NOISE STUDY FOR ENVIRONMENTAL IMPACT ASSESSMENT

for the

Proposed Dalyshope Project

near Lephalale, Limpopo Province

Study done for:

DIGBY WELLS ENVIRONMENTAL

Prepared by:

EARES Enviro Acoustic Research

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EXECUTIVE SUMMARY

INTRODUCTION

Enviro Acoustic Research cc (EARES) was commissioned by Digby Wells and Associates (Pty) Ltd to determine the potential noise impact on the surrounding environment due to proposed activities at the Dalyshope Coal Project, Lephalale, Limpopo Province.

PROJECT DESCRIPTION

Universal Coal (UC) and Anglo-American Corporation (AAC) formed a joint venture with the aim of developing the Dalyshope Project. The project will initially target the coal resources in the Dalyshope and Klaarwater farms.

Previous work by Anglo has identified four open cast pits (OC1 to OC4) that can potentially be mined economically. Initially, only OC1 (the southern pit situated on the Dalyshope farm) will be mined. Mining activities will be carried out on other pits at a later stage.

Dalyshope mine is envisaged as a small scale, fit for purpose, contractor-run mining operation, aimed at minimising capital outlay initially before building up to a large-scale truck and shovel operation. Access to the mining block will be by a ramp on the farm Dalyshope sunk down to coal elevation. The upper coal seams will be removed and the pit bottom will be covered with overburden once sufficient area of coal has been mined.

Bulk Material Handling consists of hydraulic excavators loading mining trucks that will haul the run-of-mine (ROM) coal from the coal bench, up the ramp, to a stockpile and tip at the pit-head.

Discard from the washing process will be transported back to the pit by conveyor belt for placement at the bottom of the mined-out area prior to the placement of overburden and rehabilitation.

The ROM coal will pass through a crusher before being transferred onto a conveyor belt that transports the coal to the stockpiles before the proposed washing plant.

The washing plant will be a modular cyclone washing plant, with each module capable of handling up to 1000 tph (tons per hours). Product will be placed onto individual stockpiles before being sent to the market. Currently two options are being investigated for the transportation of the product to market, i.e. trucking by road haulers (or rail on a rail link still to be constructed).

BASELINE

Ambient (background) noise levels were measured during January 2019 and September 2020 in accordance with the South African National Standard 10103:2008, also considering the protocols defined in GG 43110.

Ambient sound levels were measured at two locations using class-1 Sound Level Meters (SLMs). The SLMs would measure "average" sound levels over 10-minute periods, save the data and start with a new 10-minute measurement until the instruments were stopped. This data was augmented by a number of short-term measurements done during January 2019.

Based on the sound measurements:

- **DCDLTSL01 – R5:**
  - Considering the arithmetic average $L_{Aeq,f}$ daytime data (37.1 dBA), ambient sound levels are low, with the energy-averaged $L_{Aeq,f}$ being 43.2 dBA. This is typical of a rural noise district;
  - Considering the arithmetic average $L_{Aeq,f}$ night-time data (34.7 dBA), ambient sound levels are elevated, with the energy-averaged $L_{Aeq,f}$ being 36.3 dBA. This is typical of a rural noise district;
  - The statistical L_{A90} levels are slightly elevated during the day, but low at night.
- **JGSTSL01 – R2:**
  - Considering the arithmetic average $L_{Aeq,f}$ daytime data (38.3 dBA), ambient sound levels are low, with the energy-averaged $L_{Aeq,f}$ being 37.2 dBA. This is typical of a rural noise district;
  - Considering the arithmetic average $L_{Aeq,f}$ night-time data (33.6 dBA), ambient sound levels slightly elevated, with the energy-averaged $L_{Aeq,f}$ being 37.9 dBA. This is considered typical of a rural noise district;
  - The statistical L_{A90} levels are slightly elevated during the day, but low at night.

Considering the short-time measurements collected during the day, ambient sound levels are low and typical of a rural noise district in an undeveloped area.

Considering the results of the measurements, the developmental character of the area as well as audible observations, the recommended noise limits would be typical of a rural noise district. The acceptable zone sound levels recommended are;

- **45 dBA for daytime noise levels;** and,
- **35 dBA for night-time noise levels**.

Proposed activities at the project should not change the recommended rating levels with more than 7 dBA.

FINDINGS

Conceptual scenarios were conceptualized for the future proposed construction and operational phases with the output of the modelling exercise indicating a potential significant noise impact (for both day- and night-time activities). Mitigation is required, identified and recommended to ensure that the noise levels can be managed to minimize the significance of the noise impacts. Mitigation would include active noise monitoring for both the construction and operational phases.

MANAGEMENT & MITIGATION OF NOISE IMPACTs

Mitigation options included both management measures as well as technical changes. Options to reduce the noise impact during the construction phase include:

- It is recommended that NSD R1 be relocated further than 1,000m from the mine, or further than 200m from the access road to minimize night-time impacts;
- A berm should be constructed between the processing / washing plant as well as the active and future mining areas and the identified NSD. The mine can use topsoil, soft material or overburden spoils to construct these berms. These berms should ideally be constructed during the day, with dumping of stockpiles and residue deposits taking place behind these berms, or as far as possible from the identified NSD;
- Include a component covering environmental noise in the Health and Safety Induction to sensitize all employees and contractors about this subject, especially those employees and contractors that have to travel past receptors at night (within 200m), or might be required to do work close (within 1,000m) to receptors at night;
- Establish a complaint register with an open line to a relevant person that can act if there is a noise complaint;
- It is recommended that a noise monitoring programme is developed and implemented for the construction and operational phases;
- Ensure a good working relationship between mine management and all potentially noise-sensitive receptors. Communication channels should be established to ensure prior notice to the sensitive receptor if work is to take place close to them (especially if work is to take place within 300m from them at night). Information that should be provided to potentially sensitive receptor(s) includes:
    - Proposed working dates, the duration that work will take place in an area and working times;

  - The reason why the activity is taking place;
  - The construction methods that will be used; and
  - Contact details of a responsible person where any complaints can be lodged should there be an issue of concern.
- Ensure that equipment is well maintained and fitted with the correct and appropriate noise abatement measures. Engine bay covers over heavy equipment could be pre-fitted with sound absorbing material. Heavy equipment that fully encloses the engine bay should be considered, ensuring that the seam gap between the hood and vehicle body is minimised;
- The operation should investigate the use of white-noise alarms instead of tonal reverse alarms on heavy vehicles operating on roads, within the mining area and at stockpile areas[1][2]. The advantages of white noise alarms above tonal alarms are:
  - It is as safe as a tonal alarm[3].
  - Highly audible close to the alarm (or reversing truck)[4].
  - It generates a more uniform sound field behind a reversing vehicle[5].
  - Greater directional information, workers can locate the source faster.
  - Significantly less environmental noise and it creates significantly less annoyance far away.
  - When properly installed, white noise alarms of a similar sound power emission level are more likely to comply with the ISO 9533 standard.

Options to reduce the noise impact during the operational phase include:

- The mine should continue with the development of berms between the active mining areas and NSD as recommended. These berms should be as high as possible and should ideally block the line of sight to mining activities;
- Include a component covering environmental noise in the Health and Safety Induction to sensitize all employees and contractors about this subject, especially those employees and contractors that have to travel past receptors at night, or might be required to do work close (within 500m) to receptors at night.
- Ensure that equipment is well maintained and fitted with the correct and appropriate noise abatement measures;
- Continuation of noise measurement programme (if required, depending on recommendation from the noise measurement specialist);

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[1] White Noise Reverse Alarms: http://www.brigade-electronics.com/products.
[2] https://www.constructionnews.co.uk/home/white-noise-sounds-the-reversing-alarm/885410.article - White noise sounds the reversing alarm
[3] https://www.acoustics.asn.au/conference_proceedings/AAS2012/papers/p126.pdf - Which is Safer – Tonal or Broadband Reversing Alarms
[4] http://www.irsst.qc.ca/media/documents/PubIRSST/R-833.pdf - Safety of workers behind heavy vehicles
[5] https://www.vaultintel.com/blog/reversing-beeps-could-be-a-thing-of-the-past
https://brigade-electronics.com/white-sound-reversing-alarms-improving-safety-environment/

- Compliance with the Noise conditions of the Environmental Management Plan that covers:
  - Potential mitigation measures as defined in this report;
  - Formal register where receptors can lodge any noise complaints;
  - Noise measurement protocol to investigate any noise complaints; and
  - The commitment from the mine to consider reasonable mitigation if the noise complaint investigation indicates the validity of a noise complaint. These measures could include steps ranging from process changes, development of barriers or enclosure of the noise source and even relocation (if no other feasible alternatives exist).

RECOMMENDATIONS

While the proposed activities could have a significant noise impact on the surrounding NSD, the implementation of appropriate mitigation measures could reduce the significance of the noise impact to low. It will be required to relocate NSD R1 as recommended in the report. Therefore, with the appropriate implementation of mitigation measures, it is recommended that the proposed activities at Dalyshope be authorized (from a noise impact perspective).

FUTURE REQUIRED WORK

Active noise monitoring is recommended to take place on a six-monthly basis as proposed in this report.

Report should be sited as:

De Jager, M (2021). "*Noise Study for Environmental Impact Assessment for the Proposed Dalyshope Project near Lephalale, Limpopo Province*", Enviro-Acoustic Research cc, Pretoria

Client:

Digby Wells and Associates
for
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DW-UCDP/ENIA/202101-Rev 0

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Date:

January 2021

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GLOSSARY OF ABBREVIATIONS

AZSL	Acceptable Zone Sound Level (Rating Level)
BMH	Bulk Material Handling
dB	Decibel
EARES	Enviro-Acoustic Research cc
EMP	Environmental Management Programme
ENIA	Environmental Noise Impact Assessment
EP	Equator Principle
f	Fast setting
GG	Government Gazette
GN	Government Notice
Hz	Hertz
i	Impulse setting
i.e.	that is
IEC	International Electrotechnical Commission
IFC	International Finance Corporation
km/h	kilometres per hour
LoM	Life of Mine
m	Meters
mamsl	Meters above mean sea level
NCR	Noise Control Regulations (under Section 25 of the ECA)
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NSD	Noise-Sensitive Development
RoM	Run of Mine
RPM	Revolutions per Minute
SABS	South African Bureau of Standards

SANS	South African National Standard
SPL	Sound Power Levels
t	Time
ToR	Terms of Reference
TSF	Tailings Storage Facility
UTM	Universal Transverse Mercator
WHO	World Health Organisation

1 THE AUTHOR

The Author started his career in the mining industry as a bursar Learner Official (JCI, Randfontein), working in the mining industry, doing various mining-related courses (Mining [stoping and development], Rock Mechanics, Surveying, Sampling, Safety and Health [Ventilation, noise, illumination etc.] and Metallurgy. He did work in both underground (Coal, Gold and Platinum) as well as opencast (Coal) for 4 years, the last two during which he studied Mining Engineering. He used to be a holder of a temporary blasting certificate during the period he mined at JCI: Cook 2 shaft. He changed course from Mining Engineering to Chemical Engineering after the second year of his studies at the University of Pretoria.

After graduation he worked as a Water Pollution Control Officer at the Department of Water Affairs and Forestry for two years (first year seconded from Wates, Meiring and Barnard), where duties included the perusal (evaluation, commenting and recommendation) of various regulatory required documents (such as EMPR's, Water Licence Applications and EIA's), auditing of licence conditions as well as the compilation of Technical Documents.

Since leaving the Department of Water Affairs, Morné has been in private consulting for the last 15 years, managing various projects for the mining and industrial sector, private developers, business, other environmental consulting firms as well as the Department of Water Affairs. During that period, he has been involved in various projects, either as specialist, consultant, trainer or project manager, successfully completing a number of these projects. During that period, he gradually moved towards environmental acoustics, focusing on this field exclusively since 2007.

He has been interested in acoustics as from school days, doing projects mainly related to loudspeaker design. Interest in the matter brought him into the field of Environmental Noise Measurement, Prediction and Control as well as blasting impacts. Since 2007 he has completed more than 300 Environmental Noise Impact Assessments and Noise Monitoring Reports as well as various acoustic consulting services, including amongst others:

Wind Energy Facilities	*Full Environmental Noise Impact Assessments for - Bannf (Vidigenix), iNCa Gouda (Aurecon SA), Isivunguvungu (Aurecon), De Aar (Aurecon), Kokerboom 1 (Aurecon), Kokerboom 2 (Aurecon), Kokerboom 3 (Aurecon), Kangnas (Aurecon), Plateau East and West (Aurecon), Wolf (Aurecon), Outeniqwa (Aurecon), Umsinde Emoyeni (ARCUS) , Komsberg (ARCUS), Karee (ARCUS), Kolkies (ARCUS), San Kraal (ARCUS), Phezukomoya (ARCUS), Canyon Springs (Canyon Springs), Perdekraal (ERM), Scarlet Ibis (CESNET), Albany (CESNET), Sutherland (CSIR), Kap Vley (CSIR), Kuruman (CSIR), Rietrug (CSIR), Sutherland 2 (CSIR), Perdekraal (ERM), Teekloof (Mainstream), Eskom Aberdene (SE), Dorper (SE), Spreeukloof (SE), Loperberg (SE), Penhoek Pass (SE), Amakhala Emoyeni (SE), Zen (Savannah Environmental – SE), Goereesoe (SE), Springfontein (SE), Garob (SE), Project Blue (SE), ESKOM Kleinzee (SE), Namas (SE), Zonnequa (SE), Walker Bay (SE), Oyster Bay (SE), Hidden Valley (SE), Deep River (SE), Tsitsikamma (SE), AB (SE), West Coast One (SE), Hopefield II (SE), Namakwa Sands (SE), VentuSA Gouda (SE), Dorper (SE), Klipheuwel (SE),*

	INCA Swellendam (SE), Cookhouse (SE), Iziduli (SE), Msenge (SE), Cookhouse II (SE), Rheboksfontein (SE), Suurplaat (SE), Karoo Renewables (SE), Koningaas (SE), Spitskop (SE), Castle (SE), Khai Ma (SE), Poortjies (SE), Korana (SE), IE Moorreesburg (SE), Gunstfontein (SE), Boulders (SE), Vredenburg (Terramanzi), Loeriesfontein (SiVEST), Rhenosterberg (SiVEST), Noupoort (SiVEST), Prieska (SiVEST), Dwarsrug (SiVEST), Graskoppies (SiVEST), Philco (SiVEST), Hartebeest Leegte (SiVEST), Ithemba (SiVEST), !Xha Boom (SiVEST), Spitskop West (Terramanzi), Haga Haga (Terramanzi), Vredenburg (Terramanzi), Msenge Emoyeni (Windlab)
Mining and Industry	*Full Environmental Noise Impact Assessments for – Delft Sand (AGES), BECSA – Middelburg (Golder Associates), Kromkrans Colliery (Geovicon Environmental), SASOL Borrow Pits Project (JMA Consulting), Lesego Platinum (AGES), Lannex Colliery (Cleanstream Environmental), Evraz Vametco Mine and Plant (JMA), Goedehoop Colliery (Geovicon), Hacra Project (Prescali Environmental), Der Brochen Platinum Project (J9 Environment), Brandbach Sand (AGES), Verkeerdepan Extension (CleanStream Environmental), Dwaalboom Limestone (AGES), Jagdlust Chrome (MENCO), WPB Coal (MENCO), Landau Expansion (CleanStream Environmental), Otjikoto Gold (AurexGold), Klipfontein Colliery (MENCO), Imbabala Coal (MENCO), ATCOM East Expansion (Jones and Wagner), IPP Waterberg Power Station (SE), Kangra Coal (ERM), Schoongesicht (CleanStream Environmental), EastPlats (CleanStream Environmental), Chapudi Coal (Jacana Environmental), Generaal Coal (JE), Mopane Coal (JE), Glencore Boshoek Chrome (JMA), Langpan Chrome (PE), Vlakpoort Chrome (PE), Sekoko Coal (SE), Frankford Power (REMIG), Strahrae Coal (Ferret Mining), Transalloys Power Station (Savannah), Pan Palladum Smelter, Iron and PGM Complex (Prescali Environmental), Fumani Gold (AGES), Leiden Coal (EIMS), Colenso Coal and Power Station (SiVEST/EcoPartners), Klippoortjie Coal (Gudani), Rietspruit Crushers (MENCO), Assen Iron (Tshikovha), Transalloys (SE), ESKOM Ankerlig (SE), Nooitgedacht Titano Project (EcoPartners), Algoa Oil Well (EIMS), Spitskop Chrome (EMAssistance), Vlakfontein South (Gudani), Leandra Coal (Jacana), Grazvalley and Zoetveld (Prescali), Tjate Chrome (Prescali), Langpan Chromite (Prescali), Vereeniging Recycling (Pro Roof), Meyerton Recycling (Pro Roof), Hammanskraal Billeting Plant 1 and 2 (Unica), Development of Altona Furnace, Limpopo Province (Prescali Environmental), Haakdoorndrift Opencast at Amandelbult Platinum (Aurecon), Landau Dragline relocation (Aurecon), Stuart Coal Opencast (CleanStream Environmental), Tetra4 Gas Field Development (EIMS), Kao Diamonds – Tiping Village Relocation (EIMS), Kao Diamonds – West Valley Tailings Deposit (EIMS), Upington Special Economic Zone (EOH), Arcellor Mittal CCGT Project near Saldanha (ERM), Malawi Sugar Mill Project (ERM), Proposed Mooifontein Colliery (Geovicon Environmental), Goedehoop North Residue Deposit Expansion (Geovicon Environmental), Mutsho 600MW Coal-Fired Power Plant (Jacana Environmentals), Tshivhaso Coal-Fired Power Plant (Savannah Environmental), Doornhoek Fluorspar Project (Exigo), Royal Sheba Project (Cabanga Environmental), Rietkol Silica (Jacana), Gruisfontein Colliery (Jacana), Lehlabili Colliery (Jaco-K Consulting), Bloemendal Colliery (Enviro-Insight), Rondevly Colliery (REC), Welgedacht Colliery (REC), Kalabasfontein Extension (EIMS)*
Road and Railway	*K220 Road Extension (Urbansmart), Boskop Road (MTO), Sekoko Mining (AGES), Davel-Swaziland-Richards Bay Rail Link (Aurecon), Moloto Transport Corridor Status Quo Report and Pre-Feasibility (SiVEST), Postmasburg Housing Development (SE), Tshwane Rapid Transport Project, Phase 1 and 2 (NRM Consulting/City of Tshwane), Transnet Apies-river Bridge Upgrade (Transnet), Gautrain Due-diligence (SiVest), N2 Piet Retief (SANRAL), Atterbury Extension, CoT (Bokomoso Environmental), Riverfarm Development (Terramanzi)*
Airport	*Oudtshoorn Noise Monitoring (AGES), Sandton Heliport (Alpine Aviation), Tete Airport Scoping (Aurecon)*
Noise monitoring and Audit Reports	*Peerboom Colliery (EcoPartners), Thabametsi (Digby Wells), Doxa Deo (Doxa Deo), Harties Dredging (Rand Water), Xstrata Coal – Witbank Regional (Xstrata), Sephaku Delmas (AGES), Amakhala Emoyeni WEF (Windlab Developments), Oyster Bay WEF (Renewable Energy Systems), Tsitsikamma WEF Ambient Sound Level study (Cennergi and SE), Hopefield WEF (Umoya), Wesley WEF (Innowind), Ncora WEF (Innowind), Boschmanspoort (Jones and Wagner), Nqamakwe WEF (Innowind), Hopefield WEF Noise Analysis (Umoya), Dassiesfontein WEF Noise Analysis (BioTherm), Transnet Noise Analysis (Aurecon), Jeffries Bay Wind Farm (Globeleq), Sephaku Aganang (Exigo), Sephaku Delmas (Exigo), Beira Audit (BP/GPT), Nacala Audit (BP/GPT), NATREF (Nemai), Rappa Resources (Rayten), Measurement Report for Sephaku Delmas (Ages), Measurement Report for Sephaku Aganang (Ages), Bank of Botswana measurements (Linnspace), Skukuza Noise Measurements (Concor), Development noise measurement protocol for Mamba Cement (Exigo), Measurement Report for Mamba Cement (Exigo), Measurement Report for Nokeng Fluorspar (Exigo), Tsitsikamma Community Wind Farm Pre-operation sound measurements (Cennergi), Waainek WEF Operational Noise Measurements (Innowind), Sedibeng Brewery Noise Measurements (MENCO), Tsitsikamma Community Wind Farm Operational noise measurements (Cennergi), Noupoort Wind Farm Operational noise measurements (Mainstream), Twisdraai Colliery (Lefatshe Minerals), SASOL Prospecting (Lefatshe Minerals)*
Small Noise Impact Assessments	*TCTA AMD Project Baseline (AECOM), NATREF (Nemai Consulting), Christian Life Church (UrbanSmart), Kosmosdale (UrbanSmart), Louwlardia K220 (UrbanSmart), Richards Bay Port Expansion (AECOM), Babalegi Steel Recycling (AGES), Safika Slag Milling Plant (AGES), Arcelor Mittal WEF (Aurecon), RVM Hydroplant (Aurecon), Grootvlei PS Oil Storage (SiVEST), Rhenosterberg WEF,*

	(SiVEST), Concerto Estate (BPTrust), Ekuseni Youth Centre (MENCO), Kranskop Industrial Park (Cape South Developments), Pretoria Central Mosque (Noman Shaikh), Soshanguve Development (Maluleke Investments), Seshego-D Waste Disposal (Enviroxcellence), Zambesi Safari Equipment (Owner), Noise Annoyance Assessment due to the Operation of the Gautrain (Thornhill and Lakeside Residential Estate), Upington Solar (SE), Ilangalethu Solar (SE), Pofadder Solar (SE), Flagging Trees WEF (SE), Uyekraal WEF (SE), Ruuki Power Station (SE), Richards Bay Port Expansion 2 (AECOM), Babalegi Steel Recycling (AGES), Safika Ladium (AGES), Safika Cement Isando (AGES), RareCo (SE), Struisbaai WEF (SE), Perdekraal WEF (ERM), Kotula Tsatsi Energy (SE), Olievenhoutbosch Township (Nali), , HDMS Project (AECOM), Quarry extensions near Ermelo (Rietspruit Crushers), Proposed uMzimkhulu Landfill in KZN (nZingwe Consultancy), Linksfield Residential Development (Bokomoso Environmental), Rooihuiskraal Ext. Residential Development, CoT (Plandev Town Planners), Floating Power Plant and LNG Import Facility, Richards Bay (ERM), Floating Power Plant project, Saldanha (ERM), Vopak Growth 4 project (ERM), Elandspoort Ext 3 Residential Development (Gibb Engineering), Tiegerpoort Wedding Venue (Henwood Environmental)
Project reviews and amendment reports	*Loperberg (Savannah), Dorper (Savannah), Penhoek Pass (Savannah), Oyster Bay (RES), Tsitsikamma Community Wind Farm Noise Simulation project (Cennergi), Amakhala Emoyeni (Windlab), Spreeukloof (Savannah), Spinning Head (SE), Kangra Coal (ERM), West Coast One (Moyeng Energy), Rheboksfontein (Moyeng Energy), De Aar WEF (Holland), Quarterly Measurement Reports – Dangote Delmas (Exigo), Quarterly Measurement Reports – Dangote Lichtenburg (Exigo), Quarterly Measurement Reports – Mamba Cement (Exigo), Quarterly Measurement Reports – Dangote Delmas (Exigo) Quarterly Measurement Reports – Nokeng Fluorspar (Exigo), Proton Energy Limited Nigeria (ERM), Hartebeest WEF Update (Moorreesburg) (Savannah Environmental), Modderfontein WEF Opinion (Terramanzi), IPD Vredenburg WEF (IPD Power Vredenburg), etc.*

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2 DECLARATION OF INDEPENDENCE

I, Morné de Jager declare that:

- I act as the independent specialist in this application
- I will perform the work relating to this study in an objective manner, even if this results in views and findings that are not favourable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting environmental noise impact assessments, including knowledge of the National Environmental Management Act (107 of 1998), the Environmental Impact Assessment Regulations of 2014, and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not;
- all the particulars furnished by me in this form are true and correct;
- I realise that a false declaration is an offence in terms of regulation 71 and is punishable in terms of section 24F of the Act, and;
- I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2014.

Signature of the environmental practitioner:

Name of company:

Enviro-Acoustic Research cc

Date:

2021 – 01 – 15

3 CHECKLIST: GG43110 MINIMUM REQUIREMENTS

The National Web based Environmental Screening Tool[6] was used to screen the proposed site for the noise environmental sensitivity. The site report generated by the Screening Tool that highlighted that a Noise Impact Assessment be completed and appended to the Environmental Authorization documentation. The screening report was developed for: Mining > Mining Right.

In terms of GNR320 (20 March 2020), a Noise Study must contain, as a minimum, the following information:

Clause	Requirement	Comment / Reference
2.5.1	Contact details of the environmental assessment practitioner or noise specialist, their relevant qualifications and expertise in preparing the statement, and a curriculum vitae	See section 1
2.5.2	a signed statement of independence by the environmental assessment practitioner or noise specialist.	See section 2
2.5.3	The duration and date of the site inspection and the relevance of the season and weather condition to the outcome of the assessment	See section 6
2.5.4	A description of the methodology used to undertake the on-site assessment, inclusive of the equipment and models used, as relevant, together with the results of the noise assessment	See section 6.1
2.5.5	a map showing the proposed development footprint (including supporting infrastructure) overlaid on the noise sensitivity map generated by the screening tool	See Figure 4-1
2.5.6	confirmation that all reasonable measures have been taken through micro- siting to minimize disturbance to receptors	Various alternatives investigated for TSFs. Opencast mining locations are limited to areas where the resource is confirmed.

[6] https://screening.environment.gov.za/screeningtool/#/pages/welcome

2.5.7	a substantiated statement from the specialist on the acceptability, or not, of the proposed development and a recommendation on the approval, or not, of the proposed development	See section 15
2.5.8	any conditions to which this statement is subjected	See section 10.6
2.5.9	the assessment must identify alternative development footprints within the preferred site which would be of a "low" sensitivity as identified by the screening tool and verified through the site sensitivity verification and which were not considered	Site located in area with "Low" Noise sensitivity (Screening tool)
2.5.10	A motivation must be provided if there were development footprints identified as per paragraph 2.5.9 above that were identified as having a "low" noise sensitivity and that were not considered appropriate	Opencast mining locations are limited to areas where the resource is confirmed
2.5.11	where required, proposed impact management outcomes, mitigation measures for noise emissions during the construction and commissioning phases that may be of relative short duration, or any monitoring requirements for inclusion in the Environmental Management Programme (EMPr), and	See section 13 and 14
2.5.12	a description of the assumptions made and any uncertainties or gaps in knowledge or data as well as a statement of the timing and intensity of site inspection observations	See section 10

4 INTRODUCTION

4.1 INTRODUCTION AND PURPOSE

Enviro Acoustic Research cc (EARES) was commissioned by Digby Wells and Associates (Pty) Ltd to determine the potential noise impact on the surrounding environment due to proposed mining activities associated with the Dalyshope Project, Limpopo Province.

This report describes the potential noise impact that the operation might have, highlighting the methods used, potential issues identified, findings and recommendations. The Terms of Reference (ToR) for this study is in the guidelines provided by SANS 10103:2008, SANS 10328:2008, the procedures defined in Government Gazette 43110 of 20 March 2020 (GNR 320) and the National Noise Control Regulations GN R154 of 1992. The study also considers the noise limits as proposed by the International Finance Corporation (IFC) for a residential area which is based on studies completed by the World Health Organization (WHO).

4.2 BRIEF PROJECT DESCRIPTION

Universal Coal (UC) and Anglo-American Corporation (AAC) formed a joint venture with the aim of developing the Dalyshope Project. The project will initially target the coal resources in the Dalyshope and Klaarwater farms.

