	1	85.0	94.9	59.1	70.2	79.7	85.1	91.3	89.5	85.3	77.2	Assumed 85 dB(A) at 1m, Pump Spectrum from ENC Ch11
42	3900-PP-0006	Pump	Collector Dosing Pump 2 & 3	1	85.0	94.9	59.1	70.2	79.7	85.1	91.3	89.5	85.3	77.2	Assumed 85 dB(A) at 1m, Pump Spectrum from ENC Ch11

No.	Equipment Tag	Equipment Type	Equipment Description	No. Items	LP (dB(A)) @ 1m	Lw (dB(A))	Octave Band Central Frequency Spectrum Hz (dB(A))								Comment
43	3900-PP-0008	Pump	Reagent Area Sump Pump	1	72.9	82.8	47.0	58.1	67.6	73.0	79.2	77.4	73.2	65.1	Noise Level Calculated from ENC Ch11, Pump Spectrum from ENC Ch11
44	3900-PP-0012	Pump	Depressant Dosing Pump 1	1	85.0	94.9	59.1	70.2	79.7	85.1	91.3	89.5	85.3	77.2	Assumed 85 dB(A) at 1m, Pump Spectrum from ENC Ch11
45	3900-PP-0013	Pump	Depressant Dosing Pump 2 & 3	1	85.0	94.9	59.1	70.2	79.7	85.1	91.3	89.5	85.3	77.2	Assumed 85 dB(A) at 1m, Pump Spectrum from ENC Ch11
46	3170-CP-0001	Compressor	Plant Air Compressor Package	1	85.0	101.0	66.9	76.0	81.5	86.9	92.1	97.3	96.1	90.0	Assumed 85 dB(A) at 1m, Compressor Spectrum from ENC Ch11, Assumed Dimensions of 2x1x1m
47	3200-CR-0001	Crusher	Primary Gyratory Crusher	1	114.2	122.2	121.0	114.0	107.0	109.0	103.0	99.0	94.0	87.0	Noise Level from SoundPLAN Library, British Standard BS 5228-1:2009, Table C1
48	3200-CR-0002	Crusher	Secondary Gyratory Crusher	1	114.2	122.2	121.0	114.0	107.0	109.0	103.0	99.0	94.0	87.0	Noise Level from SoundPLAN Library, British Standard BS 5228-1:2009, Table C1
49	3200-CR-0003	Crusher	Pebble Cone Crusher 1	1	114.2	122.2	121.0	114.0	107.0	109.0	103.0	99.0	94.0	87.0	Noise Level from SoundPLAN Library, British Standard BS 5228-1:2009, Table C1
50	3200-CR-0004	Crusher	Pebble Cone Crusher 2	1	114.2	122.2	121.0	114.0	107.0	109.0	103.0	99.0	94.0	87.0	Noise Level from SoundPLAN Library, British Standard BS 5228-1:2009, Table C1
51	3200-CR-0005	Crusher	Tertiary HPGR Crusher 1	1	114.2	122.2	121.0	114.0	107.0	109.0	103.0	99.0	94.0	87.0	Noise Level from SoundPLAN Library, British Standard BS 5228-1:2009, Table C1
52	3200-CR-0006	Crusher	Tertiary HPGR Crusher 2 &3	1	114.2	122.2	121.0	114.0	107.0	109.0	103.0	99.0	94.0	87.0	Noise Level from SoundPLAN Library, British Standard BS 5228-1:2009, Table C1
53	3200-CV-0001	Conveyor	Crushed Ore Stockpile Feed Conveyor	1	89.2	97.2	72.8	79.9	81.4	87.7	94.0	91.2	87.0	77.9	Noise Level from SoundPLAN Library, British Standard BS 5228-1:2009, Table C10
54	3200-CV-0002	Conveyor	Crushed Ore Stockpile Reclaim Conveyor	1	89.2	97.2	72.8	79.9	81.4	87.7	94.0	91.2	87.0	77.9	Noise Level from SoundPLAN Library, British Standard BS 5228-1:2009, Table C10
55	3200-CV-0003	Conveyor	Pebble Stockpile Feed Conveyor	1	89.2	97.2	72.8	79.9	81.4	87.7	94.0	91.2	87.0	77.9	Noise Level from SoundPLAN Library, British Standard BS 5228-1:2009, Table C10
56	3200-CV-0004	Conveyor	Tertiary Crushers Feed Conveyor	1	89.2	97.2	72.8	79.9	81.4	87.7	94.0	91.2	87.0	77.9	Noise Level from SoundPLAN Library, British Standard BS 5228-1:2009, Table C10
57	3200-CV-0005	Conveyor	Pebble Crushers Discharge Conveyor	1	89.2	97.2	72.8	79.9	81.4	87.7	94.0	91.2	87.0	77.9	Noise Level from SoundPLAN Library, British Standard BS 5228-1:2009, Table C10
58	3200-CV-0006	Conveyor	Transfer Conveyor 1	1	89.2	97.2	72.8	79.9	81.4	87.7	94.0	91.2	87.0	77.9	Noise Level from SoundPLAN Library, British Standard BS 5228-1:2009, Table C10

No.	Equipment Tag	Equipment Type	Equipment Description	No. Items	LP (dB(A)) @ 1m	Lw (dB(A))	Octave Band Central Frequency Spectrum Hz (dB(A))								Comment
59	3200-CV-0007	Conveyor	Pebble Stockpile Reclaim Conveyor	1	89.2	97.2	72.8	79.9	81.4	87.7	94.0	91.2	87.0	77.9	Noise Level from SoundPLAN Library, British Standard BS 5228-1:2009, Table C10
60	3200-CV-0008	Conveyor	Excess Pebbles Recycle Conveyor	1	89.2	97.2	72.8	79.9	81.4	87.7	94.0	91.2	87.0	77.9	Noise Level from SoundPLAN Library, British Standard BS 5228-1:2009, Table C10
61	3200-CV-0009	Conveyor	Mill Pebble Conveyor	1	89.2	97.2	72.8	79.9	81.4	87.7	94.0	91.2	87.0	77.9	Noise Level from SoundPLAN Library, British Standard BS 5228-1:2009, Table C10
62	3200-CV-0010	Conveyor	HPGR Product Conveyor 1	1	89.2	97.2	72.8	79.9	81.4	87.7	94.0	91.2	87.0	77.9	Noise Level from SoundPLAN Library, British Standard BS 5228-1:2009, Table C10
63	3200-CV-0011	Conveyor	HPGR Product Conveyor 2 &3	1	89.2	97.2	72.8	79.9	81.4	87.7	94.0	91.2	87.0	77.9	Noise Level from SoundPLAN Library, British Standard BS 5228-1:2009, Table C10
64	3200-CV-0013	Conveyor	HPGR Tertiary Crusher Recycle Conveyor	1	89.2	97.2	72.8	79.9	81.4	87.7	94.0	91.2	87.0	77.9	Noise Level from SoundPLAN Library, British Standard BS 5228-1:2009, Table C10
65	3200-CV-0014	Conveyor	Transfer Conveyor 2	1	89.2	97.2	72.8	79.9	81.4	87.7	94.0	91.2	87.0	77.9	Noise Level from SoundPLAN Library, British Standard BS 5228-1:2009, Table C10
66	3200-CV-0015	Conveyor	Second Gyratory Feed Conveyor	1	89.2	97.2	72.8	79.9	81.4	87.7	94.0	91.2	87.0	77.9	Noise Level from SoundPLAN Library, British Standard BS 5228-1:2009, Table C10
67	3200-FE-0001	Feeder	Primary Crusher Discharge Feeder	1	85.0	94.9	59.1	70.2	79.7	85.1	91.3	89.5	85.3	77.2	Assumed 85 dB(A) at 1m, Spectrum from ENC Ch11
68	3200-FE-0002	Feeder	Secondary Crusher Discharge Feeder	1	85.0	94.9	59.1	70.2	79.7	85.1	91.3	89.5	85.3	77.2	Assumed 85 dB(A) at 1m, Spectrum from ENC Ch11
69	3200-FE-0003	Feeder	Crushed Ore Stockpile Reclaim Feeder 1	1	85.0	94.9	59.1	70.2	79.7	85.1	91.3	89.5	85.3	77.2	Assumed 85 dB(A) at 1m, Spectrum from ENC Ch11
70	3200-FE-0004	Feeder	Crushed Ore Stockpile Reclaim Feeder 2 &3	1	85.0	94.9	59.1	70.2	79.7	85.1	91.3	89.5	85.3	77.2	Assumed 85 dB(A) at 1m, Spectrum from ENC Ch11
71	3200-FE-0006	Feeder	Pebble Screen Feeder 1	1	85.0	94.9	59.1	70.2	79.7	85.1	91.3	89.5	85.3	77.2	Assumed 85 dB(A) at 1m, Spectrum from ENC Ch11
72	3200-FE-0007	Feeder	Pebble Screen Feeder 2	1	85.0	94.9	59.1	70.2	79.7	85.1	91.3	89.5	85.3	77.2	Assumed 85 dB(A) at 1m, Spectrum from ENC Ch11
73	3200-FE-0008	Feeder	Pebble Crusher Feeder 1	1	85.0	94.9	59.1	70.2	79.7	85.1	91.3	89.5	85.3	77.2	Assumed 85 dB(A) at 1m, Spectrum from ENC Ch11
74	3200-FE-0009	Feeder	Pebble Crusher Feeder 2	1	85.0	94.9	59.1	70.2	79.7	85.1	91.3	89.5	85.3	77.2	Assumed 85 dB(A) at 1m, Spectrum from ENC Ch11

