SER Decision Statement

Sydney West 330kV Substation – Battery Energy Storage System (BESS) Installation

Proposed Activity Summary

TransGrid is the proponent for the Sydney West 330kV Substation – Battery Energy Storage System (BESS) Installation. The proposed activity involves installation of BESS units, power transformer and ancillary equipment / facilities on a new bench and a new switchbay would be installed within the existing substation bench. All works would be undertaken with TransGrid's existing property boundary.

The BESS is required to address system reliability challenges as the existing large thermal generators (such as Liddell Power Station) approach retirement and more intermittent generation such as wind and solar are introduced into the network.

A Summary Environmental Report (SER) was prepared by TransGrid (April 2020) to assess the potential impacts of the proposed activity. The SER was prepared in accordance with Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act), clause 228 of the *Environmental Planning and Assessment Regulation 2000* and the *NSW Code of Practice for Authorised Network Operators* (the Code).

Determination

I, BRIAN SALTER, as an authorised person on behalf of TransGrid, have examined and considered the SER for the Sydney West 330kV Substation – Battery Energy Storage System (BESS) Installation in accordance with section 5.5 of the EP&A Act.

As per the requirements of section 2.5.1 of the Code, I have not been involved in conducting the assessment.

The proposed activity is not likely to significantly affect the environment, and is not likely to significantly affect threatened species, ecological communities or their habitats and is not to be carried out on land that is, or is part of a declared area of outstanding biodiversity value.

I determine, on behalf of TransGrid, that an Environmental Impact Statement and Species Impact Statement are not required in respect of the proposed activity. The proposed activity may now proceed subject to the implementation of the mitigation measures in the SER.

This is not a conditional decision and no further conditions are required (other than the mitigation measures stipulated in the SER).

Brian Salter

EM/ Legal Governance and Risk

TransGrid

Date: 28/04/2020

TransGrid

Summary Environmental Report

Sydney West 330kV Substation – Battery Energy Storage System (BESS) Installation

Part 5 EP&A Act Environmental Impact Assessment

April, 2020

Document Preparation History

Revision	Reviewed By	Date
01	Denise Lo	23/04/2020

Certification

I certify that I have prepared the contents of this SER 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 it contains 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. It has been prepared by persons appropriately trained and qualified in accordance with TransGrid Procedure *Authorisation to Work*.

Environmental Impact Assessment prepared by	Avi Thakur
Signed	
Date	27/04/2020
Designation	Environmental Planner
Qualification	Master of Planning, Bachelor of Engineering (Civil)
Organisation	TransGrid

Contents

List of Tables

List of Figures

1. Proposed Activity Description

1.1 Introduction

TransGrid is proposing to install a grid scale battery energy storage system (BESS) at Sydney West 330kV substation located at 200 Old Wallgrove Road, Eastern Creek (the proposed activity). The BESS is required to address system reliability challenges as the existing large thermal generators (such as Liddell Power Station) approach retirement and more intermittent generation such as wind and solar are introduced into the network.

The purpose of this SER is to determine if the proposed activity would significantly affect the environment or significantly affect threatened species, ecological communities or their habitats. This SER documents the proposed activity, assesses the potential environmental impacts and provides environmental management measures to be implemented to minimise the risk of adverse environmental impacts during construction and operation.

This SER has assessed the scope of works identified in this section. If there are changes to the scope of works following determination, further assessment and approval may be required.

TransGrid's Geographic Information System (TSS) has been relied upon to inform this SER (unless otherwise referenced in the report). TSS encapsulates the relevant up-to-date databases from various agencies. The TSS Data Extraction completed for this SER was undertaken on 20 March 2020.

1.2 Proposed Activity Location and Property Identification

Sydney West 330kV substation is located within the Blacktown Local Government Area (LGA). The substation is located at 200 Old Wallgrove Road, Eastern Creek on Lot 22 DP1246626, which is owned by the Electricity Transmission Ministerial Holding Corporation and leased and managed by TransGrid (refer Figure 1).

The landscape in the study area consists of industrial land uses and distribution centres with a relatively level topography. The study and impact areas for the proposed activity are illustrated in Figure 2.

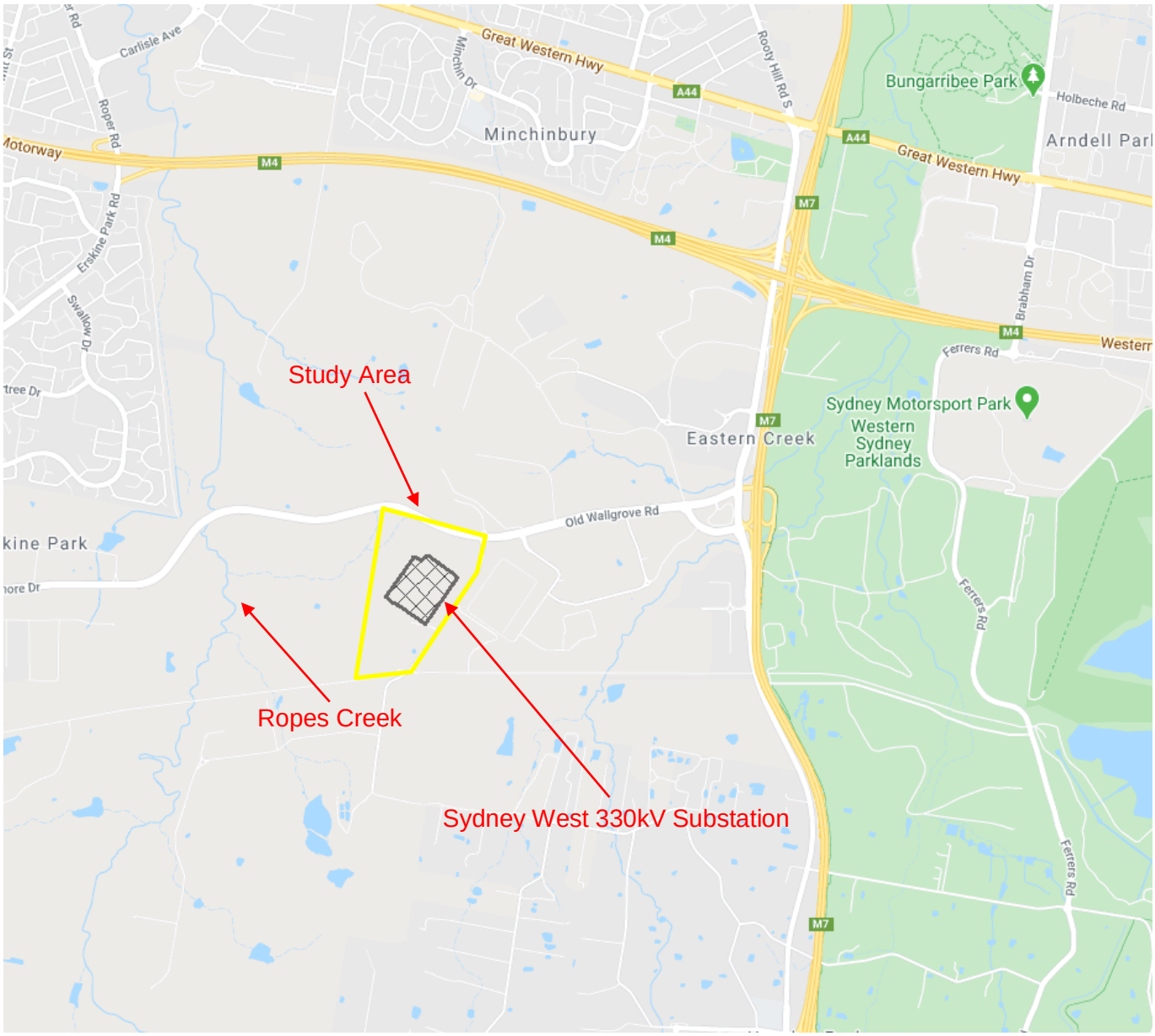


Figure 1. Locality map

Figure 2. Proposed activity location

1.3 Detailed Proposed Activity Scope

The proposed activity would involve the following:

> Construction of a new bench (approximately 115 m x 35 m) for the installation of the BESS within the TransGrid property boundary which includes:
  – Installation of 10 BESS units, which includes 33kV transformers and battery arrays;

- Installation of a 132/33kV power transformer which includes auxiliary transformer, disconnector and oil containment system;
- Installation of two 33kV switchgears (current transformers and circuit breakers) and associated cabling;
- Installation of a secondary systems control room;
- Installation of 132kV underground cabling between the new bench and existing substation via new trenching / conduits;
- Installation of welded-mesh fencing around the BESS bench area; and
- Construction of a new access road within the new bench;

> Construction of a new 132kV switchbay on the existing substation bench, which includes a voltage transformer, circuit breaker, disconnectors, post-insulators and cable sealing end structure; and

> Installation of cabling in existing and new conduits / trenches within the existing substation bench.

An indicative image of the BESS is shown in Figure 3 and the scope of the proposed activity is shown in Figure 4 and Figure 5.

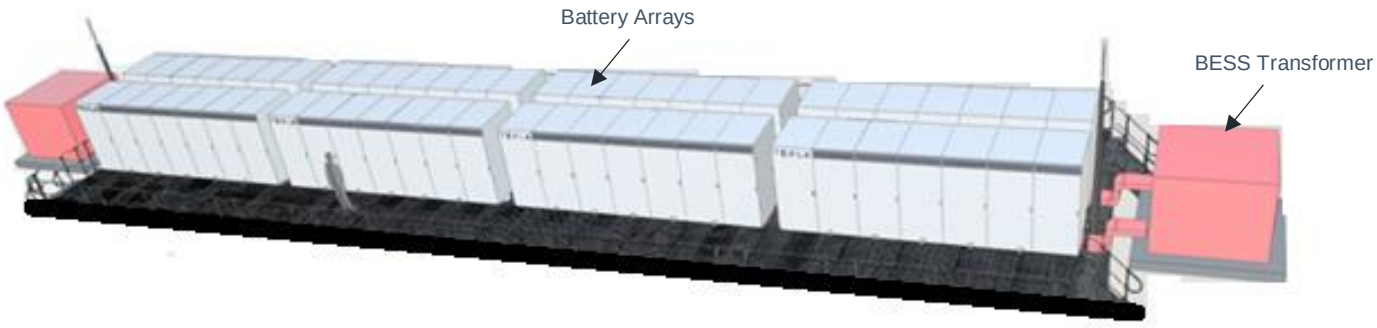


Figure 3. BESS unit concept design

Figure 4. BESS bench scope of works

Figure 5. Overview of scope of works

1.4 Proposed Activity Justification

1.4.1 Need of the Proposed Activity

The existing reliability of the National Electricity Market (NEM) is largely maintained by large synchronous thermal generation. With the future and planned retirement of existing thermal generation assets (such as Liddell Power Station in 2022) and the introduction of new intermittent generation (such as wind and solar) into the NEM, measures are required to address system reliability, particularly during times of peak demand. Grid scale battery energy storage would assist in maintaining system reliability by offering a fast frequency response during times of network instability.

