

Weston Aluminium Thermal Waste Processing Project

Noise Impact Assessment

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Table of Contents

1.0	Introduction	1
1.1	Weston Aluminium Thermal Waste Processing Project	1
1.1.1	Overview	1
1.1.2	Proposed Development	3
1.2	Report Objective	5
1.3	Relevant Guidelines	5
1.3.1	Construction	5
1.3.2	Operation	5
1.4	Reference Documents	6
1.5	Scope of Work	6
2.0	Existing Noise Environment	7
2.1	Surrounding Receivers	7
2.2	Unattended Noise Monitoring	7
2.3	Attended Noise Monitoring	9
2.4	Instrumentation	10
2.5	2015 Noise Compliance Monitoring	10
3.0	Acoustic Criteria	13
3.1	Construction Noise and Vibration Criteria	13
3.1.1	Construction Noise Management Levels	13
3.1.2	Construction Vibration Objectives	15
3.1.3	Construction Traffic Noise Criteria	16
3.2	Operational Noise and Vibration Criteria	17
3.2.1	Environmental Protection Licence 6423	17
3.2.2	Environment Protection Authority – NSW Industrial Noise Policy	17
3.2.3	Sleep Disturbance Criteria	19
3.2.4	Operational Road Traffic Noise Criteria	19
3.3	Vibration Criteria	20
4.0	Construction Noise Assessment	21
4.1	Construction Noise Impact Assessment	21
4.1.1	Discussion of Results	21
4.1.2	Cumulative Construction Noise Impacts	22
4.2	Construction Traffic Noise	22
4.3	Vibration Assessment	22
4.4	Construction Noise Management Strategies	22
4.4.1	Construction Hours	22
4.4.2	Standard Mitigation Measures	22
4.4.3	Local Road Traffic – Heavy Vehicles Noise Mitigation	23
4.4.4	Reversing Alarms	23
5.0	Operational Noise Assessment	25
5.1	Existing Operations	25
5.2	Future Operations	25
5.3	Noise Model Calibration	26
5.4	Noise Modelling Results	26
5.5	Cumulative Operational Noise Impact	28
5.6	Sleep Disturbance	30
5.7	Additional Road Traffic	31
5.8	Operational Vibration	31
5.9	Discussion	31
6.0	Conclusions	32
	Appendix A	
	Acoustic Terminology	A
	Appendix B	
	Unattended Noise Monitoring	B

Appendix C		
WA Site Noise Measurements		B
Appendix D		
Operational Noise Contour Plots		D

List of Tables

Table 1	Secretary's Environmental Assessment Requirements - Noise and Vibration	5
Table 2	Noise Catchment Areas	7
Table 3	Ambient Noise Monitoring Locations	7
Table 4	Ambient Noise Monitoring Results	9
Table 5	Existing Estimated Industrial Noise Contribution	10
Table 6	Noise Compliance Monitoring	11
Table 7	Noise at Residences Using Quantitative Assessment	13
Table 8	Background Noise Levels and Specific Noise Management Levels	14
Table 9	Construction Time Periods	14
Table 10	DIN4150 Structural Damage Vibration Criteria	15
Table 11	BS7385.2 1993 Transient Vibration Guide for Cosmetic Damage	16
Table 12	Recommended Safe Working Distances for Vibration Intensive Plant	16
Table 13	Environmental Protection Licence Noise Limits	17
Table 14	Recommended L_{Aeq} Noise Levels from Industrial Noise Sources	18
Table 15	Operational Noise Criteria	18
Table 16	Amenity Criteria Modifications	19
Table 17	Night-time Sleep Disturbance Criteria	19
Table 18	Road Traffic Noise Criteria – Freeways / Arterial / Sub-arterial Roads	20
Table 19	Construction Equipment Noise Emission Levels	21
Table 20	Sound Power Levels for Noise Intensive Plant/Activities	25
Table 21	Sound Power Levels for Noise Intensive Plant/Activities	25
Table 22	Comparison between Compliance Measurements and Modelled Noise Levels	26
Table 23	Predicted Environmental Noise Emission Levels	27
Table 24	Summary of Compliance	28
Table 25	Battery Recycling Facility Noise data	29
Table 26	Predicted Cumulative Environmental Noise Emission Levels	29
Table 27	Summary of Compliance, Cumulative Impact	30
Table 28	Predicted L_{A1} (1 minute) Environmental Noise Emission Levels	31

List of Figures

Figure 1	Location Plan	2
Figure 2	Site Plan	4
Figure 3	Noise Sensitive Receiver Locations	8

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1.0 Introduction

AECOM Australia Pty Ltd (AECOM) has been commissioned by Weston Aluminium Pty Ltd (WA) to undertake an assessment of the potential noise and vibration impacts associated with the construction and operation of the proposed Thermal Waste Processing Project (the Project).

This Construction and Operation Noise and Vibration Impact Assessment Report forms part of the Environmental Impact Statement (EIS) submission to the Department of Planning and Environment (DP&E).

1.1 Weston Aluminium Thermal Waste Processing Project

This section provides an introduction to the WA proposal to install and operate medical and other waste processing equipment at the existing WA facility (the Facility), and the purpose and content of this acoustic impact assessment report.

1.1.1 Overview

WA proposes to install new thermal waste processing equipment at their existing aluminium recycling and refining facility at 129 Mitchell Avenue, Kurri Kurri in the Hunter Valley, NSW. Refer **Figure 1** for location of the Facility. The purpose of this report is to characterise the proposal and to provide an assessment of its potential noise and vibration impacts upon nearby noise sensitive receivers.

In response to the ongoing decline in traditional focus areas within the aluminium and steel sectors, and identified growth opportunities in other and emerging markets, WA proposes to further adapt and diversify its plant, equipment and processes to enable the thermal processing of other wastes. The Project promotes development of the Kurri Kurri region, providing employment opportunities and contributes to the growth of industrial development in an environmentally sustainable manner.

The Facility is positioned in Lower Hunter to cater for ever-increasing generation of wastes and the resulting increasing in demand for specialist waste solutions regionally. Currently, such wastes must be transported significant distances, often interstate for disposal. As part of the Project, WA proposes to construct and operate purpose-built infrastructure for the safe receipt, storage and processing of medical and other wastes. WA has a strong demonstrated history of planning approval and environmental license compliance with stringent environmental requirements currently enforced through a comprehensive environmental management system.

Commercial and industrial premises are also located along Mitchell Avenue and adjoining the site to the east, west and south. Land to the north is bushland. The nearest residential receivers to the Facility are located more than 330 metres to the south-east of the site boundary (600 metres to the south-east of the Facility).

In addition, a new battery recycling facility is proposed on land to the east of the WA site. The proposed battery recycling facility does not form part this Project and is subject to a separate approval process (SSD 16_7520). However, potential cumulative noise impacts from the Project and the battery recycling facility have been addressed in this report.



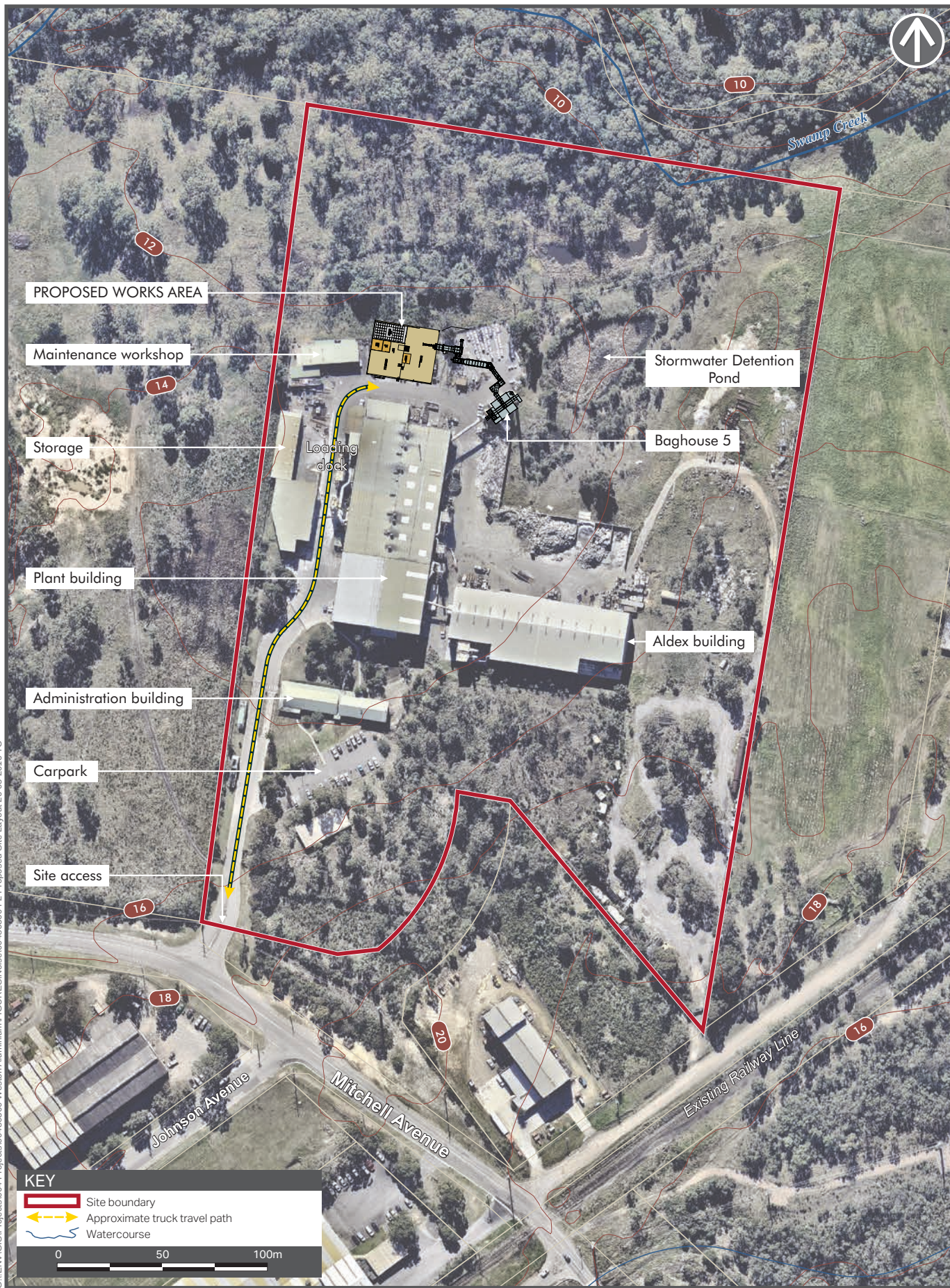
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1.1.2 Proposed Development

Proposed thermal waste processing equipment is to be incorporated into the existing WA Facility footprint, using existing access and emission control systems. Proposed plant and equipment would be located within the northern end of the site. The location of the proposed Project is shown in **Figure 2**.

A kiln is proposed to be established in an east-west orientation, with enclosed input storage facilities and a dedicated feeding system. The existing Baghouse 5 is to be utilised for emission capture and treatment of process emissions from the proposed plant and equipment before discharge to atmosphere via the existing Stack 5. This emission control system currently services Reverberatory Furnace process emissions, typically operated during one shift per day. A dry-lime scrubber system currently operates in conjunction with Baghouse 5 to treat acid gases and adsorb pollutants (e.g. PAHs and Dioxins/Furans). It is proposed that this scrubber system be upgraded to incorporate an activated carbon dosing system, with the activated carbon injected at the baghouse entry point.

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1.2 Report Objective

The Project's Environmental Impact Statement (EIS) has been prepared in accordance with Division 4.1, Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) which ensures that the potential environmental effects of a proposal are properly assessed and considered in the decision-making process.

In preparing this Noise and Vibration Impact Assessment, the Secretary's Environmental Assessment Requirements (SEARs) issued for the Project (SSD_7349) on 16 December 2015 have been addressed as required by Clause 75F of the EP&A Act. The key matters raised by the Secretary for consideration in the Noise and Vibration Impact Assessment are outlined in **Table 1** along with a reference to where the requirements are addressed within this report.

Table 1 Secretary's Environmental Assessment Requirements - Noise and Vibration

Secretary's Environmental Assessment Requirement		Section Addressed
Noise and Vibration	Noise and Vibration – including: A quantitative assessment of potential construction and operational and transport noise and vibration impacts in accordance with the relevant EPA guidelines; and	Sections 4.0 and 5.0
	Details and justification of the proposed noise mitigation and monitoring measures.	Sections 4.0 and 5.0

This report is technical in content. A glossary of acoustic terminology is included in **Appendix A**.

1.3 Relevant Guidelines

The relevant noise and vibration guidelines considering in this report are listed below.

1.3.1 Construction

- SEARs for the Waste Thermal Processing Facility (SSD 7349), dated 16 December 2015;
- NSW Environment Protection Authority Interim Construction Noise guideline, Department of Environment and Climate Change, NSW (ICNG, DECC 2009);
- NSW Environment Protection Authority Assessing vibration: a technical guideline, Department of Environment and Conservation, NSW (AVTG, DEC 2006);
- DIN Standard 4150 – Part 3 – Structural Vibration in Buildings – Effects on Structures;
- British Standard 7385: Part 2 1993 Evaluation and Measurement of Vibration in Buildings; and
- NSW Environment Protection Authority NSW Road Noise Policy, Department of Climate Change, Environment and Water, NSW (RNP, DECCW 2011).

1.3.2 Operation

- SEARs for the Waste Thermal Processing Facility (SSD 7349), dated 16 December 2015;
- NSW Environment Protection Authority NSW Industrial Noise Policy, NSW Environment Protection Authority, Sydney (INP, EPA 2000);
- NSW Environment Protection Authority Application notes – NSW industrial noise policy, (INP Application Notes, EPA, 2013);
- NSW Environment Protection Authority NSW Road Noise Policy, Department of Climate Change, Environment and Water, NSW (RNP, DECCW 2011); and
- NSW Environment Protection Authority Environmental Protection Licence No. 6423 (EPL 6423, EPA 29 October 2015).

1.4 Reference Documents

This assessment has been undertaken using the following documents as provided by WA:

- WST-PFD-01 (March 2016);
- WST-PID-01 (March 2016);
- WST-PID-02 (March 2016); and
- Weston equipment data sheets.

1.5 Scope of Work

The scope of the environmental acoustic impact assessment is presented below:

- Construction Noise and Vibration:
 - Establish construction noise management levels in accordance with the ICNG;
 - Predict construction noise levels at the nearest sensitive receivers;
 - Assess traffic noise associated with additional traffic generated during construction phase; and
 - If necessary recommend feasible and reasonable mitigation measures to control construction noise levels.
- Operational Noise and Vibration:
 - Establish the existing background noise levels in the vicinity of the proposed Thermal Waste Processing Facility in accordance with INP guidelines;
 - Determine the environmental operational noise and vibration limits, in accordance with the INP and AVTG guidelines;
 - Predict the environmental noise and vibration levels due to the operation of the modified Facility;
 - Predict any increase in road traffic noise levels due to vehicular movements associated with the proposed Project;
 - Assess the predicted noise and vibration levels in relation to the established environmental noise and vibration limits; and
 - If required, investigate measures to reduce the noise and vibration levels to comply with the environmental noise limits.

2.0 Existing Noise Environment

2.1 Surrounding Receivers

The locations of sensitive receivers relative to the WA Facility are shown in **Figure 1**. Residential receivers have been grouped together into Noise Catchment Areas (NCAs), whereby the NCAs are used to cluster residential receivers with common noise environments. The NCAs and the representative receivers are detailed in **Table 2**. These NCAs represent the closest residential receivers to the WA Facility.

Table 2 Noise Catchment Areas

Designation	Representative receiver	Approximate distance from site, m
NCA 1	84 Government Road, Weston	850
	67 Government Road, Weston	770
	72 Hart Road, Loxford	600
NCA 2	122 Mitchell Avenue, Kurri Kurri	330
	68 Northcote Street, Kurri Kurri	640

Demonstration of compliance at the residential receivers within the NCAs and surrounding industrial receivers is deemed sufficient to indicate compliance at any other.

2.2 Unattended Noise Monitoring

In order to establish the existing noise environment at the nearest residential receiver to the proposed development site, ambient noise monitoring was conducted by AECOM at 6 Tenth Street, Weston and 52 Northcote Street, Kurri Kurri.

The noise monitoring was conducted in accordance with the INP requirements. Provided in **Table 3** are details of the measurement locations.

Table 3 Ambient Noise Monitoring Locations

Duration	Address	Instrumentation	Comments
3-10 March 2016	6 Tenth Street, Weston	Rion NL 52 - SN:553967	Logger placed in front yard near side fence
3-10 March 2016	52 Northcote Street, Kurri Kurri	Rion NL 52 - SN:553967	Logger placed in front yard near front fence

A noise logger measures the noise level over the sample period and then determines L_{A1} , L_{A10} , L_{A90} , L_{Amax} and L_{Aeq} levels of the noise environment. The L_{A1} , L_{A10} and L_{A90} levels are the levels exceeded for 1%, 10% and 90% of the sample period respectively. The L_{Amax} is indicative of maximum noise levels due to individual noise events. The L_{A90} is taken as the background noise level.

The results of the noise monitoring have been processed in accordance with the procedures contained in the INP and are presented in **Table 4**.

The assessment background level (ABL) is established by determining the lowest tenth-percentile level of the L_{A90} noise data acquired over each period of interest. The background noise level or rating background level (RBL) representing the day, evening and night-time assessment periods is based on the median of individual ABLs determined over the entire monitoring duration. The RBL is representative of the average minimum background sound level (in the absence of the source under consideration), or simply the background level. 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.

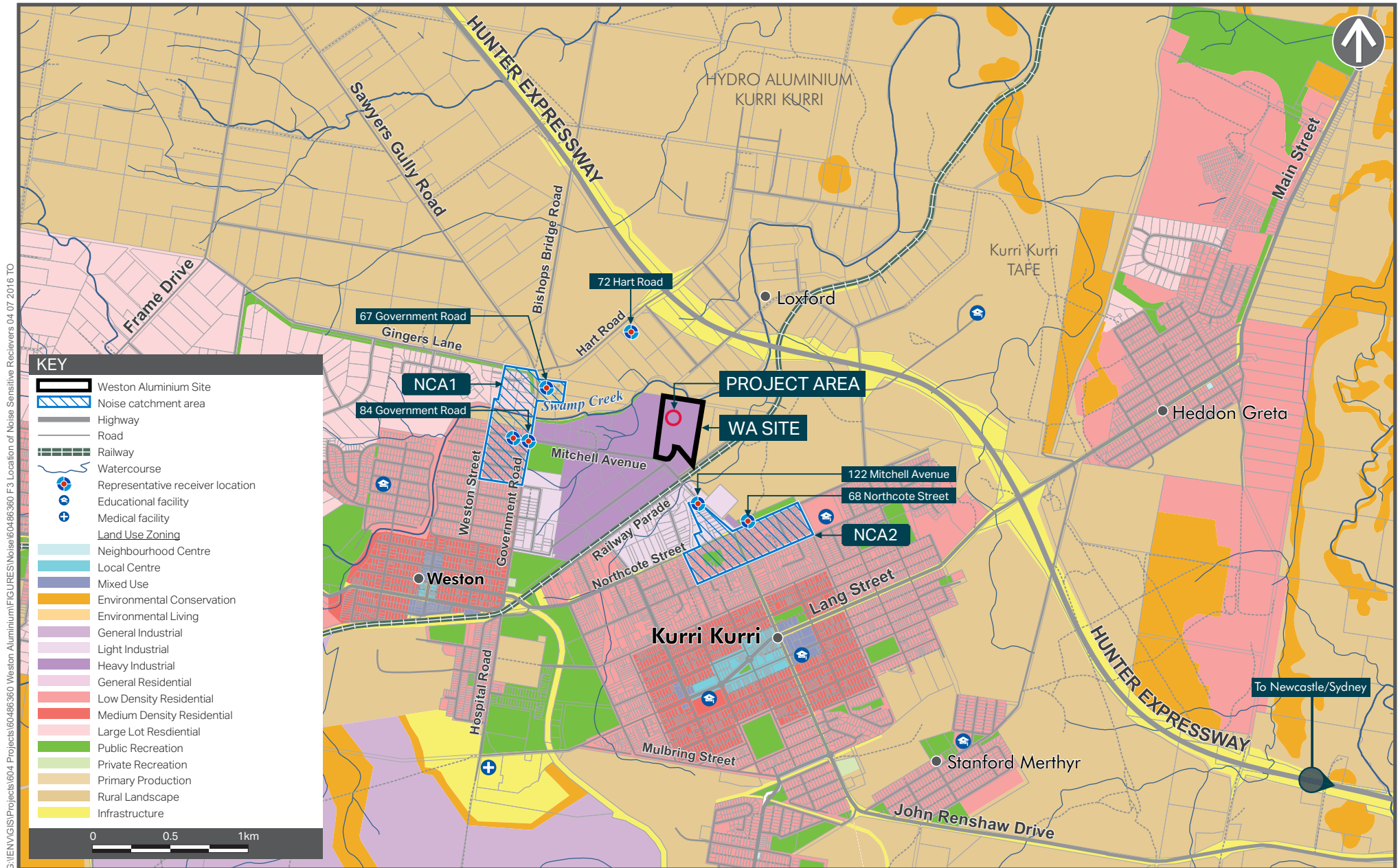


Table 4 Ambient Noise Monitoring Results

Date	Rating Background Levels L _{A90} , dB(A)			Ambient L _{Aeq} , dB(A)		
	Day ¹	Evening ²	Night ³	Day ¹	Evening ²	Night ³
Monitoring Location 1 – 6 Tenth Street, Weston						
Thursday 03 March 2016			33			45
Friday 04 March 2016	41	35	28	52	50	43
Saturday 05 March 2016	36	32	29	51	53	43
Sunday 06 March 2016	-	32	32	-	49	44
Monday 07 March 2016	39	36	36	51	47	45
Tuesday 08 March 2016	-	-	34	-	-	44
Wednesday 09 March 2016	39	37	32	52	48	44
Thursday 10 March 2016	38	33	29	50	48	43
RBL/Log Average	39	34	32	51	50	44
Monitoring Location 2 – 52 Northcote Street, Kurri Kurri						
Thursday 03 March 2016			33			55
Friday 04 March 2016	41	38	33	63	60	53
Saturday 05 March 2016	38	39	32	61	60	54
Sunday 06 March 2016	-	37	33	-	58	55
Monday 07 March 2016	42	39	34	62	59	54
Tuesday 08 March 2016	-	-	37	-	-	54
Wednesday 09 March 2016	42	39	38	62	59	54
Thursday 10 March 2016	42	39	37	62	59	56
RBL/Log Average	42	39	33	62	59	55

Notes:

1. Day is defined as 7:00 am to 6:00 pm, Monday to Saturday and 8:00 am to 6:00 pm Sundays & Public Holidays.
2. Evening is defined as 6:00 pm to 10:00 pm, Monday to Sunday & Public Holidays.
3. Night is defined as 10:00 pm to 7:00 am, Monday to Saturday and 10:00 pm to 8:00 am Sundays & Public Holidays.
4. A '-' indicates data has been excluded for this period due to inclement weather.