No.	Equipment Tag	Equipment Type	Equipment Description	No. Items	LP (dB(A)) @ 1m	Lw (dB(A))	Octave Band Central Frequency Spectrum Hz (dB(A))								Comment
75	3200-FE-0010	Feeder	Pebble Stockpile Reclaim Feeder 1	1	85.0	94.9	59.1	70.2	79.7	85.1	91.3	89.5	85.3	77.2	Assumed 85 dB(A) at 1m, Spectrum from ENC Ch11
76	3200-FE-0011	Feeder	Pebble Stockpile Reclaim Feeder 2 & 3	1	85.0	94.9	59.1	70.2	79.7	85.1	91.3	89.5	85.3	77.2	Assumed 85 dB(A) at 1m, Spectrum from ENC Ch11
77	3200-FE-0013	Feeder	Excess Pebbles Feeder	1	85.0	94.9	59.1	70.2	79.7	85.1	91.3	89.5	85.3	77.2	Assumed 85 dB(A) at 1m, Spectrum from ENC Ch11
78	3200-FE-0014	Feeder	Mill Pebble Feeder	1	85.0	94.9	59.1	70.2	79.7	85.1	91.3	89.5	85.3	77.2	Assumed 85 dB(A) at 1m, Spectrum from ENC Ch11
79	3200-FE-0015	Feeder	HPGR Feeder 1	1	85.0	94.9	59.1	70.2	79.7	85.1	91.3	89.5	85.3	77.2	Assumed 85 dB(A) at 1m, Spectrum from ENC Ch11
80	3200-FE-0016	Feeder	HPGR Feeder 2 & 3	1	85.0	94.9	59.1	70.2	79.7	85.1	91.3	89.5	85.3	77.2	Assumed 85 dB(A) at 1m, Spectrum from ENC Ch11
81	3200-FE-0018	Feeder	HPGR 1 Product Screen Feeder	1	85.0	94.9	59.1	70.2	79.7	85.1	91.3	89.5	85.3	77.2	Assumed 85 dB(A) at 1m, Spectrum from ENC Ch11
82	3200-FE-0019	Feeder	HPGR 2 & 3 Product Screen Feeder	1	85.0	94.9	59.1	70.2	79.7	85.1	91.3	89.5	85.3	77.2	Assumed 85 dB(A) at 1m, Spectrum from ENC Ch11
83	3200-RB-0001	Breaker	Rock Breaker	1	115.4	123.4	86.8	99.9	104.4	113.7	120.0	117.2	115.0	107.9	Noise Level from SoundPLAN Library, British Standard BS 5228-1:2009, Table C9
84	3200-SC-0001	Screen	Pebble screen 1	1	85.0	94.9	59.1	70.2	79.7	85.1	91.3	89.5	85.3	77.2	Assumed 85 dB(A) at 1m, Spectrum from ENC Ch11
85	3200-SC-0002	Screen	Pebble screen 2	1	85.0	94.9	59.1	70.2	79.7	85.1	91.3	89.5	85.3	77.2	Assumed 85 dB(A) at 1m, Spectrum from ENC Ch11
86	3200-SC-0003	Screen	HPGR Product Screen 1	1	85.0	94.9	59.1	70.2	79.7	85.1	91.3	89.5	85.3	77.2	Assumed 85 dB(A) at 1m, Spectrum from ENC Ch11
87	3200-SC-0004	Screen	HPGR Product Screen 2 & 3	1	85.0	94.9	59.1	70.2	79.7	85.1	91.3	89.5	85.3	77.2	Assumed 85 dB(A) at 1m, Spectrum from ENC Ch11
88	3210-CV-0001	Conveyor	Shuttle Conveyor	1	89.2	97.2	72.8	79.9	81.4	87.7	94.0	91.2	87.0	77.9	Noise Level from SoundPLAN Library, British Standard BS 5228-1:2009, Table C10
89	3210-CV-0002	Conveyor	Transfer Conveyor	1	89.2	97.2	72.8	79.9	81.4	87.7	94.0	91.2	87.0	77.9	Noise Level from SoundPLAN Library, British Standard BS 5228-1:2009, Table C10
90	3210-FE-0001	Feeder	Pebble Feeder 1	1	85.0	94.9	59.1	70.2	79.7	85.1	91.3	89.5	85.3	77.2	Assumed 85 dB(A) at 1m, Spectrum from ENC Ch11
91	3210-FE-0002	Feeder	Pebble Feeder 2 & 3	1	85.0	94.9	59.1	70.2	79.7	85.1	91.3	89.5	85.3	77.2	Assumed 85 dB(A) at 1m, Spectrum from ENC Ch11
92	3210-ML-0001	Mill	AG Mill 1	1	110.2	118.2	-	-	-	118.2	-	-	-	-	Noise Levels from report "Report on Mill Noise levels and noise level attenuation, A.F. van der Merwe, 2012"
93	3210-ML-0002	Mill	AG Mill 2 & 3	1	110.2	118.2	-	-	-	118.2	-	-	-	-	Noise Levels from report "Report on Mill Noise levels and noise level attenuation, A.F. van der Merwe, 2012"
94	3210-SC-0001	Screen	AG Mill 1 Discharge Screen	1	85.0	94.9	59.1	70.2	79.7	85.1	91.3	89.5	85.3	77.2	Assumed 85 dB(A) at 1m, Spectrum from ENC Ch11

No.	Equipment Tag	Equipment Type	Equipment Description	No. Items	LP (dB(A)) @ 1m	Lw (dB(A))	Octave Band Central Frequency Spectrum Hz (dB(A))								Comment
95	3210-SC-0002	Screen	AG Mill 2 & 3 Discharge Screen	1	85.0	94.9	59.1	70.2	79.7	85.1	91.3	89.5	85.3	77.2	Assumed 85 dB(A) at 1m, Spectrum from ENC Ch11
96	3250-CV-0001	conveyor	AG mill trommel oversize conveyor	1	89.2	97.2	72.8	79.9	81.4	87.7	94.0	91.2	87.0	77.9	Noise Level from SoundPLAN Library, British Standard BS 5228-1:2009, Table C10
97	3250-CV-0002	Conveyor	Regrind Pebbles Conveyor	1	89.2	97.2	72.8	79.9	81.4	87.7	94.0	91.2	87.0	77.9	Noise Level from SoundPLAN Library, British Standard BS 5228-1:2009, Table C10
98	3250-CV-0003	Conveyor	Regrind Excess Pebbles Conveyor	1	89.2	97.2	72.8	79.9	81.4	87.7	94.0	91.2	87.0	77.9	Noise Level from SoundPLAN Library, British Standard BS 5228-1:2009, Table C10
99	3250-CV-0004	Conveyor	Transfer Conveyor	1	89.2	97.2	72.8	79.9	81.4	87.7	94.0	91.2	87.0	77.9	Noise Level from SoundPLAN Library, British Standard BS 5228-1:2009, Table C10
100	3250-CV-0005	Conveyor	Shuttle Conveyor	1	89.2	97.2	72.8	79.9	81.4	87.7	94.0	91.2	87.0	77.9	Noise Level from SoundPLAN Library, British Standard BS 5228-1:2009, Table C10
101	3250-FE-0001	Feeder	Regrind Mill Pebble Feeder 1	1	85.0	94.9	59.1	70.2	79.7	85.1	91.3	89.5	85.3	77.2	Assumed 85 dB(A) at 1m, Spectrum from ENC Ch11
102	3250-FE-0002	Feeder	Regrind Mill Pebble Feeder 2 & 3	1	85.0	94.9	59.1	70.2	79.7	85.1	91.3	89.5	85.3	77.2	Assumed 85 dB(A) at 1m, Spectrum from ENC Ch11
103	3250-ML-0001	Mill	Regrind Pebble Mill 1	1	110.2	118.2	-	-	-	118.2	-	-	-	-	Noise Levels from report "Report on Mill Noise levels and noise level attenuation, A.F. van der Merwe, 2012"
104	3250-ML-0002	Mill	Regrind Pebble Mill 2 & 3	1	110.2	118.2	-	-	-	118.2	-	-	-	-	Noise Levels from report "Report on Mill Noise levels and noise level attenuation, A.F. van der Merwe, 2012"
105	3250-ML-0004	Mill	Secondary Regrind Mill 1	1	110.2	118.2	-	-	-	118.2	-	-	-	-	Noise Levels from report "Report on Mill Noise levels and noise level attenuation, A.F. van der Merwe, 2012"
106	3250-ML-0005	Mill	Secondary Regrind Mill 2 &3	1	110.2	118.2	-	-	-	118.2	-	-	-	-	Noise Levels from report "Report on Mill Noise levels and noise level attenuation, A.F. van der Merwe, 2012"
107	3250-ML-0007	Mill	Secondary Regrind Mill 4	1	110.2	118.2	-	-	-	118.2	-	-	-	-	Noise Levels from report "Report on Mill Noise levels and noise level attenuation, A.F. van der Merwe, 2012"
108	3250-ML-0008	Mill	Secondary Regrind Mill 5 & 6	1	110.2	118.2	-	-	-	118.2	-	-	-	-	Noise Levels from report "Report on Mill Noise levels and noise level attenuation, A.F. van der Merwe, 2012"
109	3250-SA-0001	Sampler	LIWMS Rougher Feed Sampler	1	85.0	94.9	59.1	70.2	79.7	85.1	91.3	89.5	85.3	77.2	Assumed 85 dB(A) at 1m, Spectrum from ENC Ch11
110	3400-AG-0001	Agitator	Thickener U/F Tank Agitator	1	85.0	94.9	59.1	70.2	79.7	85.1	91.3	89.5	85.3	77.2	Assumed 85 dB(A) at 1m, Spectrum from ENC Ch11
111	3400-SA-0001	Sampler	Final Concentrate Sampler	1	85.0	94.9	59.1	70.2	79.7	85.1	91.3	89.5	85.3	77.2	Assumed 85 dB(A) at 1m, Spectrum from ENC Ch11
112	3400-TH-0001	Thickener	Concentrate Thickener 1	1	85.0	94.9	59.1	70.2	79.7	85.1	91.3	89.5	85.3	77.2	Assumed 85 dB(A) at 1m, Spectrum from ENC Ch11

