SARAJI EAST MINING LEASE PROJECT

Environmental Impact Statement

Chapter 12
Noise and Vibration

BMA
BHP Mitsubishi Alliance

Table of Contents

12.0 Noise and Vibration 12-1
12.1 Introduction 12-1
12.2 Legislation, policies and guidelines 12-1
12.2.1 Environmental Protection Act 1994 and Environmental Protection Regulation 2019 12-1
12.2.2 Environmental Protection (Noise) Policy 2019 12-2
12.2.3 Model mining conditions 12-2
12.2.4 World Health Organization Guidelines for Community Noise 1999 12-3
12.2.5 enHealth 12-3
12.3 Methodology 12-3
12.3.1 Overview 12-3
12.3.2 Mine noise criteria 12-4
12.3.3 Modelling methodology 12-5
12.3.4 Construction and operation assessment scenarios 12-5
12.3.5 Cumulative noise assessment methodology 12-6
12.4 Description of environmental values 12-7
12.4.1 Sensitive receptors 12-7
12.4.2 Measured noise levels 12-10
12.5 Potential impacts 12-10
12.5.1 $L_{Aeq(1h)}$ mine noise impact 12-10
12.5.2 $L_{A1(1h)}$ noise impact 12-24
12.5.3 Low frequency noise impact 12-36
12.5.4 Cumulative noise impacts 12-38
12.6 Mitigation measures 12-40
12.7 Summary 12-41

Table of figures

Figure 12-1 Sensitive receptor locations 12-9
Figure 12-2 Construction Phase 1 (Project Year 1) – worst-case meteorological conditions – $L_{Aeq(1h)}$ free-field noise levels 12-13
Figure 12-3 Construction Phase 1 (Project Year 1) – neutral meteorological conditions – $L_{Aeq(1h)}$ free-field noise levels 12-14
Figure 12-4 Construction Phase 2.1 and Operation Phase – powerline and water line construction near Meadowbrook Homestead – worst-case meteorological conditions – $L_{Aeq(1h)}$ free-field noise levels 12-15
Figure 12-5 Construction Phase 2.1 and Operational Phase – powerline and water line construction near Meadowbrook Homestead – neutral meteorological conditions – $L_{Aeq(1h)}$ free-field noise levels 12-16
Figure 12-6 Construction Phase 2.2 and Operational Phase – powerline and water line construction near Kyewong and Tay Glen Homesteads – worst-case meteorological conditions – $L_{Aeq(1h)}$ free-field noise levels 12-17
Figure 12-7 Construction Phase 2.2 and Operational Phase – powerline and water line construction near Lake Vermont Homestead – neutral meteorological conditions – $L_{Aeq(1h)}$ free-field noise levels 12-18
Figure 12-8 Construction Phase 2.3 and Operational Phase – powerline and water line construction near Kyewong and Tay Glen Homesteads – worst-case meteorological conditions – $L_{Aeq(1h)}$ free-field noise levels 12-19
Figure 12-9 Construction Phase 2.3 and Operational Phase – powerline and water line construction near Kyewong and Tay Glen Homesteads– neutral meteorological conditions – $L_{Aeq(1h)}$ free-field noise levels 12-20
Figure 12-10 Operational Only Phase – worst-case meteorological conditions – $L_{Aeq(1h)}$ free-field noise levels 12-21
Figure 12-11 Operational Only Phase – neutral meteorological conditions – $L_{Aeq(1h)}$ free-field noise levels 12-22

Figure 12-12 Construction Phase 1 – worst-case meteorological conditions – $L_{A1(1h)}$ free-field noise levels 12-26
Figure 12-13 Construction Phase 1 – neutral meteorological conditions – $L_{A1(1h)}$ free-field noise levels 12-27
Figure 12-14 Construction Phase 2.1 and Operational Phase – powerline and water line construction near Meadowbrook Homestead – worst-case meteorological conditions – $L_{A1(1h)}$ free-field noise levels 12-28
Figure 12-15 Construction Phase 2.1 and Operational Phase – powerline and water line construction near Meadowbrook Homestead – neutral meteorological conditions – $L_{A1(1h)}$ free-field noise levels 12-29
Figure 12-16 Construction Phase 2.2 and Operational Phase – powerline and water line construction near Lake Vermont Homestead - worst-case meteorological conditions – $L_{A1(1h)}$ free-field noise levels 12-30
Figure 12-17 Construction Phase 2.2 and Operational Phase – powerline and water line construction near Lake Vermont Homestead – neutral meteorological conditions – $L_{A1(1h)}$ free-field noise levels 12-31
Figure 12-18 Construction Phase 2.3 and Operational Phase – powerline and water line construction near Kyewong and Tay Glen Homesteads - worst-case meteorological conditions – $L_{A1(1h)}$ free-field noise levels 12-32
Figure 12-19 Construction Phase 2.3 and Operational Phase – powerline and water line construction near Kyewong and Tay Glen Homesteads – neutral meteorological conditions – $L_{A1(1h)}$ free-field noise levels 12-33
Figure 12-20 Operational Only Phase - worst-case meteorological conditions – $L_{A1(1h)}$ free-field noise levels 12-34
Figure 12-21 Operational Only Phase – neutral meteorological conditions – $L_{A1(1h)}$ free-field noise levels 12-35

Table of tables

Table 12-1 EPP (Noise) acoustic quality objectives 12-2
Table 12-2 Summary of EPP (Noise) background creep criteria 12-2
Table 12-3 MMC17 noise criteria 12-3
Table 12-4 Summary of WHO Guideline noise levels 12-3
Table 12-5 Summary of Project specific external noise criteria 12-4
Table 12-6 Summary of low frequency noise screening assessment at sensitive receptors 12-4
Table 12-7 Subjective effect of increases in noise levels 12-5
Table 12-8 Meteorological noise modelling parameters 12-5
Table 12-9 Assessment scenarios 12-6
Table 12-10 Predicted operational noise impacts from Saraji Mine, including the Grevillia Pit Extension 12-7
Table 12-11 Identified sensitive receptors nearest to the Project 12-7
Table 12-12 Summary of measured noise levels 12-10
Table 12-13 Predicted external $L_{Aeq(1h)}$ noise impact to nearby receptors under neutral and worst-case meteorological conditions 12-12
Table 12-14 Summary of impacts of $L_{Aeq(1h)}$ at each receptor 12-23
Table 12-15 Predicted external $L_{A1(1h)}$ noise impact to nearby receptors 12-25
Table 12-16 Summary of impacts of $L_{A1(1h)}$ at each receptor 12-36
Table 12-17 Predicted external LLINeq(T) noise impact to nearby receptors 12-37
Table 12-18 Summary of low frequency noise impacts 12-38
Table 12-19 Predicted increase in road traffic noise levels due to the Project 12-38
Table 12-20 Predicted increase in rail traffic noise levels due to the Project 12-39
Table 12-21 Predicted increase in industrial noise impact to nearby receptors due to the Project 12-39

12.0 Noise and Vibration

12.1 Introduction

BM Alliance Coal Operations Pty Ltd (BMA) is seeking approval to develop the Saraji East Mining Lease Project (the Project) involving a single-seam underground mine and supporting infrastructure on Mining Lease Application (MLA) 70383 and MLA 70459 adjacent to, and accessed through, the existing open cut mine void within Mining Lease (ML) 1775.

Construction will commence following grant of relevant approvals and BMA's decision to proceed with the Project. Given the uncertainty of actual timing, the Project will be based on the timing assumptions adopted to date for impact assessment purposes. Should the remainder of the Project assessment process be resolved quickly, with Project construction can be assumed to commence in 2023 (Year 1), and mining assumed to commence in 2025 (Year 3), with full operation anticipated in the third year of operations through to end of mining (Year 22).

This chapter of the Environmental Impact Statement (EIS) summarises the noise and vibration impact assessment undertaken for the Project. The detailed assessment of the potential noise and vibration impacts associated with the Project is provided in **Appendix I-1 Noise and Vibration Technical Report**.

In this chapter the following noise level abbreviations are used:

- 'A' weighted: Frequency filter applied to measured noise levels to represent how humans hear sounds
- dB(A): decibels measured on the 'A' Weighted overall sound pressure level
- $L_{Aeq(T)}$: A-weighted energy-averaged noise level over the measurement period (T)
- $L_{LINeq(T)}$: Linear weighted energy-averaged noise level over the measurement period (T)
- $L_{Amax(T)}$: The maximum A-weighted noise level over the measurement period (T)
- L_{01}: Noise level exceeded for 1 per cent of the measurement period. The L_{01} represents a 'typical maximum' noise level and is often used to represent intermittent noises
- L_{10}: Noise level exceeded for 10 per cent of the measurement period. The L_{10} represents the intrusive noise level and is often used to represent traffic/ music noise
- L_{90}: Noise level exceeded for 90 per cent of the measurement period. This represents the background noise level excluding nearby sources.

12.2 Legislation, policies and guidelines

The following section discusses legislation, policies and guidelines relevant to assessing industrial noise in Queensland.

12.2.1 Environmental Protection Act 1994 and Environmental Protection Regulation 2019

The key piece of legislation in Queensland for assessing potential environmental impacts associated with development is the *Environmental Protection Act 1994* (EP Act). Performance outcomes are provided in the subordinate Environmental Protection Regulation 2019 (EP Regulation). The performance outcomes comprise:

- Item 1: Sound from the activity is not audible at a sensitive receptor
- Item 2: The release of sound to the environment from the activity is managed so that adverse effects on environmental values including health and wellbeing and sensitive ecosystems are prevented or minimised.

The EP Regulation further clarifies that either Item 1 or Item 2 of the performance outcomes is to be achieved. Due to the relative proximity of some Project-related activities to sensitive receptors, the Project is unlikely to achieve Item 1 during some activities and some meteorological conditions. This

assessment has focused on satisfying Item 2 of the performance outcome. The environmental values discussed in this performance outcome are detailed in the Environmental Protection (Noise) Policy 2019 (EPP (Noise)).

12.2.2 Environmental Protection (Noise) Policy 2019

The purpose of the EPP (Noise) is to achieve the objective of the EP Act in relation to the acoustic environment. It achieves this through identifying environmental values to be enhanced or protected to avoid environmental harm, stating acoustic quality objectives for enhancing or protecting these environmental values, and providing a framework for making decisions in relation to the acoustic environment.

Environmental values to be protected under the policy include the health and biodiversity of ecosystems, human health and wellbeing, and the amenity of the community. Most of the sensitive receptors surrounding the Project Site are residential. It is at these locations where human health and wellbeing is the key environmental value to be protected, including the ability to sleep, study, learn and to be involved in recreation and conversation.

Schedule 1 of the EPP (Noise) details acoustic quality objectives, as summarised in Table 12-1. These limits are designed to be long-term noise limits and are not applied to any individual project or enterprise. They can however inform the decision-making process around the limits and can assist in identifying whether the environmental values are protected.

Table 12-1 EPP (Noise) acoustic quality objectives

Receptor	Time of day	Acoustic quality objectives dB(A)			Environmental value
		$L_{Aeq,adj,1h}$	$L_{A10,adj,1h}$	$L_{A1,adj,1h}$	
Residence (for outdoors)	Daytime and evening	50	55	65	Health and wellbeing
Residence (for indoors)	Daytime and Evening	35	40	45	Health and wellbeing
	Night-time	30	35	40	Health and wellbeing in relation to the ability to sleep

The EPP (Noise) also discusses the control of background creep as an additional management intent. Background creep noise goals that have been nominated for the Project and are provided in Table 12-2.

Table 12-2 Summary of EPP (Noise) background creep criteria

Receptor	Background creep $L_{Aeq(1h)}$ dB(A)		
	Day	Evening	Night
Kyewong Homestead	29	28	28
Lake Vermont Homestead	29	28	29
Saraji Homestead 1	35	39	39
Saraji Homestead 2	38	41	40
Saraji Homestead 3	38	41	40
Tay Glen Homestead	34	31	31
Meadowbrook Homestead	37	35	28

12.2.3 Model mining conditions

The model conditions contained in the Queensland Department of Environment and Science (DES) (formerly the Department of Environment and Heritage Protection (DEHP)) Guideline "*Model mining conditions*" (2017) (MMC17) (DEHP, 2017b) provides the basis for "proposing environmental protection commitments in the application documents". Noise criteria recommended in the Guideline are summarised below in Table 12-3. The model mining conditions note mining camps (i.e.

accommodation) are not considered sensitive receptors. On this basis, the proposed construction village has not been assessed.

Table 12-3 MMC17 noise criteria

Receptor	$L_{Aeq,adj,T}$ dB(A)			$L_{A1,adj,T}$ dB(A)		
	Day	Evening	Night	Day	Evening	Night
Kyewong Homestead	35	35	30	40	40	35
Lake Vermont Homestead	35	35	30	40	40	35
Saraji Homestead 1	37	41	36	42	46	41
Saraji Homestead 2	40	43	37	45	48	42
Saraji Homestead 3	40	43	37	45	48	42
Tay Glen Homestead	36	35	30	41	40	35
Meadowbrook Homestead	39	37	30	44	42	35

12.2.4 World Health Organization Guidelines for Community Noise 1999

The World Health Organization (WHO) "*Guidelines for Community Noise*" (WHO Guideline) provides information and recommendations for community noise in specific environments. The document includes recommended noise levels for community noise and also provides background information on the health-related impacts attributed to various types of noise exposure. The WHO also presents guideline values for the protection of communication, night time annoyance and sleep disturbance in its document.

A summary of the WHO Guideline criterion is provided in Table 12-4.

Table 12-4 Summary of WHO Guideline noise levels

Descriptor	Expected effects	Indoor criterion dB(A)	Outdoor criterion dB(A)
Daytime and evening	Moderate annoyance and speech intelligibility	$L_{Aeq(16h)}$ 35	$L_{Aeq(16h)}$ 50
	Serious annoyance	-	$L_{Aeq(16h)}$ 55
Night-time	Sleep disturbance – continuous noise	$L_{Aeq(8h)}$ 30	$L_{Aeq(8h)}$ 35-40*
	Sleep disturbance – single events	$L_{Amax(8h)}$ 45	$L_{Amax(8h)}$ 50-55*

* Assuming a 5-10 dB reduction through an open window.

12.2.5 enHealth

The Environmental Health Committee (enHealth) is a subcommittee of the Australian Health Protection Committee (AHPC). The enHealth report "*The health effects of environmental noise – other than hearing loss"* (May 2004) examined a range of environmental noise sources, with a focus on the primary sources of road, rail, air traffic and industry noise, and reviewed key literature discussing impacts of noise exposure on quality of life, sleep disturbance, learning, cardiovascular disease, mental health and stress.

The report recommends that the WHO Guideline (WHO, 1999) be adopted as the primary reference for environmental noise levels, below which no health effects are expected.

12.3 Methodology

12.3.1 Overview

Project noise impacts were assessed for several scenarios throughout the stages of the Project, under neutral and typical worst-case meteorological conditions.

Sensitive receptors in close proximity to the Project Site all comprise dwellings, refer Section 12.4.1. The environmental values (health and wellbeing of the dwelling occupants, including the ability to sleep) at these receptor locations may be affected by mining activities and increased transport operations associated with the Project.

Blasting is not proposed as part of the Project. Therefore, the construction and operation of the Project is not expected to produce perceptible levels of vibration at nearby sensitive receptors. Vibration will not be further discussed in this chapter.

12.3.2 Mine noise criteria

12.3.2.1 Project specific noise criteria

The above legislation, guidelines, policies and standards have been reviewed for this report to determine values that preserve the amenity of the surrounding areas and protect the health and wellbeing of nearby residents. The enHealth Council document references the WHO Guideline, which outlines guideline values for community noise intended to reduce the likelihood of adverse health effects. EPP(Noise) outlines acoustic quality objectives intended to enhance or preserve health, wellbeing and other environmental values over the long term, further noting that these acoustic quality objectives were informed by the WHO Guideline.

On this basis, criteria have been proposed to protect the amenity of surrounding areas, as well as the health and wellbeing of nearby residents. Proposed Project specific criteria have been summarised in Table 12-5 and are consistent with the levels recommended in the EPP (Noise) acoustic quality objectives, WHO Guideline and previous approvals for similar developments in Queensland.

Table 12-5 Summary of Project specific external noise criteria

Period	Time	Quasi-Steady Noise $L_{Aeq(1h)}$ dB(A)	Discrete Noise $L_{A1(1h)}$ dB(A)
Day	7am – 6pm	45	55
Evening	6pm – 10pm	40	50
Night	10pm – 7am	35	45

As the proposed operation of the mine extension is likely to be operational 24 hours a day, the most stringent criteria of 35 dB(A) $L_{Aeq(1h)}$ and 45 dB(A) $L_{A1(1h)}$ have therefore been taken as the Project criteria for the assessment of operational and construction noise and are used in the remainder of the noise assessment.
This Project specific noise criterion does not apply to the assessment of an increase in noise associated with off-lease ground transportation (road and rail) due to the Project, or the assessment of low frequency noise impact. Appropriate criteria specific to these issues are discussed in the following sections.

12.3.2.2 Low frequency noise

The assessment of low frequency noise is discussed in the Ecoaccess document "*Guideline for the Assessment of Low Frequency Noise"* (Roberts, 2004). This guideline separates low frequency noise into infrasound (1 – 20 hertz (Hz)) and low frequency noise (20 – 200 Hz). For low frequency noise, the guideline provides a multi-step process that involves an initial screening test, followed by an audibility assessment should the indoor noise level fail the screening test criteria.

The initial screening assessment detailed in this guideline has been adopted for the current assessment, further assuming a 5 dB reduction through open windows to obtain the equivalent external noise criterion. This is summarised in Table 12-6 below.

Table 12-6 Summary of low frequency noise screening assessment at sensitive receptors

Period	Ecoaccess Low Frequency L_{LINeq} dBL
All time periods	55*

*The dBL noise levels should be no more than 15 dB higher than the dB(A) noise level.

The guideline also clarifies that a sound that is audible is not necessarily unacceptable.

12.3.2.3 Cumulative noise impacts, including public road and rail network traffic noise

Cumulative noise impacts are assessed by considering the current or permissible noise levels from existing and future approved industry, and the predicted increase with the inclusion of the Project. In this instance, the subjective change in noise level associated with the cumulative increase in noise levels was used as the assessment metric.

It is generally accepted that a change in noise levels of up to 2 dB is not perceptible to most people. It follows then that an increase in noise levels of no more than 2 dB is not considered to perceptibly worsen the baseline noise environment with the inclusion of the Project.

Additionally, the Noise Measurement Manual (DEHP, 2013) provides the following subjective effects of changes in noise levels as shown in Table 12-7.

Table 12-7 Subjective effect of increases in noise levels

Change in Level of dB	Subjective effect
3	Just perceptible
5	Clearly perceptible
10	Twice as loud

The above subjective effects, based on the magnitude of change in noise levels, were used to assess the cumulative impacts of noise associated with an increase in:

- road traffic noise on nearby public roads
- rail traffic noise on the local rail network
- noise impacts to nearby receptors with regard to existing and future approved noise from other industrial noise sources.

12.3.3 Modelling methodology

A computer noise model was developed in order to quantitatively assess noise impacts from the Project. This model was developed using SoundPLAN 7.4, a modelling package used for forecasting industrial noise emissions, which is accepted by DES for this purpose.

The acoustic model accounted for the following site conditions:

- ground topography – 2031 mine landforms and the intervening terrain between the Project and receptors, were digitally incorporated into the noise model
- ground absorption – a ground absorption factor of 0.8 was applied to represent the rural landscape between the Project Site and surrounding sensitive receptors
- sound power level of each noise source, its location and elevation above local ground level
- location and elevation above local ground level of all sensitive receptors
- meteorological conditions – neutral and worst-case (with temperature inversion) weather conditions were modelled for the Project Site.

These are summarised in Table 12-8. More information about the assessment methodology and input data is available in **Appendix I-1 Noise and Vibration Technical Report.**

Table 12-8 Meteorological noise modelling parameters

Meteorological condition	Temperature	Relative humidity	Wind speed and direction	Pasquil stability class
Neutral	25°C	70%	0 (calm)	D
Worst Case (1)	10°C	60%	0 (calm)	F
Worst Case (2)	10°C	60%	3 m/s, adverse (from source to receptor)	F

12.3.4 Construction and operation assessment scenarios

This noise assessment comprised the assessment of noise emissions from mining plant and equipment located at representative locations within mine landforms under neutral and worst-case weather conditions. Five assessment scenarios were considered in the assessment, spanning the life of the mine from Year 1 to Year 22.

