Noise & Vibration Impact Assessment

Kariong Sand & Soil Supplies Facilities Upgrade

90 Gindurra Road, Somersby, NSW

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Davis Earthmoving & Quarrying Pty Ltd
c/o Jackson Environment and Planning Pty Ltd
Suite 102, Level 1, 25 - 29 Berry Street
North Sydney
NSW 2060

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90 Gindurra Road, Somersby, NSW

Prepared by:

Waves Acoustic Consulting Pty Ltd

Level 7, 1 York Street, Sydney, NSW 2000
ABN 80 610 696 449

T: +61 2 7900 5548
E: info@wavesconsulting.com.au
W: www.wavesconsulting.com.au

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1 Introduction

1.1 Background

The Kariong Sand & Soil Supplies (KSSS) site is currently operated as a soil and sand recycling business, located at 90 Gindurra Rd, Somersby, NSW. Recycled sand and soil is sold for landscaping. The site's current development approval and infrastructure limits the amount of material that can be accepted and processed (screened and sorted) at the site.

Davis Earthmoving & Quarrying Pty Ltd have engaged Raybal Constructions to survey the site, seek the development approval for and implement Stage 1, involving construction of key infrastructure at the front area of the site which includes:

- The existing buildings on the site to be demolished and replaced with a processing shed and an office building. The processing shed will be used to separate the mixed materials delivered to the site.
- Security fencing along the northern boundary.

Stage 1 was approved by Central Coast Council as a local development under DA52541/2017 on 17 November 2017.

The latest application to upgrade the facilities on the site has been assessed by the EPA and Department of Planning and Environment (DoPE). The Secretary's Environmental Assessment Requirements (SEARs) have been provided for the development. The SEARs (SSD 8660) identifies the following requirements for noise and vibration:

- Comprehensive background noise monitoring assessment at all nearby noise sensitive receivers.
- Operational noise modelling and assessment in accordance with the NSW Industrial Noise Policy (INP) to include spectral data of proposed plant, noise modification factors and weather impacts on noise propagation.
- Operational traffic noise analysis in accordance with the NSW Road Noise Policy (RNP).
- Operational vibration modelling and analysis in accordance with the EPAs NSW Assessing Vibration: A Technical Guideline.
- Construction Noise and Vibration Assessment in accordance with the Interim Construction Noise Guideline (ICNG).

This assessment report will cover all requirements of the SEARs. However, please note that the SEARs request the use of the ECRTN for road traffic noise assessment which has since been rescinded and replaced by the RNP. In addition, the NSW INP has recently been replaced by the Noise Policy for Industry (NPI).

Waves Acoustic Consulting Pty Ltd (Waves Consulting) has been engaged by Mr & Mrs Ray and Sue Davis (through Jackson Environment and Planning Pty Ltd) to prepare a Noise and Vibration Impact Assessment (NVIA) to demonstrate the noise and vibration impacts associated with the project. This report presents the results of the assessment and forms part of the Environmental Impact Statement (EIS) for the proposal.

This report has been prepared to inform the EPA and the DoPE and all relevant stakeholders. The aim of the report is to assess the potential noise and vibration impacts of the proposed development on any nearby sensitive receivers and has been prepared in accordance with the guidelines outlined in Section 1.2.

1.2 Relevant Guidelines

Noise from the operation of the proposal has been assessed in accordance with the NSW Noise Policy for Industry (NPI) 2017.

Noise from additional traffic movements on the local road network has been assessed in accordance with the NSW Road Noise Policy (RNP), NSW EPA 2011.

Vibration from the operation and construction of the proposal has been assessed in accordance with Assessing Vibration: a technical guideline (DEC 2006).

Construction Noise Impacts have been assessed in accordance with the NSW Interim Construction Noise Guideline (ICNG).

2 Development Description

2.1 Overview of the Development and Potential for Impacts

Kariong Sand & Soil Supplies (KSSS) proposes to redevelop the existing industrial facilities at 90 Gindurra Road, Somersby, NSW. The existing industrial site is large (> 110,000 m^2) with several buildings and sheds to the north of the site. Mixed materials receival, sorting and crushing is currently undertaken towards the middle of the site.

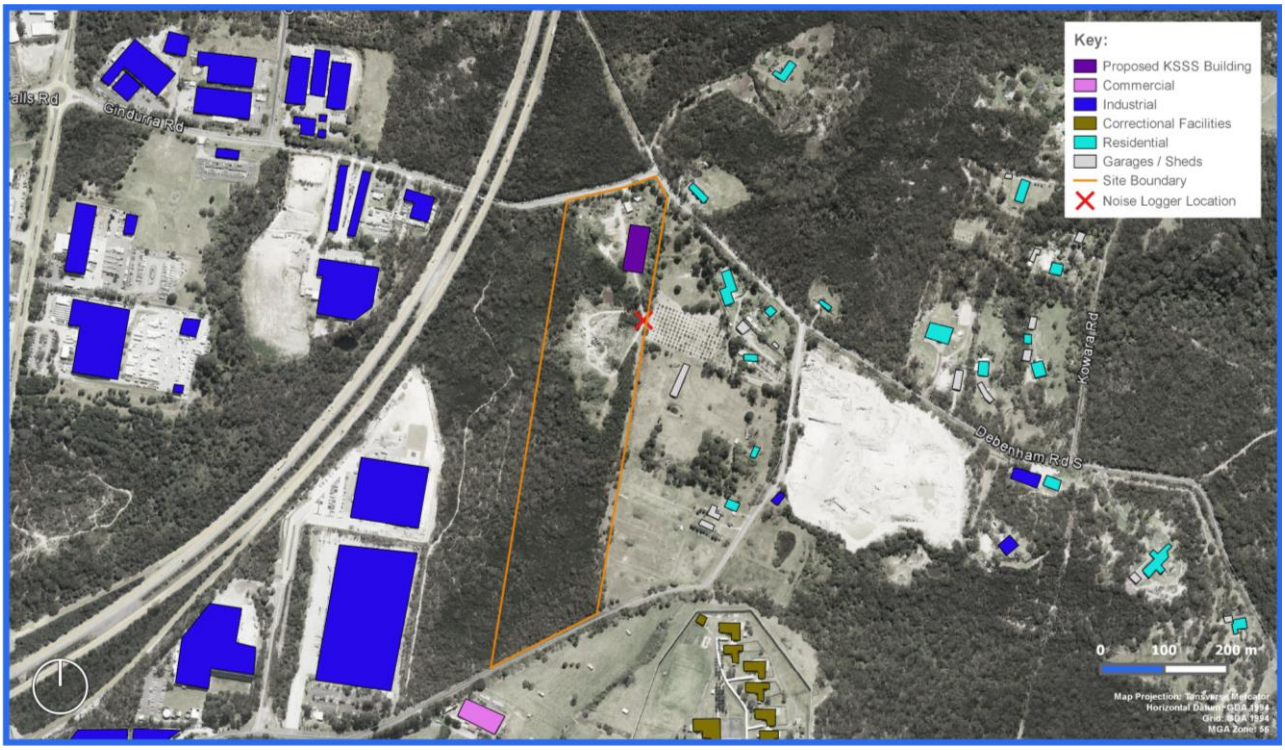
KSSS proposes to demolish the existing industrial buildings and to upgrade the site to handle a proposed capacity of up to 200,000 tonnes of material per year by 2025.

The main noise and vibration sources from the proposed facility will include:

- Offsite vehicle movements on the nearby road network.
- Onsite vehicle movements - mainly delivery trucks, excavator and loader.
- Concrete and building material processing / crushing.
- Screening and sorting of materials.
- Stockpiling of refined products.
- Mixed material processing and separation in the new processing shed.

Figure 1 below illustrates the proposed KSSS site including the new building and the proximity of the industrial and residential buildings in the surrounding area. Figure 1 also shows key features labelled including the noise monitoring location used for this assessment.

Figure 1. Site Location, Surrounding Area & Noise Logging Location



Aerial photography courtesy of Google Earth

The site is situated at an interface between industrial zoned land / buildings and rural residential dwellings. The nearest industrial buildings are approximately 130 m to the west. The industrial zone to the west is large and extends for over 1000 m. The Pacific Highway is located approximately 150 m to the west of the site and cuts through the industrial zone with an overpass above Gindurra Road.

Rural residential zones with residential dwellings are located along the north-eastern, eastern and south-eastern boundaries of the site. The closest residential dwellings are located within 50 m (north-east), 160 m (east) and 190 m (south-east) respectively from the site boundary. An open quarry (Keane Ceramics) is located further east of these residential dwellings approximately 300 m east of the site boundary.

The Kariong Correctional facility is located 170 m south-east of the site boundary. The nearest commercial facility is the Central Coast Riding for the Disabled, which is located 100 m south of the site boundary.

2.1.1 Potential Operational Noise Impacts

Potential noise impacts from operation of the proposed development which will be assessed in this report include:

- Noise emission from the fixed noise sources associated with the development to any nearby sensitive receivers ie the outdoor crushing / screening plant and mechanical services / processing activities associated with the new building.
- Noise emission from vehicle movements on site to any nearby sensitive receivers ie delivery truck, excavator and loader movements.
- Additional noise emission from vehicle movements on the adjacent roads to any nearby sensitive receivers.

2.1.2 Potential Construction Noise Impacts

Potential noise impacts from construction of the proposed development which will be assessed in this report include:

- Noise emission from the fixed noise sources associated with the construction to any nearby sensitive receivers ie the outdoor crushing / screening plant used to process existing stockpiles.
- Noise emission from vehicle movements on site to any nearby sensitive receivers ie delivery trucks, bulldozers, loaders and excavators.
- Additional noise emission from construction vehicle movements on the adjacent roads to any nearby sensitive receivers.

2.1.3 Potential Vibration Impacts

The offset distances (in all directions) between the vibrationally intensive equipment and any sensitive receivers is large (> 300 m). The potential for vibration impacts due to the construction or operation of the development are effectively nil. All vibration criteria with respect to cosmetic damage to buildings and human comfort impacts will be satisfied as a result.

No further consideration of vibration impacts is given in this assessment as a result.

2.2 Proposed Recycling Facility

Figures 2 illustrates the proposed design of the recycling facility and the location of the proposed new processing building. The main noise sources associated with the operation of the facility will be the outdoor crusher and screening plant located in the zone marked 'processing area'. The delivery truck onsite movements are indicated by the new road outlines with several loops to aid truck movements and avoid reserving manoeuvres.

Figure 2. General Layout of the Upgraded Site

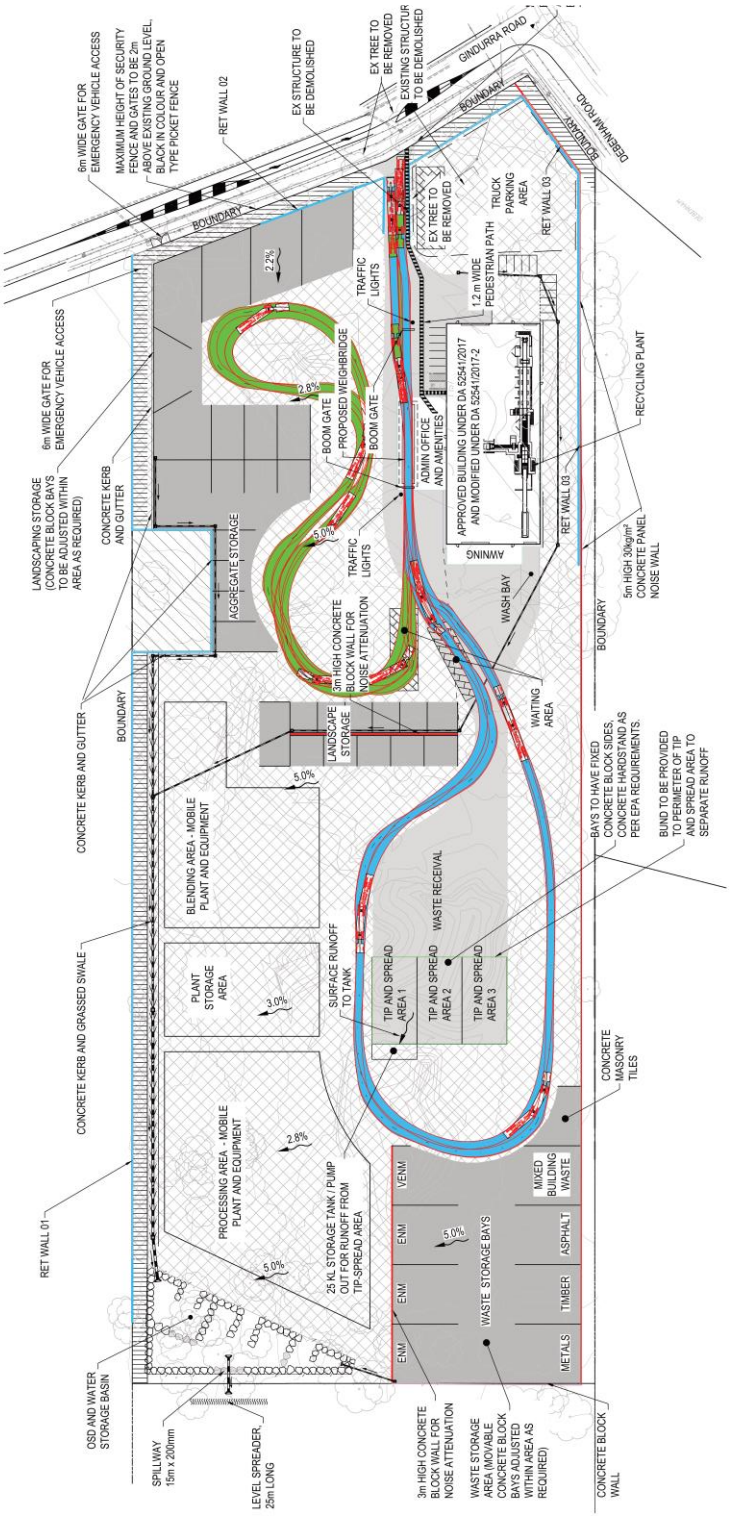
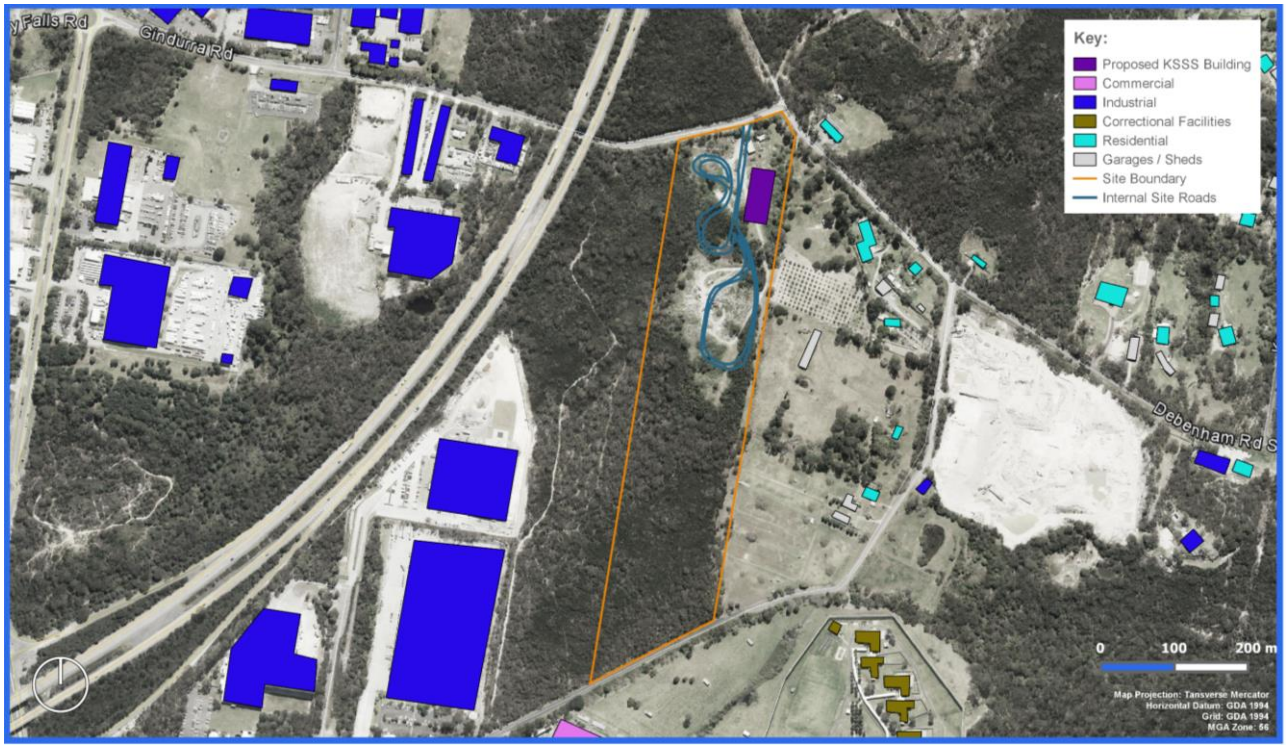


Figure 3 illustrates the physical extents of the proposed operation within the site boundary.

