



TransGrid

Addendum Review of Environmental Factors

**Coppabella Wind Farm – Rebuild of Transmission
Line 99M**

Installation of an Additional Transformer at Yass Substation

Part 5 EP&A Act Environmental Impact Assessment

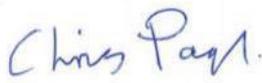
July 2020

Document Preparation History

Revision	Reviewed By	Date
RevA	Denise Lo	1 July 2020
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Certification

I certify that I have prepared this Part 5 environmental impact assessment and, to the best of my knowledge, it is in accordance with the *NSW Code of Practice for Authorised Network Operators* approved under clause 244K of the *Environmental Planning and Assessment Regulation 2000*, and the information is neither false nor misleading. It addresses, to the fullest extent possible, all matters affecting or likely to affect the environment as a result of the proposed activity.

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Executive Summary

TransGrid proposes to amend the *Coppabella Wind Farm – Rebuild of Transmission Line 99M* activity which was assessed in the Review of Environmental Factors (REF) and determined by TransGrid on 31 March 2020.

The original REF assessed the rebuild of Transmission Line 99M (Line 99M) as a double circuit line from the boundary of the Coppabella Wind Farm (CWF) to Yass 330kV substation to facilitate the grid connection of the wind farm. The total length of the rebuild is approximately 39 kilometres (km).

It has now been determined that an additional 132/330 kilovolt (kV) transformer is required to be installed at Yass substation to enable the connection of the CWF to TransGrid's 330 kV network (the proposed modified activity). This would also involve the construction of a new switchbay and transformer compound.

It has been identified that further assessment is required for the modified proposed activity as potential environmental impacts associated with the changes were not considered in the original REF. This Addendum REF only describes and assesses the proposed modifications since the original REF and should be read in conjunction with the original REF.

All relevant statutory planning instruments have been examined for the proposed modified activity. The proposed modified activity is permissible under Part 5 of the *Environmental Planning and Assessment Act 1979*.

A specialist Noise Impact Assessment determined that minor and temporary elevated noise from construction activities has the potential to occur at surrounding residential dwellings. The magnitude and extent of potential construction noise impacts is described as low with the predicted noise emissions considered consistent with noise emissions generated by other construction works conducted regularly in NSW.

An assessment of the substation operational noise incorporating the additional transformer did not predict any noise levels at surrounding residential dwellings above the adopted project noise trigger levels established in accordance with the Environment Protection Authority's *Noise Policy for Industry* (EPA, 2017).

Other additional impacts to those identified and assessed in the original REF include:

- > Potential minor temporary disruptions on the road network during the delivery of the new transformer.
- > Potential disturbance to encounter per- and polyfluoroalkyl substances (PFAS) contaminated groundwater during excavation works and installation of the additional transmission structures.
- > Potential disturbance to heavy metal, hydrocarbon and polychlorinated biphenyls (PCBs) affected soil as part of the construction of the new switchbay and transformer compound.
- > Minor erosion and sedimentation from soil disturbance activities including structure installation and excavation works carried out within the substation for the new switchbay and transformer compound.
- > Minor and temporary elevated noise from construction activities.
- > Minor amounts of dust and emissions from vehicles, equipment and earthworks during construction.

Changes to the mitigation measures are required to minimise the impacts of the modified proposed activity and these are outlined in Appendix A.

It is concluded that with consideration to the amended mitigation measures outlined in Appendix A, the modified proposed activity is not likely to have a significant impact on the environment, and is not likely to significantly affect threatened species, populations, ecological communities, or their habitats and is not carried out in declared areas of outstanding biodiversity value, therefore a Species Impact Statement is not required.

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1. Introduction

1.1 Background

A Review of Environmental Factors (REF) was prepared by TransGrid for the *Coppabella Wind Farm - Rebuild of Transmission Line 99M* activity and was determined in March 2020.

The approved activity described in the REF included the rebuild of TransGrid's Transmission Line 99M (Line 99M) from the Coppabella Wind Farm (CWF) to Yass substation as a double circuit line to support the connection of the wind farm to the National Electricity Market (NEM). Line 99M forms a 132 kilovolt (kV) connection between Yass and Murrumburrah.

As a result of the connection of other renewable generation in the Yass region which have imposed constraints on the network, there is now a requirement to install an additional transformer at Yass substation to support the grid connection of CWF. The scope of works would generally involve:

- > Construction of a new switchbay and transformer compound on the former switchyard bench, located to the immediate east of the existing Yass switchyard.
- > Minor realignment of Line 99M external to Yass substation to facilitate the entry of the rebuilt Line 99M into the new switchbay.

1.2 Purpose of the Addendum REF

The purpose of this Addendum REF is to describe the modified proposed activity, assess the potential impacts on the environment, identify any additional mitigation measures that should be implemented and determine whether the modified proposed activity can proceed.

This Addendum REF only addresses the changes to the *Coppabella Wind Farm - Rebuild of Transmission Line 99M* project. For an understanding of the entire activity, this Addendum REF should be read in conjunction with the Original REF and the Submissions Report

This Addendum REF has been prepared to address the requirements of the *Environmental Planning and Assessment Act 1979* (EP&A Act), clause 228 of the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation) and the *NSW Code of Practice for Authorised Network Operators* (IPART, 2015). For the purpose of the works described in this Addendum REF, TransGrid is the proponent and the determining authority under Part 5 of the EP&A Act.

2. Proposed Activity

2.1 Description of the Approved Activity

The key features of the determined activity as described in the original REF and Submissions Report include:

- > Replacement of all existing wooden pole transmission structures between Yass 330 kV substation and Structure 143 (inclusive) with new steel or concrete pole transmission structures up to 40 metres (m) in height (up to 20 m higher than the existing wooden pole structures). The additional height of the line is required due to outage constraints as the existing line would remain in service throughout construction.
- > Installation of optical ground wire (OPGW) on the rebuilt section of Line 99M, between Yass 330 kV substation and Structure 143 to facilitate the remote monitoring and protection of the new transmission connection.
- > Rearrangement of other transmission lines (Line 973, Line 970 and Line 990) outside of Yass 330 kV substation to facilitate the entry of the rebuilt Line 99M into the substation.
- > Construction of a new switchbay at Yass 330 kV substation to support the grid connection of CWF. This would also involve secondary systems equipment to be installed within the control room and/or auxiliary services building for the necessary control and protection requirements.

To facilitate the construction, the following ancillary works would be required:

- > Establishment of construction work sites at each structure. This would require surface disturbance of an area of approximately 40 m x 40 m surrounding the transmission structure for the laydown of equipment and materials and to support plant and machinery such as elevated works platforms (EWP) and cranes.
- > Establishment of level construction benches in areas of uneven topography to support the safe operation of plant and machinery.
- > Repair, upgrade and maintenance of existing access tracks where required and construction of new access tracks.
- > Construction of new watercourse crossings and upgrade to existing watercourse crossings.

2.2 Proposed Modified Activity Need

As a result of the connection of other renewable generation assets in the Yass region, there is now limited transfer capacity in the 132 kV network. As such, there is a requirement to connect the CWF to TransGrid's 330 kV network, which would require the installation of an additional 132/330 kilovolt (kV) transformer at Yass substation. Without the additional transformer, the CWF would not be able to connect into the 330 kV network.

To support the new transformer, a new transformer compound and switchbay would need to be constructed in the former switchyard at Yass substation, which was not considered in the original REF. Due to the positioning of the proposed new switchbay and transformer compound, the overhead crossing of the new CWF transmission connection into the new switchbay would require approximately three additional transmission structures. The reason for the positioning of the transformer on the former switchyard bench is due to insufficient space within the current substation area.

2.3 Description of the Proposed Modified Activity

2.3.1 Location

The proposed modified activity would occur at Yass substation (including the area of the former switchyard) and the adjoining land to the north within the Yass Valley Local Government Area (LGA), approximately 500 metres south-east of the edge of the Yass township. The portion of the modified proposed activity external to

Yass substation would generally occur within the existing easement, however additional easement (approximately 0.5 ha) may need to be sought to ensure the necessary development setbacks are in place and allow for a potential additional transmission structure (refer to Section 2.3.2). All other works associated with the modified proposed activity would occur on Lot 1 DP999493, which is owned by the Electricity Transmission Ministerial Holding Corporation and leased and managed by TransGrid.

For the purpose of this Addendum REF, the 'modified proposed activity area' is defined as:

- > Lot 1 DP999493, which contains the switchyards (existing and former), control room, site access road, the Yass Depot and associated buildings.
- > The area to the immediate north of the substation (Lot 5 DP1165198) where additional transmission line works are required to facilitate the transition of the CWF transmission connection into the new switchbay.

The majority of the modified proposed activity area is highly disturbed area with the existing and former switchyards completely void of vegetation. The area external to the substation comprises managed grassland with some planted trees along the northern and southern boundary fences. The area external to Yass substation is comprised of a mixture of native and non-native grassland and is subject to agricultural grazing.

The location of the proposed modified activity is shown in Figure 2-1 and with the scope of works shown in Figure 2-2.

2.3.2 Scope of Works

The proposed modified activity would include:

- > Construction of a new switchbay (including new footings and supports for new high voltage equipment) and transformer compound on an approximate 8,500 m² area on the former switchyard bench, located to the immediate east of the existing Yass switchyard.
- > Installation of a new 132/330 kV transformer and auxiliary transformer within the new compound.
- > Connection of the new transformer compound and switchbay to the existing spill oil and stormwater drainage network.
- > Installation of new secondary systems for the control and protection of the new equipment including new outdoor panels in existing equipment kiosk and associated footings and supports as required within the switchyard. Secondary systems equipment installation and upgrade works would also be carried out within the auxiliary services building.
- > Installation of cables within new cable conduits / trenches within the switchyard as required to complete the necessary connections.
- > Overhead line crossing of the CWF transmission connection into the new switchbay through the construction of three additional concrete three-pole transmission structures. The new structures would be approximately 40 m high. Two indicative options have been proposed as shown in Figure 2-2.

The existing easement is not wide enough to support the overhead line crossing into the new switchbay under both options being considered. As such, TransGrid may need to acquire an additional area up to approximately 45 m x 90 m (approximately 0.5 hectares) in the form of an easement to ensure TransGrid has the necessary access rights to construct, operate and maintain the line and to ensure that the necessary development setbacks are in place.

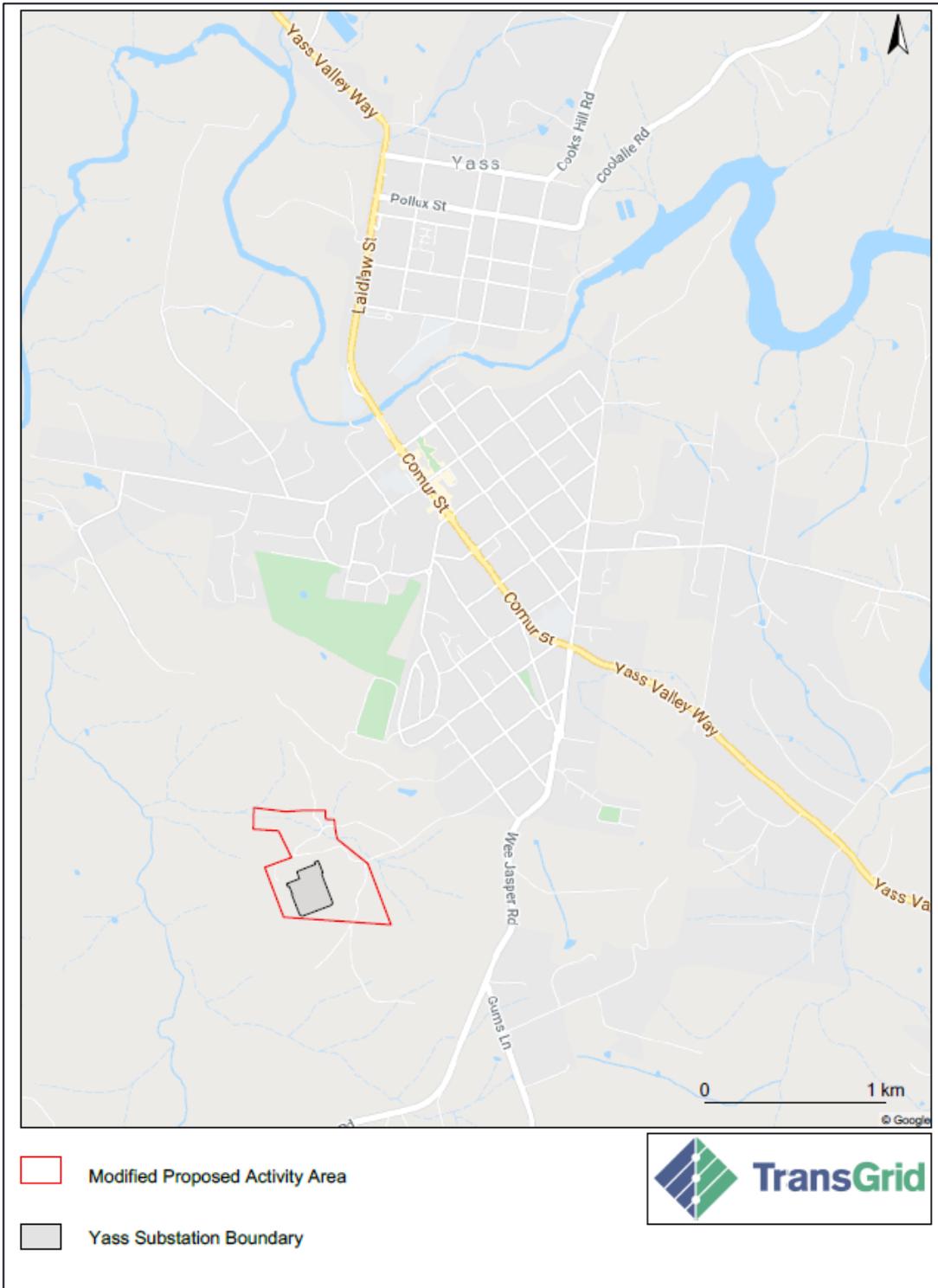


Figure 2-1: Location

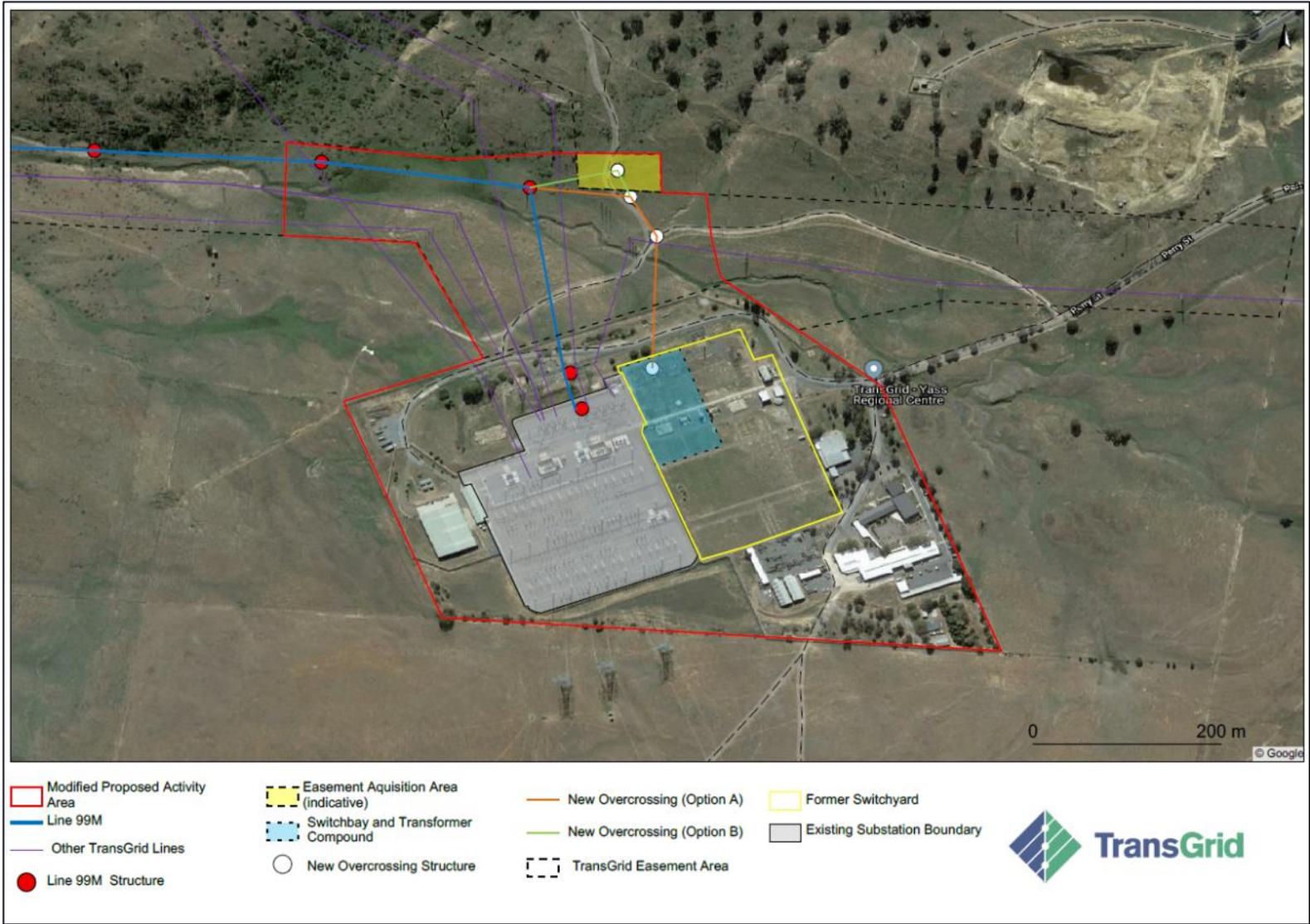


Figure 2-2: Scope of works

2.4 Construction of the Modified Proposed Activity

2.4.1 Construction Methodology

Site Establishment

Prior to construction works commencing, construction office/ amenities, equipment storage and laydown areas would be designated at a suitable location within the substation. This would not require any ground disturbance. No alterations to the existing vehicle access route would be required to facilitate the construction works.

Switchbay Bay Construction

New concrete footings would be established to support new high voltage switchgear equipment. Excavations would typically be limited to approximately 2 m in depth. The new switchgear equipment would then be placed into position onto the footings using cranes. In addition, new supports and footings would be established to support the extension of the busbar.

Cable trenches (approximately 0.6 m deep and 0.4 m wide) would be excavated using a small excavator or vacuum truck (for non-destructive digging) between the switchgear equipment and the nearest existing available cable trenches in the Yass substation switchyard connecting to the auxiliary services building. Once excavated, cables would be installed and the equipment connected.

Transformer Compound and Transformer Installation

Excavation and civil works would be carried out to construct a new transformer and auxiliary transformer banded compound. The banded compound is required to contain any unplanned oil leak from the transformer in the event of failure. Excavations for the compound are expected to be approximately 2 m in depth.

The new power transformer would be transported to the substation by a flat-bed over-mass truck. Given the oversized load, transport would be undertaken in accordance with relevant permits from the Roads and Maritime Services (RMS) and Council requirements. The transformer would be placed into position within the existing bund using a crane or transported to its position using a skate then lifted into position using a hydraulic jack. The transformer would then be oil filled over an approximate 24 hour period.

The installation of the new auxiliary transformer would follow the same general process as the power transformer, however it is not expected that an over-mass truck would be required for its transport. Should the new auxiliary transformer be an oil filled type, oil filling would occur within the banded compound following its installation.

Cable trenches (approximately 0.6 m deep and 0.4 m wide) would be excavated using a small excavator or vacuum truck (for non-destructive digging) between the new transformer compound and the nearest existing available cable trenches connecting to the auxiliary services building. Once excavated, cables would be installed connecting the transformer to the auxiliary services building.

Secondary Systems

Where required, a small excavator would be used to establish new concrete footings for the installation of new panel equipment housed in equipment kiosks throughout the switchyard. Generally, the footings are expected to be up to approximately 2 m long x 2 m wide and approximately 0.5 m deep. New cable trenches would be established from the auxiliary services building to necessary connection points within the switchyard where required, using a small excavator or vacuum truck.

Installation and modification of secondary systems equipment within the auxiliary services building may also be required.

Overhead crossing into the new switchbay

Construction of foundations for the new concrete three-pole structures would generally involve boring or excavating a hole for each pole. It is expected that each borehole would be approximately 1 m wide and up to

10 m deep. Each pole would be craned into position and stabilised with concrete. Alternatively, steel reinforcements would be placed into the hole and backfilled with concrete. The new pole would then be craned onto the footing and secured with holding down bolts.

Tension stringing would be used to carry out the stringing of conductor, OPGW and earthwires to ensure that they remain above ground. Sheaves (or pulleys) would be attached to the top of the poles in readiness for stringing work. An elevated work platform would be used to access the top of the poles to install the sheaves. The stringing process starts with a draw wire being fed through the sheaves. A draw wire would be attached to the end of cable and wire and would be pulled through the sheaves using brake and winch equipment. Sufficient tension is applied to keep the wire and cables clear of the ground and obstructions. The tension would then be adjusted to achieve the correct sag in each span. The OPGW, conductor and earthwire would then be clipped into each pole peak, and the sheaves removed.

2.4.2 Plant and equipment

Typical construction materials may include, but not be limited to, the following:

- > Steel structural supports and high voltage equipment
- > Conductor and overhead earthwire
- > Concrete
- > Electrical conduit and cables
- > Cable trench and covers
- > Imported fill material
- > Erosion and sediment controls.

Construction vehicles and equipment may include, but not be limited to the following:

- > Trucks and utility vehicles for the transport of equipment and building materials
- > Excavator, vacuum truck and hole borer for the establishment of footings
- > Brake and winch equipment for the overhead stringing of conductor and earthwire
- > General hand tools (powered and unpowered)
- > Backhoes and bobcats
- > EWPs to access above ground working areas
- > Crane for the new transformer and new structure installation
- > Air compressors and generator
- > Various power tools (angle grinder, drills, rattle gun)
- > Concrete pumps, concrete vibrators and finishers.

Exact requirements for construction materials and equipment would be determined during detailed design.

2.4.3 Construction Schedule and Hours

Construction works are scheduled to commence in late 2020 and would be carried out in conjunction with the rebuild of Line 99M, which is scheduled to take approximately 18 months to complete. There would be no change to the construction hours as described in the original REF.

3. Planning Context

3.1 Relevant Legislation

Chapter 4 of the REF considered the Commonwealth and NSW legislation applicable to the proposed activity, and additional permits/ approvals required to be obtained. The proposed modified activity continues to be consistent with the legislation considered in the REF and no additional permits or approvals are required.

The modified activity would not result in any changes to the approval pathway, being Part 5 of the EP&A Act and also would not change the classification of the proposed activity as Class 4 - REF in accordance with the *NSW Code of Practice for Authorised Network Operators*.

4. Consultation

Chapter 5 of the REF outlines consultation that was undertaken for the determined activity and considers applicable consultation and notification requirements. TransGrid carried out the consultation for the proposed modified activity in accordance with TransGrid's *Consultation Protocol for Review of Environmental Factors for Class 4 and 5 Activities* (2016) (the Protocol). This included the consultation requirements under the *State Environmental Planning Policy (Infrastructure) 2007* (ISEPP) and *Electricity Supply Act 1995* and consultation with landowner and Government agencies in accordance with general law requirements.

Details of the consultation carried out in accordance with the Protocol during the preparation of this Addendum REF is provided in Table 4-1 and proposed future consultation is outlined in Table 4-2.

Table 4-1: Consultation

Stakeholder	Reason for Consultation	Timing	Issues Raised
Yass Valley Council	Required under section 45 of the <i>Electricity Supply Act 1995</i> and clause 42 of the <i>State Environmental Planning Policy (Infrastructure) 2007</i> . Council were provided 40 days to provide a response.	Letter sent via email on 20 May 2020.	No response was received during the consultation period.
Occupiers of land adjoining Yass substation	Required under clause 42 of the <i>State Environmental Planning Policy (Infrastructure) 2007</i> . Additionally, one adjoining landholder would have proposed works occurring on their property. Occupiers of adjoining land were provided 21 days to provide a response.	Letters sent to all occupiers of land adjoining Yass substation between 20 and 22 May 2020.	
Chair of the Coppabella Windfarm Community Consultative Committee (CCC)	The Coppabella Windfarm CCC includes a number of local community members who have an active interest in the CWF the Line 99M Rebuild project.	Letter sent via email on 25 May 2020	

Table 4-2: Future Consultation

Stakeholder	Reason for Consultation	Details
Environmental Protection Authority	The Yass substation is listed on the ‘ <i>List of Contaminated Sites Notified to EPA</i> ’ due to groundwater beneath the site being contaminated with per- and polyfluoroalkyl substances (PFAS).	<p>These stakeholders would be notified of the proposed modified activity prior to the public exhibition of this Addendum REF on TransGrid’s website. The notification would include the dates of the exhibition period and details on how to lodge a submission. All submissions received would be considered and addressed by TransGrid following the public exhibition period through the preparation of a Submissions Report.</p> <p>All stakeholders previously consulted as outlined in Table 4-2 would also be notified of the exhibition period and would be invited to lodge a submission.</p>
Rural Fire Service of NSW	Potentially interested due to additional building works at Yass substation and presented previous interest as part of the original REF.	
Roads and Maritime Services	Heavy vehicle movements associated with the transformer delivery. Potential disruptions on the surrounding road network during haulage.	
NSW Department of Industry – Lands & Water	Potential to encounter PFAS contaminated groundwater.	
Potentially Noise Affected Landholders	This includes select properties along Yeo Crescent, Meriman Drive, Victoria Street, Cobham Street, Perry Street and Grand Junction Road in Yass, who may experience elevated noise levels during construction.	

5. Environmental Impact Assessment

This section of the Addendum REF provides a detailed description of the potential environmental impacts associated with the proposed changes to the activity. Key environmental impacts associated with the proposed modified activity are outlined in Section 5.1 to Section 5.5 with other non-key environmental aspects assessed in Section 5.6.

5.1 Land Use

5.1.1 Existing Environment

The proposed modified activity would occur at the Yass substation site, which is a key source of the supply of electricity in the Southern Tablelands region. The portion of the modified proposed activity area to the north of the substation also contains TransGrid owned transmission line assets. TransGrid currently holds easements for these transmission lines including Line 99M, which provides TransGrid with a right of way to construct, operate and maintain the transmission lines. This area is also used for agricultural grazing, which is the dominant land use in the surrounding area including within the transmission line easements.

5.1.2 Impact Assessment

No changes to the land use at Yass substation would occur as part of the proposed modified activity as the site would continue to operate as an electrical substation.

