Mavis South Underground Project

Noise Impact Assessment

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SLR Project No.: 620.V14283.00001

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Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
1.0	30 October 2023	G Cowie	M Caslin	G Cowie
0.1	31 August 2023	G Cowie	M Caslin	

Basis of Report

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with MetRes Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

Executive Summary

The Millennium Mine consists of two (2) mining areas with six (6) contiguous mining leases (ML):

- the Mavis area (ML 70457, ML 70483 and ML 70485); and
- the Millennium area (ML 70313, ML 70401, ML 70344).

Together Mavis and Millennium areas form a single operational project, the Millennium Mine and operate under Environmental Authority (EA) EPML00819213 (dated 12 June 2023). Millennium Mine operates open-cut mining utilising truck and shovel mining techniques, as well as underground mining utilising auger miners.

Underground mining in the Mavis area was approved in December 2021 (Mavis approved). It is now requested that an additional area to the south of the Mavis approved underground operation be approved to maximise production and provide continued utilisation of existing fleet. This area, and the subject of this EA Amendment Application, is referred to the Mavis South Underground Project (the Project). The Project proposes underground mine operation for approximately 854,000 tonnes Run of Mine (ROM) extracted over an approximate 12-month period.

This Noise Impact Assessment Technical Report has been prepared by SLR Consulting Australia Pty Ltd (SLR) on behalf of MetRes Pty Ltd (MetRes) to provide supporting information to this EA Amendment Application.

No background noise measurements were completed for this assessment. The Project is willing to accept the deemed minimum background noise level of 30 dBA as stated in Department of Environment and Science's (DES) *Model Mining Conditions* Guideline (MMC).

Schedule E of existing EA EPML00819213 contains noise conditions relevant to proposed mining operations occurring within the MLs referenced under the Millennium Mine EA. The noise limits contained within Schedule E form the basis for the noise criteria referenced within this assessment. With the adoption of the MMC deemed minimum background noise level of 30 dBA, the most stringent night-time noise limits at a noise sensitive place are:

- $L_{A10,adj,10mins}$ – 30 dBA
- $L_{A1,adj,10mins}$ – 35 dBA

This assessment has modelled a typical worst-case operational mining scenario for the proposed Project, representing mobile and fixed surface equipment proposed to operate during the planned 12-month Project duration. This single operational mining scenario has been developed based on the following understanding and assumptions:

- It is understood that the proposed mining operations as part of the Project would use the same surface support equipment (mobile and fixed) regardless of the mining rate.
- It is understood that the variation in monthly ROM coal across the planned 12-month Project duration relates to how frequently this equipment is used in each month.
- As the assessment period is based on the 10-minute EA noise limits, the surface support equipment numbers/usage will be assumed at 100% for this assessment period.
- It is assumed that the immediate landform surrounding the Mavis Mine area would be unchanged during the course of the planned 12-month Project duration.

To assess concurrent operations at Millennium Mine, as a worst case assessment approach, predicted noise levels from the Project operations model scenario have been combined with the Strip 1 predictions for the approved A-Pit North and A-Pit South open cut mine operations. This gives the concurrent model scenarios of:

- Project operations plus A-Pit North Strip 1
- Project operations plus A-Pit South Strip 1.

Strip 1 predictions have been incorporated into this assessment as this strip resulted in the higher predictions due to sitting at a higher elevation in the landform (and therefore the modelled equipment sat at a higher elevation in the model).

A high-level cumulative noise assessment has been conducted with consideration to the surrounding mines and infrastructure areas to Millennium Mine, specifically Poitrel, Daunia, Moorvale and Moorvale South Mines (open cut), Carborough Downs Mine (underground) and Red Mountain Infrastructure Coal Handling and Preparation Plant (CHPP). In absence of up-to-date noise emission data for these noted mines and infrastructure areas, this cumulative noise assessment compares the corresponding noise limits from each identified site against the EA noise limits for Millennium Mine, as well as the predicted noise levels from the Project and concurrent Millennium Mine operations.

No changes to road/rail transportation are proposed compared to what occurs under current approvals. Therefore, these activities have been excluded from this assessment.

Blasting is not proposed for Mavis South UG Project, therefore has been excluded from this assessment.

This assessment has identified the following:

- The highest predicted noise level from the proposed Project is 17 dBA L_{Aeq} at Tarkari (under the adverse weather conditions) which is compliant with the 25-27 dBA L_{Aeq}, considered to be equivalent to the EA noise limit of 30 dBA L_{A10}. All other Project noise levels are predicted be 15 dBA L_{Aeq} or below.
- The Project predicted noise level at Tarkari homestead is largely dominated by the haul trucks on the rejects and tailings haul routes, which are the closest Project sources to this receptor. The noise contribution of all fixed plant sources are negligible at Tarkari.
- The highest predicted noise levels from the concurrent mine operations are 26 dBA L_{Aeq} (Project plus A-Pit North Strip 1) and 27 dBA L_{Aeq} (Project plus A-Pit South Strip 1), both occurring at Tarkari and under adverse weather conditions. These predicted noise levels are within the 25-27 dBA L_{Aeq} range, which is considered to be equivalent to the EA noise limit of 30 dBA L_{A10}. For both scenarios, the dominant predicted noise sources at Tarkari are associated with mobile mining equipment working in the A-Pit area, with Project attributable noise levels being 9-10 dBA lower than A-Pit attributable noise levels.
- The concurrent scenarios represent worst case noise predictions and technically may not line up with the mine schedule at the time of operations (ie the Project occurring at the same time as Strip 1 for A-Pit North or Strip 1 for A-Pit South) and therefore the noise predictions would be considered to be conservative.
- All other concurrent mine operations noise levels are predicted be 24 dBA L_{Aeq} or less under adverse weather.
- Regarding cumulative noise, the relevant EA noise limits for each identified adjacent mine have been standardised to an L_{Aeq} equivalent night-time noise level. With reference to Tarkari which had the highest Project predicted noise level of 17 dBA L_{Aeq}, this is generally 10 dBA or more below the summarised L_{Aeq} equivalent night-time noise levels for the adjacent mine. Where a noise source is 10 dBA (or greater) below another noise source, the cumulative noise level of the two (2) sources when logarithmically summed is no greater than the higher noise level. Therefore where noise levels from these surrounding mines and infrastructure are achieving their respective L_{Aeq} equivalent night-time noise level, cumulative noise issues with the inclusion of the Project are not expected.

On the basis of the above findings, specific noise mitigation measures are not warranted for the proposed Project and concurrent mine operations at Millennium Mine. Notwithstanding these findings, best practice noise mitigation and management measures should be maintained including record keeping of any noise complaints received during the operations of the Project area and investigate noise management options for verified complaints.

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Acronyms and Abbreviations

dBA	Decibels, A-weighted
CHPP	Coal handling and preparation plant
Daytime	The time period of 7:00 am to 6:00 pm
DES	Department of Environment and Science
EA	Environmental Authority
Evening	The time period of 6:00 pm to 10:00 pm
MMC	DES *Model Mining Conditions* Guideline (2017)
ML	Mine lease
MLD	Mine lease development
Night-time	The time period of 10:00 pm to 7:00 am
NMM	DES *Noise Measurement Manual* (2020)
Project	Mavis South Underground Project
RBL	Rating Background Level
ROM	Run-of-Mine
RMI	Red Mountain Infrastructure
SWL	Sound power level

1.0 Introduction

1.1 Overview

The Millennium Mine consists of two (2) mining areas with six (6) contiguous mining leases (ML):

- the Mavis area (ML 70457, ML 70483 and ML 70485); and
- the Millennium area (ML 70313, ML 70401, ML 70344).

Together Mavis and Millennium areas form a single operational project, the Millennium Mine and operate under Environmental Authority (EA) EPML00819213 (dated 12 June 2023). The Millennium Mine is owned by MetRes Pty Ltd (MetRes), who are a 50/50 joint venture with Kerlong Coking Coal Pty Ltd (being 100% owned by Stanmore Resources Limited (Stanmore)) and Marmilu Pty Ltd. M Mining Pty Ltd is the manager and operator of proposed mining activities at the mines.

Millennium Mine is located approximately 160 km southwest of Mackay in Central Queensland, some 15 km southwest of the township of Coppabella and 20 km south east of Moranbah (Figure 1). The mine is accessed via an 8 km sealed road that branches from the Peak Downs Highway. The Goonyella Hay Point railway line crosses the mine to the south of the Mavis Downs lease.

1.2 Purpose and Structure

This Noise Impact Assessment Technical Report (the Report) has been prepared by SLR Consulting Australia Pty Ltd (SLR) on behalf of MetRes to provide supporting information to the EA Amendment Application under Section 226 of the *Environmental Protection Act 1994* (EP Act). The structure of the Report is outlined in Table 1.

Table 1 Report Structure

Section	Description
1.0: Introduction	Provides an overview of the purpose of the Report and outlines the structure and supporting documentation.
2.0: Project Description	Provides an overview of the Project, including site description and key noise and vibration generating Project activities.
3.0: Existing Environment	Provides an overview of the assessed noise sensitive receptors, and a summary of recent baseline noise monitoring completed for the Project.
4.0: Assessment Criteria	Provides an overview of the noise and vibration assessment criteria that have been prepared for the Report based on the existing EA.
5.0: Assessment Methodology	Presents the noise impact assessment methodology including assumptions and inputs for the operational noise modelling.
6.0: Noise and Vibration Impact Assessment	Presents the results from the operational noise modelling impact assessment, including the identification of any receptors where noise criteria are predicted to be exceeded under one (1) or more of the assessment scenarios.
7.0: Recommendations	Provides noise management recommendations for the Project based on the outcomes of the noise and vibration impact assessment.
8.0: Conclusion	Summarises the key findings of the Report.

Acoustic terminology used through this Report is explained in further detail in Appendix A.

2.0 Description of Project

2.1 Millennium Mine

Millennium Mine commenced open cut coal mining operation in 2006, however was placed in care and maintenance by the previous owner Peabody Energy Australia Pty Ltd, with the cessation of open-cut mining in 2018 and highwall mining in 2019. With the successful acquisition of Millennium Mine in July 2021, MetRes commenced operation in September 2021 to continue open-cut mine, utilising truck and shovel mining techniques, as well as underground auger miners to extract the Leichhardt seams of the Rangal Coal Measures.

At Millennium Mine, the coal is processed and loaded for transport by rail at the facility of the Red Mountain Infrastructure coal handling and preparation plant (RMI CHPP) operated by Red Mountain Infrastructure Pty Ltd (RMI), and located on ML70312. MetRes has an agreements with RMI (who is owned by Stanmore) for access to the RMI CHPP and associated infrastructure, to process and load Millennium's coal. RMI CHPP operates under a separate EA (EA EPML00819113), which is not subject to any amendments under this current EA application.

Millennium Mine is located near several operating coal mines; Stanmore's Poitrel and Daunia open cut mines to the south of the mine area, and Fitzroy Resources' Carborough Downs underground mine to the north and east. All mines in the region target the Rangal Coal Measures.

2.2 Project Overview

On 7 December 2021, approval was received from Queensland Department of Environment and Science (DES) to commence underground mining within the Mavis area (ML70457) (referred to as 'Mavis approved'). It is now requested that an additional area to the south of the Mavis approved underground operation be approved to maximise production and provide continued utilisation of existing fleet. This area, and the subject of this EA Amendment Application, is referred to the Mavis South Underground Project (the Project).

This supporting documentation accompanies the application for an EA amendment to EPML00819213 for extension of the Mavis approved mine operation for approximately 854,000 tonnes Run of Mine (ROM) extracted over an approximate 12-month period.

No new surface activities are proposed as part of this extension to the Mavis underground operation.