1.4.2 Alternative Options Considered and Preferred Option

The BESS is one of a few options (others being the upgrades of the existing Victoria – New South Wales Interconnector (VNI) and Queensland – New South Wales Interconnector (QNI)) that TransGrid proposes to implement to address network instability caused by the future retirement of thermal generation assets and the introduction of intermittent renewable energy generation.

The Sydney West 330kV substation was regarded as the preferred site due to the availability of land within the existing TransGrid property boundary for the proposed bench and ease of connectivity to a 330kV substation.

1.5 Proposed Activity Construction Details

1.5.1 Construction Methodology

An overview of the construction methodology and key activities is outlined in Table 1.

Table 1. Construction Methodology and Key Activities

Stage	Overview
Site Establishment	Prior to construction works commencing, construction office / amenities, equipment storage and stockpiles would be designated at suitable laydown areas wholly within the impact area. Vegetation within the impact area would be removed, which includes one planted tree (refer Figure 4). The proposed bench area currently serves as a cable test pit and is demarcated by a metal fence. All existing vegetation within this area, including one planted tree and grass cover, would be cleared and a 300 mm topsoil layer would be removed and stockpiled on site. The existing fences, cables and the shipping container would either be re-used, where appropriate, or transported off-site to a suitable waste facility. The cable test pit would be decommissioned and backfilled with excavated soil. Once the bench area has been completed and compacted, a welded-mesh fence approximately 3 m in height would be installed around the perimeter of the bench in accordance with TransGrid's safety regulations and guidelines.
Construction	**BESS bench** The area required for the new BESS bench would be approximately 115 m x 35 m and is located approximately 90 m north-east of the existing substation. The proposed bench area currently serves as a cable test pit and is demarcated by a fence. All existing vegetation within this area, including one planted tree and grass cover, would be cleared and a 300 mm topsoil layer would be removed and stockpiled on site. It is expected that excavated fill would be used as backfill and compacted once civil works are complete. If imported fill is required, it shall be certified at source location as pathogen and weed free Excavated Natural Material (ENM) or Virgin Excavated Natural Material (VENM). **Access road** Within the BESS bench, a new access road would be constructed for delivery of equipment and material and ongoing maintenance activities (refer Figure 4). The access road would be 5 m wide. Approximately 0.3 m of topsoil would be removed, and then the road would be compacted with road base and bitumen placed on top. **BESS** The BESS units would be installed on concrete footings with each footing approximately 20 m x 5 m and up to a depth of 1.5 m. Each unit is expected to be up to 4 m in height and up to 3 m wide. The BESS units, which includes battery arrays,

Stage	Overview
	inverters and switchgear, would be transported on site via hiab trucks and hoisted on their concrete footings. The associated 33kV transformer would be installed in a concrete bund, adjacent to the BESS unit. **Secondary systems control building** The control building would be manufactured off-site and delivered to the BESS bench via trucks. The control building would sit on a concrete footing (approximately 20 m x 4 m) with trenches and conduits for the cabling entering the building. The control building would be approximately 3 m in height. **Power transformer** The 132/33kV power transformer would be housed in a concrete bund approximately 10 m x 10 m. The concrete bund would be approximately 0.5 m in height to contain spillage from the transformer. Once the construction of bund is complete, the power transformer would be lifted into position by a crane and secured with anchor bolts. Oil-filling of the transformer would be undertaken upon installation. A new oil containment tank would be constructed adjacent to the power transformer to contain any potential oil spill. The oil containment tank (up to 15 m long and up to 3 m in diameter) would be manufactured off-site and delivered to the BESS bench via trucks. The oil containment tank would be semi-embedded (up to 1.5 m in depth) with a portion of the tank below the ground surface level and the remaining portion above the surface level. The exact dimensions of the oil containment tank would be confirmed during detailed design. **Auxiliary transformer** The auxiliary transformer would require a steel support structure to be fixed with bolts drilled into new concrete footings. The concrete footing would be approximately 3 m x 3 m and up to a depth of 1.5 m. **Switchgear** Two switchgear would be installed on concrete footings of approximately 3 m x 3 m and up to a depth of 1.5 m. Connections to the switchgear would be made by cables in new trenches / conduits. **Switchbay** The new switchbay within the existing substation would require multiple components to be installed, which would include circuit breaker, voltage transformer, disconnectors, post-insulators and cable sealing end structure. The disturbance required for all the components is expected to be within the 35 m x 10 m switchbay area. The voltage transformer would require a new steel support structure to be fixed with bolts drilled into new concrete footings. Circuit breakers, disconnectors, post-insulators and cable sealing end structure would require new footings which would vary in dimension, however, are expected to be approximately 2.5 m x 2.5 m and up to 1.5 m in depth. Connections for the switchbay would utilise existing cable trenches where available, however, some new conduits would be required. New conduits would be confined to

Stage	Overview
	the existing substation and would be established using a small excavator and would be limited to 300 mm depth. **Underground cabling** Underground cabling would be required to connect the BESS bench to the proposed cable sealing end at existing substation. A trench, approximately 300 m in length, would be excavated from the proposed BESS bench to the existing substation. The trench would be approximately 0.5 m wide and up to a depth of 1 m. The trench would be lined with concrete and covered with excavated soil and / or metal plates.
Rehabilitation	Rehabilitation would occur in stages throughout the construction program. Rehabilitation works comprising compaction and surfacing of the bench area would occur once civil works have been completed. Further rehabilitation of the site, including disposal of waste materials (at an appropriately licensed waste facility) would occur once equipment installation and construction has been completed. Rock aggregate would then be spread across the extended bench, consistent with the existing substation.

1.5.2 Construction Plant, Material and Equipment

Typical key construction materials, vehicles and equipment include:

- Steel and structural supports.
- Imported fill and aggregate as required
- Metal fencing
- Excavators (various sizes)
- Bulldozer
- Trucks (numerous types)
- Bob cats
- Utility vehicles
- Electrical conduit and cables.
- Roller
- Compactor
- Pile borer
- Elevated Work Platform
- Cranes
- Concrete
- General hand tools (powered and unpowered).

1.5.3 Construction Schedule

Construction of the proposed activity is expected to commence in August 2020 and take 9 months to complete. The proposed activity start date may alter with revision of TransGrid's project program, although the duration of the construction activities would remain the same.

1.5.4 Construction Hours

Noise generating works would be limited to the recommended standard hours for construction work outlined in the *Interim Construction Noise Guideline* (DECC, 2009) which are:

- Monday to Friday 7:00am to 6:00pm;
- Saturday 8:00am to 1:00pm;
- No works on Sundays or Public Holidays.

Work outside standard hours would only comprise:

- The delivery of materials outside standard 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;

> Vacuum and oil filling of transformers.

If the need for additional noise generating works outside standard construction hours is identified following the determination of this SER then they would require justification in accordance with the *Interim Construction Noise Guideline* (DECC, 2009) and the prior formal written consent of Environment - HSE/TransGrid.

1.6 Operation and Maintenance

The proposed activity would not result in any significant changes to existing operational or maintenance activities at the substation. Personnel would continue to access the substation to carry out inspection of the high voltage infrastructure including the BESS and perform necessary maintenance as required.

2. Planning Context and Consultation

NSW Electricity Networks Operations Pty Ltd as a trustee for NSW Electricity Operations Trust (known as TransGrid) is an authorised network operator and must complete an environmental assessment under Part 5 of the EP&A Act in accordance with the New South Wales Code of Practice for Authorised Network Operators (the Code). The appropriate assessment and approvals process in accordance with the Code for the proposed activity is **Class 3 – Summary Environmental Report (SER).**

2.1 Approvals Pathway

2.1.1 Environmental Planning and Assessment Act 1979

The EP&A Act and the *Environmental Planning and Assessment Regulation 2000* (the Regulation) provide the framework for development assessment in NSW. The EP&A Act and the Regulation include provisions to ensure that the potential environmental impacts of a development are considered in the decision making process prior to works proceeding.

As described below, the proposed activity would be permitted without development consent from Council in accordance with *State Environmental Planning Policy (Infrastructure) 2007* (the Infrastructure SEPP), and the proposed activity is therefore subject to the assessment requirements of Part 5 of the EP&A Act.

TransGrid, is an Authorised Network Operator (ANO) under the *Electricity Network Assets (Authorised Transactions) Act 2015*. TransGrid is also a prescribed determining authority under Section 5.6 of the EP&A Act and Clause 277(5) of the Regulation, for development for the purposes of an electricity transmission or distribution network that is permitted without consent (within the meaning of *State Environmental Planning Policy (Infrastructure) 2007*) and is operated or to be operated by the ANO. Accordingly, TransGrid is the proponent and determining authority for this proposed activity.

This environmental impact assessment has also been prepared in accordance with the *NSW Code of Practice for Authorised Network Operators* (the Code, September 2015), which sets out the environmental assessment requirements for ANOs. Accordingly this environmental impact assessment is deemed as a Summary Environmental Report (SER).

State Environmental Planning Policy (Infrastructure) 2007

The State Environmental Planning Policy (Infrastructure) 2007 (Infrastructure SEPP) aims to facilitate the delivery of infrastructure across NSW. Clause 41(1) of the Infrastructure SEPP provides that development for the purpose of an electricity transmission or distribution network may be carried out by or on behalf of an electricity supply authority or public authority without development consent on any land.

As this proposed activity meets the definition of development for the purposes of an electricity transmission or distribution network under Clause 41 of the Infrastructure SEPP, and would be carried out by TransGrid (an ANO), it is permitted without consent from the Council.

Duty to Consider Environmental Impacts

For activities subject to assessment under Part 5, Section 5.5 of the EP&A Act imposes a duty on a determining authority to 'examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment' by reason of the proposed activity (refer Section 6.1). In addition, Clause 228 of the EP&A Regulation identifies factors which must be taken into account when considering the likely impact of an activity on the environment. These factors have been considered in Section 6.2.

Under Section 5.7 of the EP&A Act, an environmental impact statement (EIS) is required for 'an activity that is likely to significantly affect the environment' including significant affects to threatened species, ecological

communities or their habitats and activities carried out in declared areas of outstanding biodiversity value. This activity is not likely to have a significant impact and therefore an EIS is not required.

2.2 Other Relevant NSW and Commonwealth Legislation

Other environmental planning instruments and legislation that are directly relevant to the determination and/or assessment of the proposed activity are considered in Table 2.