Figure 3. Site Aerial and Operational Extents within the Site Boundary.



Aerial photography courtesy of Google Earth

2.3 Operational Noise Levels

Table 1 provides the (estimated) overall and octave band sound power levels for the proposed outdoor equipment / activities which have been used in this assessment. These levels have been estimated based on manufacturers data for overall levels with octave band spectrum noise levels derived from the Waves Consulting noise database for similar plant / machinery.

Table 1. Estimated Sound Power Level of the Proposed Outdoor Plant

Description	Overall L_{WA} (dB re 1pW)	Octave Band Centre Frequency (Hz) L_W (dB re 1 pW)							
		63	125	250	500	1000	2000	4000	8000
Volvo L150 Front End Loader	108	98	106	108	104	104	99	93	92
CAT 329F Excavator	105	107	107	103	104	99	96	88	76
Rubble Master RM100 Crusher	108	115	115	113	103	98	97	92	91
Kleeman Screen	110	113	111	108	108	103	103	100	93
Wood Shredder 2710D	110	103	103	103	103	103	103	103	103
Large skip bin moving	102	106	102	94	94	96	89	98	89
Large skip bin loading	98	101	99	94	96	94	90	84	80

Table 2 provides the (estimated) overall and octave band sound pressure levels (reverberant) for the proposed indoor equipment associated with the new processing shed. These levels have been based on the Waves Consulting noise database for similar plant / machinery.

Table 2. Estimated Reverberant Sound Pressure Level of the Proposed Indoor Plant

Description	Overall L_{Aeq} (dB re 20 µPa)	Octave Band Centre Frequency (Hz) L_{eq} (dB re 20 µPa)							
		63	125	250	500	1000	2000	4000	8000
Stockpiling with loader (internal)	89	91	90	87	84	85	82	78	70
Manual sorting & processing operations, vehicle movements (internal)	85	81	78	77	76	83	76	74	70

2.4 Operational Hours

The proposed operational hours were provided by Jackson Environment and Planning and are summarised in Table 3.

Table 3. Summary of Operational Hours

Operational Activity	Hours
Access	24 hrs / 7 days per week (ie to allow for occasional early / late delivery or truck movements which are unavoidable due to traffic delays etc)
Opening hours (staffed)	0700 to 1800 Mon – Fri, 0800 to 1600 Sat. Closed Sunday
Waste deliveries	0700 to 1800 Mon – Fri, 0800 to 1600 Sat. Closed Sunday
Waste processing (sorting, crushing, grinding, screening)	0800 to 1700 Mon-Fri
Product sales	0700 to 1800 Mon – Fri, 0800 to 1600 Sat. Closed Sunday

2.5 Operational Traffic Generation

The proposed traffic movements for receival / removal of material at the site were provided by Jackson Environment and Planning and are summarised in Table 4.

Table 4. Summary of Traffic Generation at the Proposed Site

Type of Vehicle	Total Vehicles per Day		
	2018	2021	2025
Staff operational vehicles	4	7	9
12 t tipper	4	14	36
32 t T&D or semi	2	8	19
40 t B-double	1	5	6
Total	10	34	70

3 Noise Measurements

3.1 Unattended Noise Monitoring

To characterise the existing acoustic environment in the area, a survey of environmental noise levels was conducted from Wednesday 11 October to Thursday 19 October 2017. The noise logger was installed adjacent to the residential property at 12 Acacia Road, Somersby, NSW (see Figure 1).

The logger location was selected with consideration of other noise sources which may have influenced the measurements, security issues for the equipment and access permission from residents and landowners. Instrumentation for the survey comprised a Svan 977 Type 1 Sound Level Meter and Logger (Serial No. 45730) fitted with an environmental windshield.

The noise logger was programmed to continuously record the ambient noise levels. The sample time interval was set at 15 minutes with a Fast (125 ms) time weighting function. Calibration of the logger was checked prior to and after the measurements. Drift in calibration did not exceed ±0.5 dB. All equipment carried appropriate and current NATA (or manufacturer) calibration certificates.

The measured noise data has been filtered to remove erroneous data and any data measured during adverse weather conditions following review of historical weather reports from the Bureau of Meteorology (BOM) Gosford weather station (nearest weather station).

Daily graphs for the noise logger are attached in Appendix A. The graphs represent each 24-hour period of the L_{AF1}, L_{AF10} and L_{AF90} together with the L_{Aeq} levels for the corresponding 15-minute periods, as well as relevant weather data.

3.1 Unattended Noise Monitoring Results

To define the applicable environmental criteria at nearby noise sensitive receivers the measured data has been processed in accordance with the time periods stipulated by the EPA NSW Noise Policy for Industry (NPI). Table 5 details the background and ambient noise levels recorded during the NSW NPI daytime, evening and night-time assessment periods.

Table 5. Measured Noise Levels Corresponding to NSW NPI Assessment Periods

Date	L_{AF90} Background Noise Levels			L_{Aeq} Ambient Noise Levels		
	Day	Evening	Night	Day	Evening	Night
Wednesday 11 October, 2017		47			54	
Thursday 12 October, 2017	46	43	46	60	52	56
Friday 13 October, 2017	45	47	37	51	52	50
Saturday 14 October, 2017			33			47
Sunday 15 October, 2017		42	44		48	57
Monday 16 October, 2017	43	44	46	50	52	56
Tuesday 17 October, 2017	45	46	43	51	5!	52
RBL	**45**	**46**	**44**	-	-	-
Log Average	-	-	-	**55**	**52**	**54**

Note 1. For Monday to Saturday, Daytime 0700 to 1800 hrs, Evening 1800 to 2200 hrs, Night-time 2200 to 0700 hrs.
For Sundays and Public Holidays, Daytime 0800 to 1800 hrs, Evening 1800 to 2200 hrs, Night-time 2200 to 0800 hrs.
Note 2. The RBL noise level is representative of the *median background sound level* (in the absence of the source under consideration), or simply the background level.
Note 3. The L_{Aeq} is essentially the *average sound level*. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound of the same duration.

We note that the evening and night-time noise levels are similar to the daytime noise levels which is atypical. The logger data indicates that industrial noise throughout the evening and night-time is primarily responsible for this noise trend. During weekdays the industrial noise rises steadily throughout the evening and night-time. The overall noise level rises sharply each weekday between 0400 and 0700. This is most likely a combination of local industrial activities preparing for shipping and transport and a rise in traffic noise on the nearby Pacific

Highway. The noise environment surrounding the proposed site is dominated by a combination of local industrial noise sources and traffic noise along the Pacific Highway.

3.2 Attended Noise Measurements

Attended measurements of ambient noise were taken at several representative locations on 19 October 2017. These have been used to determine the various noise sources that influence the existing noise environment. During each measurement, the observer noted the various noise sources and the contributing noise level.

At each location, the attended measurements were performed for up to 15 minutes using a calibrated Svan 977 Type 1 Sound Level Meter and Logger (Serial No. 45730) fitted with an environmental windshield. Wind speeds were less than 5 m/s and all measurements were performed at a height of 1.5 metres above ground level.

Calibration of the logger was checked prior to and after the measurements. Drift in calibration did not exceed ±0.5 dB. All equipment carried appropriate and current NATA (or manufacturer) calibration certificates. The noise environment at each of the attended monitoring locations is described Table 6.

Table 6. Attended Noise Monitoring Results

Measurement Location	Measured Noise Levels (dB re 20 µPa)			Character of the Ambient Noise
	L_{Aeq}	L_{AFMax}	L_{AF90}	
Logger Location as per Figure 1	48	61	45	Traffic noise from the Pacific Highway, local industrial noise / reversing beepers and flora and fauna noise.
Adjacent to 242 Debenhams Road, Somersby, NSW	67	83	45	Local traffic movements, traffic noise from the Pacific Highway, industrial noise and flora and fauna noise.
Acacia Road opposite Kariong Correctional Facility	60	78	47	Local traffic movements, traffic noise from the Pacific Highway, industrial noise and flora and fauna noise.

The environmental noise in the area is typically dominated by industrial noise and road traffic on the nearby Pacific Highway and surrounding local roads. Flora and fauna noise were also found to be contributing sources of noise in the environment.

4 Operational Noise Assessment Guidelines

4.1 NSW Noise Policy for Industry (NPI)

Responsibility for the control of noise emissions in New South Wales is vested in Local Government and the NSW Environment Protection Authority (EPA).

The EPA oversees the NSW Noise Policy for Industry (NPI) 2017 which provides a framework and process for deriving noise trigger levels. The NPI replaced the Industrial Noise Policy (INP) at the end of October 2017.

The NPI sets out the procedure to determine the *project noise trigger levels* relevant to a particular industrial development. The project noise trigger level applies to existing noise-sensitive receivers; however, it may also be used in strategic planning processes for proposed land uses.

If it is predicted that the development is likely to cause the project noise trigger level to be exceeded at existing noise-sensitive receivers, management measures are required to reduce the predicted noise level.

4.1.1 Project Noise Trigger Level - Introduction

The project noise trigger level provides a benchmark or objective for assessing a proposal or site. It is not intended for use as a mandatory requirement. The project noise trigger level is a level that, if exceeded, would indicate a potential noise impact on the community, and so *trigger* a management response; for example, further investigation of mitigation measures.

The project noise trigger level, feasible and reasonable mitigation, and consideration of residual noise impacts are used together to assess noise impact and manage the noise from a proposal or site. It is the combination of these elements that is designed to ensure that acceptable noise outcomes are determined by decision makers.

The trigger level is tailored for each specific circumstance to take into account a range of factors that may affect the level of impact, including:

- Background noise environment.
- Time of day of the activity.
- Character of the noise.
- Type of receiver and nature of the area.

The scientific literature indicates that both the increase in noise level above background levels (that is, intrusiveness of a source), as well as the absolute level of noise are important factors in how a community will respond to noise from industrial sources. The project noise trigger level established in the NPI addresses each of these components of noise impact.

The project noise trigger level is the lower (that is, the more stringent) value of the *project intrusiveness noise level* and the *project amenity noise level*. The project intrusiveness noise level aims to protect against significant changes in noise levels, whilst the project amenity noise level seeks to protect against cumulative noise impacts from industry and maintain amenity for particular land uses.

Applying the most stringent requirement as the project noise trigger level ensures that both intrusive noise is limited and amenity is protected and that no single industry can unacceptably change the noise level of an area. Typically, the intrusiveness level will inform the project noise trigger level in areas with little industry (and/or ambient noise levels), whereas the amenity level will inform the project noise trigger level in areas with higher existing background noise levels. Intrusive noise levels are only applied to residential receivers (residences). For other receiver types only the amenity levels apply.

4.1.2 Project Intrusiveness Noise Level

The intrusiveness of an industrial noise source may generally be considered acceptable if the level of noise from the source (represented by the L_{Aeq} descriptor), measured over a 15-minute period, does not exceed the background noise level by more than 5 dB when beyond a minimum threshold. This intrusiveness noise level seeks to limit the degree of change a new noise source introduces to an existing environment.

The project intrusiveness noise level is determined as follows:

$L_{Aeq,15min}$ = rating background noise level + 5 dB

where:

- $L_{Aeq,15m}$ - represents the equivalent continuous (energy average) A-weighted sound pressure level of the source over 15 minutes.
- Rating Background Noise Level (RBL) - represents the background level to be used for assessment purposes, as determined by the methodology in Factsheets A & B of the NPI.

Intrusiveness noise levels are not used directly as regulatory limits. They are used in combination with the amenity noise level to assess the potential impact of noise, assess reasonable and feasible mitigation options and subsequently determine achievable noise requirements.

Minimum Project Intrusiveness Noise Levels

The NPI applies minimum RBLs to any project. These result in minimum intrusiveness noise levels as follows:

Table 7. Minimum RBLs and Project Intrusiveness Noise Levels

Time of Day	Minimum RBL (dB)	Minimum Project Intrusiveness Noise Level $L_{Aeq,15min}$ (dB)
Day	35	40
Evening	30	35
Night	30	35

4.1.3 Project Amenity Noise Level

To limit continuing increases in noise levels from application of the intrusiveness level alone, the ambient noise level within an area from all industrial noise sources combined should remain below the recommended amenity noise levels specified in Table 8 where feasible and reasonable.

The recommended amenity noise levels will protect against noise impacts such as speech interference, community annoyance and some sleep disturbance. The *recommended amenity noise levels* represent the objective for total industrial noise at a receiver location, whereas the *project amenity noise level* represents the objective for noise from a single industrial development at a receiver location.

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:

Project amenity noise level = recommended amenity noise level (from Table 8) minus 5 dB

Table 8. Recommended Amenity Noise Level as per Table 2.2 of the NPI

Receiver Type	Noise Amenity Area	Time of Day	Recommended Amenity Noise Level $L_{Aeq,period}$ (dB)
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	5 dB above the recommended amenity noise level for a residence for the relevant noise amenity area and time of day
School classroom – internal	All	Noisiest 1-hour period when in use	35
Hospital ward internal external	 All All	 Noisiest 1-hour Noisiest 1-hour	 35 50
Place of worship – internal	All	When in use	40
Area specifically reserved for passive recreation (eg national park)	All	When in use	50
Active recreation area (eg school playground, golf course)	All	When in use	55
Commercial premises	All	When in use	65
Industrial premises	All	When in use	70
Industrial interface (applicable only to residential noise amenity areas)	All	All	Add 5 dB to recommended noise amenity area

4.1.4 Recommended Amenity Noise Level – Residential Receiver Classification

Residential receivers must have the area type defined in order to select the applicable recommended amenity noise level. Table 9 below illustrates how the NPI classifies the rural, suburban and urban noise amenity area categories.

Table 9. Residential Receiver Category as per Table 2.3 of the NPI

Receiver Category	Typical Planning Zone	Typical Background Noise Levels (RBL)			Description
		Day	Eve	Night	
Rural residential	RU1, RU2, RU4, R5, E4	<40	<35	<30	**Rural** – an area with an acoustical environment that is dominated by natural sounds, having little or no road traffic noise and generally characterised by low background noise levels. Settlement patterns would be typically sparse. Note: Where background noise levels are higher than those presented in column 3 due to existing industry or intensive agricultural activities, the selection of a higher noise amenity area should be considered.
Suburban residential	RU5, RU6, R2, R3, E2, E3	<45	<40	<35	**Suburban** – an area that has local traffic with characteristically intermittent traffic flows or with some limited commerce or industry. This area often has the following characteristic: evening ambient noise levels defined by the natural environment and human activity.
Urban residential	R1, R4, B1, B3, B4	>45	>40	>35	**Urban** – an area with an acoustical environment that: ▪ is dominated by 'urban hum' or industrial source noise, where urban hum means the aggregate sound of many unidentifiable, mostly traffic and/or industrial related sound sources ▪ has through-traffic with characteristically heavy and ▪ continuous traffic flows during peak periods ▪ is near commercial districts o**r** industrial districts ▪ has any combination of the above

For this development the *rural* classification will apply to the residential receivers when defining the recommended amenity noise level.

4.1.5 Recommended Amenity Noise Level – Existing Background Noise Corrections

The recommended amenity noise level applicable to residential receivers can be changed in the following circumstances:

- When existing traffic noise levels are dominant, are 10 dB above the recommended noise amenity level and are unlikely to decrease, then the project amenity noise levels become the $L_{Aeq,period(traffic)}$ – 15 dB.
- At industrial / residential interfaces where a project seeks to make minor changes to an existing development. In this case, the recommended amenity noise levels can be increased by 5 dB in the region that is in close proximity to existing industrial premises and that extends out to a point where the existing industrial noise from the source has fallen by 5 dB or an area defined in a planning instrument.
- As per the information given in Table 9 for residential receivers in the rural category.

Although this site is affected by high traffic noise levels and existing industrial noise levels it is not possible to separate the contribution of these noise sources in the existing background noise environment. In this case, the high traffic noise adjustments and the industrial interface adjustments to the amenity noise level are not applicable. However, as per Table 9 it is possible to adjust the amenity noise levels for rural receivers if the measured RBLs are greater than the typical RBLs given in Table 9.

The background noise levels measured at the nearest residential receivers in this case are very similar during the evening and night-time periods. The trend in the noise analysis shows that industrial noise sources are dominant throughout the evening and night-time with traffic noise sources adding to the overall levels during the night-time hours 0400 to 0700. In this specific case, it is considered reasonable to increase the recommended amenity noise levels in the night-time by 5 dB to match those of the evening period as per the guidance given in the NPI.