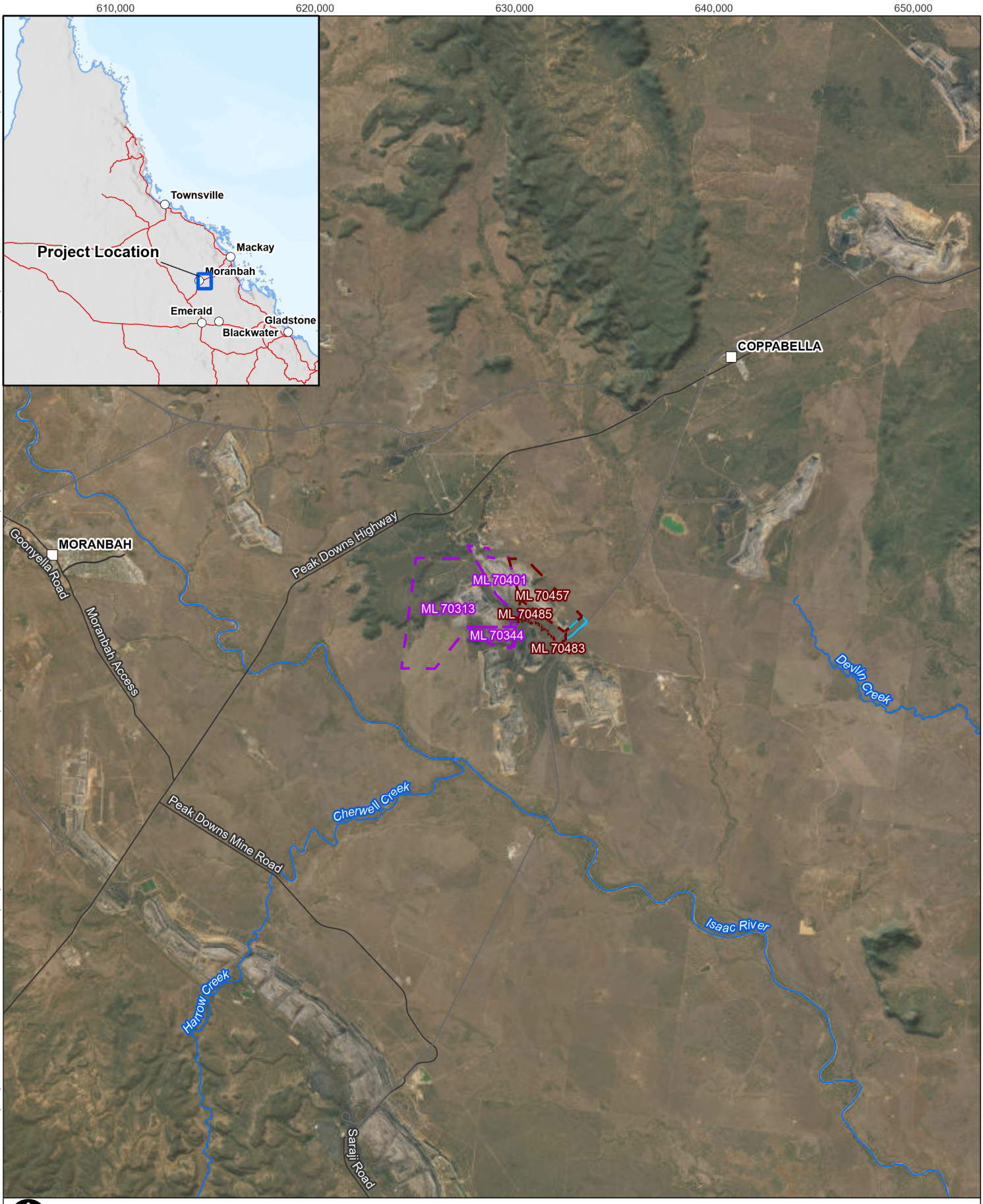
The action seeking approval is to extend the Mavis approved underground operation to the south to access the additional tonnage. The Project will utilise existing fleet demand and infrastructure requirements. The surface portal for the Project utilises existing infrastructure and access via the Mavis approved underground operation.

In consideration of concurrent mine operational activities, the proposed extension remains within EA EPML00819213 approved extraction rate of 5.5 Million tonnes per annum (Mtpa).

The proposed underground extension is currently within a portion of Mine Lease Development (MLD) 3046 (Lot3 on SP190266), as shown on Figure 1.

No changes to road/rail transportation are proposed compared to what occurs under current approvals. Therefore, these activities have been excluded from this assessment.

Blasting is not proposed for Mavis South UG Project, therefore has been excluded from this assessment.



0 2.5 5 km

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	620.14283.00001
Date Drawn:	29-Aug-2023
Drawn by:	AS

LEGEND

- Major Watercourse
- Railway
- Road
- Mavis Mine Lease
- Millennium Mine Lease
- Project Area

MAVIS SOUTH UNDERGROUND PROJECT
NOISE IMPACT ASSESSMENT

PROJECT OVERVIEW

SLR

FIGURE 1

Path: H:\Projects-SLR\620-BNE\620-BNE\620.V14283.00001 Mavis Extension UG Project\06 SLR Data\01 GIS\Mavis Extension UG Project\Mavis Extension UG Project.aprx\62014283_ANV_F01_Mavis_South_Underground_Project_Overview_01

2.3 Current Authorised Operations

In line with current requirements of Environmental Authority EPML00819213, the following activities are currently authorised operations:

- Handling and use of explosives for blasting activities associated with open-cut operational mining and testing (signature holes);
- Mine Industrial Area (MIA) – Administration, Mavis Workshop, Warehouse, Sewage Treatment Plan, water tanks, washbay, Emergency Response Team;
- Storage, handling and use of chemicals and flammable or combustible liquids;
- Potable water supply – treated water from the Isaac Regional Council's standpipe supplied to site; and
- Both coarse and fine (tailings) rejects will be disposed of in Mavis Pit waste dumps.
- Maintenance of existing power lines and associated fire breaks;
- Maintenance of hardstand/laydown areas, access tracks and roads that may utilise coarse reject material from the RMI CHPP;
- Waste management - Onsite disposal of tyres;
- Dust suppression;
- Storage of explosives at explosives magazine on ML70313;
- Maintenance of water management infrastructure including sediment and erosion control dams, stormwater runoff drainage, dewatering infrastructure network (pipelines and pumps) and the levee;
- Reshaping of spoil dumps, replacement of topsoil and revegetation of the mined out and backfilled areas;
- Review designs and conditions of various water drains;
- Construction of drains in rehabilitated areas;
- Maintaining a nature conservation corridor – New Chum Creek buffer;
- Rehabilitation of exploration boreholes;
- Ongoing monitoring required for dust, water storage, mine affected water releases, saline drainage, groundwater, receiving environment, rehabilitation and other such as noise, odour, airblast on request from the administrating authority;
- Land management activities, including but not limited to, fire breaks, weed and feral animal control;
- Rehabilitation maintenance activities such as weed management and erosion control;
- Maintenance of existing groundwater monitoring bores and all other monitoring infrastructure and equipment; and
- Ongoing stakeholder engagement with the landowner's Property Manager, landowner and State Government regarding rehabilitation and future transition to a Progressive Rehabilitation Closure Plan.

In relation to off lease activities, the following is current authorised:

- Management and monitoring activities associated with the Wotonga Offset Area;
- Waste management - off lease disposal of general and regulated waste through a licensed waste management company;

- Processing of Run off Mine (ROM) coal through the RMI CHPP to produce coking coal and a PCI (Pulverised Coal Injection) coal; and
- Transporting the product coal by rail to the Dalrymple Bay Coal terminal for export.

2.4 Concurrent Activities at Millennium Mine

Concurrent mine operations at Millennium Mine are forecast to include open-cut mining operations in A-Pit as well as operations proposed under the Project. Based on the available mine schedule, it indicates that concurrent operations of the proposed Project, A-pit North and A-pit South would occur at approximately July to December 2024. Open-cut mining in A-Pit has been documented in the A-Pit North and South assessment (EA amendment 21 June 2023).

The assessment of concurrent mine operations at Millennium Mine are discussed further in Sections 5.3 and 6.3.

2.5 Noise Generating Project Activities

As the Project relates to underground mining, there are limited activities with the potential to generate above ground noise emissions. These above ground activities which form the basis for this assessment are as follows:

- Loading and hauling of ROM coal using a combination of loaders and trucks
- Dust suppression on haul routes
- Maintenance of haul routes using graders, excavators and dozers
- Fixed plant located at the entrance of Mavis underground mine to support underground operations including mine ventilation system, compressors, and ROM coal conveyors and stackers.

As blasting is not proposed as part of the Project, no sources or activities are proposed that would produce measurable or perceptible vibration levels at assessed sensitive receptors. This is due to the offset distances between the Project operations and sensitive receptors (the nearest receptor is located approximately 7.4 km from the proposed Project activities).

Potential impacts associated with cumulative mine noise emissions from Daunia, Poitrel and Carborough Downs mines have also been considered in the assessment (Sections 5.4 and 6.4).

3.0 Existing Environment

3.1 Existing Sensitive Receptors

The Millennium and Mavis mines EA provides the following definitions regarding sensitive places:

A sensitive place means:

a) a dwelling, residential allotment, mobile home or caravan park, residential marine or other residential premises; or
b) a motel, hotel or hostel; or
c) an educational institution; or
d) a medical centre or hospital; or
e) a protected area; or
f) a public park or gardens.

Based on the above definition, the nearest noise sensitive receptors surrounding the Project (and the broader Millennium Mine) are outlined in Table 2 and shown on Figure 2.

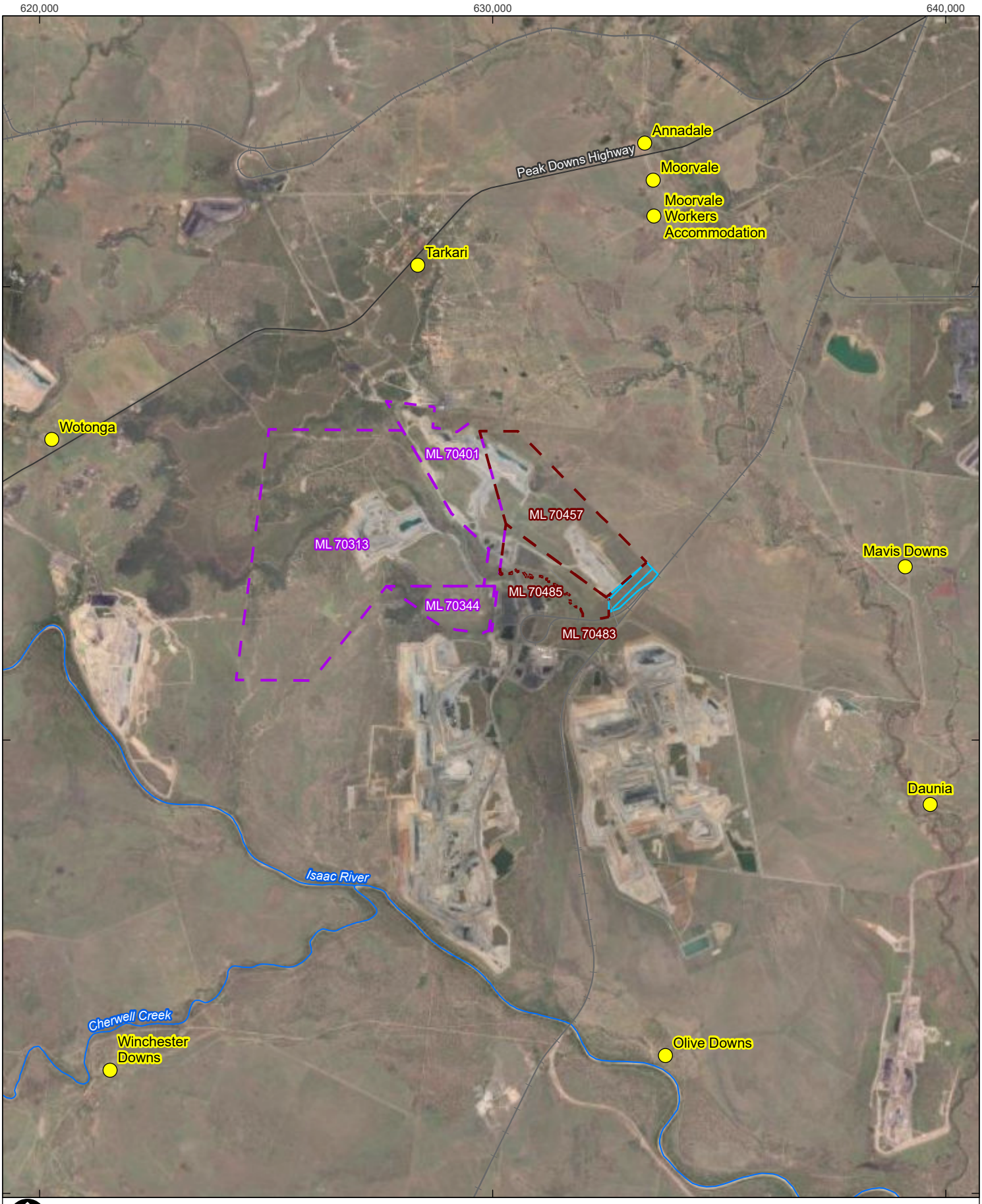
Consistent with the Department of Environment and Science's (DES) *Model Mining Conditions* Guideline (MMC), the sensitive receptors do not include places that are within the boundaries of the Millennium and Mavis mines ML (or its proposed extension under the Project), nor places that are

owned or leased by M Mining or Met Res. At the time of reporting, no current noise agreements were understood to be in place between M Mining/Met Res and any assessed sensitive receptor therefore rendering a receptor 'non-noise sensitive'.

Table 2 Assessed Noise Sensitive Receptors

Sensitive Receptor	Distance and Direction from Project [1]	Coordinates (GDA94, zone 55k)	
		X	Y
Annadale	9.1 km, north	633,353	7,573,168
Moorvale	8.3 km, north	633,541	7,572,350
Moorvale Workers Accommodation	7.6 km, north	633,556	7,571,559
Mavis Downs	6.9 km, east	639,104	7,563,822
Daunia	9.3 km, southeast	639,655	7,558,578
Olive Downs	11.2 km, south-southeast	633,811	7,553,039
Winchester Downs	15.6 km, southwest	621,553	7,552,715
Wotonga	12.2 km, west-northwest	620,267	7,566,631
Tarkari	7.4 km, northwest	628,344	7,570,474

Note 1: The existing Mavis Underground Portal has been used as a central reference position for determining distances and directions for these sensitive receptors.



