Noise and Vibration Impact Assessment

Maroota Sand Quarry
Maroota, NSW

Prepared for: Design Collaborative Pty. Limited
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Muller Acoustic Consulting

Document Information

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1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) has been commissioned by Design Collaborative Pty Limited (DC) on behalf of Deerubbin Local Aboriginal Land Council (DLALC) to prepare a Noise and Vibration Impact Assessment (NVIA) in relation to the Proposed Maroota Friable Sands Project, Maroota, NSW (the 'project').

The NVIA was completed to quantify potential noise and vibration impacts associated with the project construction, operation and transportation activities on the surrounding community and will accompany the Environmental Impact Statement (EIS) which is being prepared for project by DC.

The NIA has been primarily prepared in accordance with the following policies and guidelines:

- NSW Environment Protection Authority (EPA) 2017, Noise Policy for Industry (NPI);
- NSW Environment Protection Authority (EPA) 2011, Road Noise Policy (RNP);
- Department of Environment and Climate Change (DECC) 2009, Interim Construction Noise Guideline (ICNG);
- NSW Department of Environment and Conservation (DEC) – NSW Environmental Noise Management – Assessing Vibration: a Technical Guideline (the NSW vibration guideline), February 2006;
- NSW Government, Voluntary Land Acquisition and Mitigation Policy (VLAMP), September 2018;
- German Institute for Standardisation – DIN 4150 (1999-02) Part 3 (DIN4150-3) – Structural Vibration - Effects of Vibration on Structures;
- British Standards Institution BS 6472–1992 – Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz; and
- British Standards Institution BS 7385: Part 2-1993 (BS7385.2:1993) - Evaluation and Measurement for Vibration in Buildings — Part 2 – Guide to Damage Levels from Ground-borne Vibration, 1993.

A glossary of terms, definitions and abbreviations used in this report is provided in **Appendix A**.

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2 Project Description

The project proposes the establishment of a new extractive industry in the form of a sand quarry in undisturbed land approximately, 1km north west of Maroota, NSW which is located within The Hills Shire LGA. The project site is comprised of three lots - Lot 7005 DP1055724, Lot 202 DP752025 and Lot 231 DP 752025 with a total land area of approximately 180 hectares (ha).

The project proposes to extract approximately 500,000 tonnes per annum of friable sandstone and sand deposits from an area of approximately 50ha. The extracted materials will be transported to an onsite processing area to be screened and washed. Water will be sourced onsite via proposed dams and ground water recovery systems. The final sales products will be loaded onto road trucks and exported from site via a proposed 2km internal road connecting to Patricia Fay Drive. All vehicles will access the site via Wisemans Ferry Road and Patricia Fay Drive.

2.1 Scope of the Assessment

The NVIA includes the following key tasks:

- review construction and operating activities to identify key noise generating plant, equipment, machinery or activities proposed to be undertaken as part of the project;
- identify the closest and/or potentially most affected receivers situated within the area of influence to the project;
- establish existing noise levels to determine project-specific construction Noise Management Levels (NMLs), and operational noise criteria;
- undertake 3D noise modelling to predict levels that may occur as a result of the construction and operation of the project at the closest and/or potentially most affected receivers;
- provide a comparison of predicted noise levels against relevant construction and operational criteria;
- assess the potential noise impacts associated with construction and operational aspects of the project; and
- provide feasible and reasonable noise mitigation and management measures, and monitoring options, where NMLs or operational criteria may be exceeded.

2.2 Background

Several existing extractive industry projects are present in the locality surrounding the project site which service the construction materials market in the greater Sydney region. Existing quarries surrounding the project site include:

- The Old Northern Road Quarry;
- Hearses Road Quarry;
- Hodgson Quarry Products;
- Maroota Sandstone Quarry; and
- PF Formation, which comprises of the following individual quarry pits:
  - Hitchcock Road Quarry;
  - Old Telegraph Road Application;
  - Pit 4; and
  - Pit 5 And Pit 15.

In addition to the existing extractive industries in the area, there are several rural commercial ventures including plant nurseries, fruit growing farms and large agricultural properties.

2.3 Construction Activities & Site Preparation

The site is currently a greenfield site. The following works are required to enable quarry operations over a six to 12-month timeframe prior to the start of operations:

- Marking out the locations of the site which are to be cleared for site establishment and construction;
- Clearing of vegetation to expose working surfaces for construction of the access haul road and intersection, site infrastructure, surface water dam and the initial cut of the extraction pit;
- Initial removal of overburden to allow the construction of the access haul road and to provide exposure to raw material for the initial cut into the extraction area. Overburden will be used as fill to level the site infrastructure area to a height of 155 AHD;
- Establishment of the processing plant and associated infrastructure including weighbridge, administration area, a water tank and storage bins for dry tailings; and
- Establishment of a surface water dam and groundwater bore to provide clean water supplies to the processing plant.

2.4 Operation Activities & Site Preparation

The project consists of the following major onsite activities including:

- Clearing and removal of vegetation and mulching of trees;
- Removal of overburden and stockpiling;
- Extraction of friable sandstone and sand deposits;
- Haulage of raw material to the Run of Mine (ROM) for processing;
- Screening, washing and stockpiling of raw materials; and
- Transportation of final products off site via road trucks.

Clearing works will generally involve a small bulldozer, excavator and tree mulcher which will be undertaken on a campaign basis. Chainsaws may be used occasionally to assist in tree removal. Windrows will be initially formed at each stage by the dozer, with the windrows forming western and southern walls. Clearing works will be completed behind these windrows.

Overburden will be removed by the excavator and dump trucks and placed in previously quarried areas in accordance with the rehabilitation plan. At the commencement of operations, overburden and tailings will be stored in a temporary stockpile, to be subsequently incorporated in the rehabilitated landforms.

The extraction process will involve an excavator loading haul trucks with friable sand which is then hauled to the Run Of Mine (ROM) pad. In the harder layers a bulldozer will be used to rip the material before being loaded into haul trucks. A front end loader (FEL) then loads material from the ROM into the feed hopper of the processing plant. The process does not involve crushing as the raw material breaks down via the screening process. The remaining process involves wet processing into various product grades which are stockpiled on site. A general project layout is presented in **Figure 1**.

2.5 Site Access

Access to the project is proposed via the construction of a haul road from Patricia Fay Drive to the Infrastructure area and is shown in **Figure 1.** The route of the proposed haul road has been designed to complement the existing topography of the site and maximise the distance to the southern neighbouring properties to mitigate noise, dust and visual impacts and to minimise the project's area of disturbance.

2.6 Hours of Operation

The project will operate six days per week. Sand sales and transport will be undertaken between 6am and 6pm Monday to Friday and 6am to 2pm Saturdays. Clearing, extraction and processing activities will be undertaken between 7am and 6pm Monday to Friday and 7am to 6pm Saturdays. No operations will be undertaken on Sundays or public holidays.

On occasion necessary maintenance and equipment servicing may be required to be completed outside these hours.

2.7 Assessment Requirements

This assessment has been prepared in accordance with requirements of the NSW DPIE's EARs for the project, issued on 18 February 2020. The EARs identify matters which must be addressed in the EIS and essentially form the terms of reference for the project and are reproduced below.

- ***Noise*** *- Include a detailed assessment of the likely construction, operational, cumulative and off-site transport noise impacts of the development in accordance with the Interim Construction Noise Guideline (ICNG), July 2009, Noise Policy for Industry (NPI) and the NSW Road Noise Policy respectively, and having regard to the Voluntary Land Acquisition and Mitigation Policy (VLAMP).*

- ***Blasting & Vibration*** *– including:*

  - *Proposed hours, frequency, methods and impacts; and*

  - *An assessment of the likely blasting and vibration impacts of the development having regard to the relevant ANZEC guidelines and paying particular attention to impacts on people, buildings, livestock, infrastructure and significant natural features.*

The result of the construction noise assessment are presented in Section 7.1; the operational noise assessment is presented in Section 7.2; the VLAMP assessment is presented in Section 7.5 and the road traffic noise assessment is presented in Section 7.6. As the resource is friable, blasting will not be used, and hence no vibration or overpressure assessment as a result of blasting has been completed.

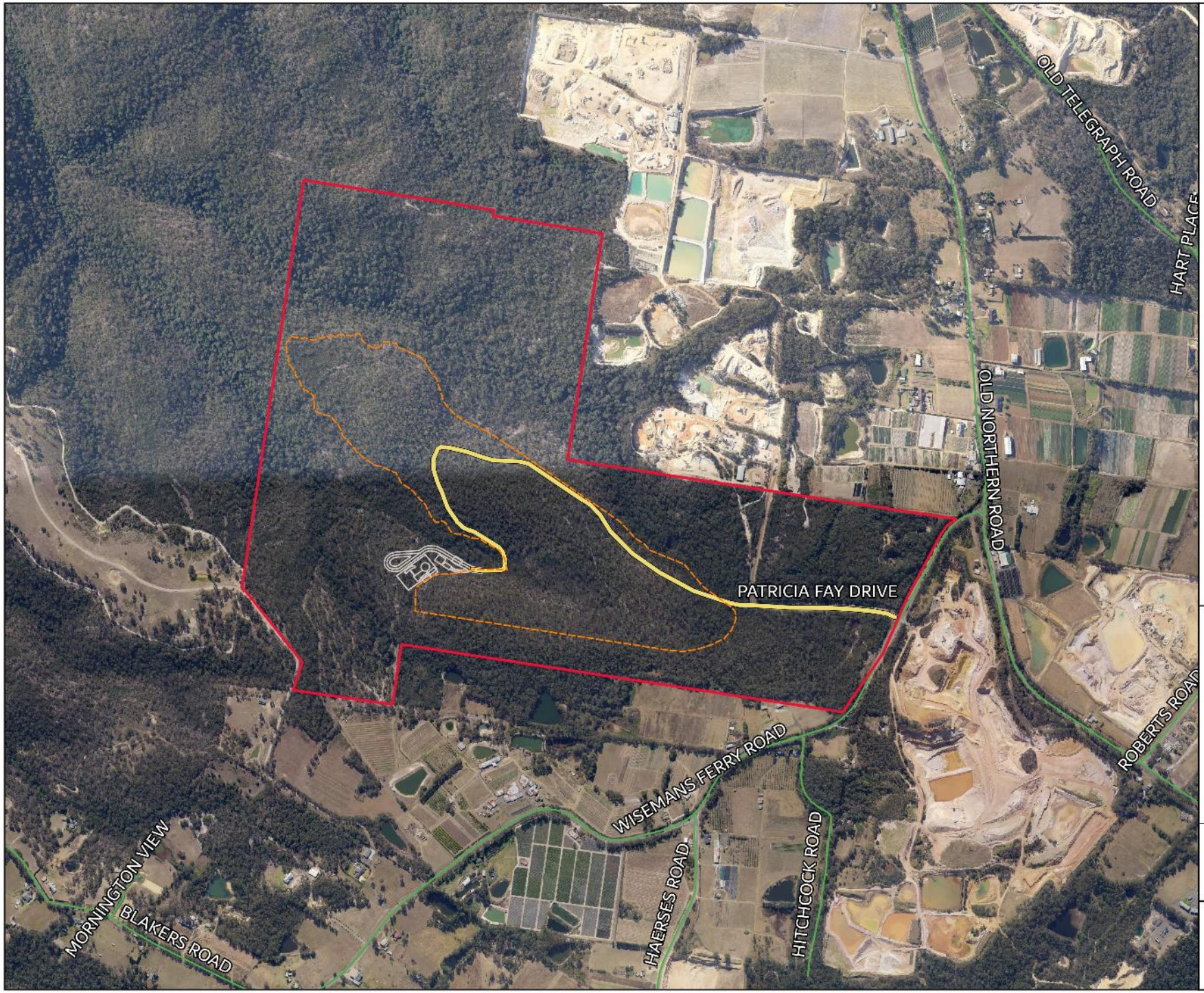

FIGURE 1

PROJECT LAYOUT

MAC201097-01

Maroota FSP

KEY

- Project Boundary
- Access Road (Initial)
- Extraction Limit
- Infrastructure Area

0 100 200 300 400 500 600 m

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2.8 Receiver Review

Receivers in the locality surrounding the project site are predominantly rural residential with some commercial and industrial receivers in the form of other sand quarry operations. Potential future receiver locations of an approved subdivision of Lot 1, 1596 Wisemans Ferry Road have also been included in the assessment. The receiver MGA(56) coordinates are presented in **Table 1**. **Figure 3** presents the receivers with respect to the site location.

Table 1 Receiver Locations

Receiver	Address	Receiver Type	(MGA56 GDA94)	
			Easting	Northing
R01	4590 Old Northern Road	Residential	313355	6296925
R02	4579 Old Northern Road	Residential	313535	6296910
R03	4572 Old Northern Road	Residential	313498	6296757
R04	4567 Old Northern Road	Residential	313614	6296750
R05	4557 Old Northern Road	Residential	313613	6296675
R06	4547 Old Northern Road	Residential	313630	6296546
R07	4544 Old Northern Road	Residential	313526	6296516
R08	4543 Old Northern Road	Residential	313647	6296494
R09	4535 Old Northern Road	Residential	313648	6296418
R10	4509 Old Northern Road - Residence 1	Residential	313646	6296271
R10A	4509 Old Northern Road - Residence 2	Residential	313656	6296165
R11	4506 Old Northern Road	Residential	313421	6296182
R12	4490 Old Northern Road	Residential	313557	6296100
R13	4486 Old Northern Road	Residential	313557	6295920
R14	4471 Old Northern Road	Residential	313737	6295884
R15	4460 Old Northern Road	Residential	313604	6295685
R16	5 Hitchcock Road	Residential	313085	6295179
R17	1725 Wisemans Ferry Road	Residential	313045	6295172
R18	1728 Wisemans Ferry Road	Residential	313013	6295246
R19	1710 Wisemans Ferry Road	Residential	312914	6295206
R20	1700 Wisemans Ferry Road - Residence 1	Residential	312794	6295092
R20A	1700 Wisemans Ferry Road - Residence 2	Residential	312712	6294986
R21	1643 Wisemans Ferry Road	Residential	312471	6294930
R22	1638 Wisemans Ferry Road	Residential	312356	6295046
R23	1630 Wisemans Ferry Road	Residential	312198	6295004
R24	1617 Wisemans Ferry Road	Residential	312187	6294869
R25	1602 Wisemans Ferry Road	Residential	312104	6295026
R26	1579 Wisemans Ferry Road	Residential	311943	6294655
R27	1584 Wisemans Ferry Road	Residential	311818	6294835
R28	1 Blakers Road	Residential	311649	6294506

Table 1 Receiver Locations

Receiver	Address	Receiver Type	(MGA56 GDA94)	
			Easting	Northing
R29	1572 Wisemans Ferry Road	Residential	311631	6294830
R30	58 Blakers Road - Residence 1	Residential	311362	6294697
R30A	58 Blakers Road - Residence 2	Residential	311223	6294675
R31	2 Mornigton View	Residential	311140	6294768
R32	4 Mornigton View	Residential	311141	6294830
R33	75 Blakers Road	Residential	310955	6294795
R34	95 Blakers Road	Residential	311022	6294965
R35	105 Blakers Road	Residential	310758	6295003
R36	117 Blakers Road	Residential	310665	6295081
R37	135 Blakers Road - Residence 1	Residential	310523	6295172
R37A	135 Blakers Road - Residence 2	Residential	310378	6295295
C01	4490 Old Northern Road	Commercial	313584	6296006
C02	4467 Old Northern Road- Nursery	Commercial	313683	6295700
C03	1563 Wisemans Ferry Road	Commercial	311830	6294539
ED01	4540 Old Northern Road- Primary School	Educational	313513	6296439
FR01	1 Mornington View	Future Residential	311161	6294703
FR02	3 Mornington View	Future Residential	311201	6294758
FR03	5 Mornington View	Future Residential	311242	6294828
FR04	Lot 1, 1596 Wisemans Ferry Road	Future Residential	311340	6295556
FR05	Lot 2, 1596 Wisemans Ferry Road	Future Residential	311075	6295675
FR06	Lot 3, 1596 Wisemans Ferry Road	Future Residential	310882	6295829
FR07	Lot 4, 1596 Wisemans Ferry Road	Future Residential	310747	6296095
FR08	Lot 5, 1596 Wisemans Ferry Road	Future Residential	310822	6296131
FR09	Lot 6, 1596 Wisemans Ferry Road	Future Residential	310964	6295948
FR10	Lot 7, 1596 Wisemans Ferry Road	Future Residential	311227	6295739
I01	4384 Old Northern Road - PF Formation	Industrial	313343	6295258
I02	4 Hitchcock Road (PF Formation Owned)	Industrial	313232	6295140
I03	28 Hitchcock Road (PF Formation Owned)	Industrial	313244	6294975
I04	6 Haerses Road (Haerses Road Quarry)	Industrial	312835	6294933
I05	7 Haerses Road (Haerses Road Quarry)	Industrial	312790	6294938
I06	45 Haerses Road (Haerses Road Quarry)	Industrial	312682	6294582

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3 Noise Policy and Guidelines

3.1 Noise Policy for Industry

The EPA released the Noise Policy for Industry (NPI) in October 2017 which provides a process for establishing noise criteria for consents and licenses enabling the EPA to regulate noise emissions from scheduled premises under the Protection of the Environment Operations Act 1997.

The objectives of the NPI are to:

- provide noise criteria that is used to assess the change in both short term and long-term noise levels;
- provide a clear and consistent framework for assessing environmental noise impacts from industrial premises and industrial development proposals;
- promote the use of best-practice noise mitigation measures that are feasible and reasonable where potential impacts have been identified; and
- support a process to guide the determination of achievable noise limits for planning approvals and/or licences, considering the matters that must be considered under the relevant legislation (such as the economic and social benefits and impacts of industrial development).

The policy sets out a process for industrial noise management involving the following key steps:

1. Determine the Project Noise Trigger Levels (PNTLs) (ie criteria) for a development. These are the levels (criteria), above which noise management measures are required to be considered. They are derived by considering two factors: shorter-term intrusiveness due to changes in the noise environment; and maintaining the noise amenity of an area.
2. Predict or measure the noise levels produced by the development with regard to the presence of annoying noise characteristics and meteorological effects such as temperature inversions and wind.
3. Compare the predicted or measured noise level with the PNTL, assessing impacts and the need for noise mitigation and management measures.
4. Consider residual noise impacts - that is, where noise levels exceed the PNTLs after the application of feasible and reasonable noise mitigation measures. This may involve balancing economic, social and environmental costs and benefits from the proposed development against the noise impacts, including consultation with the affected community where impacts are expected to be significant.

5. Set statutory compliance levels that reflect the best achievable and agreed noise limits for the development.

6. Monitor and report environmental noise levels from the development.

3.1.1 Project Noise Trigger Levels (PNTL)

The policy sets out the procedure to determine the PNTLs relevant to an industrial development. The PNTL is the lower (ie, the more stringent) of the **Project Intrusiveness Noise Level** (PINL) and **Project Amenity Noise Level** (PANL) determined in accordance with Section 2.3 and Section 2.4 of the NPI.

3.1.2 Rating Background Level (RBL)

The Rating Background Level (RBL) is a determined parameter from noise monitoring and is used for assessment purposes. As per the NPI, the RBL is an overall single figure background level representing each assessment period (day, evening and night) over the noise monitoring period. The measured RBLs relevant to the project are contained in **Section 4**.

3.1.3 Project Intrusiveness Noise Level (PINL)

The PINL ($LA_{eq(15min)}$) is the RBL + 5dB and seeks to limit the degree of change a new noise source introduces to an existing environment. Hence, when assessing intrusiveness, background noise levels need to be measured.

Background noise levels need to be determined before intrusive noise can be assessed. The NPI states that background noise levels to be measured are those that are present at the time of the noise assessment and without the subject development operating.

3.1.4 Project Amenity Noise Level (PANL)

The PANL is relevant to a specific land use or locality. To limit continuing increases in intrusiveness levels, the ambient noise level within an area from all combined industrial sources should remain below the recommended amenity noise levels specified in Table 2.2 (of the NPI). The NPI defines two categories of amenity noise levels:

- **Amenity Noise Levels (ANL)** – are determined considering all current and future industrial noise within a receiver area; and
- **Project Amenity Noise Level (PANL)** – is the recommended level for a receiver area, specifically focusing the project being assessed.

Additionally, Section 2.4 of the NPI states: “to ensure that industrial noise levels (existing plus new) remain within the recommended amenity noise levels for an area, a project amenity noise level applies for each new source of industrial noise as follows”:

PANL for new industrial developments = recommended ANL minus 5dBA.

The following exceptions apply when deriving the PANL:

- areas with high traffic noise levels;
- proposed developments in major industrial clusters;
- existing industrial noise and cumulative industrial noise effects; and
- greenfield sites.

The NPI states with respect to high traffic noise areas:

The level of transport noise, road traffic noise in particular, may be high enough to make noise from an industrial source effectively inaudible, even though the LAeq noise level from that industrial noise source may exceed the project amenity noise level. In such cases the project amenity noise level may be derived from the LAeq, period(traffic) minus 15 dB(A).

Where relevant this assessment has considered influences of traffic with respect to amenity noise levels (ie areas where existing traffic noise levels are 10dB greater than the recommended amenity noise level).

The recommended amenity noise levels as per Table 2.2 of the NPI are reproduced in Table 2.

Table 2 Amenity Criteria			
Receiver Type	Noise Amenity Area	Time of day	Recommended amenity noise level dB LAeq(period)
Residential	Rural	Day	50
		Evening	45
		Night	40
	Suburban	Day	55
		Evening	45
		Night	40
	Urban	Day	60
		Evening	50
		Night	45
Hotels, motels, caretakers' quarters, holiday accommodation, permanent resident caravan parks.	See column 4	See column 4	5dB above the recommended amenity noise level for a residence for the relevant noise amenity area and time of day
School Classroom	All	Noisiest 1-hour period when in use	35 (internal) 45 (external)
Hospital ward			
- internal	All	Noisiest 1-hour	35
- external	All	Noisiest 1-hour	50
Place of worship - internal	All	When in use	40
Passive Recreation	All	When in use	50
Active Recreation	All	When in use	55
Commercial premises	All	When in use	65
Industrial	All	When in use	70

Notes: The recommended amenity noise levels refer only to noise from industrial noise sources. However, they refer to noise from all such sources at the receiver location, and not only noise due to a specific project under consideration. The levels represent outdoor levels except where otherwise stated.

Types of receivers are defined as rural residential; suburban residential; urban residential; industrial interface; commercial; industrial – see Table 2.3 and Section 2.7 of the NPI.

Note: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

3.1.5 Determining the Significance of Residual Noise Impacts

Residual noise impacts are identified after all source and pathway feasible and reasonable noise mitigation measures have been considered. A residual noise impact may exist where the best-achievable noise level from a development, when assessed at a sensitive receiver location, is above the PNTLs.

Section 4 of the NPI outlines the process for determining the significance of residual noise impacts to ensure that effective and appropriate mitigation measures are implemented.

For new developments, where all feasible and reasonable noise mitigation measures have been applied, the significance of residual noise levels (that is, noise levels above the project noise trigger level) are assessed, in accordance with the matrix outlined in Table 4.1 of the NPI, reproduced in **Table 3**.

Table 3 Significance of Residual Noise Impacts

If the predicted noise level minus the project noise trigger level is:	And the total cumulative industrial noise level is:	Then the significance of residual noise level is:
≤ 2 dB(A)	Not applicable	Negligible
≥ 3 but ≤ 5 dB(A)	< recommended amenity noise level or > recommended amenity noise level, but the increase in total cumulative industrial noise level resulting from the development is less than or equal to 1dB	Marginal
≥ 3 but ≤ 5 dB(A)	> recommended amenity noise level and the increase in total cumulative industrial noise level resulting from the development is more than 1 dB	Moderate
> 5 dB(A)	≤ recommended amenity noise level	Moderate
> 5 dB(A)	> recommended amenity noise level	Significant

3.1.6 Maximum Noise Assessment Trigger Levels

The potential for sleep disturbance from maximum noise level events from a project during the night-time period needs to be considered. The NPI considers sleep disturbance to be both awakenings and disturbance to sleep stages.

Where night-time noise levels from a development/premises at a residential location exceed the following criteria, a detailed maximum noise level event assessment should be undertaken:

- $L_{Aeq(15min)}$ 40dB or the prevailing RBL plus 5dBA, whichever is the greater, and/or
- L_{Amax} 52dB or the prevailing RBL plus 15dBA, whichever is the greater.

A detailed assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the rating background noise level, and the number of times this happens during the night-time period.

Other factors that may be important in assessing the impacts on sleep disturbance include:

- how often the events would occur;

- the distribution of likely events across the night-time period and the existing ambient maximum events in the absence of the development;
- whether there are times of day when there is a clear change in the noise environment (such as during early morning shoulder periods); and
- current understanding of effects of maximum noise level events at night.

3.2 Voluntary Land Acquisition and Mitigation Policy

The Voluntary Land Acquisition and Mitigation Policy (VLAMP, 2018) outlines methods to determine the significance of potential exceedances of relevant noise assessment criteria and identifies potential treatments for those exceedances (VLAMP Table 1) and has been reproduced in **Table 4**.

Voluntary Mitigation Rights

A consent authority should only apply voluntary land mitigation rights where, even with the implementation of best practice management at the mine site:

- the noise generated by the development would meet the requirements of Table 1 (VLAMP) such that the impacts would be characterised marginal, moderate or significant at any residence or privately owned land; or
- the development would increase the total industrial noise level at any residence on privately owned land by more than 1dBA and noise levels at the residence are already above the recommended amenity noise levels in Table 2.2 of the NPI; or
- the development includes a private rail line and the use of that private rail line would cause exceedances of the recommended acceptable levels in Table 6 of Appendix 3 of the RING by greater than or equal to 3dBA at any residences on privately owned land.

Table 4 Characterisation of Noise Impacts and Potential Treatments (VLAMP Table 1)

If the predicted noise level minus the project noise trigger level is:	And the total cumulative industrial noise level is:	Characterisation of impacts:	Potential treatment:
All time periods 0-2dBA	Not applicable	Impacts are considered to be **negligible**	The exceedances would not be discernible by the average listener and therefore would not warrant receiver based treatments or controls
All time periods 3-5dBA	< recommended amenity noise level in Table 2.2 of the NPI; or	Impacts are considered to be **marginal**	Provide mechanical ventilation / comfort condition systems to enable windows to be closed

Table 4 Characterisation of Noise Impacts and Potential Treatments (VLAMP Table 1)			
If the predicted noise level minus the project noise trigger level is:	And the total cumulative industrial noise level is:	Characterisation of impacts:	Potential treatment:
	> recommended amenity noise level in Table 2.2 of the NPI, but the increase in total cumulative industrial noise level resulting from the development is >1dB		without compromising internal air quality / amenity.
All time periods 3-5dBA	> recommended amenity noise level in Table 2.2 of the NPI, and the increase in total cumulative industrial noise level resulting from the development is >1dB	Impacts are considered to be **moderate**	As for marginal impacts but also upgraded facade elements like windows, doors or roof insulation, to further increase the ability of the building facade to reduce noise levels.
Day and evening >5dBA	< recommended amenity noise levels in Table 2.2 of the NPI	Impacts are considered to be **moderate**	As for marginal impacts but also upgraded facade elements like windows, doors or roof insulation, to further increase the ability of the building facade to reduce noise levels.
Day and evening >5dBA	> recommended amenity noise levels in Table 2.2 of the NPI	Impacts are considered to be **significant**	Provide mitigation as for moderate impacts and see voluntary land acquisition provisions above.
Night >5dBA	Not applicable	Impacts are considered to be **significant**	Provide mitigation as for moderate impacts and see voluntary land acquisition provisions above.

Voluntary Acquisition Rights

A consent authority should only apply voluntary land acquisition rights where, even with the implementation of best practice management at the mine site:

- the noise generated by the development would be characterised as significant, according to Table 1 (VLAMP), at any residence on privately owned land; or
- the noise generated by the development would contribute to exceedances of the acceptable noise levels plus 5dB in Table 2.2 of the NPI on more than 25% of any privately owned land where there is an existing dwelling or where a dwelling could be built under existing planning controls; or

- the development includes a private rail line and the use of that private rail line would cause exceedances of the recommended maximum criteria outlined in Table 6 of Appendix 3 of the RING by greater than or equal to 3dBA at any residences on privately owned land.

Impacts would be classified as significant where:

- During the **daytime** and **evening** periods, noise levels from the project are >5dBA above the PNTLs and the total cumulative industrial noise level is greater than the recommended amenity noise levels in Table 2.2 of the NPI; or
- During the **night time** period, noise levels from the project are >5dBA above the PNTLs.

The resulting VLAMP significance criteria (where impacts would be classified as significant as above) applicable to the project are presented in **Table 14**. The criteria assume that the total cumulative industrial noise level is attributable to the project as there is no other significant industrial noise source in the area.

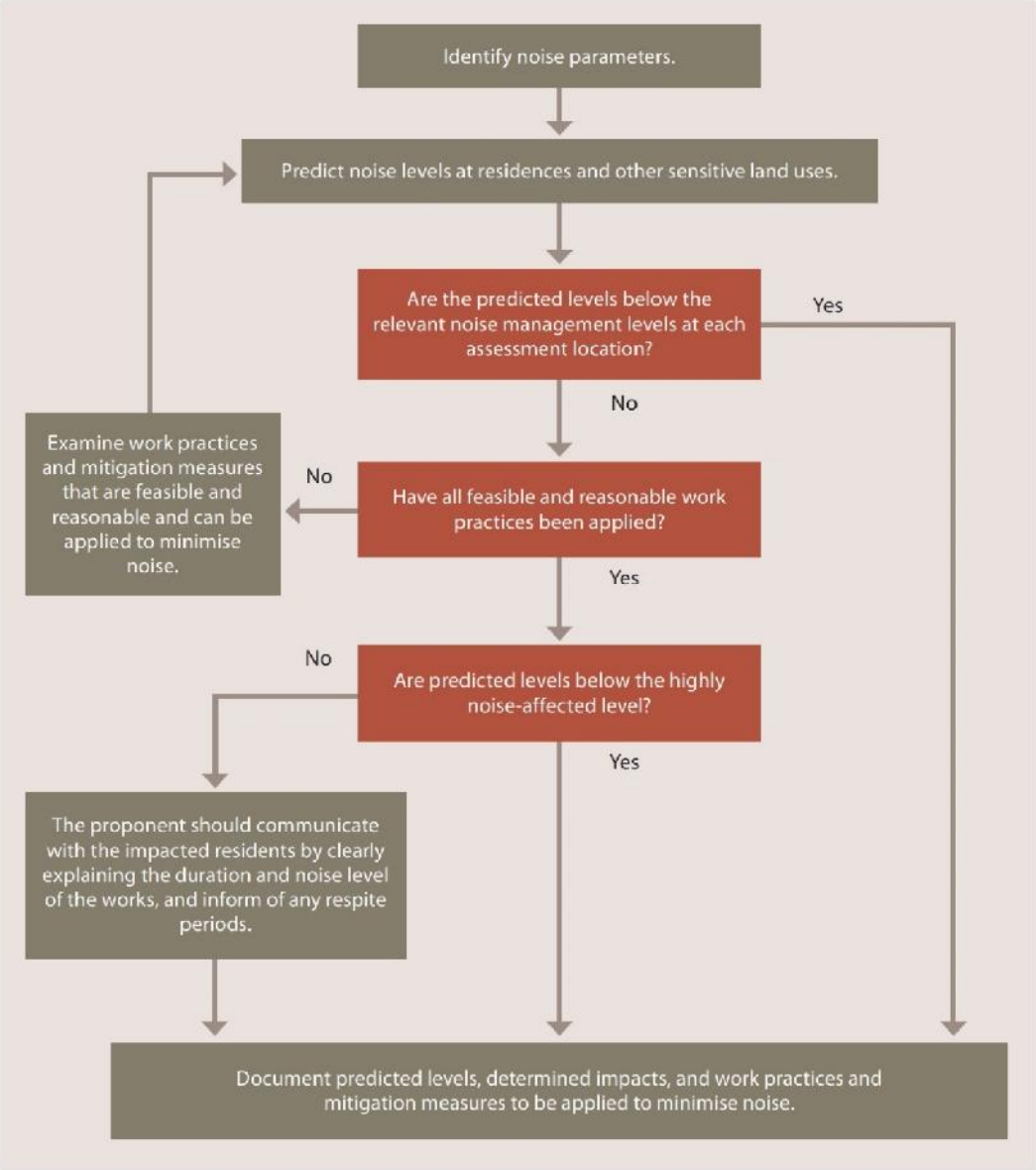
3.3 Interim Construction Noise Guideline

The ICNG sets out procedures to identify and address the impacts of construction noise on residences and other sensitive land uses. This section provides a summary of noise objectives that are applicable to the assessment. The ICNG provides two methodologies for the assessment of construction noise emissions:

- Quantitative, which is suited to major construction projects with typical durations of more than three weeks; and
- Qualitative, which is suited to short term infrastructure maintenance (< three weeks).

The qualitative assessment methodology is a more simplified approach that relies on noise management strategies. This study has adopted a quantitative assessment approach which is summarised in **Figure 2.** The quantitative approach includes identification of potentially affected receivers, derivation of the construction noise management levels, quantification of potential noise impact at receivers via predictive modelling and, provides management and mitigation recommendations.

Figure 2 Quantitative Assessment Processes for Assessing and Managing Construction Noise



Source: Department of Environment and Climate Change, 2009.

3.3.1 Standard Hours for Construction

Table 5 summaries the ICNG recommended standard hours for construction works.

Table 5 Recommended Standard Hours for Construction

Daytime	Construction Hours
Monday to Friday	7am to 6pm
Saturdays	8am to 1pm
Sundays or Public Holidays	No construction

These recommended hours do not apply in the event of direction from police, or other relevant authorities, for safety reasons or where required in an emergency to avoid the loss of lives, property and/or to prevent environmental harm.

Construction activities are anticipated to be undertaken during standard construction hours.

3.3.2 Out of Hours Construction

Works conducted outside of recommended standard hours are considered out of hours work (OOH). The ICNG suggests that any request to vary the hours of construction activities as identified above shall be:

- considered on a case by case basis or activity-specific basis;
- accompanied by details of the nature and need for activities to be undertaken during the varied construction hours;
- accompanied by written evidence that activities undertaken during the varied construction hours are strongly justified;
- appropriate consultation with potentially affected receivers and notification of the relevant regulatory authorities has occurred; and
- all practicable and reasonable mitigation measures will be put in place.

3.3.3 Construction Noise Management Levels

Section 4 of the ICNG (DECC, 2009) details the quantitative assessment method involving predicting noise levels and comparing them with the Noise Management Level (NML) and are important indicators of the potential level of construction noise impact. Table 6 reproduces the ICNG Noise Management Level (NML) for residential receivers. The NML is determined by adding 10dB (standard hours) or 5dB (OOH) to the Rating Background Level (RBL) for each specific assessment period.

Table 6 Noise Management Levels		
Time of Day	Management Level LAeq(15min)[1]	How to Apply
Recommended standard hours: Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or public holidays.	Noise affected RBL + 10dB	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured LAeq(15min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of work to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75dBA	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account times identified by the community when they are less sensitive to noise such as before and after school for work near schools, or mid-morning or mid-afternoon for work near residences; and if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours.	Noise affected RBL + 5dB	A strong justification would typically be required for work outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5dBA above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements see section 7.2.2.

Note 1: The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the construction noise management levels for noise assessment purposes and is the median of the ABL's.

3.3.4 Construction Sleep Disturbance

Section 4.3 of the ICNG (DECC, 2009) states that a sleep disturbance assessment is required where construction activities are planned to occur for more than two consecutive nights. Given that construction activities are anticipated to occur during standard construction hours, sleep disturbance has not been considered in this assessment.

3.4 Road Noise Policy

The road traffic noise criteria are provided in the Department of Environment, Climate Change and Water NSW (DECCW), Road Noise Policy (RNP), 2011. The policy sets out noise criteria applicable to different road classifications for the purpose of quantifying traffic noise impacts. Road noise criteria relevant to this assessment are presented in detail in Section 5.3.

4 Existing Environment

4.1 Background Noise Environment

4.1.1 Unattended Noise Monitoring

To quantify the existing background noise environment of the area, unattended noise monitoring was conducted at three locations which were representative of the surrounding noise catchments. The monitoring locations are shown in **Figure 3.**

The unattended noise survey was conducted in general accordance with the procedures described in Australian Standard AS 1055:2018, "Acoustics - Description and Measurement of Environmental Noise".

The measurements were carried out using three Type 1, Svantek 977 noise analysers from Tuesday 26 May 2020 to Wednesday 3 June 2020. Observations on-site identified the surrounding locality was typical of a rural environment, with passing traffic noise audible in the area. Calibration of all instrumentation was checked prior to and following measurements. Drift in calibration did not exceed ±0.5dBA. All equipment carried appropriate and current NATA (or manufacturer) calibration certificates.

Data affected by adverse meteorological conditions have been excluded from the results in accordance with methodologies provided in Fact Sheet A4 of the NPI. Residential receptors situated in surrounding area have been classified under the EPA's rural amenity category. This criterion is used in conjunction with the intrusiveness criteria to determine the limiting criteria. A summary of measured background noise levels and derived intrusive criteria are summarised in **Table 7** and plotted in graph format along with wind speed and rainfall for the monitoring period in **Appendix B**. Calibration certificates of the sound level meters used for this project are available on request.

Table 7 Background Noise Monitoring Summary

Location	Measured RBL, dB LA90(period)			Measured Ambient Level, dB LAeq(period)		
	Day	Evening	Night	Day	Evening	Night
L1 1602 Wisemans Ferry Road (west)	35 (28)[1]	30	30 (24)[1]	41	40	38
L2 1584 Wisemans Ferry Road (east)	35 (33)[1]	33	30 (28)[1]	59	51	53
L3 Old Northern Road	40	30 (28)[1]	30 (26)[1]	60	51	53

Note: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

Note: Excludes periods of wind or rain affected data. Meteorological data obtained from the Bureau of Meteorology station at Mangrove Mountain.

Note 1: As per NPI Guidance the minimum applicable RBL for the daytime period is 35dBA and 30dBA for the evening and night period (bracketed value is the measured level).

Measured noise levels at each monitoring location are used to represent the background levels at those receivers in their vicinity or Noise Catchment Area (NCA). Therefore, the RBLs measured at monitoring Location L1 would be applicable to the Wisemans Ferry Road (west) receivers R29 to R37A and FR1 to FR10 being situated at a reasonable distance from the road and not affected by road traffic noise. Similarly, the RBLs measured at monitoring Location L2 would be applicable to Wisemans Ferry Road (east) receivers R16 to R28 that are situated in proximity to the road and are more affected by road traffic noise. Location L3 would be applicable to receivers R1 to R15 along Old Northern Road.

4.1.2 Morning Shoulder Period

The project proposes to operate between 6am and 7am to load product into trucks to be transported to customers. Section A3 of the NPI states:

There will be situations that call for different assessment periods. For example, where early morning (5 am to 7 am) operations are proposed, it may be unreasonable to expect such operations to be assessed against the night-time project noise trigger levels – especially if existing background noise levels are steadily rising in these early morning hours. In these situations, and where operations outside of daytime hours can be justified, appropriate noise level targets may be negotiated with the regulatory/consent authority on a case-by-case basis. As a rule of thumb and for the purposes of deriving the intrusiveness noise level only, it may be appropriate to assign a shoulder period rating background noise level based on:

- *the lowest 10th percentile of LAF90,15min dB measurements for the equivalent of one weeks' worth of valid data taken over the shoulder period (that is, all days included in a single data set of shoulder period); or,*
- *the LAF90(shoulder period) dB value (that is, the lowest 10th percentile value of aggregate data for the equivalent of one week's worth of valid data taken over the shoulder period).*

An analysis of one week's data for the period between 6.00am and 7.00am has been completed to derive a RBL for the morning should period at each monitoring location. The resulting morning shoulder RBLs ($L_{A90(morning\text{-}shoulder)}$) are presented in **Table 8**.

Table 8 Morning Shoulder Analysis

Location	Measured RBL, dB $L_{A90(morning\ shoulder)}$
L1 Wisemans Ferry Road (west)	30 (29)[1]
L2 Wisemans Ferry Road (east)	31
L3 Old Northern Road	35

Note 1: As per NPI Guidance the minimum applicable RBL for the morning shoulder period is 30dBA (bracketed value is the measured level).

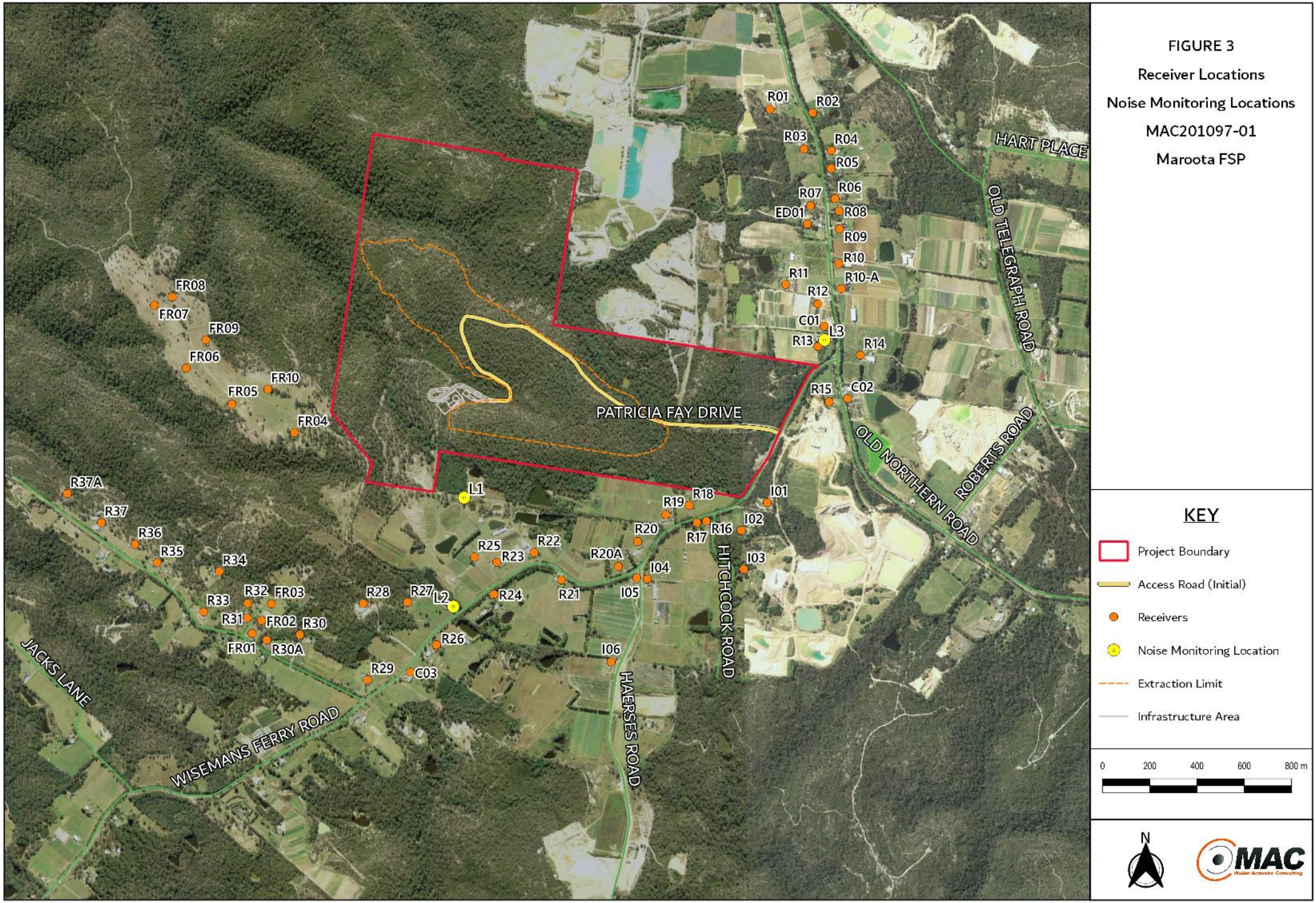


FIGURE 3
Receiver Locations
Noise Monitoring Locations
MAC201097-01
Maroota FSP
KEY
Project Boundary
Access Road (Initial)
Receivers
Noise Monitoring Location
Extraction Limit
Infrastructure Area
0
200
400
600
800 m
N
MAC
R01
R02
R03
R04
R05
R06
R07
R08
ED01
R09
R10
R10-A
R11
R12
C01
L3
R13
R14
R15
C02
FR08
FR07
FR09
FR06
FR10
FR05
FR04
R37A
R37
R36
R35
R34
R32
FR03
R33
R31
FR02
R30
FR01
R30A
L1
L2
R18
R19
R20
R16
R17
R25
R23
R22
R20A
R24
R21
R28
R27
R26
R29
C03
I01
I02
I03
I04
I05
I06
PATRICIA FAY DRIVE
HART PLACE
OLD TELEGRAPH ROAD
OLD NORTHERN ROAD
ROBERTS ROAD
HITCHCOCK ROAD
HAERSES ROAD
JACKS LANE
WISEMANS FERRY ROAD

4.2 RBLs for Assessment

The resulting RBLs for each monitoring location for all periods including the morning shoulder are summarised in **Table 9**.