4.1.6 Recommended Amenity Noise Level - Time Period Correction

The L_{Aeq} is determined over a 15-minute period for the project intrusiveness noise level and over an assessment period (day, evening and night) for the project amenity noise level. This leads to the situation where, because of the different averaging periods, the same numerical value does not necessarily represent the same amount of noise heard by a person for different time periods. To standardise the time periods for the intrusiveness and amenity noise levels, the NPI assumes the following conversion:

$L_{Aeq,15min} = L_{Aeq,period} + 3$ dB

(unless robust evidence is provided for an alternative approach for the particular project being considered)

4.1.7 Maximum Noise Level Assessment - Sleep Disturbance

The potential for sleep disturbance from maximum noise level events from premises during the night-time period needs to be considered. Sleep disturbance is considered to be both awakenings and disturbance to sleep stages.

Where the subject development / premises night-time noise levels at a residential location exceed:

- $L_{Aeq,15min}$ 40 dB or the prevailing RBL plus 5 dB, whichever is the greater.

and/or

- L_{AFmax} 52 dB or the prevailing RBL plus 15 dB, whichever is the greater.

a detailed maximum noise level event assessment should be undertaken.

The 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 extent of impacts on sleep include:

- How often high noise events will occur.
- The distribution of likely events across the night-time period and the existing ambient maximum events in the absence of the subject development.
- Whether there are times of day when there is a clear change in the noise environment (such as during early-morning shoulder periods).
- Current scientific literature available at the time of the assessment regarding the impact of maximum noise level events at night.

Maximum noise level event assessments should be based on the L_{AFmax} descriptor on an event basis under *fast* time response. The detailed assessment should consider all feasible and reasonable noise mitigation measures with a goal of achieving the above trigger levels.

4.1.8 NPI Project Noise Trigger Levels (PNTL)

Having defined the area type, the processed results of the unattended noise monitoring have been used to determine project noise trigger levels. The intrusive and amenity noise levels for nearby noise-sensitive receivers are presented in Table 10. These criteria are nominated for the purpose of assessing potential noise impacts from the onsite sources of noise associated with the proposed development.

For each assessment period, the lower (ie the more stringent) of the amenity or intrusive trigger levels are adopted (if applicable), as marked in **bold**, as the project noise trigger levels (PNTL).

Table 10. NPI Project Noise Trigger Levels

Receiver	Time of Day	RANL[1] $L_{Aeq,period}$	Measured RBL[2] $L_{AF90,15min}$	Project Noise Trigger Levels		
				Intrusive $L_{Aeq,15min}$	Amenity $L_{Aeq,15min}$	Sleep Disturbance $L_{Aeq,15min}$
Rural Residential	Day	50	45	50	**48**	-
	Evening	45	46	50	**43**	-
	Night	45[3]	44	49	**43**	**49**
Kariong Correctional Facility[4]	Day	55	45	-	**53**	-
	Evening	50	46	-	**48**	-
	Night	50	44	-	**48**	**49**
Central Coast Riding Centre for the Disabled[5]	When in use	65	-	-	**63**	-
Industrial	When in use	70	-	-	**68**	-

Note 1. RANL = Recommended Amenity Noise Level for residences in Rural areas.
Note 2. RBL = Rating Background Level.
Note 3. RANL increased for night-time period only due to existing RBLs which exceeded typical RBLs for a rural area as per Table 2.3 of the NPI.
Note 4. Correctional facility assumed as similar to temporary accommodation. Therefore 5 dB applied to the RANLs defined for the residential receivers in the area as per Table 2.2 of the NPI. No intrusiveness criteria apply in this case.
Note 5. Assumed as a commercial facility not an educational facility.

4.2 NSW Road Noise Policy (RNP)

Responsibility for the control of noise emissions in New South Wales is vested in Local Government and the NSW Environment Protection Authority (EPA). The EPA oversees the Road Noise Policy (RNP, January 2011) which provides a framework and process for deriving traffic noise criteria. The RNP criteria applicable to this development are given in Table 11 below.

Where the existing noise levels due to traffic already exceed the assessment criteria given in Table 11 then the RNP requires that the total traffic noise level increase should be limited to 2 dB for situations where additional traffic is generated on existing roads by changes to land use developments.

Table 11. RNP Road Traffic Noise Criteria for Residential Land Uses.

Road Category	Type of Project / Land Use	External Assessment Criteria (dB re 20 µPa)	
		$L_{Aeq,15hr}$ (Day)	$L_{Aeq,9hr}$ (Night)
Freeway / arterial / sub-arterial roads	Existing residences affected by additional traffic on existing freeways / arterial / sub-arterial roads generated by land use developments	55	50

5 Operational Noise Modelling

Noise modelling of the site was undertaken using SoundPLAN v7.4 modelling software.

The noise model was constructed from a combination of aerial photography, existing ground topography and design masterplans for the development. The local terrain, design of the development, receiver buildings and structures have been digitised in the noise model to develop a three-dimensional representation of the operations of the development and surrounding environment. The parameters in Table 12 were defined in the noise model to calculate noise levels at sensitive receivers.

Table 12. Noise Model Parameters

Variable	Parameter
Calculation Standard	CONCAWE
Topography	Surrounding Area – 5m resolution
Ground Absorption	0.75 (manly soft vegetation)
Receiver Height	1.5 m (mainly first storey receivers)

5.1.1 Noise Enhancing Meteorological Conditions

Noise model predictions were performed using noise enhancing meteorological conditions given in the NSW Noise Policy for Industry (NPI).

The noise enhancing meteorological conditions used in this assessment are given in Table 13 below. For all conditions the worst-case wind direction (source to receiver) for each receiver was assessed.

Table 13. Noise Enhancing Meteorological Conditions Used in the Noise Assessment

Period	Meteorological Parameters
Day / Evening	Stability categories A-D with light winds up to 3 m/s at 10 m AGL
Night	Stability category F with winds up to 2 m/s at 10 m AGL

Note 1. AGL = Above Ground Level.
Note 2. Stability categories are based on the Pasquill–Gifford stability classification scheme.
Note 3. Worst-case stability category D taken for Day / Evening periods.

This provides a conservative prediction of the potential noise impacts from the development at the surrounding sensitive receivers.

5.2 Operational Scenarios

With reference to Section 2, Table 3 and Table 4 the proposed operational scenarios can be summarised as per Table 14 below.

Table 14. Proposed Operational Scenarios

Time of Day	Description of Operational Noise Sources in Worst-Case 15-minute Period
Day (0700 to 1800 hrs)	**External Processing** – Crusher and mobile screen constant operation. **Materials Handling / Stockpiling** – Front end loader and excavator full load (ie max engine revs) operation for 50% of the time. Moving throughout the site between processing and stockpiling zones. **Processing Shed** – constant processing activities inside the new building with all facades and openings closed. **Deliveries / Truck Movements** - Two (2) B-Doubles / Semi articulated trucks moving throughout the site. Full load (ie max engine revs) operation for 50% of the time
Evening (1800 to 2200 hrs)	**Deliveries / Truck Movements** – Up to two (2) B-Doubles / Semi articulated trucks moving throughout the site. Full load (ie max engine revs) operation for 50% of the time
Night-time (2200 to 0700 hrs)	**Deliveries / Truck Movements** - One (1) B-Double / Semi articulated truck moving throughout the site. This activity will be infrequent and will typically occur during the early morning hours between 0500 and 0700 hrs. Full load (ie max engine revs) operation for 50% of the time

5.3 Fixed Operational Noise Source Levels

The simulated worst-case fixed operational noise sources include:

- Kleeman screen - Sound Power Levels (L_{WA}) as per Table 1.
- Rubblemaster RM100 crusher - Sound Power Levels (L_{WA}) as per Table 1.
- Wood Shredder 2710D - Sound Power Levels (L_{WA}) as per Table 1.
- Processing activities inside the new building comprises:
  a. Processing activities with internal reverberant sound pressure levels as per Table 2.
  b. All facades and openings are closed during noisy activities.
  c. The minimum sound insulation performance of the building facade is assumed to be at least 35 dB R_W.
- Mechanical services plant (medium sized AC plant) associated with the new building offices. Estimated Sound Power Level of 80 dB L_{WA}.

The external crushing and screening plant and the processing building will not operate during the evening or night-time. The fixed plant has been modelled to operate constantly during the day time period.

The crushing and screening plant locations were restricted in the noise model to reflect the 'processing' zone as indicated in Figure 2.

5.4 Mobile Operational Noise Source Levels

Mobile operational noise sources include:

- Delivery vehicles were modelled entering the site from Gindurra Road and then moving around the site as per the site roads shown in Figure 3. For a worst-case noise assessment, the loudest vehicle has been assessed which is the B-Double truck with a typical Sound Power Level of 106 dB L_{WA}. Delivery trucks were assumed to operate at full load (ie max engine revs) for 50% of the time while manoeuvring around the site.
- Permanent onsite vehicles which can move anywhere around the site and have noise levels as given in Table 1. The vehicles were assumed to operate at full load (ie max engine revs) for 50% of the time. The permeant onsite vehicles include:
  a. Volvo L150 front end loader.
  b. CAT 329F excavator.

5.5 Corrections for Annoying Noise Characteristics

Where a noise source contains certain characteristics, such as tonality, intermittency, irregularity or dominant low-frequency content, there is evidence to suggest that it can cause greater annoyance than other noise at the same noise level. On the other hand, some sources may cause less annoyance where only a single event occurs for a limited duration.

The NPI identifies correction factors for annoying noise characteristics which must be applied to the predicted noise levels before assessing against the PNTLs. All of the noise sources in this report have been assessed, based on the noise data available, for annoying noise characteristics. The proposed operational noise sources are generally broadband in nature and have not demonstrated any annoying characteristics as per the definitions in Fact Sheet C of the NPI.

However, due to the potential for impulsive noise when stockpiling and loading / unloading of materials and skip bins inside the processing shed the assessment will apply a 5 dB modifying factor to the predicted noise levels as per Fact Sheet C of the NPI.

6 Predicted Operational Noise Impacts

6.1 Predicted Operational Noise Impacts - NPI

Noise modelling of the fixed and mobile noise sources has been used to predict the noise emissions from the typical operation of the facility to the surrounding sensitive receivers.

With no noise mitigation several of the nearby residential receivers demonstrated exceedances of the PNTLs during day time operations when the crusher and screening plant are operational. In addition, delivery trucks and onsite vehicle movements were found to exceed the PNTLs during the evening and night-time periods.

Noise barriers were investigated as potential feasible and reasonable mitigation measures to satisfy the PNTLs. Noise modelling was undertaken to optimise the height and extents of noise barriers across the site to satisfy the PNTLs during all assessment periods. Figure 4 illustrates the optimised noise barriers across the site which are recommended to achieve compliance with the PNTLs. These barriers must be used in conjunction with restricting the crushing and screen plant to the 'processing' zone indicated.

Figure 4. Recommended Noise Barrier Locations, Heights and Extents to Achieve Compliance with the PNTLs

A selection of the predicted worst-case operational noise levels due to onsite noise sources with the recommended noise barriers are summarised and compared against the NPI project noise trigger levels in Table 15.

In addition, noise contour maps for the day, evening and night-time periods are provided in Appendix B. The noise contours presented are taken at 1.5 m elevation to simulate first storey receivers (ie typical residential receivers in the area). The noise contours show how the noise emission from the proposed development propagates into the surrounding environment.

Table 15. Predicted Operational Noise Levels Compared to PNTLs

Location	Worst-Case $L_{Aeq,15m}$			PNTLs Exceedance $L_{Aeq,15m}$			$L_{Aeq,15m}$ Sleep Disturbance
	Day	Eve	Night	Day	Eve	Night	
Residential				**48**	**43**	**43**	**49**
5 Kowara Rd	26	≤20	≤20	0	0	0	0
9 Kowara Rd	30	≤20	≤20	0	0	0	0
31 Kowara Rd	29	≤20	≤20	0	0	0	0
41 Kowara Rd	31	≤20	≤20	0	0	0	0
51 Kowara Rd	30	≤20	≤20	0	0	0	0
10 Acacia Rd	48	33	30	0	0	0	0
12 Acacia Rd	46	32	29	0	0	0	0
16 Acacia Rd	45	31	28	0	0	0	0
32 Acacia Rd	45	35	32	0	0	0	0
125 Debenhams Rd Sth	≤20	≤20	≤20	0	0	0	0
127 Debenhams Rd Sth	23	≤20	≤20	0	0	0	0
129 Debenhams Rd Sth	21	≤20	≤20	0	0	0	0
184 Debenhams Rd Sth	23	≤20	≤20	0	0	0	0
198 Debenhams Rd Sth	33	≤20	≤20	0	0	0	0
214 Debenhams Rd Sth	39	23	≤20	0	0	0	0
223 Debenhams Rd Sth	35	26	23	0	0	0	0
242 Debenhams Rd Sth	**49**	34	31	**1**	0	0	0
252 Debenhams Rd Sth	44	30	27	0	0	0	0
Correctional				**53**	**48**	**48**	**59**
Kariong Correctional Facility	44	32	29	0	0	0	0
Commercial				**63**	**63**		
Central Coast Riding for the Disabled	47	32	29	0	0	-	-
Industrial				**68**	**68**	**68**	
All Industrial sites	<50	<30	<30	0	0	0	-

The results from Table 15 and Appendix B demonstrate that the noise emissions from the site to the surrounding environment (with the recommended noise barriers and processing zone restrictions) are low. The proposed development satisfies the PNTLs at all nearby residential receivers except for 242 Debenhams Road South which has a 1 dB exceedance above the trigger level.

Table 16 below reproduces Table 4.1 and 4.2 from the NPI. This information gives guidance on the significance of residual impacts at residential premises when all other reasonable and feasible mitigation measures have been implemented.

Table 16. Significance of Residual Impacts as per Table 4.1 and 4.2 of the NPI

Predicted Noise Level minus PNTL	Total Cumulative Industrial Noise Level	Significance of the Residual Noise Level
≤ 2	Not applicable	**Negligible** - The exceedances would not be discernible by the average listener and therefore would not warrant receiver-based treatments or controls.
≥ 3 but ≥ 5	< 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 1 dB	**Marginal** - Provide mechanical ventilation/comfort condition systems to enable windows to be closed without compromising internal air quality/amenity.
≥ 3 but ≥ 5	> recommended amenity noise level and the increase in total cumulative industrial noise level resulting from the development is more than 1 dB	**Moderate** - As for 'marginal', but also upgraded façade elements, such as windows, doors or roof insulation, to further increase the ability of the building facade to reduce noise levels.
> 5	≤ recommended amenity noise level	
> 5	> recommended amenity noise level	**Significant** - May include suitable commercial agreements where considered feasible and reasonable.

In this case, the 1 dB exceedance at 242 Debenhams Road South is considered to be negligible as per the guidance in the NPI. The noise emissions from the site to all residential receivers are therefore considered compliant with the NPI guidelines. No further mitigation measures or actions are required as result.

Table 15 also demonstrates that the potential for noise impacts during the night-time which have potential for sleep disturbance events are low. The sleep disturbance PNTLs are satisfied as result.

The PNTLs at all nearby correctional, commercial and industrial receivers are also satisfied.

We note that the processing shed and associated mechanical services are based on the assumptions given in Section 5.3. The facade sound insulation performance and processing / mechanical services noise levels should be reviewed and compliance with criteria confirmed during the detailed design of the building.

6.2 Predicted Operational Noise Impacts – RNP

Comparing the applicable RNP criteria from Table 11 to the measured traffic noise along Gindurra Road / Debenhams Road South from Table 6 we find that the RNP criteria are already likely to be exceeded. Based on this, the allowable increase in noise due to traffic from the proposed site must not exceed 2 dB as per the RNP requirements.

To calculate the traffic noise impacts generated by the operation of the development the existing road traffic volumes for Gindurra / Debenhams Road South (nearest impacted roads) are required. Existing traffic data for Gindurra / Debenhams Road South was supplied by the traffic consultants for the project – Seca Solution. The increase in traffic volumes due to proposed development are provided in Table 4.

Table 17 summarises the predicted increase in noise levels on Gindurra / Debenhams Road South due to the traffic generated by the proposed development site.

Table 17. Summary of Traffic Noise Increases on Surrounding Roads (from available traffic data)

Road	Existing Traffic		Increase in Traffic (due to site)		Increase in Noise Levels dB
	Volume per Day	Percentage Heavy Vehicles %	Volume per Day	Percentage Heavy Vehicles %	
Gindurra / Debenhams Road South	~4,000	10%	70	87%	<0.5

Since the existing traffic noise levels on Gindurra / Debenhams Road South already likely exceed the RNP criteria, all new traffic noise increases must satisfy the 2 dB increase criteria. Table 17 shows that the proposed development generates negligible additional traffic noise. The RNP criteria are satisfied as a result.

7 Construction Noise & Vibration Assessment Guidelines

People are typically more tolerant to noise and vibration during the construction phase of proposals than during normal operation. This response results from recognition that the construction emissions are of a temporary nature – especially if the most noise-intensive construction impacts occur during the less sensitive daytime period. For these reasons, acceptable noise and vibration levels are normally higher during construction than during operations.