The five assessment scenarios spanning the construction and operation of the Project are summarised in Table 12-9 below.

Table 12-9 Assessment scenarios

Scenario	Anticipated activities
Construction Phase 1 (Project Year 1)	Construction of: • mine portal • construction accommodation camp • gas drainage infrastructure (three western-most gas wells and three western-most locations for the gas pipeline) • raw water dam and process water dam.
Construction Phase 2.1 and Operation Phase (Project Year 2 to Year 3)	Construction of: • powerline (close to Meadowbrook homestead) • Mine Infrastructure Area (MIA) • rail loop and load out • vent shafts (three western-most locations) • water pipelines (one near the MIA, and one near Meadowbrook homestead). • Operation of the Project (underground mining activities).
Construction Phase 2.2 and Operation Phase (Project Year 2 to Year 3)	Construction of: • powerline (close to Lake Vermont homestead) • MIA • rail loop and load out • vent shafts (three western-most locations) • water pipelines (one near the MIA, and one near Lake Vermont homestead). • Operation of the Project (underground mining activities).
Construction Phase 2.3 and Operation Phase (Project Year 2 to Year 3)	Construction of: • powerline (close to Kyewong and Tay Glen homesteads) • MIA • rail loop and load out • vent shafts (three western-most locations) • water pipelines (one near the MIA, and one near Kyewong and Tay Glen Homesteads). • Operation of the Project (underground mining activities).
Operational Only Phase (Project Year 3 to Year 22)	Operation of Project (underground and aboveground mining activities); conservatively assuming all gas wells, vents and flares are operational. Construction of gas drainage infrastructure (three eastern-most gas wells and three eastern-most locations for the gas pipeline), and vent shafts (three eastern-most locations), conservatively assuming that these works are present whilst all gas wells, vents and flares are operational.

The proposed powerline and water pipeline (during the Construction Phase 2.3) extends past Meadowbrook, Lake Vermont, Kyewong and Tay Glen homesteads. As such, separate construction scenarios (Phase 2.1, 2.2 and 2.3) have been considered for Project Year 2 to Year 3 for when powerline and water pipeline construction activities are located close to these receptors.

It is expected that decommissioning of the Project involves the use of similar heavy equipment used during construction. As such, the noise impacts from decommissioning of the Project can be taken to be no worse than the noise impacts predicted for the above five scenarios.

12.3.5 Cumulative noise assessment methodology

Road and rail traffic noise

Similar to the cumulative noise impact assessment for industrial noise, cumulative noise impacts for road traffic and rail traffic noise are based on predicted increase in traffic noise emission, and its subjective effect, due to the Project. Assumptions regarding projected increases in road traffic and rail movements used in the assessment are provided in **Chapter 14 Transport**.

Existing and possible future development

Cumulative noise impacts are assessed by considering the current or permissible noise levels from existing and future approved industry, and the predicted increase with the inclusion of the Project.

Sensitive receptors (refer to Section 12.4.1) are located in the vicinity of the existing Saraji Mine, Peak Downs Mine and Lake Vermont Mine. The existing Saraji Mine has been in operation since 1974 and was recently granted approval for an extension to the Grevillea Pit (Environmental Authority (EA) EPML00862313). It is anticipated that open cut operations at the Saraji Mine will extend into the 2040s with potential extensions depending on future approvals.

As part of the amendment to the Saraji Mine EA to accommodate the Grevillea Pit Extension, AECOM carried out a noise impact assessment contained in its technical report Saraji Open Cut Extension Project Noise and Vibration Assessment Report (30 November 2016). The predicted noise impacts from the Saraji Mine and the Grevillea Pit extension are summarised in Table 12-10. These levels are taken to comprise the noise levels from other existing and future approved industry.

Table 12-10 Predicted operational noise impacts from Saraji Mine, including the Grevillia Pit Extension

Receptor	Predicted operational noise impact $L_{Aeq(T)}$ dB(A)	
	Neutral metrological conditions	Worst case meteorological conditions
Kyewong Homestead	26	33
Lake Vermont Homestead	42	49
Saraji Homestead 1	40	46
Saraji Homestead 2	40	46
Saraji Homestead 3	42	47
Tay Glen Homestead	31	38
Meadowbrook Homestead	43	49

12.4 Description of environmental values

Environmental values to be enhanced or protected under EPP (Noise) are those that are conducive to protecting the health and biodiversity of ecosystems, to human health and wellbeing and to protecting the amenity of the community.

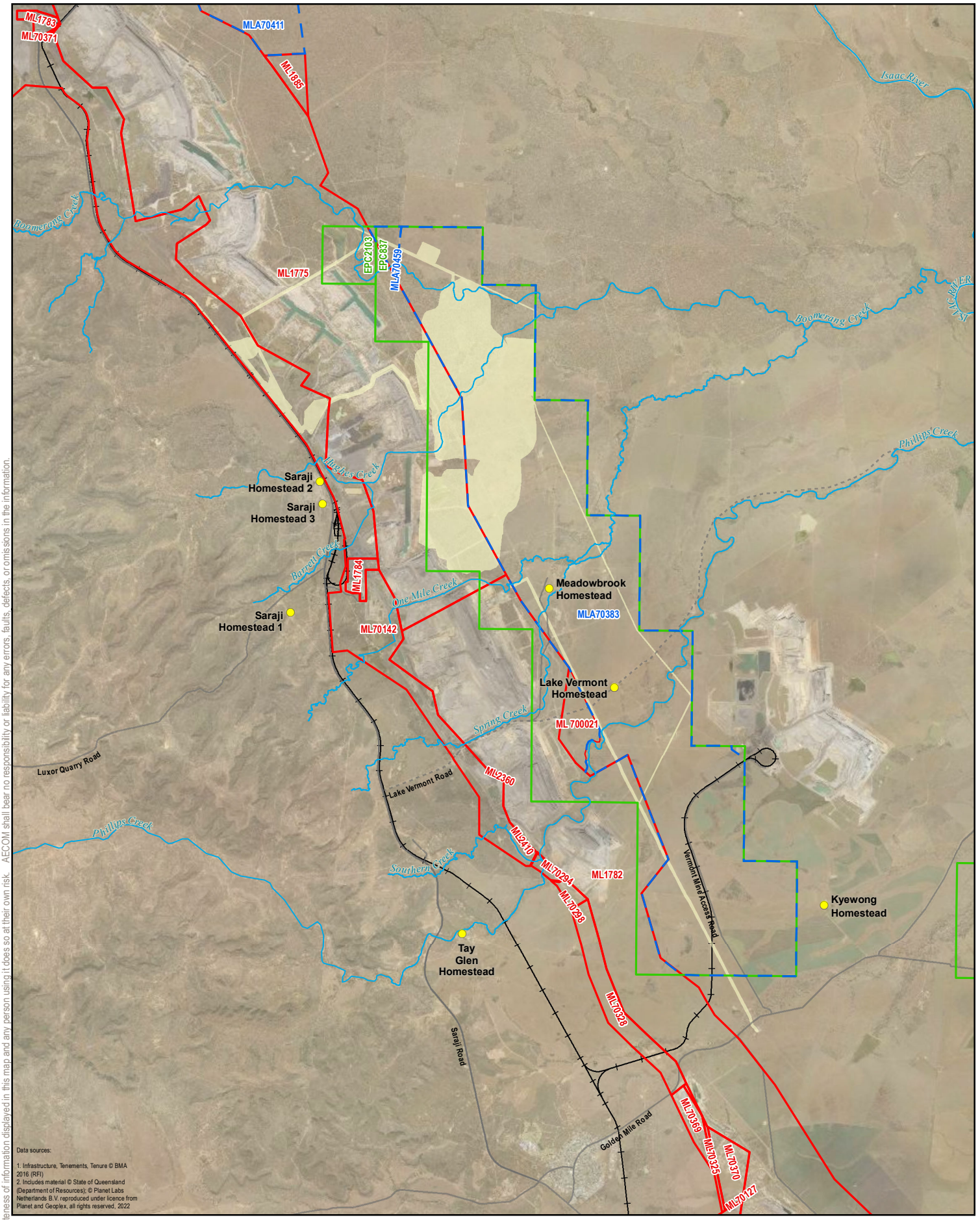
12.4.1 Sensitive receptors

Sensitive receptors are defined in Schedule 1 of the EPP (Noise). The nearest sensitive receptors to the Project Site comprise rural dwellings summarised in Figure 12-1.

Table 12-11 Identified sensitive receptors nearest to the Project

Receptor	Location	Direction from Project Site	Ownership
Meadowbrook Homestead	148.339, -22.420	Within Project Site	Vacant and will remain vacant throughout the life of the mine.
Lake Vermont Homestead	148.360, -22.448	Within Project Site	BMA owned. When required for mining or subject to mining impacts the homestead will be vacated.
Saraji Homestead 1	148.259, -22.428	4 km west of Project Site	Private landholder. Discussions between BMA and the landholder concerning a co-existence agreement have commenced.
Saraji Homestead 2	148.268, -22.389	1 km from Project Site (south of MIA)	Private landholder. Co-existence agreement currently in place between BMA and the landholder.
Saraji Homestead 3	148.268, -22.396	1 km from Project Site (south of MIA)	Private landholder. Co-existence agreement currently in place between BMA and the landholder.
Kyewong Homestead	148.426, -22.511	1 km east of Project Site	Private landholder

Receptor	Location	Direction from Project Site	Ownership
Tay Glen Homestead	148.313, -22.520	7 km west of Project Site	Private landholder



AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.

LEGEND

- Project Footprint
- Exploration Permit Coal (EPC)
- Mining Lease (ML)
- Mining Lease Application (MLA)
- Watercourse
- Private Access Road
- Public Road
- Existing Railway

Sensitive Receptors

- Homestead

N

Figure 12-1
Sensitive Receptor Locations

Environmental Impact Statement
Saraji East Mining Lease Project

0 0.5 1 2
Kilometres

Scale: 1:158,094 (when printed at A4)
Projection: Map Grid of Australia - Zone 55 (GDA94)

BMA
BHP Mitsubishi Alliance

DATE: 13/06/2023 VERSION: 5

Filename: \\na.aecomnet.com\lfs\APAC\Brisbane-AUBNE1\Secure\Projects\605X\60507031\4. Tech Work Area\4.98 GIS 2021\02_MXDs\01 Environmental Impact Statement\12 Noise and Vibration\60507031_G313_v5_A4P.mxd

12.4.2 Measured noise levels

Noise monitoring was conducted at six of the homesteads closest to the Project to characterise the existing environment values. Long term, unattended noise monitoring was undertaken by SLR consulting in 2011 and by AECOM in 2016. The background levels determined through monitoring at each location are listed in Table 12-12 alongside the duration of monitoring. Noise traces recorded at each measurement location are provided in Appendix B of **Appendix I-1 Noise and Vibration Technical Report**.

Measurements were taken in accordance with the version of the DEHP (now DES) *Noise Measurement Manual* in force at the time of the measurements. All measurements were conducted in the free-field. All sound level meters, noise loggers and calibrators were in current National Association of Testing Authorities (NATA) calibration at the time of use. The Rating Background Levels (RBL) for Saraji Homestead 2 are taken to also apply to Saraji Homestead 3, as these receptors are located relatively close to each other (approximately 550 metres apart).

Table 12-12 Summary of measured noise levels

Receptor	Period	RBL dB(A)		
		Day (7:00am – 6:00pm)	Evening (6:00pm – 10:00pm)	Night (10:00pm – 7:00am)
Kyewong Homestead	Wednesday 25 May 2011 to Thursday 9 June 2011 Thursday 16 June 2011 to Friday 17 June 2011	26	25*	25*
Lake Vermont Homestead	Wednesday 25 May 2011 to Monday 13 June 2011 Thursday 16 June 2011 to Friday 17 June 2011	26	25	26
Saraji Homestead 1	Thursday 26 May 2011 to Thursday 9 June 2011 Thursday 16 June 2011 to Friday 17 June 2011	32	36	36
Saraji Homestead 2	Thursday 26 May 2011 to Friday 3 June 2011 Thursday 16 June 2011 to Friday 17 June 2011	35	38	37
Tay Glen Homestead	Wednesday 25 May 2011 to Sunday 5 June 2011 Thursday 16 June 2011 to Friday 17 June 2011	31	28	28
Meadowbrook Homestead	Monday 10 October 2016 to Thursday 20 October 2016	34	32	25

* The calculated RBL was lower than the threshold background level of 25 dB(A). As such, the threshold background level was used.

Both Saraji Mine and nearby Lake Vermont Mine have continued to be operational since the measurements were captured in 2011; as such, industrial noise impacts to these receptors are unlikely to have become quieter after 2011. In addition, the night-time background noise measurements at Kyewong Homestead and Meadowbrook Homestead were measured to be under 25 dB(A), which is below the threshold level stated in the Guideline - Planning for Noise Control dated 2016 (PFNC). Accordingly, adopting the 2011 background measurement data is considered a conservative approach in determining the representative background noise levels at these receptors.

12.5 Potential impacts

12.5.1 $L_{Aeq(1h)}$ mine noise impact

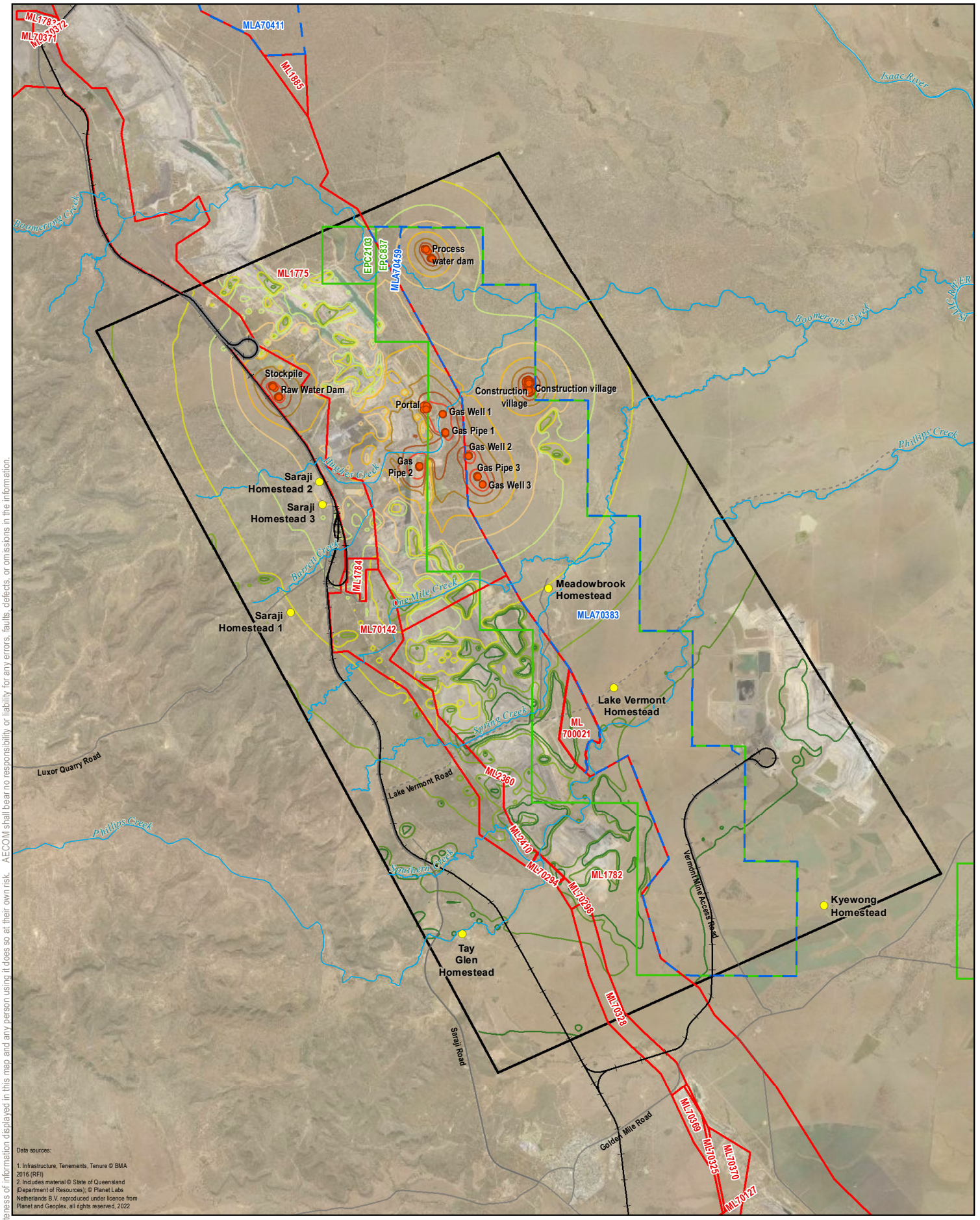
Predicted ($L_{Aeq(1h)}$) noise impacts from the mine under three modelled meteorological conditions (refer to Table 12-8) are summarised in Figure 12-2. Predicted noise levels which exceed the Project specific

noise criteria are shown in **bold**, in Table 12-12, with the magnitude of exceedance provided in the row beneath.

The corresponding noise contour maps under neutral metrological conditions and worst-case (1) meteorological conditions are provided in Figure 12-2 through to Figure 12-11. The noise contour maps for worst-case (1) meteorological conditions can be taken to also provide an indication of the noise contours under worst-case (2) meteorological conditions, as the difference in noise levels between these two meteorological conditions is less than 5 dB, and the predicted noise levels under worst-case (1) are generally higher than under worst-case (2). Refer to Table 12-12 for the difference in meteorological parameters between worst-case (1) and worst-case (2).

Table 12-13 Predicted external $L_{Aeq(1h)}$ noise impact to nearby receptors under neutral and worst-case meteorological conditions

Receptor	Project Specific Night-time Criteria $L_{Aeq(1h)}$ dB(A)	Construction Phase 1			Construction Phase 2.1 and Operational Phase			Construction Phase 2.2 and Operational Phase			Construction Phase 2.3 and Operational Phase			Operational Only Phase		
		Neutral	Worst Case (1)	Worst Case (2)	Neutral	Worst Case (1)	Worst Case (2)	Neutral	Worst Case (1)	Worst Case (2)	Neutral	Worst Case (1)	Worst Case (2)	Neutral	Worst Case (1)	Worst Case (2)
Kyewong Homestead	35	12	23	19	13	23	19	16	26	22	28	**37**	**36**	14	25	20
		-	-	-	-	-	-	-	-	-	-	2	1	-	-	-
Lake Vermont Homestead	35	22	32	29	31	**39**	**38**	**51**	**55**	**56**	35	**42**	**42**	28	**38**	35
		-	-	-	-	4	3	16	20	21	-	7	7	-	3	-
Saraji Homestead 1	35	30	**40**	**37**	29	**38**	35	28	**37**	35	28	**37**	34	34	**44**	**41**
		-	5	2	-	3	-	-	2	-	-	2	-	-	9	6
Saraji Homestead 2	35	**44**	**52**	**51**	**49**	**56**	**56**	**49**	**56**	**56**	**49**	**56**	**56**	**49**	**57**	**56**
		9	17	16	14	21	21	14	21	21	14	21	21	14	22	21
Saraji Homestead 3	35	**42**	**51**	**50**	**42**	**50**	**49**	**42**	**50**	**49**	**42**	**50**	**49**	**45**	**54**	**52**
		7	16	15	7	15	14	7	15	14	7	15	14	10	19	17
Tay Glen Homestead	35	19	29	25	21	31	27	23	33	29	23	32	29	22	33	29
		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Meadowbrook Homestead	35	31	**40**	**38**	**60**	**63**	**63**	32	**41**	**40**	29	**38**	35	**41**	**48**	**47**
		-	5	3	25	28	28	-	6	5	-	3	-	6	13	12



AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.

