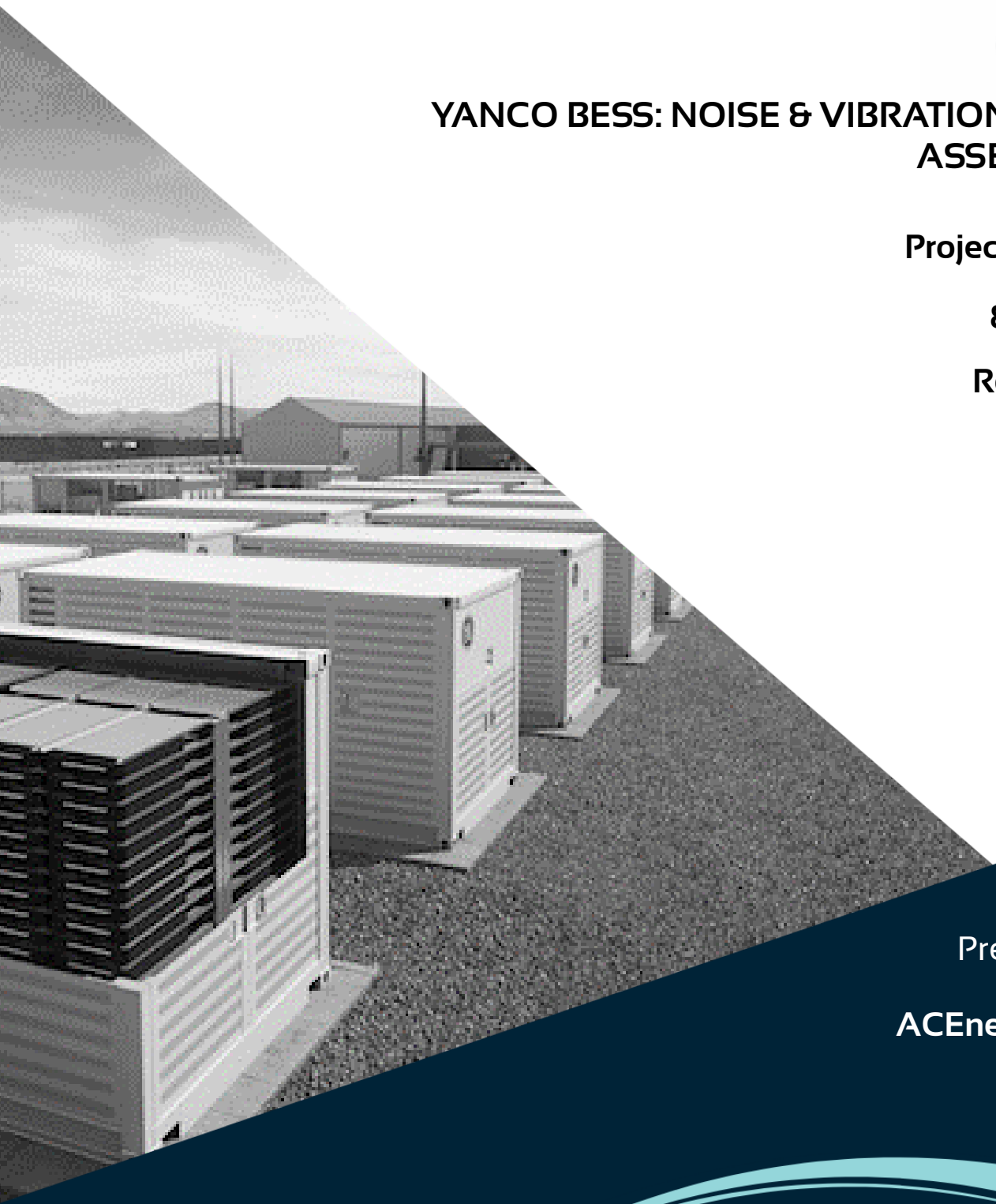

YANCO BESS: NOISE & VIBRATION IMPACT ASSESSMENT

Project ID: 15150

8/11/2024

Release: R4

Prepared For:

ACEnergy Pty Ltd

Assured Environmental

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Project Reference ID: 15150

Report Prepared by:

Assured Environmental
Unit 7, 142 Tennyson Memorial Avenue
Tennyson, QLD, 4105

Report Prepared for:

ACEnergy
578 Burke Road
Camberwell, VIC, 3124

Author: Janahan Velummylum

Reviewer: Luke McPherson

Table 1: History of Revisions

Revision	Date	Issued to	Changes
R0	27/06/2024	J. Bai	Initial Release
R1	24/07/2024	J. Bai	Update to cumulative operational assessment, construction assessment, MVPS sound levels and locality figures
R2	20/09/2024	J. Bai	Minor changes
R3	10/10/2024	J. Bai	Minor changes
R4	8/11/2024	B. Aslan	Updates to report based on RFI comments from DPHI, inclusion of construction noise management plan.

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GLOSSARY

A-Weighting	A response provided by an electronic circuit which modifies sound in such a way that the resulting level is similar to that perceived by the human ear.
dB (decibel)	This is the scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and the reference pressure (0.00002 N/m^2).
dB(A) or dBA	This is a measure of the overall noise level of sound across the audible spectrum with a frequency weighting (i.e., 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
Free field	Refers to a sound pressure level determined at a point away from reflective surfaces other than the ground with no significant contribution due to sound from other reflective surfaces; generally, as measured outside and away from buildings.
L_{Aeq}	This is the equivalent steady sound level in dB(A) containing the same acoustic energy as the actual fluctuating sound level over the given period. Noise levels often fluctuate over a wide range with time. Therefore, when a noise varies over time, the L_{Aeq} is the equivalent continuous sound which would contain the same sound energy as the time varying sound. Many studies show that human reaction to level-varying sounds tends to relate closer to the L_{Aeq} noise level than any other descriptor.
L_{A10}, L_{A90}, L_{An}	Noise level exceeded for n% of the measurement period with A-weighted, calculated by statistical analysis - where n is between 0.01% and 99.99%. For example, L_{A10} is the noise level just exceeded for 10% of the measurement period, calculated by statistical analysis and used to determine traffic noise and L_{A90} is the noise level exceeded for 90% of the measurement period, A-weighted and calculated by statistical analysis and used to determine background noise levels.
L_{AFmax}	A-weighted, fast response, maximum, sound level.
L_{AFmin}	A-weighted, fast response, minimum, sound level.
RBL	Rating background noise level – the overall single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period.
SWL	Sound Power Level in decibels is ten times the logarithm of the ratio of the sound power to the sound power reference level of 1 pico Watt.

ABBREVIATIONS

BESS	Battery Energy Storage System
MVPS	Medium Voltage Power Station
LIDAR	Light Direction and Ranging
EPA	Environmental Protection Authority (NSW)
ICNG	Interim Construction Noise Guidelines
NPfI	Noise Policy for Industry
DEC	Department of Environment and Conservation (NSW)
DECC	Department of Environment and Climate Change (NSW)
DECCW	Department of Environment, Climate Change and Water (NSW)
CRTN	Calculation of Road Traffic Noise
RNP	Road Noise Policy (NSW)
VDV	Vibration Dose Value
RMS	Root Mean Square
PPV	Peak Particle Velocity

1 INTRODUCTION

1.1 Scope of Assessment

Assured Environmental (AE) was appointed by ACEnergy Pty Ltd to undertake a noise and vibration impact assessment for the proposed Battery Energy Storage System (BESS). The development site is located at 120 Houghton Road in Yanco, (herein referred to as "Subject Site").

The noise and vibration study has been undertaken to assess the potential impacts of the construction and operation of the BESS, on nearby sensitive receptors in accordance with the following NSW policies and guidelines:

- NSW Noise Policy for Industry (NPfI) (EPA, 2017)
- NSW Assessing Vibration: a technical guideline (DEC, 2006);
- NSW Road Noise Policy (DECCW, 2011); and
- Interim Construction Noise Guideline (ICNG) (DECC, 2009).
- Draft Construction Noise Guideline (EPA, 2017)

In accordance with the requirements of the above guidelines, computational modelling and first principle calculations have been undertaken to support the assessment of the potential for adverse amenity impacts as a result of the development.

1.2 This Report

This report presents the noise and vibration impact assessment in accordance with the agreed scope of work.

2 PROPOSED SUBJECT SITE

2.1 Subject Site

The proposed Subject Site is located approximately 2 km west-south-west of Yanco in central New South Wales. The development site is located at 120 Houghton Road in Yanco, 2703, being Lots 516 and 521 DP 751745, and within the Houghton Road, Hume Road and Irrigation Way Road reserves. The area surrounding the proposed Subject Site includes agricultural purposes with associated rural dwellings.

2.2 Nearby Sensitive Receptors

There are seven single existing dwellings located in the vicinity of the proposed BESS. Table 2 and Figure 1 provide a summary of selected sensitive receptors to the proposed Subject Site and approximate distance to the infrastructure.

Table 2: Nearby Sensitive Receptors

Receptor[e]	Description	Coordinates (EPSG 32755)		Distance to BESS Equipment Boundary (m)[b][f]	Height (m)[a]
		Easting	Northing		
R01[c]	Associated Infrastructure	444601	6170886	127	1.5
R02[d]	Industrial Premises	444820	6170833	222	1.5
R03	Existing Dwelling	444308	6170597	290	1.5 [a]
R04	Existing Dwelling	445105	6170514	741	1.5 [a]
R05	Existing Dwelling	445012	6170291	800	1.5 [a]
R06	Existing Dwelling	444087	6170137	830	1.5 [a]
R07	Existing Dwelling	443920	6172073	904	1.5 [a]
R08	Existing Dwelling	444165	6172252	992	1.5 [a]
R723	Existing Dwelling	444625	6171887	890	1.5 [a]
R724	Existing Dwelling	443677	6170769	420	1.5 [a]
R725	Existing Dwelling	445421	6171402	1020	1.5 [a]

a) Residences modelled as single storey receptors ~1.5 m

b) Distance measured from boundary of BESS equipment (See green line surrounding BESS area in Appendix G) Receptor locations are assessed at the residential property boundary or, if that is more than 30 metres from the residence the reasonably most-affected point within 30metres of the residence as dictated by the NPfI)

c) R01 is energy infrastructure that is associated with the BESS equipment, as this is an associated premises it does not need to be considered for compliance.

d) R02 is a wastewater treatment facility and is considered an industrial premises.

e) Closest sensitive receptors were considered in assessment, compliance with the closest sensitive receptors will imply compliance with all further receptors.

f) Modelling software individually calculates distances from each source to receptor and calculates sound contribution, distances noted are for general reference of how far the site is from each sensitive receptor.

See Appendix D for map of receptor locations.

See Appendix E for details of road upgrade.

See Appendix G for details of Subject Site layout and distance to receptor reference.

2.3 Topography

Figure 2 illustrates the local topography, as obtained from the NSW Six Maps. It can be seen the topography is flat.