Table 2. Relevant Commonwealth and NSW Legislation

Legislation	Potential Approval Requirements	Relevance to the Proposed Activity	Permit/ Approval/ Licence Requirement
Commonwealth Legislation			
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)	Under the EPBC Act, matters of national environmental significance (MNES) are considered to assist in determining whether the proposed activity should be referred to the Commonwealth Department of Agriculture, Water and the Environment.	An EPBC Act protected matters search was undertaken on 7 April 2020 for an area within a 1 km radius of the study area. The results of the search are summarised in Section 4.3. As no impacts are predicted, an approval under the EPBC Act would not be required.	Not required
NSW Acts			
Biodiversity Conservation Act 2016 (BC Act)	The BC Act lists a number of threatened species, populations, ecological communities and declared areas of outstanding biodiversity value to be considered in deciding whether there is likely to be a significant impact on threatened biota, or their habitats. If any of these could be impacted by the proposed activity, an assessment of significance that addresses the requirements of Section 7.3 of the BC Act must be completed to determine the significance of the impact.	The proposed activity will not impact any threatened species, populations, ecological communities or declared areas of outstanding biodiversity value listed under the BC Act. Section 3.4 provides further details of the impacts to ecology.	Not required
Heritage Act 1977	Approval under Section 57(1) is required for works	There are no heritage listed items near the proposed	Not required

Legislation	Potential Approval Requirements	Relevance to the Proposed Activity	Permit/ Approval/ Licence Requirement
	to a place, building, work, relic, moveable object, precinct, or land listed on the State Heritage Register. Section 57(2) provides that an exemption from the approval requirements of Section 57(1) can be sought in certain circumstances. An excavation permit is required under Sections 139(1) and (2) to disturb or excavate any land containing or likely to contain a relic. Section 139(4) provides that exceptions from the approval requirements of Sections 139(1) and (2) can be sought in certain circumstances.	activity and the activity would not involve disturbing or excavating land on which a relic is located or where there is reasonable expectation that the excavation or disturbance is likely to result in a relic being discovered, exposed, moved, damaged or destroyed (see Section 3.6). Therefore no permits or approvals are required under the Heritage Act.	
National Parks and Wildlife Act 1974 (NPW Act)	An Aboriginal heritage impact permit (AHIP) under Section 90 of the NPW Act is required to harm or desecrate an Aboriginal heritage object. If works are located in land reserved under the NPW Act, approval from DPIE is required.	The activity would not impact any registered Aboriginal heritage sites and therefore a permit under Section 90 of the NPW Act is not required. The activity would not impact any land reserved under the NPW Act and therefore would not require approval from the DPIE.	Not required

2.3 Consultation

Clause 42 of the Infrastructure SEPP provides that written notification must be given to the local Council and adjoining occupiers for the development for the purposes of a new or existing electricity substation of any voltage. The provisions require that those notified are given a reasonable opportunity (no less than 21 days from the date on which notice was given) to make submissions on the proposed activity.

Additionally, consultation with local Council is also required to meet the provisions of section 45(4) of the *Electricity Supply Act 1995*, which requires councils are given 40 days to make submissions on the proposed activity.

Written notification was provided to Blacktown City Council and adjacent landowners on 14 February 2020. No responses were received.

No further community consultation was deemed required during the environmental assessment phase as the proposed activity is located within the existing TransGrid property boundary and is not anticipated to affect the community.

3. Environmental Impact Assessment

This section provides an assessment of the proposed activity considering potential environmental impacts. Mitigation measures required to avoid or minimise environmental impacts are identified in Appendix A.

3.1 Land Use

3.1.1 Existing Environment

The study area is currently used for the purpose of electricity transmission as a substation and office premises for TransGrid employees. The substation is located on land zoned as *SP2: Infrastructure* under the B*lacktown Local Environment Plan 2015* (BLEP 2015). The study area is surrounded by, although not part of it, Western Sydney Employment Area (WSEA), which is characterised by industrial complexes, distribution centres and waste facility developments. Ropes Creek runs approximately 900 m west of the study area (refer Figure 1).

Furthermore, the area of proposed BESS bench is currently being used as a cable testing pit and is demarcated by a fence.

The nearest residential dwelling (R03) is located approximately 1390 m south-east of the existing substation (refer Figure 8).

3.1.2 Impact Assessment

Construction

The construction of the proposed activity would be located entirely within TransGrid's existing property boundary. Therefore no land use impacts are anticipated during construction.

Operation

The proposed activity would result in a minor change of land use of the existing cable testing pit and adjacent grassed area (refer Figure 4) to a new BESS. As all works would be contained within TransGrid's existing property boundary which is more broadly used for the purpose of an electricity substation and for transmission purposes, land use change impacts would be minor. The existing cable testing pits, metal fence and shipping container would be decommissioned and re-used or disposed of appropriately at a licensed waste facility.

3.2 Geology and Soils

3.2.1 Existing Environment

The topographic landscape of the study area and surrounding is typically flat. Underlying soils within the existing substation bench consists of a mixture of fill material, generally comprising of brown silty clay with trace gravel, used as part of the initial construction of the substation. Underlying soils in the bench area would mostly consist of quartz-lithic to quartz-rich sandstone with conglomerate, mudstone and siltstone (NSWGeologyPlus, 2020).

Acid Sulfate Soil

A review of CSIRO's Australian Soil Resource Information System (ASRIS) on 24 March 2020, identified there is a low probability of acid sulfate soils occurrence in the study area.

Contamination

A search of the Environment Protection Authority's (EPA) Contaminated Land Record and List of Contaminated Sites Notified to the EPA was undertaken on 25 March 2020 for Blacktown LGA. No contaminated sites were identified within 500 m of the study area.

An asbestos survey of the site undertaken by Practical Environmental Solutions (2014) identified asbestos containing material (ACM) or presumed ACM in control room building, central building, mechanical workshop, flammable liquid / equipment store and 415V compressor building.

Naturally Occurring Asbestos

A search for Naturally Occurring Asbestos (NOA) was undertaken on 25 March 2020 on NSW SEED (Sharing and Enabling Environment Data) Portal. The search did not identify presence of NOA within 500 m of the study area.

3.2.2 Impact Assessment

Construction

During construction, the main risks to geology and soils would be erosion and sedimentation from ground disturbance activities associated with the proposed bench and underground cabling. The total volume of soil excavated is expected to be up to 200 m^3, and excavation would be undertaken by a small excavator. Areas of exposed soil, including stockpiles, have the potential to be eroded, leading to potential sedimentation impacts on surrounding land and drainage lines. These risks are expected to increase during high wind and rainfall events.

No works are proposed within areas of known asbestos contamination.

Provided the mitigation measures in Appendix A are implemented, potential erosion and sedimentation impacts during construction can be effectively managed.

Operation

The main risk to geology and soils during operation would be oil contamination caused by faulty equipment, namely the new power transformer. A new oil containment system would be constructed on the proposed bench area to reduce any risk of oil contamination from failure of the power transformer.

The risk to underlying geology and soils as part of the ongoing operation of the new BESS is considered to be low with the implementation of mitigation measures outlined in Appendix A.

3.3 Hydrology and Water Quality

3.3.1 Existing Environment

The study area is located on a relatively flat land and is not within a flood planning area under the BLEP 2015. The nearest perennial watercourse, Ropes Creek, is located approximately 900 m west of the study area and an unnamed watercourse is traversing the north-west portion of the study area (refer Figure 1).

A review of available groundwater data held by WaterNSW identified the nearest groundwater bore (GW075068.1.1) approximately 7.5 km south-east of the study area. The most recent groundwater monitoring data from June 2011 recorded groundwater at a depth of 10 m.

3.3.2 Impact Assessment

Construction

During construction, the main risks to water quality would be sedimentation into nearby waterways and stormwater drains as a result of run-off associated with ground disturbance activities as described in Section 3.2. In addition, there may be risks to water quality as a result of accidental spills as part of refuelling of plant and machinery. These potential impacts on surface water quality would be adequately managed through the implementation of the mitigation measures in Appendix A.

Excavations for the new footings would generally be limited to a depth of up to 1.5 m. As groundwater has previously been recorded in the area at a depth of 10 m, there is very low potential for groundwater to be encountered during excavation works. The NSW Office of Water state in their Dewatering Applications - Mandatory Information requirements to support licence applications for construction dewatering projects that any take of water as a result of minor temporary dewatering activities that is estimated to be less than three megalitres per year (ML/yr) would not require a licence. In the instance that groundwater is encountered, the volume of dewater extracted would not exceed the prescribed limit that would require a licence.

Operation

Construction of the new oil-filled transformers would increase the risk of oil spill during operation. The new oil spill containment system would be constructed within the proposed bench to minimise the risk of oil spills off-site.

During operation, with the new oil spill containment system and mitigation measures in Appendix A, adverse impacts to water quality of any watercourses are not expected.

3.4 Ecology

3.4.1 Existing Environment

A portion of the study area has been highly disturbed due to the construction of Sydney West 330kV substation and office premises for TransGrid employees. The impact area (besides the existing substation) has been moderately disturbed for grazing purposes and the construction of an access driveway.

A development study of the study area was conducted by Eco Logical Australia in 2017 (Eco Logical, 2017). A summary of the key findings are listed below:

- The study area has been mowed and slashed for decades with majority of the vegetation cleared for grazing purposes and later for the development of existing substation;
- Woodland vegetation, Forest Red Gum (*Eucalyptus tereticoris*), was planted to the north-east of the proposed bench in early to mid-2000's (refer Figure 6);
- Existing vegetation to the north-west and south-east of the proposed BESS bench are a result of vegetation regrowth (refer Figure 6);
- The planted and regrowth vegetation (refer Figure 6) has been classified as Cumberland Plain Woodland (CPW), listed as an endangered ecological community under the *Biodiversity Conservation Act 2016* (BC Act 2016);
- Fauna habitat is generally of poor condition;
- A large portion of the grassland is impacted by weed invasion;
- The study area does not part of any important local or regional wildlife corridor;
- No Cumberland Plain Land Snail (*Meridolum corneovirens*) were recorded during the survey.

A site visit by a TransGrid environmental officer was undertaken on 2 April 2020 to examine the tree proposed to be removed (refer Figure 4). The tree was identified as Forest Red Gum (*Eucalyptus tereticoris*), one of the assemblage of species characteristic of Cumberland Plain Woodland. The tree is still immature, at approximately 7 m tall. No nests or hollows were identified, which could represent habitat for fauna species.

The study area is not within 500 m of a bushfire prone land under the *Blacktown Local Environmental Plan* (BLEP) *2015*.

A search of the NSW BioNet Wildlife Atlas on 17 April 2020 identified one moderate or high risk threatened species or communities within 500 m the study area as identified below

> Grey-headed Flying-fox – *Pteropus poliocephalus*.

A search of the EPBC Protected Matters Search Tool on the 7 April 2020 found the following five endangered ecological communities (EECs) may occur within 1 km of the study area:

> Castlereagh Scribbly Gum and Agnes Banks Woodlands of the Sydney Basin Bioregion;
> Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland ecological community;
> Cooks River/Castlereagh Ironbark Forest of the Sydney Basin Bioregion;
> Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest; and
> Western Sydney Dry Rainforest and Moist Woodland on Shale.

Figure 6. Vegetation mapping (Eco Logical, 2017)

3.4.2 Impact Assessment

Construction

Ground disturbance works associated with the proposed activity would occur within impact area (refer Figure 2), which has previously been disturbed. Vegetation disturbance would be limited to removal of one immature forest red gum (*Eucalyptus tereticoris*) (refer Figure 4) and grassland dominated by exotic species.