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LEGEND

- Sensitive Receptor
- Major Watercourse
- Railway
- Road
- Mavis Mine Lease
- Millennium Mine Lease
- Project Area

MAVIS SOUTH UNDERGROUND PROJECT
NOISE IMPACT ASSESSMENT

PROJECT AREA AND ASSESSED NOISE SENSITIVE RECEPTORS

SLR

FIGURE 2

Path: H:\Projects-SLR\620-BNE\620-BNE\620.V14283.00001 Mavis Extension UG Project\06 SLR Data\01 GIS\Mavis Extension UG Project\Mavis Extension UG Project.aprx\62014283_ANV_F02_Project_Area_and_Assessed_Noise_Sensitive_Receptors_01

3.2 Existing Noise Levels

No background noise measurements were completed for this assessment. The Project is willing to accept the deemed minimum background noise level of 30 dBA as stated in MMC (see Section 4.0 for further details).

Based on SLRs experience in conducting background noise measurements in Queensland's mining fields, measured background noise levels at noise sensitive receptors are routinely equal to or lower than the deemed background noise levels. This is generally due to 'natural' noise sources (i.e. bird song, wind and wind generated vegetation noise, seasonal insects) controlling the sound scape. During the most sensitive night-time periods, these 'natural' sources are often either infrequently measured or are not present for periods of time, therefore the background noise level is routinely below the deemed minimum background noise level of 30 dBA L_{A90}.

Even where anthropogenic noise sources are present (i.e. from roads, existing mines etc), their contribution tends to be influenced by meteorological conditions. That is, there are periods of time where these sources can contribute to or dominate the measured background noise level (and potentially elevate it above the deemed minimum noise levels). However the opposite can also occur where meteorological conditions are such that these sources are either inaudible/ unmeasurable or they do not significantly contribute to the measured background noise level.

For this Project, the deemed minimum background noise levels are considered applicable for the Project given the rural nature that the Project area is located within and the expected low background noise levels within this area.

4.0 Noise Assessment Criteria - Millennium Mine EA Noise Limits

Schedule E of existing EA EPML00819213 contains noise conditions relevant to proposed mining operations occurring within the MLs referenced under the EA. The noise conditions relevant to the assessment are reproduced below.

E1: Noise nuisance – Noise from mining activities must not cause an environmental nuisance at any noise sensitive or commercial place.

E2 All noise from mining activities must not exceed the levels specified in Table E1: Noise Limits [see Table 3] *at any noise affected place.*

E4 Noise is not considered to be a nuisance under Condition E1 if monitoring shows that noise does not exceed the following levels in the time periods specified in Table E1: Noise Limits.

Table 3 *Table E1: Noise Limits*

Noise Level (dBA)	Monday to Saturday			Sundays and Public Holidays		
	7am – 6pm	6pm – 10pm	10pm – 7am	9am – 6pm	6pm – 10pm	10pm – 9am
Noise Measured at a 'Noise Sensitive Place'						
$L_{A10,adj,10mins}$	B/g + 5	B/g + 5	B/g + 0	B/g + 5	B/g + 5	B/g + 0
$L_{A1,adj,10mins}$	B/g + 10	B/g + 10	B/g + 5	B/g + 10	B/g + 10	B/g + 5
Noise Measured at a 'Commercial Place'						
$L_{A10,adj,10mins}$	B/g + 10	B/g + 10	B/g + 5	B/g + 10	B/g + 10	B/g + 5
$L_{A1,adj,10mins}$	B/g + 15	B/g + 15	B/g + 10	B/g + 15	B/g + 15	B/g + 10

As noted in Section 3.2, current regulatory guidelines (ie MMC) now adopt a threshold background level of 30 dBA. In the absence of current background noise monitoring, this threshold background level of 30 dBA has been adopted for this Project. Noting the proposed 24 hour, seven days per week operations for the Project, the most stringent noise limits at a noise sensitive place are as

follows, and applicable to the night-time period of 10:00 pm to 7:00 am Monday to Saturday/ 9:00 am Sundays and Public Holidays:

- $L_{A10,adj,10mins}$ – 30 dBA
- $L_{A1,adj,10mins}$ – 35 dBA

5.0 Assessment Methodology

5.1 Assessed Mining Activities and Assumptions

The selection of assessment scenarios for the Project was based on activities with the greatest potential to result in noise at the identified sensitive receptors. The assessment scenario in Table 4 were developed in consultation with M Mining to assess potential 'typical worst-case' noise levels with consideration of the underground nature of the Project, short mine duration, and limited surface equipment. Further consideration of the equipment location also included:

- When plant (noise sources) would be at the closest proximity to receptors (i.e. due to active mining pits)
- Total number of mobile plant, and location thereof within the mine, to ensure the maximum expected number of mobile plant would be considered
- Where there would be limited screening of noise from on-site structures or topography.

A single assessment scenario has been developed to assess potential noise impacts from the Project based on the following understanding and assumptions:

- It is understood that the proposed mining operations as part of the Project would use the same surface support equipment (mobile and fixed) regardless of the mining rate. This equipment, including model locations, is summarised further in Sections 5.2.3 and 5.3.
- It is understood that the variation in monthly ROM coal across the planned 12-months Project duration relates to how frequently this equipment is used in each month.
- As the assessment period is based on the 10-minute EA noise limits (detailed in Section 4.0), the surface support equipment numbers/usage will be assumed at 100% for this assessment period.
- It is assumed that the immediate landform surrounding the Mavis Mine area would be unchanged during the course of the planned 12-month Project duration.

Table 4 Assessed Operational Scenario and Associated Mining Activities

Scenario	Activities
Mavis South Underground Project	Represents Project operations for the planned 11-month duration. Surface equipment including: • Loading and hauling of ROM coal using a combination of loaders and trucks • Dust suppression on haul routes • Maintenance of haul routes using graders, excavators and dozers • Fixed plant located at the entrance of Mavis underground mine to support underground operations including mine ventilation system, compressors, and ROM coal conveyors and stackers. Eleven (11) individual pieces of mobile equipment and seven (7) individual pieces of fixed plant operating 24 hours, 7 days per week.

This assessment is based on the key assumptions outlined below:

- This assessment pertains only to the amendment of the Millennium Mine EA EPML00819213, and specifically those activities relating to the proposed Project. It incorporates all (acoustically significant) mine activities proposed under the Project.

- Only acoustically significant surface equipment (mobile and fixed) have been included in the noise model. All underground sources have been excluded from the model on the basis that their noise emissions will be adequately attenuation prior to reaching the surface. This assumption has been verified during a site visit by SLR on 14 August 2023 whereby noise from underground operations could not be detected at the underground mine portal entrance above those fixed plant operating within the Mavis Pit adjacent to the portal.
- Fixed plant, dozers, excavators and loaders have all been modelled as representative point sources. Point sources contain all acoustic energy in one fixed location.
- Haul trucks (ROM coal and rejects/tailing), graders and water carts have been modelled representative of line sources. Line sources contain all acoustic energy spread across the line source representing a path each source would travel over a representative assessment period. To calculate the path travelled over the assessment period, the following average speeds have been assumed in consultation with M Mining:
  - Haul trucks – 20 km/hr (average of different speeds in/out of pits and on flat haul roads)
  - Water Carts – 15 km/hr
  - Graders – 5 km/hr.
- With regard to modelling ROM coal haul trucks (three (3) Komatsu 785 haul trucks have been assigned to this activity in the noise model), an assumption has been made that one (1) idle haul truck would be located next to the active loader (with insignificant noise level emissions) and the remaining two (2) haul trucks are considered in calculating a total line source to simulate the haulage circuit. For the remaining haul routes (rejects and tailings), as only one (1) haul truck has been assigned to this activity, that one (1) haul truck has been accounted for in the line source and no idle haul trucks assumed.
- M Mining has provided operating haul routes (polylines) and ROM pads (polygons) for the relevant modelled areas.
- The location of the fixed plant has been references from site source measurements completed by SLR on 14 August 2023.
- Model heights for all mobile equipment have been assumed using standard SLR model heights (generally 2 m or 3 m above ground height).
- Model heights for all fixed plant have been based on observed heights during the site visit on 14 August 2023 (ranging between 0.5 m and 5 m above ground height).
- The majority of operations would be continuous 24-hours a day and seven days a week. As such, no allowance was made for periods when plant and equipment would be temporarily idle or not in use.
- Noise emission levels have been predicted based on the energy average (L_{Aeq}) noise descriptor. The following guidance outlines the relationship between the L_{Aeq} and L_{A10} noise descriptors and assessment time periods:
  - A 3 to 5 dB relationship is typically adopted for assessing mining operational noise, whereby L_{A10} noise levels are 3 to 5 dB higher than L_{Aeq} noise levels. In the context of the noise assessment criteria, the EA noise limit of 30 dBA L_{A10} would effectively become 25-27 dBA L_{Aeq}.
- To assess L_{A1} noise levels:
  - A +8 dB relationship between the L_{Aeq} and L_{A1} has been applied. This theoretical maximum (+8 dB) relationship is considered conservative in that it works off the 'cumulative' LAeq noise level (i.e. all modelled equipment considered) where, in reality, the L_{A1} is likely to result from more isolated events such as excessive engine revving from a single haul truck, dumping of material (normally associated with overburden) or dozer track slap.

  - The EA noise limits for the night-time period (Table 3) state a 5 dB difference between the L_{A10} and L_{A1} noise limits
  - Accounting for the aforementioned relationships between the L_{Aeq}, L_{A10} and L_{A1} parameters, and the 5 dB EA noise limit difference between L_{A10} and L_{A1}, if the noise prediction is 27 dBA L_{Aeq} or less, based on these relationships the L_{A10} and L_{A1} noise limits theoretically are achieved.
- Transportation (road/rail) noise has been excluded from this assessment as rail operations and vehicle movements are not proposed to change as a result of the Project. Further, given its an existing noise source, sensitive receptors are unlikely to associate future rail noise as part of the Project.
- Progressive rehabilitation activities are conducted under existing approved operations. Assessment of final rehabilitation activities (i.e. post mine closure) has not been considered.

5.2 Noise Prediction Modelling

5.2.1 Modelling Software and Algorithm

A SoundPLAN (Version 8.1) computer noise model was developed to predict mine noise levels at the identified noise sensitive receptors. SoundPLAN is a computer model software package enabling calculation of environmental noise by combining a digitised ground map (topography), the location and acoustic sound power levels of potentially critical noise sources on site and the location of receivers for assessment purposes.

The model can calculate noise levels taking into account such factors as the sound power levels and locations of noise sources, distance attenuation, ground absorption, air absorption and shielding attenuation, as well as meteorological conditions, including wind effects.

The *Conservation of Clean Air and Water Europe* (CONCAWE 1981) prediction methodology was utilised within SoundPLAN. The CONCAWE prediction method is specifically designed for large industrial facilities and incorporates the influence of wind effects and the stability of the atmosphere.

The statistical accuracy of environmental noise predictions using CONCAWE was investigated by Marsh (Applied Acoustics 15 – 1982). Marsh concluded that CONCAWE was accurate to ±2 dBA in any one octave band between 63 hertz (Hz) and 4 kHz and ± 1 dBA overall.

In relation to the modelling of atmospheric conditions, DES's (currently under review) Ecoaccess Guideline '*Planning for Noise Control*' (PNC) provides guidance with respect to assessing the potential for noise enhancements due to prevailing atmospheric conditions. This is discussed in Section 5.2.2.

5.2.2 Modelled Weather Parameters

5.2.2.1 Prevailing Wind

In accordance with PNC, meteorological data for Mavis/Millennium mines for the 12 month period of 1 January 2021 to 31 December 2021 was analysed for the following wind parameters to confirm whether a 'prevailing' wind component was a feature of the area:

- 30% occurrence in any assessment period (day, evening or night) in any season;
- 3 m/s or less source to receptor component; and
- 10 m height for wind speed.

The wind analysis, presented as wind roses in Appendix B, indicated that for the analysed 12 month period of meteorological data, there were no calculated periods of wind direction occurring at least 30 per cent of the time in any one (1) season and assessment period, and wind speeds of up to 3 m/s. Peak wind occurred during the night-time period in summer (up to 25% from a north-

northeast direction). Therefore, a prevailing wind component has not been considered a feature of the Project area and has not been included as an assessable weather condition scenario for this assessment.

5.2.2.2 Temperature Inversion

In accordance with PNC, meteorological data for Mavis/Millennium mines was analysed for the following temperature inversion parameters (non-arid) to confirm whether temperature inversions are a feature of the area:

- 30% occurrence of temperature inversions for the time period of (6:00 pm to 7:00 am during winter (June, July, August).

As noted in Fact Sheet D of the New South Wales *Noise Policy for Industry* (NPfI), the frequency of occurrence of temperature inversions may be determined either by direct measurement of inversion parameters, or by using indirect methods that allow the prediction of wind and temperature profiles to within a moderately narrow range using readily available meteorological data. The indirect method, used for the Project, allows the susceptibility of an area to inversions to be determined through the use of the relationship between atmospheric stability categories and inversions developed by the US Atomic Energy Commission.