No.	Equipment Tag	Equipment Type	Equipment Description	No. Items	LP (dB(A)) @ 1m	Lw (dB(A))	Octave Band Central Frequency Spectrum Hz (dB(A))								Comment
113	3400-TH-0002	Thickener	Concentrate Thickener 2	1	85.0	94.9	59.1	70.2	79.7	85.1	91.3	89.5	85.3	77.2	Assumed 85 dB(A) at 1m, Spectrum from ENC Ch11
114	-	Mobile Mine Equipment	Shovel_HS6040	1	97.2	105.2	96.8	95.9	98.4	97.7	98.0	97.2	83.0	83.9	British Standard BS 5228-1:2009, Table C2
115	-	Mobile Mine Equipment	FEL_993_CAT	1	87.8	95.8	75.8	77.9	83.4	88.7	91.0	89.2	88.0	76.9	British Standard BS 5228-1:2009, Table C2
116	-	Mobile Mine Equipment	Hauling Truck_CAT_785	10	104.9	112.9	87.8	95.9	105.4	107.7	107.0	105.2	101.0	93.9	British Standard BS 5228-1:2009, Table C6
117	-	Mobile Mine Equipment	Drilling Drill MD6240	2	110.1	118.1	87.8	103.9	104.4	112.7	112.0	112.2	107.0	103.9	British Standard BS 5228-1:2009, Table C9
118	-	Mobile Mine Equipment	D9 Track dozer	5	100.0	108.0	90.8	101.9	100.4	97.7	102.0	99.2	97.0	90.9	British Standard BS 5228-1:2009, Table C2
119	-	Mobile Mine Equipment	824 Wheel dozer	1	100.0	108.0	90.8	101.9	100.4	97.7	102.0	99.2	97.0	90.9	British Standard BS 5228-1:2009, Table C2
120	-	Mobile Mine Equipment	16M Grader	1	106.5	114.5	89.8	98.9	102.4	103.7	112.0	107.2	103.0	91.9	British Standard BS 5228-1:2009, Table C6
121	-	Mobile Mine Equipment	CAT_740 Watertruck	2	56.0	64.0	45.6	49.6	53.5	56.5	59.5	57.5	52.5	47.5	SoundPlan Library
122	-	Mobile Mine Equipment	CAT349 Support Backhoe	1	87.8	95.8	75.8	77.9	83.4	88.7	91.0	89.2	88.0	76.9	British Standard BS 5228-1:2009, Table C2
123	-	Mobile Mine Equipment	Atlas Copco ROCL8 Support dri	1	110.1	118.1	87.8	103.9	104.4	112.7	112.0	112.2	107.0	103.9	British Standard BS 5228-1:2009, Table C9
124	-	Mobile Mine Equipment	MobileCrane	1	89.8	97.8	81.8	87.9	90.4	87.7	92.0	92.2	85.0	76.9	British Standard BS 5228-1:2009, Table C4
125	-	Mobile Mine Equipment	FuelTruck	2	56.0	64.0	45.6	49.6	53.5	56.5	59.5	57.5	52.5	47.5	SoundPlan Library
126	-	Mobile Mine Equipment	LubeTruck	2	56.0	64.0	45.6	49.6	53.5	56.5	59.5	57.5	52.5	47.5	SoundPlan Library
127	-	Mobile Mine Equipment	Mechanic_Truck	1	56.0	64.0	45.6	49.6	53.5	56.5	59.5	57.5	52.5	47.5	SoundPlan Library
128	-	Mobile Mine Equipment	TireHandler	1	67.0	75.0	42.0	52.0	59.0	65.0	68.0	69.0	69.0	67.0	SoundPlan Library
129	-	Mobile Mine Equipment	FlatBedTruck	1	56.0	64.0	45.6	49.6	53.5	56.5	59.5	57.5	52.5	47.5	SoundPlan Library
130	-	Mobile Mine Equipment	CAT_740 articulated truck	2	103.2	111.2	88.8	96.9	102.4	105.7	106.0	103.2	100.0	92.9	British Standard BS 5228-1:2009, Table C10

No.	Equipment Tag	Equipment Type	Equipment Description	No. Items	LP (dB(A)) @ 1m	Lw (dB(A))	Octave Band Central Frequency Spectrum Hz (dB(A))								Comment
131	-	Mobile Mine Equipment	Pickup	8	78.6	86.6	-	-	-	86.6	-	-	-	-	SoundPlan Library
132	-	Mobile Mine Equipment	Crew Bus	1	63.9	71.9	68.0	63.0	64.0	63.0	59.0	60.0	58.0	51.0	British Standard BS 5228-1:2009, Table C4
133	-	Mobile Mine Equipment	CrewVan	2	63.9	71.9	68.0	63.0	64.0	63.0	59.0	60.0	58.0	51.0	British Standard BS 5228-1:2009, Table C4
134	-	Mobile Mine Equipment	Rockbreaker with backhoe	1	112.4	120.4	80.8	93.9	100.4	106.7	114.0	115.2	115.0	111.9	British Standard BS 5228-1:2009, Table C1
135	-	Mobile Mine Equipment	ForkLift	1	54.0	62.0	43.6	47.6	51.5	54.5	57.5	55.5	50.5	45.5	SoundPlan Library
136	-	Mobile Mine Equipment	StemmingLoader	1	98.9	106.9	88.8	93.9	96.4	102.7	101.0	99.2	93.0	83.9	British Standard BS 5228-1:2009, Table C2

Appendix B – Calibration Certificates

Technology Solutions
Measurement Science Laboratory

Certificate of Calibration

ANSI National Accreditation Board (ANAB) is a member of the International Laboratory Accreditation Cooperation (ILAC) Mutual Recognition Agreement (MRA). This arrangement allows for the mutual recognition of technical test and calibration data by the member accreditation bodies worldwide. For more information on the arrangement please consult www.ilac.org. The accuracies of all measurements were traceable to the SI (International System of Units) through NIST, NMISA, PTB or International Measuring Standards, unless otherwise noted. The uncertainties of measurement were estimated for a coverage factor of k=2 which approximates to a 95% confidence level.

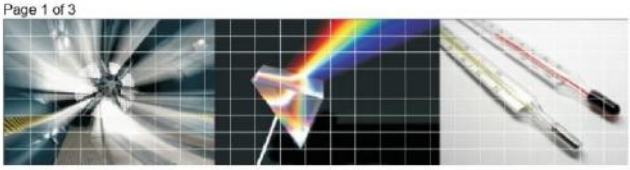
American Standard Calibration Laboratory
Measurement Science Laboratory

Certificate No	L82460	As Found/As Left	Rev 0
Manufacturer	Cirrus		
Description	Acoustic Calibrator		
Model No	CR:515		
Serial No	90005		
Plant No	AE190		
Calibrated for	Apex Environmental		
Address	Unit 4, 40 Beechgate Crescent, Southgate Business Park, Umbogin		
Temperature	23.4 °C ± 2 °C		
Relative humidity	35.6 % rh ± 5 % rh		
Barometric Pressure	851 mbar ± 5 mbar		
Date of calibration	21 October 2021		
Expiry date	21 October 2022	Issue Date	21 October 2021
Calibrated by	Digitally signed by Catharina Magdalena Pretorius Date: 2021.10.21 14:56:36 +02'00'		

This certificate is issued without alteration, and in accordance with the conditions of accreditation granted by ANAB Copyright of this certificate is owned by Technology Solutions & American Standard Calibration Laboratory and may not be reproduced other than in full, except with the prior written approval. It is a correct record of the measurements performed at the time of calibration.Subsequently the accuracy will depend on factors such as care exercised in handling the instrument and frequency of use. Recalibration should be performed after a period which has been chosen to ensure that, under normal circumstances, the instruments accuracy remains within the desired limits.The results relate to the device under calibration.

Technical Signatory Digitally signed by Catharina Magdalena Pretorius Date: 2021.10.21 14:56:54 +02'00'

Page 1 of 3



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Technology Solutions
Measurement Science Laboratory

Certificate of Calibration

Certificate No **L82460** As Found/As Left Rev 0

Standards and Equipment used

Description	Asset No	Cal due
Omnical Sound Level Calibrator	TS302	04 March 2022
Sound Level Meter	TS312	04 November 2022
Memory-Loc Barometer	TS086	12 October 2022

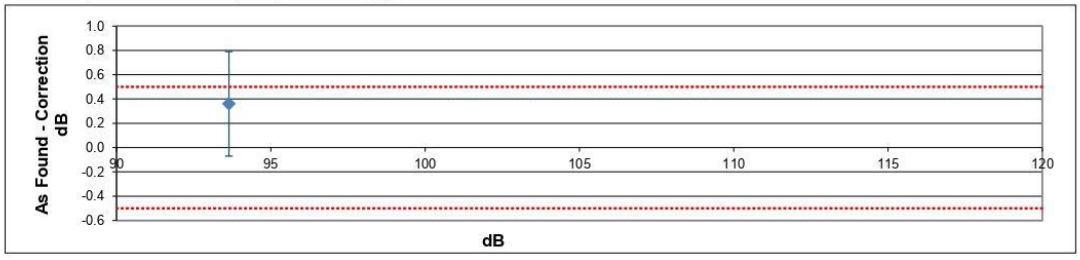
Procedure TS PL 021

Results - As Found

Function dB (IEC 651 Type 1) ± 0.5 dB

Sound Pressure Level Setting (dB)	UUT Sound Pressure Level reading (dB)	Sound Pressure Level correction (dB)
94.0 dB, 1 kHz	93.6	0.4