Construction often requires the use of heavy machinery which can generate high noise and vibration levels at nearby buildings and receivers. For some equipment, there is limited opportunity to mitigate the noise and vibration levels in a cost-effective manner and hence the potential impacts should be minimised by using feasible and reasonable management techniques.

At any particular location, the potential impacts can vary greatly depending on factors such as the relative proximity of sensitive receivers, the overall duration of the construction works, the intensity of the noise and vibration levels, the time at which the construction works are undertaken, and the character of the noise or vibration emissions.

7.1 Construction Hours

For this project the construction works would be undertaken in accordance with the Interim Construction Noise Guideline (DECCW 2009) and would typically occur during the standard working hours between:

- 0700 to 1800 hrs Monday to Friday.
- 0800 to 1300 hrs on Saturdays.

There would generally be no construction works on Sundays or public holidays.

Where Out-of-Hours Works (OOHWs) are required (for emergency works, oversized equipment delivery, etc) it is likely that they would require separate approval.

7.2 Noise Management Levels for Construction Activities

The ICNG requires proposal specific Noise Management Levels (NMLs) to be established for noise affected receivers. In the event construction noise levels are predicted to be above the NMLs, all feasible and reasonable work practices are investigated to minimise noise emissions.

Having investigated all feasible and reasonable work practices, if construction noise levels are still predicted to exceed the NMLs then the potential noise impacts would be managed via site specific construction noise management plans, to be prepared in the detailed design phase.

7.2.1 Residential Receivers

The ICNG provides an approach for determining $L_{Aeq,15min}$ NMLs at residential receivers by applying the measured $L_{AF90,15min}$ rating background noise levels (RBL), as described in Table 18.

Table 18. Determination of NMLs for Residential Receivers

Time of Day	NML $L_{Aeq,15min}$	Time of Day
Standard hours Monday to Friday 0700 to 1800 hrs Saturday 0800 to 1300 hrs No work on Sundays or public holidays	RBL + 10 dB	The **noise affected level** represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq,15min}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practises 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.
	≥ 75 dB (Highly Noise Affected)	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 restructuring 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 hours	RBL + 5 dB	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 practises have been applied and noise is more than 5 dB above the noise affected level, the proponent should negotiate with the community.

Note 1: Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence. Noise levels may be higher at upper floors of the noise affected residence.

Note 2: The RBL is the overall single-figure background noise level measured in each relevant assessment period (during or outside the recommended standard hours). The term RBL is described in detail in the NSW Noise Policy for Industry (NPI).

Adopting the measured background noise levels in Table 5 the NMLs derived for the proposal are detailed in Table 19.

Table 19. Construction NMLs for Residential Receivers

Receiver	Time of Day	Construction NMLs $L_{Aeq,15min}$ (dB)		
		Standard Hours	Out-of-Hours	Highly Noise Affected
All nearby residential receivers	Day	55	50	75
	Evening	N/A	50[1]	75
	Night-time	N/A	49	75

Note 1. Since RBLs in the evening time are marginally higher than day time RBLs the evening out-of-hours RBLs has been adjusted to match the day time RBL as this is more stringent.

The most affected receivers are typically the closest, front row receivers which have a direct line of sight to the nearby construction works. Whilst background noise levels may reduce for receivers which are further back from the proposed works (and nearby roads) the construction noise predictions are likely to drop off at a quicker rate meaning the level of impact would be lower than the most affected, closest locations.

Residential NMLs detailed in Table 19 are also applicable for the Kariong Correction Facility which is potentially affected by construction noise emission from the project.

Where construction would be undertaken during the night-time period the potential for sleep disturbance should be assessed. The current approach to identifying potential sleep disturbance impacts is to set a screening criterion for the L_{AFmax} which is 15 dB above the RBL during the night-time period (2200 to 0700 hrs). However, this project will not conduct any construction works during the night-time period. Therefore, construction related sleep disturbance impacts will be nil and considered no further in this assessment.

7.2.2 Commercial and Industrial Premises

For commercial premises, including offices, retail outlets and small commercial premises an external NML of 70 dB $L_{Aeq,15min}$ has been adopted. An external NML of 75 dB $L_{Aeq,15min}$ has been adopted for industrial premises. In both land uses, the external noise levels should be assessed at the most affected occupied point on the premises.

7.3 Construction Traffic Noise

When trucks and other vehicles are operating within the boundaries of the various construction sites, road vehicle noise contributions are included in the overall predicted $L_{Aeq,15min}$ construction site noise emissions and then compared against the NMLs. When construction related traffic moves onto the public road network a different noise assessment methodology is appropriate, as vehicle movements would be regarded as 'additional road traffic' rather than as part of the construction site.

The ICNG does not provide specific guidance in relation to acceptable noise levels associated with construction traffic. For assessment purposes, guidance is taken from the RNP; however, it is noted that these are taken as noise goals only and are not mandatory.

One of the objectives of the RNP is to apply relevant permissible noise increase criteria to protect sensitive receivers against excessive decreases in amenity as the result of a proposal. In assessing feasible and reasonable mitigation measures, an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person.

On this basis, construction traffic NMLs set at 2 dB above the existing road traffic noise levels during the daytime and night-time periods are considered appropriate to identify the onset of potential noise impacts. For any increase of more than 2 dB then consideration should be given to applying feasible and reasonable noise mitigation measures to reduce the noise impacts and preserve acoustic amenity.

7.4 Construction Vibration

An example of the recommended safe working distances for vibrationally intensive plant is provided in Table 20.

Table 20. Recommended Safe Working Distances for Vibration Intensive Plant

Plant Item	Rating / Description	Safe Working Distance	
		Cosmetic Damage[1]	Human Response[2]
Vibratory Roller	< 50 kN (Typically 1-2 tonnes)	5 m	15 m to 20 m
	< 50 kN (Typically 2-4 tonnes)	6 m	20 m
	< 50 kN (Typically 4-6 tonnes)	12 m	40 m
	< 50 kN (Typically 7-13 tonnes)	15 m	100 m
	< 50 kN (Typically 13-18 tonnes)	20 m	100 m
	< 50 kN (Typically > 18 tonnes)	25 m	100 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)	N/A
Jackhammer	Hand held	1 m (nominal)	Avoid contact with structure

Note 1: Referenced from British Standard BS 7385 Part 2-1993.
Note 2: Referenced from Assessing Vibration: A Technical Guideline.

The typical offset distance between any vibrationally intensive construction plant and the nearest residential receivers is > 300 m. Comparing the residential offset distance to the safe working distances shows that all residential receivers are located much further away than the safe working distances. Therefore, the potential for vibration impacts due to the construction of the development is effectively nil. All vibration criteria with respect to cosmetic damage to buildings and human comfort impacts will be satisfied. No further consideration of vibration impacts is given in this assessment as a result.

8 Construction Noise Modelling

The same noise model as described in Section 5 (operation noise model) was used as the basis of the construction noise model with the necessary modifications to the noise sources (ie construction activities) and construction scenarios.

8.1 Construction Scenarios & Noise Sources

Table 21 summarises the proposed construction equipment for the site. In general, the majority of the construction phase will focus on earth works to prepare the site for future operations. The earthworks will be required to remove the large existing stockpiles of material and process / crush these for use elsewhere on the site or for removal.

Table 21. Proposed Construction Plant Information and Sound Power Levels L_{WA}

Construction Item	Make / Model	Capacity	Estimated Sound Power Level L_{WA}	No. of Days	Notes
Concrete Crusher	RM100	500 tonnes / day	108	20	Approximately 10,000 tonnes of concrete on site needs to be crushed into aggregate for construction of operational pad and roads
Mobile screening plant	Kleeman screen	500 tonnes / day	110	50	Screening plant required to screen and grade crushed concrete (20 days) and ENM on site for construction of noise attenuation barrier (30 days)
Excavator	CAT 329F	~35 tonnes	105	60	Drainage works, pipe and pit construction
Front end loader	Volvo L150	~35 tonnes	108	60	General construction and loading activities across the site
Grader	-	~35 tonnes	108	10	Construction and levelling of operational pad and roadways
Bull dozer	-	~35 tonnes	110	10	Construction of noise attenuation barrier
Dump truck	-	~25 tonnes	100	30	General construction and loading activities across the site
Roller	-	~ 35 tonnes	109	14	Roadway and operational pad construction

The ICNG recommends that the realistic worst-case or conservative noise levels from the source should be predicted for assessment locations representing the most noise-exposed residences or other sensitive land uses. For most construction activities, it is expected that the construction noise levels would frequently be lower than predicted as the intensity of use and location of the construction equipment will vary throughout the site and throughout the day.

To simulate a realistic worst-case construction scenario the model will assume that all equipment is present on site and that each piece of equipment is operating at full load for 50% of the time, with the exception of the crushing and screen plant which will operate continuously. Up to two (2) dump trucks will be assumed to be in operation throughout the site at any one time.

8.2 Construction Traffic Volumes

The proposed construction traffic movements were provided by Jackson Environment and Planning and are summarised in Table 22.

Table 22. Summary of Construction Traffic Volumes

Type of Vehicle	Total Vehicles per Day
B - Double Truck	4

9 Predicted Construction Noise Impacts

The following section details the assessment of potential airborne noise impacts associated with the construction of the proposal. Construction noise goals have been determined based on the relevant government guidelines and industry standards. Potential noise levels have been predicted at sensitive receivers for the proposed construction activities and where levels are above the goals, feasible and reasonable impact mitigation measures are considered.

9.1 Construction Noise Impacts from Onsite Noise Sources

The typical $L_{Aeq,15m}$ noise levels at the surrounding noise sensitive receivers are provided in Table 23 and are representative of the 'noisiest' construction periods allowing for the simultaneous operation of noise intensive construction equipment in close proximity.

Table 23. Predicted Construction Noise Levels

Location	Worst-Case $L_{Aeq,15m}$			NML Exceedance $L_{Aeq,15m}$		
	Day	Eve	Night	Day	Eve	Night
Residential				**55**	**50**	**49**
5 Kowara Rd	38	-	-	0	-	-
9 Kowara Rd	42	-	-	0	-	-
31 Kowara Rd	45	-	-	0	-	-
41 Kowara Rd	48	-	-	0	-	-
51 Kowara Rd	46	-	-	0	-	-
10 Acacia Rd	66	-	-	11	-	-
12 Acacia Rd	64	-	-	9	-	-
16 Acacia Rd	58	-	-	3	-	-
32 Acacia Rd	60	-	-	5	-	-
127 Debenhams Rd Sth	37	-	-	0	-	-
129 Debenhams Rd Sth	32	-	-	0	-	-
184 Debenhams Rd Sth	36	-	-	0	-	-
198 Debenhams Rd Sth	43	-	-	0	-	-
214 Debenhams Rd Sth	51	-	-	0	-	-
223 Debenhams Rd Sth	56	-	-	1	-	-
242 Debenhams Rd Sth	67	-	-	12	-	-
252 Debenhams Rd Sth	55	-	-	0	-	-
Correctional				**55**	**50**	**49**
Kariong Correctional Facility	54	-	-	0	-	-
Commercial				**70**	**63**	
Central Coast Riding for the Disabled	49	-	-	0	-	-
Industrial				**75**	**68**	**68**
All Industrial sites	<50	-	-	0	0	0

During standard construction hours, exceedances of the NMLs of up to 12 dB are predicted at the closest residential receivers on Acacia Road and Debenhams Road South. This assessment has only considered construction activities inside standard construction hours. Where this is not possible then any OOHWs would be subject to separate approval on a case-by-case basis

Noise levels are not predicted to exceed 75 dB $L_{Aeq,15m}$ at any receivers. Therefore, no receivers are found to be highly noise affected as per the ICNG.

9.1.1 Standard Mitigation Measures

When construction noise levels are predicted to exceed the NMLs the ICNG recommends that construction noise mitigation measures should be considered, where reasonable and feasible. Standard construction noise mitigation measures include the following:

- Avoiding the coincidence of noisy plant working simultaneously close together would result in reduced noise emissions.
- Equipment which is used intermittently is to be shut down when not in use.
- Where possible, equipment with directional noise emissions should be oriented away from sensitive receivers.
- Regular compliance checks on the noise emissions of all plant and machinery used for the proposal would indicate whether noise emissions from plant items were higher than predicted. This also identifies defective silencing equipment on the items of plant.
- Non-tonal reversing alarms should be used on all items of plants and heavy vehicles used for construction.

9.1.2 Additional Mitigation Measures

The operational assessment found that noise walls are required to mitigate noise impacts on the nearby residential receivers. Since these mitigation measures must be implemented at some point, the construction / installation of these walls could be scheduled as early as possible in the construction phase to minimise the construction noise impacts for the remainder of the construction period.

Therefore, in this case, we recommend the 5 m high noise walls along the eastern boundary as per Figure 4 be constructed as early as practicable in the construction phase.

9.2 Construction Noise Impacts from Construction Traffic

To calculate the construction traffic noise impacts generated by the operation of the development the existing road traffic volumes for Gindurra / Debenhams Road South (nearest impacted roads) are required. Existing traffic data for Gindurra / Debenhams Road South was supplied by the traffic consultants for the project – Seca Solution. The increase in traffic volumes due to proposed construction are provided in Table 22.

Table 24 summarises the predicted increase in noise levels on Gindurra / Debenhams Road South due to the construction traffic generated by the proposed development site.

Table 24. Summary of Construction Traffic Noise Increases on Surrounding Roads (from available traffic data)

Road	Existing Traffic		Increase in Traffic (due to construction)		Increase in Noise Levels dB
	Volume per Day	Percentage Heavy Vehicles %	Volume per Day	Percentage Heavy Vehicles %	
Gindurra / Debenhams Road South	~4,000	10%	4	100%	<0.5

Table 24 shows that the proposed development generates negligible additional traffic noise. The RNP 2 dB increase criteria are satisfied as a result.

10 Conclusion

Waves Consulting has conducted a noise and vibration impact assessment of the proposed development at 90 Gindurra Road, Somersby, NSW. The proposal seeks to upgrade the existing industrial site to increase the materials processing capacity of the facility. This assessment has investigated the worst-case noise emissions associated with the construction and operation of the facility upgrade.

This assessment has demonstrated that the predicted noise emissions from the site to the surrounding environment are low. The proposed development satisfies the Project Noise Trigger Levels (PNTLs) of the NSW Noise Policy for Industry (NPI) during all time periods provided the following noise mitigation measures are included:

- 5 m high noise barriers along the eastern site boundary as per Figure 4.
- 3 m high noise barriers inside the site adjacent to the processing zone and landscaping storage zone as per Figure 4.
- Processing building facade construction to provide a minimum airborne sound insulation performance of 35 dB R_w. This requirement should be reviewed and confirmed during detailed design.
- Processing building to have all doors and openings completely closed during noisy activities.
- Processing building mechanical equipment (AC units etc) should have a maximum aggregate sound power level of 80 dB L_{WA}. This requirement should be reviewed and confirmed during detailed design.

The sleep disturbance impacts from the operational noise events generated by the site where investigated in this assessment. The proposed development satisfies the sleep disturbance trigger levels at all nearby sensitive receivers.

The existing traffic noise levels on Gindurra / Debenhams Road South already likely exceed the RNP criteria. Therefore, all new traffic noise increases must satisfy the RNP 2 dB increase criteria. Table 17 of this assessment shows that the proposed development generates negligible additional traffic noise. The NSW Road Noise Policy (RNP) criteria are satisfied as a result.

The construction noise impacts have been assessed in accordance with the NSW Interim Construction Noise Guidelines (ICNG). During standard construction hours, exceedances of the NMLs of up to 12 dB are predicted at the closest residential receivers on Acacia Road and Debenhams Road South. No receivers were found to be 'highly noise affected' as per the ICNG. Standard noise mitigation measures have been recommended for the construction phase. In addition, the operational noise walls along the eastern boundary (as per Figure 4) should be constructed as early as practicable to reduce construction noise impacts for the remainder of the construction period.

Construction traffic noise levels must satisfy the RNP 2 dB increase criteria. Table 24 of this assessment shows that the construction traffic generates negligible additional traffic noise. The NSW Road Noise Policy (RNP) criteria are satisfied as a result.

The offset distances (in all directions) between the vibrationally intensive equipment and any sensitive receivers is large (> 300 m). The potential for vibration impacts due to the construction or operation of the development are effectively nil. All vibration criteria with respect to cosmetic damage to buildings and human comfort impacts will be satisfied as a result.