The tree proposed to be removed does not meet the criteria of CPW (Environment NSW, 2020) for the following reasons:

- While there are planted CPW and regrowth remnant CPW in close proximity, the individual tree is considered to exist outside these patches of vegetation;
- The tree does not form part of the open tree canopy characteristic of CPW;
- The tree is surrounded by grassland dominated by exotic species, and does not include a near-continuous groundcover dominated by grasses and herbs.

Since the tree is not considered to be part of the CPW vegetation community and does not provide habitat to any threatened fauna species, removal of the tree would not have a significant impact on threatened flora or fauna.

Additionally, with the implementation of mitigation measures outlined in Appendix A, impacts to flora and fauna would further be reduced.

Operation

During the operation of BESS, the bushfire risk to nearby vegetation is regarded as low. The battery system is designed to prevent the unlikely scenario of a fire within the enclosure (BESS unit), by preventing the propagation of a single cell thermal runaway. The BESS unit uses fire detection systems and independent thermal imaging cameras. A fire suppression system is also utilised within each of the enclosures. The battery enclosure itself is designed to control fire without it spreading to neighbouring enclosures. Additionally, the nearest BESS unit is located approximately 15 m from the vegetation to the north, further reducing the risk of bushfire.

There would be no additional impacts to flora and fauna as part of ongoing operation of the BESS.

3.5 Aboriginal Heritage

3.5.1 Existing Environment

A desktop Aboriginal heritage due diligence assessment was undertaken in accordance with TransGrid's Aboriginal Heritage Due Diligence Assessment Procedure (July 2019).

The study area has previously been disturbed for the purpose of its use as an electrical substation. The existing substation bench has been completely disturbed, where natural shallow soils have been removed and replaced with fill material across the substation as part of the initial construction of the substation. The remainder of the impact area, external to the substation bench, has been moderately disturbed from its original state as part of vegetation clearing for the construction of existing internal access road and potentially for grazing purposes (including the area of the proposed bench).

The impact area is not on a ridge line and there are no watercourses within 200 m of the impact area. There is a potential of underlying sandstone, however there are no sandstone rock-outcrops or sandstone platforms within the study area.

A search of TransGrid's spatial system, which includes information from Aboriginal Heritage Information Management System (AHIMS), undertaken on 1 April 2020 identified two Aboriginal heritage sites within the

study area (refer Figure 7), however, no items or places of Aboriginal heritage significance were identified within 200 m of impact area.

Further verification of the site card was undertaken of the known site:

- Artefact (45-5-3842) – approximately 210 m north-west of the impact area – the site consists of a scatter of three artefacts within an area of 30 m x 10 m.
- Artefact (45-5-3939) – approximately 290 m west of the impact area – the site consists of an isolated flake in a disturbed environment adjacent to a vehicle track and dam bank.

Figure 7. Aboriginal heritage items

3.5.2 Impact Assessment

Construction

The desktop Aboriginal heritage risk assessment identified there is a moderate risk of affecting Aboriginal heritage due to moderately disturbed environment (except existing substation) and high level of disturbance required. However, upon further desktop investigation of landscape features it was determined that no

landscape features were present in the impact area and the likelihood of presence of an Aboriginal heritage site within the impact area is unlikely. Therefore no further heritage assessment is required.

Notwithstanding this, the unexpected finds protocol in Appendix A would be implemented in the unlikely instance that Aboriginal heritage is encountered during ground disturbance works.

Operation

The proposed activity would not result in any additional impacts to Aboriginal heritage as part of the ongoing operation of the substation.

3.6 Historic Heritage

3.6.1 Existing Environment

A search of the following databases was undertaken on 31 March 2020 to identify items and places of historic heritage recorded within 500 m of the study area:

- World Heritage Register;
- Commonwealth Heritage Register;
- National Heritage Register;
- NSW State Heritage Register and State Heritage Inventory (including Section 170 register for NSW government agencies); and
- *Blacktown Local Environmental Plan* (BLEP) *2015*.

No heritage items on the World Heritage Register, Commonwealth Heritage Register, National Heritage Register, NSW State Heritage Register, or listed under the BLEP 2015, are known to occur within 500 m of the study area.

3.6.2 Impact Assessment

Construction

The proposed activity would be confined to the TransGrid property boundary (study area), with no heritage listed items present within 500 m of the study area. As such, the proposed activity would not impact any surrounding historic heritage sites.

However, in the unlikely instance that historic heritage items are encountered, the unexpected finds protocol as outlined in Appendix A would be implemented.

Operation

The proposed activity would not result in in any additional impacts on historic heritage as part of the ongoing operation of the substation.

3.7 Noise and Vibration

A noise impact assessment was prepared by ERM (2019) to assess potential construction and operational noise impacts associated with the proposed activity. The assessment is included in Appendix B.

3.7.1 Existing Environment

The existing noise environment is dominated by industrial noise sources and surrounding traffic noise. Potentially sensitive noise receptors identified for the proposed activity include:

- Five residential dwellings (R01-R05), with the nearest (R03) located approximately 1390 m south-east of the existing substation; and
- Nine commercial premises (R06a-R06e and R07a-R07d), with the nearest (R06a) located approximately 160 m east of the existing substation.

Potentially sensitive noise receptors are shown in Figure 8.

Existing noise levels were modelled for the current operational arrangement of the substation. The model predicted that noise levels are compliant with the relevant adopted project specific daytime, evening and night time noise criteria at all potentially sensitive noise receptor locations.

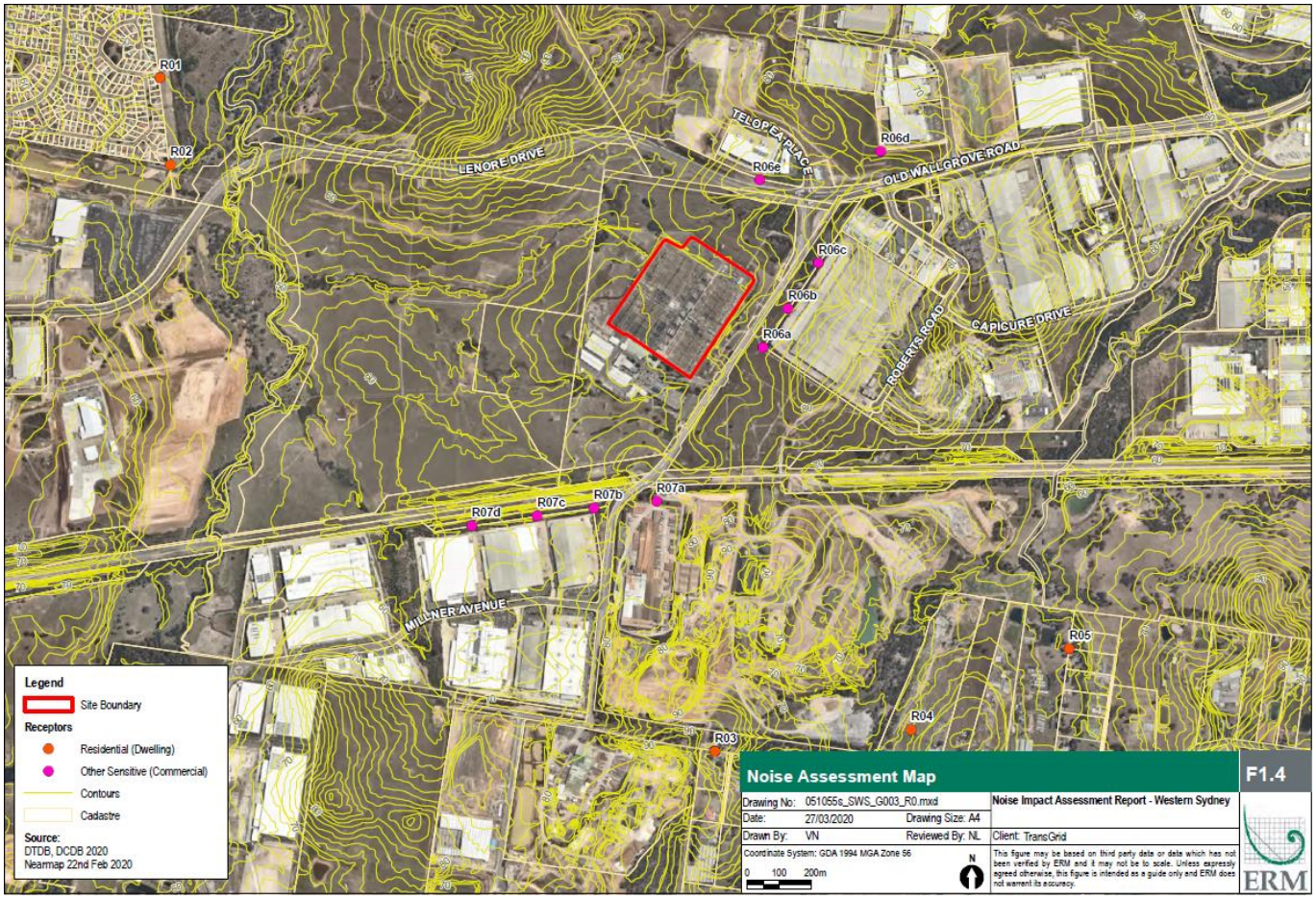


Figure 8. Potentially affected noise receptors

3.7.2 Impact Assessment

Construction

During construction, noise would be generated by the use of construction plant and equipment, movement of construction vehicles and the delivery of materials and equipment. Some night time works including delivery of high mass components of the BESS and power transformer, oil-filling of power transformer and commissioning works at the substation during planned outage events may also be required.

Modelling of construction noise predicted the potential for noise levels above the adopted project specific noise criteria at all residential receptors during site preparation and establishment works, if undertaken outside of standard working hours. However, work associated with site preparation and establishment are not expected to be undertaken outside of standard working hours as outlined in Section 1.5.4. Noise levels for all other construction works are expected to be within the adopted project specific noise criteria at all residential receptors.

Whilst elevated construction noise levels were predicted, they 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 would only be experienced for limited periods of time when works are occurring and would not be experienced over the whole daytime, evening or night-time periods. Construction noise emissions would be temporary and would not represent a permanent impact on the community and the surrounding environment.

Delivery of the power transformer using over-sized and over mass (OSOM) vehicles may be undertaken at night due to the requirement of progressive road closures by authorities. However, noise impacts are not anticipated as vehicles move progressively along the road.

Operation

Noise modelling undertaken, incorporating both normal and noise enhancing meteorological conditions, determined that the operation of the BESS would not result in any predicted noise levels above the project specific noise criteria at the surrounding potentially sensitive receptor locations during daytime, evening or night-time periods.

The operational noise compliance has been achieved with the assumption that the BESS would achieve a noise level of 75 dBA at 1 metre and the power transformer would achieve a Sound Power Level (Lw) of 95 dBA.