Previous work by Anglo has identified four open cast pits (OC1 to OC4) that can potentially be mined economically. Initially, only OC1 (the southern pit situated on the Dalyshope farm) will be mined. Mining activities will be carried out on other pits at a later stage. The proposed project includes the following mining and related infrastructure:

- An opencast pit;
- Processing plant (i.e. crushing, wash plant, screening, etc.) and product handling facilities (handling and stockpiles);
- Waste residue deposits (discard dump, hards waste dump and softs waste dump) and material stockpiles (topsoil);
- Administration office facilities (i.e. security building, administration and staff offices, reception area, ablution facilities, etc.);
- Production facilities (i.e. locker rooms, laboratory, workshops, stores, explosives magazine, etc.);
- Access roads; and
- Clean and dirty water management infrastructure.

The proposed infrastructure is highlighted in **Figure 4-1**.

4.2.1 Mining Method

Based on the Project Description[7], the Dalyshope mine is envisaged as a small scale, fit for purpose, contractor-run mining operation, aimed at minimising capital outlay initially before building up to a large-scale truck and shovel operation.

A truck and shovel open-cast strip-mining method using selective mining techniques is ideal for this type of massive, flat dipping, shallow deposit. Once in steady state, roll-over mining together with ongoing rehabilitation will take place. Access to the mining block will be by a ramp on the farm Dalyshope sunk down to coal elevation. The upper coal seams will be removed and the pit bottom will be covered with overburden once sufficient area of coal has been mined.

Mining will be carried out in strips to remove the overburden that is dumped into the previously mined-out strip. The strips will be positioned to allow for quick access to the coal seams, thereby minimising the initial capital outlay. Strip-width coincides with block widths of ±40m. These strips will then be mined consecutively starting mainly at the north eastern boundary of the pit and moving towards the western boundary of the farm.

Bulk Material Handling (BMH) consists of hydraulic excavators loading mining trucks that will haul the run-of-mine (ROM) coal from the coal bench, up the ramp, to a stockpile and tip at the pit-head.

Discard from the washing process will be transported back to the pit by conveyor belt for placement at the bottom of the mined-out area prior to the placement of overburden and rehabilitation.

4.2.2 Plant process

The ROM coal will pass through a crusher before being transferred onto a conveyor belt that transports the coal to the stockpiles before the proposed washing plant.

The washing plant will be a modular cyclone washing plant, with each module capable of handling up to 1000 tph (tons per hours). Product will be placed onto individual stockpiles before being sent to the market. Currently two options are being investigated for the transportation of the product to market, i.e. trucking by road haulers (or rail on a rail link still to be constructed).

[7] Universal Coal Energy Holdings SA (Pty) Ltd: Dalyshope Project

The plant will be developed in phases, resulting in the following scenario.

- The Pit Section, where the primary and secondary crushing will take place, will be designed to cater for the first 5 years of operation. It will have an average capacity of 2000tph.
- Raw coal stacking and reclaiming capacity will be designed at 2000tph to match the capacity of the Pit Section. This section will have the required capacity to sustain production for the first 5 years.
- Product stacking capacity will be designed at 1000tph to match the product tonnage produced in the first 5 years of operation.
- Discard handling capacity will be designed at 1000tph to match the discard tonnage produced in the first 5 years of operation.

The sections downstream of the raw coal stacking and reclaiming section can be easily Expanded which will include:

- A tertiary crushing plant section will be designed at 1000tph.
- Two wash plant modules, each rated at 500tph will provide the required capacity of 1000tph. A fines plant, thickener and filter press of suitable capacity will be provided for each pair of wash plant modules.
- Year 5 requires a combined plant capacity of 2000tph. Therefore, a second tertiary plant, a further two washing modules, a fines plant, a thickener and a filter press must be installed by the end of year 4.
- Year 6 to end of LOM requires a combined plant capacity of 4000tph. This means that the entire system provided up to and including year 5 must be duplicated.

4.3 STUDY AREA

The proposed project is located approximately 50km west of Lephalale, lying 30 – 40 km north-west-west of the existing Grootegeluk Coal Mine, the Matimba (existing) and the Medupi (under construction) Power Stations. The study area is further described in terms of environmental components that may contribute or change the sound character in the area.

4.3.1 Topography

The area is relatively flat plains. There are little natural features that could act as noise barriers considering practical distances at which sound propagates.

4.3.2 Surrounding Land Use

The area in the vicinity of the proposed development is currently classified as Vacant or Unspecified. Previous site visits revealed that the area is mainly wilderness with game ranches (tourism and hunting) being a significant part of the agricultural activities (mainly cattle farming).

4.3.3 Roads

There are a number of gravel district roads that traverses the area. There are no other roads or railway lines within 2,000 m from the proposed development. Based on observations made during this and previous site visits, the gravel roads do not carry any traffic of acoustic significance.

4.3.4 Residential areas

Excluding farm dwellings, there are no residential areas within 5,000 m from the proposed mine.

4.3.5 Other industrial and commercial processes

The Grootegeluk Coal Colliery is approximately 30 – 34 km east south-east from the proposed development. It is too far to influence the ambient sound levels in the vicinity of the proposed development. There are also a number of collieries planned in the vicinity of the proposed mine.

4.3.6 Ground conditions and vegetation

The area falls within the Savannah biome, with the vegetation type being bushveld. The ground is covered with grasses, shrubs and trees and would be considered as 50% acoustically absorbent. This influences the propagation of the sound from the mine, as the fraction of sound that is reflected from the ground would be influenced as certain frequencies would be partly absorbed by the ground surface.

4.3.7 Sensitive Receptors

Residential areas and potential noise-sensitive developments/receptors/communities were identified using tools such as Google Earth®, considering a focus area up to 2,000m from potential (noise-generating) infrastructure areas. These receptors are highlighted in **Figure 4-2**.

Also indicated on this figure are generalized 500m, 1,000m and 2,000m buffer zones. Normally noises from mining activities:

- are limited to a distance of less than 500m from active mining access roads, though this would normally be less than 200m with low traffic volumes and speeds associated with such roads. This can be increased to a distance of 1,000m, normally associated

with very busy roads (such as a busy national road where average speeds exceed 100km/h);
- are significant, and receptors staying within 500m from active mining activities normally are subject to noises at a sufficient level to be considered disturbing;
- are normally limited to a distance of approximately 1,000m from the active mining areas. Ambient sound levels are increased due to noises from mining activities, with the potential noise impact measurable;
- audible up to a distance of 2,000m at night, and may be audible up to 4,000m during very quiet periods at night with certain meteorological conditions. Noise levels from mining activities are generally less than 45 dBA further than 1,000m from the mining activities;
- of a low concern at distances greater than 2,000m from activities at night (though it may be audible up to 4,000m during very quiet periods).

These buffer distances may not be valid with very large mining or industrial operations, or in areas with very low ambient sound levels.

4.4 ENVIRONMENTAL SENSITIVITY – NOISE THEME

The project site was assessed in terms of the Noise Sensitivity Theme using the online Environmental Screening Tool[8]. Noise does not feature as a potential sensitive environmental theme when checking the site sensitivity (see also **Figure 4-3**), but the site report does stipulate the need for a Noise Impact Assessment and that the GNR320 Assessment Protocol be followed when doing the noise impact assessment.

4.5 AVAILABLE INFORMATION

The author has completed a number of projects in the direct vicinity of the project site (within 20 km), with the results of ambient sound levels, the project descriptions and findings covered in the following reports:

- De Jager, M. 2011: "*Noise impact study for Environmental Impact Assessment: Establishment of the Sekoko Coal Loading Siding on various farms near Lephalale, Limpopo*". M2 Environmental Connections cc, Pretoria.
- De Jager, M. 2012: "*Acoustical Baseline study on various farms near the town of Lephalale, Limpopo Province*". M2 Environmental Connections cc, Pretoria.

[8] https://screening.environment.gov.za/screeningtool/#/pages/welcome

- De Jager, M. 2012: "*Noise Study for Environmental Impact Assessment: Establishment of the Thabametsi 1.200 MW Coal-fired Power Station near Lephalale, Limpopo*". Enviro Acoustic Research cc, Pretoria.
- De Jager, M. (2019): "*Environmental Noise Impact Assessment for the Proposed Gruisfontein Colliery near Lephalale, Limpopo*". Enviro-Acoustic Research CC, Pretoria

4.6 COMMENTS RECEIVED DURING THE EIA

The author is not aware of any comments (specific to noise) raised by the authorities or interested and affected parties at the date this report was compiled.

4.7 TERMS OF REFERENCE

A noise impact assessment must be completed for the following reasons:

- It was identified as an environmental theme needing further investigation i.t.o. the National Screening Tool as per the procedures of Government Gazette 43110 of 20 March 2020;
- A change in land use as highlighted in SANS 10328:2008, section 5.3;
- If a noise-sensitive development is to be established within 500 m (or, in the case of a busy throughway, 1,000 m) of a road or railway line (SANS 10328:2008 [5.4 (d)]) *or visa versa*;
- If an industry is to be established within 1,000 m from a potential noise sensitive development (SANS 10328:2008 [5.4 (h)]) *or visa versa*;
- It is a controlled activity in terms of the NEMA regulations and an ENIA is required, because:
  - It may cause a disturbing noise that is prohibited in terms of section 18(1) of the Government Notice 579 of 2010;
  - It is a potential environmental theme to be further assessed as identified using the national environmental screening tool as required by GG No. 42451 of 10 May 2019 (proposed procedures);
- It is generally required by the local or district authority as part of the environmental authorization or planning approval in terms of Regulation 2(d) or GN R154 of 1992;

4.7.1 Requirements as per GG 43110

The Department of Environmental Affairs also promulgated Regulation 320, dated 20 March 2020 as published in Government Gazette No. 43110. The Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in Terms of Sections

24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation would be applicable to this project.

This regulation defines the requirements for undertaking a site sensitivity verification, specialist assessment and the minimum report content requirements for environmental impact where a specialist assessment is required but no protocol has been prescribed. It requires that the current land use be considered using the national web based environmental screening tool to confirm the site sensitivity available at: https://screening.environment.gov.za.

If an applicant intending to undertake an activity identified in the scope of this protocol for which a specialist assessment has been identified on the screening tool on a site identified as being of:

- "very high" sensitivity for noise, must submit a Noise Specialist Assessment; or
- "low" sensitivity for noise, must submit a Noise Compliance Statement.

On a site where the information gathered from the site sensitivity verification differs from the designation of "very high" sensitivity on the screening tool and it is found to be of a "low" sensitivity, a Noise Compliance Statement must be submitted.

On a site where the information gathered from the initial site sensitivity verification differs from the designation of "low" sensitivity on the screening tool and it is found to be of a "very high" sensitivity, a Noise Specialist Assessment must be submitted.

If any part of the proposed development footprint falls within an area of "very high" sensitivity, the assessment and reporting requirements prescribed for the "very high" sensitivity apply to the entire footprint excluding linear activities for which noise impacts are associated with construction activities only and the noise levels return to the current levels after the completion of construction activities, in which case a compliance statement applies. In the context of this protocol, development footprint means the area on which the proposed development will take place and includes any area that will be disturbed.

The minimum requirements for a Noise Compliance Statement are also covered in **Section 3** in the form of a checklist.

With a number of potential noise-sensitive receptors living within 2,000m from the potential future mining activities, this assessment will be comprehensive and a Noise Specialist Assessment will be submitted.

4.7.2 Requirements as per South African National Standards

In South Africa the document that addresses the issues specifically concerning environmental noise is SANS 10103:2008. It has been thoroughly revised in 2008 and brought in line with the guidelines of the World Health Organisation (WHO). It provides the maximum average ambient noise levels during the day and night to which different types of developments indoors may be exposed.

In addition, SANS 10328:2008 (Edition 3) specifies the methodology to assess the potential noise impacts on the environment due to a proposed activity that might impact on the environment. This standard also stipulates the minimum requirements to be investigated for EIA purposes. These minimum requirements are:

a) the purpose of the investigation (see **section 4.1**);
b) a brief description of the planned development or the changes that are being considered (see **section 4.2**);
c) a brief description of the existing environment including, where relevant, the topography, surface conditions and meteorological conditions during measurements (see **section 4.3** and **6**);
d) the identified noise sources together with their respective sound pressure levels or sound power levels (or both) and, where applicable, the operating cycles, the nature of sound emission, the spectral composition and the directional characteristics (see **section 7**);
e) the identified noise sources that were not taken into account and the reasons as to why they were not investigated (see **section 7**, **9** and **10**);
f) the identified noise-sensitive developments and the noise impact on them (see **section 4.2.1, 11 and 12**);
g) where applicable, any assumptions, with references, made with regard to any calculations or determination of source and propagation characteristics (see **section 10**);
h) an explanation, either by a brief description or by reference, of all measuring and calculation procedures that were followed, as well as any possible adjustments to existing measuring methods that had to be made, together with the results of calculations (see **section 9 and 10**);
i) an explanation, either by description or by reference, of all measuring or calculation methods (or both) that were used to determine existing and predicted rating levels, as well as other relevant information, including a statement of how the data were obtained and applied to determine the rating level for the area in question (see **section 6, 9** and **11**);

j) the location of measuring or calculating points in a sketch or on a map (see **section 6.2.2** and **11**);
k) quantification of the noise impact with, where relevant, reference to the literature consulted and the assumptions made (see **section 11**);
l) alternatives that were considered and the results of those that were investigated (see **section 12.3**);
m) a list of all the interested or affected parties that offered any comments with respect to the environmental noise impact investigation (see **section 4.2.1**);
n) a detailed summary of all the comments received from interested or affected parties as well as the procedures and discussions followed to deal with them (see **section 4.6**);
o) conclusions that were reached (see **section 15**);
p) proposed recommendations (see **section 15**);
q) if remedial measures will provide an acceptable solution which would prevent a significant impact, these remedial measures should be outlined in detail and included in the final record of decision if the approval is obtained from the relevant authority. If the remedial measures deteriorate after time and a follow-up auditing or maintenance programme (or both) is instituted, this programme should be included in the final recommendations and accepted in the record of decision if the approval is obtained from the relevant authority (see **section 13** and **15**); and
r) any follow-up investigation which should be conducted at completion of the project as well as at regular intervals after the commissioning of the project so as to ensure that the recommendations of this report will be maintained in the future (see **section 15**).

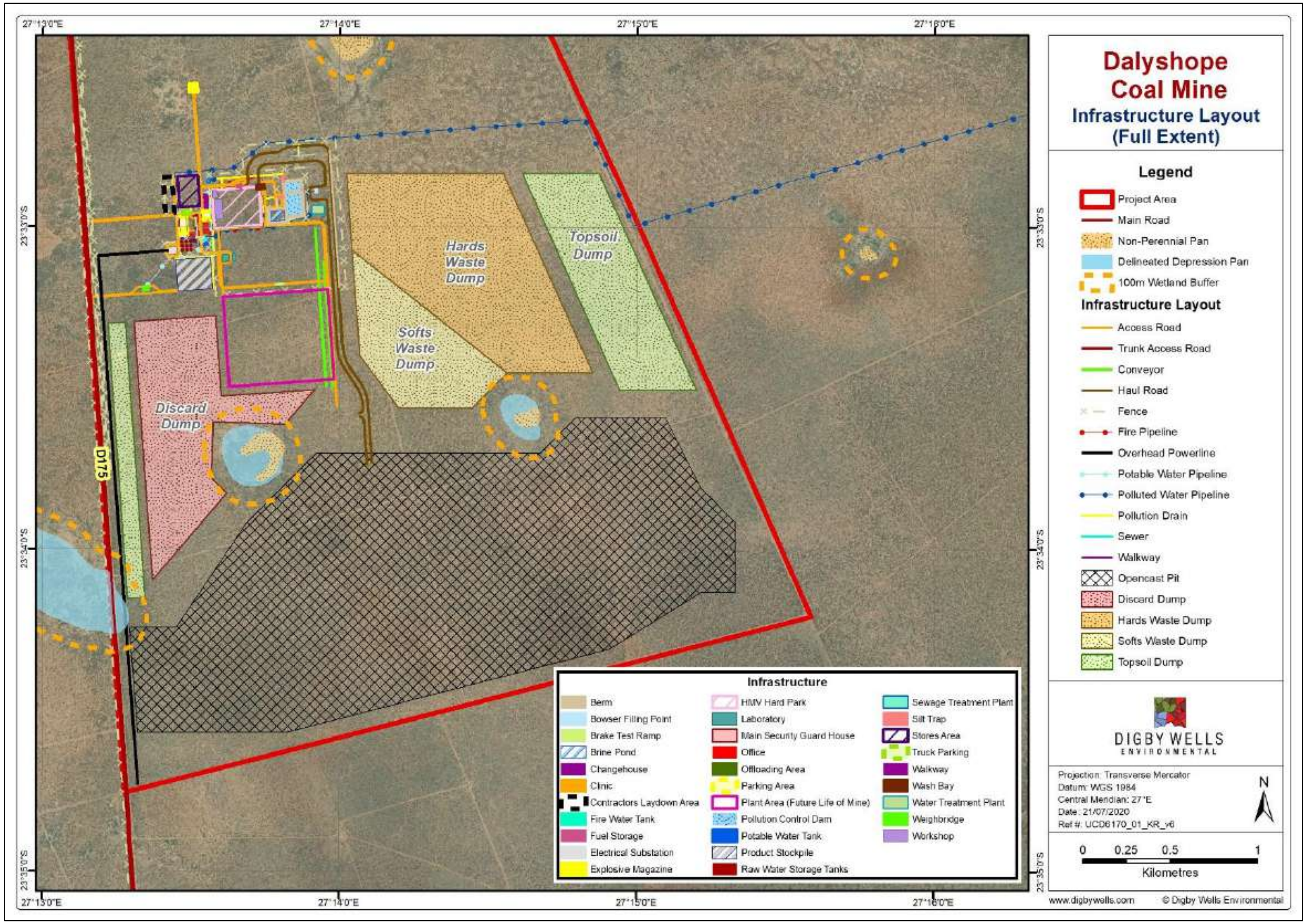

Figure 4-1: Project area and proposed project infrastructure assessed

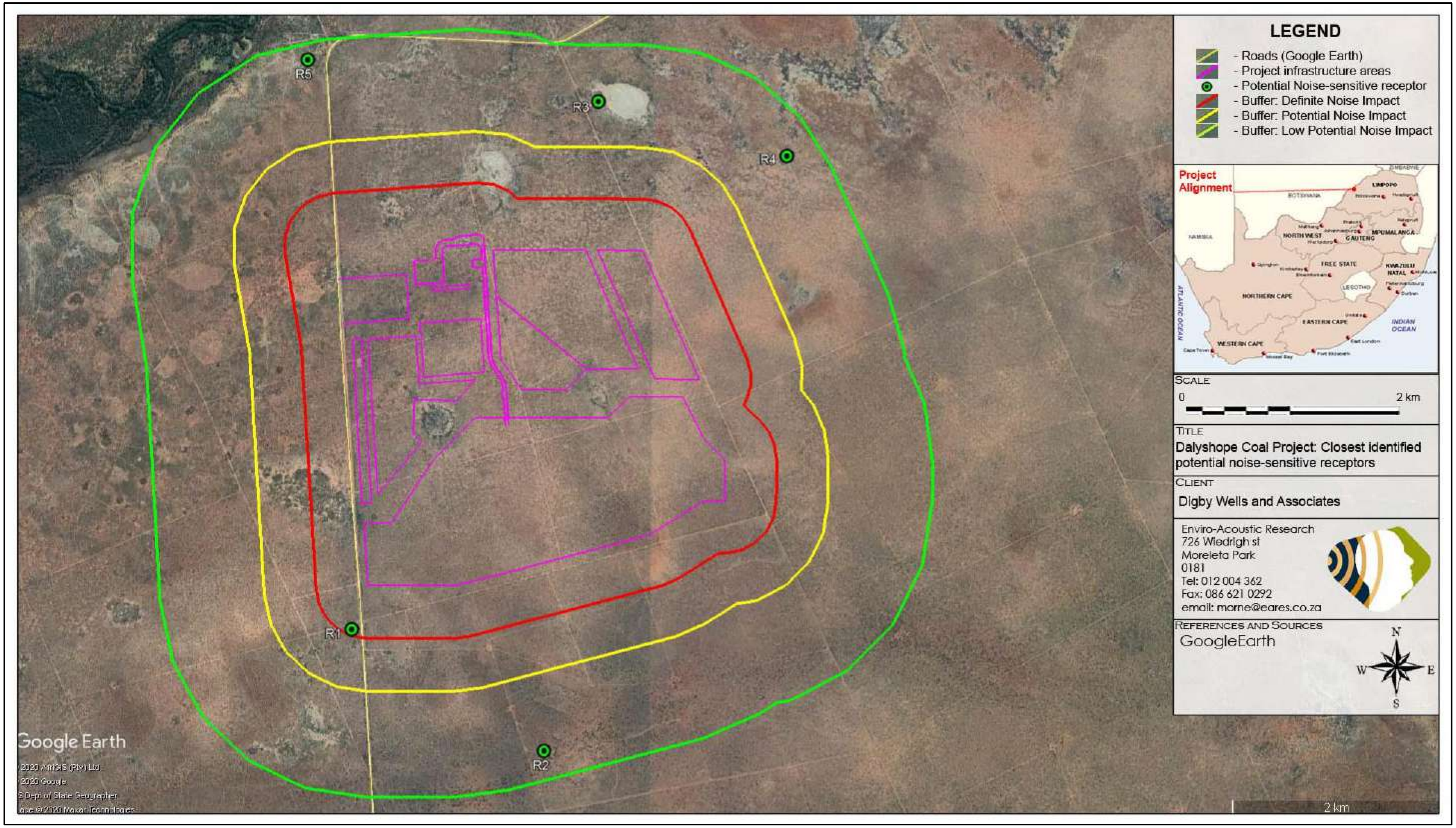

Figure 4-2: Study area and potential noise-sensitive receptors close to proposed mine infrastructure

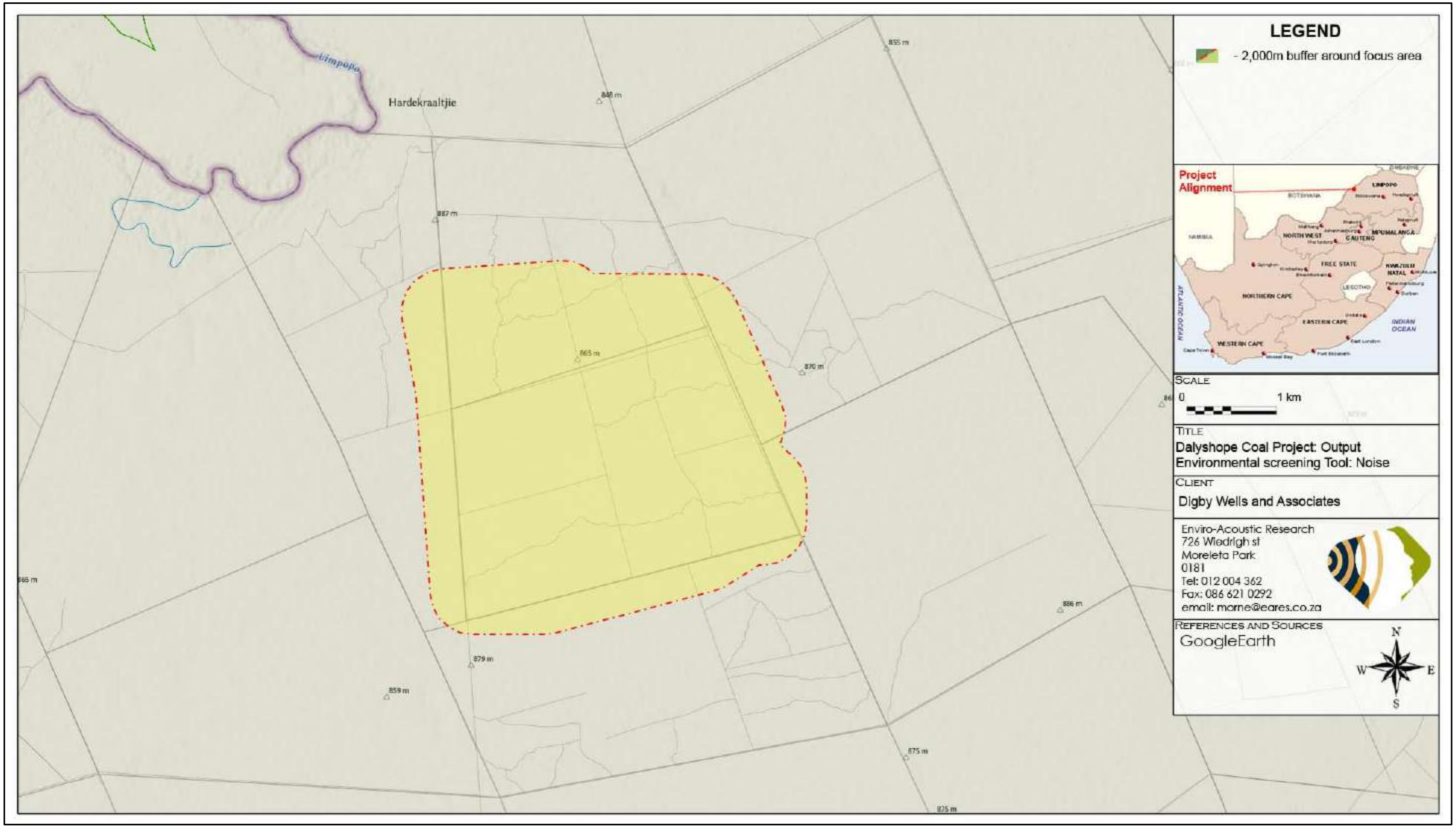

Figure 4-3: Output from the Screening Tool (noise not identified as a potential environmental sensitive theme)

5 LEGAL CONTEXT, POLICIES AND GUIDELINES

5.1 THE REPUBLIC OF SOUTH AFRICA CONSTITUTION ACT ("THE CONSTITUTION")

The environmental rights contained in section 24 of the Constitution provide that everyone is entitled to an environment that is not harmful to his or her well-being. In the context of noise, this requires a determination of what level of noise is harmful to well-being. The general approach of the common law is to define an acceptable level of noise as that which the reasonable person can be expected to tolerate in the particular circumstances. The subjectivity of this approach can be problematic, which has led to the development of noise standards (see **Section 5.4**).

"Noise pollution" is specifically included in Part B of Schedule 5 of the Constitution, which means that noise pollution control is a local authority competence, provided that the local authority concerned has the capacity to carry out this function.

5.2 THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT (ACT 107 OF 1998)

The National Environmental Management Act ("NEMA") defines "pollution" to include any change in the environment, including noise. A duty therefore arises under section 28 of NEMA to take reasonable measures while establishing and operating any facility to prevent noise pollution occurring. NEMA sets out measures, which may be regarded as reasonable. They include the following measures:

1. to investigate, assess and evaluate the impact on the environment
2. to inform and educate employees about the environmental risks of their work and the manner in which their tasks must be performed to avoid causing significant pollution or degradation of the environment
3. to cease, modify or control any act, activity or process causing the pollution or degradation
4. to contain or prevent the movement of the pollution or degradation
5. to eliminate any source of the pollution or degradation
6. to remedy the effects of the pollution or degradation

In addition, a number of regulations have been promulgated as Regulation 982 of December 2014 (Government Notice 38282) in terms of this Act. It defines minimum information requirements for specialist reports, with Government Gazette (GG) 43110 (20 March 2020) updating the minimum requirements for reporting.

GG 43110 prescribe general requirements for undertaking site sensitivity verification and for protocols for the assessment and minimum report content requirements of environmental impacts for environmental themes for activities requiring environmental authorisation. These protocols were promulgated in terms of sections 24(5)(a), (h) and 44 of the National Environmental Management Act, 1998.

When the requirements of a protocol apply, the requirements of Appendix 6 of the Environmental Impact Assessment Regulations, as amended, (EIA Regulations), promulgated under sections 24(5) and 44 of the National Environmental Management Act, 1998 (Act No. 107 of 1998), are replaced by these requirements.

5.3 THE ENVIRONMENT CONSERVATION ACT (ACT 73 OF 1989)

The Environment Conservation Act ("ECA") allows the Minister of Environmental Affairs and Tourism ("now the Ministry of Water and Environmental Affairs") to make regulations regarding noise, among other concerns. See also **section 5.3.1**.

5.3.1 National Noise Control Regulations (GN R154 of 1992)

In terms of section 25 of the ECA, the National Noise Control Regulations (GN R 154 of 1992) were promulgated. The NCRs were revised under Government Notice Number R. 55 of 14 January 1994 to make it obligatory for all authorities to apply the regulations.