The relationship, shown in Table 5 together with the modelling results for the Project (of vertical temperature gradient between 10 m and 100 m above ground level), outlines the range of temperature gradients that can be expected within each stability class with a positive temperature gradient (i.e. stability categories "E", "F" and "G") indicating a temperature inversion.

Table 5 Stability Categories and Frequency of Occurrence at the Project – Winter Months (6:00 pm – 7:00 am)

Stability Category	Range of Vertical Temperature Gradient (oC/100 m)	Percentage of Occurrence
A	DT/DZ < –1.9	0.0%
B	–1.9 ≤ DT/DZ < –1.7	0.0%
C	–1.7 ≤ DT/DZ < –1.5	3.6%
D	–1.5 ≤ DT/DZ < –0.5	15.6%
E	–0.5 ≤ DT/DZ < 1.5	12.1%
F	1.5 ≤ DT/DZ < 4.0	68.6%
G	4.0 ≤ DT/DZ	Considered as part of the F class percentage

The results of the modelling of temperature gradient over the Project area indicated a 69% occurrence of temperature inversions during the winter evening and night-time period. Therefore, temperature inversions are considered to be a characteristic of the Project area and have been considered as part of this assessment.

5.2.2.3 Project Modelled Weather Parameters

Based on the meteorological analysis presented in Sections 5.2.2.1 and 5.2.2.2, the default weather parameters recommended by PNC have been referenced to determine the effects of meteorology on noise emissions from the Project. The weather parameters applied to this assessment are summarised Table 6.

Table 6 Project Modelled Weather Parameters

Parameter	Neutral Weather	Adverse Weather – Temperature Inversion
Temperature	10°C	10°C
Humidity	70%	90%
Pasqual stability class	D	F (representative of temperature inversion)
Wind speed	0 m/s	0 m/s

5.2.3 Noise Sources, Sound Power Levels and Locations

With reference to the single modelled mine scenario (refer to Table 4), Table 7 and Table 8 summarise the following:

- Surface mine equipment make, model and numbers relevant to the assessed operational scenarios as provided by M Mining.
- Fixed plant details and numbers relevant to the operational scenarios – determined via source measurements at site on 14 August 2023.
- Assumed overall sound power level (SWL) data and source emission heights for each equipment item developed by SLR based on details from similar recently assessed coal mining projects.

Appendix C contains figures identifying the equipment-assigned locations for each modelled mine scenario which have been developed in consultation with M Mining.

Table 7 Modelled Noise Sources and Sound Power Levels – The Project

Mining Equipment	Per Item SWL, dBA LAeq	Quantity Modelled per Scenario	Assigned Location
Mobile Mining Equipment			
CAT D11 Dozer	119	1	Representative location on Mavis UG Portal to Mavis ROM Pad haul route
CAT 16M Grader	113	1	Line source covering Mavis UG Portal to Mavis ROM Pad haul route
Komatsu PC1250 Excavator	113	1	Representative location on rejects haul route (RMI CHPP to rejects stockpile)
Hitachi ZX870 Excavator	112	1	Representative location on tailings haul route (RMI CHPP to tailings stockpile)
Komatsu 785 Haul Trucks	115	5	Line sources covering the following: • 1x assigned to rejects haul, • 1x assigned to tailings haul, • 3x assigned to Mavis Underground Portal to Mavis ROM Pad haul (assume 1 is idle being loaded – see assumptions).
Komatsu WA900 Loader	118	1	Representative location Mavis ROM Pad
Komatsu 785 Water Truck	115	1	Line source covering Mavis UG Portal to Mavis ROM Pad haul route
Fixed Mining Plant			
Vent shaft electric drive motor (EDM)	88	1	Mavis Pit, based on existing position

Mining Equipment	Per Item SWL, dBA LAeq	Quantity Modelled per Scenario	Assigned Location
Vent shaft	124	1	Mavis Pit, based on existing position
Compressor (trailer mounted)	104	2	Mavis Pit, based on existing position
ROM coal conveyor chutes/transfer stations	102	2	Mavis Pit, based on existing position
Water pump	90	1	Out of pit source located on nature surface level northeast of Mavis Pit. Based on existing position

Table 8 Octave Band SWL for Modelled Noise Sources (Project Operations)

Mining Equipment	Per Item SWL, dBA LAeq	Octave Band SWL, Hz dBA Leq							
		63	125	250	500	1k	2k	4k	8k
Mobile Mining Equipment									
CAT D10 Dozer	119	98	99	109	114	112	111	109	103
CAT 16M Grader	113	94	100	106	103	109	106	102	90
Komatsu PC1250 Excavator	113	93	94	103	107	108	106	100	86
Hitachi ZX870 Excavator	112	92	93	102	106	107	105	99	85
Komatsu 785 Haul Trucks	115	87	102	104	109	108	110	103	96
Komatsu WA900 Loader	118	83	105	108	112	113	110	104	94
Komatsu 785 Water Truck	115	87	102	104	109	108	110	103	96
Fixed Mining Plant									
Vent shaft electric drive motor (EDM)	88	54	70	77	77	80	77	79	83
Vent shaft	124	72	81	91	109	118	120	119	106
Compressor (trailer mounted)	104	77	86	93	93	99	98	97	91
ROM coal conveyor chutes/transfer stations	102	61	75	88	89	94	97	96	93
Water pump	90	42	58	72	79	81	86	82	80

Regarding the fixed plant included in the noise model, a site visit was conducted by SLR on 14 August 2023 to identify the acoustically significate sources, and conducted noise measurements to assist in deriving SWLs for use in this model. Due to the simultaneous operations of these sources and generally close location of all sources, it was difficult to conduct source noise measurements isolating each source at greater distance, however nearfield measurements within several metres were possible.

The fixed plant SWLs listed in Table 8 above have been derived through a process of applying initial SWLs derived from the nearfield noise measurements and calibrating to a control location (located

250 m uphill from the vent shaft and 400 m from the southern conveyor chutes). The noise environment at this control location was dominated by the compressors in the lower frequencies (63 Hz and 125 Hz octave bands), and the air exiting from the vent shafts in the remaining octave bands. Negligible noise could be detected from the remaining fixed plant sources listed in Table 8, including the ROM coal conveyor and chutes/transfer stations (which were operating at the time of the measurements). The measurement conducted at this control position was timed to avoid any contribution from operating mobile plant.

5.3 Concurrent Operations at Millennium Mine

To assess concurrent operations at Millennium Mine, as a worst case assessment approach, predicted noise levels from the Project operations model scenario have been logarithmically summed with the Strip 1 predictions for A-Pit North and A-Pit South. For this assessment, these predictions are referenced from the SLR report '*620.30404.00800-R01-v1.0-20230324*' dated 24 March 2023 (herein referred to as the 'A-Pit Noise Assessment'), and supplemented with additional predictions to cover all noise sensitive receptors documented in Section 3.1. The A-Pit mobile mining equipment and modelled locations remain unchanged to those reported in the A-Pit Noise Assessment, therefore are not reproduced within this report.

This gives the concurrent model scenarios of:

- Project operations plus A-Pit North Strip 1
- Project operations plus A-Pit South Strip 1.

Strip 1 predictions have been incorporated into this assessment as this strip resulted in the higher predictions due to sitting at a higher elevation in the landform (and therefore the modelled equipment sat at a higher elevation in the model).

It is noted that technically these scenarios may not line up with the mine schedule at the time of operations, however it provides a worst case model/assessment approach and the predictions should be considered to be conservative.

5.4 Cumulative Noise Impact Assessment

Millennium Mine is located within the Bowen Basin, and more specifically, adjacent to Poitrel, Daunia, Moorvale and Moorvale South Mines (all open cut), and Carborough Downs Mine (underground). Numerous additional opencut and underground mines also occur within a 20-25 km radius of the Millennium Mine and consequently receptors have the potential to experience noise from multiple mines in addition to operations from Millennium Mine.

To support this assessment, consideration of cumulative noise levels has been undertaken with reference to the following surrounding mines/infrastructure and their associated EA noise conditions;

- RMI CHPP – operated by RMI – EA EPML00819113 dated 12 July 2022
- Poitrel Mine – operated by Stanmore – EA EPML00963013 dated 23 November 2022
- Daunia Mine – operated by BHP and Mitsubishi Development – EA EPML00561913 dated 30 June 2022
- Carborough Downs Coal Mine – operated by Fitzroy Mining Operations – EA EPML00959213 dated 2 March 2023
- Moorvale Mine – operated by Peabody Energy – EA EPML00802813 dated 8 August 2023
- Moorvale South Mine – operated by Peabody Energy – EA EPML00380113 dated 11 October 2021

In absence of up-to-date noise emission data for these surrounding mines and infrastructure areas, this cumulative noise assessment compares the corresponding noise limits from each identified site

against the EA noise limits for Millennium Mine, as well as the predicted noise levels from the Project and concurrent Millennium Mine operations.

6.0 Noise Impact Assessment

6.1 Project Predicted Noise Levels

The predicted noise levels from the modelled Project scenario listed in Section 5.1 are summarised in Table 9 for neutral and adverse weather conditions. These predictions relate to the listed mobile and fixed mining equipment detailed in Table 7 and are representative of the night-time period upon which the most stringent noise criteria applies noting the 24 hours, seven days a week operation proposed by the Project.

Table 9 Predicted Project Noise Levels

Sensitive Receptor	Predicted Project Noise Level (LAeq,adj,15min dBA)	
	Neutral Weather	Adverse Weather – Temperature Inversion
Annadale	<0	7
Moorvale	0	8
Moorvale Workers Accommodation	3	10
Mavis Downs	8	15
Daunia	4	12
Olive Downs	2	10
Winchester Downs	<0	7
Wotonga	4	12
Tarkari	10	17

From the modelling results summarised in Table 9, the highest predicted noise level from the proposed Project is 17 dBA L_{Aeq} at Tarkari under adverse weather conditions which is compliant with the 25-27 dBA L_{Aeq}, considered to be equivalent to the EA noise limit of 30 dBA L_{A10}. All other Project noise levels (presented in Table 9) are predicted to be 15 dBA L_{Aeq} or less. The predicted noise level at Tarkari is largely dominated by the haul trucks on the rejects and tailings haul routes, which are the closest Project sources to this receptor. The noise contribution of all fixed plant sources are negligible at Tarkari.

Noise contours for this Project scenario are contained in Appendix D.

On the basis of the above findings, specific noise mitigation measures are not warranted for the proposed Project. Notwithstanding these findings, best practice noise mitigation and management measures are outlined in Section 7.0.

6.2 Assessment of Noise Characteristics

The potential impacts from mine noise experienced at the sensitive receptors are not solely a function of the overall level of noise but also the characteristics of the noise. Consideration for the potential presence of tonal, impulsive and/or low frequency noise characteristics was investigated.

To complete a true tonal assessment, the inclusion of one-third octave data is required. As per Table 8, the spectrum data used for this assessment has been simplified at octave band data (which is widely accepted for an assessment of this nature). Consistent with the description of tonal noise in the PNC guideline and SLR's experience of noise from mine sites, there may be a distinguishable (non-tonal) "hum" associated with diesel powered equipment however the presence of tonal characteristics can often be attributed to mining plant with mechanical faults. For this assessment, no specific tonal correction has been considered on the assumption that all mining plant would be

operated in good working order and that “buzzer”, not “beeper”, reversing alarms would likely be utilised on mobile equipment particularly if working in exposed areas.

In the absence of specific low frequency noise assessment requirements in the existing EA, the following two (2) documents and associated criteria[1] are referenced to provide consideration of potential low frequency noise impact from the Project[2] onto the assessed receptors:

- DES’s former Ecoaccess *Assessment of Low Frequency Noise Guideline*, which contains an initial screening test at noise sensitive receptors whereby the overall noise level should not exceed 50 dBL Leq (internal) and the difference between the overall dBL and dBA Leq (internal) noise levels should not exceed 15 dB. For this assessment, a (conservative) 5 dB façade reduction has been applied to convert the 50 dBL internal level to an external level (i.e. 55 dBL Leq external) given that building facades generally do not attenuate low frequency noise as well as broader spectrum noise.
- DES’s *Streamlined Model Conditions for Petroleum Activities* Guideline, which is relevant to operations of industrial noise sources operating in rural Queensland, contains the following external and internal criteria that must not be exceeded (Leq unless noted otherwise). It is noted the internal criteria are generally consistent with the former Ecoaccess Assessment of Low Frequency Noise Guideline noted above.
  - 60 dBC measured outside the sensitive receptor; and
  - the difference between the external A-weighted and C-weighted noise levels is no greater than 20 dB; or
  - 50 dBZ measured inside the sensitive receptor; and
  - the difference between the internal A-weighted and Z-weighted (Max LpZ, 15 min) noise levels is no greater than 15 dB.