2.3 Attended Noise Monitoring

Attended noise measurements were undertaken on 3 March 2016 at the site and industrial noise was identified as a feature of the area. During the measurements the industrial noise contribution, shown in **Table 5**, was difficult to quantify due to elevated background noise level and prevailing wind conditions.

Table 5 Existing Estimated Industrial Noise Contribution

Location	Wind conditions	Industrial contribution dB(A)		Notes
		Day	Night	
6 Tenth Street, Weston	Day 2.5 m/s NE Night 3 m/s SE	Not Audible	39	Day Natural sounds (cicadas and birds) and traffic noise. Industry noise not audible Night Natural sounds (crickets) and occasional traffic noise. Distant traffic audible on Hunter Expressway. Industry noise audible (39 dB(A)).
52 Northcote Street, Kurri Kurri	Day 2.5 m/s NE Night 3 m/s SE	Not Audible	Not Audible	Day Natural sounds (cicadas and birds) and traffic noise. School announcements just audible. Industry noise not audible Night Natural sounds (crickets) and occasional traffic noise. Distant traffic audible on Hunter Expressway. Industry noise not audible

2.4 Instrumentation

The long-term unattended noise logging was conducted using two Rion NL 52 sound level meters, designated as Type 1 instruments having an accuracy suitable for field measurements. The long-term noise loggers were calibrated before and after the measurements with no drift in calibration exceeding ± 0.5 dB.

Attended noise measurements were conducted using a Bruel and Kjaer 2270 sound level meter. The sound level meter was calibrated before and after the measurements with no drift in calibration exceeding ± 0.5 dB.

All the acoustic instrumentation employed during the noise measurements comply with the requirements of "AS IEC 61672.1-2004 Electroacoustics - Sound level meters - Specifications".

All equipment used for this assessment has current calibration certificates (i.e. calibrated in the last two years).

2.5 2015 Noise Compliance Monitoring

Noise compliance monitoring of the WA Facility was conducted on 14 May 2015 by Spectrum Acoustics. The monitoring considers the noise impact from the existing facility on nearby residences. A summary of the noise measurement results are provided below in **Table 6**. Generally the report found compliance with the noise limit of EPL 6423.

Table 6 Noise Compliance Monitoring

Measured residential noise levels – 14 May 2015				
Location	Time	Noise level, dB(A)	Wind	Identified noise sources
66 Northcote Street	3.25 pm	54	2.5 m/s, NW	Traffic (54), dogs (40), industrial noise (35), WA not measurable (est. 32)
	9.42 pm	51	4.1 m/s, WSW	Traffic (51), industrial noise (36), WA barely audible
	11.21 pm	49	1.1 m/s, SW	Traffic (49), industrial noise (30), WA barely audible
Corner of Government Road & Tenth Street	2.40 pm	60	2.5 m/s, NW	Traffic (60), industrial noise (40), WA inaudible
	9.06 pm	54	2.5 m/s, WSW	Traffic (54), industrial noise (43), WA inaudible
	10.44 pm	54	3.6 m/s, W	Traffic (56), industrial noise (37), WA inaudible
Mitchell Avenue	3.07 pm	66	2.5 m/s, NW	Traffic (66), industrial noise (48), WA barely audible
	9.25 pm	53	4.1 m/s, WSW	Traffic (53), WA (40), industrial noise (40)
	11.03 pm	41	3.6 m/s, W	Traffic (41), WA (38), industrial noise (25)
Eastern Boundary	2.18 pm	57	2.5 m/s, NW	-
	10.25 pm	55	2.5 m/s, NW	-
Western Boundary	2.35 pm	58	2.5 m/s, NW	-
	10.07 pm	59	2.5 m/s, NW	-

Notes: WA refers to the Weston Aluminium site

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3.0 Acoustic Criteria

3.1 Construction Noise and Vibration Criteria

3.1.1 Construction Noise Management Levels

The EPA's Interim Construction Noise Guidelines (ICNG) provides the basis for construction noise assessments in NSW. This document replaces the previous publication, the Environmental Noise Control Manual, and is used as the basis for establishing construction noise management levels.

Under the ICNG guideline a construction noise management plan is required to be compiled by the Contractor, prior to construction commencing. Noise Management Levels (NMLs) must be set for the standard working hours periods (refer to **Table 7**), and must be complied with where feasible and reasonable. Work that is proposed outside of standard working hours, as defined in the ICNG, generally requires strong justification.

The noise management plan should detail the 'best practice' construction methods to be used, presenting a reasonable and feasible approach. The plan should identify the extent of the residential area affected and assess the impact on residents. The plan should detail any community relation programs that are planned. For example the program may include prior notification for particularly noisy activities, letter box drop regarding out of hours construction work to be undertaken and a 24 hour contact phone number for residents to call should they have any complaints or questions.

The ICNG defines what is considered to be feasible and reasonable as follows:

Feasible

A work practice or abatement measure is feasible if it is capable of being put into practice or of being engineered and is practical to build given project constraints such as safety and maintenance requirements.

Reasonable

Selecting reasonable measures from those that are feasible involves making a judgment to determine whether the overall noise benefits outweigh the overall adverse social, economic and environmental effects, including the cost of the measure."

The ICNG recommends that a quantitative assessment is carried out for all 'major construction projects that are typically subject to the EIA process'.

Predicted noise levels at nearby sensitive receivers (e.g. residential, sensitive commercial premises) are compared to the levels provided in Section 4 of the ICNG. Where an exceedance of the noise management levels is predicted the ICNG advises that the proponent should apply all feasible and reasonable work practises to minimise the noise impact.

3.1.1.1 Noise Management Levels for Residential Receivers

Noise management levels for residential receivers are set using the information in **Table 7**.

Table 7 Noise at Residences Using Quantitative Assessment

Time of day	Management level, L_{Aeq} ₁ (15min)	How to apply
Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or	Noise affected $RBL^2 + 10$ dB	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq(15\text{ min})}$ 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	The highly noise affected level represents the point above which there may be strong community reaction to noise.

Time of day	Management level, $L_{Aeq,1}$ (15min)	How to apply
public holidays	75 dB(A)	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 $RBL^2 + 5$ 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 practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements see section 7.2.2 of the ICNG.

Notes:

- 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.
- Rating Background Level.

The background noise levels for the nearest residential receivers are given in **Table 8** along with the specific noise management levels.

Table 8 Background Noise Levels and Specific Noise Management Levels

NCA	Rating background levels L_{A90} , dB(A)			Noise management levels L_{Aeq} , dB(A)			
	Day	Evening	Night	Day SH	Day OOH	Evening	Night
1	44	39	37	54	49	44	42
2	47	44	38	57	52	49	43

Note: SH – Standard Hours, OOH – Out of Hours

The construction works are scheduled to occur during standard construction hours as defined in **Table 9**.

Table 9 Construction Time Periods

Works period	Time period		
	Monday – Friday	Saturday	Sunday or Public Holiday
Standard	7 am – 6 pm	8 am – 1 pm	Nil
Out of Hours Works 1	6 pm – 10 pm	1 pm – 10 pm	8 am – 6 pm
Out of Hours Works 2	10 pm – 7 am	10 pm – 8 am	6 pm – 7 am

Criteria for industrial and commercial premises are shown below:

- Industrial premises: external $L_{Aeq(15min)}$ 75 dB(A); and
- Commercial (e.g. offices, retail outlets): external $L_{Aeq(15min)}$ 70 dB(A).

3.1.2 Construction Vibration Objectives

The effects of vibration in buildings can be divided into two main categories; those in which the occupants or users of the building are inconvenienced or possibly disturbed and those where the building structure may be affected.

3.1.2.1 Human Perception

Guidance in relation to acceptable vibration levels for human comfort are provided in the EPA's "Assessing Vibration: a technical guideline" (February 2006). This document is based on the guidelines contained in BS 6472-1992.

The EPA guideline provides three assessment methods, depending on whether the vibration is continuous, impulsive or intermittent.

Continuous vibration: normally be generated by fixed plant items such as generators, fans and the like where the vibration emissions continue uninterrupted (usually throughout the daytime or night-time period).

Impulsive vibration: normally be generated by short duration (i.e. less than 2 second) events with no more than three occurrences in an assessment period. A typical example would be ground compaction by dropping a large mass. Higher levels are allowed for impulsive vibration, however if more than three impulsive vibration events occur during the assessment period, the more stringent intermittent objectives are applied.

Intermittent vibration: can be defined as interrupted periods of continuous vibration (e.g. vibratory rolling, heavy truck pass-bys or rockbreaking) or continuous periods of impulsive vibration (e.g. impact pile driving). Higher vibration levels are allowed for intermittent vibration compared with continuous vibration on the basis that the higher levels over a shorter period of time. (Source: TCA CNS, 2010).

3.1.2.2 Vibration Structural Damage

Vibration levels at sensitive receiver locations must also be controlled so as to avoid the risk of damage to buildings and other structures.

The German Standard *DIN 4150-Part 3 (1999) 'Structural vibration in buildings – Effects on Structures'* provides recommended maximum levels for short-term vibration (**Table 10**). The standard states that experience has shown that if these values are not exceeded, damage that reduces the serviceability of the structure will not occur.

Table 10 DIN4150 Structural Damage Vibration Criteria

Group	Type of structure	Guideline values for velocity in mm/s			
		Vibration at the foundation			Vibration at the horizontal plane of highest floor (all frequencies)
		1 H to 10 Hz	10 H to 50 Hz	50 H to 100 Hz	
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20-40	40-50	40
2	Dwellings and buildings of similar design and/or use	5	5-15	15-20	15
3	Structures that, because of their particular sensitivity to vibration, cannot be classified under Group 1 or 2 and are of great intrinsic value (e.g. listed buildings under a preservation order)	3	3-8	8-10	8

The British Standard *BS 7385-2:1993 'Evaluation and measurement for vibration in buildings'* also provides structural damage criteria. This relates to transient vibrations such as vehicle pass-bys.

Table 11 BS7385.2 1993 Transient Vibration Guide for Cosmetic Damage

Group	Type of structure	Peak component particle velocity, mm/s	
		Vibration at the foundation	
		4 H to 15 Hz	15 H and above
1	Reinforced or framed structures Industrial and heavy commercial buildings	50	
2	Unreinforced or light framed structures. Residential or light commercial type buildings	15-20	20-50

Notes:

- Where the dynamic loading caused by continuous vibration is such as to give rise to dynamic magnification due to resonance, especially at the lower frequencies where lower guide values apply, then the guide values may need to be reduced by up to 50 %.

3.1.2.3 Safe Working Distances

The Transport Construction Authority publication the Construction Noise Strategy (CNS) recommends safe working distances to minimise disturbance to occupants of nearby buildings and is based on the British Standards *BS 6472 'Evaluation of human exposure to vibration in buildings'* and *BS 7385 'Evaluation and measurement for vibration in buildings'*.

Safe working distances for vibration intensive equipment are listed in **Table 12** below.

Table 12 Recommended Safe Working Distances for Vibration Intensive Plant

Plant	Rating/Description	Safe Working Distance	
		Cosmetic Damage	Human Response
Small Hydraulic Hammer	(300 kg – 5-12t excavator)	2 m	7 m
Medium Hydraulic Hammer	(900 kg – 12-18t excavator)	7 m	23 m
Large Hydraulic Hammer	(1,600 kg – 18-34t excavator)	22 m	73 m

3.1.3 Construction Traffic Noise Criteria

Noise from construction traffic on public roads is not covered by the ICNG. However the ICNG does refer to the Environmental Criteria for Road Traffic Noise (ECRTN), now superseded by the NSW Road Noise Policy (RNP), for the assessment of noise arising from construction traffic on public roads.

In assessing feasible and reasonable mitigation measures under the RNP, an increase of up to 2 dB(A) represents a minor impact that is considered barely perceptible to the average person.

Given the relative short duration of most construction projects and taking into consideration the recently released RNP, the noise goal applied to traffic movements on public roads generated during the construction phase of the Project is an increase in existing road traffic noise levels of no more than 2 dB(A).

3.2 Operational Noise and Vibration Criteria

3.2.1 Environmental Protection Licence 6423

The noise limits presented in the current EPL 6423 are provided below.

L5 Noise limits:

L5.1 To restrict noise impacts, truck movements to and from the premise must be limited to between the hours of 7 am and 10 pm.

L5.2 Noise from the premises must not exceed the noise limits presented in the table below.

Note: Where amenity noise levels are lower than intrusive noise levels, both levels are in the licence condition in order to ensure that intrusive noise impacts are controlled at all times.

Table 13 Environmental Protection Licence Noise Limits

Location	Daytime	Evening	Night time
Residences at the corner of Government and 10th Streets	$L_{Aeq(15 \text{ minute})}$ 48 dB(A)	$L_{Aeq(15 \text{ minute})}$ 48 dB(A), $L_{Aeq(evening)}$ 40 dB(A)	$L_{Aeq(15 \text{ minute})}$ 47 dB(A), $L_{Aeq(night)}$ 35 dB(A), $L_{Aeq(1 \text{ minute})}$ 57 dB(A)
Residences on Northcote Street	$L_{Aeq(15 \text{ minute})}$ 44 dB(A)	$L_{Aeq(15 \text{ minute})}$ 44 dB(A)	$L_{Aeq(15 \text{ minute})}$ 44 dB(A), $L_{Aeq(night)}$ 40 dB(A), $L_{Aeq(1 \text{ minute})}$ 57 dB(A)
Residences in the Light Industrial Zone on Mitchell Avenue and Railway Avenue	$L_{Aeq(15 \text{ minute})}$ 43 dB(A)	$L_{Aeq(15 \text{ minute})}$ 43 dB(A)	$L_{Aeq(15 \text{ minute})}$ 43 dB(A), $L_{Aeq(night)}$ 41 dB(A), $L_{Aeq(1 \text{ minute})}$ 55 dB(A)

3.2.2 Environment Protection Authority – NSW Industrial Noise Policy

The INP provides guidance and recommendations on the assessment of noise impacts from industrial and commercial facilities.

The assessment procedure for industrial noise sources has two components that must be satisfied:

- Controlling intrusive noise impacts in the short term for residences; and
- Maintaining noise level amenity for residences and other land uses.

Intrusive Noise Impacts

The INP states that the noise from any single source should not intrude greatly above the prevailing background noise level. Industrial noises are generally considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (L_{Aeq}), measured over a 15 minute period, does not exceed the background noise level measured in the absence of the source by more than 5 dB. This is termed the Intrusiveness Criterion. The rating background level (RBL) is the background noise level to be used for assessment purposes and is determined by the methods given in Section 3.1 of the INP. Adjustments are to be applied to the level of noise produced if the noise at the receiver contains annoying characteristics such as tonality or impulsiveness.

Protecting Noise Amenity

To limit continuing increases in noise levels, the maximum ambient noise level resulting from industrial noise sources should not normally exceed the acceptable noise levels specified in *Table 2.1* of the INP. That is, the background noise level should not exceed the level appropriate for the particular locality and land use. This is termed the Amenity criterion.

Residential receivers in this study have been classified as 'Suburban'. For residential receivers, the amenity criteria are shown in **Table 14**. Amenity criteria for other nearby receiver types are also presented in **Table 14**.

Table 14 Recommended L_{Aeq} Noise Levels from Industrial Noise Sources

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended L_{Aeq} Noise Level dB(A)	
			Acceptable	Recommended Maximum
Residence	Suburban	Day	55	60
		Evening	45	50
		Night	40	45
Industrial premises	All	When in use	70	75
Commercial Premises	All	When in use	65	70

Provided below in **Table 15** is the established criteria for each of the assessment locations.

Where there are high levels of existing industrial or transportation noise then noise from the new source must be controlled to preserve the amenity of the area. Modification factors for areas with existing high levels of industrial or transportation noise are provided in Table 2.2 of the INP. These modifications are shown in **Table 16**. The industrial noise contributions shown in **Table 16** are taken from the 2015 noise compliance monitoring results shown **Section 2.5**.

The Facility is required to meet both the intrusive and amenity criteria in accordance with the INP. The Project Specific Noise Levels (PSNL) for the various assessment periods, at the nearby residences are shown with shading in **Table 15**. For relatively constant noise emissions during the various assessment periods, the PSNL becomes the lower of either the intrusiveness or amenity criterion, this represents a conservative approach.

Table 15 Operational Noise Criteria

Location	Assessment period	Measured L_{Aeq} noise level, dB(A)	RBL (L_{A90}), dB(A)	Intrusive criteria	Amenity criteria
Residences (NCA 1)	Day	51	39	44	55
	Evening	50	34	39	43
	Night	44	32	37	37
Residences (NCA 2)	Day	62	42	47	55
	Evening	59	39	44	49
	Night	55	33	38	45
Industrial Premises	When in use	-	-	-	70
Commercial Premises	When in use	-	-	-	65

Notes:

- The amenity criteria have been adjusted in accordance with Table 2.2 of the INP. The dominant noise level in the vicinity of residences in NCA 1 and 2 is traffic noise and industrial noise from the surrounding industrial premises.

Table 16 Amenity Criteria Modifications

Time of Day	Traffic component, L_{Aeq} , (dB(A))	Acceptable noise level (dB(A))	Industrial contribution (dB(A))	Difference	Modification to acceptable noise level	Amenity criteria (dB(A))
Residences – NCA 1						
Day	51	55	40	-15	0	55
Evening	50	45	40	-5	-2	43
Night	43	40	37	-3	-3	37
Residences – NCA2						
Day	62	55	35	-20	0	55
Evening	59	49	36	-9	0	49
Night	55	45	30	-10	0	45

3.2.3 Sleep Disturbance Criteria

The INP has been updated with INP application notes which discuss sleep disturbance and its objective assessment.

To minimise the risk of sleep disturbance as a result of industrial type operations during the night-time period, the INP application notes recommend that, the $L_{A1(1 \text{ minute})}$ noise level outside a bedroom window should not exceed the L_{A90} background noise level by more than 15 dB(A) during the night-time period (10.00 pm to 7.00 am). OEH considers it is appropriate to use this metric as a screening criterion to assess the likelihood of sleep disturbance. If this screening criterion is found to be exceeded then a more detailed analysis must be undertaken and include the extent that the maximum noise level exceeds the background noise level and the number of times this is likely to happen during the night-time period.

The INP application notes reference the RNP for some guidance in assessing the potential for sleep disturbance. The RNP contains a review of research into sleep disturbance which represents NSW EPA advice on the subject of sleep disturbance due to noise events. It concludes that having considered the results of research to date that, *'Maximum internal noise levels below 50-55 dB(A) are unlikely to cause awakening reactions'*. Therefore, given that an open window provides 10 dB(A) noise attenuation from outside to inside, external noise levels of 60-65 dB(A) are unlikely to result in awakening reactions.

Based on the measured background noise levels during the night, the sleep disturbance criteria for the nearest noise sensitive residential receivers are presented in **Table 17**.

Table 17 Night-time Sleep Disturbance Criteria

Location	Measured night-time RBL, L_{A90} , 15 mins dB(A)	Sleep disturbance criteria $L_{A1(1 \text{ minute})}$ dB(A)	
		Screening Level	Awakening Reaction
NCA 1	32	47	65
NCA 2	33	48	65

3.2.4 Operational Road Traffic Noise Criteria

The ECRTN has been superseded by the RNP. The RNP has been used to assess the noise arising from traffic generated by the proposed development. The RNP guidelines are applicable for traffic movements generated as a result of the additional traffic generated during the operational phase.

The main roads providing access to the proposed development are Government Road and Mitchell Avenue. These roads are considered are sub-arterial roads. **Table 18** presents the road traffic noise

criteria from the RNP for land use developments with a potential to create additional traffic on sub-arterial and local roads. The external noise criteria are applied 1 m from the external facade of the affected building.