Subsequently, in terms of Schedule 5 of the Constitution of South Africa of 1996 legislative responsibility for administering the noise control regulations was devolved to provincial and local authorities. Provincial noise control regulations exist in the Free State, Gauteng and Western Cape provinces.

The National Noise Control Regulations (GN R154 1992) defines:
"**controlled area**" as:

a piece of land designated by a local authority where, in the case of—

a) road transport noise in the vicinity of a road-

i. the reading on an integrating impulse sound level meter, taken outdoors at the end of a period extending from 06:00 to 24:00 while such meter is in operation, exceeds 65 dBA; or
ii. the equivalent continuous "A"-weighted sound pressure level at a height of at least 1,2 meters, but not more than 1,4 meters, above the ground for a period extending from 06:00 to 24:00 as calculated in accordance with SABS 0210-1986, titled: "Code of Practice for calculating and predicting road traffic noise",

published under Government Notice No. 358 of 20 February 1987, and projected for a period of 15 years following the date on which the local authority has made such designation, exceeds 65 dBA;

c) industrial noise in the vicinity of an industry-

  i. the reading on an integrating impulse sound level meter, taken outdoors at the end of a period of 24 hours while such meter is in operation meter is in operation, exceeds 61 dBA; or
  ii. the calculated outdoor equivalent continuous "A"-weighted sound pressure level at a height of at least 1,2 meters, but not more than 1,4 meters, above the ground for a period e, exceeds 61 dBA.

"**disturbing noise**" as:
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.

"**zone sound level**" as:
a derived dBA value determined indirectly by means of a series of measurements, calculations or table readings and designated by a local authority for an area. This is the same as the Rating Level as defined in SANS 10103.

In addition:
In terms of Regulation 2 -
"A local authority may –
(a) establish a new township unless the lay-out plan concerned, if required by a local authority, indicates in accordance with the specifications of the local authority, the existing and future sources of noise, with concomitant dBA values which are foreseen in the township for a period of 15 years following the date on which the erection of the buildings in and around the township commences;
(c):" if a noise emanating from a building, premises, vehicle, recreational vehicle or street is a disturbing noise or noise nuisance, or may in the opinion of the local authority concerned be a disturbing noise or noise nuisance, instruct in writing the person causing such noise or who is responsible therefor, or the owner or occupant of such building or premises from which or from where such noise emanates or may emanate, or all such persons, to discontinue or cause to be discontinued such noise, or to take steps to lower the lever of the noise to a level conforming to the requirements of these Regulations within the period stipulated in the instruction: Provided that the provisions of this paragraph shall not apply

in respect of a disturbing noise or noise nuisance caused by rail vehicles or aircraft which are not used as recreational vehicles;
(d): before changes are made to existing facilities or existing uses of land or buildings, or before new buildings are erected, in writing require that noise impact assessments or tests are conducted to the satisfaction of that local authority by the owner, developer, tenant or occupant of the facilities, land or buildings or that, for the purposes of regulation 3(b) or
(f) designate a controlled area in its area of jurisdiction or amend or cancel an existing controlled area by notice in the Official Gazette concerned.

In terms of Regulation 4 of the Noise Control Regulations:
"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".

General prohibition
3. No person shall -
(c) make changes to existing facilities or existing uses of land or buildings or erect new buildings, if it shall in the opinion of a local authority house or cause activities which shall, after such change or erection, cause a disturbing noise, unless precautionary measures to prevent the disturbing noise have been taken to the satisfaction of the local authority;

Clause 7.(1) however exempts noise of the following activities, namely -
"The provisions of these regulations shall not apply, if -
(a) the emission of sound is for the purposes of warning people of a dangerous situation;
(b) the emission of sound takes place during an emergency."

5.4 NOISE STANDARDS

There are a few South African scientific standards (SABS) relevant to noise from developments, industry and roads. They are:

- SANS 10103:2008. 'The measurement and rating of environmental noise with respect to annoyance and to speech communication'.
- SANS 10210:2004. 'Calculating and predicting road traffic noise'.
- SANS 10328:2008. 'Methods for environmental noise impact assessments'.
- SANS 10357:2004. 'The calculation of sound propagation by the Concave method'.
- SANS 10181:2003. 'The Measurement of Noise Emitted by Road Vehicles when Stationary'.
- SANS 10205:2003. 'The Measurement of Noise Emitted by Motor Vehicles in Motion'.

The relevant standards use the equivalent continuous rating level as a basis for determining what is acceptable. The levels may take single event noise into account, but single event noise by itself does not determine whether noise levels are acceptable for land use purposes. With regards to SANS 10103:2008, the recommendations are likely to inform decisions by authorities, but non-compliance with the standard will not necessarily render an activity unlawful *per se.*

It must be noted that SANS 10103:2008 does stipulate *"for industries legitimately operating in an industrial district during the entire 24 h day/night cycle,* $L_{Req,d} = L_{Req,n}$ *=70 dBA can be considered as typical and normal".*

5.5 INTERNATIONAL GUIDELINES

While a number of international guidelines and standards exists, those selected below are used by numerous countries for environmental noise management.

5.5.1 Guidelines for Community Noise (WHO, 1999)

The World Health Organization's (WHO) document on the *Guidelines for Community Noise* is the outcome of the WHO expert task force meeting held in London, United Kingdom, in April 1999. It is based on the document entitled "Community Noise" that was prepared for the World Health Organization and published in 1995 by the Stockholm University and Karolinska Institute.

The scope of WHO's effort to derive guidelines for community noise is to consolidate actual scientific knowledge on the health impacts of community noise and to provide guidance to environmental health authorities and professionals trying to protect people from the harmful effects of noise in non-industrial environments. It discusses the specific effects of noise on communities including:

- Interference with communication, noise-induced hearing impairment, sleep disturbance effects, cardiovascular and psychophysiological effects, mental health effects, effects on performance, annoyance responses and effects on social behavior.

It further discusses how noise can affect (and propose guideline noise levels) specific environments such as residential dwellings, schools, preschools, hospitals, ceremonies, festivals and entertainment events, sounds through headphones, impulsive sounds from toys, fireworks and firearms, and parklands and conservation areas.

To protect the majority of people from being affected by noise during the daytime, it proposes that sound levels at outdoor living areas should not exceed 55 dB L_{Aeq} for a steady, continuous noise. To protect the majority of people from being moderately annoyed during the day, the outdoor sound pressure level should not exceed 50 dB L_{Aeq}. At night, equivalent sound levels at the outside façades of the living spaces should not exceed 45 dBA and 60 dBA L_{Amax} so that people may sleep with bedroom windows open. It is critical to note that this guideline requires the sound level measuring instrument to be set on the "fast" detection setting.

5.5.2 Night Noise Guidelines for Europe (WHO, 2009)

Refining previous Community Noise Guidelines issued in 1999, and incorporating more recent research, the World Health Organization has released a comprehensive report on the health effects of night time noise, along with new (non-mandatory) guidelines for use in Europe. Rather than a maximum of 30 dB inside at night (which equals 45-50 dB max outside), the WHO now recommends a maximum year-round outside night-time noise average of 40 db to avoid sleep disturbance and its related health effects. The report notes that only below 30 dB (outside annual average) are "*no significant biological effects observed*," and that between 30 and 40 dB, several effects are observed, with the chronically ill and children being more susceptible; however, "*even in the worst cases the effects seem modest*." Elsewhere, the report states more definitively, "*There is no sufficient evidence that the biological effects observed at the level below 40 dB (night, outside) are harmful to health*." At levels over 40 dB "*Adverse health effects are observed*" and "*many people have to adapt their lives to cope with the noise at night. Vulnerable groups are more severely affected*."

The 184-page report offers a comprehensive overview of research into the various effects of noise on sleep quality and health (including the health effects of non-waking sleep arousal), and is recommended reading for anyone working with noise issues. The use of an outdoor noise standard is in part designed to acknowledge that people do prefer to leave windows open when sleeping, though the year-long average may be difficult to obtain (it would require longer-term sound monitoring than is usually budgeted for by either industry or neighbourhood groups).

While recommending the use of the average level, the report notes that some instantaneous effects occur in relation to specific maximum noise levels, but that the health effects of these "cannot be easily established."

5.5.3 Equator Principles

The **Equator Principles** (EPs) are a voluntary set of standards for determining, assessing and managing social and environmental risk in project financing. Equator Principles Financial Institutions (EPFIs) commit to not providing loans to projects where the borrower will not or is unable to comply with their respective social and environmental policies and procedures that implement the EPs.

The Equator Principles were developed by private sector banks and were launched in June 2003. Revision III of the EPs has been in place since June 2013. The participating banks chose to model the Equator Principles on the environmental standards of the World Bank (1999) and the social policies of the International Finance Corporation (IFC). Eighty-three financial institutions (2016) have adopted the Equator Principles, which have become the de facto standard for banks and investors on how to assess major development projects around the world.

5.5.4 IFC: General EHS Guidelines – Environmental Noise Management

These guidelines are applicable to noise created beyond the property boundaries of a development that conforms to the Equator Principles. The environmental standards of the World Bank have been integrated into the social policies of the IFC since April 2007 as the International Finance Corporation Environmental, Health and Safety (EHS) Guidelines.

It states that noise prevention and mitigation measures should be applied where predicted or measured noise impacts from project facilities/operations exceed the applicable noise level guideline at the most sensitive point of reception. The preferred method for controlling noise from stationary sources is to implement noise control measures at source. It goes as far as to proposed methods for the prevention and control of noise emissions, including:

- Selecting equipment with lower sound power levels;
- Installing silencers for fans;
- Installing suitable mufflers on engine exhausts and compressor components;
- Installing acoustic enclosures for equipment casing radiating noise;
- Improving the acoustic performance of constructed buildings, apply sound insulation;
- Installing acoustic barriers without gaps and with a continuous minimum surface density of 10 kg/m^2 in order to minimize the transmission of sound through the barrier. Barriers should be located as close to the source or to the receptor location to be effective;
- Installing vibration isolation for mechanical equipment;
- Limiting the hours of operation for specific pieces of equipment or operations, especially mobile sources operating through community areas ;

- Re-locating noise sources to less sensitive areas to take advantage of distance and shielding;
- Placement of permanent facilities away from community areas if possible;
- Taking advantage of the natural topography as a noise buffer during facility design;
- Reducing project traffic routing through community areas wherever possible;
- Planning flight routes, timing and altitude for aircraft (airplane and helicopter) flying over community areas; and
- Developing a mechanism to record and respond to complaints.

It sets noise level guidelines (see **Table 5-1**) and highlights the certain monitoring requirements pre- and post-development. It adds another criterion in that the existing background ambient noise level should not rise by more than 3 dBA. This criterion will effectively sterilize large areas of any development. Therefore, it is EARE's considered opinion that this criterion was introduced to address cases where the existing ambient noise level is already at, or in excess of the recommended limits.

Table 5-1: IFC Table .7.1-Noise Level Guidelines

Receptor type	One hour L_{Aeq} (dBA)	
	Daytime 07:00 - 22:00	Night-time 22:00 – 07:00
Residential; institutional; educational	55	45
Industrial; commercial	70	70

The document uses the $L_{Aeq,1hr}$ noise descriptors to define noise levels. It does not determine the detection period, but refers to the IEC standards, which requires the fast detector setting on the Sound Level Meter during measurements in Europe.

5.5.5 European Parliament Directive 200/14/EC

Directive 2000/14/EC relating to the noise emission in the environment by equipment for use outdoors was adopted by the European Parliament and the Council and first published in May 2000 and applied from 3 January 2002. The directive placed sound power limits on equipment to be used outdoors in a suburban or urban setting. Failure to comply with these regulations may result in products being prohibited from being placed on the EU market. Equipment list is vast and includes machinery such as compaction machineries, dozers, dumpers, excavators, etc. Manufacturers as a result started to consider noise emission levels from their products to ensure that their equipment will continue to have a market in most countries.

6 CURRENT ENVIRONMENTAL SOUND CHARACTER

6.1 EFFECT OF SEASON ON SOUND LEVELS

Natural sounds are a part of the environmental noise surrounding humans. In rural areas the sounds from insects and birds would dominate the ambient sound character, with noises such as wind flowing through vegetation increasing as wind speed increase. Work by Fégeant (2002) stressed the importance of wind speed and turbulence causing variations in the level of vegetation generated noise. In addition, factors such as the season (e.g. dry or no leaves versus green leaves), the type of vegetation (e.g. grass, conifers, deciduous), the vegetation density and the total vegetation surface all determine both the sound level as well as spectral characteristics.

Ambient sound levels are significantly affected by the area where the sound measurement location is situated. When the sound measurement location is situated within an urban area, close to industrial plants or areas with a constant sound source (ocean, rivers, etc.), seasons and even increased wind speeds could have a significant impact on ambient sound levels.

Sound levels in undeveloped rural areas (away from occupied dwellings) however are impacted by changes in season for a number of complex reasons. The two main reasons are:

- Faunal communication during the warmer spring and summer months as various species communicate in an effort to find mates; and
- Seasonal changes in weather patterns, mainly wind (also see **section 6.1.1**).

For environmental noise, weather plays an important role; the greater the separation distance, the greater the influence of the weather conditions; so, from day to day, a road 1,000 m away can sound very loud or can be completely inaudible.

Other environmental factors that impact on sound propagation includes wind, temperature and humidity, as discussed in the following sections.

6.1.1 Environmental factors that influence the propagation of sound

Sound is a sequence of waves of pressure that propagate through a compressible medium such as air. In air, there are three main properties that can affect the behaviour of sound propagation, namely:

1. The motion of the medium itself, e.g. wind in air. In the case of wind, if the air movement is in the direction of the sound wave, the sound can be transported further;

2. The relationship between density and pressure. This relationship, affected by temperature, determines the speed of sound within the medium;
3. The viscosity of the medium. This determines the rate at which sound is attenuated.

During this propagation, the sound waves can be reflected, refracted or attenuated by this medium. Atmospheric absorption depends on frequency, relative humidity, temperature and atmospheric pressure.

6.1.2 Effect of wind on ambient sound levels

Wind speed can be a significant factor for ambient sound levels at most rural locations. With no wind, there is little vegetation movement that could generate noises, however, as wind speeds increase, the rustling of leaves increases which subsequently can increase sound levels. This directly depends on the type of vegetation in a certain area. The impact of increased wind speeds on sound levels depends on the vegetation type (deciduous versus conifers), the density of vegetation in an area, seasonal changes (in winter deciduous trees are bare) as well as the height of this vegetation. This excludes the effect of faunal communication as vegetation may create suitable habitats and food sources for fauna, attracting more animals in number and species diversity as may be found in the natural veldt.

6.1.3 Effect of wind on sound propagation

Excluding wind-induced noises relating to increased wind speeds, wind alters sound propagation by the mechanism of refraction; that is, wind bends sound waves. Wind nearer to the ground moves more slowly than wind at higher altitudes, due to surface characteristics such as hills, trees, and man-made structures that interfere with the wind. This wind gradient, with faster wind at higher elevation and slower wind at lower elevation, causes sound waves to bend downward when they are traveling to a location downwind of the source and to bend upward when traveling toward a location upwind of the source. Waves bending downward means that a listener standing downwind of the source will hear louder noise levels than the listener standing upwind of the source. This phenomenon can significantly impact sound propagation over long distances and when wind speeds are high.

6.1.4 Effect of temperature on sound propagation

On a typical sunny afternoon, air is warmest near the ground and temperature decreases at higher altitudes. This temperature gradient causes sound waves to refract upward, away from the ground and results in lower noise levels being heard at a measurement location. In the evening, this temperature gradient will reverse, resulting in cooler temperatures near the ground. This condition, often referred to as a temperature inversion will cause sound to bend downward toward the ground and results in louder noise levels at the listener's position. Like wind gradients, temperature gradients can influence sound propagation over long distances and can significantly complicate noise propagation modelling.

6.2 SOUND MEASUREMENTS - PROCEDURE

Ambient (background) noise levels were measured during January 2019 and September 2020 in accordance with the South African National Standard SANS 10103:2008 "***The measurement and rating of environmental noise with respect to land use, health, annoyance and to speech communication***", also considering the protocols defined in GG 43110.

The guidelines and protocol define the procedures, minimum equipment accuracy and time periods (in which measurements must be collected) such as:

- type of equipment (Class 1) to be used;
- minimum duration of measurement as well as time periods when measurements must take place;
- microphone positions and height above ground level;
- calibration procedures and instrument checks; and
- supplementary weather measurements and observations.

During these site visits, ambient sound levels were measured over at least one full night-time period at two locations using class-1 Sound Level Meters (SLMs) with the measurement localities presented in **Figure 6-1** as blue squares. The SLMs would measure "average" sound levels over 10-minute periods, save the data and start with a new 10-minute measurement till the instrument was stopped. The SLMs were referenced at 1,000 Hz directly before and after the measurements were taken. In all cases drift was less than 1.0 dBA. This data was augmented by a number of short-term measurements done during January 2019.

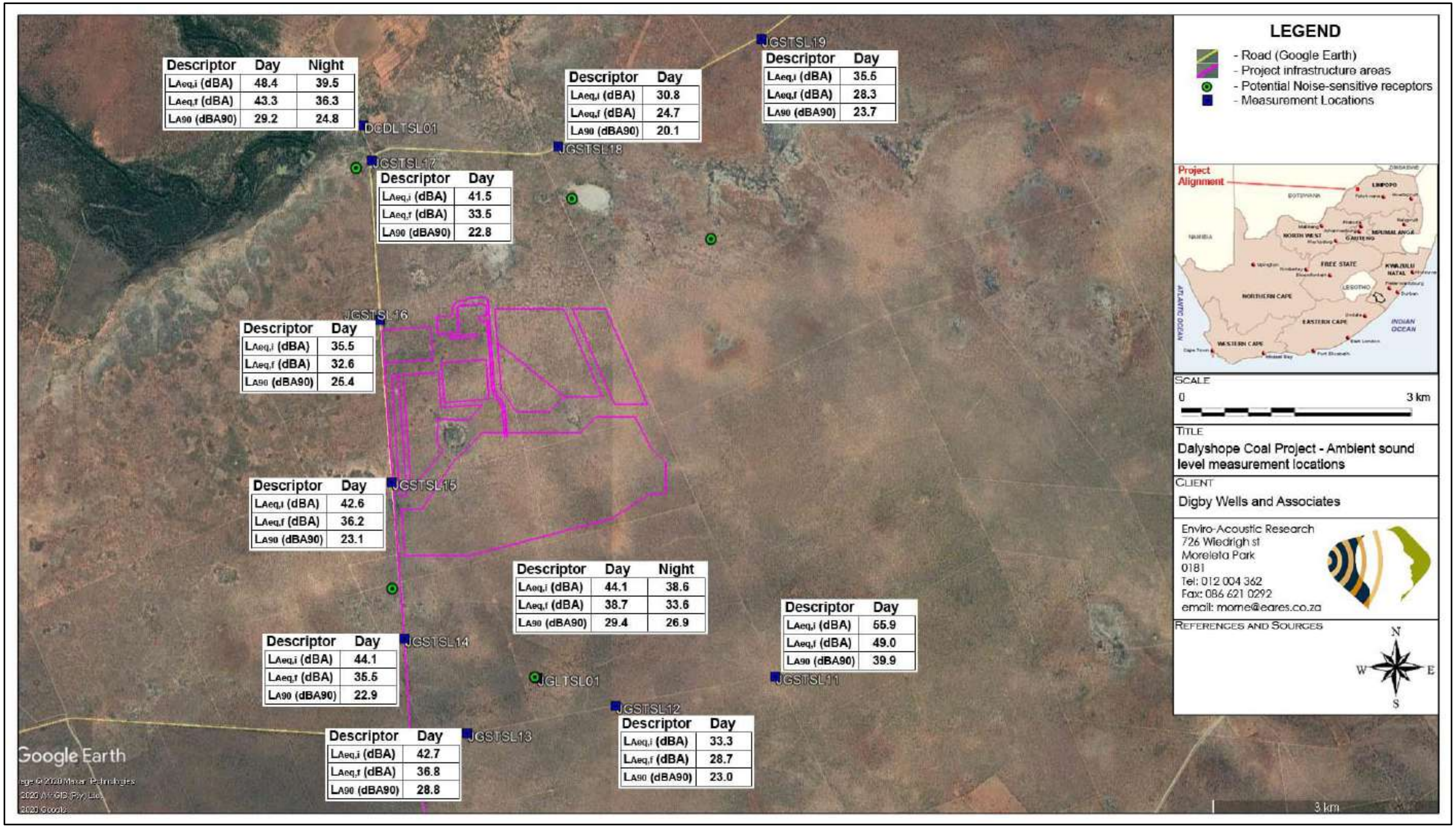

Figure 6-1: Localities where ambient sound levels were measured

6.2.1 Long-term Measurement Location DCDLTSL01

The equipment defined in **Table 6-1** was used for gathering data.

Table 6-1: Equipment used to gather data (Svan 977) at DCDLTSL01

Equipment	Model	Serial no	Calibration Date
SLM	Svan 977	34160	March 2020
Pre-amplifier	SV 12L	32395	March 2020
Microphone	ACO 7052E	54645	March 2020
Calibrator	Quest QC-20	QOC 020005	Jun 2020

* Microphone fitted with the RION WS-03 outdoor all-weather windshield.

The measurement location was selected to be indicative of potential ambient sound levels in the vicinity of the project site. A photo of the measurement location is presented in **Appendix B**. Refer to **Table 6-2** highlighting sounds heard during equipment deployment and collection.

Table 6-2: Noises/sounds heard during site visits at DCDLTSL01

Noises/sounds heard during onsite investigations		
Magnitude Scale Code: • Barely Audible • Audible • Dominating	**During equipment deployment**	
	Faunal and Natural	Birds clearly audible and dominant. Wind-induced noises audible and significant at times.
	Residential	-
	Industrial & transportation	Eskom transformer audible during quiet periods.
	During equipment collection	
	Faunal and Natural	Birds dominant. Wind induced noise quite significant at times.
	Residential	-
	Industrial & transportation	Mining sounds just audible. Reverse alarms in distance.

6.2.1.1 Summary of Ambient Sound levels measured

Impulse time-weighted equivalent sound levels $L_{AIeq,10min}$ and fast time-weighted equivalent sound levels $L_{AFeq,10min}$ are presented in **Figure 6-2** and summarized in **Table 6-3** below. The maximum (L_{Amax}), minimum (L_{Amin}) and 90th percentile (L_{A90}) statistical values are illustrated in **Figure 6-3**.

The impulse time-weighted sound descriptor is mainly used in South Africa to define sound and noise levels. Fast-weighted equivalent sound levels are included in this report as this is the sound descriptor used in most international countries to define the Ambient Sound Level.

The L_{A90} level is presented in this report to define the "background ambient sound level", or the sound level that can be expected if there were little single events (loud transient noises) that impacts on average sound level. The L_{A90} level is elevated, indicating the presence of constant noises in the area that raises the noise levels.

Maximum noise level exceeded 65 dBA only a few times at night. If maximum noise levels exceed 65 dBA more than 10 times at night, it may increase the probability where a receptor may be awakened at night, ultimately impacting on the quality of sleep[9].

Table 6-3: Sound levels considering various sound level descriptors at DCDLTSL01

	$L_{Amax,i}$ (dBA)	$L_{Aeq,i}$ (dBA)	$L_{Aeq,f}$ (dBA)	$L_{A90,f}$ (dBA90)	$L_{Amin,f}$ (dBA)
Day arithmetic average	-	48.4	43.3	29.2	-
Night arithmetic average	-	39.5	36.3	24.8	-
Day minimum	-	29.7	26.2	-	20.4
Day maximum	87.1	63.0	57.9	-	-
Night minimum	-	20.9	20.5	-	18.9
Night maximum	67.4	49.4	47.1	-	-
Day 1 equivalent	-	45.6	41.3	-	-
Night 1 Equivalent	-	42.7	40.4	-	-
Day 2 equivalent	-	45.7	41.7	-	-
Night 2 Equivalent	-	31.4	27.7	-	-
Day 3 equivalent	-	44.2	37.5	-	-
Night 3 Equivalent	-	38.3	30.3	-	-
Day 4 equivalent	-	48.8	43.4	-	-

The numerous 10-minute measurements are further classified for the day- and night-time periods in terms of the SANS 10103:2008 typical noise district areas in **Figure 6-4** (day) and **Figure 6-5** (night).

6.2.1.2 Spectral Frequencies

Lower frequencies (20 – 250 Hz): This frequency band is generally dominated by noises originating from anthropogenic activities (vehicles idling and driving, pumps and motors, etc.) as well as certain natural phenomena (wind, ocean surf splash etc.). Motor vehicle engine rpm (revolutions per minute, 1000 - 6000 rpm) mostly convert to this range of frequency. Lower frequencies (above infrasound etc.) also have the potential to propagate much further than the higher frequencies.

Night-time data: Wind-induced noises dominated the first night spectral character, with the second- and third-night's data indicating slight peaks at 50, 125 and 200 Hz. The source of these peaks is unknown.

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(9) World Health Organization, 2009, '*Night Noise Guidelines for Europe.*

Daytime data: Wind-induced noises dominated the first- and second-day's spectral character, with slight peaks at 125 and 200 Hz. The source of these peaks is unknown.

Middle frequencies surrounding 1,000 Hz (200 – 2,000 Hz) – This range contains energy mostly associated with human speech (350 Hz – 2,000 Hz; mostly below 1,000 Hz) and dwelling noises (including sounds from larger animals such as chickens, dogs, goats, sheep and cattle). Road-tyre interaction (from vehicular traffic) normally features in 630 – 1,600 Hz range. Ventilation fans could also increase acoustic energy in this frequency band.
Night-time data: Wind-induced noises dominated the first night spectral character, with the second- and third-night's data indicating a slight peak at 800 Hz. The source of this peak is unknown.
Daytime data: Wind-induced noises dominated the first- and second-day's spectral character, with a very slight peak at 800 Hz. The source of this peak is unknown.

Higher frequency (2,000 Hz upwards) – Smaller faunal species such as birds, crickets and cicada use this range to communicate and hunt etc.
Night-time data: Wind-induced noises dominated the first night spectral character, with no clear character the second- and third-night.
Daytime data: While wind-induced noises did influence the first- and second-day's spectral character, birds likely contributed to a slight peak at 2,500 Hz.