Consistent with the overall A-weighted predicted noise levels (presented in Table 9), the highest predicted dBC and dBL external noise levels are predicted to occur at Tarkari under adverse conditions. The predicted Leq noise levels are 35 dBL and 33 dBC (under adverse weather) which complies with the respective criteria. Therefore, low frequency noise is not predicted to be an issue for the Project.

There is potential for impulsive noise from track slap associated with the dozers. Measures to mitigate such noise events from the operation of the dozer, and mitigate impulsive noise, are provided in Section 7.0. If these mitigation measures are implemented effectively, impulsive noise characteristics can be managed such that impulsive noise penalties may not apply.

6.3 Concurrent Mine Operations

The predicted noise levels from the modelled concurrent Millennium Mine operational scenarios listed in Section 5.3 are summarised in Table 10 (Project plus A-Pit North) and Table 11 (Project plus A-Pit South) for neutral and adverse weather conditions. These predictions are representative of the night-time period upon which the most stringent noise criteria applies noting the 24 hours, seven days a week operation proposed by the Project.

[1] These criteria reference dBL/dBZ and dBC noise levels and comparison back to dBA noise levels – dBL/dBZ refer to decibels ‘unweighted’ (i.e. linear or zero-weight)) or decibels ‘C-weighted’ (dBC). Both are common frequency ‘weightings’ (or lack thereof) for assessing low frequency noise.

[2] With reference to DES *Noise Measurement Manual* and the former Ecoaccess *Assessment of Low Frequency Noise Guideline*, low frequency noise is defined as noise from the 10 Hz to 200 Hz frequency range).

Table 10 Predicted Concurrent Mine Operations Noise Levels – Project plus A-Pit North

Sensitive Receptor	Predicted Noise Level (LAeq,adj,15min dBA)					
	Project		A-Pit North Strip 1		Concurrent	
	Neutral Weather	Adverse Weather	Neutral Weather	Adverse Weather	Neutral Weather	Adverse Weather
Annadale	<0	7	2	12	4	13
Moorvale	0	8	3	13	5	14
Moorvale Workers Accommodation	3	10	3	14	6	15
Mavis Downs	8	15	<0	9	8	16
Daunia	4	12	2	12	6	15
Olive Downs	2	10	6	17	8	17
Winchester Downs	<0	7	6	17	7	17
Wotonga	4	12	7	17	9	18
Tarkari	10	17	16	26	17	26

Table 11 Predicted Concurrent Mine Operations Noise Levels – Project plus A-Pit South

Sensitive Receptor	Predicted Noise Level (LAeq,adj,15min dBA)					
	Project		A-Pit South Strip 1		Concurrent	
	Neutral Weather	Adverse Weather	Neutral Weather	Adverse Weather	Neutral Weather	Adverse Weather
Annadale	<0	7	9	19	9	19
Moorvale	0	8	9	19	10	20
Moorvale Workers Accommodation	3	10	10	20	11	21
Mavis Downs	8	15	8	18	11	20
Daunia	4	12	6	16	8	18
Olive Downs	2	10	7	17	8	18
Winchester Downs	<0	7	7	17	8	18
Wotonga	4	12	14	24	14	24
Tarkari	10	17	17	27	18	27

From the modelling results summarised in Table 10 and Table 11, the highest predicted noise levels from the concurrent mine operations at Millennium Mine are 26 dBA L_{Aeq} (Project plus A-Pit North) and 27 dBA L_{Aeq} (Project plus A-Pit South), both occurring at Tarkari and under adverse weather conditions. These predicted noise levels are within the 25-27 dBA L_{Aeq} range, which is considered to be equivalent to the EA noise limit of 30 dBA L_{A10}. For both scenarios, the dominant predicted noise sources at the Tarkari are associated with mobile mining equipment working in the A-Pit area, with Project attributable noise levels being 9-10 dBA lower than A-Pit attributable noise levels.

As noted in Section 5.3, these concurrent scenarios represent worst case noise predictions and technically may not line up with the mine schedule at the time of operations (ie the Project occurring at the same time as Strip 1 for A-Pit North or Strip 1 for A-Pit South).

All other concurrent mine operations noise levels (presented in Table 10 and Table 11) are predicted be 24 dBA L_{Aeq} or less under adverse weather.

Noise contours for these concurrent mine operation scenarios are contained in Appendix E.

On the basis of the above findings, specific noise mitigation measures are not warranted for the proposed concurrent mine operations at Millennium Mine. Notwithstanding these findings, best practice noise mitigation and management measures are outlined in Section 7.0.

6.4 Cumulative Noise

Table 12 provides a summary of relevant EA night-time noise limits for each of the noted mines/ infrastructure areas immediately surrounding Millennium Mine, the Project and the assessed noise sensitive receptors. The focus for this comparison is on noise limits applicable to more steady-state noise emissions (ie L_{Aeq}, L_{A10}) rather than short-term L_{A1}/L_{Amax} noise limits. This comparison also focuses on 'Sensitive Places' and not 'Commercial Places' as no commercial place has been identified for the Project assessment. In addition to the summary of applicable noise limits, it is also important to put into context the planned coal extraction rates for the Project in comparison to the approved ROM coal tonnage rates for each of these mines (where reported). Summaries of these rates have also been added to Table 12.

Table 12 Cumulative Noise – Review of Relevant EA Night-time Noise Limits (Sensitive Places) and ROM Coal Mtpa Rates

Mine/Infrastructure Area	Night-time Noise Limit (as reported)	Night-time Noise Limit Expressed as an Equivalent L_{Aeq} Level	ROM Coal Extraction Rate (Mtpa)
Millennium Mine	B/g + 0 $L_{A10,adj,10mins}$ 30 dBA $L_{A10,adj,10mins}$ [1]	25-27 dBA $L_{Aeq,adj,10mins}$	5.5
RMI CHPP	B/g + 0 $L_{A10,adj,10mins}$ 30 dBA $L_{A10,adj,10mins}$ [1]	25-27 dBA $L_{Aeq,adj,10mins}$	-
Poitrel Mine	35 dBA $L_{Aeq,adj,1hr}$	35 dBA $L_{Aeq,adj,1hr}$	7.0
Daunia Mine	B/g + 3 $L_{Aeq,adj,10mins}$ 33 dBA $L_{Aeq,adj,10mins}$ [1]	33 dBA $L_{Aeq,adj,10mins}$	4.5
Carborough Downs Coal Mine	B/g + 0 $L_{A10,adj,10mins}$ 30 dBA $L_{A10,adj,10mins}$ [1]	25-27 dBA $L_{Aeq,adj,10mins}$	5
Moorvale Mine	Min $L_{A90,15min}$ plus 3 33 dBA $L_{A90,15mins}$ [1]	36 dBA $L_{Aeq,adj,15mins}$ [2]	1.5
Moorvale South Mine	30 + 0 $L_{A10,adj,10mins}$ 30 dBA $L_{A10,adj,10mins}$	25-27 dBA $L_{Aeq,adj,10mins}$	2.0

Note 1: Equivalent night-time noise limit adopting the MMC deemed minimum background noise level of 30 dBA.

Note 2: This equivalent LAeq noise level assumes a conservative 3 dB relationship between LA90 and LAeq representing steady state mine noise throughout a given 15-minute period. For time vary mine noise, this relationship would be much greater and difficult to estimate a standard number.

Adapting the predicted Project noise levels reported in Table 9 to the L_{Aeq} equivalent night-time noise levels summarised in Table 12, with reference to Tarkari which had the highest predicted noise level of 17 dBA L_{Aeq}, this predicted noise level is generally 10 dBA or greater below the summarised night-time noise levels. Where a noise source is 10 dBA (or greater) below another noise source, the cumulative noise level of the two (2) sources when logarithmically summed is no greater than the higher noise level. Therefore where noise levels from these surrounding mines and infrastructure are achieving their respective L_{Aeq} equivalent night-time noise level, cumulative noise issues with the inclusion of the Project are not expected.

Regarding a comparison to concurrent operational noise levels at Millennium Mine, with reference to Tarkari which had the highest predicted noise level of 26 to 27 dBA L_{Aeq} depending on scenario, these predicted noise levels are comparable to the L_{Aeq} equivalent night-time noise levels for a number of noted mine EA (namely RMI CHPP, Carborough Downs Coal Mine and Moorvale South Mine). As noted in Section 6.3, these concurrent operational noise levels at Tarkari are dominated by the approved open-cut coal mining in A-Pit, with the Project's attributable noise levels being

9-10 dBA lower than A-Pit attributable noise levels. Of these noted mines/infrastructure areas, Carborough Downs Coal Mine is the only mine within a proximity to Takari homestead (ie within 5 km) that could generate noise levels nearing the L_{Aeq} equivalent night-time noise level of 25-27 dBA L_{Aeq}. SLR understands that Tarkari is owned by Carborough Downs Coal Mine, therefore this receptor would be considered non-noise sensitive to Carborough Downs Coal Mine operations and their EA noise limits do not apply. This inherently manages any cumulative noise issues from operational mine noise for these two (2) mines as experienced at Tarkari.

Regarding extraction rates, the Project proposes to extract 854,000 tonnes of ROM coal over an approximate 12-month period. Similarly, the approved A-Pit project has targeted 884,000 tonnes of ROM coal to be extracted over a 20-month period (mining in A-Pit has already commenced). Both values are well below the approved 5.5 Mtpa ROM coal rate for Millennium Mine. The proposed ROM coal extraction amount for the Project when expressed as an Mtpa value, being 0.85 Mtpa, is the lowest of the surrounding mines considered in this review.

7.0 Recommendations

As no operations under the Project are predicted to exceed the nominated noise criteria, no specific mitigation measures are warranted for operational noise from the Project. Similarly, concurrent Millennium Mine operational noise levels are predicted within the 25-27 dBA L_{Aeq} range, which is considered to be equivalent to the EA noise limit of 30 dBA L_{A10}, therefore no specific mitigation measures are warranted for concurrent Millennium Mine operations.

In stating these findings, it is important to note the following points regarding the Project:

- The Project involves underground mining with minimal surface activities (ie noise generating activities).
- The Project proposes to extract approximately 854,000 tonnes of ROM coal over an approximate 12-month period. In consideration of concurrent mine operational activities, the proposed extension remains within EA EPML00819213 approved extraction rate of 5.5 Mtpa.
- Concurrent mining scenarios represent worst case noise predictions and technically may not line up with the mine schedule at the time of operations.

Notwithstanding this finding, the following best practise advice is provided for consideration during mine planning and operations to minimise off-site noise levels during the Project operations:

- Avoid clustering of mobile equipment on haul roads and other exposed/elevated areas, such as during shift changeovers. Haul truck arrival and departures from go lines should be staggered where possible.
- Dumping of material can include engineering controls to minimise the distance the material falls and lining bins and chutes with rubber to dampen the impact.
- Equipment should be shut down when not in use.
- All equipment should be operated in accordance with the manufacturer's instruction and in order to minimise noise impact events.
- Broadband "buzzer", not tonal "beeper", reversing alarms should be utilised on all mobile plant.
- In the event of a complaint regarding potential impulsive noise disturbance such as dozer track slap, this could be minimised through idle wheel modification, use of track slides and grousers, and management controls such as gear limitation (forward and reverse in 1st gear only).
- As a continuation of current site practice, M Mining should keep records of any noise complaints received during the operations of the Project area and investigate noise management options for verified complaints.

8.0 Conclusion

This technical noise assessment has modelled a typical worst-case operational mining scenario for the proposed Mavis South Underground Project at Millennium Mine and assessed the predicted noise levels at surrounding noise sensitive receptors against the applicable noise limits contained within the existing Millennium Mine EA EPML00819213. Additional concurrent mine operations scenarios have also been assessed incorporating modelled noise levels from the approved A-Pit North and South open cut mine operations at Millennium Mine. This assessment has identified the following:

- The highest predicted noise level from the proposed Project is 17 dBA L_{Aeq} at Tarkari (under the adverse weather conditions) which is compliant with the 25-27 dBA L_{Aeq}, considered to be equivalent to the EA noise limit of 30 dBA L_{A10}. All other Project noise levels are predicted to be 15 dBA L_{Aeq} or below.
- The Project predicted noise level at Tarkari homestead is largely dominated by the haul trucks on the rejects and tailings haul routes, which are the closest Project sources to this receptor. The noise contribution of all fixed plant sources are negligible at Tarkari.
- The highest predicted noise levels from the concurrent mine operations are 26 dBA L_{Aeq} (Project plus A-Pit North Strip 1) and 27 dBA L_{Aeq} (Project plus A-Pit South Strip 1), both occurring at Tarkari and under adverse weather conditions. These predicted noise levels are within the 25-27 dBA LAeq range, which is considered to be equivalent to the EA noise limit of 30 dBA L_{A10}. For both scenarios, the dominant predicted noise sources at the Tarkari are associated with mobile mining equipment working in the A-Pit area, with Project attributable noise levels being 9-10 dBA lower than A-Pit attributable noise levels.
- The concurrent scenarios represent worst case noise predictions and technically may not line up with the mine schedule at the time of operations (ie the Project occurring at the same time as Strip 1 for A-Pit North or Strip 1 for A-Pit South).
- All other concurrent mine operations noise levels are predicted be 24 dBA L_{Aeq} or less under adverse weather.

