# Noise and Vibration Impact Assessment

## Proposed Dolwendee Quarry - Environmental Impact Statement

Prepared for : KMH Environmental Pty Ltd

23 November 2015

# *Document Information*

## Noise and Vibration Impact Assessment

### Proposed Dolwendee Quarry

**Prepared for:** KMH Environmental Pty Ltd

Level 1, 81 Hunter Street

NEWCASTLE NSW 2300

**Prepared by:** Muller Acoustic Consulting Pty Ltd

PO Box 262, Newcastle NSW 2300

ABN: 36 602 225 132

P: +61 2 4920 1833

www.mulleracoustic.com

| Document ID | Status | Date | Prepared | Signed |
|---|---|---|---|---|
| MAC150135RP1 | Final | 23 November 2015 | Oliver Muller |  |

## Executive Summary

Muller Acoustic Consulting Pty Ltd (MAC) has completed a noise and vibration impact assessment (NVIA) for the proposed Dolwendee Quarry (the 'quarry'). The quarry will be situated at Hollydeen, approximately 6kms northwest of Denman, NSW. The NVIA has been prepared on behalf of KMH Environmental Pty Ltd (KMH) for Upper Hunter Holdings Pty Ltd (UHH). The quarry proposes to extract an average of 250,000 tonnes of sandstone and conglomerate material per annum.

The assessment considered the following noise-related aspects of the quarry:

- operational noise;
- traffic noise generated by the quarry;
- construction noise;
- blast overpressure and vibration; and
- cumulative noise.

The assessment has been undertaken in accordance with the following policies and guidelines:

- Environment Protection Authority (EPA) 2000, NSW Industrial Noise Policy (INP);
- NSW Department of Environment, Climate Change and Water (DECCW) 2011, Road Noise Policy (RNP);
- Department of Environment and Climate Change (DECC) 2009, Interim Construction Noise Guideline (ICNG); and
- Australian and New Zealand Environment Conservation Council (ANZECC) 1990; Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration.

The modelling included an assessment of quarrying operations within proposed extractions areas including, drilling, processing, product loading and transportation. Based on the modelling results, quarry operations are expected to comply with the Project Specific Noise Levels (PSNLs) at all residential receivers considered in this assessment.

The road traffic noise associated with quarry truck movements are expected to comply with relevant RNP criteria and will be negligible compared to existing Golden Highway noise.

Construction works associated with the intersection and quarry haul/access road are expected to satisfy the relevant construction noise criteria at all assessed receivers.

Blasting emissions associated with the project are expected to remain negligible and below relevant criteria at all receivers for blasts adopting an MIC of up to 100kgs.

Operation of the quarry would not increase existing cumulative industrial noise in the Hollydeen catchment, and would remain below the INPs amenity criteria for rural receivers.

CONTENTS

# 1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) has been commissioned by KMH Environmental Pty Ltd (KMH) on behalf of Upper Hunter Holdings Pty Ltd (UHH) to prepare a noise and vibration impact assessment (NVIA) for the proposed quarry (the 'quarry'), to be established at the property "Dolwendee", approximately 6kms northwest of Denman, NSW.

The NVIA was completed to quantify potential acoustic impacts associated with operation of the quarry on the surrounding Hollydeen community and will accompany the Environmental Impact Statement (EIS) that is being prepared for the project. The NVIA has been prepared in accordance with the following policies and guidelines:

- Environment Protection Authority (EPA) 2000, NSW Industrial Noise Policy (INP);
- NSW Department of Environment, Climate Change and Water (DECCW) 2011, Road Noise Policy (RNP);
- Department of Environment and Climate Change (DECC) 2009, Interim Construction Noise Guideline (ICNG); and
- Australian and New Zealand Environment Conservation Council (ANZECC) 1990; Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration.

A glossary of terms, definitions and abbreviations used in this report, along with a list of common noise sources and their typical sound level is provided in Appendix A.

## 1.1 Background

The proposed quarry is to be located on an existing rural property "Dolwendee", 770 Merriwa Road (The Golden Highway) approximately 6kms northwest of Denman NSW. The quarry will extract an average of 250,000 tonnes of sandstone and conglomerate material per annum.

The quarry propose to use a combination of dry rip and blast extraction methods. The excavator used for ripping would also load a mobile crusher at the site of extraction. A front end loader (FEL) will then load processed material to either stockpiles or trucks for transport offsite.

The quarry will operate during daytime hours only from 7am to 6pm, Monday to Friday, 8am to 1pm on Saturdays, with no operations on Sundays or Public Holidays. There are up to eight blast events proposed per year at the quarry.

Some minor construction works are associated with the quarry including, construction of the access/haul road and upgrade of the intersection to The Golden Highway.

# 2 Noise Policy and Guidelines

The following section summarises relevant policy and guidelines pertinent to undertaking an industrial noise assessment. Key policies relevant to the quarry include the INP, RNP, ICNG and the ANZECC guidelines for blasting.

## 2.1 Industrial Noise policy

The EPA released the NSW INP in January 2000. The INP provides a process for establishing noise criteria for consents and licences enabling the EPA to regulate noise emissions from scheduled premises under the Protection of the Environment Operations Act 1997.

The specific policy objectives of the INP are:

- to establish noise criteria that would protect the community from excessive intrusive noise and preserve amenity for specific land uses;
- to use the criteria as the basis for deriving project specific noise levels;
- to promote uniform methods to predict, quantify and assess noise impacts, including a procedure for evaluating meteorological effects;
- to outline a range of mitigation measures that could be used to minimise noise impacts;
- to provide a formal process to guide the determination of feasible and reasonable noise limits for consents or licences that reconcile noise impacts with the economic, social and environmental considerations of industrial development; and
- to carry out functions relating to the prevention, minimisation and control of noise from premises scheduled under the Act.

### 2.1.1 Assessing Intrusiveness

The intrusiveness criterion essentially means that the equivalent continuous noise level ($LA_{eq}$) from the project should not be more than 5dB above the existing rating background level (RBL) in any assessment period. Therefore, when assessing intrusiveness, the background noise needs to be measured. Where the RBL is less than 30dBA, a value of 30dBA is used.

### 2.1.2 Assessing Amenity

The amenity assessment is based on noise criteria relevant to a specific land use or locality. The criteria relate only to limiting cumulative or combined levels of industrial noise in a locality. Where existing

industrial noise approaches the criterion value, then noise levels from proposed industries need meet the amenity criteria so that cumulative noise or 'industrial-creep' is minimised. The amenity assessment methodology takes into consideration areas of high traffic noise when assessing ambient industrial noise.

Private residences and other sensitive receivers potentially affected by the quarry are safeguarded by the EPA's amenity categories as presented in Table 2.1 of the INP. Table 2.1 of the INP for residential receivers is reproduced in Table 1.

**Table 1 Receiver Locations – Assessing Amenity**

| Type of Receiver | Indicative Noise Amenity Area | Period | Recommended LAeq(Period) Noise Level, dBA | |
|---|---|---|---|---|
| | | | Acceptable | Recommended Max |
| Residence | Rural | Day | 50 | 55 |
| | | Evening | 45 | 50 |
| | | Night | 40 | 45 |
| | Suburban | Day | 55 | 60 |
| | | Evening | 45 | 50 |
| | | Night | 40 | 45 |
| | Urban | Day | 60 | 65 |
| | | Evening | 50 | 55 |
| | | Night | 45 | 50 |
| | Urban/ Industrial Interface | Day | 65 | 70 |
| | | Evening | 55 | 60 |
| | | Night | 50 | 55 |

Note : Monday – Saturday Daytime 7am to 6pm; Evening 6pm to 10pm; Night-time 10pm to 7am. On Sundays and Public Holidays, Daytime 8am to 6pm; Evening 6pm to 10pm; Night-time 10pm-8am.

## 2.2 Road Noise Policy

The road traffic noise criteria are provided in the NSW EPA's Road Noise Policy (RNP) (EPA, 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 4.

## 2.3 Interim Construction Noise Guideline

The assessment and management of noise from construction works is completed using the ICNG. The ICNG is specifically aimed at managing noise from construction works and is used to assist in setting statutory conditions in licences or other regulatory instruments.

The ICNG sets out procedures to identify and address the impacts of construction noise on residences and other sensitive land uses.

### 2.3.1 Standard Hours for Construction

Table 2 summaries the ICNG recommended standard hours for construction activities where the noise from construction is audible at residential premises.

**Table 2 Recommended Standard Hours for Construction**

| Daytime | Preferred 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.

### 2.3.2 Construction Noise Management Levels

Table 3 reproduces the ICNG management levels for residential receivers. The construction noise criteria is the sum of the management level and relevant rating background level (RBL) for each specific assessment period.

| Table 3 ICNG Residential Management Levels | | |
|---|---|---|
| Time of day | Management level LAeq (15-minute) | 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.[1] | The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured LAeq(15 min) 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 works 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 works near schools), or mid-morning or mid-afternoon for works near residences. -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 works 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 5 dBA 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.

## 2.4 Blasting Guideline

The limits adopted by EPA for blasting are provided in the Australian and New Zealand Environment Conservation Council (ANZECC) - Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration. Blasting criteria relevant to this assessment are presented in detail in Section 4.

## 2.5 Cumulative Noise

Cumulative noise is assessed against the INP amenity criteria and is summarised in Section 4.

# 3 Existing Environment

## 3.1 Receiver Review

The quarry is located in a rural area on the northern side of The Golden Highway, Hollydeen NSW. Receivers in the locality surrounding the quarry are primarily rural/residential. Figure 1 provides a locality plan identifying the position of receivers in relation to the quarry. The receiver addresses, MGA(56) coordinates and approximate distance to the project are summarised in Table 4.

**Table 4 Receiver Locations**

| Receivers | Easting | Northing | Approximate Distance to Quarry (m)[1] |
|---|---|---|---|
| R1 | 279421 | 6423256 | 2,440 |
| R2 | 280139 | 6423694 | 3,200 |
| R3 | 280488 | 6424290 | 3,885 |
| R4 | 279611 | 6424217 | 3,420 |
| R5 | 279126 | 6424418 | 3,465 |
| R6 | 278278 | 6425589 | 4,555 |
| R7 | 278357 | 6424355 | 3,320 |
| R8 | 277982 | 6423715 | 2,700 |
| R9 | 276868 | 6423293 | 2,730 |
| R10 | 276970 | 6422365 | 1,985 |
| R11 | 275686 | 6421686 | 2,855 |
| R12 | 276037 | 6420447 | 2,100 |
| R13 | 275984 | 6420889 | 3,445 |
| R14 | 276187 | 6420326 | 2,335 |
| R15 | 277180 | 6420743 | 1,285 |
| R16[2] | 278445 | 6419804 | 1,240 |
| R17 | 277259 | 6419827 | 1,690 |
| R18 | 278139 | 6419516 | 1,560 |
| R19 | 278282 | 6419219 | 1,830 |
| R20 | 278711 | 6419410 | 1,645 |
| R21 | 279077 | 6419035 | 2,100 |
| R22 | 279363 | 6419207 | 2,050 |

Note 1 : Distance measured from residence to approximate pit centre at x: 278415, y : 6421045.

Note 2 : Owned by the proponent.

## 3.2 Background Noise Environment

### 3.2.1 Unattended Noise Monitoring

To quantify the existing background noise environment of the area, unattended noise logging was conducted at two locations adjacent to The Golden Highway and Reedy Creek Road within the site property boundary. The locations were selected to represent noise levels in two noise catchments primarily controlled by ambient traffic noise. Logger 1 is considered representative of receivers situated to the south in close proximity to The Golden Highway. Logger 2 is considered representative of receivers situated to the west and north of the project site. The selected monitoring locations are shown in Figure 1.

The unattended noise survey was conducted in general accordance with the procedures described in Australian Standard AS 1055-1997, "Acoustics - Description and Measurement of Environmental Noise".

The measurements were carried out using Svantek Type 1, 977 noise analysers from Monday 4 May 2015 to Wednesday 13 May 2015. Observations on-site identified the surrounding locality was typical of a rural environment, with wind, birds and intermittent traffic noise audible. Calibration of all instrumentation was checked prior to and following measurements. Drift in calibration did not exceed ±0.5 dBA. 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 Chapter 3 of the INP. The results of long-term unattended noise monitoring are provided in Table 5. The noise monitoring charts for the background logging assessment are provided in Appendix B.