To support the overhead transmission line termination into the new switchbay, approximately 0.5 hectares of additional land tenure may need to be acquired in the form of an easement to provide TransGrid the necessary access rights to construct, operate and maintain the line and to ensure that the necessary developmental setbacks are in place. The required land acquisition would unlikely result in any change to the land use within the easement acquisition area as agricultural grazing would be permissible and would likely continue in the affected area.

5.2 Geology and Soils

5.2.1 Existing Environment

Geology and Soils

Soils within the modified proposed activity area include the:

- > Naturally occurring residual soils in the undeveloped parts of the Yass substation site and to the immediate north of the substation. These naturally occurring soils are characterised by sandy clays, underlain with weathered rock.
- > Modified soils within the existing substation and former switchyard, which generally comprise imported fill material used as part of the initial construction of the substation bench. Imported fill within the substation site ranges from sandy clays to gravelly clay and underlain with shale rock at depths ranging from approximately 0.2 m to 3 m below the ground surface.

Soil Contamination

A Contaminated Site Investigation (CSI) carried out by Jacobs (2017) identified previous soil contamination at Yass substation in the area of the proposed new switchbay and transformer compound. The CSI identified concentration of contaminants in soil including heavy metals, hydrocarbons and polychlorinated biphenyls

(PCBs), as being within the Site Assessment Criteria¹ (SAC). Per- and polyfluoroalkyl substances (PFAS) were also identified in soil samples collected, however were below the SAC.

5.2.2 Impact Assessment

Erosion and Sedimentation

The proposed modified activity would not result in any changes to the assessed impacts in relation to erosion and sedimentation risks as detailed in Section 6.2.2 of the original REF.

Excavations as part of the switchbay and transformer compound construction and structure installation for the overhead line crossing works has the potential to cause erosion and sedimentation. With the implementation of the erosion and sedimentation controls (mitigation measure GS1) no additional impacts are expected. As such, no additional mitigation measures to those outlined in the original REF are required.

Soil Contamination

The proposed modified activity has the potential to disturb approximately 10,000 m³ of heavy metal, hydrocarbon and PCB impacted soil as part of the construction of the new switchbay and transformer compound within the former switchyard area at Yass substation. Whilst the concentration of contaminants is generally within limits that would not adversely affect human health or terrestrial/aquatic ecosystems, any excess spoil would need to be appropriately stored and classified in accordance with stored, sampled and analysed by a NATA Registered laboratory and managed in accordance with the *Waste Classification Guidelines* (EPA, 2014). It would then need to be transported and disposed of at a suitably licenced facility in accordance with its waste classification (original Mitigation Measure GS3, Appendix A).

5.3 Hydrology and Water Quality

5.3.1 Existing Environment

The nearest surface water feature consists of an unnamed creek line which passes through the proposed modified activity area to the north of Yass substation, which drains into the Yass River (refer to Figure 5-1).

Groundwater is generally shallow (generally within 5 metres below ground level) within the proposed modified activity area and generally flows in a north westerly direction towards Booroo Ponds.

Elevated concentrations of per- and polyfluoroalkyl substances (PFAS) were reported by Jacobs (2017) in groundwater near the northern boundary of the former switchyard, which triggered the Yass substation site being placed on the 'List of Contaminated Sites Notified to EPA'.

Further investigation on the nature and extent of the PFAS contamination was carried out by Jacobs (2020) which concluded that:

- > Concentrations of PFAS was reported above the SAC in samples collected from two groundwater monitoring wells (YD-GW02, YD-GW07) located along the northern boundary of the substation and from a third groundwater monitoring well (YD-GW08) located approximately 90 m to the north of Yass substation.
- > Concentrations of PFAS in groundwater monitoring well YD-GW09 located approximately 50 m south west of Structure 3 on Line 99M were either below the SAC or below the limits of reporting. As such, it is considered unlikely that PFAS contaminated groundwater would be present in groundwater west of Structure 3.
- > Concentrations of PFAS were reported above the SAC in five surface water samples (YD-SW01, YD-SW03, YD-SW04, YD-SW05, YD-SW06) collected from the unnamed creek, located to the immediate north of Yass substation, which flows into Yass River.

¹). SAC refer to the limits set that provide confidence that contaminant concentrations would not adversely affect human health or terrestrial/aquatic ecosystems.

Based on the above, it is considered that PFAS contaminated groundwater and surface water would be present within the proposed modified activity area, particularly in the area to the north of the switchyard.



Figure 5-1: Hydrology and surface water features

5.3.2 Impact Assessment

The proposed modified activity has the potential to encounter PFAS contaminated groundwater as part of the excavation/boring for the three new transmission structures, replacement of Structure 1 to Structure 3 on Line 99M (as detailed in the original REF) and all excavation works within Yass substation in relation to the works described in Section 2.2. Groundwater containing PFAS, if not appropriately handled and managed, has the potential to:

- > Contaminate the surrounding agricultural grazing land, terrestrial ecology and affect livestock; and
- > Further impact the aquatic ecology in surrounding watercourses including riparian vegetation and fish stocks.

To manage impacts associated with PFAS contaminated groundwater mitigation measure HW4 has been amended and HW5 included to include the requirements to store and test any groundwater encountered during excavation works within the substation, former switchyard and boring/excavation as part of the new structure installation. Providing the mitigation measures HW4 and HW5 are implemented, potential contamination impacts on surface waters features can be effectively managed.

The proposed modified activity would not result in any other changes or additional impacts on hydrology and water quality to that outlined in the original REF.

5.4 Aboriginal Heritage

5.4.1 Existing Environment

The proposed modified activity area has been subject to significant modification as part of the:

- > Initial construction of the Yass substation;
- > Construction of the transmission lines to the immediate north of the substation and ongoing vegetation maintenance activities carried out within their easements; and
- > Historical and current agricultural grazing activities.

The nearest registered Aboriginal heritage site listed on the Aboriginal Heritage Information Management System (AHIMS) (search carried out on 2 July 2020) is AHIMS 51-4-0052 which comprises a low-density artefact scatter with few artefacts exposed on the surface of a dirt track, trending east–west from the Yass substation (refer to Figure 5-2). The recorded artefacts are surrounded by a potential archaeological deposit (PAD), with its boundary located approximately beyond 100 m from any ground disturbance associated with the proposed modified activity.

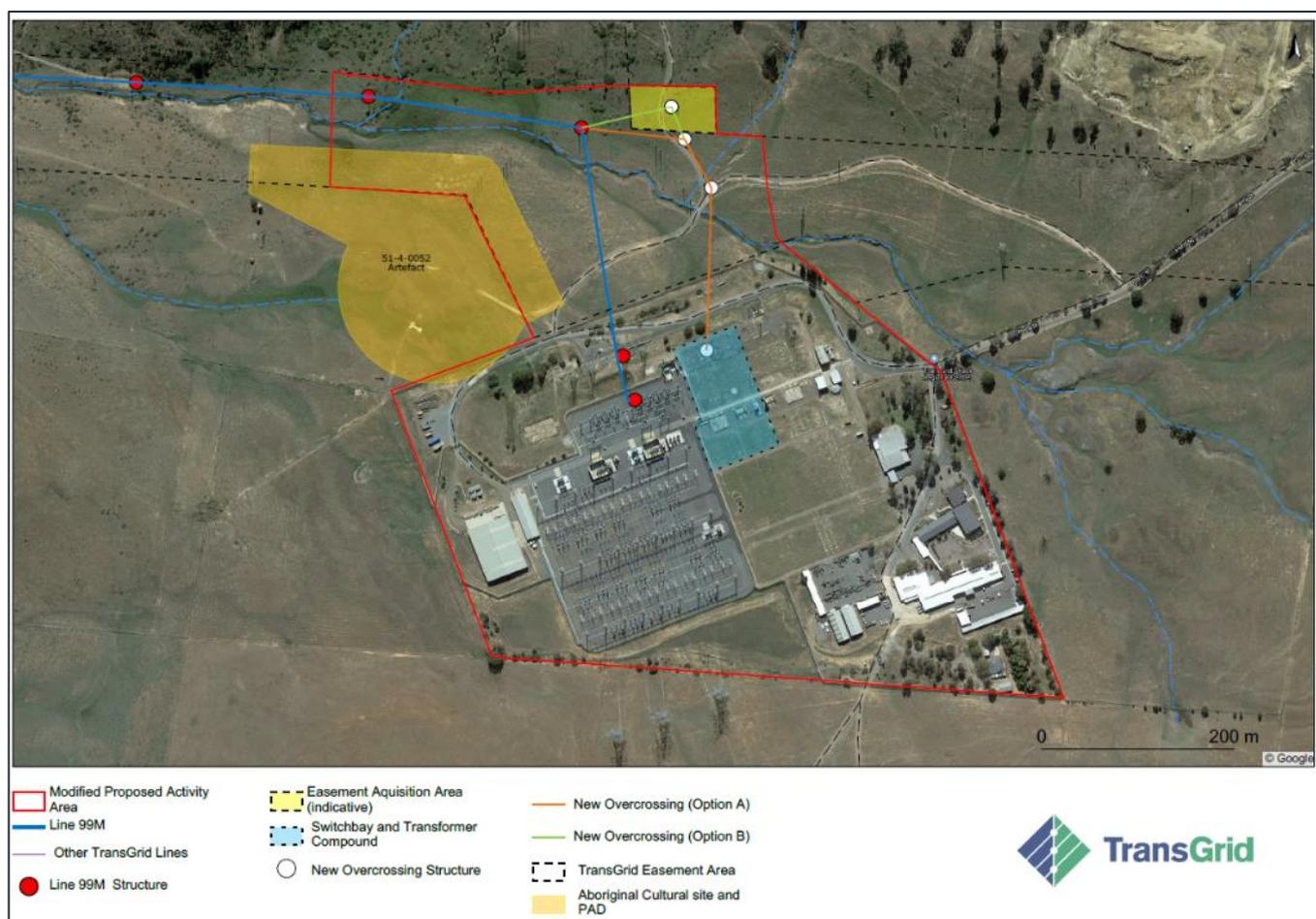


Figure 5-2: AHIMS 51-4-0052 and associated PAD

5.4.2 Impact Assessment

An assessment for potential impacts to Aboriginal heritage was undertaken by applying the due diligence process as described in the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (DECCW, 2010). This process and the outcome of the assessment is outlined in Table 5-1.

Table 5-1: Aboriginal Heritage Due Diligence Process

Step	Aboriginal Heritage Due Diligence Question	Response
1	Will the activity disturb the ground surface (or culturally modified trees)?	Yes. Ground disturbance would occur as part of the installation of the three additional transmission structures, new transformer compound and switchbay and trenching for cable connections within the substation switchyard.
2a	Are there any relevant confirmed site records or other associated landscape feature information on AHIMS?	Yes. The previously recorded AHIMS 51-4-0052 comprising an artefact scatter and associated PAD is located beyond 100 m from proposed areas of ground disturbance associated with the proposed modified activity.
2b	Are there any other sources of information of which a person is already aware?	Yes. The Aboriginal heritage due diligence assessment carried out by OzArk (2019) as part of the original REF did not identify any potential Aboriginal heritage areas of sensitivity including any recorded Aboriginal sites within the Line 99M easement section which traverses the proposed modified activity area.
2c	<p>Are there any landscape features that are likely to indicate presence of Aboriginal objects? This includes:</p> <ul style="list-style-type: none"> > Areas within 200 m of watercourse; > Sand dune systems; > Ridgetops, ridge lines and headlands, area above or below a cliff face; and > Caves and rock shelters. 	<p>Yes. The proposed modified activity would involve the boring/excavation works for the installation of three additional transmission structures within 200 m of a minor unnamed second order non-perennial watercourse.</p> <p>There are no other landscape features within the proposed modified activity area which are likely to indicate presence of Aboriginal occupation.</p>
3	Can harm to Aboriginal objects listed on AHIMS or identified by other sources of information and/or can the carrying out of the activity at the relevant landscape features be avoided?	<p>Yes. Ground disturbance associated with the proposed modified activity is located beyond 100 m from the mapped boundary of AHIMS 51-4-0052 and the associated PAD. As such, no impact to the Aboriginal heritage site would occur was part of the proposed modified activity.</p> <p>Whilst ground disturbance would occur within 200 m of a minor unnamed watercourse, the area has been highly modified as part of the initial construction of the transmission line assets and substation, vegetation clearing within the easement and historical and ongoing agricultural grazing. Based on these physical disturbance processes, the landscape has been highly modified and it is considered to unlikely contain any intact Aboriginal objects.</p>

Based on the due diligence assessment in Table 5 1, the proposed activity can proceed without further archaeological assessment providing the unexpected finds protocol (Mitigation Measure HE3) in Appendix A is implemented.

5.5 Noise and Vibration

A Noise Impact Assessment (NIA) was carried out by ERM (2020) for the proposed modified activity with the results summarised below with regards to construction and operational noise impacts. The complete report is provided in Appendix B.

5.5.1 Existing Environment

The noise environment of the area surrounding the substation is best described as ‘rural’ in accordance with the Environment Protection Authority’s *Noise Policy for Industry* (NPI) (EPA, 2017). As such, the acoustical environment is dominated by natural sounds, having little or no road traffic noise and generally characterised by low background noise levels.

The NIA considered a total of 19 residential receptor locations and one place of worship as shown Figure 5-3. The closest residential receiver (R3) is located approximately 610 m to the north east of the proposed modified activity area. The place of worship (R08) is located approximately 900 m to the south east of the proposed modified activity area.

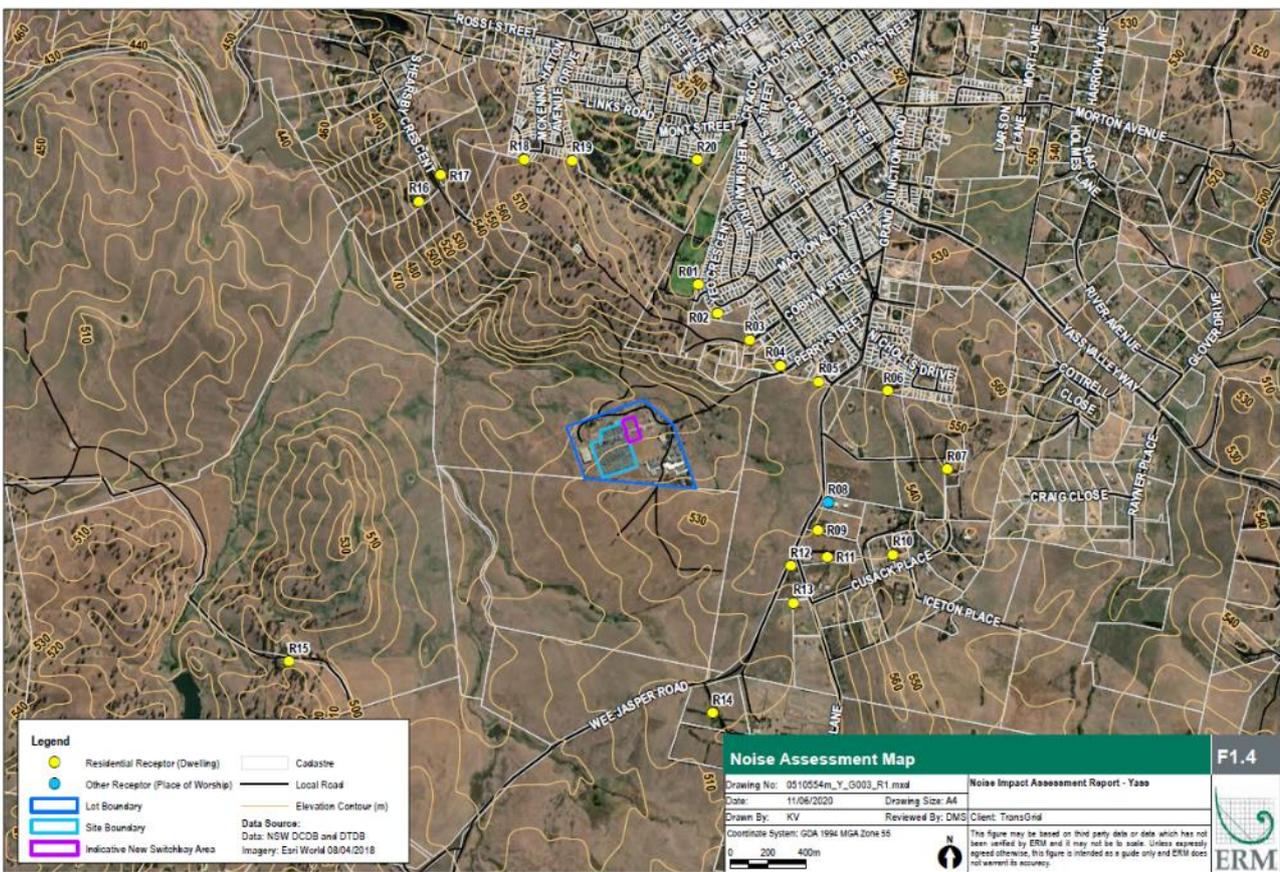


Figure 5-3: Sensitive Receptor Locations

5.5.2 Impact Assessment

Construction Noise Assessment

The assessment of construction noise considered a total of five construction scenarios:

1. Site preparation and establishment;
2. General construction of Infrastructure
3. Delivery of equipment
4. Oil filling of new equipment
5. Transmission line construction works to the immediate north of the substation.

In accordance with the *NSW Interim Construction Noise Guideline* (ICNG) (DECC, 2009), the Noise Management Levels (NML) adopted for construction noise were as follows:

- > 45 dBA during standard hours² and 40 dBA during non-standard daytime hours and 35 dBA during evening and night time hours at residential receptor locations.
- > 55 dBA at all times at the Place of Worship (R08).

The construction noise impact assessment determined the following:

- > During daytime standard hours elevated noise levels of up to 5 dBA were predicted at six residential receptors locations (R02, R03, R04, R05, R09 and R10) during site preparation and establishment.
- > During daytime standard hours, no exceedances were predicted for the other construction noise scenarios noise that were modelled.
- > Predicted noise levels at the place of worship were compliant with the NMLs across all construction noise scenarios.
- > Should any construction noise occur outside of standard daytime hours, noise exceedances above the adopted NMLs are predicted for at least one construction noise scenario across all residential receptor locations. Notwithstanding this, any works occurring outside of daytime standard hours are expected to be limited in extent and duration and are expected to include activities such as:
 - The delivery of materials and equipment (such as the new transformer) as requested by police or other authorities for safety reasons.
 - Emergency work to avoid the loss of lives and/or property.
 - Work timed to correlate with system planning outages.

The magnitude and extent of potential impacts associated with these elevated noise levels is best described as low during daytime standard hours with the predicted noise emissions considered consistent with noise emissions generated by other construction works conducted regularly in NSW. Although exceeding criteria, the predicted construction noise levels do not represent a constant emission that would be experienced by the community on a daily basis throughout the project's schedule of works.

Providing the mitigation measures NV1 and NV2 in Appendix A are implemented, construction noise impacts can be sufficiently managed.

Operational Noise Assessment

In accordance with the NPI, the Project-specific Noise Trigger Levels (PNTL) adopted for operational noise of the Yass substation were as follows:

- > 40 dBA during standard daytime hours³ and 35 dBA during evening and night time hours at residential receptor locations.
- > 48 dBA at all times at the Place of Worship (R08).

² ICNG, 2009 daytime standard hours are 7 AM to 6 PM Monday to Friday, and 8 AM to 1 PM Saturdays. Daytime non-standard hours are 1 PM to 6PM Saturdays and 8AM to 6 PM Sundays. Evening hours are 6 PM to 10PM Monday to Sunday (seven days per week). Night-time hours are all remaining hours.

³ NPI, 2017 daytime is the period from 7 AM to 6 PM, Monday to Saturday; or 8 AM to 6 PM on Sundays and public holidays. The evening is the period from 6 PM to 10 PM, Monday to Sunday (seven days per week) and night-time is all remaining periods.

The operational noise assessment determined that the introduction of the additional 132/330 kV transformer and auxiliary transformer would result in operational noise being below the PNTL across all twenty receptor locations under both standard and noise enhancing meteorological conditions.

5.6 Other Non-Key Environmental Aspects

Table 5-2 assesses the change in, or additional impacts associated with other non-key environmental aspects that require consideration for the modified proposed activity.

Table 5-2: Change to Environmental Impacts from the Modified Proposed Activity

Environmental Issue	Changes to Impacts
Ecology	<p>The modified proposed activity would occur within the highly disturbed area of the existing Yass substation, former switchyard as well as the area to the north of the substation, which is currently subject to agricultural grazing. No trees are required to be removed as part of the modified activity.</p> <p>A search of the Department of Planning, Industry and Environment’s Atlas of NSW Wildlife (BioNet) on 15 April 2020 did not report any previously identified threatened flora or fauna within the proposed modified activity area.</p> <p>Vegetation disturbance would be limited to the native and exotic grass cover to the north of the substation. This grassland, which is subject to agricultural grazing, is not anticipated to support habitat for any threatened flora or fauna or threatened ecological communities.</p>
Non-Aboriginal Heritage	<p>The proposed modified activity would not result in any changes or additional impacts on non-Aboriginal heritage to that outlined in the original REF.</p>
Traffic and Access	<p>The proposed modified activity would not result in any significant changes or additional impacts in relation to traffic and transport to that outlined in the original REF.</p> <p>The proposed modified activity would require the transport of the new power transformer to Yass substation using an over-mass transporter vehicle which would be subject to relevant permit requirements from Council and RMS. The existing site access road to the Yass substation is suitable to accommodate the over-mass transporter vehicle and no closures to public roads are anticipated. Subject to permit requirements, the delivery of the new equipment may occur during night time hours to minimise potential impacts on the surrounding road network.</p>
Air Quality and Climate Change	<p>The proposed modified activity would not result in any changes or additional air quality related impacts to that outlined in the original REF. Air quality related impacts would typically include minor dust emissions generated during excavation works and vehicle movements over exposed surfaces. There would also be minor exhaust emissions generated from construction plant and vehicles.</p>
Visual Amenity	<p>The proposed modified activity would not result in any significant changes or additional visual amenity related impacts. The additional three transmission structures and the new switchbay and transformer compound would be visually consistent with the surrounding high voltage infrastructure at Yass substation and the surrounding transmission lines.</p>

Environmental Issue	Changes to Impacts
Waste	Aside from the contaminated waste spoil and potential PFAS addressed in Section 5.2 and 5.3 impacted groundwater, potential waste streams generated by the proposed modified activity would be similar to those described in the original REF. No additional mitigation measures would be required.
Electric and Magnetic Fields (EMF)	<p>The addition of the new transformer may result in a localised alteration to EMF contours in the immediate vicinity of the equipment, but no increase at TransGrid's property boundary is expected. The level of EMF in the vicinity of the new transformer would be consistent with the rest of the existing substation. As the equipment is within a restricted access area, there would be no impact of raised EMF levels on the local community. The security system for the site, including substation fencing and closure of gates, would be maintained (as appropriate) throughout the construction work activity and the ongoing operation, to provide safety to the public.</p> <p>EMF levels associated with Transmission Line 99M would remain unchanged as part of the proposed modified activity.</p>
Social and Economic Considerations	Aside from potential minor construction noise and traffic related impacts described above, the proposed modified activity would not result in any significant changes or additional socio-economic related impacts. Social and economic benefits would arise due to the proposed modified activity enabling the connection of CWF.
Cumulative Impacts	The proposed modified activity would not result in any changes or additional cumulative impacts.

5.7 Summary of Impacts

The assessment of the proposed modified activity identified the following key environmental impacts:

- > Potential minor temporary disruptions on the road network during the delivery of the new transformer.
- > Potential to encounter PFAS contaminated groundwater during excavation works and installation of the additional transmission structures.
- > Potential to encounter heavy metal, hydrocarbon and polychlorinated biphenyls (PCBs) affected soil as part of the construction of the new switchbay and transformer compound.
- > Minor erosion and sedimentation from soil disturbance activities including structure installation and excavation works carried out within the substation for the new switchbay and transformer compound.
- > Minor and temporary elevated noise from construction activities.
- > Minor amounts of dust and emissions from vehicles, equipment and earthworks during construction.

Based on the impact assessment of the proposed modified activity, the nature and magnitude of the impacts are considered minor and can be appropriately managed with the implementation of the revised mitigation measures in Appendix A.

6. Mitigation Measures

A review of the mitigation measures in the Original REF and Submissions Report was undertaken and changes to these measures are required as a result of the proposed modified activity. Table 6-1 provides an overview of the changes to the mitigation measures. Text underlined in Table 6-1 shows amended mitigation measures or a new measure.

An updated consolidated list of mitigation measures is included in Appendix A of this document.

Table 6-1: Revised and Additional Mitigation Measures

Mitigation Measures	
Environmental Management and Incident Response	
HW4	If minor dewatering is required <u>outside the modified proposed activity area</u> , the management of discharge water shall be documented in the CEMP. Discharge water should be limited to vegetated, grassed areas, away from waterways, and within the transmission line easement. If the discharge water is highly turbid, dewatering through a filter sock (or similar) shall be considered, where appropriate, to minimise sedimentation.
HW5	<u>Any groundwater encountered as part of excavation and boring works within the modified proposed activity area must be pumped from the excavation and appropriately stored prior to being classified in accordance with the Waste Classification Guidelines (EPA, 2014). The collected groundwater would then need to be managed and disposed of in accordance with its waste classification.</u>

7. Consideration of Statutory Factors

7.1 Section 5.5 and 5A of the EP&A Act

Under Section 5.5 of the EP&A Act, the determining authority (being TransGrid), has a duty to consider all matters affecting or likely to affect the environment by reason of the proposed modified activity and the effects on any wilderness area. Table 7-1 provides a summary of how each of the factors has been considered for the proposed modified activity.

Table 7-1: Consideration of Section 5.5 of EP&A Act – Duty to Consider Environmental Impact

Factor	Comment
1 Examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of that activity.	All potential matters which have the potential to affect the environment as part of the proposed modified activity have been assessed in Section 5.
3 Without limiting subsection 1, consider the effect on any wilderness area (within the meaning of the <i>Wilderness Act 1987</i>) in the locality in which the activity is intended to be carried on.	The proposed activity would not affect any wilderness area.

7.2 Section 7.3 of the Biodiversity Conservation Act 2016

Under Section 7.3 of the *Biodiversity Conservation Act 2016*, the determining authority (being TransGrid) has a duty to take into account whether there is likely to be a significant effect on threatened species, or ecological communities, or their habitats or whether the activity is to be carried out in a declared area of outstanding biodiversity value.

The proposed modified activity is not likely to significantly affect threatened species, or ecological communities, or their habitats and would not be carried out in an area of declared outstanding biodiversity value.