Table 18 Road Traffic Noise Criteria – Freeways / Arterial / Sub-arterial Roads

Period	Parameter	Criterion
Sub-Arterial Roads		
Day (7:00 am – 10:00 pm)	L _{Aeq} (15hr)	60 dB(A)
Night (10:00 pm – 7:00 am)	L _{Aeq} (9hr)	55 dB(A)

Note that where the criteria have already been exceeded the RNP recommends that:

“Where existing traffic noise levels are above the noise assessment criteria, the primary objective is to reduce these through feasible and reasonable measures to meet the assessment criteria. A secondary objective is to protect against excessive decreases in amenity as the result of the project by applying the relative increase criteria.

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.

...

For existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level should be limited to 2 dB above that of the corresponding ‘no build option’.”

3.3 Vibration Criteria

Unlike the criteria applicable to noise emissions, vibration criteria are the same for both the construction and operational phases of this project. EPA's 'Assessing Vibration: a technical guideline', (DECCW, 2006), provides guidelines to minimise disturbance to occupants of nearby buildings and is based on *British Standard BS 6472 'Evaluation of human exposure to vibration in buildings'*. This document has been designed to be used in evaluating and assessing the effects on amenity of vibration emissions from industry, transportation and machinery. The guideline is used in assessments of vibration impacts caused by the construction and operation of new developments.

Vibration criteria are set primarily according to whether the particular activities of interest are continuous in nature or intermittent, whether they occur during the daytime or night-time and the type of receiver to be assessed e.g. commercial or residential.

The effects of vibration in buildings can be divided into three main categories:

- Those in which the occupants or users of the building are inconvenienced or possibly disturbed, i.e. human disturbance or discomfort;
- Those in which the integrity of the building or the structure itself may be prejudiced; and
- Those where the building contents may be affected.

Therefore, vibration levels at sensitive receiver locations must be controlled so as to prevent discomfort and regenerated noise, and in some extreme cases, structural damage.

4.0 Construction Noise Assessment

4.1 Construction Noise Impact Assessment

Construction noise has been assessed in accordance with ICNG guidelines. The works are scheduled to occur over a period of 6-8 weeks and there are no residential receivers within 600 m of the proposed development site. The proposed construction activities comprise of clearing, excavation, slab and building construction activities.

The assessment of the construction noise is based on the noise generated by the proposed construction equipment. **Table 19** presents the sound power levels (SWL) of the construction equipment planned to be utilised on this development. In addition, **Table 19** also presents predicted construction noise levels at the nearest residential and commercial receivers. The predicted noise levels only take into consideration hemispherical distance propagation, ground and air absorption and shielding from any intervening structures have not been considered. Therefore, the predicted construction noise levels at nearby receivers are considered to be conservative. It is also important to note that a number of the proposed construction activities will be conducted inside the proposed building, which would further attenuate construction noise levels.

Table 19 Construction Equipment Noise Emission Levels

Equipment	Equipment sound power level ¹ – dB(A)	Distance to nearest receiver (m)		Predicted sound pressure level, L _{Aeq} - dB(A)	
		Residential	Industrial	Residential	Industrial
Concrete agitator	106	600	300	42	48
Concrete vibrator	97	600	300	33	39
Breakers	112	600	300	48	54
Pneumatic hand tools	108	600	300	44	50
Truck (Rigid or Articulated)	98 – 108	600	300	34-44	40-50
Excavator	99	600	300	35	41
Crane	104	600	300	40	46
Forklifts	104	600	300	40	46
Tele-handlers	104	600	300	40	46

Notes:

1. The above sound power levels are based upon the Australian Standard AS2436-1981, "Guide to Noise control on construction, maintenance and demolition sites", the UK Department for Environment, Food and Rural Affairs (DEFRA) and AECOM's database.

4.1.1 Discussion of Results

The predicted noise levels presented in **Table 19** indicate that the maximum construction noise levels at nearby residential receivers (i.e. 122 Mitchell Avenue, Kurri Kurri) would range from 33 – 48 dB(A). These are below the noise management levels during standard construction hours.

The maximum construction noise levels at nearby industrial receivers (i.e. 125 Mitchell Avenue, Kurri Kurri) would range from 39 – 54 dB(A). These are below the noise management levels during standard construction hours.

General mitigation measures (see **Section 4.4.2**) should be sufficient to control noise levels to within reasonable levels at nearby sensitive receivers.

4.1.2 Cumulative Construction Noise Impacts

Construction of the Project could potentially overlap with the construction of an adjacent battery recycling facility. It is understood that similar construction plant to those listed in **Table 19** will be used to construct the battery recycling facility. If both construction works were to overlap the predicted construction noise may increase by up to 3 dB from those predicted in **Table 19**. In this case compliance with the construction noise management levels would still be expected.

4.2 Construction Traffic Noise

The forecast trip generation volumes during the construction phase are estimated to be approximately:

- Up to ten light vehicles per day accessing the Project Area (assuming an occupancy rate of one person per car); and
- Approximately two heavy vehicles (trucks) accessing the Project Area per day. Truck movements are likely to be spread throughout the day as equipment and materials are required onsite.

Due to the small number of additional construction vehicles the increase in noise as a result of construction traffic would be inconsequential (less than 1dB(A)) on Mitchell Avenue. Therefore, the issue of impacts caused by construction traffic need not be considered any further.

4.3 Vibration Assessment

Vibration intensive works are proposed to occur during ground preparation works to break up the existing hardstand area to allow for construction of the Project. This area is currently compacted roadbase used as a storage area. Due to the significant distances to sensitives receivers it is expected that these works would have a negligible impact on any receiver.

Despite this, safe working distances that relate to cosmetic/structural damage and human discomfort would be implemented for the proposed works. These are presented in **Section 3.1.2.3**. Breakers are the only vibration intensive equipment that could potentially be used during the construction of the facility. The safe working distances for structural damage and human response will be complied with when using breakers due to the large (over 300 m) offset distances to neighbouring structures.

4.4 Construction Noise Management Strategies

The ICNG accepts that construction activities potentially result in elevated noise, albeit on a temporary basis, and where physical mitigation options are limited, stresses the importance of community engagement in a frank and upfront manner.

The ICNG recommends that the contractor demonstrate best practicable means of controlling noise and include noise mitigation measures in the construction management plan to minimise the noise impact at sensitive receivers. This may include the work practices described below:

4.4.1 Construction Hours

Limit construction work to standard construction hours.

4.4.2 Standard Mitigation Measures

All construction activities associated with the development of the Project will be subject to the standard noise and vibration mitigation measures described below:

The contractor will, where reasonable and feasible, apply best practice noise mitigation measures including:

- Maximising the offset distance between noisy plant items and nearby noise sensitive receivers;
- Avoiding the coincidence of noisy plants working simultaneously close together and adjacent to sensitive receivers would be avoided, where practicable;
- Where possible, equipment with directional noise emissions would be orientated away from sensitive receivers;

- Locate noisy plant away from potentially noise affected neighbours or behind barriers, such as sheds or walls;
- Loading and unloading would be carried out away from sensitive receivers, where practicable;
- The selection of site access points would take into account the proximity of noise sensitive receivers;
- Maintenance work on construction plants with the potential to generate noise impacts would be carried out away from noise sensitive receivers and confined to standard daytime construction hours, where possible;
- Relocate any vibration generating plant and equipment away from noise and vibration sensitive receivers in order to minimise any potential vibration impacts;
- Turn off plant that is not being used;
- Ensure plant is regularly maintained, and repair or replace equipment that becomes noisy; and
- Arrange the work site to minimise the use of movement alarms on vehicles and mobile plant.

4.4.3 Local Road Traffic – Heavy Vehicles Noise Mitigation

The following mitigation measures are proposed in order to minimise the impact of from heavy vehicles on local roads:

- All trucks would be fitted with mufflers and any other noise control equipment in good working order;
- As far as practical and safety consideration, truck drivers would avoid:
 - Heavy acceleration and braking;
 - Compression braking;
 - Reversing as far as practicable;
 - High speeds;
 - Pick-ups and deliveries outside standard construction hours; and
 - Idling outside noise sensitive receivers.
- Truck routes to and from the worksite will be via major roads where possible.

4.4.4 Reversing Alarms

The potential noise impact associated with reversing alarms will be managed and minimised via a combination of proactive driver/operator training and operational procedures. The following mitigation strategies will be undertaken, taking into account that WorkCover Work Health and Safety WH&S requirements would need to be satisfied with respect to safety surrounding construction vehicles.

- The primary means for minimising reversing alarm noise would be through a dedicated effort on the part of all construction equipment drivers to minimise, wherever feasible, the amount of reversing of their vehicles;
- Wherever feasible, turning circles would be created at the end points of vehicle work legs, which would allow trucks to turn and avoid the need for reversing; and
- Emphasis would be placed during driver training and site induction sessions on the potential adverse impact of reversing alarms and the need to minimise their use.

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5.0 Operational Noise Assessment

5.1 Existing Operations

The existing WA recycling facility has been modelled using SoundPlan Version 7.3 to determine the existing noise levels from the use of the facility at nearby receivers. Two scenarios have been considered, daytime and night-time. The evening scenario is identical to the night-time scenario.

The following features were included in the noise model:

- Ground topography;
- Ground absorption;
- Buildings; and
- Receivers.

The operational noise model included the noise sources presented in **Table 20**. These noise sources are based upon noise levels measured during site visit on 3 March 2016. A summary of these measurements is provided in **Appendix C**.

Table 20 Sound Power Levels for Noise Intensive Plant/Activities

Equipment	Sound power level, L_{Aeq} dB(A)
Baghouse 1 Fan (daytime only)	105
Baghouse 4 Fan	105
Baghouse 5 Fan	105
Baghouse 6 Fan	105
Furnace	104
Forklift (daytime only)	104
Tele-handler (daytime only)	104
Truck Tipping Material (daytime only)	106 ²
Truck Driving (daytime only)	98 ²

Notes:

1. Baghouse Fans 2 and 3 only operate on an infrequent basis. Their contribution is therefore not included;
2. Time weighted to a 15 minute period.

5.2 Future Operations

The future WA Facility, including the proposed Project, has been modelled using SoundPlan to determine predicted noise levels from the use of the Facility at nearby receivers. The sound power levels for each of the new sources used in the model are provided in **Table 21**. In addition to the fans listed below the existing Baghouse 5 Fan will be used as the incineration plants Induced Draft Fan.

Table 21 Sound Power Levels for Noise Intensive Plant/Activities

Equipment	Quantity	Sound power level, L_{Aeq} dB(A), per Unit	
		Inlet	Case radiated
Forced Air Cooler Fan	1	97	89
Secondary Combustion Air Fan	1	96	89
Primary Burner Combustion Air Fan (includes inlet silencer)	1	85	93
Secondary Burner Combustion Air Fan (includes inlet silencer)	1	85	93

The inlet noise sources listed above have been assumed to be located on the roof of the future Project structure (12 m above ground level) and will be directed north. The case radiated noise levels have been assumed to be located within the proposed Project building. The proposed Project building has been assumed to have open doors (5 m x 8 m) located on the east and south sides of the facility.

5.3 Noise Model Calibration

A comparison was made between the existing Facility operation noise model and the compliance noise measurements taken in 2015. Comparisons were not made with the 2016 attended measurements as the contribution from the WA site was generally not audible. Generally the two results correlate well (are within 2 dB). However, the noise model does seem to over predict by 6 dB on the western boundary during the daytime.

Table 22 Comparison between Compliance Measurements and Modelled Noise Levels

Location	Time	Modelled wind	Noise level, L_{Aeq} dB(A)	
			2015 Compliance measurements	Predicted
Mitchell Avenue	Day	3 m/s NW	< 48	41
	Night	3 m/s NW	38	40
Eastern Boundary	Day	3 m/s NW	57	58
	Night	3 m/s NW	55	55
Western Boundary	Day	3 m/s NW	58	64
	Night	3 m/s NW	59	57

5.4 Noise Modelling Results

Based on the assumption and modelling parameters set out in the previous section, the operational noise levels of the proposed Facility were predicted at the nearest sensitive receivers.

The facility was modelled using the worst case scenario of all equipment operating simultaneously and continuously over a full 15 minute period. The model assessed neutral conditions, worst case wind conditions (3 m/s wind source to receiver) and F Class temperature inversions.

The predicted environmental noise emission levels from the operation of the proposed facility at the nearest sensitive receivers are presented in **Table 23**. Derived INP criteria (refer to **Table 15**) are also presented in

Table 21.

As the noise emissions from the Facility, existing and future would be dominated by relatively constant building services noise, the L_{Aeq} period has been assumed to be equal to the assessed $L_{Aeq, 15 \text{ min}}$ for the worst case operational scenario. This represents a conservative assumption.

The Project Specific Noise Levels (PSNL) for the various assessment periods, at the nearby residences are shown with shading **Table 24**. For relatively constant noise emissions during the various assessment periods, the PSNL becomes the lower of either the intrusiveness or amenity criterion, this represents a conservative approach.

A noise contour plot for the future operational scenario is presented in **Appendix D**.

Table 23 Predicted Environmental Noise Emission Levels

Location	Criterion, L_{Aeq} , dB(A)		Sound pressure level, L_{Aeq} , dB(A)				
			Day		Night		
	Day	Night	Neutral	Wind	Neutral	Wind	F Class Inv
Existing operations (excluding the Project)							
84 Government Road, Weston	44	37	32	36	29	33	33
67 Government Road, Weston	44	37	34	38	31	35	35
72 Hart Road, Loxford	44	37	37	41	34	37	37
122 Mitchell Avenue, Kurri Kurri	47	38	39	41	38	41	41
68 Northcote Street, Kurri Kurri	47	38	34	38	34	38	38
Future operations (including the Project)							
84 Government Road, Weston	44	37	32	36	29	34	34
67 Government Road, Weston	44	37	35	39	31	35	35
72 Hart Road, Loxford	44	37	37	41	34	37	37
122 Mitchell Avenue, Kurri Kurri	47	38	39	42	39	41	41
68 Northcote Street, Kurri Kurri	47	38	34	38	34	38	38

Notes:

1. The predicted noise levels at the residential receivers have been assessed against the night-time criterion. This is the most stringent criterion. Compliance with the night-time noise limits will ensure compliance with the day and evening noise limits.

Table 24 Summary of Compliance

Location	Summary of compliance				
	Day		Night		
	Neutral	Wind	Neutral	Wind	F Class Inv
Existing operations (excluding the Project)					
84 Government Road, Weston	Complies	Complies	Complies	Complies	Complies
67 Government Road, Weston	Complies	Complies	Complies	Complies	Complies
72 Hart Road, Loxford	Complies	Complies	Complies	Complies	Complies
122 Mitchell Avenue, Kurri Kurri	Complies	Complies	Complies	Exceeds INP ²	Exceeds INP ²
68 Northcote Street, Kurri Kurri	Complies	Complies	Complies	Complies	Complies
Future operations (including the Project)					
84 Government Road, Weston	Complies	Complies	Complies	Complies	Complies
67 Government Road, Weston	Complies	Complies	Complies	Complies	Complies
72 Hart Road, Loxford	Complies	Complies	Complies	Complies	Complies
122 Mitchell Avenue, Kurri Kurri	Complies	Complies	Marginally Exceeds INP ¹	Exceeds INP ²	Exceeds INP ²
68 Northcote Street, Kurri Kurri	Complies	Complies	Complies	Complies	Complies

Notes:

1. A marginal exceedance equated to 1 dB which is generally not perceptible to the human hearing.
2. INP exceedance are a maximum of 3 dB over criteria which is at the lower end of what human hearing can distinguish.

As shown in **Table 23** and **Table 24** the Project would generally be in compliance with the Project specific criteria. Some small exceedances (up to 3dB) have been modelled to potentially occur at the receiver at 122 Mitchell Avenue however for the following reasons these exceedances are expected to have a minor impact on this receiver:

- The exceedances are only predicted to occur at night and during noise enhancing meteorological conditions including an F-Class temperature inversion which generally only occur during winter when receivers have dwellings sealed;
- The assessment assumes a constant operation of Project equipment for the duration of the assessment period providing further conservativeness; and
- The predicted noise level are only up to 1dB over existing plant noise levels meaning there will be a negligible change in overall impacts as a result of the Project. As evidenced by the lack of noise complaints received by the proponent existing noise levels are not problematic for local receivers.

For these reasons operational noise impacts as a result of the Project are anticipated to be minor. Furthermore it should be noted that the receiver at which the potential for a small exceedance to occur is surrounded by commercial and industrial neighbours.

5.5 Cumulative Operational Noise Impact

A cumulative noise assessment has been completed for the cumulative impact of both the proposed neighbouring battery recycling facility and the future operations of the Weston Aluminium Facility. Plant items associated with the operation of the battery recycling facility, as presented in **Table 25**, have been included in the cumulative assessment. The predicted cumulative noise results are shown in **Table 26** and **Table 27**.

Table 25 Battery Recycling Facility Noise data

Equipment	Sound power level, L _{Aeq} dB(A)	Location
Vibrating feeder	90	indoor
Agitators	90	indoor
Hammer mills with sound proof enclosure	98	indoor
Scrubber fan	90	outdoor
Crystallizer area:	88	indoor
Foundry area (furnace)	88	indoor
Outside fans (U720-U820-U421)	90	outdoor
Cooling tower pump	88	outdoor
Oxygen Plant	90	indoor
PP Recovery Facility	93	indoor
Delivery Trucks	98 ¹	outdoor

Notes:

1. Time weighted to a 15 minute period.

Table 26 Predicted Cumulative Environmental Noise Emission Levels

Location	Criterion, L _{Aeq} , dB(A)		Sound pressure level, L _{Aeq} , dB(A)				
			Day		Night		
	Day	Night	Neutral	Wind	Neutral	Wind	F Class Inv
Future operations (excluding the Project and the Battery Recycling Facility)							
84 Government Road, Weston	44	37	32	37	30	34	34
67 Government Road, Weston	44	37	35	39	33	37	37
72 Hart Road, Loxford	44	37	37	43	35	38	38
122 Mitchell Avenue, Kurri Kurri	47	38	40	43	40	42	42
68 Northcote Street, Kurri Kurri	47	38	34	38	34	38	38

Notes:

1. The predicted noise levels at the residential receivers have been assessed against the night-time criterion. This is the most stringent criterion. Compliance with the night-time noise limits will ensure compliance with the day and evening noise limits.

Table 27 Summary of Compliance, Cumulative Impact

Location	Summary of compliance				
	Day		Night		
	Neutral	Wind	Neutral	Wind	F Class Inv
Future operations (excluding the Project and the Battery Recycling Facility)					
84 Government Road, Weston	Complies	Complies	Complies	Complies	Complies
67 Government Road, Weston	Complies	Complies	Complies	Complies	Complies
72 Hart Road, Loxford	Complies	Complies	Complies	Marginally Exceeds INP ¹	Marginally Exceeds INP ¹
122 Mitchell Avenue, Kurri Kurri	Complies	Complies	Exceeds INP ²	Exceeds INP ²	Exceeds INP ²
68 Northcote Street, Kurri Kurri	Complies	Complies	Complies	Complies	Complies

Notes:

- A marginal exceedance equated to 1 dB which is generally not perceptible to the human hearing.
- INP exceedance are a maximum of 2-4 dB over criteria which is at the lower end of what human hearing can distinguish.

As shown in **Table 26** and **Table 27** the Project would generally be in compliance with the Project specific criteria. Some marginal exceedances have been predicted to potentially occur at the receiver at 122 Mitchell Avenue (up to 4 dB) and 72 Hart Road, Loxford (up to 1 dB). The cumulative noise levels are generally predicted to be 1-2 dB above the noise levels predicted for the future Weston Aluminium site on its own. In addition the residence at 122 Mitchell Avenue is surrounded by commercial and industrial neighbours, therefore cumulative noise impacts are expected to be minor. In addition the cumulative noise levels are predicted to be 1-2 dB above noise levels from the existing WA facility. A difference of 2 dB is considered to be barely perceptible to the average person.

5.6 Sleep Disturbance

The application notes for the *Industrial Noise Policy* recommend that sleep disturbance is assessed based on the emergence of the L_{A1} (1 minute) noise level over the corresponding L_{A90} (15 minute) noise level.

The following screening criterion for sleep disturbance is recommended for the assessment of sleep disturbance:

$$L_{A1} (1 \text{ minute}) < L_{A90} (15 \text{ minute}) + 15 \text{ dB(A)}$$

Truck movements and material handling will be limited to the daytime, therefore the noise sources expected to control the L_{A1} (1 minute) levels will be the bag house fans. These fans are continuous noise sources. The L_{A1} (1 minute) sound power level s for the bag house fans are equivalent to the L_{Aeq} sound power levels. Predicted L_{A1} (1 minute) sound pressure levels at the nearest residential receivers are shown in Table 28 below. These results indicate compliance with the sleep disturbance screening criteria.

Table 28 Predicted L_{A1} (1 minute) Environmental Noise Emission Levels

Location	Criterion, L _{A1} (1 minute), dB(A)	Sound pressure level, L _{A1} (1 minute), dB(A)		
		Night		
	Night	Neutral	Wind	F Class Inv
Future operations (excluding the Project and the Battery Recycling Facility)				
84 Government Road, Weston	47	30	34	34
67 Government Road, Weston	47	33	37	37
72 Hart Road, Loxford	47	35	38	38
122 Mitchell Avenue, Kurri Kurri	48	40	42	42
68 Northcote Street, Kurri Kurri	48	34	38	38

5.7 Additional Road Traffic

Trucks will enter and exit the site from Mitchell Avenue. Truck movements will be limited to between the hours of 7am and 10pm in accordance with the sites EPL conditions. During peak operational times this may mean a total of increase of up to 2 to 3 heavy vehicles per hour during operations.