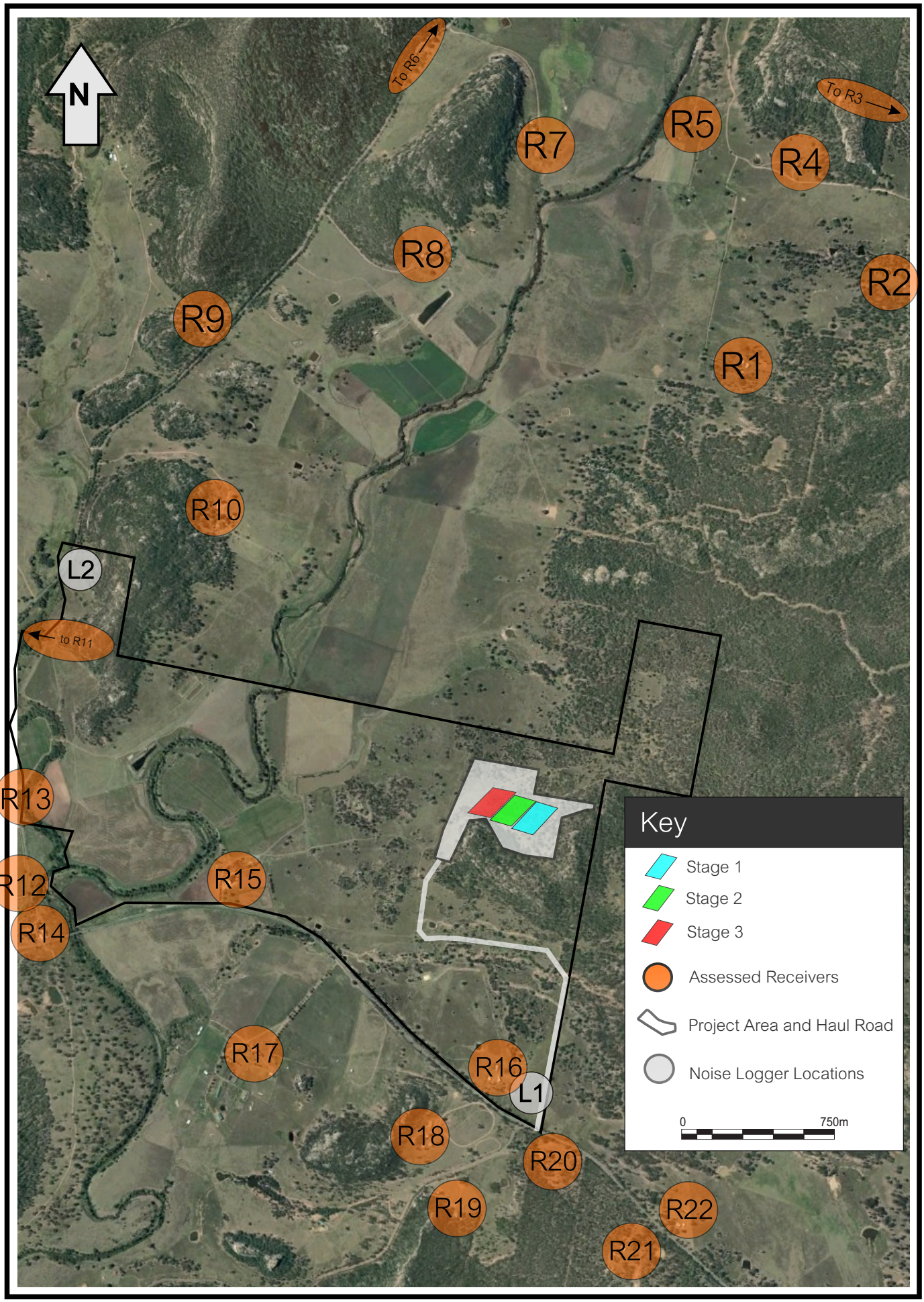



Figure 1 - Locality plan

Dolwendee Quarry

MAC
Muller Acoustic Consulting

| Table 5 Background Noise Monitoring Summary | | | |
|---|---|---|---|
| Catchment and Representative Receivers | Period[1] | Measured Background Noise Level (LA90), RBL, dBA | Measured LAeq, dBA |
| L1 (R14 to R22) | Day | 42 | 57 |
| | Evening | 26 | 53 |
| | Night | 22 | 53 |
| L2 (R1 to R13) | Day | 29 | 56 |
| | Evening | 25 | 51 |
| | Night | 21 | 49 |

Note 1 : Monday to Saturday: Day 7am to 6pm; Evening 6pm to 10pm; Night 10pm to 7am. On Sundays and Public Holidays, Daytime 8am to 6pm; Evening 6pm to 10pm; Night-time 10pm-8am.

Note : excludes periods of wind or rain affected data, meteorological data obtained from the Bureau of Meteorology Scone Meteorology Station (BOM #061363).

To gain a better understanding of the existing noise environment, MAC conducted attended noise monitoring at the unattended locations during calm clear weather conditions. The purpose of the measurements were to ascertain dominant ambient noise sources and to quantify any existing industrial noise contribution. It was noted that no existing industrial (or mining) noise was audible at the monitoring locations.

The results of attended noise measurements and observations are summarised in Table 6.

| Table 6 Operator-Attended Noise Survey Results, 4 May 2015 | | | | | |
|---|---|---|---|---|---|
| Monitoring Location | Time (hrs) | Primary Noise Descriptor (dBA re 20 µPa) | | | Description and SPL, dBA |
| | | LAmax | LA90 | LAeq | |
| L1 | 14:15 | 83 | 33 | 52 | Rural Noise 30 to 35dBA<br>Golden Highway Traffic 38 to 60dBA |
| L2 | 13:45 | 81 | 17 | 51 | Traffic on Reedy Creek Rd 38 to 55dBA<br>Rural Noise 15 to 30dBA |

# 4 Project Specific Noise Criteria

## 4.1 Operational Noise Criteria

The operational noise emission criteria for the quarry have been set in accordance with Section 4.0 of the INP. The intrusiveness and amenity design criteria have been set, based on logging measurements conducted at catchments representative of surrounding receivers to the project site. The Project Specific Noise Levels (PSNLs) (project criteria) is the lower of the intrusive or amenity criteria. It is noted that only the daytime assessment period is relevant to this assessment as quarry operations will be limited to the daytime only.

The background noise levels for setting the intrusiveness criteria have been determined in the absence of any noise from the proposed quarry site. The existing LAeq in the area surrounding the site is dominated by traffic and rural noise sources.

A review of transport noise in accordance with Section 2.2.3 of the INP identified that corrections to the amenity criteria to account for high traffic noise is not applicable, as levels are not more than 10 dB above the recommended acceptable amenity levels. Additionally, as there is no existing industrial noise contribution at representative receivers, no adjustment to the amenity criteria is necessary and the recommended acceptable amenity levels from Table 2.1 of the INP has been adopted as the amenity criteria. The PSNLs for the quarry are presented in Table 7.

It is noted that receivers R17, R18, R19 and R21 are approximately double the distance to the Golden Highway than the L1 monitoring location. As the Golden Highway is the controlling ambient noise source for the area, background noise levels at R17, R18, R19 and R21 are expected to be lower than L1. To account for the potential lower received noise levels at R17, R18, R19 and R21, a 3dB reduction of the L1 RBL has been made. *Technical note : A 3dB reduction is the level attenuation achieved when the distance is doubled from a receiver to a line source (ie road).*

| Table 7 Daytime Project Specific Noise Criteria, dBA $L_{Aeq(15minute)}$ | | | | |
|---|---|---|---|---|
| Receiver | Measured RBL $L_{A90}$, dBA[1] | Intrusiveness Criteria $L_{Aeq(15minute)}$, dBA | Amenity Criterion $L_{Aeq(period)}$, dBA | PSNL |
| R1 | 30 (29) | 35 | 50 | 35 |
| R2 | 30 (29) | 35 | 50 | 35 |
| R3 | 30 (29) | 35 | 50 | 35 |
| R4 | 30 (29) | 35 | 50 | 35 |
| R5 | 30 (29) | 35 | 50 | 35 |
| R6 | 30 (29) | 35 | 50 | 35 |
| R7 | 30 (29) | 35 | 50 | 35 |
| R8 | 30 (29) | 35 | 50 | 35 |
| R9 | 30 (29) | 35 | 50 | 35 |
| R10 | 30 (29) | 35 | 50 | 35 |
| R11 | 30 (29) | 35 | 50 | 35 |
| R12 | 30 (29) | 35 | 50 | 35 |
| R13 | 30 (29) | 35 | 50 | 35 |
| R14 | 42 | 47 | 50 | 47 |
| R15 | 42 | 47 | 50 | 47 |
| R16 | 42 | 47 | 50 | 47 |
| R17 | 39[2] | 44 | 50 | 44 |
| R18 | 39[2] | 44 | 50 | 44 |
| R19 | 39[2] | 44 | 50 | 44 |
| R20 | 42 | 47 | 50 | 47 |
| R21 | 39[2] | 44 | 50 | 44 |
| R22 | 42 | 47 | 50 | 47 |

Note 1 : Where the RBL is lower than 30 dB(A), a RBL of 30 dB(A) is applied, the measured RBL is shown in brackets.

Note 2 : Adjusted down to take into account the additional offset distance to The Golden Highway.

## 4.2 Road Traffic Noise Criteria

The road traffic noise criteria are provided in the NSW EPA's Road Noise Policy (RNP) (2011).

The 'Freeway/arterial/sub-arterial road' category as specified in the RNP was adopted for The Golden Highway (Merriwa Road) and this assessment. Table 8 reproduces the road traffic noise assessment criteria reproduced from the RNP relevant for this road type.

| Table 8 Road Traffic Noise Assessment Criteria for Residential Land Uses | | | |
|---|---|---|---|
| Road category | Type of project/development | Assessment Criteria - dBA | |
| | | Day (7am to 10pm) | Night (10pm to 7am) |
| Freeway/arterial/sub-arterial road | Existing residences affected by additional traffic on existing freeways/sub-arterial/roads generated by land use developments | 60dBA, LAeq(15hour) | 55dBA, LAeq(9hour) |

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 2 dB, which is generally accepted as the threshold of perceptibility to a change in noise level.

### 4.2.1 Relative Increase Criteria

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 9 due to the addition of quarry vehicles on The Golden Highway should be considered for mitigation.

| Table 9 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(15hour) +12 dB (external) | Existing traffic LAeq(9hour)+ 12 dB (external) |

## 4.3 Construction Noise Criteria

The construction noise criteria for this project have been established using results obtained from background monitoring data.

Noise associated with construction activities for extractive industries are often assessed as operational noise, as the emissions from plant and associated equipment are similar. However, construction works away from the quarry area include the haul road construction and intersection upgrade to The Golden Highway. These activities have several differences when compared to extractive activities, including consisting of a short duration of works compared with the proposed quarry life and the construction location is geographically removed from the main extraction area.

Construction activities within the extraction area, while limited, have not been reviewed separately in this assessment, as the noise associated with the processing and quarrying activities are similar to the associated construction emissions for this area.

Proposed construction of the access/haul road and intersection upgrade will be limited to daytime hours (ie. standard hours). Therefore, the criteria have been developed for nearby residential receivers based on standard hours for weekday periods. Table 10 provides a summary of the project construction noise criteria.

**Table 10 Construction Noise Criteria Summary**

| Receiver | Assessment Period | RBL, dBA[1] | Criteria LAeq(15minute) dBA |
|---|---|---|---|
| R1 | Day | 30 (29) | 40 |
| R2 | Day | 30 (29) | 40 |
| R3 | Day | 30 (29) | 40 |
| R4 | Day | 30 (29) | 40 |
| R5 | Day | 30 (29) | 40 |
| R6 | Day | 30 (29) | 40 |
| R7 | Day | 30 (29) | 40 |
| R8 | Day | 30 (29) | 40 |
| R9 | Day | 30 (29) | 40 |
| R10 | Day | 30 (29) | 40 |
| R11 | Day | 30 (29) | 40 |
| R12 | Day | 30 (29) | 40 |
| R13 | Day | 30 (29) | 40 |
| R14 | Day | 42 | 52 |
| R15 | Day | 42 | 52 |
| R16 | Day | 42 | 52 |
| R17 | Day | 39[2] | 49 |
| R18 | Day | 39[2] | 49 |
| R19 | Day | 39[2] | 49 |
| R20 | Day | 42 | 52 |
| R21 | Day | 39[2] | 49 |
| R22 | Day | 42 | 52 |

Note 1 : Where the RBL is lower than 30 dB(A), a RBL of 30 dB(A) is applied, the measured RBL is shown in brackets.

Note 2 : Adjusted down to take into account the additional offset distance to The Golden Highway.

## 4.4 Blasting Criteria

The limits adopted by EPA for blasting are provided in the Australian and New Zealand Environment Conservation Council (ANZECC) - Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration.

The limits address two main effects of blasting:

- airblast noise overpressure; and
- ground vibration.

### 4.4.1 Airblast

The recommended maximum level for airblast is 115 dB linear peak. The level of 115 dB may be exceeded on up to 5 percent of the total number of blasts over 12 months. However, the level should not exceed 120 dB linear peak at any time.

### 4.4.2 Ground Vibration

Peak particle velocity (PPV) from ground vibration should not exceed 5 mm/s for more than 5 percent of the total number of blasts over 12 months. However, the maximum level should not exceed 10 mm/s at any time. The ANZECC blast limits are reproduced in Table 11.

**Table 11 Airblast Overpressure and Ground Vibration Limits**

| Airblast | |
|---|---|
| Overpressure level dB(Linpeak) | Allowable exceedance |
| 115 | 5% of the total number of blasts over 12 months |
| 120 | 0% |
| **Ground vibration** | |
| Peak particle velocity (mm/s) | Allowable exceedance |
| 5 | 5% of the total number of blasts over 12 months |
| 10 | 0% |

## 4.5 Cumulative Noise Criteria

To limit continuing increases in industrial noise within a particular area, ambient industrial noise should not exceed the levels specified in Table 2.1 of the INP. There are several existing industrial sources in the vicinity of Hollydeen, including Mangoola Coal approximately 5km to the northeast of site. Therefore, cumulative operational noise has been considered in this assessment and compared against the INP's

acceptable and recommended maximum amenity criteria levels. The acceptable and maximum amenity criteria levels are reproduced in Table 12.

**Table 12 Receiver Locations**

| Type of Receiver | Indicative Noise Amenity Area | Period | Recommended LAeq(Period) Noise Level, dBA | |
|---|---|---|---|---|
| | | | Acceptable | Recommended Max |
| Residence | Rural | Day | 50 | 55 |
| | | Evening | 45 | 50 |
| | | Night | 40 | 45 |

# 5 Noise Assessment Methodology

## 5.1 Operational Noise Modelling Methodology

A computer model was developed to determine the acoustic impacts of quarry noise emissions to neighbouring receivers for four operational stages.

Brüel and Kjær Predictor Type 7810 (Version 10.01) noise modelling software was used to assess potential noise impacts associated with the quarry. A three-dimensional digital terrain map giving all relevant topographic information was used in the modelling process.

Additionally, the model uses relevant noise source data, ground type, shielding such as barriers and/or adjacent buildings and atmospheric information to predict noise levels at the nearest potentially affected receivers. Plant and equipment were modelled at various locations and heights, representative of realistic operating conditions for assessed scenarios. Appendix C provides modelled plant locations adopted for this assessment.

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'.

## 5.2 Operational Noise Modelling Parameters

The model incorporated three-dimensional digitised ground contours for the quarry, as derived from proposed site plans, proposed barriers and the surrounding land base topography, superimposed on each other. The noise model predicts LAeq 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 Section 4 of the INP have been applied to calculations.

### 5.2.1 Meteorological Analysis

Noise emissions from industry can be significantly affected by prevailing weather conditions. Wind has the potential to increase noise at a receiver when it is light and travels from the direction of the noise source. As the strength of the wind increases the noise produced by the wind will mask the audibility of most industrial sources.

Meteorological conditions that enhance received noise levels include source to receiver winds and the presence of temperature inversions. To account for the potential for enhancements, the INP specifies that the source to the receiver wind component of speeds up to 3 m/s for 30% or more of the time in any seasonal period (ie day, evening or night), is considered to be a feature wind and predictions must incorporate these conditions.