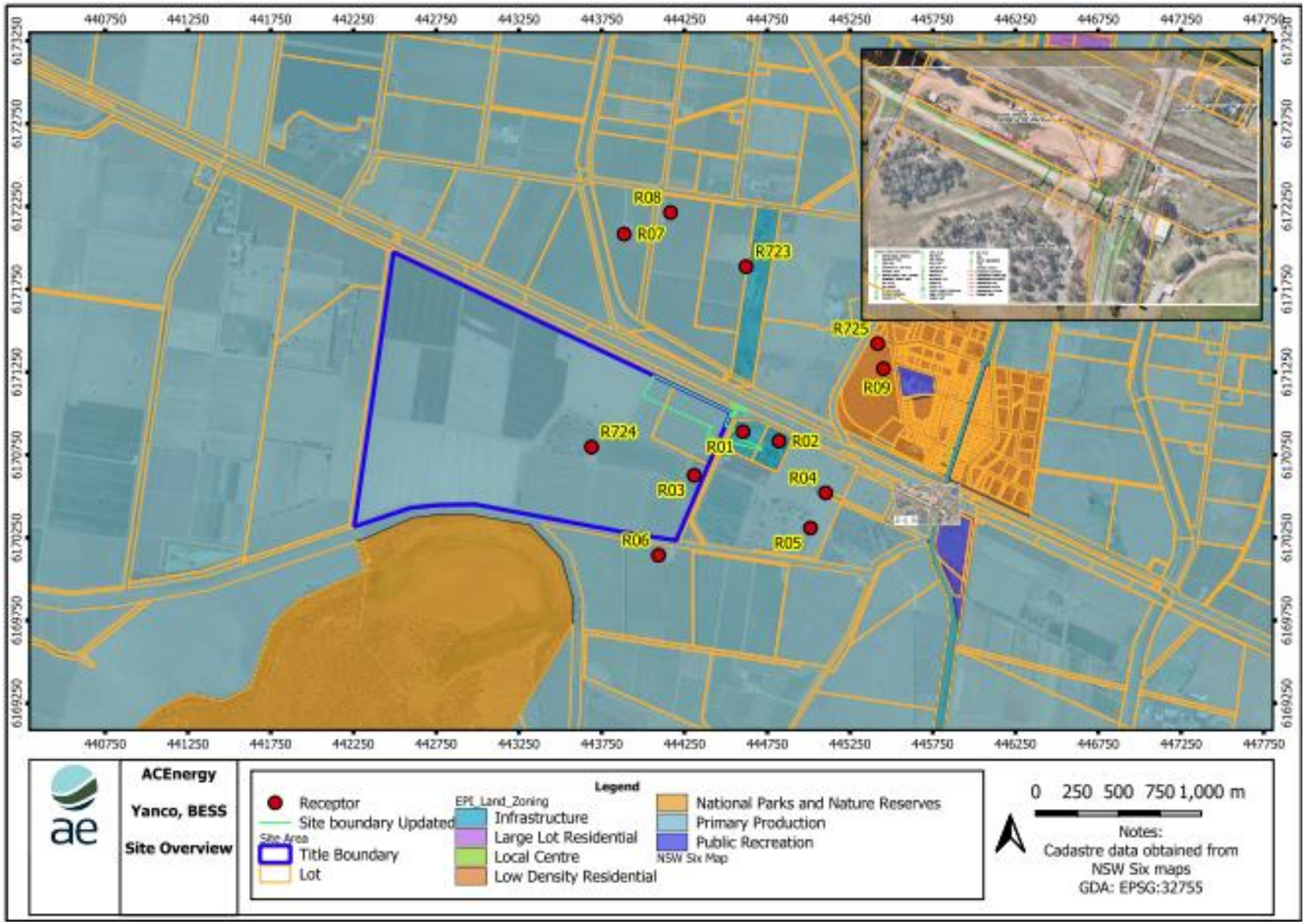


Figure 1: Site Overview

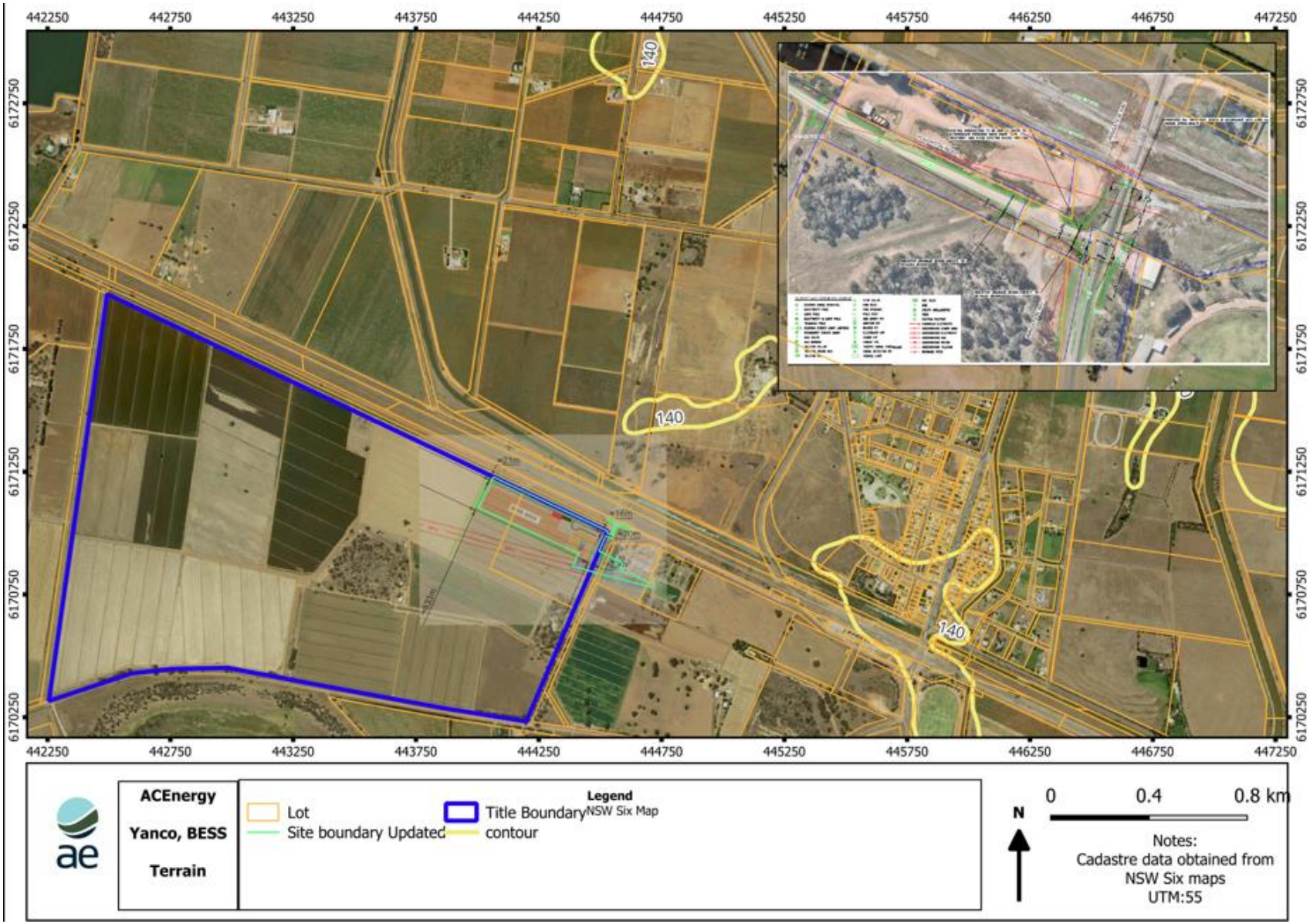


Figure 2: Site Local Topography

3 CONSTRUCTION NOISE ASSESSMENT

3.1 Duration of Construction Works

The construction of the BESS is expected to take approximately 33 weeks (~8 months), with a number of different activities undertaken over that time. Additionally, there is an overlap of construction periods with the nearby Yanco Solar Farm, the cumulative impact of the overlapping construction periods is assessed in section 3.8.

Construction would be restricted to what the EPA term 'recommended construction hours' (as described in Table 3) which are between 7 am and 6 pm Monday to Friday and 8 am to 1 pm Saturday, with no works on Sundays or Public Holidays.

The assessment has therefore considered the potential for adverse amenity impacts associated with construction during recommended standard hours only.

Table 3: Standard Construction Hours

Work type	Weekday	Saturday	Sunday or Public Holiday
Normal Construction	0700 to 1800	0800 to 1300	No work

3.2 Interim Construction Noise Guideline

Guidance on the assessment and management of construction noise in NSW is provided in the Interim Construction Noise Guideline 2009 (ICNG) published by the NSW EPA.

The main objectives of the Guideline are to:

- Promote a clear understanding of ways to identify and minimise noise from construction works;
- Focus on applying all 'feasible' and 'reasonable' work practices to minimise construction noise impacts;
- Encourage construction to be undertaken only during the recommended standard hours, unless approval is given for works that cannot be undertaken during these hours;
- Streamline the assessment and approval stages and reduce time spent dealing with complaints at the project implementation stage;
- Provide flexibility in selecting site-specific feasible and reasonable work practices in order to minimise noise impacts; and
- Provide guidelines for assessing noise generated during the construction phase of developments.

In achieving these objectives, the guideline provides a framework for the qualitative and quantitative assessment of potential construction noise impacts noting that, for major projects, a quantitative assessment is the preferred approach.

Table 4 presents construction noise criteria outlined in the guideline. 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.

Table 4: NSW EPA Construction Noise Criteria – Residential Receivers

Time of Day	Management Level (Free-field)	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 public holidays	Noise affected 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 $L_{Aeq\ (15\ min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise affected RBL + 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.

Where nearby sensitive uses are predicted to be noise affected, the proponent of the project is required to apply reasonable and feasible noise mitigation measures noting that a noise mitigation measure is feasible if it is capable of being put into practice and is practical to build given the project constraints.

Selecting reasonable mitigation measures from those that are feasible involves making a judgement to determine whether the overall noise benefit outweighs the overall social, economic, and environmental effects.

For construction outside standard hours, the assessment criteria has been determined based on the minimum allowable RBL as provided in the NPfI. That is, for the purposes of the assessment it is assumed that the RBL is 40 dB(A) for daytime periods (standard operating hours) thereby resulting in a noise affected management level of 50 dB(A) and a highly noise affected management level of 75 dB(A).

3.3 Construction Noise Sources

It is noted that construction works are expected to progress across the site such that plant and equipment would only be in a single area for a short period of time. Given this, the potential for adverse impacts at any one receptor is expected to only occur for a short period of time. Table 5 presents a summary of the plant and equipment likely to be required to complete the on-site construction works. The sound power levels presented have been sourced from published noise emission datasets and the library of source noise levels maintained by Assured Environmental.

Table 5: Construction Noise Sources

Construction Phase a)	Timeframe	Plant Item	Number Required	Sound Power Level, dB(A)	Acoustical Usage Factor, % c)
Road upgrade on Houghton Road	Prior to construction period	Bulldozer D9	1	116	40
		Excavator (tracked) 35t	1	110	40
		Chainsaw 4-5 hp	2	114	20
		Tub grinder/ mulcher 40-50 hp	1	116	50
		Front end loader	1	112	40
		Scraper 651	1	110	40
		Backhoe	1	111	40
		Compactor	1	106	20
		Dump truck	4	110	40
		Road truck	4	108	40
		Water Cart	1	114	40
			1	107	40
Site preparation and construction of acoustic wall and ancillary infrastructure	Weeks 1-8	Truck & Dog [b)]	2	110	40
		Compactor	2	103	20
		Bulldozer	1	109	40
		Water Cart	1	103	40
		Vibratory Roller	2	103	20
Concrete footing installation and cable installation	Weeks 5-17	Concrete truck	2-5 per day	99-106	40
		Excavator	2	105	40
		Concrete truck discharge	2	96	100
BESS and inverter container installation	Weeks 15-23	Piling Rig	1	112 - 124	20
		Fanna Crane	2	107	16
		Loader	2	107	40
		Generator	1	73	50
		Trucks	3	108	20
Control room building and Demobilisation	Weeks 18 - 26	Front end loader	1	91	40
		Excavator	1	102	40
		Fanna Crane	1	107	40
		Power Generator	1	103	50
		Truck & Dog	2	110	40
Electrical wiring and testing	Weeks 26-29	Hand tools	5	95	50
Road works, Drainage (internal)	Weeks 32-33	Backhoe	1	110	40
		Excavator	1	102	40

Construction Phase a)	Timeframe	Plant Item	Number Required	Sound Power Level, dB(A)	Acoustical Usage Factor, % c)
		Road truck	1	102	20
		Vibratory Roller	1	103	20
All	All	Light Vehicle	33 / day [d]		
All	All	Heavy Vehicle	16 / day [d]		

a) Construction plant used intermittently as required. Continuous use not expected.
b) Truck movements associated with deliveries assumed to move through site at 10 km per hour as a moving point source.
c) The 'Acoustical Usage Factor' represents the percentage of time that a particular item of equipment is assumed to be running at full power while working on site.
d) Vehicle volumes based on peak vehicle traffic during construction.
e) Equipment used in construction are based on conservative estimates of equipment used in construction phases

3.4 Assessment of Impacts

For the purposes of predicting impacts associated with noise emissions from the Subject Site on nearby sensitive receptors, calculations of the noise impacts from construction activities have been undertaken using first principal calculations based on the distance separation of the receptor and the facility infrastructure.

Construction activities across the site will vary in location and duration; mobile plant will move around the Subject Site throughout the construction phase, whereas activities such as trenching, and piling will slowly move along the line of BESS equipment. As such, whilst the piling activities are noisy, once each pile is complete, the area is not revisited and therefore the highest predicted noise levels associated with piling will be short-lived for each receptor.

Table 6 presents predicted most affected receptor noise levels taking into consideration the following assumptions:

- All equipment and plant are in the same area – at the closest point to the Project Area boundary to the receptors. This is considered to be a hypothetical worst-case scenario and unlikely to occur;
- The equipment quantities are currently estimates; and
- Propagation is assumed to occur over hard ground and no screening objects between the source and the receiver.

During the loudest stages of construction nearby receptors do exceed the Noise Affected criteria of 50 dB(A) but comply with the Highly Noise Affected criterion of 75 dB(A). It is recommended that reasonable and feasible mitigation measures such as those presented in Section 3.5 and the Noise Management Plan presented in Section 3.7 of this report are implemented to reduce the noise impact at all receptors.

Table 7 presents the predicted noise levels at the closest residential receptor from the edge of the road upgrade construction works. The construction for these works will occur prior to all other construction activities and therefore can be assessed independently. It is also noted that the road construction period is expected to be relatively short period of two weeks for all works to be completed.

The closest residential receptor was measured at approximately 110m from the edge of Houghton Road upgrade, the other noted receptors R134 and R143 are non-residential Industrial facilities located approximately 60m from the edge of the road upgrade. (Refer to Appendix E for locations of receptors).

All receptors are further than 180m from the edge of the road upgrade will be below the "Highly Affected Noise Criteria" and at distances further than 3000 metres from the edge of the road upgrade will fall below the "Noise Affected Criteria"

During the upgrade of Houghton Road, the closest residential receptors are above the Highly Noise Affected criterion of 75 dB(A). it is recommended that reasonable and feasible mitigation measures such as those presented in Section 3.6 and the Noise Management Plan presented in Section 3.7 of this report are implemented to reduce the noise impact at the affected receptors.

It is noted that noise level estimates were calculated using worst case scenario with no ground absorption and minimum distances between plant equipment and sensitive receptors. In

practice, construction activities will take place at variable distances, as such the construction assessment is conservative and actual construction noise levels would be lower than those predicted.

It is recommended that reasonable and feasible mitigation measures such as those presented in Section 3.5, 3.6 and the Noise Management Plan presented in Section 3.7 are implemented to reduce the noise impact at the noise affected receptors.

Table 6: Predicted Construction Noise Levels at Sensitive Receptors

Receptor	Standard Hours Criteria		Construction Phase					
	Noise Affected	Highly Noise Affected	Site preparation and construction of acoustic wall and ancillary infrastructure a)	Concrete footing installation and cable installation	BESS and inverter container installation	Control room building and Demobilisation	Electrical wiring and testing	Road works, Drainage (internal)
R01	50	75	66	60	65	65	45	59
R02	50	75	59	54	59	59	39	53
R03	50	75	59	53	58	58	38	52
R04	50	75	62	56	61	61	41	55
R05	50	75	53	48	53	52	33	47
R06	50	75	54	48	54	53	34	47
R07	50	75	55	49	55	54	35	48
R08	50	75	53	47	52	52	32	46
R723	50	75	52	46	52	51	32	45
R724	50	75	52	47	52	52	32	46
R725	50	75	51	45	50	50	30	44

Table 7: Predicted Construction Noise Levels during Road Upgrade at nearest residential receptor

Receptor [a]	Standard Hours Criteria		Distance from Edge of Road Upgrade	Construction Phase
	Noise Affected	Highly Noise Affected		Upgrade to Local Road (Houghton Road)
R134 (Industrial)	50	75	60m	84
R 43 (Industrial)	50	75	60m	84
R146 (Residential)	50	75	110m	79
R192 (Residential)	50	75	145m	77
2 Main Avenue (Residential)[b]	50	75	200	74

a) Receptors identified using EIS scoping report receptor map, see Appendix F

b) Closest residential receptor after R192, it is implied that all receptors at a distance between 2 Main Avenue and 3000 metres from the edge of the road upgrade with fall under the "Noise Affected Criteria"

3.5 Mitigation of Construction Noise Levels

Given the variable and mobile nature of the construction works, the use of permanent or temporary acoustic barriers at source is not considered feasible. Potential controls available to the construction contractor to minimise potential impacts for construction works could include:

- Limiting the type and scale of concurrent activities undertaken close to sensitive receptors where possible.
- Using broad band reversing alarms on all mobile plant and equipment if practical.
- Examine different types of machines that perform the same function and compare the noise level data to select the least noisy machine.
- Operating plant in a quiet and efficient manner.
- Reduce throttle setting and turn off equipment when not being used; and
- Regularly inspect and maintain equipment to ensure it is in good working order including checking the condition of mufflers.