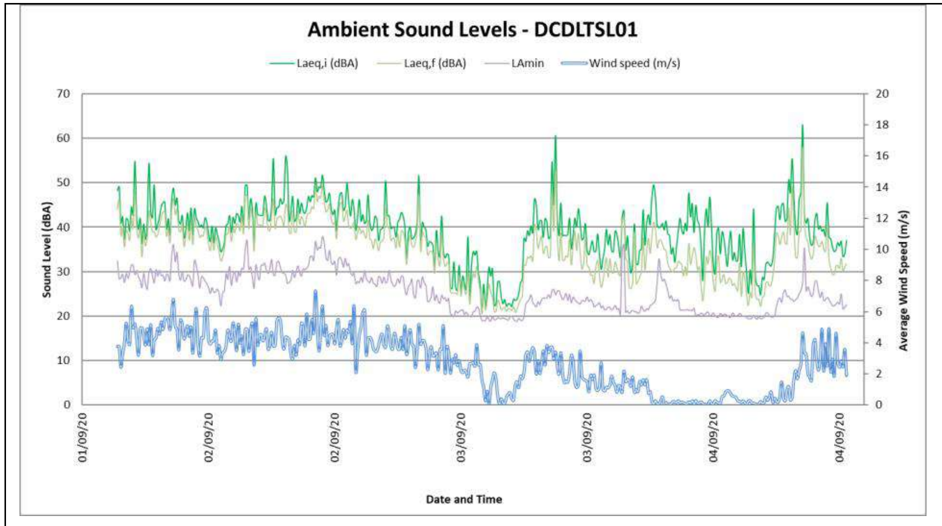

Figure 6-2: Ambient Sound Levels at DCDLTSL01

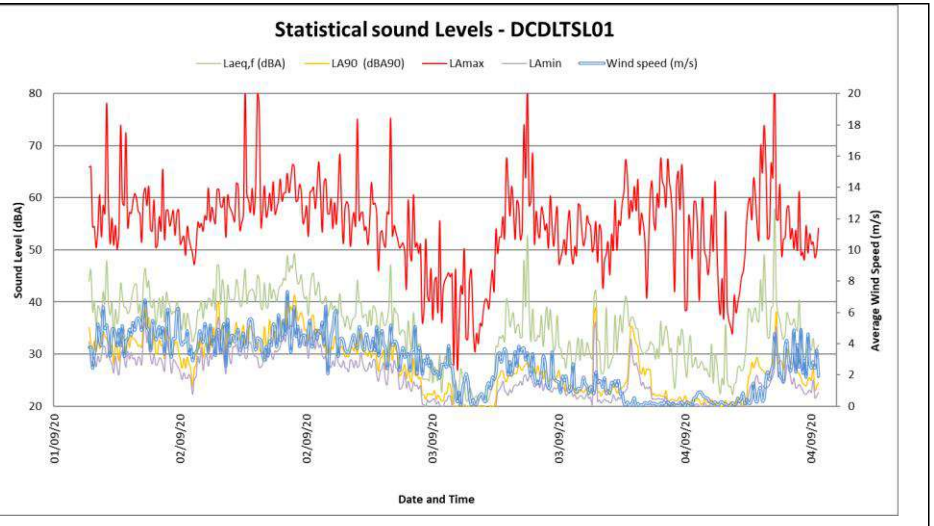

Figure 6-3: Maximum, minimum and Statistical sound levels at DCDLTSL01

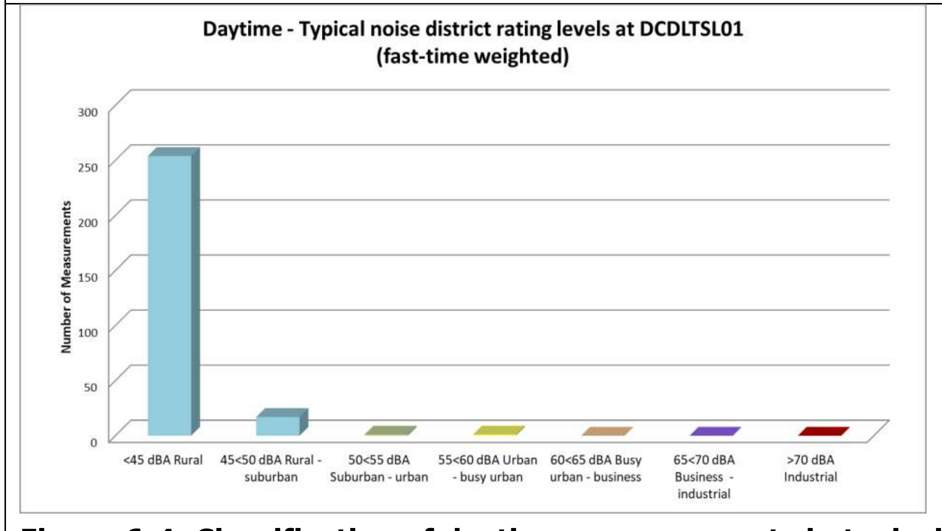

Figure 6-4: Classification of daytime measurements in typical noise districts at DCDLTSL01

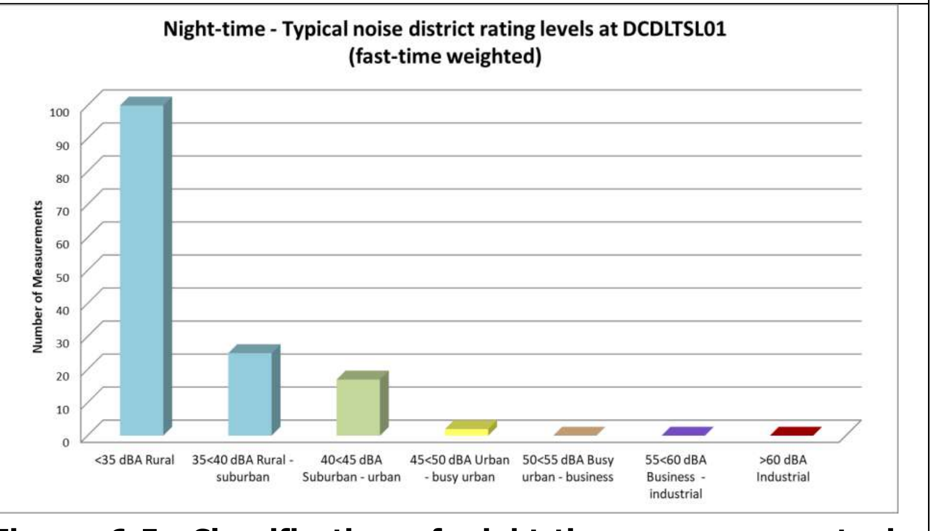

Figure 6-5: Classification of night-time measurements in typical noise districts at DCDLTSL01

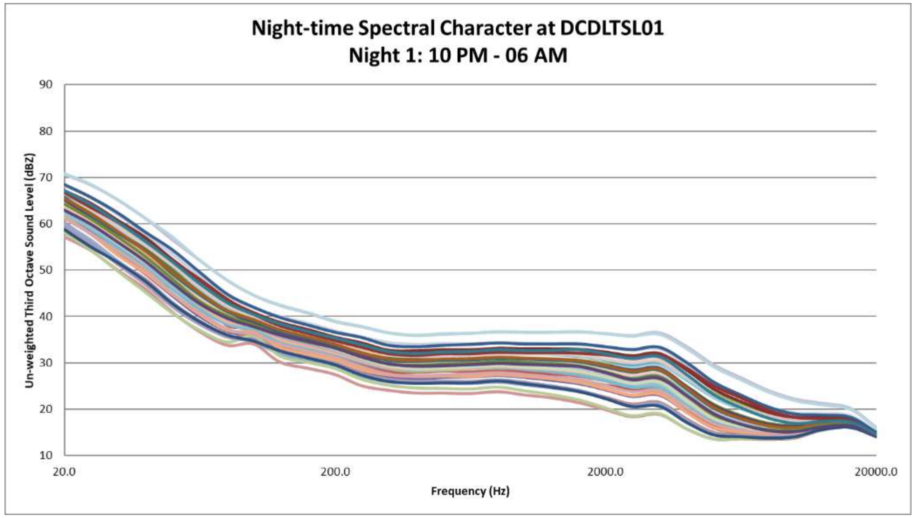

Figure 6-6: Spectral frequencies – DCDLTSL01, Night 1

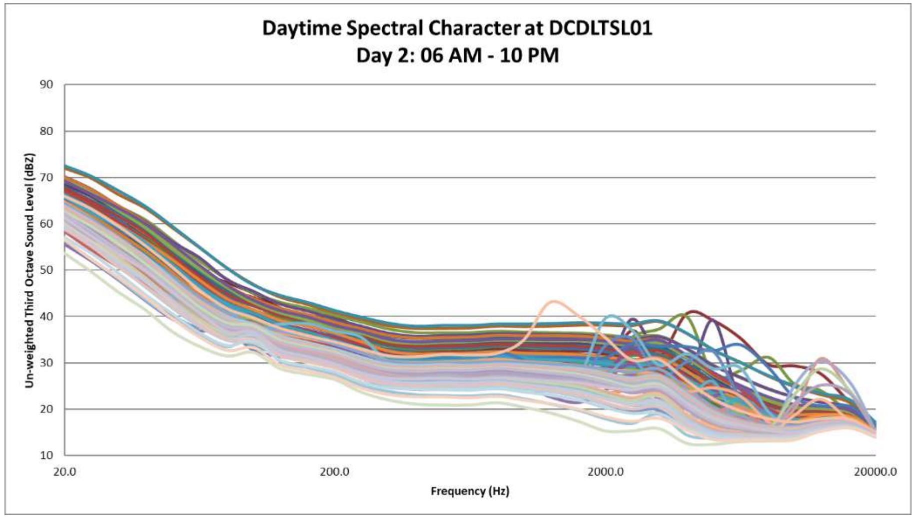

Figure 6-7: Spectral frequencies - DCDLTSL01, Day 2

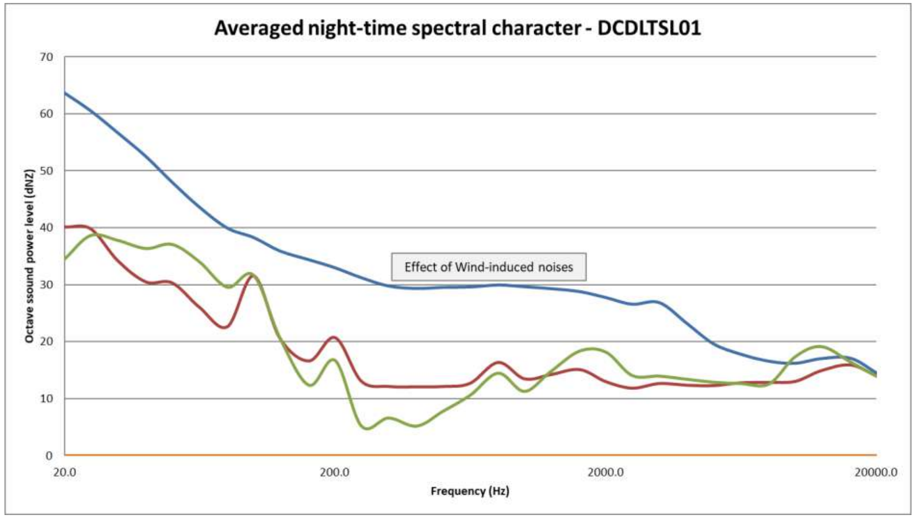

Figure 6-8: Average night-time frequencies - DCDLTSL01

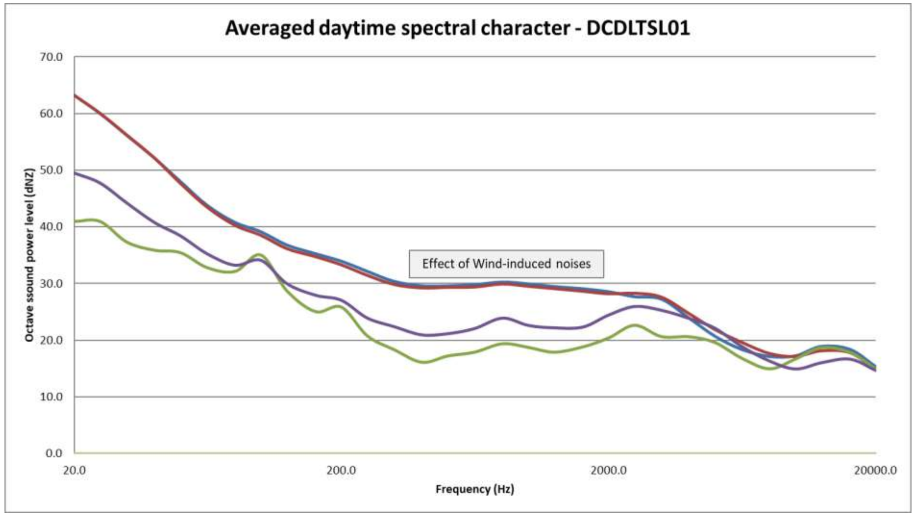

Figure 6-9: Average daytime frequencies - DCDLTSL01

6.2.2 Long-Term Measurement Location JGSTSL01

Ambient (background) sound levels were measured over a one night-time period from 21 to 22 January 2019, augmented with a number of short, 10-minute measurements (see **Table 6-7**). The microphone was deployed at the house, away from any identifiable potential noise sources. There were no large trees within 20m from the microphone though there were some wind-induced noises at times. The equipment defined in **Table 6-1** was used for gathering data.

Table 6-4: Equipment used to gather data (Rion NA-28) at JGSTSL01

Equipment	Model	Serial no	Calibration
SLM	SVAN 977	36176	December 2017
Microphone	ACO Pacific 7052E	49596	December 2017
Calibrator	Quest CA-22	J 2080094	July 2018
Anenometer	WH3081PC	-	-

* Microphone fitted with the RION WS-03 outdoor all-weather windshield.

The measurement location was selected to be reflective of ambient sound levels in the area. Refer to **Table 6-5** highlighting sounds heard during equipment deployment and collection.

Table 6-5: Noises/sounds heard during site visits at JGSTSL01

Noises/sounds heard during onsite investigations		
Magnitude – Colour Code Used **Barely Audible** **Audible** **Dominating**	**During equipment deployment**	
	Faunal and Natural	Bird sounds dominant. Insects at times. Wind-induced noises at times.
	Residential	-
	Industrial & transportation	-
	During equipment collection	
	Faunal and Natural	Bird sounds dominant. Insects at times.
	Residential	-
	Industrial & transportation	-

6.2.2.1 Summary of Ambient Sound Levels measured

Impulse time-weighted equivalent sound levels $L_{AIeq,10min}$ and fast time-weighted equivalent sound levels $L_{AFeq,10min}$ are presented in **Figure 6-10** and summarized in **Table 6-6** below. The maximum (L_{Amax}), minimum (L_{Amin}) and 90th percentile (L_{A90}) statistical values are illustrated in **Figure 6-11**.

Table 6-6: Sound level descriptors as measured at JGSTSL01

	$L_{Amax,i}$ (dBA)	$L_{Aeq,i}$ (dBA)	$L_{Aeq,f}$ (dBA)	$L_{A90,f}$ (dBA90)	$L_{Amin,f}$ (dBA)
Day arithmetic average	-	44	39	29	-
Night arithmetic average	-	39	34	27	-
Day minimum	-	32	29	-	24
Day maximum	71	59	55	-	-
Night minimum	-	31	27	-	23
Night maximum	73	54	49	-	-
Day 1 equivalent	-	44	38	-	-
Night 1 Equivalent	-	44	38	-	-
Day 2 equivalent	-	51	43	-	-

The numerous 10-minute measurements are further classified for the day- and night-time periods in terms of the SANS 10103:2008 typical noise district areas in **Figure 6-12** (day) and **Figure 6-13** (night). Most of the daytime measurements fall within the rural noise district rating level, with most of the night-time measurements in the rural-sub-urban noise district rating level.

6.2.2.2 Spectral Frequencies

Lower frequency (20 – 250 Hz) – Noise sources of significance in this frequency band would include nature (wind and surf especially – indicated by a relative smooth curve) and sounds of anthropogenic origin and vehicles (engine sounds and electric motors – erratic bumps at certain frequencies). Lower frequencies tend to travel further through the atmosphere than higher frequencies. People generally do not hear these frequencies unless very quiet due to the low response of the ear to these low frequencies. Sounds from wind-induced noises generally have significant acoustic energy in this frequency range (normally identified by a smooth curve).

Night-time data: indicated a site with very little acoustic energy in this frequency range (average of approximately 9 dBA).
Daytime data: shows a site with insignificant acoustic energy in this frequency band with a character similar of the night-time spectral data (average of approximately 13 dBA).

Third octave surrounding the 1,000 Hz (200 – 2,000 Hz) – This range contains energy mostly associated with human speech (350 Hz – 2,000 Hz) and dwelling noises (including sounds from larger animals such as chickens, dogs, goats, sheep and cattle).

Road-tyre interaction (from vehicular traffic) normally peaking in 630 – 1,600 Hz range (depending on vehicular speed and road characteristics).

Night-time data: indicated a site with a bit of acoustic energy in this frequency range (average of approximately 28 dBA). Early morning measurements show a clearly discernible peak at 1,000 Hz (likely birds).
Daytime data: shows a site with some acoustic energy in this frequency range (average of approximately 34 dBA). Most measurements show a clearly discernible peak at 800 – 1,000 Hz.

Higher frequency (2,000 Hz upwards) – Smaller faunal species such as birds, crickets and cicada use this range to communicate and hunt etc.

Night-time data: indicated a site with a bit of acoustic energy in this frequency range (average of approximately 27 dBA) with no clear character (different sources). There are a number of measurements where there were numerous peaks between 2,500 – 5,000 Hz, a frequency band used by birds and insects.
Daytime data: shows some acoustic energy in this frequency band due to various different sources, likely birds and insects (average of approximately 37 dBA - no clear character).

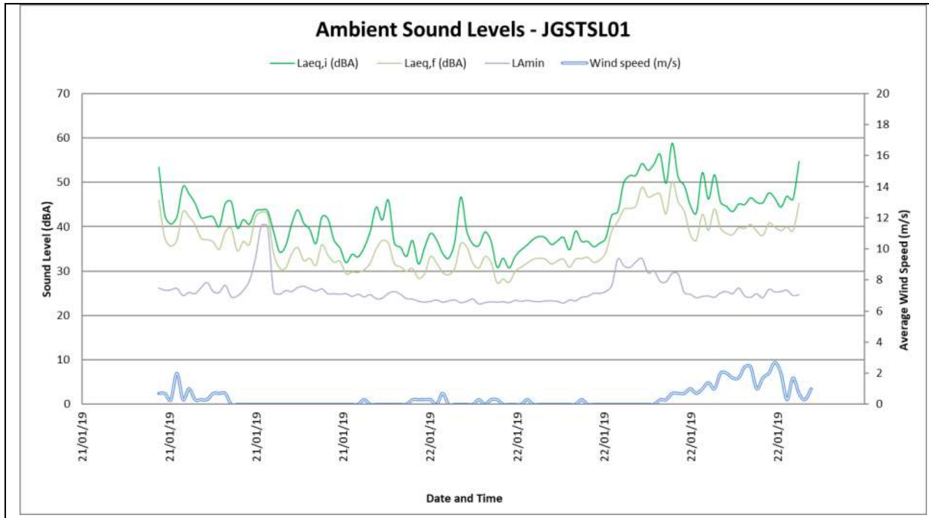

Figure 6-10: Ambient sound levels at JGSTSL01

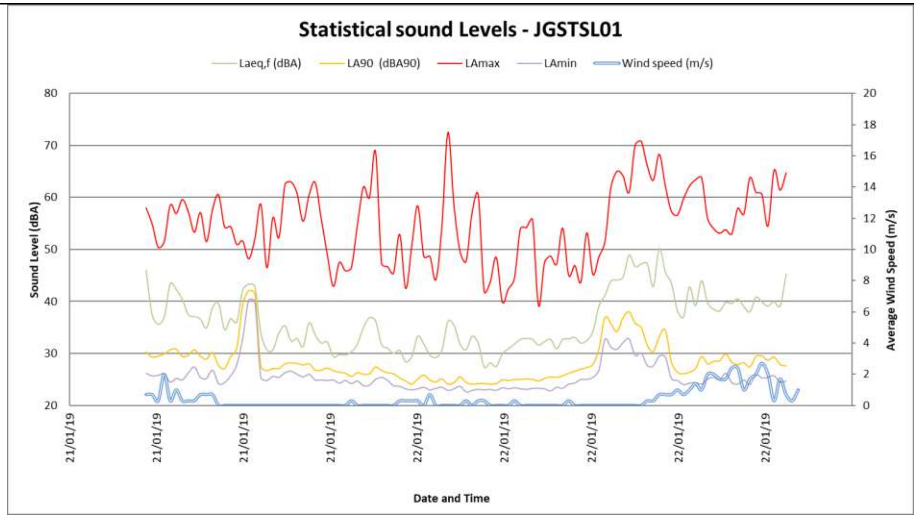

Figure 6-11: Maximum, minimum and statistical values at JGSTSL01

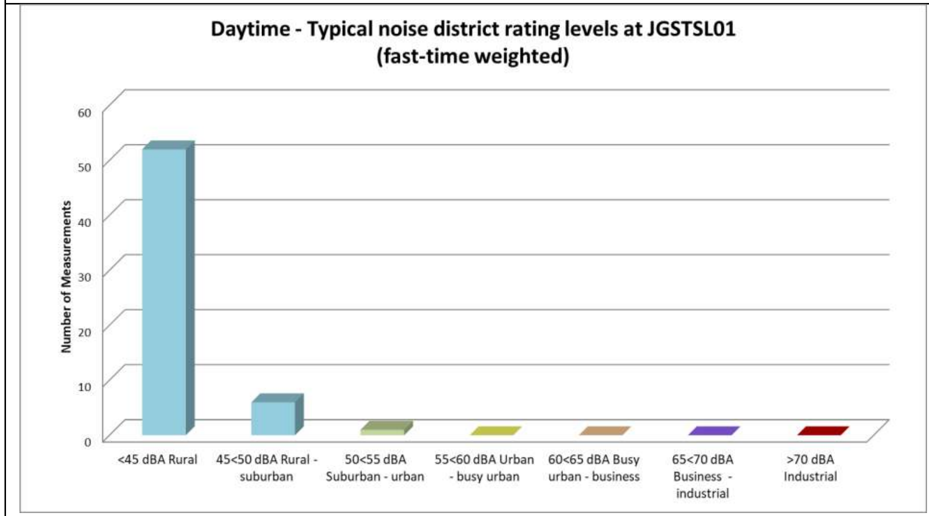

Figure 6-12: Classification of daytime measurements in typical noise districts at JGSTSL01

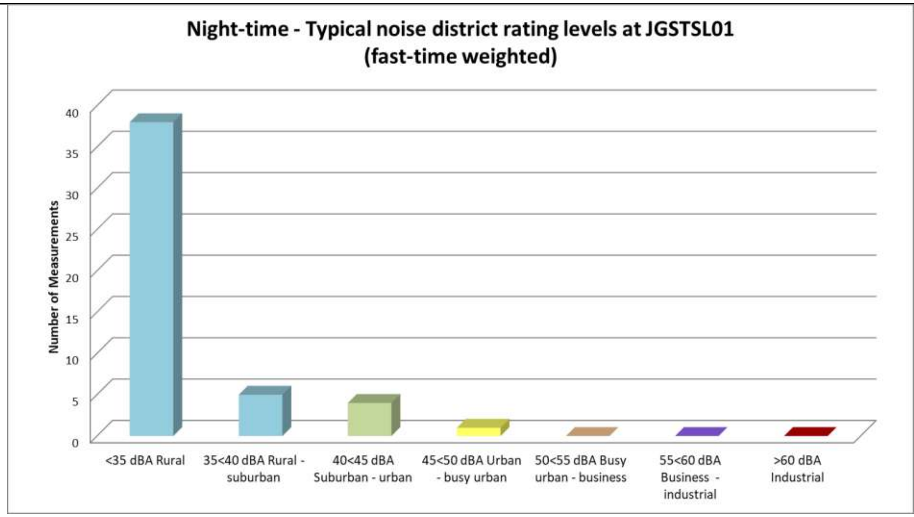

Figure 6-13: Classification of night-time measurements in typical noise districts at JGSTSL01

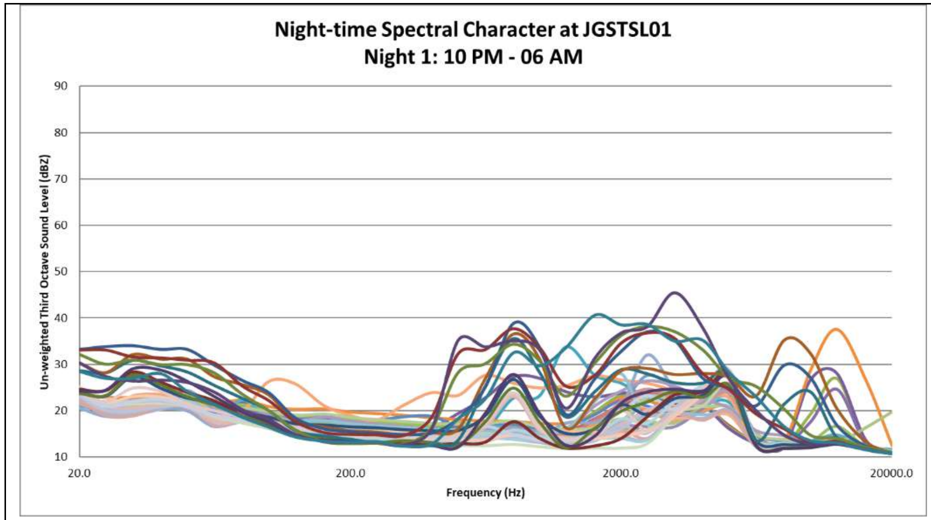

Figure 6-14: Night 1 spectral frequencies at JGSTSL01

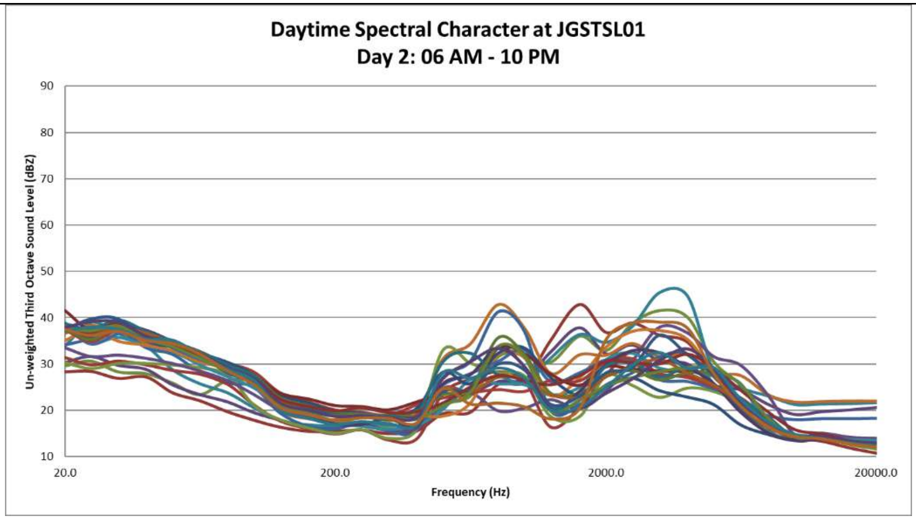

Figure 6-15: Day 2 spectral frequencies at JGSTSL01

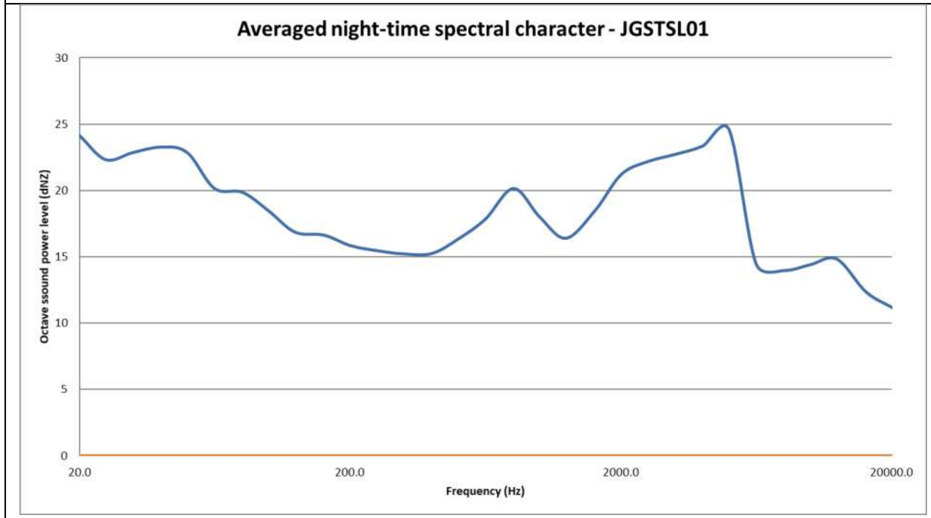

Figure 6-16: Average night-time frequencies at JGSTSL01

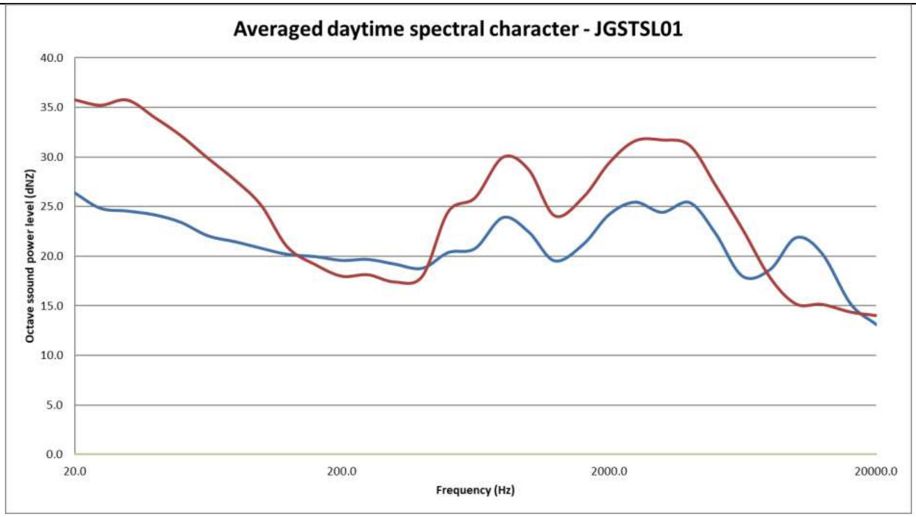

Figure 6-17: Average daytime frequencies at JGSTSL01

Table 6-7: Summary of singular noise measurements

Measurement location	$L_{Aeq,i}$ level (dBA)	$L_{Aeq,i}$ level (dBA)	$L_{Aeq,i}$ level (dBA)	$L_{Aeq,f}$ level (dBA)	L_{A90} Level (dBA90)	Comments
GSTASL11	66	56	27	49	40	Birds dominating, with birds in trees close to microphone generating significant noise. Frogs (suspected) clearly audible and significant. Some wind gusts at times with minimal influence on sound levels.
GSTASL12	43	33	18	29	23	Birds dominating with frogs clearly audible. Some minor wind induced noises at times.
GSTASL13	58	43	22	37	29	Birds dominating. Birds in tree close to microphone.
GSTASL14	58	44	19	36	23	Birds dominating.
GSTASL15	52	43	20	36	23	Birds dominating.
GSTASL16	50	36	22	33	25	Birds dominating. Insects clearly audible (bees).
GSTASL17	56	42	20	33	23	Birds dominating. Voices from people in area. Insects. Some wind induced noises.
GSTASL18	47	31	17	25	20	Birds and insects.
GSTASL19	46	36	21	28	24	Birds dominant. Insects audible. Some wind induced noises with Aeolian sounds at times from power lines. Wind induced noises from tree.