Table 9 Assessment RBLs

Location	Measured RBL, dB LA90(period)			
	Day	Evening	Night	Morning Shoulder
L1 Wisemans Ferry Road (west)	35	30	30	30
L2 Wisemans Ferry Road (east)	35	33	30	31
L3 Old Northern Road	40	30	30	35

Note: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods; morning shoulder period is from 6am to 7am.

5 Assessment Criteria

5.1 Operational Noise Criteria

5.1.1 Project Intrusiveness Noise Levels

The PINLs for the project are presented in **Table 10** and have been determined based on RBL +5dBA.

Table 10 Project Intrusiveness Noise Levels

Receiver	Period[1]	RBL dB LA_{90}	PINL dB $LA_{eq(15min)}$
(L1) Wisemans Ferry Road (west) Receivers R29-R37A & FR1-FR10	Day	35	40
	Evening	30	35
	Night	30	35
	Morning Shoulder	30	35
(L2) Wisemans Ferry Road (east) Receivers R16-R28	Day	35	40
	Evening	33	38
	Night	30	35
	Morning Shoulder	31	36
(L3) Old Northern Road Receivers R1-R15	Day	40	45
	Evening	30	35
	Night	30	35
	Morning Shoulder	35	40

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

5.1.2 Project Amenity Noise Levels

The PANLs for residential receivers and other receiver types (ie non-residential) potentially affected by the project are presented in **Table 11**.

Table 11 Amenity Noise Levels and Project Amenity Noise Levels

Receivers	Noise Amenity Area	Assessment Period[1]	Recommended ANL dB LAeq(period)[2]	PANL dB LAeq(period)[3]	PANL dB LAeq(15min)[5]
(L1) Wisemans Ferry Road (west) Receivers R29-R37A & FR1-FR10	Rural	Day	50	45	48
		Evening	45	40	43
		Night	40	35	38
(L2) Wisemans Ferry Road (east) Receivers R16-R28	Rural	Day	50	45	48
		Evening	45	40	43
		Night	40	38[4]	41
(L3) Old Northern Road Receivers R1-R15	Rural	Day	50	45	48
		Evening	45	40	43
		Night	40	38[4]	41
Commercial Premises C1-C3	All	When in Use	65	60	63
Industrial Premises I1-I6	All	When in Use	70	65	68
Educational Receiver ED1	All	Noisiest 1 Hour	35 (internal) 45[6] (external)	30 (internal) 40[6] (external)	33 (internal) 43[6] (external)

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.
Note 2: Recommended amenity noise levels as per Table 2.2 of the NPI.
Note 3: Project Amenity Noise Level equals the amenity noise level – 5dB as there is other industry proposed for the area.
Note 4: $LA_{eq,period\ (traffic)}$ calculated as per section 2.4.1 of the NPI (i.e. existing $LA_{eq\ traffic}$ -15dB).
Note 5: Includes a +3dB adjustment to the amenity period level to convert to a 15-minute assessment period as per Section 2.2 of the NPI.
Note 6: Assumes 10dB attenuation for partially opened window.

5.1.3 Project Noise Trigger Levels

The PNTLs are the lower of either the PINL or the PANL. **Table 12** presents the derivation of the PNTLs in accordance with the methodologies outlined in the NPI.

Table 12 Project Noise Trigger Levels

Receivers	Period[1]	PINL dB $L_{Aeq(15min)}$	PANL dB $L_{Aeq(15min)}$	PNTL dB $L_{Aeq(15min)}$
(L1) Wisemans Ferry Road (west) Receivers R29-R37A & FR1-FR10	Day	40	48	40
	Evening	35	43	35
	Night	35	38	35
	Morning Shoulder	35	N/A	35
(L2) Wisemans Ferry Road (east) Receivers R16-R28	Day	40	48	40
	Evening	38	43	38
	Night	35	41	35
	Morning Shoulder	36	N/A	36
(L3) Old Northern Road Receivers R1-R15	Day	45	48	45
	Evening	35	43	35
	Night	35	41	35
	Morning Shoulder	40	N/A	40
Commercial Premises C1-C3	When in Use	N/A	63	N/A
Industrial Premises I1-I6	When in Use	N/A	68	N/A
Educational Receiver ED1	Noisiest 1 Hour	N/A	43[2](external)	N/A

Note 1: Day – the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening – the period from 6pm to 10pm; Night – the remaining periods.

Note 2: Assumes 10dB attenuation for partially opened window.

5.1.4 Maximum Noise Assessment Trigger Levels

The maximum noise trigger levels shown in **Table 13** are based on night time RBLs and trigger levels as per Section 2.5 of the NPI. The trigger levels will be applied to transient noise events that have the potential to cause sleep disturbance.

Table 13 Maximum Noise Trigger Level – Morning Shoulder Period

Residential Receivers - Wisemans Ferry Road (west)			
$L_{Aeq(15min)}$		L_{Amax}	
40dB $L_{Aeq(15min)}$ or RBL + 5dB		52dB L_{Amax} or RBL + 15dB	
Trigger	40	Trigger	52
RBL(30) +5dB	35	RBL(30) +15dB	45
Highest	**40**	**Highest**	**52**
Residential Receivers - Wisemans Ferry Road (east)			
$L_{Aeq(15min)}$		L_{Amax}	
40dB $L_{Aeq(15min)}$ or RBL + 5dB		52dB L_{Amax} or RBL + 15dB	
Trigger	40	Trigger	52
RBL(31) +5dB	36	RBL(31) +15dB	46
Highest	**40**	**Highest**	**52**
Residential Receivers - Old Northern Road			
$L_{Aeq(15min)}$		L_{Amax}	
40dB $L_{Aeq(15min)}$ or RBL + 5dB		52dB L_{Amax} or RBL + 15dB	
Trigger	40	Trigger	52
RBL(35) +5dB	40	RBL(35) +15dB	50
Highest	**40**	**Highest**	**52**

Note: Monday to Saturday; Night 10pm to 7am. On Sundays and Public Holidays Night 10pm to 8am.

Note: NPI identifies that maximum of the two values is to be adopted which is shown in bold font.

5.2 Voluntary Land Acquisition and Mitigation Policy

The resulting VLAMP significance criteria (where impacts would be classified as significant as above) applicable to the project are presented in **Table 14**. The criteria assume that the total cumulative industrial noise level is attributable to the project as there is no other significant industrial noise source in the area.

Table 14 VLAMP Project Specific Significance Criteria

Catchment	Period	PNTL dB $LA_{eq(15min)}$	VLAMP Significant Impact Thresholds		
			Voluntary Acquisition[1]		Vacant Lands Acquisition[2]
			Recommended ANL dB $LA_{eq(period)}$	PNTL+5dB dB $LA_{eq(15min)}$	Recommended ANL +5dB dB $LA_{eq(period)}$
(L1) Wisemans Ferry Road (west) Receivers R29-R37A & FR1-FR10	Day	40	50	45	55
	Evening	35	45	40	50
	Night	35	40	40	45
(L2) Wisemans Ferry Road (east) Receivers R16-R28	Day	40	50	45	55
	Evening	38	45	43	50
	Night	36	40	41	45
(L3) Old Northern Road Receivers R1-R15	Day	40	50	45	55
	Evening	35	45	40	50
	Night	35	40	40	45

Note 1: Voluntary acquisition rights where the Project Noise Level (PNL) exceeds the PNTL by more than 5dB.

Note 2: Project Noise Levels (PNL) exceed the relevant criteria on more than 25% for any privately-owned land parcels.

5.3 Road Traffic Noise Criteria

Table 15 presents the road traffic noise assessment criteria reproduced from the RNP relevant for this road category.

Table 15 Road Traffic Noise Assessment Criteria

Road category	Type of project/development	Assessment Criteria – dBA	
		Day (7am to 10pm)	Night (10pm to 7am)
Freeways/arterial/ sub-arterial Roads	Existing residences affected by additional traffic on freeways/arterial/sub-arterial roads generated by land use developments	60dB LAeq(15hr)	55dB LAeq(9hr)
Local roads	Existing residences affected by additional traffic on local roads generated by land use developments	55dB LAeq(1hr)	50dB LAeq(1hr)
School Classrooms	Proposed road projects and traffic generating developments	40dB LAeq(1hr) (internal) when in use	N/A
Hospital Wards		35dB LAeq(1hr) (internal)	35dB LAeq(1hr) (internal)
Places of Worship		40dB LAeq(1hr) (internal)	40dB LAeq(1hr) (internal)
Open Space (active use)		60dB LAeq(1hr)	N/A
Open Space (passive use)		55dB LAeq(1hr)	N/A
Isolated residences in commercial or industrial zones		Refer to AS2107 for internal levels	

Additionally, the RNP states where existing road traffic noise criteria are already exceeded, any additional increase in total traffic noise level should be limited to 2dBA, which is generally accepted as the threshold of perceptibility to a change in noise level.

In addition to meeting the assessment criteria, any significant increase in total traffic noise at receivers must be considered. Receivers experiencing increases in total traffic noise levels above those presented in Table 16 due to the addition of project vehicles on the roads surrounding the project should be considered for mitigation.

Table 16 Increase Criteria for Residential Land Uses			
Road Category	Type of Project/Development	Total Traffic Noise Level Increase, dBA	
		Day (7am to 10pm)	Night (10pm to 7am)
Freeway/arterial/sub-arterial roads and transitways	New road corridor/redevelopment of existing road/land use development with the potential to generate additional traffic on existing road.	Existing traffic LAeq(15hr) +12dB (external)	Existing traffic LAeq(9hr) + 12dB (external)

5.4 Construction Noise Criteria

The relevant NMLs for standard construction hours are presented in **Table 17**.

Table 17 Construction Noise Management Levels			
Catchment (No) Receiver ID	Assessment Period	Adopted RBL dB LA_{90}	NML dB $LA_{eq(15min)}$
(L1) Wisemans Ferry Road (west) Receivers R29-R37A & FR1-FR10	Standard Hours	35	45 (RBL+10dBA)
(L2) Wisemans Ferry Road (east) Receivers R16-R28	Standard Hours	35	45 (RBL+10dBA)
(L3) Old Northern Road Receivers R1-R15	Standard Hours	40	50 (RBL+10dBA)
Educational Receiver ED1	When in use	N/A	45 (internal) 55 (external)
Industrial Premises I1-I6	When in use	N/A	75 (external)
Commercial Premises C1-C3	When in use	N/A	70 (external)

5.5 Vibration

Department of Environment and Conservation (DEC) 2006, *Assessing Vibration: A Technical Guideline* (the 'Guideline') provides guidance on determining effects of vibration on buildings occupants. The guideline does not address vibration induced damage to structures, blast induced vibration effects or structure borne noise effects.

British Standard BS 7385:Part 2-1993 "Evaluation and measurement for vibration in buildings Part 2", gives guidance on the levels of vibration which building structures could be damaged. BS7385 also takes into consideration the frequency of the vibration which is critical when assessing the likelihood of building damage.

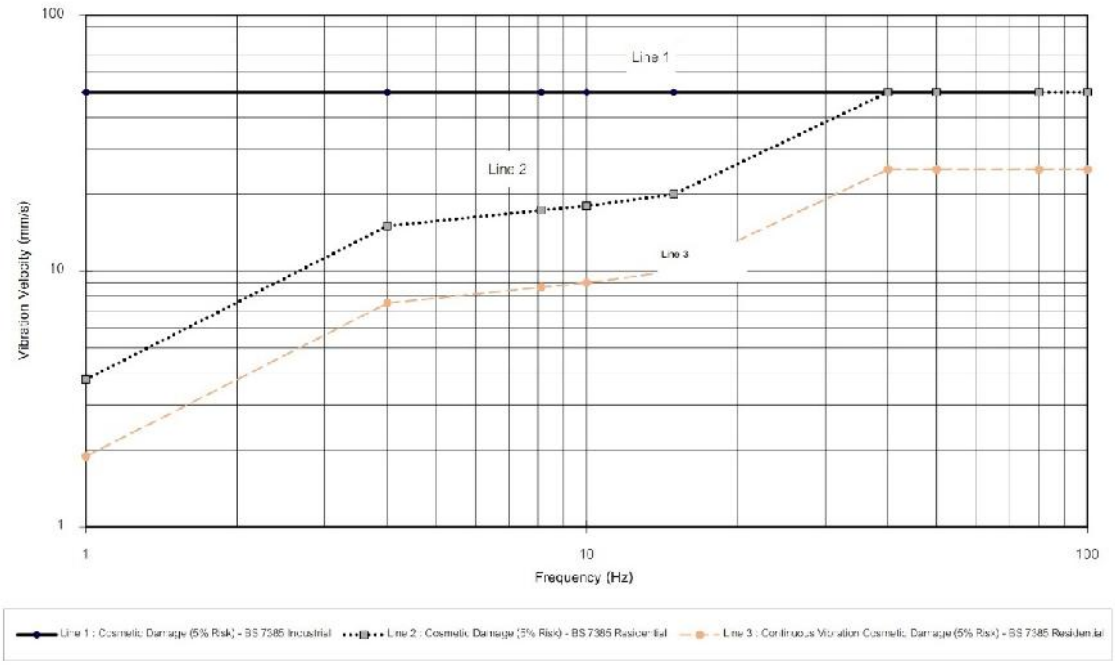
Guide values are set for building vibration based on the lowest vibration levels above which damage has been credibly demonstrated. These levels are judged to result in a minimum risk of vibration-induced damage, where minimal risk for a named effect is usually taken as a 95% probability of no effect.

The recommended limits (guide values) for transient vibration to ensure minimal risk of cosmetic damage to residential and heavy commercial/industrial buildings are presented in **Table 18**, with a visual representation presented in **Figure 4**. Where sources of continuous vibration may give rise to dynamic magnification due to resonance, the values provided in **Table 18** should be reduced by 50%, this is especially the case with respect to Peak Particle Velocity (PPV) at lower frequencies.

Table 18 Transient Vibration Guide Values - Minimal Risk of Cosmetic Damage

Line	Type of Building	Peak Component Particle Velocity in Frequency Range of Predominant Pulse	
		4 Hz to 15 Hz	15 Hz and above
1	Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	
2	Unreinforced or light framed structures Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

Figure 4– Transient Vibration Guide Values - Minimal Risk of Cosmetic Damage



5.6 Human Comfort – Assessing Vibration a Technical Guideline

Humans are far more sensitive to vibration than is commonly realised and may detect vibration levels which are well below levels that may cause damage to buildings or structures. Assessing vibration: a technical guideline was published in February of 2006 by the DECC and is based on guidelines contained in BS 6472 – 1992, Evaluation of human exposure to vibration in buildings (1-80 Hz) and provides guidance on assessing vibration against human comfort.

The guideline presents preferred and maximum vibration values for use in assessing human responses to vibration and provides recommendations for measurement and evaluation techniques. At vibration values below the preferred values, there is a low probability of adverse comment or disturbance to building occupants. Where all feasible and reasonable mitigation measures have been applied and vibration values are still beyond the maximum value, it is recommended the operator negotiate directly with the affected community.

The guideline defines three vibration types and provides direction for assessing and evaluating the applicable criteria. Table 2.1 of the guideline provides examples of the three vibration types and has been reproduced in **Table 19**.

Table 19 Examples of types of vibration (from Table 2.1 of the guideline)

Continuous Vibration	Impulsive Vibration	Intermittent Vibration
Machinery, steady road traffic, continuous construction activity (such as tunnel boring machinery)	Infrequent: Activities that create up to three distinct vibration events in an assessment period, e.g. occasional dropping of heavy equipment, occasional loading and unloading. Blasting is assessed using ANZECC (1990)	Trains, intermittent nearby construction activity, passing heavy vehicles, forging machines, impact pile driving, jack hammers. Where the number of vibration events in an assessment period is three or fewer these would be assessed against impulsive vibration criteria.

5.7 Continuous Vibration

Appendix C of the guideline outlines acceptable criteria for human exposure to continuous vibration (1-80 Hz), the criteria are dependent on both the time of activity (usually daytime or night-time) and the occupied place being assessed. **Table 20** reproduces the preferred and maximum criteria relating to measured peak velocity.

Table 20 Criteria for Exposure to Continuous Vibration

Place	Time[1]	Peak Velocity (mm/s)	
		Preferred	Maximum
Critical working Areas (e.g. hospital operating theatres, precision laboratories)	Day or Night	0.14	0.28
Residences	Day	0.28	0.56
	Night	0.20	0.40
Offices	Day or Night	0.56	1.1
Workshops	Day or Night	1.1	2.2

Note: rms velocity (mm/s) and vibration velocity value (dB re 10^{-9} mm/s) values given for most critical frequency >8Hz assuming sinusoidal motion.

Note 1: Daytime is 7am to 10pm and Night-time is 10pm to 7am.

5.7.1 Impulsive Vibration

Appendix C of the guideline outlines acceptable criteria for human exposure to impulsive vibration (1-80 Hz), these criteria are dependent on both the time of activity (usually daytime or night-time) and the occupied place being assessed. Impulsive vibration (as defined in Section 2.1 of the guideline) is generally associated with infrequent activities that create up to three (3) distinct vibration events in an assessment period e.g. occasional dropping of heavy equipment, occasional loading and unloading. **Table 21** reproduces the preferred and maximum criteria relating to measured peak velocity.

Table 21 Criteria for Exposure to Impulsive Vibration

Place	Time[1]	Assessment Criteria	
		Peak Velocity (mm/s)	
		Preferred	Maximum
Critical working Areas (e.g. hospital operating theatres, precision laboratories)	Day or Night-time	0.14	0.28
Residences	Daytime	8.6	17.0
	Night-time	2.8	5.6
Offices	Day or Night-time	18.0	36.0
Workshops	Day or Night-time	18.0	36.0

Note 1: Daytime is 7am to 10pm and Night-time is 10pm to 7am.

5.7.2 Intermittent Vibration

Intermittent vibration (as defined in Section 2.1 of the guideline) is assessed using the vibration dose concept which relates to vibration magnitude and exposure time.

Intermittent vibration is representative of activities such as impact hammering, rolling or general excavation work (such as an excavator tracking).

Section 2.4 of the Guideline provides acceptable values for intermittent vibration in terms of vibration dose values (VDV) which requires the measurement of the overall weighted RMS (root mean square) acceleration levels over the frequency range 1-80 Hz. To calculate VDV the following formula (refer section 2.4.1 of the guideline) was used:

$$VDV = \left[\int_0^T a^4(t)dt \right]^{0.25}$$

Where VDV is the vibration dose value in $m/s^{1.75}$, a (t) is the frequency-weighted RMS of acceleration in m/s^2 and T is the total period of the day (in seconds) during which vibration may occur.

The Acceptable Vibration Dose Values (VDV) for Intermittent Vibration is reproduced in **Table 22**.

Table 22 Acceptable Vibration Dose Values (VDV) for Intermittent Vibration

Location	Daytime		Night-time	
	Preferred Value, m/s1.75	Maximum Value, m/s1.75	Preferred Value, m/s1.75	Maximum Value, m/s1.75
Critical Areas	0.10	0.20	0.10	0.20
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

Note: Daytime is 7am to 10pm and Night-time is 10pm to 7am

Note: These criteria are indicative only, and there may be a need to assess intermittent values against continuous or impulsive criteria for critical areas.

There is a low probability of adverse comment or disturbance to building occupants at vibration values below the preferred values. Adverse comment or complaints may be expected if vibration values approach the maximum values. The guideline states that activities should be designed to meet the preferred values where an area is not already exposed to vibration.

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6 Modelling Methodology

A computer model was developed to quantify project noise emissions to neighbouring receivers using DGMR (iNoise, Version 2021) noise modelling software. iNoise is an intuitive and quality assured software for industrial noise calculations in the environment. 3D noise modelling is considered industry best practice for assessing noise emissions from projects.

The model incorporated a three-dimensional digital terrain map giving all relevant topographic information used in the modelling process. Additionally, the model uses relevant noise source data, ground type, attenuation from barrier or buildings and atmospheric information to predict noise levels at the nearest potentially affected receivers. Where relevant, modifying factors in accordance with Fact Sheet C of the NPI have been applied to calculations.

The model calculation method used to predict noise levels was in accordance with ISO 9613-1 'Acoustics - Attenuation of sound during propagation outdoors. Part 1: Calculation of the absorption of sound by the atmosphere' and ISO 9613-2 'Acoustics - Attenuation of sound during propagation outdoors. Part 2: General method of calculation' including corrections for meteorological conditions using CONCAWE[1]. The ISO 9613 standard from 1996 is the most used noise prediction method worldwide. Many countries refer to ISO 9613 in their noise legislation. However, the ISO 9613 standard does not contain guidelines for quality assured software implementation, which leads to differences between applications in calculated results. In 2015 this changed with the release of ISO/TR 17534-3. This quality standard gives clear recommendations for interpreting the ISO 9613 method. iNoise fully supports these recommendations. The models and results for the 19 test cases are included in the software.

6.1 Assessment Scenarios

6.1.1 Construction

During the construction phase, the south western section of the project site will be cleared first (refer to **Figure 5**) to provide a pad for the processing plant and loadout area. Clearing of the extraction Stage 1 and part of Stage 2 plus the internal haul road connecting to Patricia Fay Drive will be completed by the end of the six month construction phase. Trees from clearing will be taken to the mulcher to be processed.

[1] Report no. 4/18, "the propagation of noise from petroleum and petrochemical complexes to neighbouring communities", Prepared by C.J. Manning, M.Sc., M.I.O.A. Acoustic Technology Limited (Ref.AT 931), CONCAWE, Den Haag May 1981

6.1.2 Operation

Extraction will be undertaken sequentially from Stage 1 through to Stage 7. Clearing of each stage will occur ahead of extraction and will take approximately two months to complete per year. Several scenarios were adopted in this assessment to quantify noise levels to receivers surrounding the project, over the life of the project as follows:

- The initial cut will be located immediately to the east of the site infrastructure area. Raw material stockpiles can be created by dozer push due to the close proximity of the initial cut to the infrastructure area site. This phase will generate 13,000m^3 of excess overburden that will be temporarily stored before being rehandled in Year 2 to create landforms.
- Project Year 1 – expand the initial cut to the east and continues to utilise dozer push to create stockpiles near the processing plant (located at P1). The mining operation will transition to load and haul once room is established in the pit. Years 2-4 continues to expand the extraction pit east to expose a highwall.
- Project Year 5 – commencement of excavation of the south-western side of the quarry from a bench height of 185 AHD. During Stage 2, extraction continues in the large south-east section of the extraction pit.
- Project Year 10 - The pit expands to the north-west along the central ridgeline during Stage 3. At the start of PY11, the processing plant will be relocated to P2 on the south-eastern side of the quarry to reduce haul distances.
- Project Year 15 - The quarry will continue to expand to the north-west during Stage 4. During PY 16 - PY17 the processing plant will be relocated to P3.
- Project Year 20 - The north-west extremities of the pit will be mined between years 21 and 28 during Stage 5.

The extraction and clearing plan including the processing plant locations is presented in **Figure 5.**

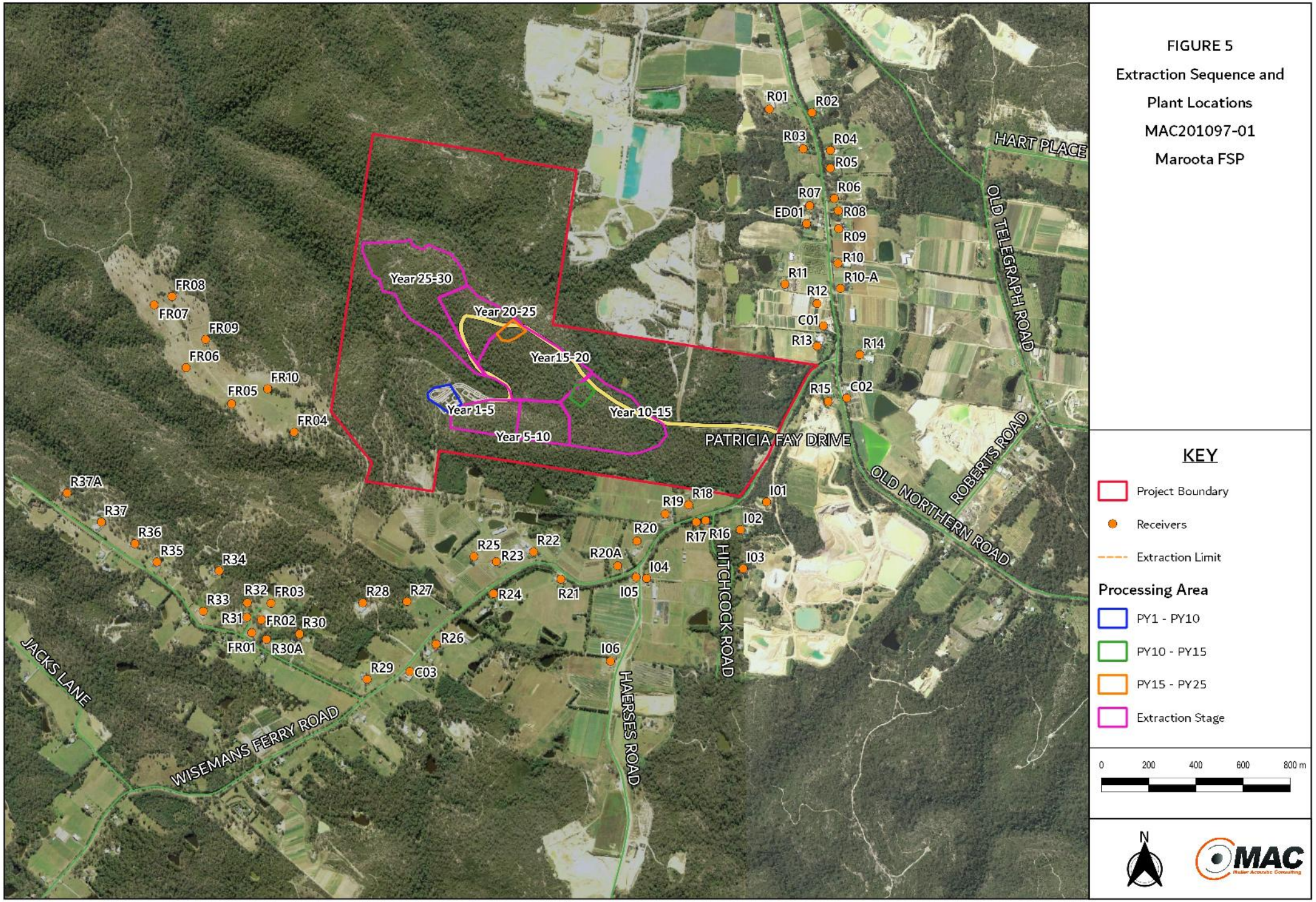
FIGURE 5
Extraction Sequence and
Plant Locations
MAC201097-01
Maroota FSP
KEY
Project Boundary
Receivers
Extraction Limit
Processing Area
PY1 - PY10
PY10 - PY15
PY15 - PY25
Extraction Stage
0
200
400
600
800 m
N
MAC
Year 25-30
Year 20-25
Year15-20
Year 10-15
Year 5-10
Year 1-5
R01
R02
R03
R04
R05
R06
R07
R08
ED01
R09
R10
R10-A
R11
R12
C01
R13
R14
R15
C02
FR08
FR07
FR09
FR06
FR10
FR05
FR04
R37A
R37
R36
R35
R34
R33
R32
FR03
R31
FR02
R30
FR01
R30A
R28
R27
R29
C03
R26
R25
R23
R22
R24
R21
R20A
R20
R19
R18
R17
R16
I01
I02
I03
I04
I05
I06
HART PLACE
OLD TELEGRAPH ROAD
PATRICIA FAY DRIVE
ROBERTS ROAD
OLD NORTHERN ROAD
HITCHCOCK ROAD
HAERSES ROAD
JACKS LANE
WISEMANS FERRY ROAD

6.2 Plant & Equipment Sound Power Levels

Sound power levels (SWLs) used in modelling for the project were obtained from data provided by DC and the MAC noise database. The noise SWLs used in modelling are summarised in **Table 23**. Duration adjustments have been applied to plant where required to represent typical operations over a 15-minute period. **Appendix C** provides the sound power data of modelled plant and equipment.

Table 23 Equipment Sound Power Levels (re dBA 10^{-12} Watts)

Operations						
Plant /Equipment	Location	Quantity	Utilisation	Sound Power Level (Lw)	Daytime (7am-6pm)	Morning Shoulder (6am-7am)
Processing Plant	ROM (P1 - P3)	1	100%	107	✓	X
Tree Mulcher	156m RL	1	100%	116	✓	X
Volvo A40 Articulated Haul Truck	Pit to ROM	2	3 per 15min	108	✓	X
CAT349D Excavator	Pit	1	100%	109	✓	X
CAT D9 Dozer	Pit	1	100%	108	✓	X
Volvo Water Cart (6 wheel road truck)	Pit to ROM	1	1 per 15min	101	✓	X
CAT 980G FEL	ROM	1	100%	108	✓	X
CAT 980G FEL	Processing & Sales Area	1	100%	108	✓	✓
Standard Road Truck	Access Road	N/A	3 per 15min	102	✓	✓
Construction (Standard Hours)						
Plant /Equipment	Location	Quantity	Utilisation	Sound Power Level (Lw)		
CAT349D Excavator	Processing Area & Access Road	1	100%	109		
Volvo A40 Articulated Haul Truck	Processing Area & Access Road	2	3 per 15min	108		
CAT D9 Dozer	Processing Area & Access Road	1	100%	108		
Volvo Water Cart (6 wheel road truck)	Processing Area & Access Road	1	1 per 15min	101		

Note 1: Day – the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening – the period from 6pm to 10pm; Night – the remaining periods

6.3 Mitigation Measures

Table 24 presents several examples of Best Management Practice (BMP), Best Available Technology Economically Achievable (BATEA) and reasonable and feasible measures considered in the mitigation process and the justification of the resulting noise management measures adopted into the project. This format is consistent with the decision making matrix provided in Table 3.1 of the NPI.

Table 24 – Reasonable and Feasible Mitigation Measures Matrix

Mitigation Option	Feasible mitigation test	Reasonable mitigation test	Justification for adopting or disregarding this option
Enclosure of Process plant (including cladding)	The processing plant is not a major noise contributor compared to the extraction fleet.	Costly and adds to maintenance access issues for servicing plant, and provides moderate sound attenuation	**Rejected** – whilst achieving a significant reduction of this individual source, overall noise levels at receivers are not reduced
Optimisation of Processing Plant Location	To reduce overall off site noise emissions	Location still affords operational flexibility	**Adopted** - the overall cost is not onerous compared to attenuation achieved
Optimisation of Mulcher Location	To reduce overall off site noise emissions	Location still affords operational flexibility	**Adopted** - the overall cost is not onerous compared to attenuation achieved
Mulcher Barrier	The mulcher is a significant noise contributor compared to the process plant and mobile equipment	Attenuation levels achieved by this noise control is considered a reasonable approach to obtaining additional noise reductions at site	**Adopted** - the overall cost is not onerous compared to attenuation achieved.
Aftermarket exhaust mufflers will be applied to excavators and dozers (ref: https://www.aletek.com.au/)	To reduce overall sound power levels and off site noise emissions from mobile equipment	Attenuation levels achieved by this noise control is considered a reasonable approach to obtaining additional noise reductions at site	**Adopted** - the overall cost is not onerous compared to attenuation achieved.
Bund along southern extent of extraction area	To reduce overall off site noise emissions	Attenuation levels achieved by this noise control achieves a minor reduction for a limited time	**Rejected** – a bund along the southern extent of the extraction area would have significant biodiversity, visual and economic impacts while resulting in only a minor noise reduction for a limited time

Table 24 – Reasonable and Feasible Mitigation Measures Matrix			
Mitigation Option	**Feasible mitigation test**	**Reasonable mitigation test**	**Justification for adopting or disregarding this option**
Pit redesign – working face 5m minimum	To reduce overall off site noise emissions for the proposed extraction stages	Attenuation levels achieved by this noise control achieves a moderate reduction for a significant period	**Adopted** - the overall cost is not onerous compared to attenuation achieved over a longer period of the project life
Alternate mining sequence (north to south)	To reduce overall off site noise emissions for the proposed extraction stages	Attenuation levels achieved by this noise control achieves a moderate reduction for a significant period	**Rejected** - if mining proceeded from the north to the south, excess material would need to be stockpiled and stored for a significant period until the southern highwall was exposed later in the Project's life inhibiting the implementation of a progressive rehabilitation.
Permanent Noise Monitoring Terminal (NMT)	A NMT will alert operators when noise levels exceed trigger levels	Predictions show that PNTLs may be exceeded when clearing operations occur in conjunction with normal extraction and processing.	**Adopted** - the overall cost is not onerous and allows for operations to work PNTLs
Permanent Weather Station	The weather station, integrated with the NMT will alert operators when noise enhancing winds are present	Predictions show that PNTLs may be exceeded under noise enhancing conditions.	**Adopted** - the overall cost is not onerous and provides real time data, allowing for operational flexibility

Therefore, the following noise mitigation measures have been included in the assessment scenarios:

- Siting of the plant such that there is a 3m to 5m bund on the southern and eastern boundaries of the processing area (depending Project Year);
- Extraction areas are developed such that equipment works behind an advancing face of 5m.
- Location of the tree mulcher at RL 156m or lower with a 3m barrier to minimise noise propagation; and
- During noise enhancing conditions (prevailing winds), clearing activities and tree mulching will be suspended.

6.4 Noise Modelling Parameters

The model incorporated information provided by DC which included three-dimensional digitised ground contours for the plant and surrounding site, location of plant as derived from proposed site plans, and the surrounding land base topography, superimposed on each other. The noise model predicts LA_{eq} noise levels, although it should be noted that this assessment has assumed that all plant and equipment operate simultaneously. In practice, such an operating scenario would be unlikely to occur, and the results should therefore be considered conservatively high. Where relevant, modifying factors in accordance with Fact Sheet C2 of the NPI have been applied to calculations.

6.4.1 Meteorological Analysis

Noise emissions from industry can be significantly influenced by prevailing weather conditions. Light stable winds (<3m/s) and temperature inversions have the potential to increase noise at a receiver.

Fact Sheet D of the NPI provides two options when considering meteorological effects:

- adopt the noise enhancing conditions for all assessment periods without an assessment of how often the conditions occur – a conservative approach that considers a source to receiver winds for all receivers and F class temperature inversions with wind speeds up to 2m/s at night; or
- determine the significance of noise enhancing conditions. This requires assessing the significance of temperature inversions (F and G Class stability categories) for the night time period and the significance of light winds up to 3m/s for all assessment periods during stability categories other than E, F or G.

Given that a detailed analysis of the significance of noise enhancing conditions has not been undertaken the default NPI meteorological conditions adopted in the noise modelling assessment are summarised in **Table 25**.

Table 25 Modelled Meteorological Parameters

Assessment Condition[1]	Temperature	Wind Speed / Direction	Relative Humidity	Atmospheric Stability Class[2]
Day - Calm	20°C	<0.5m/s	50%	D
Day - Enhancing	20°C	3m/s all directions	50%	D
Morning Shoulder - Calm	10°C	<0.5m/s	50%	D
Morning Shoulder - Enhancing	10°C	2m/s all directions	50%	F

Note 1: Day 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening 6pm to 10pm; Night - the remaining periods.

Note 2: Pasquil-Gifford Stability Class.

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7 Noise Assessment Results

This assessment has quantified potential noise emissions from construction and operational phases of the project with results presented in **Table 26**. Predicted noise levels from construction activities are expected to satisfy the construction NMLs at all receivers.

7.1 Construction Noise

Table 26 Predicted Construction Noise Levels – dB $LA_{eq(15min)}$

Receiver	Month 1	Month 3	Month 6	NML
R01	<30	<30	<30	50
R02	<30	<30	<30	
R03	<30	<30	<30	
R04	<30	<30	<30	
R05	<30	<30	<30	
R06	<30	<30	<30	
R07	<30	<30	<30	
R08	<30	<30	<30	
R09	<30	<30	<30	
R10	<30	<30	<30	
R10-A	<30	<30	<30	
R11	<30	<30	31	
R12	<30	<30	30	
R13	<30	<30	<30	
R14	<30	<30	<30	
R15	<30	<30	<30	
R16	<30	<30	34	45
R17	<30	<30	34	
R18	31	32	38	
R19	31	32	40	
R20	30	33	40	
R20A	<30	32	39	
R21	<30	34	40	
R22	30	38	43	
R23	33	39	42	
R24	<30	33	35	
R25	38	41	42	
R26	<30	<30	30	
R27	30	33	32	

Table 26 Predicted Construction Noise Levels – dB $L_{Aeq(15min)}$				
Receiver	Month 1	Month 3	Month 6	NML
R28	<30	30	29	
R29	<30	<30	30	
R30	<30	<30	<30	
R30A	<30	<30	<30	
R31	<30	<30	<30	
R32	<30	<30	<30	
R33	<30	<30	<30	45
R34	<30	<30	<30	
R35	<30	<30	<30	
R36	<30	<30	<30	
R37	<30	<30	<30	
R37A	<30	<30	<30	
FR01	<30	<30	<30	
FR02	<30	<30	<30	
FR03	<30	<30	<30	
FR04	34	35	32	
FR05	33	32	31	
FR06	34	33	30	45
FR07	<30	<30	<30	
FR08	<30	<30	<30	
FR09	35	34	31	
FR10	36	37	35	
C01	<30	<30	<30	
C02	<30	<30	<30	70
C03	<30	<30	<30	
ED01	<30	<30	<30	55
I01	<30	<30	32	
I02	<30	<30	34	
I03	<30	<30	<30	
I04	<30	<30	34	75
I05	<30	32	38	
I06	<30	29	33	

Note: Exceedances of NMLs are shown in bold text.

7.2 Operations Noise

Noise levels from the project have been calculated at existing and potential future receiver locations (1.5 m above ground level) for all operating periods for the equipment sound power levels in Section 6.2 for two operational modes:

- 'All Operations' - clearing, extraction, haulage, processing and product transport; and
- 'Typical Operations' - extraction, haulage, processing and product transport.

Predicted noise levels for All Operations during calm conditions are presented in Table 27. Typical Operations for calm conditions are presented in Table 28; and Typical Operations for noise enhancing conditions are presented in Table 29 (refer Section 6.4.1) as clearing activities will not occur during noise enhancing conditions (refer to Section 8). Noise levels exceeding the PNTL by up to 2dB are shown in **bold**, and where noise levels exceed the PNTL by up to 5dB, they are shown in ***bold italic***. Appendix D presents noise contours for all assessed scenarios.