Uncertainty of Measurement: (± dB) 0.43

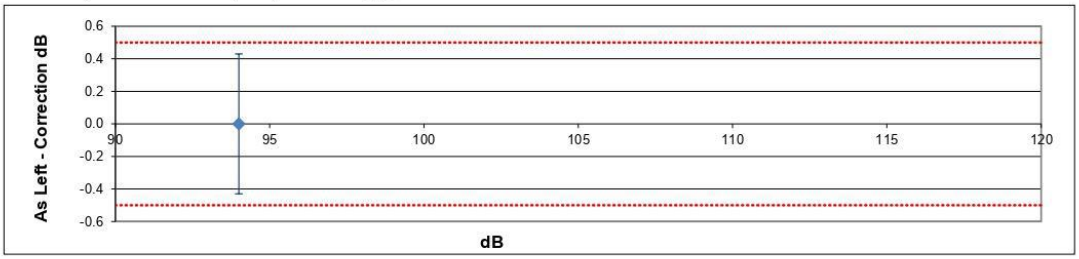


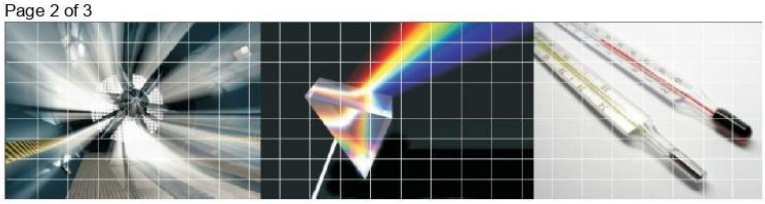
Results - As Left

Function dB (IEC 651 Type 1) ± 0.5 dB

Sound Pressure Level Setting (dB)	UUT Sound Pressure Level reading (dB)	Sound Pressure Level correction (dB)
94.0 dB, 1 kHz	94.0	0.0

Uncertainty of Measurement: (± dB) 0.43





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Certificate of Calibration

Certificate No **L82460** As Found/As Left Rev 0

Compliance with Specifications - ILAC-G8

When a specification describes an interval with an upper and lower limit, a statement of compliance or non-compliance with specification is made where the ratio of the expanded uncertainty interval to the specified interval is reasonably small and fit for purpose.

Compliance: If the specification limit is not breached by the measurement result plus the expanded uncertainty with a 95% coverage probability, then compliance with the specification can be stated (See Case 1 of Fig.1). This can be reported as "Compliance" or "Compliance – The measurement result is within (or below) the specification limit when the measurement uncertainty is taken into account". In calibration this is often reported as "Pass";

Non-compliance: If the specification limit is exceeded by the measurement result minus the expanded uncertainty with a 95% coverage probability, then noncompliance with the specification can be stated. (See Case 4 of Fig.1) This can be reported as "Non-compliance" or "Non-compliance – The measurement result is outside (or above) the specification limit when the measurement uncertainty is taken into account". In calibration this is often reported as "Fail";

If the measurement result plus/minus the expanded uncertainty with a 95 % coverage probability overlaps the limit (See Case 2 and 3 of Fig.1), it is not possible to state either compliance or non-compliance. Where applicable in this report this condition is referred to as "Undetermined" and the user of the device must determine fitness for use in their measurement processes.

In cases where measurement uncertainty is not taken into account when making compliance statements, the shared risk approach is implemented and noted according on the calibration certificate.

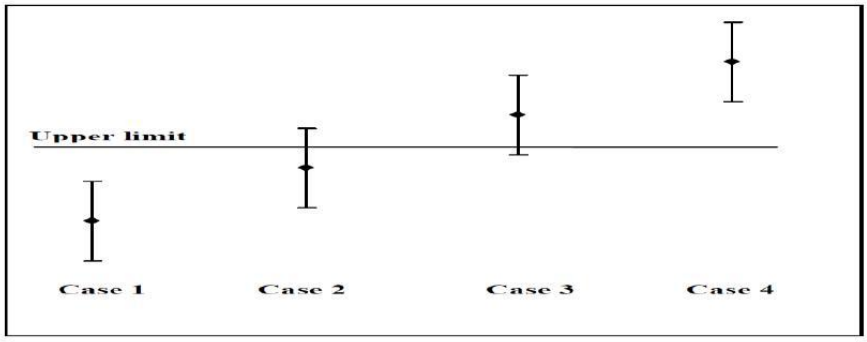


Fig. 1

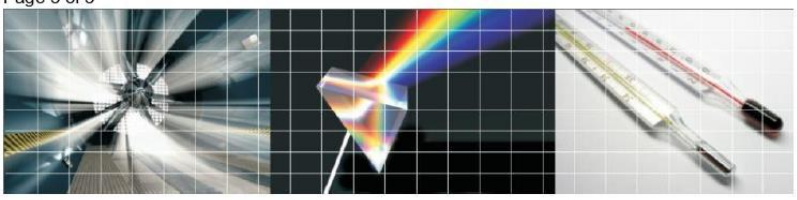
Comments

The Correction Must be Added Algebraically to the UUT Reading to Obtain the Corrected Value.

Instrument Adjusted As Per Manufacturers Adjustment Procedure.

Instrument Received in Good Physical and Functional Condition.

End of Calibration Certificate



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Certificate of Calibration

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American Standard Calibration Laboratory
Measurement Science Laboratory

Certificate No	L79159	As Found/As Left	Rev 0
Manufacturer	Cirrus		
Description	Sound Level Meter; Microphone		
Model No	CR:171B; MK:224		
Serial No	G301092; 9379F; 212208C		
Plant No	AE191		
Calibrated for	Apex Environmental		
Address	Unit 4, 40 Beechgate Crescent, Southgate Business Park, Umbogintwini, 4126		
Temperature	22.4 °C ± 2 °C		
Relative humidity	44.9 % rh ± 5 % rh		
Barometric Pressure	853 mbar ± 5 mbar		
Date of calibration	23 October 2020		
Expiry date	23 October 2022	Issue Date	23 October 2020

Calibrated by E Terblanche
Digitally signed by Terblanche Enrico
Date: 2020.10.23 15:45:33 +02'00'

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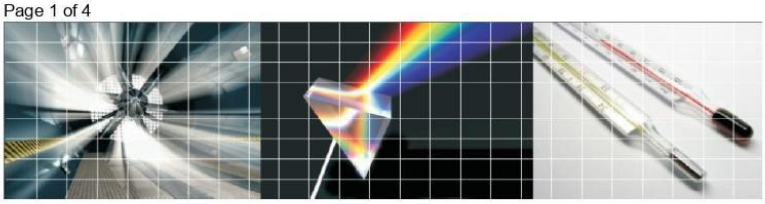
Technical Signatory E Terblanche
Digitally signed by Terblanche Enrico
Date: 2020.10.23 15:45:49 +02'00'



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Measurement Science Laboratory

Certificate of Calibration

Certificate No **L79159** As Found/As Left Rev 0

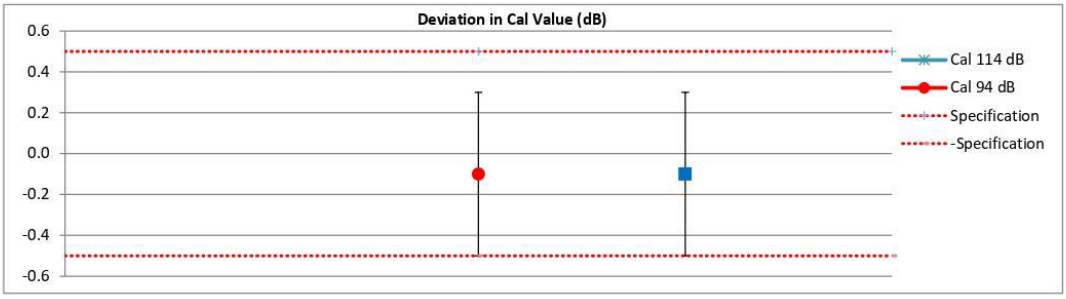
Standards and Equipment used

Description	Asset No	Cal due
Omnical Sound Level Calibrator	TS302	03 March 2021
Memory-Loc Barometer	TS085	09 October 2021

Procedure TS PL 021 **Uncertainty of Measurement (± dB)** 0.43

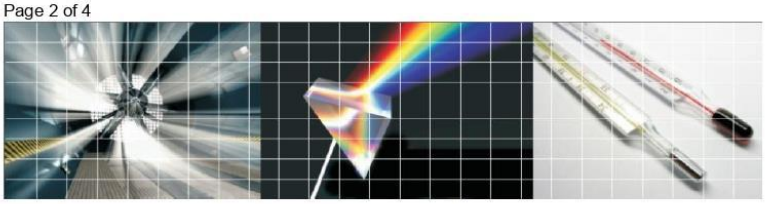
Results

Status	Input	UUT Reading (dB)	Correction	Specification (± dB)	Conclusion
As Found	94 dB, 1 kHz	94.1	-0.1	0.50	Pass
As Found	114 dB, 1 kHz	114.1	-0.1	0.50	Pass
As Left	94 dB, 1 kHz	94.1	-0.1	0.50	Pass
As Left	114 dB, 1 kHz	114.1	-0.1	0.50	Pass



Frequency Weighting - Corrections have been applied according to IEC 61672:2013

Level Range	Weight	Response	Applied Value	UUT Average Reading (dB)	Correction (dB)
20 - 140 dB	La	Slow	94 dB, 125 Hz	94.10	-0.10
		Slow	94 dB, 250 Hz	94.00	0.00
		Slow	94 dB, 500 Hz	94.10	-0.10
		Slow	94 dB, 1 kHz	94.10	-0.10
		Slow	94 dB, 2 kHz	93.60	0.40
		Slow	94 dB, 4 kHz	93.70	0.30
20 - 140 dB	La	Slow	114 dB, 125 Hz	114.10	-0.10
		Slow	114 dB, 250 Hz	114.00	0.00
		Slow	114 dB, 500 Hz	114.10	-0.10
		Slow	114 dB, 1 kHz	114.10	-0.10
		Slow	114 dB, 2 kHz	113.60	0.40
		Slow	114 dB, 4 kHz	113.80	0.20