It is recommended that during any work generating high noise levels that have impulsive, intermittent, low frequency or tonal characteristics, consultation with sensitive receptors occurs regularly.

As highest predicted noise levels do not exceed the highly affected noise criteria of 75 dB(A) at any receptor, the implementation of additional noise controls (except those listed above) is not considered necessary. During works, following best practice mitigation detailed above and staff training regarding excessive noise from machinery use is recommended.

3.6 Mitigation of Construction Noise associated with Houghton Road Upgrade

When considering reasonable and feasible mitigation measures it is necessary to consider the number of affected people and the community views on the work. The Road upgrade is expected to be completed within a relatively short two-week timeframe, with noisiest works only predicted to occur for a short period. Additionally, given the variable and mobile nature of the road works the assessment at the edge of the road upgrade is conservative.

As the predicted noise is above the highly noise affected management level, all feasible and reasonable mitigation shall be applied as well as engagement with the consent authority or regulator to identify other measures to manage noise impacts.

It is noted that all further receptors not identified in table 7 will fall below the "Highly affected" (75 dB(A)) noise criteria. All receptors that are within 180m – 3000m will fall in the "noise affected criteria". These receptors have a predicted noise level of greater than or equal to 50dB(A). It is advised that nearby residential receptors within approximately a 3km radius will should be notified of construction works.

Where appropriate, engagement with the community is encouraged to determine the preferred mitigation approach. Potential controls available to the construction contractor to minimise potential impacts from construction include.

- negotiated agreements and/or respite periods to restrict work activity.
- identification of times when the community is less sensitive to noise, including options for longer periods of construction in exchange for restrictions on construction times.
- Alternative accommodation during construction

3.7 Construction Noise Management Plan

In addition to the best practice noise mitigation practices, the following additional management measures are recommended to assist in managing community disturbance during construction. Table 8 provides a description of each of the additional measures.

Table 8: Additional Mitigation (RMS, 2016)

Mitigation Measure	Description
Notification (N) (letterbox drop or equivalent)	Advanced warning of works and potential disruptions can assist in reducing the impact on the community. The notification may consist of a letterbox drop (or equivalent) detailing work activity, time periods over which these will occur, impacts and mitigation measures. Notification should be a minimum of 5 working days prior to the start of works. The approval conditions for projects may also specify requirements for notification to the community about works that may impact on them.
Specific notifications (SN)	Specific notifications are letterbox dropped (or equivalent) to identified stakeholders no later than seven calendar days ahead of construction activities that are likely to exceed the noise objectives. The specific notification provides additional information when relevant and informative to more highly affected receivers than covered in general letterbox drops.
Phone calls (PC)	Phone calls detailing relevant information made to identified/affected stakeholders within seven calendar days of proposed work. Phone calls provide affected stakeholders with personalised contact and tailored advice, with the opportunity to provide comments on the proposed work and specific needs. Where the resident cannot be telephoned then an alternative form of engagement should be used.
Individual briefings (IB)	Individual briefings are used to inform stakeholders about the impacts of high noise activities and mitigation measures that will be implemented. Project representatives would visit identified stakeholders at least 48 hours ahead of potentially disturbing construction activities. Individual briefings provide affected stakeholders with personalised contact and tailored advice, with the opportunity to comment on the project. Where the resident cannot be met with individually then an alternative form of engagement should be used.
Respite Offers (RO)	Respite Offers should be considered made where there are high noise and vibration generating activities near receivers. As a guide work should be carried out in continuous blocks that do not exceed 3 hours each, with a minimum respite period of one hour between each block.

	The actual duration of each block of work and respite should be flexible to accommodate the usage of and amenity at nearby receivers. The purpose of such an offer is to provide residents with respite from an ongoing impact. This measure is evaluated on a project-by-project basis and may not be applicable to all projects.
Respite Period 1 (RI)	Out of hours construction noise in out of hours period 1 shall be limited to no more than three consecutive evenings per week except where there is a Duration Respite. For night work these periods of work should be separated by not less than one week and no more than 6 evenings per month.
Duration Respite (DR)	Respite offers and respite periods 1 and 2 may be counterproductive in reducing the impact on the community for longer duration projects. In this instance and where it can be strongly justified it may be beneficial to increase the work duration, number of evenings or nights worked through Duration Respite so that the project can be completed more quickly.
Alternative Accommodation (AA)	Alternative accommodation options may be offered to residents living in close proximity to construction works that are likely to experience highly intrusive noise levels. The specifics of the offer will be identified on a project-by-project basis. Additional aspects for consideration shall include whether the highly intrusive activities occur throughout the night or before midnight.
Verification (V)	Please see Appendix F of the Construction Noise and Vibration Guideline (2016) for more details about verification of Noise and Vibration levels as part of routine checks of noise levels or following reasonable complaints. This verification should include measurement of the background noise level and construction noise. Note this is not required for projects less than three weeks unless to assist in managing complaints.

Table 9 provides a summary of the noise management measures recommended for each activity for each receptor for the standard construction hours. Table 10 Provides a summary of the noise management measures for the "highly affected" receptors during the construction of the road upgrade on Houghton Road.

Table 9: Recommended Management Measures for each Receptor during Standard Hours

Receptor	Management Measured by Activity					
	Site preparation and construction of acoustic wall and ancillary infrastructure a)	Concrete footing installation and cable installation	BESS and inverter container installation	Control room building and Demobilisation	Electrical wiring and testing	Road works, Drainage
R01	N, V	N, V	N, V	N, V	-[a]	N, V
R02	N, V	N, V	N, V	N, V	-[a]	N, V
R03	N, V	N, V	N, V	N, V	-[a]	N, V
R04	N, V	N, V	N, V	N, V	-[a]	N, V
R05	N, V	-[a]	N, V	N, V	-[a]	-[a]
R06	N, V	-[a]	N, V	N, V	-[a]	-[a]
R07	N, V	-[a]	N, V	N, V	-[a]	-[a]
R08	N, V	-[a]	N, V	N, V	-[a]	-[a]
R723	N, V	-[a]	N, V	N, V	-[a]	-[a]
R724	N, V	-[a]	N, V	N, V	-[a]	-[a]
R725	N, V	-[a]	N, V	N, V	-[a]	-[a]

a) Below the "noise affected" criteria and requires no additional noise management controls

Table 10: Recommended Management Measures for each Receptor during Standard Hours for Road upgrade to Houghton Road

Receptor	Management Measured by Activity
	Upgrade to Local Road (Houghton Road)
R134	N, V, PC, RO,
R43	N, V, PC, RO,
R146 (Residential)	N, V, PC, RO,
R192 (Residential)	N, V, PC, RO,
2 Main Avenue, Yanco (Residential)	N, V
Receptors within 180m – 3000m radius of edge of road construction works	N, V

3.8 Assessment of Cumulative Impacts

The Yanco Solar Farm owned by Origin is to be constructed concurrently to the construction of the Yanco BESS substation. The Yanco Solar Farm operated by Origin is set to begin construction in July of 2024. Construction of the Yanco Solar Farm is expected to take approximately 40 weeks (~9 months) to complete.

Construction of Yanco BESS is expected to begin in November of 2025. Construction is expected to take approximately 33 weeks (~8 months). There are approximately 22 weeks (~5 month) of overlap where construction will occur at both locations.

An Environmental Impact Statement (EIS) has previously been completed for Yanco Solar Farm as part of the development approvals process. The noise component of the EIS completed by Renzo Tonin & Associates[a] (RTA) included a construction noise assessment for Yanco Solar Farm. The construction noise assessment was conducted for Yanco Solar Farm based on predicted construction activities. The RTA report was accepted in the approved EIS for the Yanco Solar Farm and therefore the predicted receptor levels identified in this assessment can accepted as valid and can be used in the cumulative assessment for both projects.

It is noted the receptor levels predicted in the Renzo Tonin & Associates report are described in a range of noise levels (See Appendix C). AE used the most conservative limit of the ranges provided in this EIS for Yanco Solar Farm in assessing the cumulative impact to assess against worst-case impacts.

Cumulative impact of the projects was assessed at four receptors identified in both the EIS for Yanco Solar Farm and those identified within this report. Predicted receptor levels were calculated for each construction assessment individually then log summed to reach cumulative noise level at each respective receptor.

Receptors identified in Table 11 will be most affected by the cumulative impacts from both construction projects. Other receptors identified in this report are further away from both construction projects and hence less affected by the cumulative construction impact. Compliance found at receptors identified in both reports will imply compliance at all other sensitive receptors.

Table 11: Predicted Noise Levels at Sensitive Receptors for Cumulative Construction Assessment

Receptor as defined by AE receptor locations	Receptor as defined in Renzo Tonin & Associates	Standard Hours Criteria		Scenario Assessed		
		Noise Affected	Highly Noise Affected	Peak Construction Noise from Yanco BESS	Yanco Solar Farm Peak Construction Noise (RTA Report)	Cumulative Impact
R2	R22	50	75	62	36	62
R4	R23	50	75	54	30	54
R7	R19	50	75	52	44	53

a Yanco Solar Farm: Construction & Operations & Vibration Assessment: prepared by Renzo Tonin & Associates (their Report no TJ856-01F01; dated 06 February 2019)

R8	R20	50	75	52	51	55

The assessment of the cumulative impact from both projects demonstrates the highest predicted noise levels do not exceed the highly affected noise criteria of 75 dB(A) at any receptor, the implementation of additional noise controls (except those listed above in section 3.5) is not considered necessary. During works, following best practice mitigation detailed above and staff training regarding excessive noise from machinery use is recommended.

4 OPERATIONAL NOISE ASSESSMENT

4.1 Operational Noise Criteria

4.1.1 Overview

The acoustic assessment has been completed in accordance with the procedure identified in the NPfI. The NPfI recognises that scientific literature has identified 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.

In response to this, the NPfI establishes two separate noise criteria to meet environmental noise objectives: one to account for intrusive noise and the other to protect the amenity of particular land uses. These two criteria are then used to determine project triggers levels against which the proposed development will be assessed. 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.

The derivation of the two sets of criteria is presented in Table 12. For residential dwellings, the noise criteria are assessed at the most-affected point (i.e., highest noise level) on or within the property boundary. Where the property boundary is more than 30 metres from the house, then the criteria apply at the most-affected point within 30 m of the house.

4.1.2 Intrusiveness Noise Criteria

The project intrusiveness noise level is intended to protect against significant changes in noise levels as a result of industrial development. To achieve this, the NPfI describes intrusive noise as noise that exceeds background noise levels (as defined by the Rating Background Level or RBL) by more than 5 db.

Given the rural location of the site, the impact assessment has assumed baseline noise levels equivalent to the minimum background noise levels provided in the NPfI. Therefore, Table 12 presents the derivation of the intrusiveness criteria based on the minimum background noise level established by the NPfI.

Table 12: Derived Intrusiveness Noise Criteria

Receptor	Intrusiveness $L_{Aeq,15\text{-minute}}$ Criteria		
	Day	Evening	Night
All nearby residential receptors [a)]	40 [b)]	35 [b)]	35 [b)]

a) For a residence, the project noise trigger level and maximum noise levels are to be assessed at the reasonably most-affected point on or within the residential property boundary or, if that is more than 30 metres from the residence, at the reasonably most affected point within 30 metres of the residence, but not closer than 3 metres to a reflective surface and at a height of between 1.2–1.5 metres above ground level.

b) Minimum background noise level established by the NPfI 2017 + 5 dB.

4.1.3 Amenity Criteria

The project amenity noise level seeks to protect against cumulative noise impacts from industry and maintain amenity for particular land uses.

Table 13: NPfI Amenity Noise Levels

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended L_{Aeq} Noise Level (dB(A))	
			Total Industrial Noise	Project Specific
Residence	Rural	Day	50	50
		Evening	45	45
		Night	40	40
Industrial Premises	All	When in use	70	65

4.1.4 Project Trigger Levels

The project trigger level (i.e., the noise criteria considered by the assessment) is the lower value of the project intrusiveness noise level and the project amenity level, after the conversion to $L_{Aeq,\ 15\ min}$ dB(A) equivalent level. Table 14 presents the standardised intrusiveness noise level and the project amenity level as derived by adding 3 dB to each period of the day.

Table 14: Determining Project Trigger Level

Type of Receiver	Time of Day	Standardised $L_{Aeq,\ 15\ min}$ Noise Level (dB)		
		Intrusiveness Criteria	Project Specific ANL	Project Trigger Level
Residence	Day	40	50 + 3 = 53	40
	Evening	35	45 + 3 = 48	35
	Night	35	40 + 3 = 43	35
Industrial Premises	Day	-	65 + 3 = 68	68
	Evening	-	65 + 3 = 68	68
	Night	-	65 + 3 = 68	68

4.1.5 Sleep Disturbance

NSW EPA have identified a screening assessment for sleep disturbance based on the night-time noise levels at a residential location. Where noise levels at a residential location exceed:

- $L_{Aeq,\ 15\ min}$ 40 dB(A) or the prevailing RBL plus 5 dB, whichever is greater; and/or
- L_{AFmax} 52 dB(A) or the prevailing RBL plus 15 whichever is the greater, a detailed maximum noise level event assessment should be undertaken.