7.3 Clause 228 of the EP&A Regulation

Clause 228(2) of the EP&A Regulation details those factors that must be taken into account when consideration is given to the likely impact of any activity on the environment, for the purposes of Part 5 of the EP&A Act. Table 7-2 provides a summary on how each of the Clause 228 factors has been considered for the proposed modified activity.

Table 7-2: Consideration of Clause 228 factors

Factor	Potential Impact
a. any impact on a community	Aside from potential minor construction noise and traffic related impacts, the proposed modified activity would not result in any significant changes or additional socio-economic related impacts.
b. any transformation of a locality	Approximately 0.5 hectares of additional land tenure may need to be acquired in the form of an easement to support the proposed modified activity. Impacts on agricultural grazing

Factor	Potential Impact
	are expected to be minor and grazing could continue to operate within the area to be acquired. As, such there would be no significant impact on the locality and surrounding area.
c. any environmental impact on the ecosystems of the locality	The proposed modified activity is not expected to impact any ecosystems of the locality.
d. any reduction of the aesthetic, recreational, scientific or other environmental quality	The proposed modified activity would not result in any changes or additional visual amenity related impacts.
e. any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations	The proposed modified activity is not expected to affect known Aboriginal or non-Aboriginal heritage.
f. any impact on the habitat of protected fauna (within the meaning of the <i>National Parks and Wildlife Act 1974</i>)	The proposed modified activity would not impact on the habitat of any protected animals
g. any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air	The proposed modified activity would not increase the risk of endangering any listed species or ecological community listed under either the BC Act or EPBC Act.
h. any long-term effects on the environment	The proposed modified activity is not expected to cause any long-term effects on the environment.
i. any degradation of the quality of the environment	The proposed modified activity has the potential to cause minor construction noise and surrounding residential receptors. Elevated noise would generally be limited to the standard hours of construction and would not represent a constant emission that would be experienced by the community on a daily basis throughout the project's schedule of works.
j. any risk to the safety of the environment	<p>The proposed modified activity would require hot works during construction, imposing potential fire safety risks. Furthermore, the handling of chemicals such as fuel and oil would be required for the operation and maintenance of plant and equipment.</p> <p>Providing hot works is carried out in accordance with relevant TransGrid procedures, impacts associated with bushfire can be effectively managed. Furthermore, any chemicals required for the proposed activity would be stored and handled in accordance with the mitigation measures in Appendix A to reduce any risk of contamination to the environment.</p>

Factor	Potential Impact
k. any reduction in the range of beneficial uses of the environment	The proposed modified activity may require approximately 0.5 hectares of additional land tenure in the form of an easement. Impacts on agricultural grazing are expected to be minor and grazing could continue to operate within the area to be acquired. As such, there is not expected to be any significant net long term loss of agricultural land.
l. any pollution of the environment	The proposed activity has the potential to encounter underlying PFAS contaminated groundwater and contaminated soil. Providing the mitigation measures in Appendix A are implemented, the risk of pollution to the surrounding environment can be effectively managed.
m. any environmental problems associated with the disposal of waste	Providing waste streams (including potentially PFAS affected groundwater and contaminated soil) is managed in accordance with the mitigation measures in Appendix A, no environmental problems from the disposal of waste are anticipated.
n. any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply	There would be no increase in demand on resources that are likely to become in short supply.
o. any cumulative environmental effect with other existing or likely future activities	The proposed activity would not contribute to any significant potential cumulative impacts when considered in conjunction with other existing or likely future activities.
p. any impact on coastal processes and coastal hazards, including those under projected climate change conditions	The proposed activity is not located within a coastal zone and therefore would not affect any coastal processes or coastal hazards.

7.4 Matters of National Environmental Significance (MNES) under EPBC Act

Under the EPBC Act, TransGrid is required to consider matters of national environmental significance (MNES) and impacts to Commonwealth land, to assist in determining whether the proposed activity should be referred to the Commonwealth Department of Agriculture, Water and the Environment. Table 7-3 provides a summary of how MNES have been considered for the proposed modified activity.

Table 7-3: Consideration of Matters of National Environmental Significance

MNES/Commonwealth Land	Potential Impact
Any impact on a World heritage property?	Nil. No change from the original REF and Submissions Report.
Any impact on a National heritage place?	Nil. No change from the original REF and Submissions Report.

MNES/Commonwealth Land	Potential Impact
Any impact on any wetlands of international importance?	Nil. No change from the original REF and Submissions Report.
Any impact on a Commonwealth listed threatened species or ecological communities?	Nil. No change from the original REF and Submissions Report.
Any impacts on a Commonwealth listed migratory species?	Nil. No change from the original REF and Submissions Report.
Any impact on a Commonwealth marine area?	Nil. No change from the original REF and Submissions Report.
Any impact on the Great Barrier Reef Marine Park?	Nil. No change from the original REF and Submissions Report.
Does the proposed activity involve a nuclear action (including uranium mines)?	Nil. No change from the original REF and Submissions Report.
Does the proposed activity involve a water resource, in relation to coal seam gas development and large coal mining development?	Nil. No change from the original REF and Submissions Report.

8. Conclusion

The *Coppabella Wind Farm - Rebuild of Transmission Line 99M* proposed modified activity has been assessed under Part 5 of the EP&A Act and this Addendum REF has been prepared in accordance with relevant legislation, including but not limited to Section 5.5 of the EP&A Act, Clause 228 of the EP&A Regulation and the Commonwealth EPBC Act. Actions to mitigate (prevent, minimise, or offset) potential and likely impacts have been prescribed in Appendix A. These measures shall be implemented in undertaking the activity.

This Addendum REF provides a true and fair review of the proposed modified activity in relation to its potential effects on the environment. It addresses, to the fullest extent possible, all matters affecting or likely to affect the environment as a result of the modified activity above and beyond the existing impacts assessed as part of the determined REF.

Considering the assessment of the impacts detailed in this Addendum REF, it is concluded that the activity **is not likely to have a significant impact on the environment**. Therefore, an Environmental Impact Statement under s. 5.7 (1) of the EP&A Act is not required, and Part 5.1 of the Act is not triggered.

In addition, it is concluded that the activity is not likely to significantly affect threatened species, populations, ecological communities or their habitats and is not to be carried out on land that is a declared area of outstanding biodiversity value, and therefore a Species Impact Statement is not required.

This conclusion has been based on the assessment undertaken within this Addendum REF.

Supplementary assessment and determination in accordance with the EP&A Act would be required for:

- (a) works outside of the scope of work assessed in the original REF and this Addendum REF for which the environmental impact has not been considered; or
- (b) modifications to the activity scope, methodology or recommended mitigation measures, that alter the environmental impact assessed in the original REF and this Addendum REF.

9. References

Environment Protection Authority (2014) *Waste Classification Guidelines*.

Environment Protection Authority (2017) *Noise Policy for Industry*. October 2017.

ERM (2020). *Yass 330kV Substation Noise Impact Assessment*. Report prepared for TransGrid, June, 2020.

Jacobs (2017). *Contaminated Site Investigation - Yass Depot*. Report prepared for TransGrid, November 2017.

Jacobs (2020). *PFAS Investigation - Yass Substation*. Report prepared for TransGrid, April 2020.

NSW Department of Environment and Climate Change (DECC) (2009). *NSW Interim Construction Noise Guideline* (ICNG, 2009), July 2009

IPART (2015). *NSW Code of Practice for Authorised Network Operators*, September 2015.

NSW Department of Environment, Climate Change and Water (DECCW) (2010). *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales*, September 2010.

Appendix A Revised Mitigation Measures

Mitigation Measures	
Environmental Management and Incident Response	
EM1	A Construction Environmental Management Plan (CEMP) shall be prepared and submitted by the Contractor to Environment – HSE/ TransGrid for review and endorsement four weeks prior to the commencement of works, including site establishment. The CEMP shall be prepared in accordance with TransGrid’s procedure <i>Preparation of a Construction Environmental Management Plan</i> .
EM2	All works shall be undertaken in accordance with the TransGrid Environmental Handbook.
EM3	All workers shall be inducted onto the Environmental Management Plan, site environmental conditions and sensitivities identified in this REF and receive training as appropriate. All workers shall receive Aboriginal heritage awareness training. Records shall be kept of this induction and training.
EM4	An Environmental Supervisor shall be included as part of the construction staff to oversee implementation of the Environmental Management Plan and to ensure that all mitigation measures are being effectively applied. In addition to the Contractors Environmental Supervisor, TransGrid shall appoint an Environmental Inspector to regularly check that the work is being carried out in compliance with all environmental approval and legislative conditions.
EM5	The following additional environmental approvals/licences/permits are required for the activity: <ul style="list-style-type: none"> > A Section 138 permit and Road Occupancy Licence shall be obtained from Roads and Maritime Services (RMS) prior to carrying out works in, on or over Hume Highway which is a classified road. > A permit is required to be obtained from NSW Department of Primary Industries-Fisheries (DPI-Fisheries) for the proposed watercourse crossing works at: <ul style="list-style-type: none"> - Booroo Creek (1st order watercourse) between Structures 8-9. - Booroo Creek (4th order watercourse) between Structures 9-10. - Illalong River (4th order watercourse) to access Structure 99 and 100. - Balgala Creek (3rd order watercourse) between Structures 122 and 123. - Bobbara Creek (5th order) to access Structure 143 from Coppabella Road. > Controlled Activity Approval to be sought from NSW Department of Primary Industries-Water prior to carrying out works at same locations listed above. > Aboriginal Heritage Impact Permit for works at Structures 11 and 12 on Line 99M.
EM6	All environmental incidents and near misses shall be reported to TransGrid. All pollution incidents that threatens or harms the environment shall be reported immediately to relevant authorities, in accordance with the <i>Protection of the Environment Operations Act 1997</i> (POEO Act).
EM7	Environmental spill kits containing spill response materials suitable for the works being undertaken shall be kept on site at all times and be used in the event of a spill. Any spills shall be contained, cleaned up promptly and immediately reported to the TransGrid site representative.
EM8	All chemicals or other hazardous substances shall be stored in a bunded area and away from any drainage lines/pits. The capacity of the bunded area shall be at least 130% of the largest chemical

Mitigation Measures

	volume contained within the bunded area. The location of the bunded enclosure/s shall be shown on the Site Plans.
EM9	Any environmentally sensitive areas shall be clearly delineated and shown on Site Plans and identified on site.
EM10	A REF Close Out Report shall be prepared at the conclusion of the construction of the proposed activity to document how and whether the conditions and measures were observed, and the nature of and reasons for any non-compliance.

Land Use

LU1	Ongoing consultation shall occur with all affected landholders prior to and during construction to allow the planning of activities on their land which may conflict with the construction works. Landholder requirements shall be discussed on an individual basis.
LU2	On completion of the work disturbed areas shall be stabilised, and returned to as close to original condition or as otherwise agreed with the landholder. TransGrid is to undertake any repair works of access tracks and watercourses which have been damaged during construction in consultation with the landholder.

Geology and Soils

GS1	An Erosion and Sediment Control Plan (ESCP) shall be prepared as part of the CEMP. All erosion and sediment control measures shall be designed, implemented and maintained in accordance with relevant sections of “ <i>Managing Urban Stormwater: Soil and Construction Volume 1</i> ” (Landcom, 2004) (‘the Blue Book’) (particularly Section 2.2) and “ <i>Managing Urban Stormwater: Soil and Construction Volume 2A – Installation of Services</i> ” (DECC, 2008a)”. The ESCP shall include stockpiles, stormwater run-off, trees, site boundaries, site access and storage areas. Exposed surfaces shall be kept to a minimum to limit the potential for erosion. Erosion and sediment controls shall remain in place and be monitored and maintained until such time the site has been stabilised.
GS2	Any imported fill shall be certified at source location (e.g. Quarrymaster or property owner) as pathogen and weed free Excavated Natural Material (ENM) or Virgin Excavated Natural Material (VENM) in accordance with the <i>Protection of the Environment Operations Act 1997</i> (POEO Act) and the <i>Protection of the Environment (Waste) Regulation 2014</i> (POEO Waste Regulation).
GS3	Any material or soil suspected of showing evidence of contamination shall be sampled and analysed by a NATA Registered laboratory and managed in accordance with the <i>Waste Classification Guidelines</i> (EPA, 2014), <i>the Guidelines on the Duty to Report Contamination</i> (EPA, 2015) and the <i>Contaminated Land Management Act 1997</i> .
GS4	Access tracks off public roads shall not be used in wet weather conditions where there is a risk of damage to the tracks which could cause soil erosion and sediment control issues.

Hydrology and Water Quality

HW1	Spoil shall be stockpiled in a manner so as to avoid the possibility of sediments entering watercourses (including stormwater drains) or migrating off-site.
HW2	Any bulk fuel or hazardous material transport vehicles shall be parked on level ground a minimum of 40 m away from watercourses (including drainage line). No refuelling or bulk herbicide preparation shall occur within 40 metres of a watercourse.
HW3	Watercourse crossings shall be constructed in accordance with the <i>Fisheries Management Act 1994</i> , <i>Policy and guidelines for fish habitat conservation and management 2013</i> , <i>Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings</i> (Fairfull and Witheridge,

Mitigation Measures

	2003), <i>Controlled Activity Guidelines</i> under the <i>Water Management Act 2000</i> (WM Act) and the DPI - <i>Water's Guidelines for watercourse crossings on waterfront land</i> .
HW4	If minor dewatering is required outside the modified proposed activity area, the management of discharge water shall be documented in the CEMP. Discharge water should be limited to vegetated, grassed areas, away from waterways, and within the transmission line easement. If the discharge water is highly turbid, dewatering through a filter sock (or similar) shall be considered, where appropriate, to minimise sedimentation.
HW5	Any groundwater encountered as part of excavation and boring works within the modified proposed activity area must be pumped from the excavation and appropriately stored prior to being classified in accordance with the <i>Waste Classification Guidelines</i> (EPA, 2014). The collected groundwater would then need to be managed and disposed of in accordance with its waste classification.

Ecology

EC1	Ground disturbance (including vehicle movements) and vegetation clearing shall not occur within any of the mapped areas containing White Box Yellow Box Blakely's Red Gum Woodland EECs and Derived grassland of the NSW South Western Slopes (refer to Figure 6-2 and Figure 6-3 of the REF).
EC2	Weed control mitigation and management strategies shall be documented and implemented in accordance with the CEMP. All herbicide selection and use shall be in accordance with TransGrid requirements.
EC3	Ground disturbance works and plant traversing the site shall avoid Wombat (<i>Vombatus ursinus</i>) burrows identified near Structures 10, 11 and 13 and any other burrows which may occur within the study area.
EC4	Any fallen timber, dead wood and bush rock (if present) encountered on site shall be left in situ or relocated to a suitable place nearby.
EC5	Consultation with DPI Fisheries would be carried out as part of the design of all watercourse crossings upgrade and construction works to ensure the designs meet relevant requirements and to confirm if a Part 7 Permit is required.
EC6	Consultation with the landholder would be carried out prior to any undertaking any clearing of planted vegetation along the following Spans 19-20, 21-23, 27-28, 30-31, 62A-63, 88-89, 96-98 and 114-115.
EC7	Any disturbed riparian areas would be remediated with native endemic vegetation as appropriate.
EC8	Consultation with each landholder shall occur prior to the commencement of construction to understand any biosecurity risks specific to their land. Any properties with an on-farm biosecurity plan shall be complied with and specific measures incorporated in the CEMP.

Heritage

HE1	AHIMS 51-4-0392 (Yass River-OS1) - To manage the unavoidable impact to the site, an Aboriginal Heritage Impact Permit (AHIP) pursuant to Section 90 of the <i>National Parks and Wildlife Act 1997</i> shall be sought from the NSW Office of Environment and Heritage prior to any works occurring at Structure 11 and 12. Once obtained, all works at these locations must comply with the conditions outlined in the AHIP.
HE2	To protect AHIMS 50-5-0027 (Booroo Ponds 1) and the associated sensitive terrace landform the following measures shall be implemented:

Mitigation Measures

	<ul style="list-style-type: none"> > No ground disturbance associated with improving access through the gate on the existing access track to structure 10 shall occur north of GDA Zone 55 672249E; 6142442N as shown in Figure 6-7. > Works in the area should take place in dry weather to minimise ground churning. > All ground disturbance works within the terrace landform (area west of the fence line) must be kept to a strict minimum > As much as possible, the depression in the terrace (former erosion) should be utilised as the location of the access track/earth works as shown in Figure 6-7.
HE3	<p>In the event that a site or artefact (as defined by the <i>National Parks and Wildlife Act 1974</i> or <i>Heritage Act 1977</i>) is identified during construction works, works shall cease at the location and no further harm to the object shall occur. The find shall be immediately reported to TransGrid, and the regulator in accordance with legislation. No work shall commence in the vicinity of the find until any required approvals have been given by the regulator. In the event that skeletal remains are encountered during the activity, works must stop immediately, the area secured to prevent unauthorised access and NSW Police, OEH and TransGrid contacted.</p>

Noise and Vibration

NV1	<p>Noise generating works shall be in accordance with the <i>Interim Construction Noise Guideline</i> (DECC, 2009):</p> <ul style="list-style-type: none"> > 7:00am – 6:00pm Monday to Friday. > 8:00am – 1:00pm Saturdays. > No work on Sundays or Public Holidays. <p>Work outside normal hours, on Sundays and public holidays shall only comprise:</p> <ul style="list-style-type: none"> > The delivery of materials outside normal hours requested by police or other authorities for safety reasons. > Emergency work to avoid the loss of lives and/or property. > Work timed to correlate with system planning outages. <p>Other noise generating works outside of the standard construction hours shall require the prior formal written consent of Environment - HSE/TransGrid and require justification in accordance with the Guideline.</p>
NV2	<p>Noise affected neighbouring properties shall be notified as to the timing and duration of the construction works at least 7 days prior to commencing work. The notification shall provide details on who to contact should they have any issues or require further information. Noise affected properties in Yass include:</p> <ul style="list-style-type: none"> > Yeo Crescent – Numbers 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, 59, 61, 63 > Merriman Drive – Numbers 67, 69, 70 > Victoria Street – Numbers 3, 11/9, 10/9, 9/9, 8/9, 7/9, 6/9, 5/9, 4/9, 3/9, 2/9, 1/9, 11, 13, 15, 19, 21, 25, 27, 31, 33, 35, 37, 45, 47, 49, 51, 53 > Cobham Street – Numbers 49, 51, 53, 55, 57, 59, 61, 54, 58, 74, 62, 60 > Perry Street- Numbers 1A, 1B, 1C, 1, 3, 5, 7, 9, 11, 13, 15, 19, 21, 23, 25, 27, 29, 31, 33, 30, 26, 24, 18, 16, 14, 12, 10 > Grand Junction Road. Number 114

Traffic and Access

Mitigation Measures

TA1	Transportation and equipment delivery movements on public roads shall be in accordance with RMS and Council requirements.
TA2	Access track works shall be constructed in accordance with the <i>Soils and Construction Volume 2C Unsealed Roads (DECC, 2008)</i> .
TA3	Traffic, transportation and access mitigation and management strategies shall be documented and implemented in accordance with the CEMP and updated as required. This shall include: <ul style="list-style-type: none"> > The management of the delivery of equipment and materials. > Access to and from the site including nominated roads and site access tracks should be undertaken in consultation with the landholder. > Traffic management to be implemented for conductor, OPGW and earth wire road crossings > Parking. > Speed limits. > Road occupancy licence conditions.

Air Quality and Climate Change

AQ1	If necessary, dust suppression techniques shall be implemented, and incorporated into the Environmental Management Plan, as per the techniques outlined in the “Blue Book”, such as water spraying of surfaces, covering stockpiles and covering surplus soils and materials during transportation.
AQ2	Air quality mitigation and management strategies shall be documented and implemented in accordance with the CEMP. This shall include: <ul style="list-style-type: none"> > Reducing vehicle speeds when in the vicinity of residences to minimise the generation of nuisance dust. > Progressively revegetating or otherwise rehabilitating disturbed areas as works are completed.

Visual Amenity

VA1	All construction plant, equipment, waste and excess materials shall be contained within the designated boundaries of the work site and shall be removed from the site following the completion of construction.
VA2	TransGrid shall undertake further direct consultation with each landholder to identify opportunities to further minimise impacts on visual amenity.

Waste

WA1	Waste mitigation and management strategies shall be documented in the Construction Environmental Management Plan, and be in accordance with TransGrid Waste Procedures and associated Work Instructions.
WA2	All waste, including surplus soils, which cannot be reused shall be classified in accordance with the <i>Waste Classification Guidelines (EPA, 2014)</i> , removed from the site and disposed of at a facility that can lawfully accept the waste in accordance with the POEO Act and POEO Waste Regulation.
WA3	Concrete trucks shall be permitted to flick wet wipe their discharge chutes with the effluent discharged into prepared bored holes, prepared excavations/formwork or a watertight receptacle for recycling or disposal. No concrete washout or agitators is permitted.
WA4	Wooden poles, including pole butts, shall be disposed of in accordance with the TransGrid document – Waste Management of Timber Poles or gifted to landholders in accordance with the OEH's ‘ <i>Protocols for recycling redundant utility poles and bridge timbers in New South Wales</i> ’ (2011) and

Mitigation Measures

TransGrid requirements. If gifted, TransGrid shall provide the landholder information on what the pole is treated with, how to appropriately handle treated timber, and what it can and cannot be used for.

Electric and Magnetic Fields

EF1 All designs shall be in accordance with the International Commission on Non-Ionizing Radiation Protection (ICNIRP) Guidelines for limiting exposure to EMF (ARPANSA 2010).

Social and Economic Considerations

No Additional Mitigation Measures

Bushfire

BF1 All works shall be undertaken in accordance with TransGrid's Hot Works and Fire Risk Work Procedure.

BF2 Fuels and other hazardous materials shall be stored to minimise potential impacts on bushfires.

Cumulative Impacts

No Additional Mitigation Measures

Appendix B Noise Impact Assessment



TransGrid

Yass 330kV Substation

Noise Impact Assessment Report

12 June 2020

Project No.: 0510554

Document Details	
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Document subtitle	Noise Impact Assessment Report
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Date	12 June 2020
Version	01
Author/s	Steven De Luzuriaga (SD)
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Signature Page

12 June 2020

Yass 330kV Substation

Noise Impact Assessment Report

Approved - Unsecure Version

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EXECUTIVE SUMMARY

TransGrid is proposing to install a new 132/330 kV transformer and associated auxiliary transformer at the existing 330kV Yass Substation (the substation) to facilitate the connection of the Coppabella Wind Farm. The substation is located at Yass, in the Southern Tablelands of New South Wales (NSW). At the time this report was prepared, the substation consisted of nine potential noise generating assets:

- three primary transformers (TX), and two auxiliary transformers;
- three reactors, and
- one capacitor bank.

The proposed activity involves the following scope of works:

- Construction of a new switch bay and transformer compound on an approximate 8,500 m² area on the former switchyard bench, located to the immediate east of the existing Yass switchyard;
- Construction of new footings and supports for the new high voltage equipment associated with the new switchbay;
- Installation of a new 132/330 kV transformer (TX) and auxiliary transformer (AUX) within the new compound;
- Connection of the new transformer compound and switchbay to the existing spill oil and stormwater drainage network;
- Installation of new secondary systems for the control and protection of the new equipment including new outdoor panels and associated footings and supports as required within the switchyard;
- Installation of cables within new cable conduits / trenches within the switchyard as required to complete the necessary connections;
- Overhead crossing of existing transmission lines external to the Yass substation boundary to facilitate the entry of the rebuilt double circuit lines into their respective switchbays; and
- Undergrounding of a section of an existing transmission line within the Yass substation site boundary.

Environmental Resources Management Australia Pty Ltd (ERM) has been engaged by TransGrid to conduct an assessment of construction noise impacts and future potential operational noise impacts (if any) associated with the project and proposed installation of new equipment. Whilst construction is rigorously addressed, the assessment of future potential operational noise impacts is the focus of this report.

Assessment Overview

The assessment was conducted to identify receptors situated in the potential area of influence of site emission sources and significant noise generating plant, equipment and/or activities associated with the project and their likely/known emissions.

The two key noise policy and guidelines adopted for this assessment were:

- NSW Department of Environment and Climate Change (DECC) – NSW Interim Construction Noise Guideline (ICNG, 2009), July 2009; and
- NSW Environment Protection Authority – Noise Policy for Industry (NPI, 2017), October 2017.

A summary of the project has been provided in **Section 1** whilst the overall assessment methodology is presented in **Section 2** of this report. Existing background noise levels of the area were established using the base levels defined in NPI, 2017, as documented in **Section 3** of this report.

Noise assessment criteria were then developed with due regard to these background noise levels and in accordance with current recognised NSW standards and guidelines applicable to the projects proposed construction and operational activities, refer **Section 4** of this report.

Applicable construction and operational assessment scenarios were developed based on project information provided by TransGrid. Noise levels were predicted, and compared to Noise Management Levels (NML) and criteria to establish compliance, evaluate potential impacts and establish potential

mitigation/management measures where necessary to reduce levels and minimise impacts. The construction and operational noise assessments are presented in **Section 5** and **Section 6** of this report.

Outcomes

The construction noise assessment identified that predicted levels for all construction scenarios have the potential to exceed NML, especially during evening (6PM to 10PM) and night-time (10PM to 7AM Monday to Friday, and to 8AM Sundays/public holidays).

The magnitude and extent of potential impacts associated with these elevated noise levels is best described as low during the daytime and moderate to high during the evening/night-time. They are however as anticipated for the construction works and activities required and the distance offsets to nearby receptors. They are consistent with noise emissions generated by other construction works conducted regularly in NSW by others.

It is therefore recommended that TransGrid implement its normal construction management practices and aim to avoid any particularly noisy works during the evening and night-time. Very noisy works should be limited to the ICNG, 2009 recommended standard hours (i.e. 7 AM to 6 PM Monday to Friday, and 8 AM to 1 PM Saturdays, with no work on Sundays or public holidays, where feasible, reasonable and safe to do so).

It is understood that works outside the ICNG, 2009 recommended standard hours is not proposed for this project, however some works may be unavoidable with essential tasks being timed to correlate with system planning outages. A consolidated set of recommended construction noise reducing mitigation and management measures are outlined in **Section 7.1** of this report.

The operational noise assessment identified that all predicted L_{eq} , 15 minute noise levels for existing and proposed operations are at or below the Project Noise Trigger Level (PNTL) at all the identified receptors. The substation is compliant with NPI, 2017 requirements for all assessment periods. As such no additional recommendations for noise reducing mitigation or management measures are warranted to those already implemented into the project design.