Table 27 Predicted Operations Noise Levels – ALL Operations Calm Conditions

Receiver	Predicted Noise Level dB LAeq(15min)												PNTL dB LAeq(15min)	
	PY1		PY5		PY10		PY15		PY20		PY25			
	Day	MS	Day	MS	Day	MS	Day	MS	Day	MS	Day	MS	Day	MS
R01	31	<30	31	<30	32	<30	33	<30	32	<30	30	<30	45	35
R02	30	<30	<30	<30	31	<30	32	<30	31	<30	<30	<30		
R03	32	<30	31	<30	33	<30	33	<30	32	<30	30	<30		
R04	<30	<30	<30	<30	31	<30	31	<30	<30	<30	<30	<30		
R05	32	<30	31	<30	32	<30	32	<30	31	<30	<30	<30		
R06	33	<30	31	<30	33	<30	33	<30	32	<30	30	<30		
R07	33	<30	32	<30	34	<30	34	<30	33	<30	31	<30		
R08	33	<30	31	<30	33	<30	33	<30	32	<30	30	<30		
R09	33	<30	31	<30	34	<30	34	<30	32	<30	30	<30		
R10	32	<30	30	<30	33	<30	32	<30	<30	<30	<30	<30		
R10A	32	<30	30	<30	33	<30	32	<30	30	<30	<30	<30		
R11	35	<30	34	<30	37	<30	37	<30	34	<30	32	<30		
R12	34	<30	32	<30	36	<30	34	<30	31	<30	30	<30		
R13	33	<30	<30	<30	35	<30	33	<30	31	<30	<30	<30		
R14	32	<30	30	<30	33	<30	32	<30	<30	<30	<30	<30		
R15	33	<30	31	<30	35	<30	34	<30	30	<30	<30	<30		
R16	37	<30	33	<30	37	<30	36	32	34	<30	33	<30	40	36
R17	37	<30	34	<30	38	31	37	32	34	<30	33	<30		
R18	39	32	37	<30	**41**	34	39	34	38	32	37	32		
R19	40	32	37	30	**42**	35	38	34	36	31	35	31		
R20	**41**	31	37	<30	40	33	37	33	36	30	35	30		

Table 27 Predicted Operations Noise Levels – ALL Operations Calm Conditions

Receiver	Predicted Noise Level dB LAeq(15min)												PNTL dB LAeq(15min)	
	PY1		PY5		PY10		PY15		PY20		PY25			
	Day	MS	Day	MS	Day	MS	Day	MS	Day	MS	Day	MS	Day	MS
R20A	40	31	36	<30	37	<30	36	30	34	<30	33	<30	40	36
R21	39	<30	33	<30	36	<30	36	<30	35	<30	33	<30		
R22	**41**	30	36	<30	38	<30	37	<30	36	<30	35	<30		
R23	**41**	35	37	32	38	<30	37	<30	37	<30	36	<30		
R24	37	<30	38	33	38	<30	38	<30	37	<30	36	<30		
R25	**42**	36	31	<30	33	<30	33	<30	33	<30	31	<30		
R26	32	30	30	<30	30	<30	30	<30	31	<30	<30	<30		
R27	36	32	32	<30	31	<30	32	<30	32	<30	31	<30		
R28	33	<30	31	<30	30	<30	31	<30	31	<30	30	<30		
R29	33	<30	31	<30	31	<30	31	<30	30	<30	<30	<30	40	35
R30	34	<30	31	<30	30	<30	31	<30	31	<30	<30	<30		
R30A	33	<30	30	<30	<30	<30	30	<30	30	<30	<30	<30		
R31	33	<30	31	<30	30	<30	31	<30	31	<30	<30	<30		
R32	33	<30	31	<30	<30	<30	31	<30	31	<30	<30	<30		
R33	32	<30	30	<30	<30	<30	30	<30	30	<30	<30	<30	40	35
R34	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30		
R35	32	<30	31	<30	<30	<30	31	<30	31	<30	30	<30		
R36	32	<30	31	<30	<30	<30	30	<30	31	<30	30	<30		
R37	32	<30	30	<30	<30	<30	<30	<30	30	<30	<30	<30		
R37A	31	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30		

Table 27 Predicted Operations Noise Levels – ALL Operations Calm Conditions

Receiver	Predicted Noise Level dB LAeq(15min)												PNTL dB LAeq(15min)	
	PY1		PY5		PY10		PY15		PY20		PY25			
	Day	MS	Day	MS	Day	MS	Day	MS	Day	MS	Day	MS	Day	MS
FR01	32	<30	30	<30	<30	<30	30	<30	30	<30	<30	<30	40	35
FR02	33	<30	31	<30	<30	<30	30	<30	31	<30	<30	<30		
FR03	31	<30	30	<30	<30	<30	30	<30	30	<30	<30	<30		
FR04	39	34	37	31	34	<30	36	<30	36	<30	35	<30		
FR05	38	33	37	<30	35	<30	36	<30	37	<30	37	<30		
FR06	37	34	37	30	35	<30	34	<30	36	<30	35	<30		
FR07	33	<30	33	<30	30	<30	33	<30	33	<30	32	<30		
FR08	34	<30	33	<30	31	<30	33	<30	33	<30	32	<30		
FR09	38	34	38	31	35	<30	36	<30	37	<30	37	<30		
FR10	40	35	39	31	37	<30	38	<30	39	<30	39	<30		
C01	33	<30	31	<30	34	<30	33	<30	31	<30	<30	<30	63	
C02	32	<30	31	<30	32	<30	32	<30	30	<30	<30	<30		
C03	34	<30	31	<30	30	<30	31	<30	31	<30	<30	<30		
ED01	33	<30	32	<30	35	<30	34	<30	33	<30	31	<30	43	
I01	36	30	35	<30	39	31	38	30	36	30	36	30	68	
I02	37	<30	34	<30	37	<30	35	30	34	<30	33	<30		
I03	31	<30	<30	<30	30	<30	31	<30	31	<30	<30	<30		
I04	37	<30	31	<30	35	<30	34	<30	33	<30	32	<30		
I05	39	30	36	<30	38	30	35	30	34	<30	33	<30		
I06	35	<30	32	<30	33	<30	32	<30	32	<30	30	<30		

Note: Day (7am – 6pm); MS – Morning Shoulder (MS 6am – 7am)

Table 28 Predicted Operations Noise Levels – TYPICAL Operations Calm Conditions dB LAeq(15min)

Receiver	Predicted Noise Level dB LAeq(15min)												PNTL dB LAeq(15min)	
	PY1		PY5		PY10		PY15		PY20		PY25			
	Day	MS	Day	MS	Day	MS	Day	MS	Day	MS	Day	MS	Day	MS
R01	<30	<30	<30	<30	<30	<30	33	<30	32	<30	30	<30	45	35
R02	<30	<30	<30	<30	<30	<30	32	<30	31	<30	<30	<30		
R03	<30	<30	<30	<30	30	<30	33	<30	32	<30	30	<30		
R04	<30	<30	<30	<30	<30	<30	31	<30	<30	<30	<30	<30		
R05	<30	<30	<30	<30	<30	<30	32	<30	31	<30	<30	<30		
R06	<30	<30	<30	<30	31	<30	33	<30	32	<30	30	<30		
R07	30	<30	<30	<30	32	<30	34	<30	33	<30	31	<30		
R08	<30	<30	<30	<30	31	<30	33	<30	32	<30	30	<30		
R09	<30	<30	<30	<30	32	<30	34	<30	32	<30	30	<30		
R10	<30	<30	<30	<30	32	<30	32	<30	<30	<30	<30	<30		
R10A	<30	<30	<30	<30	32	<30	32	<30	30	<30	<30	<30		
R11	32	<30	32	<30	35	<30	37	32	34	<30	32	<30		
R12	31	<30	30	<30	34	<30	34	<30	31	<30	30	<30		
R13	<30	<30	<30	<30	33	<30	33	<30	31	<30	<30	<30		
R14	<30	<30	<30	<30	31	<30	32	<30	<30	<30	<30	<30		
R15	<30	<30	30	<30	34	<30	34	<30	30	<30	<30	<30		
R16	<30	<30	32	<30	35	<30	36	32	34	<30	33	<30	40	36
R17	30	<30	33	<30	36	31	37	32	34	<30	33	<30		
R18	34	32	36	<30	39	34	39	34	38	32	37	32		
R19	34	32	36	30	41	35	38	34	36	31	35	31		
R20	36	31	36	<30	38	33	37	33	36	30	35	30		

Table 28 Predicted Operations Noise Levels – TYPICAL Operations Calm Conditions dB LAeq(15min)

Receiver	Predicted Noise Level dB LAeq(15min)												PNTL dB LAeq(15min)	
	PY1		PY5		PY10		PY15		PY20		PY25			
	Day	MS	Day	MS	Day	MS	Day	MS	Day	MS	Day	MS	Day	MS
R20A	34	31	35	<30	33	<30	36	30	34	<30	33	<30	40	36
R21	32	<30	33	<30	33	<30	36	<30	35	<30	33	<30		
R22	35	30	35	<30	33	<30	37	<30	36	<30	35	30		
R23	35	35	36	32	34	<30	37	<30	37	<30	36	<30		
R24	30	29	30	<30	28	<30	33	<30	33	<30	31	<30		
R25	38	36	38	33	34	<30	38	<30	37	<30	36	<30		
R26	<30	30	<30	<30	<30	<30	30	<30	31	<30	<30	<30		
R27	33	32	32	<30	<30	<30	32	<30	32	<30	31	<30		
R28	30	<30	30	<30	<30	<30	31	<30	31	<30	30	<30		
R29	30	<30	30	<30	<30	<30	31	<30	30	<30	<30	<30	40	35
R30	31	<30	30	<30	<30	<30	31	<30	31	<30	<30	<30		
R30A	30	<30	30	<30	<30	<30	30	<30	30	<30	<30	<30		
R31	30	<30	30	<30	<30	<30	31	<30	31	<30	<30	<30		
R32	30	<30	30	<30	<30	<30	31	<30	31	<30	<30	<30	40	35
R33	30	<30	<30	<30	<30	<30	30	<30	30	<30	<30	<30		
R34	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30		
R35	30	<30	30	<30	<30	<30	31	<30	31	<30	30	<30		
R36	30	<30	<30	<30	<30	<30	30	<30	31	<30	30	<30		
R37	<30	<30	<30	<30	<30	<30	<30	<30	30	<30	<30	<30		
R37A	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30		

Table 28 Predicted Operations Noise Levels – TYPICAL Operations Calm Conditions dB LAeq(15min)

Receiver	Predicted Noise Level dB LAeq(15min)												PNTL dB LAeq(15min)	
	PY1		PY5		PY10		PY15		PY20		PY25			
	Day	MS	Day	MS	Day	MS	Day	MS	Day	MS	Day	MS	Day	MS
FR01	30	<30	30	<30	<30	<30	30	<30	30	<30	<30	<30	40	35
FR02	30	<30	30	<30	<30	<30	30	<30	31	<30	<30	<30		
FR03	<30	<30	<30	<30	<30	<30	30	<30	30	<30	<30	<30		
FR04	37	34	36	31	<30	<30	36	<30	36	<30	35	<30		
FR05	35	33	34	<30	<30	<30	36	<30	37	<30	37	<30		
FR06	35	34	35	30	<30	<30	34	<30	36	<30	35	<30		
FR07	31	<30	30	<30	<30	<30	33	<30	33	<30	32	<30		
FR08	32	<30	31	<30	<30	<30	33	<30	33	<30	32	<30		
FR09	35	34	35	31	<30	<30	36	<30	37	<30	37	<30		
FR10	37	35	36	31	<30	<30	38	<30	39	<30	39	<30		
C01	<30	<30	30	<30	32	<30	33	<30	31	<30	<30	<30	63	
C02	<30	<30	30	<30	30	<30	32	<30	30	<30	<30	<30		
C03	30	<30	30	<30	<30	<30	31	<30	31	<30	<30	<30		
ED01	30	<30	30	<30	32	<30	34	<30	33	<30	31	<30	43	
I01	32	30	33	<30	38	31	38	30	36	30	36	30	68	
I02	33	<30	33	<30	35	<30	35	30	34	<30	33	<30		
I03	<30	<30	<30	<30	<30	<30	31	<30	31	<30	<30	<30		
I04	<30	<30	<30	<30	33	<30	34	<30	33	<30	32	<30		
I05	34	30	35	<30	35	30	35	30	34	<30	33	<30		
I06	31	<30	31	<30	30	<30	32	<30	32	<30	30	<30		

Note: Day (7am – 6pm); MS – Morning Shoulder (MS 6am – 7am)

Table 29 Predicted Operations Noise Levels – TYPICAL Operations Noise Enhancing Conditions dB LAeq(15min)														
Receiver	Predicted Noise Level dB LAeq(15min)												PNTL dB LAeq(15min)	
	PY1		PY5		PY10		PY15		PY20		PY25			
	Day	MS	Day	MS	Day	MS	Day	MS	Day	MS	Day	MS	Day	MS
R01	32	<30	31	<30	32	<30	36	<30	35	<30	33	<30	45	35
R02	31	<30	30	<30	31	<30	34	<30	33	<30	32	<30		
R03	32	<30	32	<30	33	<30	36	<30	35	<30	33	<30		
R04	29	<30	30	<30	32	<30	34	<30	31	<30	29	<30		
R05	31	<30	31	<30	32	<30	35	<30	34	<30	32	<30		
R06	32	<30	32	<30	34	<30	36	<30	35	<30	33	<30		
R07	33	<30	32	<30	35	<30	36	<30	36	<30	34	<30		
R08	32	<30	32	<30	34	<30	36	<30	35	<30	33	<30		
R09	32	<30	32	<30	35	<30	36	<30	35	<30	33	<30		
R10	32	<30	32	<30	35	<30	35	<30	32	<30	30	<30		
R10A	32	<30	32	<30	35	<30	35	<30	33	<30	31	<30		
R11	35	<30	35	<30	38	32	40	35	37	<30	35	<30		
R12	34	<30	33	<30	37	30	37	30	34	<30	32	<30		
R13	32	<30	<30	<30	36	31	36	31	34	<30	32	<30		
R14	31	<30	32	<30	33	<30	35	<30	32	<30	<30	<30		
R15	32	<30	33	<30	36	30	37	30	33	<30	32	<30		
R16	31	<30	34	<30	37	32	39	34	37	31	36	31	40	36
R17	33	<30	36	30	39	33	40	35	37	32	36	32		
R18	37	32	39	32	**42**	**37**	**42**	36	**41**	35	40	35		
R19	37	32	39	33	***43***	**38**	**41**	**37**	39	34	38	34		
R20	38	31	39	32	40	35	40	35	39	33	38	33		

Table 29 Predicted Operations Noise Levels – TYPICAL Operations Noise Enhancing Conditions dB LAeq(15min)														
Receiver	Predicted Noise Level dB LAeq(15min)												PNTL dB LAeq(15min)	
	PY1		PY5		PY10		PY15		PY20		PY25			
	Day	MS	Day	MS	Day	MS	Day	MS	Day	MS	Day	MS	Day	MS
R20A	37	31	38	30	36	32	39	33	37	31	36	31	40	36
R21	35	<30	35	30	35	30	39	30	38	31	36	31		
R22	38	30	38	31	36	31	40	31	39	33	38	33		
R23	38	35	39	35	37	31	40	32	40	32	39	32		
R24	33	<30	33	<30	31	<30	36	<30	36	<30	34	<30		
R25	**41**	36	**41**	36	37	32	**41**	32	40	32	39	32		
R26	32	30	32	30	<30	<30	33	<30	34	<30	32	<30		
R27	35	32	35	32	<30	<30	35	<30	35	<30	33	<30		
R28	33	<30	33	<30	<30	<30	34	<30	34	<30	33	<30		
R29	33	<30	33	<30	30	<30	34	<30	33	<30	32	<30	40	35
R30	34	<30	33	<30	<30	<30	33	<30	33	<30	31	<30		
R30A	33	<30	33	<30	<30	<30	33	<30	33	<30	31	<30		
R31	33	<30	33	<30	<30	<30	34	<30	33	<30	32	<30		
R32	33	<30	33	<30	<30	<30	34	<30	34	<30	32	<30	40	35
R33	33	<30	32	<30	<30	<30	33	<30	33	<30	32	<30		
R34	<30	<30	<30	<30	<30	<30	32	<30	31	<30	31	<30		
R35	33	<30	32	<30	<30	<30	33	<30	34	<30	33	<30		
R36	33	<30	32	<30	<30	<30	33	<30	34	<30	33	<30		
R37	32	<30	31	<30	<30	<30	32	<30	32	<30	31	<30		
R37A	31	<30	30	<30	<30	<30	31	<30	31	<30	30	<30		

Table 29 Predicted Operations Noise Levels – TYPICAL Operations Noise Enhancing Conditions dB LAeq(15min)

Receiver	Predicted Noise Level dB LAeq(15min)												PNTL dB LAeq(15min)	
	PY1		PY5		PY10		PY15		PY20		PY25			
	Day	MS	Day	MS	Day	MS	Day	MS	Day	MS	Day	MS	Day	MS
FR01	33	<30	33	<30	<30	<30	33	<30	33	<30	32	<30	40	35
FR02	33	<30	33	<30	<30	<30	33	<30	33	<30	32	<30		
FR03	32	<30	32	<30	<30	<30	33	<30	33	<30	31	<30		
FR04	40	34	39	34	31	<30	39	<30	39	<30	38	<30		
FR05	38	33	37	32	31	<30	39	<30	40	<30	39	<30		
FR06	38	34	38	33	<30	<30	37	<30	39	<30	38	<30		
FR07	34	<30	33	<30	<30	<30	36	<30	36	<30	35	<30		
FR08	34	<30	34	<30	<30	<30	36	<30	36	<30	35	<30		
FR09	38	34	38	34	30	<30	39	<30	40	<30	40	<30		
FR10	40	35	39	34	32	<30	**41**	<30	**42**	<30	**42**	<30		
C01	32	<30	33	<30	35	30	36	30	34	<30	31	<30	63	
C02	31	<30	33	<30	33	<30	35	<30	33	<30	30	<30		
C03	33	<30	33	<30	29	<30	34	<30	33	<30	32	<30		
ED01	33	<30	33	<30	35	<30	37	<30	36	<30	34	<30	43	
I01	35	30	36	30	40	34	41	33	39	33	39	33	68	
I02	35	<30	36	<30	38	32	38	33	37	31	36	31		
I03	<30	<30	<30	<30	<30	<30	34	<30	33	<30	31	<30		
I04	31	<30	32	<30	35	30	37	<30	36	30	35	30		
I05	37	30	37	30	38	33	38	33	37	31	36	31		
I06	34	<30	34	<30	33	<30	35	<30	35	<30	33	<30		

Note: Day (7am – 6pm); MS – Morning Shoulder (6am – 7am)

7.2.1 Project Year 1

Predicted noise levels from All Operations for calm conditions satisfy the PNTLs during the morning shoulder at all assessed receivers. Similarly, noise levels satisfy the PNTLs during the daytime period, except at four (4) receivers (R20, R22, R23 and R25) where noise levels are expected to exceed the PNTLs by up to 2dB. Predicted noise levels from Typical Operations for calm conditions satisfy the PNTLs during the daytime and morning shoulder at all assessed receivers.

Predicted noise levels from Typical Operations for noise enhancing conditions satisfy the PNTLs during the daytime and morning shoulder at all assessed receivers except at receiver R25 where noise levels are expected to exceed the PNTLs by up to 1dB.

For potential future receivers, predicted noise levels from All Operations and Typical Operations satisfy the PNTLs during the morning shoulder and daytime periods at all assessed receivers for all conditions.

7.2.2 Project Year 5

Predicted noise levels from All Operations and Typical Operations satisfy the PNTLs during the daytime and morning shoulder at all assessed receivers for calm conditions.

Predicted noise levels from Typical Operations for noise enhancing conditions satisfy the PNTLs during the daytime and morning shoulder at all assessed receivers except at receiver R25 where noise levels are expected to exceed the PNTLs by up to 1dB.

For potential future receivers, predicted noise levels from All Operations and Typical Operations satisfy the PNTLs during the morning shoulder and daytime periods at all assessed receivers for all conditions.

7.2.3 Project Year 10

Predicted noise levels from All Operations for calm conditions satisfy the PNTLs during the morning shoulder at all assessed receivers. Similarly, noise levels satisfy the PNTLs during the daytime period, except at two (2) receivers, R18 and R20, where noise levels are expected to exceed the PNTLs by up to 2dB.

Predicted noise levels from Typical Operations for calm conditions satisfy the PNTLs during the daytime and morning shoulder at all assessed receivers except at one (1) receiver, R19, where noise levels are expected to exceed the PNTLs by up to 1dB.

Predicted noise levels from Typical Operations for noise enhancing conditions satisfy the PNTLs during the daytime at all assessed receivers except at two (2) receivers, R18 and R19 where noise levels are expected to exceed the PNTLs by up to 2dB and 3dB respectively.

Predicted noise levels from Typical Operations for noise enhancing conditions satisfy the PNTLs during the morning shoulder at all assessed receivers except at two (2) receivers, R18 and R19 where noise levels are expected to exceed the PNTLs by up to 1dB and 2dB respectively.

For potential future receivers, predicted noise levels from All Operations and Typical Operations satisfy the PNTLs during the morning shoulder and daytime periods at all assessed receivers for all conditions.

7.2.4 Project Year 15

Predicted noise levels from All Operations and Typical Operations satisfy the PNTLs during the daytime and morning shoulder at all assessed receivers for calm conditions.

Predicted noise levels from Typical Operations for noise enhancing conditions satisfy the PNTLs during the daytime at all assessed receivers except at three (3) receivers, R18, R19 and R25 where noise levels are expected to exceed the PNTLs by up to 2dB.

Predicted noise levels from Typical Operations for noise enhancing conditions satisfy the PNTLs during the morning shoulder at all assessed receivers except at one (1) receiver R19 where noise levels are expected to exceed the PNTLs by up to 1dB.

For potential future receivers, predicted noise levels from All Operations and Typical Operations satisfy the PNTLs during the morning shoulder and daytime periods at all assessed receivers for all conditions except at receiver FR10 where noise levels are expected to exceed the PNTLs by up to 1dB during the daytime for noise enhancing conditions for Typical Operations.

7.2.5 Project Year 20

Predicted noise levels from All Operations and Typical Operations satisfy the PNTLs during the daytime and morning shoulder at all assessed receivers for calm conditions.

Predicted noise levels from Typical Operations for noise enhancing conditions satisfy the PNTLs during the daytime and morning shoulder at all assessed receivers except at receiver R18 where noise levels are expected to exceed the PNTLs by up to 1dB.

For potential future receivers, predicted noise levels from All Operations and Typical Operations satisfy the PNTLs during the morning shoulder and daytime periods at all assessed receivers for all conditions except at receiver FR10 where noise levels are expected to exceed the PNTLs by up to 2dB during the daytime for noise enhancing conditions for Typical Operations.

7.2.6 Project Year 25

Predicted noise levels from All Operations and Typical Operations satisfy the PNTLs during the daytime and morning shoulder at all assessed receivers for calm conditions and noise enhancing conditions.

For potential future receivers, predicted noise levels from All Operations and Typical Operations satisfy the PNTLs during the morning shoulder and daytime periods at all assessed receivers for all conditions except at receiver FR10 where noise levels are expected to exceed the PNTLs by up to 2dB during the daytime for noise enhancing conditions for Typical Operations.

7.3 Residual Impacts

In accordance with NPI methodology, where predicted noise levels exceed the PNTLs by up to 2dB, the residual impact is Negligible and where predicted noise levels exceed the PNTLs by up to 3dB to 5dB the residual impact is Marginal (refer **Section 3.1.5**). A summary of residual impacts is presented in **Table 30**, resulting in Marginal impacts at receivers R18, R19, R20, R22, R23 and R24 from Project Year 1 to Project Year 10.

Table 30 Residual Noise Impacts

Significance of residual noise level[1]		Negligible <2dB	Marginal >3dB and <5dB	Moderate >3dB and <5dB	Moderate >5dB	Significant >5dB
PY1	Calm[2]	R20 R22 R23 R25	--	--	--	--
	Enhancing[3]	R25	--	--	--	--
PY5	Calm[2]	--	--	--	--	--
	Enhancing[3]	R25	--	--	--	--
PY10	Calm[2]	R18 R19	--	--	--	--
	Enhancing[3]	R18	R19	--	--	--
PY15	Calm[2]	--	--	--	--	--
	Enhancing[3]	R18 R19 R25 FR10	--	--	--	--
PY20	Calm[2]	--	--	--	--	--
	Enhancing[3]	R18 FR10	--	--	--	--
PY25	Calm[2]	--	--	--	--	--
	Enhancing[3]	FR10	--	--	--	--

Note 1: Differences between predicted noise level and recommended amenity noise level – refer to Table 4.1 of NPI for full definitions

Note 2: All Operations during calm conditions.

Note 3: Typical Operations during noise enhancing conditions.

The Negligible residual noise impacts during Project Year 1 to Project Year 5, being of a minor magnitude can be managed in conjunction with the appropriate noise monitoring system and management controls described in **Section 8.**

The Marginal residual noise impacts during Project Year 10 occur during noise enhancing conditions, noise management measures would need to be implemented for when such conditions occur.

7.4 Maximum Noise Level Assessment

In assessing maximum noise events, typical L_{Amax} noise levels from transient events were assessed to the nearest residential receivers. For the maximum noise assessment, a sound power level of 115dBA was adopted to represent potential tailgate bangs or front end loader scraping from loading activities during the morning shoulder period. Predicted noise levels from $L_{Aeq(15min)}$ and L_{Amax} events for assessed receivers are presented in **Table 31.** Results identify that the maximum noise trigger levels (40dB $L_{Aeq(15min)}$ and 52dB L_{Amax}) will be satisfied for all assessed receivers.

Table 31 Predicted Maximum Noise Levels – Noise Enhancing Conditions

Receiver	Predicted Noise Level dB LAeq(15min)											
	PY1		PY5		PY10		PY15		PY20		PY25	
	LAeq(15min)	LA(max)	LAeq(15min)	LA(max)	LAeq(15min)	LA(max)	LAeq(15min)	LA(max)	LAeq(15min)	LA(max)	LAeq(15min)	LA(max)
R01	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40
R02	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40
R03	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40
R04	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40
R05	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40
R06	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40
R07	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40
R08	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40
R09	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40
R10	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40
R10A	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40
R11	<30	<40	<30	<40	32	<40	35	<40	<30	<40	<30	<40
R12	<30	<40	<30	<40	30	<40	30	<40	<30	<40	<30	<40
R13	<30	<40	<30	<40	31	<40	31	<40	<30	<40	<30	<40
R14	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40
R15	<30	<40	<30	<40	30	<40	30	<40	<30	<40	<30	<40
R16	<30	<40	<30	<40	32	41	34	41	31	<40	31	<40
R17	<30	<40	30	<40	33	41	35	41	32	<40	32	<40
R18	32	<40	32	<40	37	43	36	43	35	42	35	42
R19	32	<40	33	<40	38	43	37	43	34	<40	34	<40
R20	31	<40	32	<40	35	41	35	41	33	<40	33	<40

Table 31 Predicted Maximum Noise Levels – Noise Enhancing Conditions

Receiver	Predicted Noise Level dB LAeq(15min)											
	PY1		PY5		PY10		PY15		PY20		PY25	
	LAeq(15min)	LA(max)	LAeq(15min)	LA(max)	LAeq(15min)	LA(max)	LAeq(15min)	LA(max)	LAeq(15min)	LA(max)	LAeq(15min)	LA(max)
R20A	31	<40	30	<40	32	<40	33	<40	31	<40	31	<40
R21	<30	<40	30	<40	30	<40	30	<40	31	<40	31	<40
R22	30	<40	31	<40	31	<40	31	<40	33	<40	33	<40
R23	35	40	35	40	31	<40	32	<40	32	<40	32	<40
R24	<30	42	<30	42	<30	<40	<30	<40	<30	<40	<30	<40
R25	36	<40	36	<40	32	<40	32	<40	32	<40	32	<40
R26	30	<40	30	<40	<30	<40	<30	<40	<30	<40	<30	<40
R27	32	<40	32	<40	<30	<40	<30	<40	<30	<40	<30	<40
R28	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40
R29	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40
R30	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40
R30A	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40
R31	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40
R32	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40
R33	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40
R34	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40
R35	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40
R36	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40
R37	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40
R37A	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40
FR01	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40

Table 31 Predicted Maximum Noise Levels – Noise Enhancing Conditions

Receiver	Predicted Noise Level dB LAeq(15min)											
	PY1		PY5		PY10		PY15		PY20		PY25	
	LAeq(15min)	LA(max)	LAeq(15min)	LA(max)	LAeq(15min)	LA(max)	LAeq(15min)	LA(max)	LAeq(15min)	LA(max)	LAeq(15min)	LA(max)
FR02	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40
FR03	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40
FR04	34	<40	34	<40	<30	<40	<30	<40	<30	<40	<30	<40
FR05	33	<40	32	<40	<30	<40	<30	<40	<30	<40	<30	<40
FR06	34	41	33	41	<30	<40	<30	<40	<30	<40	<30	<40
FR07	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40
FR08	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40	<30	<40
FR09	34	41	34	41	<30	<40	<30	<40	<30	<40	<30	<40
FR10	35	41	34	41	<30	<40	<30	<40	<30	<40	<30	<40

7.5 VLAMP Assessment

Table 32 presents the findings of noise predictions for the VLAMP assessment presenting the predicted level range for each noise catchment area and the number of receivers in each VLAMP assessment category.

Results of the assessment as per VLAMP definitions shows that the Wisemans Ferry Road noise catchment area is expected to experience Negligible Impacts from Project Year 1 through to Project Year 15, however, during Year 10 there will be one receiver (R19) that may experience Marginal Impacts.

It is recommended that the appropriate mitigation rights be made available to receiver R19.

Predicted noise levels do not exceed the acceptable noise level by more than 5dB on any privately owned vacant lands as shown in Appendix D.

Table 32 Project Operations Noise Levels - VLAMP Assessment

Catchment (No) Receiver ID	Period[1]	Significance Criteria		Project Noise Level (PNL) Range dB $LA_{eq(15min)}$ No of (existing) Receivers					
		Acquisition	Vacant Land	PY1	PY5	PY10	PY15	PY20	PY25
Wisemans Ferry Road (west) Receivers (L1) R29-R37A	Day	45	55	<30-34	<30-33	<30-31	<30-34	<30-34	<30-33
	Morning Shoulder	40	45	<30	<30	<30	<30	<30-26	<30-26
Negligible	0-2dB over PNTL			Nil	Nil	Nil	Nil	Nil	Nil
Marginal/Moderate	3-5dB over PNTL			Nil	Nil	Nil	Nil	Nil	Nil
Moderate/Significant	>5dB over PNTL			Nil	Nil	Nil	Nil	Nil	Nil
Wisemans Ferry Road (east) Receivers (L2) R16-R28	Day	45	55	31-42	30-41	<30-43	30-42	28-37	29-40
	Morning Shoulder	41	45	<30-36	<30-36	<30-38	<30-37	<30	<30-35
Negligible	0-2dB over PNTL			4	1	2	3	Nil	Nil
Marginal/Moderate	3-5dB over PNTL			nil	Nil	1	Nil	Nil	Nil
Moderate/Significant	>5dB over PNTL			Nil	Nil	Nil	Nil	Nil	Nil
Old Northern Road Receivers R1-R15 (L3)	Day	45	55	<30-35	<30-35	31-38	31-40	28-37	26-35
	Morning Shoulder	40	45	<30	<30	<30-32	<30-35	<30	<30
Negligible	0-2dB over PNTL			Nil	Nil	Nil	Nil	Nil	Nil
Marginal/Moderate	3-5dB over PNTL			Nil	Nil	Nil	Nil	Nil	Nil
Moderate/Significant	>5dB over PNTL			Nil	Nil	Nil	Nil	Nil	Nil

7.6 Road Traffic Noise Assessment

The main offsite haul route for the transportation of sales product is via Wisemans Ferry Road and/ or Old Northern Road. The proposed worst-case transportation schedule would result in approximately 40 loads (average 38t) per day, resulting in 100 movements per day, or 6 movements per hour.

The nearest residential dwelling on Wisemans Ferry Road is approximately 15m from the road. Road traffic noise calculations are based on the parameters presented in **Table 33** at the nearest residential receiver to the proposed transport route. Calculations have assumed there is potentially a receiver situated at 15m from Old Northern Road.

Table 33 Road Traffic Noise Calculation Parameters

Receiver	Offset Distance (m)	Trucks/day	Movements/day	Speed km/h
R21 Wisemans Ferry Road	15	50	100	80
Any receiver Old Northern Road	15	50	100	80

Predicted road traffic noise levels from the project are presented in **Table 34.** Calculations were completed, to represent traffic flows from the project at an offset distance of 15m for receivers adjacent to either Wisemans Ferry Road or Old Northern Road using the Traffic Noise Model (TNM) by the United States Department of Transport, Federal Highway Administration Low Volume Calculation Tool.

Table 34 Operational Road Traffic Noise Levels

Offset from Road	Period	Assessment Criteria dB $LA_{eq(period)}$	Calculated Project Traffic Noise dB $LA_{eq(period)}$	Compliant
15m	Day	60 $LA_{eq(15hr)}$	53	Yes
	Night	55 $LA_{eq(9hr)}$	46	Yes

Results demonstrate that project traffic noise levels would comply with the relevant RNP criteria.

8 Noise Mitigation and Management

8.1 Noise Management Measures

A Noise Management Plan (NMP) to guide, manage, quantify, and control noise emissions from the Amended Project will be required to effectively control noise emissions at off site receivers. The key features required in the NMP are outlined below:

- Equipment Noise Levels
  - Selection and procurement of equipment to meet the sound power levels specified in this assessment;
  - Maintenance of equipment to continually meet their specified sound power level; and
  - Regular testing and measurement of equipment noise levels.
- Operations
  - Utilise predictive weather forecasting to identify potential noise enhancing conditions;
  - Implement triggers from noise monitoring terminals when noise levels are approaching the relevant PNTLs;
  - Evaluate noise levels, weather conditions and activities to proactively reduce equipment numbers or redirect operations to more shielded areas.

The noise measurement procedures employed throughout any monitoring program for the Project shall be guided by the requirements of AS 1055:2018 “Acoustics - Description and Measurement of Environmental Noise” and the EPA’s Noise Policy for Industry (NPI), 2017. Noise monitoring will be undertaken by a suitably qualified acoustic specialist or suitably qualified and trained environment officer.

A noise monitoring program will be developed as part of the overall site Noise Management Plan (NMP). It is envisaged that the NMP will require a combination of real time meteorological data and (unattended) real time noise monitoring terminals (NMT) to allow for proactive management of potential noise generated by project activities over the life of the Project.

The objectives of the noise monitoring program are as follows:

- measure noise levels from the Project operations providing real time data to a central location (such as the control centre) and warnings to operators when noise levels are approaching PNTLs and/or exceeding them;

- the noise monitoring system will need to assess project noise levels and non-site related ambient and background noise;
- identify potential noise sources and their relative contribution to noise impacts;
- specify appropriate intervals for noise monitoring to evaluate, assess and report the Project noise contribution;
- outline the methodologies to be adopted for monitoring construction and operations noise, including justification for monitoring intervals or triggers, weather conditions, monitoring location selection and timing; and
- incorporate noise management and mitigation strategies to be outlined in the NMP.

8.1.1 Noise Monitoring Terminals

As indicated above, and to supplement the other proposed mitigation measures, DLALC commits to the installation and maintenance of a real-time noise monitoring network during the life of the Project.

The real-time network will likely feature real-time Noise Monitoring Terminals (NMT) in the receiver catchment area in the vicinity of the Project. In combination with data from the meteorological monitoring station and project-specific trigger conditions, the real-time monitoring network will be used to inform reactive management practices to prevent adverse impacts at sensitive receptors.

It is envisaged that the NMT(s) would require the following technical specifications:

- measure A, C and Z weighting filters, 1/3 octaves, LA_{eq}, LA_{min}, LA_{max} and statistical parameters (LA_1 – LA_{99});
- capable of recording and storing audio files that can be used to identify noise sources;
- connectivity to the existing mine control centre to enable access to real time noise metrics and audio; and
- be capable of sending alarms/alerts to relevant personnel when noise levels exceed warning/trigger levels, when noise levels are approaching the PNTLs or indicating exceedances such that additional mitigation measures and controls can be implemented to minimise impacts to nearby sensitive receivers.

8.1.2 Operator Attended Noise Monitoring

Operator attended noise measurements and recordings shall be conducted to quantify noise emissions from the Project as well as the overall level of ambient noise. Attended noise monitoring would typically be conducted for regular compliance monitoring and in response to complaints, or other investigations.

When required, the operator shall quantify and characterise the maximum (L_{Amax}) and the energy equivalent (L_{Aeq}) intrusive noise level from construction over a 15-minute measurement period. In addition, the operator shall quantify and characterise the overall levels of ambient noise over the 15-minute measurement interval. It is recommended that instrumentation used during the monitoring is to be equivalent to a Type 1 meter with 1/3 octave band analysis and have audio recording functionality for post processing source identification. It is noted that 1/3 octave band analysis is required to establish whether modification factors in accordance with the NPI are to be applied.

All acoustic instrumentation used as part of the attended monitoring program must been designed to comply with the requirements of AS IEC 61672.1-2019, Electroacoustics – Sound level meters - Specifications and shall have current calibration certificates. All instrumentation shall be programmed to record statistical noise level indices in 15-minute intervals including L_{Amax}, L_{Amin} and L_{Aeq}.

Instrument calibration shall be checked before and after each measurement survey, with the variation in calibrated levels not exceeding ±0.5 dBA. The measurement position(s) should be selected considering:

- weather conditions such as rain and wind, insect noise;
- the location and direction of any noise source/s;
- the most sensitive position at the affected receiver; and
- the need to avoid reflecting surfaces (where possible).

8.1.3 Data Presentation and Reporting

The measured $L_{Aeq(15min)}$ noise level contributions from operations as well as the overall ambient noise levels together with the weather and activities at the time of the measurement shall be recorded.

In the event of an exceedance of the PNTLs, the relevant environmental personnel shall be informed of the location, the margin of exceedance and the source of emission (where possible). The noise level, meteorological conditions at the time of the survey and plant operating data shall be documented and forwarded to the relevant environmental personnel so that an appropriate response can be made with respect to conformance.

Reporting of monitoring will include the following:

- monitoring location(s);

- list of operating plant and equipment;
- measured noise levels from the Project;
- overall ambient noise levels;
- comparison of results with relevant PNTLs;
- monitoring equipment details;
- weather conditions; and
- comments specific to each site.

Compliance reports, discussing compliance against the PNTLs, will be prepared and submitted to the relevant environmental personnel as required. Compliance reports will include a summary of the information listed in the preceding sections, specifically issues or non-compliances and the response or management of the issues and non-compliances. Exceedances and outcomes of incident investigations are expected to be reported to the relevant regulators and stakeholders.

8.2 Complaints Handling

- Provide a readily accessible contact point, for example, through a toll-free information and complaints line and give complaints a fair hearing.
- Have a documented complaints process, including an escalation procedure so that if a complainant is not satisfied there is a clear path to follow.
- Records of all community complaints will be maintained on an up-to-date complaints register. The records will include:
  - date and time of the complaint;
  - the means by which the complaint was made (telephone, mail or email);
  - any personal details of the complainant that were provided, or if no details are provided, a note to that effect;
  - the nature of the complaint;
  - any actions taken by the site supervisor in relation to the complaint, including any follow up contact with the complainant and the timing for implementing action; and
  - if no action was taken by site supervisor/construction contractor in relation to the complaint, the reason why no action was taken.

- Community complaints will be allocated to the relevant company representative immediately to facilitate the implementation of corrective actions. The details of the complaint will also be circulated to the applicable operations personnel for action, where required.
- Procedures, roles and responsibilities will be outlined in the Noise Management Plan.

8.3 Construction Noise

The results of the assessment indicate that noise levels during construction are expected to satisfy the NMLs at all identified noise sensitive receivers including complying with the highly noise affected criteria of 75dB $LA_{eq(15min)}$ for all activities.

Although the assessment has identified that construction NMLs are expected to be satisfied, the Project construction manager may adopt additional noise mitigation measures to further reduce noise emissions to receivers for specific construction activities or in consultation with receivers, or where noise monitoring identifies any exceedance of the NMLs.

Australian Standard AS 2436-2010 (R2016) "*Guide to Noise Control on Construction, Maintenance and Demolition Sites"* sets out numerous practical recommendations to assist in mitigating construction noise emissions. These recommendations include operational strategies, source noise control strategies, noise barrier control strategies, and community consultation.

Standard, Level 1 and Level 2 mitigation measures are described in Table 35.

Table 35 Construction Noise Mitigation Measures	
Mitigation Level	Mitigation Measures
Standard Mitigation	▪ Toolbox and induction of personnel prior to shift to discuss noise control measures that may be implemented to reduce noise emissions to surrounding receivers; ▪ Training (of employees to conduct quieter work practices); ▪ Equipment which is used intermittently is to be shut down when not in use; ▪ Where possible, machinery will be located/orientated to direct noise away from the closest sensitive receivers; ▪ Undertake regular maintenance of machinery to minimise noise emissions. Maintenance will be confined to standard daytime construction hours and where possible, away from noise sensitive receivers; ▪ The quietest suitable machinery reasonably available will be selected for each work activity; ▪ Where feasible substitute noisy plant items for a quieter alternatives should be considered; ▪ Avoid queuing of vehicles adjacent to any receivers; ▪ Where practicable, ensure noisy plant/machinery are not working simultaneously in close proximity to receivers; ▪ Where possible, all plant are to utilise a broad band reverse alarm in lieu of the traditional hi-frequency type reverse alarm; and ▪ Minimising the need for reversing or movement alarms.
Level 1 Mitigation (Including Standard Mitigation Level)	▪ Scheduling of construction activities to minimise the number of work areas and simultaneous activities occurring in those areas to minimise noise levels; ▪ Wherever possible, subject to feasibility and reasonability, the quietest plant and equipment should be utilised in combination with management measures to minimise noise impacts; ▪ Where vehicle queuing is required, for example due to safety reasons, engines are to be switched off to reduce their overall noise impacts on receivers; ▪ Notification of OOH works; and ▪ Conduct noise monitoring to validate noise emissions are within NMLs.
Level 2 Mitigation (Including Mitigation Level 1)	▪ Use mobile noise screens (which can achieve noise reductions of up to 8dBA), optimise the positioning of plant and equipment to minimise line of site to receivers or substitute noisy equipment to reduce the noise level at nearby receivers for these activities; ▪ Conduct noise monitoring to validate noise emissions are within NMLs; ▪ Respite periods; and ▪ Potential temporary alternative accommodation.

Should compliance noise monitoring (see **Section 8.1.2**) indicate exceedances of the noise criteria, a combination of comprehensive noise mitigation treatments (i.e. noise barriers, equipment enclosures, silencers, regular equipment maintenance, etc) and consultation with the local community will be considered on a case by case basis to manage exceedances.

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9 Vibration Assessment

9.1 Construction

A qualitative assessment of potential vibration impacts has been completed. Due to the nature of the works proposed and distances to potential vibration sensitive receivers, vibration impacts from the project would be negligible.

The Construction Noise & Vibration Strategy (CNVS) (V4.1 Transport for NSW, 2019) sets out safe working distances to achieve the human response criteria for vibration (refer Table 36). The key vibration generating source proposed to be used is a vibratory roller used for road construction. For a large vibratory roller, the Construction Noise Strategy sets a safe working distance of 100m to achieve the residential human response criteria for continuous vibration. Therefore, as the nearest receivers to the project are greater than 100m, human exposure to vibration is anticipated to be minimal. Furthermore, where the human response criteria are satisfied, the structural or cosmetic criteria for sensitive receivers will be achieved. Therefore, vibration impacts are not considered to be a significant issue and have not been considered further in this assessment.

9.2 Operation

The major potential sources of vibration would be ripping of the harder layers with a bulldozer. Generally, peak levels of vibration from ripping typically occurs as the dozer takes off to commence the ripping process.

Table 36 provides the minimum working distances from the CNVS for the use of various vibration intensive sources to nearby receivers to meet cosmetic damage and human response criteria. The minimum offset distance to the nearest residential receivers is approximately 280m and will approximately occur during Project Year 10 operations. As the offset distance is greater than the minimum offset distance for even the largest item of plant, and hence vibration impacts are not expected at any dwelling.

Table 36 Minimum Working Distances or Vibratory Plant (m)

Plant item	Rating / Description	Minimum working distance	
		Cosmetic damage (BS 7385)	Human response (OH&E Vibration guideline)
Vibratory Roller	< 50 kN (Typically 1-2 tonnes)	5 m	15 m to 20 m
	< 100 kN (Typically 2-4 tonnes)	6 m	20 m
	< 200 kN (Typically 4-6 tonnes)	12 m	40 m
	< 300 kN (Typically 7-13 tonnes)	15 m	100 m
	> 300 kN (Typically 13-18 tonnes)	20 m	100 m
	> 300 kN (> 18 tonnes)	25 m	100 m
Small Hydraulic Hammer	(300 kg - 5 to 12t excavator)	2 m	7 m
Medium Hydraulic Hammer	(900 kg – 12 to 18t excavator)	7 m	23 m
Large Hydraulic Hammer	(1600 kg – 18 to 34t excavator)	22 m	73 m
Vibratory Pile Driver	Sheet piles	2 m to 20 m	20 m
Pile Boring	≤ 800 mm	2 m (nominal)	4 m
Jackhammer	Hand held	1 m (nominal)	2 m

Note: Source, CNVG (Roads and Maritime, 2016)

10 Discussion and Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has been commissioned by Design Collaborative Pty Limited on behalf of Deerubbin Local Aboriginal Land Council to prepare a Noise and Vibration Impact Assessment in relation to the Proposed Maroota Friable Sands Project, Maroota, NSW.

The Proposed Maroota Friable Sands Project proposes to extract approximately 500,000 tonnes per annum of friable sandstone and sand deposits from an area of approximately 50ha. The extracted materials will be transported to an onsite processing area with final products exported from site by truck via a proposed 2km internal road connecting to Patricia Fay Drive and Wisemans Ferry Road for delivery to customers.

The project will operate six days per week with sand sales and transport from 6am to 6pm Monday to Friday and 6am to 2pm Saturdays. Clearing, extraction and processing activities will be undertaken between 7am and 6pm Monday to Friday and 7am to 6pm Saturdays.

The assessment has identified approximately 40 rural residential receivers in the locality surrounding the project site. Potential future receiver locations of an approved subdivision to the south west of Wisemans Ferry Road have also been included in the assessment.

Preliminary noise modelling identified that clearing operations, a campaign of approximately two months duration per year, when undertaken at the same time as typical extractive and processing operations have potential to exceed the relevant noise criteria under the influence of noise enhancing conditions (ie winds). Therefore, the following noise mitigation measures have been included in the assessment scenarios:

- During noise enhancing conditions (prevailing winds), clearing activities and tree mulching will not occur in conjunction with extractive and processing operations;
- Location of the tree mulcher at RL 156m or lower with a 3m barrier;
- Siting of the processing plant such that there is a 3m to 5m bund on the southern and eastern boundaries; and
- Extraction areas are developed such that equipment works behind an advancing face of 5m.

In addition, a noise monitoring program will be developed as part of the overall site Noise Management Plan (NMP) consisting of regular operator attended compliance monitoring, real time meteorological data and (unattended) real time noise monitoring terminal (NMT) to allow for proactive management of potential noise generated by project activities over the life of the Project, particularly during noise enhancing conditions.

Predicted noise levels from construction activities are expected to satisfy the construction NMLs at all receivers. Human exposure to vibration is anticipated to be minimal as the nearest receivers to the project are greater than 100m. Furthermore, where the human response criteria are satisfied, the structural or cosmetic criteria for sensitive receivers will be achieved.