As discussed in Section 4.4.3, the predicted noise levels at residential locations do not exceed 40 dB(A) $L_{Aeq,\ 15\ min}$, therefore a detailed sleep disturbance assessment is not required. Further, given the noise sources associated with the operation of the BESS are all continuous. As such, consideration of compliance against the L_{AFmax} sleep disturbance criteria is unwarranted.

4.2 Predictive Modelling

4.2.1 Noise Modelling Methodology

For the purposes of predicting impacts associated with noise emissions from the Subject Site on nearby sensitive receptors, noise modelling of the sources was completed using the proprietary software CadnaA (2024 MR2 build 203.5403) developed by DataKustik. CadnaA incorporates the influence of meteorology, topography, ground type and air absorption in addition to source characteristics to predict noise impacts at receptor locations. All predictions have been undertaken in accordance with CONCAWE.

The model is utilised to assess the potential noise emissions from the Subject Site under a range of operating scenarios and meteorological conditions. The noise modelling also allows investigation of possible noise management solutions, in the event that non-compliance with the assessment criterion is predicted.

The NPfI presents guidelines for the consideration of meteorological effects on noise propagation, specifically, temperature inversions and/or gradient winds. NPfI provides two options for assessing meteorological effects as detailed in table 11.

4.3 Meteorology

Noise levels were predicted using the CONCAWE propagation methodology, which incorporates the influence of meteorological conditions on the propagation of noise through the atmosphere. The modelled meteorological parameters shown in Table 15 were selected to predict the worst-case noise levels at all receptors during all seasons and all time periods.

Table 15: Model Parameters

Parameter	Day (Noise-Enhancing)	Evening (Noise-Enhancing)	Night (Noise-Enhancing)
Temperature	20°C	10°C	10°C
Relative Humidity	75%	75%	75%
Wind Speed (m/s)	3.0	3.0	2.0
Stability Class	D	D	F
Wind Direction:	Worst Case	Worst Case	Worst Case

4.4 Model Configuration

Table 16 summarises the model configuration used for the modelling.

Table 16: Model Configuration

Parameter	Approach
Standards	CONCAWE
Time Periods	Day (07:00 - 18:00 hours) Evening (18:00 - 22:00 hours) Night (22:00 - 07:00 hours)
Digital Topography	LIDAR data at 5 m intervals.

Parameter	Approach
Ground Absorption	Based on aerial mapping. Subject site ground absorption set to 0.1, surrounding rural areas ground absorption set to 1.0.
Meteorology	Day and Evening: Stability class D at 3 m/s Night: Stability class F at 2 m/s Worst case wind direction (source to receptor)

4.4.1 Noise Sources

It is understood that the equipment and associated noise level data used as the basis for this assessment will be comparable with the final selections for the proposed facility. The primary recommendation will be that a suitably qualified acoustic consultant is engaged during detailed design to ensure that compliance with relevant criteria is achieved at nearby noise sensitive receptors. Should equipment with lower sound power level information than adopted, then the nominated noise control strategies may be amended with approval by a suitably qualified acoustic consultant.

All noise sources associated with BESS are considered continuous in nature and are associated with fixed plant items operating in the charging and distribution process. Where annoying noise characteristics have been identified the adjustment has been included in the L_{Aeq} column. The sound power levels have been taken from the following sources.

- BESS noise data taken from AE data base, the BESS is assumed to not have openings or exhaust vents on the top façade of the unit – this allows for primary distribution of noise to be through the side facades of the BESS unit.
- BESS equipment oriented such that loudest façade (i.e., Front façade) is directed towards the north (towards R06).
- MVPS (Medium Voltage Power Station) equipment oriented such that loudest façade (i.e., ac outlet) is directed north (towards R06).
- 1/3 Octave spectral data for inverters were obtained from Manufacturers technical datasheet (SSC3450UP-XT w/ Silencer Kit).
- 1/3 Octave spectral data for BESS systems were taken from AE noise source database.
- Transformer (large-scale connection asset) SWL calculated from Standard 60076/IEC-2001.
- 1/3 Octave spectral data for transformers were taken from the Australian Acoustical Society [(b)].
- A review of tonality was assessed with respect to procedures detailed in the NPFI, Computational modelling did not predict tonal characteristics to be present at sensitive receptors; therefore, additional tonal corrections were not applied to the sources.

(b) Paper Number 23, Proceedings of ACOUSTICS 2011: Low-frequency and Tonal Characteristics of Transformer Noise: Prepared by Michael Gange November 2011

Table 17: Noise Sources

Equipment	Noise Source	Qty	Height (m)	Usage Period (%)			Sound Power Level (dB(A))		Noise Characteristics (as per the NPFI)
				Day	Evening	Night	L_{Aeq}	L_{Amax}	
MVPS (Medium Voltage Power Station) [a] Inverter Container with Sound Proofing	MVPS Inverter (Top façade)	88	2.90	100	100	100	60[a]	n/a	None
	MVPS Inverter (Front façade)	88	2.90	100	100	100	76[a]	n/a	None
	MVPS Inverter (Back façade)	88	2.90	100	100	100	72[a]	n/a	None
	MVPS Inverter (AC inlet Side)	88	2.90	100	100	100	69[a]	n/a	None
	MVPS Inverter (AC outlet Side)	88	2.90	100	100	100	72[a]	n/a	None
MVPS Internal Transformer (4 MVA)	MVPS internal transformer (Top façade)	88	2.90	100	100	100	76	n/a	None
	MVPS Transformer (Side façades)	88	2.90	100	100	100	76	n/a	None
BESS (Battery Energy Storage System) [b]	BESS Front side	352	2.90	100	100	100	80	n/a	None
	BESS Back side	352	2.90	100	100	100	67	n/a	None
	BESS Left side	352	2.90	100	100	100	67	n/a	None
	BESS Right side	352	2.90	100	100	100	68	n/a	None
175 MVA Transformer	175 MVA Transformer	2	2.00	100	100	100	80[c]	n/a	None

a) Datasheet provides Sound pressure level at 0.2 m at each of the different facades. Model was calibrated so each façade produced a sound pressure level at 0.2 m as described in table.

b) Assumes BESS unit has no exhaust points or openings on top façade of the unit, allowing for sound to be dominantly distributed through the side facades of the BESS unit.

c) Sound power calculation guided by Standard 60076-10/IEC-2001.

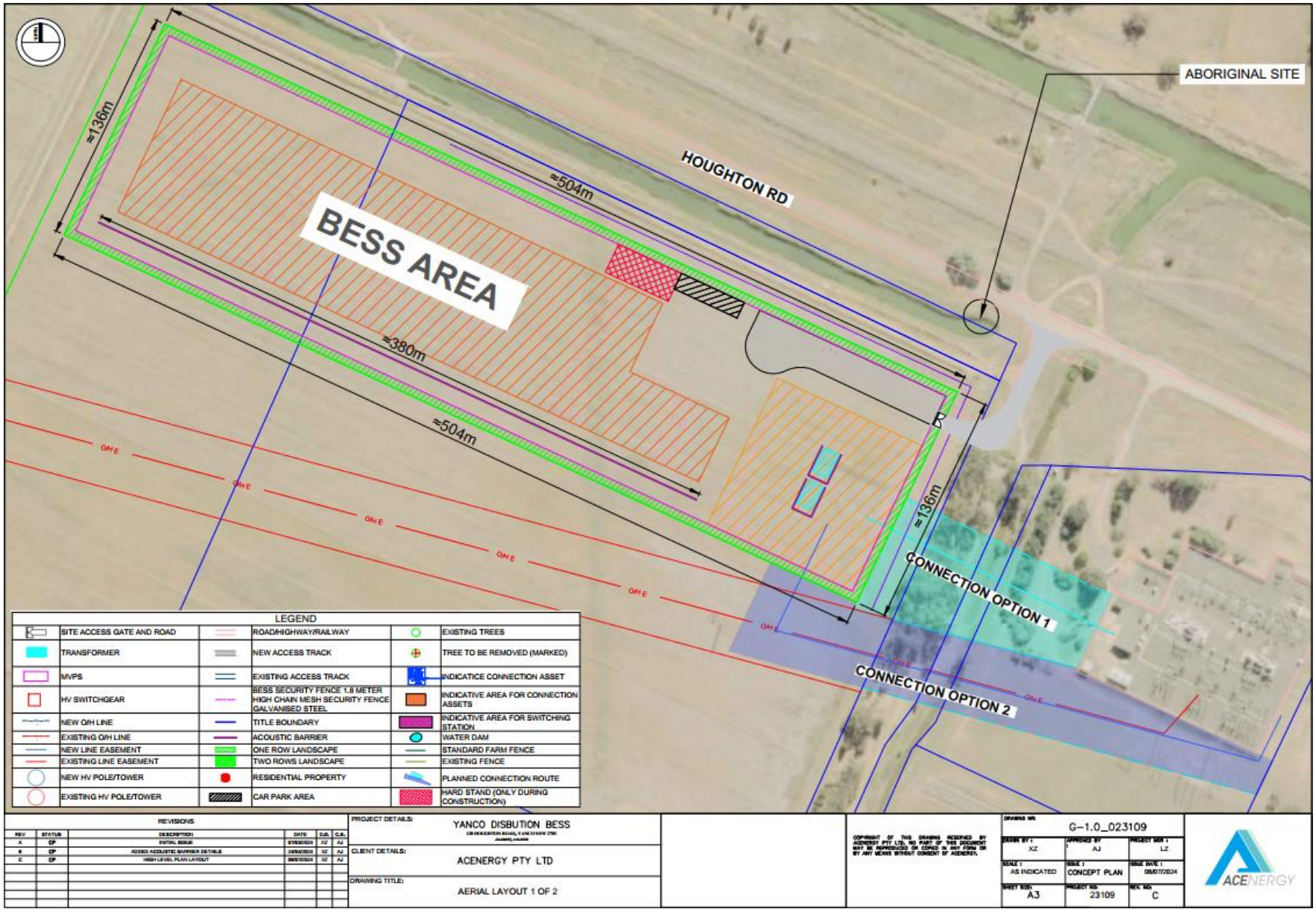


Figure 3: Equipment Locations

4.4.2 Predicted Operational Noise Levels (Pre-Mitigation)

Review of the predicted noise levels without acoustic mitigation does not demonstrate compliance with the intrusive noise criteria. Without acoustic mitigation in place exceedances were predicted at R724 and R03. An exceedance of ~4dB is predicted at R03 and ~1dB exceedance at R724 during the evening and night periods when the Subject Site is modelled without acoustic mitigation.

Receptor	Predicted Operational Noise Levels, $L_{Aeq, 15min}$			Intrusive Noise Criteria (dB(A))			Comply (Y/N)
	Day	Eve	Night	Day	Eve	Night	
R01[a]	43	43	43	-	-	-	-
R02[b]	36	36	36	68	68	68	Y | Y | Y
R03	39	39	39	45	35	35	Y | N | N
R04	25	25	25	40	35	35	Y | Y | Y
R05	24	24	24	40	35	35	Y | Y | Y
R06	29	29	29	40	35	35	Y | Y | Y
R07	19	19	19	40	35	35	Y | Y | Y
R08	19	19	19	40	35	35	Y | Y | Y
R09	19	19	19	40	35	35	Y | Y | Y
R723	24	24	24	40	35	35	Y | Y | Y
R724	35	36	36	40	35	35	Y | N | N
R725	18	18	18	40	35	35	Y | Y | Y

c) R01 is an electrical substation and is considered an associated premises to the Subject Site
d) R02 is a wastewater treatment facility and is considered and industrial premises.

4.4.3 Predicted Operational Noise Levels (With Acoustic Mitigation)

Review of the predicted noise levels with acoustic mitigation confirms that compliance with the intrusive noise criteria established in accordance with the NPfI can be achieved for all receptors for day, evening, and night periods under worst-case meteorological conditions.

The findings of this assessment rely on the equipment sound power levels presented in Table 17 and the acoustic mitigation (barriers) detailed below. Alternative equipment selections may be considered where the sound power levels are the same or lower than those used in this assessment.

It is noted that closest sensitive receptors were considered in this assessment, all other receptors are further away and compliance with closer receptors will infer compliance with all other more distant receptors.

Detailed noise contours can be found in Appendix C.

Table 18: Predicted Receptor Noise Levels - Operational Phase

Receptor	Predicted Operational Noise Levels, $L_{Aeq, 15min}$			Intrusive Noise Criteria (dB(A))			Comply (Y/N)
	Day	Eve	Night	Day	Eve	Night	
R01[a]	39	39	39	-	-	-	-
R02[b]	33	33	33	68	68	68	Y | Y | Y
R03	34	34	34	45	35	35	Y | Y | Y
R04	22	22	22	40	35	35	Y | Y | Y
R05	20	20	20	40	35	35	Y | Y | Y
R06	24	24	24	40	35	35	Y | Y | Y
R07	21	21	21	40	35	35	Y | Y | Y
R08	23	23	23	40	35	35	Y | Y | Y
R09	17	17	17	40	35	35	Y | Y | Y
R723	26	26	26	40	35	35	Y | Y | Y
R724	32	32	32	40	35	35	Y | Y | Y
R725	17	17	17	40	35	35	Y | Y | Y

e) R01 is an electrical substation and is considered an associated premises to the Subject Site
f) R02 is a wastewater treatment facility and is considered an industrial premises.