3.8 Traffic and Access

3.8.1 Existing Environment

Access to the study area is provided by an existing driveway off Old Wallgrove Road. Currently, the substation and associated office premises are accessed by operational personnel, TransGrid employees and periodic contractors for business, maintenance and operational purposes. Vehicle parking space is available with the study area, adjacent to the office premises.

The surrounding road network is used predominantly by large vehicles due to the large number of distribution centres, industrial and waste facilities within the WSEA.

3.8.2 Impact Assessment

Construction

During construction, the existing access driveway off Old Wallgrove Road (refer Figure 5) would be utilised. This driveway is currently in a suitable condition and would not require any upgrade works for construction vehicle access.

During construction, there would be minor increase in traffic on the surrounding road network associated with the delivery of equipment, machinery and plant, transportation of waste off-site and the daily arrival and departure of the construction staff.

The delivery of power transformer would be carried out by OSOM vehicles and in accordance with the relevant permits from council and Transport for NSW (TfNSW). OSOM vehicles require progressive road closures, which has a potential to disrupt the local road network. However, since the delivery of power transformer by OSOM is likely to be undertaken at night, outside peak traffic hours, the potential disruption to local road network is considered to be minor. Additionally, with the implementation of mitigation measures outlined in Appendix A, the impacts would further be reduced.

Operation

The existing substation operational and maintenance schedules may vary to accommodate the maintenance requirements of the new BESS equipment, however this is not expected to contribute any significant additional traffic on the surrounding road network.

3.9 Air Quality

3.9.1 Existing Environment

The existing air quality in the study area and surrounding area is influenced by emissions from motor vehicles associated with the distribution centres, industrial and waste facility processes which occurs in the surrounding industrial precinct.

3.9.2 Impact Assessment

Construction

Potential air quality impacts during construction would be associated with the generation of dust and emissions from the movement of plant and equipment at the substation and associated construction traffic. The main source of dust emissions would be from excavation works, and stockpiles associated with establishing the BESS bench and underground cabling. Suitable mitigation measures as outlined in Appendix A would be implemented to manage the release of dust from excavated areas both during and post construction.

The dust load generated over a typical construction day is likely to be minor and is not expected to result in reduced local air quality, provided that adequate management measures are implemented during the works.

Operation

The new switchbay equipment would contain sulphur hexafluoride (SF_6) which is a commonly used insulation gas. SF_6 has a high greenhouse gas equivalent, meaning its release into the atmosphere, especially in large quantities, can contribute to the greenhouse effect. Within the high voltage equipment, SF_6 is sealed within gas-tight compartments, however leaks have the potential to occur.

In the event of an unplanned release of SF_6 from the equipment, the quantity of SF_6 potentially being emitted into the atmosphere would be minor in nature and would not contribute to the effects of climate change.

Notwithstanding this, measures outlined in Appendix A would be implemented to control any release of SF_6.

3.10 Visual Amenity

3.10.1 Existing Environment

The existing visual landscape surrounding the study area is generally characterised by distribution centres and industrial complexes. The existing substation is partially visible from Old Wallgrove Road and Lenore Drive.

The nearest residential dwelling is approximately 1390 m south-east of the existing substation (refer Figure 8).

3.10.2 Impact Assessment

Construction

During construction, there are likely to be moderate visual impacts associated with the construction activities and the presence of construction vehicles, equipment and plant, however, they would not be visible to residential receptors due to the distance and obstructed view, however may be partially visible to road users of

Old Wallgrove Road and Lenore Drive. Once construction activities have been completed, all construction plant, equipment, waste and excess materials would be removed from site. Mitigation measures, as outlined in Appendix A, would be implemented to minimise localised visual impacts associated with the physical presence of the construction works.

Operation

The installation of BESS and associated equipment on the proposed bench would be the primary additional visual element within the study area. Whilst the proposed activity would increase the visual footprint of the substation, the additional equipment and building would be visually consistent with existing infrastructure within the study area. Moreover, due to the distance and obscured views of the proposed BESS from the nearest residential receptors, it is unlikely the proposed activity would result in any visual impacts to residential receptors. Furthermore, the study area is surrounded by industrial complexes and distribution centres.

The proposed BESS bench may be partially visible from Old Wallgrove Road and Lenore Drive upon completion of work, however would be consistent with the existing substation infrastructure.

3.11 Waste

3.11.1 Existing Environment

Waste material currently generated at the substation includes domestic garbage, wastewater from site amenities, redundant equipment and waste oils, greases and lubricants from maintenance of the substation. Waste generation associated with the office premises includes domestic garbage, office supplies and redundant electronics.

3.11.2 Impact Assessment

Construction

Waste generated during the construction phase would typically include:

- Excavated spoil;
- Existing steel fence, shipping container, cables on the proposed BESS bench;
- Waste metal and cabling;
- Concrete;
- Off-cuts and excess construction material;
- Used, excess or unsuitable erosion and sediment control structure materials;
- Waste oils, greases and lubricants from maintenance of construction plant and equipment; and
- Domestic and putrescible waste (including food waste, bottles, cans and paper).

All waste generated during construction would be removed from the site, or reused if appropriate.

Operation

No change to the existing waste streams is expected as part of the ongoing operation of the BESS and the substation.

3.12 Electric and Magnetic Fields (EMF)

3.12.1 Existing Environment

Electric and Magnetic Fields (EMF) are part of the natural environment and EMF is produced wherever electricity or electrical equipment is in use.

EMF is currently produced by the busbars and other overhead and underground connections within the substation, transformers, switchgear and underground cables at the substation.

3.12.2 Impact Assessment

The BESS and associated equipment are expected to contribute to only localised changes to EMF in the immediate vicinity of the new equipment. Additionally, the BESS would be designed to ensure that overall EMF from the new equipment and the cumulative EMF from the broader substation site, does not exceed the EMF limits prescribed by ARPANSA (2010). Given this, the proposed activity is not expected to contribute to any EMF exposure risks to:

> Workers performing periodic maintenance works at the substation site; and
> Workers at the surrounding industrial / warehouse premises.

3.13 Social and Economic Considerations

3.13.1 Existing Environment

Sydney West 330kV substation forms an integral component in the electrical supply network in the Western Sydney region. Employment in surrounding areas is driven by distribution centres and industrial complexes with minimal residential development.

3.13.2 Impact Assessment

Construction

During construction, there may be negligible positive benefits to the local economy, due to an increase in retail sales from the workers. Due to the short duration of the proposed activity, there would be no significant long term impacts on the local economy, and negligible impact on social infrastructure or services in the region.

Operation

Once operational, the BESS would increase the electrical transmission system reliability across the Sydney region. Overall, this would have a positive impact on residents and commercial users within the Sydney region through its assistance in reducing black out events, particularly during times of peak demand, such as hot summer days.

3.14 Cumulative Impacts

3.14.1 Existing Environment

The study area, although not part of it, is surrounded by WSEA. The objective of WSEA is to promote economic development through creation of employment within the WSEA. Major sources of employment in the region are distribution centres, industrial complexes and waste recovery facilities.

A review of the NSW DPIE's Major Projects website (accessed on 2 April 2020) identified several major projects being undertaken or proposed within the WSEA, which are primarily distribution centres and waste recovery

facilities. Currently, WSEA is undergoing major developments, aimed at generating employment in the area, which dominates the environment in proximity of the study area.

3.14.2 Impact Assessment

The assessment of cumulative impacts focused on the proposed activity's interaction with other projects in the vicinity of the proposed activity, and where construction and/or operational timeframes are likely to be concurrent.

There is potential that minor construction projects may occur in proximity to the study area. This may include the construction of dwellings; small renovation projects and demolition works approved by local council.

It is likely proposed activity would coincide with construction schedule of several other projects within the vicinity, given the nature of WSEA. There is a potential for cumulative impacts from noise, traffic and access and dust. However, the cumulative impacts of work associated with the proposed activity are considered to be minor, temporary and localised in nature. Significant cumulative impacts are not anticipated.

4. Consideration of Statutory Factors

4.1 Section 5.5 of the EP&A Act and 7.3 of the Biodiversity Conservation Act 2016

Under Section 5.5 of the EP&A Act, the determining authority (being TransGrid), has a duty to consider the effect of the proposed activity on the environment and the effects on any wilderness areas. Table 3 provides a summary of how each of the factors has been considered.

Table 3. Consideration of Section 5.5 of the EP&A Act - Duty to Consider Environmental Impact

Factor	Comment
5.5(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 environmental impacts have been considered and assessed in Section 3.
5.5(3). Consider the effect of an activity on any wilderness area (within the meaning of the *Wilderness Act 1987)* in the locality in which the activity is intended to be carried on.	The proposed activity would not affect any wilderness areas.

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, ecological communities, or their habitats or whether the activity is to be carried out in a declared area of outstanding biodiversity value.

No threatened species, ecological communities, or their habitats or areas of declared outstanding biodiversity value would be affected by the proposed activity.

It is unlikely that there would be any significant effect on threatened species, ecological communities, or their habitats.

4.2 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 4 provides a summary on how each of the Clause 228 factors has been considered.

Table 4. Consideration of Clause 228 Factors

Factor	Potential Impact
a. any impact on a community	There would be no adverse impacts on the community as a result of the proposed activity.
b. any transformation of a locality	The proposed activity would result in minor visual impact of the locality, however, it is not expected to transform the locality as works would be limited to TransGrid's property, and would be consistent with the existing land use.
c. any environmental impact on the ecosystems of the locality	Vegetation to be disturbed would be limited to maintained grassland and one tree within the impact area (refer Table

Factor	Potential Impact
	4). It is unlikely to have any significant impact on the ecosystems of the locality.
d. any reduction of the aesthetic, recreational, scientific or other environmental quality	During construction, the proposed activity would be confined to TransGrid's existing property boundary. As such, construction works is expected to have only a negligible impact on the aesthetic and environmental quality of the surrounding area. No impact on the scientific or recreational value would occur. The new equipment on proposed BESS bench would be visually consistent with the existing substation, with views obscured by vegetation and existing infrastructure. There would be no long-term reduction of the aesthetic, recreational, scientific or other environmental quality.
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 activity would not affect any known Aboriginal or historical sites. Additionally, the mitigation measures identified in Appendix A would be implemented to manage the protection of any unexpected Aboriginal or non-Aboriginal heritage finds during the proposed activity.
f. any impact on the habitat of protected animals (within the meaning of the Biodiversity Conservation Act 2016)	The impact to habitat of any protected fauna is unlikely as the tree proposed to be removed is not known to provide habitat to any endangered or threatened flora or fauna species.
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 activity would not endanger any species of animal, plant or other form of life.
h. any long-term effects on the environment	The proposed activity would not have any long-term effects on the environment, as the substation would continue to operate in a similar manner.
i. any degradation of the quality of the environment	During construction, there would be potential minor degradation of the quality of the environment due to traffic, noise, dust, and visual impacts. These impacts would be short term and managed appropriately through the implementation of mitigation measures in Appendix A.
j. any risk to the safety of the environment	There would be a minor risk to the environment from potential oil and chemical spills used during construction. These risks would be minimised through the implementation of the mitigation measures outlined in Appendix A.