The NSW INP Section 5.3 Wind Effects states:

> *'Wind effects need to be assessed where wind is a feature of the area. Wind is considered to be a feature where source to receiver wind speeds (at 10 m height) of 3 m/s or below occur for 30 percent of the time or more in any assessment period in any season.'*

To determine the prevailing conditions for the quarry, weather data during the period January 2013 to May 2015 was obtained from the Bureau of Meteorology's (BOM) Scone weather station located approximately 35 km north east of Hollydeen, NSW. The data was analysed using the EPA's Noise enhancement wind analysis (NEWA) program in order to determine the frequency of occurrence of winds of speeds up to 3 m/s in each season.

Table 13 summarises the results of the wind analysis and includes the dominant wind direction and percentage occurrence during each season for the daytime assessment period. The results of the detailed analysis of meteorological data is presented in Appendix D.

**Table 13 Seasonal Frequency of Occurrence Wind Speed Intervals - Daytime**

| Period | Wind Direction ±(45°) | % Wind Speeds (m/s) |
|---|---|---|
| | | 0.5 to 3 m/s |
| Summer | NW | 15 |
| Autumn | NW | 16 |
| Winter | SE | 20 |
| Spring | SE | 13 |

Based on the results of this analysis, the relevant meteorological conditions adopted in the noise modelling assessment are summarised in Table 14.

**Table 14 Modelled Site Specific Meteorological Parameters**

| Assessment Condition | Temperature | Wind Speed / Direction | Relative Humidity | Temperature Gradient |
|---|---|---|---|---|
| Daytime - Calm | 20°C | n/a | 60% | n/a |

### 5.2.2 Modelling Scenarios

Four modelling scenarios were adopted in this assessment to represent noise emissions at various stages of the quarry life as the quarry progresses from east to west. The stages are summarised below:

- Stage 1 : Extraction of material from the eastern area of the pit;
- Stage 2 : Initial extraction of material from the centre area of the pit;
- Stage 3 : Initial extraction of material from the western area of the pit; and
- Stage 4 : Extraction and blasting (equivalent to Stage 1 with drill rig).

It is noted that noise modelling has assumed plant to operate at the surface of each stage and therefore provides a worst case assessment of quarry noise levels. Appendix C provides modelled plant locations adopted for this assessment. Figure 1 provides a visual representation of the locality of the stages within the quarry.

### 5.2.3 Sound Power Levels - Operation

Mobile plant noise emission data used in modelling for this assessment were obtained from the MAC noise database for relevant noise sources that are proposed to be used in the quarry. The noise emission levels used in modelling are summarised in Table 15. Appendix E provides the octave sound power data of modelled plant for the operational scenarios.

**Table 15 Equipment Sound Power Levels**

| Item | Sound Power Level (SWL), dBA |
|---|---|
| Mobile Jaw Crusher (x1) | 110 |
| Mobile Cone Crusher (x1) | 113 |
| Mobile Screen (x1) | 106 |
| Excavator (x1) | 111 |
| Loader (x1) | 106 |
| Road Trucks (x3) | 102 |
| Water Truck (x1) | 101 |

| Table 15 Equipment Sound Power Levels | |
|---|---|
| Item | Sound Power Level (SWL), dBA |
| Diesel Generator (x1) | 93 |
| Drill Rig (x1) | 114 |
| Dozer (x1) | 110 |
| Haul Truck (x1) | 108 |

## 5.3 Construction Noise Modelling Parameters

### 5.3.1 Sound Power Levels - Construction

The construction noise emission levels used in modelling are summarised in Table 16. The construction scenario adopted a generic construction fleet representative of plant used in road upgrade activities. Plant items for this assessment were situated in and around the site access gate and along the proposed haul road entry to provide an indicative worst case representation of noise emissions during construction. The construction modelling assessment adopted methodologies consistent with the operational assessment.

| Table 16 Equipment Sound Power Levels | |
|---|---|
| Item | Sound Power Level (SWL), dBA |
| Compactor | 110 |
| Road Trucks ( x 4) | 102 |
| Grader | 108 |
| Backhoe/Small Excavator | 101 |

# 6 Noise Modelling Results and Discussion

## 6.1 Operational Noise Results

Daytime (7am to 6pm) quarry operations include quarrying, processing operations, product loading and transportation. The predicted noise levels at each residential receiver during calm meteorologic conditions for each stage of the quarry are provided in Table 17.

The results of the model (Table 17) show that daytime noise emissions from the quarry for all stages satisfy the PSNL at all residential receivers. Appendix F provides noise contour results for quarry operations.

**Table 17 Daytime Predicted Operational Noise Levels, dBA $L_{Aeq(15minute)}$**

| Receiver | Stage 1 | Stage 2 | Stage 3 | Stage 4 | PSNL |
|---|---|---|---|---|---|
| R1 | 23 | 22 | 22 | 23 | 35 |
| R2 | <20 | <20 | <20 | 20 | 35 |
| R3 | <20 | <20 | <20 | <20 | 35 |
| R4 | <20 | <20 | <20 | <20 | 35 |
| R5 | <20 | <20 | <20 | <20 | 35 |
| R6 | <20 | <20 | <20 | <20 | 35 |
| R7 | 20 | 20 | 20 | 21 | 35 |
| R8 | 23 | 23 | 23 | 24 | 35 |
| R9 | 20 | 21 | 21 | 21 | 35 |
| R10 | 27 | 28 | 29 | 28 | 35 |
| R11 | 22 | 23 | 23 | 23 | 35 |
| R12 | 22 | 24 | 24 | 22 | 35 |
| R13 | 22 | 24 | 25 | 23 | 35 |
| R14 | 22 | 24 | 25 | 23 | 47 |
| R15 | 30 | 31 | 34 | 31 | 47 |
| R16 | 32 | 32 | 32 | 32 | 47 |
| R17 | 26 | 27 | 28 | 27 | 44 |
| R18 | 28 | 27 | 28 | 28 | 44 |
| R19 | 26 | 26 | 26 | 27 | 44 |
| R20 | 30 | 30 | 30 | 30 | 47 |
| R21 | 24 | 24 | 24 | 25 | 44 |
| R22 | 25 | 24 | 24 | 25 | 47 |

## 6.2 Traffic Noise Results

The United States (US) Environment Protection Agency's road traffic calculation method was used to predict the LAeq noise levels from site trucks travelling past receivers along The Golden Highway (Merriwa Road). This method is an internationally accepted theoretical traffic noise prediction model and is ideal for calculating road traffic noise where relatively small traffic flows are encountered.

Product dispatch from the quarry will be up to 30 loads per day (60 movements). For this assessment, it has been conservatively assumed that all 60 truck movements travel along The Golden Highway, in one direction to and from site.

The results of the traffic noise calculations are presented in Table 18 and demonstrate the noise levels from quarry road trucks would remain below the relevant daytime criterion.

**Table 18 Operational Road Traffic Noise Levels – Daytime (7am to 10pm)**

| Distance to Nearest Receiver(m) | Assessment Criterion | Existing Noise – Golden Highway | Additional Site Traffic Noise[2] | Existing + Future Quarry Combined Total |
|---|---|---|---|---|
| | | Day LAeq(15hour), dBA | | |
| 20 | 60 | 63[1] | 43 | 63 |
| 100 | 60 | 56[3] | 37 | 56 |

Note 1: Calculated based on reduced distance to The Golden Highway (3dB for halving of distance against Logger L1 data).

Note 2: Calculated value assuming 60 truck movements per day.

Note 3: Measured data from noise Logger L1.

Existing ambient traffic noise levels for Golden Highway were calculated to be above the daytime criterion. The road noise calculations assume all traffic to and from site would be from one direction on the Golden Highway, therefore, the results should be considered conservative.

The traffic noise contribution from the quarry is predicted to be negligible compared to existing Golden Highway traffic. At the nearest privately owned residences, which are 20m from The Golden Highway, the RNP criterion is predicted to be satisfied. Additionally, existing road traffic noise levels are not increasing by more than 2 dB and satisfy the relative increase noise criterion.

## 6.3 Construction Noise Results

Predicted $L_{Aeq(15minute)}$ noise emissions for construction satisfy relevant construction noise criteria for all assessed receivers. Table 19 presents the results of the construction noise model assessment.

**Table 19 - Daytime Predicted Construction Noise Levels, dBA $L_{Aeq(15minute)}$**

| Receiver | Predicted LAeq(15minute) noise levels, dBA | Criteria LAeq(15minute), dBA |
|---|---|---|
| R1 | <20 | 40 |
| R2 | <20 | 40 |
| R3 | <20 | 40 |
| R4 | <20 | 40 |
| R5 | <20 | 40 |
| R6 | <20 | 40 |
| R7 | <20 | 40 |
| R8 | <20 | 40 |
| R9 | <20 | 40 |
| R10 | <20 | 40 |
| R11 | <20 | 40 |
| R12 | <20 | 40 |
| R13 | <20 | 40 |
| R14 | <20 | 52 |
| R15 | 24 | 52 |
| R16 | 46 | 52 |
| R17 | 24 | 49 |
| R18 | 36 | 49 |
| R19 | 35 | 49 |
| R20 | 45 | 52 |
| R21 | 32 | 49 |
| R22 | 31 | 52 |

## 6.4 Blasting Results

Blasting is proposed for the project up to eight times per year. Airblast overpressure and vibration from blasting has been quantified for the project and is presented in the report 'Dolwendee Blasting for Inclusion in the EIS Report – May 2015' (Peter Bellairs Consulting Pty Ltd, 2015).

Results of the blast calculations identify that adopting an MIC of up to 100kg will satisfy the relevant ANZECC criteria at the nearest residential receivers for both overpressure and vibration.

## 6.5 Cumulative Noise Results

The cumulative noise assessment has reviewed existing industrial noise in the locality surrounding the proposed quarry.

Existing daytime noise levels in the catchment surrounding the quarry identified existing mining noise levels as inaudible. It is reiterated that the daytime attended noise survey at location Logger 2 resulted in an ambient LA90 noise level of 17dBA.

The predicted contribution of quarry noise to the surrounding catchment is generally <35 dBA. Therefore, the overall change to existing industrial noise levels is expected to remain below 35dBA and satisfy the INPs daytime amenity criteria of 50dBA, $LA_{eq(period)}$ for rural receivers.

# 7 Conclusion

MAC has conducted a NVIA of potential impacts from the proposed Dolwendee Quarry located at 770 Merriwa Road (The Golden Highway), Hollydeen, NSW.

The assessment has quantified potential operational noise emissions pertaining to extraction, processing, drilling and dispatch via road trucks. The results of the NVIA demonstrate that operational noise levels comply with the relevant INP criteria for the daytime assessment period.

Additionally, the NVIA demonstrates that the road noise criterion (RNP) will be satisfied at receiver distances of greater than 20m, additionally road noise generated by the project will be insignificant in comparison to existing Golden Highway traffic.

Results identify that noise levels from the proposed construction works are anticipated to satisfy standard hours construction noise criteria at all of the surrounding receivers.

Overpressure and vibration from blasting are predicted (Peter Bellairs Consulting Pty Ltd, 2015) to satisfy the ANZECC criteria for the nearest residential receivers when an MIC of up to 100kgs is used.

Catchments surrounding the quarry are anticipated to have a negligible increase in cumulative industrial noise as a result of the quarry and remain below the INPs amenity criteria.

# 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 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 INP 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 noise associated with a given environment. Typically a composite of sounds from many 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 noise. |
| 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 Linear or decibels Z-weighted. |
| Hertz (Hz) | The measure of frequency of sound wave oscillations per second - 1 oscillation per second equals 1 hertz. |
| LA10 | A noise level which is exceeded 10 % of the time. It is approximately equivalent to the average of maximum noise levels. |
| LA90 | Commonly referred to as the background noise, this is the level exceeded 90 % of the time. |
| LAeq | The summation of noise over a selected period of time. It is the energy average noise from a source, and is the equivalent continuous sound pressure level over a given period. |
| LAmax | The maximum root mean squared (rms) sound pressure level received at the microphone during a measuring interval. |
| RBL | 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 intrusiveness criteria for noise assessment purposes and is the median of the ABL's. |
| Sound power level (LW) | This is a measure of the total power radiated by a source. The sound power of a source is a fundamental location of the source and is independent of the surrounding environment. Or a measure of the energy emitted from a source as sound and is given by :<br>= 10.log10 (W/Wo)<br>Where : W is the sound power in watts and Wo is the sound reference power at 10-12 watts. |

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 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 |