4.4.4 Recommended Mitigation

To achieve compliance the following mitigations are recommended:

- Noise barriers are proposed as shown in Figure 4. In order to be effective, the acoustic barrier would need to be free of gaps and be constructed of material with a mass density greater than or equal to 12 kg/m^2 excluding structural components.
- The southern noise barrier is approximately 388 m length and 4.5 m in height, the barrier also has been modelled to include 150 mm gap between the ground and bottom of the barrier. (Barrier construction to allow for flood design).
- Southern acoustic barrier is to be constructed such that there is a 10 m spacing between the acoustic barriers and BESS equipment to allow for fire safety.
- The barriers around the large scale 175 MVA transformers are 4 m in height. The barrier may be open on the northern face.
- Placement of the MVPS equipment as discussed with ACEnergy, MVPS front face of all units to be facing north to help with directionality. The arrangement of the inverters is critical to ensure the loudest side of the equipment is facing away from the closest sensitive receptors to the south.
- Similarly, placement of BESS equipment as discussed with ACEnergy, BESS front side (loudest) facing towards the north for all BESS units to help with noise directionality away from the closest sensitive receptors to the south.

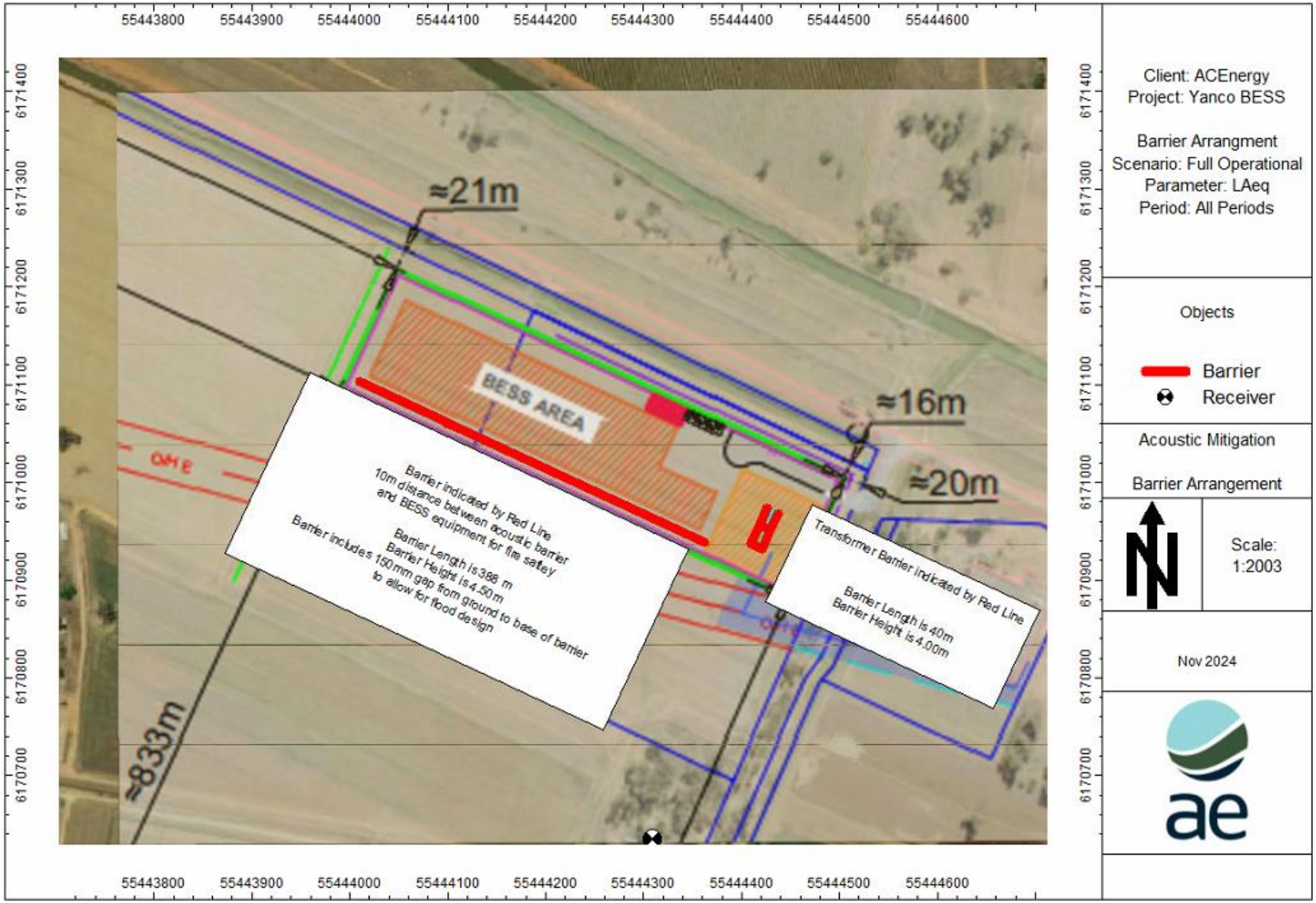


Figure 4: Barrier Locations

4.4.5 Predicted Cumulative Operational Noise Levels

An Environmental Impact Statement (EIS) has previously been completed for Yanco Solar Farm as part of the development approvals process. The noise component of the EIS completed by Renzo Tonin & Associates[c] (RTA) included an operational noise assessment for Yanco Solar Farm.

The operational noise assessment was conducted for Yanco Solar Farm in which the worst-case meteorological conditions were used in assessment. These values were used to assess the cumulative operational impact from both projects.

The RTA report was accepted in the approved EIS for the Yanco Solar Farm and therefore the predicted receptor levels identified in this assessment can accepted as valid and can be used in the cumulative assessment for both projects.

Cumulative impact of the projects was assessed at four receptors identified in both the EIS for Yanco Solar Farm and those identified within this report. Predicted receptor levels were calculated for each operational assessment individually then log summed to reach cumulative noise level at each respective receptor.

Receptors identified in 15 will be most affected by the cumulative impacts from both construction projects. Other receptors identified in this report are further away from both construction projects and hence less affected by the cumulative operational impact. Compliance found at receptors identified in both reports will imply compliance at all other sensitive receptors.

c Yanco Solar Farm: Construction & Operations & Vibration Assessment: prepared by Renzo Tonin & Associates (their Report no TJ856-01F01; dated 06 February 2019)

Table 15: Predicted Noise Levels at Sensitive Receptors for Cumulative Operational Assessment (Moderate Temperature Inversion – Worst Case)

Receptor as defined by AE receptor locations	Receptor as defined in Renzo Tonin & Associates	Intrusive Noise Criteria			Operational Noise levels			Comply (Y/N)
		Day	Eve	Night	Solar Farm Operational Impact (RTA Report)	BESS Operational Impact	Cumulative Impact	
R3	R22	40	35	35	24	33	34	Y | Y | Y
R4	R23	40	35	35	27	31	32	Y | Y | Y
R8	R19	40	35	35	33	24	34	Y | Y | Y
R7	R20	40	35	35	24	20	25	Y | Y | Y

Table 15 demonstrates that under worst case meteorological conditions the cumulative assessment finds the receptors to be in compliance with applicable criteria.

5 ROAD TRAFFIC NOISE ASSESSMENT

5.1 Introduction

Noise impacts associated with vehicle movements during the operational phase of the BESS project are expected to be negligible as no staff will be permanently based on-site. Visitation will be limited to periodic maintenance and infrequent plant and equipment replacements. During construction and any future decommissioning of the farm however, traffic movements will be more significant.

For assessment purposes ACEnergy has provided predicted vehicle volumes during the construction phase. Construction is expected to be completed over an eight-month period and it is anticipated that up to a peak of approximately 70 workers would be on-site.

The Traffic Impact Assessment was used for accurate traffic volumes for the purpose of road traffic noise assessment. The traffic impact assessment refers to a peak vehicle volume from the Subject Site to be a total of 25 Light Vehicles and 14 Heavy vehicles.

For the purposes of a conservative estimate of road traffic noise, additional one-time vehicle movements of over-size over-mass vehicles (OSOM) used in transport of large equipment were also considered during this peak hour.

The acoustic modelling used an estimated peak of 33 light vehicles and 16 heavy vehicles to be travelling to and from Subject Site based on predicted peak hour traffic volumes and the inclusion of OSOM vehicles and associated escort vehicles. The assessment has considered the potential impacts associated with noise emissions from the maximum expected 33 light and 16 heavy vehicle movements from the site entry along one possible route:

- **Vehicle Transport Route: East and West along Houghton Road.**

Following additional assumptions have been made with a summary of road traffic data presented in Table 19.

- It has been assumed that 14 trucks per day would arrive spread out across the 11-hour workday. However, for a worst-case assessment, 14 trucks per hour was modelled to simulate all heavy vehicles on the road to Subject Site during the night-time period (0600-0700).

- A total of 8 OSOM (over size over mass) vehicles are required in total. The OSOM vehicles are used for the transportation of 2 transformers, 4 switch rooms and 2 mobile cranes. Additionally, these vehicles require escort vehicles – conservatively a total of 6 escort vehicles are required for the transport for the transformers and 2 escort vehicles for all other OSOM vehicles.

- OSOM vehicles are not expected to all travel to the Subject Site on the same day, additionally OSOM vehicles are unlikely to arrive at the same time as the peak hour during which all other vehicles will be arriving on site. However, for a conservative modelling approach an additional 2 OSOM vehicles (heavy) and 8 escort vehicles (light) were considered in addition to the peak vehicle traffic generated by the Subject Site.

- All movements are expected to occur during standard construction hours (7 am to 6 pm Monday to Friday and 8 am to 1 pm Saturday). For a worst-case assessment all vehicles were assessed to be travelling to site before 7am and therefore assessment against the nighttime criteria was done to account for this potential.

Table 19: Road Traffic Data

Road Segment	Assessment Metric	Vehicle Type	Vehicle Speed	Number of additional Movements	
				Day (7 am to 10 pm)	Night (10pm – 7 am)
Local Road (1-hour criteria) Houghton Road	$L_{Aeq,(period)}$ 55 (external	Light	60 km/hr	33	33
		Heavy	60 km/hr	16	16

5.2 Assessment Criteria

The ICNG does not provide criteria for the assessment of construction road traffic during the project. Given this, reference is made to the noise criteria provided in the NSW Road Noise Policy (RNP). Based on the type of roadway, Table 20 presents the applicable road traffic noise criteria for existing residences affected by traffic on existing roadways generated by land use developments.

Table 20: Applicable Road Traffic Noise Criteria

Road Category	Type of Project & Land Use	Assessment Criteria
Local roads	Existing residences affected by additional traffic on existing local roads generated by land use developments	Day: $L_{Aeq,1\ hour}$ 55 dB(A) Night: $L_{Aeq,1\ hour}$ 50 dB(A) (external)
Freeway/arterial/sub-arterial roads	Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	Day: $L_{Aeq,15\text{-}hour}$ 60 dB(A) Night: $L_{Aeq,9\text{-}hour}$ 55 dB(A) (external)

5.3 Noise Modelling Methodology

For the purposes of predicting impacts associated with road traffic noise emissions was completed using the proprietary software CadnaA (2024 MR2 build 203.5403) developed by DataKustik. The model incorporates the influence of topography, ground type and air absorption in addition to source characteristics to predict noise impacts at receptor locations. All predictions have been undertaken in accordance with Calculation of Road Traffic Noise (CRTN) methodology developed by the UK Department of Transport. In accordance with the requirements of the Road Noise Policy (RNP), the predictive noise modelling incorporated the following assumptions:

- L_{Aeq} values were calculated from the L_{A10} values predicted by the CRTN methodology using the approximation $L_{Aeq,1\ hour} = L_{A10,1\ hour} - 3$.
- Noise source heights were set at 0.5 m above road level for cars, 1.5 m for heavy vehicle engines and 3.6 m for heavily vehicle exhausts.
- Noise from heavy vehicle exhausts is 8 dB lower than the steady continuous engine noise; and
- Corrections established for Australian conditions applied through a negative correction to the CRTN predations of -1.7 dB for façade-corrected levels (Samuels and Saunders, 1982).

Review of the predicted noise level presented in Table 21 confirms that compliance with the RNP is achieved at the closest receptors to each potential route.

Traffic volumes along the surrounding roads were not available to AE at the time of this assessment, thus we have considered this assessment qualitatively. Given the rural location, it is expected that the existing traffic along these roads produces a noise level below the allowable levels in Table 20. Where this is the case, no further assessment would be warranted. It is also noted due to the large distance between residential premises and Houghton Road potential noise impacts generated from road traffic along this route are significantly attenuated.

Where this is not the case (i.e., where existing traffic along these roads produces noise above the levels in Table 20), the RNP allows a development to generate additional traffic as long as the increase in noise levels at receptors is no more than 2 dB. Given the very low traffic generated in the proposed expansion, the increase in traffic as a result of the expansion of the Subject Site would result in a negligible (< 2 dB) increase in noise at surrounding residences.

The vehicle movements to and from the site represent a negligible change in noise generated along Houghton Road.

As such, AE expects that compliance with the RNP criteria is achieved in all instances.

Table 21: Predicted $L_{Aeq,period}$ Noise Contribution Levels at Sensitive Receptors - Road Traffic Noise

Sensitive Receptor	Setback from Roadway	Period	Parameter	Criteria	Predicted Noise Level	Comply (Y/N)
Houghton Road	116 m	Day	$L_{Aeq,1\ hour}$	55 dB(A)	46 dB(A)	Y
		Night	$L_{Aeq,1\ hour}$	50 dB(A)	46 dB(A)	Y

6 VIBRATION ASSESSMENT

6.1 Introduction

A review of the proposal indicates there is potential for impacts as a result of vibration generated by plant and equipment during the construction phase. Given this, an assessment of the potential for vibration impacts has been undertaken. In particular, the assessment has considered the potential for impacts on both human comfort and structural damage for the nearest residence to the construction works.

6.2 Assessment Criteria

The vibration criteria presented in the Environmental Noise Management – *Assessing Vibration: A Technical Guideline* (2006) published by the NSW Department of Environment and Conservation (DEC) have been adopted for the assessment. The technical guide provides vibration criteria associated with amenity impacts (human annoyance) for the three categories of vibration:

- Continuous vibration (e.g., road traffic, continuous construction activity);
- Impulsive vibration includes less than three distinct vibration events in an assessment period (e.g., occasional dropping of heavy equipment); and
- Intermittent vibration includes interrupted periods of continuous vibration (e.g., drilling), repeated periods of impulsive vibration (e.g. pile driving) or continuous vibration that varies significantly in amplitude.