Due to the small number of additional vehicles the increase in noise as a result of traffic generated by the development would be inconsequential (less than 1 dB(A)) on Mitchell Avenue. Therefore, the issue of impacts caused by operational traffic need not be considered any further.

5.8 Operational Vibration

Due to the offset distances between the Project and the nearest neighbouring building or structure, there is not expected to be any operational vibration impact associated with the Project in regards to either cosmetic damage or human comfort.

5.9 Discussion

Generally the proposed facility will comply with the noise requirements discussed in **Section 3.0**. 1-3 dB exceedances of the established INP criteria are conservatively predicted at 122 Mitchell Avenue, Kurri Kurri, however compliance with the existing EPL noise limits is predicted at this location. In addition noise levels are not expected to increase significantly (less than 1 dB) when comparing the existing and future operational scenarios.

It is considered that additional noise controls are not required for the proposed facility for the following reasons:

- Compliance with the EPL noise limits is predicted;
- Compliance with the INP noise requirements is predicted with the exception of 122 Mitchell Avenue where a 1-3 dB exceedance is predicted under conservative, worst-case conditions; and
- Noise levels are not predicted to increase significantly (less than 1 dB) when comparing the existing Facility and the future Facility and this exceedance would only occur during noise enhancing meteorological conditions. Therefore overall operational impacts would be minor.

Cumulative noise impacts (from the future WA facility and the battery recycling facility) are predicted to be 1-2 dB higher than the existing WA facility. Therefore cumulative noise impacts are expected to be minor.

6.0 Conclusions

The impacts of noise and vibration associated with the construction and operation of the WA Thermal Waste Processing Project at the existing WA Facility have been assessed.

The scope of the assessment included noise measurement surveys, establishing noise and vibration criteria, noise and vibration model predictions for construction and operational scenarios, a noise and vibration impact assessment relative to appropriate criteria and recommendations for noise and vibration control measures where necessary.

This impact assessment addresses the SEARs relating to noise by considering the impact of noise and vibration on nearby noise sensitive receivers during the construction and operational phase of the proposed Facility. The noise and vibration assessment was carried out in accordance with NSW regulatory requirements which results in addressing the assessment as follows:

Construction Noise and Vibration

The construction noise and vibration assessment was conducted in accordance with EPA's Interim Construction Noise Guidelines (ICNG) and the EPA's Assessing vibration: a technical guideline (AVTG).

The noise and vibration assessment associated with the construction phase of the Project, indicates compliance with the ICNG and the AVTG noise and vibration management levels at the nearest residential and commercial receivers.

Cumulative construction noise impacts have been assessed (from the construction of the future WA facility and the battery recycling facility). This assessment indicates compliance with the ICNG noise management levels at the nearest residential and commercial receivers.

Construction Road Traffic Noise

The road traffic noise associated with construction activities was assessed in accordance with EPA's NSW Road Noise Policy (RNP) guidelines.

The road traffic noise assessment associated with the construction phase of the Facility indicates compliance with the RNP acoustic criteria.

Operational Noise and Vibration

The operational noise and vibration assessment was conducted in accordance with EPA's NSW Industrial Noise Policy (INP) guidelines and the AVTG.

The operational noise and vibration impact assessment indicates compliance at all assessment locations during the daytime periods and a minor exceedance during night-time period under conservative, worst-case modelled conditions where noise enhancing meteorology occurs. Due to the conservative nature of the modelling this impact is expected to have a negligible impact on the receiver.

Cumulative noise impacts (from the future WA facility and the battery recycling facility) have been assessed. The assessed impacts on the nearest residential and commercial receivers are expected to be minor.

Sleep Disturbance

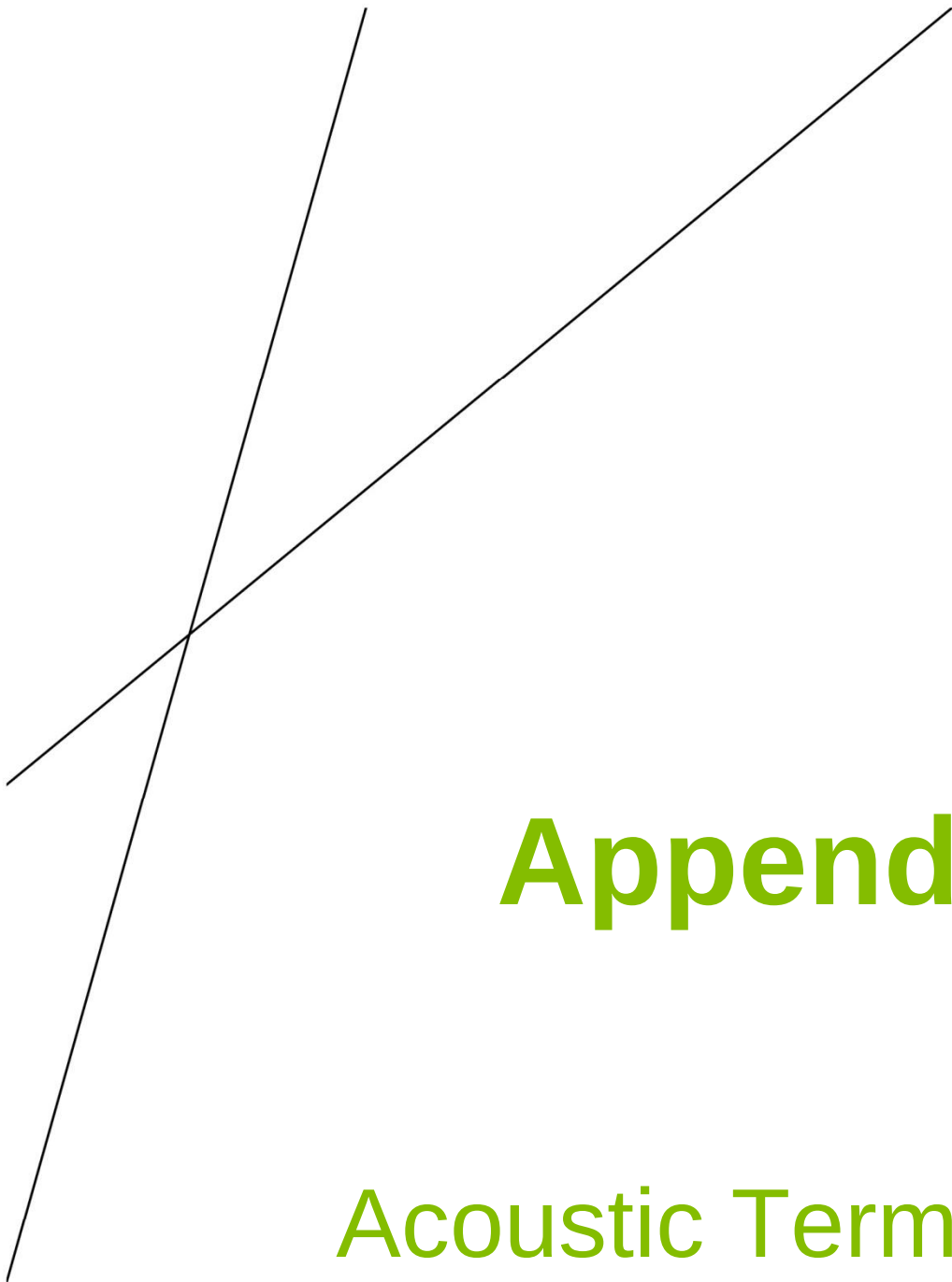
The sleep disturbance assessment was conducted in accordance with EPA's INP guidelines. The assessment indicates compliance at all assessment locations during the night-time period.

Operational Road Traffic Noise

The road traffic noise assessment was conducted in accordance with EPA's RNP guidelines.

The road traffic noise assessment associated with the operational phase of the Facility indicates compliance with the RNP acoustic criteria.

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Appendix A

Acoustic Terminology

Appendix A Acoustic Terminology

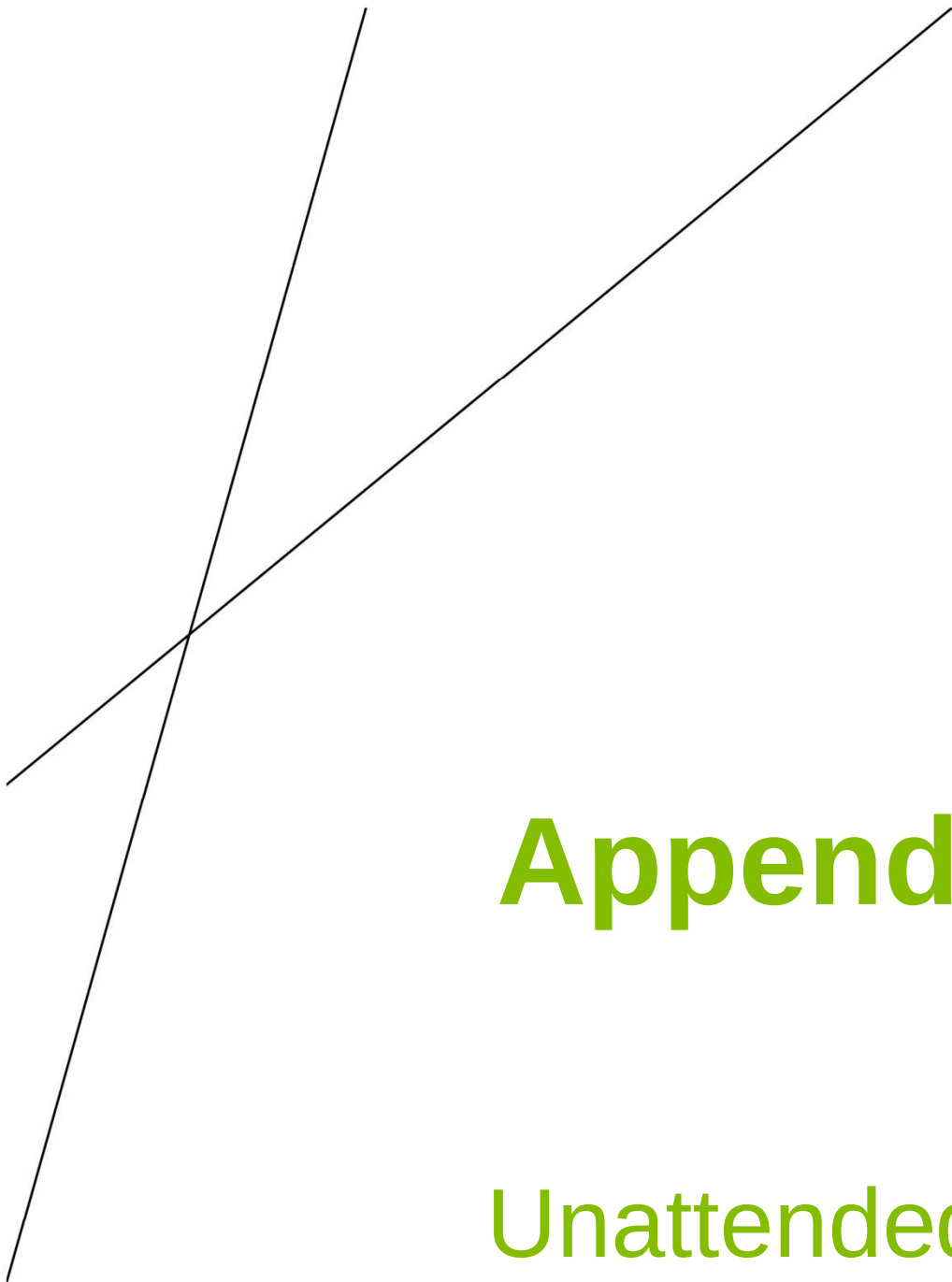
The following is a brief description of acoustic terminology used in this report.

Sound power level	The total sound emitted by a source																						
Sound pressure level	The amount of sound at a specified point																						
Decibel [dB]	The measurement unit of sound																						
A Weighted decibels [dB(A)]	The A weighting is a frequency filter applied to measured noise levels to represent how humans hear sounds. The A-weighting filter emphasises frequencies in the speech range (between 1kHz and 4 kHz) which the human ear is most sensitive to, and places less emphasis on low frequencies at which the human ear is not so sensitive. When an overall sound level is A-weighted it is expressed in units of dB(A).																						
Decibel scale	The decibel scale is logarithmic in order to produce a better representation of the response of the human ear. A 3 dB increase in the sound pressure level corresponds to a doubling in the sound energy. A 10 dB increase in the sound pressure level corresponds to a perceived doubling in volume. Examples of decibel levels of common sounds are as follows: <table> <tr> <td>0dB(A)</td><td>Threshold of human hearing</td></tr> <tr> <td>30dB(A)</td><td>A quiet country park</td></tr> <tr> <td>40dB(A)</td><td>Whisper in a library</td></tr> <tr> <td>50dB(A)</td><td>Open office space</td></tr> <tr> <td>70dB(A)</td><td>Inside a car on a freeway</td></tr> <tr> <td>80dB(A)</td><td>Outboard motor</td></tr> <tr> <td>90dB(A)</td><td>Heavy truck pass-by</td></tr> <tr> <td>100dB(A)</td><td>Jackhammer/Subway train</td></tr> <tr> <td>110 dB(A)</td><td>Rock Concert</td></tr> <tr> <td>115dB(A)</td><td>Limit of sound permitted in industry</td></tr> <tr> <td>120dB(A)</td><td>747 take off at 250 metres</td></tr> </table>	0dB(A)	Threshold of human hearing	30dB(A)	A quiet country park	40dB(A)	Whisper in a library	50dB(A)	Open office space	70dB(A)	Inside a car on a freeway	80dB(A)	Outboard motor	90dB(A)	Heavy truck pass-by	100dB(A)	Jackhammer/Subway train	110 dB(A)	Rock Concert	115dB(A)	Limit of sound permitted in industry	120dB(A)	747 take off at 250 metres
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80dB(A)	Outboard motor																						
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100dB(A)	Jackhammer/Subway train																						
110 dB(A)	Rock Concert																						
115dB(A)	Limit of sound permitted in industry																						
120dB(A)	747 take off at 250 metres																						
Frequency [f]	The repetition rate of the cycle measured in Hertz (Hz). The frequency corresponds to the pitch of the sound. A high frequency corresponds to a high pitched sound and a low frequency to a low pitched sound.																						
Equivalent continuous sound level [Leq]	The constant sound level which, when occurring over the same period of time, would result in the receiver experiencing the same amount of sound energy.																						
Lmax	The maximum sound pressure level measured over the measurement period																						
Lmin	The minimum sound pressure level measured over the measurement period																						
L10	The sound pressure level exceeded for 10% of the measurement period. For 10% of the measurement period it was louder than the L10.																						

L90	The sound pressure level exceeded for 90% of the measurement period. For 90% of the measurement period it was louder than the L90.
Ambient noise	The all-encompassing noise at a point composed of sound from all sources near and far.
Background noise	The underlying level of noise present in the ambient noise when extraneous noise (such as transient traffic and dogs barking) is removed. The L90 sound pressure level is used to quantify background noise.
Traffic noise	The total noise resulting from road traffic. The Leq sound pressure level is used to quantify traffic noise.
Day	The period from 0700 to 1800 h Monday to Saturday and 0800 to 1800 h Sundays and Public Holidays.
Evening	The period from 1800 to 2200 h Monday to Sunday and Public Holidays.
Night	The period from 2200 to 0700 h Monday to Saturday and 2200 to 0800 h Sundays and Public Holidays.
Assessment background level [ABL]	The overall background level for each day, evening and night period for each day of the noise monitoring.
Rating background level [RBL]	The overall background level for each day, evening and night period for the entire length of noise monitoring.

*Definitions of a number of terms have been adapted from Australian Standard AS1633:1985 "Acoustics – Glossary of terms and related symbols", the DECCW's NSW Industrial Noise Policy and the DECCW's Environmental Criteria for Road Traffic Noise.

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Appendix B

Unattended Noise Monitoring

Appendix B Unattended Noise Monitoring

Weston Aluminium - 03/03/16 - 11/03/16

Logger Setup

Logger Type: Rion NL52
 Serial No : 553967
 Address: 6 Tenth Street , Weston
 Location: Front Yard
 Facade / Free Field: Free Field
 Environment: Industry Audible. Traffic noise.

Logger Setup Photo



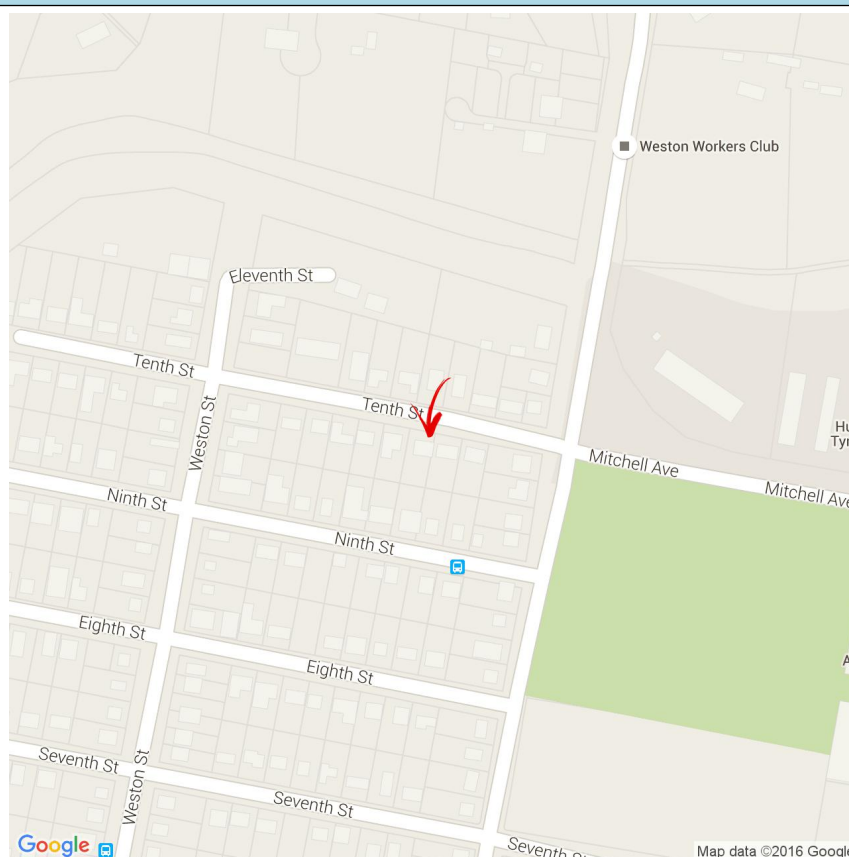
INP Noise Level, dB(A)