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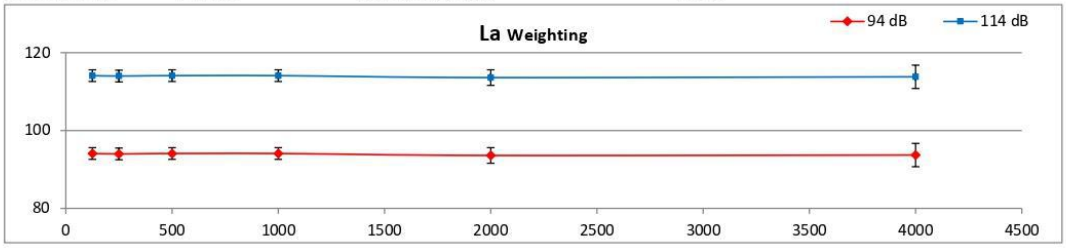
Measurement Science Laboratory

Certificate of Calibration

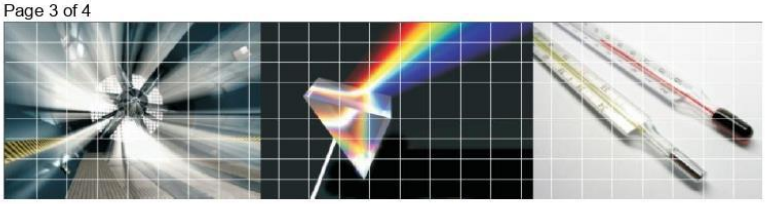
Certificate No **L79159** As Found/As Left Rev 0



SPL Accuracy

Level Range	Weight	Response	Applied Value	UUT Average Reading (dB)	Correction (dB)
20 - 140 dB	La	Fast	74 dB, 1 kHz	74.00	0.00
		Slow	74 dB, 1 kHz	74.00	0.00
	Lc	Fast	74 dB, 1 kHz	74.00	0.00
		Slow	74 dB, 1 kHz	74.00	0.00
20 - 140 dB	La	Fast	84 dB, 1 kHz	84.00	0.00
		Slow	84 dB, 1 kHz	84.00	0.00
	Lc	Fast	84 dB, 1 kHz	84.00	0.00
		Slow	84 dB, 1 kHz	84.00	0.00
20 - 140 dB	La	Fast	94 dB, 1 kHz	94.10	-0.10
		Slow	94 dB, 1 kHz	94.10	-0.10
	Lc	Fast	94 dB, 1 kHz	94.10	-0.10
		Slow	94 dB, 1 kHz	94.10	-0.10
	La	Fast	94 dB, 1 kHz		
		Slow	94 dB, 1 kHz		
	Lc	Fast	94 dB, 1 kHz		
		Slow	94 dB, 1 kHz		
20 - 140 dB	La	Fast	104 dB, 1 kHz	104.10	-0.10
		Slow	104 dB, 1 kHz	104.10	-0.10
	Lc	Fast	104 dB, 1 kHz	104.10	-0.10
		Slow	104 dB, 1 kHz	104.10	-0.10
20 - 140 dB	La	Fast	114 dB, 1 kHz	114.10	-0.10
		Slow	114 dB, 1 kHz	114.10	-0.10
	Lc	Fast	114 dB, 1 kHz	114.10	-0.10
		Slow	114 dB, 1 kHz	114.10	-0.10
	La	Fast	114 dB, 1 kHz		
		Slow	114 dB, 1 kHz		
	Lc	Fast	114 dB, 1 kHz		
		Slow	114 dB, 1 kHz		

Page 3 of 4



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Certificate of Calibration

Certificate No **L79159** As Found/As Left Rev 0

Compliance with Specifications - ILAC-G8

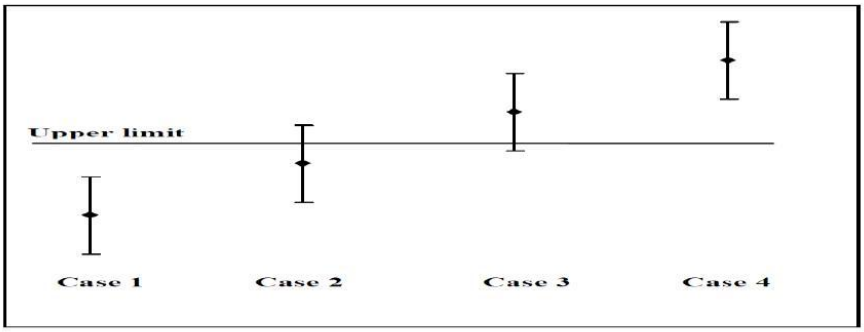
When a specification describes an interval with an upper and lower limit, a statement of compliance or non-compliance with specification is made where the ratio of the expanded uncertainty interval to the specified interval is reasonably small and fit for purpose.

Compliance: If the specification limit is not breached by the measurement result plus the expanded uncertainty with a 95% coverage probability, then compliance with the specification can be stated (See Case 1 of Fig.1). This can be reported as "Compliance" or "Compliance – The measurement result is within (or below) the specification limit when the measurement uncertainty is taken into account". In calibration this is often reported as "Pass";

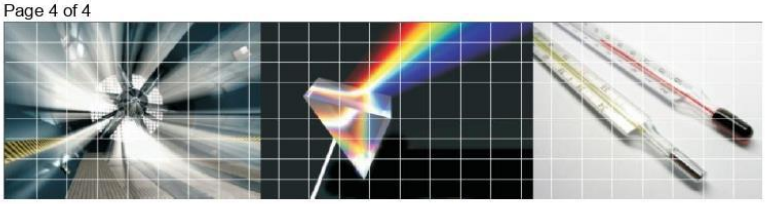
Non-compliance: If the specification limit is exceeded by the measurement result minus the expanded uncertainty with a 95% coverage probability, then noncompliance with the specification can be stated. (See Case 4 of Fig.1) This can be reported as "Non-compliance" or "Non-compliance – The measurement result is outside (or above) the specification limit when the measurement uncertainty is taken into account". In calibration this is often reported as "Fail";

If the measurement result plus/minus the expanded uncertainty with a 95 % coverage probability overlaps the limit (See Case 2 and 3 of Fig.1), it is not possible to state either compliance or non-compliance. Where applicable in this report this condition is referred to as "Undetermined" and the user of the device must determine fitness for use in their measurement processes.

In this certificate, the measurement uncertainty is not taken into account when making compliance statements, as defined in the contract review process.



End of Calibration Data



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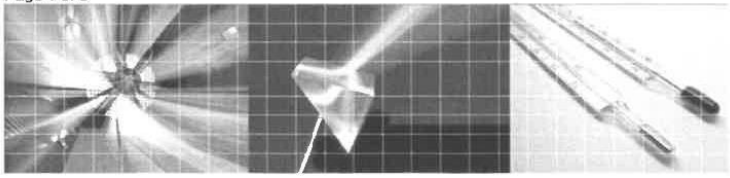
American Standard Calibration Laboratory
Measurement Science Laboratory

Certificate No	L80435	As Found/As Left	Rev 0
Manufacturer	Quest Technologies		
Description	Acoustic Calibrator		
Model No	QC-10		
Serial No	QE5120165		
Plant No	AE009		
Calibrated for	Apex Environmental		
Address	Unit 4, 40 Beechgate Crescent, Southgate Business Park, Umbogintwini, 4126		
Temperature	23.6 °C ± 2 °C		
Relative humidity	57 % rh ± 5 % rh		
Barometric Pressure	852 mbar ± 5 mbar		
Date of calibration	05 March 2021		
Expiry date	05 March 2022	Issue Date	05 March 2021
Calibrated by	*V Oosthuizen*	Digitally signed by Visser Oosthuizen Date: 2021.03.05 12:16:02 +02'00'	

This certificate is issued without alteration, and in accordance with the conditions of accreditation granted by ANAB Copyright of this certificate is owned by Technology Solutions & American Standard Calibration Laboratory and may not be reproduced other than in full, except with the prior written approval. It is a correct record of the measurements performed at the time of calibration. Subsequently the accuracy will depend on factors such as care exercised in handling the instrument and frequency of use. Recalibration should be performed after a period which has been chosen to ensure that, under normal circumstances, the instruments accuracy remains within the desired limits. The results relate to the device under calibration.