# Appendix B – Noise Logging Data

Measured Ambient Noise Levels

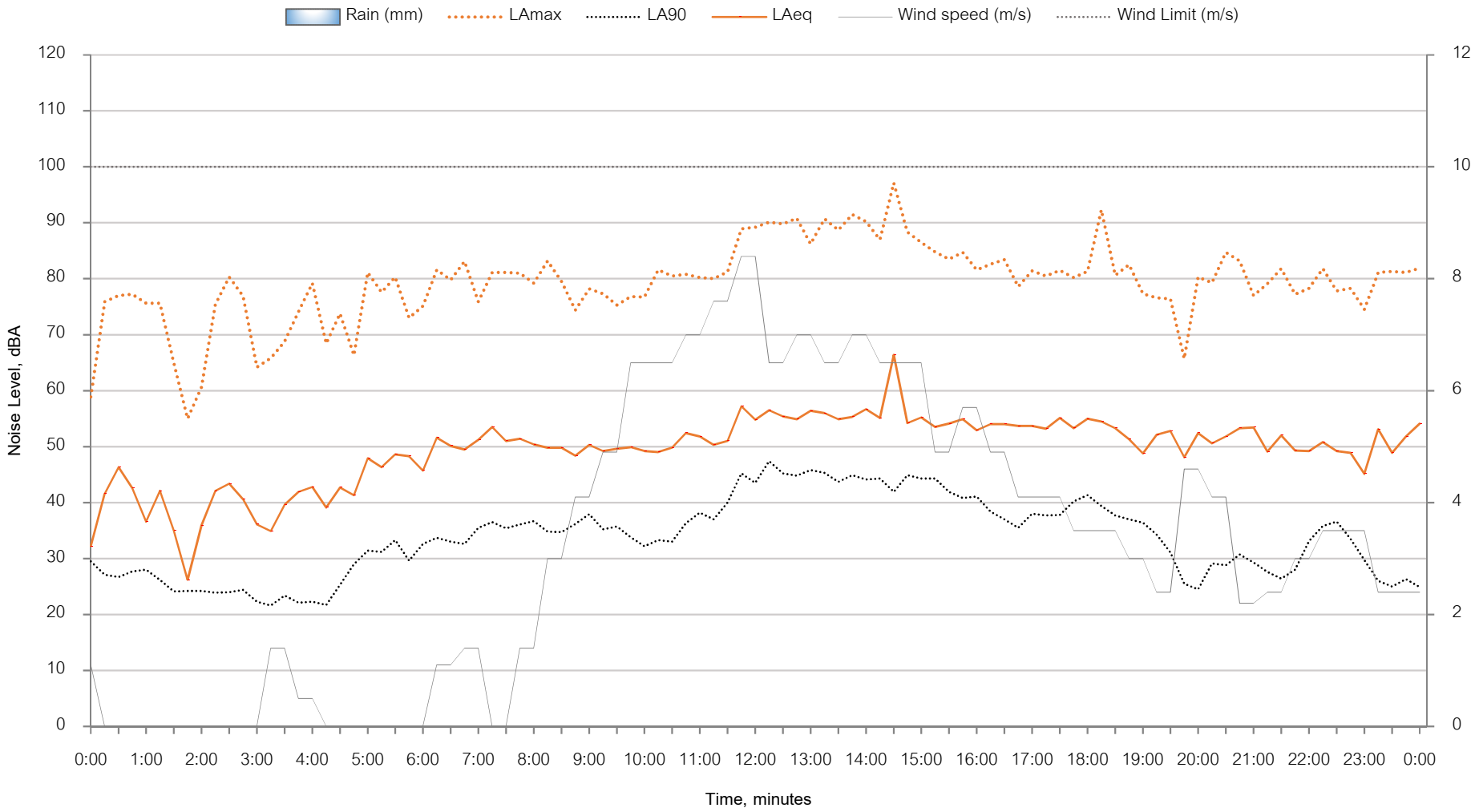
Location 1 - Golden Highway

Monday, 04-05-15

Measured Ambient Noise Levels

Location 1 - Golden Highway

Tuesday, 05-05-15



Measured Ambient Noise Levels

Location 1 - Golden Highway

Wednesday, 06-05-15

Measured Ambient Noise Levels

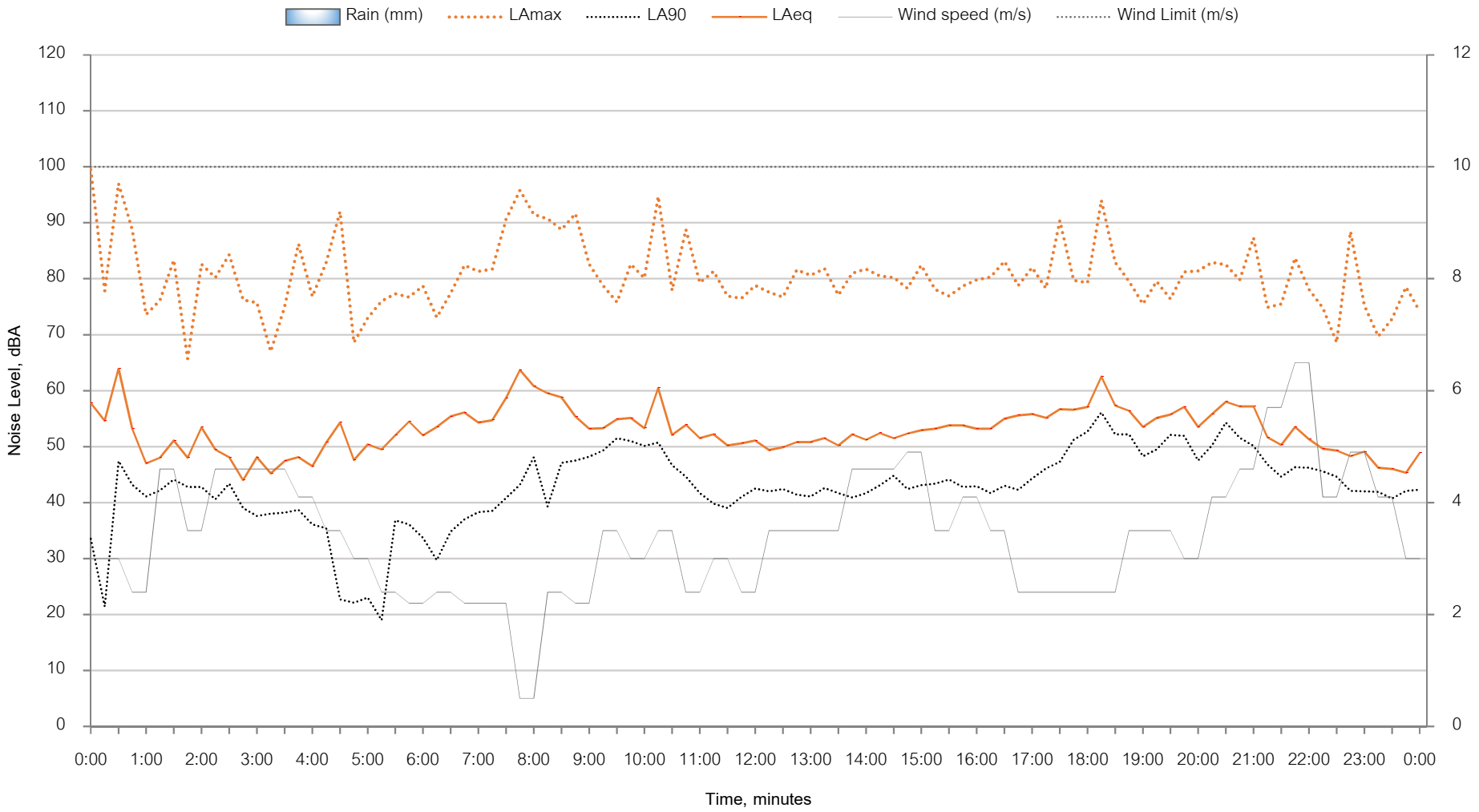
Location 1 - Golden Highway

Thursday, 07-05-15

Measured Ambient Noise Levels

Location 1 - Golden Highway

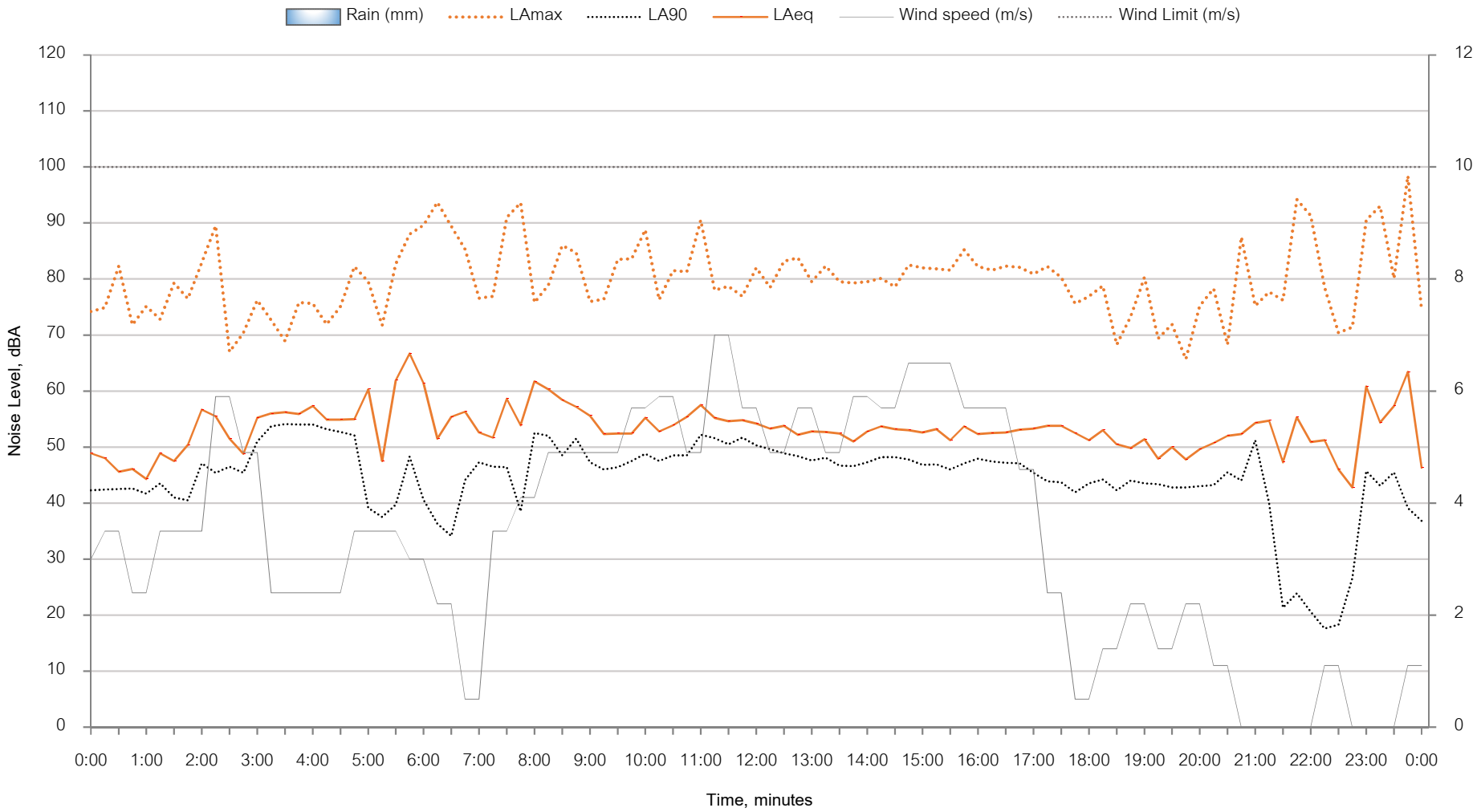
Friday, 08-05-15



Measured Ambient Noise Levels

Location 1 - Golden Highway

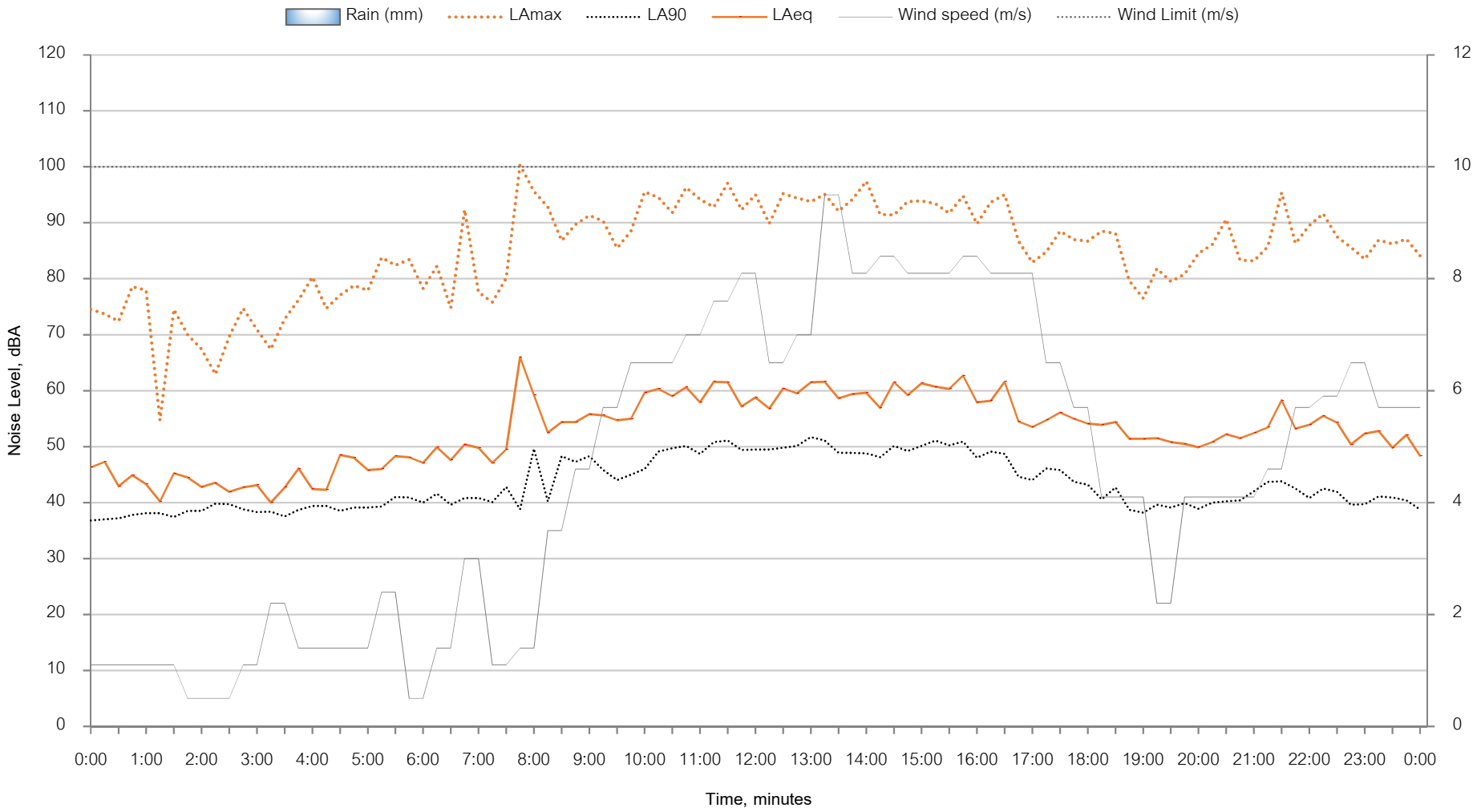
Saturday, 09-05-15



Measured Ambient Noise Levels

Location 1 - Golden Highway

Sunday, 10-05-15



Measured Ambient Noise Levels

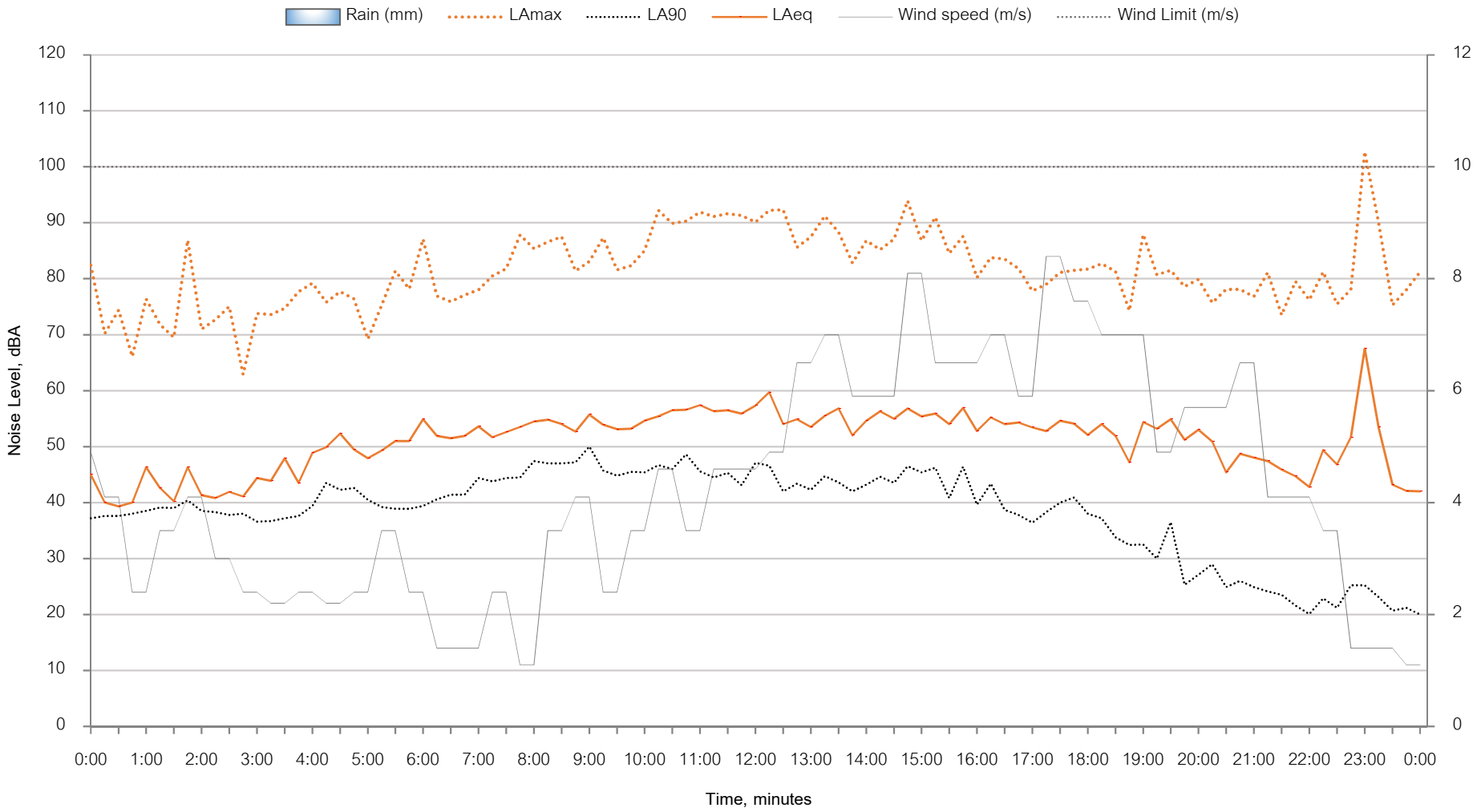
Location 1 - Golden Highway

Monday, 11-05-15

Measured Ambient Noise Levels

Location 1 - Golden Highway

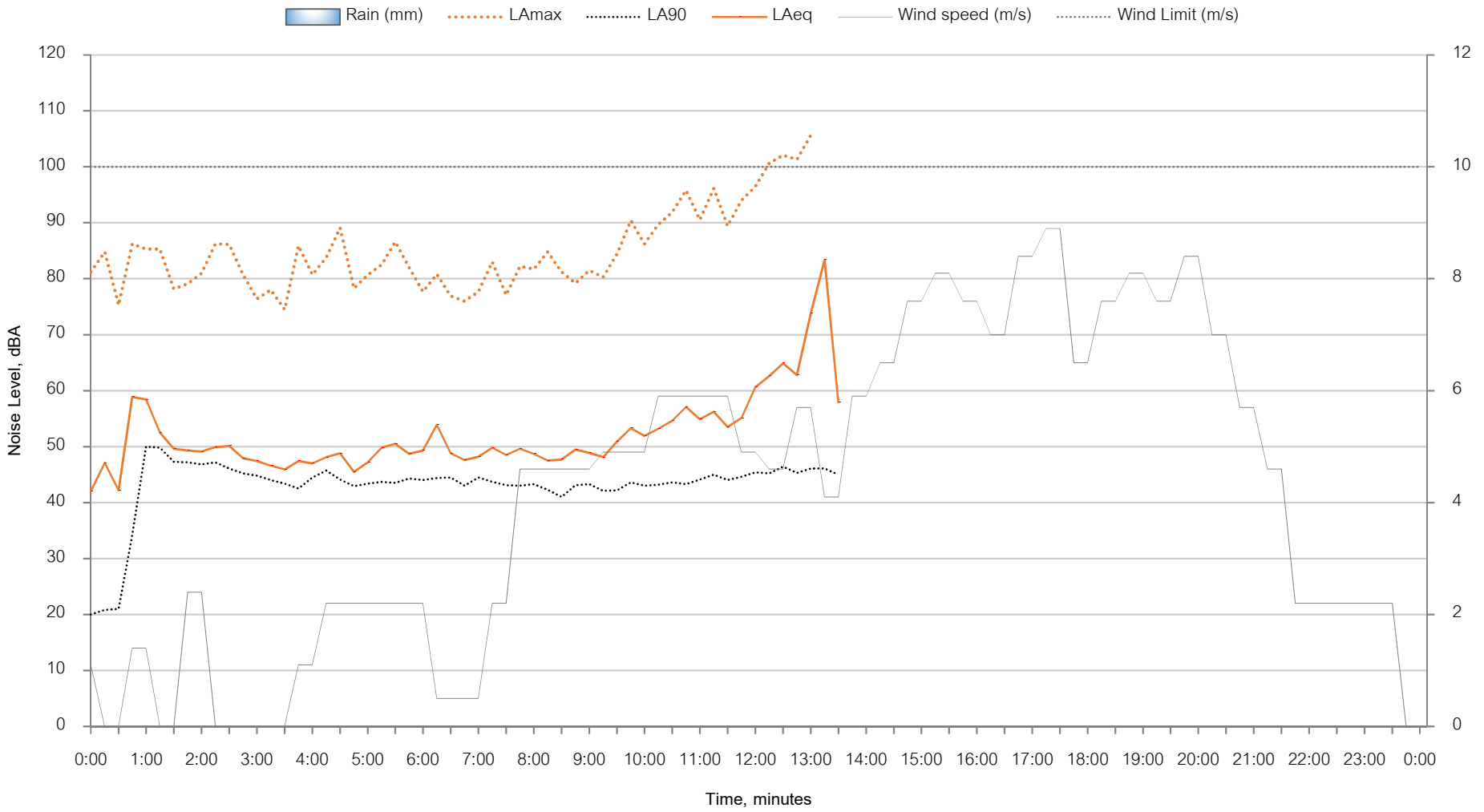
Tuesday, 12-05-15



Measured Ambient Noise Levels

Location 1 - Golden Highway

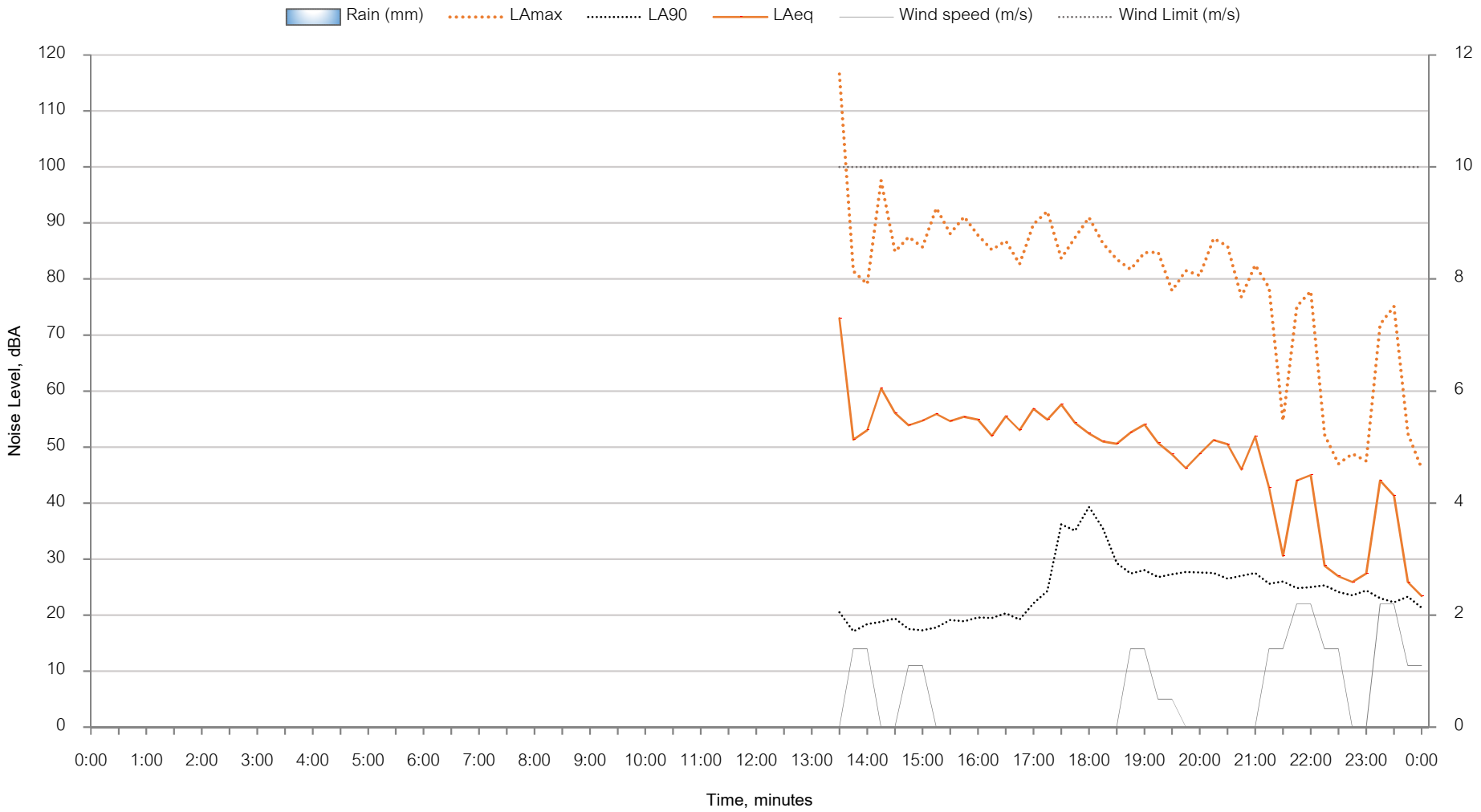
Wednesday, 13-05-15



Measured Ambient Noise Levels

Location 2 - Wybong Road

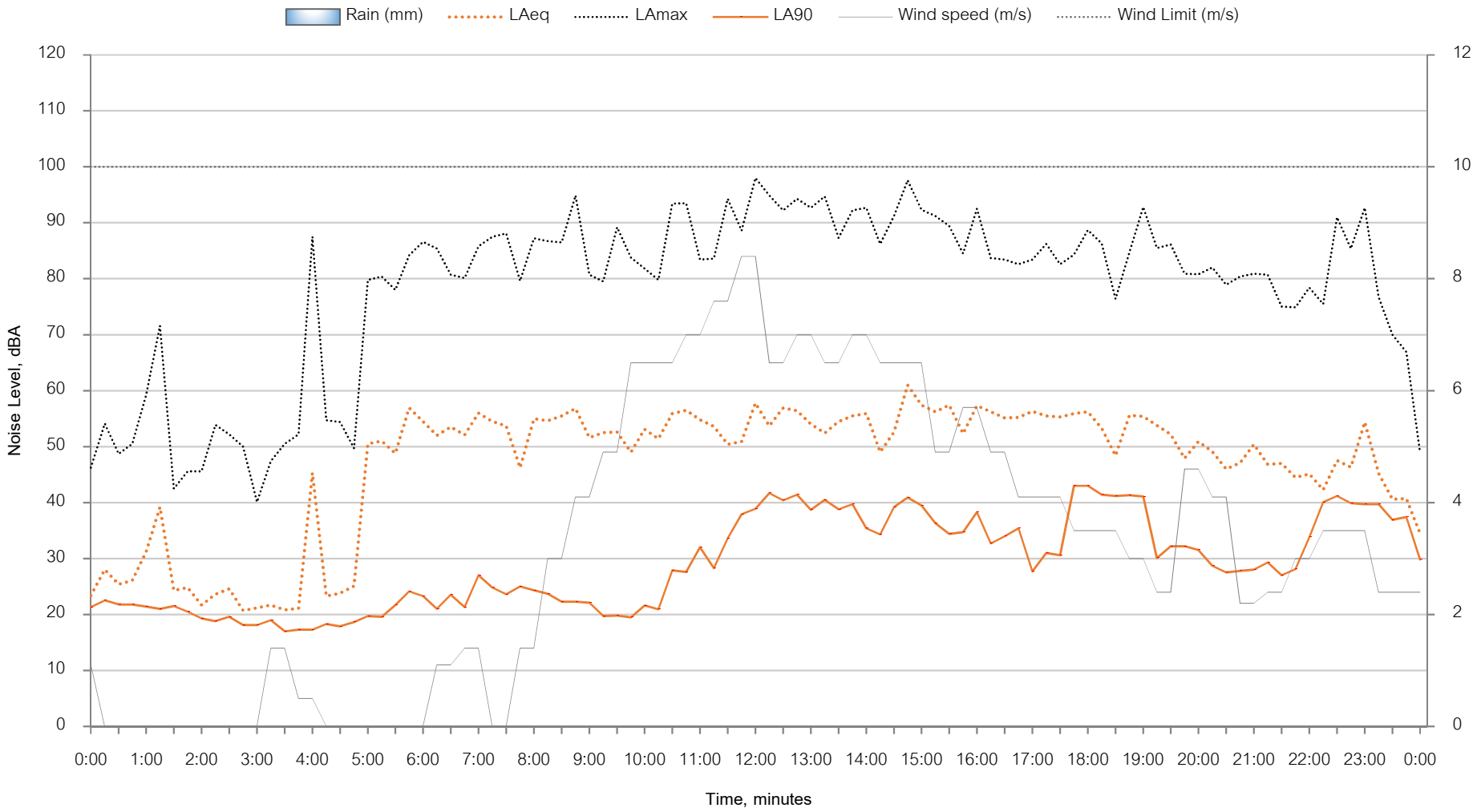
Monday, 04-05-15



Measured Ambient Noise Levels