	Log Average	RBL
Day	51	39
Evening	49	34
Night	44	32

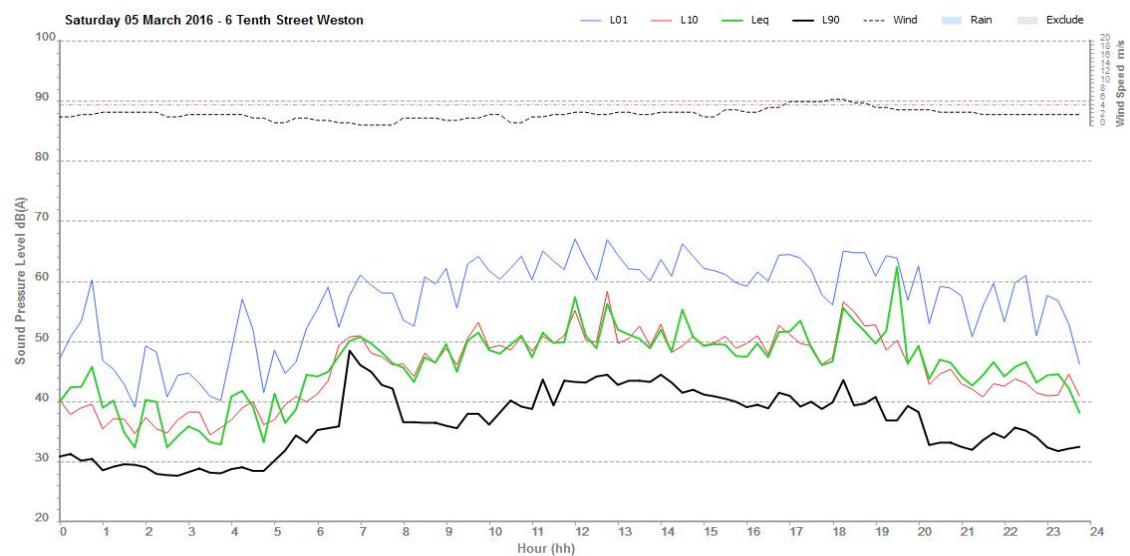
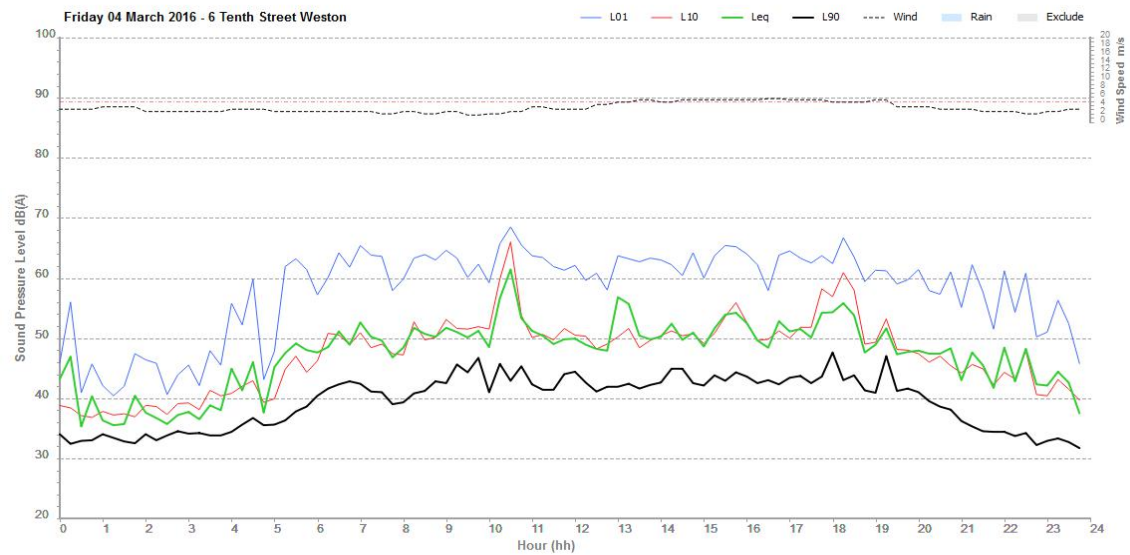
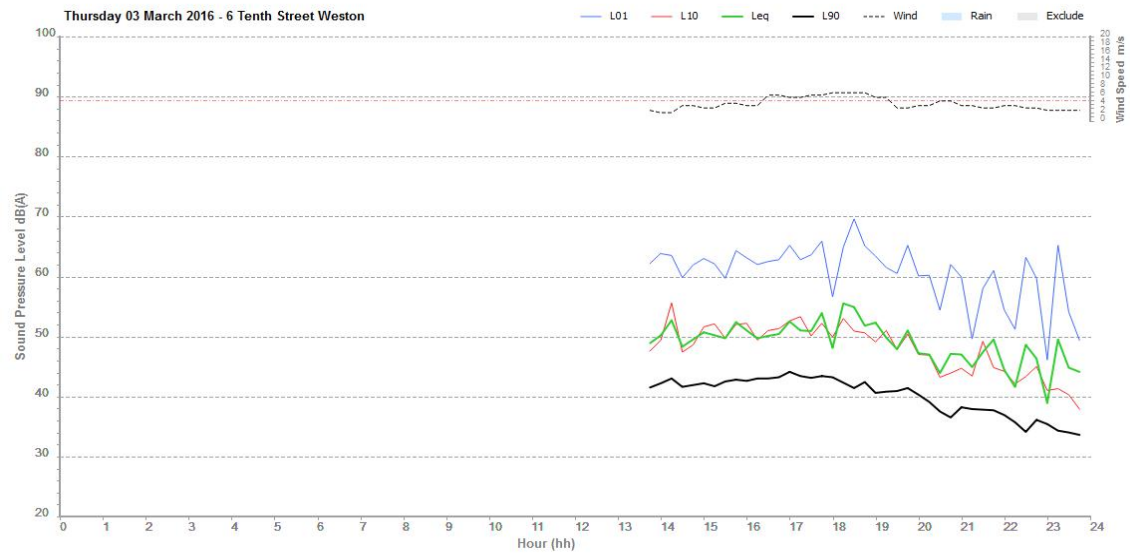
RNP Noise Level, dB(A)

	L _{Aeq(1hr)}	L _{Aeq(period)}
Day (7am - 10 pm)	-	-
Night (10pm - 7am)	-	-

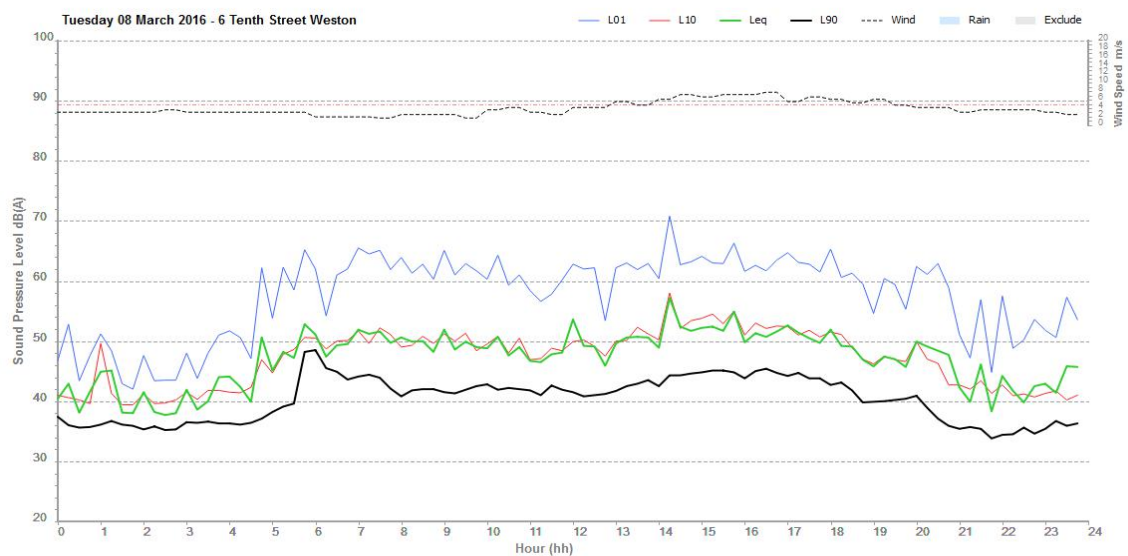
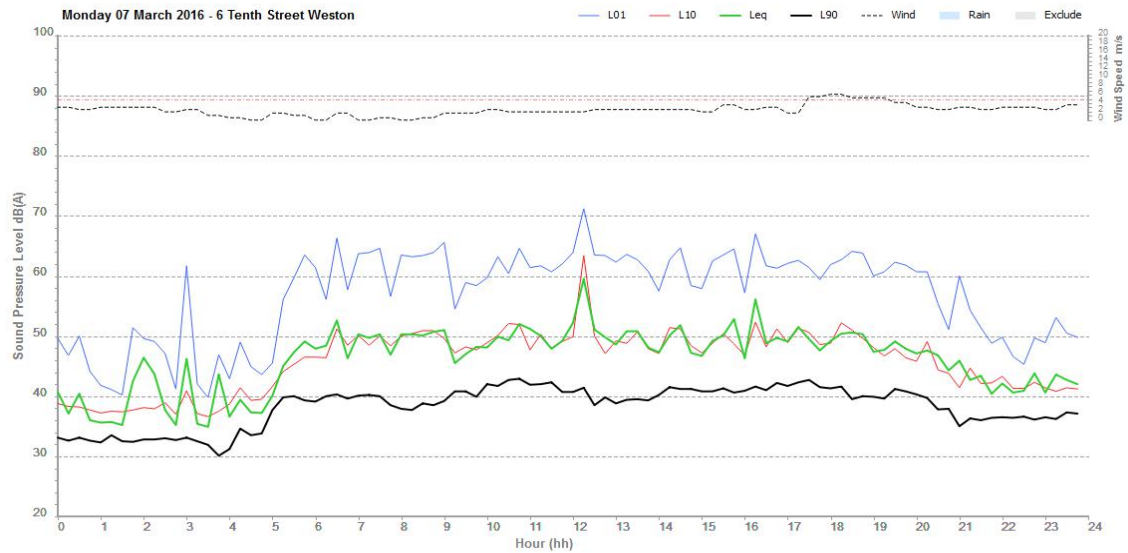
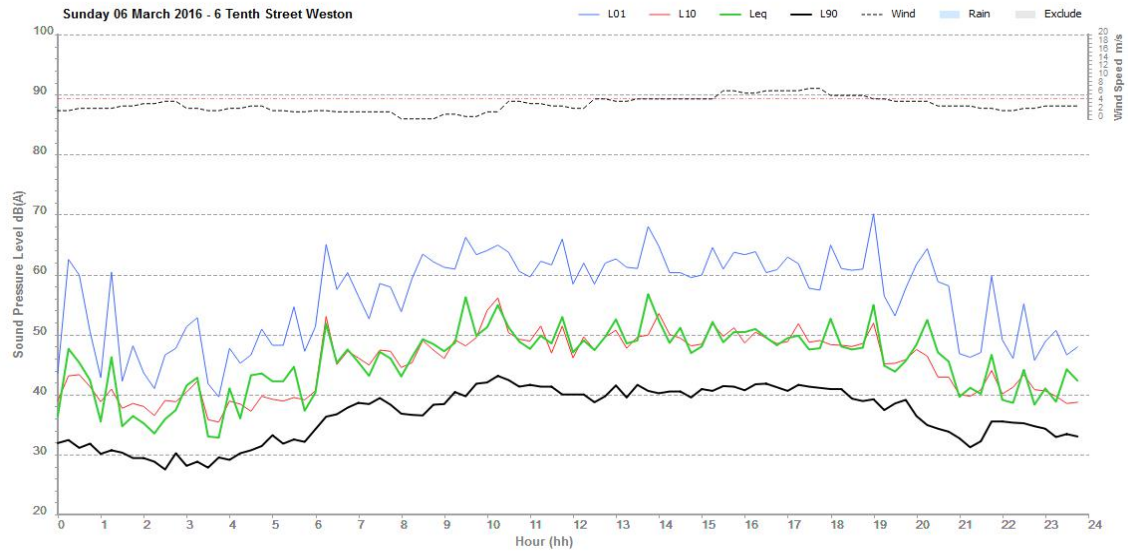
Logger Location Map



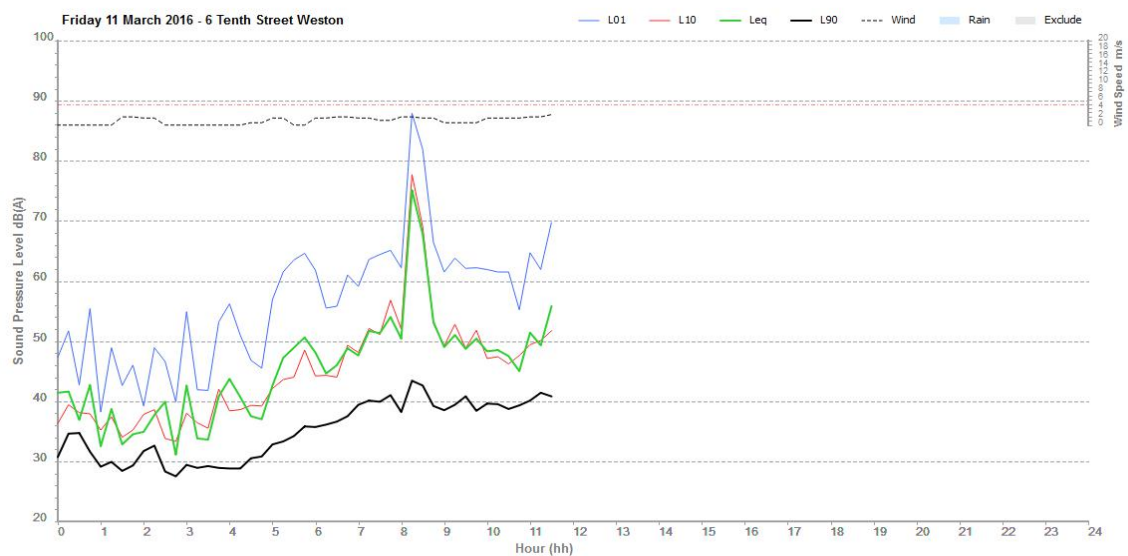
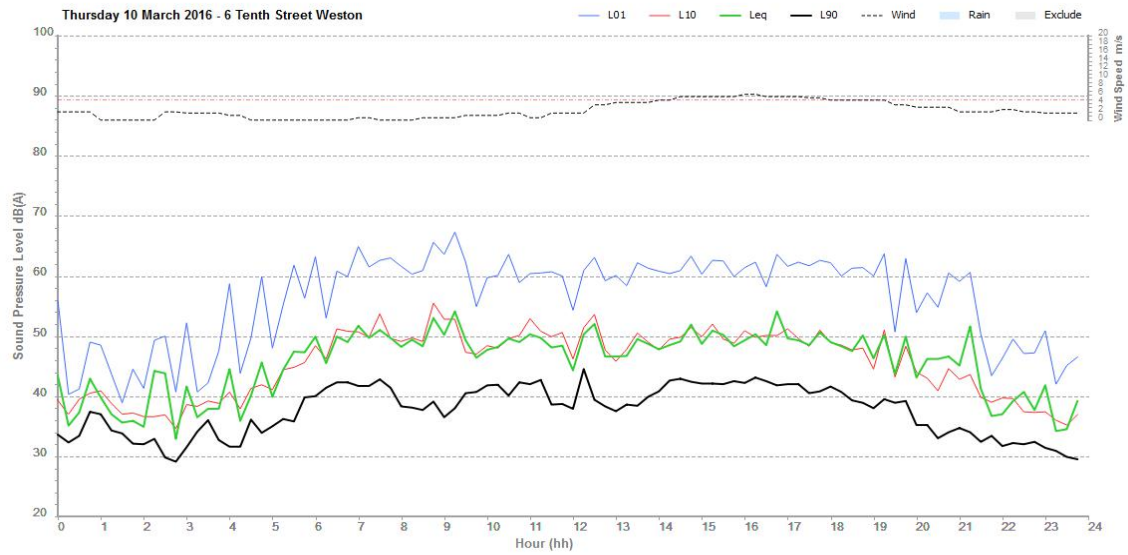
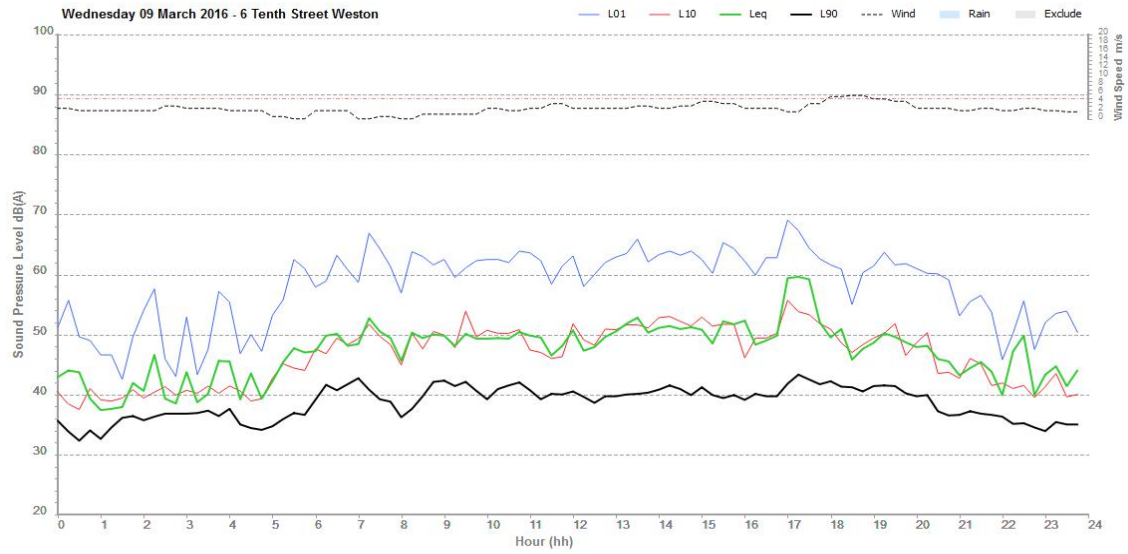
Logger Graphs



Logger Graphs



Logger Graphs



Weston Aluminium - 03/03/16 - 11/03/16

Logger Setup

Logger Type: Rion NL52
 Serial No : 1043455
 Address: 52 Northcote Street , Kurri Kurri
 Location: Front Yard
 Facade / Free Field: Free Field
 Environment: No industry audible, birds.
 Traffic dominant.

Logger Setup Photo



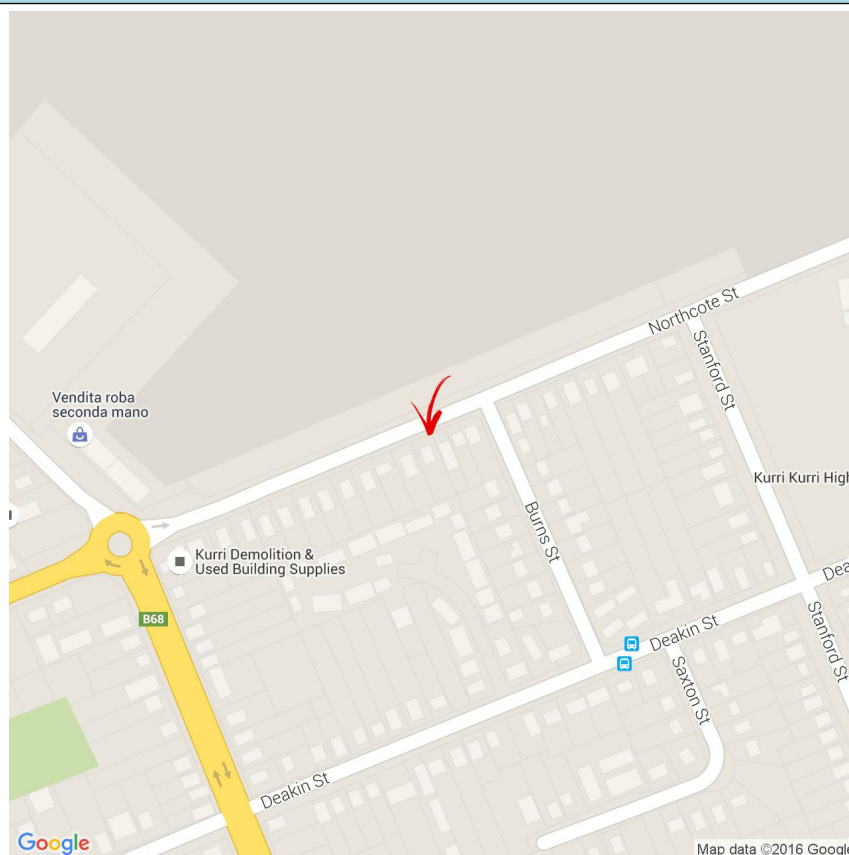
INP Noise Level, dB(A)

	Log Average	RBL
Day	61	42
Evening	60	38
Night	55	33

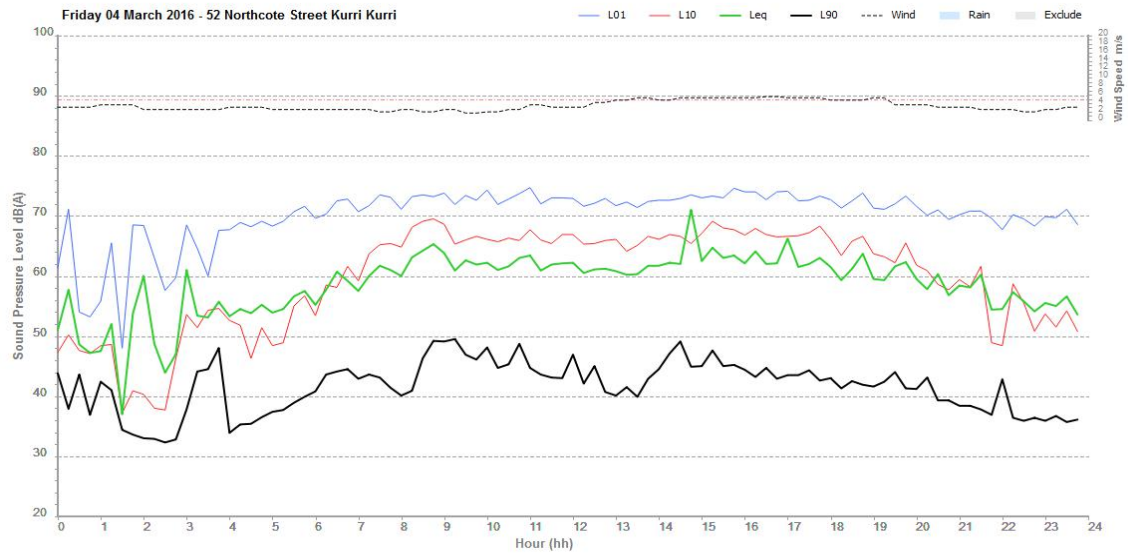
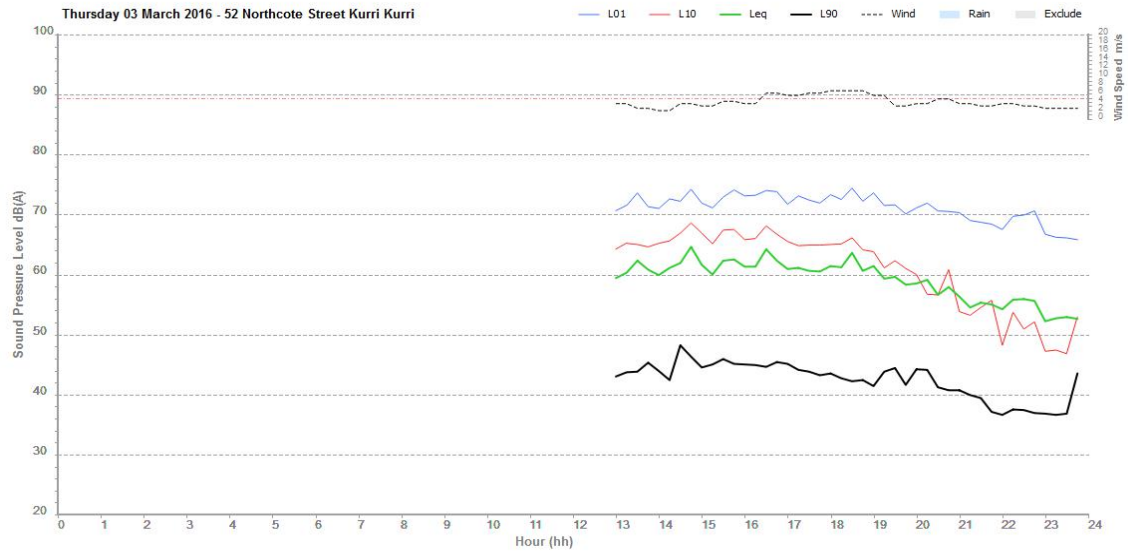
RNP Noise Level, dB(A)