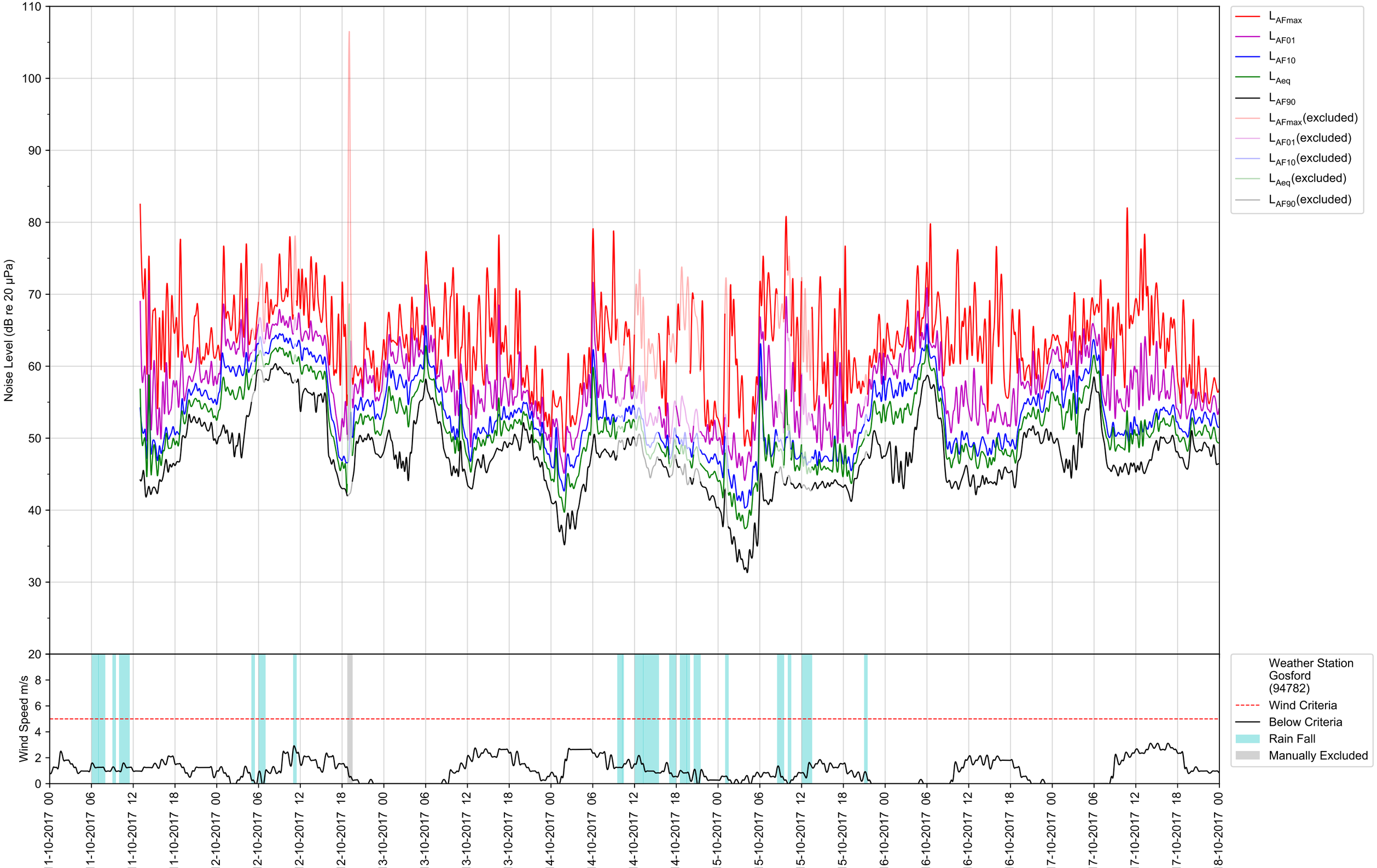
It is concluded that the proposed materials processing facility is a complying development with respect to noise and vibration impacts and is therefore suitable for construction and operation.

APPENDIX A:
GRAPHICAL NOISE LOGGER DATA

Project: Davis Earthmoving & Quarrying Pty Ltd
Project Number: 60.00741.03
Location: 90 Gindurra Road, Kariong, NSW 2178
Equipment: Svan 977
Serial Number: 45635
Pre Calibration: 0.40 dB
Post Calibration: 0.15 dB

Graphical Noise Logger Data
Week 1: 11-10-2017 to 18-10-2017

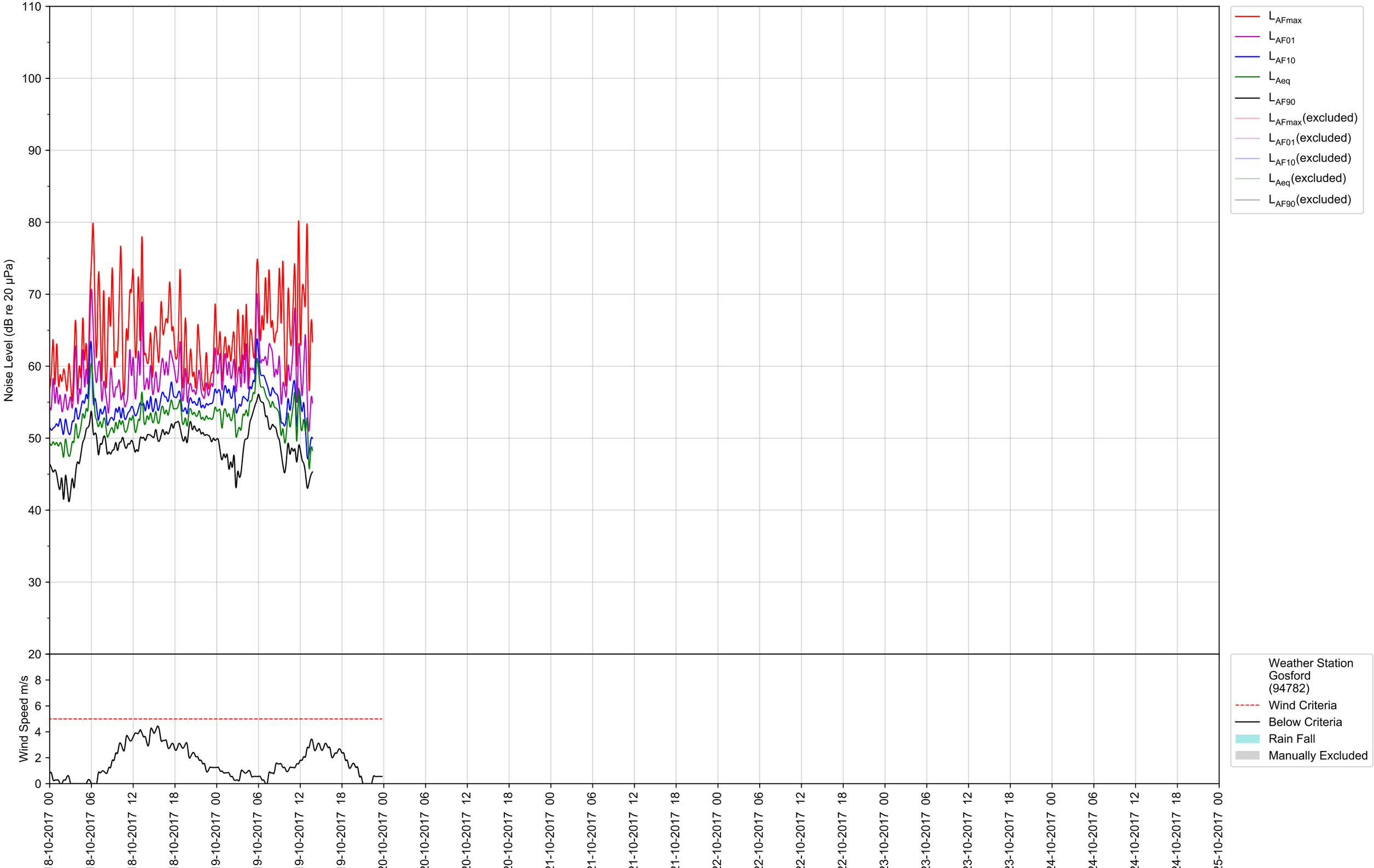
Waves CONSULTING



Project: Davis Earthmoving & Quarrying Pty Ltd
Project Number: 60.00741.03
Location: 90 Gindurra Road, Kariong, NSW 2178
Equipment: Svan 977
Serial Number: 45635
Pre Calibration: 0.40 dB
Post Calibration: 0.15 dB

Graphical Noise Logger Data
Week 2: 18-10-2017 to 25-10-2017

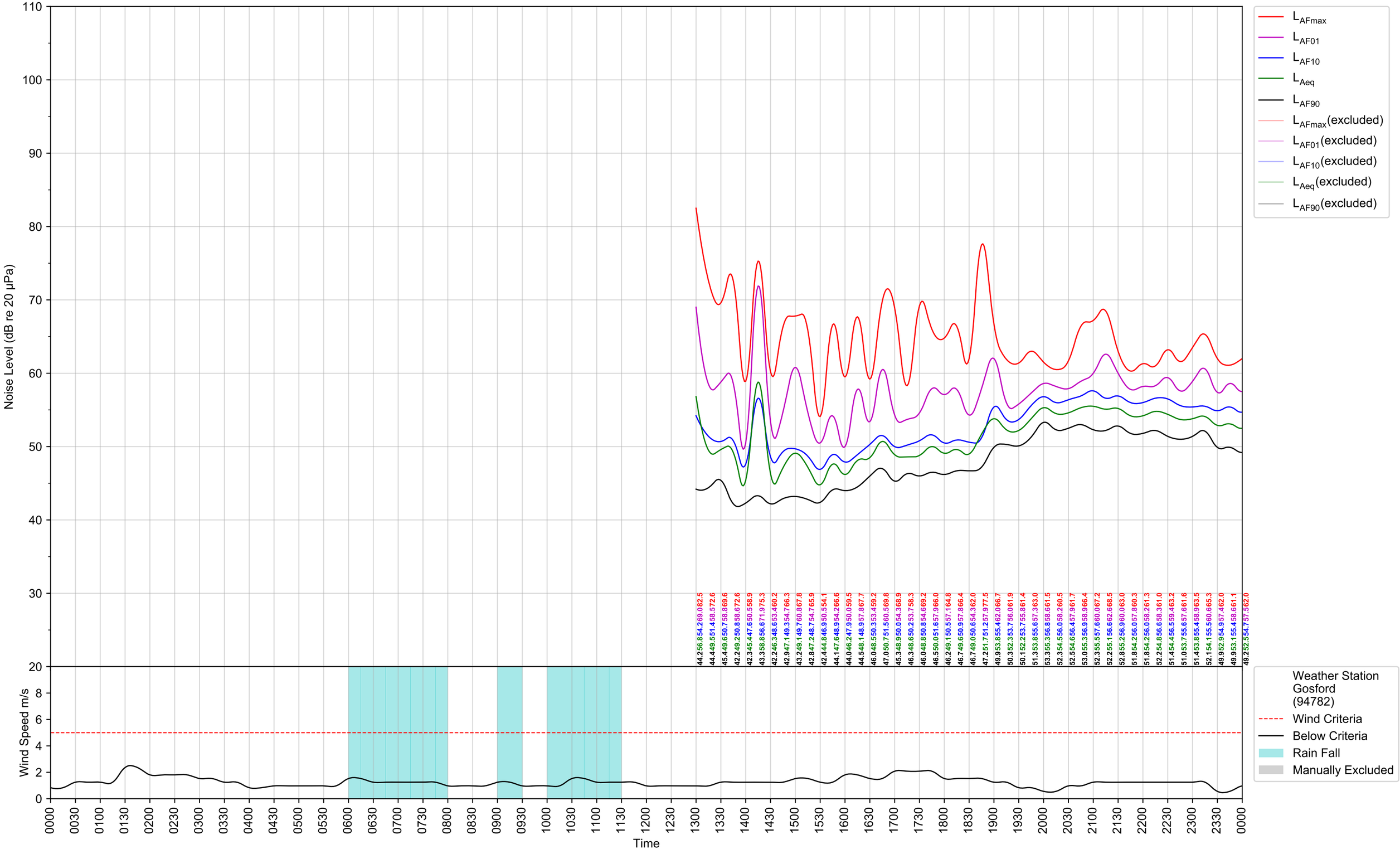
Waves CONSULTING



Project: Davis Earthmoving & Quarrying Pty Ltd
Project Number: 60.00741.03
Location: 90 Gindurra Road, Kariong, NSW 2178
Equipment: Svan 977
Serial Number: 45635
Pre Calibration: 0.40 dB
Post Calibration: 0.15 dB

Graphical Noise Logger Data
Date: Wednesday 11 October 2017

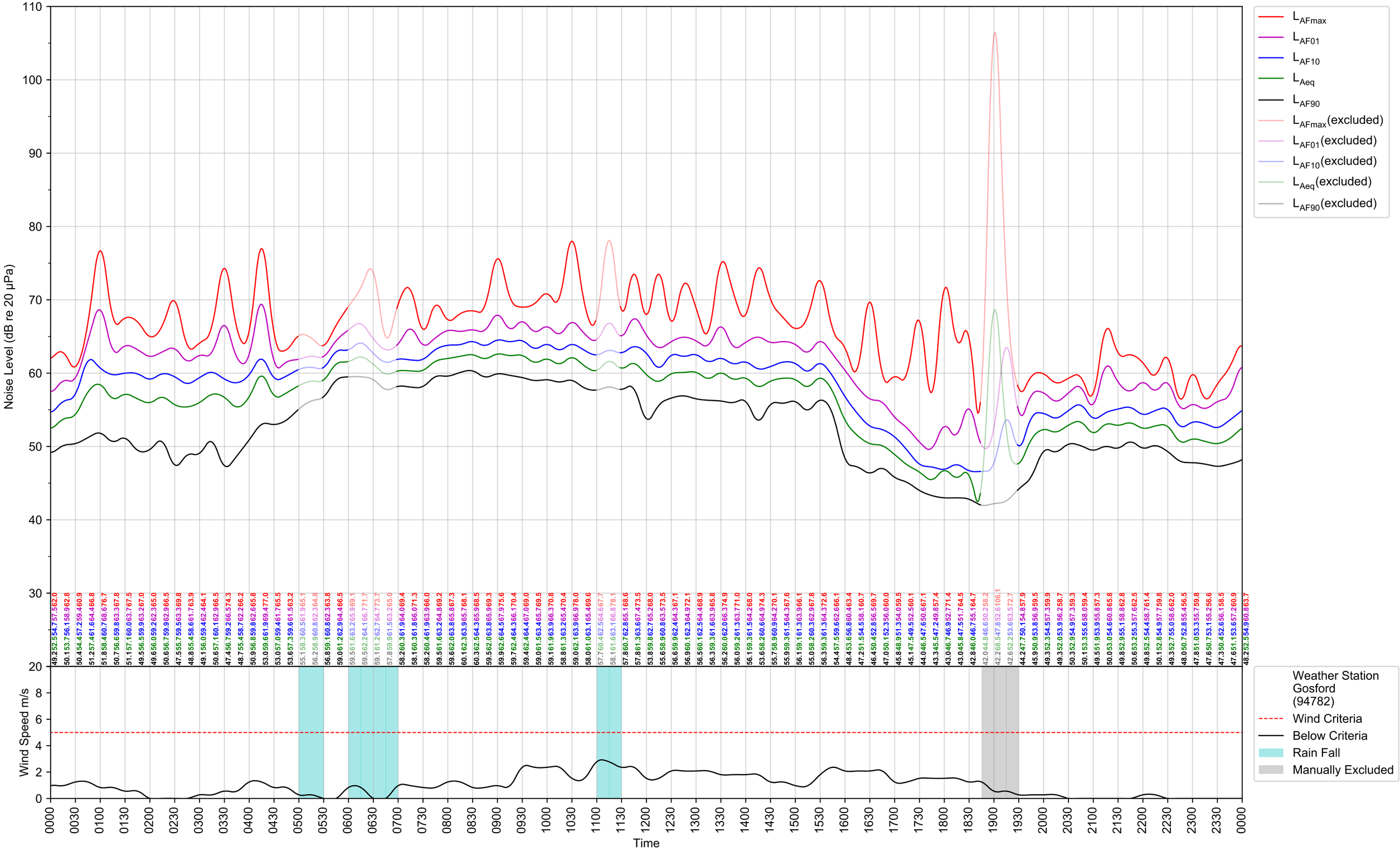
Waves CONSULTING



Project: Davis Earthmoving & Quarrying Pty Ltd
Project Number: 60.00741.03
Location: 90 Gindurra Road, Kariong, NSW 2178
Equipment: Svan 977
Serial Number: 45635
Pre Calibration: 0.40 dB
Post Calibration: 0.15 dB