As operational compliance has been achieved with the assumption that the proposed new primary transformer would achieve a sound power level of 100.8 dBA and the associated auxiliary transformer would achieve a sound power level of 74 dBA, the safeguards and provisions are provided as outlined in **Section 7.2** of this report, and reproduced below:

- During equipment procurement, ensure that the new primary transformer and auxiliary transformer achieve the operational sound power levels of 100.8 dBA and 74 dBA or better. Based on discussions with TransGrid and the authors of this report, this value can be achieved and TransGrid are committed to doing so as far as is currently considered feasible, reasonable and safe.
- All formal / reoccurring operational noise complaints should be investigated and where necessary operator attended noise validation, and compliance measurements should be undertaken to measure and compare the site noise level contributions to a) the predicted values; and b) the PNTLs presented in this report:
 - All site noise levels should be measured in the absence of any influential source not associated with the project;
 - If the measured site noise levels are below the predicted values and comply with the PNTLs presented in this report, no further mitigation or management measures are required; and
 - If the measured site noise levels are above the predicted noise levels or PNTLs presented in this report, further mitigation and/or management measures should be considered.

Based on the outcomes of this assessment the potential for noise impacts to nearby receptors is minimal, and these impacts (if any) would be low. The recommendations provided in this report will assist reduce project noise emissions, where necessary, to compliant levels and to minimise residual impacts as far as may be feasible, reasonable and safe to do so.

1. INTRODUCTION

TransGrid operates and manages high voltage transmission networks across New South Wales (NSW), the Australian Capital Territory (ACT) and other areas of the National Electricity Market (NEM). This network includes the existing 330kV Yass Substation (the substation) located at Yass, in the Southern Tablelands of New South Wales (NSW). At the time this report was prepared, the substation consisted of nine potential noise generating assets:

- three primary transformers (TX), and two auxiliary transformers;
- three reactors, and
- one capacitor bank.

TransGrid is proposing to install a new 132/330 kV transformer and associated auxiliary transformer at the existing the substation to facilitate the connection of the Coppabella Wind Farm into the Substation. The proposed activity involves the following scope of works:

- Construction of a new switch bay and transformer compound on an approximate 8,500 m² area on the former switchyard bench, located to the immediate east of the existing Yass switchyard;
- Construction of new footings and supports for the new high voltage equipment associated with the new switchbay;
- Installation of a new 132/330 kV transformer (TX) and auxiliary transformer (AUX) within the new compound;
- Connection of the new transformer compound and switchbay to the existing spill oil and stormwater drainage network;
- Installation of new secondary systems for the control and protection of the new equipment including new outdoor panels and associated footings and supports as required within the switchyard;
- Installation of cables within new cable conduits / trenches within the switchyard as required to complete the necessary connections;
- Overhead crossing of existing transmission lines external to the Yass substation boundary to facilitate the entry of the rebuilt double circuit lines into their respective switchbays; and
- Undergrounding of a section of an existing transmission line within the Yass substation site boundary.

Environmental Resources Management Australia Pty Ltd (ERM) has been engaged by TransGrid to conduct an assessment of construction noise impacts and future potential operational noise impacts (if any) associated with the project and proposed installation of new equipment. Whilst construction is rigorously addressed, the assessment of future potential operational noise impacts is the focus of this report.

This report presents the methodology, results and findings of the construction and operational noise impact assessment completed for the substation. Further information regarding the proposed project is provided in **Section 1.1** and **1.2** below.

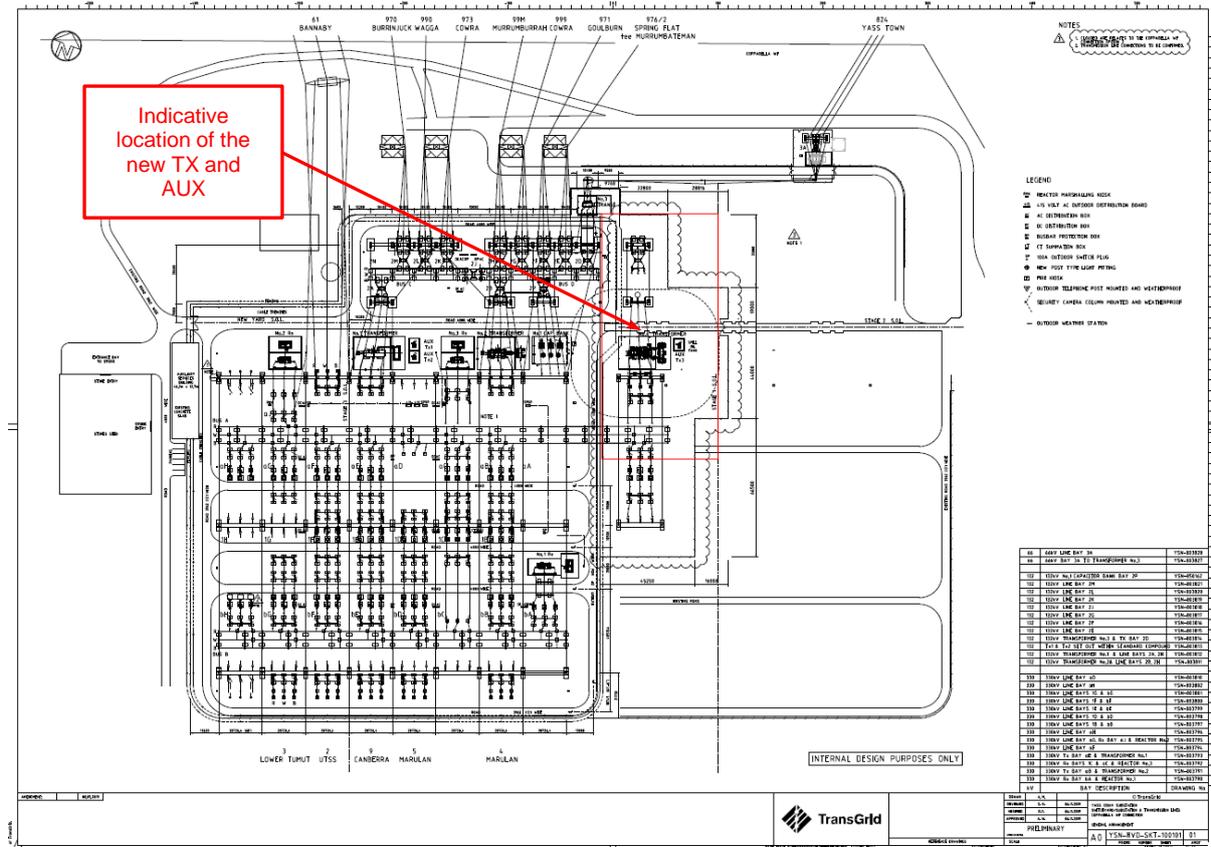
1.1 Background

Nuisance, or an unacceptable level of noise amenity, may arise from operational activities associated with new or existing TransGrid sites (i.e. substations). The potential for noise issues to arise is associated with emissions from significant noise generating sources/assets such as capacitor banks and reactors as well as primary transformers, Static Var Compensators (SVC) and synchronous condensers.

In this case, the ancillary infrastructure, secondary systems, substation bench, protection/control equipment, switch bays, disconnectors, circuit breaker and bus-bar are not significant noise generating features. As stated above the substation redevelopment would include the installation of a new 132/330 kV transformer and associated auxiliary transformer and this is the focus for noise assessment.

The existing substation and proposed location of the new transformers are presented in **Figure 1.1**.

Figure 1.1 Indicative Yass Substation Equipment Installation



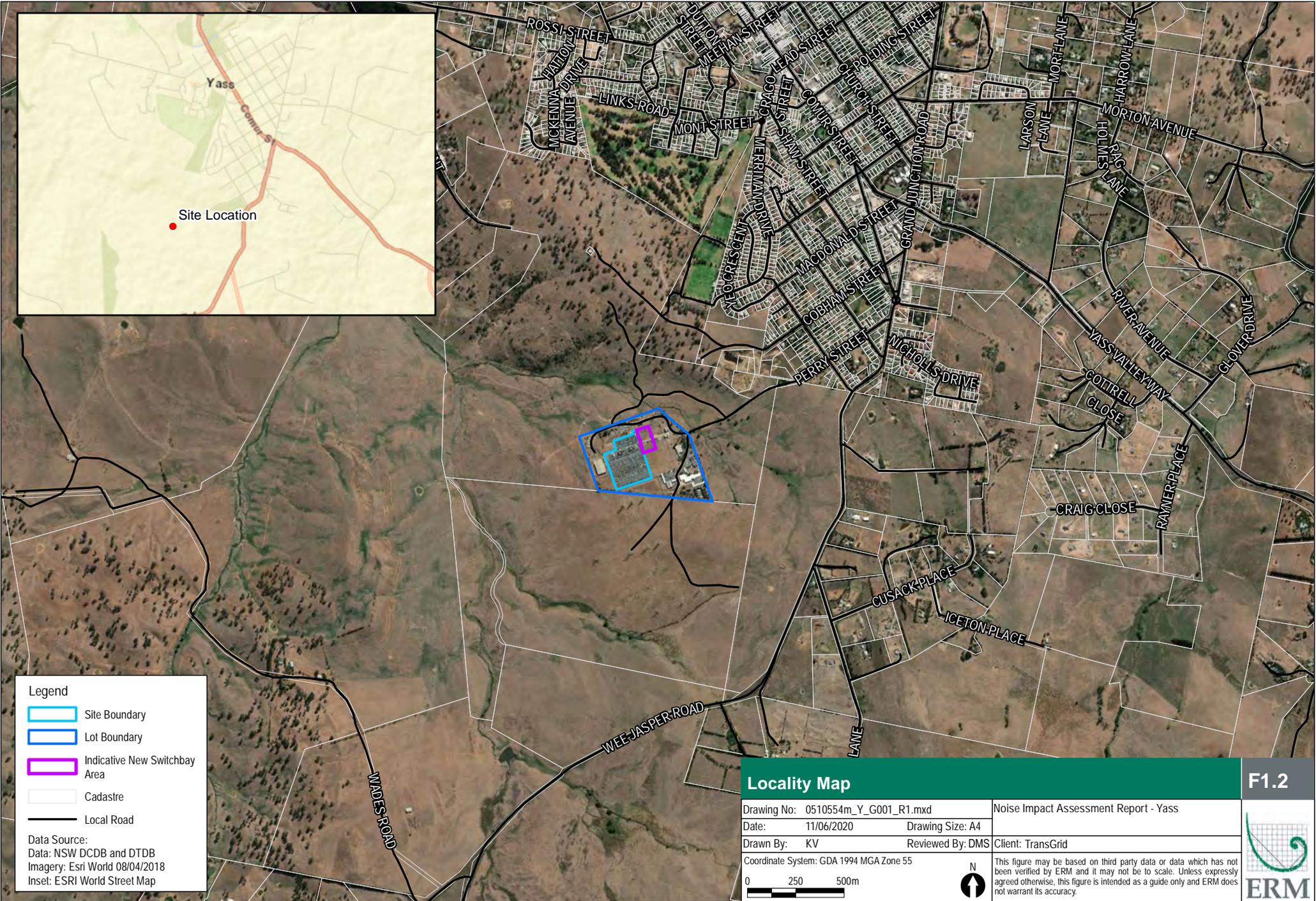
Source: TransGrid, April 2020

1.2 Site Description

The Yass substation site is located off Perry Street, Yass in NSW. It is approximately 2 kilometres south-west of the centre of Yass. Perry Street is a local road that turns off Grand Junction Road. Grand Junction Road is a major road that turns into Wee Jasper Road, leaving Yass to the south.

The substation operational site, and broader TransGrid lot boundary is zoned as Infrastructure (SP2). The TransGrid lot is surrounded by E4 (Environmental Living) lands. More broadly there is a mixture of lands uses for areas zoned for infrastructure, public recreation, general residential and large lot residential.

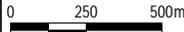
The substation site, the surrounding area and other items of importance to this assessment are identified in **Figure 1.2** to **Figure 1.4** below.

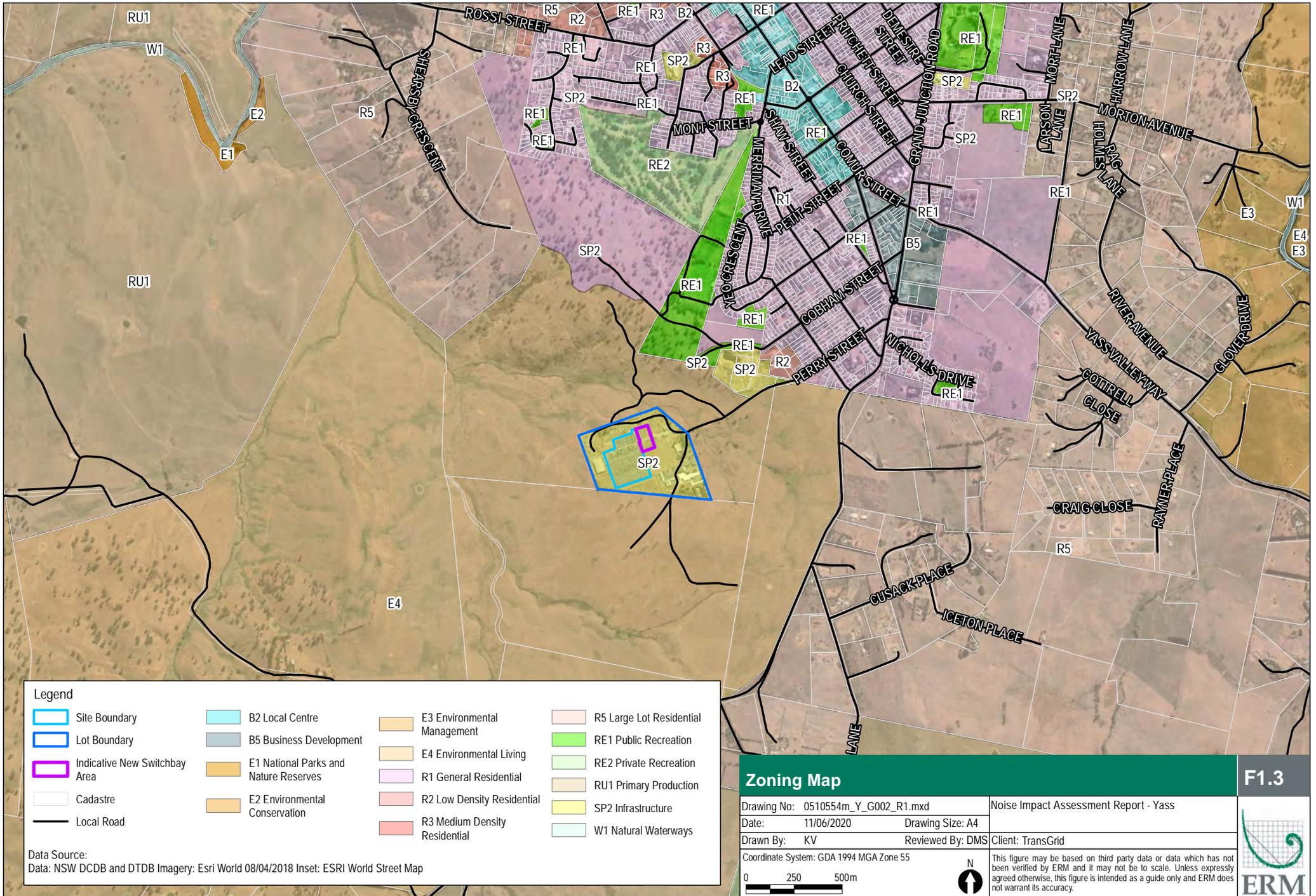


Legend

-  Site Boundary
-  Lot Boundary
-  Indicative New Switchbay Area
-  Cadastre
-  Local Road

Data Source:
 Data: NSW DCDB and DTDB
 Imagery: Esri World 08/04/2018
 Inset: ESRI World Street Map

Locality Map		F1.2
Drawing No: 0510554m_Y_G001_R1.mxd	Noise Impact Assessment Report - Yass	
Date: 11/06/2020	Drawing Size: A4	
Drawn By: KV	Reviewed By: DMS	Client: TransGrid
Coordinate System: GDA 1994 MGA Zone 55		
		 <p>This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.</p>

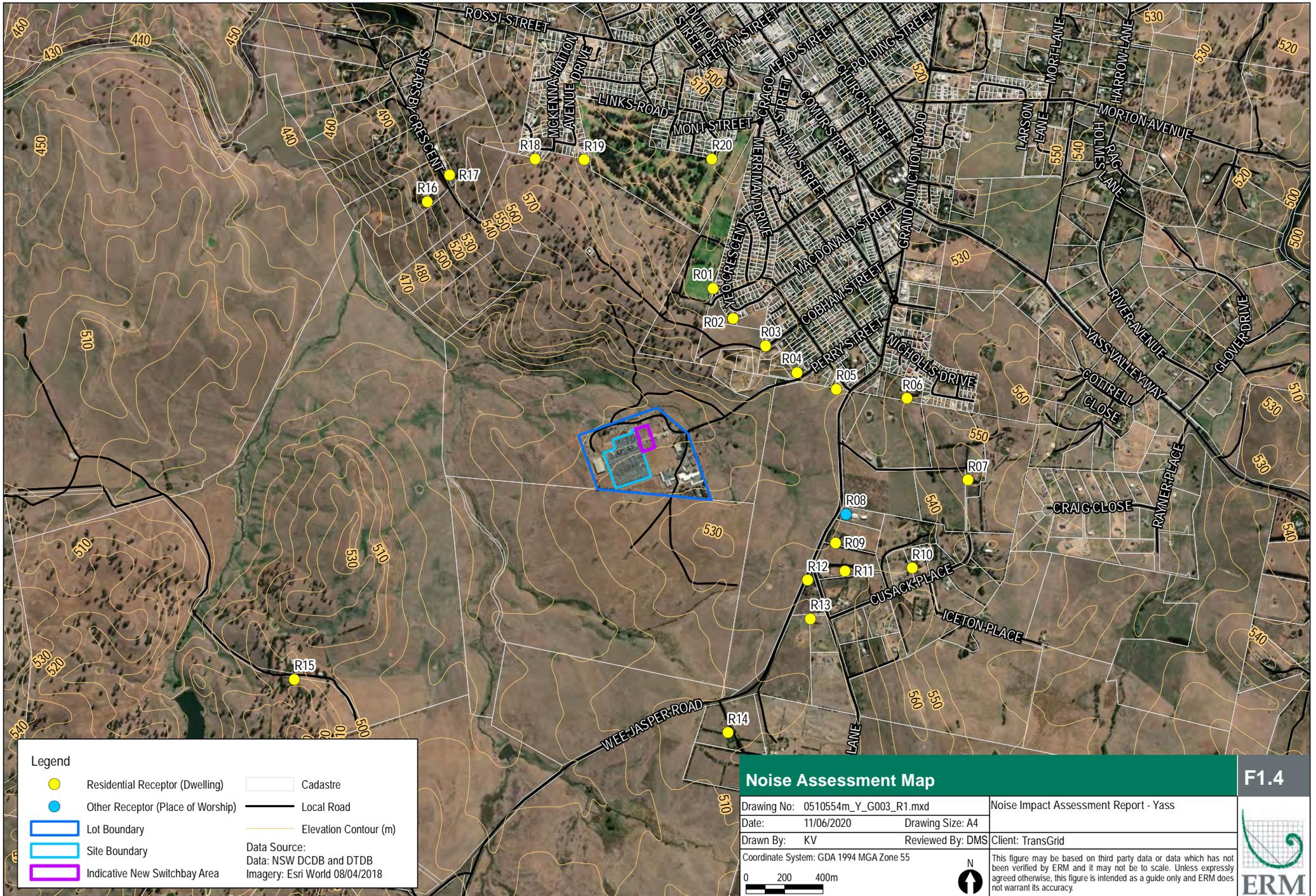


Legend

Site Boundary	B2 Local Centre	E3 Environmental Management	R5 Large Lot Residential
Lot Boundary	B5 Business Development	E4 Environmental Living	RE1 Public Recreation
Indicative New Switchbay Area	E1 National Parks and Nature Reserves	R1 General Residential	RE2 Private Recreation
Cadastre	E2 Environmental Conservation	R2 Low Density Residential	RU1 Primary Production
Local Road		R3 Medium Density Residential	SP2 Infrastructure
			W1 Natural Waterways

Data Source:
Data: NSW DCDB and DTDB Imagery: Esri World 08/04/2018 Inset: ESRI World Street Map

Zoning Map		F1.3
Drawing No: 0510554m_Y_G002_R1.mxd	Noise Impact Assessment Report - Yass	
Date: 11/06/2020	Drawing Size: A4	
Drawn By: KV	Reviewed By: DMS	Client: TransGrid
Coordinate System: GDA 1994 MGA Zone 55		
<p>This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.</p>		



2. ASSESSMENT METHODOLOGY

This section describes the assessment methodology adopted to assess potential construction and operational noise impacts at the closest and/or potentially most affected sensitive receptors situated in the vicinity of the project.

A glossary of relevant acoustical concepts and terminology is provided in **Appendix A**.

All sound pressure levels presented in this report (e.g. noise levels predicted at a receptor) are in decibels referenced to 2×10^{-5} Pa. All sound power levels presented in this report (e.g. noise levels assigned to specific sources) are decibels referenced to 10^{-12} W.

2.1 Scope of Work

To assess project construction and operational noise, the following scope of work was undertaken for this assessment:

- Review and validate the available project and third-party data and information as considered relevant to the assessment;
- Review aerial photography, zoning data, cadastre data and third-party project data to identify existing and potential future residential (dwelling) and other sensitive (e.g. industrial) receptors situated within the area of influence of the site (**Section 3**);
- Develop project-specific noise criteria by which potential impacts would be assessed (**Section 4**);
- Identify significant noise generating plant, equipment and machinery that may be in use or activities that would be undertaken as part of the project and their source emission level to develop applicable assessment scenarios (**Section 5** and **Section 6**);
- Develop a project-specific noise model to predict project construction, and operational levels for each of the assessment scenarios developed. Following this, predicted levels were compared to project-specific criteria to identify any noise levels that exceed criteria and determine the magnitude and extent of any impacts (**Section 5** and **Section 6**); and
- Recommend noise reducing mitigation and management measures and/or provisions for monitoring suitable to the predicted levels and anticipated impacts. These measures are designed to reduce project noise emissions to compliant levels and to minimise impacts as far as may be feasible, reasonable and safe to implement (refer **Section 7**).

2.2 Policy Setting

In NSW, noise pollution is regulated through the *Protection of the Environment Operations Act 1997* (POEO Act) as the critical piece of environmental protection legislation. Noise pollution is defined under the POEO Act as:

'the emission of offensive noise, which means noise that by reason of its level, nature, character or quality, or the time at which it is made, or any other circumstances, is harmful (or is likely to be harmful) to or interferes unreasonably (or is likely to interfere unreasonably) with the comfort or repose of a person outside the premises from which the noise is emitted.'

Under the POEO Act, the '*POEO (Noise Control) Regulation 2008*' addresses common noisy activities that occur in residential situations; it limits the time of day that noisy articles (such as lawn mowers, stereos and leaf blowers) are permitted to be heard in neighbouring residences; however it does not specify noise limits and an applicable approach for the assessment of existing sites.

Various noise assessment guidelines endorsed by NSW consent and regulatory authorities provide a guideline framework and methodology for deriving acceptable levels and standard methods for assessing and measuring construction and operational impacts with due regard to the POEO Act. The guidelines and standards are discussed in **Section 2.3**.

2.3 Relevant Policy, Guidelines and Standards

This assessment will be conducted with due regard to and in accordance with the following policy, guidelines and standards:

- International Organisation for Standardisation (ISO) 9613 Part 2 - 1996 (ISO 9613:2, 1996) - *Acoustics - Attenuation of Sound during Propagation Outdoors - Part 2: General Method of Calculation*;
- International Organisation for Standardisation (ISO) 17534 - 2015 (ISO 17534, 2015) – *Acoustics - Software for the Calculation of Sound Outdoors*, as achieved by the modelling software referenced in this report;
- NSW Department of Environment and Climate Change (DECC) – *NSW Interim Construction Noise Guideline* (ICNG, 2009), July 2009;
- NSW Environment Protection Authority – *Noise Policy for Industry* (NPI, 2017), October 2017; and
- Standards Australia AS 2436 - 2010 (AS 2436, 2010) – *Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites*.

Further information regarding the application of the relevant noise policy and guideline is provided in **Section 2.3.1** and **2.3.2**.

2.3.1 NSW Interim Construction Noise Guideline

For this project the ICNG, 2009 is the suitable guideline document to quantifiably assess potential noise emissions and impacts associated with project construction. The ICNG, 2009 assessment methodology is detailed in **Appendix B** of this report.

The ICNG, 2009 has been adopted to develop the project-specific construction noise management levels, assess potential impacts and recommend (in conjunction with current good construction management practices) any noise reducing mitigation and management measures, and/or provisions for monitoring suitable to the predicted levels and anticipated impacts.

2.3.2 NSW Noise Policy for Industry

For this project the NPI, 2017 is the suitable policy document to quantifiably assess potential noise emissions and impacts associated with the project's operation. The NPI, 2017 assessment methodology is detailed in **Appendix B** of this report.

The NPI, 2017 has been adopted to develop the project-specific noise criteria, assess potential impacts and recommend any noise reducing mitigation and management measures and/or provisions for monitoring suitable to the predicted levels and anticipated impacts.

2.4 Cumulative Impacts

Noise impact assessments are generally based on predicting project-specific levels at the closest and/or most affected receptors and then comparing these to criteria or management levels that apply to the type of emission being considered. In the case of construction and operational emissions, the noise criteria are derived based on assumed existing noise levels for the area. These assumed values were those presented as the base levels in NPI, 2017.

The construction noise criteria (ICNG, 2009) and management levels are also based on existing noise levels measured at locations surrounding the site but focus on the direct impacts from the site under assessment.

Cumulative impacts are beyond the control of TransGrid, are temporary in most circumstances and are best managed by local or state consent authorities for significant projects. Therefore, a qualitative assessment of potential cumulative impacts has been conducted, but limited discussion regarding cumulative impacts is required.

The operational noise criteria are based on existing noise levels at locations surrounding the site under assessment, such that existing conditions and industrial noise contributions are considered as part of the assessment approach. The NPI, 2017 criteria are designed to prevent any long-term increase in cumulative industrial noise that could occur and have been adopted for this assessment.

In the absence of measured background noise levels the base levels defined in NPI, 2017 were adopted in combination with a precautionary approach to establish the most stringent criteria that can apply in accordance with NPI, 2017. Hence, cumulative impacts are not anticipated were compliance with the most stringent NPI, 2017 criteria is identified, such is the case in this assessment.

2.5 Noise Modelling

Key features, inputs and assumptions that have informed the noise modelling and assessment are reproduced or outlined in **Table 2.1** below.

The noise modelling and assessment conducted are of potentially “noisy” plant and equipment only. Non-noise generating plant/equipment does not form part of the noise modelling and assessment.