6.3 AMBIENT SOUND LEVELS – FINDINGS & SUMMARY

Based on the sound measurements:

- **DCDLTSL01 – R5:**
  - Considering the arithmetic average $L_{Aeq,f}$ daytime data (37.1 dBA), ambient sound levels are low, with the energy-averaged $L_{Aeq,f}$ being 43.2 dBA. This is typical of a rural noise district;
  - Considering the arithmetic average $L_{Aeq,f}$ night-time data (34.7 dBA), ambient sound levels are elevated, with the energy-averaged $L_{Aeq,f}$ being 36.3 dBA. This is typical of a rural noise district;
  - The statistical L_{A90} levels are slightly elevated during the day, but low at night.
- **JGSTSL01 – R2:**
  - Considering the arithmetic average $L_{Aeq,f}$ daytime data (38.3 dBA), ambient sound levels are low, with the energy-averaged $L_{Aeq,f}$ being 37.2 dBA. This is typical of a rural noise district;
  - Considering the arithmetic average $L_{Aeq,f}$ night-time data (33.6 dBA), ambient sound levels are elevated, with the energy-averaged $L_{Aeq,f}$ being 37.9 dBA. This is typical of a rural noise district;
  - The statistical L_{A90} levels are slightly elevated during the day, but low at night.

Considering the short-time measurements collected during the day, ambient sound levels are low and typical of a rural noise district in an undeveloped area.

Considering the results of the measurements, the developmental character of the area as well as audible observations, the recommended noise limits would be typical of a rural noise district. The acceptable zone sound level recommended are:

- **45 dBA for daytime noise levels;** and,
- **35 dBA for night-time noise levels**.

Proposed activities at the project should not change the recommended rating levels with more than 7 dBA.

7 POTENTIAL NOISE SOURCES

Increased noise levels are directly linked with the various activities associated with the construction of the proposed mine and related infrastructure, as well as the operational phase of the activity as conceptualised in the following sections.

7.1 CONSTRUCTION NOISES

7.1.1 Construction of Mining Infrastructure

The following are likely the main construction related sources:

- Site survey and development of a contractors camp and storage;
- Development of the internal and access roads – bulldozers, graders;
- Vegetation removal and the stripping of topsoil at open cast pit, dumps and stockpile areas and well as certain infrastructure by means of bulldozers, excavators, articulated dump trucks (ADT), water dozers, etc. Typical practice is to stockpile stripped topsoil close to the mining or project areas as a berm, to be used for backfilling or to be hauled to specific stockpiles/dumps – assuming five Articulated Dump Trucks (ADTs) trips per hour to the soft overburden dump;
- Development of the topsoil, hards- and soft overburden dumps/stockpiles (around mining pits) - bulldozers, ADTs, etc.;
- Development of the initial boxcut - excavators, ADTs, drill rigs, etc. The model will evaluate a scenario where overburden was blasted and excavators are loading the overburden on ADTs for moving to the hard overburden dump (10 ADTs per hour);
- Digging of foundations for certain structures. Due to the volume of concrete that will be required, an on-site batching plant may be required to ensure a continuous concreting operation. The source of aggregate is as yet undefined but is expected to be derived from an offsite source or brought in as ready-mix; and
- Civil construction activities.

Potential maximum noise levels generated by construction equipment, as well as the potential extent are presented in **Table 7-1**. The potential extent depends on a number of factors, including the prevailing ambient sound levels during the instance the maximum noise event occurred, as well as the spectral characteristics of the noise and the ambient soundscape in the surroundings.

Average or equivalent sound levels are another factor that impacts on the ambient sound levels and is the constant sound level that the receptor can experience. Typical sound power levels associated with various activities that may be found at a construction site is presented in **Table 7-2**.

The level and character of the construction noise will be highly variable as different activities with different equipment take place at different times, for different periods of time (operating cycles), in different combinations/sequences and on different parts of the construction site.

7.1.2 Delivery/Access roads, design, specifications & information

The main source of traffic noise during the construction phase relates to traffic to the project site as well as on the site due to material delivery as well construction crew vehicle movement. The access routes acoustical contribution to the surrounding sound environment depends on a host of factors ranging from road traffic volumes, vehicle specifications (tyre design, light or heavy etc.), road tyre interaction specifications (including road paving design such as surface porosity, surface texture etc.), road traffic speeds and a host of other considerations.

Construction traffic is expected to be generated throughout the entire construction period; however, the volume and type of traffic generated will be dependent upon the construction activities being conducted, which will vary during the construction period.

Details of construction traffic is not available and traffic volumes were assumed, considering other, similar projects, considering potential worst-case scenarios (peak). There will also be a peak of traffic during the start of the project when equipment and material will be delivered to the project site, with most trips concentrated in the mornings and evenings.

For the purpose of this assessment, peak construction traffic will be assumed at:

- 100 heavy and 40 light vehicles per hour (daytime); and
- 20% of the peak daytime traffic used for night-time traffic.

All vehicles will travel at an average speed of 60 km/h on access roads and 40 km/h within the mine boundary.

Table 7-1: Potential maximum noise levels generated by construction equipment

Equipment Description[10]	Impact Device?	Maximum Sound Power Levels (dBA)	Operational Noise Level at given distance considering potential maximum noise levels (Cumulative as well as the mitigatory effect of potential barriers or other mitigation not included – simple noise propagation modelling only considering distance) (dBA)											
			5 m	10 m	20 m	50 m	100 m	150 m	200 m	300 m	500 m	750 m	1000 m	2000 m
Backhoe	No	114.7	89.7	83.7	77.6	69.7	63.7	60.1	57.6	54.1	49.7	46.2	43.7	37.6
Chain Saw	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Compactor (ground)	No	114.7	89.7	83.7	77.6	69.7	63.7	60.1	57.6	54.1	49.7	46.2	43.7	37.6
Compressor (air)	No	114.7	89.7	83.7	77.6	69.7	63.7	60.1	57.6	54.1	49.7	46.2	43.7	37.6
Concrete Batch Plant	No	117.7	92.7	86.7	80.6	72.7	66.7	63.1	60.6	57.1	52.7	49.2	46.7	40.6
Concrete Mixer Truck	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Concrete Pump Truck	No	116.7	91.7	85.7	79.6	71.7	65.7	62.1	59.6	56.1	51.7	48.2	45.7	39.6
Crane	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Dozer	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Drill Rig Truck	No	118.7	93.7	87.7	81.6	73.7	67.7	64.1	61.6	58.1	53.7	50.2	47.7	41.6
Drum Mixer	No	114.7	89.7	83.7	77.6	69.7	63.7	60.1	57.6	54.1	49.7	46.2	43.7	37.6
Dump Truck	No	118.7	93.7	87.7	81.6	73.7	67.7	64.1	61.6	58.1	53.7	50.2	47.7	41.6
Excavator	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Flat Bed Truck	No	118.7	93.7	87.7	81.6	73.7	67.7	64.1	61.6	58.1	53.7	50.2	47.7	41.6
Front End Loader	No	114.7	89.7	83.7	77.6	69.7	63.7	60.1	57.6	54.1	49.7	46.2	43.7	37.6
Generator	No	116.7	91.7	85.7	79.6	71.7	65.7	62.1	59.6	56.1	51.7	48.2	45.7	39.6
Grader	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Impact Pile Driver	Yes	129.7	104.7	98.7	92.6	84.7	78.7	75.1	72.6	69.1	64.7	61.2	58.7	52.6
Jackhammer	Yes	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Man Lift	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6

[10]Equipment list and Sound Power Level source: http://www.fhwa.dot.gov/environment/noise/construction_noise/handbook/handbook09.cfm

Mounted Impact Hammer	Yes	124.7	99.7	93.7	87.6	79.7	73.7	70.1	67.6	64.1	59.7	56.2	53.7	47.6
Paver	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Pickup Truck	No	89.7	64.7	58.7	52.6	44.7	38.7	35.1	32.6	29.1	24.7	21.2	18.7	12.6
Pumps	No	111.7	86.7	80.7	74.6	66.7	60.7	57.1	54.6	51.1	46.7	43.2	40.7	34.6
Rivit Buster/Chipping Gun	Yes	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Rock Drill	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Roller	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Sand Blasting (single nozzle)	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Scraper	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Slurry Plant	No	112.7	87.7	81.7	75.6	67.7	61.7	58.1	55.6	52.1	47.7	44.2	41.7	35.6
Slurry Trenching Machine	No	116.7	91.7	85.7	79.6	71.7	65.7	62.1	59.6	56.1	51.7	48.2	45.7	39.6
Soil Mix Drill Rig	No	114.7	89.7	83.7	77.6	69.7	63.7	60.1	57.6	54.1	49.7	46.2	43.7	37.6
Tractor	No	118.7	93.7	87.7	81.6	73.7	67.7	64.1	61.6	58.1	53.7	50.2	47.7	41.6
Vacuum Excavator (Vac-Truck)	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Vacuum Street Sweeper	No	114.7	89.7	83.7	77.6	69.7	63.7	60.1	57.6	54.1	49.7	46.2	43.7	37.6
Ventilation Fan	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Vibrating Hopper	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Vibratory Concrete Mixer	No	114.7	89.7	83.7	77.6	69.7	63.7	60.1	57.6	54.1	49.7	46.2	43.7	37.6
Vibratory Pile Driver	No	129.7	104.7	98.7	92.6	84.7	78.7	75.1	72.6	69.1	64.7	61.2	58.7	52.6
Warning Horn	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Welder/Torch	No	107.7	82.7	76.7	70.6	62.7	56.7	53.1	50.6	47.1	42.7	39.2	36.7	30.6

Table 7-2: Potential equivalent noise levels generated by various equipment

Equipment Description	Equivalent (average) Sound Levels (dBA)	Operational Noise Level at given distance considering equivalent (average) sound power emission levels (Cumulative as well as the mitigatory effect of potential barriers or other mitigation not included – simple noise propagation modelling only considering distance) (dBA)											
		5 m	10 m	20 m	50 m	100 m	150 m	200 m	300 m	500 m	750 m	1000 m	2000 m
Bulldozer CAT D11	113.3	88.4	82.3	76.3	68.4	62.3	58.8	56.3	52.8	48.4	44.8	42.3	36.3
Bulldozer CAT D6	108.2	83.3	77.3	71.2	63.3	57.3	53.7	51.2	47.7	43.3	39.8	37.3	31.2
Bulldozer Komatsu 375	114.0	89.0	83.0	77.0	69.0	63.0	59.5	57.0	53.4	49.0	45.5	43.0	37.0
Crusher/Screen (MTC Mobile)	109.6	84.6	78.6	72.6	64.6	58.6	55.1	52.6	49.0	44.6	41.1	38.6	32.6
Crushing plant (50 tons/h)	114.5	89.5	83.5	77.5	69.5	63.5	60.0	57.5	54.0	49.5	46.0	43.5	37.5
Conveyor transfer	103.2	78.3	72.2	66.2	58.3	52.2	48.7	46.2	42.7	38.3	34.7	32.2	26.2
Drilling Machine	109.6	84.6	78.6	72.6	64.6	58.6	55.1	52.6	49.1	44.6	41.1	38.6	32.6
Dumper/Haul truck - CAT 700	115.9	91.0	85.0	78.9	71.0	65.0	61.4	58.9	55.4	51.0	47.5	45.0	38.9
Dumper/Haul truck - Terex 30 ton	112.2	87.2	81.2	75.2	67.2	61.2	57.7	55.2	51.7	47.2	43.7	41.2	35.2
Excavator - Hitachi EX1200	113.1	88.1	82.1	76.1	68.1	62.1	58.6	56.1	52.6	48.1	44.6	42.1	36.1
Excavator - Hitachi 870 (80 t)	108.1	83.1	77.1	71.1	63.1	57.1	53.6	51.1	47.5	43.1	39.6	37.1	31.1
FEL - Bell L1806C	102.7	77.7	71.7	65.7	57.7	51.7	48.2	45.7	42.1	37.7	34.2	31.7	25.7
FEL - CAT 950G	102.1	77.2	71.2	65.1	57.2	51.2	47.6	45.1	41.6	37.2	33.7	31.2	25.1
FEL - Komatsu WA380	100.7	75.7	69.7	63.7	55.7	49.7	46.2	43.7	40.1	35.7	32.2	29.7	23.7
General noise	108.8	83.8	77.8	71.8	63.8	57.8	54.2	51.8	48.2	43.8	40.3	37.8	31.8
Grader - Operational Hitachi	108.9	83.9	77.9	71.9	63.9	57.9	54.4	51.9	48.4	43.9	40.4	37.9	31.9
Grader	110.9	85.9	79.9	73.9	65.9	59.9	56.4	53.9	50.3	45.9	42.4	39.9	33.9
Screening plant	105.5	80.6	74.6	68.5	60.6	54.6	51.0	48.5	45.0	40.6	37.0	34.6	28.5
Water Dozer, CAT	113.8	88.8	82.8	76.8	68.8	62.8	59.3	56.8	53.3	48.8	45.3	42.8	36.8

7.1.3 Blasting Noises

Rock blasting will be required to break down rock and the coal resource. Blasting generates significant acoustic energy over a very short period of time and noise-sensitive receptors often raise blasting noises as a first concern. However, blasting will not be considered as part of the noise impact assessment for the following reasons:

- This will the subject of a separate study;
- Blasting is highly regulated and control of blasting to protect human health, equipment and infrastructure will ensure that any blasts will use minimum explosives and will occur in a controlled manner;
- Blasting is a highly specialised field, and various management options are available to the blasting specialist. Options available to minimise the risk to equipment, people and infrastructure includes:
    - The use of different explosives that have a lower detonation speed, which reduces vibration, sound pressure levels as well as air blasts.
    - Blasting techniques such as blast direction and/or blast timings (both blasting intervals and sequence).
    - Reducing the total size of the blast.
    - Damping materials used to cover the explosives.
- People are generally more concerned over ground vibration and air blast levels that might cause building damage than the impact of the noise from the blast. This is normally associated with close proximity mining/quarrying.

Blasts will be an infrequent occurrence, with a loud but a relative instantaneous character. Potentially affected parties will receive sufficient notice (siren and blasting schedule) and the knowledge that the blast will be over relative fast result in a higher acceptance of the noise associated with the blast.

7.2 OPERATIONAL NOISES – GENERAL

7.2.1 Mining and Processing Activities

Coal will be mined through an opencast bench mining method. Each bench height will be assumed to be 10 metres, with the final mining depth determined by the coal resource. It should be noted that the mining activities are selected to illustrate a potential worst-case scenario and may not relate to actual mining activities or locations.

The following mining method will be assumed for the noise model:

- Vegetation and topsoil will be stripped ahead of mining using a bulldozer. At least one cut will already be stripped and available for drilling between the active topsoil stripping operation and the open void. This will be limited to day-time activities;
- The topsoil will be loaded onto dump trucks by excavators and hauled to stockpiles or areas that require rehabilitation using articulated dump trucks. This will be mainly limited to the day-time period (estimated at no more than 230,000 tpa). It will be assumed that the topsoil will be used to develop berms around the mining site up to a height of 5 m as well as stockpiled at the location indicated in **Figure 4-1**;
- Soft overburden will be loaded onto dump trucks by excavators and hauled to the dump (see **Figure 4-1**) or areas that require rehabilitation. This could take place 24 hours per day (estimated at no more than 400,000 tpa);
- Drilling operations will take place at four locations in the active mining pit. All drilling activities will take place 24 hours per day:
  - Drilling of overburden at two different locations, 10 m below ground surface;
  - Drilling of overburden/midburden at two different locations, 20 m below ground surface;
  - Drilling of a potential coal resource will not be included as the inclusion of four drill rigs, operating under full load 100% of the time will represent a worst-case scenario, with an area source to be included at all active mining areas.
- After the hard overburden was broken by means of blasting, it will be loaded onto ADTs by excavators and hauled to dumps or areas that require rehabilitation. Loading will take place 10 and 20 m below the surface level. This will be repeated until the coal resource is reached. Excavation and the hauling of overburden will continue at night (moving up to 4,200,000 tpa);
- The drilling of the coal resource, as well as the loading of the coal resource will not be considered due to the assumption that the overburden excavators and trucks operate at a 100% load all operational hours, as well as this factor will be included in the area source.
- The Run of Mine (RoM) will be crushed at the pit head before conveyed (conveyor belt) to the plant. This will take place 24 hours per day (moving approximately 30,000,000 tpa or 3,500 tph). This may require multiple conveyors though the model will only consider one conveyor generating 80 dBA (re 10^{-12} watt);
- Topsoil and soft material will be placed on the edge of the mining area to act in as a noise protection berm. These berms will be located between the active mining activities and the closest receptors and will be at least 5 m high;

- Processing of the RoM, with the discard hauled to the discard dump (moving 20,000,000 tpa discard) using haul trucks; and
- Various plant activities to beneficiate the resource, stockpiling and loading onto road trucks to allow transport to the market (product estimated to be 33% of RoM or 10,000,000 tpa).

The level and character of the noise during this phase is more constant than with the construction phase, but can be significantly higher and more intrusive, especially if there is an impulsive[11] component involved (such as from tipping, crushing and equipment banging on other equipment) and these noise generating activities takes place at night. A list of proposed mobile production equipment that may be required is presented in **Table 7-3**.

Table 7-3: List of mobile production equiment

PRODUCTION EQUIPMENT	CONSTRUCTION PHASE TO OPERATIONAL PHASE YEAR 5	OPERATIONAL PHASE YEAR 5 ONWARD
D8 Dozer	1	2
D9 Dozer	2	3
D10 Dozer	1	4
Grader	3	4
Water trucks	3	4
Diesel Trucks	2	3
Service Trucks	1	3
Drill Rigs	5	10
LDV	15	19
Crane	1	1
Water Pumps	5	7
Blasting Bakkie	2	2
Explosive Trucks	2	4
ADT	5	24
Komatsu HD785-7 (40m3)	7	25
Excavators: PC 1000	1	5
Excavators: PC 3000	2	4

[11] A sound characterized by brief excursions of sound pressure (transient signal) that significantly exceed the ambient sound level.

At this preliminary stage of the project, there are not lists of the equipment that will be used at the plant, though the processes that would be required may include:

- In-pit crushing (primary and secondary);
- Conveyors(s) from the pit-head to the plant area;
- RoM stacking and reclaiming in the plant area;
- Tertiary crushing and screening;
- Wash plants, such as Dense Medium Separation (DMS) and Dense-Medium Cyclones (DMC);
- Product and discard management; and
- Ancillary services including compressed air supply and reticulation, magnetite pit, flocculent preparation system, water clarification and reticulation system.

Plant activities, processes and equipment will be included as a noise source (area source generating 65 dBA/m^2)[12].

As with all noises (and with the construction phase), the audibility, as well as the potential of a noise impact on receptors, is determined by factors such as the sound character, spectral frequencies, number and magnitude of maximum noise events, the average noise levels etc. Potential maximum noise levels generated by various equipment and the potential extent of these sounds are presented in in **Table 7-1**, with **Table 7-2** illustrating the equivalent (average) noise levels and potential extent.

Sound power emission levels as defined in **Table 7-4** will be used in the noise modelling for both the construction and operational phases.

Table 7-4: Sound power emission levels used for operational phase modelling

Equipment	**Sound power level, dB re1 pW, in octave band, Hz**							**SPL**
Centre frequency	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**(dBA)**
ADT truck – Komatsu HD785	96.1	101.1	105.2	106.3	106.9	105.2	102.8	113.0
Bulldozer – CAT D11	126.0	128.0	115.0	119.0	119.0	114.0	108.0	121.0
Crushers (various)	121.1	122.3	120.1	120.0	117.3	112.5	106.3	121.7
Drilling Machine (max)	104.0	114.0	116.0	111.0	109.0	107.0	101.0	118.0
Excavator - Hitachi EX1200	96.1	101.1	105.2	106.3	106.9	105.2	102.8	113.0
General noise	95.0	100.0	103.0	105.0	105.0	100.0	100.0	108.8
Road Truck average	90.0	101.0	102.0	105.0	105.0	104.0	99.0	109.6

[12]Good Practice Guide for Strategic Noise Mapping and the Production of Associated Data on Noise Exposure (EC WG-AEN, 2006)

Conveyor belt (dBA/m)	95.0	100.0	103.0	105.0	105.0	100.0	100.0	80.0
Area source (dBA/m^2)	95.0	100.0	103.0	105.0	105.0	100.0	100.0	80.0

7.2.2 Traffic

A source of noise during the operational phase will be traffic to and from the project site, traffic in and around the colliery, ROM and product transport and activities associated with waste management. Estimated trips are summarized in the following table based on the tons of material to be moved.

Table 7-5: Estimated and assumed transport volumes

Type of Vehicle	Estimated Daily Movements (round trips both)	Peak hourly used for noise model
On mine (24/7) – Topsoil Dumps	20	1
On mine (24/7) – Soft Dump	20	1
On mine (24/7) – Hard dumps	350	16
On mine (24/7) - RoM	2600	110
To / from mine, Work Trips – Cars	-	40
To / from mine, Work Trips – Busses	-	10
To / from mine, Business Trips / Deliveries	-	10
Product transport (daytime only)	2,000	170

All vehicles will travel at an average speed of 60 km/h on access roads and 40 km/h within the mine boundary. Coal hauling to the market will only take place during the daylight hours. Night-time traffic will be the same during the operational phase as the traffic during the construction phase.

7.2.3 Blasting

Blasting will not be considered in this report for the reasons defined in **section 7.1.3**.

7.3 POTENTIAL NOISE SOURCES: FUTURE NOISE SCENARIO – DECOMMISSIONING

The Decommissioning Phase is considered as the phase which begins after the last coal is removed from the mine area and ends when the mine receives a Closure certificate from the DMRE.

Rehabilitation normally takes place concurrently with mining, and final rehabilitation allows for the backfilling of all the remaining material and building rubble into the open pit area and the sloping of the high-wall areas.

Activities that can take place include:

- Decommissioning and rehabilitation of the remaining infrastructure unless it is required for post-mining impact management or for the final end land use. This includes the following:
  - Removal of all remaining redundant infrastructure.
  - Removal of any contaminated soil.
  - The rehabilitation of disturbed areas including the necessary ripping of compacted soils and the shaping of rehabilitated areas to ensure free drainage.
  - Placement of topsoil on rehabilitated surface areas followed by seeding (if necessary to re-establish vegetation).
  - Monitoring and maintenance of the rehabilitated areas.
  - Application for a Closure Certificate for the site.

However, while there are numerous activities that can take place during the decommissioning stage, the potential noise impact will only be discussed in general. This is because the noise impacts associated with the decommissioning phase is normally less than both the construction and operational phases for the following reasons:

- Final decommissioning normally takes place only during the day, a time period when existing ambient sound levels are higher, generally masking most external noises for surrounding receptors; and
- There is a lower urgency of completing this phase and less equipment remains onsite (and are used simultaneously) to affect the final decommissioning.

8 METHODS: NOISE IMPACT ASSESSMENT

8.1 WHY NOISE CONCERNS COMMUNITIES[13]

Noise can be defined as "unwanted sound", and an audible acoustic energy that adversely affects the physiological and/or psychological well-being of people, or which disturbs or impairs the convenience or peace of any person. One can generalise by saying that sound becomes unwanted when it:

- Hinders speech communication;
- Impedes the thinking process;
- Interferes with concentration;
- Obstructs activities (work, leisure and sleeping); and
- Presents a health risk due to hearing damage.

However, it is important to remember that whether a given sound is "noise" depends on the listener or hearer. The driver playing loud rock music on their car radio hears only music, but the person in the traffic behind them hears nothing but noise.

Response to noise is unfortunately not an empirical absolute, as it is seen as a multi-faceted psychological concept, including behavioural and evaluative aspects. For instance, in some cases, annoyance is seen as an outcome of disturbances, and in other cases it is seen as an indication of the degree of helplessness with respect to the noise source.

Noise does not need to be loud to be considered "disturbing". One can refer to a dripping tap in the quiet of the night, or the irritating "thump-thump" of the music from a neighbouring house at night when one would prefer to sleep.

Severity of the annoyance depends on factors such as:

- Background sound levels and the background sound levels the receptor is used to;
- The manner in which the receptor can control the noise (helplessness);
- The time, unpredictability, frequency distribution, duration, and intensity of the noise;
- The physiological state of the receptor; and
- The attitude of the receptor about the emitter (noise source).

[13] World Health Organization, 1999; Noise quest, 2010; Journal of Acoustical Society of America, 2009

8.1.1 Annoyance associated with Industrial Processes

Annoyance is the most widely acknowledged effect of environmental noise exposure, and is considered to be the most widespread. It is estimated that less than a third of the individual noise annoyance is accounted for by acoustic parameters, and that the non-acoustic factors plays a major role. Non-acoustic factors that have been identified include age, economic dependence on the noise source, attitude towards the noise source and self-reported noise sensitivity.

On the basis of a number of studies into noise annoyance, exposure-response relationships were derived for high annoyance from different noise sources. These relationships, illustrated in **Figure 8-1**, are recommended in a European Union position paper published in 2002,[14] stipulating policy regarding the quantification of annoyance. This can be used in environmental health impact assessment and cost-benefit analysis to translate noise maps into overviews of the numbers of persons that may be annoyed, thereby giving insight into the situation expected in the long-term. It is not applicable to local complaint-type situations or to an assessment of the short-term effects of a change in noise levels.