Noise from the project have been assessed for the two major operational modes:

- 'All Operations' - clearing, extraction, haulage, processing and product transport during Calm Conditions; and
- 'Typical Operations' - extraction, haulage, processing and product transport during Noise Enhancing Conditions.

Generally, predicted noise levels from All Operations and Typical Operations satisfy the PNTLs during the daytime and morning shoulder at all assessed receivers (including potential future receivers) during calm conditions over the life of the project. Noise emissions from the project has potential to exceed the PNTLs at times by up to 2dB and are considered Negligible Impacts in accordance with NPI methodology. During project Year 10, predicted noise levels exceed the PNTLs by 3dB at one receiver (R19) and the appropriate mitigation rights under VLAMP should be made available.

For potential future receivers, predicted noise levels from All Operations and Typical Operations satisfy the PNTLs during the morning shoulder and daytime periods at all assessed receivers for all conditions except at receiver FR10 where noise levels are expected to exceed the PNTLs by up to 2dB (Negligible Impact) during the daytime for noise enhancing conditions for Typical Operations.

Sleep disturbance is not anticipated during the morning shoulder period as emissions from impact noise are predicted to remain below the EPA maximum noise trigger levels.

Predicted road traffic noise levels from the project at receivers adjacent to either Wisemans Ferry Road or Old Northern Road are expected to comply with the relevant RNP criteria.

Operational vibration effects are not expected as the minimum offset distance to the nearest residential receivers is approximately 280m from any operational vibration source such as dozers ripping sandstone.

Based on the Noise Assessment results, with the implementation of noise mitigation and management measures, there are no noise related issues which would prevent approval of the proposed project.

Appendix A – Glossary of Terms

A number of technical terms have been used in this report and are explained in **Table A1**.

Table A1 Glossary of Acoustical Terms

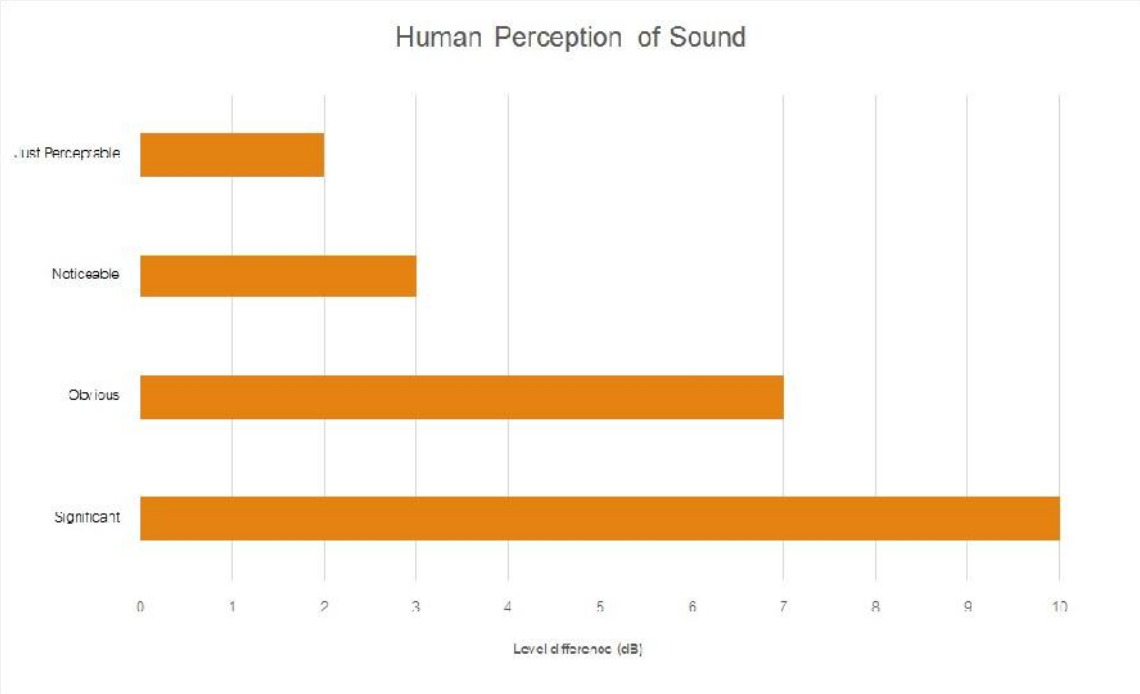
Term	Description
1/3 Octave	Single octave bands divided into three parts
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment Background Level (ABL) is defined in the NPI as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured L90 statistical noise levels.
Ambient Noise	The total noise associated with a given environment. Typically, a composite of sounds from all sources located both near and far where no particular sound is dominant.
A Weighting	A standard weighting of the audible frequencies designed to reflect the response of the human ear to sound.
Background Noise	The underlying level of noise present in the ambient noise, excluding the noise source under investigation, when extraneous noise is removed. This is usually represented by the LA90 descriptor
dBA	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
dB(Z), dB(L)	Decibels Z-weighted or decibels Linear (unweighted).
Extraneous Noise	Sound resulting from activities that are not typical of the area.
Hertz (Hz)	The measure of frequency of sound wave oscillations per second - 1 oscillation per second equals 1 hertz.
LA10	A sound level which is exceeded 10% of the time.
LA90	Commonly referred to as the background noise, this is the level exceeded 90% of the time.
LAeq	Represents the average noise energy or equivalent sound pressure level over a given period.
LAmax	The maximum sound pressure level received at the microphone during a measuring interval.
Masking	The phenomenon of one sound interfering with the perception of another sound. For example, the interference of traffic noise with use of a public telephone on a busy street.
RBL	The Rating Background Level (RBL) as defined in the NPI, is an overall single figure representing the background level for each assessment period over the whole monitoring period. The RBL, as defined is the median of ABL values over the whole monitoring period.
Sound power level (Lw or SWL)	This is a measure of the total power radiated by a source in the form of sound and is given by 10.log10 (W/Wo). Where W is the sound power in watts to the reference level of 10^{-12} watts.
Sound pressure level (Lp or SPL)	the level of sound pressure; as measured at a distance by a standard sound level meter. This differs from Lw in that it is the sound level at a receiver position as opposed to the sound 'intensity' of the source.

Table A2 provides a list of common noise sources and their typical sound level.

Table A2 Common Noise Sources and Their Typical Sound Pressure Levels (SPL), dBA

Source	Typical Sound Pressure Level
Threshold of pain	140
Jet engine	130
Hydraulic hammer	120
Chainsaw	110
Industrial workshop	100
Lawn-mower (operator position)	90
Heavy traffic (footpath)	80
Elevated speech	70
Typical conversation	60
Ambient suburban environment	40
Ambient rural environment	30
Bedroom (night with windows closed)	20
Threshold of hearing	0

Figure A1 – Human Perception of Sound



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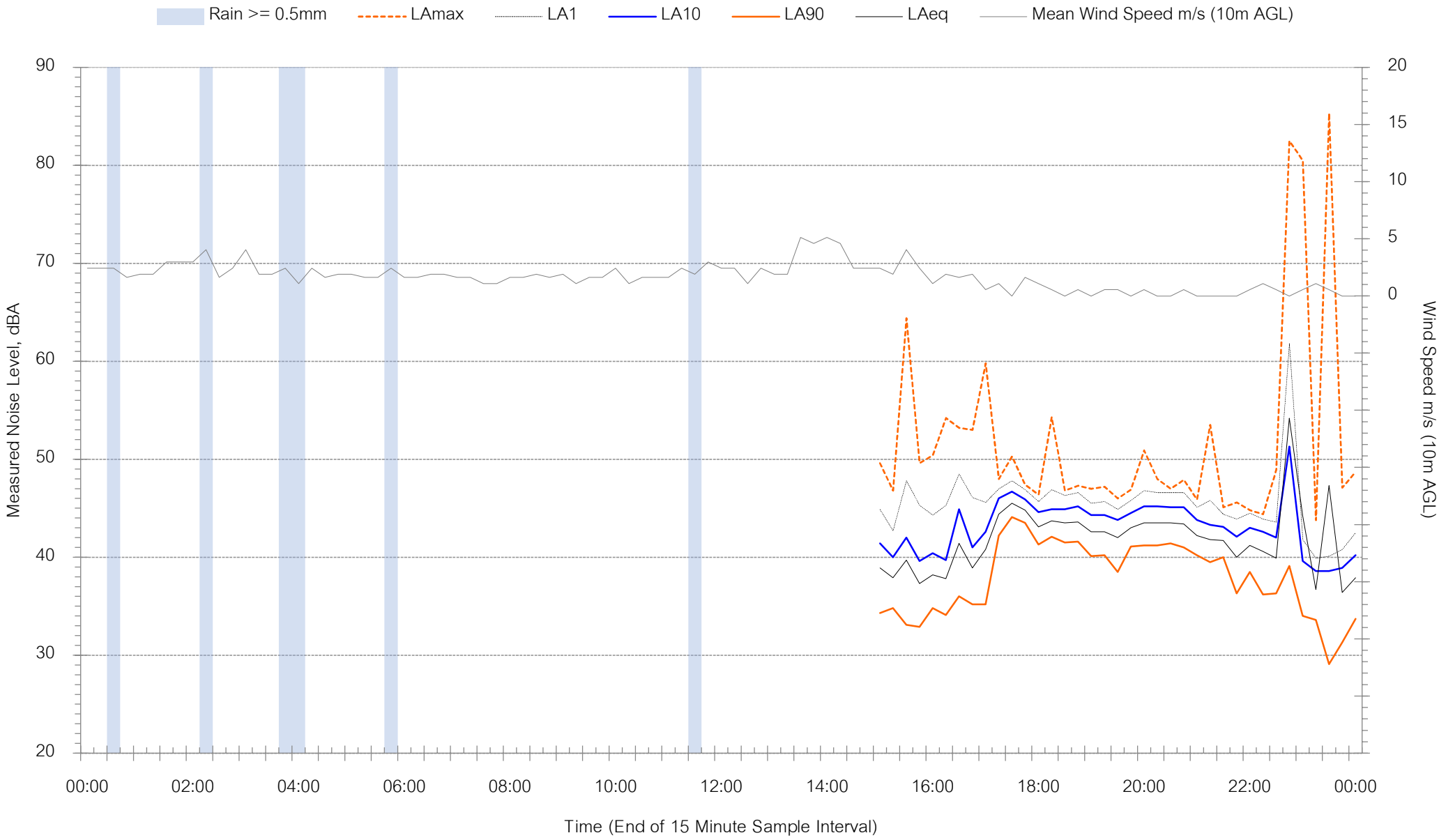
Appendix B – Noise Monitoring Charts