Location 2 - Wybong Road

Tuesday, 05-05-15



Measured Ambient Noise Levels

Location 2 - Wybong Road

Wednesday, 06-05-15

Measured Ambient Noise Levels

Location 2 - Wybong Road

Thursday, 07-05-15

Measured Ambient Noise Levels

Location 2 - Wybong Road

Friday, 08-05-15

Measured Ambient Noise Levels

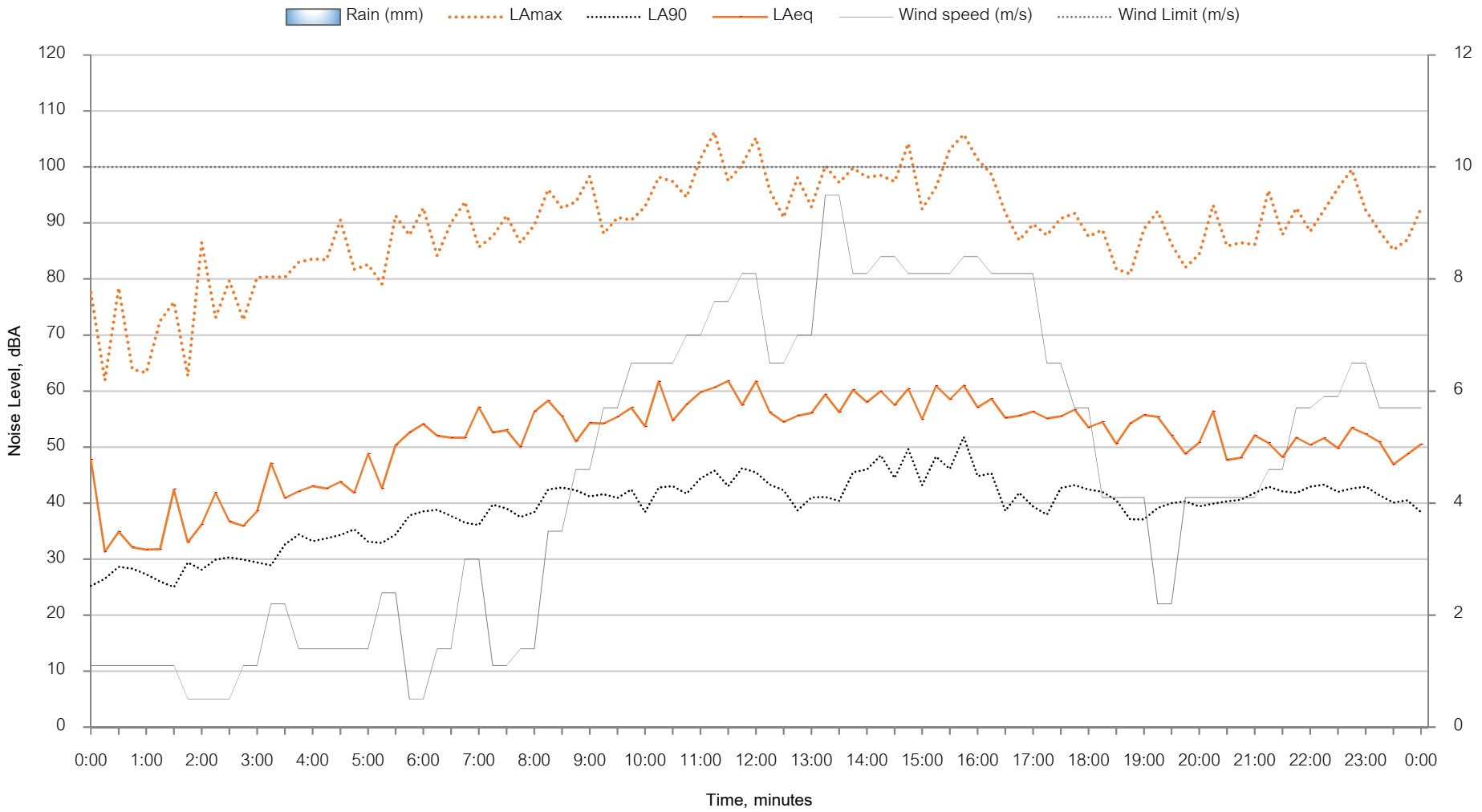
Location 2 - Wybong Road

Saturday, 09-05-15

Measured Ambient Noise Levels

Location 2 - Wybong Road

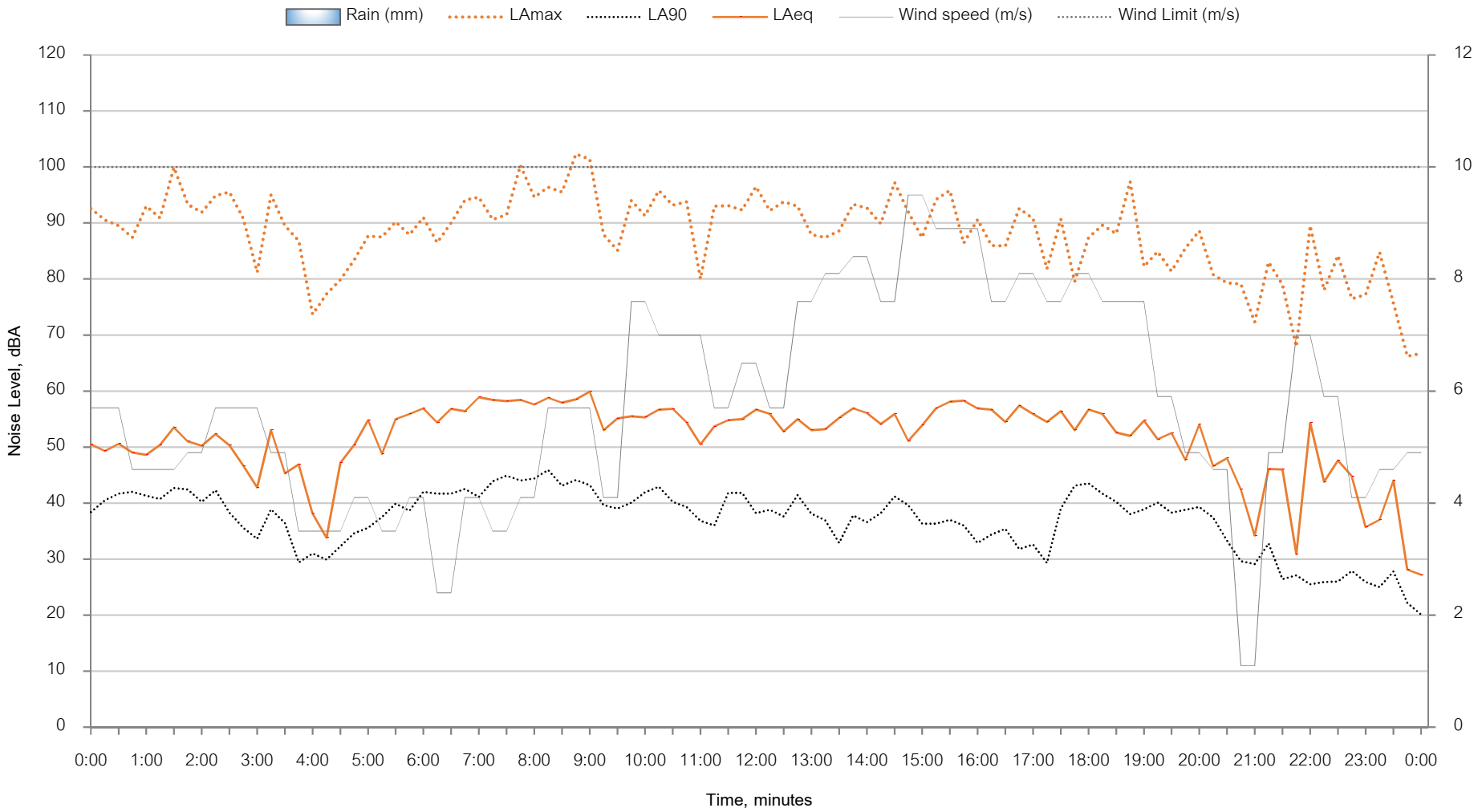
Sunday, 10-05-15



Measured Ambient Noise Levels

Location 2 - Wybong Road

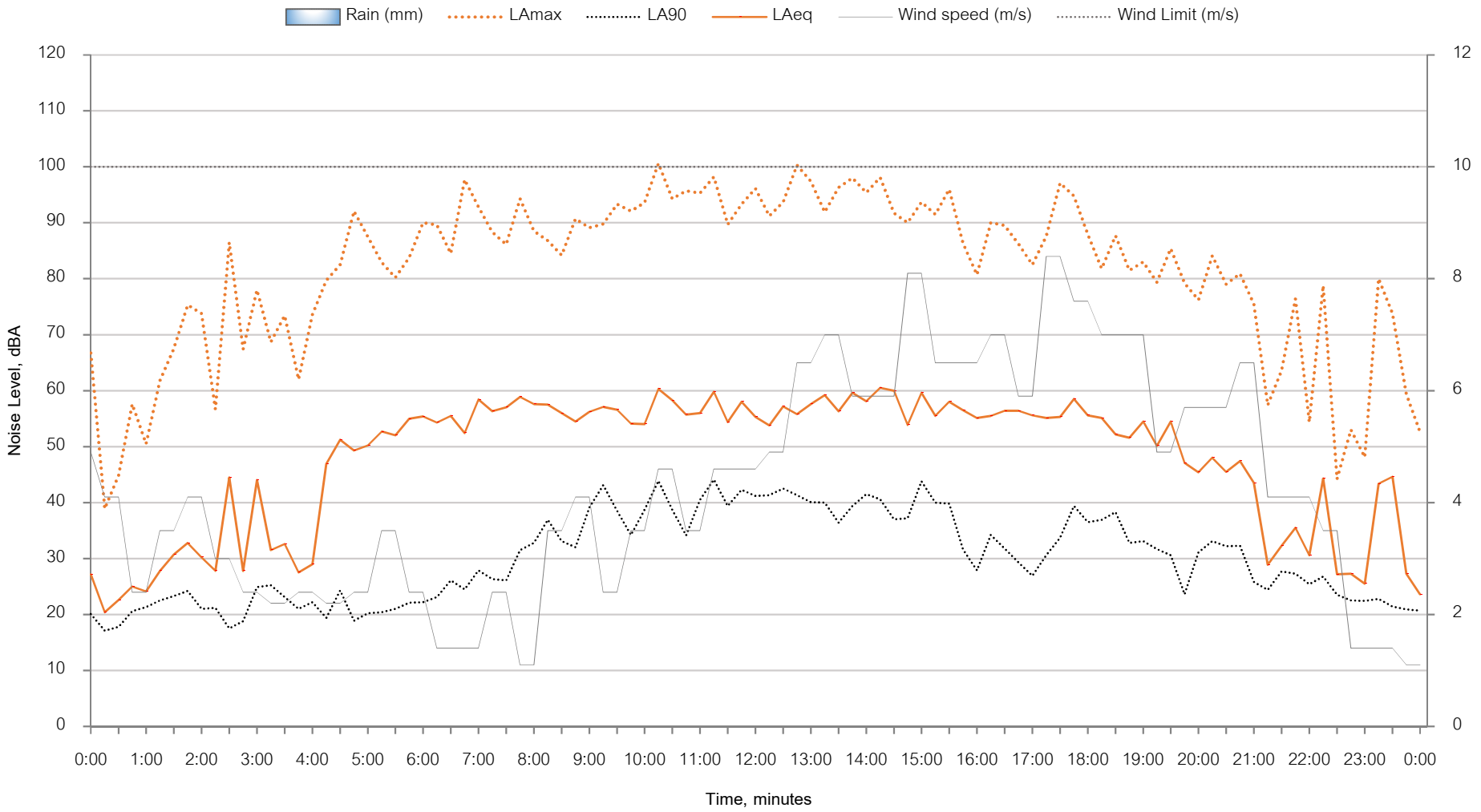
Monday, 11-05-15



Measured Ambient Noise Levels

Location 2 - Wybong Road

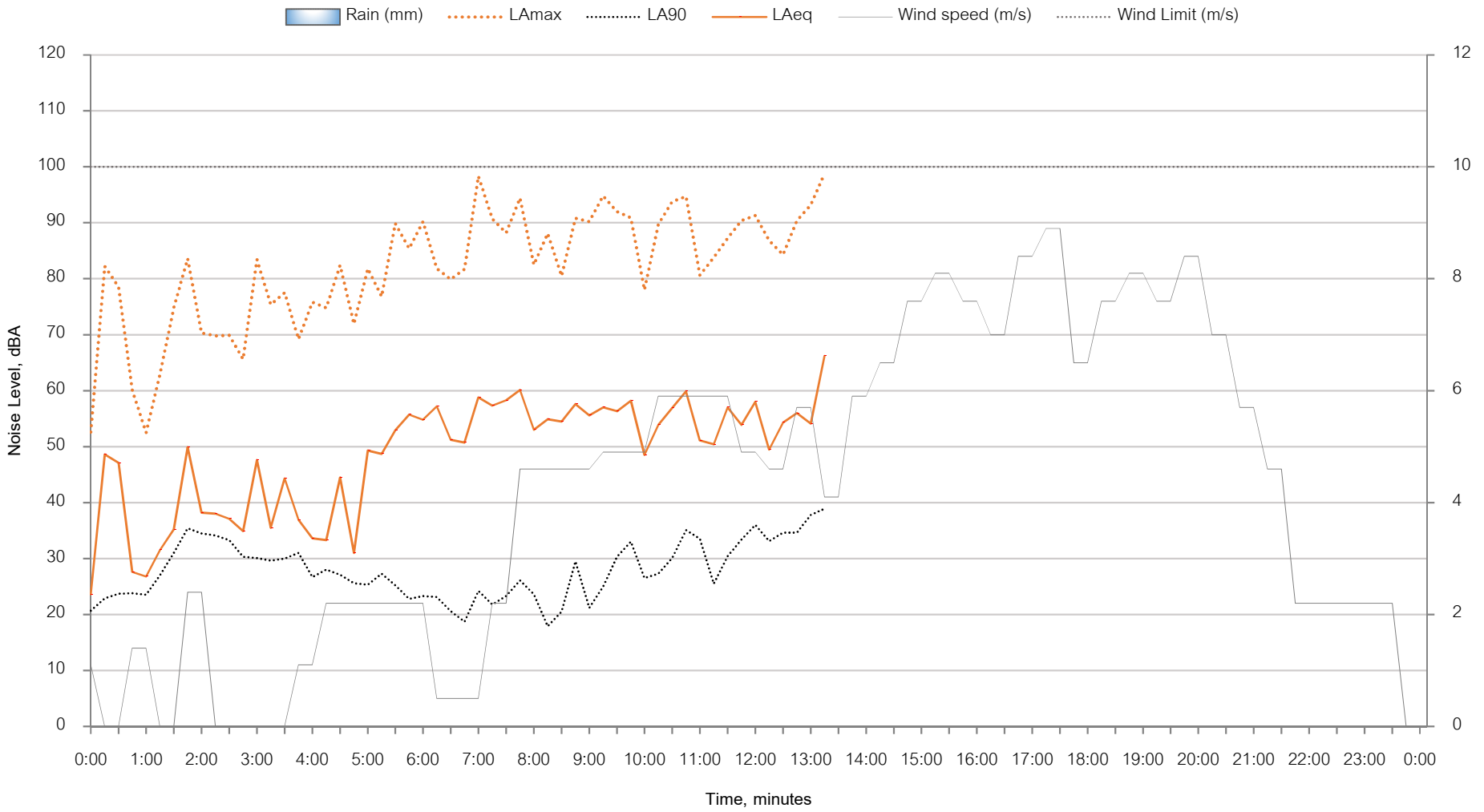
Tuesday, 12-05-15



Measured Ambient Noise Levels

Location 2 - Wybong Road

Wednesday, 13-05-15



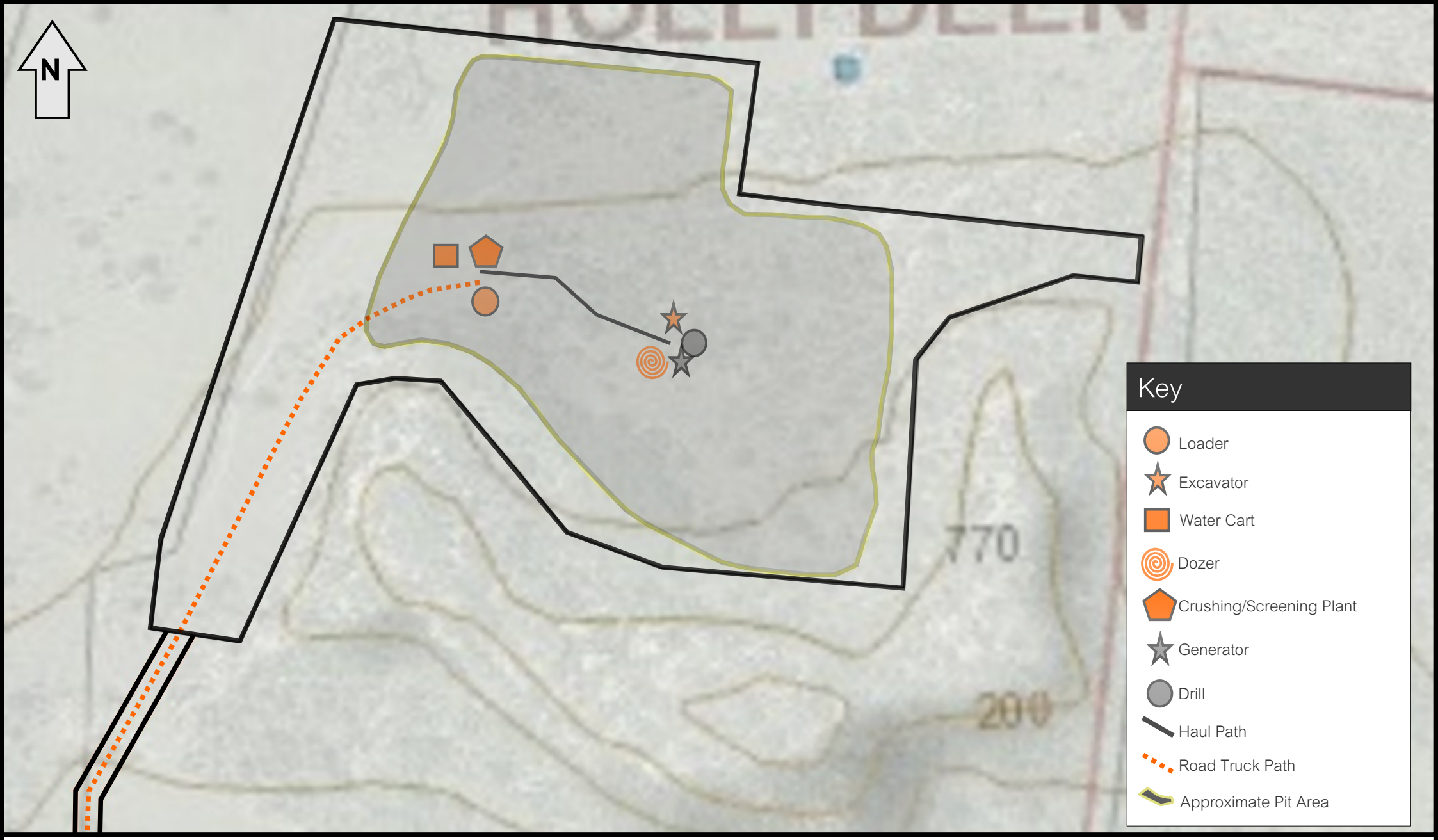
# Appendix C – Modelled Plant Locations


MAC
Muller Acoustic Consulting

Appendix C1

Modelled Plant Locations - Stage 1

0 150m

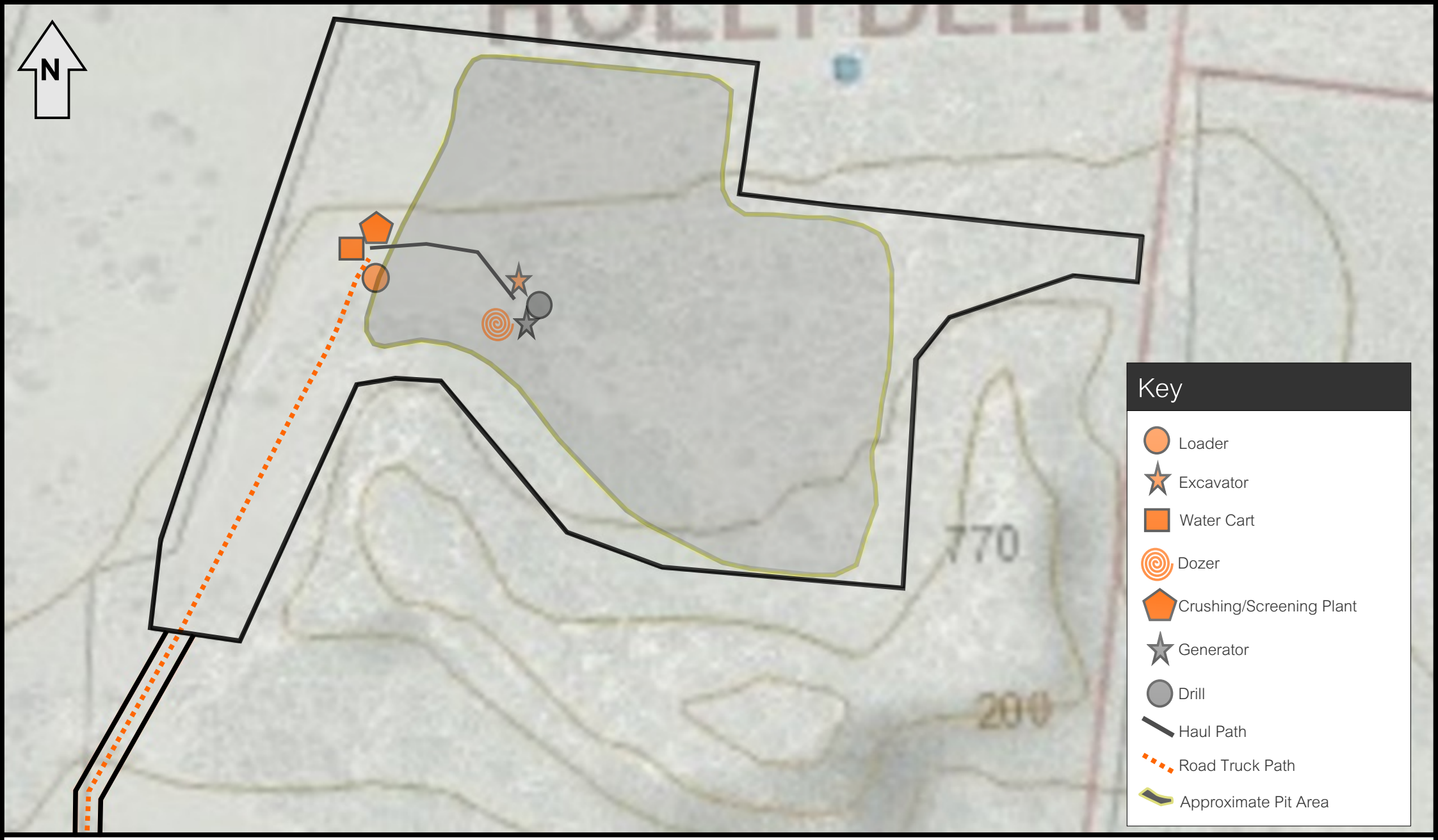



MAC
Muller Acoustic Consulting

Appendix C2

Modelled Plant Locations - Stage 2

0 150m




MAC
Muller Acoustic Consulting

Appendix C3

Modelled Plant Locations - Stage 3

0 150m