Further discussion regarding the effects of meteorological conditions and potentially annoying noise characteristics is provided in **Sections 2.5.1** as relevant to the assessment.

Table 2.1 Noise Modelling Features, Inputs and Assumptions

ID	Feature	Description
1	Noise modelling software	<ul style="list-style-type: none"> <li data-bbox="568 347 2036 512">■ Brüel and Kjær's Predictor 7810 (Version 12) noise modelling software package was utilised to calculate noise levels using ISO 9613:2, 1996 noise propagation algorithms (international method for general purpose, 1/1 octaves). Meteorological corrections have been calculated via the CONCAWE method (<i>Report no. 4/18, The propagation of noise from petroleum and petrochemical complexes to neighbouring communities</i>, Prepared by C.J. Manning, M.Sc., M.I.O.A. Acoustic Technology Limited (Ref.AT 931), CONCAWE, Den Haag May 1981). <li data-bbox="568 539 2036 667">■ The Predictor software package allowed 3D elevation data to be combined with ground regions, water, foliage, significant building structures and receptor locations, to create a detailed and accurate representation of the site and surrounding area. The noise model allowed for the quantification of noise levels from multiple sources, based on sound power or pressure levels emitted from each source. <li data-bbox="568 694 2036 751">■ Brüel and Kjær's Predictor 7810 (Version 12) software achieves the requirements of ISO 17534, 2015 as applicable to the ISO9613:2, 1996 calculative algorithm.
2	Construction and Operational Noise Level Predictions	<ul style="list-style-type: none"> <li data-bbox="568 798 2036 962">■ Sound Power Level (L_w, dBA) data incorporated into the project-specific noise models were provided by TransGrid, obtained from a portfolio wide noise risk assessment previously completed for TransGrid, relevant Australian Standards or adapted from a proprietary source term database available at the time of the assessment. <ul style="list-style-type: none"> <li data-bbox="622 903 2036 962">- This assessment has considered standard good-practice construction mitigation measures via noise modelling by adopting the AS2436, 2010 mid-point values for all sound power levels obtained from that standard. <li data-bbox="568 989 2036 1015">■ 3D elevation, zoning and cadastre spatial data were obtained from the <i>NSW Government - Land and Property Information (LPI)</i>. <li data-bbox="568 1042 2036 1101">■ Buildings near the project were included in the noise model based on this spatial data or manually digitised from aerial photography. Buildings within the project were included in the noise model based on plans provided for use in the assessment.
2	Construction and Operational Noise Level Predictions (Cont'd)	<ul style="list-style-type: none"> <li data-bbox="568 1145 2036 1241">■ Potentially sensitive receptor locations were identified to assess noise impacts. These locations were selected to ensure the most affected points were evaluated. The receptor locations adopted for this assessment were shown in Figure 1.2 to Figure 1.4, and are described further in Table 3.2 of this report. <li data-bbox="568 1268 2036 1327">■ In all cases, the noise has been assessed at the most-affected point at or within the residential property boundary or, if that is more than 30 metres from the property, at the most-affected point within 30 metres of the property. In assessing amenity noise levels at

ID	Feature	Description
		<p>commercial or industrial premises, the noise level was assessed at the reasonably most-affected point on or within the property boundary.</p> <ul style="list-style-type: none"> ■ Noise levels were calculated at 1.5 metres m above ground level for all receptors, in accordance with the ICNG, 2009 and NPI, 2017 requirements. A ground factor of 0.7 was adopted for general modelling area, 0.0 is hard, 1.0 is soft. ■ To represent general construction emissions, capturing the size, layout and number of noise generating plant / equipment, “area sources” were utilised to predict Leq, 15 minute noise levels in dBA. A separate area source was placed in the model for each phase of works, stage and activity to represent the distribution of noise across the broader project site. For operational emissions, a combination of “point sources” were utilised with separate sources placed in the model for each key noise generating item of equipment. ■ The construction and operational noise assessment scenarios and modelling data are summarised in Sections 5 and 6 and presented in detail in Appendix C of this report. ■ All predicted noise level values have considered and applied the relevant ICNG, 2009 and NPI, 2017 modifying factors (penalties) for offensive noise characteristics (where applicable).
3	Meteorological Conditions	<ul style="list-style-type: none"> ■ General meteorological conditions for the project-specific noise models included a temperature of 9.2°C (annual mean minimum), and humidity of 72% (annual mean for 9 AM statistics), representative of average conditions for the area. These temperature and humidity values were determined based on annual average weather data publically available from the Bureau of Meteorology (BOM) Weather Station situated at Burrinjuck Dam: <ul style="list-style-type: none"> - Site number: 073007; - Location: Latitude: 35.00° South / Longitude: 148.6° East; - Elevation: 390 metres. ■ The effects of noise-enhancing meteorological conditions, as applicable to the operational noise modelling and assessment, are described in Section 2.5.1 below.

2.5.1 *Effects of Meteorological Conditions*

As per the NPI, 2017 meteorological conditions need to be considered for the operational phase of industrial activity, under a range of meteorological conditions. For the purpose of this assessment it has been assumed that prevailing wind conditions could occur in any direction, such that all wind directions have been assessed for the noise enhancing scenarios documented herein.

Accordingly, standard meteorological conditions and noise-enhancing meteorological conditions have been considered, for the operational noise modelling, based on the following meteorological parameters:

- Standard meteorological conditions: daytime, evening and night Pasquill–Gifford stability Category D conditions and calm winds.
- Noise-enhancing meteorological conditions: daytime and evening Pasquill–Gifford stability Category D conditions, light source-to-receiver winds (3 m/s) and a night-time stability Category F temperature inversion condition, light source-to-receiver winds (2 m/s).

Construction noise modelling has adopted neutral conditions only (representing conditions commonly experienced during the daytime period, when works would mostly occur) and calm winds for all scenarios.

3. EXISTING NOISE ENVIRONMENT

This section summarises the existing noise environment, identifies the noise sensitive receptors within the potential area of influence of the project, describes the approach adopted to quantify existing levels, and presents the resultant baseline environmental noise levels established for this assessment.

3.1 Existing Noise Environment

A key element in assessing noise impacts is an understanding of the existing ambient and background noise levels in the vicinity of the closest and/or potentially most affected noise sensitive receptors situated near the site.

The noise environment in the vicinity of the key residential (dwelling) project receptors is best described as 'rural' defined by the NPI, 2017 as an area with an acoustical environment that is dominated by natural sounds, having little or no road traffic noise and generally characterised by low background noise levels. This area often has evening ambient noise levels defined by the natural environment and human activity.

A "rural" area may be located in either a rural landscape, large lot residential, primary production, primary production small lots or environmental living zone, as defined on a council zoning map (i.e. Local Environmental Plan (LEP) or other planning instruments).

Due to the rural setting at the identified residential locations, the existing noise environment of those areas is likely to experience low ambient and background noise levels. The minimum assumed rating background noise levels have therefore been considered in this assessment (Table 2.1 of the NPI, 2017). For industrial receptors a similar precautionary approach has been adopted utilising the most stringent values that can apply at these receptors in accordance with NPI, 2017. This is further outlined in **Section 3.3** below.

3.2 Potentially Sensitive Noise Receptors

The potentially sensitive noise receptors where compliance has been assessed are presented below in **Table 3.1**, as identified in **Figure 1.4** of **Section 1** above.

The locations identified in **Table 3.1** were established based on the following:

- information provided by or on behalf of TransGrid;
- a subsequent review of aerial photography;
- review of land use zoning data and third party information; and
- the results of preliminary noise modelling, where receptor positions were optimised to predict likely worst-case noise levels.

These locations do not represent every receptor located in the vicinity of the project but have been selected for this noise assessment as they are considered to be representative of the locations that will potentially experience the highest or worst-case impacts associated with the construction and ongoing operation.

The GPS coordinates listed for each receptor in **Table 3.1** are those presented in **Figure 1.4** as adopted for the modelling and assessment scenarios.

Table 3.1 Potentially Sensitive Receptors

ID	Type	Description	GPS Co-ordinates (UTM, Zone 55H)		Ground Height, metres	Approximate Distance from project, metres	Direction from project
			Easting	Northing			
R01	Residential Receptor (Dwelling)	A residential (dwelling) land-use situated north-east of the substation, at a distance of 700 metres.	674518	6141438	532	700	North-east
R02	Residential Receptor (Dwelling)	A residential (dwelling) land-use situated north-east of the substation, at a distance of 620 metres.	674622	6141282	550	620	North-east
R03	Residential Receptor (Dwelling)	A residential (dwelling) land-use situated north-east of the substation, at a distance of 610 metres.	674792	6141142	548	610	North-east
R04	Residential Receptor (Dwelling)	A residential (dwelling) land-use situated east of the substation, at a distance of 700 metres.	674956	6141004	530	700	East
R05	Residential Receptor (Dwelling)	A residential (dwelling) land-use situated east of the substation, at a distance of 810 metres.	675159	6140919	529	810	East
R06	Residential Receptor (Dwelling)	A residential (dwelling) land-use situated east of the substation, at a distance of 1160 metres.	675531	6140869	540	1160	East
R07	Residential Receptor (Dwelling)	A residential (dwelling) land-use situated east of the substation, at a distance of 1500 metres.	675848	6140446	561	1500	East
R08	Other Receptor (Place of Worship)	Other Receptor (place of worship) land-use situated south-east of the substation, at a distance of 900 metres.	675211	6140268	531	900	South-east
R09	Residential Receptor (Dwelling)	A residential (dwelling) land-use situated south-east of the substation, at a distance of 910 metres.	675158	6140121	533	910	South-east
R10	Residential Receptor (Dwelling)	A residential (dwelling) land-use situated south-east of the substation, at a distance of 1350 metres.	675558	6139990	541	1350	South-east
R11	Residential Receptor (Dwelling)	A residential (dwelling) land-use situated south-east of the substation, at a distance of 1020 metres.	675207	6139975	536	1020	South-east

ID	Type	Description	GPS Co-ordinates (UTM, Zone 55H)		Ground Height, metres	Approximate Distance from project, metres	Direction from project
			Easting	Northing			
R12	Residential Receptor (Dwelling)	A residential (dwelling) land-use situated south-east of the substation, at a distance of 890 metres.	675011	6139927	531	890	South-east
R13	Residential Receptor (Dwelling)	A residential (dwelling) land-use situated south-east of the substation, at a distance of 1050 metres.	675026	6139727	529	1050	South-east
R14	Residential Receptor (Dwelling)	A residential (dwelling) land-use situated south of the substation, at a distance of 1400 metres.	674595	6139137	516	1400	South
R15	Residential Receptor (Dwelling)	A residential (dwelling) land-use situated south-west of the substation, at a distance of 1890 metres.	672333	6139413	516	1890	South-west
R16	Residential Receptor (Dwelling)	A residential (dwelling) land-use situated north-west of the substation, at a distance of 1500 metres.	673026	6141887	508	1500	North-west
R17	Residential Receptor (Dwelling)	A residential (dwelling) land-use situated north-west of the substation, at a distance of 1550 metres.	673144	6142026	528	1550	North-west
R18	Residential Receptor (Dwelling)	A residential (dwelling) land-use situated north of the substation, at a distance of 1430 metres.	673590	6142110	559	1430	North
R19	Residential Receptor (Dwelling)	A residential (dwelling) land-use situated north of the substation, at a distance of 1350 metres.	673845	6142105	546	1350	North
R20	Residential Receptor (Dwelling)	A residential (dwelling) land-use situated north of the substation, at a distance of 1350 metres.	674512	6142109	510	1350	North

3.3 Rating Background Noise Levels

The Rating Background Noise Levels (RBL) for the daytime (L90, 11 hour), evening (L90, 4 hour) and night-time (L90, 9 hour) are presented in **Table 3.2** below for all potential noise-sensitive receptors, as established based on minimum NPI, 2017 requirements.

The RBL values are adopted to establish ICNG, 2009 construction noise management levels and NPI, 2017 operational criteria for residential (dwelling) receptors as identified in **Section 4** of this report.

Table 3.2 Rating Background Noise Levels

ID	Receptor Type	Rating Background Noise Levels (RBL) in dBA		
		L90, 11 hour (Daytime)	L90, 4 hour (Evening)	L90, 9 hour (Night-time)
R01	Residential Receptor (Dwelling)	35	30	30
R02	Residential Receptor (Dwelling)	35	30	30
R03	Residential Receptor (Dwelling)	35	30	30
R04	Residential Receptor (Dwelling)	35	30	30
R05	Residential Receptor (Dwelling)	35	30	30
R06	Residential Receptor (Dwelling)	35	30	30
R07	Residential Receptor (Dwelling)	35	30	30
R08	Other Receptor (Place of Worship)	35	30	30
R09	Residential Receptor (Dwelling)	35	30	30
R10	Residential Receptor (Dwelling)	35	30	30
R11	Residential Receptor (Dwelling)	35	30	30
R12	Residential Receptor (Dwelling)	35	30	30
R13	Residential Receptor (Dwelling)	35	30	30
R14	Residential Receptor (Dwelling)	35	30	30
R15	Residential Receptor (Dwelling)	35	30	30
R16	Residential Receptor (Dwelling)	35	30	30
R17	Residential Receptor (Dwelling)	35	30	30
R18	Residential Receptor (Dwelling)	35	30	30
R19	Residential Receptor (Dwelling)	35	30	30
R20	Residential Receptor (Dwelling)	35	30	30

4. PROJECT-SPECIFIC ASSESSMENT CRITERIA

This section presents the construction and operational noise assessment criteria established for the project in accordance with the ICNG, 2009 and the NPI, 2017. These values are based on the assessment methodology summarised in **Section 2**, the existing noise conditions in **Section 3** and the detailed assessment requirements presented in **Appendix B** of this report.

4.1 NSW Interim Construction Noise Guideline

The project-specific construction “Noise Management Levels” (NML), for works within and outside the recommended standard hours for construction, are presented in **Table 4.1** below. These NML have been established with due regard to the requirements of the ICNG, 2009 for all identified residential (dwelling) and other sensitive (industrial) receptors.

In accordance with the ICNG, 2009 NML values for other sensitive receptors, i.e. nearby industrial areas, are fixed levels based on usage. They do not rely on the RBL utilised for residential receptors.

Table 4.1 Construction Noise Management Levels (NML)

Receptor Type	Construction Noise Management Levels (NML): Leq, 15 minute in dBA				HNML: Leq, 15 minute in dBA ³	Sleep Disturbance Criteria in dBA	
	Daytime Hours		Evening	Night	Daytime: Standard Hours Only	Night-time only	
	Standard	Non-standard				Leq, 15minute	Lmax
Residential	45	40	35	35	75	40	52
Place of Worship	55	55	55	55	-	-	-

1. Dash “-“ indicates that this criteria does not apply at that receptor.
2. ICNG, 2009 daytime standard hours are 7 AM to 6 PM Monday to Friday, and 8 AM to 1 PM Saturdays. Daytime non-standard hours are 1 PM to 6PM Saturdays and 8AM to 6 PM Sundays. Evening hours are 6 PM to 10PM Monday to Sunday (seven days per week). Night-time hours are all remaining hours.
3. HNML = “Highly Noise Affected Management Level”.

4.2 NSW Noise Policy for Industry

The project-specific intrusiveness noise level, recommended amenity noise level (residential receptors) and the project amenity noise levels are presented in **Table 4.2** below. These criteria represent the operational noise criteria used to assess potential impacts, with the most stringent of these values adopted as the project-specific “Noise Trigger Level”, PNTL.

In accordance with the NPI, 2017, PNTL for other sensitive receptors, i.e. nearby industrial premises, are fixed levels based on usage. They do not rely on the RBL utilised for residential receptors. The NPI, 2017 assessment periods are defined as follows: daytime is the period from 7 AM to 6 PM, Monday to Saturday; or 8 AM to 6 PM on Sundays and public holidays. The evening is the period from 6 PM to 10 PM, Monday to Sunday (seven days per week) and night-time is all remaining periods.

Table 4.2 Project-specific Noise Trigger Levels (PNTL)

Receptor Type	Intrusiveness Noise Level Leq, 15 minute in dBA			Recommended Amenity Noise Level Leq, period in dBA			Project Amenity Noise Level Leq, 15 minute in dBA ³			PNTL Leq, 15 minute in dBA			Sleep Disturbance Criteria in dBA	
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	Night-time only	
													Leq, 15 minute	Lmax
Residential	40	35	35	50	45	40	48	43	38	40	35	35	40	52
Place of Worship	-	-	-	50	50	50	48	48	48	48	48	48	-	-

1. Dash “-” indicates that this criteria does not apply at that receptor.
2. NPI, 2017 daytime is the period from 7 AM to 6 PM, Monday to Saturday; or 8 AM to 6 PM on Sundays and public holidays. The evening is the period from 6 PM to 10 PM, Monday to Sunday (seven days per week) and night-time is all remaining periods.
3. Project Amenity Noise Level = Recommended Amenity Noise Level minus 5 dBA plus 3 dBA to convert from a period level to a 15-minute level.
4. Rural Amenity Level adopted for residential receptors.

5. CONSTRUCTION ASSESSMENT

This section presents the construction noise assessment completed for the project as per the requirements of the ICNG, 2009.

5.1 Assessment Scenarios

Based on the noise modelling methodology described in **Section 2** of this report, emissions have been predicted for key project noise generating stages, based on the work elements, equipment and associated activities. These construction emission sources/scenarios are summarised below in **Table 5.1**. Each has the potential to occur outside the recommended standard hours of construction, and has been assessed as such in accordance with the ICNG, 2009.

The predicted noise levels and compliance assessment (comparison of predictions to the project-specific NML) is then presented in **Table 5.2** for each scenario, including the maximum noise event scenario. The detailed noise modelling data and assessment scenarios are provided in **Appendix C**.

Table 5.1 Construction Emission Sources & Assessment Scenarios

CON ID	Description	Sound Power Level (Lw) in dBA
01	This noise impact assessment scenario is associated with the potential first stage of works, being Site Preparation and Establishment . This covers general site enabling works including clearance of surplus material, ground compaction, establishment of new concrete footings/slabs and delivery of materials (or similar).	Total Lw of 123
02	This noise impact assessment scenario is associated with the potential second stage of works, being General Construction of Infrastructure . Works for this scenario include construction and installation of new infrastructure on the substation.	Total Lw of 117
03	This noise impact assessment scenario is associated with the Delivery of New Equipment . This scenario includes heavy vehicles, light vehicles, cranes and tools potentially associated with the delivery and loading/unloading of assets.	Total Lw of 113
04	This noise impact assessment scenario is associated with the Oil Filling stage of works. Works for this scenario include oil filling of the new assets on the substation.	Total Lw of 111
05	This noise impact assessment scenario is associated with the Installation of Overhead Crossing Of the Rebuilt Line into the New Switchbays . This scenario includes heavy vehicles, light vehicles, cranes and tools potentially associated with the construction of new high voltage lines and towers.	Total Lw of 120
L _{max}	A maximum noise event scenario associated with any type of transient or impulsive noise emitting event e.g. metal-on-metal contact and so on.	Total Lw of 129

5.2 Predicted Construction Noise Levels

Based on the construction assessment scenarios and associated data presented in **Table 5.1** above, Leq, 15 minute and L_{max} noise levels (in dBA) have been predicted and then compared to the NML identified previously in **Section 4, Table 4.1** of this report. The resultant values (and an assessment of compliance, predicted minus criteria) are presented in **Table 5.2** below. Any compliance values that exceed criteria are highlighted in **bold** typeset.

Table 5.2 Predicted Construction Noise Levels and Compliance

ID	Predicted Construction (CON) Noise Levels in dBA: Leq, 15 minute and Lmax						Comparison to NML – Standard and Non-standard hours Presented as “CON01 / CON02 / CON03 / CON04 / CON05” Results and the Lmax scenario (far right column)				
	01	02	03	04	05	Lmax	Daytime, standard hours	Daytime, non-standard hours	Evening, non-standard hours	Night-time, non-standard hours	Lmax (night)
R01	42	36	31	30	37	52	-3 / -9 / -14 / -15 / -8	2 / -4 / -9 / -10 / -3	7 / 1 / -4 / -5 / 2	7 / 1 / -4 / -5 / 2	0
R02	48	43	38	36	43	56	3 / -2 / -7 / -9 / -2	8 / 3 / -2 / -4 / 3	13 / 8 / 3 / 1 / 8	13 / 8 / 3 / 1 / 8	4
R03	50	44	40	37	45	57	5 / -1 / -5 / -8 / 0	10 / 4 / 0 / -3 / 5	15 / 9 / 5 / 2 / 10	15 / 9 / 5 / 2 / 10	5
R04	49	43	39	36	44	56	4 / -2 / -6 / -9 / -1	9 / 3 / -1 / -4 / 4	14 / 8 / 4 / 1 / 9	14 / 8 / 4 / 1 / 9	4
R05	47	41	37	34	43	54	2 / -4 / -8 / -11 / -2	7 / 1 / -3 / -6 / 3	12 / 6 / 2 / -1 / 8	12 / 6 / 2 / -1 / 8	2
R06	43	37	33	31	39	51	-2 / -8 / -12 / -14 / -6	3 / -3 / -7 / -9 / -1	8 / 2 / -2 / -4 / 4	8 / 2 / -2 / -4 / 4	-1
R07	42	36	33	29	39	49	-3 / -9 / -12 / -16 / -6	2 / -4 / -7 / -11 / -1	7 / 1 / -2 / -6 / 4	7 / 1 / -2 / -6 / 4	-3
R08	46	40	36	34	43	53	-9 / -15 / -19 / -21 / -12	-9 / -15 / -19 / -21 / -12	-9 / -15 / -19 / -21 / -12	-9 / -15 / -19 / -21 / -12	-
R09	46	40	35	34	41	53	1 / -5 / -10 / -11 / -4	6 / 0 / -5 / -6 / 1	11 / 5 / 0 / -1 / 6	11 / 5 / 0 / -1 / 6	1
R10	42	36	32	30	38	50	-3 / -9 / -13 / -15 / -7	2 / -4 / -8 / -10 / -2	7 / 1 / -3 / -5 / 3	7 / 1 / -3 / -5 / 3	-2
R11	45	39	34	32	40	52	0 / -6 / -11 / -13 / -5	5 / -1 / -6 / -8 / 0	10 / 4 / -1 / -3 / 5	10 / 4 / -1 / -3 / 5	0

ID	Predicted Construction (CON) Noise Levels in dBA: Leq, 15 minute and Lmax						Comparison to NML – Standard and Non-standard hours Presented as “CON01 / CON02 / CON03 / CON04 / CON05” Results and the Lmax scenario (far right column)				
	01	02	03	04	05	Lmax	Daytime, standard hours	Daytime, non-standard hours	Evening, non-standard hours	Night-time, non-standard hours	Lmax (night)
R12	46	41	36	34	42	54	1 / -4 / -9 / -11 / -3	6 / 1 / -4 / -6 / 2	11 / 6 / 1 / -1 / 7	11 / 6 / 1 / -1 / 7	2
R13	44	38	33	32	39	52	-1 / -7 / -12 / -13 / -6	4 / -2 / -7 / -8 / -1	9 / 3 / -2 / -3 / 4	9 / 3 / -2 / -3 / 4	0
R14	41	36	31	30	37	50	-4 / -9 / -14 / -15 / -8	1 / -4 / -9 / -10 / -3	6 / 1 / -4 / -5 / 2	6 / 1 / -4 / -5 / 2	-2
R15	38	32	27	26	34	46	-7 / -13 / -18 / -19 / -11	-2 / -8 / -13 / -14 / -6	3 / -3 / -8 / -9 / -1	3 / -3 / -8 / -9 / -1	-6
R16	38	33	27	27	34	49	-7 / -12 / -18 / -18 / -11	-2 / -7 / -13 / -13 / -6	3 / -2 / -8 / -8 / -1	3 / -2 / -8 / -8 / -1	-3
R17	40	34	29	28	37	49	-5 / -11 / -16 / -17 / -8	0 / -6 / -11 / -12 / -3	5 / -1 / -6 / -7 / 2	5 / -1 / -6 / -7 / 2	-3
R18	39	33	28	27	33	48	-6 / -12 / -17 / -18 / -12	-1 / -7 / -12 / -13 / -7	4 / -2 / -7 / -8 / -2	4 / -2 / -7 / -8 / -2	-4
R19	40	35	30	27	34	49	-5 / -10 / -15 / -18 / -11	0 / -5 / -10 / -13 / -6	5 / 0 / -5 / -8 / -1	5 / 0 / -5 / -8 / -1	-3
R20	41	35	30	29	35	50	-4 / -10 / -15 / -16 / -10	1 / -5 / -10 / -11 / -5	6 / 0 / -5 / -6 / 0	6 / 0 / -5 / -6 / 0	-2

1. CON01 = Site Preparation and Establishment, CON02 = General Construction of Infrastructure, CON03 = Delivery of New Equipment, CON04 = New High Voltage Lines

5.2.2 Discussion of Results

The results presented in **Table 5.2** identify the following:

- Predicted L_{eq} , 15 minute noise levels range between 26 and 50 dBA (37 dBA on average) for the construction works and activities envisaged for the project. The highest L_{eq} , 15 minute noise levels are predicted at the most affected residential receptor R03 situated north east of the site and range between 37 and 50 dBA.
- Predicted L_{eq} , 15 minute noise levels are below daytime HNML (for works within the recommended standard hours of construction) value of L_{eq} , 15 minute \leq 75 dBA at all receptors.
- Predicted L_{max} noise levels are above the night-time sleep disturbance criteria at the residential receptors R02, R03, R04, R05, R09 and R12.
- Predicted L_{max} noise levels at the night-time sleep disturbance criteria at the residential receptors and at the criteria at the receptor R01, R11 and R13.
- Predicted L_{eq} , 15 minute noise levels are at or below the daytime (standard) NML at all receptors except R02, R03, R04, R05, R09 and R12 during CON01, where the NML is exceeded by up to 5 dBA.
- Predicted L_{eq} , 15 minute noise levels during daytime (non-standard) hours exceed NML at a number of receptors during CON01, CON02 and CON4 by up to 8 dBA.
- Predicted L_{eq} , 15 minute noise levels during evening and night time (non-standard) hours exceed NML at a number of receptors during all construction scenarios by up to 15 dBA.
- The highest predicted values and worst-case impacts are for the "site preparation and establishment" (CON01) and "new high voltage lines" (CON05) works. Predicted L_{eq} , 15 minute noise levels are substantially lower at the most affected residential receptors for other construction scenarios.

5.2.3 Summary of Findings

The predicted noise levels outlined above identify that construction noise levels have the potential to exceed the applicable criteria, especially during non-standard daytime hours, the evening and night-time.

The magnitude and extent of potential impacts associated with these elevated noise levels is best described as low during the daytime and moderate to high during the evening/night-time. They are however as anticipated for the construction works and activities required and the distance offsets to nearby receptors. They are consistent with noise emissions generated by other construction works conducted regularly in NSW by others. The potential for impacts to occur is heightened during the night-time period when receptor sensitivity to noise is generally increased.