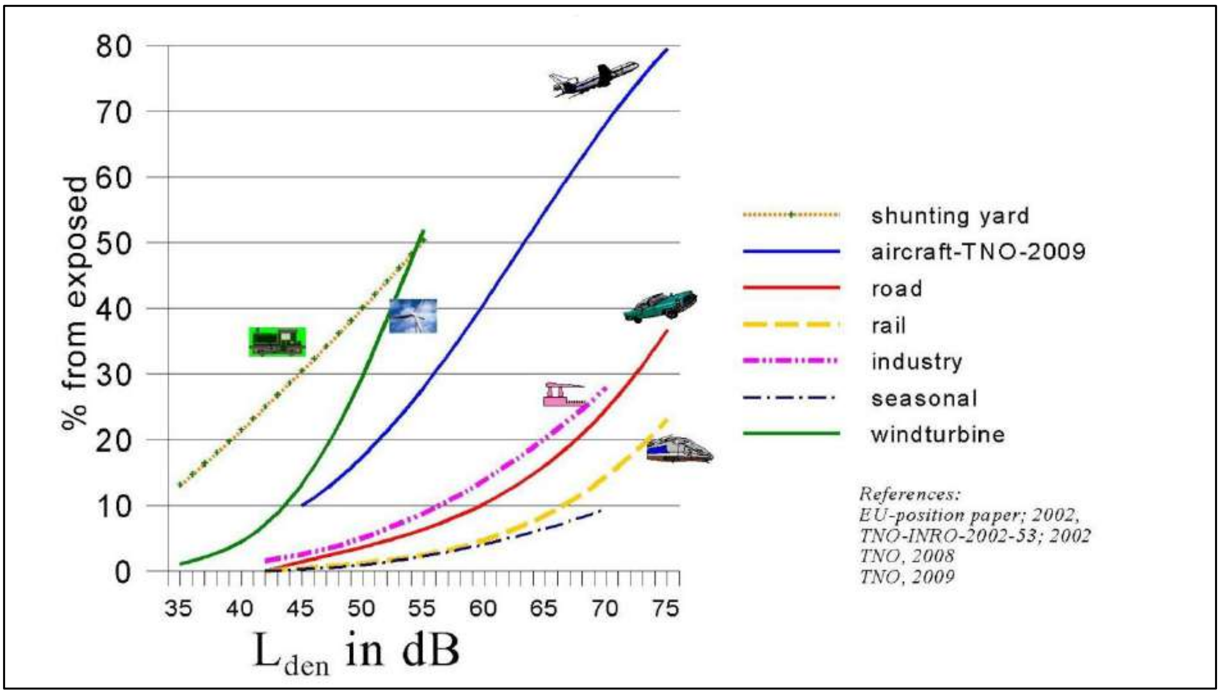

Figure 8-1: Percentage of annoyed persons as a function of the day-evening-night noise exposure at the façade of a dwelling

(14) Image from presentation, Almgren (2011). Sources Miliue, 2010, European Comm., 2010, Jansen, 2009.

As shown in **Figure 8-1**, there is significant potential of annoyance associated with noise from shunting operations, mainly due to the highly impulsive character of the noises created.

8.2 IMPACT ASSESSMENT CRITERIA

8.2.1 Overview: The Common Characteristics

The word "noise" is generally used to convey a negative response or attitude to the sound received by a listener. There are four common characteristics of sound, any or all of which determine listener response and the subsequent definition of the sound as "noise". These characteristics are:

- Intensity;
- Loudness;
- Annoyance; and
- Offensiveness.

Of the four common characteristics of sound, intensity is the only one that is not subjective and can be quantified. Loudness is a subjective measure of the effect sound has on the human ear. As a quantity it is therefore complicated, but has been defined by experimentation on subjects known to have normal hearing.

The annoyance and offensive characteristics of noise are also subjective. Whether or not a noise causes annoyance mostly depends upon its reception by an individual, the environment in which it is heard, the type of activity and mood of the person and how acclimatised or familiar that person is to the sound.

8.2.2 Noise criteria of concern

The criteria used in this report were drawn from the criteria for the description and assessment of environmental impacts from the EIA Regulations of 2014 in terms of the NEMA, SANS 10103:2008, and guidelines from the WHO.

There are a number of criteria that are of concern for the assessment of noise impacts. These can be summarised in the following manner:

- *Increase in noise levels:* People or communities often react to an increase in the ambient noise level they are used to, caused by a new source of noise. With regards to the Noise Control Regulations, an increase of more than 7 dBA is considered a disturbing noise. See also **Figure 8-2**.
- *Zone Sound Levels:* Previously referred to as the acceptable rating levels, it sets acceptable noise levels for various areas. See also **Table 8-1**.

- *Absolute or total noise levels:* Depending on their activities, people generally are tolerant to noise up to a certain absolute level, e.g. 65 dBA. Anything above this level will be considered unacceptable.

In South Africa, the document that addresses the issues concerning environmental noise is SANS 10103:2008 (See also **Table 8-1**). It provides the equivalent ambient noise levels (referred to as Rating Levels), $L_{Req,d}$ and $L_{Req,n}$, during the day and night respectively to which different types of developments may be exposed.

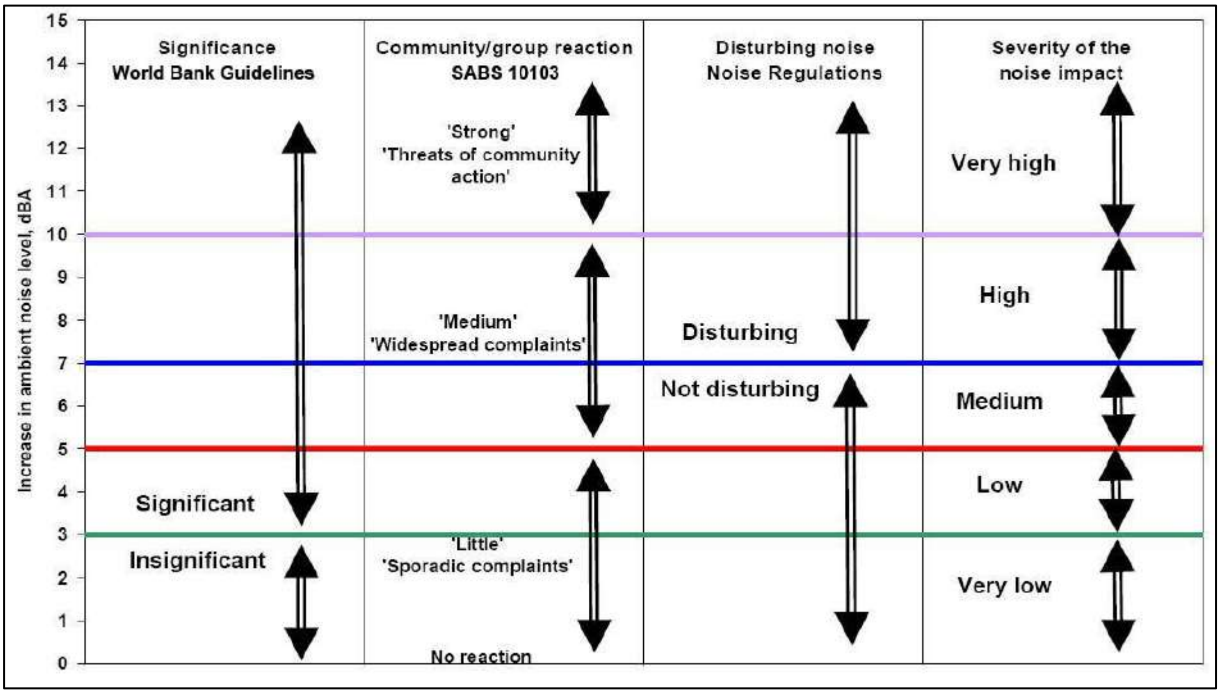

Figure 8-2: Criteria to assess the significance of impacts stemming from noise

SANS 10103:2008 also provides a guideline for estimating community response to an increase in the general ambient noise level caused by an intruding noise. If Δ is the increase in sound level, the following criteria are of relevance:

- **Δ ≤ 3 dBA:** An increase of 3 dBA or less will not cause any response from a community. It should be noted that for a person with average hearing acuity an increase of less than 3 dBA in the general ambient noise level would not be noticeable.
- **3 < Δ ≤ 5 dBA:** An increase of between 3 dBA and 5 dBA will elicit 'little' community response with 'sporadic complaints'. People will just be able to notice a change in the sound character in the area.
- **5 < Δ ≤ 15 dBA:** An increase of between 5 dBA and 15 dBA will elicit a 'medium' community response with 'widespread complaints'. In addition, an increase of 10 dBA is subjectively perceived as a doubling in the loudness of a noise. For an increase of

more than 15 dBA the community reaction will be 'strong' with 'threats of community action'.

Note that an increase of more than 7 dBA is defined as a disturbing noise and prohibited by national and provincial noise control regulations.

Table 8-1: Acceptable Zone Sound Levels for noise in districts (SANS 10103:2008)

1	2	3	4	5	6	7	EARES rating colour code
Type of district	Equivalent continuous rating level ($L_{Req,T}$) for noise dBA						
	Outdoors			Indoors, with open windows			
	Day/night $L_{R,dn}$	Daytime $L_{Req,d}$	Night-time $L_{Req,n}$	Day/night $L_{R,dn}$	Daytime $L_{Req,d}$	Night-time $L_{Req,n}$	
Residential areas							
a) Rural districts	45	45	35	35	35	25	Rural
b) Suburban districts with little road traffic	50	50	40	40	40	30	Suburban
c) Urban districts	55	55	45	45	45	35	Urban
Non-residential areas							
d) Urban districts with one or more of the following: workshops; business premises; and main roads	60	60	50	50	50	40	Busy urban
e) Central business districts	65	65	55	55	55	45	Business
f) Industrial districts	70	70	60	60	60	50	Industrial

8.3 Setting Appropriate Noise Limits

Onsite ambient sound measurements (**Section 6.2.2**) indicated a quiet environment. Considering the developmental nature of the area, the acceptable rating level would be typical of a rural noise district. Noise-generating activities should not change the noise rating levels with more than 7 dB.

8.4 Determining the Significance of the Noise Impact

Regulation 50(c), of the MPRDR (2004) under the MPRDA (2002) requires an assessment of nature (status), extent, duration, probability and significance of the identified potential environmental impacts of the proposed mining operation.

The level of detail as depicted in the EIA regulations was fine-tuned by assigning specific values to each impact. In order to establish a coherent framework within which all impacts could be objectively assessed, it was necessary to establish a rating system, which was applied consistently to all the criteria. For such purposes, each aspect was assigned a value as defined in the third column in the tables below.

The impact consequence is determined by summing the scores of Magnitude (**Table 8-2**), Duration (**Table 8-3**) and Spatial Extent (**Table 8-4**). The impact significance is determined by multiplying the Consequence result with the Probability score (**Table 8-5**). An explanation of the impact assessment criteria is defined in the following tables.

Table 8-2: Impact Assessment Criteria – Magnitude

This defines the impact as experienced by any receptor. In this report, the receptor is defined as any resident in the area but excludes faunal species.		
Rating	**Description**	**Score**
Low	Increase in average sound pressure levels between 0 and 3 dB from the expected ambient sound levels. Ambient sound levels are defined by the lower of the measured $L_{AIeq,8hr}$ or $L_{AIeq,16hr}$ during measurement dates. Total projected noise level is less than the Zone Sound Level and/or noise limits defined by the IFC/WHO in wind-still conditions.	2
Low Medium	Increase in average sound pressure levels between 3 and 5 dB from the expected ambient sound levels. Total projected noise levels between 3 and 5 above the Zone Sound Level and/or noise limits defined by the IFC/WHO (wind-less conditions).	4
Medium	Increase in average sound pressure levels between 5 and 7 dB from the ambient sound levels. Increase in sound pressure levels between 5 and 7 above the Zone Sound Level and/or noise limits defined by the IFC/WHO (wind-less conditions). Sporadic complaints expected.	6
High	Increase in average sound pressure levels between 7 and 10 from the ambient sound level. Total projected noise levels between 7 and 10 dBA above the Zone Sound Level and/or noise limits defined by the IFC/WHO (wind-less condition). Medium to widespread complaints expected.	8
Very High	Increase in average ambient sound pressure levels higher than 10 dBA. Total projected noise levels higher than 10 dB above the Zone Sound Level and/or noise limits defined by the IFC/WHO (wind less-conditions). Change of 10 dBA is perceived as 'twice as loud', leading to widespread complaints and even threats of community or group action. Any point where instantaneous noise levels exceed 65 dBA at any receptor.	10

Table 8-3: Impact Assessment Criteria - Duration

The lifetime of the impact that is measured in relation to the lifetime of the proposed development (construction, operational and closure phases). Will the receptors be subjected to increased noise levels for the lifetime duration of the project, or only infrequently.		
Rating	**Description**	**Score**
Temporary	Impacts are predicted to be of short duration (less than a month) and intermittent/occasional.	1
Short term	Impacts that are predicted to last for up to 6 months.	2
Medium term	Impacts that are predicted to last between 6 months and a year.	3
Long-term	Impacts that will continue for the life of the Project, but ceases when the Project stops operating.	4
Permanent	Impacts that cause a permanent change in the affected receptor or resource that endures/last substantially beyond the Project lifetime.	5

Table 8-4: Impact Assessment Criteria – Spatial extent

Classification of the physical and spatial scale of the impact		
Rating	**Description**	**Score**
Site	The impacted area extends only as far as the activity, such as footprint occurring within the total site area.	1
Local	The impact could affect the local area (within 1,000 m from site).	2
Regional	The impact could affect the area including the neighbouring farms, the transport routes and the adjoining towns (further than 1,000 m from site).	3
National	The impact could have an effect that expands throughout the country (South Africa).	4
International	Where the impact has international ramifications that extend beyond the boundaries of South Africa.	5

Table 8-5: Impact Assessment Criteria – Probability

This describes the likelihood of the impacts actually occurring, and whether it will impact on an identified receptor. The impact may occur for any length of time during the life cycle of the activity, and not at any given time. The classes are rated as follows:		
Rating	**Description**	**Score**
Improbable	The possibility of the impact occurring is none, due either to the circumstances, design or experience. The chance of this impact occurring is zero (0%).	1
Possible	The possibility of the impact occurring is very low, due either to the circumstances, design or experience. The chances of this impact occurring is defined to be up to 25%.	2
Likely	There is a possibility that the impact will occur to the extent that provisions must, therefore, be made. The chances of this impact occurring are defined to be between 25% and 50%.	3
Highly Likely	It is most likely that the impacts will occur at some stage of the development. Plans must be drawn up before carrying out the activity. The chances of this impact occurring are defined between 50% and 75%.	4

Definite	The impact will take place regardless of any prevention plans, and only mitigation actions or contingency plans to contain the effect can be relied on. The chance of this impact occurring is defined to be between 75% and 100%.	5

In order to assess each of these factors for each impact, the following ranking scales as contained in the following table apply (see **Table 8-6**).

Table 8-6: Impact Assessment Criteria – Ranking Scales

PROBABILITY		**MAGNITUDE**	
Description / Meaning	**Score**	**Description / Meaning**	**Score**
Definite/don't know	5	Very high/don't know	10
Highly likely	4	High	8
Likely	3	Medium	6
Possible	2	Low Medium	4
Improbable	1	Low	2
DURATION		**SPATIAL SCALE**	
Description / Meaning	**Score**	**Description / Meaning**	**Score**
		International	5
Permanent	5	National	4
Long Term	4	Regional	3
Short term	2	Local	2
Temporary	1	Footprint	1

8.4.1 Identifying the Potential Impacts without Mitigation Measures (WOM)

Following the assignment of the necessary weights to the respective aspects, criteria are summed and multiplied by their assigned probabilities, resulting in a Significance Rating (SR) value for each impact (prior to the implementation of mitigation measures).

Table 8-7: Impact Assessment Criteria – Significance

SR<30	Low (L)	Impacts with little real effect and which should not have an influence on or require modification of the project design or alternative mitigation. No mitigation is required.
30<**SR** <60	Medium (M)	Where it could have an influence on the decision unless it is mitigated. An impact or benefit which is sufficiently important to require management. Of moderate significance - could influence the decisions about the project if left unmanaged.
SR>60	High (H)	The impact is significant, mitigation is critical to reduce impact or risk. Resulting impact could influence the decision depending on the possible mitigation. An impact which could influence the decision about whether or not to proceed with the project.

8.4.2 Identifying the Potential Impacts with Mitigation Measures (WM)

All noise impacts can be managed to acceptable levels with sufficient capital and management commitments, but it is often difficult to assess the potential noise impact after the implementation of mitigation measures. This is because of various uncertainties not known at the time the report was compiled, including:

- Level of commitment from mine management and willingness to implement the required measures to reduce the noise impacts;
- Knowledge of the mine about the potential significance of noise impact on the health and wellbeing of NSD;
- Available capital to implement acceptable mitigation measures; and
- Limitations with regards to available equipment or time schedules.

This report does recommend measures to mitigate potential noise impacts to a low significance, not considering the potential costs or changes to operational schedules, details or management.

9 METHODS: CALCULATION OF NOISE LEVELS

9.1 POINT SOURCES – CONSTRUCTION ACTIVITIES USING MOBILE EQUIPMENT

The noise emissions from various sources were calculated in detail for the conceptual existing and operational activities by using the sound propagation algorithms described by the ISO 9613-2 model. The following were considered:

- The octave band sound pressure emission levels of processes and equipment;
- The distance of the receivers from the noise sources;
- The impact of atmospheric absorption;
- The operational details of the proposed project, such as projected areas where activities will be taking place;
- Screening corrections where applicable;
- Topographical layout; and
- Acoustical characteristics of the ground.

9.2 LINEAR SOURCES – ROADS

The noise emission into the environment due to project road traffic will be calculated using the sound propagation model described in RLS-90. Calculated corrections such as the following will be considered:

- Distance of receptor from the road;
- Road construction material;
- Average speeds of travel;
- Types of vehicles used;
- Road gradient; and
- Ground acoustical conditions.

While the output of the RLS-90 model provides a L_{A10} level, this report will use this level as the calculated L_{Aeq} level, together with the output of the ISO 9613-2 model and represent this as the noise level. The L_{A10} level is normally higher than the L_{Aeq} and this level will represent the worst-case scenario.

10 ASSUMPTIONS AND LIMITATIONS

10.1 LIMITATIONS - ACOUSTICAL MEASUREMENTS

Limitations due to environmental acoustical measurements include the following:

- Ambient sound levels are the cumulative effects of innumerable sounds generated at various instances both far and near. High measurements may not necessarily mean that noise levels in the area are high. Similarly, a low sound level measurement will not necessarily mean that the area is always quiet, as sound levels will vary over seasons, time of the day, faunal characteristics, vegetation in the area and meteorological conditions (especially wind). This is excluding the potential effect of sounds from anthropogenic origin. It is impossible to quantify and identify the numerous sources that influenced a measurement using the reading result at the end of the measurement. Therefore, trying to define ambient sound levels using the result of one 10-minute measurement can be inaccurate (very low confidence level in the results) for the reasons mentioned above. The more measurements that can be collected at a location the higher the confidence levels in the ambient sound level determined. The more complex the sound environment, the longer the required measurement. When singular measurements are used, a precautious stance must be adopted (as done in this report).
- Ambient sound levels are dependent not only on time of day and meteorological conditions but also change due to seasonal differences. Ambient sound levels are generally higher in summer months when faunal activity is higher and lower during the winter due to reduced faunal activity. Winter months unfortunately also coincide with lower temperatures and very stable atmospheric conditions, ideal conditions for propagation of noise. Many faunal species are more active during warmer periods than colder periods. Certain cicada species can generate noise levels up to 120 dB for mating or distress purposes, sometimes singing in synchronisation magnifying noise levels they produce from their tymbals[15].
- It is assumed that the measurement locations represent other residential dwellings in the area (similar environment), yet, in practice, this can be highly erroneous as there are numerous factors that can impact on ambient sound levels, including:
    - the distance to closest trees, number and type of trees as well as the height of trees;
    - available habitat and food for birds and other animals;
    - distance to residential dwelling, type of equipment used at dwelling (compressors, air-con);

[15]Clyne, D. *"Cicadas: Sound of the Australian Summer, Australian Geographic"* Oct/Dec Vol 56. 1999.

    - general maintenance condition of house (especially during windy conditions); and
    - number and type of animals kept in the vicinity of the measurement locations (typical land use taking place around the dwelling).
- Measurements over wind speeds of 3 -5 m/s could provide data influenced by wind-induced noises;
- Ambient sound levels recorded near rivers, streams, wetlands, trees and bushy areas can be high due to faunal activity, which can dominate the sound levels around the measurement point (specifically during summertime, rainfall event or during the dawn chorus of bird songs). This generally is still considered naturally quiet and accepted as features of the natural baseline, and in various cases sought after and pleasing. Using this data to define the ambient sound level will result in a higher rating level, and data collected close to such measurement locations will not be considered;
- Considering one or more sound descriptor or equivalent can improve an acoustical assessment. Parameters such as L_{AMin}, L_{Aeq}, L_{AMax}, L_{A10}, L_{A90} and spectral analysis forms part of the many variables that can be considered. However, South African legislation requires consideration of the impulse-weighted L_{Aeq} setting that will be considered when measuring ambient sound levels;
- Exact location of a sound level meter in an area in relation to structures, infrastructure, vegetation, wetlands and external noise sources will influence measurements. It may determine whether you are measuring anthropogenic sounds from a receptors dwelling, or measuring environmental ambient baseline contributors of significance (faunal, roads traffic, railway traffic movement etc.); and
- As a residential area develops, the presence of people will result in increased dwelling-related sounds. These are generally a combination of traffic noises, voices, animals and equipment (including TVs and radios). The result is that ambient sound levels will increase as an area matures.

10.2 CALCULATING NOISE EMISSIONS – ADEQUACY OF PREDICTIVE METHODS

Limitations due to the calculations of the noise emissions into the environment include the following:

- Many sound propagation models do not consider sound characteristics as calculations are based on an equivalent level (with the appropriate correction implemented e.g. tone or impulse). These other characteristics include intrusive sounds or amplitude modulation;
- Most sound propagation models do not consider refraction through the various temperature layers (specifically relevant during the night-times);

- Most sound propagation models do not consider the low frequency range (third octave 16 Hz – 31.5 Hz). This would be relevant to facilities with a potentially low frequency issues;
- Many environmental models consider sound to propagate in hemi-spherical way. Certain noise sources (e.g. a speakers, exhausts, fans) emit sound power levels in a directional manner;
- The impact of atmospheric absorption is simplified and very uniform meteorological conditions are considered. This is an over-simplification and the effect of this in terms of sound propagation modelling is difficult to quantify;
- Many environmental models are not highly suited for close proximity calculations; and
- Acoustical characteristics of the ground are over-simplified, with ground conditions accepted as uniform. Ground conditions will not be considered in this assessment.

Due to these assumptions, modelling generally could be out with as much as +10 dBA, although realistic values ranging from 3 dBA to less than 5 dBA are more common in practice.

10.3 ADEQUACY OF UNDERLYING ASSUMPTIONS

Noise experienced at a certain location is the cumulative result of innumerable sounds emitted and generated both far and close, each in a different time domain, each having a different spectral character at a different sound level. Each of these sounds is also impacted differently by surrounding vegetation, structures and meteorological conditions that result in a total cumulative noise level represented by a few numbers on a sound level meter.

As previously mentioned, it is not the purpose of noise modelling to accurately determine a likely noise level at a certain receptor but to calculate a noise rating level that is used to identify potential issues of concern.

10.4 UNCERTAINTIES ASSOCIATED WITH MITIGATION MEASURES

Any noise impact can be mitigated to have a low significance; however, the cost of mitigating this impact may be prohibitive, or the measure may not be socially acceptable (such as the relocation of an NSD). These mitigation measures may be engineered, technological or due to management commitment.

For the purpose of the determination of the significance of the noise impact mitigation measures were selected that is feasible, mainly focussing on management of noise impacts using rules, policy and require a management commitment. This, however, does not mean that noise levels cannot be reduced further, only that to reduce the noise levels further may require significant additional costs (whether engineered, technological or management).

It was assumed the mitigation measures proposed for the construction phase will be implemented and continued during the operational phase.

10.5 Uncertainties of Information Provided

While it is difficult to define the character of a measured noise in terms of numbers (third octave sound power levels), it is difficult to accurately model noise levels at a receptor from any operation. The projected noise levels are the output of a numerical model with the accuracy depending on the assumptions made during the setup of the model. The assumptions include the following:

- This assessment did not include a noise audit to identify all potential noise sources nor to define the sound power emission levels of these activities (and equipment) within the focus area, but used aerial images to identify potential noise generating activities. These noise generating activities was used to develop the noise contours to illustrate the impact from existing activities.
- It is technically difficult and time-consuming to improve the measurement of spectral distribution of large equipment in an industrial setting. This is due to the many correction factors that need to be considered (e.g. other noise sources active in the area, adequacy of average time setting, surrounding field non-uniformity etc.[16] as per SANS 9614-3:2005);
- That octave sound power levels selected for processes and equipment accurately represent the sound character and power levels of these processes and equipment. The determination of octave sound power levels in itself is subject to errors, limitations and assumptions with any potential errors carried over to any model making use of these results;
- Sound power emission levels from processes and equipment changes depending on the load the process and equipment are subject to. While the octave sound power level is the average (equivalent) result of a number of measurements, this measurement relates to a period that the process or equipment was subject to a certain load (work required from the engine or motor to perform action). Normally these measurements are

[16] SANS 9614-3:2005. "Determination of sound power levels of noise sources using sound intensity – Part 3: Precision method for measurement by scanning".

collected when the process or equipment is under high load. The result is that measurements generally represent a worst-case scenario;

- As it is unknown which processes and equipment will be operational (when and for how long), modelling considers a scenario where processes and equipment are under full load for a set time period. Modelling assumptions comply with the precautionary principle and operational time periods are frequently overestimated. The result is that projected noise levels would likely be over-estimated;
- Modelling cannot capture the potential impulsive character of a noise that can increase the potential nuisance factor;
- The XYZ topographical information is derived from the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) Global DEM data, a product of Japan's Ministry of Economy, Trade, and Industry (METI) and the National Aeronautical and Space Administration (NASA). There are known inaccuracies and artefacts in the data set, yet this is still one of the most accurate data sets to obtain 3D-topographical information;
- The impact of atmospheric absorption is simplified and very uniform meteorological conditions are considered. This is an over-simplification and the effect of this in terms of sound propagation modelling is difficult to quantify; and
- Acoustical characteristics of the ground are over-simplified with ground conditions accepted as uniform. Fifty per cent (50%) soft ground conditions will be modelled as the area where the construction activities are proposed is well vegetated and sufficiently uneven to allow the consideration of soft ground conditions.

10.6 CONDITIONS TO WHICH THIS STUDY IS SUBJECT

This study is not subject to any conditions.

11 PROJECTED NOISE RATING LEVELS

11.1 CONCEPTUAL SCENARIOS – PROPOSED FUTURE CONSTRUCTION ACTIVITIES

A worst-case scenario will be investigated, considering the conceptual noise-generating activities depicted in **Figure 11-1**:

- Road traffic as presented in **Figure 11-1**;
- all equipment would be operating under full load (generate the most noise) at a number of locations (as depicted in **Figure 11-1**) both night and day. The height of these noise sources is located at 2 - 3 m above ground level;
- atmospheric conditions would be ideal for sound propagation (15 ^{o}C air temperature, 60% humidity);
- that heavy mining vehicles operating onsite travels at 40 km/h;
- that long-haul trucks transporting material and equipment on the gravel road to, and from the mine, travels at 60 km/h; and
- equipment is operating at surface level without the benefit of the berms, stockpiles or an overburden dump to attenuate noise levels.

A conceptual future scenario, illustrating total future noise contours due to the proposed construction activities are illustrated in **Figure 11-3** (daytime) with the night-time future noise rating level contours illustrated in **Figure 11-4**. Conceptual projected noise levels and how the proposed activities may change the ambient sound levels are defined in **Appendix C, Table 1**.

11.2 CONCEPTUAL SCENARIOS – PROPOSED FUTURE OPERATIONAL ACTIVITIES

A worst-case scenario will be investigated, considering the conceptual noise-generating activities depicted in **Figure 11-2:**

- Road traffic as presented in **Figure 11-2**;
- all equipment would be operating under full load (generate the most noise) at a number of locations both night and day. The height of these noise sources is located at 2 - 3 m above ground level;
- atmospheric conditions would be ideal for sound propagation (15 ^{o}C air temperature, 60% humidity);
- that heavy mining vehicles operating onsite travels at 40 km/h;
- that long-haul trucks transporting material and equipment on the gravel road to, and from the mine, travels at 60 km/h;
- plant equipment (including the conveyor belt) is operating at surface level;
- mining is taking place 10 and 20m below ground surface (worst-case scenario); and

- there are 5m berms around the mine limiting line of sight to the mine.