LEGEND

- Exploration Permit Coal (EPC)
- Mining Lease (ML)
- Mining Lease Application (MLA)
- Assessment Boundary
- Watercourse
- Private Access Road
- Public Road
- Rail Loop
- Existing Railway
- Noise Sources

Sensitive Receptors

- Homestead

Predicted Noise Levels dB(A) $L_{Aeq(1h)}$

25	50
30	55
35	60
40	65
45	70

N

Figure 12-2
Construction Phase 1 (Project Year 1) - Worst-case meteorological conditions - $L_{Aeq(1h)}$ free-field noise levels

Environmental Impact Statement
Saraji East Mining Lease Project

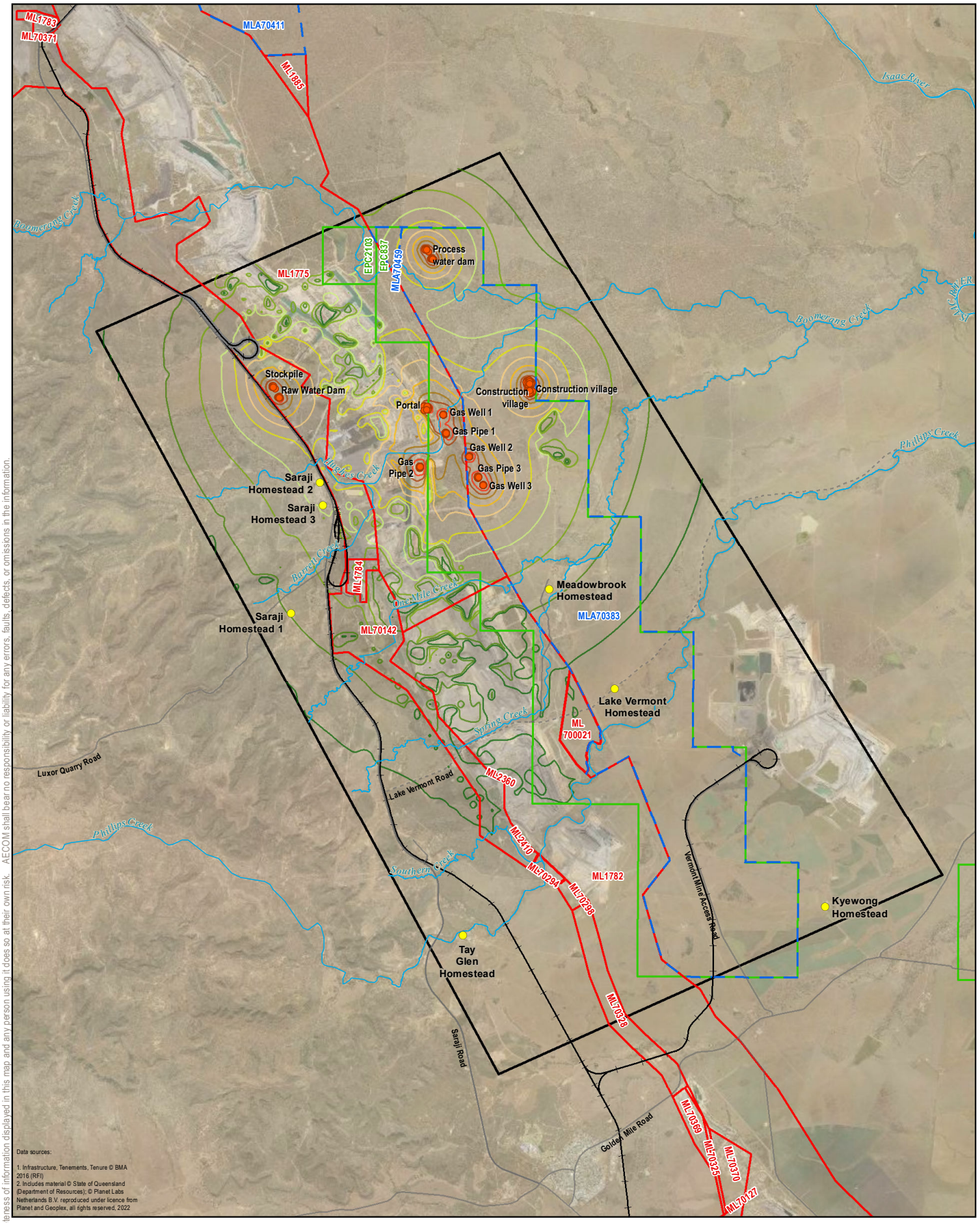
0 0.5 1 2
Kilometres

Scale: 1:158,094 (when printed at A4)
Projection: Map Grid of Australia - Zone 55 (GDA94)

BMA
BHP Mitsubishi Alliance

DATE: 3/08/2023 VERSION: 5

Filename: L:\Secure\Projects\605X\60507031\4. Tech Work Area\4.98 GIS 2021\02_MXDs\01 Environmental Impact Statement\12 Noise and Vibration\60507031_G314_v5_A4P.mxd



Data sources:

1. Infrastructure, Tenements, Tenure © BMA 2016 (RFI)
2. Includes material © State of Queensland (Department of Resources); © Planet Labs Netherlands B.V. reproduced under licence from Planet and Geoplex, all rights reserved, 2022

LEGEND

- Exploration Permit Coal (EPC)
- Mining Lease (ML)
- Mining Lease Application (MLA)
- Assessment Boundary
- Watercourse
- Private Access Road
- Public Road
- Rail Loop
- Existing Railway
- Noise Sources

Sensitive Receptors

- Homestead

Predicted Noise Levels dB(A) $L_{Aeq(1h)}$

25 30 35 40 45 50 55 60 65 70

Figure 12-3
Construction Phase 1 (Project Year 1) – neutral meteorological conditions – $L_{Aeq(1h)}$ free-field noise levels

Environmental Impact Statement
Saraji East Mining Lease Project

0 0.5 1 2
Kilometres

Scale: 1:158,094 (when printed at A4)

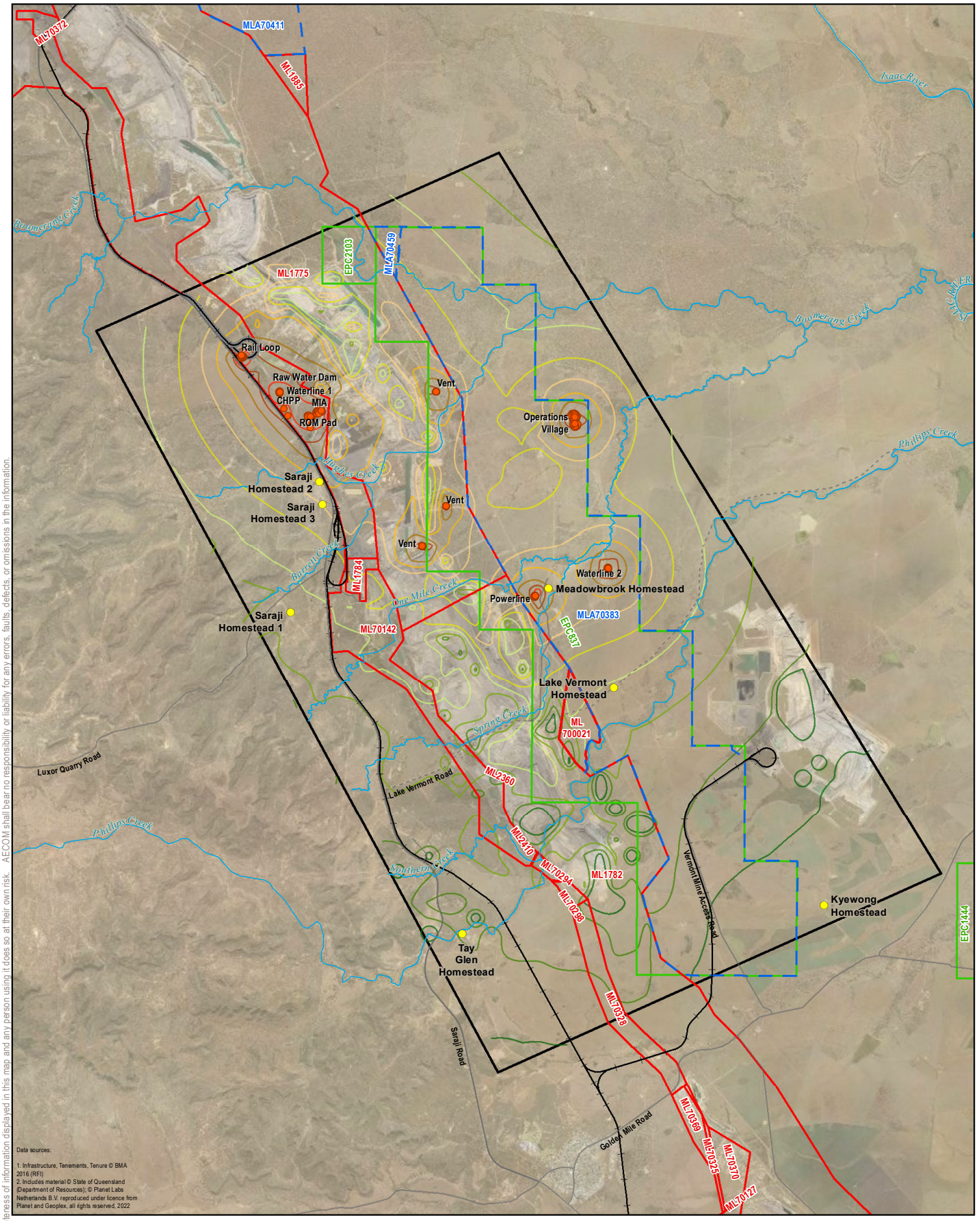
Projection: Map Grid of Australia - Zone 55 (GDA94)

BMA
BHP Mitsubishi Alliance

DATE: 3/08/2023 VERSION: 5

AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.

Filename: L:\Secure\Projects\605X\60507031\4. Tech Work Area\4.98 GIS 2021\02_MXDs\01 Environmental Impact Statement\12 Noise and Vibration\60507031_G315_v5_A4P.mxd



Data sources:

1. Infrastructure, Tenements, Tenure © BMA 2016 (RFI)
2. Includes material © State of Queensland (Department of Resources); © Planet Labs Netherlands B.V. reproduced under licence from Planet and Geoplex, all rights reserved, 2022

AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.

LEGEND

- Exploration Permit Coal (EPC)
- Mining Lease (ML)
- Mining Lease Application (MLA)
- Assessment Boundary
- Watercourse
- Private Access Road
- Public Road
- Rail Loop
- Existing Railway
- Noise Sources

Sensitive Receptors

- Homestead

Predicted Noise Levels dB(A) $L_{Aeq(1h)}$

25	50
30	55
35	60
40	65
45	70

N

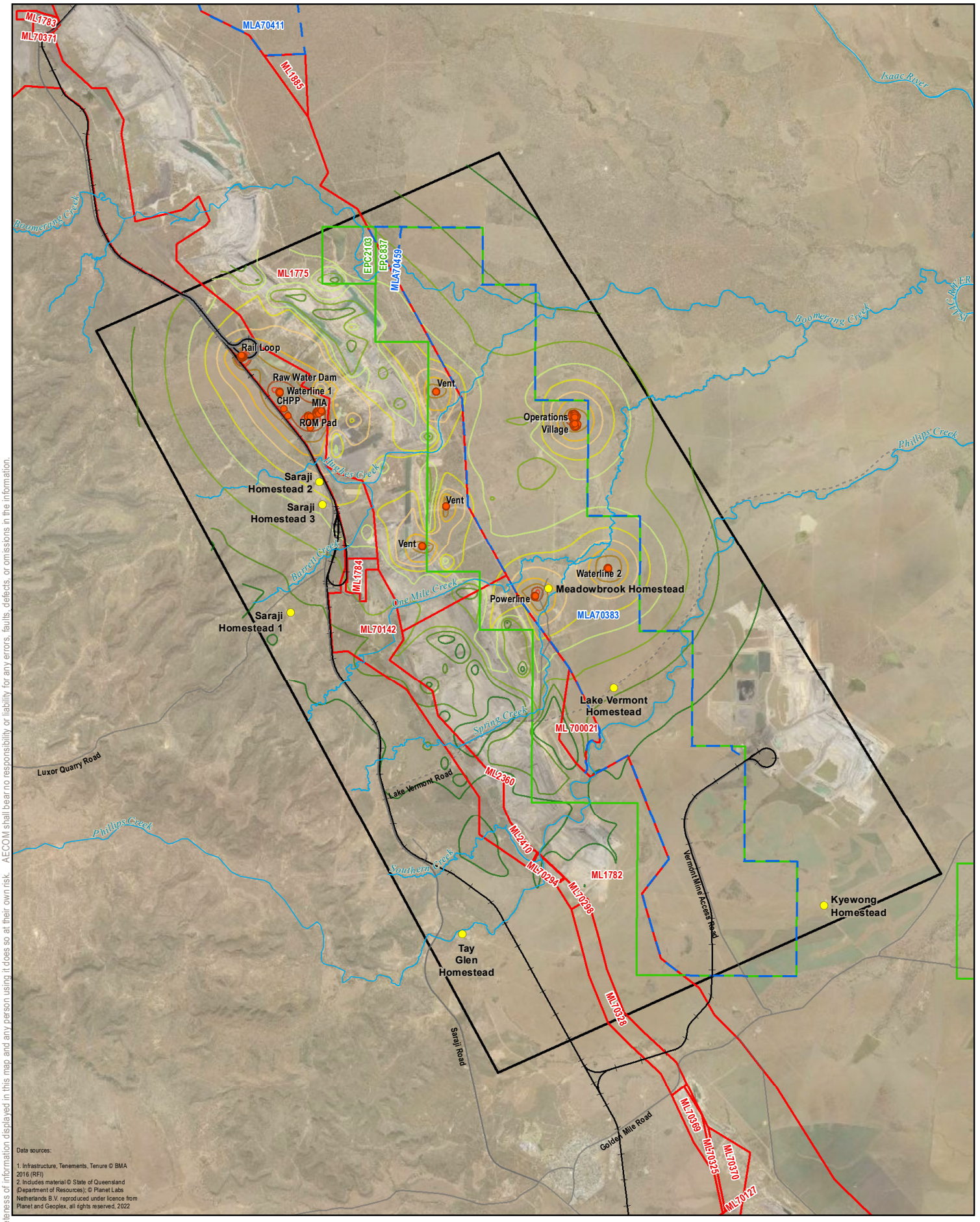
Figure 12-4
Construction Phase 2.1 and Operational Phase – powerline and water line construction near Meadowbrook Homestead – neutral meteorological conditions – $L_{Aeq(1h)}$ free-field noise levels
Environmental Impact Statement
Saraji East Mining Lease Project

0 0.5 1 2
Kilometres
Scale: 1:158,094 (when printed at A4)
Projection: Map Grid of Australia - Zone 55 (GDA94)

BMA
BHP Mitsubishi Alliance

DATE: 3/08/2023 VERSION: 5

Filename: L:\Secure\Projects\605X\60507031\4. Tech Work Area\4.98 GIS 2021\02_MXDs\01 Environmental Impact Statement\12 Noise and Vibration\60507031_G316_v5_A4P.mxd



LEGEND

- Exploration Permit Coal (EPC)
- Mining Lease (ML)
- Mining Lease Application (MLA)
- Assessment Boundary
- Watercourse
- Private Access Road
- Public Road
- Rail Loop
- Existing Railway
- Noise Sources

Sensitive Receptors

- Homestead

Predicted Noise Levels dB(A) $L_{Aeq(1h)}$

25 50
30 55
35 60
40 65
45 70

N

Figure 12-5
Construction Phase 2.1 and Operational Phase – powerline and water line construction near Meadowbrook Homestead – neutral meteorological conditions – $L_{Aeq(1h)}$ free-field noise levels

Environmental Impact Statement Saraji East Mining Lease Project

0 0.5 1 2
Kilometres

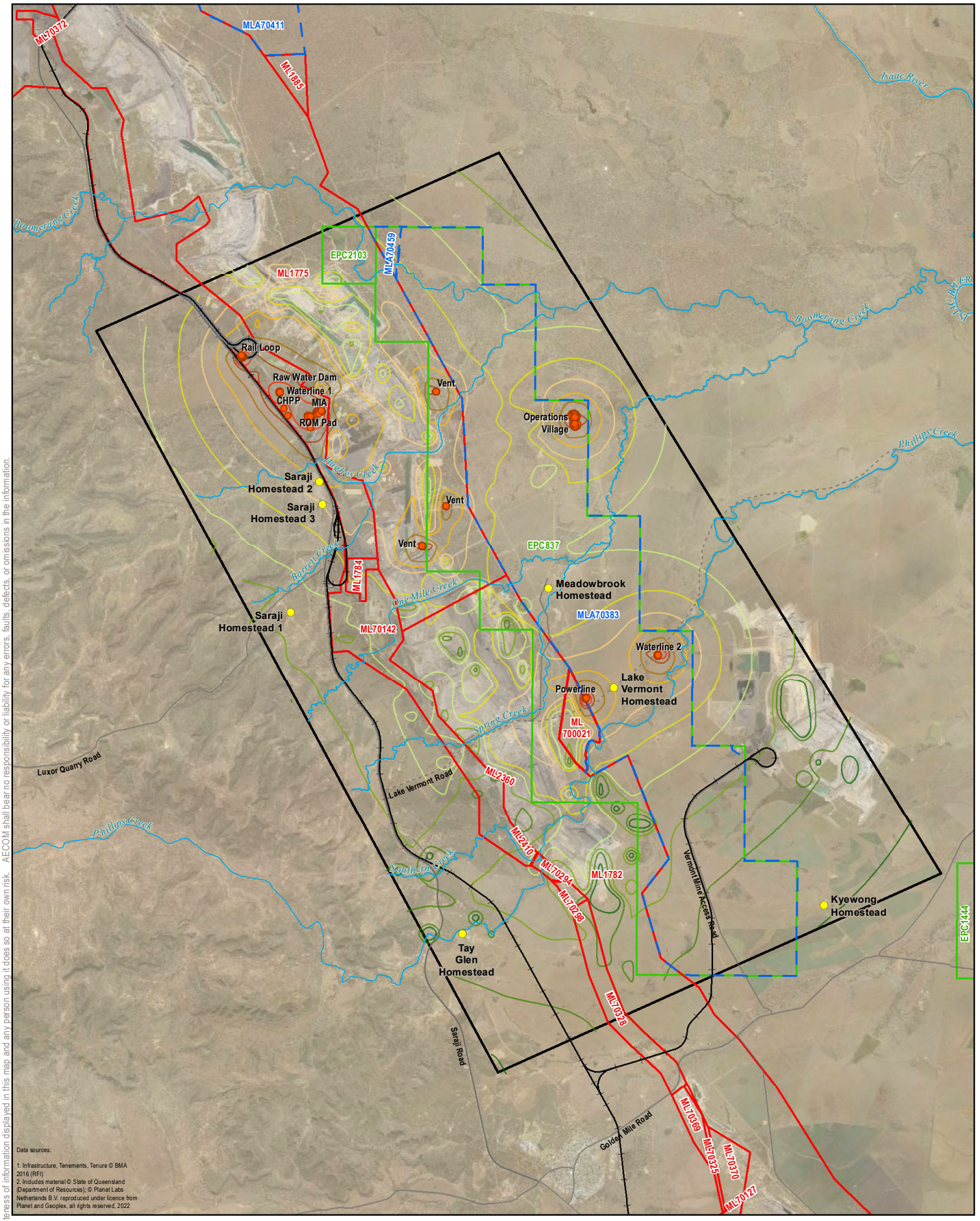
Scale: 1:158,094 (when printed at A4)
Projection: Map Grid of Australia - Zone 55 (GDA94)

BMA
BHP Mitsubishi Alliance

DATE: 3/08/2023 VERSION: 3

AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.

Filename: L:\Secure\Projects\605X\60507031\4. Tech Work Area\4.98 GIS 2021\02_MXDs\01 Environmental Impact Statement\12 Noise and Vibration\60507031_G317_v3_A4P.mxd



AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.