Technical Signatory *V Oosthuizen* Digitally signed by Visser Oosthuizen Date: 2021.03.05 12:16:14 +02'00'

Page 1 of 3



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Certificate of Calibration

Certificate No **L80435** As Found/As Left Rev 0

Standards and Equipment used

Description	Asset No	Cal due
Omnical Sound Level Calibrator	TS302	04 March 2022
Sound Level Meter	TS312	04 November 2022
Memory-Loc Barometer	TS086	09 October 2021

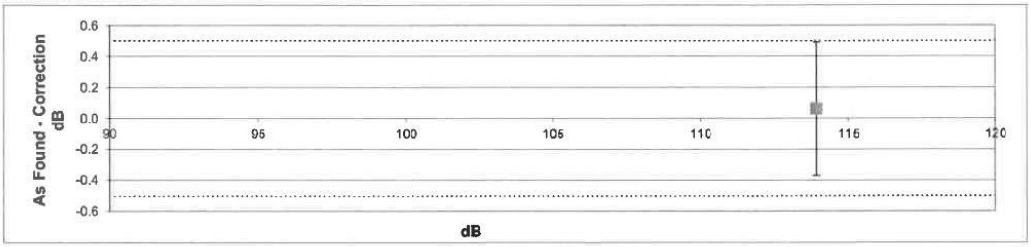
Procedure TS PL 021

Results - As Found

Function dB (IEC 651 Type 1) ± 0.5 dB

Sound Pressure Level Setting (dB)	UUT Sound Pressure Level reading (dB)	Sound Pressure Level correction (dB)
114.0 dB, 1 kHz	113.9	0.1

Uncertainty of Measurement: (± dB) 0.44

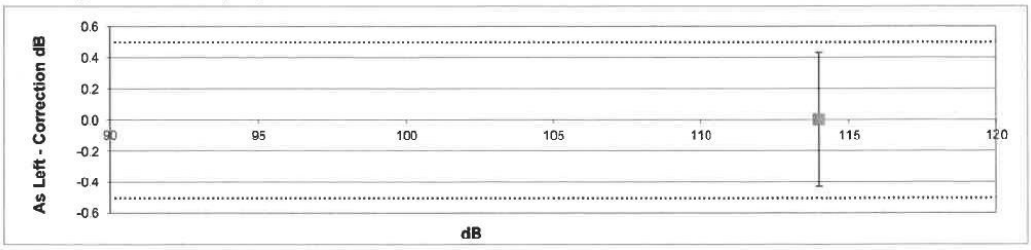


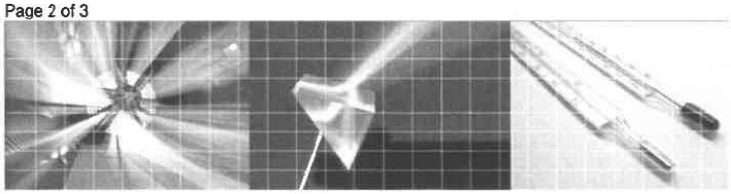
Results - As Left

Function dB (IEC 651 Type 1) ± 0.5 dB

Sound Pressure Level Setting (dB)	UUT Sound Pressure Level reading (dB)	Sound Pressure Level correction (dB)
114.0 dB, 1 kHz	114.0	0.0

Uncertainty of Measurement: (± dB) 0.44





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Certificate of Calibration

Certificate No **L80435** As Found/As Left Rev 0

Compliance with Specifications - ILAC-G8

When a specification describes an interval with an upper and lower limit, a statement of compliance or non-compliance with specification is made where the ratio of the expanded uncertainty interval to the specified interval is reasonably small and fit for purpose.

Compliance: If the specification limit is not breached by the measurement result plus the expanded uncertainty with a 95% coverage probability, then compliance with the specification can be stated (See Case 1 of Fig.1). This can be reported as "Compliance" or "Compliance – The measurement result is within (or below) the specification limit when the measurement uncertainty is taken into account". In calibration this is often reported as "Pass";

Non-compliance: If the specification limit is exceeded by the measurement result minus the expanded uncertainty with a 95% coverage probability, then noncompliance with the specification can be stated. (See Case 4 of Fig.1) This can be reported as "Non-compliance" or "Non-compliance – The measurement result is outside (or above) the specification limit when the measurement uncertainty is taken into account". In calibration this is often reported as "Fail";

If the measurement result plus/minus the expanded uncertainty with a 95 % coverage probability overlaps the limit (See Case 2 and 3 of Fig.1), it is not possible to state either compliance or non-compliance. Where applicable in this report this condition is referred to as "Undetermined" and the user of the device must determine fitness for use in their measurement processes.

In cases where measurement uncertainty is not taken into account when making compliance statements, the shared risk approach is implemented and noted according on the calibration certificate.

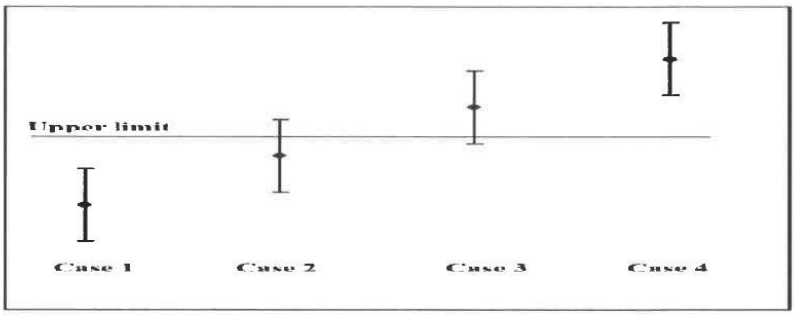


Fig. 1

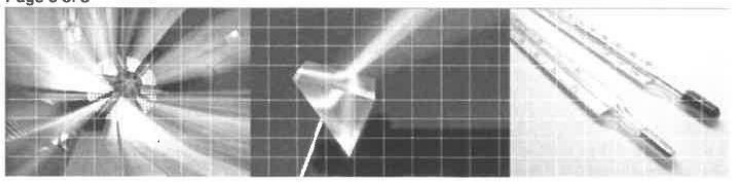
Comments

The Correction Must be Added Algebraically to the UUT Reading to Obtain the Corrected Value.

Instrument Adjusted As Per Manufacturers Adjustment Procedure.

Instrument Received in Good Physical and Functional Condition.

End of Calibration Certificate



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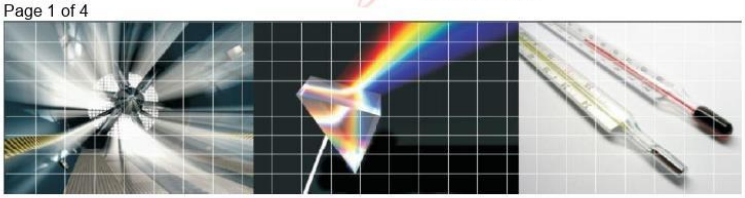
American Standard Calibration Laboratory
Measurement Science Laboratory

Certificate No	L81127	As Found/As Left	Rev 0
Manufacturer	Rion		
Description	Sound Level Meter; Microphone		
Model No	NL-32; UC-53A		
Serial No	00403212; 32517; 316568		
Plant No	BLACK KIT; AE007		
Calibrated for	Apex Environmental		
Address	Unit 4, 40 Beechgate Crescent, Southgate Business Park, Umbogintwini, 4126		
Temperature	25.5 °C ± 2 °C		
Relative humidity	41.2 % rh ± 5 % rh		
Barometric Pressure	863 mbar ± 5 mbar		
Date of calibration	24 May 2021		
Expiry date	24 May 2023	Issue Date	24 May 2021

Calibrated by: C M Pretorius — Digitally signed by Catharina Magdalena Pretorius, Date: 2021.05.24 14:44:30 +02'00'

This certificate is issued without alteration, and in accordance with the conditions of accreditation granted by ANAB Copyright of this certificate is owned by Technology Solutions & American Standard Calibration Laboratory and may not be reproduced other than in full, except with the prior written approval. It is a correct record of the measurements performed at the time of calibration.Subsequently the accuracy will depend on factors such as care exercised in handling the instrument and frequency of use. Recalibration should be performed after a period which has been chosen to ensure that, under normal circumstances, the instruments accuracy remains within the desired limits.The results relate to the device under calibration.

Technical Signatory: C M Pretorius — Digitally signed by Catharina Magdalena Pretorius, Date: 2021.05.24 14:44:40 +02'00'



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Certificate of Calibration

Certificate No **L81127** As Found/As Left Rev 0

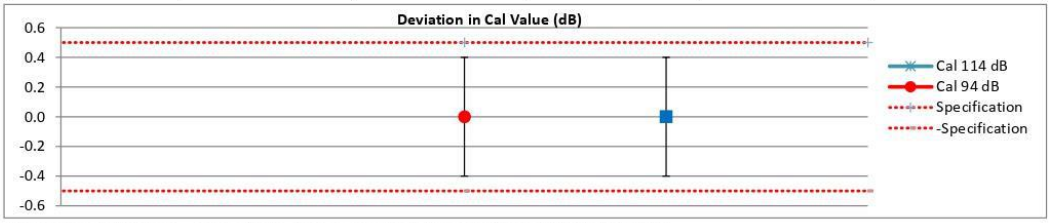
Standards and Equipment used

Description	Asset No	Cal due
Omnical Sound Level Calibrator	TS302	04 March 2022
Memory-Loc Barometer	TS086	09 October 2021

Procedure TS PL 021 **Uncertainty of Measurement (± dB)** 0.43

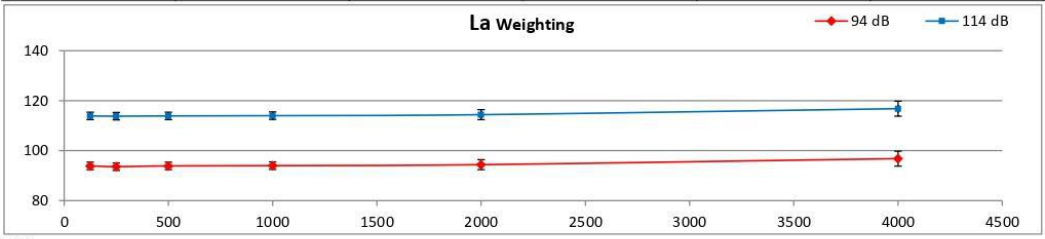
Results

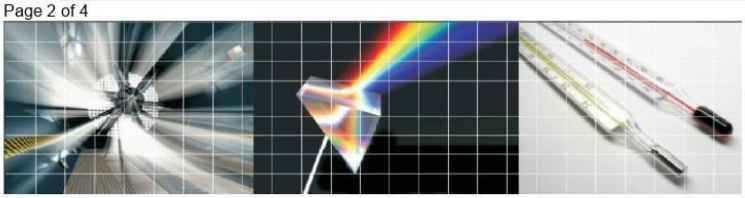
Status	Input	UUT Reading (dB)	Correction	Specification (± dB)	Conclusion
As Found	94 dB, 1 kHz	94.5	-0.5	0.50	Pass
As Found	114 dB, 1 kHz	114.4	-0.4	0.50	Pass
As Left	94 dB, 1 kHz	94.0	0.0	0.50	Pass
As Left	114 dB, 1 kHz	114.0	0.0	0.50	Pass