A conceptual future scenario illustrating total future noise contours due to potential operational activities are illustrated in **Figure 11-5** (daytime) with the night-time future noise rating level contours illustrated in **Figure 11-6**. Conceptual projected noise levels and how the proposed activities may change the ambient sound levels are defined in **Appendix C, Table 2**.

11.3 POTENTIAL DECOMMISSIONING, CLOSURE AND POST-CLOSURE NOISE LEVELS

The potential for a noise impact to occur during the decommissioning and closure phase will be much lower than that of the operational phases and noise from these phases will not be investigated further.

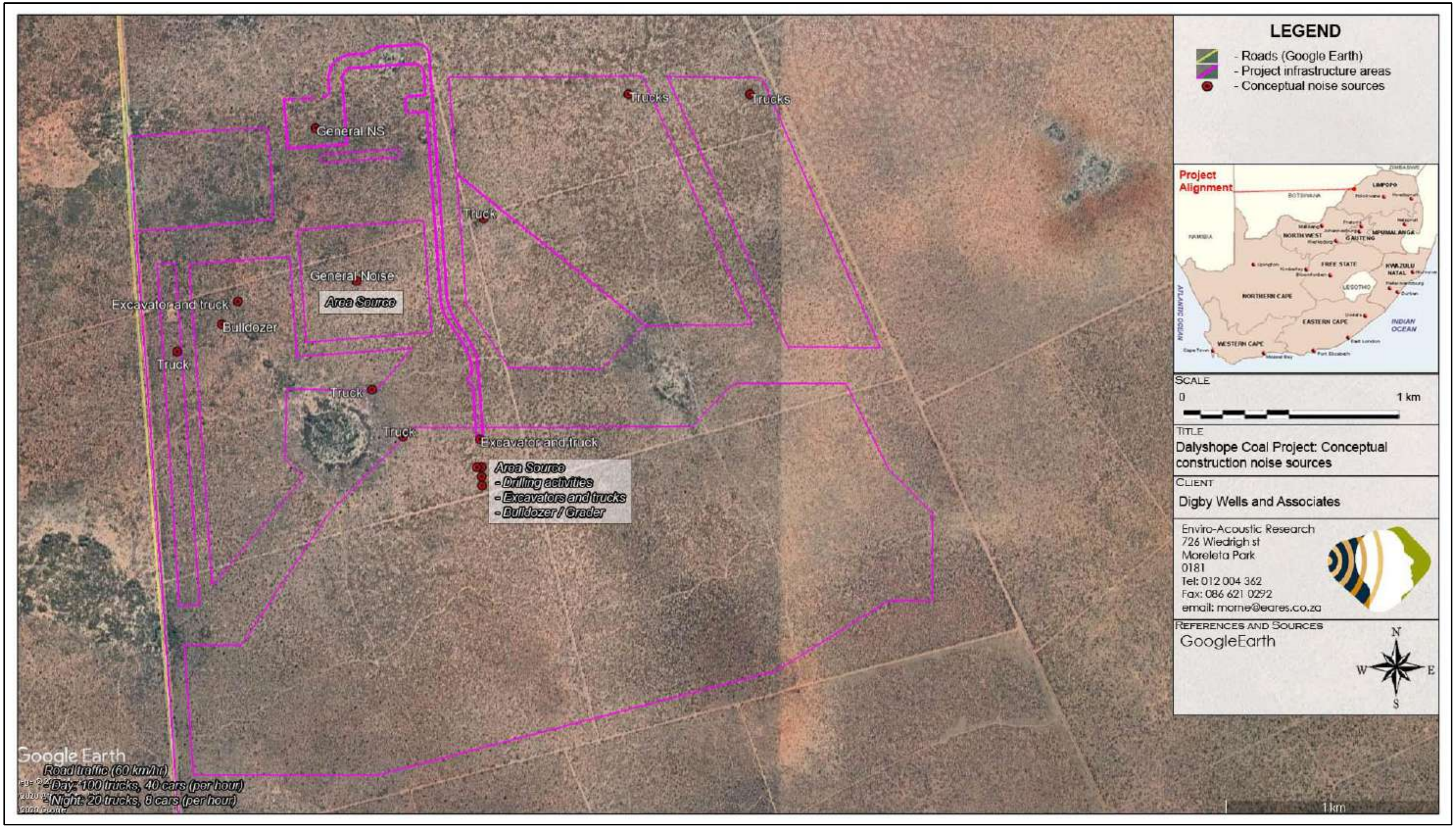

Figure 11-1: Conceptual noise sources for Construction Phase

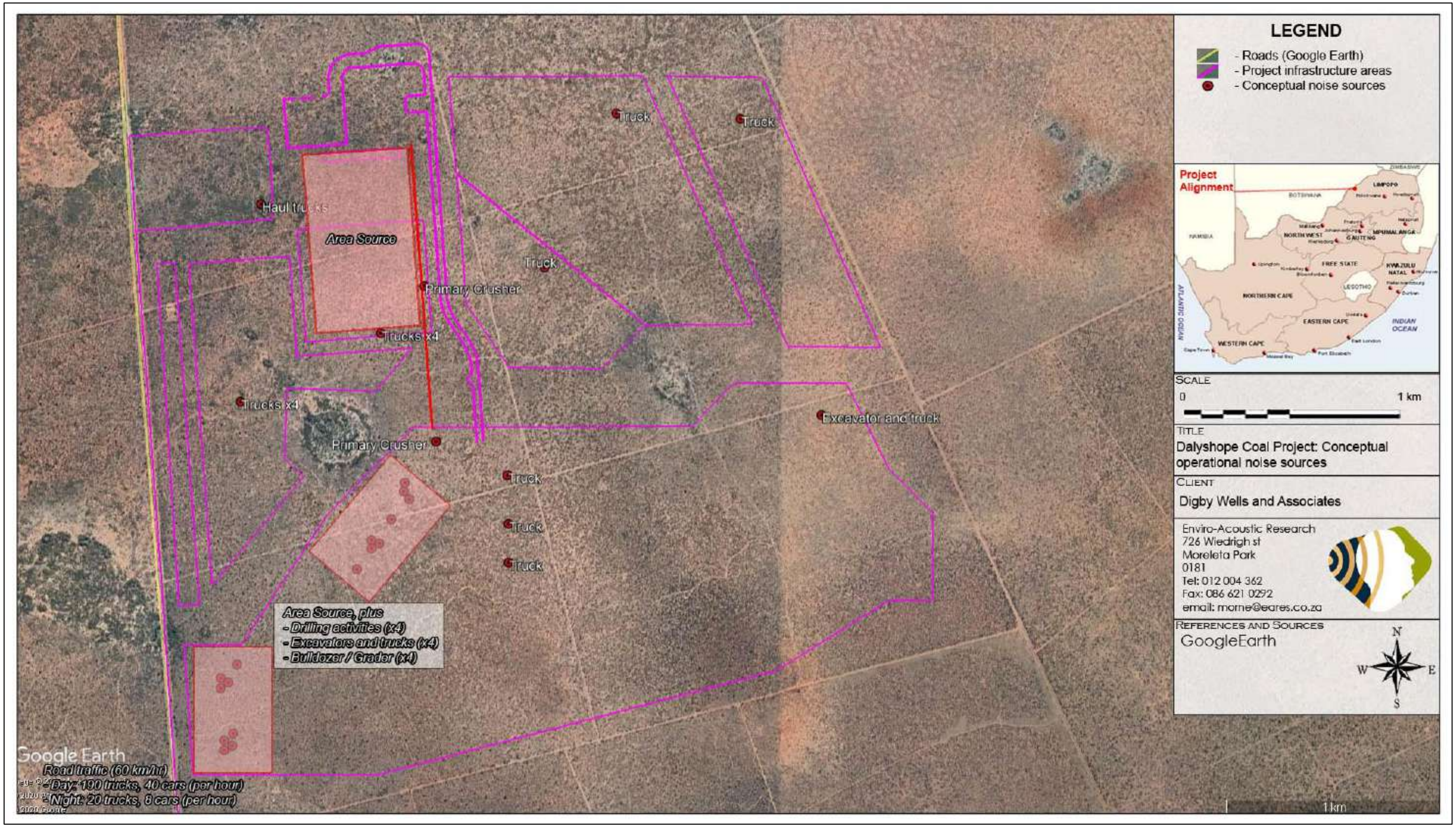

Figure 11-2: Conceptual noise sources for Operational Phase

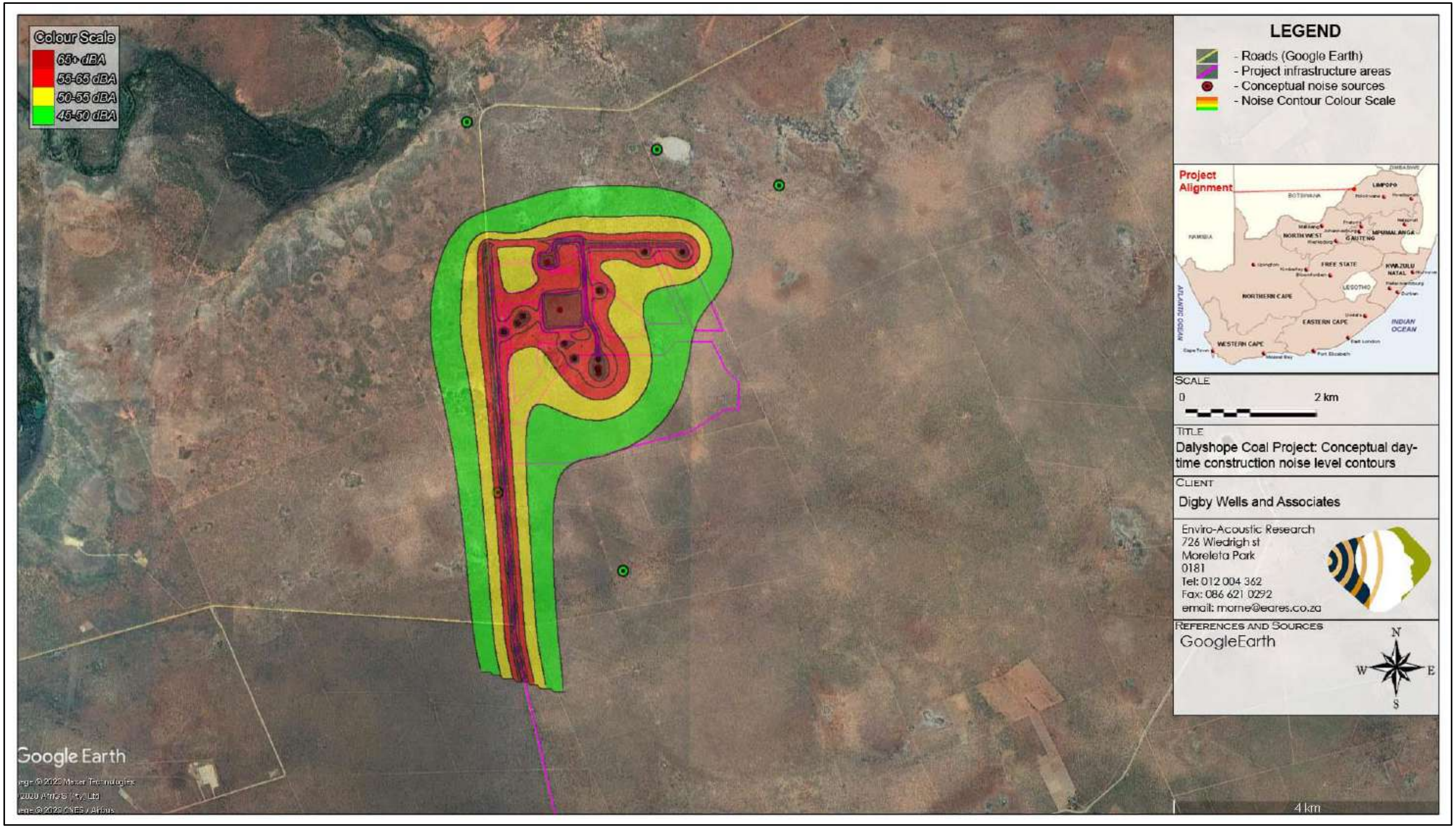

Figure 11-3: Projected conceptual future daytime noise rating levels during the construction phase

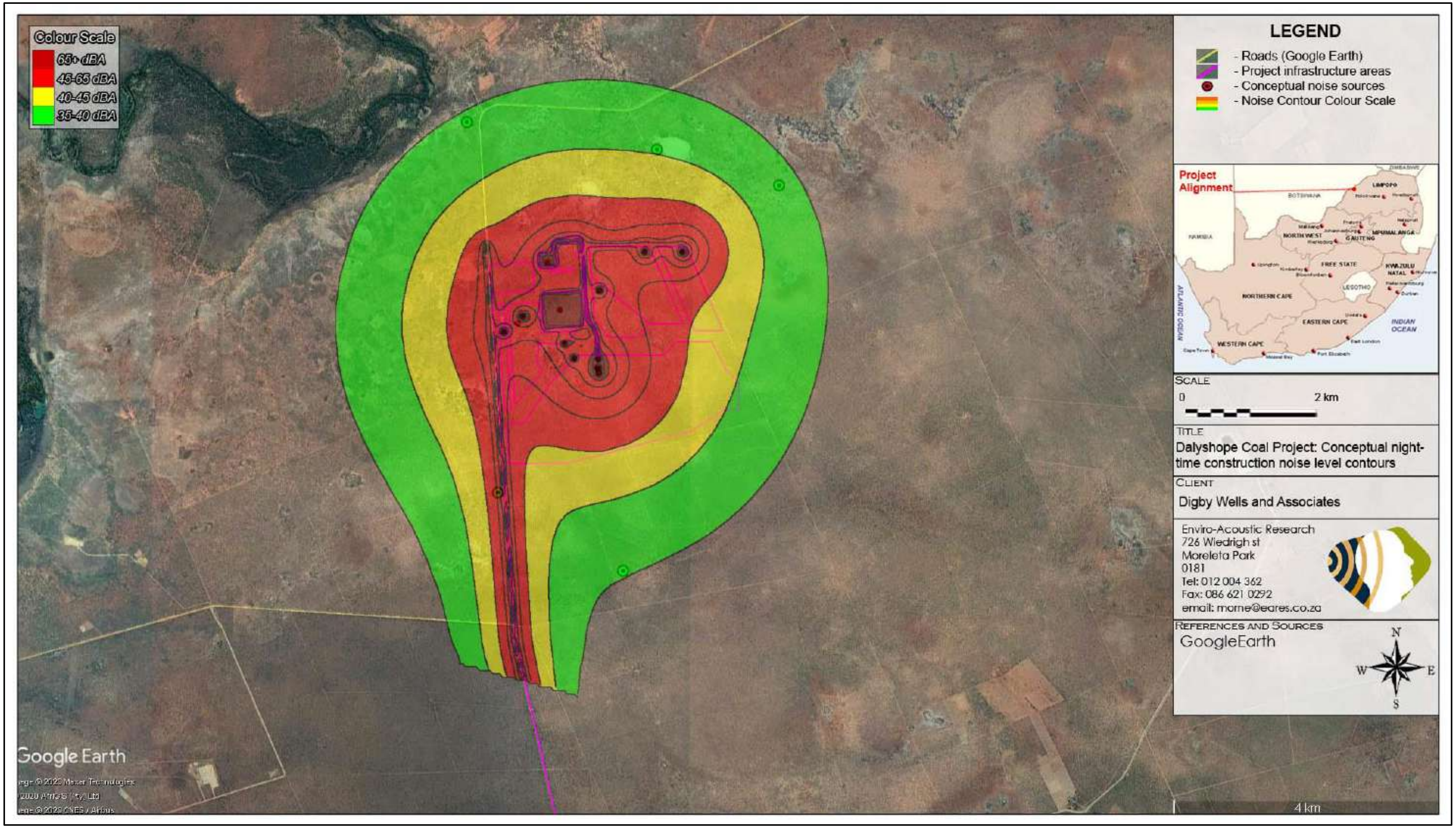

Figure 11-4: Projected conceptual future night-time noise rating levels during the construction phase

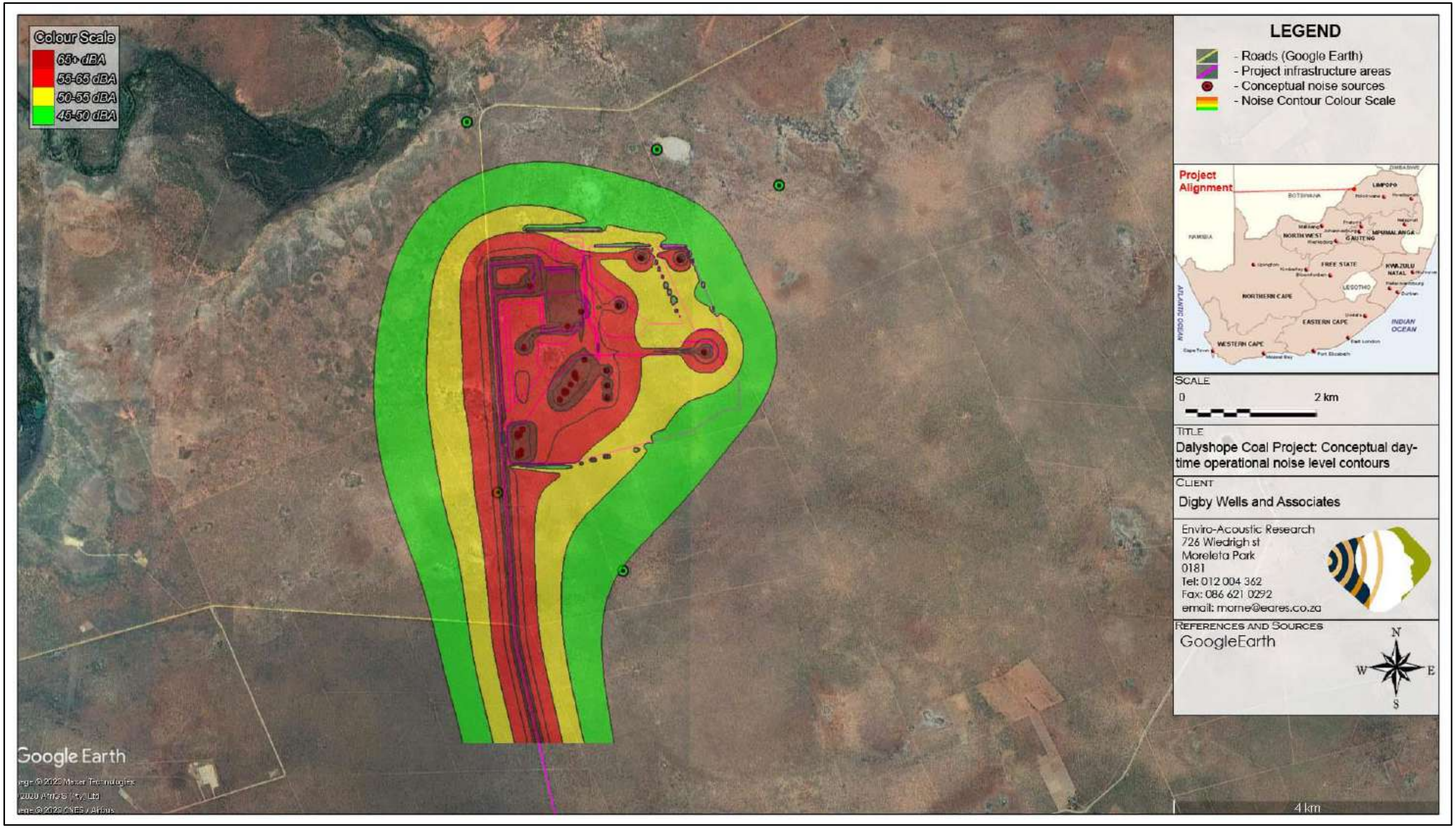

Figure 11-5: Projected conceptual future daytime operational noise rating levels

Figure 11-6: Projected conceptual future night-time operational noise rating levels

12 SIGNIFICANCE OF THE NOISE IMPACT

12.1 FUTURE CONSTRUCTION - NOISE IMPACT

The impact assessment for the various construction activities (as conceptualised) was calculated in **section 11.1**. The potential significance of the noise impacts is summarized in **Table 12-1** and **Table 12-2** for the day and night-time scenarios.

Table 12-1: Impact Assessment: Potential future day-time construction

Nature:	***Numerous simultaneous future construction activities during the day***	
Acceptable Rating Level	Precautious approach, with ambient sound level measurements indicating potential noise rating levels typical of a rural noise district (see **section 6.2.2**). Use $L_{R,d}$ = 45 dBA, noise levels exceeding 52 dBA potentially disturbing (noise levels exceeding 55 dBA higher than the acceptable sound level for daytime residential use – WHO and IFC guidelines). Projected noise levels, and the potential change in ambient sound levels are defined in **Appendix C, Table 1**, with the impact as assessed per receptor / NSD highlighted in the same table.	
	Without Mitigation	***With Mitigation***
Magnitude (Table 8-2)	Very High (10 – NSD R1) Low (2 – other NSD)	Low (2 - all surrounding NSD)
Duration (Table 8-3)	Short to medium term (2)	Short to medium term (2)
Extent ($\Delta L_{Aeq,D}$>7dBA) (Table 8-4)	Local (2)	Local (2)
Probability (Table 8-5)	Definite (5 – NSD R1) Improbable (1 – all NSD)	Improbable (1 - all NSD)
Significance (Table 8-7)	**High (70 – NSD R1)**	**Low (6 - other NSD)**
Significance (Table 8-7)	**Low (6 – other NSD)**	
Status	Negative	Negative
Reversibility	High	High
Degree of Confidence	**High**	
Mitigation:	Due to NSD R1 located within 100m from the main access road, projected noise levels would be higher than the recommended zone rating level, or the noise limit as recommended for residential use (WHO and IFC guideline). Due to the proximity to the mining area mitigation will be difficult, with the most viable option being the relocation of NSD R1.	
Residual Impacts:	This impact will only disappear after mine decommissioning and closure is completed.	

Table 12-2: Impact Assessment: Potential future night-time construction

<table>
<tr><td>Nature:</td><td colspan="2">Numerous simultaneous future construction activities at night</td></tr>
<tr><td>Acceptable Rating Level</td><td colspan="2">Precautious approach, with ambient sound level measurements indicating potential noise rating levels typical of a rural noise district.
Use $L_{R,n}$ = 35 dBA, noise levels exceeding 42 dBA potentially disturbing (total noise levels exceeding 45 dBA higher than the acceptable sound level for residential use – WHO and IFC guidelines).
Projected noise levels, and the potential change in ambient sound levels are defined in Appendix C, Table 1, with the impact as assessed per receptor / NSD highlighted in the same table.</td></tr>
<tr><td></td><td>Without Mitigation</td><td>With Mitigation</td></tr>
<tr><td>Magnitude (Table 8-2)</td><td>Very High (10 – NSD R1)
Medium (6 – NSD R3)
Low-Medium (4 – NSD R2 and R4)</td><td>Low (2 - all surrounding NSD)</td></tr>
<tr><td>Duration (Table 8-3)</td><td>Short to medium term (2)</td><td>Short to medium term (2)</td></tr>
<tr><td>Extent ($\Delta L_{Aeq,D}$>7dBA) (Table 8-4)</td><td>Regional (3)</td><td>Regional (3)</td></tr>
<tr><td>Probability (Table 8-5)</td><td>Definite (5 – NSD R1)
Likely (3 – NSD R3)
Possible (2 – other NSD)</td><td>Improbable (1 - all NSD)</td></tr>
<tr><td>Significance (Table 8-7)</td><td>High (75 – NSD R1)</td><td rowspan="3">Low

(14 to 18 – NSDs R2, R3, R4 and R5)</td></tr>
<tr><td>Significance (Table 8-7)</td><td>Low (33 – NSD R3)</td></tr>
<tr><td>Significance (Table 8-7)</td><td>Low (14 to 18 – other NSD)</td></tr>
<tr><td>Status</td><td>Negative</td><td>Negative</td></tr>
<tr><td>Reversibility</td><td>High</td><td>High</td></tr>
<tr><td>Irreplaceable loss of resources?</td><td>No loss of resources.</td><td>No loss of resources.</td></tr>
<tr><td>Degree of Confidence</td><td colspan="2">High</td></tr>
<tr><td>Mitigation and mitigation efficiency:</td><td colspan="2">Due to NSD R1 located within 100m from the main access road, projected noise levels would be higher than the recommended zone rating level, or the noise limit as recommended for residential use (WHO and IFC guideline). Due to the proximity to the mining area mitigation will be difficult, with the most viable option being the relocation of NSD R1. Other measures that would reduce the night-time noise levels at other NSD include:
• the construction of berms between active and future mining areas (including the plant infrastructure) and the identified NSD. The berms should be as high as possible and should ideally break the line of sight between the mining activities and the NSD. The berms should idelly be constructed during the daytime period with the dumping of material taking place behind these berms at night;
• the mine should consider the recommendations defined in section 13;</td></tr>
</table>

	• the mine should implement a noise monitoring programme. Recommendations regarding a potential monitoring programme is defined in **section 14**; • it is recommended that the mine development team minimize night-time (22:00 – 06:00) traffic that may pass within 200m from residential areas, such as Sandbult.
Residual Impacts:	This impact will only disappear after mine decommissioning and closure is completed.

12.2 Future Operational - Noise Impact

The impact assessment for the various operational activities (as conceptualised) was calculated in **section 11.2**. The potential significance of the noise impacts is summarized in **Table 12-3** and **Table 12-4** for the day and night-time scenarios respectively.

Table 12-3: Impact Assessment: Potential future day-time operational activities

Nature:	***Numerous simultaneous future operational activities during the day***	
Acceptable Rating Level	Precautious approach, with ambient sound level measurements indicating potential noise rating levels typical of a rural noise district (see **section 6.2.2**). Use $L_{R,d}$ = 45 dBA, noise levels exceeding 52 dBA potentially disturbing (noise levels exceeding 55 dBA higher than the acceptable sound level for daytime residential use – WHO and IFC guidelines). Projected noise levels, and the potential change in ambient sound level are defined in **Appendix C, Table 2**, with the impact as assessed per receptor / NSD highlighted in the same table.	
	Without Mitigation	***With Mitigation***
Magnitude (Table 8-2)	Low (2 – other NSD)	Low (2 – other NSD)
Duration (Table 8-3)	Long term (4)	Long term (4)
Extent ($\Delta L_{Aeq,D}$>7dBA) (Table 8-4)	Local (2)	Local (2)
Probability (Table 8-5)	Improbable (1 – other NSD)	Improbable (1 – other NSD)
Significance (Table 8-7)	**Low (8 - all NSD)**	**Low (8 - all NSD)**
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No loss of resources.	No loss of resources.
Degree of Confidence	**High**	
Mitigation and mitigation efficiency:	No mitigation is required due to low significance of the impact.	
Residual Impacts:	This impact will only disappear after mine decommissioning and closure is completed.	

Table 12-4: Impact Assessment: Potential future night-time operational activities

Nature:	***Numerous simultaneous future operational activities at night***	
Acceptable Rating Level	Precautious approach, with ambient sound level measurements indicating potential noise rating levels typical of a rural noise district. Use $L_{R,n}$ = 45 dBA, noise levels exceeding 45 dBA potentially disturbing (total noise levels exceeding 48 dBA higher than the acceptable sound level for residential use – WHO and IFC guidelines). Projected noise levels, and the potential change in ambient sound level are defined in **Appendix C, Table 2**, with the impact as assessed per receptor / NSD highlighted in the same table.	
	Without Mitigation	***With Mitigation***
Magnitude (Table 8-2)	Medium (6 – all identified NSD within 2,000)	Medium (6 – all identified NSD within 2,000 with noise levels above 38 dBA) Low-medium (4 – all identified NSD with noise levels below 38 dBA)
Duration (Table 8-3)	Long (4)	Long (4)
Extent ($\Delta L_{Aeq,D}$>7dBA) (Table 8-4)	Regional (3)	Regional (3)
Probability (Table 8-5)	Highly likely (4 – NSD R2 and R3) Likely (3 – NSD R4)	Likely to possible (3 to 2, depending on the noise levels after mitigation)
Significance (Table 8-7)	**Medium** **(52 and 33 – NSD R2, R3 and R4)**	**Medium** **(noise levels above 38 dBA)**
	Low (18 – NSD R5)	**Low** **(noise levels below 38 dBA)**
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No loss of resources.	No loss of resources.
Comments	Worst case scenario with numerous simultaneous construction activities	
Degree of Confidence	**High**	
Mitigation and mitigation efficiency:	Other measures that would reduce the night-time noise levels at other NSD include: • the mine should consider the recommendations defined in **section 13**; • the mine should implement a noise monitoring programme. Recommendations regarding potential a monitoring programme is defined in **section 14**; • it is recommended that the mine development team minimize night-time (22:00 – 06:00) traffic that may pass within 200m from residential areas, such as Sandbult, with no hauling at night.	
Residual Impacts:	This impact will only disappear after mine decommissioning and closure is completed.	