LEGEND

- Exploration Permit Coal (EPC)
- Mining Lease (ML)
- Mining Lease Application (MLA)
- Assessment Boundary
- Watercourse
- Private Access Road
- Public Road
- Rail Loop
- Existing Railway
- Noise Sources

Sensitive Receptors

- Homestead

Predicted Noise Levels dB(A) $L_{Aeq(1h)}$

25 30 35 40 45 50 55 60 65 70

N

Figure 12-6
Construction Phase 2.2 and Operational Phase – powerline and water line construction near Kyewong and Tay Glen Homesteads – worst-case meteorological conditions – $L_{Aeq(1h)}$ free-field noise levels

Environmental Impact Statement
Saraji East Mining Lease Project

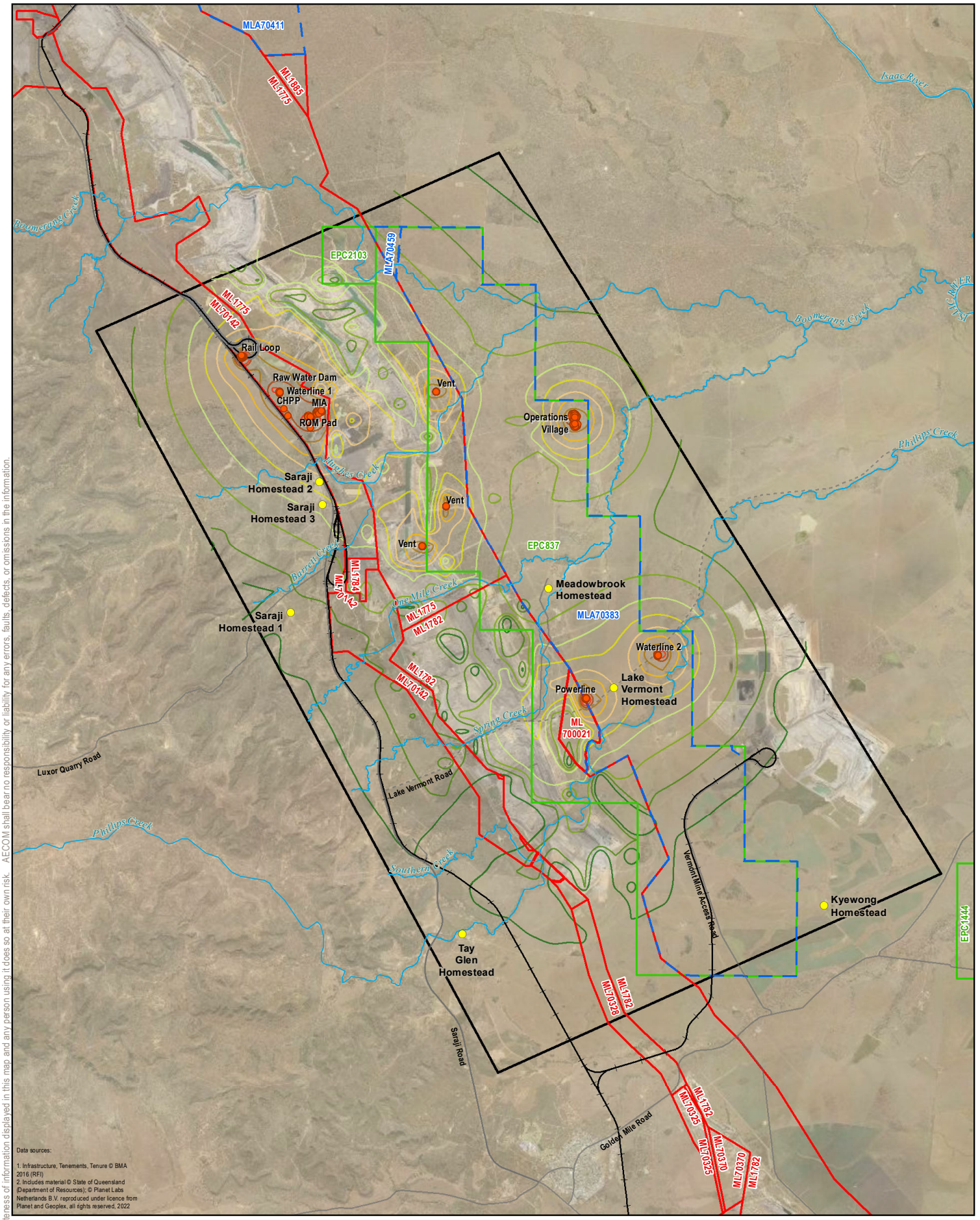
0 0.5 1 2
Kilometres

Scale: 1:158,094 (when printed at A4)
Projection: Map Grid of Australia - Zone 55 (GDA94)

BMA
BHP Mitsubishi Alliance

DATE: 3/08/2023 VERSION: 5

Filename: L:\Secure\Projects\605X\60507031\4. Tech Work Area\4.98 GIS 2021\02_MXDs\01 Environmental Impact Statement\12 Noise and Vibration\60507031_G318_v5_A4P.mxd



AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.

LEGEND

- Exploration Permit Coal (EPC)
- Mining Lease (ML)
- Mining Lease Application (MLA)
- Assessment Boundary
- Watercourse
- Private Access Road
- Public Road
- Rail Loop
- Existing Railway
- Noise Sources

Sensitive Receptors

- Homestead

Predicted Noise Levels dB(A) $L_{Aeq(1h)}$

25 50
30 55
35 60
40 65
45 70

N

Figure 12-7
Construction Phase 2.2 and Operational Phase – powerline and water line construction near Lake Vermont Homestead – neutral meteorological conditions – $L_{Aeq(1h)}$ free-field noise levels

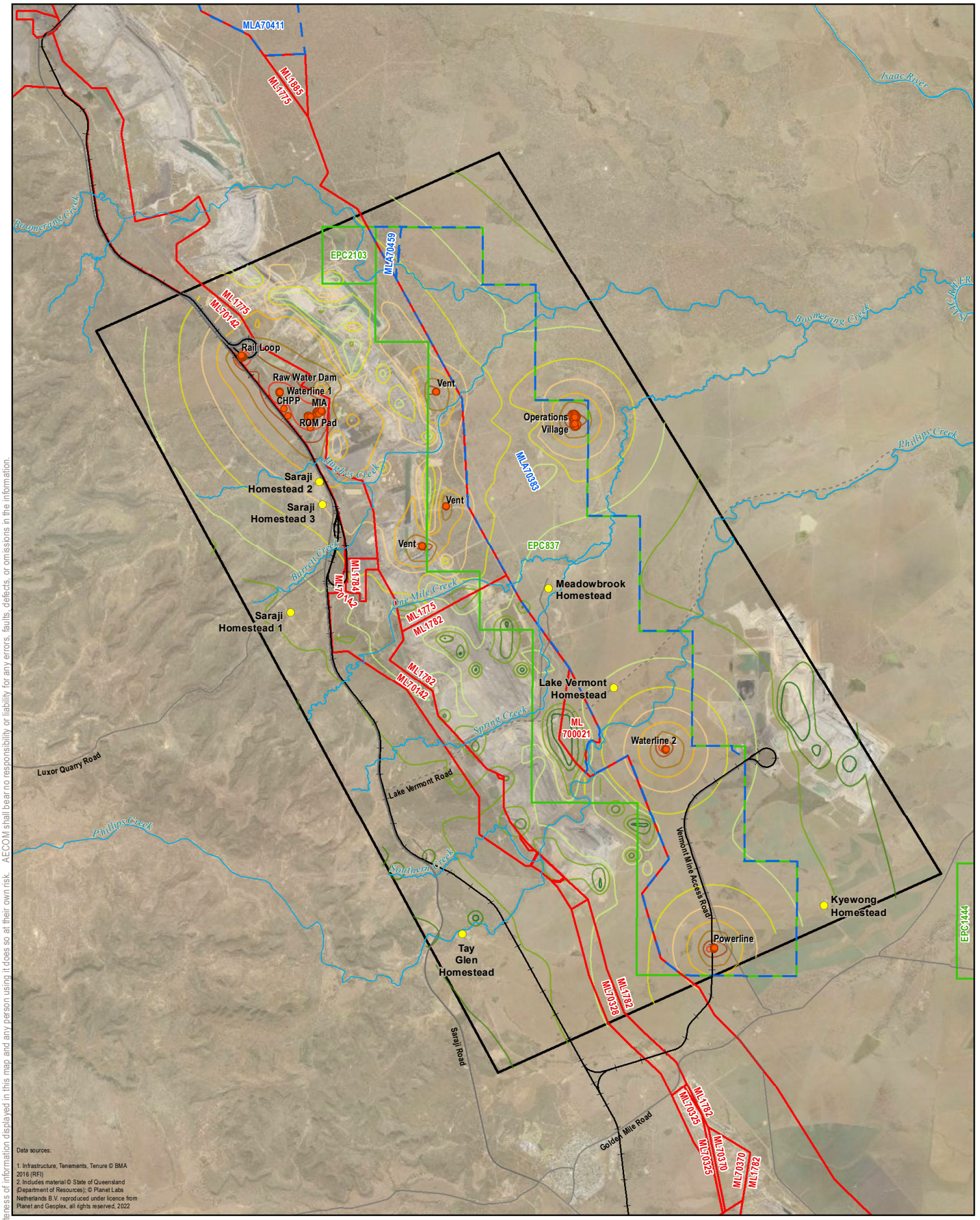
Environmental Impact Statement Saraji East Mining Lease Project

0 0.5 1 2
Kilometres
Scale: 1:158,094 (when printed at A4)
Projection: Map Grid of Australia - Zone 55 (GDA94)

BMA
BHP Mitsubishi Alliance

DATE: 3/08/2023 VERSION: 5

Filename: L:\Secure\Projects\605X\60507031\4. Tech Work Area\4.98 GIS 2021\02_MXDs\01 Environmental Impact Statement\12 Noise and Vibration\60507031_G319_v5_A4P.mxd



Data sources:

1. Infrastructure, Tenements, Tenure © BMA 2016 (RFI)
2. Includes material © State of Queensland (Department of Resources); © Planet Labs Netherlands B.V. reproduced under licence from Planet and Geoplex, all rights reserved, 2022

AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.

LEGEND

- Exploration Permit Coal (EPC)
- Mining Lease (ML)
- Mining Lease Application (MLA)
- Assessment Boundary
- Watercourse
- Private Access Road
- Public Road
- Rail Loop
- Existing Railway
- Noise Sources

Sensitive Receptors

- Homestead

Predicted Noise Levels dB(A) $L_{Aeq(1h)}$

25 30 35 40 45 50 55 60 65 70

N

Figure 12-8
Construction Phase 2.3 and Operational Phase – powerline and water line construction near Kyewong and Tay Glen Homesteads – worst-case meteorological conditions – $L_{Aeq(1h)}$ free-field noise levels
Environmental Impact Statement
Saraji East Mining Lease Project

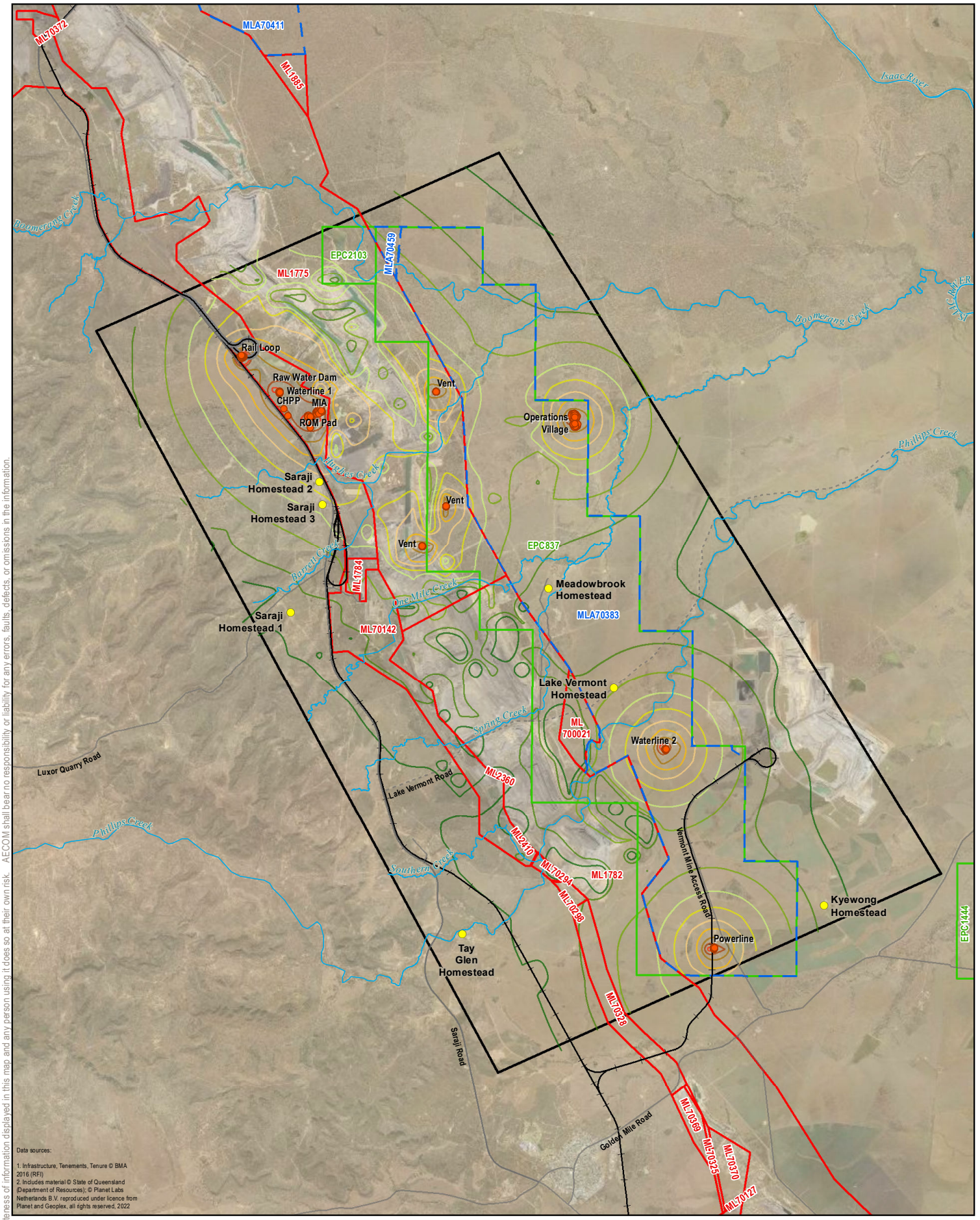
0 0.5 1 2
Kilometres

Scale: 1:158,094 (when printed at A4)
Projection: Map Grid of Australia - Zone 55 (GDA94)

BMA
BHP Mitsubishi Alliance

DATE: 3/08/2023 VERSION: 5

Filename: L:\Secure\Projects\605X\60507031\4. Tech Work Area\4.98 GIS 2021\02_MXDs\01 Environmental Impact Statement\12 Noise and Vibration\60507031_G320_v5_A4P.mxd



AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.

LEGEND

- Exploration Permit Coal (EPC)
- Mining Lease (ML)
- Mining Lease Application (MLA)
- Assessment Boundary
- Watercourse
- Private Access Road
- Public Road
- Rail Loop
- Existing Railway
- Noise Sources

Sensitive Receptors

- Homestead

Predicted Noise Levels dB(A) $L_{Aeq(1h)}$

- 25
- 30
- 35
- 40
- 45
- 50
- 55
- 60
- 65
- 70

N

Figure 12-9
Construction Phase 2.3 and Operational Phase – powerline and water line construction near Kyewong and Tay Glen Homesteads – neutral meteorological conditions – $L_{Aeq(1h)}$ free-field noise levels
Environmental Impact Statement
Saraji East Mining Lease Project

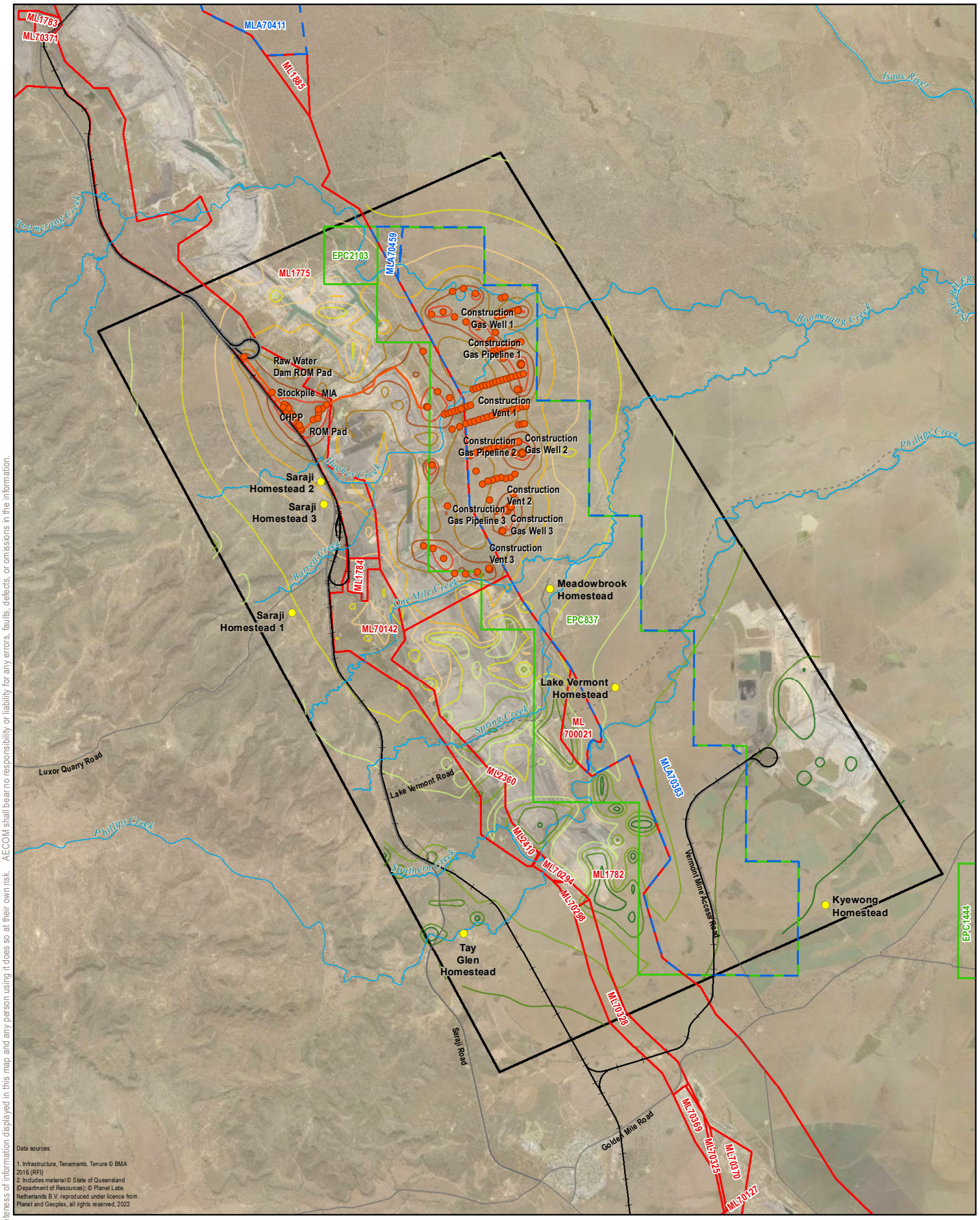
0 0.5 1 2
Kilometres

Scale: 1:158,094 (when printed at A4)
Projection: Map Grid of Australia - Zone 55 (GDA94)

BMA
BHP Mitsubishi Alliance

DATE: 3/08/2023 VERSION: 5

Filename: L:\Secure\Projects\605X\60507031\4. Tech Work Area\4.98 GIS 2021\02_MXDs\01 Environmental Impact Statement\12 Noise and Vibration\60507031_G321_v5_A4P.mxd



LEGEND

- Exploration Permit Coal (EPC)
- Mining Lease (ML)
- Mining Lease Application (MLA)
- Assessment Boundary
- Watercourse
- Private Access Road
- Public Road
- Rail Loop
- Existing Railway
- Conveyor Belt
- Noise Sources

Sensitive Receptors

- Homestead

Predicted Noise Levels dB(A) $L_{Aeq(1h)}$

25	50
30	55
35	60
40	65
45	70

Figure 12-10
Operational Only Phase – worst-case meteorological conditions – $L_{Aeq(1h)}$ free-field noise levels