Frequency Weighting - Corrections have been applied according to IEC 61672:2013

Level Range	Weight	Response	Applied Value	UUT Average Reading (dB)	Correction (dB)
40 - 130 dB	La	Slow	94 dB, 125 Hz	93.90	0.10
		Slow	94 dB, 250 Hz	93.60	0.40
		Slow	94 dB, 500 Hz	93.90	0.10
		Slow	94 dB, 1 kHz	94.00	0.00
		Slow	94 dB, 2 kHz	94.40	-0.40
		Slow	94 dB, 4 kHz	96.80	-2.80
40 - 130 dB	La	Slow	114 dB, 125 Hz	113.90	0.10
		Slow	114 dB, 250 Hz	113.80	0.20
		Slow	114 dB, 500 Hz	113.90	0.10
		Slow	114 dB, 1 kHz	114.00	0.00
		Slow	114 dB, 2 kHz	114.40	-0.40
		Slow	114 dB, 4 kHz	116.80	-2.80





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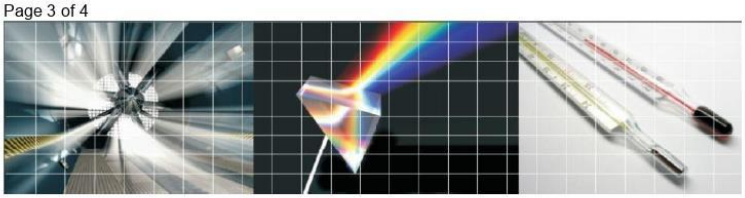
Certificate of Calibration

Certificate No **L81127** As Found/As Left Rev 0

SPL Accuracy

Level Range	Weight	Response	Applied Value	UUT Average Reading (dB)	Correction (dB)
20 - 80 dB	La	Fast	74 dB, 1 kHz	74.10	-0.10
		Slow	74 dB, 1 kHz	74.10	-0.10
		Impulse	74 dB, 1 kHz		
	Lc	Fast	74 dB, 1 kHz	74.20	-0.20
		Slow	74 dB, 1 kHz	74.20	-0.20
		Impulse	74 dB, 1 kHz		
20 - 90 dB	La	Fast	84 dB, 1 kHz	84.00	0.00
		Slow	84 dB, 1 kHz	84.00	0.00
		Impulse	84 dB, 1 kHz		
	Lc	Fast	84 dB, 1 kHz	84.00	0.00
		Slow	84 dB, 1 kHz	84.00	0.00
		Impulse	84 dB, 1 kHz		
20 - 100 dB	La	Fast	94 dB, 1 kHz	94.00	0.00
		Slow	94 dB, 1 kHz	94.00	0.00
		Impulse	94 dB, 1 kHz		
	Lc	Fast	94 dB, 1 kHz	94.00	0.00
		Slow	94 dB, 1 kHz	94.00	0.00
		Impulse	94 dB, 1 kHz		
20 - 110 dB	La	Fast	94 dB, 1 kHz	94.00	0.00
		Slow	94 dB, 1 kHz	94.00	0.00
		Impulse	94 dB, 1 kHz		
	Lc	Fast	94 dB, 1 kHz	94.00	0.00
		Slow	94 dB, 1 kHz	94.00	0.00
		Impulse	94 dB, 1 kHz		
30 - 120 dB	La	Fast	104 dB, 1 kHz	104.00	0.00
		Slow	104 dB, 1 kHz	104.00	0.00
		Impulse	104 dB, 1 kHz		
	Lc	Fast	104 dB, 1 kHz	104.00	0.00
		Slow	104 dB, 1 kHz	104.00	0.00
		Impulse	104 dB, 1 kHz		
40 - 130 dB	La	Fast	114 dB, 1 kHz	114.00	0.00
		Slow	114 dB, 1 kHz	114.00	0.00
		Impulse	114 dB, 1 kHz		
	Lc	Fast	114 dB, 1 kHz	114.00	0.00
		Slow	114 dB, 1 kHz	114.00	0.00
		Impulse	114 dB, 1 kHz		
	La	Fast	114 dB, 1 kHz		
		Slow	114 dB, 1 kHz		
		Impulse	114 dB, 1 kHz		
	Lc	Fast	114 dB, 1 kHz		
		Slow	114 dB, 1 kHz		
		Impulse	114 dB, 1 kHz		



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Certificate of Calibration

Certificate No **L81127** As Found/As Left Rev 0

Compliance with Specifications - ILAC-G8

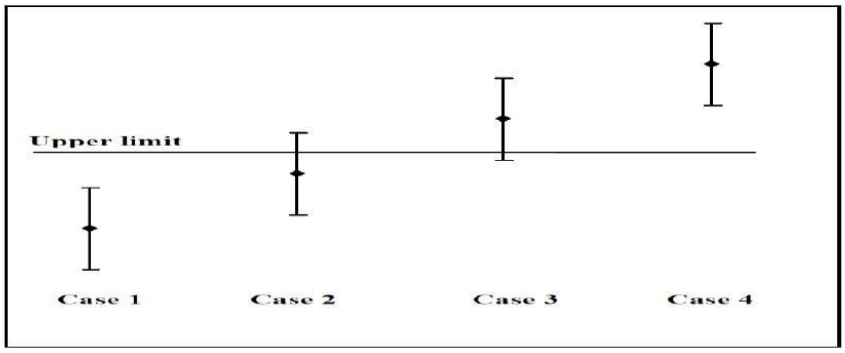
When a specification describes an interval with an upper and lower limit, a statement of compliance or non-compliance with specification is made where the ratio of the expanded uncertainty interval to the specified interval is reasonably small and fit for purpose.

Compliance: If the specification limit is not breached by the measurement result plus the expanded uncertainty with a 95% coverage probability, then compliance with the specification can be stated (See Case 1 of Fig.1). This can be reported as "Compliance" or "Compliance – The measurement result is within (or below) the specification limit when the measurement uncertainty is taken into account". In calibration this is often reported as "Pass";

Non-compliance: If the specification limit is exceeded by the measurement result minus the expanded uncertainty with a 95% coverage probability, then noncompliance with the specification can be stated. (See Case 4 of Fig.1) This can be reported as "Non-compliance" or "Non-compliance – The measurement result is outside (or above) the specification limit when the measurement uncertainty is taken into account". In calibration this is often reported as "Fail";

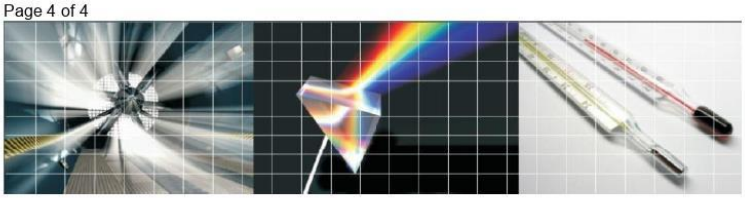
If the measurement result plus/minus the expanded uncertainty with a 95 % coverage probability overlaps the limit (See Case 2 and 3 of Fig.1), it is not possible to state either compliance or non-compliance. Where applicable in this report this condition is referred to as "Undetermined" and the user of the device must determine fitness for use in their measurement processes.

In this certificate, the measurement uncertainty is not taken into account when making compliance statements, as defined in the contract review process.



Instrument Received in Good Physical and Functional Condition.

Instrument Adjusted As Per Manufacturers Adjustment Procedure. End of Calibration Data.



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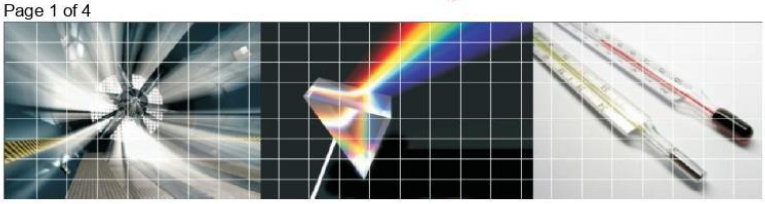
American Standard Calibration Laboratory
Measurement Science Laboratory

Certificate No	L78118	As Found/As Left	Rev 0
Manufacturer	Rion		
Description	Sound Level Meter; Microphone		
Model No	NL-32; NH-21; UC-53A		
Serial No	00403213; 32518; 316569		
Plant No	Yellow Kit; AE006		
Calibrated for	Apex Environmental		
Address	Unit 4, 40 Beechgate Crescent, Southgate Business Park, Umbogintwini, 4126		
Temperature	19.6 °C ± 2 °C		
Relative humidity	24.6 % rh ± 5 % rh		
Barometric Pressure	866 mbar ± 5 mbar		
Date of calibration	17 July 2020		
Expiry date	17 July 2022	Issue Date	17 July 2020

Calibrated by E Terblanche Digitally signed by Terblanche Enrico Date: 2020.07.17 10:01:13 +02'00'

Technical Signatory E Terblanche Digitally signed by Terblanche Enrico Date: 2020.07.17 10:01:39 +02'00'