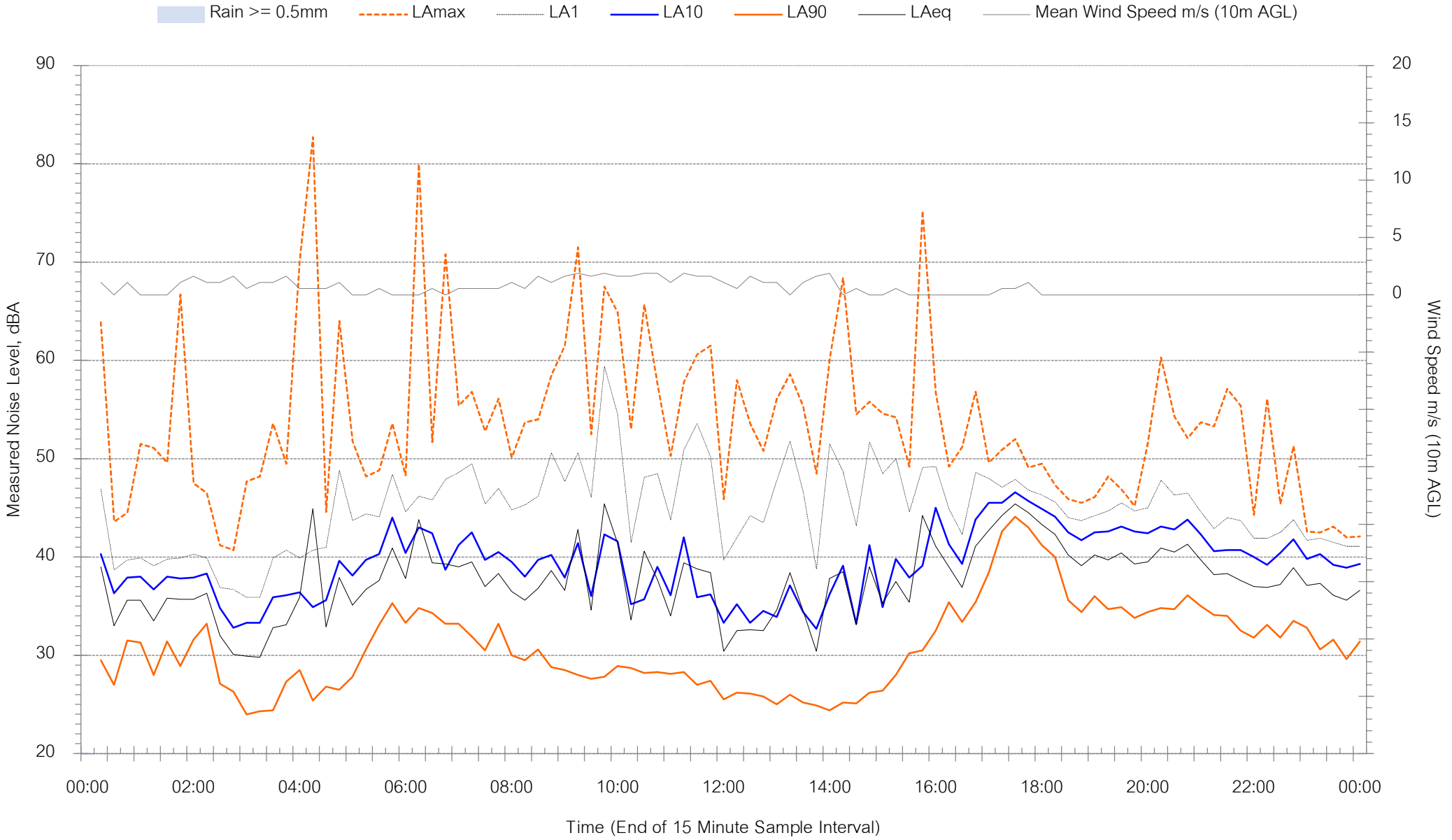
Background Noise Levels

Logger 1-1602 Wisemans Ferry Road, Maroota - Tuesday 26 May 2020



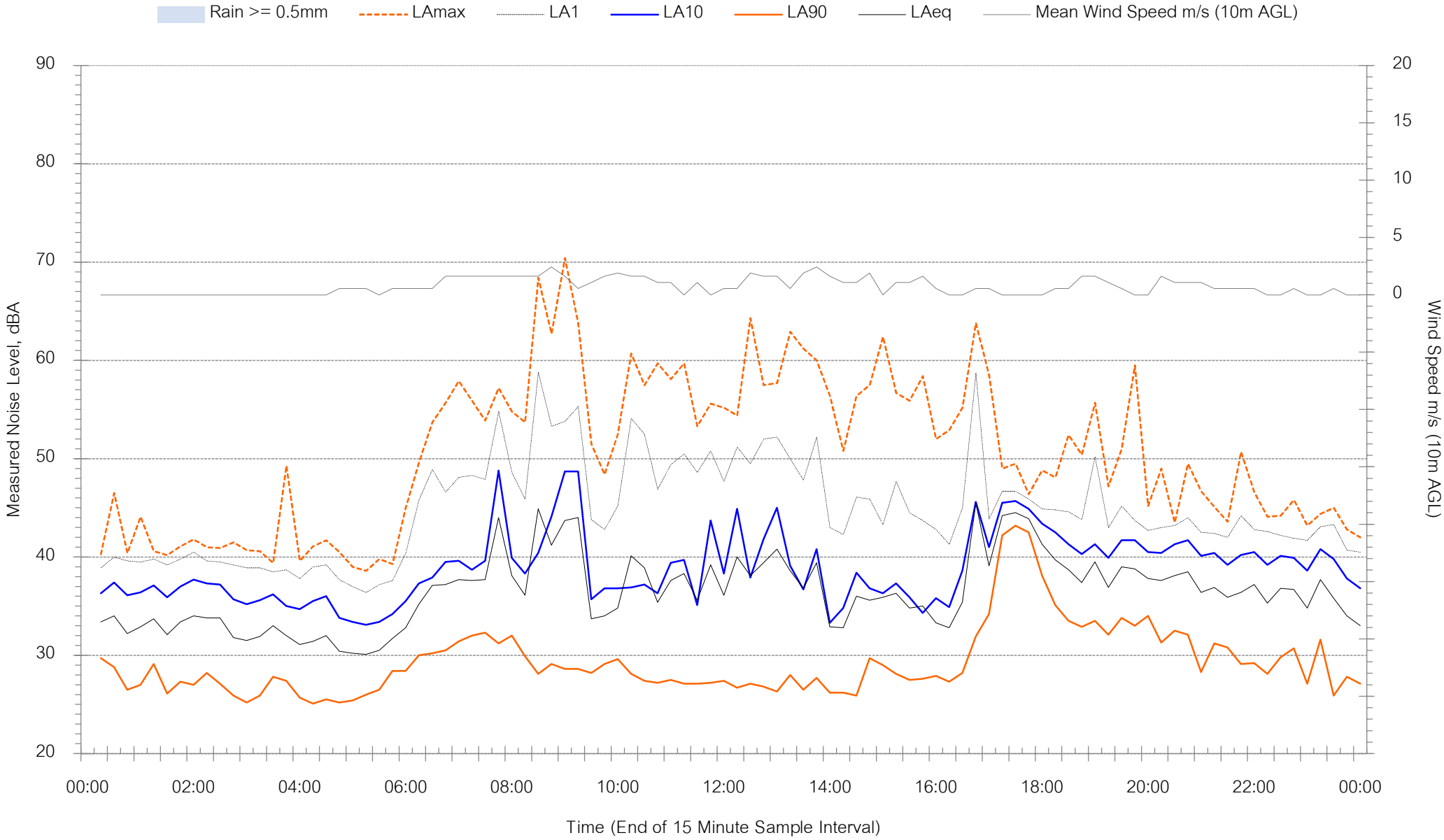
Background Noise Levels

Logger 1-1602 Wisemans Ferry Road, Maroota - Wednesday 27 May 2020



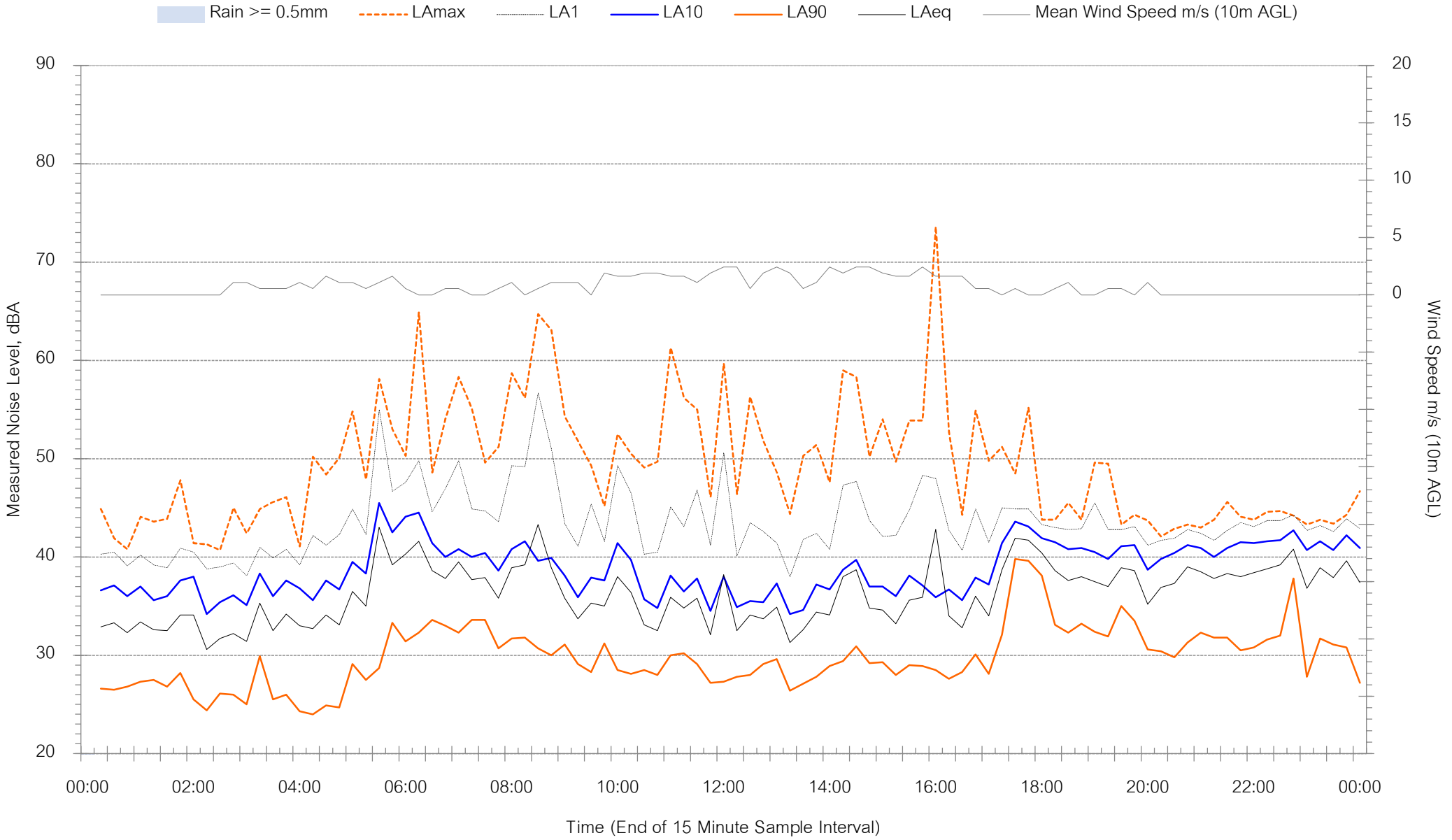
Background Noise Levels

Logger 1-1602 Wisemans Ferry Road, Maroota - Thursday 28 May 2020



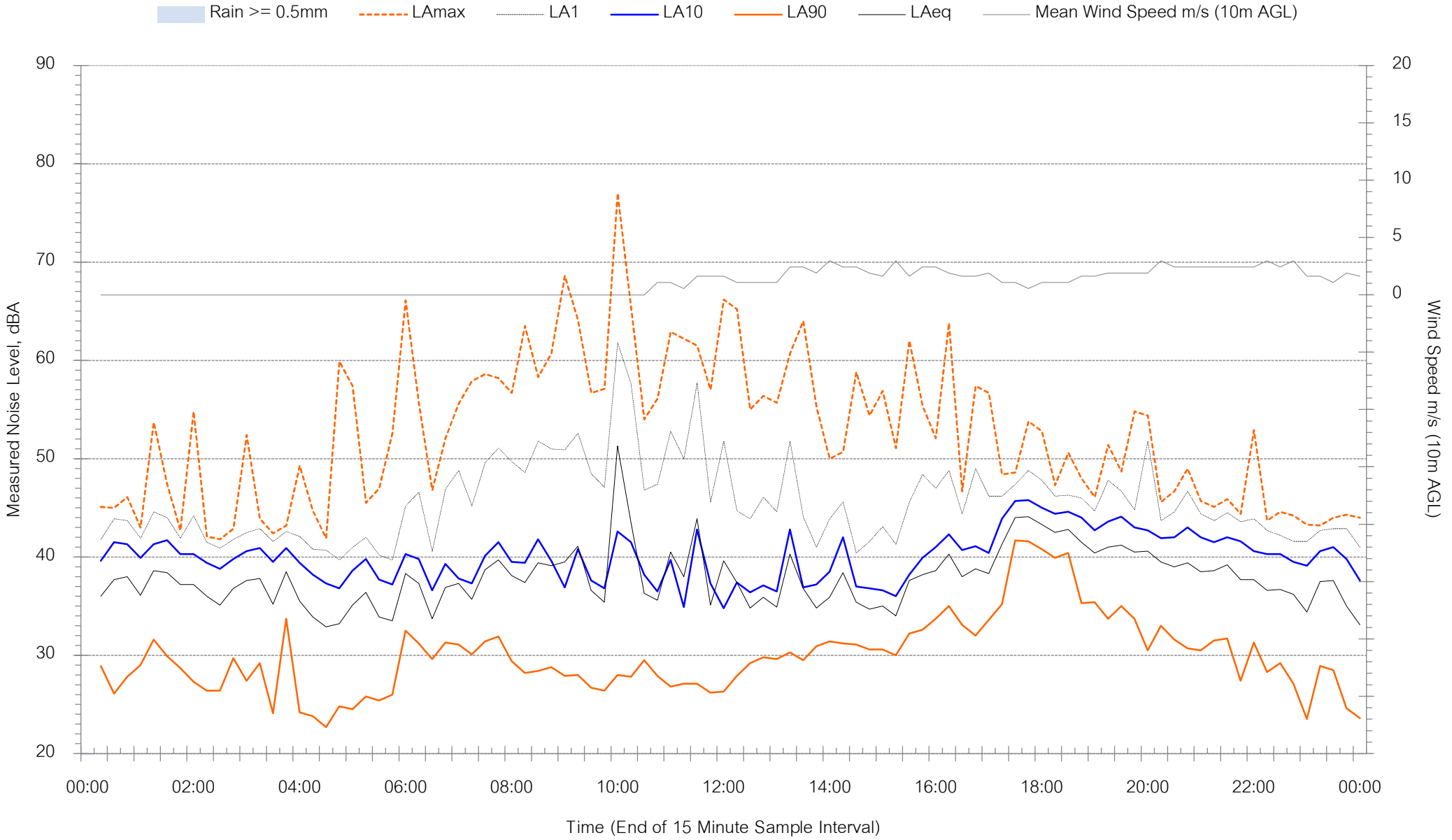
Background Noise Levels

Logger 1-1602 Wisemans Ferry Road, Maroota - Friday 29 May 2020



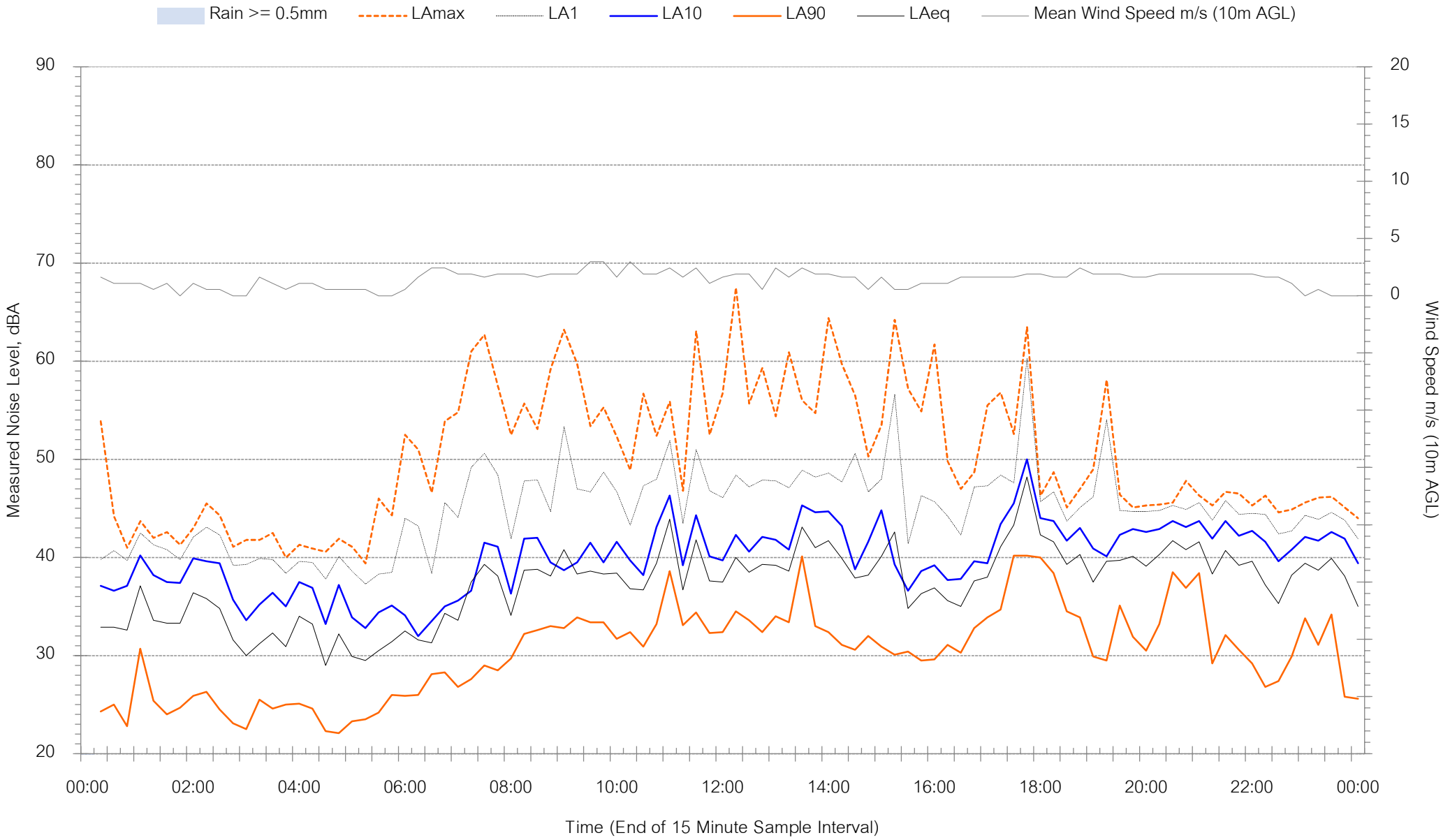
Background Noise Levels

Logger 1-1602 Wisemans Ferry Road, Maroota - Saturday 30 May 2020



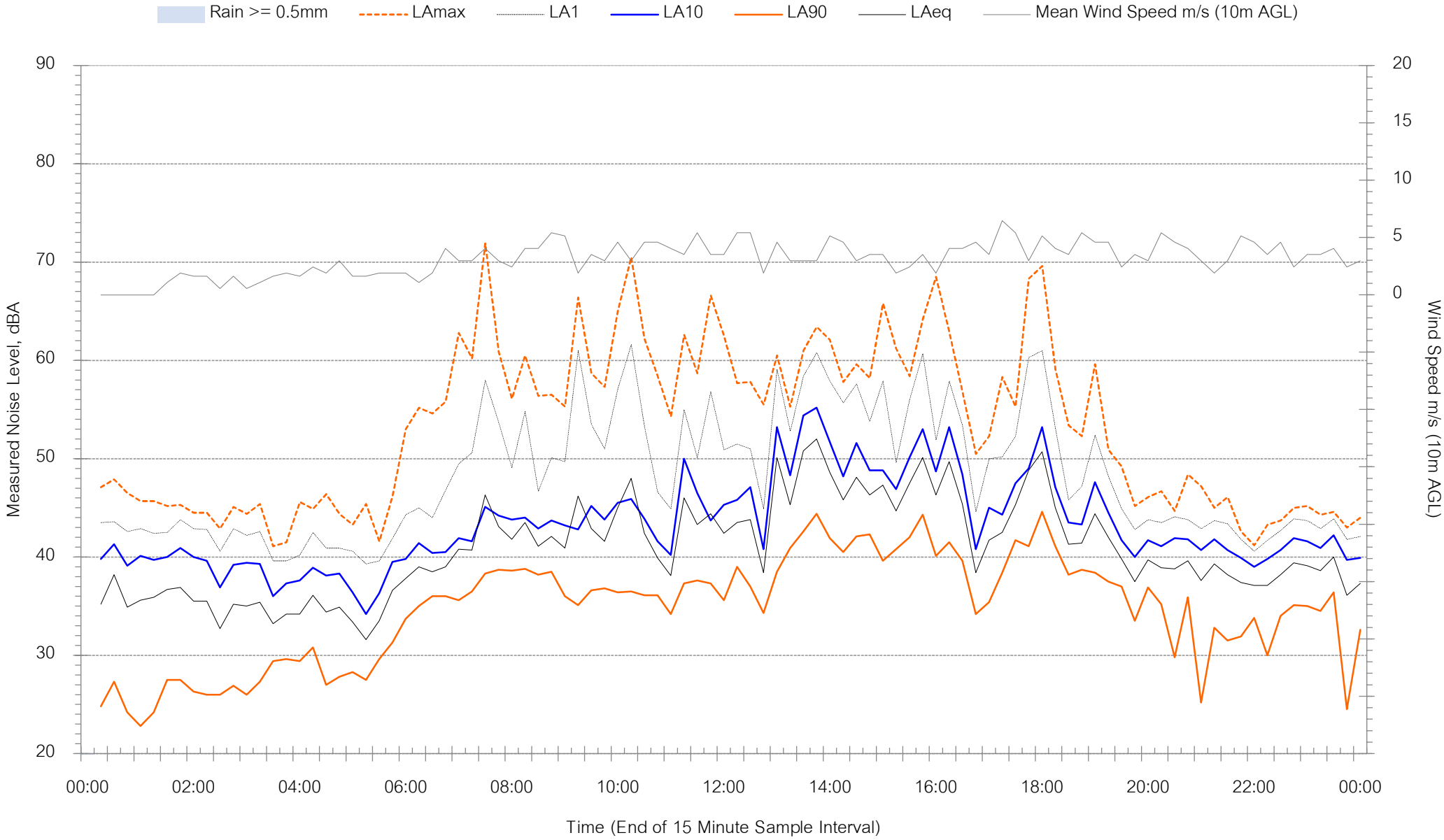
Background Noise Levels

Logger 1-1602 Wisemans Ferry Road, Maroota - Sunday 31 May 2020



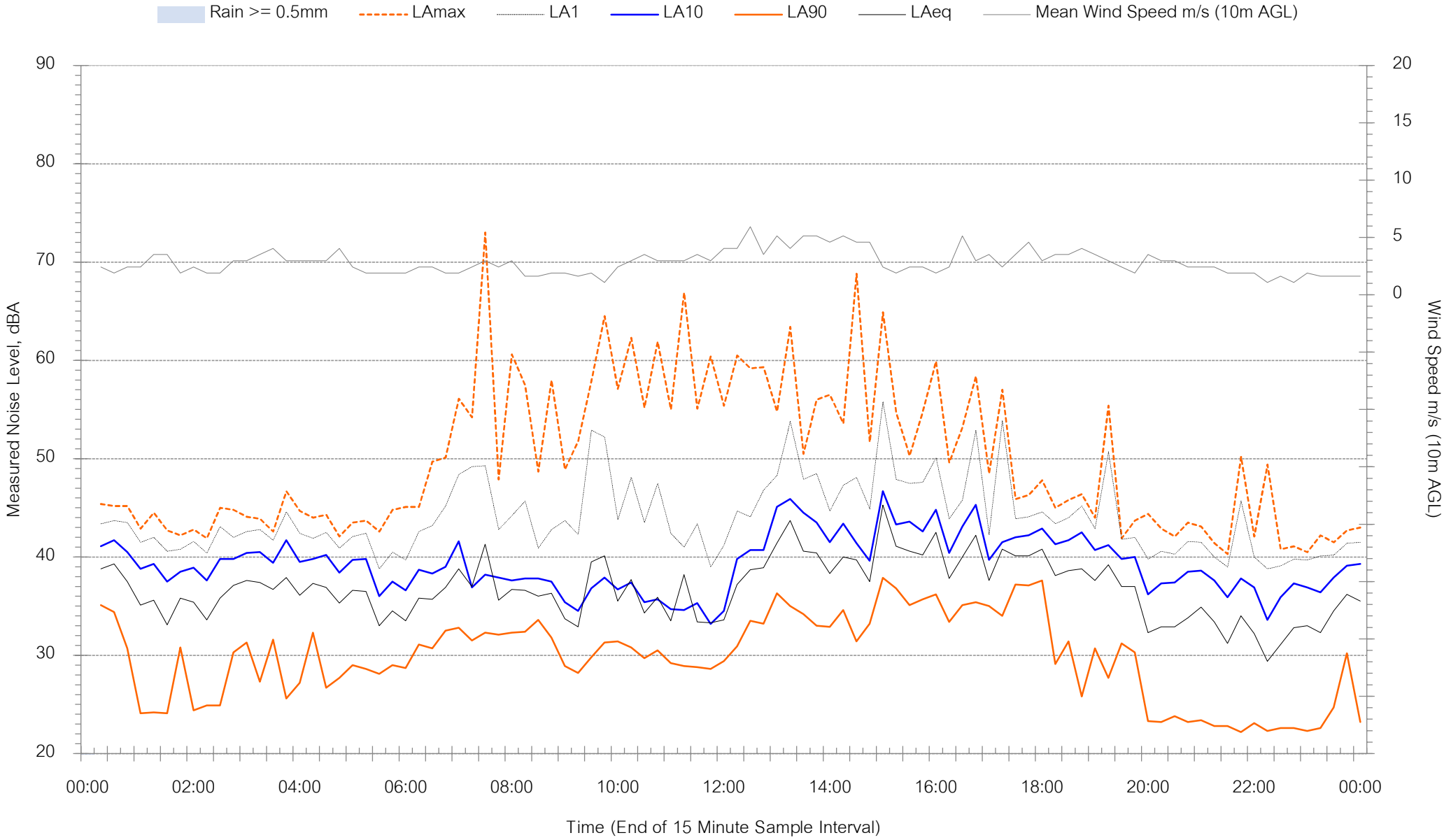
Background Noise Levels

Logger 1-1602 Wisemans Ferry Road, Maroota - Monday 1 June 2020



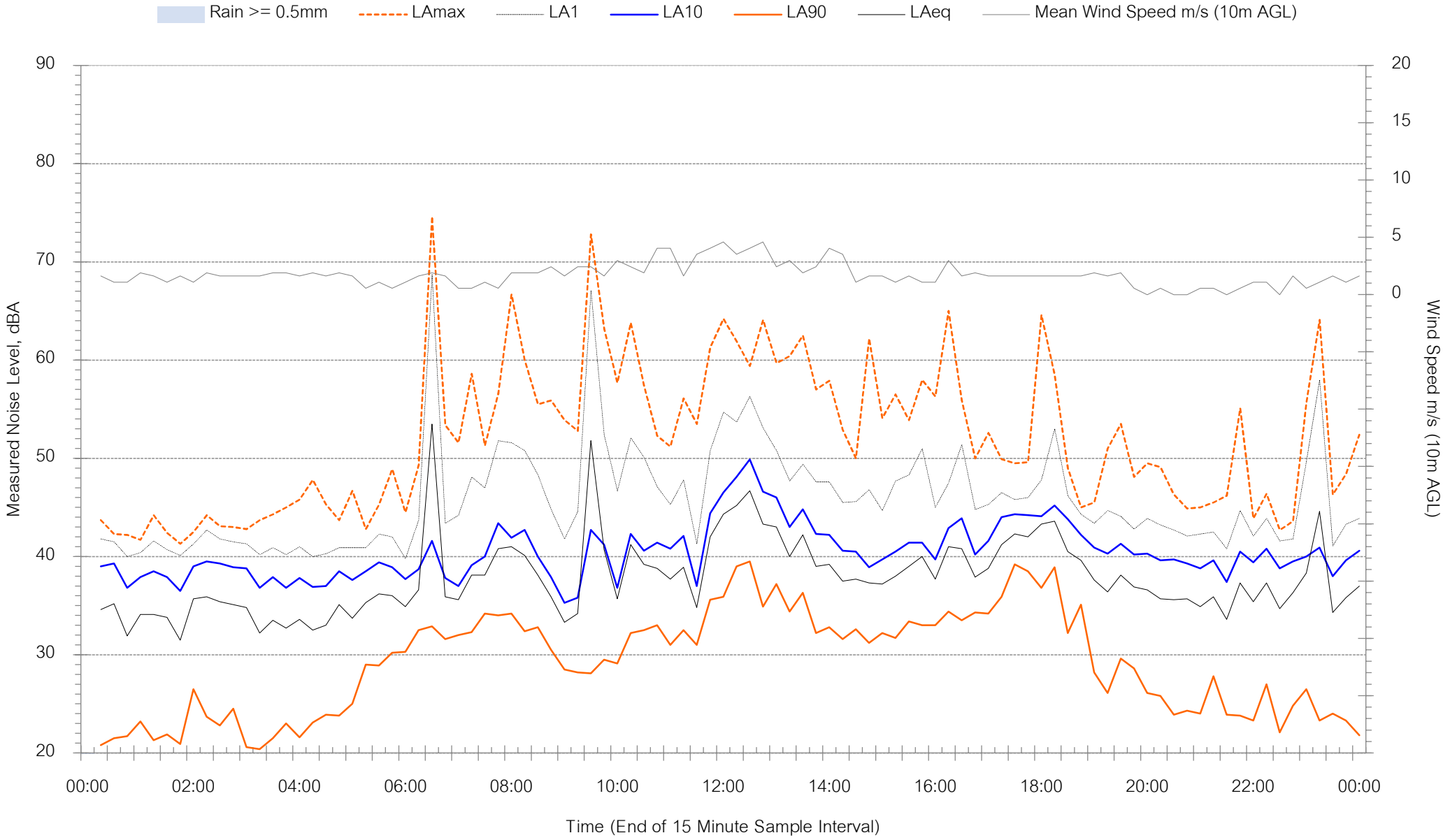
Background Noise Levels

Logger 1-1602 Wisemans Ferry Road, Maroota - Tuesday 2 June 2020



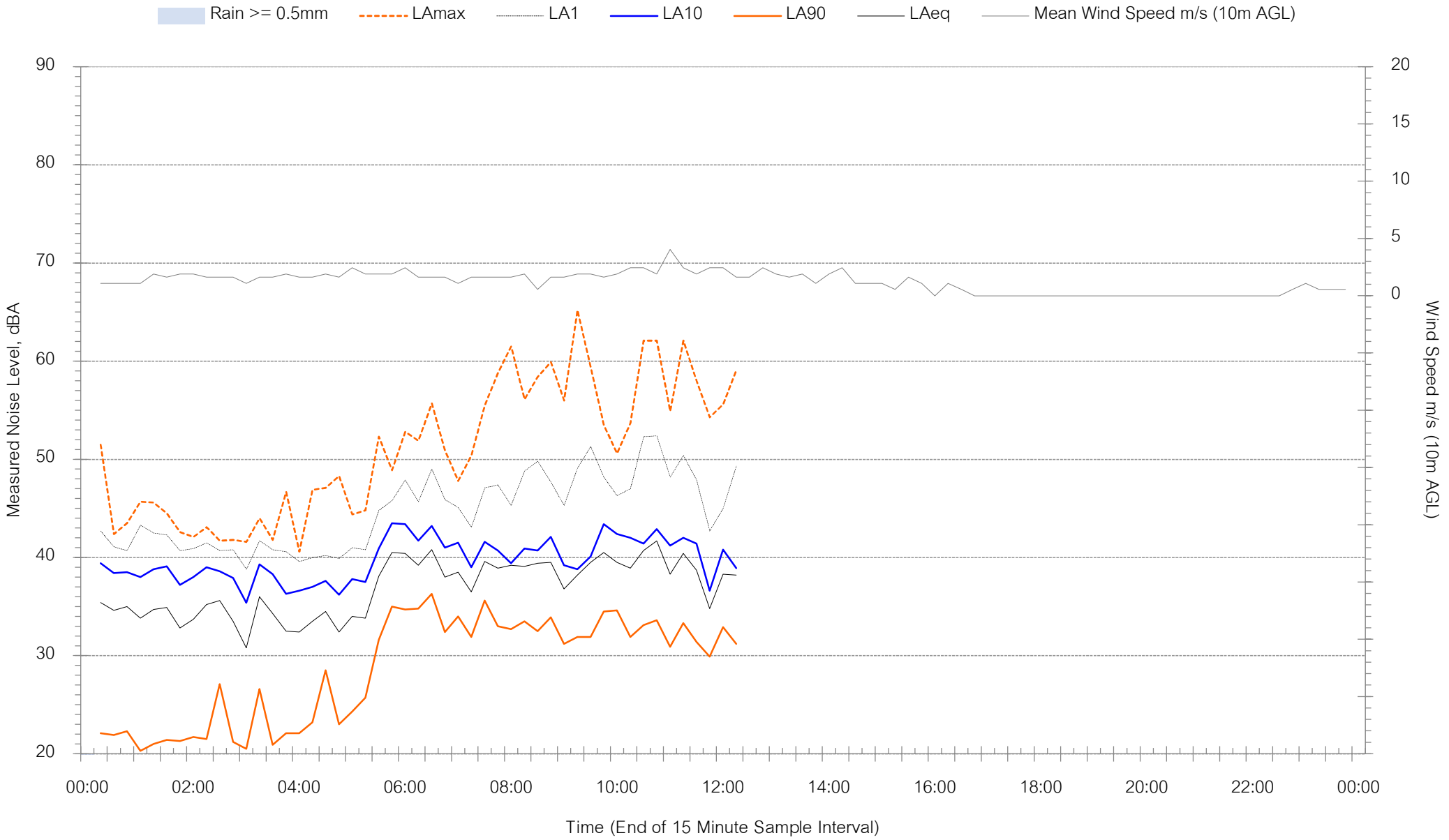
Background Noise Levels

Logger 1-1602 Wisemans Ferry Road, Maroota - Wednesday 3 June 2020



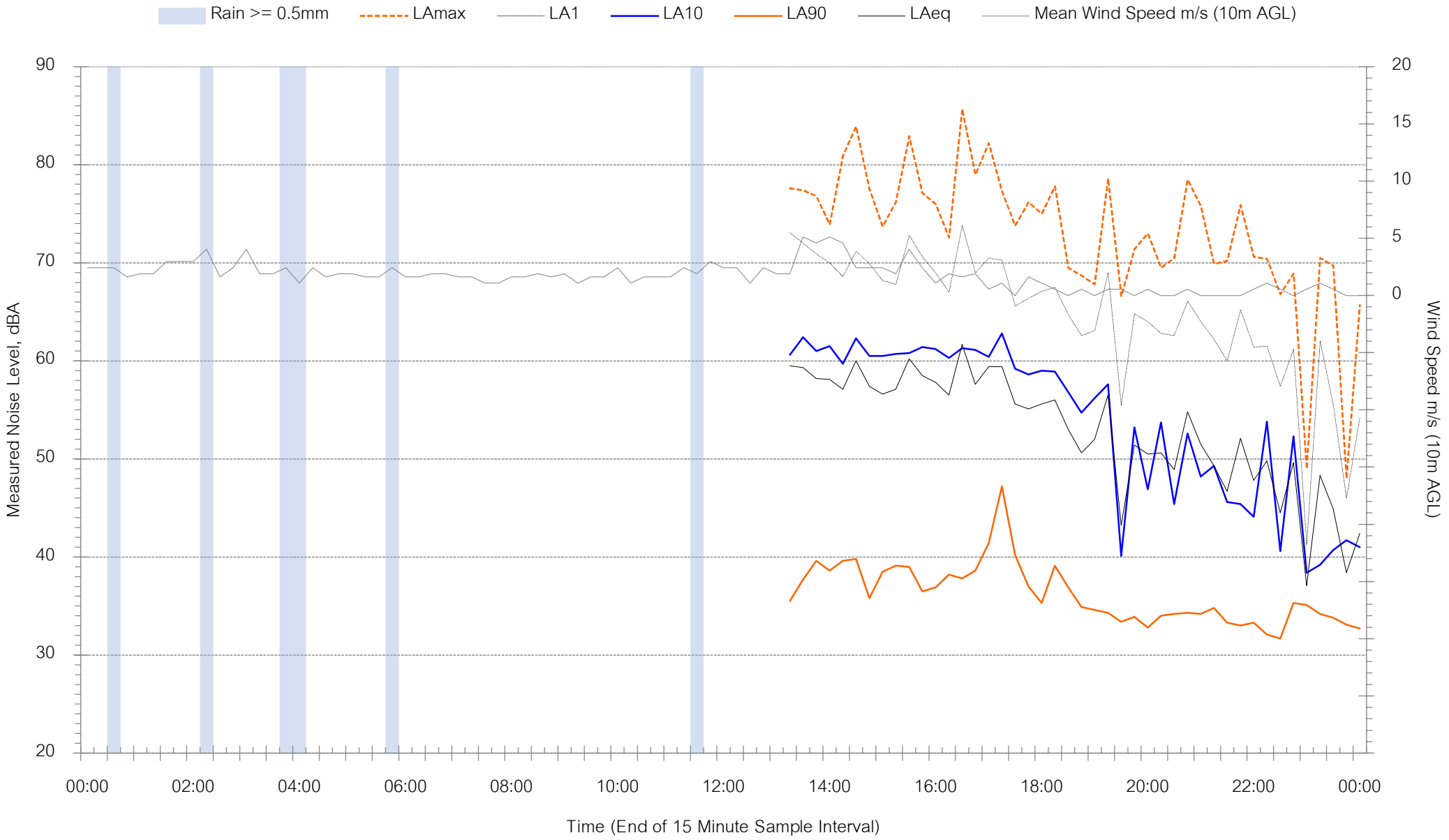
Background Noise Levels

Logger 1-1602 Wisemans Ferry Road, Maroota - Thursday 4 June 2020



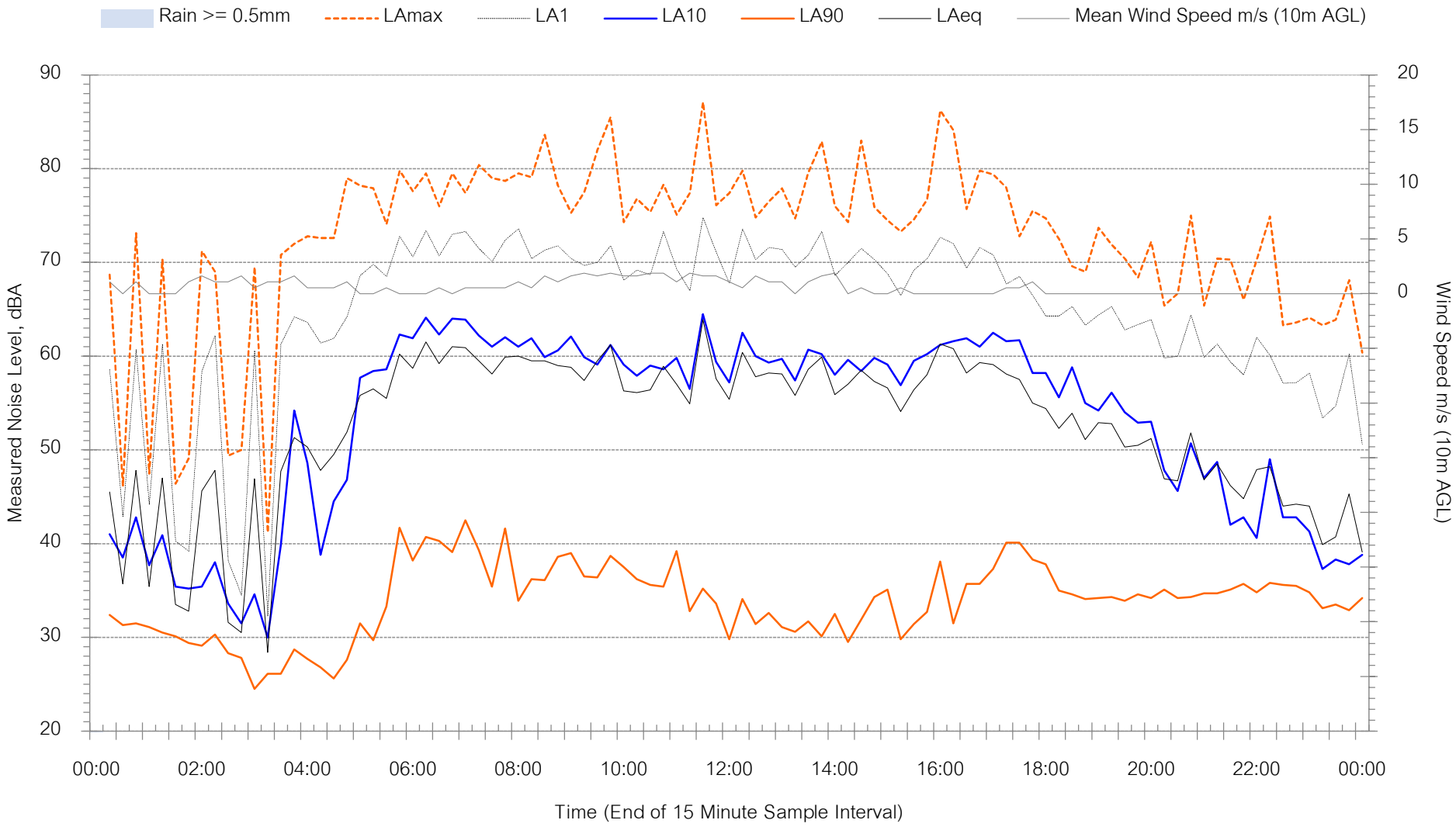
Background Noise Levels

Logger 2 -1584 Wisemans Ferry Road, Maroota - Tuesday 26 May 2020



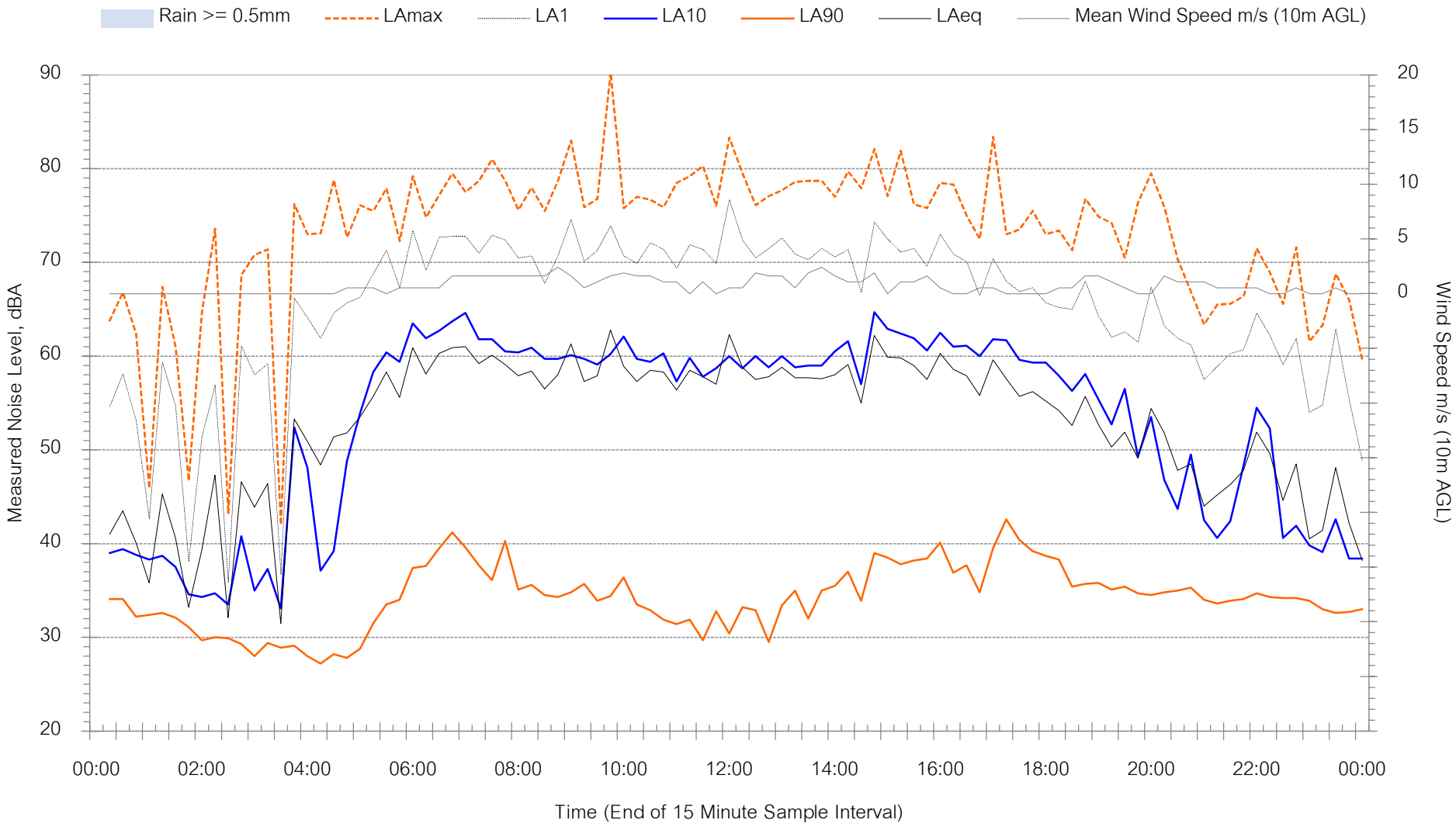
Background Noise Levels

Logger 2 -1584 Wisemans Ferry Road, Maroota - Wednesday 27 May 2020



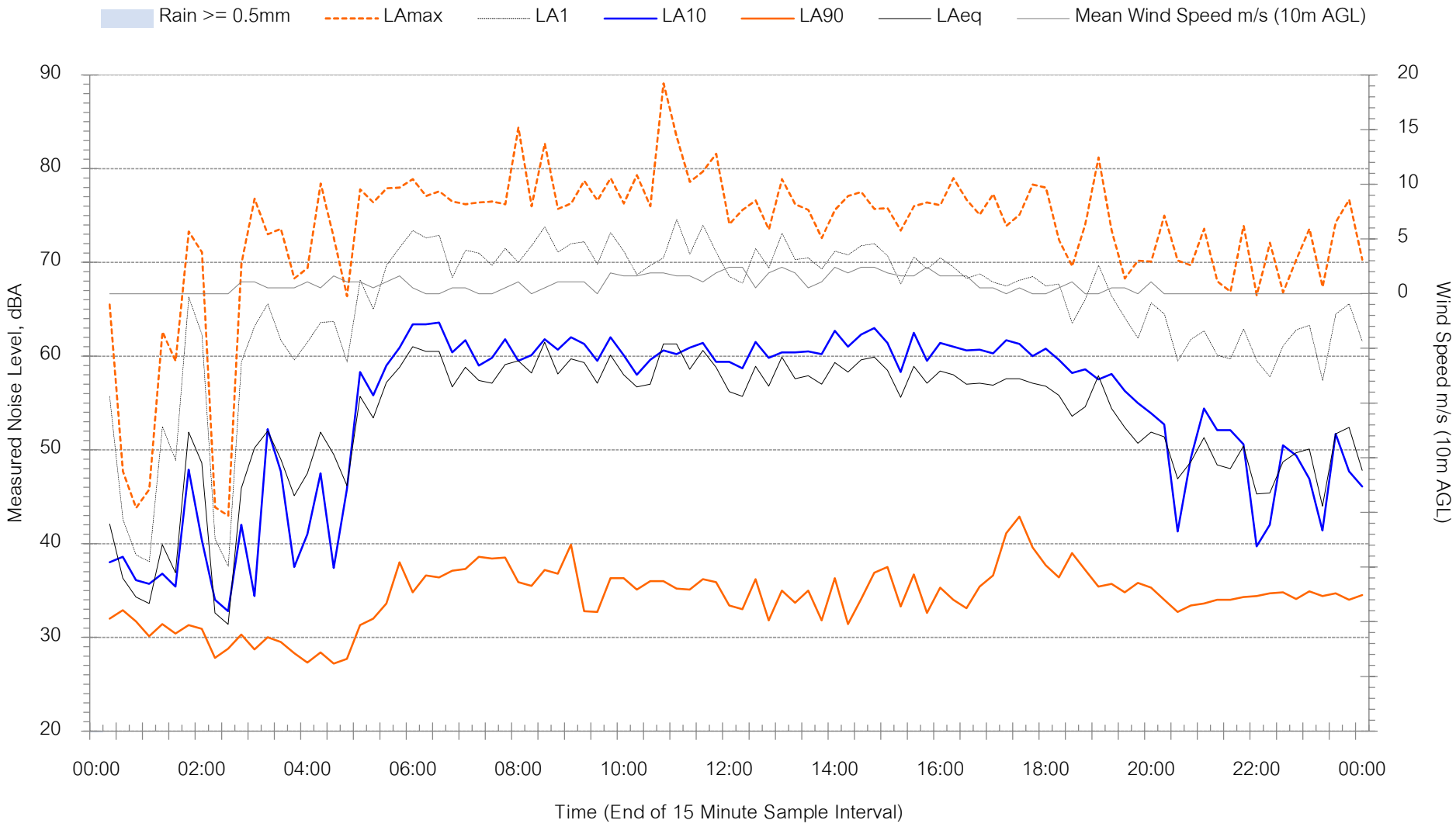
Background Noise Levels

Logger 2 -1584 Wisemans Ferry Road, Maroota - Thursday 28 May 2020



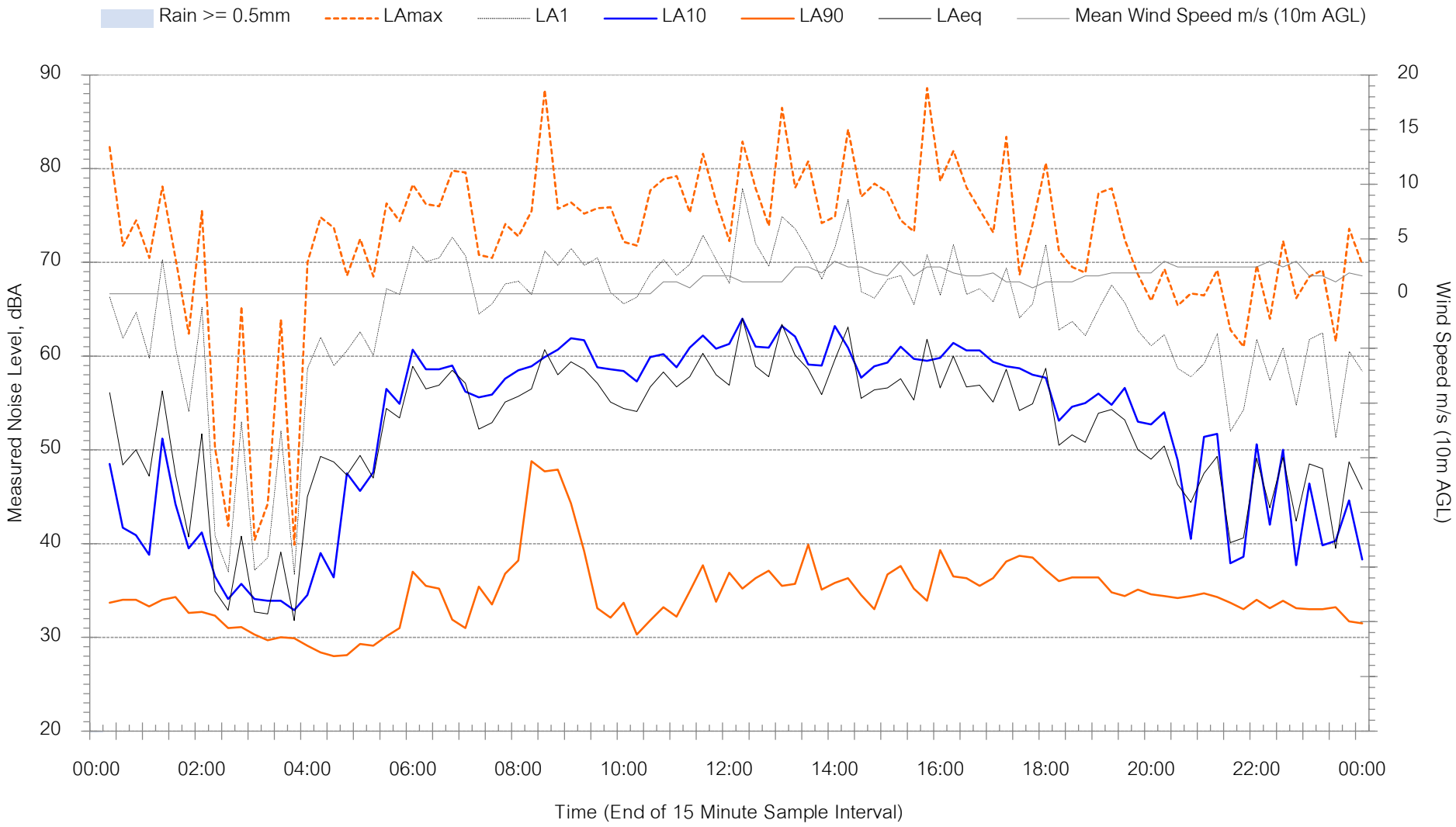
Background Noise Levels

Logger 2 -1584 Wisemans Ferry Road, Maroota - Friday 29 May 2020



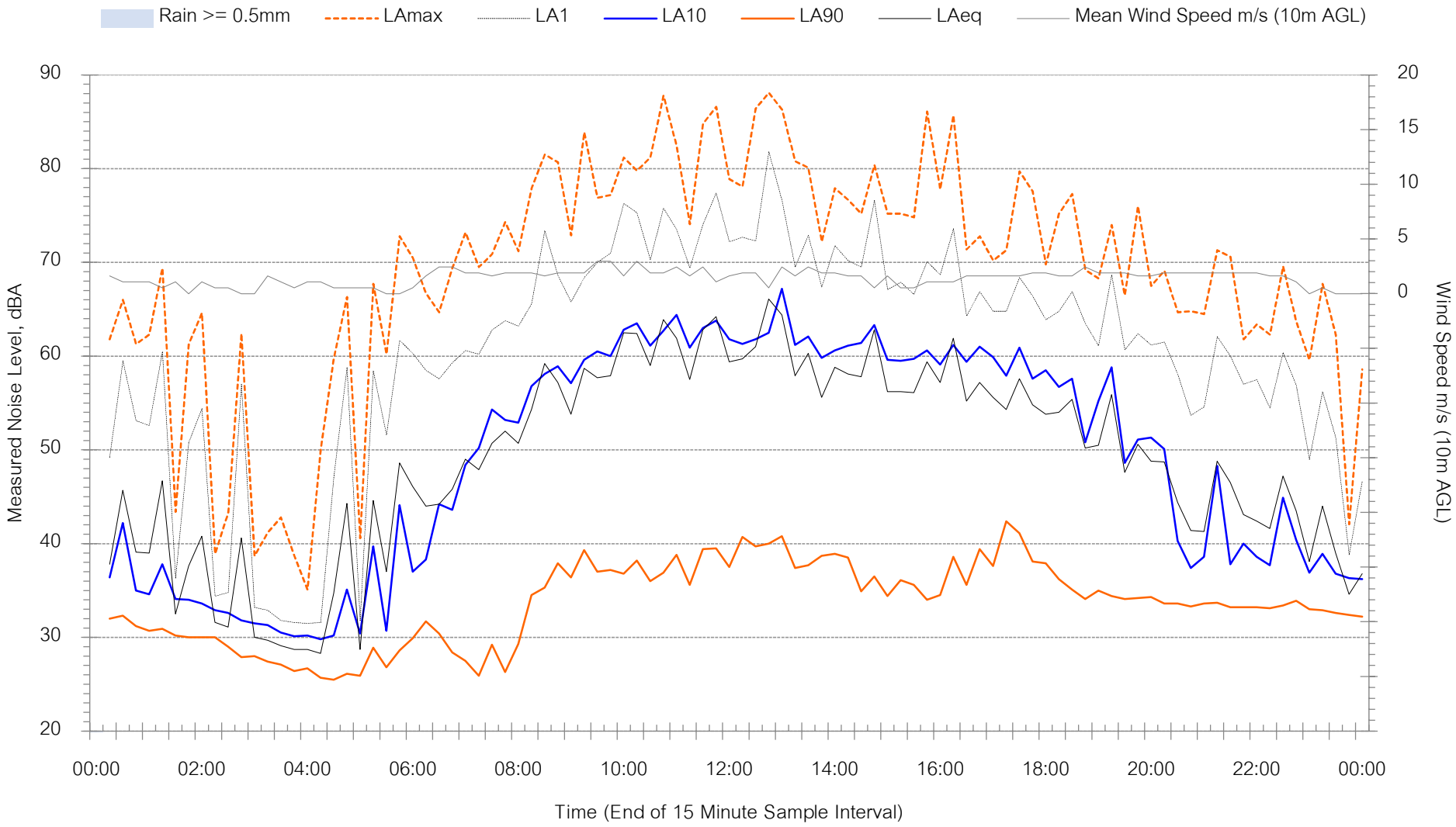
Background Noise Levels

Logger 2 -1584 Wisemans Ferry Road, Maroota - Saturday 30 May 2020



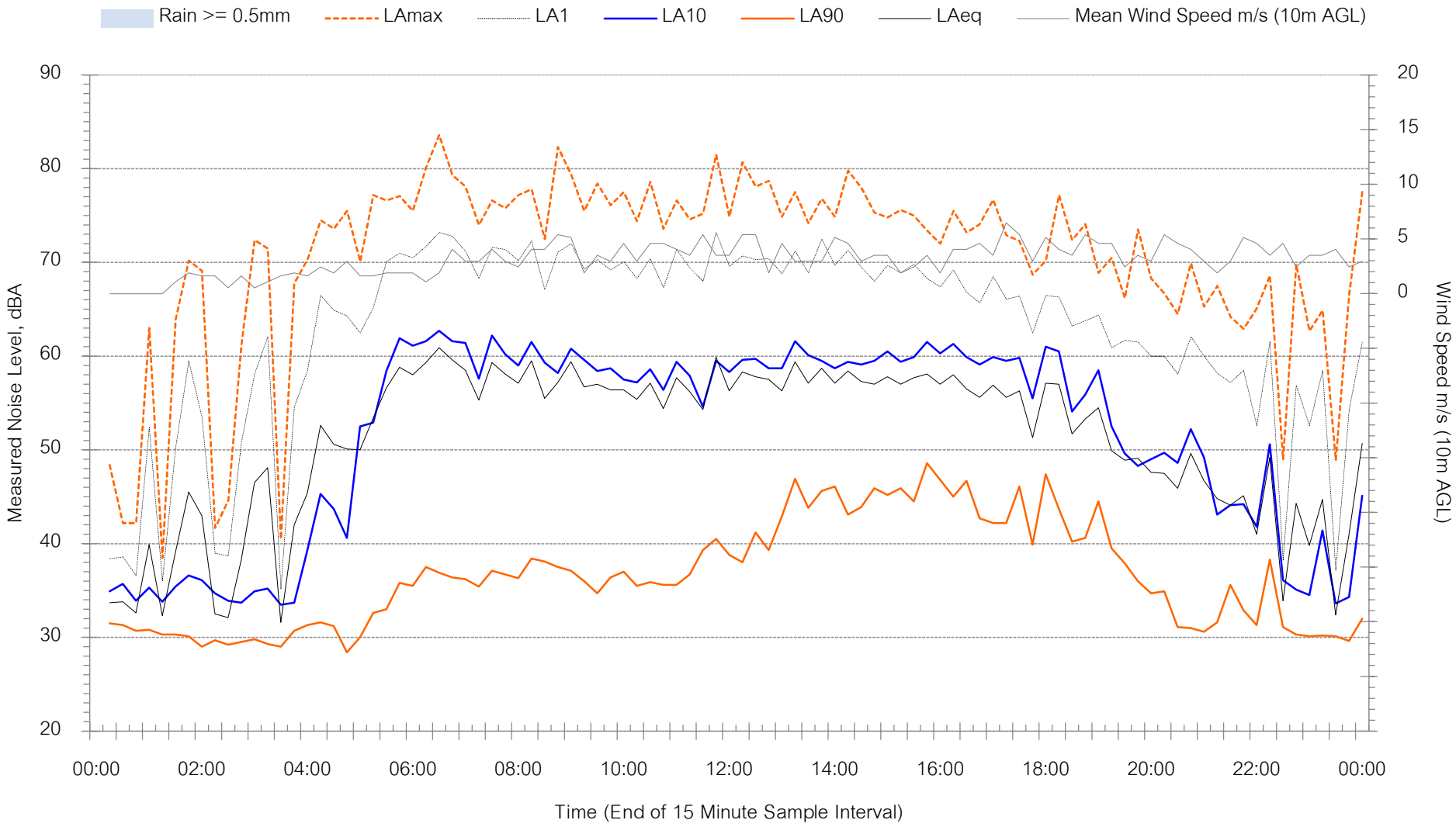
Background Noise Levels

Logger 2 -1584 Wisemans Ferry Road, Maroota - Sunday 31 May 2020



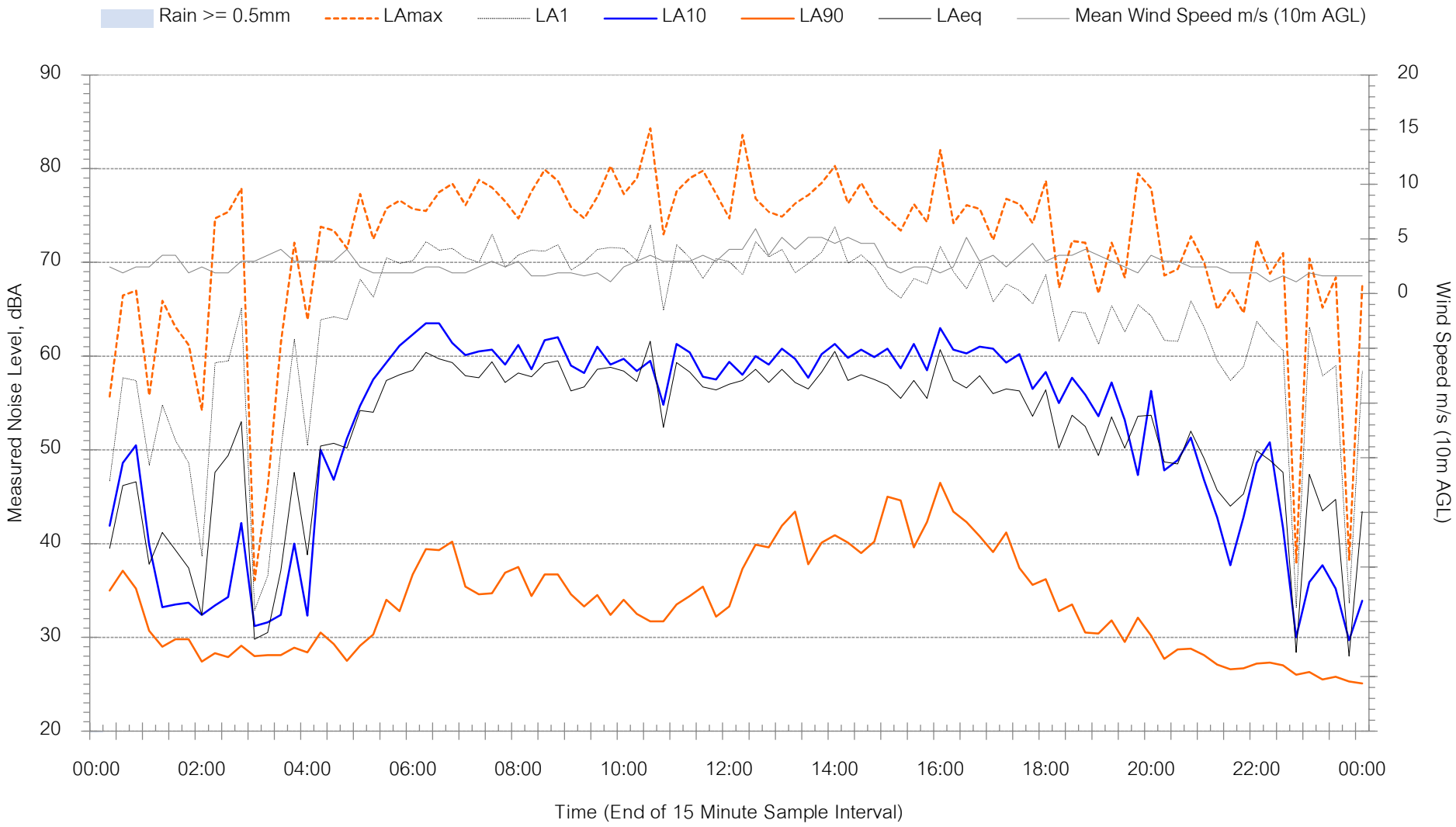
Background Noise Levels

Logger 2 -1584 Wisemans Ferry Road, Maroota - Monday 1 June 2020



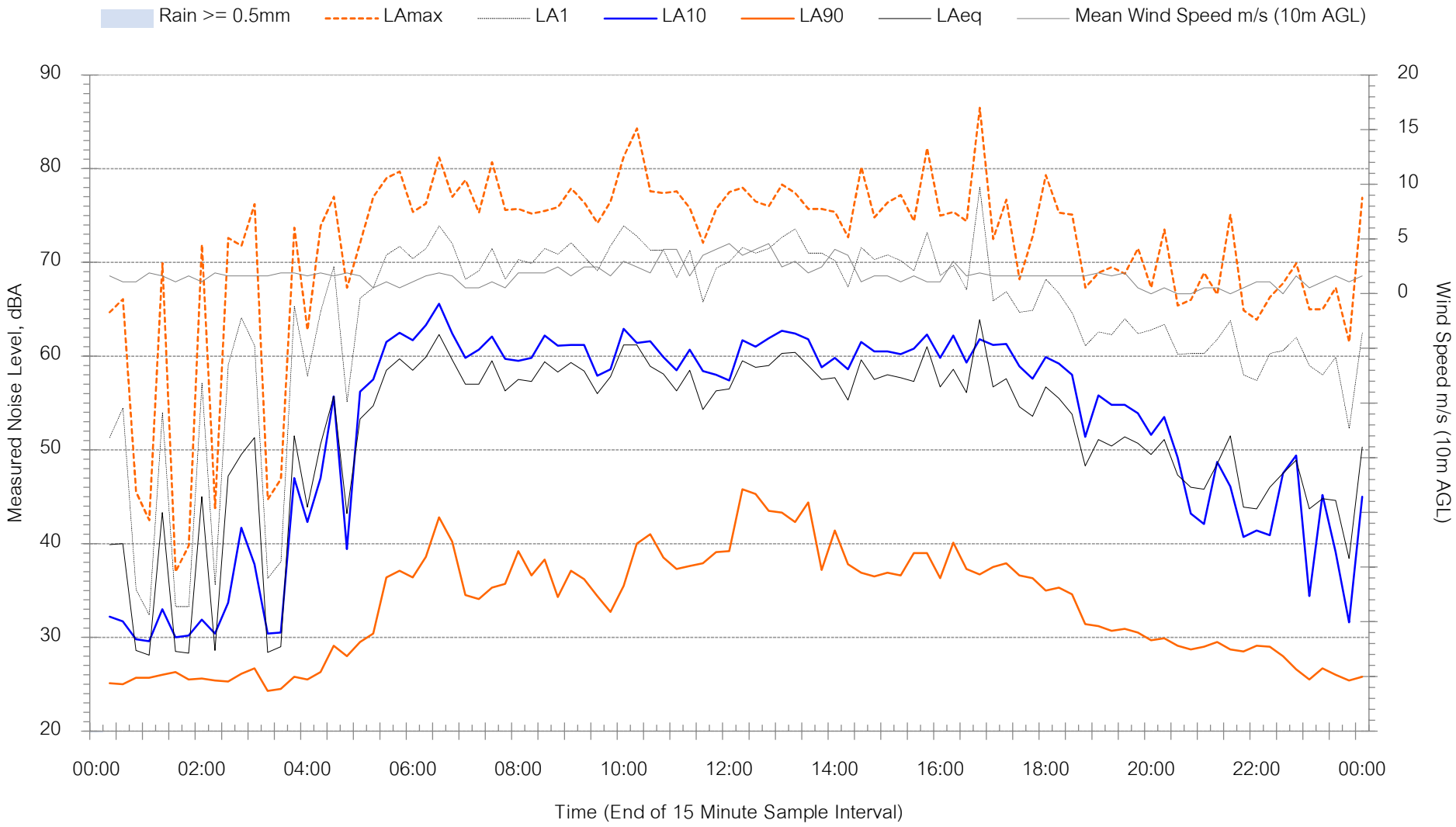
Background Noise Levels

Logger 2 -1584 Wisemans Ferry Road, Maroota - Tuesday 2 June 2020



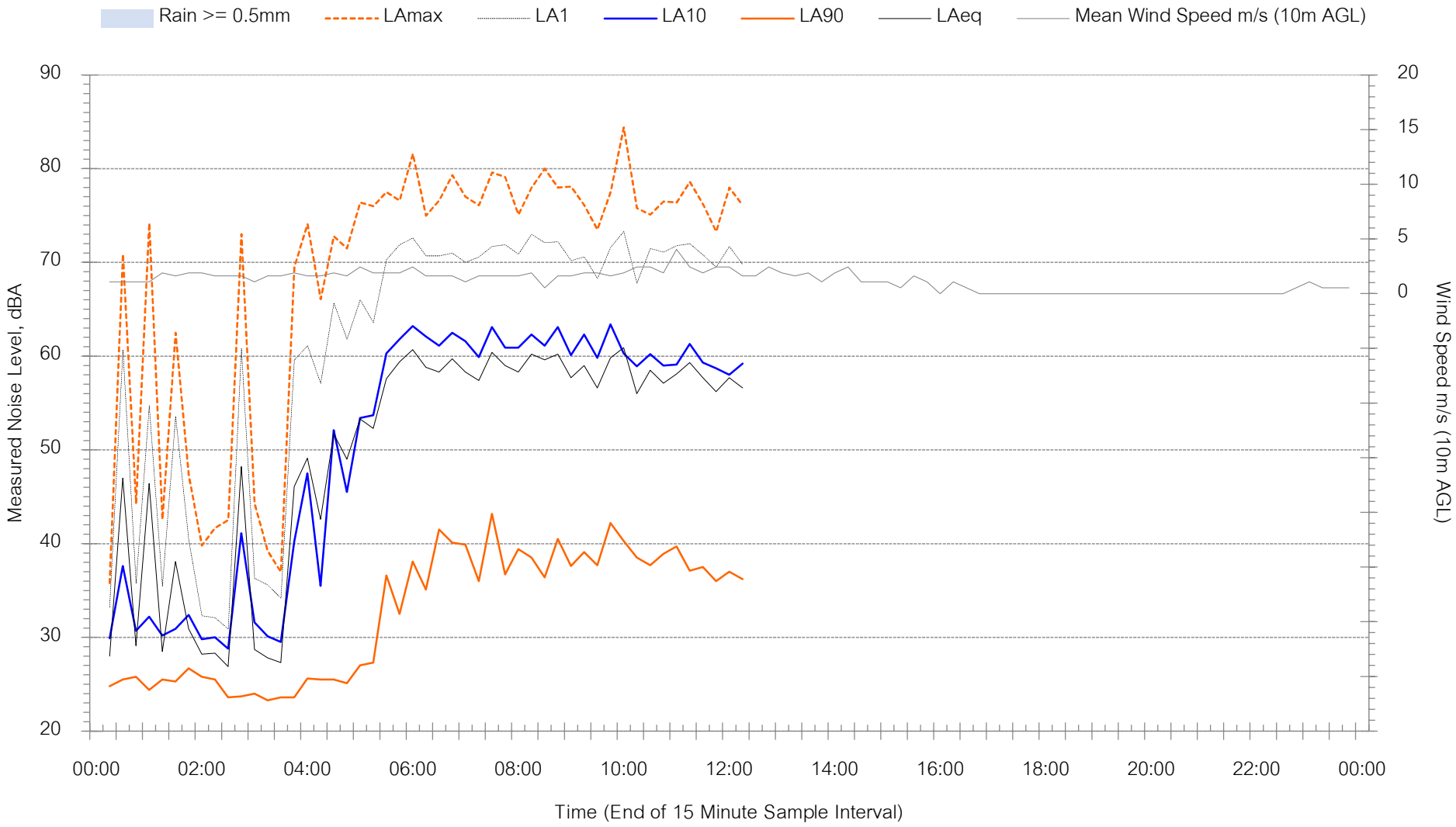
Background Noise Levels

Logger 2 -1584 Wisemans Ferry Road, Maroota - Wednesday 3 June 2020



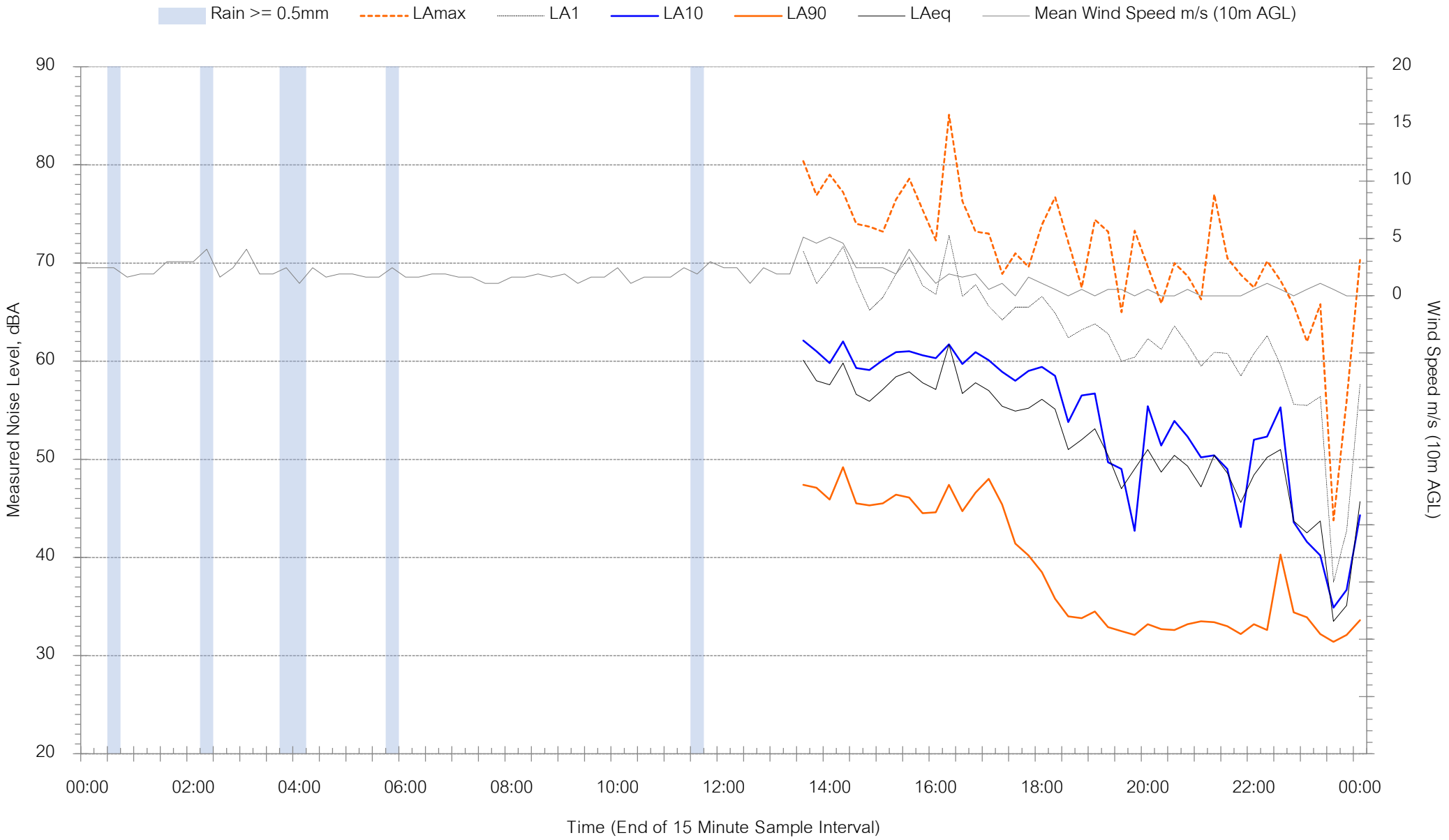
Background Noise Levels

Logger 2 -1584 Wisemans Ferry Road, Maroota - Thursday 4 June 2020



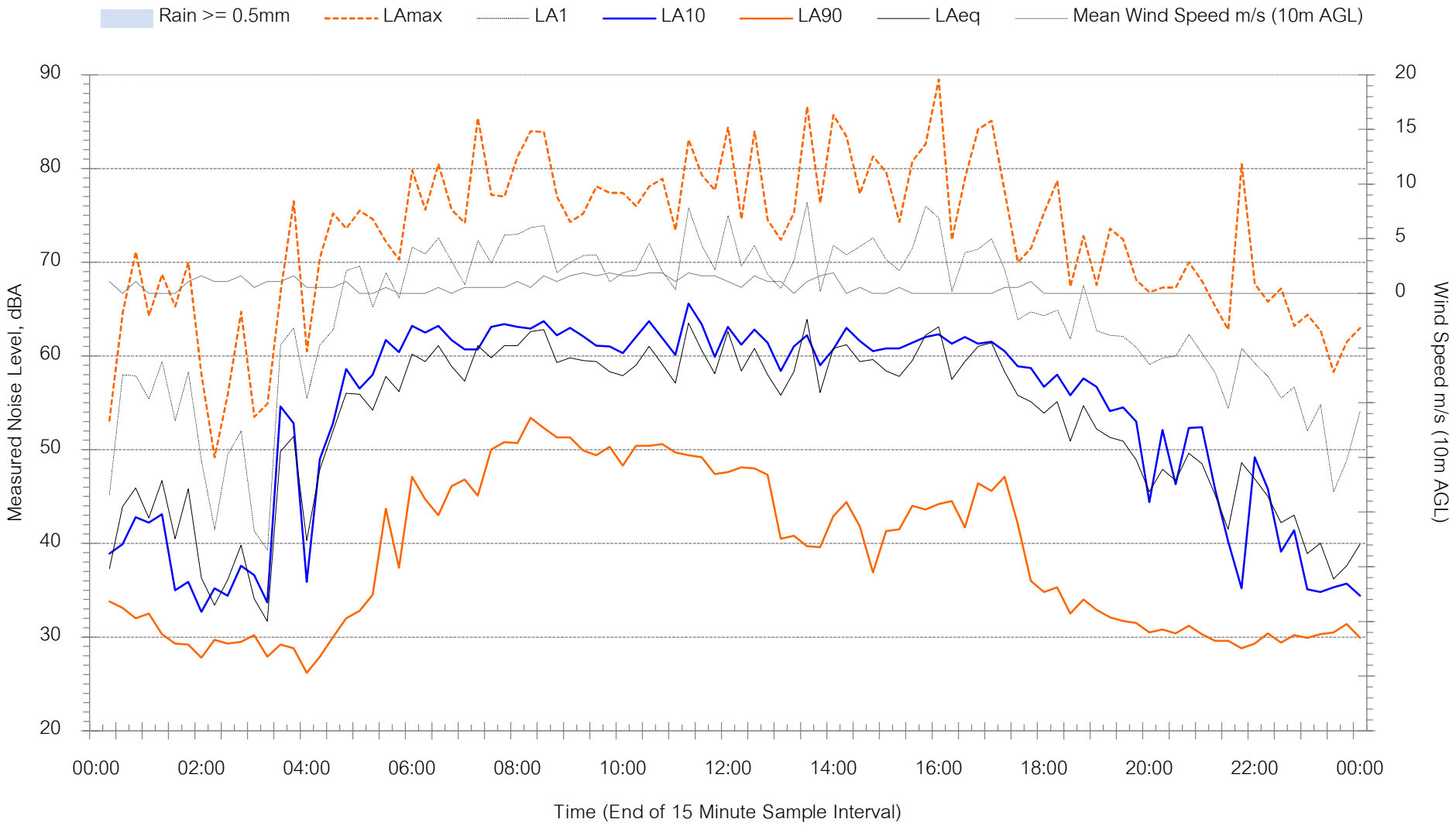
Background Noise Levels