	L _{Aeq(1hr)}	L _{Aeq(period)}
Day (7am - 10 pm)	-	-
Night (10pm - 7am)	-	-

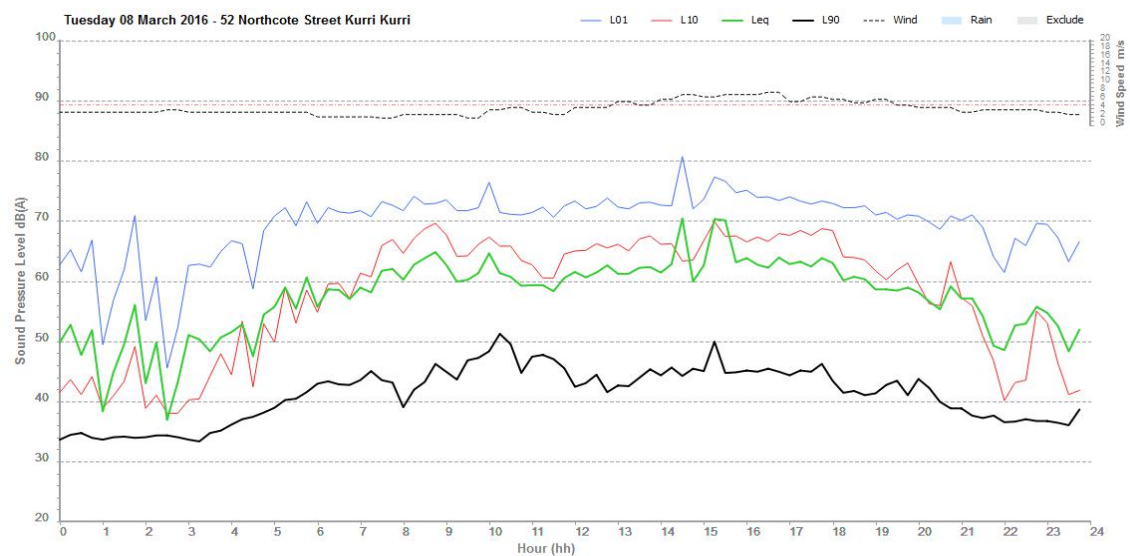
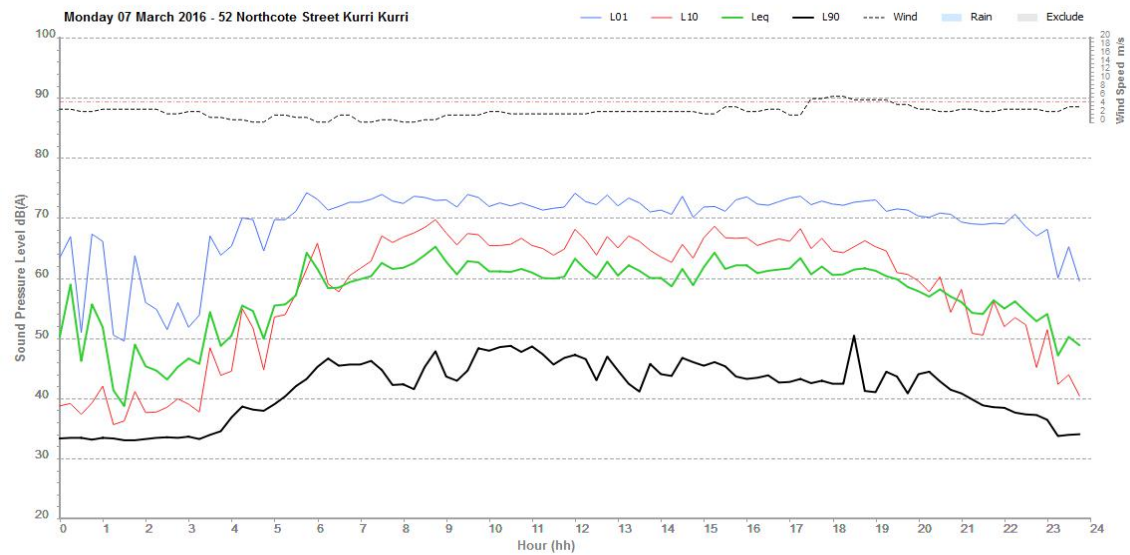
Logger Location Map



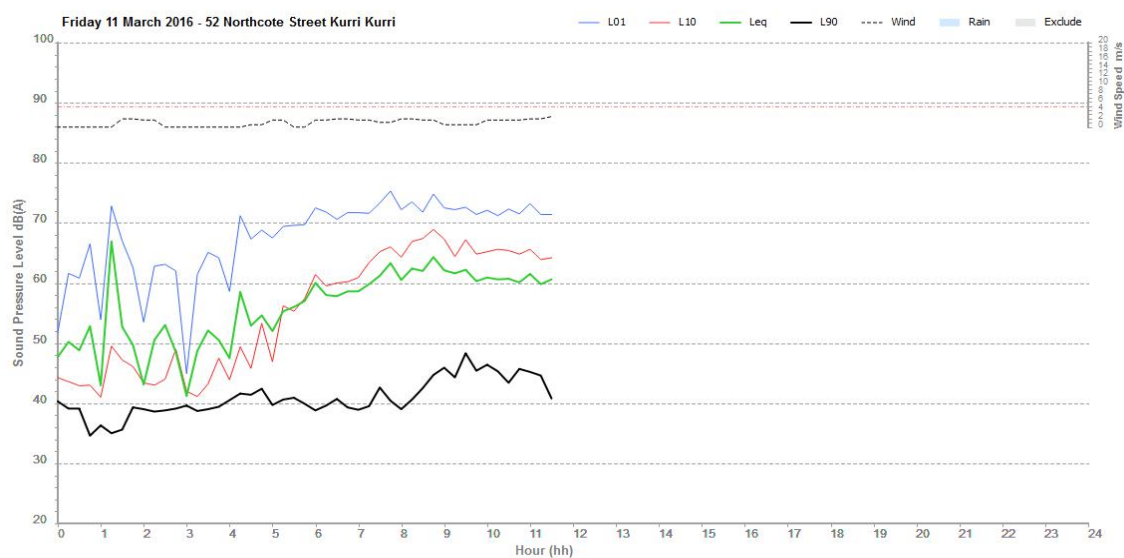
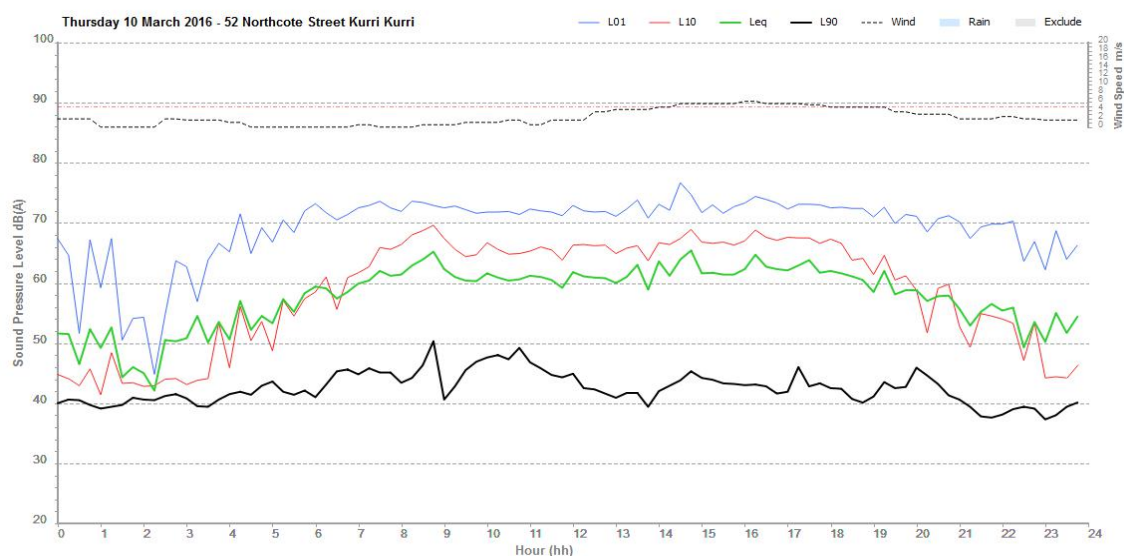
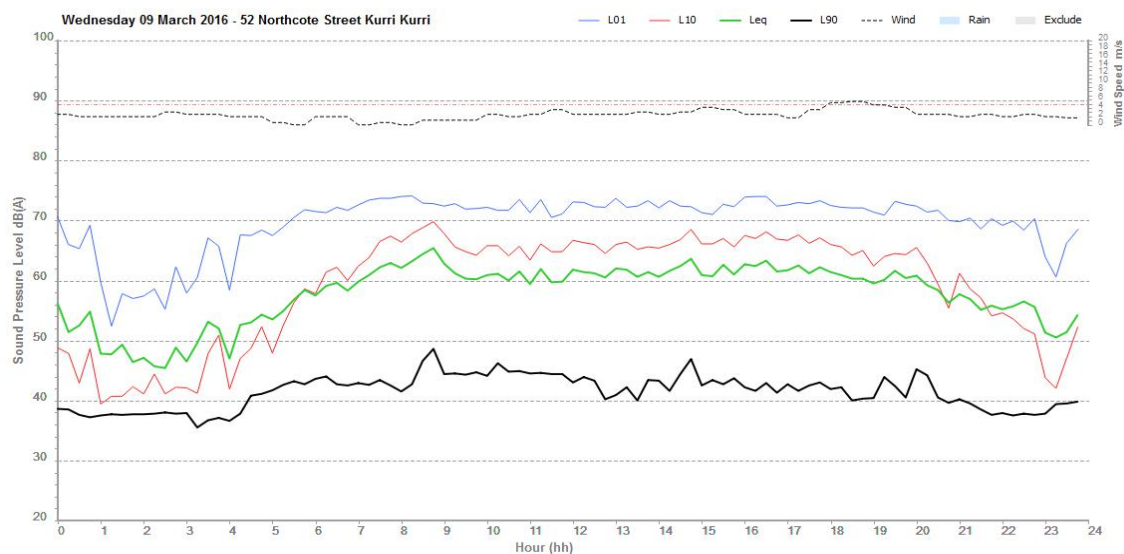
Logger Graphs

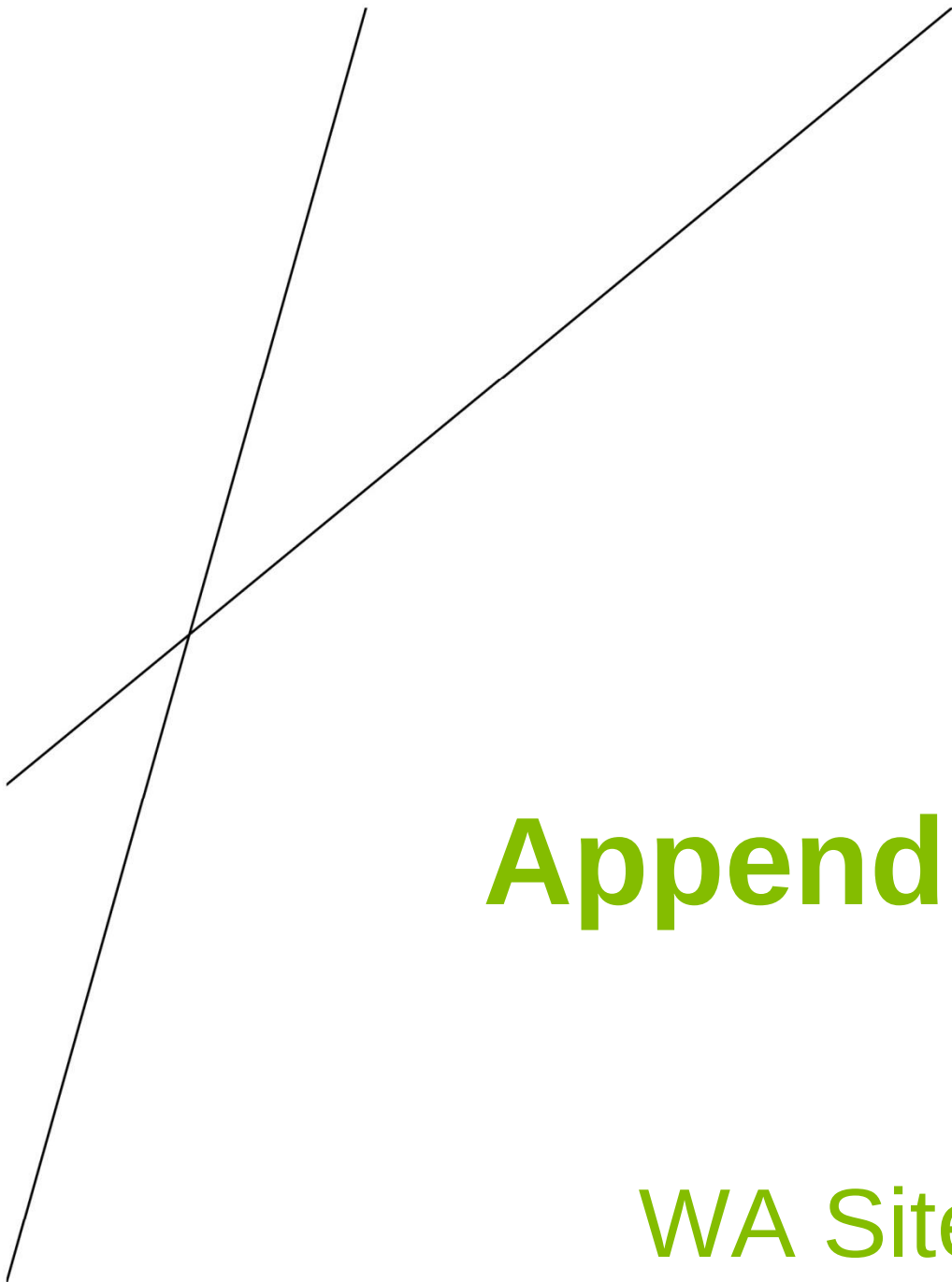


Logger Graphs



Logger Graphs



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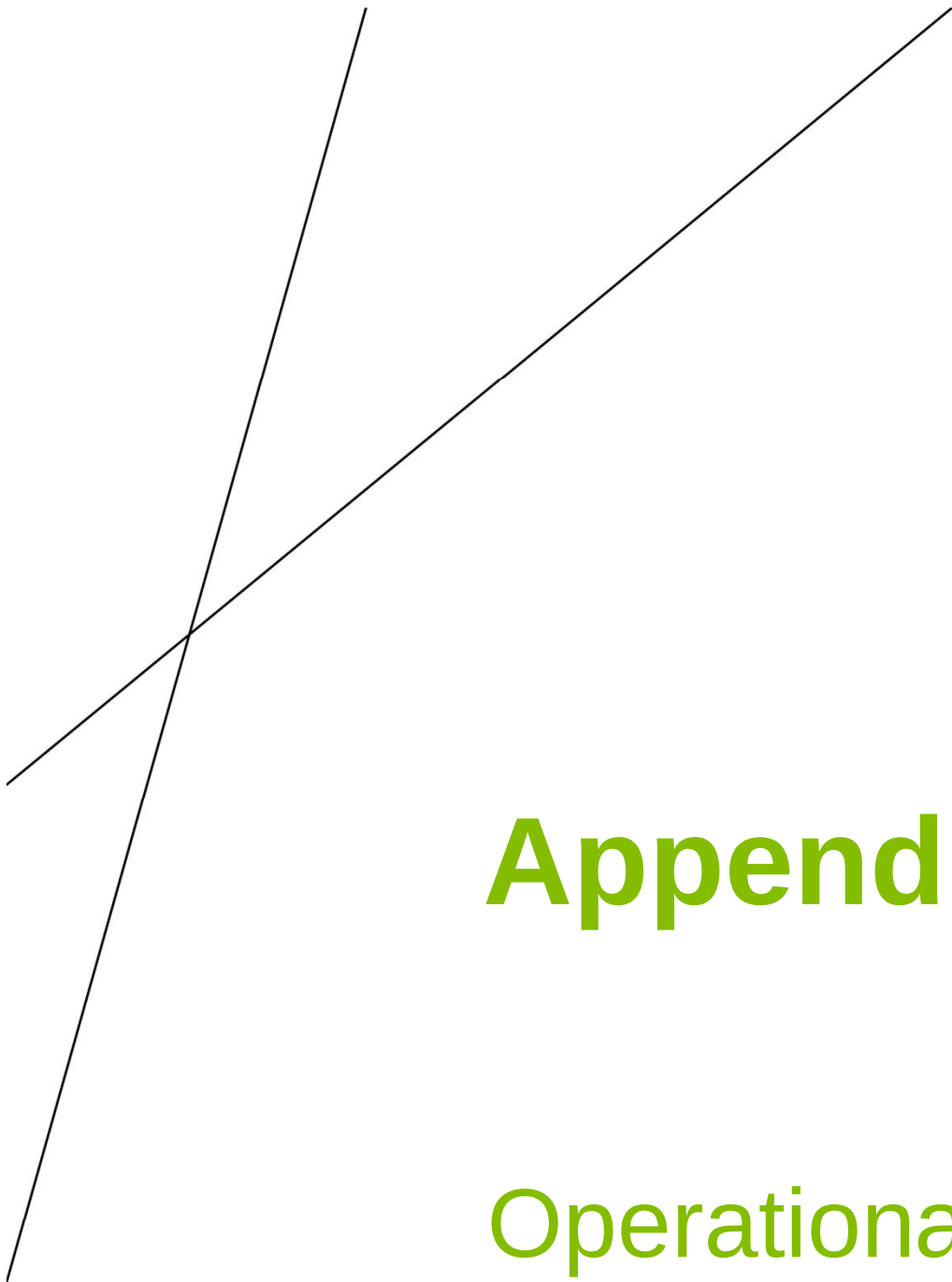
Appendix C

WA Site Noise Measurements

Appendix C WA Site Noise Measurements

The following measurements were taken on the 3 March 2016 at the WA site.