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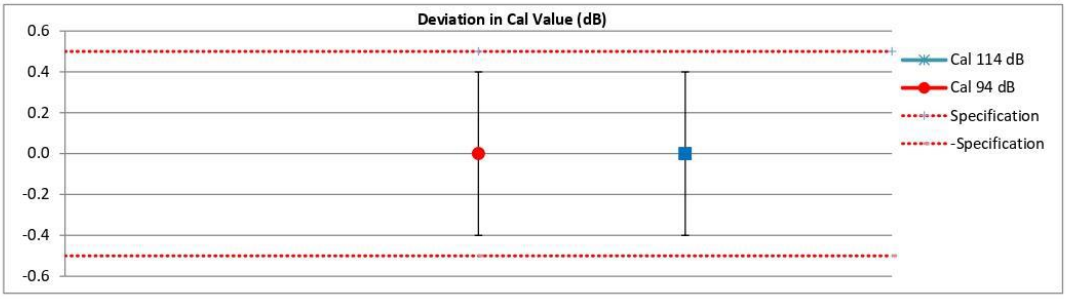
Standards and Equipment used

Description	Asset No	Cal due
Omnical Sound Level Calibrator	TS302	03 March 2021
Memory-Loc Barometer	TS085	13 October 2020

Procedure TS PL 021 **Uncertainty of Measurement (± dB)** 0.43

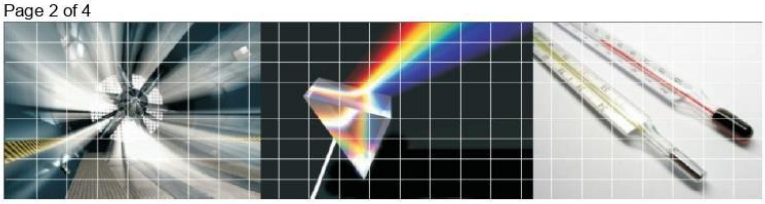
Results

Status	Input	UUT Reading (dB)	Correction	Specification (± dB)	Conclusion
As Found	94 dB, 1 kHz	94.8	-0.8	0.50	Fail
As Found	114 dB, 1 kHz	114.8	-0.8	0.50	Fail
As Left	94 dB, 1 kHz	94.0	0.0	0.50	Pass
As Left	114 dB, 1 kHz	114.0	0.0	0.50	Pass



Frequency Weighting - Corrections have been applied according to IEC 61672:2013

Level Range	Weight	Response	Applied Value	UUT Average Reading (dB)	Correction (dB)
40 - 130 dB	La	Slow	94dB, 125 Hz	93.60	0.40
		Slow	94 dB, 250 Hz	93.80	0.20
		Slow	94 dB, 500 Hz	93.90	0.10
		Slow	94 dB, 1 kHz	94.00	0.00
		Slow	94 dB, 2 kHz	93.80	0.20
		Slow	94dB, 4 kHz	95.10	-1.10
40 - 130 db	La	Slow	114 dB, 125 Hz	113.60	0.40
		Slow	114 dB, 250 Hz	113.80	0.20
		Slow	114 dB, 500 Hz	113.90	0.10
		Slow	114 dB, 1 kHz	114.00	0.00
		Slow	114 dB, 2 kHz	113.80	0.20
		Slow	114 dB, 4 kHz	115.10	-1.10



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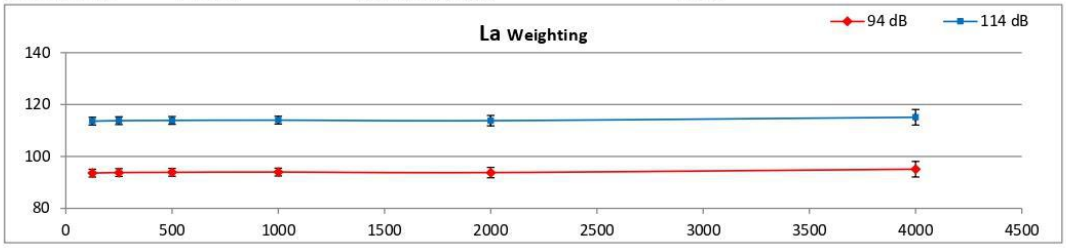
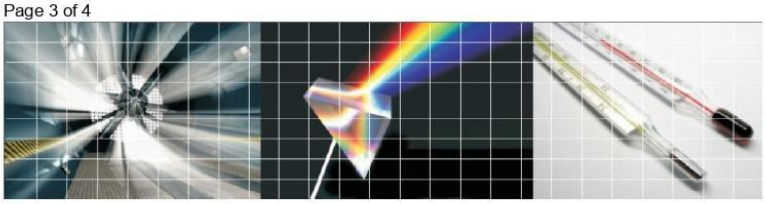


SPL Accuracy

Level Range	Weight	Response	Applied Value	UUT Average Reading (dB)	Correction (dB)
20 - 80 dB	La	Fast	74 dB, 1 kHz	74.00	0.00
		Slow	74 dB, 1 kHz	74.00	0.00
	Lc	Fast	74 dB, 1 kHz	74.00	0.00
		Slow	74 dB, 1 kHz	74.00	0.00
20 - 90 dB	La	Fast	84 dB, 1 kHz	84.00	0.00
		Slow	84 dB, 1 kHz	84.00	0.00
	Lc	Fast	84 dB, 1 kHz	84.00	0.00
		Slow	84 dB, 1 kHz	84.00	0.00
20 - 100 dB	La	Fast	94 dB, 1 kHz	94.00	0.00
		Slow	94 dB, 1 kHz	94.00	0.00
	Lc	Fast	94 dB, 1 kHz	94.00	0.00
		Slow	94 dB, 1 kHz	94.00	0.00
20 - 110 dB	La	Fast	94 dB, 1 kHz	94.00	0.00
		Slow	94 dB, 1 kHz	94.00	0.00
	Lc	Fast	94 dB, 1 kHz	94.00	0.00
		Slow	94 dB, 1 kHz	94.00	0.00
20 - 110 dB	La	Fast	104 dB, 1 kHz	104.00	0.00
		Slow	104 dB, 1 kHz	104.00	0.00
	Lc	Fast	104 dB, 1 kHz	104.00	0.00
		Slow	104 dB, 1 kHz	104.00	0.00
30 - 120 dB	La	Fast	114 dB, 1 kHz	114.00	0.00
		Slow	114 dB, 1 kHz	114.00	0.00
	Lc	Fast	114 dB, 1 kHz	114.00	0.00
		Slow	114 dB, 1 kHz	114.00	0.00
40 - 130 dB	La	Fast	114 dB, 1 kHz	114.00	0.00
		Slow	114 dB, 1 kHz	114.00	0.00
	Lc	Fast	114 dB, 1 kHz	114.00	0.00
		Slow	114 dB, 1 kHz	114.00	0.00



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Compliance with Specifications - ILAC-G8

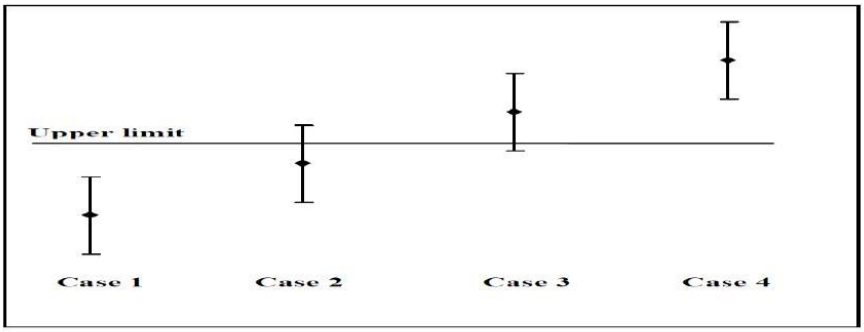
When a specification describes an interval with an upper and lower limit, a statement of compliance or non-compliance with specification is made where the ratio of the expanded uncertainty interval to the specified interval is reasonably small and fit for purpose.

Compliance: If the specification limit is not breached by the measurement result plus the expanded uncertainty with a 95% coverage probability, then compliance with the specification can be stated (See Case 1 of Fig.1). This can be reported as "Compliance" or "Compliance – The measurement result is within (or below) the specification limit when the measurement uncertainty is taken into account". In calibration this is often reported as "Pass";

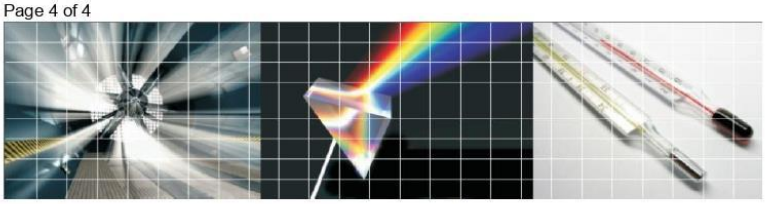
Non-compliance: If the specification limit is exceeded by the measurement result minus the expanded uncertainty with a 95% coverage probability, then noncompliance with the specification can be stated. (See Case 4 of Fig.1) This can be reported as "Non-compliance" or "Non-compliance – The measurement result is outside (or above) the specification limit when the measurement uncertainty is taken into account". In calibration this is often reported as "Fail";

If the measurement result plus/minus the expanded uncertainty with a 95 % coverage probability overlaps the limit (See Case 2 and 3 of Fig.1), it is not possible to state either compliance or non-compliance. Where applicable in this report this condition is referred to as "Undetermined" and the user of the device must determine fitness for use in their measurement processes.

In this certificate, the measurement uncertainty is not taken into account when making compliance statements, as defined in the contract review process.



Instrument Adjusted As Per Manufacturers Adjustment Procedure. End of Calibration Data.



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Appendix C – Noise Baseline Equipment Set-up

Figure C1 – Location 1: Chennells Farm – Venture Compound

Figure C2 – Location 2 – Chennells Farm – Hillcrest 40 Block

Figure C3 – Location 3 – Siyavuna Primary School

Figure C4 – Location 4 – Ngobese Homestead

Figure C5 – Location 5 – Mxosheni Combined School

Figure C6 – Location 6 – Nogajuka Primary School

Figure C7 – Location 7 – Mehlamasha Combined School