Graphical Noise Logger Data
Date: Thursday 12 October 2017

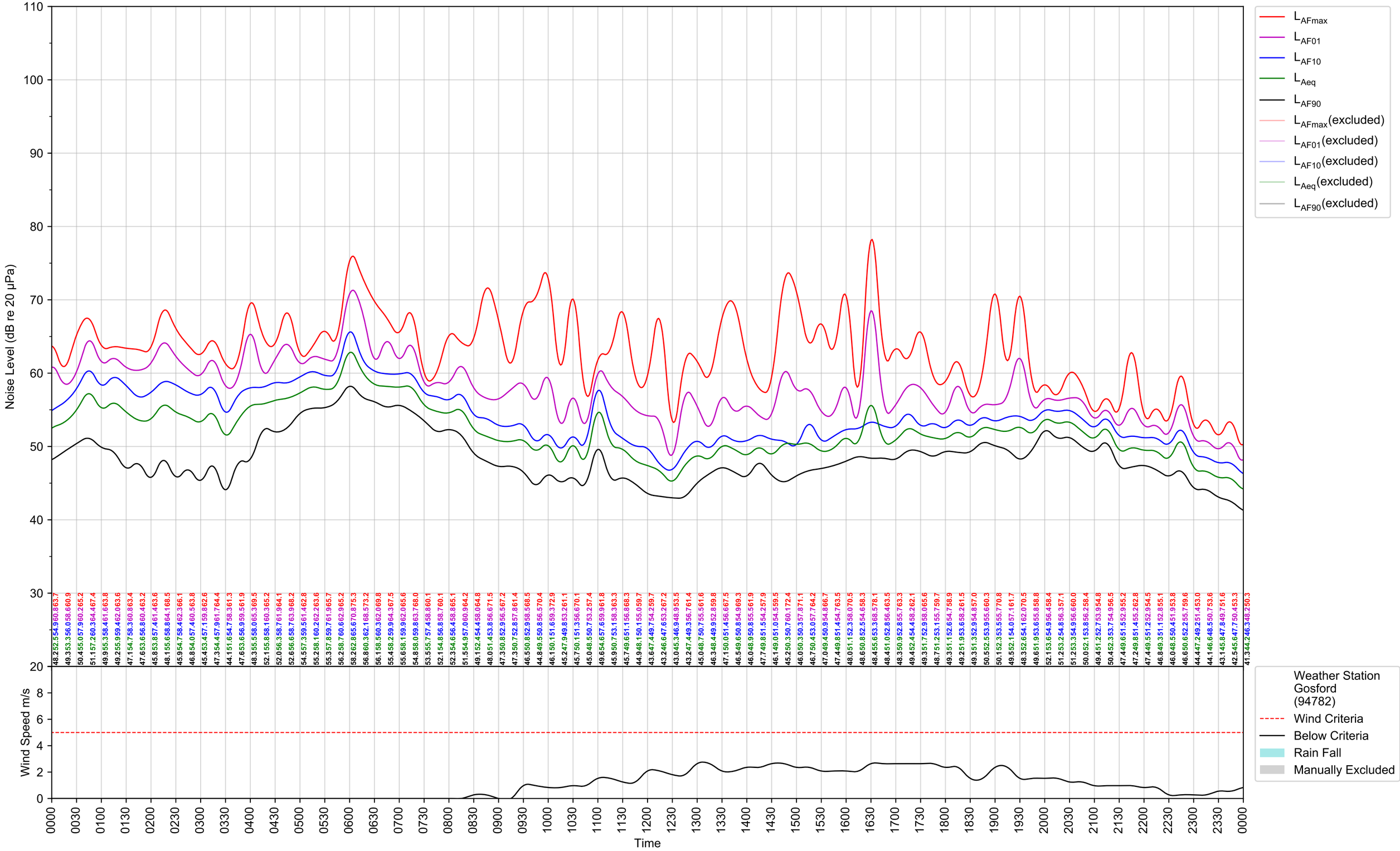
Waves CONSULTING



Project: Davis Earthmoving & Quarrying Pty Ltd
Project Number: 60.00741.03
Location: 90 Gindurra Road, Kariong, NSW 2178
Equipment: Svan 977
Serial Number: 45635
Pre Calibration: 0.40 dB
Post Calibration: 0.15 dB

Graphical Noise Logger Data
Date: Friday 13 October 2017

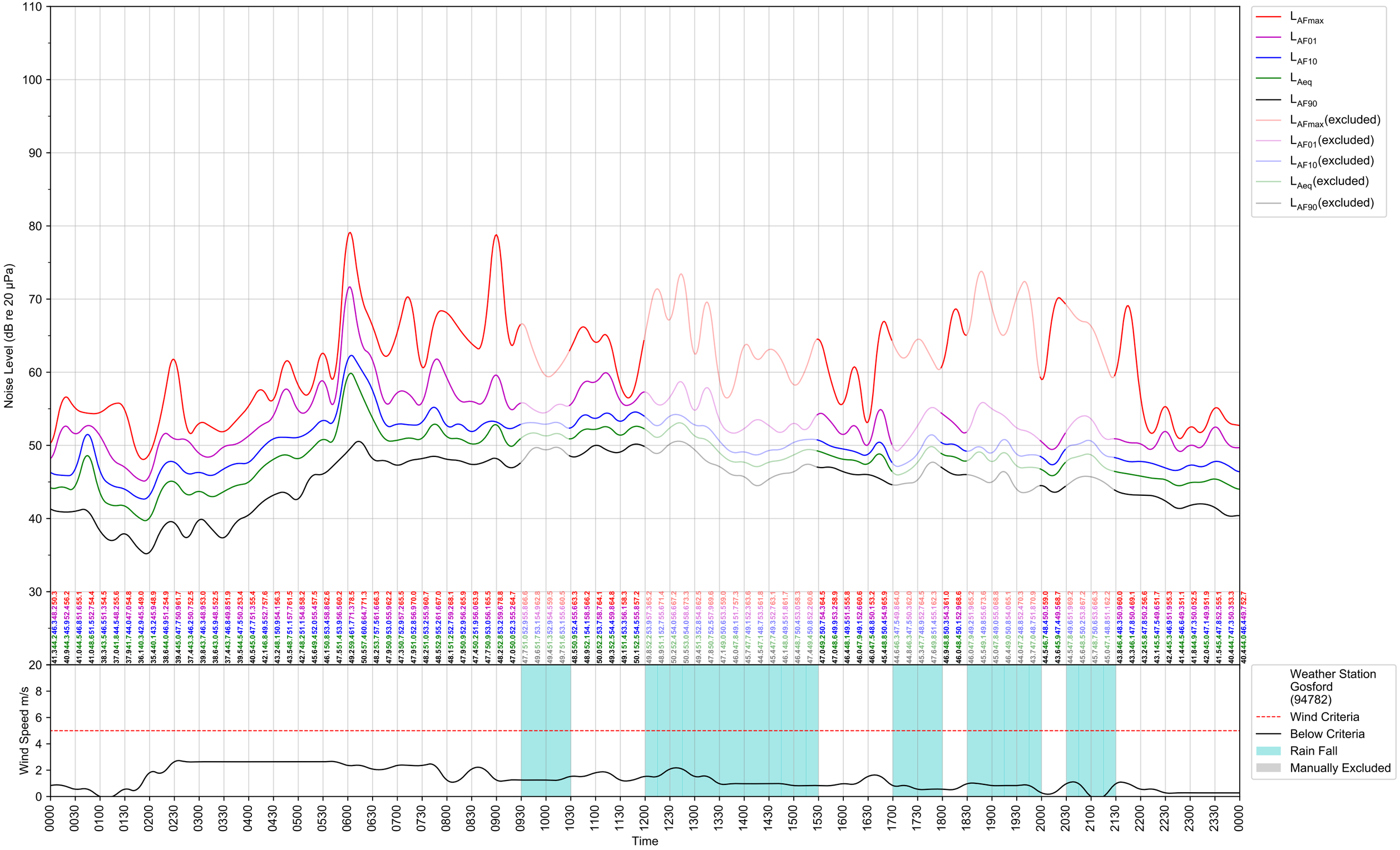
Waves CONSULTING



48.2	52.5	54.9	60.8	63.7						
49.3	53.3	56.0	58.6	60.9						
50.4	55.0	57.9	60.2	65.2						
51.1	57.2	60.3	64.4	67.4						
49.9	55.3	58.4	61.6	63.8						
49.2	55.9	59.4	62.0	63.6						
47.1	54.7	58.3	60.8	63.4						
47.6	53.6	56.8	60.4	63.2						
45.8	53.8	57.4	61.4	63.6						
48.1	55.6	58.8	64.1	68.5						
45.9	54.7	58.4	62.3	66.1						
46.8	54.0	57.4	60.5	63.8						
45.4	53.4	57.1	59.8	62.6						
47.3	54.4	57.9	61.7	64.4						
44.1	51.6	54.7	58.3	61.3						
47.6	53.6	56.9	59.5	61.9						
48.3	55.5	58.0	65.3	69.5						
52.1	55.8	58.1	60.3	65.2						
52.0	56.3	58.7	61.9	64.1						
52.6	56.6	58.7	63.9	68.2						
54.5	57.3	59.5	61.4	62.8						
55.2	58.1	60.2	62.2	63.6						
55.3	57.8	59.7	61.9	65.7						
56.2	58.7	60.6	62.9	65.2						
58.2	62.8	65.6	70.8	75.3						
56.8	60.3	62.1	68.5	73.2						
56.1	58.5	60.3	62.0	69.8						
55.4	58.2	59.9	64.3	67.5						
55.6	58.1	59.9	62.0	65.6						
54.8	58.0	59.8	63.7	68.0						
53.5	55.7	57.4	58.8	60.1						
52.1	54.8	56.8	58.8	60.1						
52.3	54.6	56.4	58.8	65.1						
51.5	54.9	57.0	60.9	64.2						
49.1	52.4	54.4	58.0	64.8						
48.0	51.4	53.8	56.6	71.5						
47.3	50.8	52.9	56.7	67.2						
47.3	50.7	52.8	57.8	61.4						
46.5	50.8	52.9	58.5	68.5						
44.8	49.5	50.8	56.5	70.4						
46.1	50.1	51.6	59.3	72.9						
45.2	47.9	49.8	53.2	61.1						
45.7	50.1	51.3	56.6	70.1						
45.0	48.5	50.7	53.2	57.4						
49.6	54.6	57.9	61.1	61.8						
45.9	50.7	53.1	58.3	63.3						
45.7	49.6	51.1	56.8	68.3						
44.9	48.1	50.1	55.0	59.7						
43.6	47.4	49.7	54.2	59.7						
43.2	46.6	47.6	53.2	67.2						
43.0	45.3	46.9	48.9	53.5						
43.2	47.4	49.3	56.7	61.4						
45.0	48.7	50.7	55.5	61.6						
46.3	48.4	49.9	52.8	59.8						
47.1	50.0	51.4	56.6	67.5						
46.5	49.6	50.8	54.9	69.3						
46.0	48.9	50.8	55.5	61.9						
47.7	49.8	51.5	54.2	57.9						
46.1	49.0	51.0	54.5	59.5						
45.2	50.3	50.7	60.1	72.4						
46.0	50.3	50.3	57.8	71.1						
46.7	50.4	53.0	57.7	64.2						
47.0	49.4	50.9	54.8	66.7						
47.4	49.8	51.4	54.7	63.5						
48.0	51.1	52.3	58.0	70.5						
48.6	50.8	52.5	54.6	58.3						
48.4	55.6	53.3	68.5	78.1						
48.4	51.0	52.8	56.4	63.5						
48.3	50.9	52.8	55.7	63.3						
49.4	52.4	54.4	58.2	62.1						
49.3	51.7	52.9	58.0	65.6						
48.7	51.2	53.1	55.7	59.7						
49.3	51.1	52.6	54.7	58.9						
49.2	51.9	53.6	58.2	61.5						
49.3	51.3	52.9	54.8	57.0						
50.5	52.5	53.9	55.6	60.3						
50.1	52.3	53.5	55.7	70.8						
49.5	52.1	54.0	57.1	61.7						
48.3	52.6	54.1	62.0	70.5						
49.6	51.9	53.6	55.8	58.8						
52.1	53.6	54.9	56.4	58.4						
51.2	53.2	54.8	56.3	57.1						
51.2	53.3	54.9	56.6	60.0						
50.0	52.1	53.8	56.2	58.4						
49.4	51.2	52.7	53.9	54.8						
50.4	52.3	53.7	54.9	56.5						
47.4	49.6	51.5	52.9	55.2						
47.2	49.8	51.4	55.2	62.8						
47.4	49.5	51.2	52.9	54.5						
46.8	49.3	51.1	52.8	55.1						
46.6	50.6	52.2	55.7	59.6						
44.4	47.2	49.2	51.4	53.0						
44.1	46.6	48.5	50.7	53.6						
43.1	45.8	47.8	49.7	51.6						
42.5	45.6	47.7	50.4	53.3						
41.3	44.2	46.3	48.2	50.3						

Project: Davis Earthmoving & Quarrying Pty Ltd
Project Number: 60.00741.03
Location: 90 Gindurra Road, Kariong, NSW 2178
Equipment: Svan 977
Serial Number: 45635
Pre Calibration: 0.40 dB
Post Calibration: 0.15 dB

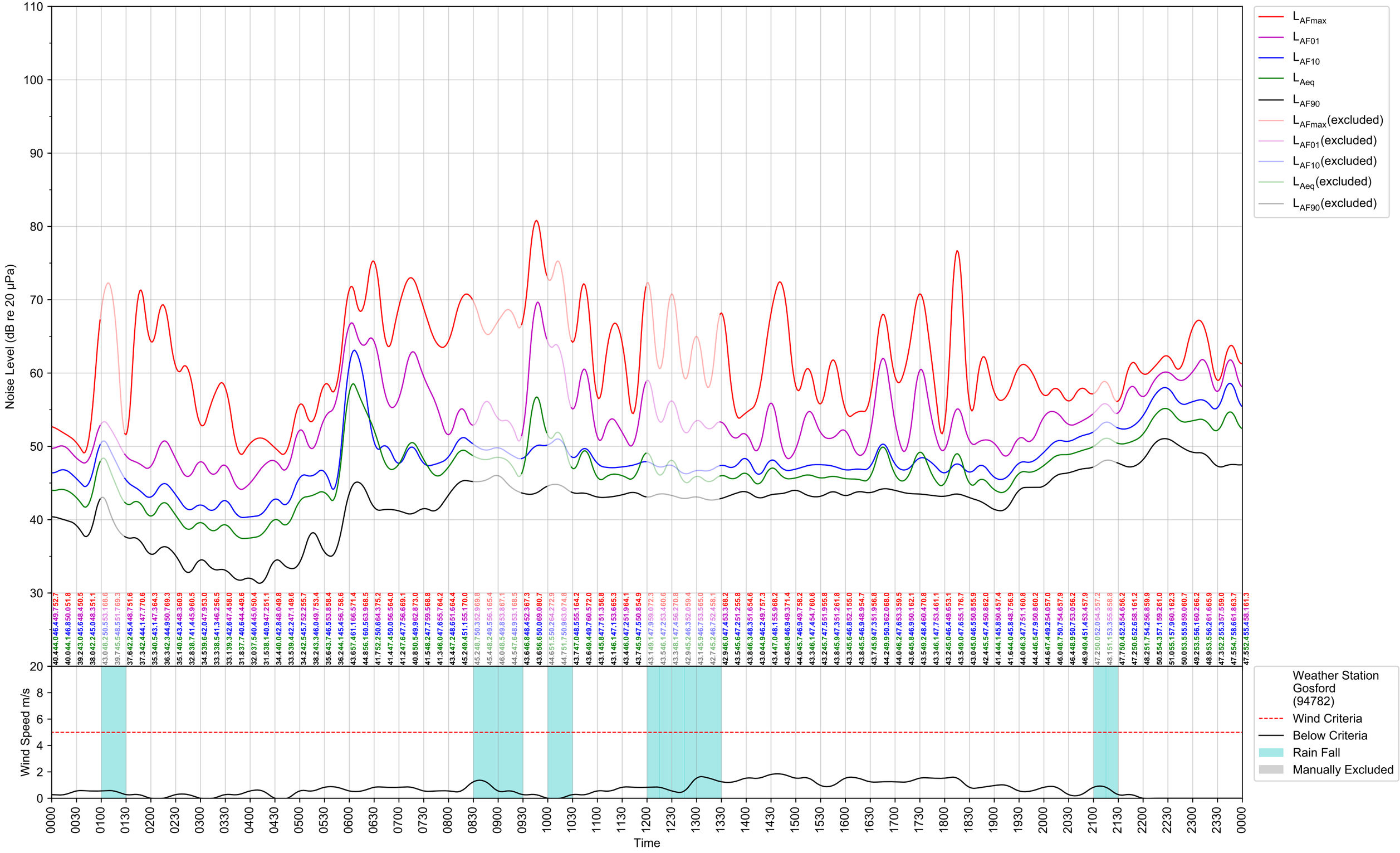
Graphical Noise Logger Data
Date: Saturday 14 October 2017



Project: Davis Earthmoving & Quarrying Pty Ltd
Project Number: 60.00741.03
Location: 90 Gindurra Road, Kariong, NSW 2178
Equipment: Svan 977
Serial Number: 45635
Pre Calibration: 0.40 dB
Post Calibration: 0.15 dB