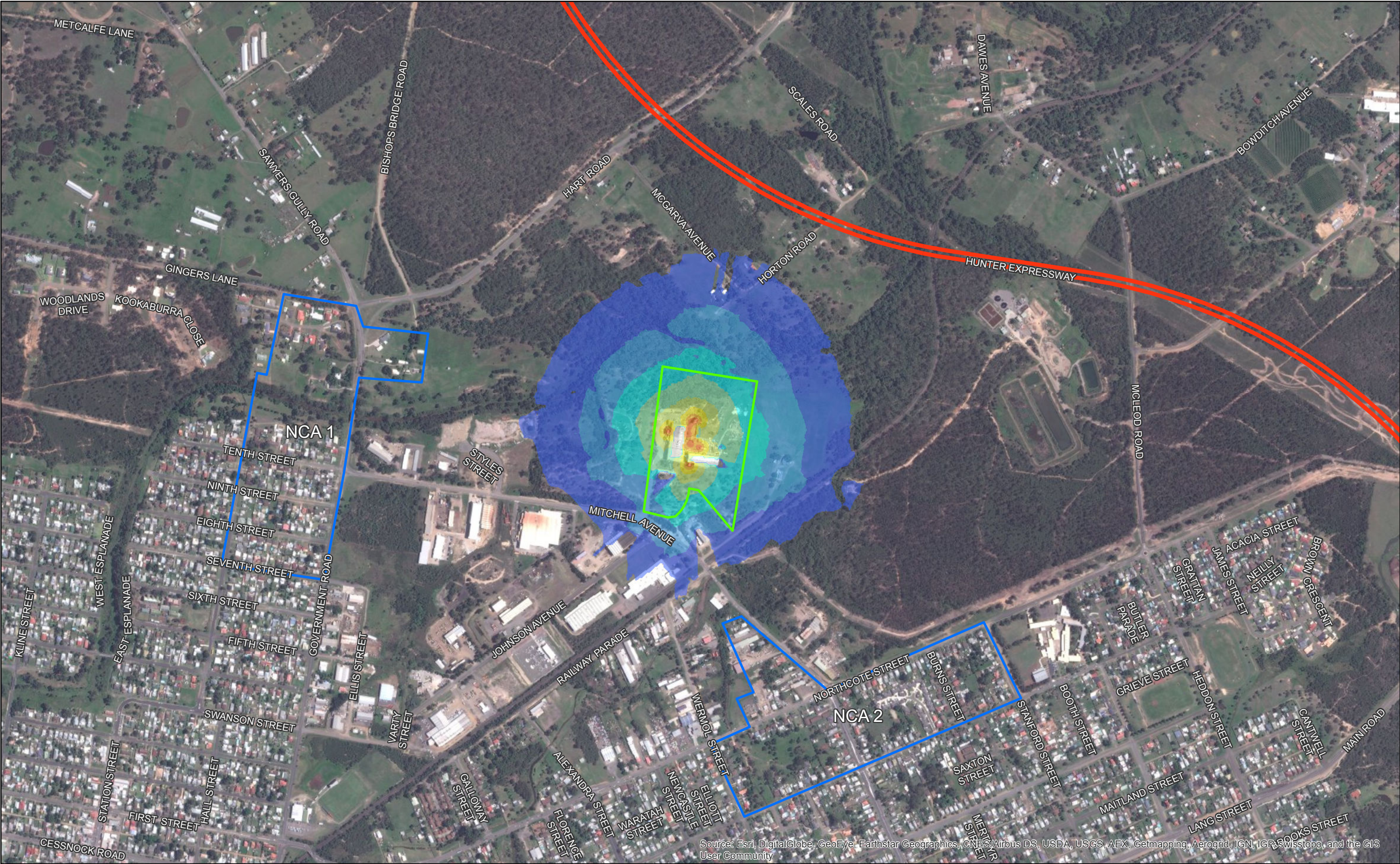
Item	Distance, m	Sound pressure level, L_{eq} dB							
		Octave frequency bands, Hz							Overall, dB(A)
		63	125	250	500	1000	2000	4000	
Baghouse 1	10	85	82	80	76	71	64	58	77
Baghouse 4	10	89	81	78	75	72	67	63	77
Baghouse 5	10	92	82	78	74	72	69	69	78
Baghouse 6	30	77	75	69	64	61	56	54	67
Forklifts	5	84	82	76	73	80	70	64	82
Furnace	10	84	86	81	75	69	61	55	77
Tip scrap	15	93	86	85	84	79	78	79	87

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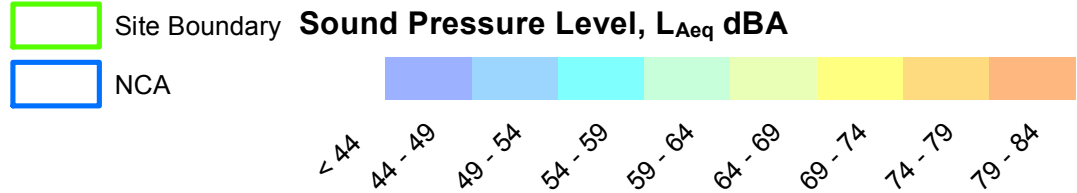
Appendix D

Operational Noise Contour Plots

Appendix D Operational Noise Contour Plots



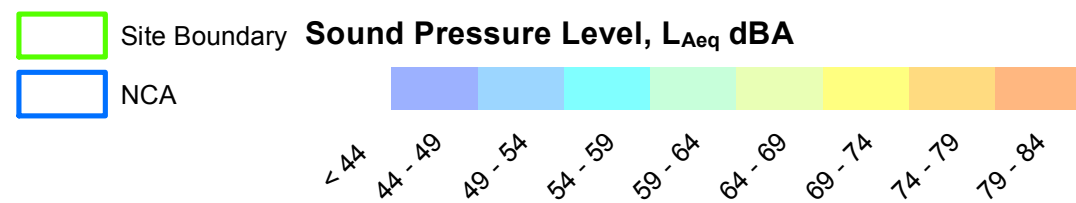
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, ICR, Swisstopo, and the GIS User Community



Weston Aluminium
Existing Scenario - Daytime - Neutral Weather



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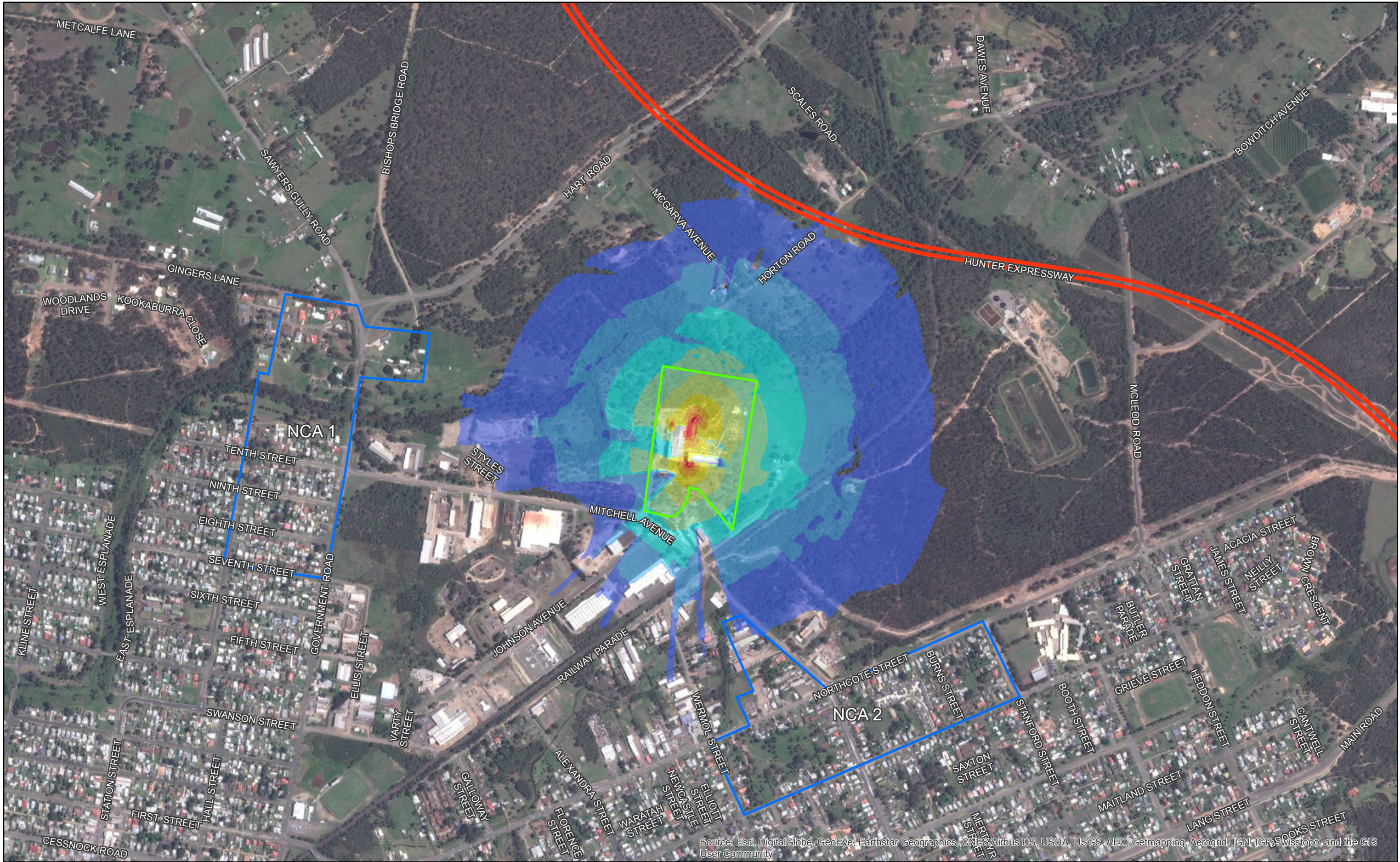


Weston Aluminium
Existing Scenario - Daytime - 3 m/s Wind

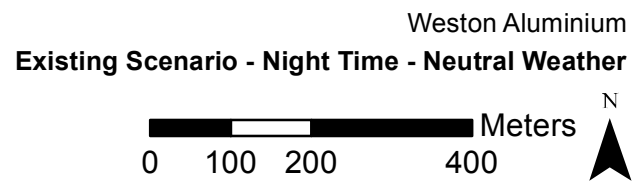
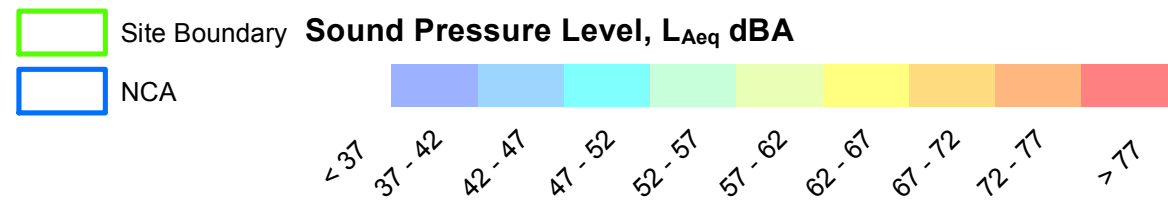
APR 2016

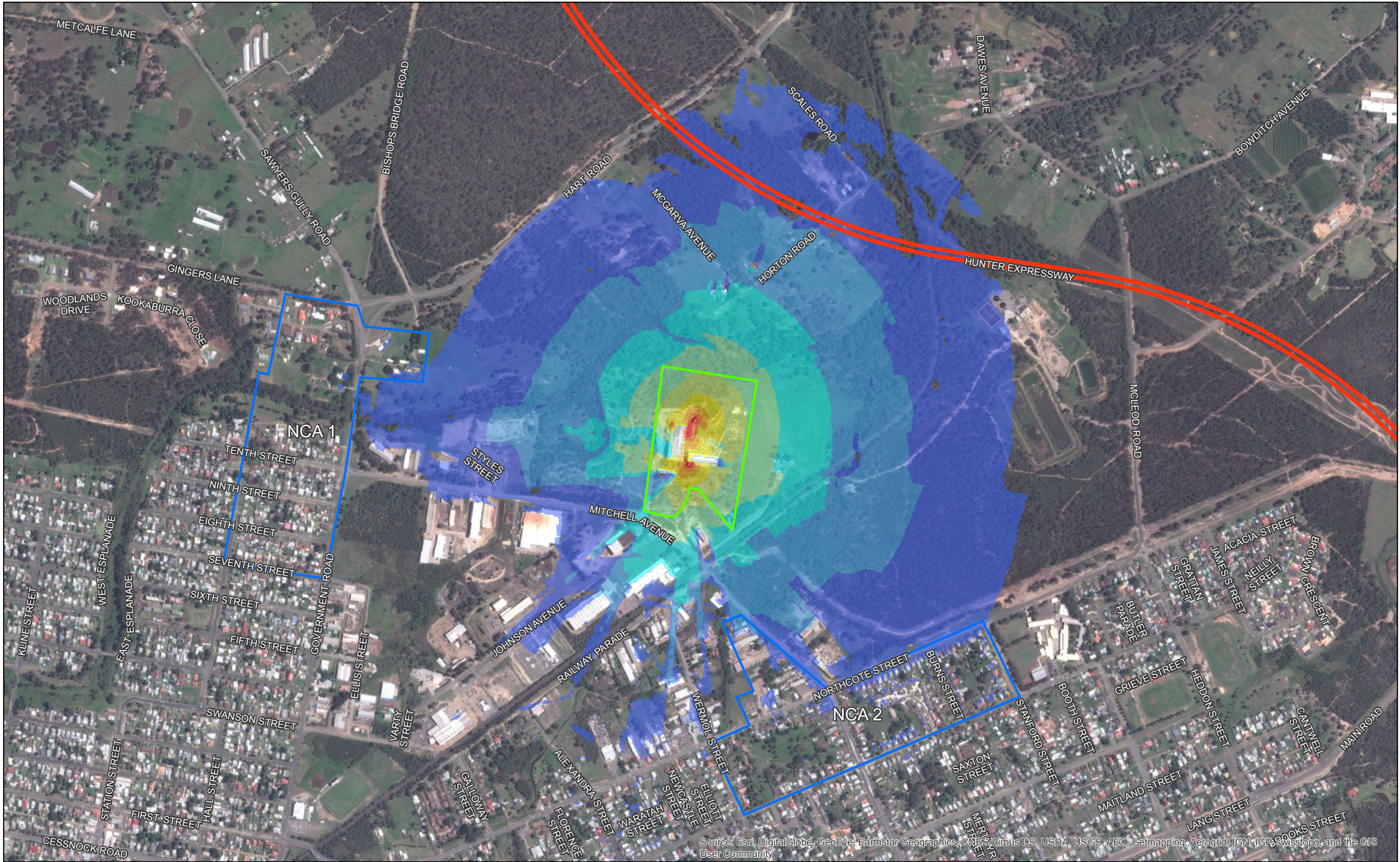
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Fig. 2

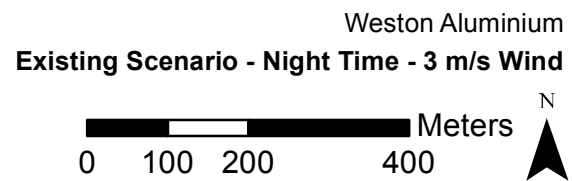
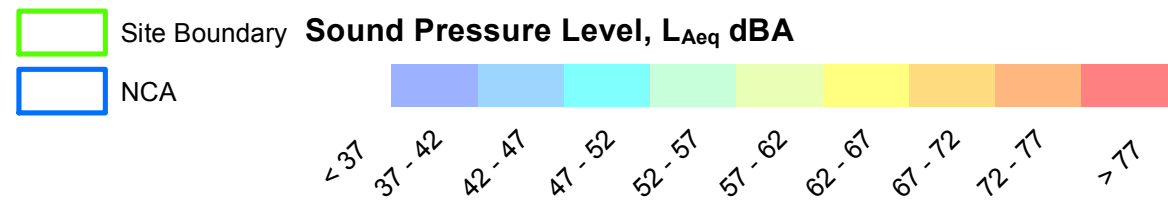


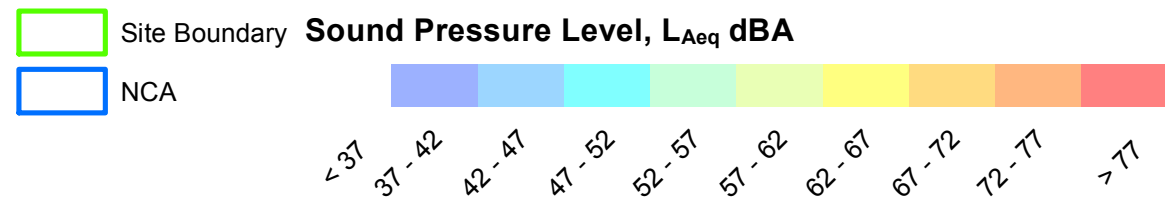
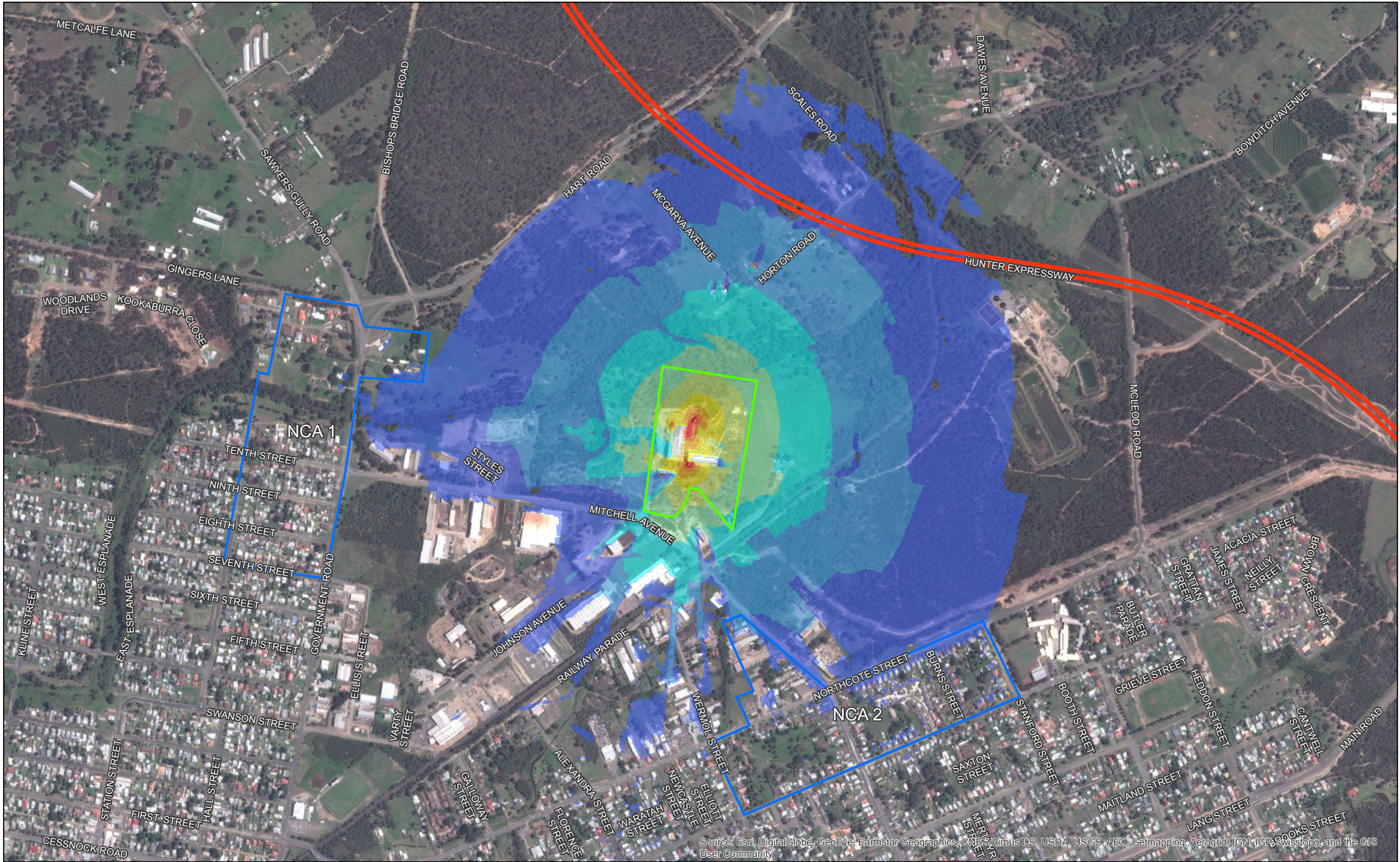
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Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGR, Swisstopo, and the GIS User Community

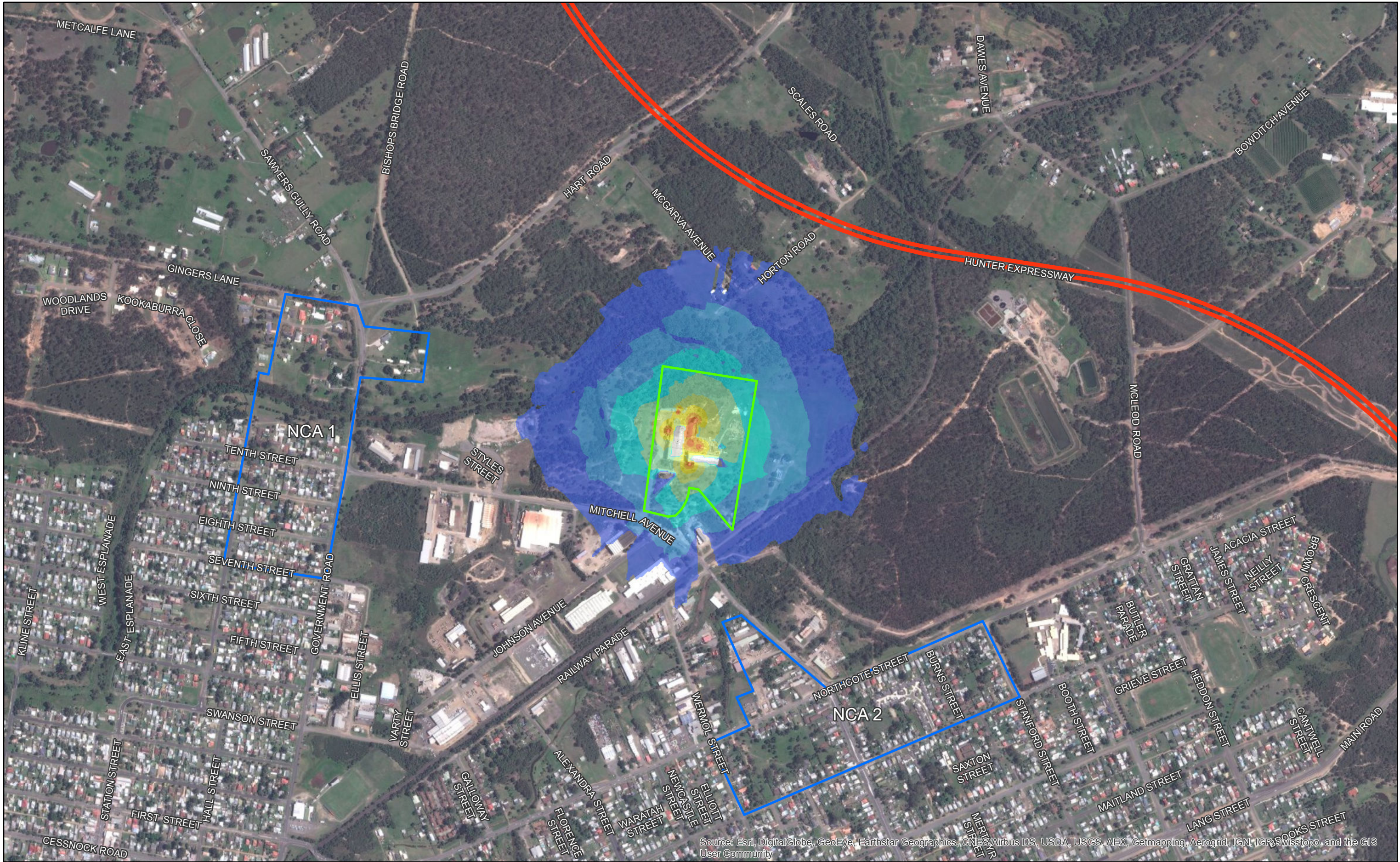




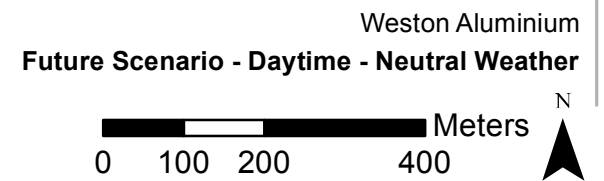
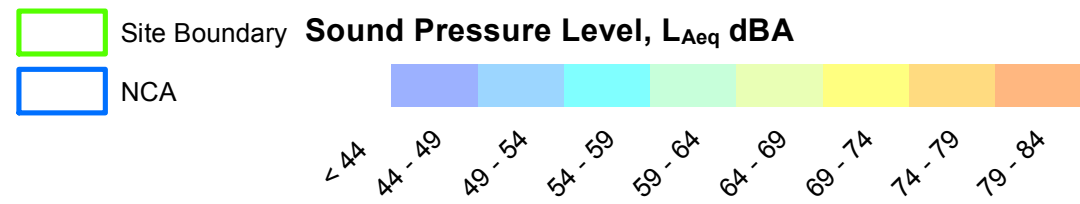
Weston Aluminium
Existing Scenario - Night Time - F Class Inversion