Environmental Impact Statement
Saraji East Mining Lease Project

0 0.5 1 2
Kilometres

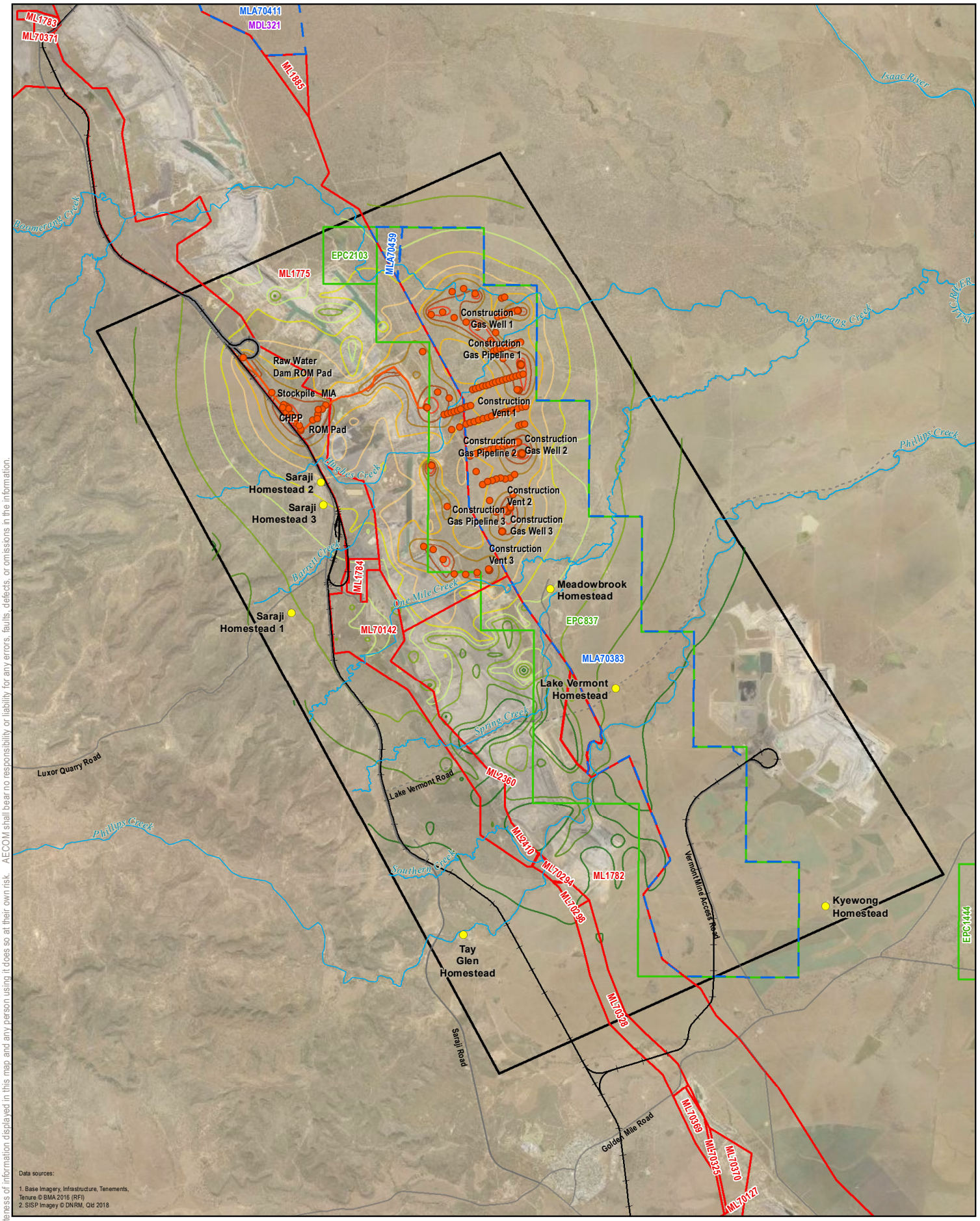
Scale: 1:158,094 (when printed at A4)
Projection: Map Grid of Australia - Zone 55 (GDA94)

BMA
BHP Mitsubishi Alliance

DATE: 3/08/2023 VERSION: 5

AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.

Filename: L:\Secure\Projects\605X\60507031\4. Tech Work Area\4.98 GIS 2021\02_MXDs\01 Environmental Impact Statement\12 Noise and Vibration\60507031_G322_v5_A4P.mxd



LEGEND

- Exploration Permit Coal (EPC)
- Mining Lease (ML)
- Mining Lease Application (MLA)
- Assessment Boundary
- Watercourse
- Private Access Road
- Public Road
- Rail Loop
- Existing Railway
- Conveyor Belt
- Noise Sources

Sensitive Receptors

- Homestead

Predicted Noise Levels dB(A) $L_{Aeq(1h)}$

25	50
30	55
35	60
40	65
45	70

Figure 12-11
Operational Only Phase – neutral meteorological conditions – $L_{Aeq(1h)}$ free-field noise levels

Environmental Impact Statement
Saraji East Mining Lease Project

0 0.5 1 2
Kilometres

Scale: 1:158,094 (when printed at A4)
Projection: Map Grid of Australia - Zone 55 (GDA94)

BMA
BHP Mitsubishi Alliance

DATE: 3/08/2023 VERSION: 3

AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.

Filename: L:\Secure\Projects\605X\60507031\4. Tech Work Area\4.98 GIS 2021\02_MXDs\01 Environmental Impact Statement\12 Noise and Vibration\60507031_G323_v3_A4P.mxd

A summary of continuous noise emission impacts to each sensitive receptor is provided in Table 12-14.

Table 12-14 Summary of impacts of $L_{Aeq(1h)}$ at each receptor

Receptor	Summary of impact
Kyewong Homestead	Noise from the Project is predicted to be under the 35 dB(A) $L_{Aeq(1h)}$ Project specific criterion at this receptor for all modelled scenarios except during Construction Phase 2.3, which is consistent with the construction of the powerline and water pipeline at positions along their respective proposed corridors closest to this receptor. The magnitude of exceedance during Construction Phase 2.3 is predicted to be 1-2 dB(A) above the Project specific noise criterion, noting that a change in noise level of up to 2 dB is not perceptible to most people. As such the predicted noise levels are considered to effectively meet the nominated noise criterion. Additionally, it is envisaged that exposure to this noise level is relatively short-lived, as the nature of construction works along the powerline and water pipeline have noise-generating activities which move closer to, and then subsequently away from, this receptor. Standard management measures discussed in Section 12.6 would be implemented to minimise impacts at this location.
Lake Vermont Homestead	The highest noise level of 56 dB(A) $L_{Aeq(1h)}$ is predicted during Construction Phase 2.2 and Operational Phase when the construction of the powerline and water pipeline is closest to this receptor. This predicted noise level exceeds the Project specific night-time criterion by 21 dB(A). However, it is expected that exposure to this noise level is relatively short-lived, as the nature of construction works along the powerline and water pipeline have noise-generating activities which move closer to, and then subsequently away from, this receptor. When the construction of the powerline and water pipeline is located farther north (Construction Phase 2.1 and Operational Phase) and farther south (Construction Phase 2.3 and Operational Phase) of this receptor, the predicted noise levels are much lower at 39 and 42 dB(A) $L_{Aeq(1h)}$ respectively. The highest predicted noise level during the Operational Only Phase is 38 dB(A) $L_{Aeq(1h)}$, which is 18 dB(A) quieter than the highest predicted noise level during the Construction Phase 2.2 and Operational Phase overlap period. The predicted noise level during the Operational Only Phase exceeds the Project specific night-time noise criterion by 3 dB(A). A combination of the additional mitigation measures described in Section 12.6 (provision of air conditioning and mechanical ventilation and upgrades to the building façade) is expected to allow a reduction in noise levels of approximately 25 dB(A) through the closed façade, giving rise to residual impacts of 31 dB(A) $L_{Aeq(1h)}$ internally during Construction Phase 2.2 and Operational Phase. This residual impact effectively meets the Acoustic Quality Objective inside bedrooms of 30 dB(A) $L_{Aeq(1h)}$, noting that a difference in noise levels of up to 2 dB is not perceptible to most people. The residual impact during Operational Only Phase with the abovementioned treatments is 13 dB(A) $L_{Aeq(1h)}$, which is well under the Acoustic Quality Objective inside bedrooms.
Saraji Homestead 1	The highest noise level of 44 dB(A) $L_{Aeq(1h)}$ is predicted during the Operational Only Phase of the Project. This predicted noise level exceeds the Project specific night-time criterion by 9 dB(A). Analysis of the predicted noise levels indicates that nearby mine ventilation (vent shafts) comprise the highest contributors of noise to this receptor. Implementation of an additional mitigation measure as described in Section 12.6 (provision of air-conditioning and mechanical ventilation) is expected to allow a reduction in noise levels of approximately 15dB(A) through the closed façade, giving rise to residual impacts of 29 dB(A) $L_{Aeq(1h)}$ which meets the Acoustic Quality Objective inside bedrooms of 30 dB(A) $L_{Aeq(1h)}$.
Saraji Homestead 2	Noise levels of up to 57 dB(A) $L_{Aeq(1h)}$ are predicted during the Operational Only Phase of the Project. This predicted noise level exceeds the Project specific night-time criterion by 22 dB(A). Analysis of the predicted noise levels indicates that the conveyor, crusher, mobile plant and other sources of noise within the MIA are the highest contributors of noise to this receptor. A combination of the additional mitigation measures described in Section 12.6 (provision of air conditioning and mechanical ventilation and upgrades to the building façade) is expected to allow a reduction in noise levels of approximately 25 dB(A) through the closed façade, giving rise to residual impacts of 32 dB(A) $L_{Aeq(1h)}$ internally. This residual impact effectively meets the Acoustic Quality Objective inside bedrooms of 30 dB(A) $L_{Aeq(1h)}$, noting that a difference in noise levels of up to 2 dB is not perceptible to most people.
Saraji Homestead 3	Noise levels of up to 54 dB(A) $L_{Aeq(1h)}$ are predicted during the Operational Only Phase of the Project. This predicted noise level exceeds the Project specific night-time criterion by 19 dB(A). Analysis of the predicted noise levels indicates that the vent shafts, conveyor, crusher, mobile plant and other sources of noise within the MIA are the highest contributors of noise to this receptor.

Receptor	Summary of impact
	A combination of the additional mitigation measures described in Section 12.6 (provision of air conditioning and mechanical ventilation and upgrades to the building façade) is expected to allow a reduction in noise levels of approximately 25 dB(A) through the closed façade, giving rise to residual impacts of 29 dB(A) $L_{Aeq(1h)}$ internally, which meets the Acoustic Quality Objective inside bedrooms of 30 dB(A) $L_{Aeq(1h)}$.
Tay Glen Homestead	Noise is predicted to be below the 35 dB(A) $L_{Aeq(1h)}$ Project specific criterion for the life of the mine. Higher noise levels predicted during Construction Phase 2.3 and Operational Phase are consistent with the construction of the powerline and water pipeline at positions along their respective proposed corridors closest to this receptor. Standard management measures discussed in Section 12.6 would be implemented to minimise impacts at this location.
Meadowbrook Homestead	The highest noise level of 63 dB(A) $L_{Aeq(1h)}$ is predicted during Construction Phase 2.1 and Operational Phase when the construction of the powerline and water pipeline is closest to this receptor. This predicted noise level exceeds the Project specific night-time criterion by 28 dB(A). It is expected that exposure to this noise level is relatively short lived, as the nature of construction works along the powerline has noise-generating activities which move closer to, and then subsequently away from, this receptor. When the construction of the powerline and water pipeline is located farther south (Construction Phase 2.2 and Operational Phase, and subsequently Construction Phase 2.3 and Operational Phase), the noise levels are much lower at 41 dB(A) $L_{Aeq(1h)}$. The highest predicted noise level during Operational Only Phase is 48 dB(A) $L_{Aeq(1h)}$ which is 15 dB(A) quieter than the highest predicted noise level during Construction Phase 2.1 and Operational Phase. The predicted noise level during the Operational Phase Only exceeds the Project specific night-time noise criterion by 13 dB(A). A combination of the additional mitigation measures described in Section 12.6 (provision of air conditioning and mechanical ventilation and upgrades to the building façade) is expected to allow a reduction in noise levels of approximately 25 dB(A) through the closed façade; giving rise to residual impacts of 38 dB(A) $L_{Aeq(1h)}$ during the Construction Phase 2.1 and Operational Phase, and 23 dB(A) $L_{Aeq(1h)}$ during the Operational Phase. As this residual impact continues to exceed the Acoustic Quality Objective inside bedrooms of 30 dB(A) $L_{Aeq(1h)}$ during Construction Phase 2.1 and Operational Phase, further noise treatments may be required during these periods. These include limiting construction activities, relocation of sleeping or living spaces, or relocation of the building or occupants (as described in Section 12.6). The impacts at Meadowbrook homestead are not of concern as it is vacant and will remain so throughout the life of mine.

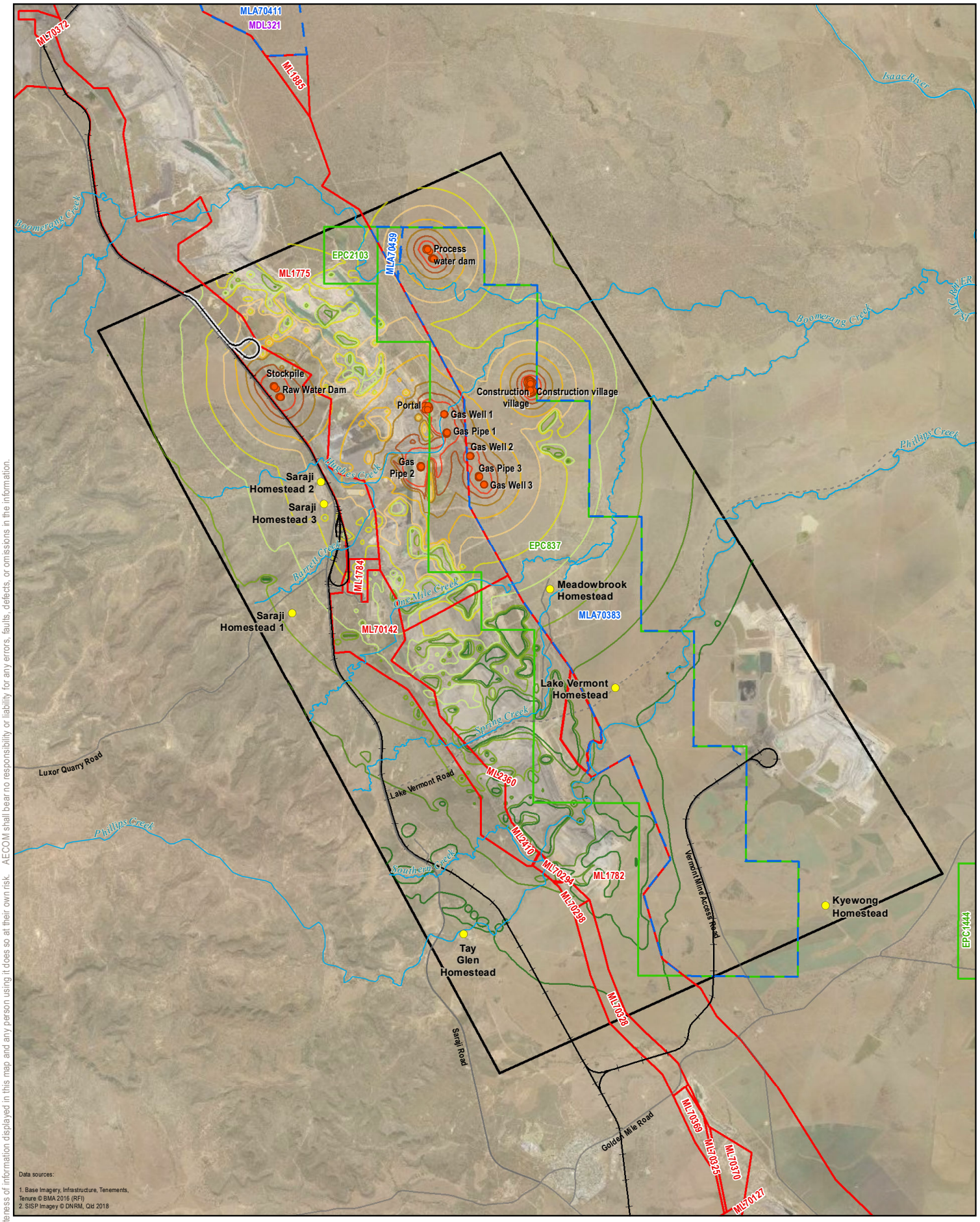
12.5.2 $L_{A1(1h)}$ noise impact

Discrete ($L_{A1(1h)}$) noise impact from the mine under three modelled meteorological conditions are summarised in Table 12-15. Predicted noise levels which exceed the Project specific noise criterion have been shown in **bold,** in Table 12-15, with the magnitude of exceedance provided in the row beneath.

The corresponding noise contour maps under neutral metrological conditions and worst-case (1) meteorological conditions are provided in Figure 12-12 through to Figure 12-21. The noise contours maps for worst-case (1) meteorological conditions can be taken to also provide an indication of the noise contours under worst-case (2) meteorological conditions, as the difference in noise levels between these two meteorological conditions is less than 5 dB, and the predicted noise levels under worst-case (1) are generally higher than under worst-case (2). Refer to Table 12-15 for the difference in meteorological parameters between worst-case (1) and worst-case (2).