Factor	Potential Impact
k. any reduction in the range of beneficial uses of the environment	There would be no reduction in the range of beneficial uses of the environment as a result of the proposed activity.
l. any pollution of the environment	There would be potential for pollution from vehicle emissions, noise, dust and oil and chemical spills to occur during construction. These impacts would be managed through the implementation of the mitigation measures outlined in Appendix A.
m. any environmental problems associated with the disposal of waste	The proposed activity is not expected to result in any environmental problems associated with the disposal of waste during construction or operation, providing all waste is adequately classified and managed in accordance with the mitigation measures in Appendix A.
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, or 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 provided the mitigation measures in Appendix A are implemented.
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 area and would not affect any coastal processes or coastal hazards, including those under projected climate change conditions.

4.3 Matters of National Environmental Significance (MNES) under the EPBC Act

Under the EPBC Act, TransGrid is required to consider matters of national environmental significance (MNES), to assist in determining whether the proposed activity should be referred to the Commonwealth Department of Agriculture, Water and the Environment. Table 5 provides a summary of how MNES have been considered.

Table 5. MNES under EPBC Act

MNES / Commonwealth Land	Potential Impact
Any impact on a World heritage property?	No World heritage places are located in proximity to the proposed activity.
Any impact on a National heritage place?	No National heritage places are located within proximity to the proposed activity.
Any impact on any wetlands of international importance?	No wetlands of international importance are located in proximity to the proposed activity.

MNES / Commonwealth Land	Potential Impact
Any impact on a Commonwealth listed threatened species or ecological communities?	The proposed activity would not affect any EPBC Act listed threatened species or communities.
Any impacts on a Commonwealth listed migratory species?	No impact on migratory species is expected.
Any impact on a Commonwealth marine area?	The proposed activity is not located within or in proximity to any Commonwealth marine area.
Any impact on the Great Barrier Reef Marine Park?	The proposed activity is not located in proximity to the Great Barrier Reef.
Does the proposed activity involve a nuclear action (including uranium mines)?	The proposed activity does not involve a nuclear action.
Does the proposed activity involve a water resource, in relation to coal seam gas development and large coal mining development?	The proposed activity is not associated with a coal seam gas or mining development.
Is the proposed activity likely to have a significant impact on the environment on Commonwealth land?	The proposed activity is not located on or within close proximity to any Commonwealth lands.

4.4 Consideration of Ecologically Sustainable Development under the EP&A Act

Obligations under the *Environmental Planning and Assessment Act 1979* and the *Energy Services Corporations Act 1995* require that TransGrid protects the environment by conducting its operations in compliance with the principles of ecologically sustainable development (ESD), namely:

- The precautionary principle;
- Intergenerational equity;
- Conservation of biological diversity and ecological integrity; and
- Improved valuation, pricing and incentive mechanisms.

The principles of ESD have been applied during the proposed activity design and assessment. Mitigation measures (Appendix A) would be applied to avoid or minimise impacts.

5. Environmental Management

TransGrid is committed to conducting its activities and services, including the current proposed activity, in a manner that minimises pollution, environmental impacts, and complies with relevant legislation, industry standards and codes of practice. To achieve this, TransGrid maintains an Environmental Management System (EMS) that is certified under the international standard ISO 14001. All activities undertaken for the activity would be consistent with the EMS and the TransGrid Environmental Handbook. The proposed activity as currently described in Section 1 is not likely to significantly affect the environment. As a result of the detailed environmental assessment undertaken in this SER, environmental management mitigation measures have been included in Appendix A.

Where the mitigation measures in technical reports differ from those listed in Appendix A, the mitigation measures contained in Appendix A take precedence.

A Construction Environmental Management Plan (CEMP) shall be prepared and submitted 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 Preparation of a Construction Environmental Management Plan.

Due to the low level of environmental risk an Environmental Inspector would not be required for the proposed activity. However, an Environmental Supervisor shall be included as part of the construction staff to regularly audit the work activities to ensure that all mitigation measures are being effectively applied and that the work is being carried out in compliance with all environmental approval and legislative conditions.

The operation of the activity would be managed in accordance with TransGrid's certified Environmental Management System, which includes detailed maintenance procedures to minimise potential environmental impacts. Due diligence environmental checks, including environmental information generated from GIS where relevant, are undertaken before any maintenance works are carried out. No new environmental constraints or mitigation measures have been identified as part of this SER that are relevant to the ongoing operation and maintenance of the asset.

6. Summary and Conclusion

The Sydney West 330kV Substation – BESS Installation has been assessed under Part 5 of the EP&A Act and this Summary Environmental Report 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. An assessment of potential impacts and the data sets and sources consulted are identified in Section 5. The key impacts associated with the proposed activity include:

- Minor, temporary noise impacts generated from construction activities;
- Minor increase in traffic movements during construction potentially causing congestion on the surrounding road network; and
- Minor amounts of dust and emissions from earthworks, exposed areas and stockpiles during construction.

All other impacts were assessed as negligible.

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. Considering the assessment undertaken within this SER it is considered that the environmental risk from potential impacts is low.

This SER provides a true and fair review of the 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 activity.

Considering the assessment of the impacts detailed in this SER, it is concluded that the activity **is not likely to significantly affect the environment** and therefore an Environmental Impact Statement is not required.

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

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

This SER is limited to the assessment of the activity described in Section 1. Supplementary assessment and determination in accordance with the *Environmental Planning and Assessment Act 1979* would be required for:

- Works outside of the scope of work assessed in this environmental impact assessment, for which the environmental impact has not been considered; or
- Modifications to the activity scope, methodology or recommended mitigation measures, that alter the environmental impact assessed in this environmental impact assessment.

7. References

ARPANSA (2010) Guidelines for Limiting Exposure to EMF

Department of Environment and Climate Change (2008a) Managing Urban Stormwater: Soil and Construction Volume 2A – Installation of Services

Department of Environment and Climate Change (2009) Interim Construction Noise Guideline

Department of Planning and Environment (2015) NSW Code of Practice for Authorised Network Operators

Eco Logical Australia (2017) Development Strategy – Old Wallgrove Road Eastern Creek and 34-36 Britton Street Smithfield

Environment NSW (2020) Cumberland Plain Woodland in the Sydney Basin Bioregion. Accessed on 22 April 2020 https://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/nsw-threatened-species-scientific-committee/determinations/final-determinations/2008-2010/cumberland-plain-woodland-critically-endangered-ecological-community-listing

Environment Protection Authority (2014) Waste Classification Guidelines

Environment Protection Authority (2015b) Guidelines on the Duty to Report Contamination

Environmental Protection Authority (2000) Noise Policy for Industry

ERM (2020), Sydney West 330kV Substation Noise Impact Assessment Report

International Commissioning on Non-Ionizing Radiation Protection (2010) Guidelines for limiting exposure to time-varying electric and magnetic fields (1Hz – 100kHz)

Landcom (2004) Managing Urban Stormwater: Soil and Construction Volume 1

NSWGeologyPlus (2020) Geological Survey. Accessed on 16 April 2020 https://api.tiles.mapbox.com

Office of Environment and Heritage (2010) Aboriginal Cultural Heritage Consultation Requirements

Practical Environmental Solutions (2014) Asbestos Register Review Sydney West 330kV Substation

Appendix A Summary of Mitigation Measures

Mitigation Measures	
Environmental Management and Incident Response	
EM1	A Construction Environmental Management Plan (CEMP) shall be prepared and submitted 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 *Preparation of a Construction Environmental Management Plan.*
EM2	All works shall be undertaken in accordance with the TransGrid Environmental Handbook.
EM3	All workers shall be inducted onto the CEMP, site environmental conditions and sensitivities identified in this SER and receive training as appropriate. 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 CEMP and to ensure that all mitigation measures are being effectively applied. In addition to the Contractor's 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: • Road occupancy license (ROL) would be required for partial closure of Old Wallgrove Road prior to delivery of power transformer on OSOM.
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 *Protection of the Environment Operations Act 1997* (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 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.
EM10	A SER Close Out Report shall be prepared (in accordance with the Code requirements) 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.

Geology and Soils	
GS1	An Erosion and Sediment Control Plan (ESCP) shall be prepared. All erosion and sediment control measures shall be designed, implemented and maintained in accordance with relevant sections of "Managing Urban Stormwater: Soil and Construction Volume 1" (Landcom, 2004) ('the Blue Book) (particularly Section 2.2) and "Managing Urban Stormwater: Soil and Construction Volume 2A – Installation of Services" (DECC, 2008)".
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 Protection of the *Environment Operations Act 1997 (POEO Act)* and the Waste Regulation.
GS3	Any excavated material suspected of showing evidence of contamination shall be sampled and analysed by a NATA Registered laboratory and managed in accordance with the Waste Classification Guidelines (EPA, 2014), the Guidelines on the Duty to Report Contamination (EPA, 2015) and the *Contaminated Land Management Act 1997*.
GS4	All oil handling shall be undertaken in accordance with TransGrid procedure Oil Management.
Hydrology and Water Quality	
HW1	No refuelling or bulk herbicide preparation shall occur within 40 metres of drainage lines/pits.
Heritage	
HE1	In the event that a site or artefact (as defined by the *National Parks and Wildlife Act 1974* or *Heritage Act 1977*) 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, DPIE and TransGrid contacted.
Noise and Vibration	
NV1	Noise generating works shall be in accordance with the *Interim Construction Noise Guideline* (DECC, 2009): > 7:00am – 6:00pm Monday to Friday. > 8:00am – 1:00pm Saturdays. > No work on Sundays or Public Holidays. Work outside normal hours, on Sundays and public holidays shall only comprise: > 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. > Vacuum and oil filling of equipment. 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.

NV2	The proposed BESS shall achieve a noise level of 75 dBA at 1 metre and the power transformer shall achieve a Sound Power Level (Lw) 95 dBA.
Traffic and Access	
TA1	Transportation and equipment delivery movements on public roads shall be in accordance with RMS and Council requirements.
TA2	Traffic, transportation and access mitigation and management strategies shall be documented and implemented in accordance with the CEMP and updated as required.
TA3	A Traffic Management Plan (TMP) shall be prepared for delivery of power transformer by OSOM.
Air Quality	
AQ1	If necessary, dust suppression techniques shall be implemented, and incorporated into the CEMP, 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.
AQ3	Works would be undertaken in accordance with TransGrid's SF6 policies and procedures.
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.
Waste	
WA1	Waste mitigation and management strategies shall be documented in the CEMP, and be in accordance with TransGrid Waste Procedures and associated Work Instructions. > All waste, including surplus soils, which cannot be reused shall be classified in accordance with the *Waste Classification Guidelines* (EPA, 2014), 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.
WA2	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.
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).