Although exceeding criteria, the predicted construction noise levels do not represent a constant emission that would be experienced by the community on a daily basis throughout the project's schedule of works.

The predicted levels will only be experienced for limited periods of time when works and activities are occurring and will not be experienced over the whole daytime, evening or night-time periods. Construction noise emissions are temporary and do not represent a permanent impact on the community and the surrounding environment.

Night works are occasionally required at substations, regardless of whether they are associated with TransGrid or not. These works are primarily related to system outages. In this case, construction works outside the ICNG, 2009 recommended standard hours is not proposed, however some works may be unavoidable with essential tasks being timed to correlate with system planning outages.

Some noise from construction sites is inevitable, such that the ICNG, 2009 focuses on minimising construction noise impacts, rather than only on achieving numeric noise levels. These results identify that general good-practice construction noise management techniques combined with some additional but basic project-specific measures would be sufficient to maintain acceptable noise levels at all receptors, during the daytime, evening and night-time.

The results also highlight that construction works could occur during the daytime (standard) hours with only limited constraints, if any, whilst maintaining a low impact.

Any significant high noise emitting works and activities should, however, be avoided during the daytime (non-standard), evening and especially the night-time to limit impacts (if any) to the daytime period when people are generally less sensitive to construction noise. Daytime (non-standard), evening and night-time works can however occur whilst maintain low to moderate impacts, with the successful implementation of mitigation and management measures.

Based on the results and findings discussed above, recommendations for noise reducing mitigation, management measures, safeguards and/or provisions for monitoring are provided in **Section 7**. They are designed to assist TransGrid in achieving compliance and minimise any residual impacts as far as is commonly feasible, reasonable and safe to do so.

6. OPERATIONAL NOISE ASSESSMENT

This section presents the operational noise assessment completed for the project as per the requirements of the NPI, 2017.

6.1 Assessment Scenarios

The potential worst-case noise generating situation (all plant and equipment operating concurrently and at full load) was considered, as applicable to the proposed operational activities summarised in **Sections 1** and **2** of this report. These assessment scenarios include consideration of noise enhancing meteorological conditions as summarised in **Section 2.5.1**.

Operational emission sources are summarised in **Table 6.1**. The detailed noise modelling data and assessment scenarios are provided in **Appendix C** of this report.

Table 6.1 Operational Emission Sources & Assessment Scenarios

ID	Description	Sound Power Level (Lw) in dBA – per unit
01	This assessment scenario is associated with: Existing Operations . Existing operations for the Yass Substation includes the three primary transformers, three reactors, two auxiliary transformers and one capacitor banks. As described in Section 2.5.1 , standard and noise enhancing meteorological conditions have been modelled for this scenario.	1 x Transformer Lw of 94 1 x Transformer Lw of 102 1 x Transformer Lw of 85 3 x Reactor Lw of 90 2 x Auxiliary Transformer Lw of 74 1 x Capacitor Bank Lw of 85
02	This assessment scenario is associated with: Existing and Proposed Operations . Existing + Proposed operations at the Yass Substation includes the concurrent operation of the four primary transformers, three reactors, three auxiliary transformers, one capacitor bank. This includes the addition of one new primary transformer and one new auxiliary transformer. As described in Section 2.5.1 , standard and noise enhancing meteorological conditions have been modelled in this scenario.	Existing operations PLUS: 1 x Transformer Lw of 100.8 2 x Auxiliary Transformer Lw of 74

6.2 Predicted Operational Noise Levels

Based on the noise modelling methodology described in **Section 2** of this report and the operational assessment scenarios and data presented in **Table 6.1** above, daytime, evening and night time Leq, 15 minute noise levels (in dBA) have been predicted.

The predicted noise levels and a compliance assessment (comparison of predictions to PNTL) is then provided in **Table 6.2** and **6.5** for each scenario.

All predicted operational noise levels are inclusive of the meteorological conditions described in **Section 2.5.1**. The resultant values and an assessment of compliance (predicted minus criteria) are presented in **Tables 6.2** and **6.5** below.

A noise contour map for the worst-case (night-time) conditions is presented in **Figure 6.1**.

Table 6.2 Predicted Operational Noise Levels and Compliance: Existing Substation Operations (Standard MET)

ID	Scenario	PNTL: Leq 15 minute in dBA	Predicted Operational Noise levels Leq 15 minute in dBA			Comparison to PNTL (Predicted – Criteria) Leq, 15 minute in dBA			Comparison to Sleep Disturbance Criteria Leq, 15 min of 40 dBA	Compliant?
		Daytime / Evening / Night	Day	Evening	Night	Day	Evening	Night		
R01	Existing Substation Operations (Standard MET)	40 / 35 / 35	25	25	25	-15	-10	-10	-15	Yes
R02		40 / 35 / 35	28	28	28	-12	-7	-7	-12	Yes
R03		40 / 35 / 35	30	30	30	-10	-5	-5	-10	Yes
R04		40 / 35 / 35	29	29	29	-11	-6	-6	-11	Yes
R05		40 / 35 / 35	27	27	27	-13	-8	-8	-13	Yes
R06		40 / 35 / 35	25	25	25	-15	-10	-10	-15	Yes
R07		40 / 35 / 35	24	24	24	-16	-11	-11	-16	Yes
R08		48 / 48 / 48	27	27	27	-21	-21	-21	-13	Yes
R09		40 / 35 / 35	27	27	27	-13	-8	-8	-13	Yes
R10		40 / 35 / 35	24	24	24	-16	-11	-11	-16	Yes
R11		40 / 35 / 35	26	26	26	-14	-9	-9	-14	Yes
R12		40 / 35 / 35	26	26	26	-14	-9	-9	-14	Yes
R13		40 / 35 / 35	24	24	24	-16	-11	-11	-16	Yes
R14		40 / 35 / 35	24	24	24	-16	-11	-11	-16	Yes
R15		40 / 35 / 35	23	23	23	-17	-12	-12	-17	Yes
R16		40 / 35 / 35	21	21	21	-19	-14	-14	-19	Yes
R17		40 / 35 / 35	22	22	22	-18	-13	-13	-18	Yes
R18		40 / 35 / 35	20	20	20	-20	-15	-15	-20	Yes
R19		40 / 35 / 35	20	20	20	-20	-15	-15	-20	Yes
R20		40 / 35 / 35	20	20	20	-20	-15	-15	-20	Yes

Table 6.3 Predicted Operational Noise Levels and Compliance: Existing Substation Operations (Noise Enhancing MET)

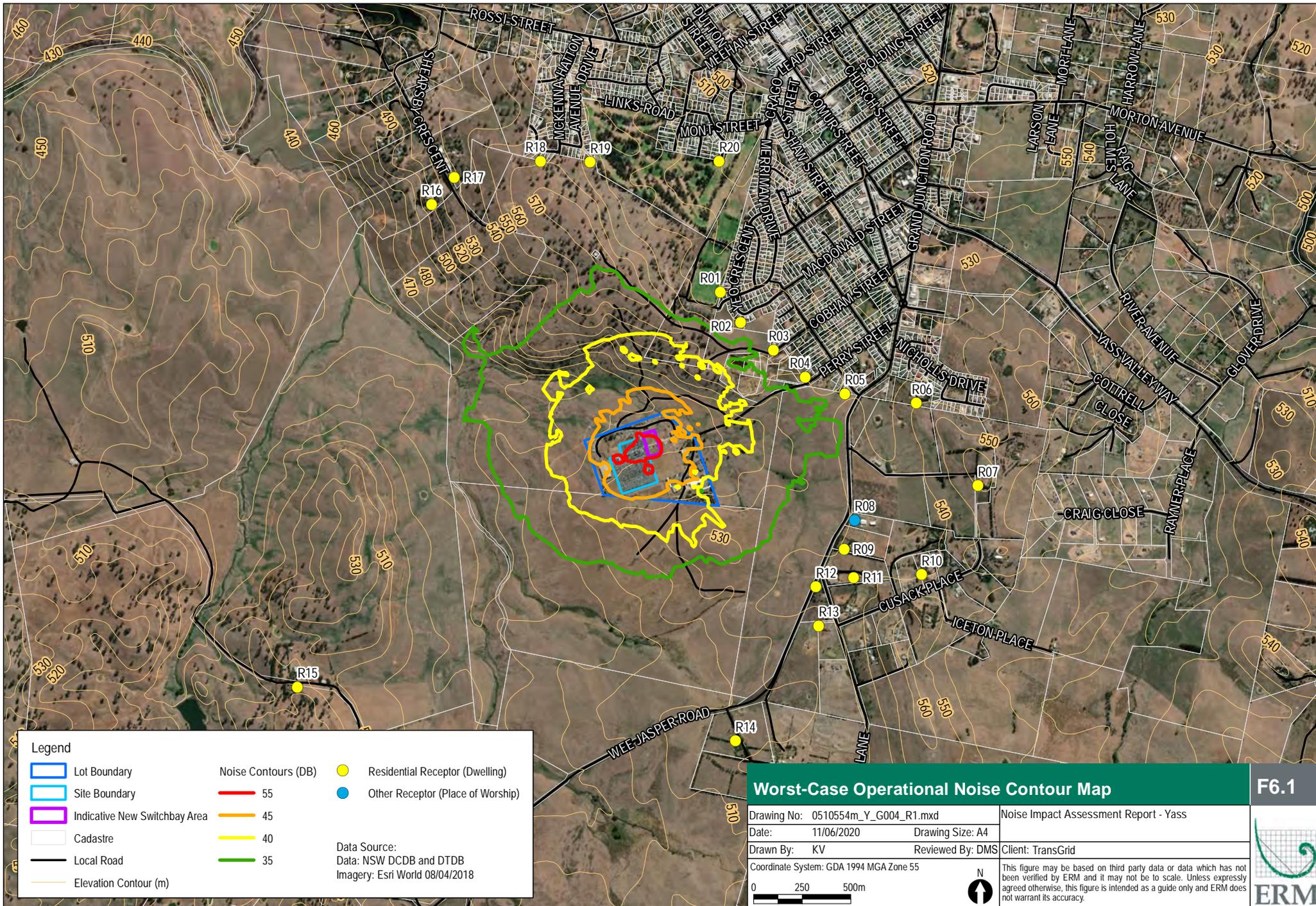
ID	Scenario	PNTL: Leq 15 minute in dBA	Predicted Operational Noise levels Leq 15 minute in dBA			Comparison to PNTL (Predicted – Criteria) Leq, 15 minute in dBA			Comparison to Sleep Disturbance Criteria Leq, 15 min of 40 dBA	Compliant?
		Daytime / Evening / Night	Day	Evening	Night	Day	Evening	Night		
R01	Existing Substation Operations (Noise Enhancing MET)	40 / 35 / 35	28	28	28	-12	-7	-7	-12	Yes
R02		40 / 35 / 35	31	31	31	-9	-4	-4	-9	Yes
R03		40 / 35 / 35	33	33	33	-7	-2	-2	-7	Yes
R04		40 / 35 / 35	32	32	32	-8	-3	-3	-8	Yes
R05		40 / 35 / 35	30	30	30	-10	-5	-5	-10	Yes
R06		40 / 35 / 35	28	28	28	-12	-7	-7	-12	Yes
R07		40 / 35 / 35	27	27	27	-14	-9	-9	-14	Yes
R08		48 / 48 / 48	30	30	30	-18	-18	-18	-10	Yes
R09		40 / 35 / 35	30	30	30	-10	-5	-5	-10	Yes
R10		40 / 35 / 35	27	27	27	-13	-8	-8	-13	Yes
R11		40 / 35 / 35	29	29	29	-11	-6	-6	-11	Yes
R12		40 / 35 / 35	29	29	29	-11	-6	-6	-11	Yes
R13		40 / 35 / 35	27	27	27	-13	-8	-8	-13	Yes
R14		40 / 35 / 35	27	27	27	-13	-8	-8	-13	Yes
R15		40 / 35 / 35	25	25	25	-15	-10	-10	-15	Yes
R16		40 / 35 / 35	24	24	24	-16	-11	-11	-16	Yes
R17		40 / 35 / 35	24	24	24	-16	-11	-11	-16	Yes
R18		40 / 35 / 35	23	23	23	-17	-12	-12	-17	Yes
R19		40 / 35 / 35	23	23	23	-17	-12	-12	-17	Yes
R20		40 / 35 / 35	23	23	23	-17	-12	-12	-17	Yes

Table 6.4 Predicted Operational Noise Levels / Compliance: Proposed Substation (Standard MET)

ID	Scenario	PNTL: Leq 15 minute in dBA	Predicted Operational Noise levels Leq 15 minute in dBA			Comparison to PNTL (Predicted – Criteria) Leq, 15 minute in dBA			Comparison to Sleep Disturbance Criteria Leq, 15 min of 40 dBA	Compliant?
		Daytime / Evening / Night	Day	Evening	Night	Day	Evening	Night		
R01	Existing + Proposed Substation Operations (Standard MET)	40 / 35 / 35	28	28	28	-12	-7	-7	-12	Yes
R02		40 / 35 / 35	31	31	31	-9	-4	-4	-9	Yes
R03		40 / 35 / 35	32	32	32	-8	-3	-3	-8	Yes
R04		40 / 35 / 35	31	31	31	-9	-4	-4	-9	Yes
R05		40 / 35 / 35	29	29	29	-11	-6	-6	-11	Yes
R06		40 / 35 / 35	27	27	27	-13	-8	-8	-13	Yes
R07		40 / 35 / 35	26	26	26	-15	-10	-10	-15	Yes
R08		48 / 48 / 48	29	29	29	-19	-19	-19	-11	Yes
R09		40 / 35 / 35	29	29	29	-11	-6	-6	-11	Yes
R10		40 / 35 / 35	26	26	26	-14	-9	-9	-14	Yes
R11		40 / 35 / 35	28	28	28	-12	-7	-7	-12	Yes
R12		40 / 35 / 35	28	28	28	-12	-7	-7	-12	Yes
R13		40 / 35 / 35	27	27	27	-13	-8	-8	-13	Yes
R14		40 / 35 / 35	26	26	26	-14	-9	-9	-14	Yes
R15		40 / 35 / 35	24	24	24	-16	-11	-11	-16	Yes
R16		40 / 35 / 35	24	24	24	-16	-11	-11	-16	Yes
R17		40 / 35 / 35	24	24	24	-16	-11	-11	-16	Yes
R18		40 / 35 / 35	24	24	24	-16	-11	-11	-16	Yes
R19		40 / 35 / 35	24	24	24	-16	-11	-11	-16	Yes
R20		40 / 35 / 35	24	24	24	-16	-11	-11	-16	Yes

Table 6.5 Predicted Operational Noise Levels / Compliance: Proposed Substation (Noise Enhancing MET)

ID	Scenario	PNTL: Leq 15 minute in dBA	Predicted Operational Noise levels Leq 15 minute in dBA			Comparison to PNTL (Predicted – Criteria)Leq, 15 minute in dBA			Comparison to Sleep Disturbance Criteria Leq, 15 min of 40 dBA	Compliant?
		Daytime / Evening / Night	Day	Evening	Night	Day	Evening	Night		
R01	Existing + Proposed Substation Operations (Noise Enhancing MET)	40 / 35 / 35	31	31	31	-9	-4	-4	-9	Yes
R02		40 / 35 / 35	34	34	34	-6	-1	-1	-6	Yes
R03		40 / 35 / 35	35	35	35	-5	0	0	-5	Yes
R04		40 / 35 / 35	34	34	34	-6	-1	-1	-6	Yes
R05		40 / 35 / 35	32	32	32	-8	-3	-3	-8	Yes
R06		40 / 35 / 35	30	30	30	-10	-5	-5	-10	Yes
R07		40 / 35 / 35	28	28	28	-12	-7	-7	-12	Yes
R08		48 / 48 / 48	32	32	32	-16	-16	-16	-8	Yes
R09		40 / 35 / 35	32	32	32	-8	-3	-3	-8	Yes
R10		40 / 35 / 35	29	29	29	-11	-6	-6	-11	Yes
R11		40 / 35 / 35	31	31	31	-9	-4	-4	-9	Yes
R12		40 / 35 / 35	31	31	31	-9	-4	-4	-9	Yes
R13		40 / 35 / 35	30	30	30	-10	-5	-5	-10	Yes
R14		40 / 35 / 35	29	29	29	-11	-6	-6	-11	Yes
R15		40 / 35 / 35	27	27	27	-13	-8	-8	-13	Yes
R16		40 / 35 / 35	27	27	27	-13	-8	-8	-13	Yes
R17		40 / 35 / 35	27	27	27	-13	-8	-8	-13	Yes
R18		40 / 35 / 35	27	27	27	-13	-8	-8	-13	Yes
R19		40 / 35 / 35	27	27	27	-13	-8	-8	-13	Yes
R20		40 / 35 / 35	27	27	27	-13	-8	-8	-13	Yes



Legend

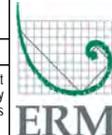
- Lot Boundary
- Site Boundary
- Indicative New Switchbay Area
- Cadastrate
- Local Road
- Elevation Contour (m)
- Noise Contours (DB)
 - 55
 - 45
 - 40
 - 35
- Residential Receptor (Dwelling)
- Other Receptor (Place of Worship)

Data Source:
 Data: NSW DCDB and DTDB
 Imagery: Esri World 08/04/2018

Worst-Case Operational Noise Contour Map

F6.1

Drawing No: 0510554m_Y_G004_R1.mxd	Noise Impact Assessment Report - Yass	
Date: 11/06/2020	Drawing Size: A4	
Drawn By: KV	Reviewed By: DMS	Client: TransGrid
Coordinate System: GDA 1994 MGA Zone 55		



6.2.1 Discussion of Results

The results presented in **Table 6.2** and **6.3** identify the following:

- Predicted Leq, 15 minute noise levels for the existing substation operations are between 20 and 30 dBA, for standard meteorological conditions and between 23 and 33 dBA for noise enhancing meteorological conditions.
- Predicted Leq, 15 minute noise levels for the proposed substation operations are between 24 and 32 dBA, for standard meteorological conditions and between 27 and 35 dBA for noise enhancing meteorological conditions.
- The highest Leq, 15 minute noise levels are predicted at R03 (30 to 35 dBA). R03 is the closest and/or most affected residential receptor situated within the potential area of influence of the substation at which the highest Leq, 15 minute noise levels are predicted.
- Predicted Leq, 15 minute noise levels for proposed operations are compliant (i.e. at or below) with the NPI, 2017 for the daytime, evening and night-time periods at all receptors, under all meteorological conditions.
- Due to the nature of operational activities on the site and the absence of maximum noise generating operations, an L_{max} model was not required. The operation of the substation equipment generally involves a constant noise emission; therefore, the Leq, 15 minute parameter is applicable to the assessment of sleep disturbance. Predicted Leq, 15 minute noise levels for proposed operations are below the Leq, 15 minute sleep disturbance criteria of 40 dBA at all applicable residential receptors. The sites night-time operations are compliant with the NPI, 2017 requirements.

6.2.2 Summary of Findings

The predicted noise levels identified above are as anticipated for the installation of the new primary transformer and auxiliary transformer at the substation. Operational emissions are compliant with the NPI, 2017 requirements. These predicted levels and compliance identify a low anticipated noise impact when compared, for example, to other sites assessed where emissions may exceed criteria.

Based on the results and findings discussed above, recommended safeguards and/or provisions for monitoring are provided in **Section 7**. They are designed to assist TransGrid in maintaining compliance and minimise any residual impacts as far is commonly feasible, reasonable and safe to do so.

7. RECOMMENDATIONS

This section presents any recommendations for construction and operational noise reducing mitigation, management measures, safeguards and/or provisions for monitoring.

7.1 Construction Noise

Based on the findings presented in **Section 5** of this report, predicted construction noise levels have the potential to exceed ICNG, 2009 NML for scenarios all construction scenarios, especially during the evening (6PM to 10PM) and night-time (10PM to 7AM Monday to Friday, and to 8AM Sundays/public holidays). L_{max} noise levels are also predicted to exceed the sleep disturbance criteria by up to 5 dBA at the closest residential receptors. It is understood that works outside the ICNG, 2009 recommended standard hours is not proposed, however some works may be unavoidable with essential tasks being timed to correlate with system planning outages.

The magnitude and extent of potential impacts associated with these elevated noise levels is best described as low during the daytime and moderate to high during the evening/night-time. This is anticipated when considering the construction works and activities required, and the distance offsets to nearby receptors.

It is therefore recommended that TransGrid implement its normal construction management practices and aim to avoid any particularly noisy works during the evening and night-time. Very noisy works should be limited to the ICNG, 2009 recommended standard hours i.e. 7 AM to 6 PM Monday to Friday, and 8 AM to 1 PM Saturdays, with no work on Sundays or public holidays, where feasible, reasonable and safe to do so.

The following construction noise mitigation and management measures are recommended:

- Any unforeseen work that is required outside the recommended standard hours should have prior consideration following TransGrid's standard noise management procedures. These should be suitably mitigated and managed with a goal of achieving the NML at all residential receptors or undertaken with agreement from the appropriate consent authority or potentially affected receptor/s;
- TransGrid should notify all residential receptors of any works occurring outside the recommended standard hours. This notification should occur for those receptors where noise levels are predicted to be above NMLs, refer **Section 5.2** of this report. These residents should also be updated during the works, if substantial changes to the construction methodology occur that may increase potential noise impacts;
- Plan works to avoid very noise activities during the evening and night-time. Any work that is required outside the recommended standard hours should have prior consideration following TransGrid's standard noise management procedures and be suitably mitigated and managed with a goal of achieving the NML at all residential receptors or undertaken in consultation with the potentially most affected receptor/s;
- Where unforeseen high noise generating daytime works (e.g. > 75 dBA) or evening/night-time works (e.g. > 65 dBA) would occur, potential respite periods, e.g. three hours of work, followed by one hour of respite should be applied. Respite should be implemented if it is the preference of the affected receptor/s and if practical to implement during the works. In some circumstances respite may extend the duration of works and inadvertently increase noise impacts; hence due care should be taken when considering this management measure;
- During the construction design, choose appropriate plant, equipment and/or machinery for each task and adopt efficient work practices to minimise the total construction period and the number of noise sources on the site;
- Select the quietest item of plant, equipment and social machinery available where options that suit the design permit;

- During the works:
 - avoid unnecessary noise due to idling diesel engines, and fast engine speeds when equipment can be powered down and/or lower speeds are sufficient.
 - instruct drivers to travel directly to the site and avoid any extended periods of engine idling at or near residential areas, especially at night.
 - ensure all plant, equipment and/or machinery used on the site are in good condition, with particular emphasis on exhaust silencers, covers on engines and transmissions and squeaking or rattling components. Excessively noisy machines should be repaired or removed from the site.
- During the works, ensure that all plant, equipment and vehicles movements are optimised in a forward direction to avoid triggering motion alarms that are typically required when these items are used in reverse. Where it is possible tonal motion alarms should be replaced with broadband “squash duck” motion alarms;
- During any unforeseen night works, activities with the potential to generate impulsive noise should be strictly avoided. These types of noise events are particularly annoying; especially at night and have the potential to generate sleep disturbance or awakening impacts; and
- If any reoccurring construction noise complaints are received, operator attended noise validation, and compliance measurements should be undertaken to measure and compare the site noise level contributions to a) the predicted values; and b) the NMLs presented in this report:
 - All site noise levels should be measured in the absence of any influential source not associated with the project.
 - If the measured site noise levels are below the predicted values and comply with the NMLs presented in this report, no further mitigation or management measures are required.
 - If the measured site noise levels are above the predicted noise levels or NML presented in this report, further mitigation and/or management measures should be considered.

7.2 Operational Noise

Based on the findings presented in **Section 6**, all predicted operational Leq, 15 minute noise levels for worst-case future operations are below the PNTL at all identified receptors. The substation is deemed compliant with the NPI, 2017 for the daytime, evening and night-time periods. As such no further recommendations for noise reducing mitigation or management measures are warranted, or provided in this report. Suitable safeguards and/or provisions for monitoring have however been recommended below to assist operational noise levels being maintained below the applicable NPI, 2017 PNTL.

7.2.1 Safeguards & Provisions

Operational compliance has been achieved with the assumption that the proposed new primary transformer would achieve a sound power level of 100.8 dBA and the associated auxiliary transformer would achieve a sound power level of 74 dBA. On this basis the following safeguards and provisions are provided:

- During equipment procurement, ensure that the new primary transformer and auxiliary transformer achieve the operational sound power levels of 100.8 dBA and 74 dBA or better. Based on discussions with TransGrid and the authors of this report, this value can be achieved and TransGrid are committed to doing so as far as is currently considered feasible, reasonable and safe; and
- All formal / reoccurring operational noise complaints should be investigated and where necessary operator attended noise validation, and compliance measurements should be undertaken to measure and compare the site noise level contributions to a) the predicted values; and b) the PNTLs presented in this report:
 - All site noise levels should be measured in the absence of any influential source not associated with the project;
 - If the measured site noise levels are below the predicted values and comply with the PNTLs presented in this report, no further mitigation or management measures are required; and
 - If the measured site noise levels are above the predicted noise levels or PNTLs presented in this report, further mitigation and/or management measures should be considered.

8. CONCLUSION

This noise impact assessment was completed on behalf of TransGrid for the proposed installation of a new reactor at the existing 330kV Yass Substation located off Perry Street, Yass in NSW. The assessment was conducted to achieve a scope of works that allowed for the following:

- successful identification of potential receptors situated in the vicinity and potential area of influence of site emission sources; and
- identification of significant noise generating plant, equipment and/or activities associated with the project and their likely/known emissions.

A summary of the project has been provided in **Section 1** and the overall assessment methodology is presented in **Section 2** of this report.

Existing background noise levels of the area were established using the base levels defined in NPI, 2017, as documented in **Section 3** of this report. Noise assessment criteria were then developed with due regard to these background noise levels and in accordance with current recognised NSW standards and guidelines applicable to the projects proposed construction and operational activities, refer **Section 4** of this report.

Applicable construction and operational assessment scenarios were developed based on project information provided by TransGrid. Noise levels were predicted, and compared to NMLs and criteria to establish compliance and evaluate potential impacts. Based on these impacts potential mitigation/management measures are recommended, where necessary, to reduce levels and minimise impacts. The construction and operational noise assessments are presented in **Section 5** and **Section 6** of this report.

The construction noise assessment identified that predicted levels for all construction scenarios have the potential to exceed NML, especially during the evening (6PM to 10PM) and night-time (10PM to 7AM Monday to Friday, and to 8AM Sundays/public holidays). The magnitude and extent of potential impacts associated with these elevated noise levels is best described as low during the daytime and moderate to high during the evening/night-time. They are however as anticipated for the construction works and activities required and the distance offsets to nearby receptors. They are consistent with noise emissions generated by other construction works conducted regularly in NSW by others.