# Appendix D – Analysed Meteorology

| Table D1 NEWA Analysed Meteorological Conditions, Scone NSW | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Direction | Season | Day | Evening | Night | Direction | Season | Day | Evening | Night |
| | | Percentage Occurrence % | | | | | Percentage Occurrence % | | |
| 0 | Summer | 13.2 | 11.3 | 12 | 180 | Summer | 7.8 | 7.5 | 7.9 |
| 0 | Autumn | 15.5 | 10.7 | 9.7 | 180 | Autumn | 10.7 | 12.9 | 11.9 |
| 0 | Winter | 7.5 | 12.6 | 9.7 | 180 | Winter | 18.7 | 12.1 | 18.8 |
| 0 | Spring | 7.2 | 8.7 | 10.1 | 180 | Spring | 11.9 | 10.4 | 12.2 |
| 22.5 | Summer | 12.9 | 11.2 | 11.6 | 202.5 | Summer | 7.8 | 8.6 | 7.9 |
| 22.5 | Autumn | 15.2 | 11.1 | 10.1 | 202.5 | Autumn | 10 | 10.6 | 11.2 |
| 22.5 | Winter | 7.2 | 11.7 | 9.4 | 202.5 | Winter | 17.5 | 11.1 | 17.2 |
| 22.5 | Spring | 7.4 | 8.2 | 9.4 | 202.5 | Spring | 12.2 | 10.1 | 11.1 |
| 45 | Summer | 6.8 | 6.7 | 6.5 | 225 | Summer | 7.7 | 7.3 | 7 |
| 45 | Autumn | 9.2 | 8.9 | 7.4 | 225 | Autumn | 8.2 | 7.4 | 9.5 |
| 45 | Winter | 5.8 | 7.3 | 6.7 | 225 | Winter | 13.4 | 8.2 | 11 |
| 45 | Spring | 5.6 | 6.5 | 5.9 | 225 | Spring | 9.8 | 7.9 | 7.7 |
| 67.5 | Summer | 7.1 | 6.1 | 5.7 | 247.5 | Summer | 7.7 | 6.5 | 6.7 |
| 67.5 | Autumn | 9.6 | 9 | 9.5 | 247.5 | Autumn | 8.2 | 6.3 | 8.2 |