On the basis of the above findings, specific noise mitigation measures are not warranted for the proposed Project and concurrent mine operations at Millennium Mine. Notwithstanding these findings, best practice noise mitigation and management measures should be maintained including record keeping of any noise complaints received during the operations of the Project area and investigate noise management options for verified complaints.

9.0 References

Legislation (Queensland)

Queensland *Environmental Protection Act* 1994

Guidelines, Standards, EAs etc

Queensland Department of Environment and Science's *Environmental Authority EPML00819213* June 2023

Queensland Department of Environment and Science's *Environmental Authority EPML00819113* July 2022

Queensland Department of Environment and Science's *Environmental Authority EPML00963013* November 2022

Queensland Department of Environment and Science's *Environmental Authority EPML00561913* June 2022

Queensland Department of Environment and Science's *Environmental Authority EPML00959213* March 2023

Queensland Department of Environment and Science's *Environmental Authority EPML00802813* August 2023

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Queensland Department of Environment and Science's *Application Requirements for Activities with Noise Impacts* Guideline 2017

Queensland Department of Environment and Science's *Model Mining Conditions* Guideline 2017

Queensland Department of Environment and Science's *Noise guideline: assessment of low frequency noise* 2005 (Draft). Unpublished.

Queensland Department of Environment and Science's *Noise Measurement Manual* 2020

Queensland Department of Environment and Science's *Planning for Noise Control* Guideline 2004 (under review by DES – not currently an approved DES guideline)

Queensland Department of Environment and Science's *Streamlined Model Conditions for Petroleum Activities* Guideline 2016

Appendix A Acoustic Terminology

Mavis South Underground Project

Noise Impact Assessment

MetRes Pty Ltd

SLR Project No.: 620.V14283.00001

30 October 2023

Sound Level (or Noise Level)

The terms sound and noise are almost interchangeable, except that in common usage noise is often used to refer to unwanted sound.

Sound (or noise) consists of minute fluctuations in atmospheric pressure capable of evoking the sense of hearing. The human ear (and those of other species) responds to changes in sound pressure over a very wide range. The loudest sound pressure to which the human ear responds is ten million times greater than the softest. The decibel (dB or dBL) scale reduces this ratio to a more manageable size by the use of logarithms.

A-weighted Sound Pressure Level

The overall level of a sound is usually expressed in terms of dBA, which is measured using a sound level meter with an 'A-weighting' filter. This is an electronic filter having a frequency response corresponding approximately to human hearing.

Sound Power Level

The sound power of a source is the rate at which it emits acoustic energy. As with sound pressure, sound power levels (SWL) are expressed in dB units, but are identified by the symbols SWL.

The relationship between sound power and sound pressure may be likened to an electric radiator, which is characterised by a power rating but has an effect on the surrounding environment that can be measured in terms of a different parameter, temperature.

Change in Sound Pressure Levels

For human perception, a change of 1 dBA or 2 dBA in the level of a sound is considered to be indiscernible, while a 3 dBA to 5 dBA change corresponds to a small but noticeable change in loudness. A 10 dBA change corresponds to an approximate doubling or halving in loudness.

Typical Sound Pressure Levels

The table below lists examples of typical sound pressure levels.

Table A1 Examples of Typical Sound Pressure Levels

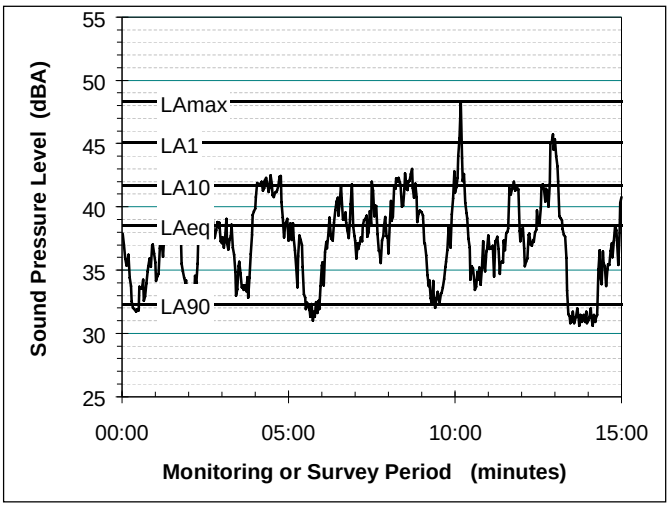
Sound Pressure Level (dBA)	Typical Example	Subjective (Human) Evaluation
130	Threshold of pain	Intolerable
120	Metal hammering	Extremely noisy
110	Grinding on steel	
100	Loud car horn at 3 metres (m)	Very noisy
90	Dog bark at 1 m	
80	Cicadas at 1 m	Loud
70	Noise level directly adjacent to a busy main road	
60	Ambient noise level in urban area close to main roads	Moderate to quiet
50	Typical rural environment with high insect noise or close to a main road	
40	Ambient noise level in a rural environment with light breezes and some noise from insects, birds and distant traffic	Quiet to very quiet
30	Ambient noise level in a typical rural noise environment in the absence of insect noise and wind	
20	Ambient noise level in remote and quiet rural environment away from main roads with no wind and no insect noise	Almost silent

Statistical Noise Levels

Sounds that vary in level over time, such as road traffic noise and most community noise, are commonly described in terms of the statistical exceedance levels (LAN), where LAN is the A-weighted sound pressure level exceeded for N% of a given measurement period. For example, the LA1 is the noise level exceeded for 1% of the time and LA10 the noise exceeded for 10% of the time.

Figure A1 below presents a hypothetical 15 minute noise measurement, illustrating various common statistical indices of interest.

Figure A1 Hypothetical 15 Minute Noise Measurement



Of particular relevance to this study, are:

- L_{Amax} The A-weighted maximum sound pressure level of any given measurement period.
- L_{A1} The A-weighted noise level exceeded for 1% during any given measurement period.
- L_{A10} The A-weighted noise level exceeded for 10% during any given measurement period. This is commonly referred to as the average maximum noise level.
- L_{A90} The A-weighted noise level exceeded for 90% during any given measurement period, often referred to as the 'background' noise level.
- L_{Aeq} The A-weighted equivalent noise level (basically the average noise level). It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.

Noise Propagation

Provided the receptor is in the far-field of the noise source, noise levels will reduce as a receptor moves further away from the source. This is due to spreading of the noise source energy over distance. For a simple point source (for example, a motor) the theoretical reduction in noise levels is 6 dBA per doubling of distance. For a line source (for example, a busy road) the theoretical reduction is 3 dBA per doubling of distance. In reality however other factors affect noise propagation. These include ground absorption, air absorption, acoustic screening and meteorological effects.

Meteorological Effects

At distances over 500 m, meteorological affects (for example, local weather and atmospheric conditions) can substantially enhance or impair noise propagation. The most influential meteorological conditions on noise propagation are wind speed and direction and the occurrence of temperature inversions. Ambient air temperature and humidity and atmospheric pressure also affect noise propagation although to a lesser extent than wind and temperature inversions.

Wind Conditions

Wind conditions enhance noise propagation when the wind is blowing from a noise source towards a receptor and therefore noise levels at the receptor will be higher under these conditions. The wind can be thought to carry the noise in the direction it is heading. Where winds blow from the receptor towards the source, the propagation of noise is impaired and therefore lower noise levels will be experienced at the receptor.

It is important to consider the effect of prevailing wind conditions when assessing noise propagation over larger distances. Wind roses, which graph long term variations in wind speed and direction, are a useful tool for analysing prevailing wind conditions where available.

Temperature Inversions

Temperature inversions are a meteorological phenomenon where a layer of cold air is trapped at the ground surface under a layer of warmer air. Temperature inversions enhance noise propagation because sound travelling away from the ground is reflected back down from where the colder air meets the warmer air due to the change in pressure between the two layers.

Conditions that favour the development of a strong surface inversion are nights with calm winds and clear skies. Calm winds prevent warmer air above the surface from mixing down to the ground, and clear skies increase the rate of cooling at the Earth's surface. It is therefore important to consider the effect of temperature inversions when assessing noise propagation over larger distances and during night-time periods.

Appendix B Wind Roses

Mavis South Underground Project

Noise Impact Assessment

MetRes Pty Ltd

SLR Project No.: 620.V14283.00001

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Figure B1 Wind Roses – Daytime