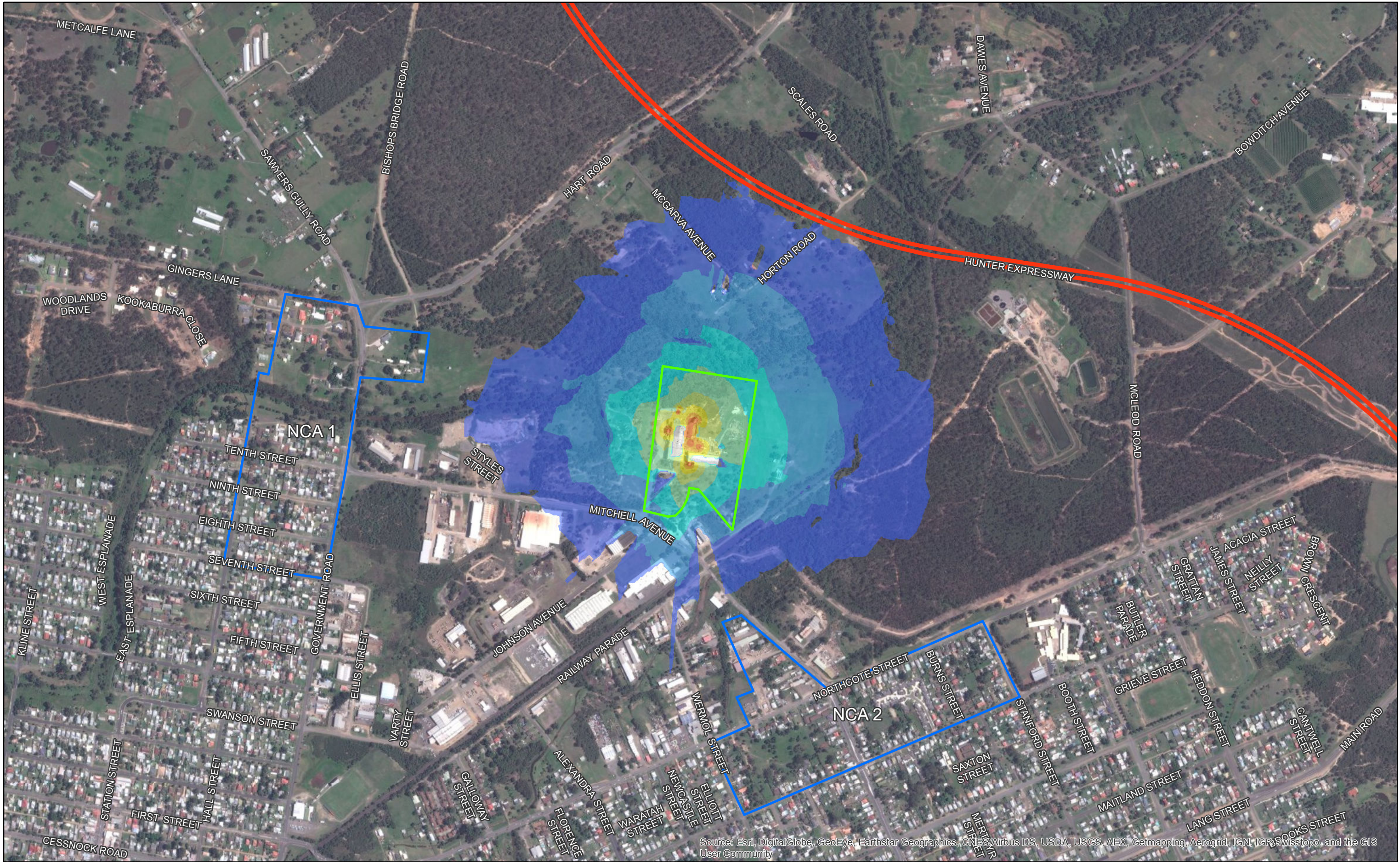
APR 2016
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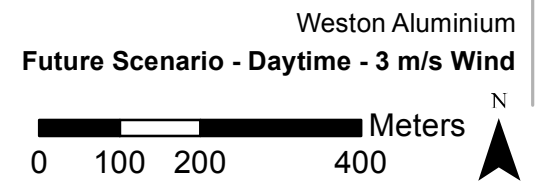
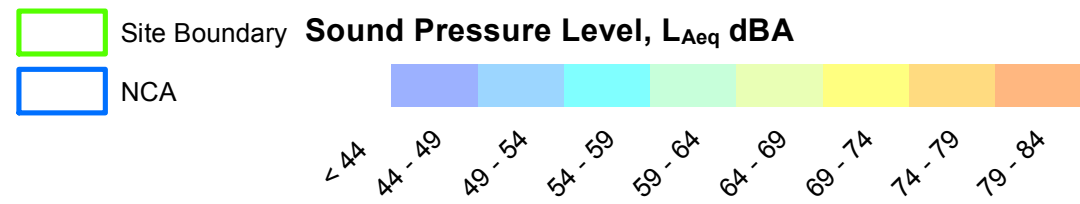
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGR, Swisstopo, and the GIS User Community

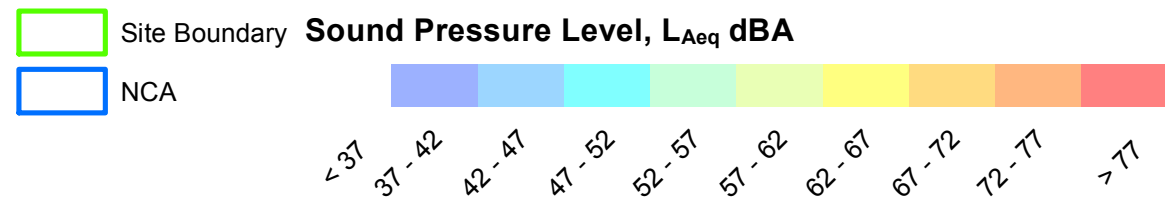
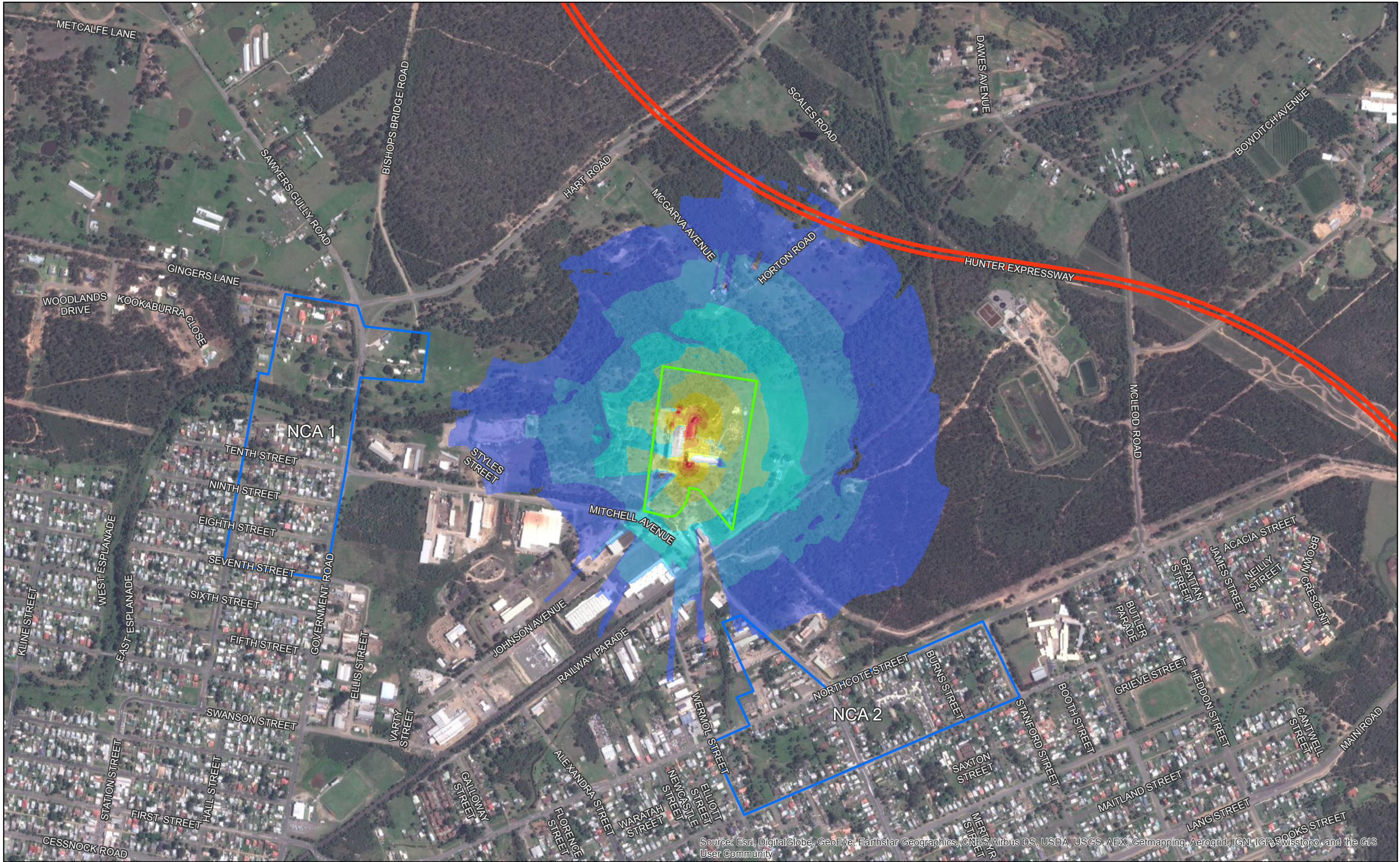


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Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, ICR, Swisstopo, and the GIS User Community

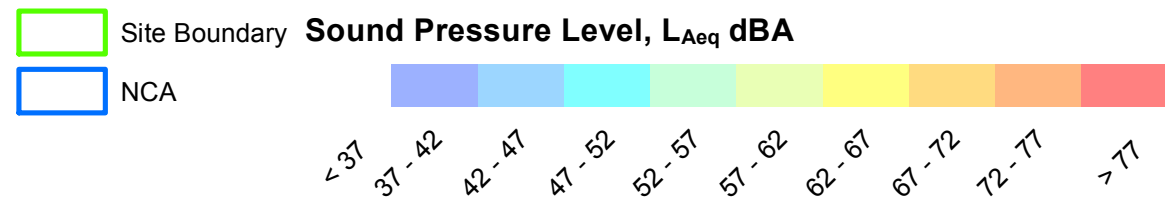
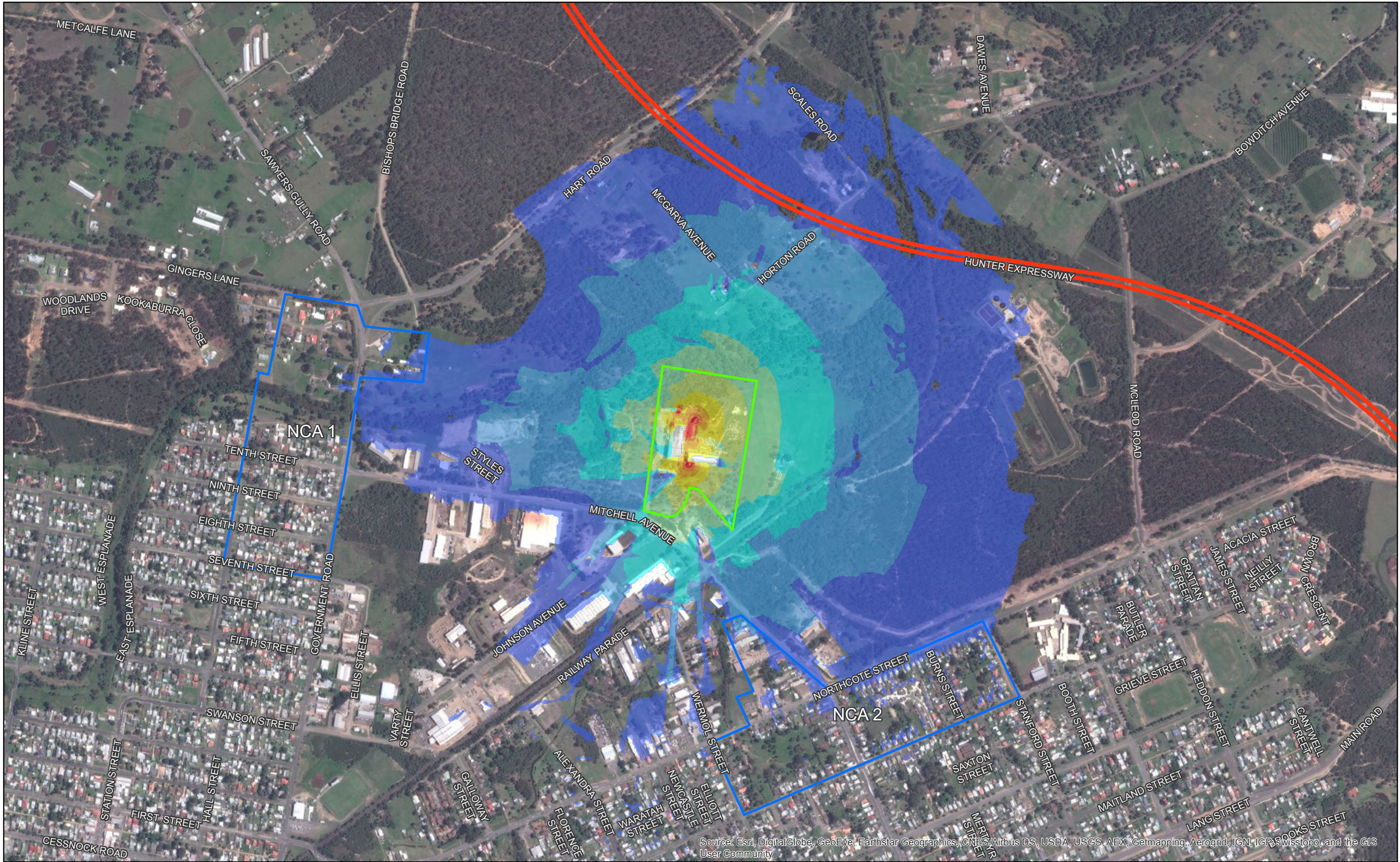




Weston Aluminium
Future Scenario - Night Time - Neutral Weather



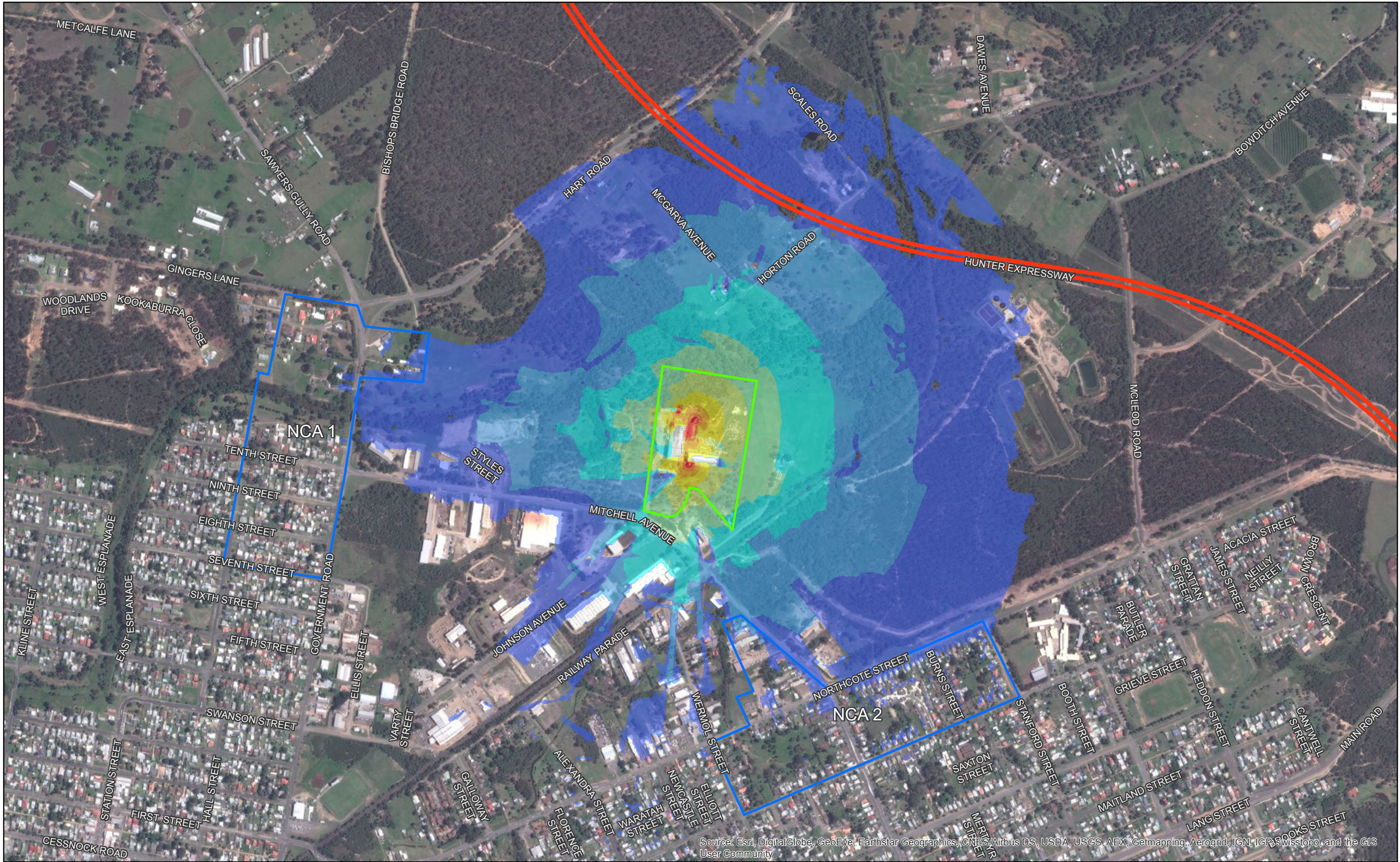
APR 2016
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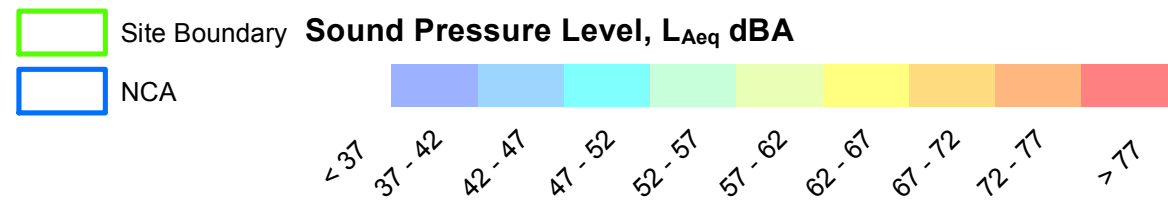
Weston Aluminium
Future Scenario - Night Time - 3 m/s Wind



APR 2016
60327214



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, Swisstopo, and the GIS User Community



Weston Aluminium
Future Scenario - Night Time - F Class Inversion