It is therefore recommended that TransGrid implement its normal construction management practices and aim to avoid any particularly noisy works during the evening and night-time. Very noisy works should be limited to the ICNG, 2009 recommended standard hours i.e. 7 AM to 6 PM Monday to Friday, and 8 AM to 1 PM Saturdays, with no work on Sundays or public holidays, where feasible, reasonable and safe to do so. It is understood that works outside the ICNG, 2009 recommended standard hours is not proposed for this project, however some works may be unavoidable with essential tasks being timed to correlate with system planning outages. A consolidated set of recommended construction noise reducing mitigation and management measures are outlined in **Section 7.1** of this report.

The operational noise assessment identified that all predicted Leq, 15 minute noise levels for existing and proposed operations are at or below the PNTL at all the identified receptors. The substation is compliant with NPI, 2017 requirements for all assessment periods. As such no additional recommendations for noise reducing mitigation or management measures warranted to those already implemented into the project design. Suitable safeguards and provisions for monitoring were provided as outlined in **Section 7.2** of this report.

Based on the outcomes of this assessment the potential for noise impacts to nearby receptors is minimal, and these impacts (if any) would be low. The recommendations provided in this report will assist reduce project noise emissions, where necessary, to compliant levels and to minimise residual impacts as far as may be feasible, reasonable and safe to do so.

REFERENCES

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

International Organisation for Standardisation (ISO) 9613 Part 2 - 1996 (ISO 9613:2, 1996) – **Acoustics - Attenuation of Sound during Propagation Outdoors - Part 2: General Method of Calculation**

International Organisation for Standardisation (ISO) 17534 - 2015 – (ISO 17534, 2015) – **Acoustics - Software for the Calculation of Sound Outdoors**, as achieved by the modelling software referenced in this report

NSW Department of Environment and Climate Change (DECC) – **NSW Interim Construction Noise Guideline** (ICNG, 2009), July 2009

NSW Environment Protection Authority – **Noise Policy for Industry** (NPI, 2017), October 2017

Standards Australia AS 2436–2010 (AS 2436, 2010) – **Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites**

APPENDIX A ACOUSTICS GLOSSARY

Glossary – Acoustical Concepts and Terminology

What Is Noise And Vibration?

Noise

Noise is often defined as a sound, especially one that is loud, unpleasant or that causes disturbance or simply as unwanted sound, but technically, noise is the perception of a series of compressions and rarefactions above and below normal atmospheric pressure.

Vibration

Vibration refers to the oscillating movement of any object. In a sense noise is the movement of air particles and is essentially vibration, though in regards to an environmental assessment vibration is typically taken to refer to the oscillation of a solid object(s). The impact of noise on objects can lead to vibration of the object, or vibration can be experienced by direct transmission through the ground, this is known as ground-borne vibration.

Essentially, noise can be described as what a person hears, and vibration as what they feel.

What Factors Contribute To Environmental Noise?

The noise from an activity, like construction works, at any location can be affected by a number of factors, the most significant being:

- How loud the activity is?
- How far away the activity is from the receptor?
- What type of ground is between the activity and the receptor e.g. concrete, grass, water or sand?
- How the ground topography varies between the activity and the receptor, for example, is it flat, hilly, mountainous? Blocking the line of sight to a noise source will generally reduce the level of noise at the receptor.
- Are there any other obstacles that block the line of sight between the source and the receptor e.g. buildings or purpose built noise walls?

How to Measure and Describe Noise?

Noise is measured using a specially designed “sound level meter” which must meet internationally recognised performance standards. Audible sound pressure levels vary across a range of 10^7 Pascals (Pa), from the threshold of hearing at $20\mu\text{Pa}$ to the threshold of pain at 200Pa. Scientists have defined a statistically described logarithmic scale called Decibels (dB) describe noise more manageably.

To demonstrate how this scale works, the following points give an indication of how an average person perceives the noise levels and differences:

- 0 dB - represents the threshold of human hearing (for a young person with ears in good condition).
- 50 dB – represents average conversation.
- 70 dB – represents average street noise, local traffic etc.
- 90 dB – represents the noise inside an industrial premises or factory.
- 140 dB - represents the threshold of pain – the point at which permanent hearing damage may occur.

Unless otherwise stated in this report, all sound pressure levels (predicted or measured noise levels at a location or point) are expressed in decibels (dB, re: 2×10^{-5} Pascals, Pa) with the “A-weighting” curve applied and adopting the relevant acoustical or statistical noise level parameter e.g. Leq, 15 minute, Leq, 1hour or L90, 9 Hour.

All sound power levels (source noise emission values) are expressed in decibels (dB, re: 10^{-12} Watts, W) with the “A-weighting” curve applied (represents human hearing) and adopting the relevant acoustical or statistical noise level parameter.

Human Response to Changes in Noise Levels

The following concepts offer qualitative guidance in respect of the average response to changes in noise levels:

- Differences in noise levels of less than approximately 2 dBA are generally imperceptible in practice, an increase of 2 dBA is hardly perceivable.
- Differences in noise levels of around 5 dBA are considered to be significant.
- Differences in noise levels of around 10 dBA are generally perceived to be a doubling (or halving) of the perceived loudness of the noise. An increase of 10 dBA is perceived as twice as loud. Therefore an increase of 20 dBA is four times as loud and an increase of 30 dBA is eight times as loud etc.
- The addition of two identical noise levels will increase the dBA level by about 3 dBA. For example, if one car is idling at 40 dBA and then another identical car starts idling next to it, the total dB level will be about 43 dBA.
- The addition of a second noise level of similar character which is at least 8 dBA lower than the existing noise level will not add significantly to the overall dBA level.
- A doubling of the distance between a noise source and a receptor results approximately in a 3 dBA decrease for a line source (for example, vehicles travelling on a road) and a 6 dBA decrease for a point source (for example, the idling car discussed above).
- A doubling of traffic volume for a line source results approximately in a 3 dBA increase in noise, halving the traffic volume for a line source results approximately in a 3 dBA decrease in noise.

Terms to Describe the Perception of Noise

The following terms offer quantitative and qualitative guidance in respect of the audibility of a noise source:

- **Inaudible / Not Audible** - the noise source and/or event could not be heard by the operator, masked by extraneous noise sources not associated with the source. If a noise source is ‘inaudible’ its noise level may be quantified as being less than the measured LA90 background noise level, potentially by 10 dB or greater.
- **Barely Audible** – the noise source and/or event are difficult to define by the operator, typically masked by extraneous noise sources not associated with the source. If a source is ‘barely audible’ its noise level may be quantified as being 5 - 7 dB below the measured LA90 or LAeq noise level, depending on the nature of the source e.g. constant or intermittent.
- **Just Audible** – the noise source and/or event may be defined by the operator. However, there are a number of extraneous noise sources contributing to the measurement. The noise level should be quantified based on instantaneous noise level contributions, noted by the operator.
- **Audible** - the noise source and/or event may be easily defined by the operator. There may be a number of extraneous noise sources contributing to the measurement. The noise level should be quantified based on instantaneous noise level contributions, noted by the operator.
- **Dominant** – the noise source and/or event are noted by the operator to be significantly ‘louder’ than all other noise sources. The noise level should be quantified based on instantaneous noise level contributions, noted by the operator.

The following terms offer qualitative guidance in respect of acoustic terms used to describe the frequency of occurrence of a noise source during an operator attended environmental noise measurements:

- **Constant** – this indicates that the operator has noted the noise source(s) and/or event to be constantly audible for the duration of the noise measurement e.g. an air-conditioner that runs constantly during the measurement.
- **Intermittent** – this indicates that the operator has noted the noise source(s) and/or event to be audible, stopping and starting intervals for the duration of the noise measurement, e.g. cars passing by.
- **Infrequent** – this indicates that the operator has noted the noise source(s) and/or event to be constantly audible, however; not occurring regularly or at intervals for the duration of the noise measurement e.g. a small number of aircraft are noted during the measurement.

How to Calculate or Model Noise Levels

There are two recognised methods which are commonly adopted to determine the noise at a particular location from a proposed activity. The first is to undertake noise measurements while the activity is in progress and measures the noise, the second is to calculate the noise based on known noise emission data for the activity in question.

The second option is preferred as the first option is largely impractical regarding cost and time constraints, notwithstanding the meteorological factors that may also influence its quantification. Furthermore, it is also generally considered unacceptable to create an environmental impact simply to measure it. In addition, the most effective mitigation measures are determined and implemented during the design phase and often cannot be readily applied during or after the implementation phase of a project.

Because a number of factors can affect how 'loud' a noise is at a certain location, the calculations can be very complex. The influence of other ambient sources and the contribution from a particular source in question can be difficult to ascertain. To avoid these issues, and to quantify the direct noise contribution from a source/site in question, the noise level is often calculated using noise modelling software packages. The noise emission data used in may be obtained from the manufacturer or from ERM's database of measured noise emissions.

Acoustic Terminology & Statistical Noise Descriptors

Environmental noise levels such as noise generated by industry, construction and road traffic are commonly expressed in dBA. The A-weighting scale follows the average human hearing response and enables comparison of the intensity of noise with different frequency characteristics. Time-varying noise sources are often described in terms of statistical noise descriptors. The following descriptors are commonly used when assessing noise and are referred to throughout this acoustic assessment:

- **Ambient noise** – the all-encompassing noise associated within a given environment. It is the composite of sounds from many sources, both near and far.
- **Background noise** – the underlying level of noise present in the ambient noise, excluding the noise source under investigation, when extraneous noise is removed. This is described using the LA90 descriptor.
- **Cognitive noise** – noise in which the source is recognised as being annoying.
- **Decibel** (dB is the adopted abbreviation for the decibel) – A measure of sound level. The decibel is a logarithmic way of describing a ratio. The ratio may be power, sound pressure, voltage, intensity or other parameters. In the case of sound pressure, it is equivalent to 10 times the logarithm (to base 10) of the ratio of a given sound pressure squared to a reference sound pressure squared.

- **dBA** -Unit used to measure 'A-weighted' sound pressure levels. A-weighting is an adjustment made to sound-level measurement to approximate the response of the human ear.
- **dBC** – unit used to measure 'C-weighted' sound pressure levels. C-weighting is an adjustment made to sound-level measurements which takes account of low-frequency components of noise within the audibility range of humans.
- **dBZ or dBL** – unit used to measure 'Z-weighted' sound pressure levels with no weighting applied, linear.
- **Hertz (Hz)** - the measure of frequency of sound wave oscillations per second. 1 oscillation per second equals 1 hertz.
- **Octave** – a division of the frequency range into bands, the upper frequency limit.
- **1/3 Octave** – single octave bands divided into three parts.
- **Leq** - this level represents the equivalent or average noise energy during a measurement period. The Leq, 15 min noise descriptor simply refers to the Leq noise level calculated over a 15 minute period. Indeed, any of the below noise descriptors may be defined in this way, with an accompanying time period (e.g. L10, 15 minute) as required.
- **LAF90, 15 min** - The A-weighted sound pressure level measured using fast time weighting that is exceeded for 90% of the time over a 15-minute assessment period. This is a measure of background noise.
- **LAF90, period (day/evening/night)** – The A-weighted sound pressure level, obtained by using fast time weighting that is equal to or exceeded for 90% of the day, evening and night periods (as defined in this policy) for each 24-hour period.
- **LAF90, (shoulder period)** - The A-weighted sound pressure level measured using fast time weighting that is exceeded for 90% of aggregate sound pressure level data for the equivalent of one week's worth of valid data taken over the shoulder period.
- **L_{Aeq, T}** - The time-averaged sound pressure level. The value of the A-weighted sound pressure level of a continuous steady sound that, with a measurement time interval T, has the same mean square sound pressure level as a sound under consideration with a level that varies with time (AS1055.1-1997).
- **L_{Amax}** - The maximum sound pressure level of an event measured with a sound level meter satisfying AS IEC 61672.1-2004 set to 'A' frequency weighting and fast time weighting.
- **LN** - the percentile sound pressure level exceeded for N% of the measurement period calculated by statistical analysis.
- **L10** - the noise level exceeded for 10 per cent of the time and is approximately the average of the maximum noise levels.
- **L90** - the noise level exceeded for 90 per cent of the time and is approximately the average of the minimum noise levels. The L90 level is often referred to as the "background" noise level and is commonly used as a basis for determining noise criteria for assessment purposes.
- **Low frequency** - Noise containing major components in the low-frequency range (10 hertz [Hz] to 160 Hz) of the frequency spectrum.
- **Masking** - The phenomenon of one sound interfering with the perception of another sound. For example, the interference of traffic noise with use of a public telephone on a busy street (Bies and Hansen, 1996).
- **Sound Power Level (L_w)** - this is a measure of the total power radiated by a source. The Sound Power of a source is a fundamental property of the source and is independent of the surrounding environment.

- **Sound Pressure Level (Lp)** - the level of sound pressure; as measured at a distance by a standard sound level meter with a microphone. This differs from LW in that this is the received sound as opposed to the sound 'intensity' at the source.
- **Spectral characteristics** - The frequency content of noise.
- **Tonal noise (tonality)**: noise containing a prominent frequency and characterised by a definite pitch.

Noise Policy for Industry (NPI, 2017) Specific Terminology

The following terminology is from the NSW Environment Protection Authority – Noise Policy for Industry (NPI, 2017), October 2017.

- **Annoyance** - An emotional state connected to feelings of discomfort, anger, depression and helplessness. It is generally measured by means of the ISO15666 defined questionnaire (EEA, 2010).
- **Assessment period** - The period in a day over which assessments are made: day (7 am to 6 pm); evening (6 pm to 10 pm); or night (10 pm to 7 am).
- **Best available technology economically achievable (BATEA)** - Equipment, plant and machinery incorporating the most advanced and affordable technology available to minimise noise output.
- **Best management practice (BMP)** - Adoption of particular operational procedures that minimise noise while retaining productive efficiency.
- **Cluster of industry** - An industrial/port estate, area, zone, or proposed area or zone where more than three separate industrial uses are co-located in a contiguous fashion and are operating or proposed to operate.
- **Construction activities** - Activities that are related to the establishment phase of a development and that will occur on a site for only a limited period of time.
- **Correction for duration**: this is applied where a single-event noise is continuous for a period of less than two and a half hours in any assessment period. The allowable exceedance of the LA_{eq}, 15 min equivalent noise criterion for the duration of the event is shown in Table C3 of the NPI. This adjustment is designed to account for unusual and one-off events, and does not apply to regular and/or routine high-noise level events.
- **Cumulative industrial noise level** - The total level of noise from all industrial sources.
- **Greenfield site** - Undeveloped land.
- **High traffic amenity level** - The level of transport noise, road traffic noise in particular, may be high enough to make noise from an industrial source effectively inaudible, even though the LA_{eq} noise level from that industrial noise source may exceed the project amenity noise level. In such cases the project amenity noise level may be derived from the LA_{eq}, period (traffic) minus 15 dBA. Refer to Section 2.4.1 of the NPI for additional details.
- **Impulsive noise** - Noise with a high peak of short duration, or a sequence of such peaks.
- **Industrial noise sources** - As defined in Section 1.4 of the NPI, noise from mechanical plant and equipment; industrial and commercial processes; mobile sources confined to a particular location (for example, drag lines, haul trucks, intermodal facilities and rail shunting yards); and vehicle movements within the premises and/or on private roads.
- **Intrusive noise** - Refers to noise that intrudes above the background level by more than 5 dB. The intrusiveness noise level is set out in further detail throughout Section 2.3 of the NPI.

- **Intermittent noise:** noise where the level suddenly drops/increases several times during the assessment period, with a noticeable change in source noise level of at least 5 dBA; for example, equipment cycling on and off. The intermittency correction is not intended to be applied to changes in noise level due to meteorology.
- **Maximum correction:** the maximum correction to be applied to the predicted or the measured level where two or more modifying factors are present. The maximum adjustment is 10 dBA where the noise contains two or more modifying factors (excluding the duration correction).
- **Noise impact assessment (NIA)** - The component of an Environmental Impact Statement, Environmental Assessment, Statement of Environmental Effects, or licence application that considers the impacts of noise resulting from a development or activity.
- **Noise-sensitive land uses** - Land uses that are sensitive to noise, such as residential areas, churches, schools and recreation areas.
- **Non-compliance** - Any exceedance of a consent/licence limit is considered a non-compliance. However, the type of regulatory action taken by a regulatory authority will depend on a number of factors, in accordance with the authority's prosecution policies and guidelines.
- **Non-mandatory** - In this policy this means not required by legislation. The policy specifies project noise trigger levels to be strived for, but the legislation does not make these levels compulsory. However, the policy will be used as a guide to setting statutory (legally enforceable) limits for licences and consents.
- **Performance-based goals** - Goals specified in terms of the outcomes/performance to be achieved, but not in terms of the means of achieving them.
- **Premises** - includes: (a) a building or structure, or (b) land or a place (whether enclosed or built on or not), or (c) a mobile plant, vehicle, vessel or aircraft, as defined in the Protection of the Environment Operations Act 1997.
- **Proponent** - The developer of the industrial noise source.
- **Residence** - A lawful and permanent structure erected in a land-use zone that permits residential use (or for which existing use rights under the EP&A Act apply) where a person/s permanently reside and is not, nor associated with, a commercial undertaking such as caretakers' quarters, hotel, motel, transient holiday accommodation or caravan park.
- **Receiver** - The noise-sensitive land use at which noise from a development can be heard.
- **Significant meteorological effects** - In relation to temperature inversions, this means at least 30% of the total night time during the winter months. In relation to wind speeds this means at least 30% of the time or more in any assessment period (day, evening, night) in any season.
- **Sleep disturbance** - Awakenings and disturbance to sleep stages.
- **Temperature inversion** - An atmospheric condition in which temperature increases with height above the ground.
- **Very noise enhancing meteorological conditions** – Meteorological conditions outside of the range of either standard or noise-enhancing meteorological conditions as adopted in the noise impact assessment following the procedures in Fact Sheet D of the NPI.

Operator Attended Measurements

The table below presents typical abbreviations that are used to describe common noise sources that may be noted during environmental noise measurements.

General Field Note Abbreviations

Abbreviation	Noise Source
ANML (B-I-D-L)	Animals (birds – insects – domestic - livestock)
ACF T	Aircraft
CPBY	Car pass by
DLCN	Dialogue, conversations e.g. with passers-by
DTRF	Distant traffic
LTRF	Local traffic
OIND	Other industry/industrial sites
OPTR	Operator
RDOC	Residential/occupants
RHUM	Rural harm
SHUM	Suburban harm
UHUM	Urban harm
WBGV	Windblown vegetation

During operator attended noise measurements, the sound level meter will present the instantaneous noise level and record acoustical and statistical parameters. In certain acoustical environments, where a range of noise sources are audible and detectable, the sound level meter cannot measure a direct source noise level, and it is often necessary to account for the contribution and duration of the sources.

Noted Percentile Contribution – the first table below presents noise level deductions that are typically applied based on the percentage contribution of a noise source(s).

Noted Time Contribution – the second table below presents noise level deductions that may be applied based on the percentage of time that a noise source(s) is audible during a 15-minute measurement. Where the noise emission from a source is clearly detectable, and the contribution can be measured, these deductions are not necessary.

Noise Level Deductions – Noted Percentile Contribution

Percentage Contribution	Noise Adjustment Level, dBA
5%	-13.0
10%	-10.0
15%	-8.2
20%	-7.0
25%	-6.0
30%	-5.2
35%	-4.6
40%	-4.0
45%	-3.5
50%	-3.0
55%	-2.6
60%	-2.2
65%	-1.9
70%	-1.5
75%	-1.2
80%	-1.0
85%	-0.7
90%	-0.5
95%	-0.2
100%	0.0

Noise Level Deductions – Noted Time Contribution

Event Duration (Minutes)	Noise Level Adjustment, dBA
1	-11.8
2	-8.8
3	-7.0
4	-5.7
5	-4.8
6	-4.0
7	-3.3
8	-2.7
9	-2.2
10	-1.8
11	-1.3
12	-1.0
13	-0.6
14	-0.3
15	0.0

APPENDIX B DETAILED METHODOLOGY (ICNG, 2009 / NPI, 2017)

NSW Interim Construction Noise Guidelines (ICNG, 2009) Methodology and Application Notes

The aim of the NSW Department of Environment and Climate Change (DECC) – *NSW Interim Construction Noise Guideline, July 2009* (ICNG, 2009) is to provide guidance on managing construction works to minimise noise (including airborne noise, ground-borne noise and blasting), with an emphasis on communication and cooperation with all involved in, or affected by, construction noise.

The main objectives of the ICNG, 2009 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.

No single approach can minimise noise from all types of construction. The level of effort and sophistication needed to assess impacts and identify ways to minimise noise will be guided by factors such as the duration of works and the extent of the noise. Short-term works or low noise level works will be typically easier to assess and manage. The Guideline may also be useful for determining authorities and other approval authorities when dealing with noise from construction and maintenance works on smaller-scale projects.

The steps for managing noise impacts from construction are:

- identify sensitive land uses that may be affected;
- identify hours for the proposed construction works;
- identify noise impacts at sensitive land uses; and
- select and apply the best work practices to minimise noise impacts.

Recommended Standard Hours

The ICNG, 2009 presents an accepted method by which construction noise impacts may be assessed for a range of receptor types for works completed in NSW. It provides a set of recommended standard hours of construction, as reproduced below:

- Monday to Friday: 7 am to 6 pm;
- Saturday: 8 am to 1 pm; and
- No work on Sundays or public holidays.

The ICNG, 2009 encourages works to occur within the recommended standard hours of construction unless justification is provided. It focuses on minimising construction noise impacts, rather than only on achieving numeric noise levels, and recognises that some noise from construction sites is inevitable. The ICNG, 2009 encourages organisations involved with construction, maintenance or upgrading works (e.g. large scale contractors or Government agencies) to develop their best-practice techniques for managing construction noise and vibration, and implementing feasible and reasonable mitigation measures.

Noise Management Levels (NML)

Residential Receptors

People's reaction to noise from construction will depend on the time of day that works are undertaken. Residents are usually most annoyed by work at night-time as it has the potential to disturb sleep. Noise from work on evenings, Saturday afternoons, Sundays and public holidays can also be annoying to most residents as it may interrupt leisure activities.

The ICNG sets out noise management levels (NML) for residences and how they are to be applied for construction projects. Restrictions to the hours of construction may apply to activities that generate noise at residences above the 'highly noise affected' noise management level. The RBL is used when determining the NMLs, consistent with the approach described for the NPI (refer **Section B.2**).

The method for developing construction NMLs for residential noise sensitive receptors is detailed in the table below. The method for developing construction NMLs for other sensitive receptors are outlined in the sections below.

Construction Airborne Noise Management Levels for Residential Receptors (ICNG)

Time of day	Noise management level, $L_{eq} - dBA$	How to apply
<p>Recommended standard hours (SH): Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays</p>	<p>Noise affected Rating Background Level (RBL) + 10 dBA</p>	<p>The noise affected level represents the point above which there may be some community reaction to noise.</p> <ul style="list-style-type: none"> Where the predicted or measured $L_{eq, 15 \text{ minute}}$ 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.
	<p>Highly noise affected 75 dBA</p>	<p>The highly noise affected level represents the point above which there may be strong community reaction to noise.</p> <ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> 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.
<p>Outside recommended standard hours (OOH) - All other times including Public Holidays</p>	<p>Noise affected Rating Background Level (RBL) + 5 dBA</p>	<ul style="list-style-type: none"> A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied, and noise is more than 5 dBA above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements see Section 7.2.2 of the ICNG.

Other Sensitive Land Uses

Other sensitive land uses, such as schools, typically consider noise from construction to be disruptive when the properties are being used (such as during school times). Table 3 of the ICNG presents management levels for noise at other sensitive land uses based on the principle that the characteristic activities for each of these land uses should not be unduly disturbed. Table 3 of the ICNG is reproduced in the table.

Other Sensitive Receptors (NML)

Land Use	Management level, LAeq, 15 minute (applies when properties are being used)
Classrooms at schools and other educational institutions	Internal noise level 45 dBA (External noise level 55 dBA)*
Hospital wards and operating theatres	Internal noise level 45 dBA (External noise level 55 dBA)*
Places of worship	Internal noise level 45 dBA (External noise level 55 dBA)*
Active recreation areas (characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion)	External noise level 65 dBA
Passive recreation areas (characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation)	External noise level 60 dBA
Community centres	Depends on the intended use of the centre. Refer to the recommended 'maximum' internal levels in AS2107 for specific uses.

* Internal noise levels are to be assessed at the centre of the occupied room. External noise levels are to be assessed at the most affected point within 50 m of the area boundary. Where internal noise levels cannot be measured, external noise levels may be used. A conservative estimate of the difference between internal and external noise levels is 10 dB for buildings other than residences. Some buildings may achieve greater performance, such as where windows are fixed (that is, cannot be opened).

Commercial and Industrial Receptors

Due to the broad range of sensitivities that commercial or industrial land can have to noise from construction, the process of defining management levels is separated into three categories. As defined by the ICNG the external noise levels should be assessed at the most-affected occupied point of the premises:

- Industrial premises: external Leq, 15 minute ≤ 75 dBA.
- Offices, retail outlets: external Leq, 15 minute ≤ 70 dBA.
- Other businesses that may be very sensitive to noise, where the noise level is project specific as discussed in the ICNG.

Ground-borne Noise at Residences

Ground-borne noise is noise generated by vibration transmitted through the ground into a structure. Ground-borne noise caused, for example, by underground works such as tunnelling can be more noticeable than airborne noise. The following ground-borne noise levels for residences indicate when management actions should be implemented. The ICNG outlines fixed NML for ground-borne noise. These ground-borne NMLs are applicable at residences and indicate when management actions should be implemented. These levels recognise the temporary nature of construction and are only applicable when ground-borne noise levels are higher than airborne noise levels. The ground-borne noise levels are for evening and night-time periods only, as the objectives are to protect the amenity and sleep of people when they are at home.

- **Evening** (6 pm to 10 pm): Leq, 15 minute 40 dBA (internal).
- **Night-time** (10 pm to 7 am): Leq, 15 minute 35 dBA (internal).

The internal noise levels are to be assessed at the centre of the most affected habitable room.

NSW Noise Policy for Industry, 2017 Methodology

Overview

The purpose of the policy is to ensure noise impacts associated with particular industrial developments are evaluated and managed in a consistent and transparent manner. It provides noise levels for assessing the potential impact of noise from industry and includes a framework for considering feasible and reasonable noise mitigation measures. The *Environmental Planning and Assessment Act 1979* (EP&A Act) and the *Protection of the Environment Operations Act 1997* (POEO Act) require that authorities examine and take into account matters affecting the environment when making decisions about development and activities. The policy also provides a procedure for the development of appropriate and achievable statutory noise limits and operational requirements for development consents and environment protection licences.