Table 22 and Table 23 present the criteria for continuous and impulsive vibration and intermittent vibration, respectively.

Table 22: Continuous & Impulsive Vibration Criteria for Residences – Peak Velocity

Location	Vibration Type	Preferred Limit (mm/s)	Maximum Limit (mm/s)
Residences	Continuous	0.28	0.56
Residences	Impulsive	8.6	17

Table 23: Intermittent Vibration Criteria for Residences

Location	Assessment Period	Preferred Value (m/s1.75)	Maximum Value (m/s1.75)
Residences	Daytime	0.20	0.40

The criteria are suitable for assessing human annoyance in response to vibration levels. In order to assess potential damage to buildings, reference has been made to British Standard *BS 7385-2: 1993 Evaluation and measurement of vibration in buildings – Part 2: Guide to damage levels from ground borne vibration*. Table 24 presents vibration criteria for assessing the potential for building damage.

Table 24: Transient Vibration Guide Values for Cosmetic Damage

Type of Building	Peak Particle Velocity (mm/s)	
	4 Hz to 15 Hz	15 Hz and above
Unreinforced or light framed structures – residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

6.3 Potential Vibration Sources

Table 25 identifies the vibration source levels for the equipment likely to be used for the construction of the BESS.

Table 25: Vibration Source levels – Peak Particle Velocity

Equipment Item	PPV at 10 metres (mm/s)	Source
Piling (press-in method)	1 – 2	Rockhill, D.J. et. al. [b)]
Roller	5 – 6	DEC
7 tonne compactors	5 – 7	DEC
Loaded trucks (rough surface)	5	USA DT [a)]
Loaded trucks (smooth surface)	1 – 2	USA DT [a)]
Excavator	2.5 – 4	DEC

a) Transit Noise and Vibration Impact Assessment, US Department of Transportation, May 2006
b) Rockhill, D.J., Bolton, M.D. & White, D.J. (2003) 'Ground-borne vibrations due to press-in piling operations'

6.4 Assessment of Potential Impacts

Based on the vibration source levels at 10 metres (presented in Table 25), peak particle velocities have been predicted at various separation distances. The NSW DEC indicates that in predicting vibration levels, it can be assumed that the vibration level is inversely proportional to distance (with the relationship varying between $d^{-0.8}$ to $d^{-1.6}$ based on field data).

The US Department of Transportation's Transit Noise and Vibration Impact Assessment (May 2006) presents the following construction vibration propagation formula assuming an inverse relationship:

$$PPV@d_2 = PPV@d_1 \times (d_1/d_2)^{1.5}$$

where: d_1 = distance 1 (reference distance for source data) (m)

d_2 = distance 2 (separation distance for predicted PPV) (m)

PPV = peak particle velocity (mm/s)

The above formula has been considered for predicted PPVs at various distances from construction equipment. Based on the above information, Table 26 presents PPV predictions for the various construction equipment.

Table 26: Predicted Peak Particle Velocity at Sensitive Receptors (mm/s)

Distance from Source (m)	Predicted Peak Particle Velocity (mm/s)				
	Roller	7 tonne compactors	Excavator	Loaded trucks (rough surfaces)	Loaded trucks (smooth surfaces)
10	6.00	7.00	4.00	5.00	1 – 2
20	2.12	2.47	1.41	1.77	0.35 – 0.71
30	1.15	1.35	0.77	0.96	0.19 – 0.38
40	0.75	0.88	0.50	0.63	0.13 – 0.25
50	0.54	0.63	0.36	0.45	0.09 – 0.18
60	0.41	0.48	0.27	0.34	0.07 – 0.14
70	0.32	0.38	0.22	0.27	0.06 – 0.11
80	0.27	0.31	0.18	0.22	0.05 – 0.09
90	0.22	0.26	0.15	0.19	0.04 – 0.07
100	0.19	0.22	0.13	0.16	0.03 – 0.06
150	0.1	0.12	0.07	0.09	0.02 – 0.03
Type	Continuous			Intermittent	
Nuisance Criteria	Residential 0.28 (preferred) / 0.56 (max)			Residential 0.20 (preferred) / 0.40 (max)	
Building Criteria	Residential 15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz 20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above				

The predicted vibration levels presented in Table 26 indicate compliance with the continuous maximum vibration nuisance criteria for locations at a separation distance of 50-60 metres. Compliance with the building damage criteria is predicted at 10 metres from construction for each source. Therefore, as the closest receptor is 300 m from the nearest vibration source, there will be no adverse impact.

For intermittent vibration associated with haul vehicles, it is difficult to provide an appropriate comparison with the relevant criteria (which is presented as a Vibration Dose Value (VDV) in $m/s^{1.75}$). The calculation of a VDV requires both the overall weighted RMS (root mean square) acceleration (m/s^2) typically obtained from on-site measurements and the estimated time period for vibration events.

It is noted, however, that the compactor PPV at distances of 300 m (the distance to the nearest sensitive receptor from potential piling) is predicted to be within the maximum continuous criteria of 0.56 mm/s. This comparison with the continuous criteria (as a conservative approach) indicates that vibration levels associated with compactor are not considered to be significant (which is expected given the significant separation distances).

7 CONCLUSION

ACEnergy propose to develop a BESS in Yanco, NSW. The impact assessment has considered the potential for adverse impacts resulting from noise (construction, road traffic and operational) and vibration emissions on nearby residential uses.

The assessment of potential noise impacts has considered the construction phase should occur during standard hours only. For construction during standard hours, adverse amenity impacts during construction are considered unlikely. During works, following best practice mitigation detailed above and staff training regarding excessive noise from machinery use is recommended.

Similarly, the cumulative construction noise from the nearby Yanco Solar Farm and the Yanco BESS were assessed, adverse amenity impacts during the cumulative construction phase are also considered unlikely.

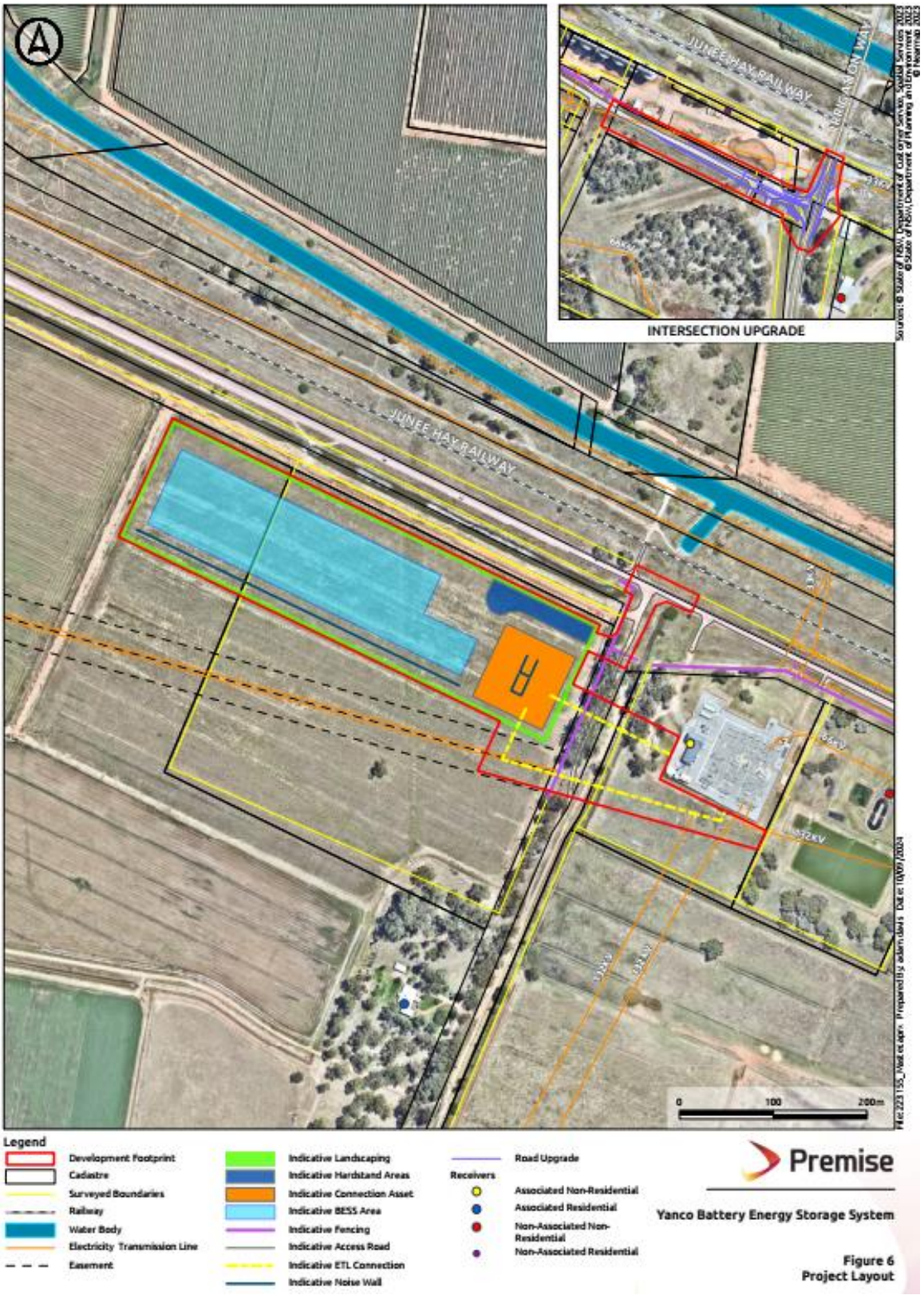
The assessment of potential impacts from road traffic and vibration emissions from the Yanco BESS were conducted. During the operation phase of the projects vibration and road traffic emissions are considered negligible due to the nature of the BESS equipment and minimal staff vehicle volumes during the operational phase.

The largest potential for impact from road and vibration impacts occurs during the construction phase of the project. Detailed assessment of impacts during the construction phase identified adverse amenity impacts from road traffic and vibration emissions to be unlikely and compliance with applicable criteria is expected to be achieved.

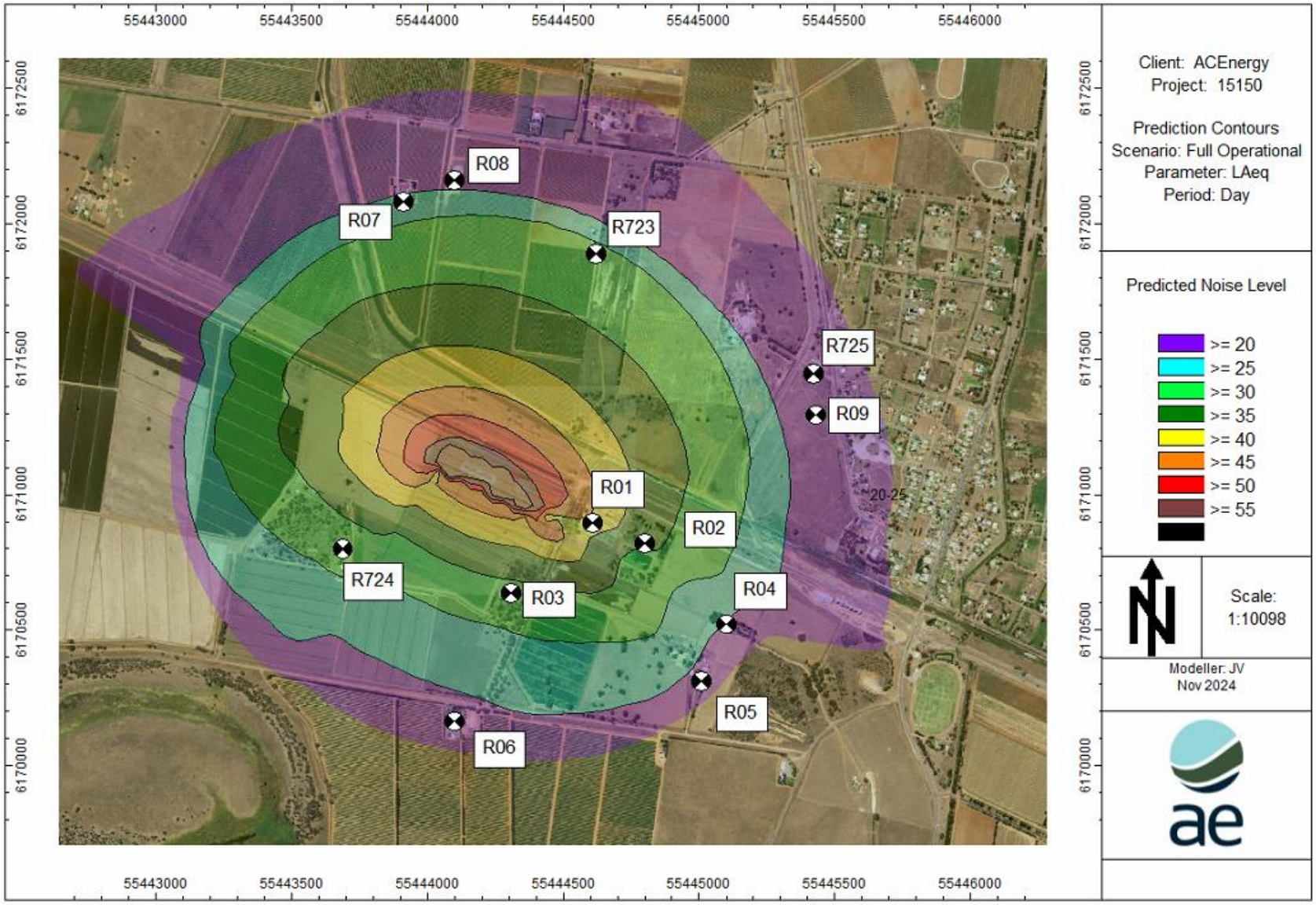
For the operational phase of the project, adverse amenity impacts are considered unlikely and compliance with applicable criteria is expected to be achieved provided the recommended acoustic barriers are implemented.