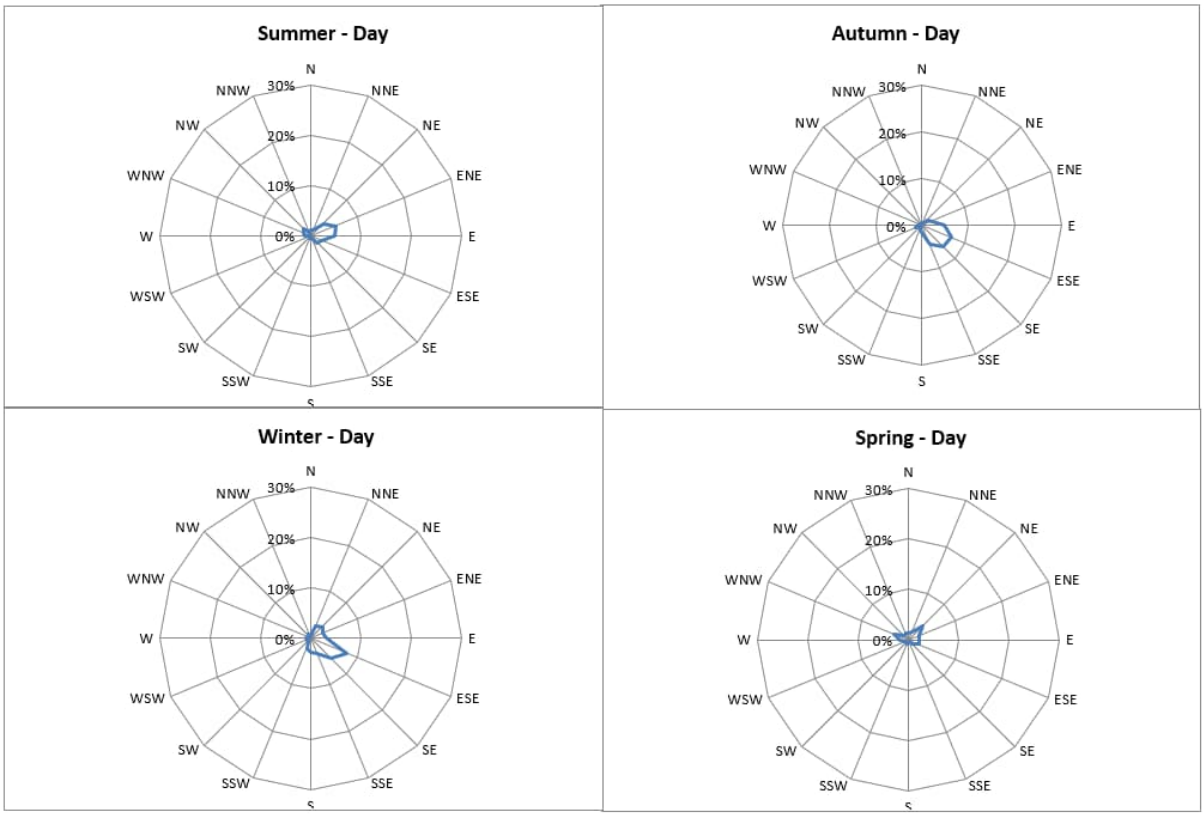


Figure B2 Wind Roses – Evening

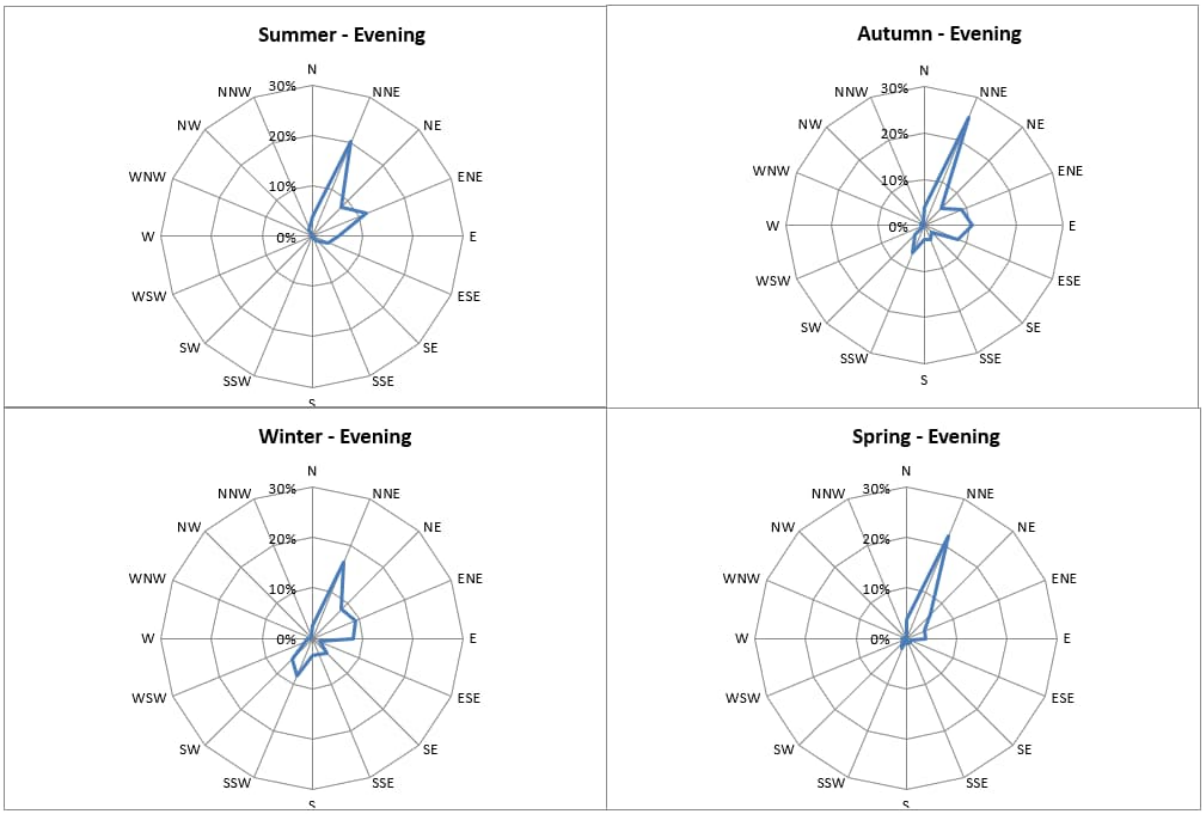
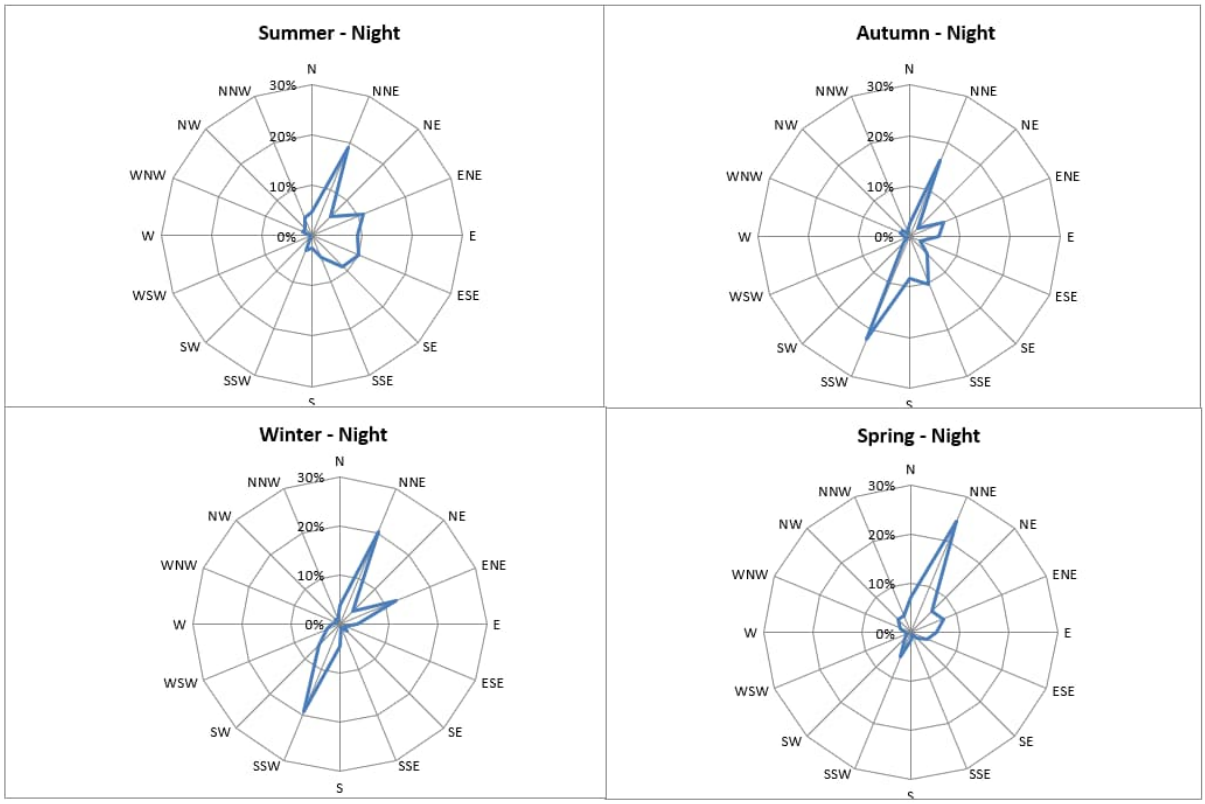


Figure B3 Wind Roses – Night-time



Appendix C Modelled Project Mining Equipment – Mobile and Fixed

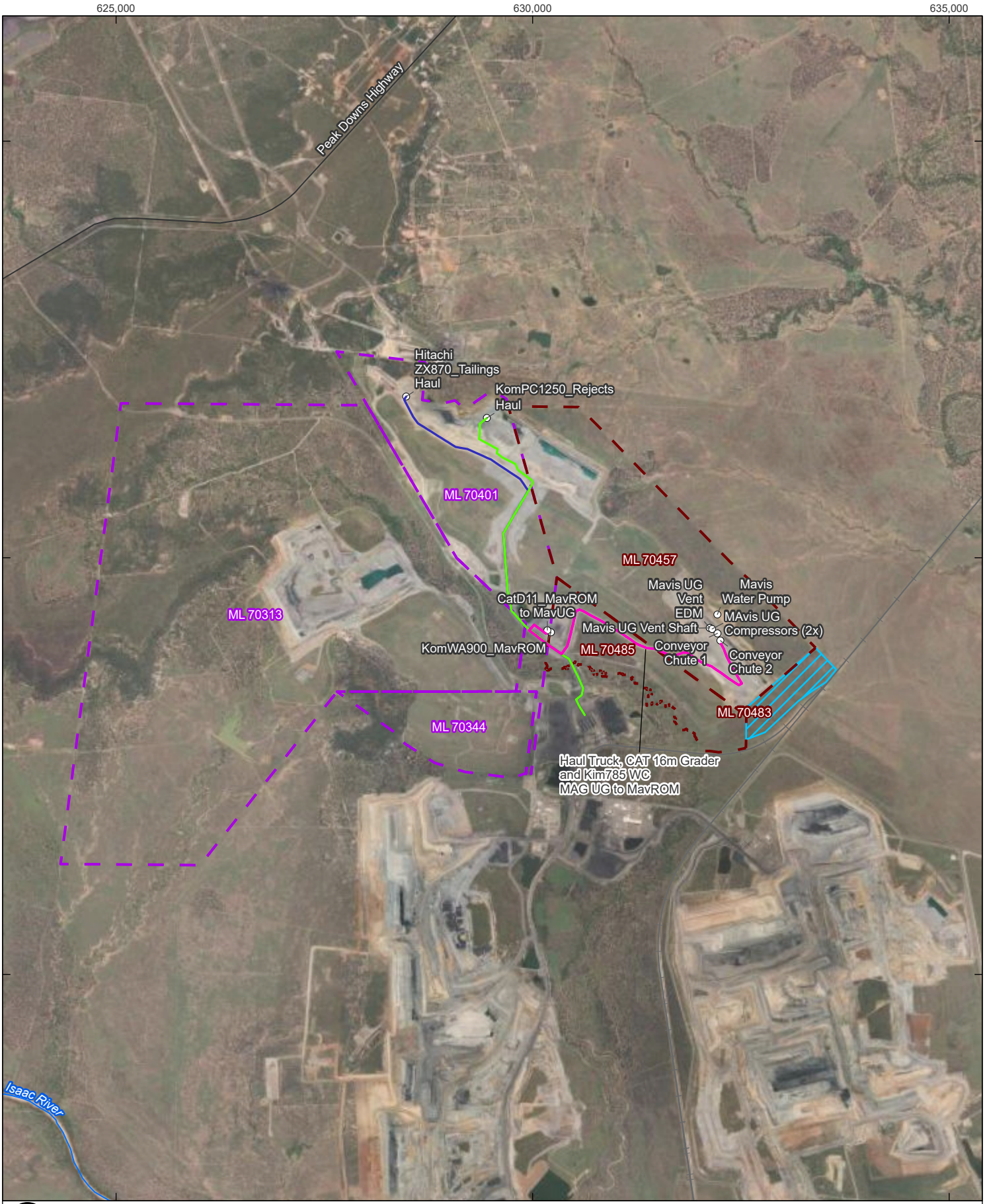
Mavis South Underground Project

Noise Impact Assessment

MetRes Pty Ltd

SLR Project No.: 620.V14283.00001

30 October 2023



0 1 2 km

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:60,000 at A4
Project Number:	620.14283.00001
Date Drawn:	29-Aug-2023
Drawn by:	AS

LEGEND

- Mobile and Fixed Mining Equiptment
- **Mobile Mining Equiptment**
- MavUG Portal to MavROM
- Haul Truck_CHPP to Rejects
- Haul Truck_CHPP to Tailings
- Major Watercourse
- Railway
- Road
- Mavis Mine Lease
- Millennium Mine Lease
- Project Area

MAVIS SOUTH UNDERGROUND PROJECT
NOISE IMPACT ASSESSMENT

MODELLED PROJECT MINING EQUIPMENT – MOBILE AND FIXED

SLR

APPENDIX C

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Appendix D Noise Contours – Project Operations

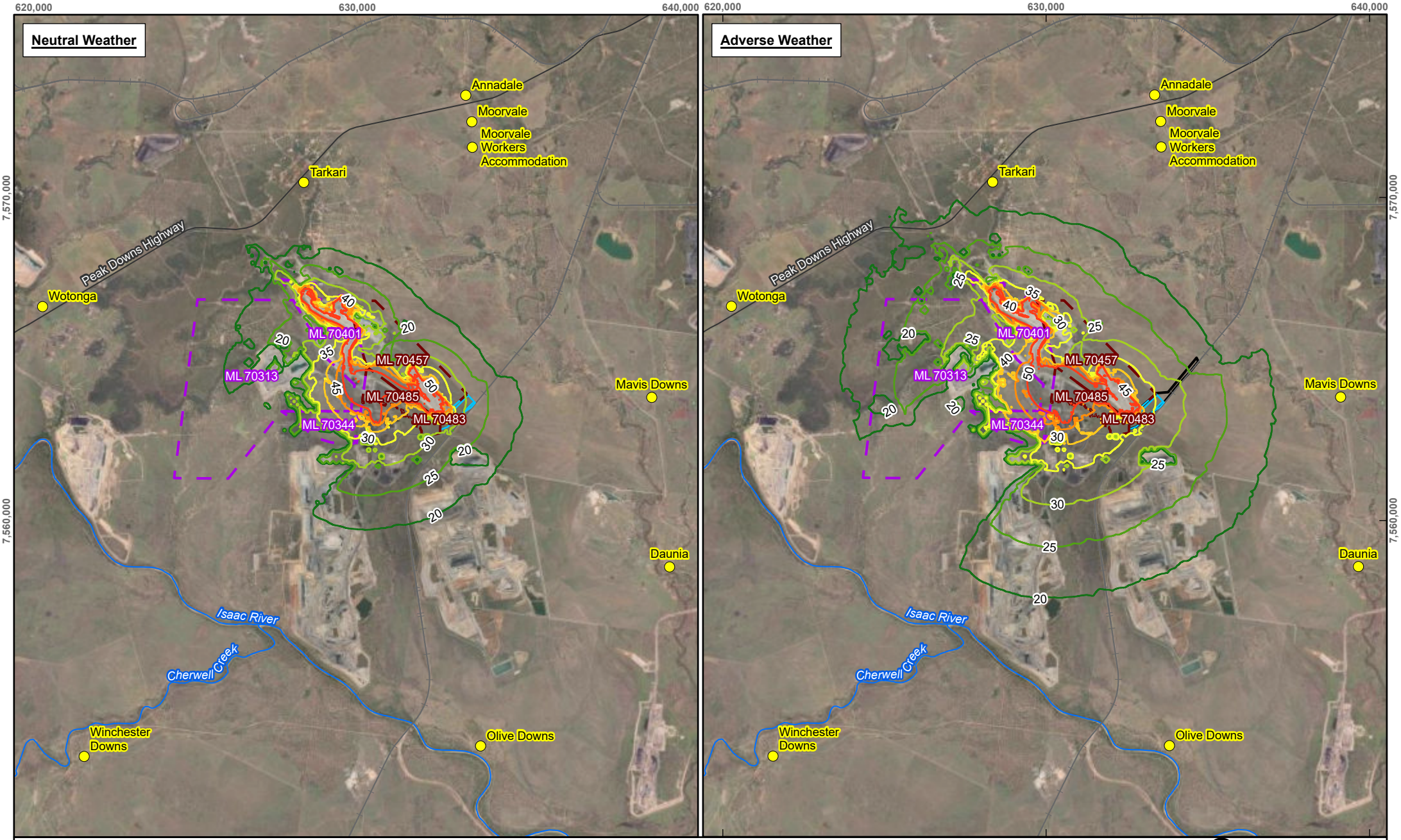
Mavis South Underground Project

Noise Impact Assessment

MetRes Pty Ltd

SLR Project No.: 620.V14283.00001

30 October 2023



0 2.5 5 km

Scale: 1:150,000 at A4
Coordinate System: GDA 1994 MGA Zone 55

Date Drawn: 29-Aug-2023
Project Number: 620.14283

Sensitive Receptor
Major Watercourse
Road
Railway
Mavis Mine Lease
Millennium Mine Lease
Project Area