Table 12-15 Predicted external $L_{A1(1h)}$ noise impact to nearby receptors

Receptor	Project Specific Night-time Criteria $L_{A1(1h)}$ dB(A)	Construction phase 1			Construction Phase 2.1 and Operational Phase			Construction Phase 2.2 and Operational Phase			Construction Phase 2.3 and Operational Phase			Operational Only Phase		
		Neutral	Worst Case (1)	Worst Case (2)	Neutral	Worst Case (1)	Worst Case (2)	Neutral	Worst Case (1)	Worst Case (2)	Neutral	Worst Case (1)	Worst Case (2)	Neutral	Worst Case (1)	Worst Case (2)
Kyewong Homestead	45	8	18	14	12	21	18	16	24	21	32	41	40	13	23	19
		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lake Vermont Homestead	45	18	27	24	31	40	40	**55**	**59**	**60**	39	**46**	**46**	28	39	36
		-	-	-	-	-	-	10	14	15	-	1	1	-	-	-
Saraji Homestead 1	45	26	36	33	27	35	33	27	35	33	27	35	33	36	**46**	43
		-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
Saraji Homestead 2	45	44	**52**	**52**	**50**	**56**	**57**	**50**	**56**	**57**	**50**	**56**	**57**	**51**	**58**	**58**
		-	7	7	5	11	12	5	11	12	5	11	12	6	13	13
Saraji Homestead 3	45	42	**51**	**51**	43	**50**	**50**	43	**50**	**50**	43	**50**	**50**	45	**53**	**52**
		-	6	6	-	5	5	-	5	5	-	5	5	-	8	7
Tay Glen Homestead	45	15	25	21	20	29	26	24	33	30	22	31	28	22	34	30
		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Meadowbrook Homestead	45	29	39	38	**64**	**67**	**68**	32	41	40	25	33	32	43	**49**	**49**
		-	-	-	19	22	23	-	-	-	-	-	-	-	-	4



LEGEND

- Exploration Permit Coal (EPC)
- Mining Lease (ML)
- Mining Lease Application (MLA)
- Assessment Boundary
- Watercourse
- Private Access Road
- Public Road
- Rail Loop
- Existing Railway
- Noise Sources

Sensitive Receptors

- Homestead

Predicted Noise Levels dB(A) $L_{A1(1h)}$

25	50
30	55
35	60
40	65
45	70

N

Figure 12-12

Construction Phase 1 – worst-case meteorological conditions – $L_{A1(1h)}$ free-field noise levels

Environmental Impact Statement
Saraji East Mining Lease Project

0 0.5 1 2
Kilometres

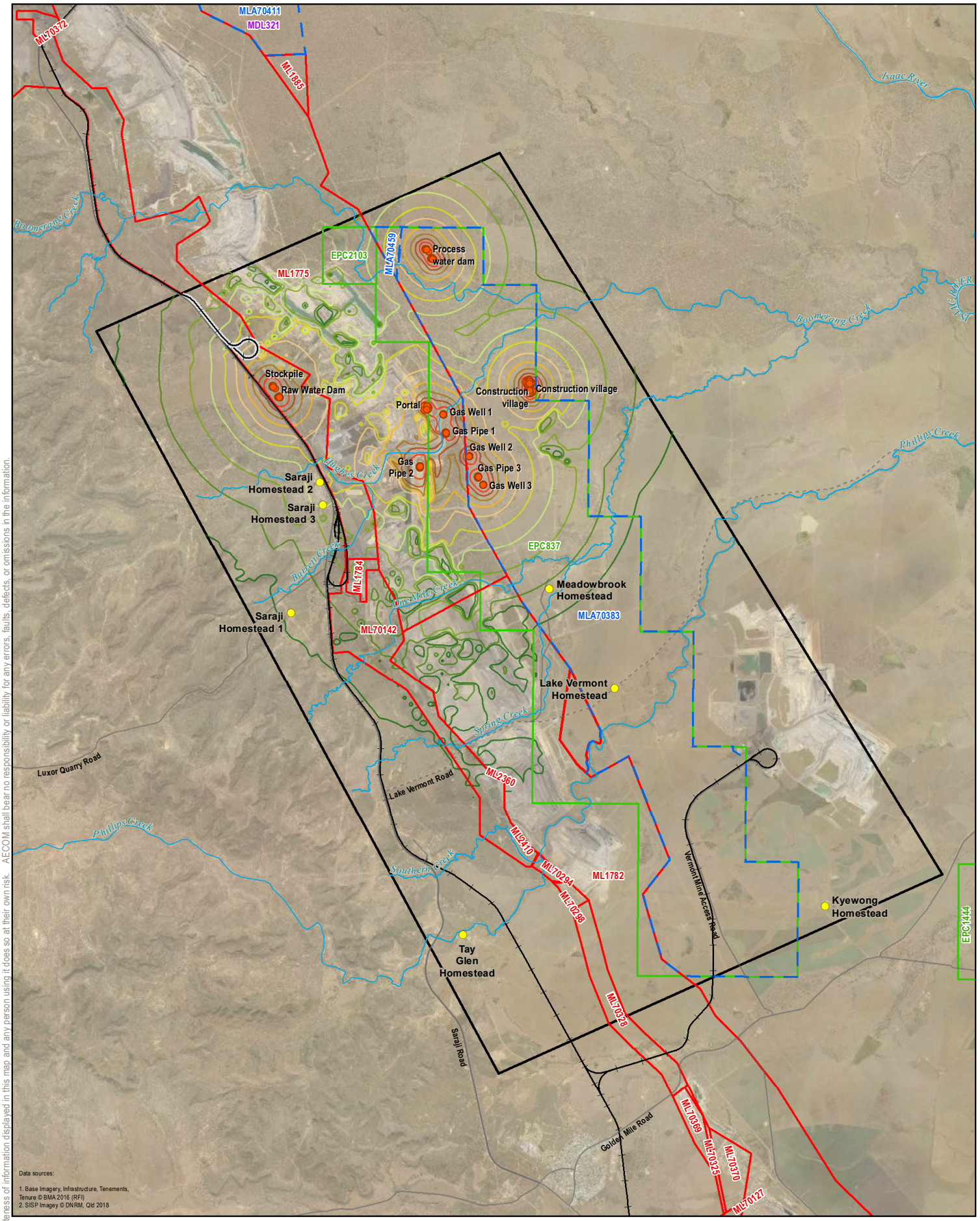
Scale: 1:158,094 (when printed at A4)

Projection: Map Grid of Australia - Zone 55 (GDA94)

BMA
BHP Mitsubishi Alliance

DATE: 3/08/2023 VERSION: 4

AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.



AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.

LEGEND

- Exploration Permit Coal (EPC)
- Mining Lease (ML)
- Mining Lease Application (MLA)
- Assessment Boundary
- Watercourse
- Private Access Road
- Public Road
- Rail Loop
- Existing Railway
- Noise Sources

Sensitive Receptors

- Homestead

Predicted Noise Levels dB(A) $L_{A1(1h)}$

- 25 — 50
- 30 — 55
- 35 — 60
- 40 — 65
- 45 — 70

Figure 12-13
Construction Phase 1 – neutral meteorological conditions – $L_{A1(1h)}$ free-field noise levels

Environmental Impact Statement
Saraji East Mining Lease Project

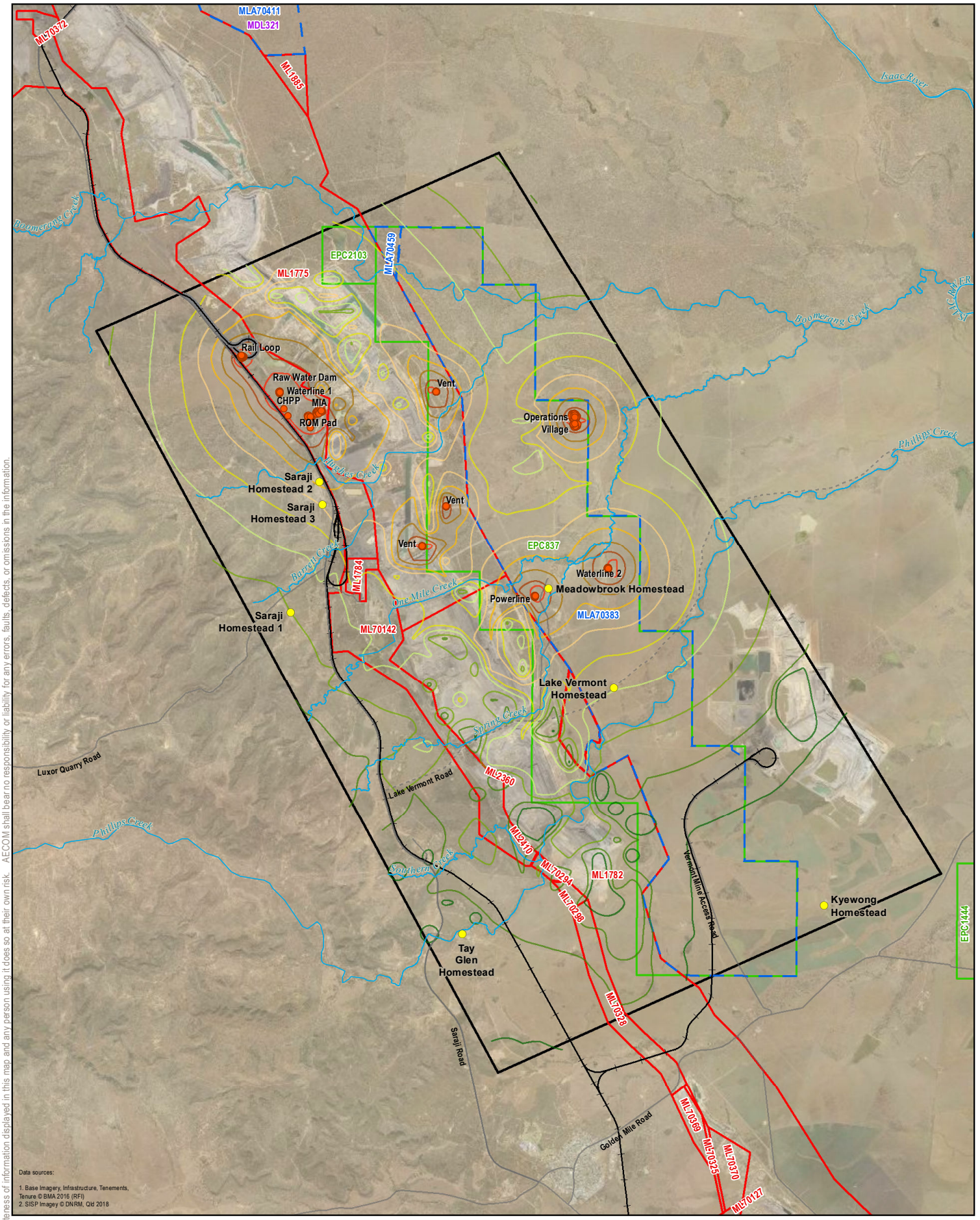
0 0.5 1 2
Kilometres

Scale: 1:158,094 (when printed at A4)
Projection: Map Grid of Australia - Zone 55 (GDA94)

BHP Mitsubishi Alliance

DATE: 3/08/2023 VERSION: 3

Filename: L:\Secure\Projects\605X\60507031\4. Tech Work Area\4.98 GIS 2021\02_MXDs\01 Environmental Impact Statement\12 Noise and Vibration\60507031_G325_v3_A4P.mxd



AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.

LEGEND

- Exploration Permit Coal (EPC)
- Mining Lease (ML)
- Mining Lease Application (MLA)
- Assessment Boundary
- Watercourse
- Private Access Road
- Public Road
- Rail Loop
- Existing Railway
- Noise Sources

Sensitive Receptors

- Homestead

Predicted Noise Levels dB(A) $L_{A1(1h)}$

25	50
30	55
35	60
40	65
45	70

N

Figure 12-14
Construction Phase 2.1 and Operational Phase – powerline and water line construction near Meadowbrook Homestead – worst-case meteorological conditions – $L_{A1(1h)}$ free-field noise levels

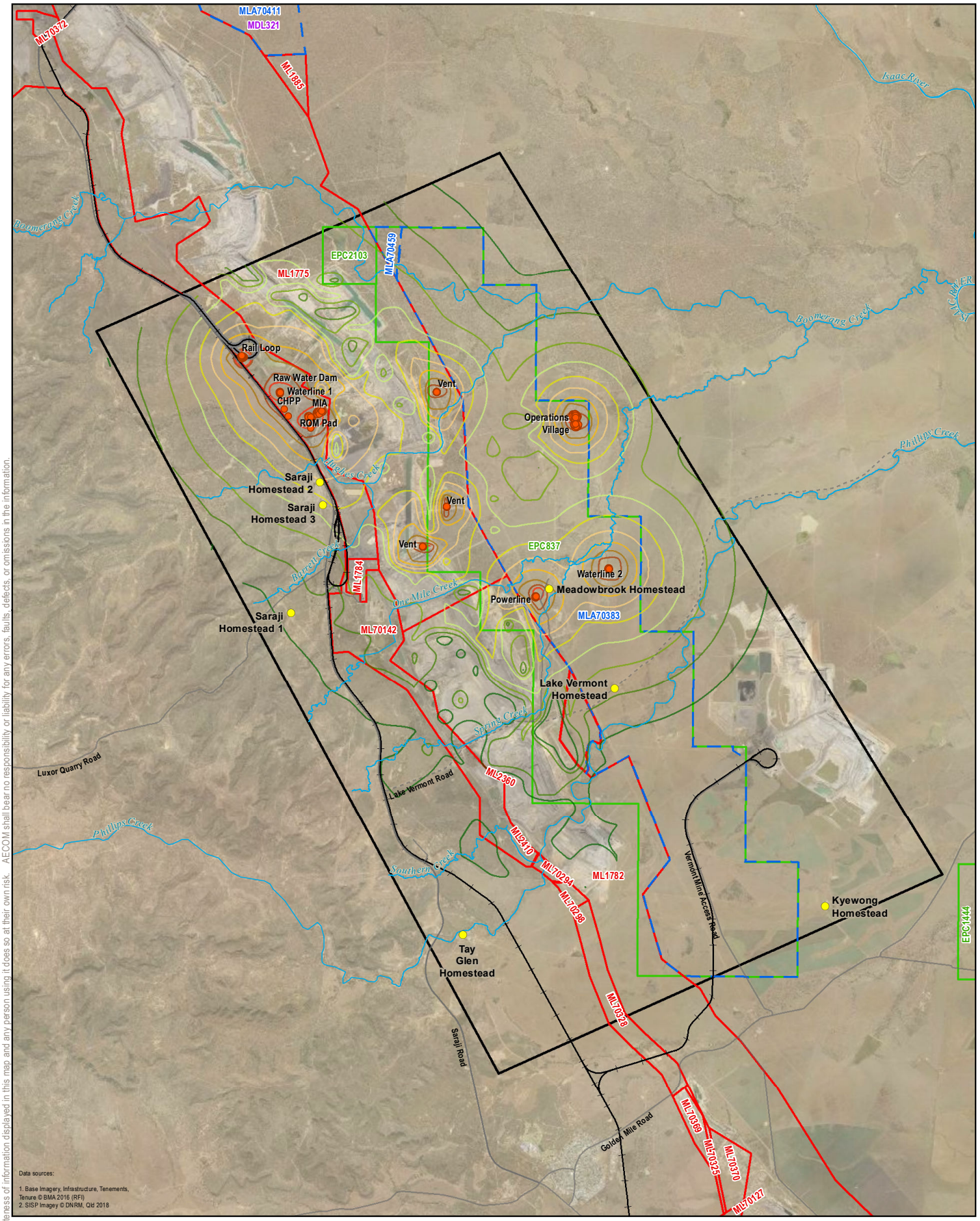
Environmental Impact Statement
Saraji East Mining Lease Project

0 0.5 1 2
Kilometres
Scale: 1:158,094 (when printed at A4)
Projection: Map Grid of Australia - Zone 55 (GDA94)

BMA
BHP Mitsubishi Alliance

DATE: 3/08/2023 VERSION: 3

Filename: L:\Secure\Projects\605X\60507031\4. Tech Work Area\4.98 GIS 2021\02_MXDs\01 Environmental Impact Statement\12 Noise and Vibration\60507031_G326_v3_A4P.mxd



AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.

LEGEND

- Exploration Permit Coal (EPC)
- Mining Lease (ML)
- Mining Lease Application (MLA)
- Assessment Boundary
- Watercourse
- Private Access Road
- Public Road
- Rail Loop
- Existing Railway
- Noise Sources

Sensitive Receptors

- Homestead

Predicted Noise Levels dB(A) $L_{A1(1h)}$

25	50
30	55
35	60
40	65
45	70

N

Figure 12-15
Construction Phase 2.1 and Operational Phase – powerline and water line construction near Meadowbrook Homestead – neutral meteorological conditions – $L_{A1(1h)}$ free-field noise levels

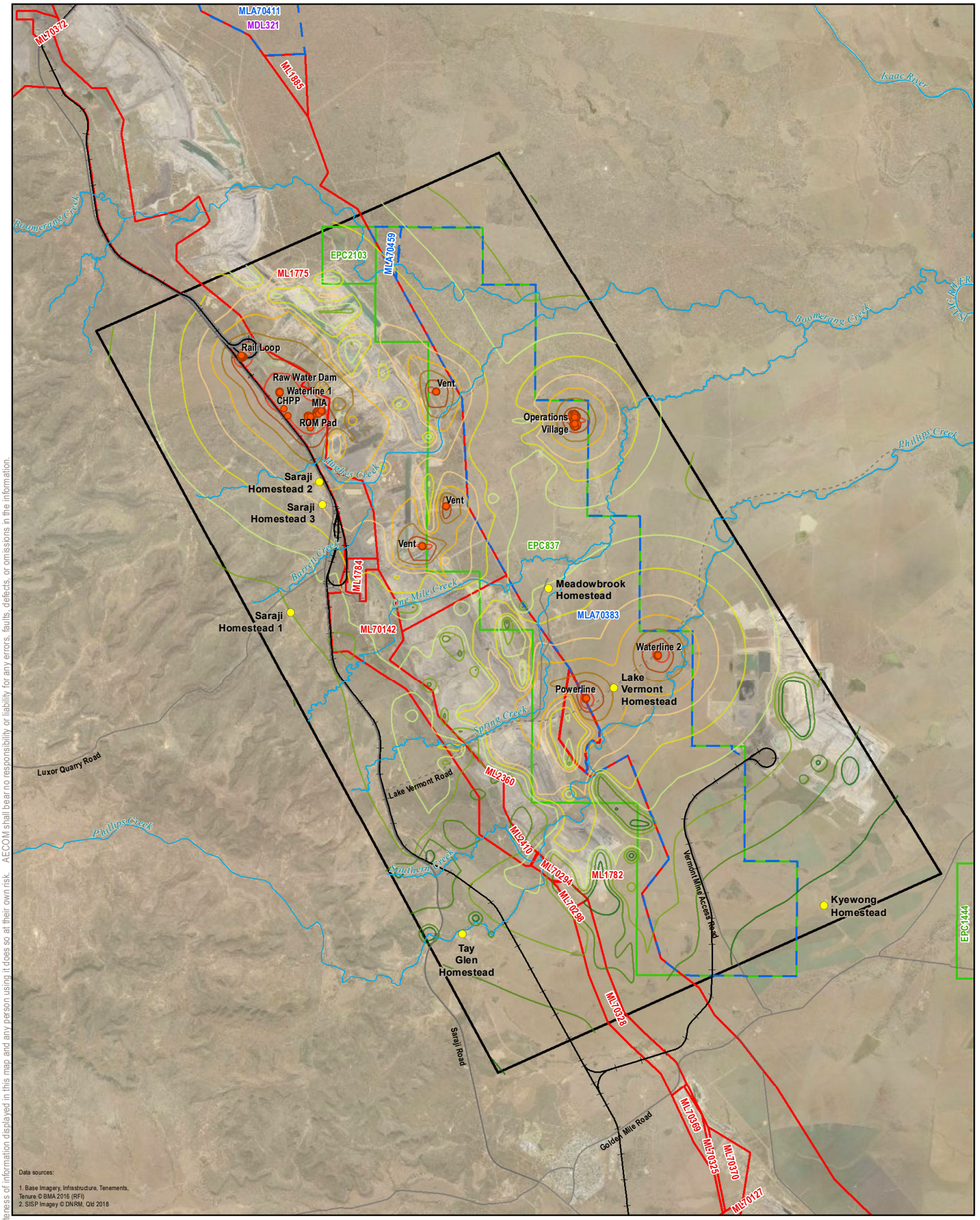
Environmental Impact Statement
Saraji East Mining Lease Project

0 0.5 1 2
Kilometres
Scale: 1:158,094 (when printed at A4)
Projection: Map Grid of Australia - Zone 55 (GDA94)

BMA
BHP Mitsubishi Alliance

DATE: 3/08/2023 VERSION: 3

Filename: L:\Secure\Projects\605X\60507031\4. Tech Work Area\4.98 GIS 2021\02_MXDs\01 Environmental Impact Statement\12 Noise and Vibration\60507031_G327_v3_A4P.mxd



AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.