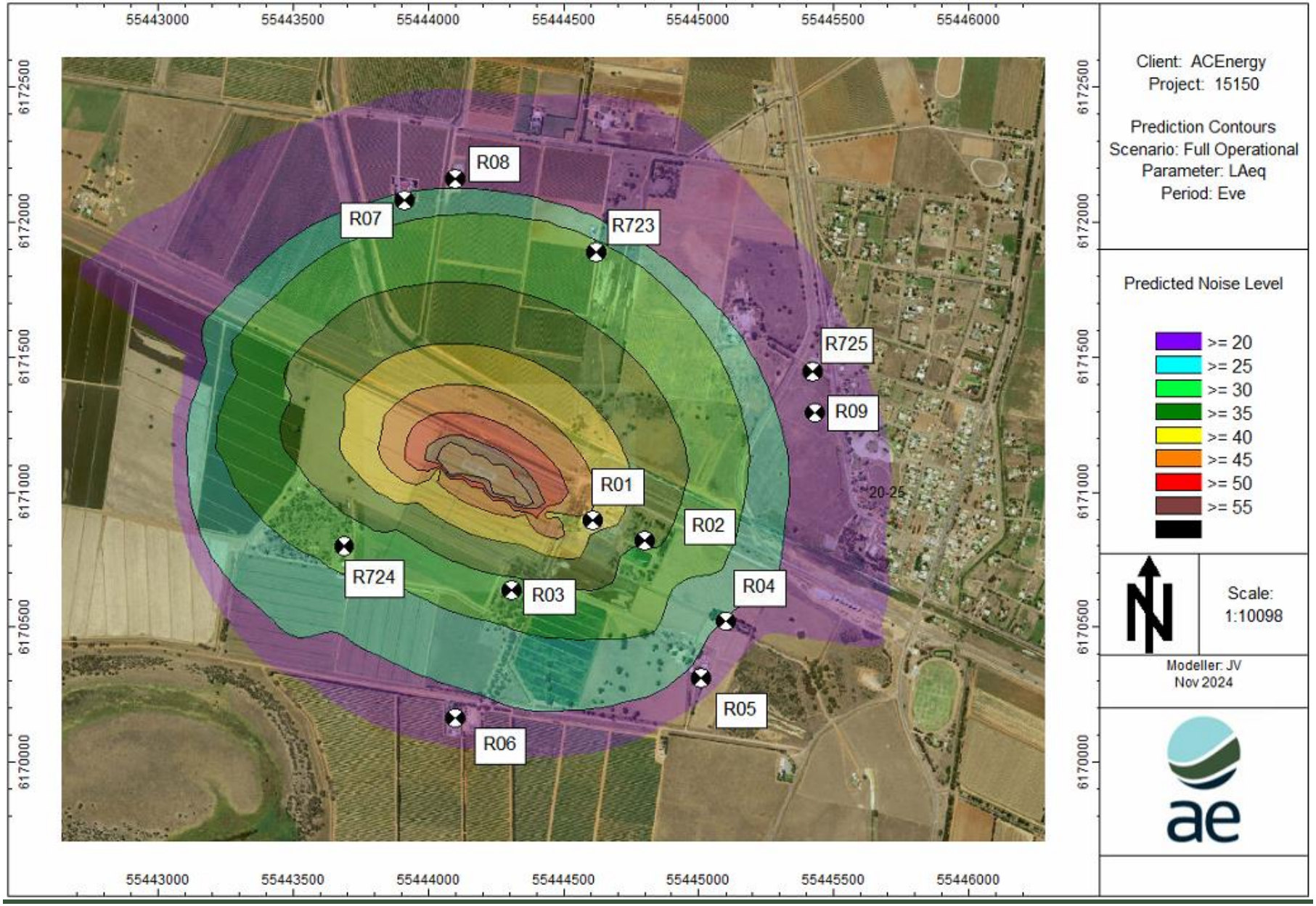
Overall, based on the results of the assessment, the risk of residual adverse impacts as a result of the proposed BESS is considered to be low with noise and vibration emissions complying with the applicable criteria. Hence, from an acoustic and vibrational perspective, the proposed Subject Site is considered acceptable for the proposed use.

APPENDIX A: PROPOSED PLANS



APPENDIX B: NOISE CONTOURS

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55446000
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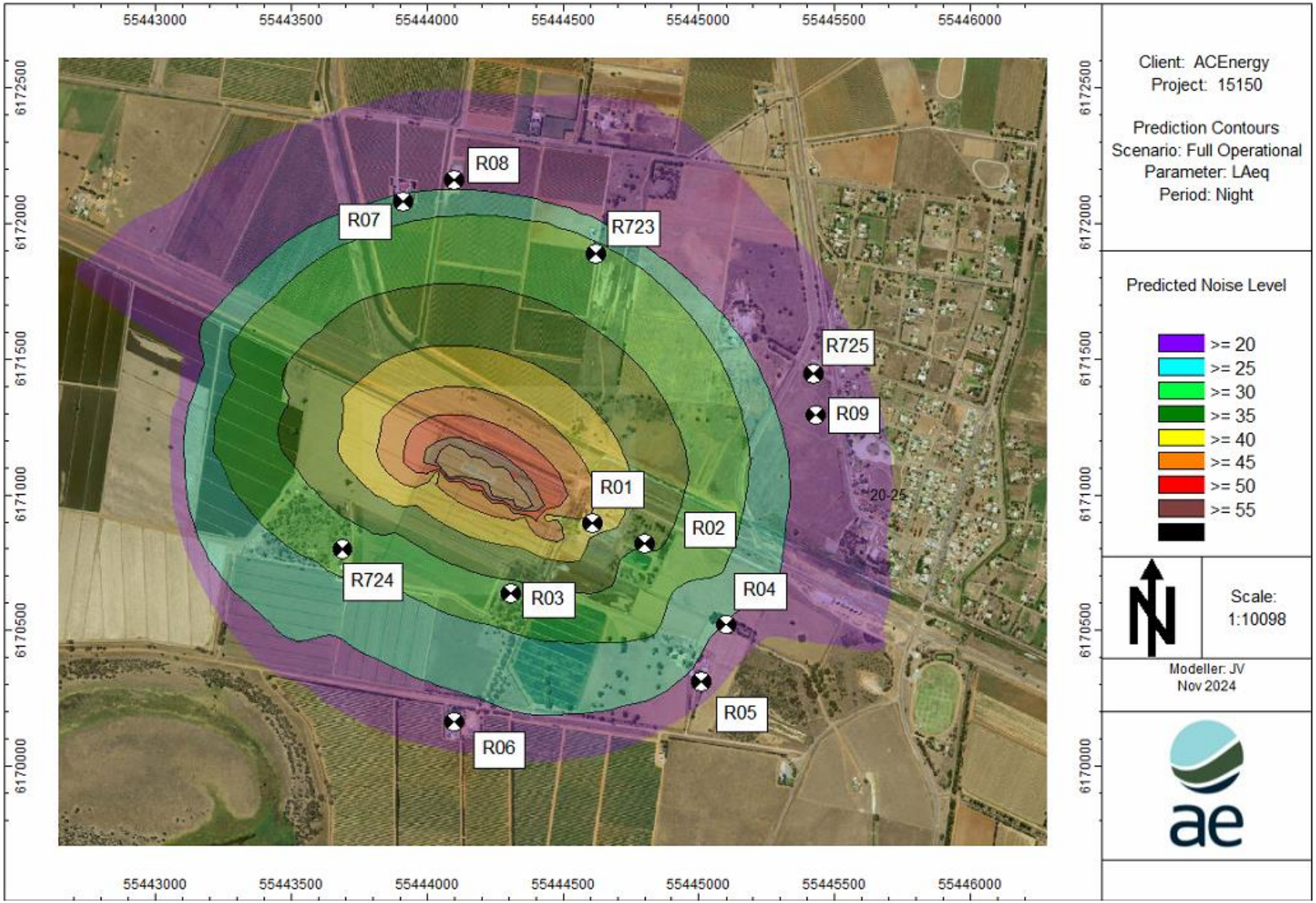
6172000
6171500
6171000
6170500
6170000
R08
R07
R723
R725
R09
R01
R02
R724
R03
R04
R05
R06
20-25
Client: ACEnergy
Project: 15150
Prediction Contours
Scenario: Full Operational
Parameter: LAeq
Period: Eve
Predicted Noise Level
>= 20
>= 25
>= 30
>= 35
>= 40
>= 45
>= 50
>= 55
Scale:
1:10098
Modeller: JV
Nov 2024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55444000
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55445000
55445500
55446000
6172500
6172000
6171500
6171000
6170500
6170000
R08
R07
R723
R725
R09
R01
R02
R724
R03
R04
R05
R06
20-25
Client: ACEnergy
Project: 15150
Prediction Contours
Scenario: Full Operational
Parameter: LAeq
Period: Night
Predicted Noise Level
>= 20
>= 25
>= 30
>= 35
>= 40
>= 45
>= 50
>= 55
Scale:
1:10098
Modeller: JV
Nov 2024

APPENDIX C: RENZO TONIN & ASSOCIATES: CONSTRUCTION NOISE PREDICTIONS AT RECEIVER LOCATIONS

Table 4.5 – Predicted $L_{Aeq,15min}$ Solar Farm Construction Noise Levels at Receiver Locations, dB(A)

Plant Item	Plant Description	Predicted $L_{eq(15min)}$ Construction Noise Levels																						
		R01	R02	R03	R04	R05	R06	R07	R08	R09	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19	R20	R21	R22	R23
Noise Management Level[1]		*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*
1	Small pile driver	<20-44	<20-**54**	<20-**52**	24-**54**	21-**51**	<20-**46**	<20-**63**	<20-**46**	<20-44	<20-**46**	<20-41	23-38	23-38	23-38	25-36	24-36	22-32	20-35	20-40	<20-**47**	<20-**52**	<20-32	<20-26
2	Fixed Crane	<20-43	<20-**53**	<20-**51**	23-**53**	20-**50**	<20-45	<20-**62**	<20-45	<20-43	<20-45	<20-40	22-37	22-37	22-37	24-35	23-35	21-31	<20-34	<20-39	<20-**46**	<20-**51**	<20-31	<20-25
3	Front End Loader	<20-43	<20-**53**	<20-**51**	23-**53**	20-**50**	<20-45	<20-**62**	<20-45	<20-43	<20-45	<20-40	22-37	22-37	22-37	24-35	23-35	21-31	<20-34	<20-39	<20-**46**	<20-**51**	<20-31	<20-25
4	Backhoe	<20-41	<20-**51**	<20-**49**	21-**51**	<20-**48**	<20-43	<20-**60**	<20-43	<20-41	<20-43	<20-38	20-35	20-35	20-35	22-33	21-33	<20-29	<20-32	<20-37	<20-44	<20-**49**	<20-29	<20-23
5	Grader	<20-40	<20-**50**	<20-**48**	<20-**50**	<20-**47**	<20-42	<20-**59**	<20-42	<20-40	<20-42	<20-37	<20-34	<20-34	<20-34	21-32	<20-32	<20-28	<20-31	<20-36	<20-43	<20-**48**	<20-28	<20-22
6	Vibratory Roller	<20-39	<20-**49**	<20-**47**	<20-**49**	<20-**46**	<20-41	<20-**58**	<20-41	<20-39	<20-41	<20-36	<20-33	<20-33	<20-33	<20-31	<20-31	<20-27	<20-30	<20-35	<20-42	<20-**47**	<20-27	<20-21
7	Concrete Truck	<20-39	<20-**49**	<20-**47**	<20-**49**	<20-**46**	<20-41	<20-**58**	<20-41	<20-39	<20-41	<20-36	<20-33	<20-33	<20-33	<20-31	<20-31	<20-27	<20-30	<20-35	<20-42	<20-**47**	<20-27	<20-21
8	Delivery Truck	<20-38	<20-**48**	<20-**46**	<20-**48**	<20-45	<20-40	<20-**57**	<20-40	<20-38	<20-40	<20-35	<20-32	<20-32	<20-32	<20-30	<20-30	<20-26	<20-29	<20-34	<20-41	<20-**46**	<20-26	<20-20
9	Water Cart	<20-37	<20-**47**	<20-45	<20-**47**	<20-44	<20-39	<20-**56**	<20-39	<20-37	<20-39	<20-34	<20-31	<20-31	<20-31	<20-29	<20-29	<20-25	<20-28	<20-33	<20-40	<20-45	<20-25	<20
10	Concrete Pump	<20-35	<20-45	<20-43	<20-45	<20-42	<20-37	<20-**54**	<20-37	<20-35	<20-37	<20-32	<20-29	<20-29	<20-29	<20-27	<20-27	<20-23	<20-26	<20-31	<20-38	<20-43	<20-23	<20
11	Power Generator	<20-33	<20-43	<20-41	<20-43	<20-40	<20-35	<20-**52**	<20-35	<20-33	<20-35	<20-30	<20-27	<20-27	<20-27	<20-25	<20-25	<20-21	<20-24	<20-29	<20-36	<20-41	<20-21	<20
12	Concrete Vibrator	<20-33	<20-43	<20-41	<20-43	<20-40	<20-35	<20-**52**	<20-35	<20-33	<20-35	<20-30	<20-27	<20-27	<20-27	<20-25	<20-25	<20-21	<20-24	<20-29	<20-36	<20-41	<20-21	<20
13	Light vehicles (eg 4WD)	<20-33	<20-43	<20-41	<20-43	<20-40	<20-35	<20-**52**	<20-35	<20-33	<20-35	<20-30	<20-27	<20-27	<20-27	<20-25	<20-25	<20-21	<20-24	<20-29	<20-36	<20-41	<20-21	<20
Up to 3 (noisiest) plant operating concurrently		23-**48**	24-**59**	24-**57**	28-**59**	25-**56**	21-**50**	20-**68**	<20-**50**	<20-**48**	22-**50**	22-45	28-42	27-42	28-42	29-40	28-40	26-36	25-39	24-44	24-**51**	21-**56**	<20-36	<20-30