Graphical Noise Logger Data
Date: Sunday 15 October 2017

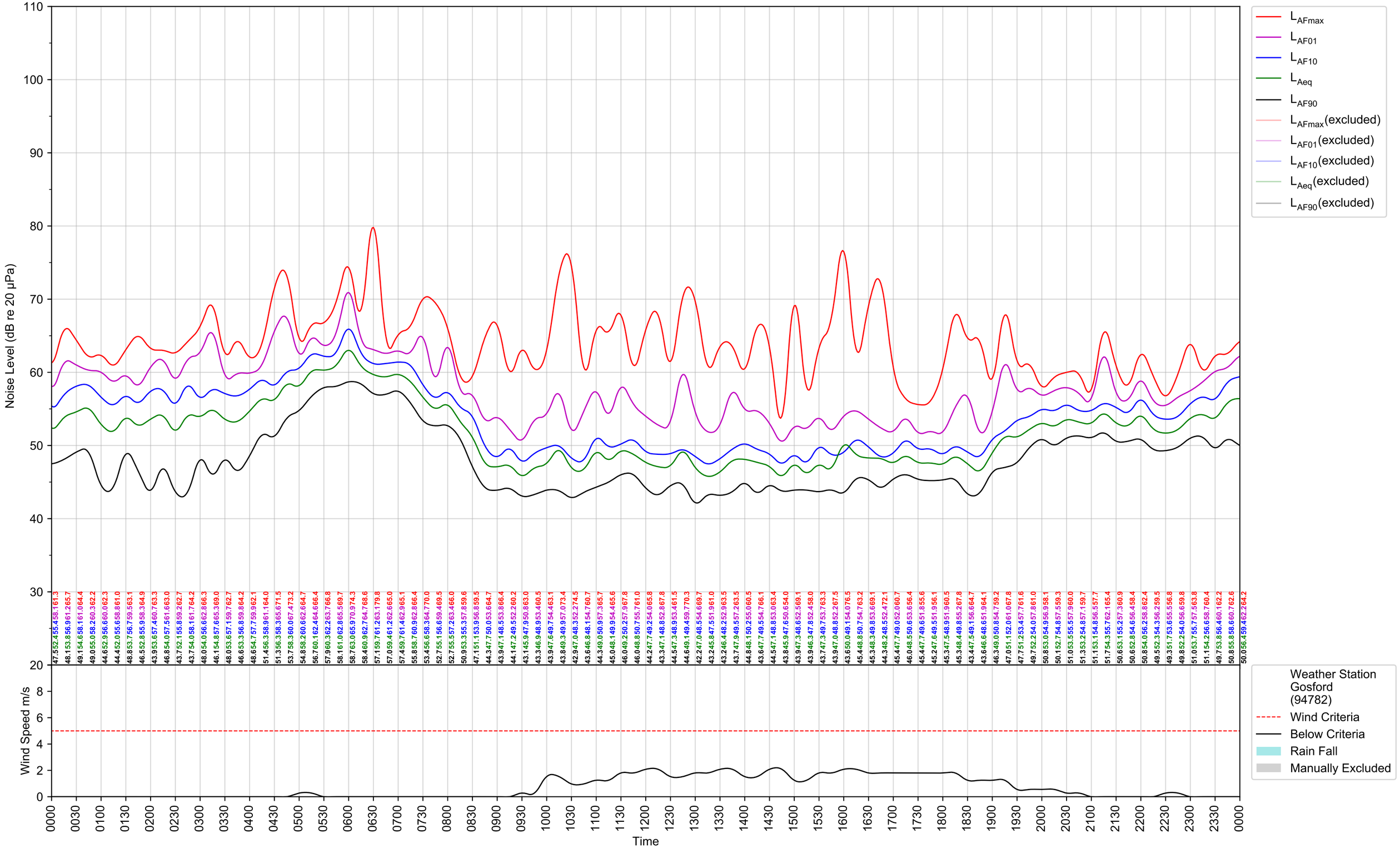
Waves CONSULTING



Project: Davis Earthmoving & Quarrying Pty Ltd
Project Number: 60.00741.03
Location: 90 Gindurra Road, Kariong, NSW 2178
Equipment: Svan 977
Serial Number: 45635
Pre Calibration: 0.40 dB
Post Calibration: 0.15 dB

Graphical Noise Logger Data
Date: Monday 16 October 2017

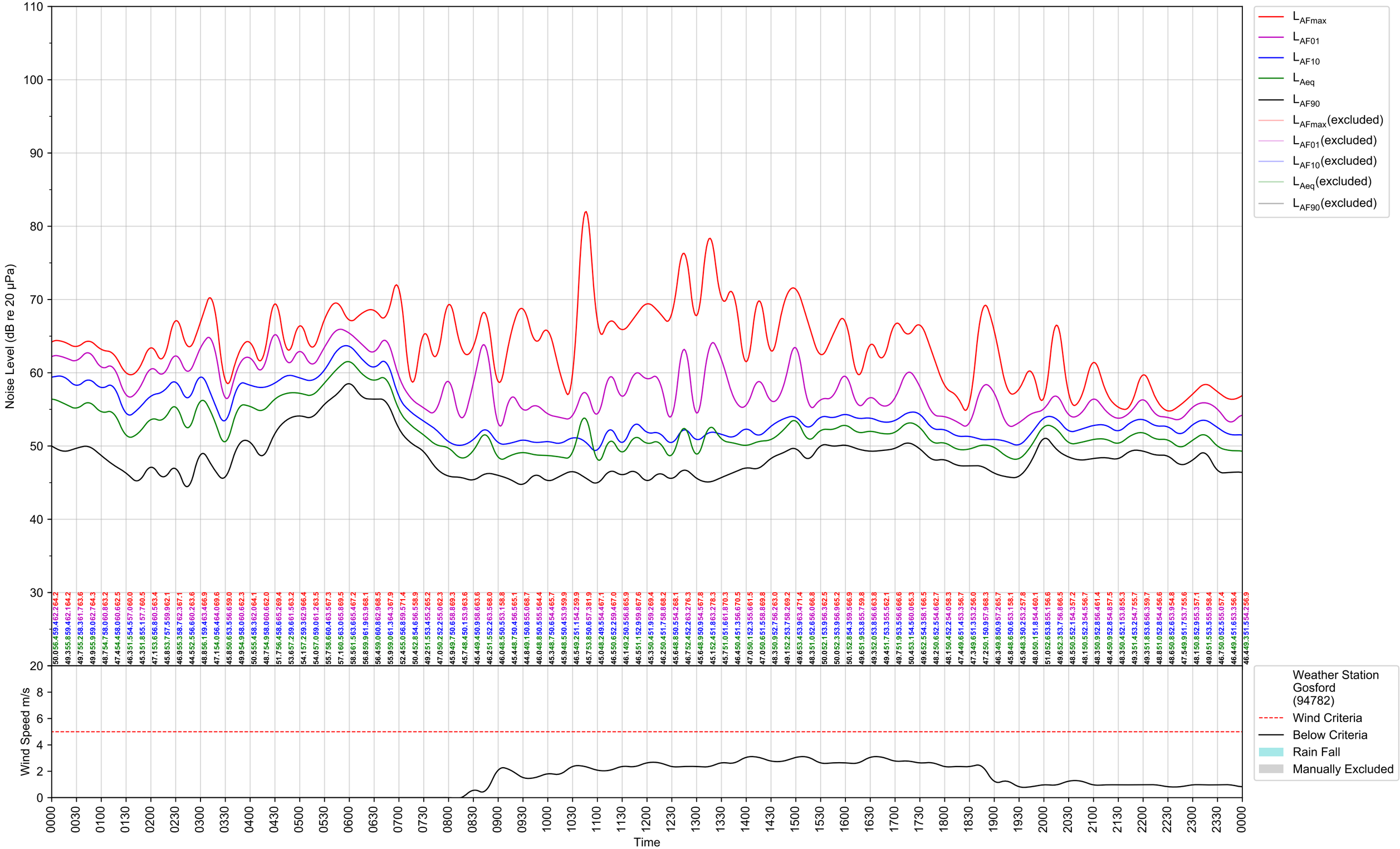
Waves CONSULTING



Project: Davis Earthmoving & Quarrying Pty Ltd
Project Number: 60.00741.03
Location: 90 Gindurra Road, Kariong, NSW 2178
Equipment: Svan 977
Serial Number: 45635
Pre Calibration: 0.40 dB
Post Calibration: 0.15 dB

Graphical Noise Logger Data
Date: Tuesday 17 October 2017

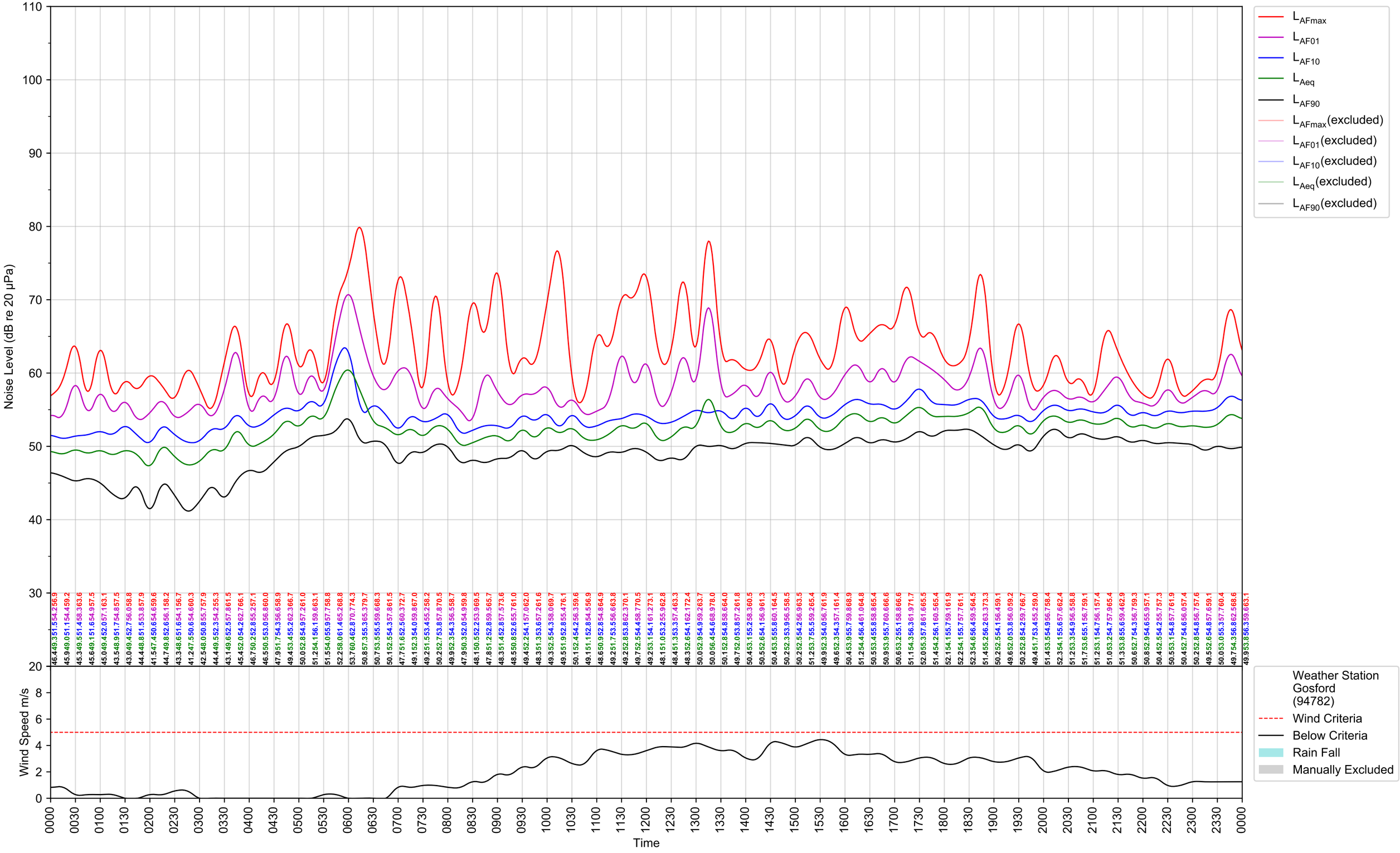
Waves CONSULTING



Project: Davis Earthmoving & Quarrying Pty Ltd
Project Number: 60.00741.03
Location: 90 Gindurra Road, Kariong, NSW 2178
Equipment: Svan 977
Serial Number: 45635
Pre Calibration: 0.40 dB
Post Calibration: 0.15 dB