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

- Determining the project noise trigger levels for a development; these are the benchmark levels above which noise management measures are required to be considered. They are derived by considering two factors: shorter-term intrusiveness due to changes in the noise environment, and maintaining the noise amenity of an area. Measurement of existing background levels, using procedures outlined in Fact Sheets A and B, is required for this step.
- Predicting or measuring the noise levels produced by the development, having regard to the presence of annoying noise characteristics (Fact Sheet C) and meteorological effects such as temperature inversions and wind (Fact Sheet D).
- Comparing the predicted or measured noise level with the project noise trigger level, and assessing impacts and the need for noise mitigation and management measures.
- Considering residual noise impacts, that is, noise levels that exceed the project noise trigger levels after the application of feasible and reasonable noise mitigation measures. This may involve balancing economic, social and environmental costs and benefits from the proposed development against the noise impacts, including consultation with the affected community where impacts are expected to be significant.
- Setting statutory compliance levels that reflect the best achievable and agreed noise limits for the development.
- Monitoring and reporting environmental noise levels from the development.

Project Noise Trigger Levels

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

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

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

- receiver's background noise environment;
- time of day of the activity;
- character of the noise; and
- type of receiver and nature of the area.

The project noise trigger level is the lower (that is, the more stringent) value of the project intrusiveness noise level and project amenity noise level, as summarised below.

The project **intrusiveness** noise level aims to protect against significant changes in noise levels, whilst the project **amenity** noise level seeks to protect against cumulative noise impacts from industry and maintain amenity for particular land uses. Applying the most stringent requirement as the project noise trigger level ensures that both intrusive noise is limited and amenity is protected and that no single industry can unacceptably change the noise level of an area.

When determining whether noise mitigation is 'feasible and reasonable', the starting point is identifying mitigation measures that would result in achieving the relevant project noise trigger levels, and then identifying why particular measures may not be either feasible or reasonable.

Project intrusiveness noise level

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

$L_{Aeq, 15min} = \text{rating background noise level} + 5 \text{ dB}$	
where:	
$L_{Aeq, 15min}$	represents the equivalent continuous (energy average) A-weighted sound pressure level of the source over 15 minutes.
and	
Rating background noise level	represents the background level to be used for assessment purposes, as determined by the method outlined in Fact Sheets A and B.

Minimum assumed RBLs apply in this policy. These result in minimum intrusiveness noise levels are reproduced from the NPI, 2017 in the table below.

Minimum assumed RBLs and project intrusiveness noise levels.

Time of day	Minimum assumed rating background noise level (dBA)	Minimum project intrusiveness noise levels (LAeq,15min dBA)
Day	35	40
Evening	30	35
Night	30	35

Amenity noise levels and project amenity noise levels

To limit continuing increases in noise levels from application of the intrusiveness level alone, the ambient noise level within an area from all industrial noise sources combined should remain below the recommended amenity noise levels specified in the table below, where feasible and reasonable. The recommended amenity noise levels will protect against noise impacts such as speech interference, community annoyance and some sleep disturbance.

The recommended amenity noise levels represent the objective for total industrial noise at a receiver location, whereas the project amenity noise level represents the objective for noise from a single industrial development at a receiver location.

To ensure that industrial noise levels (existing plus new) remain within the recommended amenity noise levels for an area, a project amenity noise level applies for each new source of industrial noise as follows:

Project amenity noise level for industrial developments = recommended amenity noise level (Table 2.2) minus 5 dB(A)

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

Amenity Noise Levels

Receiver	Noise Amenity Area	Time of Day	Recommended Amenity Noise Level (LAeq, period dBA)
Residential	Rural	Day ²	50
		Evening ³	45
		Night ⁴	40
	Suburban	Day ²	55
		Evening ³	45
		Night ⁴	40
	Urban	Day ²	60
		Evening ³	50
		Night ⁴	45
Hotels, motels, caretakers' quarters, holiday accommodation, permanent resident caravan parks	See column 4	See column 4	5 dBA above the recommended amenity noise level for a residence for the relevant noise amenity area and time of day
School classroom – internal	All	Noisiest 1-hour period when in use	35 (see notes for table)
Hospital ward internal external	All	Noisiest 1-hour	35
	All	Noisiest 1-hour	50
Place of worship – internal	All	When in use	40
Area specifically reserved for passive recreation (e.g. national park)	All	When in use	50
Active recreation area (e.g. school playground, golf course)	All	When in use	55
Commercial premises	All	When in use	65
Industrial premises	All	When in use	70
Industrial interface (applicable only to residential noise amenity areas)	All	All	Add 5 dBA to recommended noise amenity area

1. The recommended amenity noise levels refer only to noise from industrial sources. However, they refer to noise from all such sources at the receiver location, and not only noise due to a specific project under consideration. The levels represent outdoor levels except where otherwise stated.
2. day – the period from 7 am to 6 pm Monday to Saturday or 8 am to 6 pm on Sundays and public holidays
3. evening – the period from 6 pm to 10 pm
4. night – the remaining periods.

The table below provides guidance on assigning residential receiver noise categories; however, careful judgement based on site-specific circumstances and consultation with the relevant planning/licensing authority may be required in some circumstances.

Determining which of the residential receiver categories applies.

Receiver Category	Typical planning zoning – standard instrument*	Typical existing background noise levels	Description
Rural residential	U1 – primary production RU2 – rural landscape RU4 – primary production small lots R5 – large lot residential E4 – environmental living	Daytime RBL <40 dBA Evening RBL <35 dBA Night RBL <30 dBA	Rural – an area with an acoustical environment that is dominated by natural sounds, having little or no road traffic noise and generally characterised by low background noise levels. Settlement patterns would be typically sparse. Note: Where background noise levels are higher than those presented in column 3 due to existing industry or intensive agricultural activities, the selection of a higher noise amenity area should be considered.
Suburban residential	RU5 – village RU6 – transition R2 – low density residential R3 – medium density residential E2 – environmental conservation E3 – environmental management	Daytime RBL <45 dBA Evening RBL <40 dBA Night RBL <35 dBA	Suburban – an area that has local traffic with characteristically intermittent traffic flows or with some limited commerce or industry. This area often has the following characteristic: evening ambient noise levels defined by the natural environment and human activity.
Urban residential	R1 – general residential R4 – high density residential B1 – neighbourhood centre (boarding houses and shop-top housing) B2 – local centre (boarding houses) B4 – mixed use	Daytime RBL > 45 dBA Evening RBL > 40 dBA Night RBL >35 dBA	Urban – an area with an acoustical environment that: <ul style="list-style-type: none"> ■ is dominated by ‘urban hum’ or industrial source noise, where urban hum means the aggregate sound of many unidentifiable, mostly traffic and/or industrial related sound sources ■ has through-traffic with characteristically heavy and continuous traffic flows during peak periods ■ is near commercial districts or industrial districts ■ has any combination of the above.

Sleep disturbance

As stated in the NPI the potential for sleep disturbance from maximum noise level events generated by premises during the night-time period needs to be considered. The term “sleep disturbance” is considered to be both awakenings and disturbance to sleep stages.

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

- $L_{eq,15\text{ minute}}$ 40 dBA or the prevailing RBL plus 5 dB, whichever is the greater, and/or
- L_{max} 52 dBA or the prevailing RBL plus 15 dB, whichever is the greater,

a detailed maximum noise level event assessment should be undertaken.

The detailed assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the rating background noise level, and the number of times this happens during the night-time period. Some guidance on possible impact is contained in the review of research results in the NSW Road Noise Policy (RNP, 2011)

Predicting Noise Levels

The important parameters for predicting noise are listed below. These will set the boundaries of the noise prediction process. They need to be determined and clearly identified for noise impacts to be predicted adequately. The parameters are:

- all noise sources related to the proposed development, including vehicles that operate on site
- source noise levels, site location and effective height of the noise source – references should be provided for all source noise levels used in the assessment (for example, direct measurement, previous Environmental Impact Statement, and manufacturers’ specifications)
- annoying characteristics of the noise sources that may be experienced at receiver locations (for example, tonality, low frequency, and intermittency; see NPI Fact Sheet C)
- all stages of project development, including whether noise emissions may vary depending on site operations, for example, during delivery/despatch activities
- all receivers potentially affected by the development
- meteorological conditions applicable to the site (from NPI Fact Sheet D) to determine the meteorological conditions that should be adopted for the noise impact assessment
- site features (including natural and constructed, development and surrounding land uses) that affect noise propagation
- operating times of the development.

The noise impact of the development can be determined by comparing the predicted noise levels at the receiver with the corresponding project noise trigger levels that have been derived for that particular location. The development is considered to cause a noise impact if the predicted noise level at the receiver exceeds the corresponding project noise trigger level. The extent of noise impact from the development is defined by the extent the predicted noise level exceeds the project noise trigger level.

Mitigating Noise from Industrial Developments

Where the project noise trigger levels are exceeded, feasible and reasonable noise mitigation measures should be evaluated, with the aim of reducing noise to the project noise trigger levels. Section 3.4 of the NPI gives a broad overview of ways to mitigate noise from industrial activities. It is not intended to be prescriptive guidance. It will be the responsibility of the proponent to demonstrate the selected mitigation measures are appropriate, and to justify any mitigation measures proposed (or disregarded) as part of a noise impact assessment. This advice provides useful guidance to developers of industrial activities to consider during the early stages of planning and design.

The aim of this process is to evaluate what mitigation measures are both feasible and reasonable and the effect these will have on noise outcomes if applied.

Measures for reducing noise impacts from industrial activities follow three main control strategies:

- reducing noise at the source;
- reducing noise in transmission to the receiver; and
- reducing noise at the receiver.

These control strategies should be considered in a hierarchical way so that all the measures that reduce noise for a large number of receivers (that is, source controls) are exhausted before more localised mitigation measures are considered. When determining whether noise mitigation is 'feasible and reasonable', the starting point is identifying mitigation measures that would result in achieving the relevant project noise trigger levels, and then identifying why particular measures may not be either feasible or reasonable.

Residual noise

A residual noise impact may exist where the best-achievable noise level from a development, when assessed at a sensitive receiver location, remains above the project noise trigger levels. Chapter 4 of NPI, 2017 presents the method for determining the significance of residual noise impacts that may exist where the best-achievable noise level from development, when assessed at a sensitive receiver location, remains above the project noise trigger levels.

Residual noise impacts are identified **after** all source and pathway feasible and reasonable noise mitigation measures have been considered. The significance of the residual impact and the need to assess receiver-based treatment options may need to be considered as part of an authority's determination/approval process.

Determining the significance of any residual noise impact is an essential component of the noise assessment process, to ensure that effective and appropriate mitigation measures are taken in each case. A guide to the significance of residual noise impacts is outlined in **Table 2.4** below.

Significance of residual noise impacts.

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

Examples of noise mitigation at a residence that may be required by planning authorities to mitigate residual noise impacts are outlined below, based on the significance of the residual noise levels.

- **Negligible:** The exceedances would not be discernible by the average listener and therefore would not warrant receiver-based treatments or controls.
- **Marginal:** Provide mechanical ventilation/comfort condition systems to enable windows to be closed without compromising internal air quality/amenity.
- **Moderate:** As for 'marginal', but also upgraded façade elements, such as windows, doors or roof insulation, to further increase the ability of the building façade to reduce noise levels.
- **Significant:** May include suitable commercial agreements where considered feasible and reasonable.

NOI, 2017 Fact Sheets (A to F)

Fact Sheet A: Determining Existing Noise Levels

Fact Sheet A provides guidance for determining the background noise level or rating background noise level (RBL) which can be utilised in relevant noise assessments.

The background noise level is defined here as 'the underlying level of noise present in ambient noise, generally excluding the noise source under investigation, when extraneous noise is removed'. Sound levels contributing to background levels can include sound from nearby traffic, birds, insects, animals, machinery and similar sources, if these sounds are a normal feature of the location.

The background noise level is represented by the LAF90, 15 min descriptor when undertaking short-term monitoring. In comparison, the rating background noise level is the single-figure background noise level derived from monitoring over a representative period of time, typically one full week. The rating background noise level is used for assessment purposes.

Fact Sheet A also provides information regarding:

- determining existing industrial noise levels;
- 'shoulder' assessment periods;
- meteorological conditions for background noise monitoring; and
- duration of monitoring.

Fact Sheet B: Measurement Procedures for Determining Background Noise

Fact Sheet B gives a detailed description of instrumentation requirements, and procedures for measurement and analysis for determining background noise levels. It also contains information regarding the determination of background noise using long-term noise measurements, determining background noise using short-term noise measurements and reporting requirements.

Fact Sheet C: Corrections for Annoying Noise Characteristics

Some noise sources may contain certain characteristics, such as tonality, intermittency, irregularity or dominant low-frequency content and there is evidence to suggest that these characteristics can cause greater annoyance than other noise emissions at the same level.

Fact Sheet C outlines the "correction factors" (penalties) that are to be applied to the source noise level at the receptor (before comparison to criteria) to account for the potential additional annoyance caused by these characteristics. Fact Sheet C also provides definitions to support these modifying factor corrections.

Fact Sheet D: Accounting for Noise-Enhancing Weather Conditions

Certain meteorological conditions have the potential to increase noise levels at receptors influenced by the effects of temperature inversions, being atmospheric conditions where temperatures increase with height above ground level, or wind gradients, that is, wind velocities increasing with height, and with wind direction from the source to the receptor. The extent that noise-enhancing temperature inversions and winds can increase levels will vary depending on the distance to the receptor from the source and condition being experienced.

Fact Sheet D provides guidance around noise-enhancing weather conditions, and outlines approaches for consideration of meteorological conditions for both the impact assessment phase (pre-operation) and compliance assessment phase (post-operation) for an industrial activity.

Fact Sheet D also contains methods for determining the frequency of temperature inversions, and methods for determining the frequency of wind.

Fact Sheet E: Worked Case Studies

Fact Sheet E includes a number of worked case studies that describe how to successfully apply the principles of the NPI in a variety of circumstances. Worked case studies include:

- a general application case study;
- a high traffic noise case study;
- an extractive industry proposed for quiet rural area (significance of meteorological assessment);
- existing intensive primary industry; and
- modifications to existing industrial premises co-located with existing urban residential land uses.

Fact Sheet F: Feasible and Reasonable Mitigation

Fact Sheet F describes and provides guidance for the application of feasible and reasonable mitigation measures. The following should be taken into consideration when determining feasible and reasonable mitigation measures:

- Noise impacts;
- Noise mitigation benefits;
- Cost effectiveness of noise mitigation; and
- Community views.

APPENDIX C DETAILED NOISE ASSESSMENT DATASET

Scenario	Description	Equipment	Quantity	Duty Factor	Base L _W Value	NPI Penalty, dBA	Total L _W Value	Source	Noise Source Term Data											
									Spectral Data in dBA											
									31.5Hz	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	16kHz	L _W Total, dBA	
CON01	Site Preparation and Establishment	Excavator (approx. 20 tonne)	2	0.75	105	-	106.8	Adopted from Australian Standard AS2436	64.3	85.0	93.7	96.3	101.6	102.6	97.9	92.6	85.4	106.8		
		Concrete agitator truck	2	0.5	109	-	109.0	Adopted from Australian Standard AS2436	68.5	84.5	92.7	94.2	101.0	106.4	101.6	94.9	88.4	109.0		
		Concrete pump truck	2	0.5	108	-	108.0	Adopted from Australian Standard AS2436	77.1	85.1	93.2	95.6	100.9	103.6	102.1	96.3	91.0	108.0		
		Roller	2	1	108	-	111.0	Adopted from Australian Standard AS2436	60.4	78.6	93.7	104.2	104.6	105.8	104.0	95.8	89.7	111.0		
		Grader	2	0.75	110	-	111.8	Adopted from Australian Standard AS2436	64.7	83.9	96.0	104.5	105.9	107.1	103.3	96.1	83.0	111.8		
		Jackhammer	2	1	113	5	121.0	Adopted from TNSW CNS	82.1	96.9	109.6	112.3	113.8	115.7	114.8	107.9	100.2	121.0		
		Light Vehicle (idle)	4	0.5	95	-	98.0	Adopted from Australian Standard AS2436	67.1	75.1	83.2	85.6	90.9	93.6	92.1	86.3	81.0	98.0		
		Heavy Vehicle (idle)	4	0.5	107	-	110.0	Adopted from Australian Standard AS2436	65.7	91.1	95.4	101.8	105.1	102.4	104.4	93.4	86.6	110.0		
		Light Vehicle (moving)	4	0.7	95	-	99.5	Adopted from Australian Standard AS2436	68.6	76.6	84.7	87.1	92.4	95.1	93.6	87.8	82.5	99.5		
		Heavy Vehicle (moving)	4	0.7	107	-	111.5	Adopted from Australian Standard AS2436	67.2	92.6	96.9	103.3	106.6	103.9	105.9	94.9	88.1	111.5		
		Total >>>	28.0	-	118.1	-	123.0	-	123.0	-	83.9	99.7	110.5	114.4	117.8	116.6	109.3	101.8	123.0	
		CON02	General Construction of Infrastructure	Cherry Picker	2	0.5	105	-	105.0	Adopted from Australian Standard AS2436	70.9	93.1	97.4	93.4	98.7	97.2	98.2	93.8	84.6	105.0
Crane (mobile)	2			0.75	104	-	105.8	Adopted from Australian Standard AS2436	68.2	79.3	88.9	91.1	98.8	98.8	94.7	102.1	91.7	105.8		
Hand tools (electric)	4			0.5	102	-	105.0	Adopted from Australian Standard AS2436	61.7	85.4	90.5	90.2	100.8	100.9	96.2	84.5	74.4	105.0		
Hand tools (pneumatic)	2			0.5	116	-	116.0	Adopted from Australian Standard AS2436	77.1	91.9	104.6	107.3	108.8	110.7	109.8	102.9	95.2	116.0		
Light Vehicle (idle)	4			0.5	95	-	98.0	Adopted from Australian Standard AS2436	67.1	75.1	83.2	85.6	90.9	93.6	92.1	86.3	81.0	98.0		
Light Vehicle (moving)	4			0.7	95	-	99.5	Adopted from Australian Standard AS2436	68.6	76.6	84.7	87.1	92.4	95.1	93.6	87.8	82.5	99.5		
Total >>>	18.0			-	116.8	-	117.1	-	117.1	-	79.2	96.1	105.7	107.7	110.3	111.7	110.5	105.9	97.3	117.1
CON03	Delivery of Infrastructure			Crane (mobile)	1	0.75	104	-	102.8	Adopted from Australian Standard AS2436	65.2	76.3	85.9	88.1	95.8	95.8	91.7	99.1	88.7	102.8
		Hand tools (electric)	1	0.25	102	-	102.8	Adopted from Australian Standard AS2436	52.7	76.4	81.5	81.2	91.8	91.9	87.2	75.5	65.4	96.0		
		Hand tools (pneumatic)	1	0.25	116	-	110.0	Adopted from Australian Standard AS2436	71.1	85.9	98.6	101.3	102.8	104.7	103.8	96.9	89.2	110.0		
		Light Vehicle (idle)	1	0.5	95	-	92.0	Adopted from Australian Standard AS2436	61.1	69.1	77.2	79.6	84.9	87.6	86.1	80.3	75.0	92.0		
		Heavy Vehicle (idle)	1	0.5	107	-	104.0	Adopted from Australian Standard AS2436	59.7	85.1	89.4	95.8	99.1	96.4	98.4	87.4	80.6	104.0		
		Light Vehicle (moving)	1	0.7	95	-	93.5	Adopted from Australian Standard AS2436	62.6	70.6	78.7	81.1	86.4	89.1	87.6	81.8	76.5	93.5		
		Heavy Vehicle (moving)	1	0.5	107	-	104.0	Adopted from Australian Standard AS2436	59.7	85.1	89.4	95.8	99.1	96.4	98.4	87.4	80.6	104.0		
		Total >>>	7.0	-	117.4	-	112.5	-	112.5	-	73.3	90.6	99.8	103.4	106.2	106.5	106.1	101.6	92.7	112.5
CON04	Oil Filling	Oil Pump System	2	1	100	-	103.0	-	63.9	81.9	88.4	86.5	97.0	99.0	96.3	90.4	85.4	103.0		
		Heavy Vehicle (idle)	2	0.5	107	-	107.0	Adopted from Australian Standard AS2436	62.7	88.1	92.4	98.8	102.1	99.4	101.4	90.4	83.6	107.0		
		Heavy Vehicle (moving)	2	0.5	107	-	107.0	Adopted from Australian Standard AS2436	62.7	88.1	92.4	98.8	102.1	99.4	101.4	90.4	83.6	107.0		
		Total >>>	6.0	-	110.4	-	110.8	-	110.8	-	67.9	91.6	96.2	101.9	105.7	104.0	105.0	95.2	110.8	
CON05	Line Works	Excavator (approx. 20 tonne)	2	0.75	105	-	106.8	Adopted from Australian Standard AS2436	64.3	85.0	93.7	96.3	101.6	102.6	97.9	92.6	85.4	106.8		
		Concrete agitator truck	2	0.5	109	-	109.0	Adopted from Australian Standard AS2436	68.5	84.5	92.7	94.2	101.0	106.4	101.6	94.9	88.4	109.0		
		Concrete pump truck	2	0.5	108	-	108.0	Adopted from Australian Standard AS2436	77.1	85.1	93.2	95.6	100.9	103.6	102.1	96.3	91.0	108.0		
		Cherry Picker	2	0.5	105	-	105.0	Adopted from Australian Standard AS2436	70.9	93.1	97.4	93.4	98.7	97.2	98.2	93.8	84.6	105.0		
		Crane (mobile)	2	0.75	104	-	105.8	Adopted from Australian Standard AS2436	68.2	79.3	88.9	91.1	98.8	98.8	94.7	102.1	91.7	105.8		
		Hand tools (electric)	4	0.5	102	-	105.0	Adopted from Australian Standard AS2436	61.7	85.4	90.5	90.2	100.8	100.9	96.2	84.5	74.4	105.0		
		Hand tools (pneumatic)	2	0.5	116	-	116.0	Adopted from Australian Standard AS2436	77.1	91.9	104.6	107.3	108.8	110.7	109.8	102.9	95.2	116.0		
		Light Vehicle (idle)	4	0.5	95	-	98.0	Adopted from Australian Standard AS2436	67.1	75.1	83.2	85.6	90.9	93.6	92.1	86.3	81.0	98.0		
		Heavy Vehicle (idle)	4	0.5	107	-	110.0	Adopted from Australian Standard AS2436	65.7	91.1	95.4	101.8	105.1	102.4	104.4	93.4	86.6	110.0		
		Light Vehicle (moving)	4	0.7	95	-	99.5	Adopted from Australian Standard AS2436	68.6	76.6	84.7	87.1	92.4	95.1	93.6	87.8	82.5	99.5		
		Heavy Vehicle (moving)	4	0.7	107	-	111.5	Adopted from Australian Standard AS2436	67.2	92.6	96.9	103.3	106.6	103.9	105.9	94.9	88.1	111.5		
		Total >>>	16.0	-	118.8	-	119.8	-	119.8	-	81.9	99.1	107.1	110.3	113.5	114.4	113.4	107.3	99.4	119.7
Lmax	Transient or impulsive noise emitting event e.g. metal-on-metal contact	Lmax	1	1	129	-	129.0	-	111.8	111.8	121.8	122.3	123.0	122.6	117.0	111.2	106.4	129.0		
		Total >>>	1.0	-	129.0	-	129.0	-	111.8	111.8	121.8	122.3	123.0	122.6	117.0	111.2	106.4	129.0		

Substation	Asset				Reduced Noise Specification Required (Y/N)	Reduced Noise Specification (Lw)	Comment	Individual Noise Source Term Data										
	ID	Description	Status	Sound Power Level of Asset (Lw)				Spectral Data in dBA										
								12.5Hz	16Hz	20Hz	25Hz	31.5Hz	40Hz	50Hz	63Hz	80Hz	100Hz	LW Tdbl dBA
Yass 330kV	R01	No. 1 Reactor	Existing	90.00	No	n/a	No walls (Lw from TransGrid Noise Risk Assessment)	82.23	83.73	83.03	83.43	80.23	77.23	70.63	66.23	59.13	90.00	
Yass 330kV	R02	No. 2 Reactor	Existing	90.00	No	n/a	No walls (Lw from TransGrid Noise Risk Assessment)	82.23	83.73	83.03	83.43	80.23	77.23	70.63	66.23	59.13	90.00	
Yass 330kV	R03	No. 3 Reactor	Existing	90.00	No	n/a	No walls (Lw from TransGrid Noise Risk Assessment)	82.23	83.73	83.03	83.43	80.23	77.23	70.63	66.23	59.13	90.00	
Yass 330kV	CB01	No. 1 Capacitor Bank	Existing	85.00	No	n/a	No walls (Lw from TransGrid Noise Risk Assessment)	76.76	75.84	82.94	73.78	65.47	66.89	59.87	56.34	51.06	85.00	
Yass 330kV	AUX01	Aux-Tx (No. 1 Transformer)	Existing	74.00	No	n/a	No walls (Lw from TransGrid Noise Risk Assessment)	65.26	61.66	70.86	67.96	61.66	52.16	47.46	46.96	49.56	74.00	
Yass 330kV	AUX02	Aux-Tx (No. 2 Transformer)	Existing	74.00	No	n/a	No walls (Lw from TransGrid Noise Risk Assessment)	65.26	61.66	70.86	67.96	61.66	52.16	47.46	46.96	49.56	74.00	
Yass 330kV	TX01	No. 1 Transformer	Existing	94.00	No	n/a	4 Side Walls (Lw from TransGrid Noise Risk Assessment)	85.26	81.66	90.86	87.96	81.66	72.16	67.46	66.96	69.56	94.00	
Yass 330kV	TX02	No. 2 Transformer	Existing	102.00	No	n/a	4 Side Walls (Lw from TransGrid Noise Risk Assessment)	93.26	89.66	98.86	95.96	89.66	80.16	75.46	74.96	77.56	102.00	
Yass 330kV	TX03	No. 3 Transformer	Existing	85.00	No	n/a	3 Side Walls (Lw from TransGrid Noise Risk Assessment)	76.26	72.66	81.86	78.96	72.66	63.16	58.46	57.96	60.56	85.00	
Yass 330kV	TX01	No. 4 Transformer	New	100.80	No	n/a		92.06	88.46	97.66	94.76	88.46	78.96	74.26	73.76	76.36	100.80	
Yass 330kV	TX03	Aux-Tx (No. 4 Transformer)	New	74.00	No	n/a		65.26	61.66	70.86	67.96	61.66	52.16	47.46	46.96	49.56	74.00	

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