Logger3-4486 Old Northern Road, Maroota - Tuesday 26 May 2020



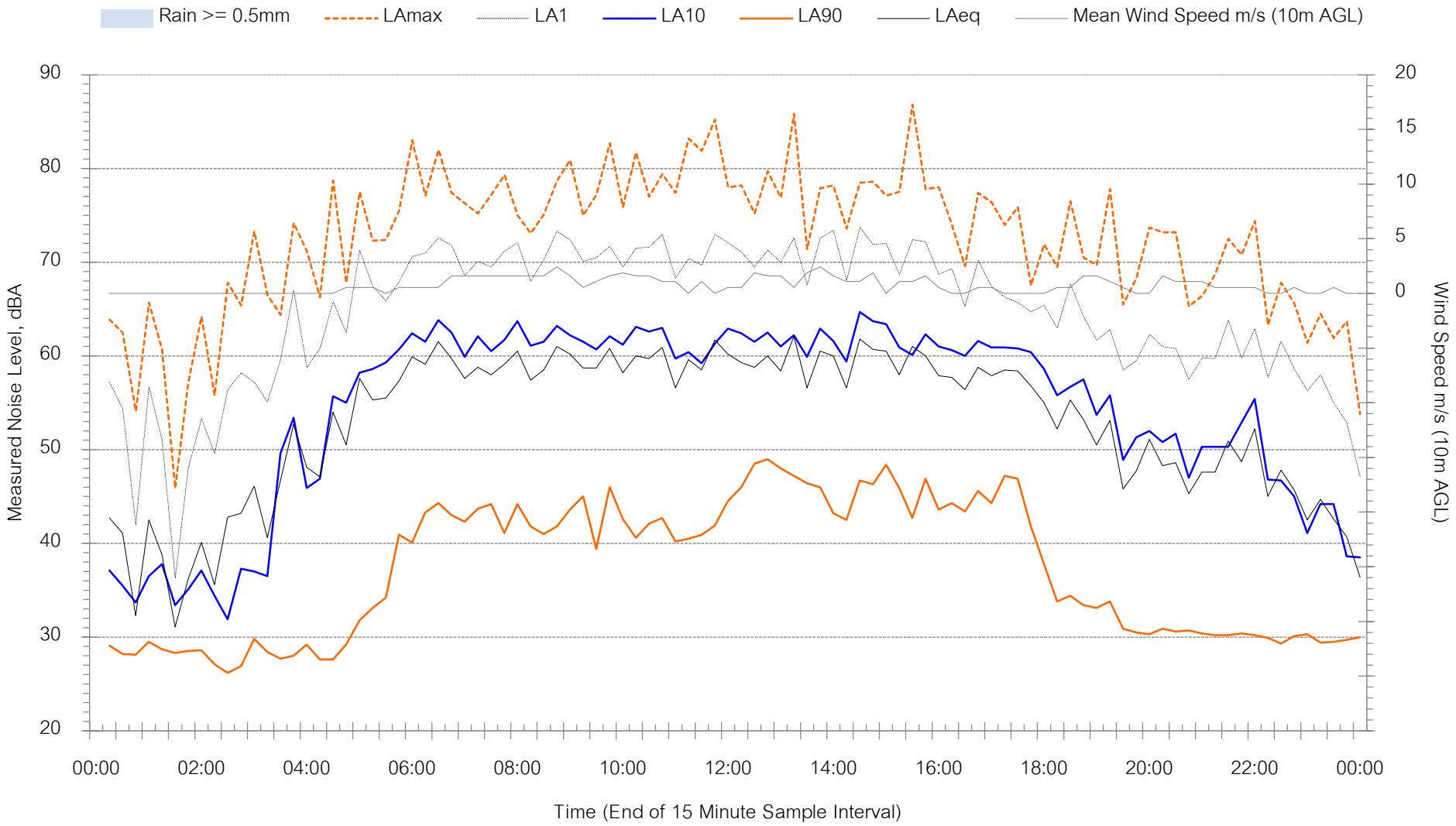
Background Noise Levels

Logger3-4486 Old Northern Road, Maroota - Wednesday 27 May 2020



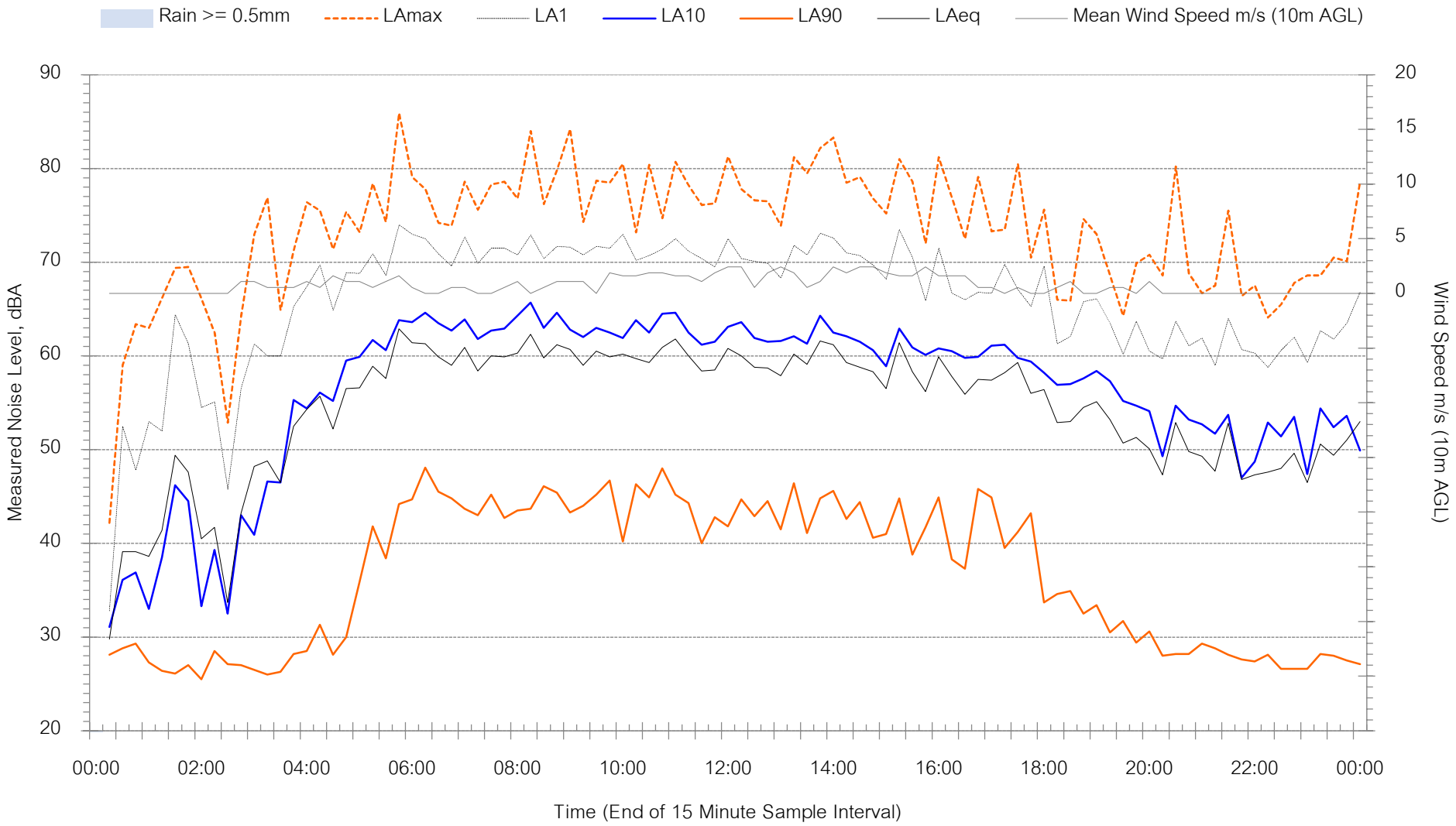
Background Noise Levels

Logger3-4486 Old Northern Road, Maroota - Thursday 28 May 2020



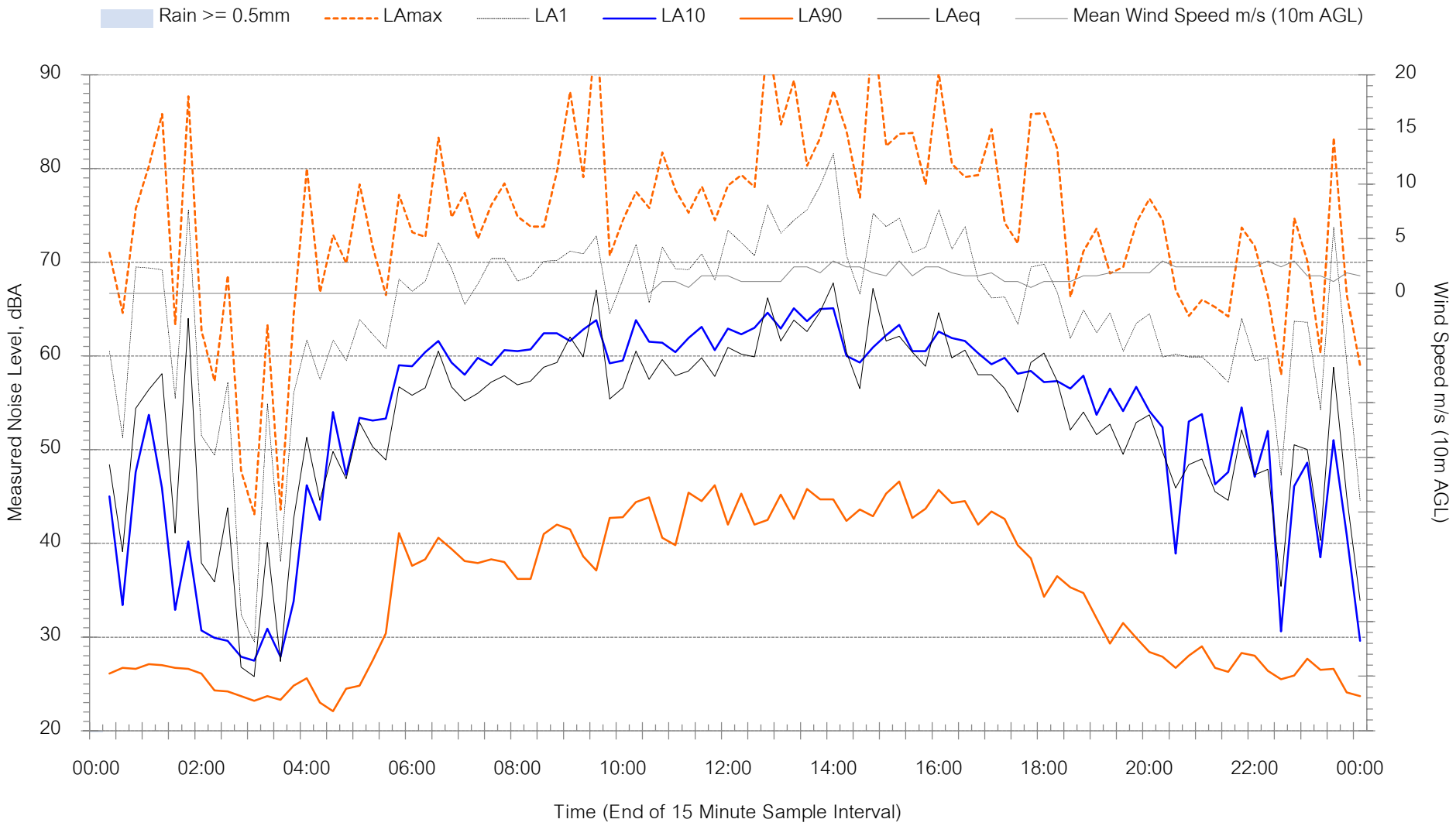
Background Noise Levels

Logger3-4486 Old Northern Road, Maroota - Friday 29 May 2020



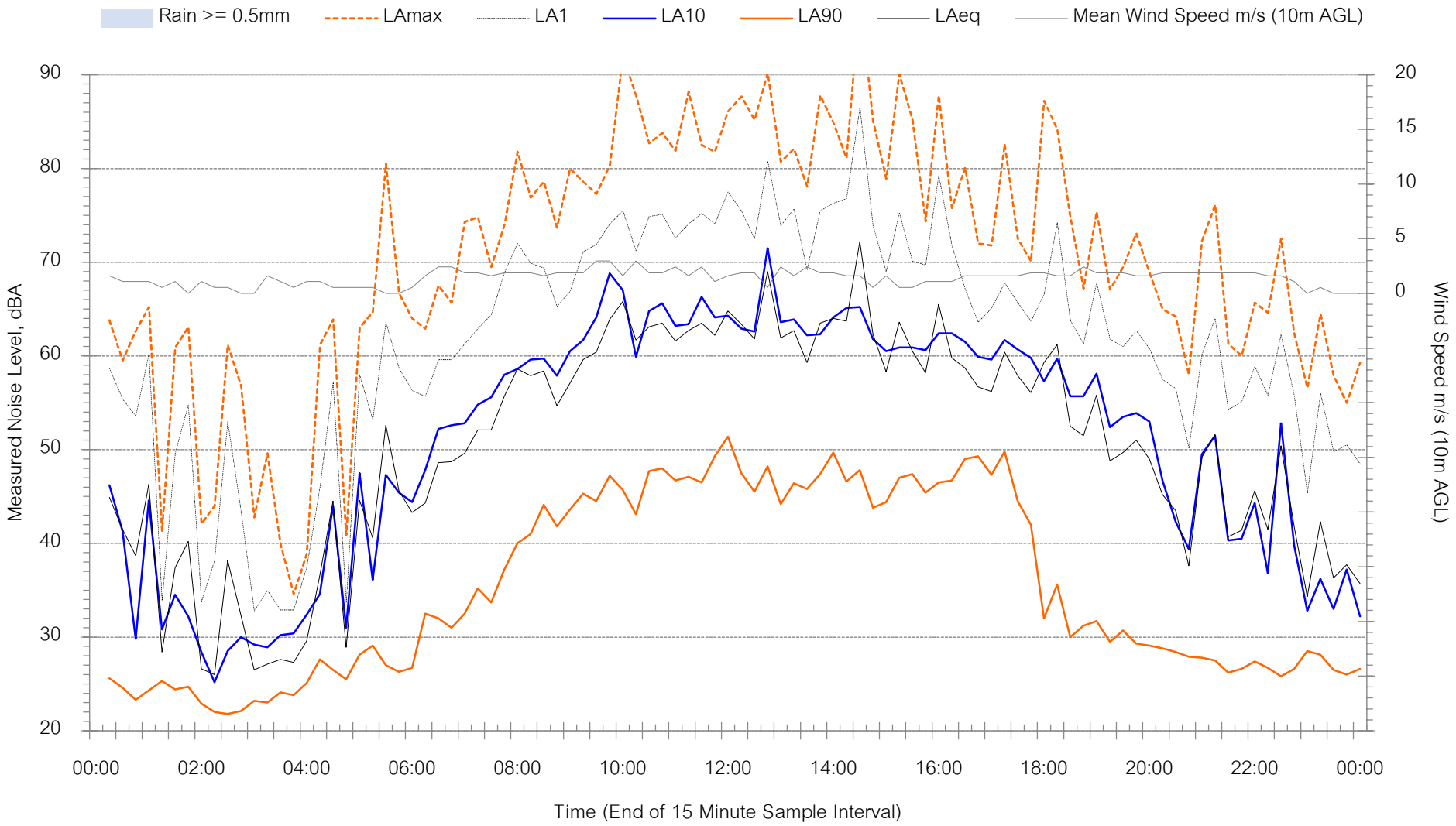
Background Noise Levels

Logger3-4486 Old Northern Road, Maroota - Saturday 30 May 2020



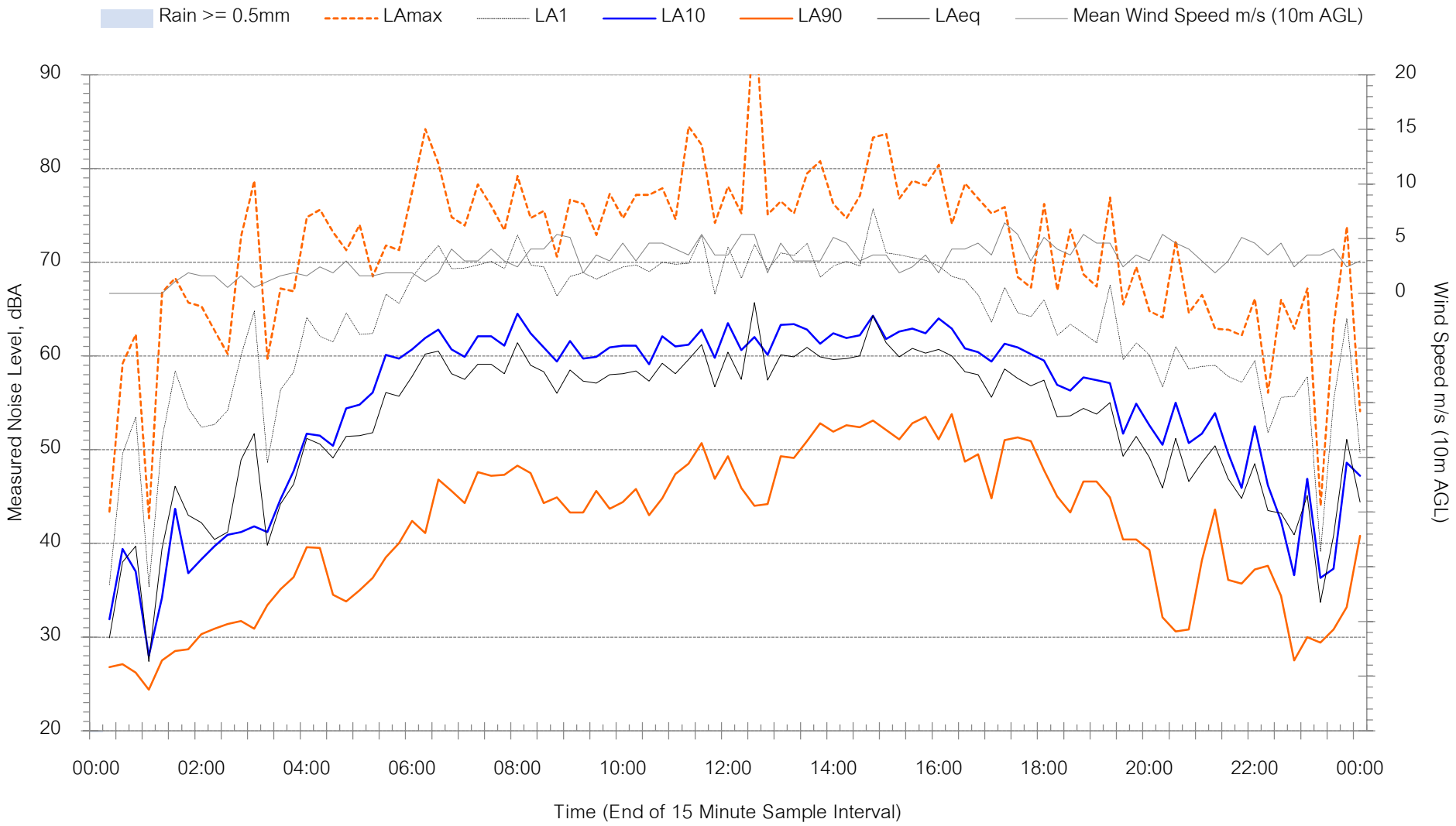
Background Noise Levels

Logger3-4486 Old Northern Road, Maroota - Sunday 31 May 2020



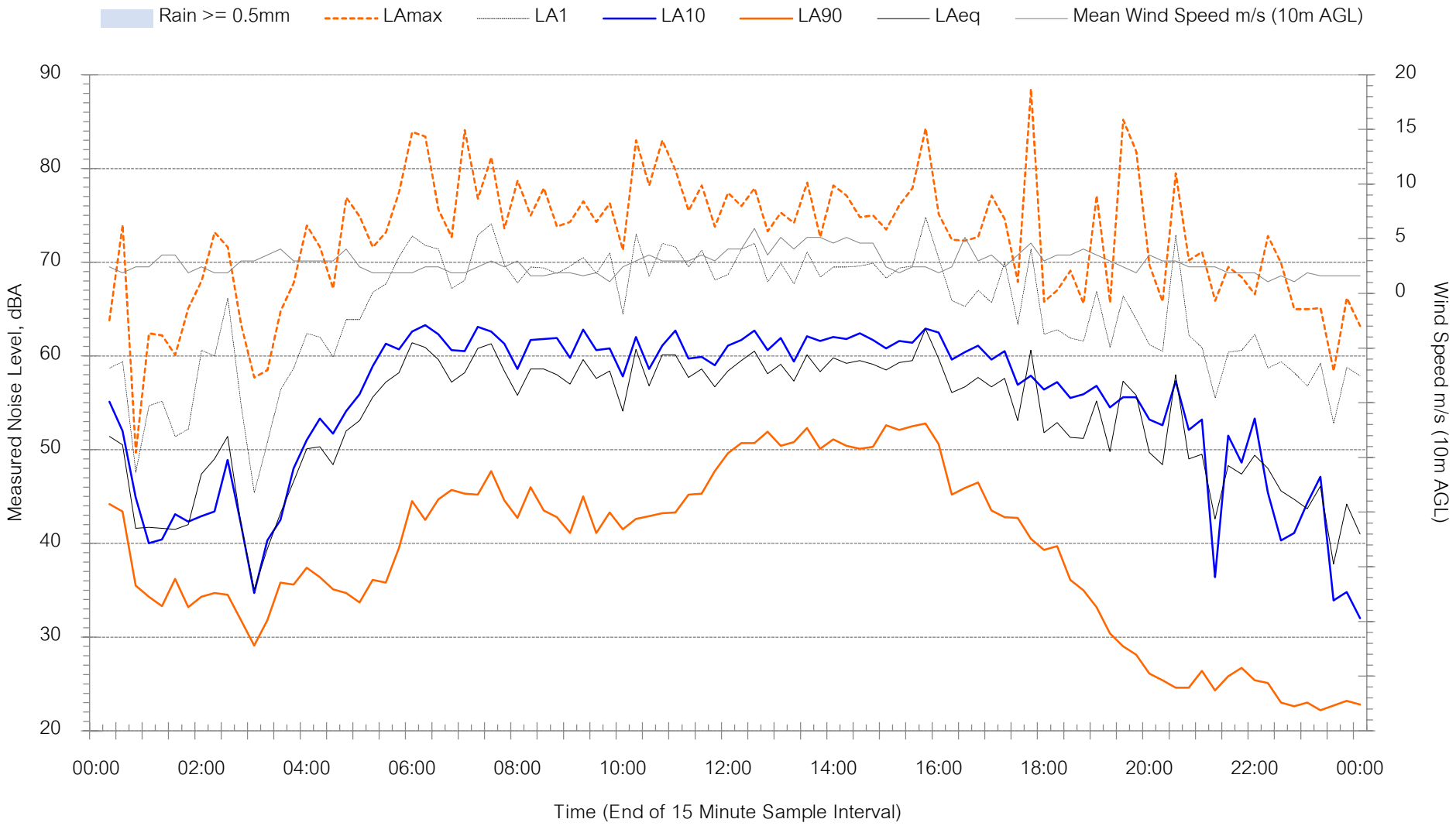
Background Noise Levels

Logger3-4486 Old Northern Road, Maroota - Monday 1 June 2020



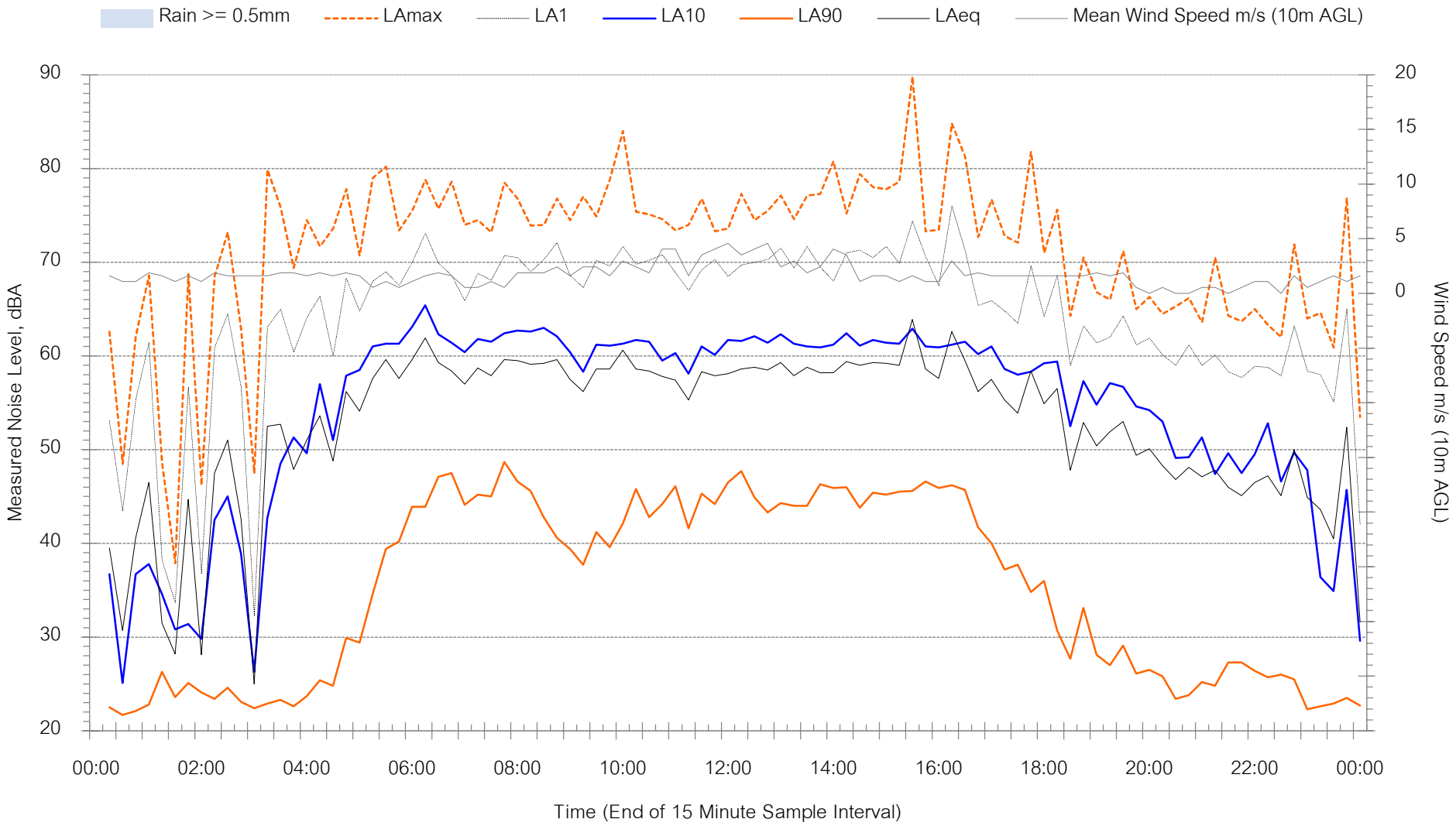
Background Noise Levels

Logger3-4486 Old Northern Road, Maroota - Tuesday 2 June 2020



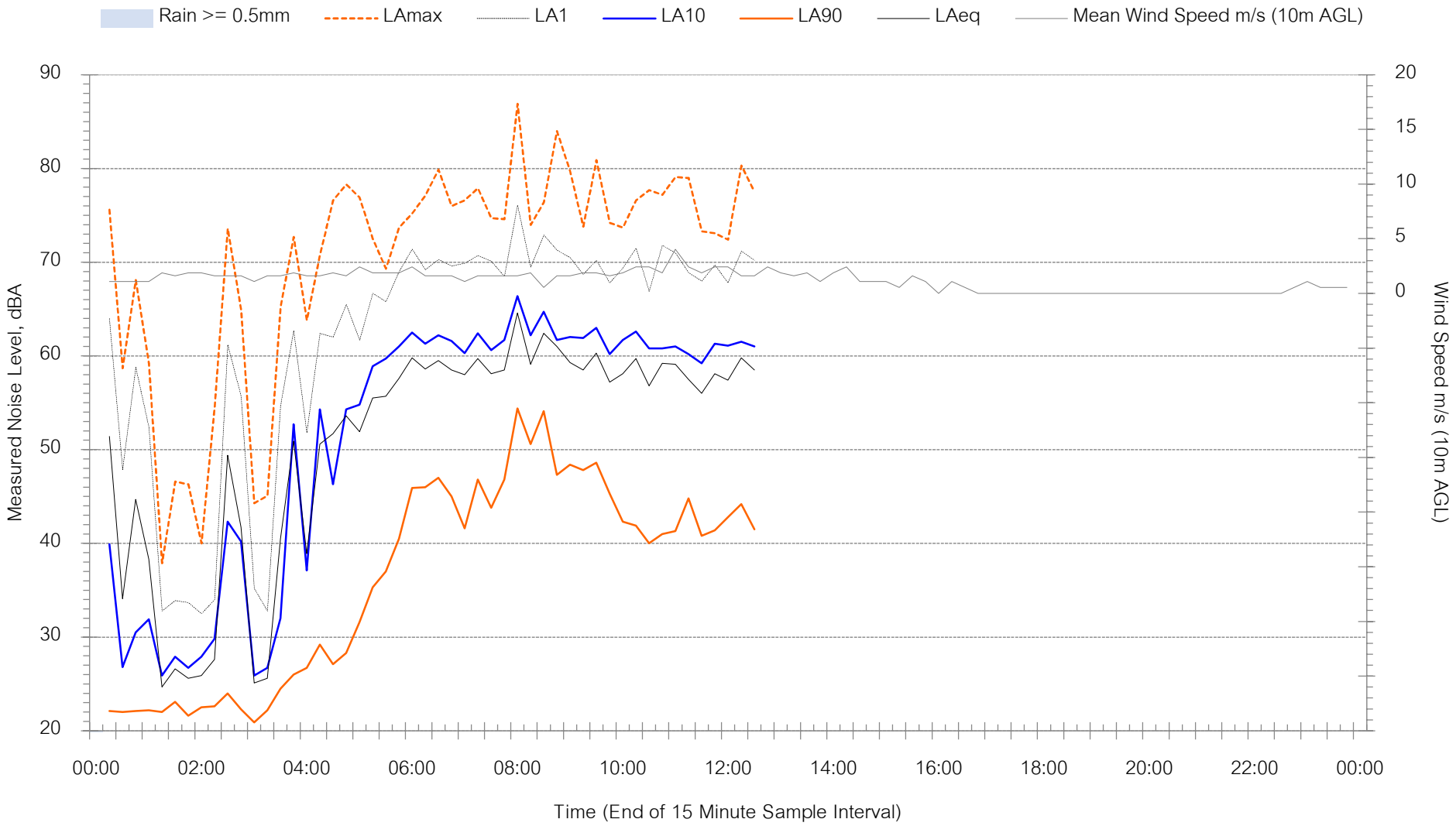
Background Noise Levels

Logger3-4486 Old Northern Road, Maroota - Wednesday 3 June 2020



Background Noise Levels

Logger3-4486 Old Northern Road, Maroota - Thursday 4 June 2020



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Appendix C – Sound Power Data

Table C1 - Octave Sound Power Level Spectra									
Noise Source	Octave Band Centre Frequency (Hz), dBA								Total
	63	125	250	500	1000	2000	4000	8000	dBA
CAT349D Excavator	89	102	104	103	101	100	93	85	109
CATD9 Dozer	86	95	99	107	103	102	100	90	110
CATD9 Dozer Clearing	86	95	99	107	103	102	100	90	110
CAT349D Excavator	89	102	104	103	101	100	93	85	109
CAT966 Wheel Loader	79	96	95	101	105	101	94	87	108
Processing Plant	82	90	93	102	101	100	96	89	107
CAT966 Wheel Loader	79	96	95	101	105	101	94	87	108
Tree Mulcher	89	96	102	110	110	110	107	98	116
Volvo A40 Articulated Haul Truck	92	96	102	102	103	100	93	84	108
Standard B Double Road truck	89	95	90	89	93	97	92	85	102
Volvo 6 Wheel Water Cart	81	82	89	91	95	97	89	81	101
Volvo 6 Wheel Fuel Truck	81	82	89	91	95	97	89	81	101

Appendix D – Noise Contour Plots & Detailed Results

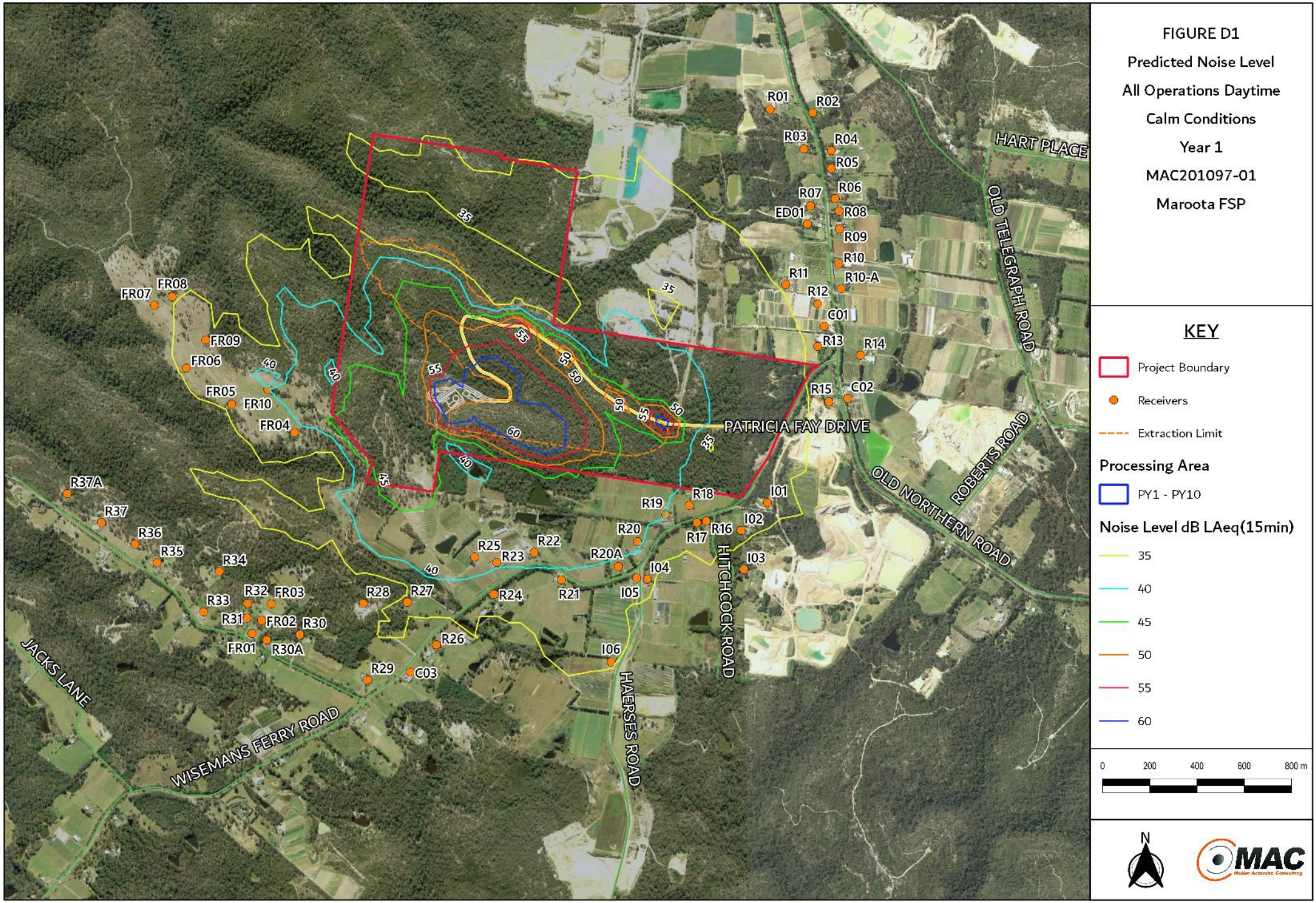
FIGURE D1
Predicted Noise Level
All Operations Daytime
Calm Conditions
Year 1
MAC201097-01
Maroota FSP
KEY
Project Boundary
Receivers
Extraction Limit
Processing Area
PY1 - PY10
Noise Level dB LAeq(15min)
35
40
45
50
55
60
0
200
400
600
800 m
N
MAC
R01
R02
R03
R04
R05
R06
R07
R08
R09
R10
R10-A
R11
R12
R13
R14
R15
R16
R17
R18
R19
R20
R20A
R21
R22
R23
R24
R25
R26
R27
R28
R29
R30
R30A
R31
R32
R33
R34
R35
R36
R37
R37A
ED01
C01
C02
C03
FR01
FR02
FR03
FR04
FR05
FR06
FR07
FR08
FR09
FR10
I01
I02
I03
I04
I05
I06
HART PLACE
OLD TELEGRAPH ROAD
PATRICIA FAY DRIVE
ROBERTS ROAD
OLD NORTHERN ROAD
HITCHCOCK ROAD
HAERSES ROAD
WISEMANS FERRY ROAD
JACKS LANE