| 67.5 | Winter | 8.6 | 8.8 | 9.3 | 247.5 | Winter | 11.4 | 6.7 | 8.3 |
| 67.5 | Spring | 7.8 | 7.9 | 8.6 | 247.5 | Spring | 8.6 | 7.3 | 7.6 |
| 90 | Summer | 7.5 | 6.2 | 6.3 | 270 | Summer | 8.9 | 7.6 | 7.4 |
| 90 | Autumn | 11 | 13.1 | 12.1 | 270 | Autumn | 8.6 | 5.8 | 6.7 |
| 90 | Winter | 12.8 | 10.5 | 13.6 | 270 | Winter | 8.5 | 7.4 | 6.1 |
| 90 | Spring | 9.7 | 11 | 10.9 | 270 | Spring | 8.1 | 7.3 | 7.8 |
| 112.5 | Summer | 8.5 | 7 | 6.9 | 292.5 | Summer | 10.9 | 9.1 | 9.6 |
| 112.5 | Autumn | 12.5 | 16.6 | 14.4 | 292.5 | Autumn | 10.7 | 6.6 | 6.6 |
| 112.5 | Winter | 17.5 | 13.2 | 18 | 292.5 | Winter | 6.7 | 8.6 | 5.7 |
| 112.5 | Spring | 11.4 | 13.2 | 13.7 | 292.5 | Spring | 8 | 7.4 | 9 |
| 135 | Summer | 9.1 | 7.4 | 8 | 315 | Summer | 14.5 | 12.1 | 13.1 |
| 135 | Autumn | 13.1 | 17.8 | 15.5 | 315 | Autumn | 15.5 | 9.8 | 8.9 |
| 135 | Winter | 19.9 | 14.6 | 21.5 | 315 | Winter | 8.5 | 12 | 8.3 |
| 135 | Spring | 13.1 | 14.1 | 16.4 | 315 | Spring | 8.7 | 9.1 | 11.8 |
| 157.5 | Summer | 8.2 | 8 | 8.1 | 337.5 | Summer | 12.4 | 9.9 | 11.1 |
| 157.5 | Autumn | 11.5 | 16.7 | 13.1 | 337.5 | Autumn | 13.6 | 8.4 | 7.9 |
| 157.5 | Winter | 19 | 13.6 | 21.3 | 337.5 | Winter | 6.8 | 11.8 | 7.5 |
| 157.5 | Spring | 12.5 | 12.7 | 14 | 337.5 | Spring | 7 | 7.7 | 10.1 |