Noise Levels dBA LAeq

20
25
30
35
40
45
50

MAVIS SOUTH UNDERGROUND PROJECT
NOISE IMPACT ASSESSMENT

NOISE CONTOURS – PROJECT OPERATIONS

APPENDX D

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Appendix E Noise Contours – Concurrent Millennium Mine Operations (Project plus A-Pit)

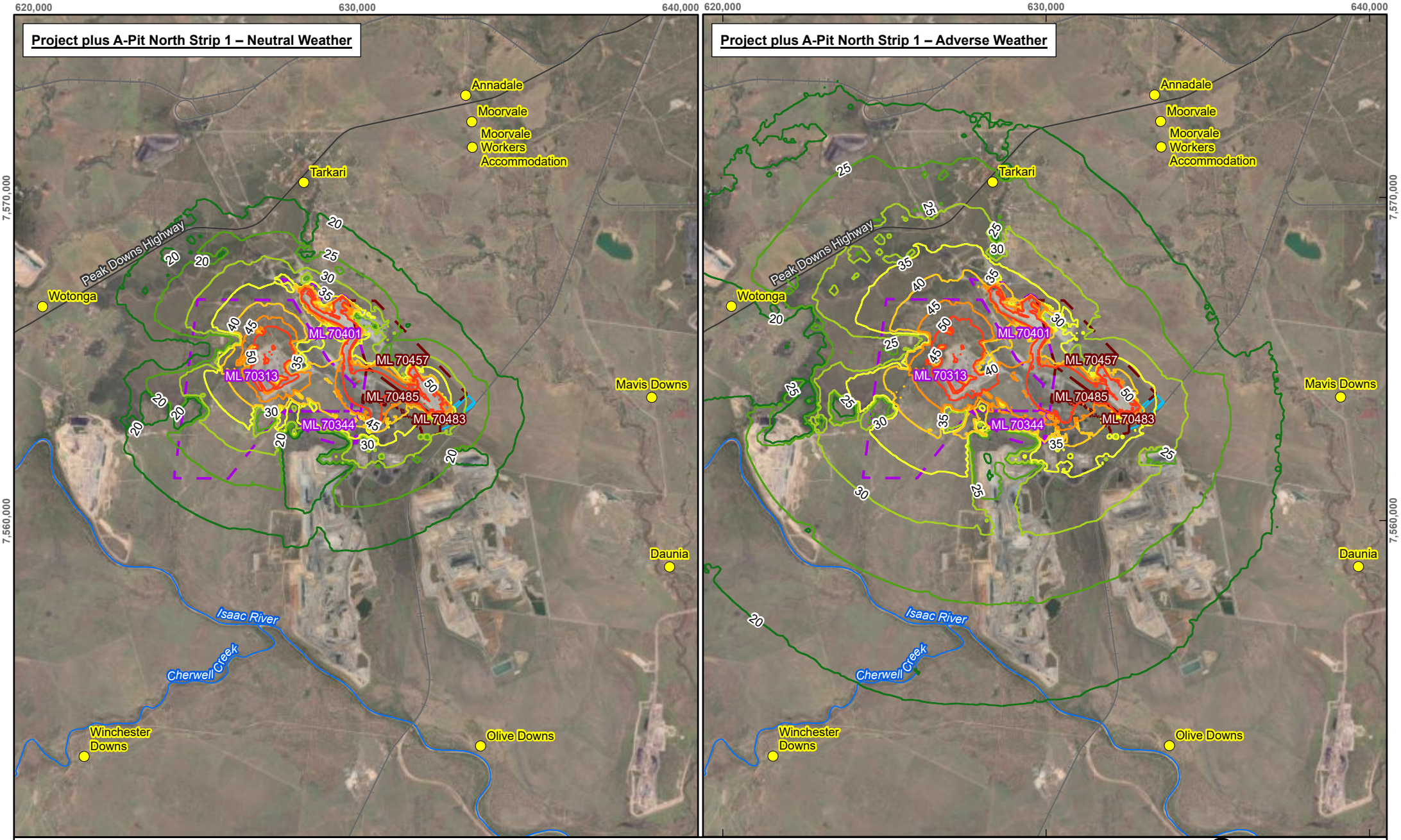
Mavis South Underground Project

Noise Impact Assessment

MetRes Pty Ltd

SLR Project No.: 620.V14283.00001

30 October 2023



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MAVIS SOUTH UNDERGROUND PROJECT NOISE IMPACT ASSESSMENT

NOISE CONTOURS – CONCURRENT MILLENNIUM MINE OPERATIONS

APPENDX E-1

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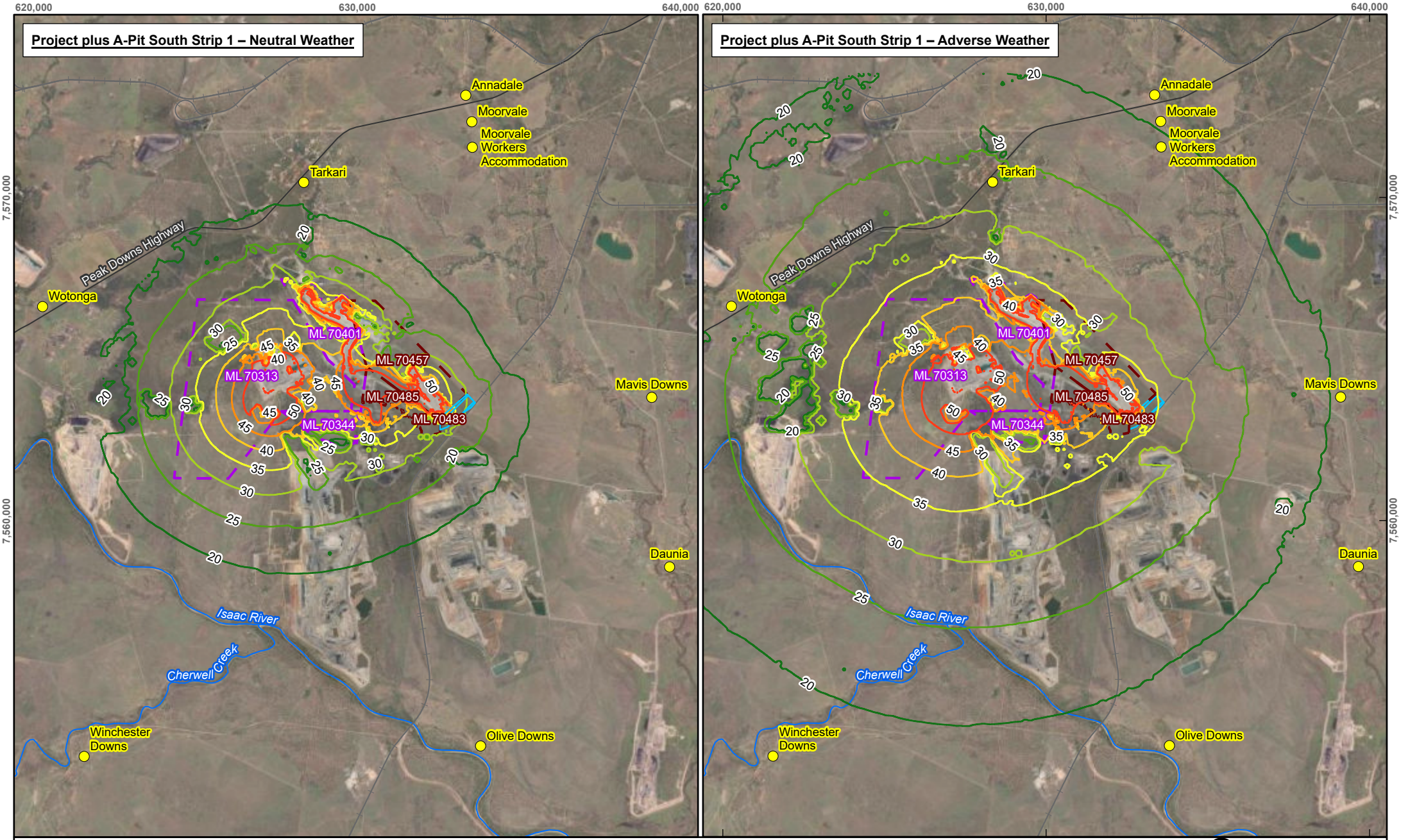

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MAVIS SOUTH UNDERGROUND PROJECT
NOISE IMPACT ASSESSMENT

NOISE CONTOURS – CONCURRENT MILLENNIUM MINE OPERATIONS

APPENDIX E-2

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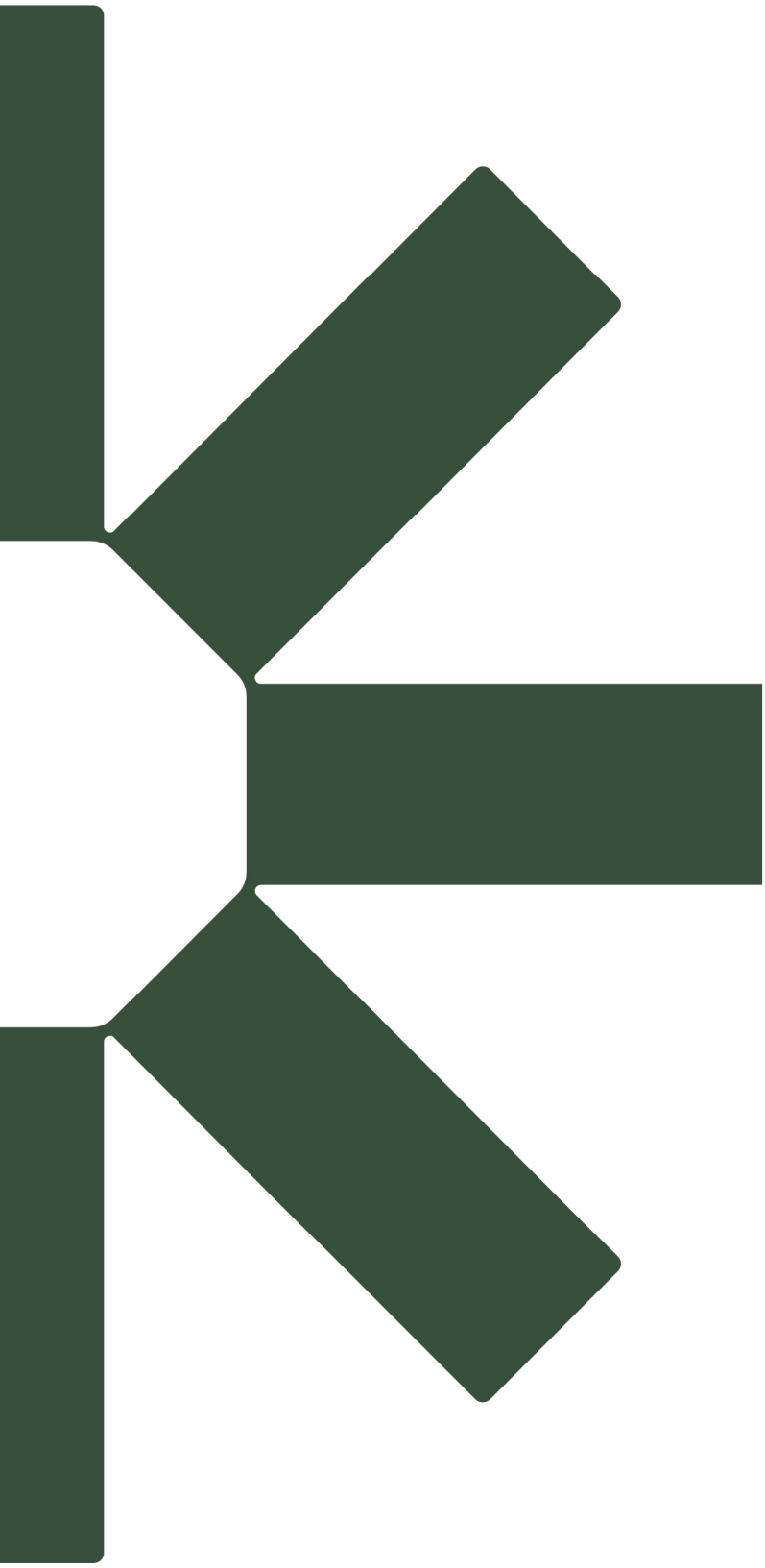

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