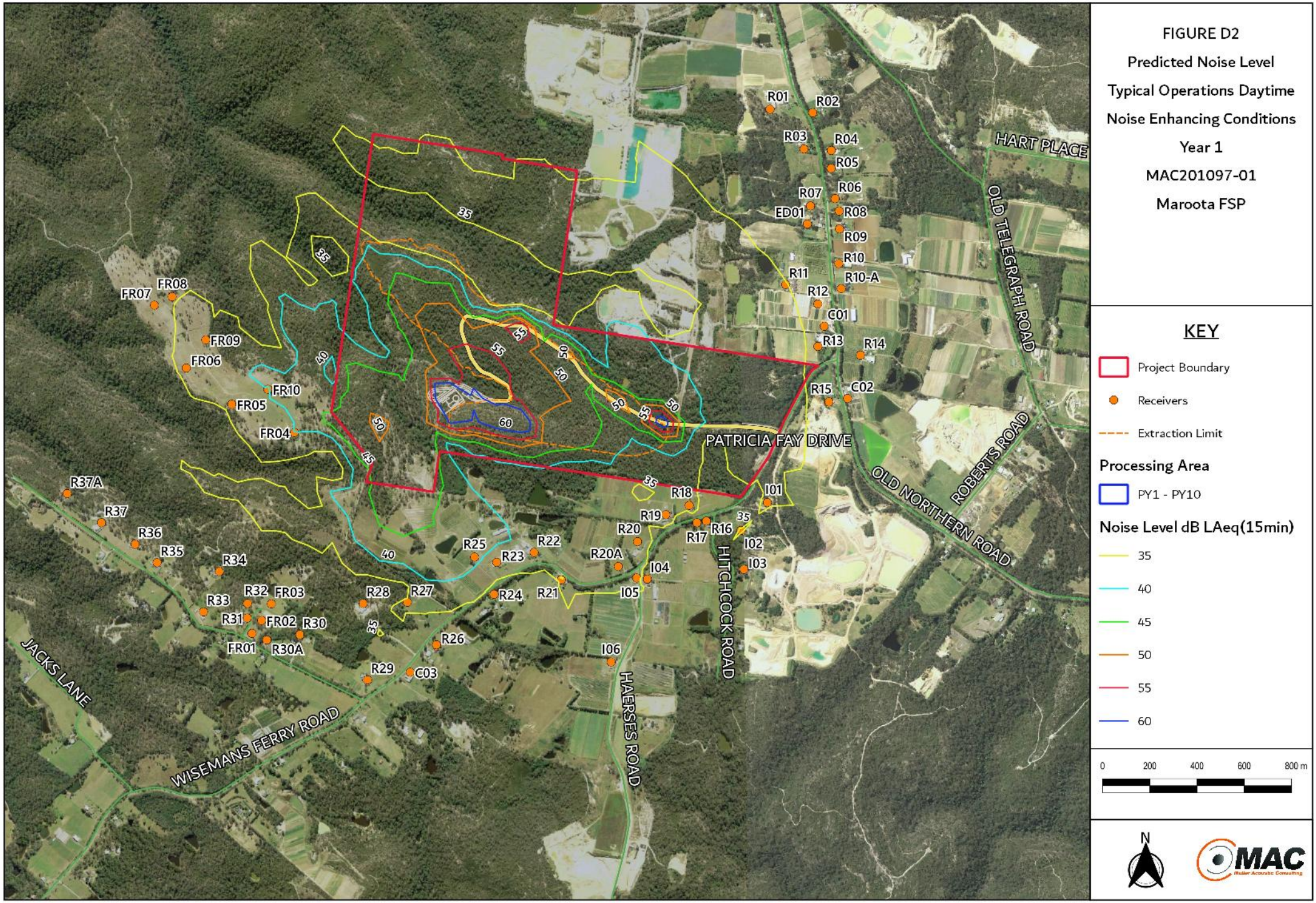
FIGURE D2
Predicted Noise Level
Typical Operations Daytime
Noise Enhancing Conditions
Year 1
MAC201097-01
Maroota FSP
KEY
Project Boundary
Receivers
Extraction Limit
Processing Area
PY1 - PY10
Noise Level dB LAeq(15min)
35
40
45
50
55
60
0
200
400
600
800 m
N
MAC
Muller Acoustic Consulting
R01
R02
R03
R04
R05
R06
R07
R08
R09
R10
R10-A
R11
R12
R13
R14
R15
R16
R17
R18
R19
R20
R20A
R21
R22
R23
R24
R25
R26
R27
R28
R29
R30
R30A
R31
R32
R33
R34
R35
R36
R37
R37A
ED01
C01
C02
C03
I01
I02
I03
I04
I05
I06
FR01
FR02
FR03
FR04
FR05
FR06
FR07
FR08
FR09
FR10
HART PLACE
OLD TELEGRAPH ROAD
PATRICIA FAY DRIVE
ROBERTS ROAD
OLD NORTHERN ROAD
HITCHCOCK ROAD
HAERSES ROAD
WISEMANS FERRY ROAD
JACKS LANE

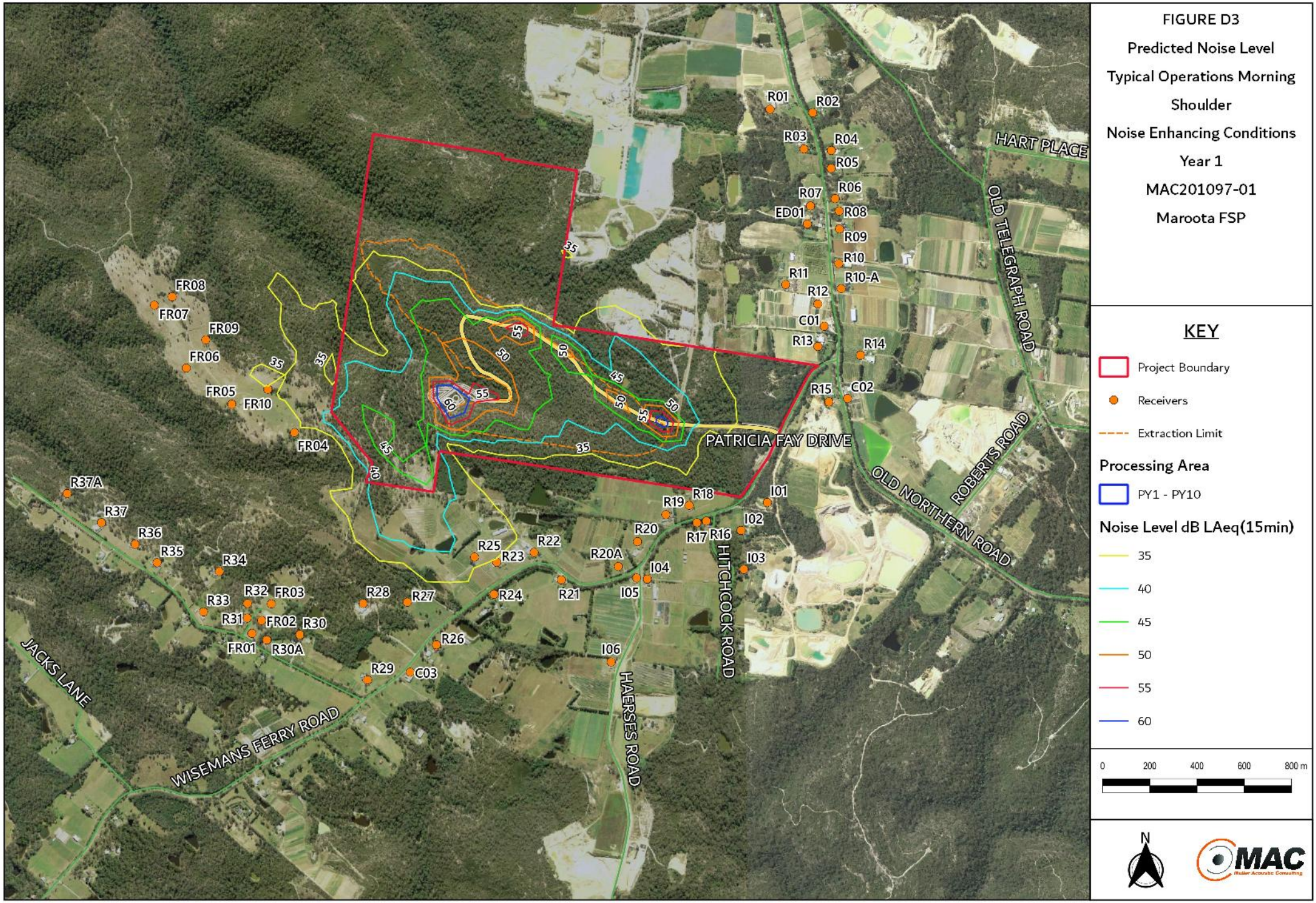
FIGURE D3
Predicted Noise Level
Typical Operations Morning Shoulder
Noise Enhancing Conditions
Year 1
MAC201097-01
Maroota FSP
KEY
Project Boundary
Receivers
Extraction Limit
Processing Area
PY1 - PY10
Noise Level dB LAeq(15min)
35
40
45
50
55
60
0
200
400
600
800 m
N
MAC
Muller Acoustic Consulting
HART PLACE
OLD TELEGRAPH ROAD
PATRICIA FAY DRIVE
OLD NORTHERN ROAD
ROBERTS ROAD
HITCHCOCK ROAD
HAERSES ROAD
JACKS LANE
WISEMANS FERRY ROAD
R01
R02
R03
R04
R05
R06
R07
R08
R09
R10
R10-A
R11
R12
R13
R14
R15
R16
R17
R18
R19
R20
R20A
R21
R22
R23
R24
R25
R26
R27
R28
R29
R30
R30A
R31
R32
R33
R34
R35
R36
R37
R37A
ED01
C01
C02
C03
I01
I02
I03
I04
I05
I06
FR01
FR02
FR03
FR04
FR05
FR06
FR07
FR08
FR09
FR10

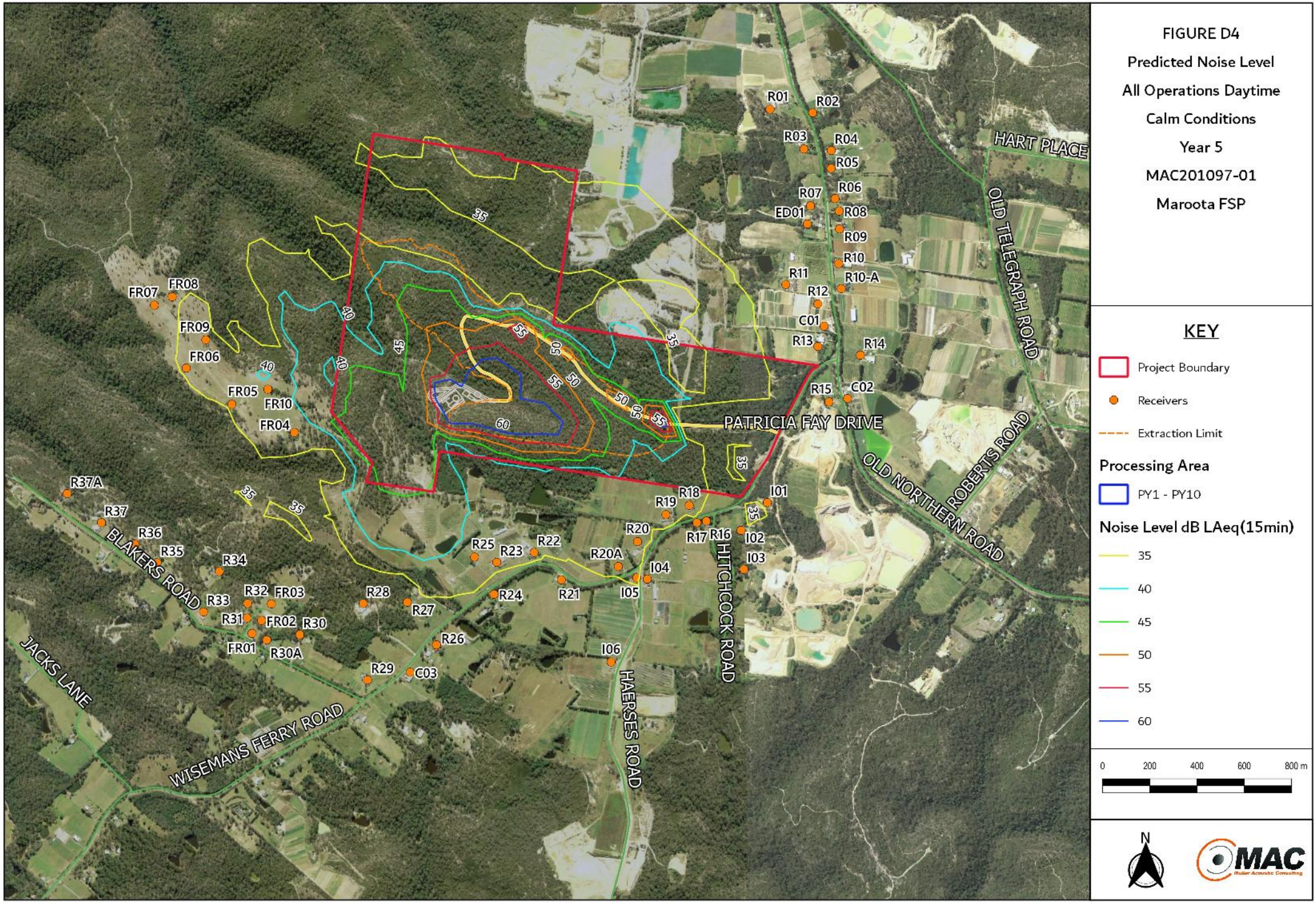
FIGURE D4
Predicted Noise Level
All Operations Daytime
Calm Conditions
Year 5
MAC201097-01
Maroota FSP
KEY
Project Boundary
Receivers
Extraction Limit
Processing Area
PY1 - PY10
Noise Level dB LAeq(15min)
35
40
45
50
55
60
0
200
400
600
800 m
N
MAC
R01
R02
R03
R04
R05
R06
R07
R08
R09
R10
R10-A
R11
R12
R13
R14
R15
R16
R17
R18
R19
R20
R20A
R21
R22
R23
R24
R25
R26
R27
R28
R29
R30
R30A
R31
R32
R33
R34
R35
R36
R37
R37A
ED01
C01
C02
C03
FR01
FR02
FR03
FR04
FR05
FR06
FR07
FR08
FR09
FR10
I01
I02
I03
I04
I05
I06
HART PLACE
OLD TELEGRAPH ROAD
PATRICIA FAY DRIVE
OLD NORTHERN ROBERTS ROAD
HITCHCOCK ROAD
HAERSES ROAD
BLAKERS ROAD
JACKS LANE
WISEMANS FERRY ROAD

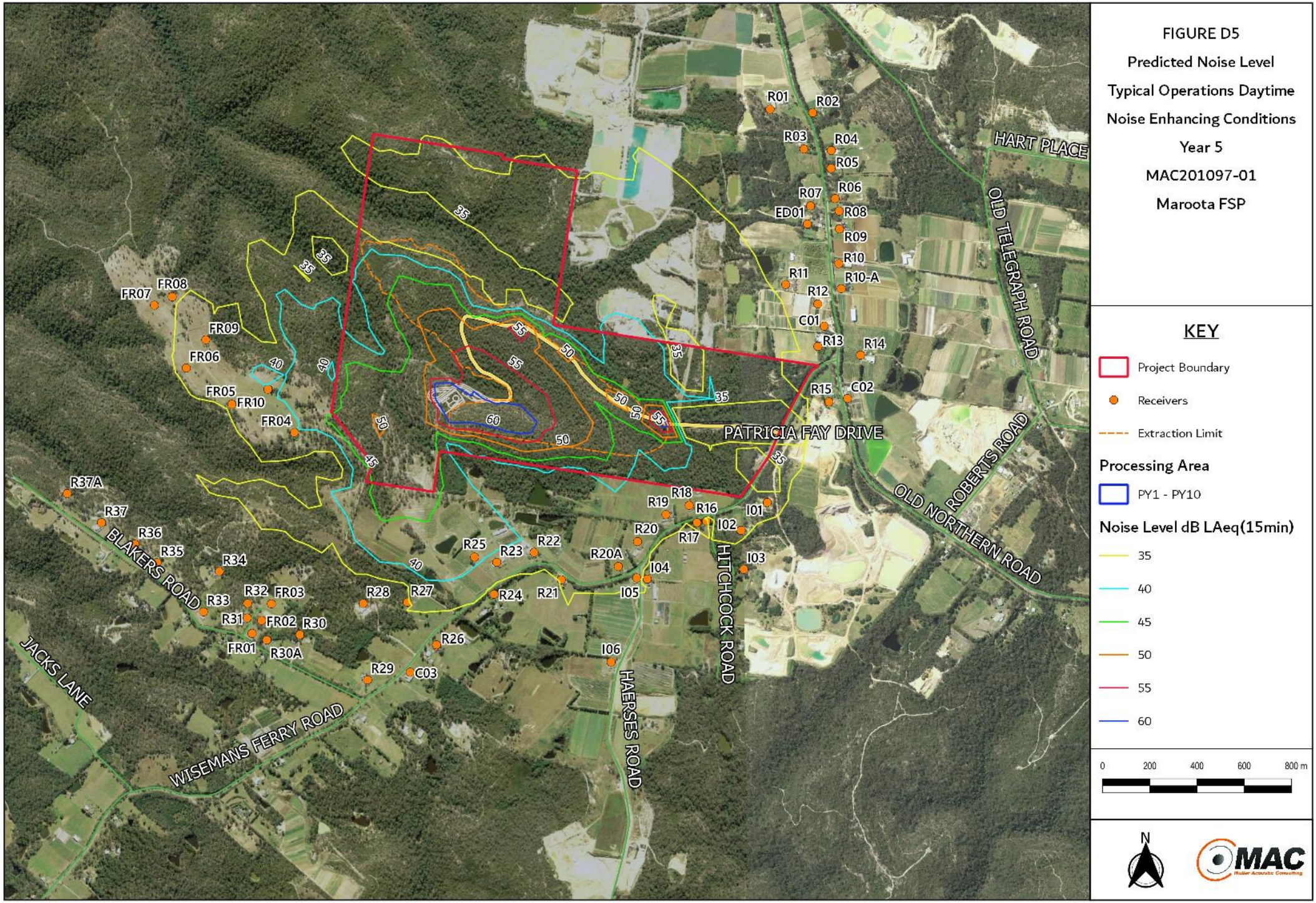
FIGURE D5
Predicted Noise Level
Typical Operations Daytime
Noise Enhancing Conditions
Year 5
MAC201097-01
Maroota FSP
KEY
Project Boundary
Receivers
Extraction Limit
Processing Area
PY1 - PY10
Noise Level dB LAeq(15min)
35
40
45
50
55
60
0
200
400
600
800 m
N
MAC
Muller Acoustic Consulting
PATRICIA FAY DRIVE
HART PLACE
OLD TELEGRAPH ROAD
ROBERTS ROAD
OLD NORTHERN ROAD
HITCHCOCK ROAD
HAERSES ROAD
BLAKERS ROAD
JACKS LANE
WISEMANS FERRY ROAD
R01
R02
R03
R04
R05
R06
R07
ED01
R08
R09
R10
R10-A
R11
R12
C01
R13
R14
R15
C02
R16
R17
R18
R19
R20
R20A
R21
R22
R23
R24
R25
R26
R27
R28
R29
C03
I01
I02
I03
I04
I05
I06
R30
R30A
R31
R32
R33
R34
R35
R36
R37
R37A
FR01
FR02
FR03
FR04
FR05
FR06
FR07
FR08
FR09
FR10

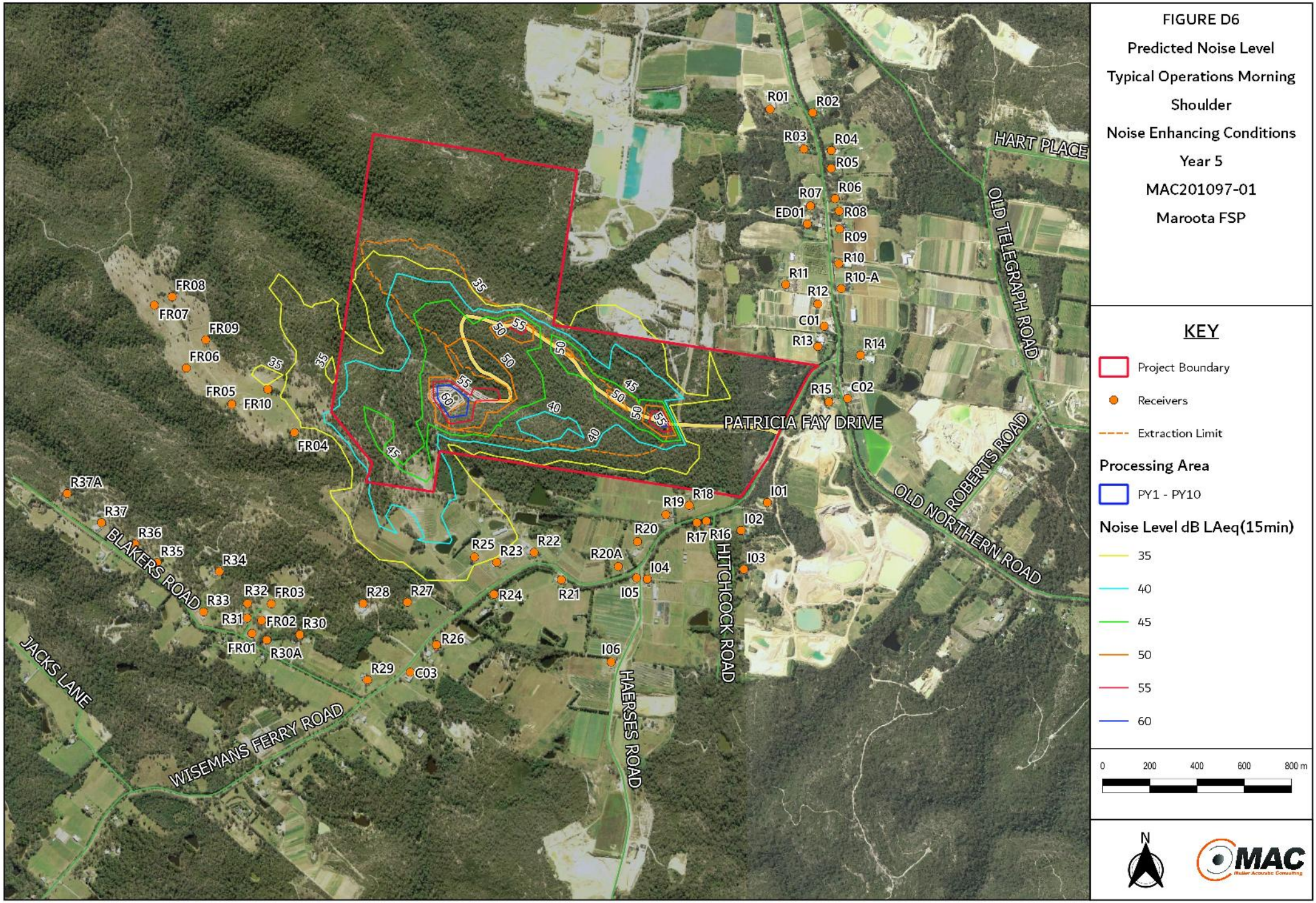
FIGURE D6
Predicted Noise Level
Typical Operations Morning Shoulder
Noise Enhancing Conditions
Year 5
MAC201097-01
Maroota FSP
KEY
Project Boundary
Receivers
Extraction Limit
Processing Area
PY1 - PY10
Noise Level dB LAeq(15min)
35
40
45
50
55
60
0 200 400 600 800 m
N
MAC
PATRICIA FAY DRIVE
HART PLACE
OLD TELEGRAPH ROAD
OLD NORTHERN ROAD
ROBERTS ROAD
HITCHCOCK ROAD
HAERSES ROAD
BLAKERS ROAD
WISEMANS FERRY ROAD
JACKS LANE
R01
R02
R03
R04
R05
R06
R07
R08
R09
R10
R10-A
R11
R12
R13
R14
R15
R16
R17
R18
R19
R20
R20A
R21
R22
R23
R24
R25
R26
R27
R28
R29
R30
R30A
R31
R32
R33
R34
R35
R36
R37
R37A
ED01
C01
C02
C03
FR01
FR02
FR03
FR04
FR05
FR06
FR07
FR08
FR09
FR10
I01
I02
I03
I04
I05
I06

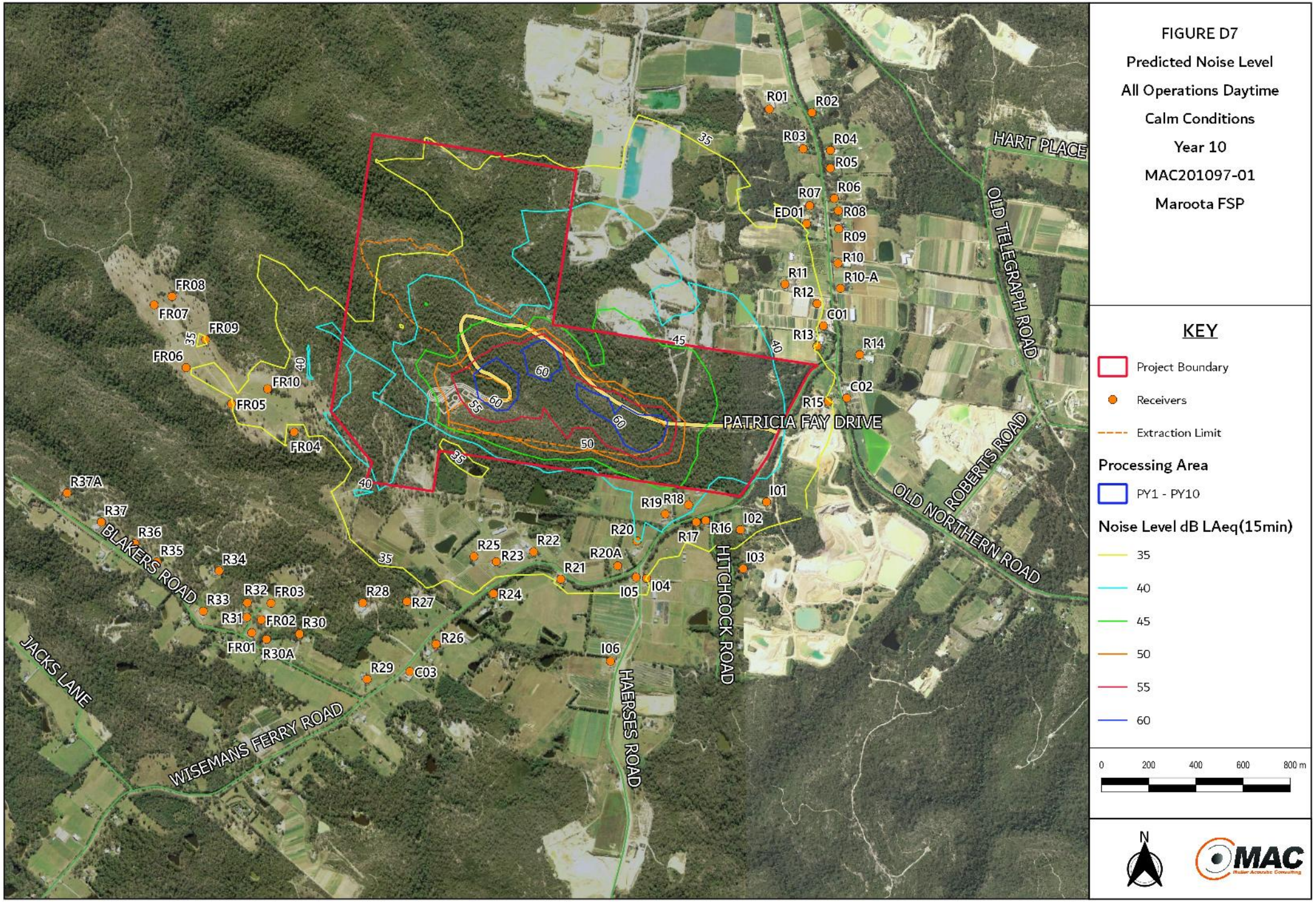
FIGURE D7
Predicted Noise Level
All Operations Daytime
Calm Conditions
Year 10
MAC201097-01
Maroota FSP
KEY
Project Boundary
Receivers
Extraction Limit
Processing Area
PY1 - PY10
Noise Level dB LAeq(15min)
35
40
45
50
55
60
0
200
400
600
800 m
N
MAC
HART PLACE
OLD TELEGRAPH ROAD
PATRICIA FAY DRIVE
ROBERTS ROAD
OLD NORTHERN ROAD
HITCHCOCK ROAD
HAERSES ROAD
BLAKERS ROAD
JACKS LANE
WISEMANS FERRY ROAD
R01
R02
R03
R04
R05
R06
R07
R08
R09
R10
R10-A
R11
R12
R13
R14
R15
R16
R17
R18
R19
R20
R20A
R21
R22
R23
R24
R25
R26
R27
R28
R29
R30
R30A
R31
R32
R33
R34
R35
R36
R37
R37A
ED01
C01
C02
C03
I01
I02
I03
I04
I05
I06
FR01
FR02
FR03
FR04
FR05
FR06
FR07
FR08
FR09
FR10

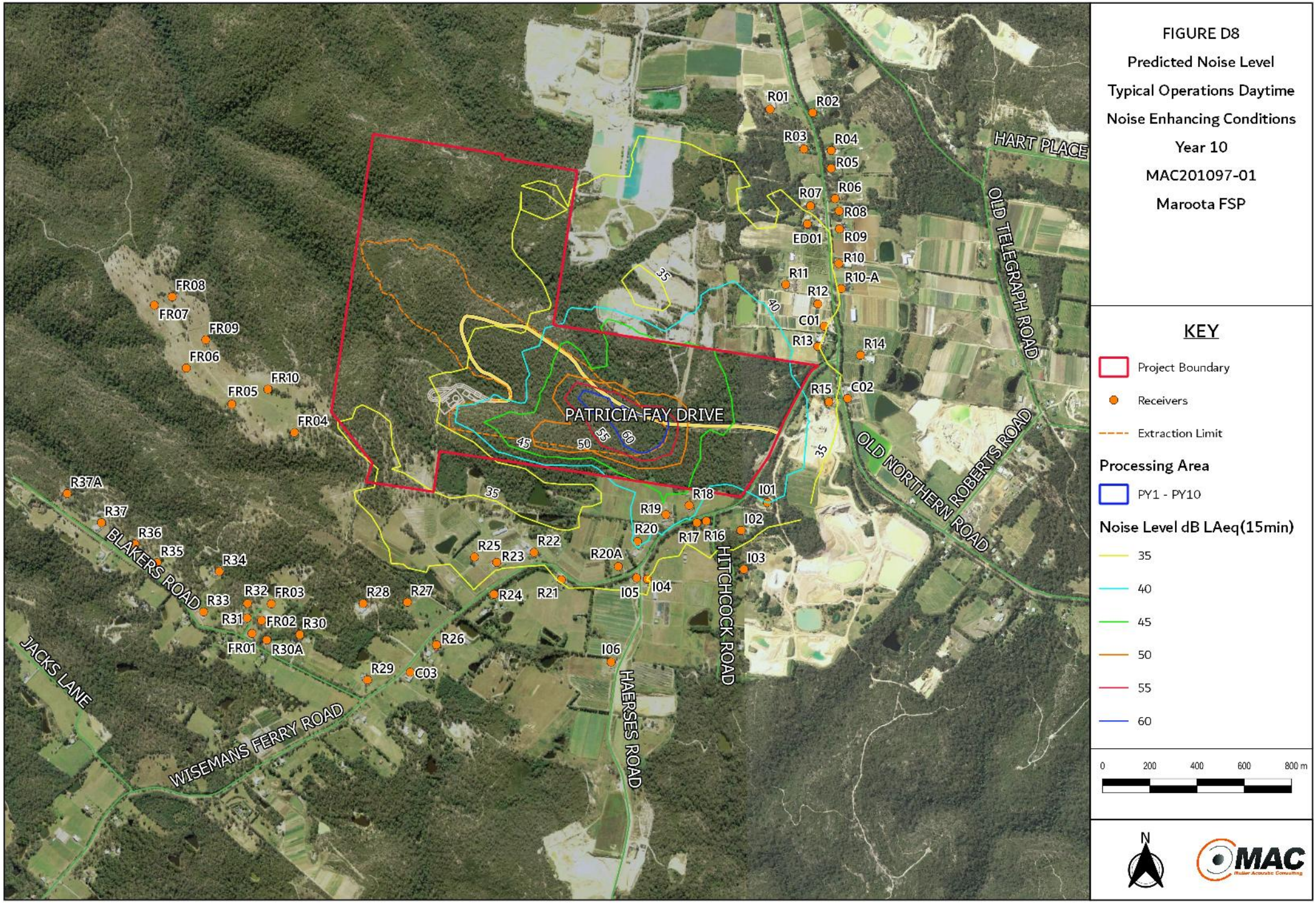
FIGURE D8
Predicted Noise Level
Typical Operations Daytime
Noise Enhancing Conditions
Year 10
MAC201097-01
Maroota FSP
KEY
Project Boundary
Receivers
Extraction Limit
Processing Area
PY1 - PY10
Noise Level dB LAeq(15min)
35
40
45
50
55
60
0
200
400
600
800 m
N
MAC
PATRICIA FAY DRIVE
HART PLACE
OLD TELEGRAPH ROAD
OLD NORTHERN ROBERTS ROAD
HITCHCOCK ROAD
HAERSES ROAD
BLAKERS ROAD
JACKS LANE
WISEMANS FERRY ROAD
R01
R02
R03
R04
R05
R06
R07
R08
R09
R10
R10-A
R11
R12
R13
R14
R15
R16
R17
R18
R19
R20
R20A
R21
R22
R23
R24
R25
R26
R27
R28
R29
R30
R30A
R31
R32
R33
R34
R35
R36
R37
R37A
ED01
C01
C02
C03
I01
I02
I03
I04
I05
I06
FR01
FR02
FR03
FR04
FR05
FR06
FR07
FR08
FR09
FR10

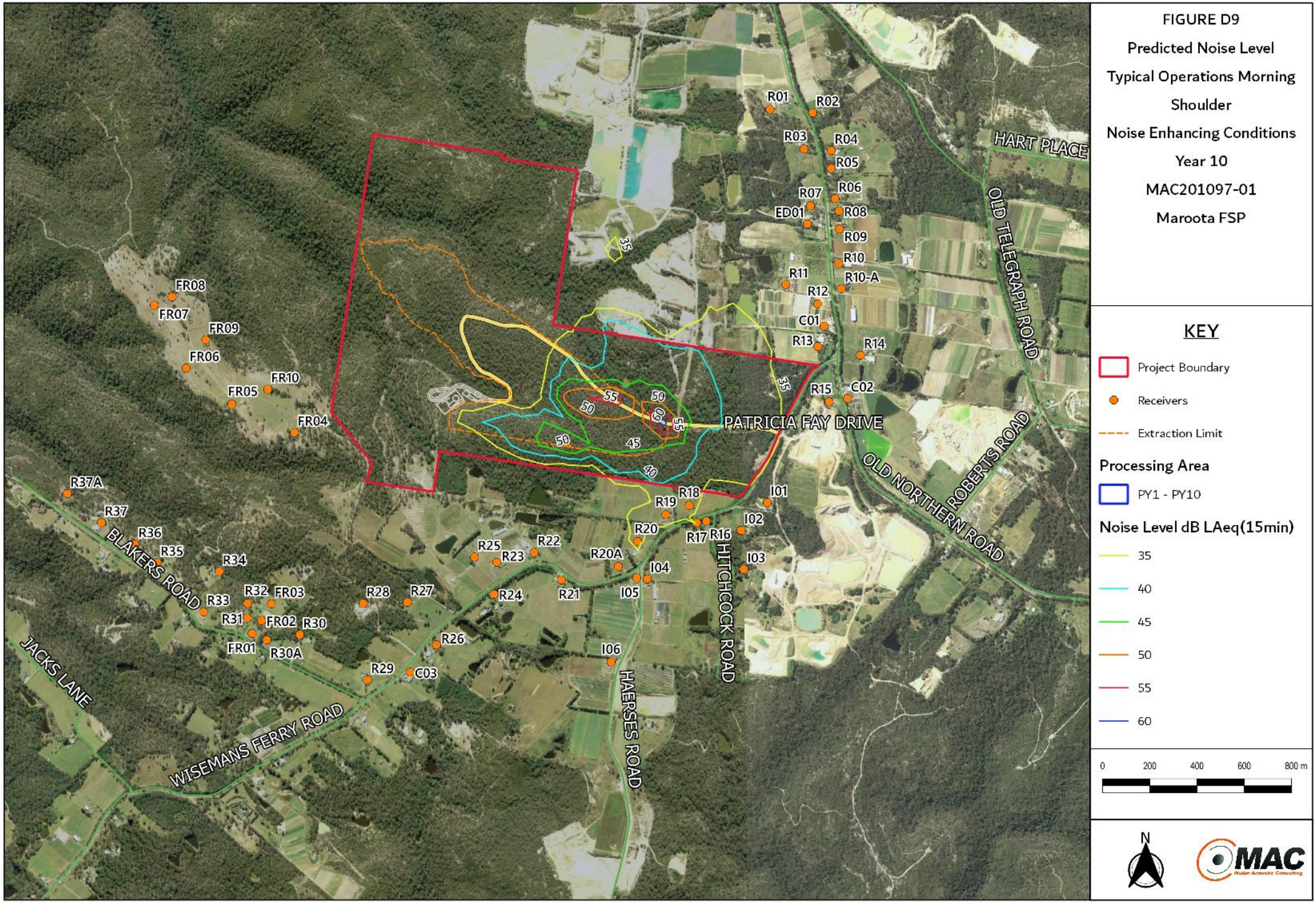
FIGURE D9
Predicted Noise Level
Typical Operations Morning Shoulder
Noise Enhancing Conditions
Year 10
MAC201097-01
Maroota FSP
KEY
Project Boundary
Receivers
Extraction Limit
Processing Area
PY1 - PY10
Noise Level dB LAeq(15min)
35
40
45
50
55
60
0 200 400 600 800 m
N
MAC
PATRICIA FAY DRIVE
HART PLACE
OLD TELEGRAPH ROAD
OLD NORTHERN ROAD
ROBERTS ROAD
HITCHCOCK ROAD
HAERSES ROAD
BLAKERS ROAD
JACKS LANE
WISEMANS FERRY ROAD
R01
R02
R03
R04
R05
R06
R07
ED01
R08
R09
R10
R10-A
R11
R12
C01
R13
R14
R15
C02
R16
R17
R18
R19
R20
R20A
R21
R22
R23
R24
R25
R26
R27
R28
R29
C03
R30
R30A
R31
R32
R33
R34
R35
R36
R37
R37A
FR01
FR02
FR03
FR04
FR05
FR06
FR07
FR08
FR09
FR10
I01
I02
I03
I04
I05
I06

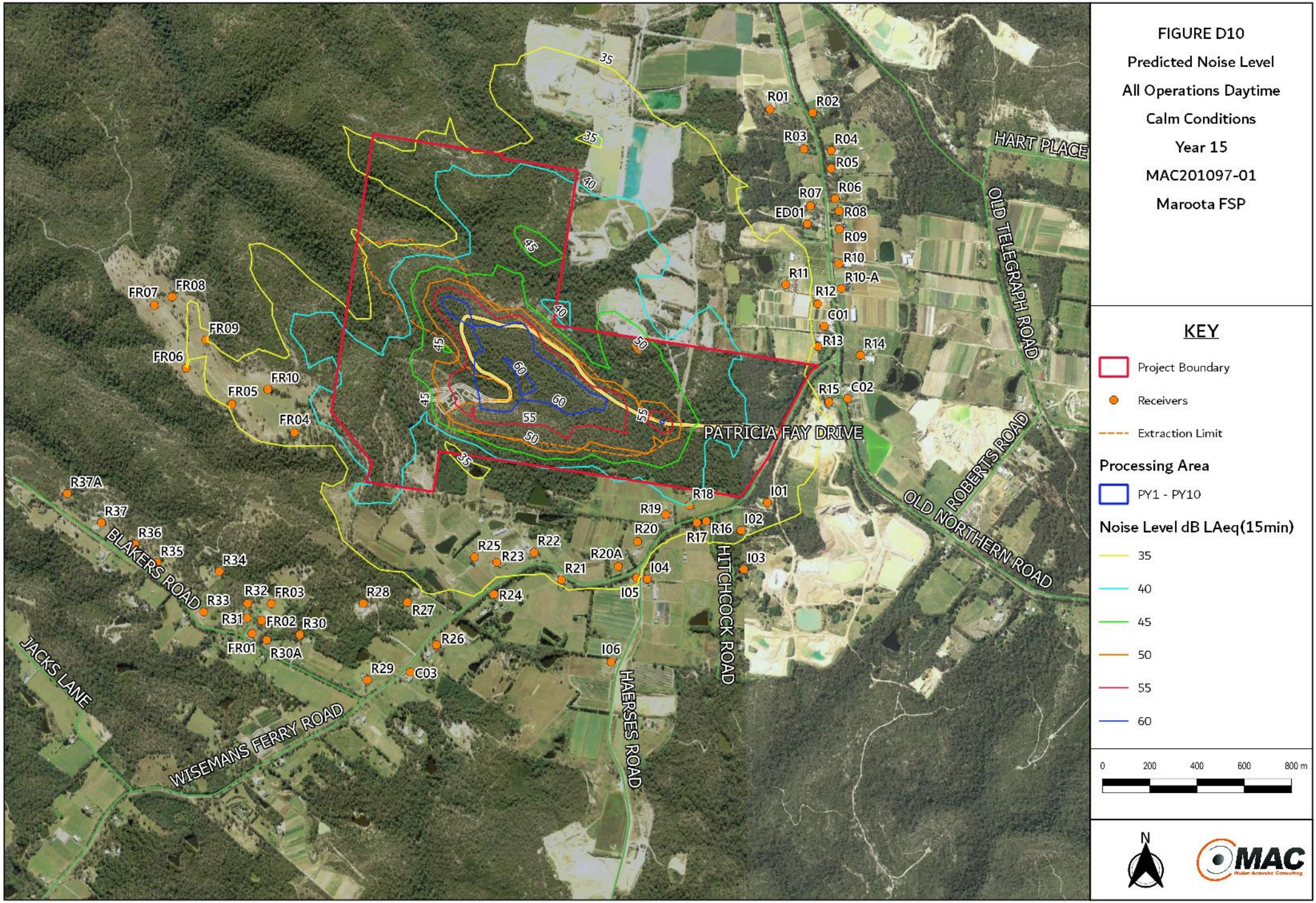
FIGURE D10
Predicted Noise Level
All Operations Daytime
Calm Conditions
Year 15
MAC201097-01
Maroota FSP
KEY
Project Boundary
Receivers
Extraction Limit
Processing Area
PY1 - PY10
Noise Level dB LAeq(15min)
35
40
45
50
55
60
0
200
400
600
800 m
N
MAC
HART PLACE
OLD TELEGRAPH ROAD
PATRICIA FAY DRIVE
ROBERTS ROAD
OLD NORTHERN ROAD
HITCHCOCK ROAD
HAERSES ROAD
BLAKERS ROAD
JACKS LANE
WISEMANS FERRY ROAD
R01
R02
R03
R04
R05
R06
R07
ED01
R08
R09
R10
R10-A
R11
R12
C01
R13
R14
R15
C02
R16
R17
R18
I01
I02
I03
I04
I05
I06
R19
R20
R20A
R21
R22
R23
R24
R25
R26
R27
R28
R29
C03
R30
R30A
R31
R32
R33
R34
R35
R36
R37
R37A
FR01
FR02
FR03
FR04
FR05
FR06
FR07
FR08
FR09
FR10