LEGEND

- Exploration Permit Coal (EPC)
- Mining Lease (ML)
- Mining Lease Application (MLA)
- Assessment Boundary
- Watercourse
- Private Access Road
- Public Road
- Rail Loop
- Existing Railway
- Noise Sources

Sensitive Receptors

- Homestead

Predicted Noise Levels dB(A) $L_{A1(1h)}$

25	50
30	55
35	60
40	65
45	70

N

Figure 12-16
Construction Phase 2.2 and Operational Phase – powerline and water line construction near Lake Vermont Homestead - worst-case meteorological conditions – $L_{A1(1h)}$ free-field noise levels

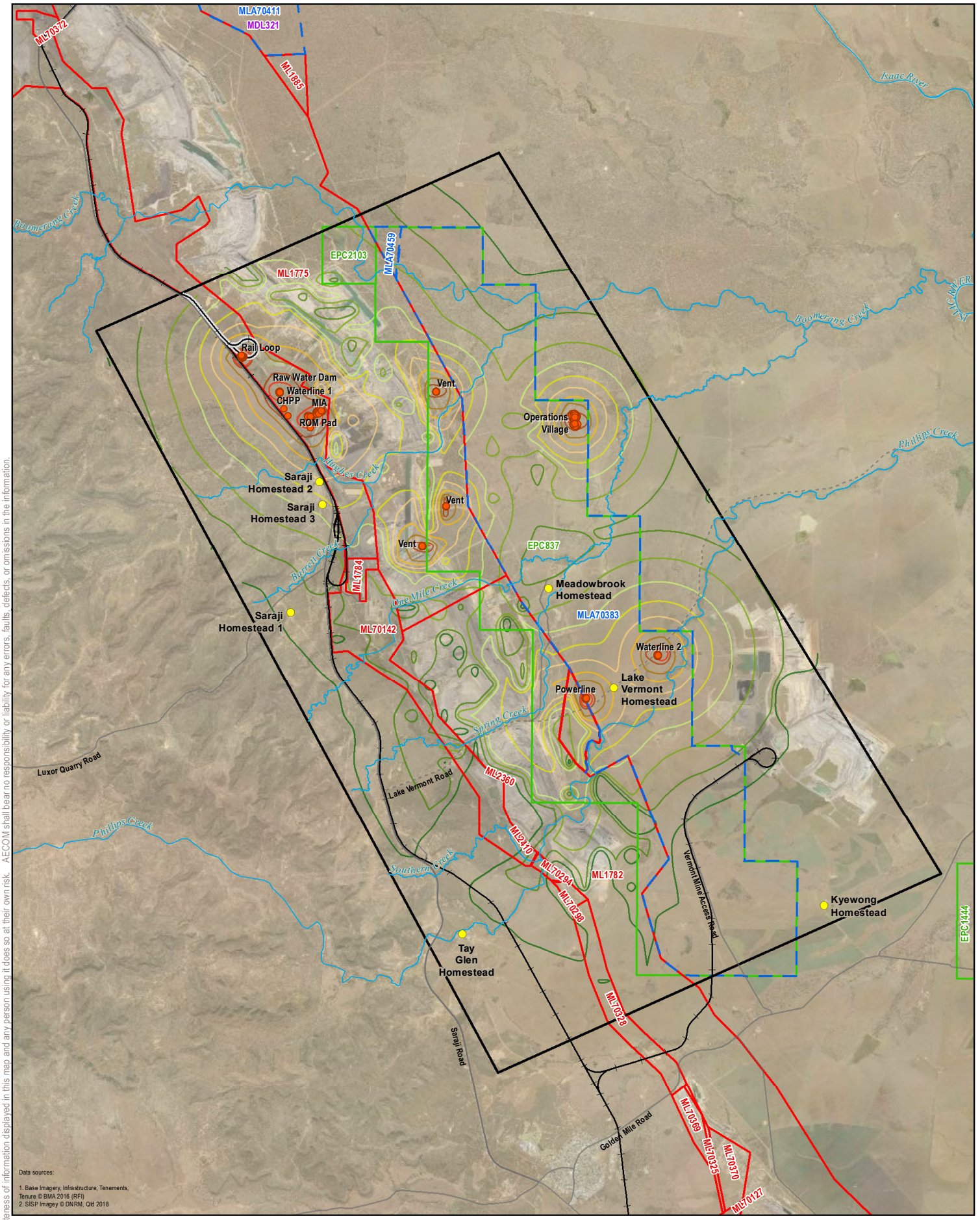
Environmental Impact Statement
Saraji East Mining Lease Project

0 0.5 1 2
Kilometres
Scale: 1:158,094 (when printed at A4)
Projection: Map Grid of Australia - Zone 55 (GDA94)

BMA
BHP Mitsubishi Alliance

DATE: 3/08/2023 VERSION: 3

Filename: L:\Secure\Projects\605X\60507031\4. Tech Work Area\4.98 GIS 2021\02_MXDs\01 Environmental Impact Statement\12 Noise and Vibration\60507031_G328_v3_A4P.mxd



Data sources:

1. Base Imagery, Infrastructure, Tenements, Tenure © BMA 2016 (RFI)
2. SISP Imagery © DNRM, Qld 2018

AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.

LEGEND

- Exploration Permit Coal (EPC)
- Mining Lease (ML)
- Mining Lease Application (MLA)
- Assessment Boundary
- Watercourse
- Private Access Road
- Public Road
- Rail Loop
- Existing Railway
- Noise Sources

Sensitive Receptors

- Homestead

Predicted Noise Levels dB(A) $L_{A1(1h)}$

25	50
30	55
35	60
40	65
45	70

N

Figure 12-17
Construction Phase 2.2 and Operational Phase – powerline and water line construction near Lake Vermont Homestead – neutral meteorological conditions – $L_{A1(1h)}$ free-field noise levels

Environmental Impact Statement
Saraji East Mining Lease Project

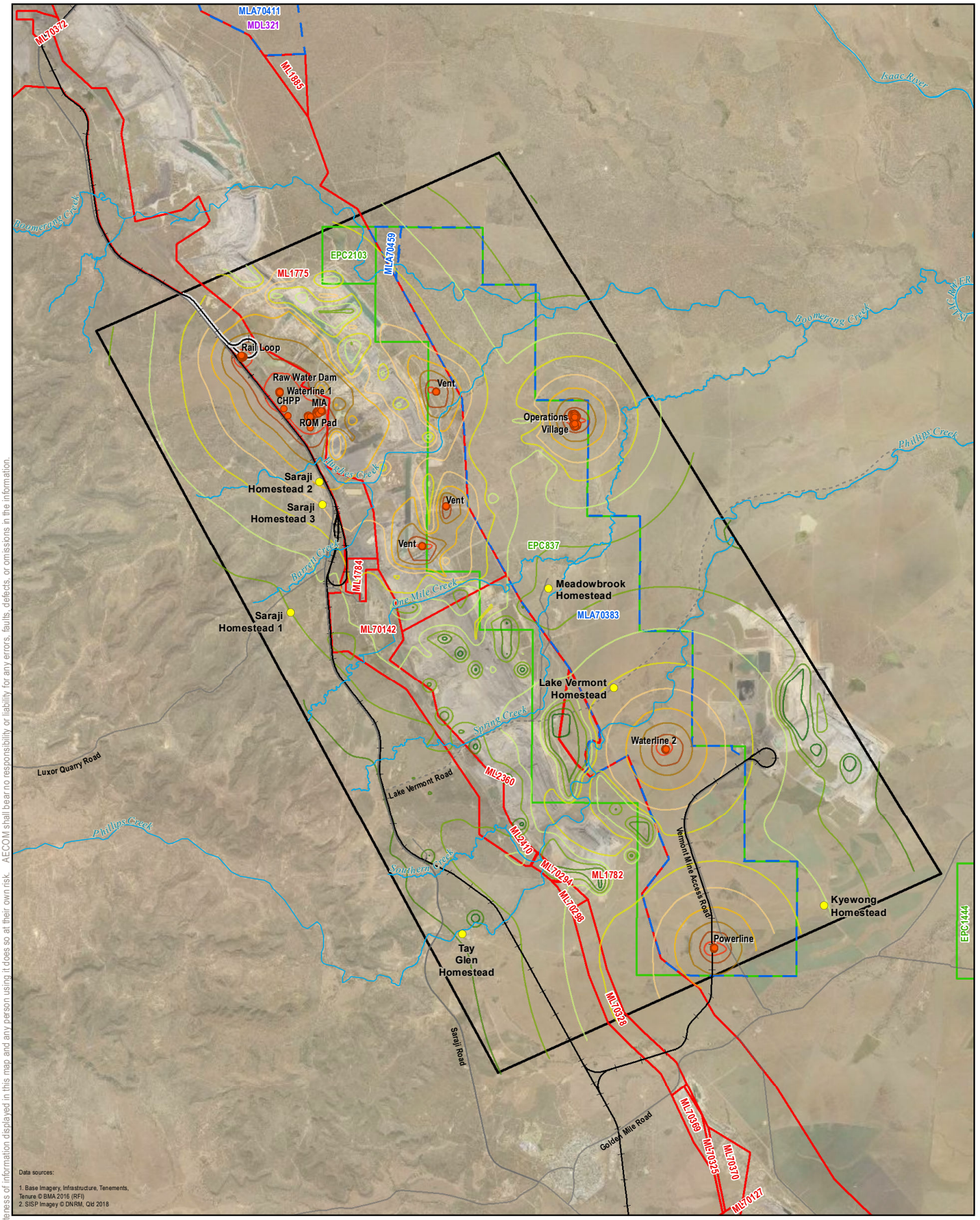
0 0.5 1 2
Kilometres

Scale: 1:158,094 (when printed at A4)
Projection: Map Grid of Australia - Zone 55 (GDA94)

BMA
BHP Mitsubishi Alliance

DATE: 3/08/2023 VERSION: 3

Filename: L:\Secure\Projects\605X\60507031\4. Tech Work Area\4.98 GIS 2021\02_MXDs\01 Environmental Impact Statement\12 Noise and Vibration\60507031_G329_v3_A4P.mxd



LEGEND

- Exploration Permit Coal (EPC)
- Mining Lease (ML)
- Mining Lease Application (MLA)
- Assessment Boundary
- Watercourse
- Private Access Road
- Public Road
- Rail Loop
- Existing Railway
- Noise Sources

Sensitive Receptors

- Homestead

Predicted Noise Levels dB(A) $L_{A1(1h)}$

25	50
30	55
35	60
40	65
45	70

N

Figure 12-18

Construction Phase 2.3 and Operational Phase – powerline and water line construction near Kyewong and Tay Glen Homesteads – worst-case meteorological conditions – $L_{A1(1h)}$ free-field noise levels

Environmental Impact Statement
Saraji East Mining Lease Project

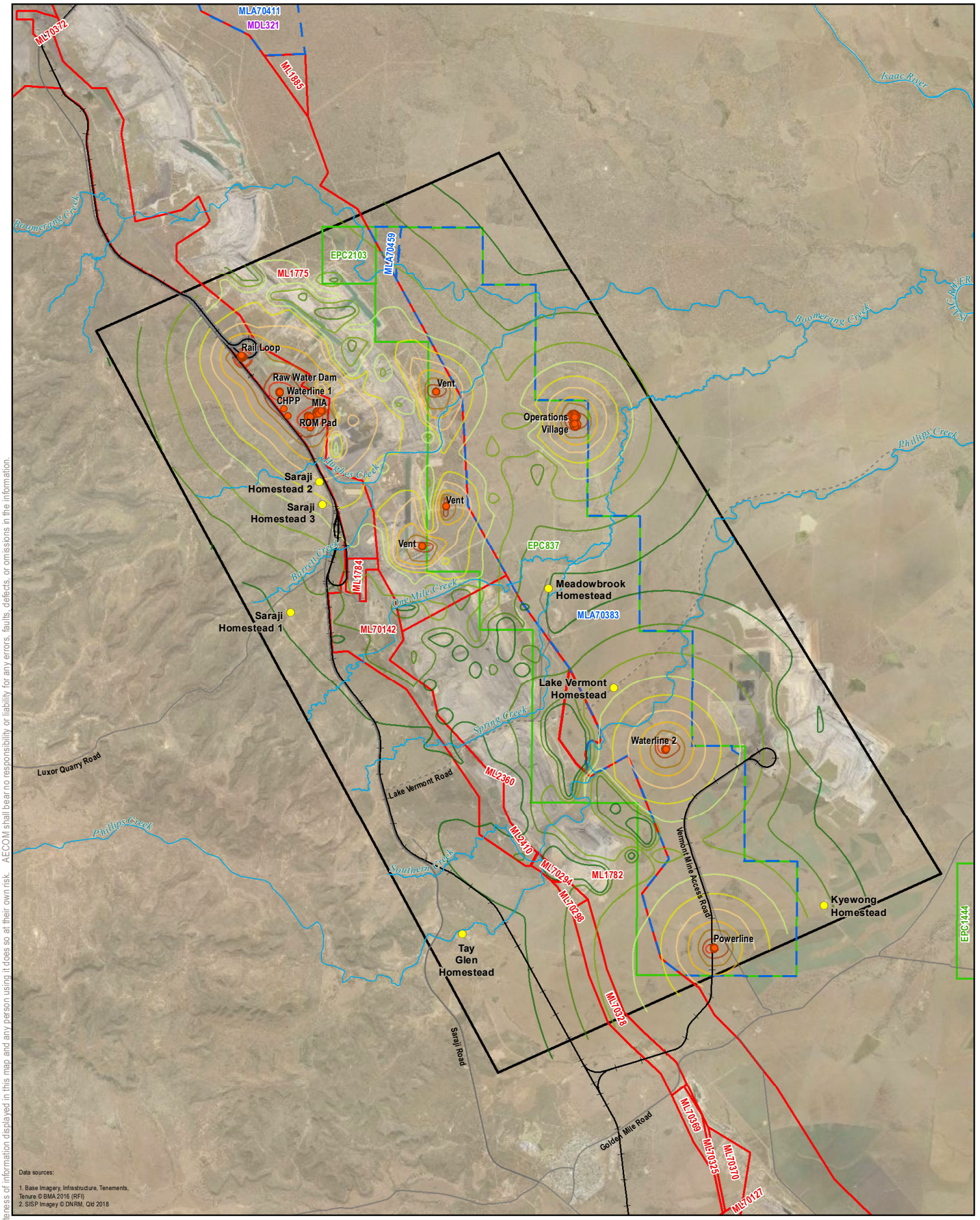
0 0.5 1 2
Kilometres
Scale: 1:158,094 (when printed at A4)
Projection: Map Grid of Australia - Zone 55 (GDA94)

BMA
BHP Mitsubishi Alliance

DATE: 3/08/2023 VERSION: 3

AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.

Filename: L:\Secure\Projects\605X\60507031\4. Tech Work Area\4.98 GIS 2021\02_MXDs\01 Environmental Impact Statement\12 Noise and Vibration\60507031_G330_v3_A4P.mxd



AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.

LEGEND

- Exploration Permit Coal (EPC)
- Mining Lease (ML)
- Mining Lease Application (MLA)
- Assessment Boundary
- Watercourse
- Private Access Road
- Public Road
- Rail Loop
- Existing Railway
- Noise Sources

Sensitive Receptors

- Homestead

Predicted Noise Levels dB(A) $L_{A1(1h)}$

25	50
30	55
35	60
40	65
45	70

N

Figure 12-19
Construction Phase 2.3 and Operational Phase – powerline and water line construction near Kyewong and Tay Glen Homesteads – neutral meteorological conditions – $L_{A1(1h)}$ free-field noise levels

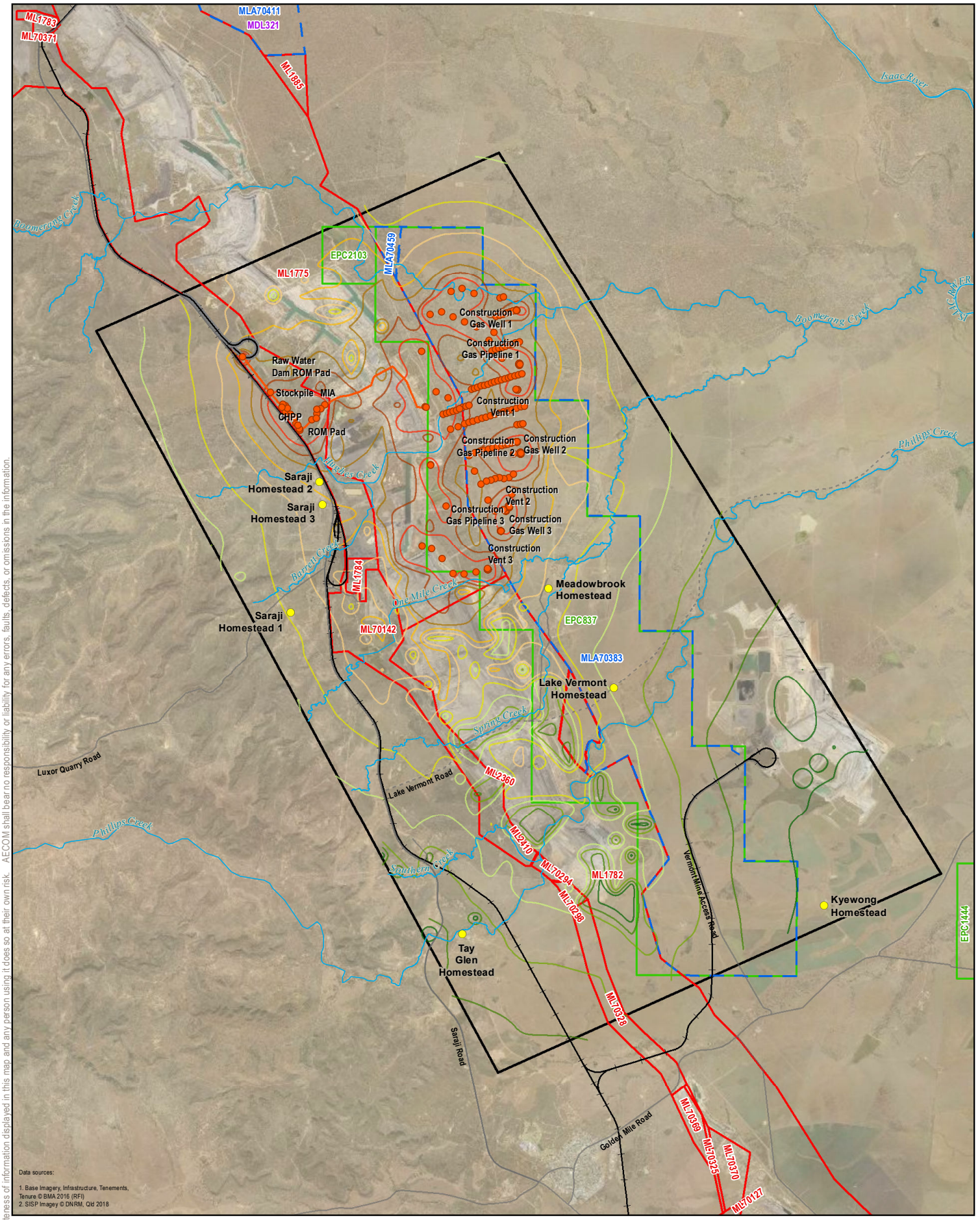
Environmental Impact Statement
Saraji East Mining Lease Project

0 0.5 1 2
Kilometres
Scale: 1:158,094 (when printed at A4)
Projection: Map Grid of Australia - Zone 55 (GDA94)

BMA
BHP Mitsubishi Alliance

DATE: 3/08/2023 VERSION: 3

Filename: L:\Secure\Projects\605X\60507031\4. Tech Work Area\4.98 GIS 2021\02_MXDs\01 Environmental Impact Statement\12 Noise and Vibration\60507031_G331_v3_A4P.mxd



AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.