Graphical Noise Logger Data
Date: Wednesday 18 October 2017

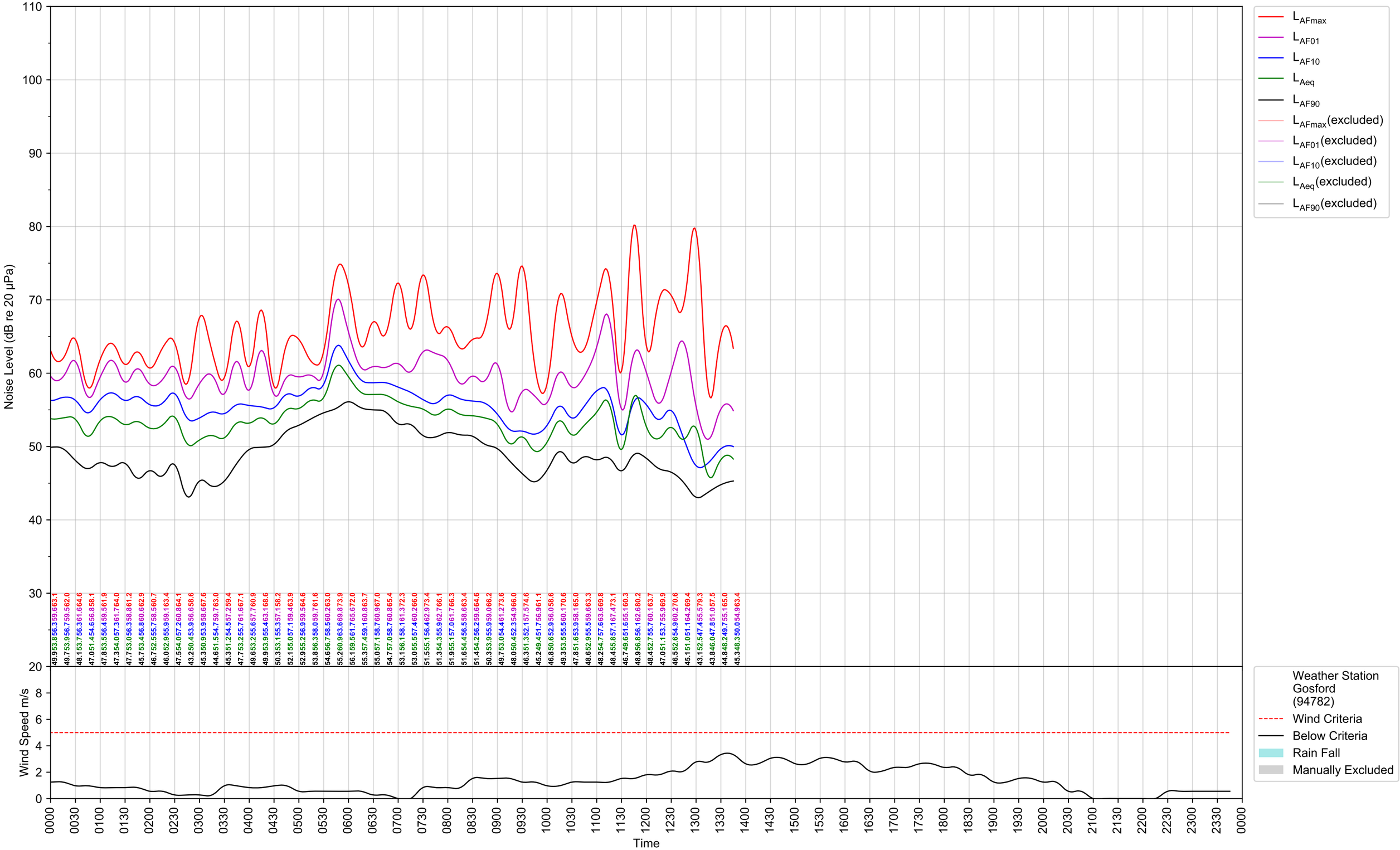
Waves CONSULTING



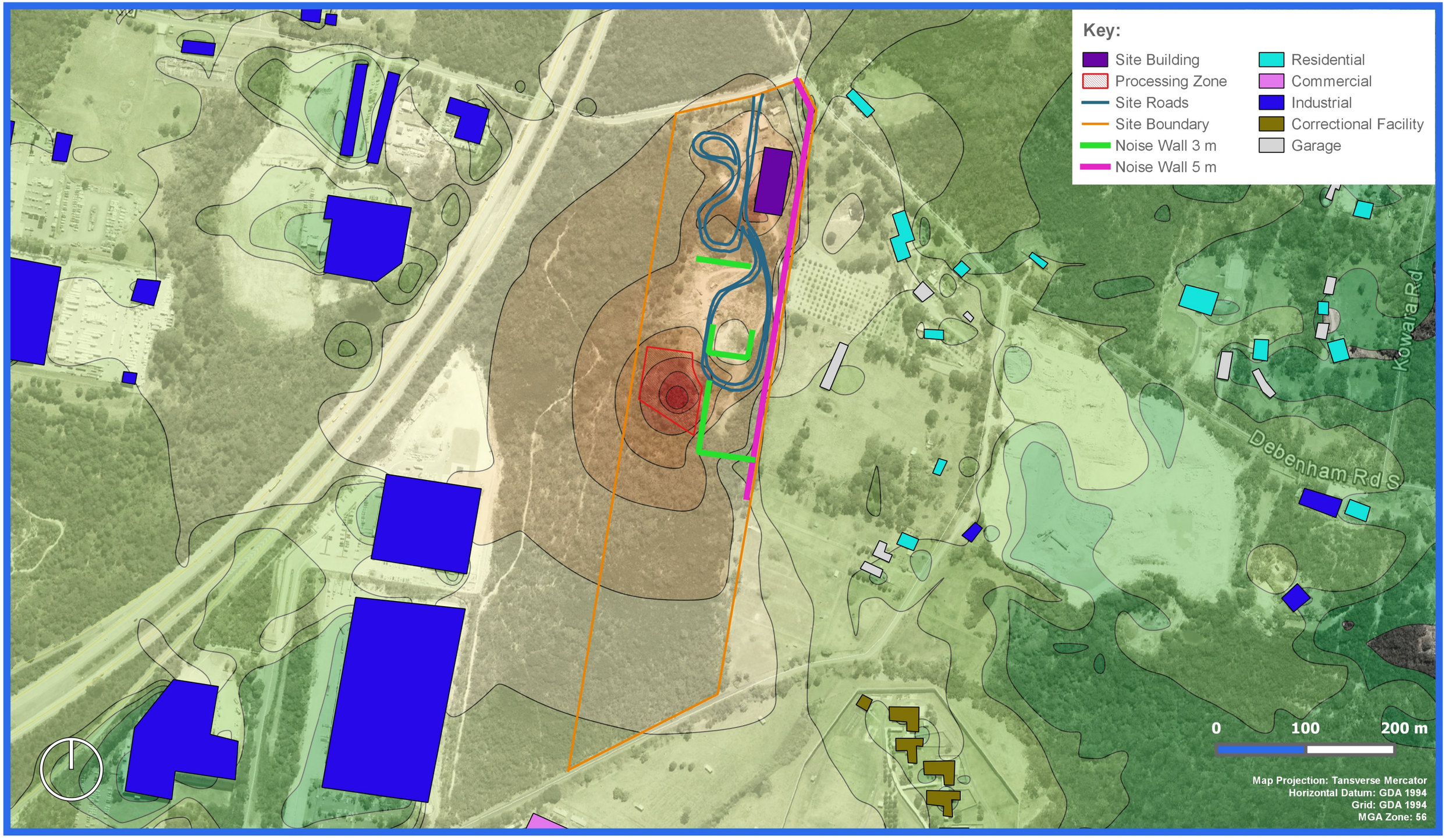
Project: Davis Earthmoving & Quarrying Pty Ltd
Project Number: 60.00741.03
Location: 90 Gindurra Road, Kariong, NSW 2178
Equipment: Svan 977
Serial Number: 45635
Pre Calibration: 0.40 dB
Post Calibration: 0.15 dB

Graphical Noise Logger Data
Date: Thursday 19 October 2017

Waves CONSULTING



APPENDIX B:
NOISE CONTOUR MAPS



LAeq,15min (dB)

20	35	55	75
25	40	60	80
30	45	65	
	50	70	

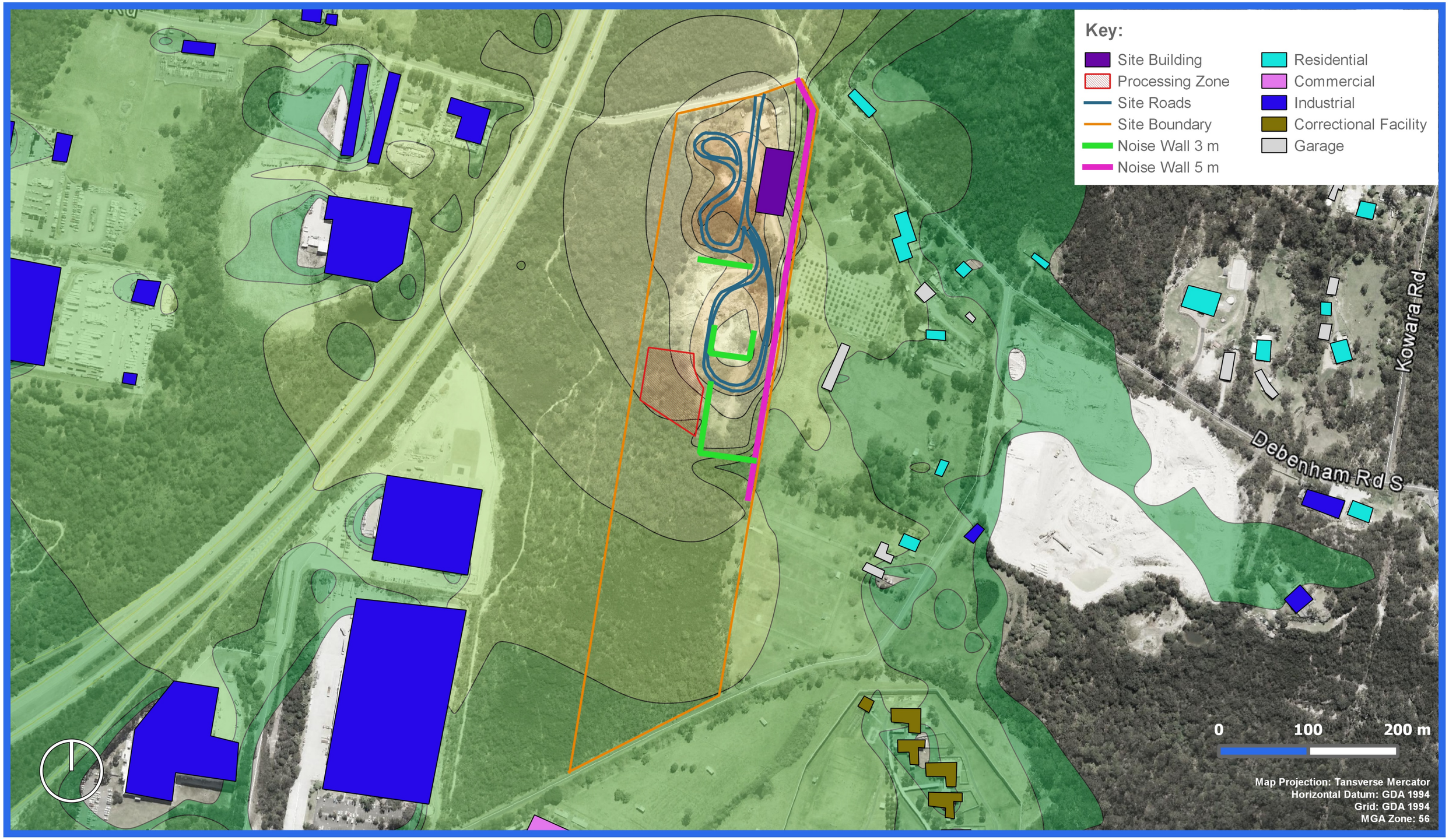
*Images courtesy of Google Earth

Kariong Sand & Soil Supplies Facilities Upgrade
90 Gindurra Road, Somersby, NSW

NOISE IMPACT ASSESSMENT
Operational Noise Contours - Day

Waves CONSULTING

Project Number: 60.00741.03
Date: 11 January 2019
Revision: 02
Prepared by: TC



LAeq,15min (dB)

20	35	55	75
25	40	60	80
30	45	65	
	50	70	

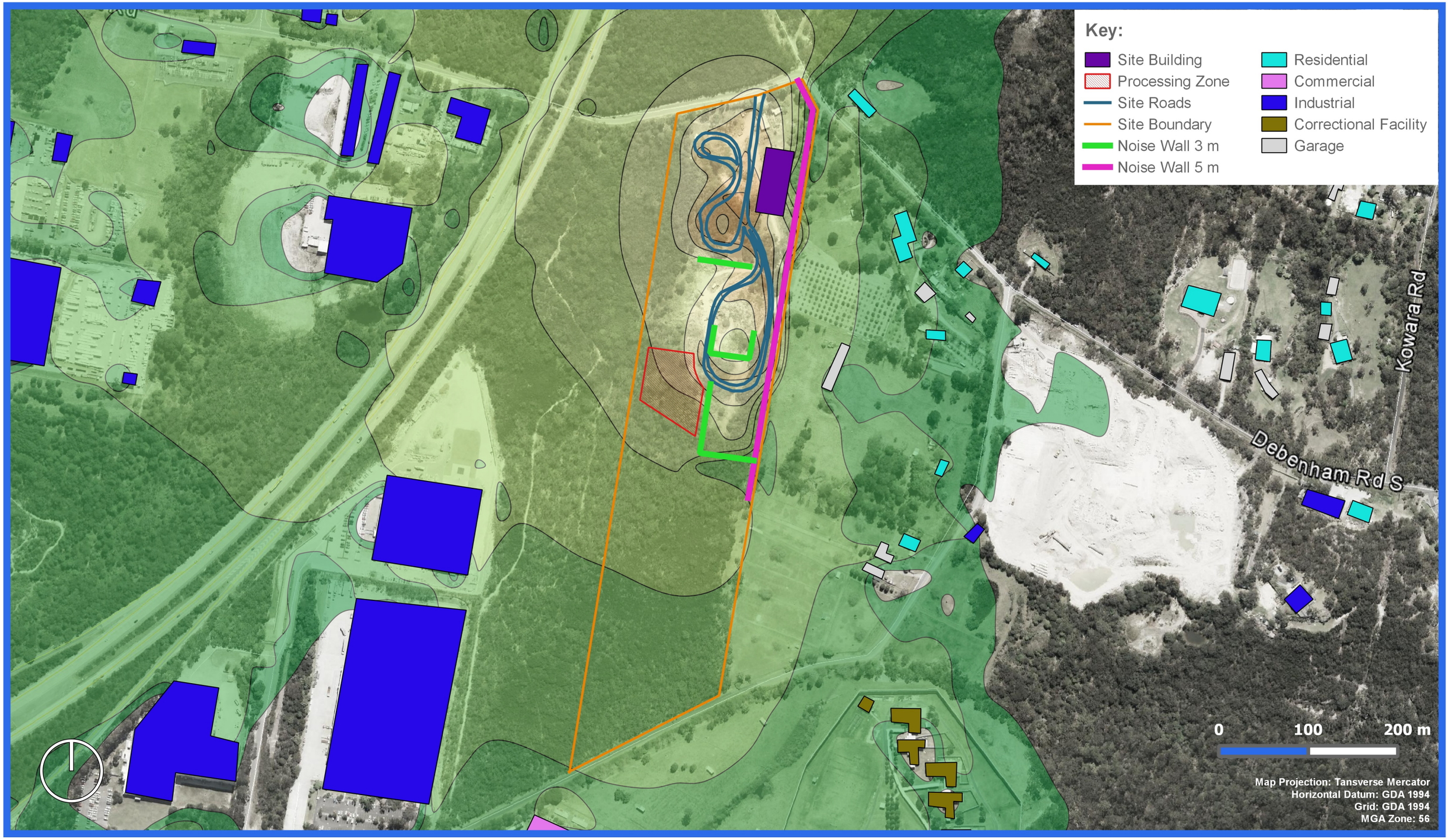
*Images courtesy of Google Earth

Kariong Sand & Soil Supplies Facilities Upgrade
90 Gindurra Road, Somersby, NSW

NOISE IMPACT ASSESSMENT
Operational Noise Contours - Evening

Waves CONSULTING

Project Number: 60.00741.03
Date: 11 January 2019
Revision: 02
Prepared by: TC



LAeq,15min (dB)

20	35	55	75
25	40	60	80
30	45	65	
	50	70	

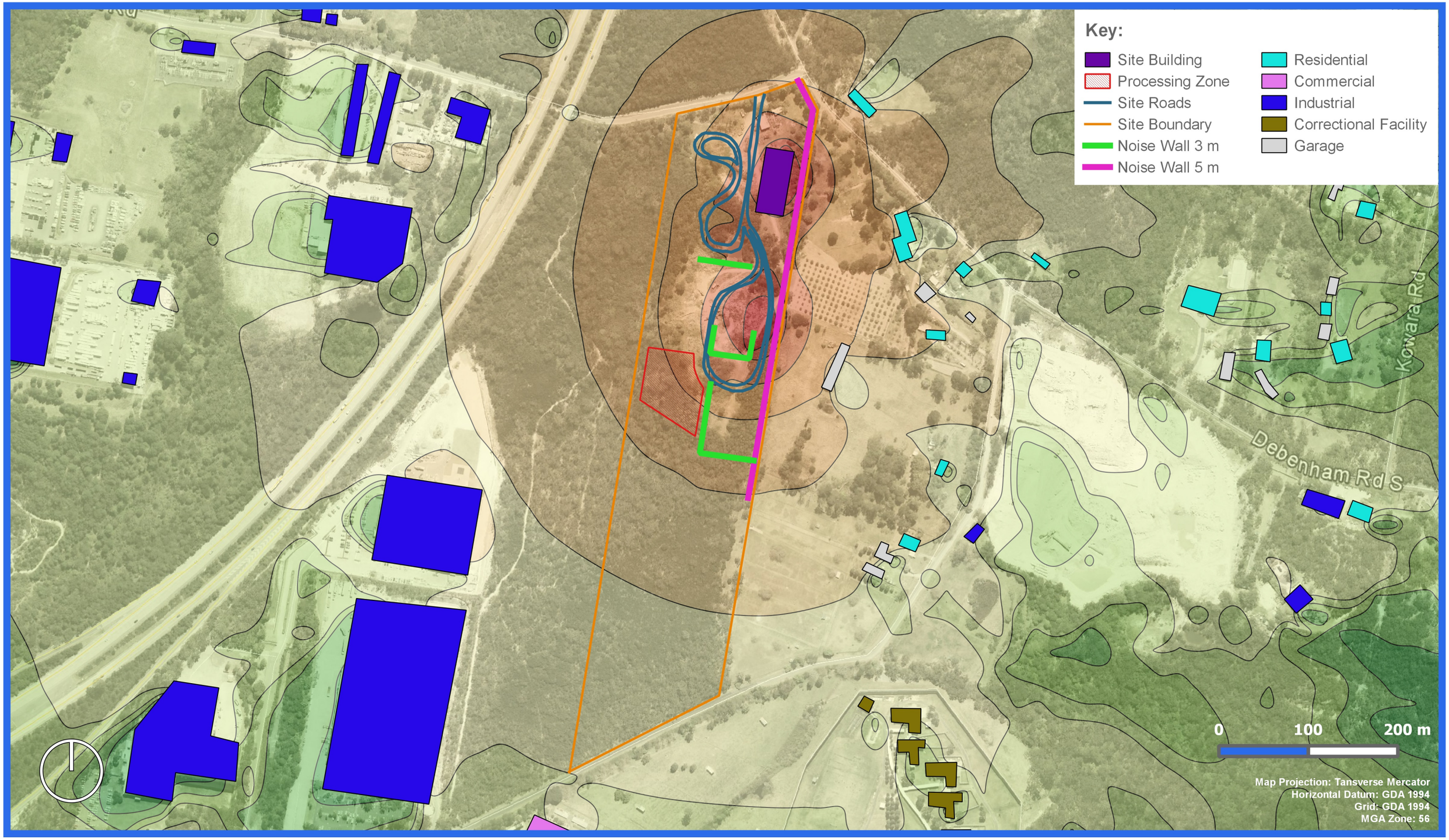
*Images courtesy of Google Earth

Kariong Sand & Soil Supplies Facilities Upgrade
90 Gindurra Road, Somersby, NSW

NOISE IMPACT ASSESSMENT
Operational Noise Contours - Night

Waves CONSULTING

Project Number: 60.00741.03
Date: 11 January 2019
Revision: 02
Prepared by: TC



LAeq,15min (dB)

20	35	55	75
25	40	60	80
30	45	65	
	50	70	

*Images courtesy of Google Earth

Kariong Sand & Soil Supplies Facilities Upgrade
90 Gindurra Road, Somersby, NSW

NOISE IMPACT ASSESSMENT
Construction Noise Contours - Standard Hours

Waves CONSULTING

Project Number: 60.00741.03
Date: 11 January 2019
Revision: 02
Prepared by: TC