12.3 EVALUATION OF ALTERNATIVES

12.3.1 Alternative 1: No-go option

The ambient sound levels will remain as is. The noise levels experienced by the surrounding receptors (from the activity) will remain as it is currently. Ambient sound levels are already elevated due to noises from industrial activities and road traffic in the area.

12.3.2 Alternative 2: Proposed development of mine

The proposed development of the Dalyshope Coal project (worst-case evaluated) will raise the noise levels at the closest potential noise-sensitive developments as identified.

Considering the existing ambient sound levels, there is a potential that the proposed construction and operational activities will impact on the ambient sound levels at the identified NSD. In terms of acoustics, there is no real benefit to the surrounding environment (closest receptors).

The project will greatly assist in the economic growth and development challenges South Africa is facing by allowing the mining activities at Dalyshope to continue. This will assist in providing employment and other business opportunities. Considering only noise[17], people in the area not directly affected by increased noise levels may have a positive perception of the project and could see the need and desirability of the project.

[17] Considering only noise as other environmental factors may affect other people.

13 MITIGATION OPTIONS

13.1 CONSTRUCTION PHASE MITIGATION MEASURES

The study considers the potential noise impacts on the surrounding environment due to construction activities. It was determined that the potential noise impacts could be of a high significance and additional mitigation is required for the construction phase. The mitigation measures must be implemented during the construction phase to ensure acceptable noise levels during the operational phase. These mitigation measures include a combination of management and technical measures.

13.1.1 Mitigation options available to reduce Construction Noise Impact

Mitigation options included both management measures as well as technical changes. Options to reduce the noise impact during the construction phase include:

- It is recommended that NSD R1 be relocated further than 1,000m from the mine, or further than 200m from the access road to minimize night-time impacts;
- A berm should be constructed between the processing / washing plants as well as the active and future mining areas and the identified NSD. The mine can use topsoil, soft material or overburden spoils to construct these berms. These berms should ideally be constructed during the day, with dumping of stockpiles and residue deposits taking place behind these berms, or as far as possible from the identified NSD;
- Include a component covering environmental noise in the Health and Safety Induction to sensitize all employees and contractors about this subject, especially those employees and contractors that have to travel past receptors at night (within 200m), or might be required to do work close (within 1,000m) to receptors at night;
- Establish a complaints register with an open line to a relevant person that can act if there is a noise complaint;
- It is recommended that a noise monitoring programme is developed and implemented for the construction and operational phases;
- Ensure a good working relationship between mine management and all potentially noise-sensitive receptors. Communication channels should be established to ensure prior notice to the sensitive receptor if work is to take place close to them (especially if work is to take place within 300 m from them at night). Information that should be provided to potentially sensitive receptor(s) includes:
  - Proposed working dates, the duration that work will take place in an area and working times;
  - The reason why the activity is taking place;
  - The construction methods that will be used; and

  - Contact details of a responsible person where any complaints can be lodged should there be an issue of concern.
- Ensure that equipment is well maintained and fitted with the correct and appropriate noise abatement measures. Engine bay covers over heavy equipment could be pre-fitted with sound absorbing material. Heavy equipment that fully encloses the engine bay should be considered, ensuring that the seam gap between the hood and vehicle body is minimised;
- The operation should investigate the use of white-noise alarms instead of tonal reverse alarms on heavy vehicles operating on roads, within the mining area and at stockpile areas[18][19]. The advantages of white noise alarms above tonal alarms are:
  - It is as safe as a tonal alarm[20].
  - Highly audible close to the alarm (or reversing truck)[21].
  - It generates a more uniform sound field behind a reversing vehicle[22].
  - Greater directional information, workers can locate the source faster.
  - Significantly less environmental noise and it creates significantly less annoyance far away.
  - When properly installed, white noise alarms of a similar sound power emission level are more likely to comply with the ISO 9533 standard.

13.1.2 Construction mitigation options that should be included in the EMP

- The mine should construct berms between mining areas and identified NSD;
- The mine must ensure that noise levels are less than 45 dBA at night at all NSD;
- Include a component covering environmental noise in the Health and Safety Induction to sensitize all employees and contractors about this subject, especially those employees and contractors that have to travel past receptors at night (within 200m), or might be required to do work close (within 1,000m) to receptors at night.
- Establish complaints register with an open line to a relevant person that can act if there is a noise complaint.
- It is recommended that a noise monitoring programme is developed and implemented for the construction and operational phases.

[18] White Noise Reverse Alarms: http://www.brigade-electronics.com/products.
[19] https://www.constructionnews.co.uk/home/white-noise-sounds-the-reversing-alarm/885410.article - White noise sounds the reversing alarm
[20] https://www.acoustics.asn.au/conference_proceedings/AAS2012/papers/p126.pdf - Which is Safer – Tonal or Broadband Reversing Alarms
[21] http://www.irsst.qc.ca/media/documents/PubIRSST/R-833.pdf - Safety of workers behind heavy vehicles
[22] https://www.vaultintel.com/blog/reversing-beeps-could-be-a-thing-of-the-past
https://brigade-electronics.com/white-sound-reversing-alarms-improving-safety-environment/

13.2 OPERATIONAL PHASE MITIGATION MEASURES

The study considers the potential noise impact on the surrounding environment due to operational activities. It was determined that the potential noise impact could be of a medium significance for night-time operational activities. Mitigation options included both management measures as well as technical changes.

13.2.1 Mitigation options available to reduce Operational Noise Impact

Mitigation measures should include:

- The mine should continue with the development of berms between the active mining areas and NSD as recommended. These berms should be as high as possible and should ideally block the line of sight to mining activities;
- Include a component covering environmental noise in the Health and Safety Induction to sensitize all employees and contractors about this subject, especially those employees and contractors that have to travel past receptors at night, or might be required to do work close (within 500m) to receptors at night.
- Ensure that equipment is well maintained and fitted with the correct and appropriate noise abatement measures;
- Continuation of noise measurement programme (if required, depending on recommendation from the noise measurement specialist);
- Compliance with the Noise conditions of the Environmental Management Plan that covers:
  - Potential mitigation measures as defined in this report;
  - Formal register where receptors can lodge any noise complaints;
  - Noise measurement protocol to investigate any noise complaints; and
  - The commitment from the mine to consider reasonable mitigation if the noise complaint investigation indicates the validity of a noise complaint. These measures could include steps ranging from process changes, development of barriers or enclosure of the noise source and even relocation (if no other feasible alternatives exist).

13.2.2 Operation mitigation options that should be included in the EMP

I. The mine must implement a line of communication (i.e. a helpline where complaints could be lodged). All potential sensitive receptors should be made aware of these contact numbers, or alternative means to communicate issues. The mine should maintain a commitment to the local community and respond to concerns in an expedient fashion. Sporadic and legitimate noise complaints could develop and if valid, should be investigated. Feedback must be provided to the affected stakeholder(s) with details of any steps taken to mitigate the impact (if valid complaint) or preventative steps to minimise this from happening again.

II. All employees and contractors should receive induction that includes an environmental awareness component (noise). This is to allow employees and contractors to realize the potential noise risks that activities (especially night-time activities) pose to the surrounding environment.

III. The continuation of a noise measurement programme (if recommended by the noise measurement specialist to continue during the construction phase measurements).

IV. Compliance with the Noise conditions of the Environmental Management Plan that covers:
   - Potential mitigation measures as defined in this report;
   - Formal register where receptors can lodge any noise complaints;
   - Noise measurement protocol to investigate any noise complaints; and
   - The commitment from the mine to consider reasonable mitigation if the noise complaint investigation indicates the validity of a noise complaint. These measures could include steps ranging from process changes, development of barriers or enclosure of the noise source and even relocation of the NSD (if no other feasible alternatives exist).

14 ENVIRONMENTAL MONITORING PLAN

Environmental Noise Monitoring can be divided into two distinct categories, namely:

- Passive monitoring – the registering of any complaints (reasonable and valid) regarding noise; and
- Active monitoring – the measurement of noise levels at identified locations.

Because of the projected high noise levels, active noise monitoring is recommended at selected NSD around the mining areas. In addition, should a reasonable and valid noise complaint be registered, the mine should investigate the noise complaint as per the guidelines below. These guidelines should be used as a rough guideline as site specific conditions may require that the monitoring locations, frequency or procedure be adapted.

14.1 MEASUREMENT LOCALITIES AND PROCEDURES

14.1.1 Measurement Localities and Frequency

Six-monthly noise measurements are recommended at representative locations around the mine, including measurements at NSD R2 and R3. The location(s) and frequency for future noise measurements can be recommended by an acoustic consultant. Should there be a noise complaint, once-off noise measurements must be conducted at the location of the person that registered a valid and reasonable noise complaint. The measurement location should consider the direct surroundings to ensure that other sound sources cannot influence the reading. A second instrument can be deployed at the mine (close to the source of noise) during the measurement.

14.1.2 Measurement Procedures

Ambient sound measurements should be collected as defined in SANS 10103:2008. Due to the variability that naturally occurs in sound levels at most locations, it is recommended that semi-continuous measurements are conducted over a period of at least 24 hours, covering at least a full day- (06:00 – 22:00) and night-time (22:00 – 06:00) period. Measurements should be collected in 10-minute bins defining the 10-minute descriptors such as $L_{AIeq,10min}$ (National Noise Control Regulation requirement), $L_{A90,f}$ (background noise level as used internationally) and $L_{AFeq,10min}$ (Noise level used to compare with IFC noise limit). Spectral frequencies should also be measured to define the potential origin of noise. When a noise complaint is being investigated, measurements should be collected during a period or in conditions similar to when the receptor experienced the disturbing noise event.

15 CONCLUSIONS AND RECOMMENDATIONS

This ENIA covers the proposed activities at the proposed Dalyshope Coal Project near Lephalale, Limpopo Province. The proposed project includes the following infrastructure:

- An opencast pit;
- Processing plant (i.e. crushing, wash plant, screening, etc.) and product handling facilities (handling and stockpiles);
- Waste residue deposits (discard dump, hards waste dump and softs waste dump) and material stockpiles (topsoil);
- Administration office facilities (i.e. security building, administration and staff offices, reception area, ablution facilities, etc.);
- Production facilities (i.e. locker rooms, laboratory, workshops, stores, explosives magazine, ablution facilities, etc.);
- Access roads; and
- Clean and dirty water management infrastructure.

Conceptual scenarios were conceptualized for the future proposed construction and operational phase with the output of the modelling exercise indicating a potential significant noise impact (for both day- and night-time activities). Mitigation is required, identified and recommended to ensure that the noise levels can be managed to minimize the significance of the noise impact. Mitigation would include active noise monitoring for both the construction and operational phases.

While the proposed activities could have a significant noise impact on the surrounding NSD, the implementation of appropriate mitigation measures could reduce the significance of the noise impact to low. It will be required to relocate NSD R1 as recommended in the report. Therefore, with the appropriate implementation of mitigation measures, it is recommended that the proposed activities at Dalyshope be authorized (from a noise impact perspective).

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APPENDIX A

Glossary of Acoustic Terms, Definitions and General Information

1/3-Octave Band	A filter with a bandwidth of one-third of an octave representing four semitones, or notes on the musical scale. This relationship is applied to both the width of the band, and the centre frequency of the band. See also definition of octave band.
A – Weighting	An internationally standardised frequency weighting that approximates the frequency response of the human ear and gives an objective reading that therefore agrees with the subjective human response to that sound.
Air Absorption	The phenomena of attenuation of sound waves with distance propagated in air, due to dissipative interaction within the gas molecules.
Alternatives	A possible course of action, in place of another, that would meet the same purpose and need (of proposal). Alternatives can refer to any of the following, but are not limited hereto: alternative sites for development, alternative site layouts, alternative designs, alternative processes and materials. In Integrated Environmental Management the so-called "no go" alternative refers to the option of not allowing the development and may also require investigation in certain circumstances.
Ambient	The conditions surrounding an organism or area.
Ambient Noise	The all-encompassing sound at a point being composed of sounds from many sources both near and far. It includes the noise from the noise source under investigation.
Ambient Sound	The all-encompassing sound at a point being composite of sounds from near and far.
Ambient Sound Level	Means the reading on an integrating impulse sound level meter taken at a measuring point in the absence of any alleged disturbing noise at the end of a total period of at least 10 minutes after such a meter was put into operation. In this report the term Background Ambient Sound Level will be used.
Amplitude Modulated Sound	A sound that noticeably fluctuates in loudness over time.
Anthropogenic	Human impact on the environment or anthropogenic impact on the environment includes impacts on biophysical environments, biodiversity and other resources
Applicant	Any person who applies for an authorisation to undertake a listed activity or to cause such activity in terms of the relevant environmental legislation.
Assessment	The process of collecting, organising, analysing, interpreting and communicating data that is relevant to some decision.
Attenuation	Term used to indicate reduction of noise or vibration, by whatever method necessary, usually expressed in decibels.
Audible frequency Range	Generally assumed to be the range from about 20 Hz to 20,000 Hz, the range of frequencies that our ears perceive as sound.
Ambient Sound Level	The level of the ambient sound indicated on a sound level meter in the absence of the sound under investigation (e.g. sound from a particular noise source or sound generated for test purposes). Ambient sound level as per Noise Control Regulations.
Axle	Shaft connecting two wheels on either side of the vehicle. The wheels are forced to rotate at the same speed. Vehicles with independent wheels have 'stub axles' that do not connect the two wheels on either side of the vehicle.
Ballast	A layer of coarse stones supporting the sleepers.
Baseplate	A track component designed to hold the rail in place, usually with resilience to provide improved vibration isolation.
Broadband Noise	Spectrum consisting of a large number of frequency components, none of which is individually dominant.
C-Weighting	This is an international standard filter, which can be applied to a pressure signal or to a *SPL* or *PWL* spectrum, and which is essentially a pass-band filter in the frequency range of approximately 63 to 4000 Hz. This filter provides a more constant, flatter, frequency response, providing significantly less adjustment than the A-scale filter for frequencies less than 1000 Hz.
dB(A)	Sound Pressure Level in decibel that has been A-weighted, or filtered, to match the response of the human ear.
Decibel (db)	A logarithmic scale for sound corresponding to a multiple of 10 of the threshold of hearing. Decibels for sound levels in air are referenced to an atmospheric pressure of 20 μ Pa.
Diffraction	The process whereby an acoustic wave is disturbed and its energy redistributed in space as a result of an obstacle in its path, Reflection and refraction are special cases of diffraction.
Direction of Propagation	The direction of flow of energy associated with a wave.
Disturbing noise	Means a noise level that exceeds the zone sound level or, if no zone sound level has been designated, a noise level that exceeds the ambient sound level at the same measuring point by 7 dBA or more.
Echolocation	Echo locating animals emit calls out to the environment and listen to the echoes of those calls that return from various objects near them. They use these echoes to locate and

	identify the objects. Echolocation is used for navigation and for foraging (or hunting) in various environments.
Environment	The external circumstances, conditions and objects that affect the existence and development of an individual, organism or group; these circumstances include biophysical, social, economic, historical, cultural and political aspects.
Environmental Control Officer	Independent Officer employed by the applicant to ensure the implementation of the Environmental Management Plan (EMP) and manages any further environmental issues that may arise.
Environmental impact	A change resulting from the effect of an activity on the environment, whether desirable or undesirable. Impacts may be the direct consequence of an organisation's activities or may be indirectly caused by them.
Environmental Impact Assessment	An Environmental Impact Assessment (EIA) refers to the process of identifying, predicting and assessing the potential positive and negative social, economic and biophysical impacts of any proposed project, plan, programme or policy that requires authorisation of permission by law and that may significantly affect the environment. The EIA includes an evaluation of alternatives, as well as recommendations for appropriate mitigation measures for minimising or avoiding negative impacts, measures for enhancing the positive aspects of the proposal, and environmental management and monitoring measures.
Environmental issue	A concern felt by one or more parties about some existing, potential or perceived environmental impact.
Equivalent continuous A-weighted sound exposure level ($L_{Aeq,T}$)	The value of the average A-weighted sound pressure level measured continuously within a reference time interval *T*, which have the same mean-square sound pressure as a sound under consideration for which the level varies with time.
Equivalent continuous A-weighted rating level ($L_{Req,T}$)	The Equivalent continuous A-weighted sound exposure level ($L_{Aeq,T}$) to which various adjustments has been added. More commonly used as ($L_{Req,d}$) over a time interval 06:00 – 22:00 (T=16 hours) and ($L_{Req,n}$) over a time interval of 22:00 – 06:00 (T=8 hours). It is a calculated value.
F (fast) time weighting	(1) Averaging detection time used in sound level meters. (2) Fast setting has a time constant of 125 milliseconds and provides a fast reacting display response allowing the user to follow and measure not too rapidly fluctuating sound.
Footprint area	Area to be used for the construction of the proposed development, which does not include the total study area.
Free Field Condition	An environment where there is no reflective surfaces.
Frequency	The rate of oscillation of a sound, measured in units of Hertz (Hz) or kiloHertz (kHz). One hundred Hz is a rate of one hundred times per second. The frequency of a sound is the property perceived as pitch: a low-frequency sound (such as a bass note) oscillates at a relatively slow rate, and a high-frequency sound (such as a treble note) oscillates at a relatively high rate.
Green field	A parcel of land not previously developed beyond that of agriculture or forestry use; virgin land. The opposite of Greenfield is Brownfield, which is a site previously developed and used by an enterprise, especially for a manufacturing or processing operation. The term Brownfield suggests that an investigation should be made to determine if environmental damage exist.
Grinding	A process for removing a thin layer of metal from the top of the rail head in order to remove roughness and/or to restore the correct profile. Special grinding trains are used for this.
G-Weighting	An International Standard filter used to represent the infrasonic components of a sound spectrum.
Harmonics	Any of a series of musical tones for which the frequencies are integral multiples of the frequency of a fundamental tone.
I (impulse) time weighting	(1) Averaging detection time used in sound level meters as per South African standards and Regulations. (2) Impulse setting has a time constant of 35 milliseconds when the signal is increasing (sound pressure level rising) and a time constant of 1,500 milliseconds while the signal is decreasing.
Impulsive sound	A sound characterized by brief excursions of sound pressure (transient signal) that significantly exceed the ambient sound level.
Infrasound	Sound with a frequency content below the threshold of hearing, generally held to be about 20 Hz. Infrasonic sound with sufficiently large amplitude can be perceived, and is both heard and felt as vibration. Natural sources of infrasound are waves, thunder and wind.

Integrated Development Plan	A participatory planning process aimed at developing a strategic development plan to guide and inform all planning, budgeting, management and decision-making in a Local Authority, in terms of the requirements of Chapter 5 of the Municipal Systems Act, 2000 (Act 32 of 2000).
Integrated Environmental Management	IEM provides an integrated approach for environmental assessment, management, and decision-making and to promote sustainable development and the equitable use of resources. Principles underlying IEM provide for a democratic, participatory, holistic, sustainable, equitable and accountable approach.
Interested and affected parties	Individuals or groups concerned with or affected by an activity and its consequences. These include the authorities, local communities, investors, work force, consumers, environmental interest groups and the general public.
Interburden	Material of any nature that lies between two or more bedded ore zones or coal seams. Term is primarily used in surface mining
Joint rail	A connection between two lengths of rail, often held together by an arrangement of bolts and fishplates.
Key issue	An issue raised during the Scoping process that has not received an adequate response and that requires further investigation before it can be resolved.
Listed activities	Development actions that is likely to result in significant environmental impacts as identified by the delegated authority (formerly the Minister of Environmental Affairs and Tourism) in terms of Section 21 of the Environment Conservation Act.
Locomotive	A powered vehicle used to draw or propel a train of carriages or wagons (as opposed to a multiple unit).
L_{AMin} and L_{AMax}	Is the RMS (root mean squared) minimum or maximum level of a noise source.
Loudness	The attribute of an auditory sensation that describes the listener's ranking of sound in terms of its audibility.
Magnitude of impact	Magnitude of impact means the combination of the intensity, duration and extent of an impact occurring.
Masking	The raising of a listener's threshold of hearing for a given sound due to the presence of another sound.
Mitigation	To cause to become less harsh or hostile.
Natural Sounds	Are sounds produced by natural sources in their normal soundscape.
Negative impact	A change that reduces the quality of the environment (for example, by reducing species diversity and the reproductive capacity of the ecosystem, by damaging health, or by causing nuisance).
Noise	a. Sound that a listener does not wish to hear (unwanted sounds). b. Sound from sources other than the one emitting the sound it is desired to receive, measure or record. c. A class of sound of an erratic, intermittent or statistically random nature.
Noise Level	The term used in lieu of sound level when the sound concerned is being measured or ranked for its undesirability in the contextual circumstances.
Noise-sensitive development	developments that could be influenced by noise such as: a) districts (see table 2 of SANS 10103:2008) 1. rural districts, 2. suburban districts with little road traffic, 3. urban districts, 4. urban districts with some workshops, with business premises, and with main roads, 5. central business districts, and 6. industrial districts; b) educational, residential, office and health care buildings and their surroundings; c) churches and their surroundings; d) auditoriums and concert halls and their surroundings; e) recreational areas; and f) nature reserves. In this report Noise-sensitive developments is also referred to as a Potential Sensitive Receptor
Octave Band	A filter with a bandwidth of one octave, or twelve semi-tones on the musical scale representing a doubling of frequency.
Overburden	In mining and in archaeology, overburden (also called waste or spoil) is the material that lies above an area of economic or scientific interest. In mining, it is most commonly the rock, soil, and ecosystem that lies above a coal seam or ore body
Pavement	Road surface or pavement is the durable surface material laid down on an area intended to sustain vehicular or foot traffic, such as a road or walkway.
Positive impact	A change that improves the quality of life of affected people or the quality of the environment.

Property	Any piece of land indicated on a diagram or general plan approved by the Surveyor-General intended for registration as a separate unit in terms of the Deeds Registries Act and includes an erf, a site and a farm portion as well as the buildings erected thereon
Public Participation Process	A process of involving the public in order to identify needs, address concerns, choose options, plan and monitor in terms of a proposed project, programme or development
Reflection	Redirection of sound waves.
Refraction	Change in direction of sound waves caused by changes in the sound wave velocity, typically when sound wave propagates in a medium of different density.
Reverberant Sound	The sound in an enclosure which results from repeated reflections from the boundaries.
Reverberation	The persistence, after emission of a sound has stopped, of a sound field within an enclosure.
Rail head	The bulbous part at the top of the rail.
Rolling Stock	Rolling stock comprises all the vehicles that move on a railway. It usually includes both powered and unpowered vehicles, for example locomotives, railroad cars, coaches, and wagons.
ROM	The coal delivered from the mine that reports to the coal preparation plant is called run-of-mine, or ROM, coal. This is the raw material for the CPP, and consists of coal, rocks, middlings, minerals and contamination
Shunting	Shunting, in railway operations, is the process of sorting items of rolling stock into complete train sets.
Railway Sidings	A siding, in rail terminology, is a low-speed track section distinct from a running line or through route such as a main line or branch line or spur. It may connect to through track or to other sidings at either end.
Significant Impact	An impact can be deemed significant if consultation with the relevant authorities and other interested and affected parties, on the context and intensity of its effects, provides reasonable grounds for mitigating measures to be included in the environmental management report. The onus will be on the applicant to include the relevant authorities and other interested and affected parties in the consultation process. Present and potential future, cumulative and synergistic effects should all be taken into account.
S (slow) time weighting	(1) Averaging times used in sound level meters. (2) Time constant of one [1] second that gives a slower response which helps average out the display fluctuations.
Sound Level	The level of the frequency and time weighted sound pressure as determined by a sound level meter, i.e. A-weighted sound level.
Sound Power	Of a source, the total sound energy radiated per unit time.
Sound Pressure Level (SPL)	Of a sound, 20 times the logarithm to the base 10 of the ratio of the RMS sound pressure level to the reference sound pressure level. International values for the reference sound pressure level are 20 micropascals in air and 100 millipascals in water. SPL is reported as L_p in dB (not weighted) or in various other weightings.
Soundscape	Sound or a combination of sounds that forms or arises from an immersive environment. The study of soundscape is the subject of acoustic ecology. The idea of soundscape refers to both the natural acoustic environment, consisting of natural sounds, including animal vocalizations and, for instance, the sounds of weather and other natural elements; and environmental sounds created by humans, through musical composition, sound design, and other ordinary human activities including conversation, work, and sounds of mechanical origin resulting from use of industrial technology. The disruption of these acoustic environments results in noise pollution.
Study area	Refers to the entire study area encompassing all the alternative routes as indicated on the study area map.
Sustainable Development	Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts: the concept of "needs", in particular the essential needs of the world's poor, to which overriding priority should be given; and the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and the future needs (Brundtland Commission, 1987).
Timbre	Timbre (also known as tone colour or tone quality) is the quality of the sound made by a particular voice or musical instrument.
Tread braked	The traditional form of wheel brake consisting of a block of friction material (which could be cast iron, wood or nowadays a composition material) hung from a lever and being pressed against the wheel tread by air pressure (in the air brake) or atmospheric pressure in the case of the vacuum brake.
Tone	Noise can be described as tonal if it contains a noticeable or discrete, continuous note. This includes noises such as hums, hisses, screeches, drones, etc. and any such subjective description is open to discussion and contradiction when reported.
Wagon	A freight-carrying vehicle.

Zone of Potential Influence	The area defined as the radius about an object, or objects beyond which the noise impact will be insignificant.
Zone Sound Level	Means a derived dBA value determined indirectly by means of a series of measurements, calculations or table readings and designated by a local authority for an area. This is similar to the Rating Level as defined in SANS 10103:2008.

APPENDIX B

Site Investigation – Photos of measurement locations

Photo B.1: DCDLTSL01 – Measurement location at R5

Photo B.2: JGLTSL01 – Measurement location at R2

APPENDIX C

Calculated conceptual noise levels

Appendix C, Table 1: Projected noise levels - construction activities

	NSD	Noise rating level (dBA)	Projected Noise Level (dBA)	Change in rating level (dBA)	Magni-tude	Dura-tion	Extent	Proba-bility	Signifi-cance
Day	1	45	59.4	14.6	10	2	2	5	70
Day	2	45	37.2	0.7	2	2	2	1	6
Day	3	45	40.4	1.3	2	2	2	1	6
Day	4	45	36.8	0.6	2	2	2	1	6
Day	5	45	34.2	0.3	2	2	2	1	6
Night	1	35	52.5	17.6	10	2	3	5	75
Night	2	35	35.3	3.2	4	2	3	2	18
Night	3	35	39.5	5.8	6	2	3	3	33
Night	4	35	36.4	3.8	4	2	3	2	18
Night	5	35	33.8	2.5	2	2	3	2	14

Appendix C, Table 2: Projected noise levels - operational activities

	NSD	Noise rating level (dBA)	Projected Noise Level (dBA)	Change in rating level (dBA)	Magni-tude	Dura-tion	Extent	Proba-bility	Signifi-cance
Day	1	45	65.2	20.2	To be mitigated construction phase.				
Day	2	45	44.7	2.9	2	4	2	1	8
Day	3	45	42.1	1.8	2	4	2	1	8
Day	4	45	37.1	0.7	2	4	2	1	8
Day	5	45	37.7	0.7	2	4	2	1	8
Night	1	35	54.8	19.8	To be mitigated construction phase.				
Night	2	35	43.2	8.8	6	4	3	4	52
Night	3	35	41.6	7.5	6	4	3	4	52
Night	4	35	38.9	5.4	4	4	3	3	33
Night	5	35	36.6	3.9	2	4	3	2	18

End of Report