LEGEND

- Exploration Permit Coal (EPC)
- Mining Lease (ML)
- Mining Lease Application (MLA)
- Assessment Boundary
- Watercourse
- Private Access Road
- Public Road
- Rail Loop
- Existing Railway
- Conveyor Belt
- Noise Sources

Sensitive Receptors

- Homestead

Predicted Noise Levels dB(A) $L_{A1(1h)}$

25 50
30 55
35 60
40 65
45 70

Figure 12-20
Operational Only Phase - worst-case meteorological conditions – $L_{A1(1h)}$ free-field noise levels

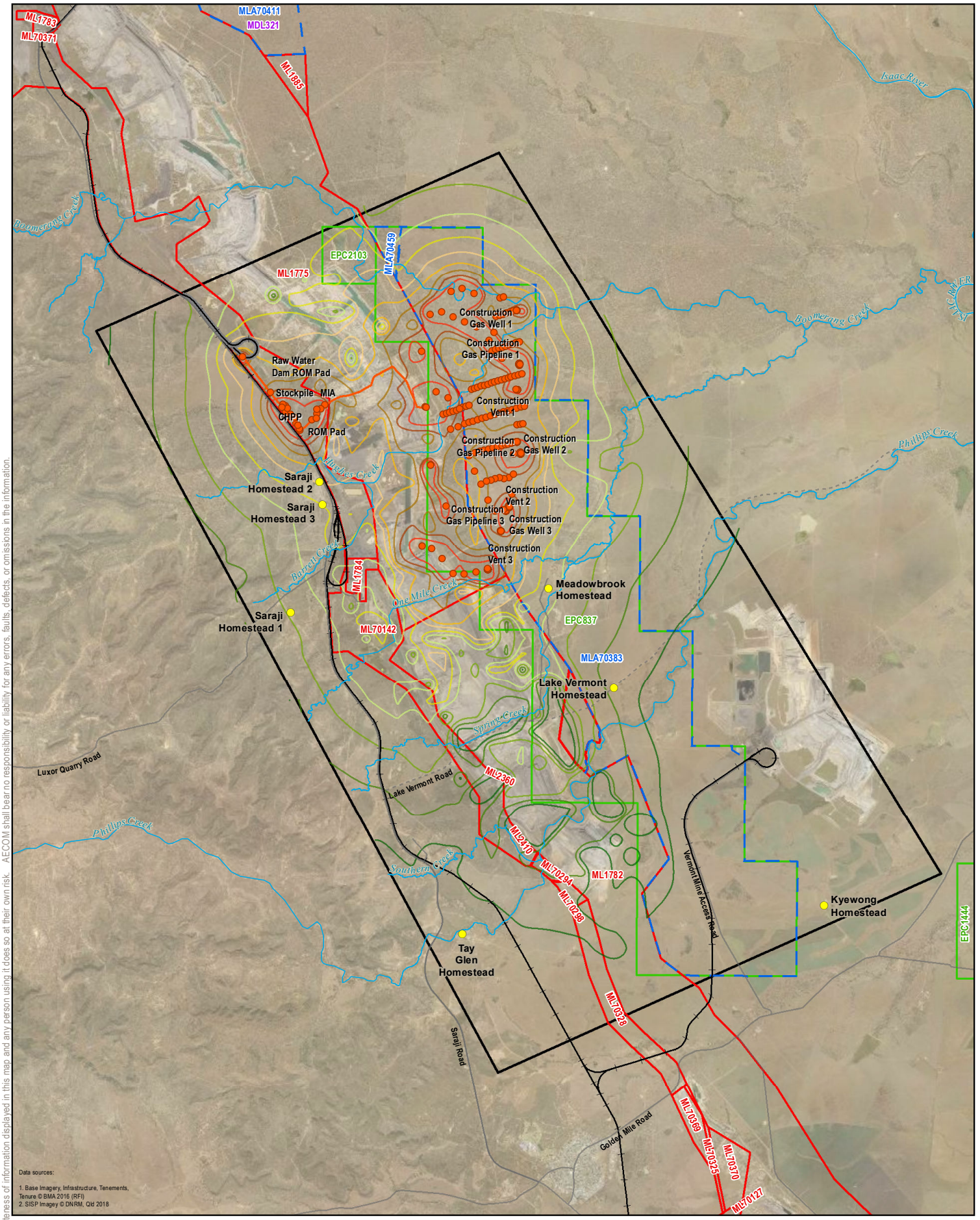
Environmental Impact Statement
Saraji East Mining Lease Project

0 0.5 1 2
Kilometres

Scale: 1:158,094 (when printed at A4)
Projection: Map Grid of Australia - Zone 55 (GDA94)

BMA
BHP Mitsubishi Alliance

DATE: 3/08/2023 VERSION: 3



LEGEND

- Exploration Permit Coal (EPC)
- Mining Lease (ML)
- Mining Lease Application (MLA)
- Assessment Boundary
- Watercourse
- Private Access Road
- Public Road
- Rail Loop
- Existing Railway
- Conveyor Belt
- Noise Sources

Sensitive Receptors

- Homestead

Predicted Noise Levels dB(A) $L_{A1(1h)}$

25	50
30	55
35	60
40	65
45	70

N

Figure 12-21

Operational Only Phase – neutral meteorological conditions – $L_{A1(1h)}$ free-field noise levels

Environmental Impact Statement Saraji East Mining Lease Project

0 0.5 1 2

Kilometres

Scale: 1:158,094 (when printed at A4)

Projection: Map Grid of Australia - Zone 55 (GDA94)

BMA

BHP Mitsubishi Alliance

DATE: 3/08/2023 VERSION: 4

AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.

A summary of discrete noise impacts to each sensitive receptor is provided in Table 12-16. The recommended management measures for each location are described in Section 12.6.

Table 12-16 Summary of impacts of $L_{A1(1h)}$ at each receptor

Receptor	Summary of impact
Kyewong Homestead	Noise from the Project is predicted to be under the 45 dB(A) $L_{A1(1h)}$ Project specific criterion for the life of the mine.
Lake Vermont Homestead	The highest noise level of 60 dB(A) $L_{A1(1h)}$ is predicted during Construction Phase 2.2 and Operational Phase when the construction of the powerline and water pipeline are closest to this receptor. This predicted noise level exceeds the Project specific night-time criterion by 15 dB(A). It is expected that exposure to this noise level is relatively short-lived, as the nature of construction works along the powerline and water pipeline has noise-generating activities which move closer to, and then subsequently away from, this receptor. The highest predicted noise level during the operational phase is 39 dB(A) $L_{A1(1h)}$ which is 21 dB(A) quieter than during Construction Phase 2.2 and Operational Phase, and under the Project specific night-time criterion.
Saraji Homestead 1	Noise from the Project is predicted to be under the 45 dB(A) $L_{A1(1h)}$ noise level for all modelled scenarios except during the Operational Only Phase. The magnitude of exceedance is predicted to be 1 dB(A) above the Project specific noise criterion, noting that a change in noise level of up to 2 dB is not perceptible to most people. As such this magnitude of exceedance is considered to be small, and the predicted noise levels are considered to effectively meet the nominated noise criterion.
Saraji Homestead 2	Noise levels of up to 58 dB(A) $L_{A1(1h)}$ were predicted during the Operational Only Phase. This predicted noise level exceeds the Project specific night-time criterion by 13 dB(A). Analysis of the predicted noise levels indicates that noise from the primary crusher within the MIA comprised the highest contributor of noise to this receptor, followed by noise from mobile plant operating within the MIA.
Saraji Homestead 3	Noise levels of up to 53 dB(A) $L_{A1(1h)}$ were predicted during the Operational Only Phase. This predicted noise level exceeds the Project specific night-time criterion by 8 dB(A).
Tay Glen Homestead	Noise from the Project is predicted to be under the 45 dB(A) $L_{A1(1h)}$ Project specific criterion for the life of the mine.
Meadowbrook Homestead	The highest noise level of 68 dB(A) $L_{A1(1h)}$ is predicted during Construction Phase 2.1 and Operational Phase when the construction of the powerline and water pipeline is closest to this receptor. This predicted noise level exceeds the Project specific night-time criterion by 23 dB(A). It is expected that exposure to this noise level is relatively short-lived, as the nature of construction works along the powerline has noise-generating activities which move closer to, and then subsequently away from, this receptor. The highest predicted noise level during the Operational Only Phase is 49 dB(A) $L_{A1(1h)}$, which is 19 dB(A) quieter than during Construction Phase 2.1 and Operational Phase. The predicted noise level during the Operational Only Phase exceeds the Project specific night-time noise criterion by 4 dB(A).

12.5.3 Low frequency noise impact

Operational low frequency noise impacts from the mine under three modelled meteorological conditions are summarised in Table 12-17. The predicted noise levels were compared against the screening assessment discussed in the Ecoaccess guideline *Assessment of Low Frequency Noise*.

The screening assessment requires both the $L_{LINeq(T)}$ noise level to be above 55 dBL, and the difference between the A-weighted $L_{Aeq(T)}$ and unweighted $L_{LINeq(T)}$ to be greater than 15 dB, for there to be an increased likelihood of low frequency noise annoyance. The $L_{Aeq(T)}$ predicted noise levels are presented in Table 12-19 for reference. For convenience, only $L_{LINeq(T)}$ values which exceed both trigger requirements, i.e. greater than 55 dB(L) and 15 dB greater than their corresponding A-weighted values in Table 12-17 have been shown in **bold**.

Table 12-17 Predicted external LLINeq(T) noise impact to nearby receptors

Receptor	Ecoaccess low frequency noise criterion L_{LINeq} dBL	Construction Phase 1			Construction Phase 2.1 and Operational Phase			Construction Phase 2.2 and Operational Phase			Construction Phase 2.3 and Operational Phase			Operational Only Phase		
		Neutral	Worst Case (1)	Worst Case (2)	Neutral	Worst Case (1)	Worst Case (2)	Neutral	Worst Case (1)	Worst Case (2)	Neutral	Worst Case (1)	Worst Case (2)	Neutral	Worst Case (1)	Worst Case (2)
Kyewong Homestead	55*	29	39	36	31	39	37	34	41	39	45	49	49	31	40	38
Lake Vermont Homestead	55*	40	47	45	48	52	52	**64**	**66**	**67**	51	54	54	46	51	51
Saraji Homestead 1	55*	49	54	53	47	53	52	47	52	51	46	52	51	51	**57**	56
Saraji Homestead 2	55*	**60**	**65**	**64**	**64**	**68**	**68**	**64**	**68**	**68**	**64**	**68**	**68**	**65**	**68**	**68**
Saraji Homestead 3	55*	**58**	**63**	**62**	**59**	**63**	**63**	**59**	**63**	**63**	**59**	**63**	**63**	**61**	**65**	**65**
Tay Glen Homestead	55*	38	45	44	40	47	46	42	48	47	41	48	47	43	49	50
Meadowbrook Homestead	55*	49	53	53	**72**	**73**	**74**	50	54	54	47	52	51	**57**	**60**	**60**

*Additionally, the dBL noise levels should be no more than 15 dB higher than the dB(A) noise level.

A summary of the low frequency impacts to sensitive receptors is provided in Table 12-18.

Table 12-18 Summary of low frequency noise impacts

Receptor	Summary of impacts
Kyewong Homestead	Predicted noise levels are anticipated to comply with the conditions of the initial low frequency noise assessment.
Lake Vermont Homestead	Predicted noise levels are anticipated to comply with the conditions of the initial low frequency noise assessment.
Saraji Homestead 1	Likelihood of increased low frequency noise annoyance is predicted during Operational Phase during worst-case meteorological conditions with adverse winds, although this comprises a marginal (1 dB) exceedance of the first step in the screening assessment.
Saraji Homestead 2	The likelihood of increased low frequency noise annoyance is predicted during Construction Phase 1, and Operational Phase.
Saraji Homestead 3	The likelihood of increased low frequency noise annoyance is predicted during neutral meteorological conditions, across all modelled scenarios.
Tay Glen Homestead	Predicted noise levels are anticipated to comply with the conditions of the initial low frequency noise assessment.
Meadowbrook Homestead	The likelihood of increased low frequency noise annoyance is predicted during neutral meteorological conditions in the Operational Phase. However, Meadowbrook Homestead is vacant and will remain so throughout the life of mine.

12.5.4 Cumulative noise impacts

Road traffic noise

The predicted increase in traffic noise levels, with and without the influence of the Project, are summarised in Table 12-19 below.

Table 12-19 Predicted increase in road traffic noise levels due to the Project

Road	Scenario	Annual average daily traffic (percentage of heavy vehicle)			
		Year 1	Year 2	Year 3	Year 18
Saraji Road	Without Project	2,005 (15%)	2,045 (15%)	2,045 (15%)	2,420 (15%)
	With Project	2,329 (27%)	2,579 (33%)	2,195 (21%)	2,570 (20%)
Predicted Increase in LA10 (18h) Noise Level dB		+1.9	+2.8	+1.0	+0.8
Peak Down Highway	Without Project	2,960 (18%)	3,020 (18%)	3,020 (18%)	3,575 (18%)
	With Project	3,284 (26%)	3,554 (30%)	3,170 (22%)	3,725 (21%)
Predicted Increase in LA10 (18h) Noise Level dB		+1.3	+1.9	+0.6	+0.5

For all scenarios except Saraji Road in Year 1, the predicted increase in road traffic noise levels is no more than 2 dB (0.4 is rounded down, while 0.5 is rounded up). As discussed in Section 12.2, changes in noise levels of up to 2 dB are not perceptible to most people. Therefore, no adverse noise impacts are expected due to increased road traffic noise on public roads.

For Saraji Road in Year 1, the increase in road traffic noise is predicted to be 3 dB (rounded up from 2.8 dB). A 3 dB change in noise levels is just perceptible to most people. In addition, this change in noise level is only predicted for Year 1; the change in noise level reduces to +1 dB the following year when traffic generation from the mine falls with the completion of the construction phase of the mine. As such, given the “just perceptible” increase in noise levels for only one year, the predicted impacts are considered to be negligible.

Noise impacts outlined in this section were predicted based on the assumptions and methodology discussed in Section 12.3.1. The predicted increase in rail noise levels as a result of this Project are summarised in Table 12-20 below.

Table 12-20 Predicted increase in rail traffic noise levels due to the Project

Rail network	Daily train movements	
	Year 1-3	Year 3-20
Without Project	12	12
With Project	12	18
Predicted increase in $L_{Aeq(24h)}$ noise level dB	No change	+1.8
Predicted increase in single event maximum noise level dB	No change	No Change

The above increase in noise levels is predicted to be less than 2 dB. As discussed in Section 12.2, changes in noise levels of up to 2 dB are not perceptible to most people. Therefore, no adverse noise impacts are expected due to increased rail movement noise.

Cumulative noise with existing and future development

The noise impacts in this section are based on the following:

- predicted operational $l_{aeq(1h)}$ mine noise impacts from the existing Saraji Mine (including Grevillea Pit extension) to nearby receptors, which are considered to be the baseline noise impact to these receptors. These were discussed in Table 12-19 and reproduced in Table 12-21 under the 'Saraji Mine component' columns
- predicted operational $l_{aeq(1h)}$ mine impact from the Project to nearby receptors, as discussed in section 12.3.5 these are shown under the 'Project component' columns in Table 12-21
- the cumulative noise impacts are based on the energy-addition of the above component noise impacts, shown in **bold** in Table 12-21.

Table 12-21 Predicted increase in industrial noise impact to nearby receptors due to the Project

Receptor	Predicted operational noise impact LAeq(1h) dB(A) – neutral conditions				Predicted operational noise impact LAeq(1h) dB(A) – worst-case conditions			
	Saraji Mine component	Project component	Cumulative noise levels	Predicted increase in noise level	Wider Saraji Mine	Project component	Cumulative noise levels	Predicted increase in noise level
Kyewong Homestead	26	14	**26**	0	33	25	**34**	1
Lake Vermont Homestead	42	28	**42**	0	49	38	**49**	0
Saraji Homestead 1	40	34	**41**	1	46	44	**48**	2
Saraji Homestead 2	40	49	**50**	10	46	57	**57**	11
Saraji Homestead 3	42	45	**47**	5	47	54	**55**	8
Tay Glen Homestead	31	22	**31**	0	38	33	**39**	1
Meadowbrook Homestead	43	41	**45**	2	49	48	**52**	3

Generally, changes in noise levels of up to 2 dB are not perceptible to most people. Therefore, no adverse noise impacts are expected due to increased industrial noise at Kyewong Homestead, Lake Vermont Homestead, Saraji Homestead 1 and Tay Glen Homestead.

A 3 dB change in noise levels is just perceptible to most people. As such, the increase in operational industrial noise is considered to be “just perceptible” at Meadowbrook Homestead. This homestead is owned by BMA and will remain vacant throughout the life of mine.

The noise levels at Saraji Homestead 2 and Saraji Homestead 3 are predicted to be 5 to 11 dB higher during operation with the inclusion of the Project. Subjectively, this increase in industrial noise ranges from “clearly perceptible” to “twice as loud”, as discussed in Section 12.2. Both homesteads have co-existence agreements currently in place with BMA and when required for mining or subject to mining impacts, the homesteads will be vacated.

12.6 Mitigation measures

The type of noisy plant and equipment used on the Project are dictated by mine activities; accordingly, alternative plant and equipment which may have lower power ratings (and consequently lower noise emissions levels) cannot practically be used to reduce noise impacts without compromising the Project’s throughput. Also, the locations of noisy plant and equipment are constrained by the mine plan, MIA layout, and operational requirements of the mine; accordingly, these noisy plant and equipment cannot practically be located farther away from sensitive receptors so as to reduce noise impacts.

BMA will implement standard noise control measures for the Project, including:

- maintaining machinery to minimise noise
- working with equipment suppliers to provide machinery that is designed to be quieter
- stopping and starting up equipment as far away as possible from receptors
- maintaining internal roads in good working order
- use of broadband reverse alarms on all machinery that regularly reverse (e.g. bulldozers and front-end loaders)
- noise control to the ventilation shafts, including:
    - orientate discharge outlets away from nearby sensitive receptors
    - variable speed devices fitted to fan motors
- treatments to conveyors, such as the use of low noise idlers, and partial enclosures
- Providing awareness and understanding of noise issues through site inductions for all staff and contractors.

Community and complaints management techniques will be undertaken in accordance with the community complaints and grievances procedure that is current at the time of Project commencement. Such techniques include:

- taking steps to inform the community as to how complaints can be made
- investigating the complaints and, where required, the use of appropriate dispute resolution activities
- maintaining a complaint register to record all relevant information associated with the complaint, including the personnel responsible for handling the complaint and the corrective actions taken
- ensuring that a complainant is advised of the outcomes in relation to their complaint.

It is noted that co-existence agreements are currently in place, or being actively sought, at the following receptors:

- Lake Vermont Homestead – BMA owned. When required for mining or subject to mining impacts the homestead will be vacated
- Saraji Homestead 1 – discussions between BMA and the landholder concerning a co-existence agreement have commenced
- Saraji Homestead 2 – Co-existence agreement currently in place between BMA and the landholder

- Saraji Homestead 3 – Co-existence agreement currently in place between BMA and the landholder

BMA will consider the above current or pending agreements with potentially affected landholders when finalising mitigation measures. Specific noise treatments at potentially affected receptors may include the following additional noise mitigation measures to control noise ingress into habitable spaces:

- provision of air-conditioning and mechanical ventilation (to allow windows and doors to remain closed)
- upgrades to the building façade, including treatments to roof, walls, doors, windows and raised floors (if any), if the building is not of contemporary construction.

Specific recommendations for additional noise mitigation measures at relevant locations include:

- Lake Vermont Homestead – a combination of the additional noise mitigation measures is envisaged to allow a reduction in noise levels to acceptable residual impacts. As the dwelling is owned by BMA, the final treatments are dependent on further discussions between BMA and the occupant
- Saraji Homestead 1 – provision of air conditioning and mechanical ventilation is expected to allow a reduction in noise levels to acceptable residual impacts. Negotiations have commenced between BMA and the landholder regarding a co-existence agreement, and final treatments are dependent on further discussions between both parties
- Saraji Homestead 2 - a combination of the additional noise mitigation measures is envisaged to allow a reduction in noise levels to acceptable residual impacts. An agreement is currently in place between BMA and the landholder, and the final treatments are dependent on further discussions between both parties
- Saraji Homestead 3 – a combination of the additional noise mitigation measures is envisaged to allow a reduction in noise levels to acceptable residual impacts. An agreement is currently in place between BMA and the landholder, and the final treatments are dependent on further discussions between both parties.

BMA will finalise the noise mitigation measures in consultation with potentially affected landholders prior to the construction phase.

When requested by the administering authority or as a result of a noise or vibration complaint (which is neither frivolous nor vexatious nor based on mistaken belief in the opinion of the authorised officer), noise or vibration monitoring will be undertaken at the nearest privately-owned dwelling or affected receiver and the results notified to the administering authority. A complaints-based system for monitoring noise and vibration is considered appropriate for the Project given that:

- co-existence agreements are currently in place, or actively being sought, at receptors which are predicted to receive noise exceeding the Project specific noise criterion
- the predicted increase in industrial noise at other privately owned receptors during operational phase of the Project is predicted to be imperceptible.

12.7 Summary

Noise emissions during neutral and worst-case meteorological conditions were predicted for a range of construction and operational scenarios. Based on the results of the noise assessment, noise emissions from the Project during construction and operation phases are forecast to exceed the nominated noise criteria at five receptors (Lake Vermont Homestead, Saraji Homestead 1, Saraji Homestead 2, Saraji Homestead 3 and Meadowbrook Homestead).

The overall increase in operational mine noise levels as a result of the Project (when considering noise from the existing Saraji Mine) is predicted to be “clearly perceptible “to “twice as loud” at Saraji Homesteads 2 and 3, “just perceptible” at the Meadowbrook Homestead, and not perceptible to most people at the other receptors. Both Saraji Homesteads 2 and 3 have co-existence agreements currently in place with BMA and Meadowbrook Homestead is vacant.

The increase in noise levels associated with increased road traffic on public roads and rail movement on the local rail network is not predicted to be perceptible to most people, with the exception of Saraji Road during Year 1 when the increase is “just perceptible”.

BMA will consider the current or pending agreements with potentially affected landholders when finalising mitigation measures. BMA will finalise the noise mitigation measures prior to the construction phase.