Notes: 1. Noise Management Levels for day period (ie. standard construction hours)
2. **Bold** font represents exceedance of the relevant NML

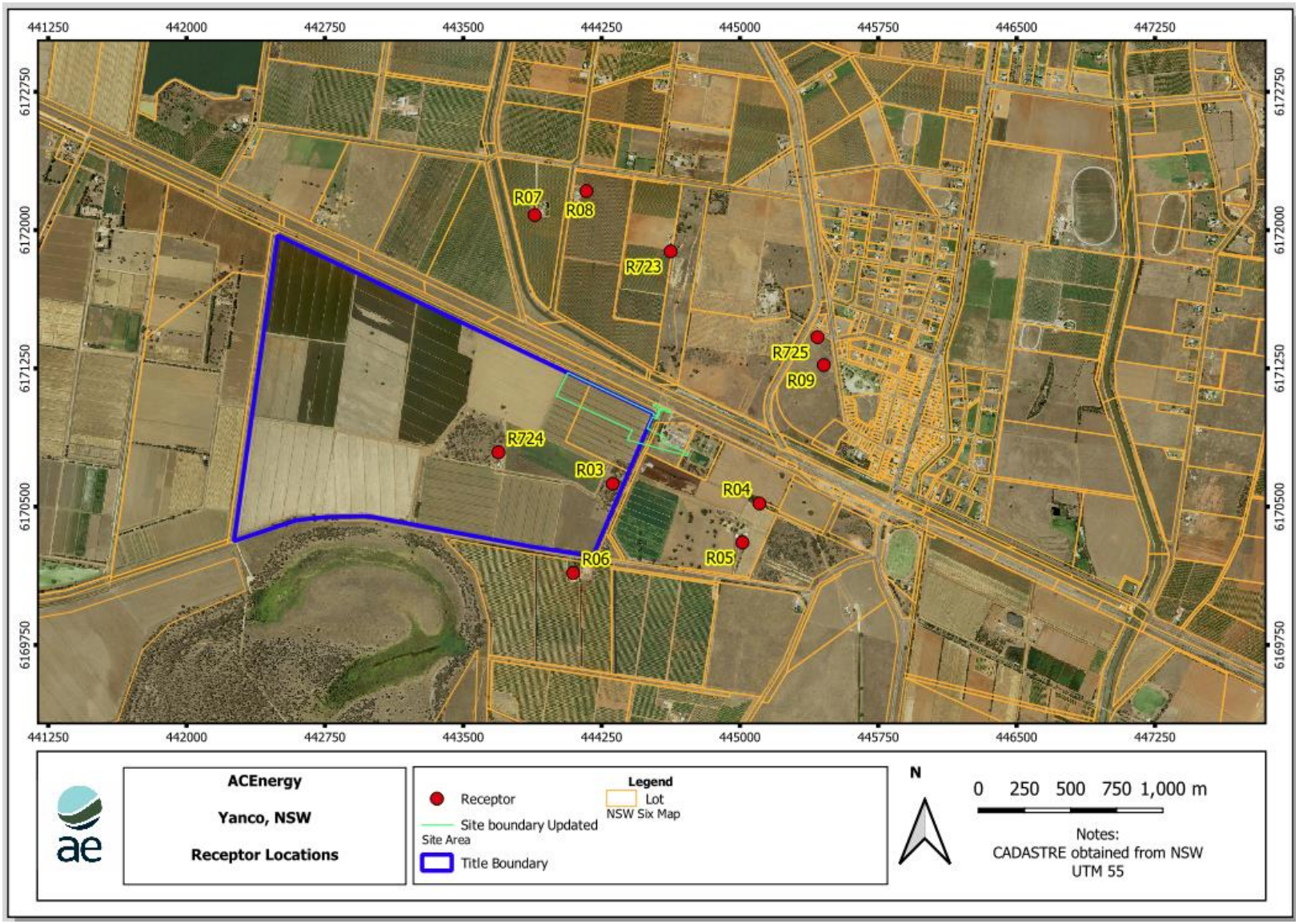
Table 4.6 – Predicted $L_{Aeq,15min}$ Easement Construction Noise Levels at Receiver Locations, dB(A)

Plant Item	Plant Description	Predicted $L_{eq(15min)}$ Construction Noise Levels																						
		R01	R02	R03	R04	R05	R06	R07	R08	R09	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19	R20	R21	R22	R23
Noise Management Level[1]		*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*
1	Front End Loader	21-30	<20-25	<20-24	<20-24	<20-21	<20	<20	<20	<20	<20	<20	<20-23	<20-23	<20-23	22-27	23-27	23-26	26-30	27-34	27-37	<20	30-40	24-37
2	Grader	<20-27	<20-22	<20-21	<20-21	<20	<20	<20	<20	<20	<20	<20	<20-20	<20	<20-20	<20-24	<20-24	20-23	23-27	24-31	24-34	<20	27-37	21-34
3	Vibratory Roller	<20-26	<20-21	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20-23	<20-23	<20-22	22-26	23-30	23-33	<20	26-36	20-33
4	Delivery Truck	<20-25	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20-22	<20-22	<20-21	21-25	22-29	22-32	<20	25-35	<20-32
5	Water Cart	<20-24	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20-21	<20-21	<20-20	20-24	21-28	21-31	<20	24-34	<20-31
6	Light vehicles (eg 4WD)	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20-20	<20-24	<20-27	<20	<20-30	<20-27
Up to 3 (noisiest) plant operating concurrently		23-33	<20-28	<20-26	<20-26	<20-23	<20	<20	<20	<20	<20-20	<20	21-26	21-26	22-26	25-30	25-30	26-29	29-33	30-37	29-39	<20	32-42	27-40

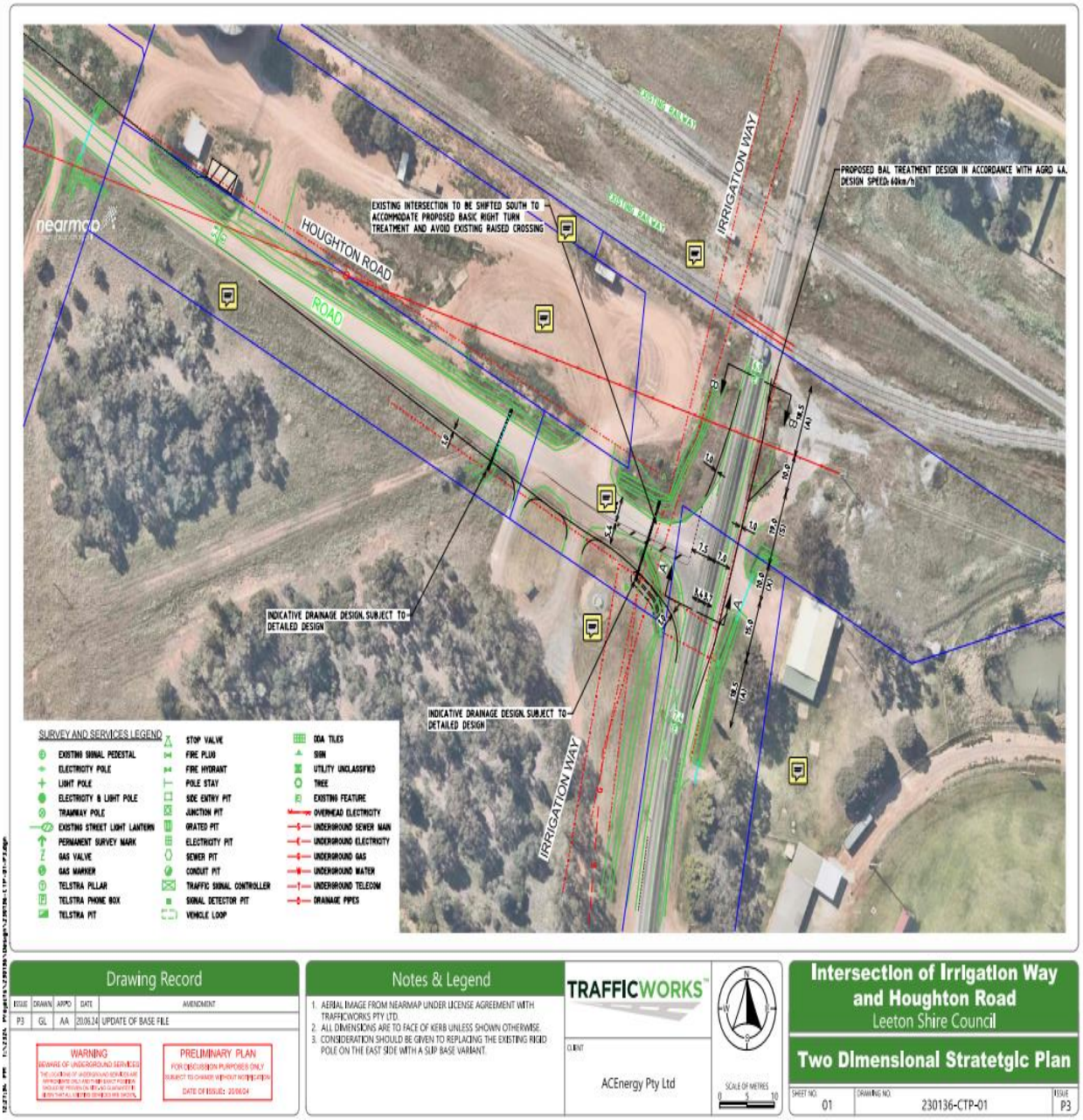
Notes: 1. Noise Management Levels for day period (ie. standard construction hours)


R08
R09
L1
R07
R06
R21
R10
R11
ROAD
R05
ROAD
BACK
R12
R13
R14
YANCO
R04
TOORAK
ROAD
ROAD
R15
R16
R17
GLADMAN
DENBSEY
R03
R02
RESEARCH
ROAD
R18
R19
R20
R01
HOUGHTON
ROAD
R22
R23
PV Footprint
Monitoring location
Receiver locations
Proposed powerline easement
Project site boundaries

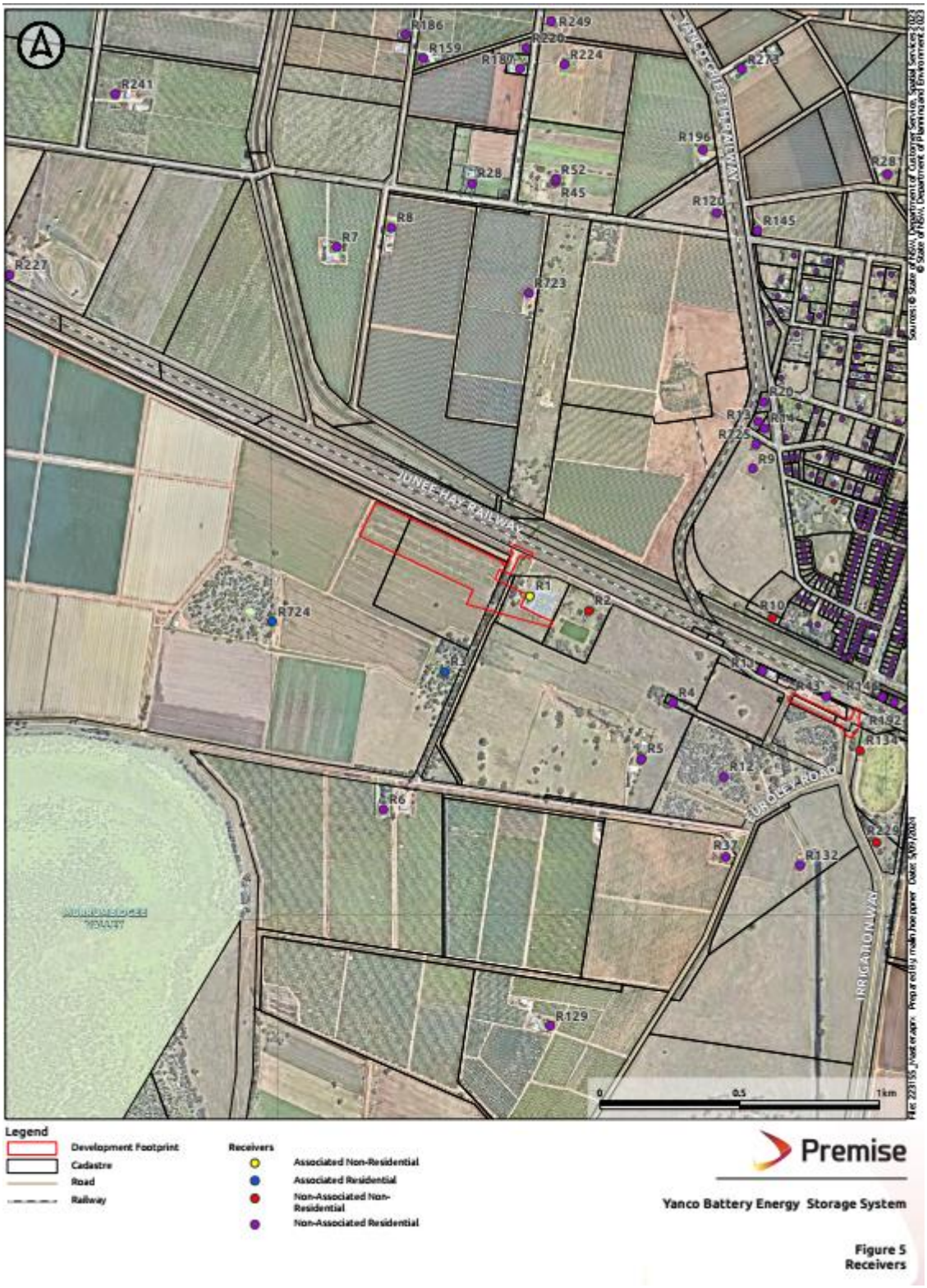
APPENDIX D: RECEPTOR LOCATIONS



APPENDIX E: ROAD UPGRADE



APPENDIX F: EIS RECEPTOR LOCATIONS



APPENDIX G: SUBJECT SITE DETAILED