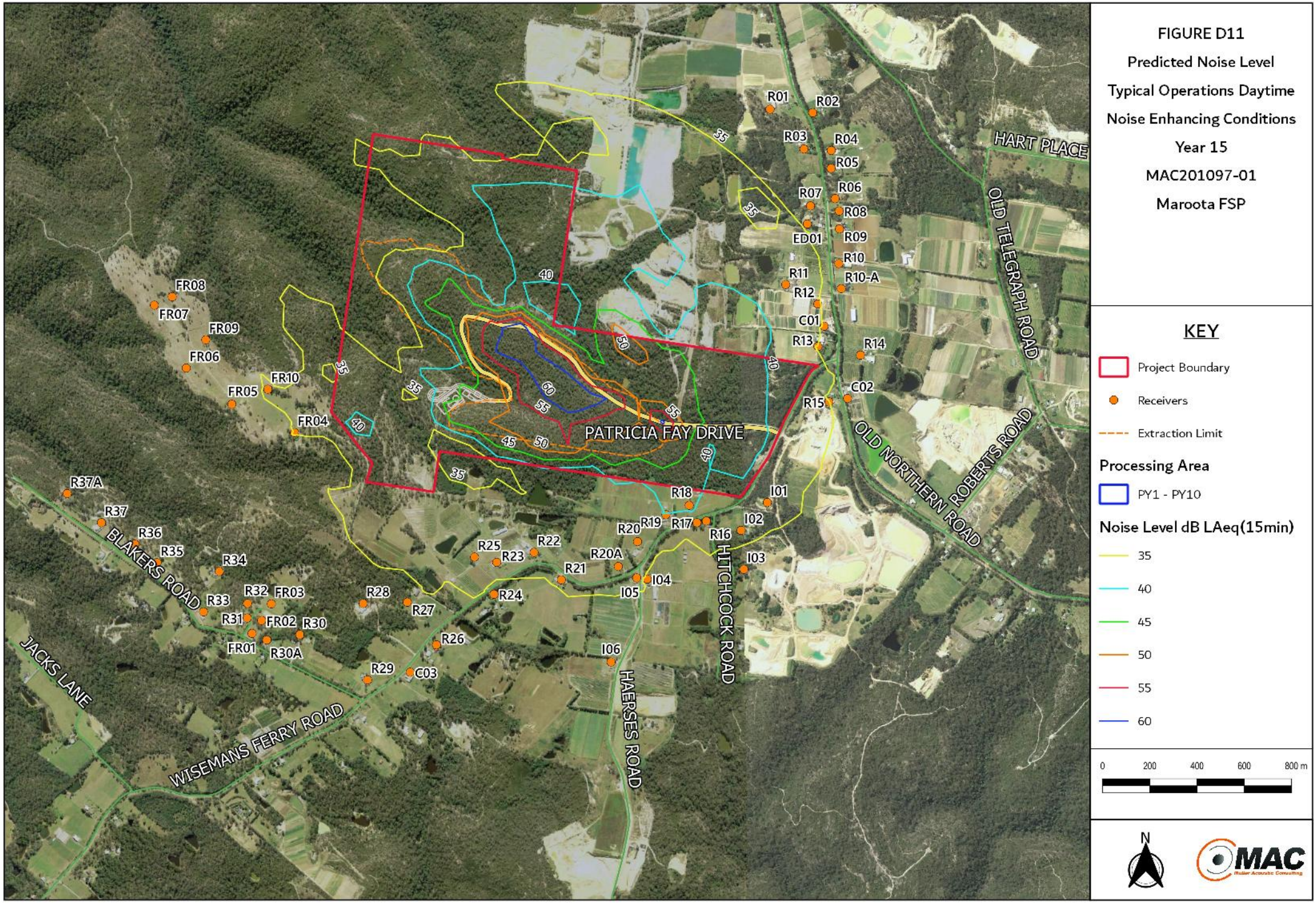
FIGURE D11
Predicted Noise Level
Typical Operations Daytime
Noise Enhancing Conditions
Year 15
MAC201097-01
Maroota FSP
KEY
Project Boundary
Receivers
Extraction Limit
Processing Area
PY1 - PY10
Noise Level dB LAeq(15min)
35
40
45
50
55
60
0
200
400
600
800 m
N
MAC
PATRICIA FAY DRIVE
HART PLACE
OLD TELEGRAPH ROAD
OLD NORTHERN ROAD
ROBERTS ROAD
HITCHCOCK ROAD
HAERSES ROAD
BLAKERS ROAD
JACKS LANE
WISEMANS FERRY ROAD
R01
R02
R03
R04
R05
R06
R07
R08
R09
R10
R10-A
R11
R12
R13
R14
R15
R16
R17
R18
R19
R20
R20A
R21
R22
R23
R24
R25
R26
R27
R28
R29
R30
R30A
R31
R32
R33
R34
R35
R36
R37
R37A
ED01
C01
C02
C03
I01
I02
I03
I04
I05
I06
FR01
FR02
FR03
FR04
FR05
FR06
FR07
FR08
FR09
FR10

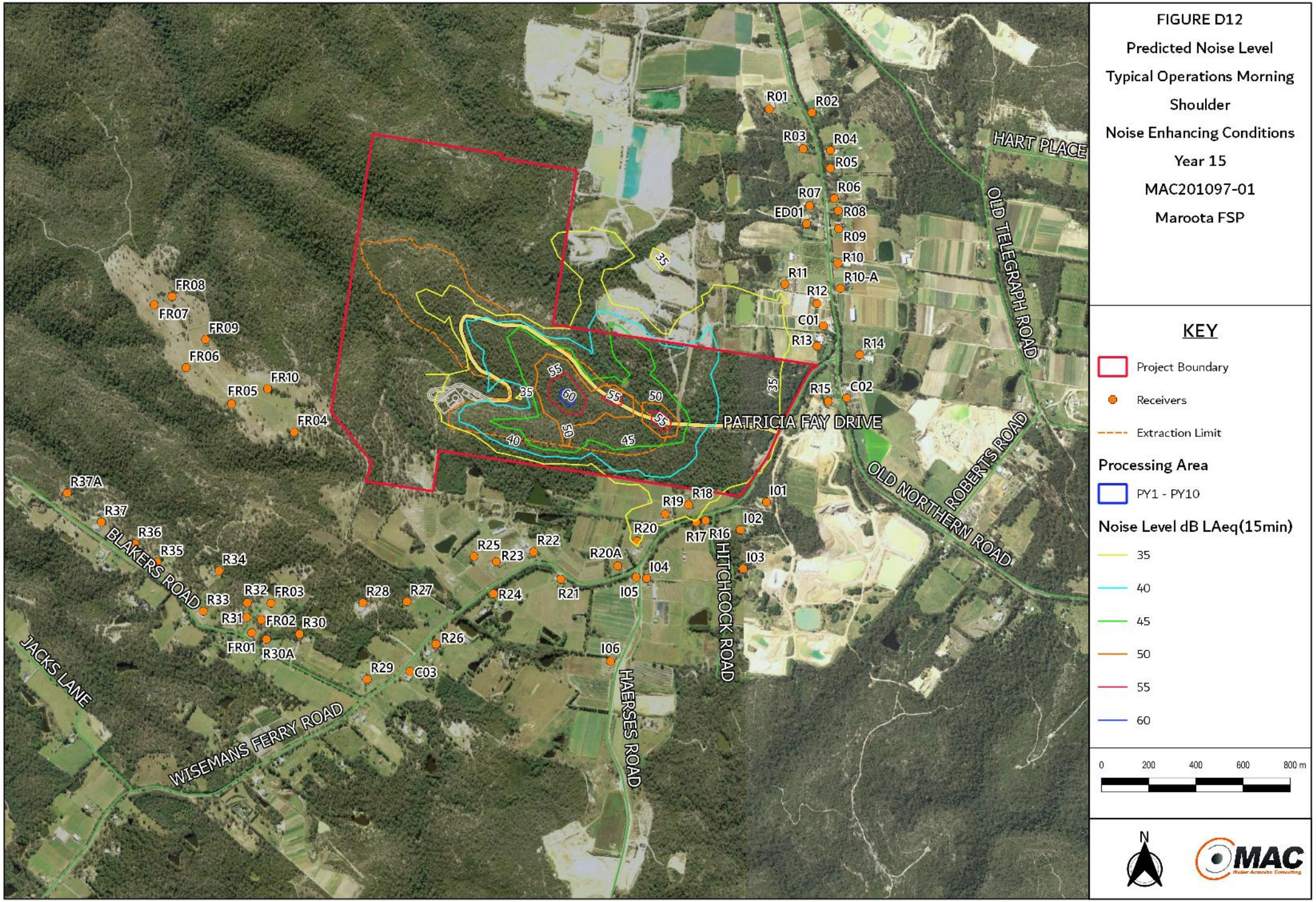
FIGURE D12
Predicted Noise Level
Typical Operations Morning Shoulder
Noise Enhancing Conditions
Year 15
MAC201097-01
Maroota FSP
KEY
Project Boundary
Receivers
Extraction Limit
Processing Area
PY1 - PY10
Noise Level dB LAeq(15min)
35
40
45
50
55
60
0 200 400 600 800 m
N
MAC
PATRICIA FAY DRIVE
HART PLACE
OLD TELEGRAPH ROAD
OLD NORTHERN ROAD
ROBERTS ROAD
HITCHCOCK ROAD
HAERSES ROAD
BLAKERS ROAD
JACKS LANE
WISEMANS FERRY ROAD
R01
R02
R03
R04
R05
R06
R07
R08
ED01
R09
R10
R10-A
R11
R12
C01
R13
R14
R15
C02
R16
R17
R18
R19
R20
R20A
R21
R22
R23
R24
R25
R26
R27
R28
R29
R30
R30A
R31
R32
R33
R34
R35
R36
R37
R37A
FR01
FR02
FR03
FR04
FR05
FR06
FR07
FR08
FR09
FR10
C03
I01
I02
I03
I04
I05
I06

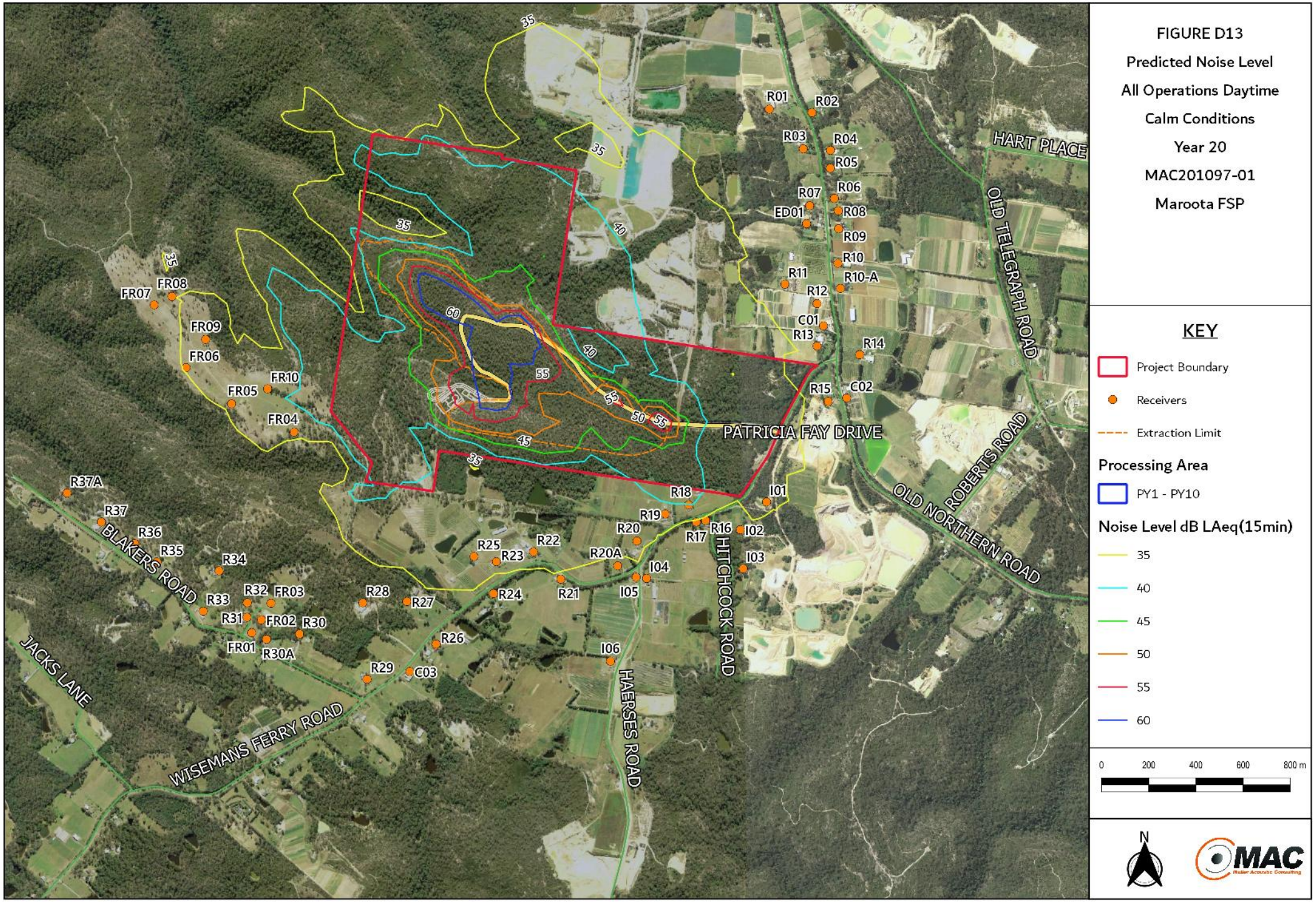
FIGURE D13
Predicted Noise Level
All Operations Daytime
Calm Conditions
Year 20
MAC201097-01
Maroota FSP
KEY
Project Boundary
Receivers
Extraction Limit
Processing Area
PY1 - PY10
Noise Level dB LAeq(15min)
35
40
45
50
55
60
0
200
400
600
800 m
N
MAC
HART PLACE
OLD TELEGRAPH ROAD
PATRICIA FAY DRIVE
ROBERTS ROAD
OLD NORTHERN ROAD
HITCHCOCK ROAD
HAERSES ROAD
BLAKERS ROAD
JACKS LANE
WISEMANS FERRY ROAD
R01
R02
R03
R04
R05
R06
R07
ED01
R08
R09
R10
R10-A
R11
R12
C01
R13
R14
R15
C02
R16
R17
R18
I01
I02
I03
R19
R20
R20A
I04
I05
R21
R22
R23
R24
R25
R26
I06
R27
R28
R29
C03
R30
R30A
FR01
R31
FR02
R32
FR03
R33
R34
R35
R36
R37
R37A
FR04
FR05
FR10
FR06
FR09
FR07
FR08

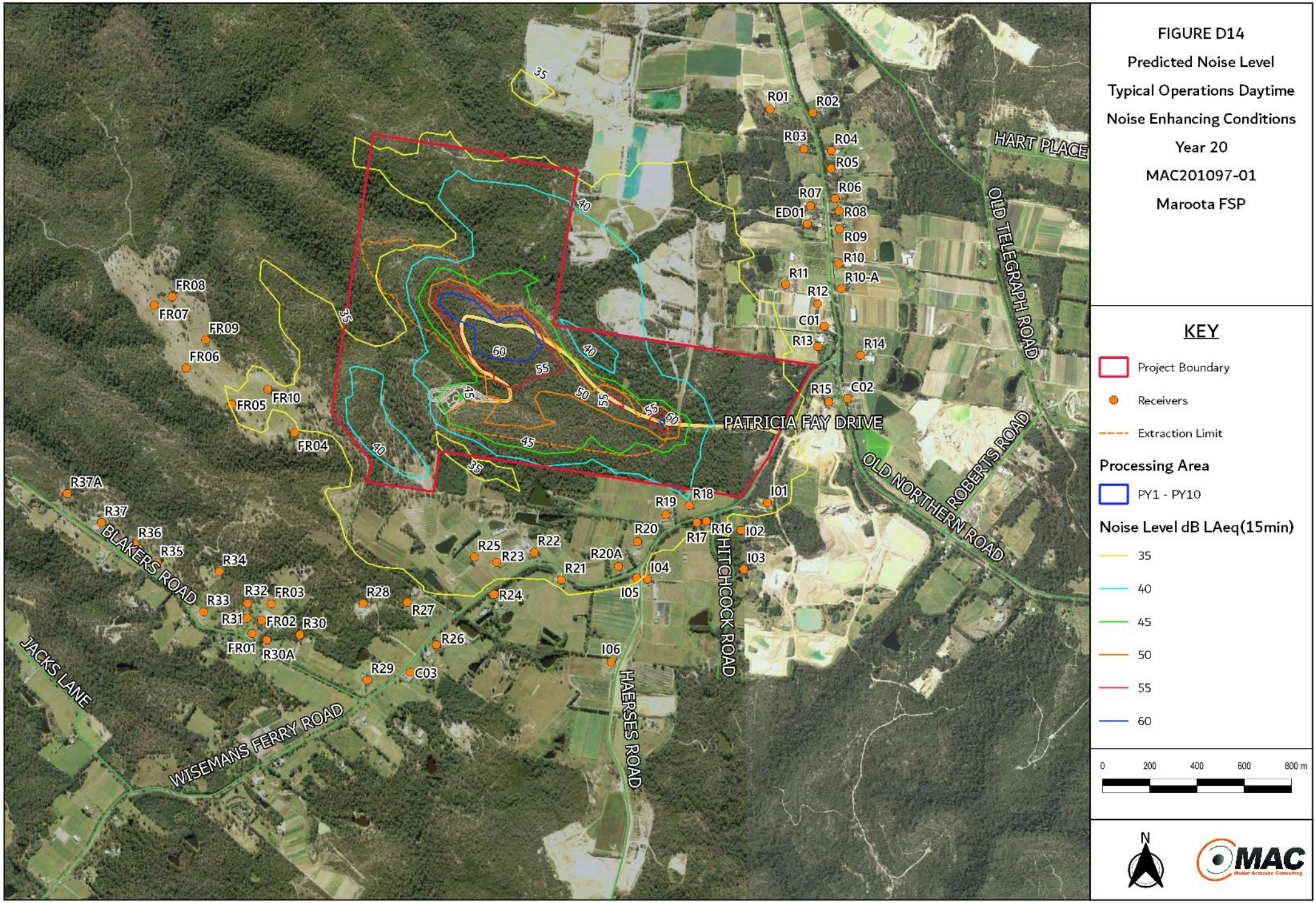
FIGURE D14
Predicted Noise Level
Typical Operations Daytime
Noise Enhancing Conditions
Year 20
MAC201097-01
Maroota FSP
KEY
Project Boundary
Receivers
Extraction Limit
Processing Area
PY1 - PY10
Noise Level dB LAeq(15min)
35
40
45
50
55
60
0
200
400
600
800 m
N
MAC
HART PLACE
OLD TELEGRAPH ROAD
PATRICIA FAY DRIVE
OLD NORTHERN ROAD
ROBERTS ROAD
HITCHCOCK ROAD
HAERSES ROAD
BLAKERS ROAD
JACKS LANE
WISEMANS FERRY ROAD
R01
R02
R03
R04
R05
R06
R07
R08
R09
R10
R10-A
R11
R12
R13
R14
R15
R16
R17
R18
R19
R20
R20A
R21
R22
R23
R24
R25
R26
R27
R28
R29
R30
R30A
R31
R32
R33
R34
R35
R36
R37
R37A
ED01
C01
C02
C03
FR01
FR02
FR03
FR04
FR05
FR06
FR07
FR08
FR09
FR10
I01
I02
I03
I04
I05
I06

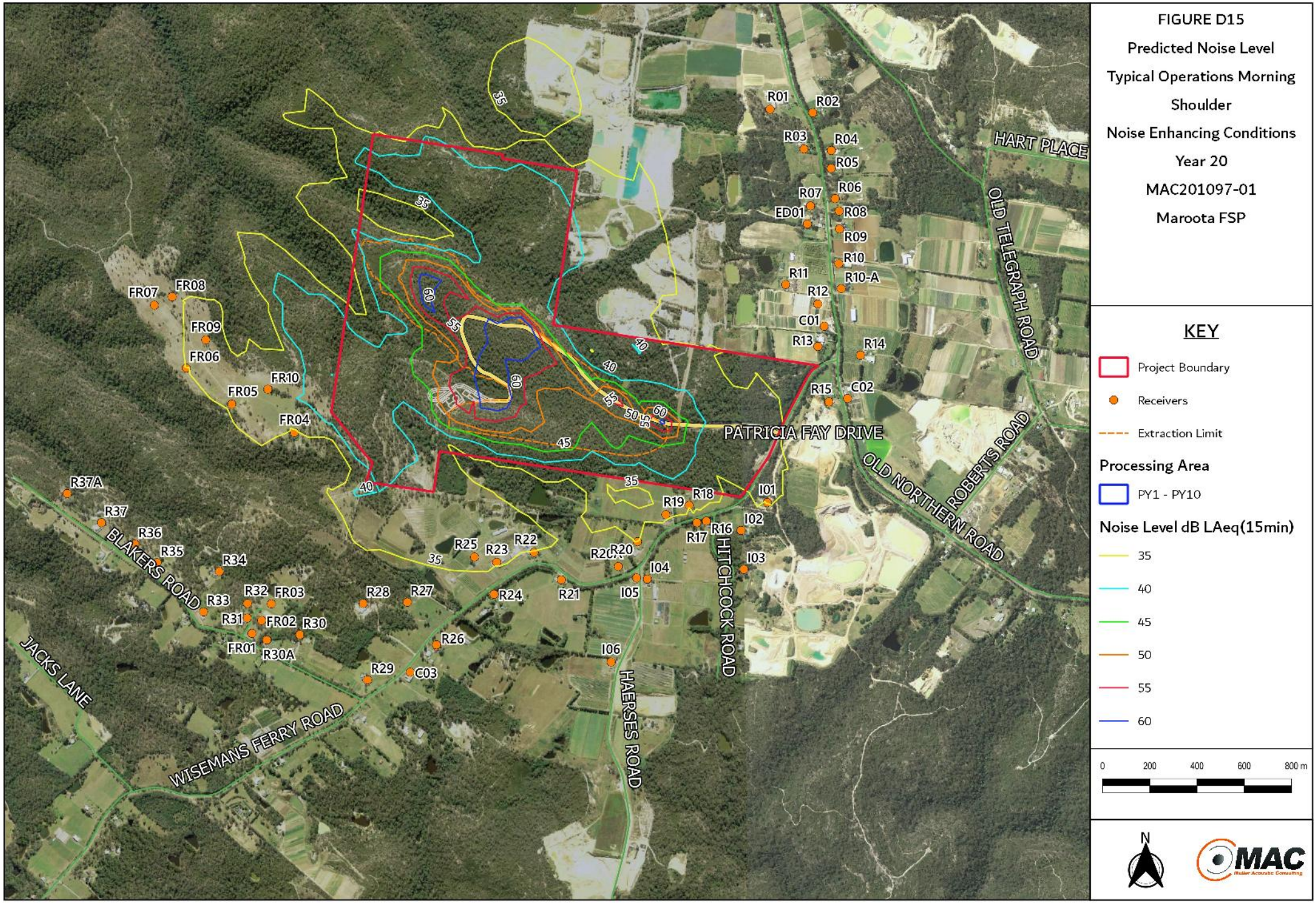
FIGURE D15
Predicted Noise Level
Typical Operations Morning Shoulder
Noise Enhancing Conditions
Year 20
MAC201097-01
Maroota FSP
KEY
Project Boundary
Receivers
Extraction Limit
Processing Area
PY1 - PY10
Noise Level dB LAeq(15min)
35
40
45
50
55
60
0
200
400
600
800 m
N
MAC
HART PLACE
OLD TELEGRAPH ROAD
OLD NORTHERN ROBERTS ROAD
PATRICIA FAY DRIVE
HITCHCOCK ROAD
HAERSES ROAD
BLAKERS ROAD
JACKS LANE
WISEMANS FERRY ROAD
R01
R02
R03
R04
R05
R06
R07
ED01
R08
R09
R10
R10-A
R11
R12
C01
R13
R14
R15
C02
R16
R17
R18
R19
I01
I02
I03
I04
I05
I06
R20
R21
R22
R23
R24
R25
R26
R27
R28
R29
C03
R30
R30A
R31
R32
R33
R34
R35
R36
R37
R37A
FR01
FR02
FR03
FR04
FR05
FR06
FR07
FR08
FR09
FR10

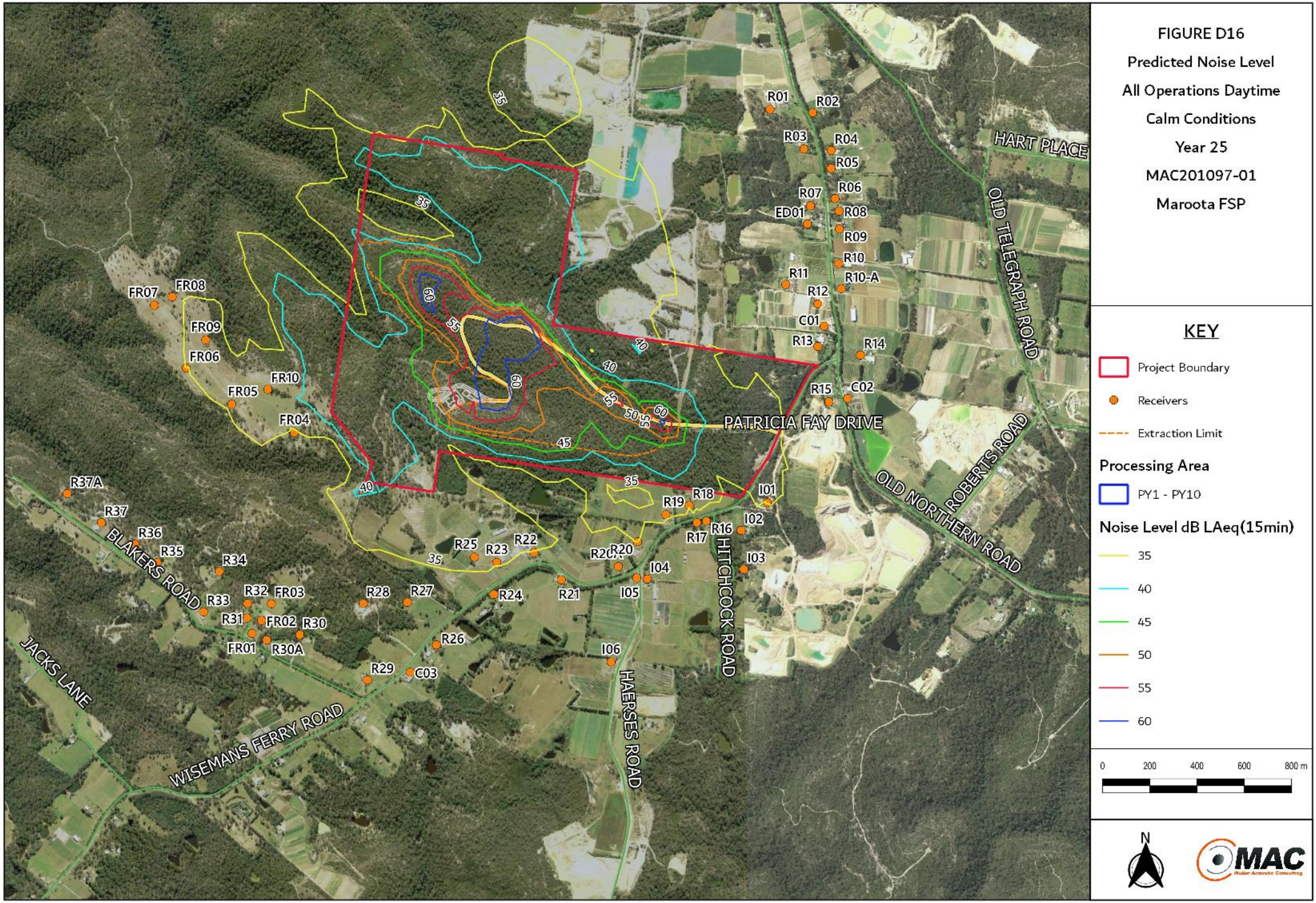
FIGURE D16
Predicted Noise Level
All Operations Daytime
Calm Conditions
Year 25
MAC201097-01
Maroota FSP
KEY
Project Boundary
Receivers
Extraction Limit
Processing Area
PY1 - PY10
Noise Level dB LAeq(15min)
35
40
45
50
55
60
0
200
400
600
800 m
N
MAC
HART PLACE
OLD TELEGRAPH ROAD
PATRICIA FAY DRIVE
ROBERTS ROAD
OLD NORTHERN ROAD
HITCHCOCK ROAD
HAERSES ROAD
BLAKERS ROAD
JACKS LANE
WISEMANS FERRY ROAD
R01
R02
R03
R04
R05
R06
R07
R08
R09
R10
R10-A
R11
R12
R13
R14
R15
R16
R17
R18
R19
R20
R21
R22
R23
R24
R25
R26
R27
R28
R29
R30
R30A
R31
R32
R33
R34
R35
R36
R37
R37A
ED01
C01
C02
C03
I01
I02
I03
I04
I05
I06
FR01
FR02
FR03
FR04
FR05
FR06
FR07
FR08
FR09
FR10

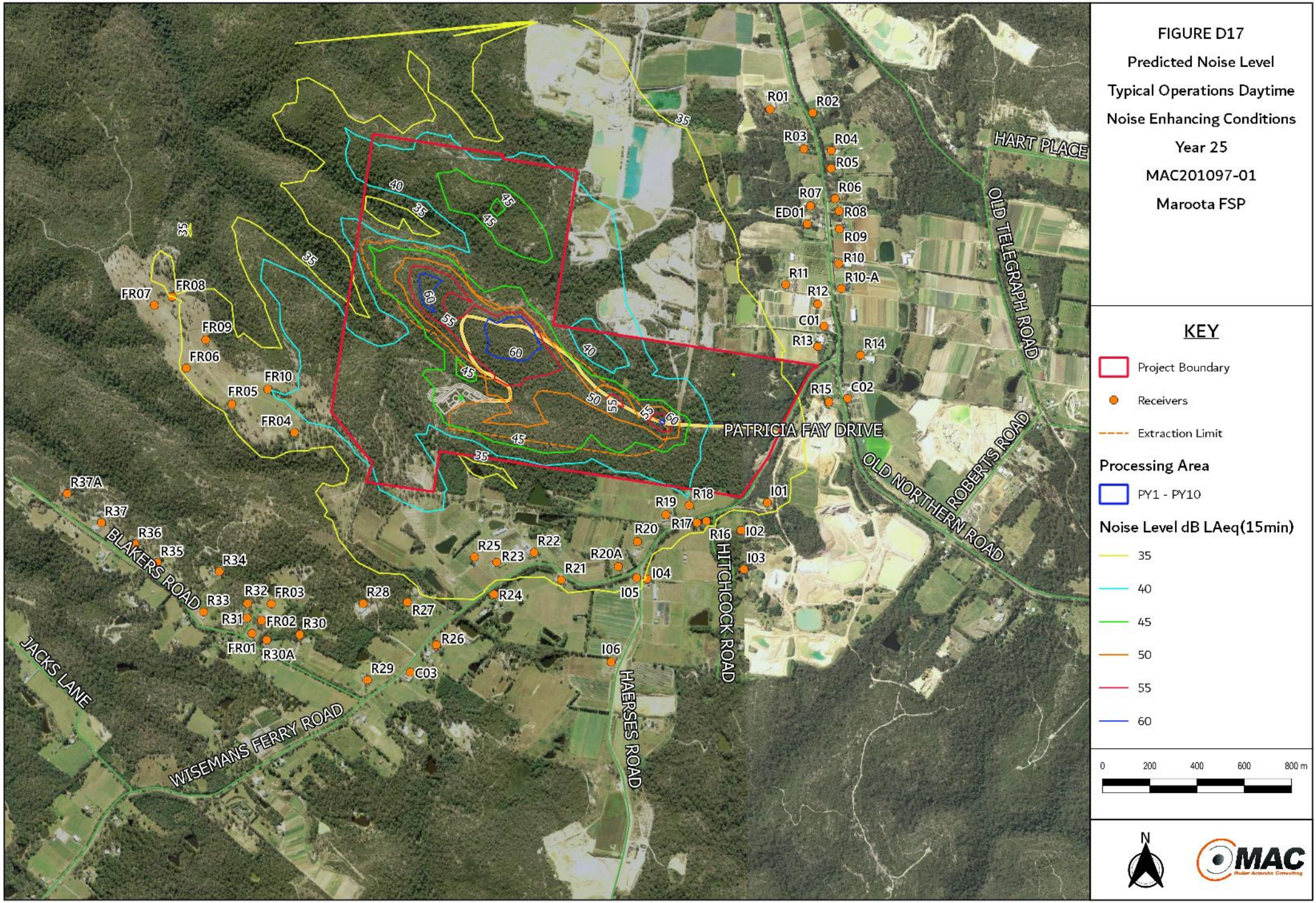
FIGURE D17
Predicted Noise Level
Typical Operations Daytime
Noise Enhancing Conditions
Year 25
MAC201097-01
Maroota FSP
KEY
Project Boundary
Receivers
Extraction Limit
Processing Area
PY1 - PY10
Noise Level dB LAeq(15min)
35
40
45
50
55
60
0
200
400
600
800 m
N
MAC
Muller Acoustic Consulting
HART PLACE
OLD TELEGRAPH ROAD
OLD NORTHERN ROAD
ROBERTS ROAD
PATRICIA FAY DRIVE
HITCHCOCK ROAD
HAERSES ROAD
BLAKERS ROAD
JACKS LANE
WISEMANS FERRY ROAD
R01
R02
R03
R04
R05
R06
R07
R08
R09
R10
R10-A
R11
R12
R13
R14
R15
R16
R17
R18
R19
R20
R20A
R21
R22
R23
R24
R25
R26
R27
R28
R29
R30
R30A
R31
R32
R33
R34
R35
R36
R37
R37A
ED01
C01
C02
C03
I01
I02
I03
I04
I05
I06
FR01
FR02
FR03
FR04
FR05
FR06
FR07
FR08
FR09
FR10

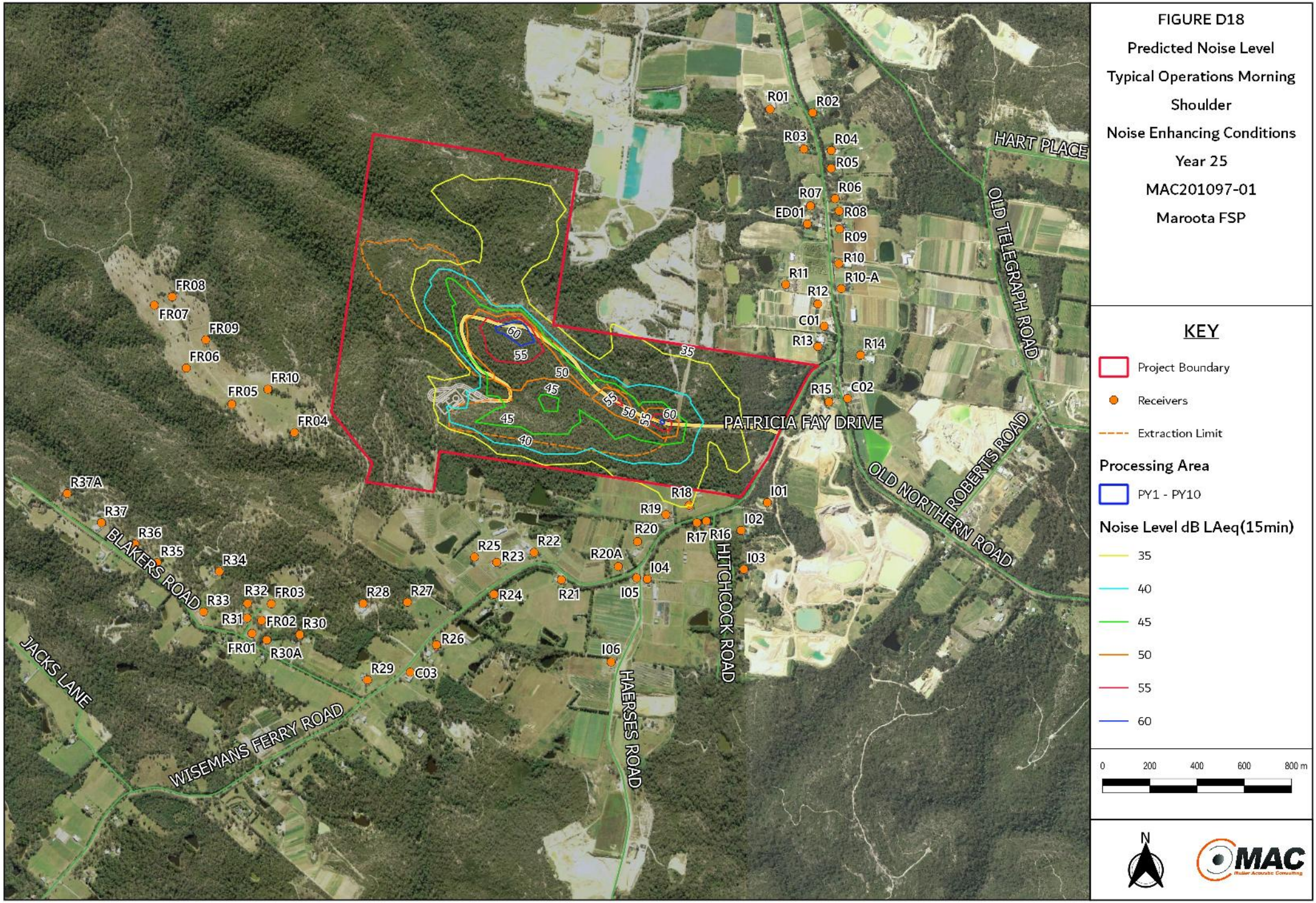
FIGURE D18
Predicted Noise Level
Typical Operations Morning Shoulder
Noise Enhancing Conditions
Year 25
MAC201097-01
Maroota FSP
KEY
Project Boundary
Receivers
Extraction Limit
Processing Area
PY1 - PY10
Noise Level dB LAeq(15min)
35
40
45
50
55
60
0 200 400 600 800 m
N
MAC
PATRICIA FAY DRIVE
HART PLACE
OLD TELEGRAPH ROAD
OLD NORTHERN ROAD
ROBERTS ROAD
HITCHCOCK ROAD
HAERSES ROAD
BLAKERS ROAD
WISEMANS FERRY ROAD
JACKS LANE
R01
R02
R03
R04
R05
R06
R07
R08
ED01
R09
R10
R10-A
R11
R12
C01
R13
R14
R15
C02
R16
R17
R18
R19
R20
R20A
R21
R22
R23
R24
R25
R26
R27
R28
R29
R30
R30A
R31
R32
R33
R34
R35
R36
R37
R37A
FR01
FR02
FR03
FR04
FR05
FR06
FR07
FR08
FR09
FR10
C03
I01
I02
I03
I04
I05
I06

All Operations - Extraction, Processing, Clearing & Mulching (7am-6pm)
Sales (6am-6pm)

PNTL		Year 1			Year 5			Year 10			Year 15			Year 20			Year 25		
Day	MS	Name	Day Calm	MS Calm	Name	Day Calm	MS Calm	Name	Day Calm	MS Calm	Name	Day Calm	MS Calm	Name	Day Calm	MS Calm	Name	Day Calm	MS Calm
63	63	C01	33	26	C01	31	24	C01	34	27	C01	33	27	C01	31	21	C01	28	21
63	63	C02	32	26	C02	31	23	C02	32	24	C02	32	26	C02	30	21	C02	27	21
63	63	C03	34	29	C03	31	26	C03	30	21	C03	31	21	C03	31	23	C03	29	23
43	43	ED01	33	28	ED01	32	24	ED01	35	26	ED01	34	26	ED01	33	24	ED01	31	24
40	35	FR01	32	28	FR01	30	25	FR01	29	19	FR01	30	21	FR01	30	22	FR01	29	22
40	35	FR02	33	28	FR02	31	25	FR02	29	18	FR02	30	21	FR02	31	22	FR02	29	22
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40	35	FR06	37	34	FR06	37	30	FR06	35	19	FR06	34	21	FR06	36	24	FR06	35	24
40	35	FR07	33	28	FR07	33	24	FR07	30	13	FR07	33	19	FR07	33	22	FR07	32	22
40	35	FR08	34	28	FR08	33	25	FR08	31	12	FR08	33	19	FR08	33	21	FR08	32	21
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40	35	FR10	40	35	FR10	39	31	FR10	37	23	FR10	38	24	FR10	39	27	FR10	39	27
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68	68	I02	37	29	I02	34	26	I02	37	29	I02	35	30	I02	34	28	I02	33	28
68	68	I03	31	22	I03	28	21	I03	30	20	I03	31	22	I03	31	24	I03	29	24
68	68	I04	37	26	I04	31	25	I04	35	27	I04	34	26	I04	33	28	I04	32	28
68	68	I05	39	30	I05	36	27	I05	38	30	I05	35	30	I05	34	28	I05	33	28
68	68	I06	35	28	I06	32	24	I06	33	26	I06	32	25	I06	32	25	I06	30	25
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45	35	R12	34	27	R12	32	24	R12	36	27	R12	34	27	R12	31	21	R12	30	21
45	35	R13	33	27	R13	17	6	R13	35	28	R13	33	28	R13	31	21	R13	29	21
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40	36	R17	37	28	R17	34	28	R17	38	31	R17	37	32	R17	34	29	R17	33	29
40	36	**R18**	39	32	R18	37	29	**R18**	41	34	R18	39	34	R18	38	32	R18	37	32
40	36	**R19**	40	32	R19	37	30	**R19**	42	35	R19	38	34	R19	36	31	R19	35	31
40	36	**R20**	41	31	R20	37	29	**R20**	40	33	R20	37	33	R20	36	30	R20	35	30
40	36	**R20A**	40	31	R20A	36	27	R20A	37	29	R20A	36	30	R20A	34	28	R20A	33	28
40	36	**R21**	39	29	R21	33	27	R21	36	27	R21	36	27	R21	35	28	R21	33	28
40	36	**R22**	41	30	R22	36	28	R22	38	28	R22	37	29	R22	36	30	R22	35	30
40	36	**R23**	41	35	R23	37	32	R23	38	29	R23	37	29	R23	37	29	R23	36	29
40	36	**R24**	37	29	R24	31	26	R24	33	23	R24	33	22	R24	33	25	R24	31	25
40	36	**R25**	42	36	R25	38	33	R25	38	29	R25	38	29	R25	37	29	R25	36	29
40	36	R26	32	30	R26	30	27	R26	30	19	R26	30	19	R26	31	22	R26	29	22
40	36	R27	36	32	R27	32	29	R27	31	20	R27	32	20	R27	32	23	R27	31	23
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40	35	R37A	31	25	R37A	29	21	R37A	28	17	R37A	28	17	R37A	29	19	R37A	27	19

		All Operations - Extraction, Processing, Clearing & Mulching (7am-6pm) Sales (6am-6pm)																	
PNTL		Year 1			Year 5			Year 10			Year 15			Year 20			Year 25		
Day	MS	Name	Day Calm	MS Calm	Name	Day Calm	MS Calm	Name	Day Calm	MS Calm	Name	Day Calm	MS Calm	Name	Day Calm	MS Calm	Name	Day Calm	MS Calm
63	63	C01	33	26	C01	31	24	C01	34	27	C01	33	27	C01	31	21	C01	28	21
63	63	C02	32	26	C02	31	23	C02	32	24	C02	32	26	C02	30	21	C02	27	21
63	63	C03	34	29	C03	31	26	C03	30	21	C03	31	21	C03	31	23	C03	29	23
43	43	ED01	33	28	ED01	32	24	ED01	35	26	ED01	34	26	ED01	33	24	ED01	31	24
40	35	FR01	32	28	FR01	30	25	FR01	29	19	FR01	30	21	FR01	30	22	FR01	29	22
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40	35	FR03	31	28	FR03	30	25	FR03	29	16	FR03	30	19	FR03	30	21	FR03	29	21
40	35	FR04	39	34	FR04	37	31	FR04	34	21	FR04	36	25	FR04	36	25	FR04	35	25
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40	35	FR07	33	28	FR07	33	24	FR07	30	13	FR07	33	19	FR07	33	22	FR07	32	22
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40	35	FR10	40	35	FR10	39	31	FR10	37	23	FR10	38	24	FR10	39	27	FR10	39	27
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68	68	I02	37	29	I02	34	26	I02	37	29	I02	35	30	I02	34	28	I02	33	28
68	68	I03	31	22	I03	28	21	I03	30	20	I03	31	22	I03	31	24	I03	29	24
68	68	I04	37	26	I04	31	25	I04	35	27	I04	34	26	I04	33	28	I04	32	28
68	68	I05	39	30	I05	36	27	I05	38	30	I05	35	30	I05	34	28	I05	33	28
68	68	I06	35	28	I06	32	24	I06	33	26	I06	32	25	I06	32	25	I06	30	25
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45	35	R10A	32	25	R10A	30	23	R10A	33	26	R10A	32	26	R10A	30	20	R10A	28	20
45	35	R11	35	29	R11	34	26	R11	37	29	R11	37	32	R11	34	25	R11	32	25
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40	36	**R18**	39	32	R18	37	29	**R18**	41	34	R18	39	34	R18	38	32	R18	37	32
40	36	**R19**	40	32	R19	37	30	**R19**	42	35	R19	38	34	R19	36	31	R19	35	31
40	36	**R20**	41	31	R20	37	29	**R20**	40	33	R20	37	33	R20	36	30	R20	35	30
40	36	**R20A**	40	31	R20A	36	27	R20A	37	29	R20A	36	30	R20A	34	28	R20A	33	28
40	36	**R21**	39	29	R21	33	27	R21	36	27	R21	36	27	R21	35	28	R21	33	28
40	36	**R22**	41	30	R22	36	28	R22	38	28	R22	37	29	R22	36	30	R22	35	30
40	36	**R23**	41	35	R23	37	32	R23	38	29	R23	37	29	R23	37	29	R23	36	29
40	36	**R24**	37	29	R24	31	26	R24	33	23	R24	33	22	R24	33	25	R24	31	25
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