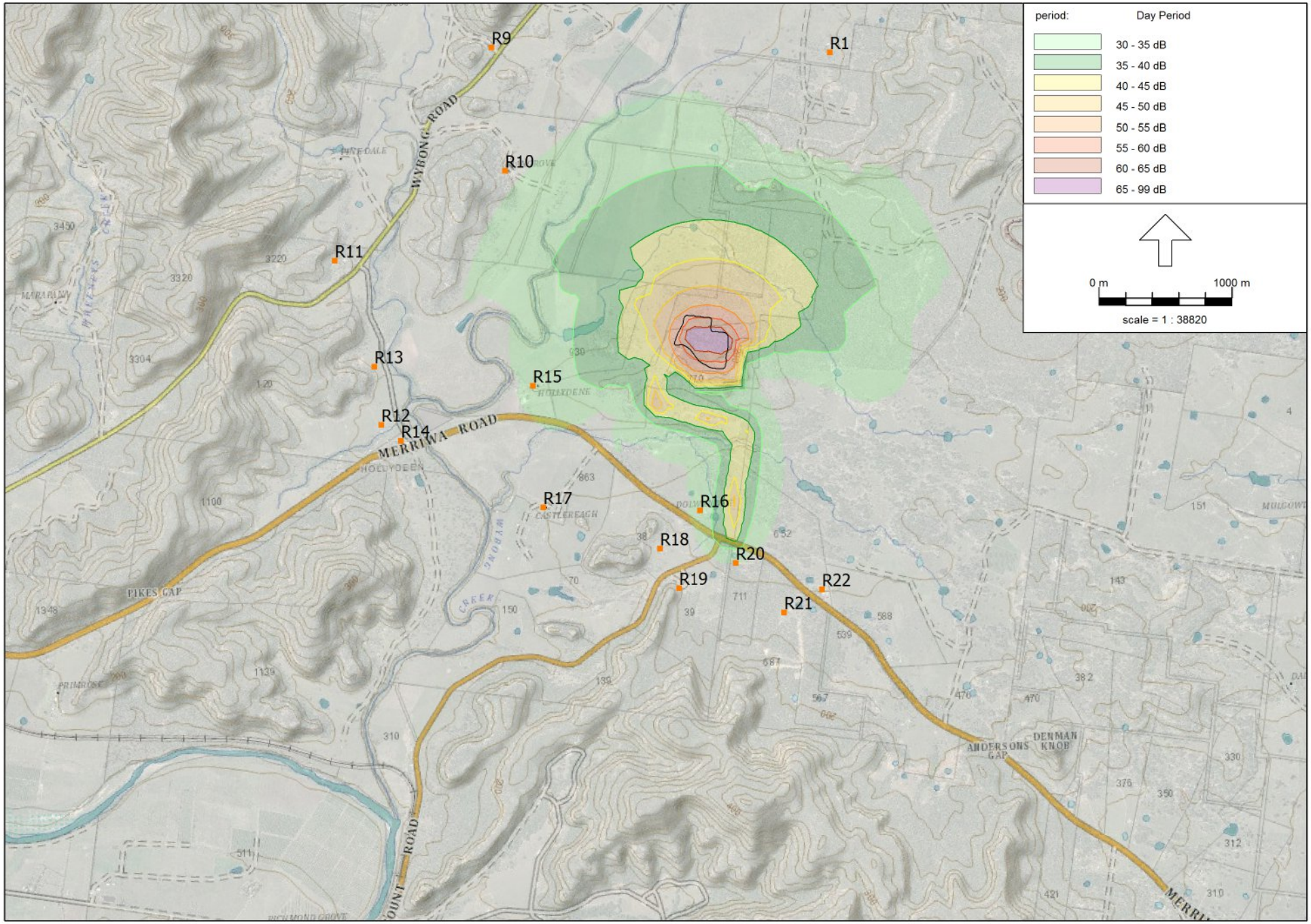
# Appendix E – Octave SWL Data

Table E1 LAeq(15-min) dB(A) Sound Power Level Spectrum

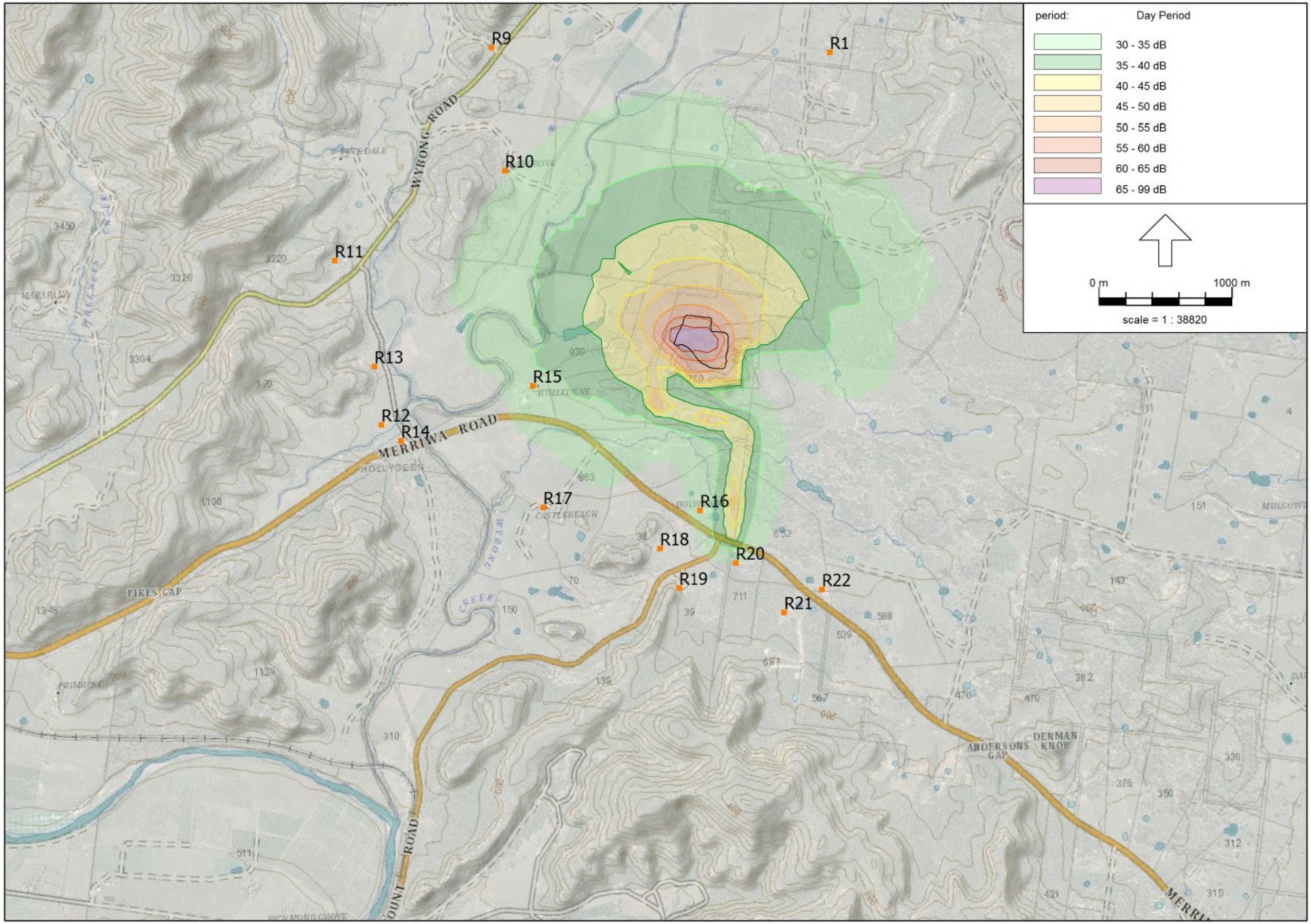
| Noise Source | Octave Band Centre Frequency (Hz), dBA | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | dB(A) |
| Operational Plant | | | | | | | | | |
| Mobile Crusher | 80 | 89 | 94 | 104 | 105 | 105 | 101 | 88 | 110 |
| Mobile Cone Crusher | 85 | 96 | 101 | 107 | 109 | 107 | 100 | 88 | 113 |
| Mobile Screen | 83 | 94 | 89 | 96 | 99 | 101 | 100 | 97 | 106 |
| Dozer | 86 | 95 | 99 | 107 | 103 | 102 | 100 | 90 | 110 |
| Haul Truck | 92 | 96 | 102 | 102 | 103 | 100 | 93 | 84 | 108 |
| Excavator[1] | 85 | 99 | 99 | 106 | 105 | 103 | 99 | 92 | 111 |
| Loader | 77 | 95 | 94 | 100 | 101 | 98 | 93 | 90 | 106 |
| Road Truck | 89 | 95 | 90 | 89 | 93 | 97 | 92 | 85 | 102 |
| Water Truck | 81 | 82 | 89 | 91 | 95 | 97 | 89 | 81 | 101 |
| Diesel Generator | 55 | 76 | 86 | 88 | 87 | 84 | 78 | 67 | 93 |
| Drill Rig | 81 | 103 | 104 | 106 | 109 | 108 | 100 | 92 | 114 |

Note 1 : Includes a +5dB modifying factor for tonality.

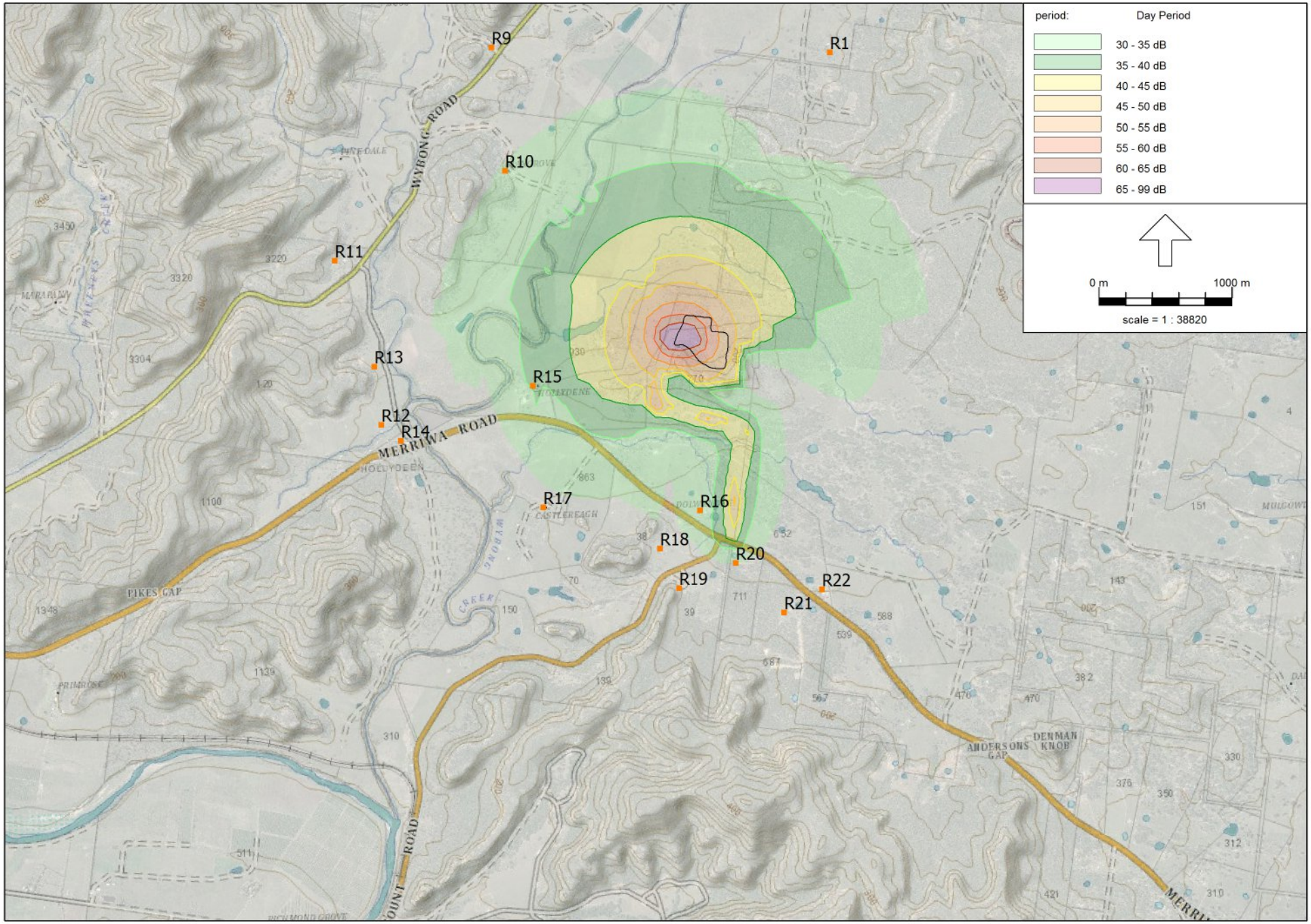
# Appendix F – Operational Noise Contours




Industrial noise - ISO 9613.1/2, [Dolwndee Quarry - Stage 1] , Predictor V10.01




Industrial noise - ISO 9613.1/2, [Dolwndee Quarry - Stage 2] , Predictor V10.01




Industrial noise - ISO 9613.1/2, [Dolwndee Quarry - Stage 3] , Predictor V10.01

Muller Acoustic Consulting Pty Ltd
PO Box 262, Newcastle NSW 2300
ABN: 36 602 225 132
P: +61 2 4920 1833
www.mulleracoustic.com

MAC
Muller Acoustic Consulting