Appendix B Noise Impact Assessment Report

TransGrid

Sydney West 330/132kV Substation

Noise Impact Assessment Report

16 April 2020

Project No.: 0510554

The business of sustainability

ERM

Document Details	
Document title	Sydney West 330/132kV Substation
Document subtitle	Noise Impact Assessment Report
Project No.	0510554
Date	16 April 2020
Version	FINAL
Author/s	Nathan Lynch (NL)
Client Name	TransGrid

Document History

Version	Revision	Author	Reviewed by	ERM approval to issue		Comments
				Name	Date	
Draft	01	NL	JB	Jane Barnett	27.03.20	Draft for client review
Draft	02	NL	-	-	-	Revised draft for client review
Final	01	NL	JB	Jane Barnett	16.04.20	Final report for client

Signature Page

16 April 2020

Sydney West 330/132kV Substation

Noise Impact Assessment Report

Approved - Unsecure Version

Steven De Luzuriaga
Senior Acoustic Consultant

Approved - Unsecure Version

Jane Barnett
Partner

Approved - Unsecure Version

Nathan Lynch
Principal Acoustic Consultant

Environmental Resources Management Australia Pty Ltd
Level 15, 309 Kent Street
Sydney NSW 2000
Australia

CONTENTS

List of Tables

List of Figures

EXECUTIVE SUMMARY

TransGrid is proposing to install a grid-scale Battery Energy Storage System (BESS) and associated transformer at the existing 330/132kV Sydney West Substation (the substation) located at 200 Old Wallgrove Road, Eastern Creek in New South Wales (NSW). At the time this report was prepared, the substation consisted of 15 potential noise generating assets; five primary transformers, six capacitor banks, one Static Var Compensator (SVC), one SVC transformer and two SVC exhaust fans.

The existing reliability of the National Electricity Market (NEM) is largely maintained by large synchronous thermal generation. With the future and planned retirement of existing thermal generation assets (such as Liddell Power Station in 2022) and the introduction of new intermittent generation (such as wind and solar) into the NEM, measures are required to address system reliability, particularly during times of peak demand. TransGrid is proposing to install a grid-scale Battery Energy Storage System (BESS) and associated transformer at the substation. Installation of BESS would assist in maintaining system reliability by offering a fast frequency response during times of network instability. The proposed works at the substation include:

- *Construction of a new bench (approximately 115 m x 35 m) within TransGrid's existing property boundary.*
- *Installation of the BESS unit and ancillary infrastructure (including transformer and switchgear) on the new bench.*
- *Construction of control room on new bench which would include installation of control and protection panels, and cooling and lighting systems.*
- *Installation of switchgear within the existing switchyard.*
- *Cable connections between the new bench and the existing switchyard.*
- *Installation of palisade fencing around the new bench.*

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

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

*A previous assessment has been conducted for the substation as documented in the TransGrid Sydney West Substation Acoustics Assessment report, dated 19 September 2011 and prepared by AECOM (AECOM, 2011). Existing background noise levels of the area were reviewed and adopted from the AECOM, 2011 report as reproduced in **Chapter 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 **Chapter 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 ***Chapter 5*** *and* ***Chapter 6*** *of this report.*

Outcomes

The construction noise assessment identified that predicted "site preparation and establishment" (identified as assessment scenario "CON01" in this report) noise levels comply with ICNG, 2009 NML for works within the recommended standard hours of construction. Predicted levels do however have the potential to exceed the ICNG, 2009 residential receptor NML, for works outside the recommended hours i.e. during the non-standard daytime (1PM to 6PM Saturdays and 8AM to 6PM Sundays/public holidays), the evening (6PM to 10PM) and night-time (10PM to 7AM Monday to Friday, and 10PM to 8AM Sundays/public holidays). Predicted noise levels for "general construction of infrastructure" and "delivery of infrastructure" (identified in this report as assessment scenarios "CON02" and "CON03" respectively) are at or below the NMLs for all assessment periods and at all receptors.

These predicted noise levels and associated impacts are 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 magnitude and extent of potential impacts associated with these elevated CON01 noise levels is best described as low during the daytime and low to moderate during the evening/night-time. Impacts associated with CON02 and CON03 noise levels are best described as low for all time periods. L_{max} noise levels are predicted to comply with sleep disturbance criteria at all residential receptors and as such low impacts are anticipated.

It was 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 demonstrated with the assumption that the proposed new BESS would achieve a noise level of 75 dBA at 1 metre and its transformer would achieve a Sound Power Level (L_W) of 95 dBA; safeguards and provisions were provided as outlined in ***Section 7.2*** *of this report, and reproduced below:*

- *During equipment procurement, ensure that the new BESS achieves the operational noise level of 75 dBA at 1 metre and its transformer achieves a L_W of 95 dBA or better. Based on discussions with TransGrid and the authors of this report, these values 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 330/132kV Sydney West Substation (the substation) located at 200 Old Wallgrove Road, Eastern Creek in New South Wales (NSW). At the time this report was prepared, the substation consisted of 15 potential noise generating assets; five primary transformers, six capacitor banks, one Static Var Compensator (SVC), one SVC transformer and two SVC exhaust fans.

The existing reliability of the National Electricity Market (NEM) is largely maintained by large synchronous thermal generation. With the future and planned retirement of existing thermal generation assets (such as Liddell Power Station in 2022) and the introduction of new intermittent generation (such as wind and solar) into the NEM, measures are required to address system reliability, particularly during times of peak demand. TransGrid is proposing to install a grid-scale Battery Energy Storage System (BESS) and associated transformer at the substation. Installation of BESS would assist in maintaining system reliability by offering a fast frequency response during times of network instability. The proposed works at the substation include:

- Construction of a new bench (approximately 115 m x 35 m) within TransGrid's existing property boundary.
- Installation of the BESS unit and ancillary infrastructure (including transformer and switchgear) on the new bench.
- Construction of control room on new bench which would include installation of control and protection panels, and cooling and lighting systems.
- Installation of switchgear within the existing switchyard.
- Cable connections between the new bench and the existing switchyard.
- Installation of palisade fencing around the new bench.

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, SVC, synchronous condensers and/or battery systems.

In this case, the ancillary infrastructure, secondary systems, switchgards, protection/control equipment, switchbay, cable connections are not significant noise generating features. As stated above the new substation bench would include the installation of the BESS and its transformer which are the focus for this noise assessment.

The existing substation and proposed location of the new bench is presented in **Figure 1.1** below.

Figure 1.1 Indicative Sydney West Substation Equipment Installation

Source: TransGrid, February 2020

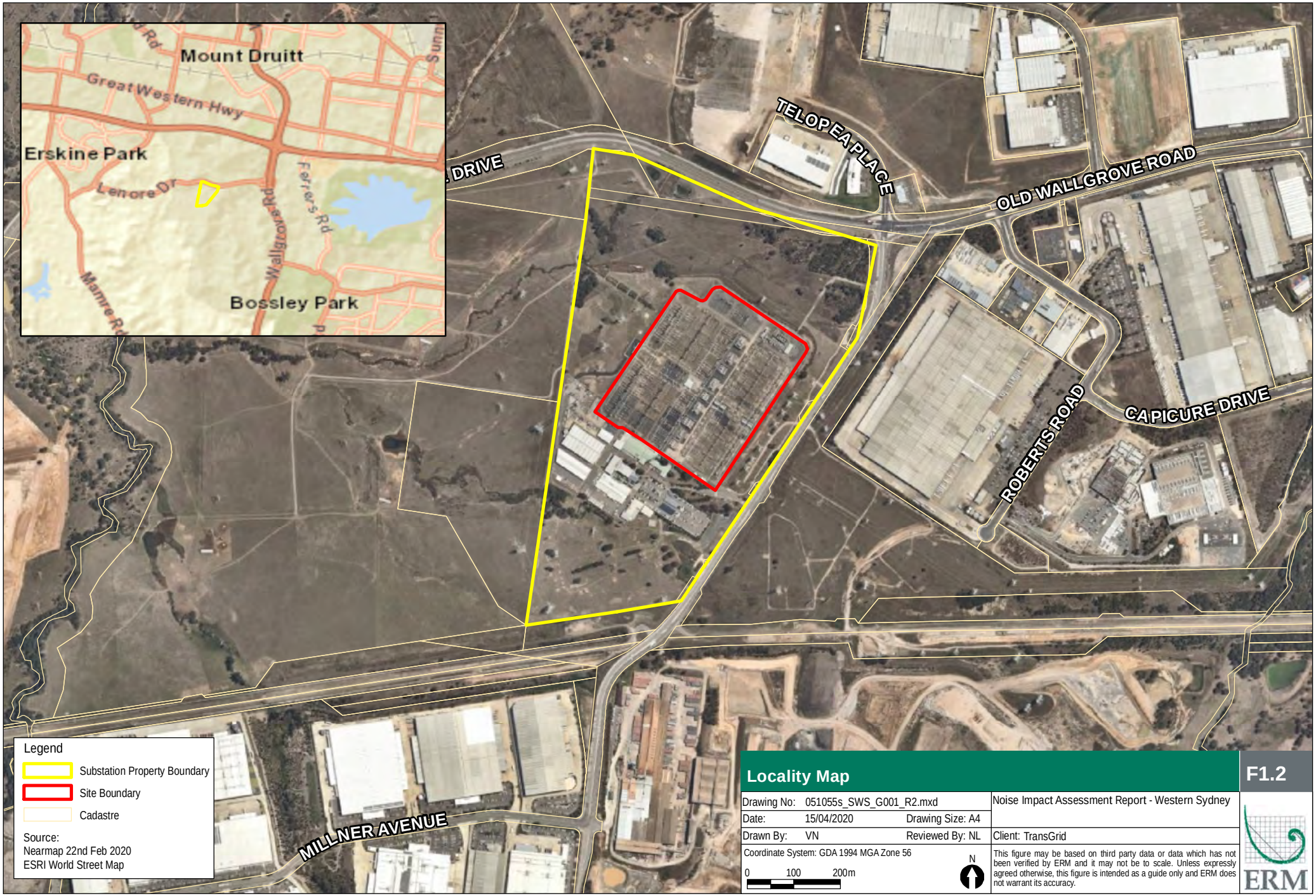
1.2 Site Description

The Sydney West substation site is located at 200 Old Wallgrove Road, Eastern Creek in NSW. The substation is ~1.4 kilometres south-east of Erskine Park (a large residential area) and ~14 kilometres south-east of Penrith, a major residential/commercial centre for the region. The substation is largely surrounded by the Western Sydney Employment Area (WSEA, mostly commercial and industrial facilities) to the north, east and south. Old Wallgrove Road (which becomes Lenore Drive at the intersection of Millner Avenue) is ~300 metres north of existing substation equipment and ~100 metres north of the BESS. The Westlink M7 (toll road) is situated ~1.9 kilometres east of the substation.

Directly south and adjacent to the substation operational boundary is a TransGrid depot. Given the far north position of the BESS and its transformer (with respect to the existing substation equipment) and the TransGrid ownership/usage of this depot, it has not been assessed as a sensitive receptor in this report. This is consistent with the AECOM, 2001 report.

The substation operational site, and broader TransGrid lot boundary is zoned as Infrastructure (SP2). The TransGrid lot is bounded by IN1 (General Industrial) lands to the north, east, south and west however there is E2 (Environmental Conservation) zoned lands that adjoin the north-west corner of the TransGrid owned lands. More broadly there is a mixture of lands uses for areas zoned as infrastructure, primary production, public recreation and 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.



Locality Map

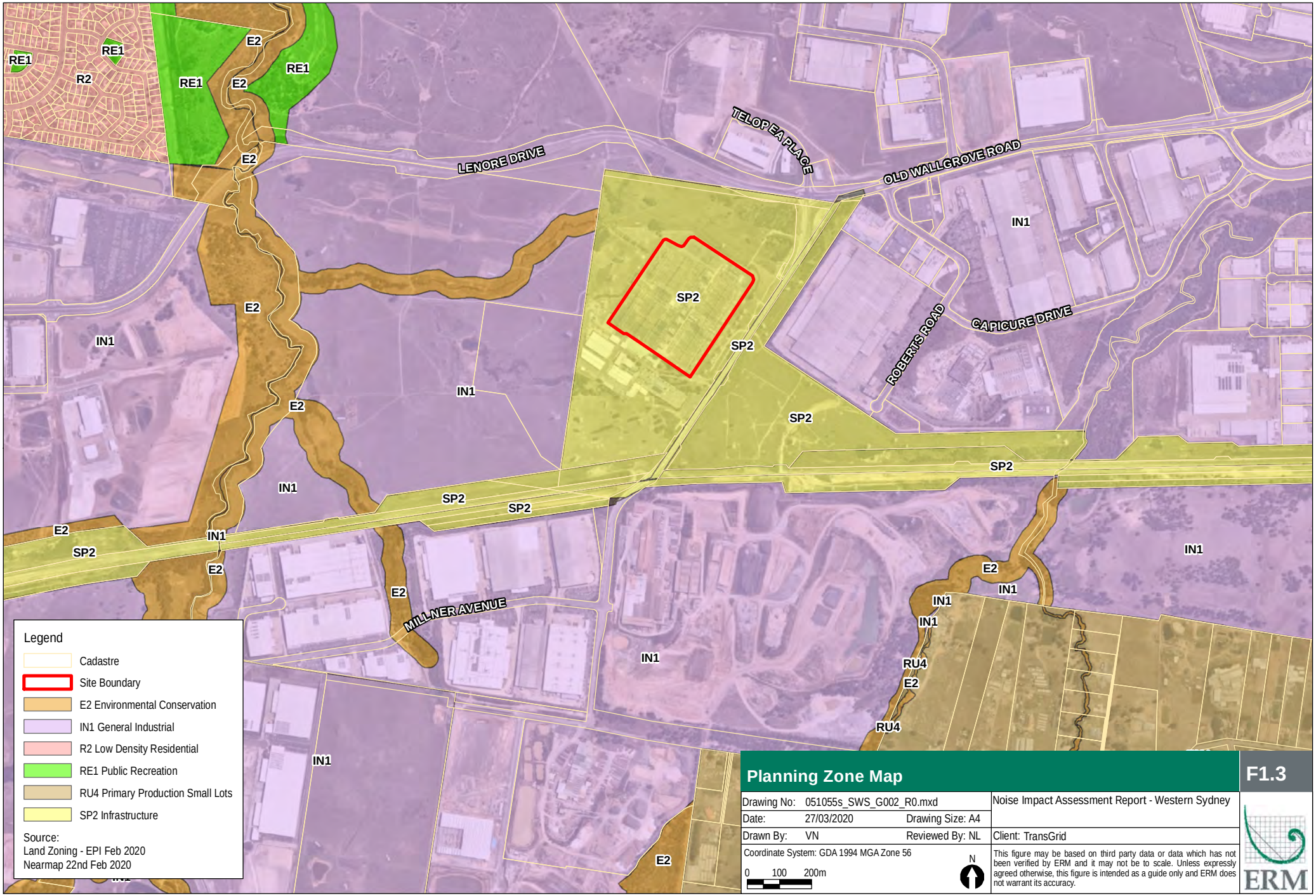
F1.2

Drawing No:	051055s_SWS_G001_R2.mxd		Noise Impact Assessment Report - Western Sydney
Date:	15/04/2020	Drawing Size: A4	
Drawn By:	VN	Reviewed By: NL	Client: TransGrid

Coordinate System: GDA 1994 MGA Zone 56

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.

ERM


RE1
R2
E2
LENORE DRIVE
TELOPEA PLACE
OLD WALLGROVE ROAD
IN1
SP2
ROBERTS ROAD
CAPICURE DRIVE
MILLNER AVENUE
RU4
Legend
Cadastre
Site Boundary
E2 Environmental Conservation
IN1 General Industrial
R2 Low Density Residential
RE1 Public Recreation
RU4 Primary Production Small Lots
SP2 Infrastructure
Source:
Land Zoning - EPI Feb 2020
Nearmap 22nd Feb 2020
Planning Zone Map
F1.3
Drawing No: 051055s_SWS_G002_R0.mxd
Date: 27/03/2020
Drawing Size: A4
Drawn By: VN
Reviewed By: NL
Coordinate System: GDA 1994 MGA Zone 56
0 100 200m
N
Noise Impact Assessment Report - Western Sydney
Client: TransGrid
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.
ERM

Noise Assessment Map

F1.4

Drawing No:	051055s_SWS_G003_R0.mxd		Noise Impact Assessment Report - Western Sydney
Date:	27/03/2020	Drawing Size: A4	
Drawn By:	VN	Reviewed By: NL	Client: TransGrid

Coordinate System: GDA 1994 MGA Zone 56

ERM

2. ASSESSMENT METHODOLOGY

This chapter 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 x 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 (**Chapter 3**).
- Develop project-specific noise criteria by which potential impacts would be assessed (**Chapter 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 (**Chapter 5** and **Chapter 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 (**Chapter 5** and **Chapter 6**).
- 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 **Chapter 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.
- 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. Hence, cumulative impacts are not anticipated where compliance with these NPI, 2017 criteria (both intrusiveness and amenity) 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.

Existing Noise Assessment: an operational noise assessment was previously conducted for the substation in 2011. The methodology, results and findings of that assessment are documented in the *TransGrid Sydney West Substation Acoustics Assessment* report, dated 19 September 2011 and prepared by AECOM (AECOM, 2011). This AECOM, 2011 report identified that the site was fully compliant with criteria. However, noise modelling detail and accuracy has progressed substation since then. The noise modelling conducted in 2020 was compared to the modelling presented in the AECOM, 2011 report to the extent possible given the changes in modelling and the results broadly aligned at the most affected receptors.

Table 2.1 Noise Modelling Features, Inputs and Assumptions

ID	Feature	Description
1	Noise modelling software	■ 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). ■ For sound calculated using ISO9613:2, 1996 the indicated accuracy is ± 3 dBA at the source to receiver distances of up to 1000 metres and unknown at distances above 1000 metres. ■ 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. The model computed the noise propagation in the assessment area of influence to precisely quantify A-weighted decibels ($L_{eq,\ 15\ minute}$ and L_{max} parameters both in dBA) at identified receptors. ■ 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	■ Sound Power Level (L_W, dBA) data incorporated into the project-specific noise models were adopted from the AECOM, 2011 report, provided by TransGrid, obtained from relevant Australian Standards or adapted from a proprietary source term database available at the time of the assessment. - L_W is a measure of the total power radiated by a source. It is a fundamental property of the source and is independent of the surrounding environment. - L_W differs from a Sound Pressure Level (L_P) which is the level of sound pressure as measured at a distance by a standard sound level meter with a microphone. L_P is the received sound (e.g. $L_{eq,\ 15\ minute}$ in dBA) as opposed to L_W which is the sound 'intensity' at the source. - 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. ■ 3D elevation, zoning and cadastre spatial data were obtained from the *NSW Government - Land and Property Information* (LPI). ■ 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.

ID	Feature	Description
2	Construction and Operational Noise Level Predictions *(Cont'd)*	■ 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. ■ 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 commercial or industrial premises, the noise level was assessed at the reasonably most-affected point on or within the property boundary. ■ 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 0.5 was adopted for general modelling area, 0.0 is hard, 1.0 is soft. ■ To accurately represent general construction emissions, capturing the size, layout and number of noise generating plant / equipment, "area sources" were utilised to predict $L_{eq,\ 15\ minute}$ 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", "area sources", "emitting facades" and "emitting roofs" 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 **Chapter 5** and **6** and presented in detail in **Appendix C** of this report. All L_W, dBA values have considered and applied the relevant ICNG, 2009 and NPI, 2017 modifying factors (penalties) for offensive noise characteristics, prior to modelling.
3	Meteorological Conditions	■ General meteorological conditions for the project-specific noise models included a temperature of 12.4°C (annual mean minimum), and humidity of 74% (annual mean for 9 AM statistics), representative of average conditions for the area. An assumed atmospheric pressure of 101.33 kPA was adopted. 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 Penrith Lakes: - Site number: 067113 - Locations: Latitude: 33.72° South / Longitude: 150.68° East - Elevations: 25 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 stable conditions only (representing conditions commonly experienced during the daytime period, when works would mostly occur) and calm winds for all scenarios.

Based on the predicted noise levels presented in this report the effects of noise enhancing meteorological conditions are very minimal such that their influence to construction noise levels (and of course operations) is anticipated to be limited, if any at all.

3. EXISTING NOISE ENVIRONMENT

This chapter 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 'suburban' defined by the NPI, 2017 as an area that has local traffic with characteristically intermittent traffic flows or with some limited commerce or industry. This area often has evening ambient noise levels defined by the natural environment and human activity.

A 'suburban' 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).

Existing Baseline Data: This 'suburban' classification is consistent with the AECOM, 2011 assessment. The baseline noise data documented in the AECOM, 2011 report was reviewed and evaluated by the authors of this report and is considered suitable for re-use despite the subsequent release of NPI, 2017. This baseline data is further described in **Section 3.3** below. All operational noise criteria have however been updated as per NPI, 2017 requirements as identified in **Chapter 4** of this report.

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 **Chapter 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 AECOM, 2011 report was referenced to select receptor locations and these were verified based on preliminary noise modelling to ensure the most affected positions were selected. The receptor list was then expanded to include additional locations for new premises that had been constructed since the AECOM, 2011 assessment work. R06a and R07a are the same locations (R6 and R7) assessed in the AECOM, 2011 report with additional locations R06b-e and R07b-d included.

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 (Dwelling)	Residential (dwelling) receptors west of the substation site in Erskine Park. They are situated approximately 1520 to 1620 metres from key substation noise generating sources.	297401	6256849	50	1620	West
R02	Residential (Dwelling)		297433	6256577	50	1520	West
R03	Residential (Dwelling)	Residential (dwelling) receptors south and south-west of the substation site. They are situated approximately 1390 to 1590 metres from key substation noise generating sources. They are the closest residential receptors. They are situated in close proximity to existing commercial and industrial premises near the substation site.	299138	6254743	84	1390	South
R04	Residential (Dwelling)		299751	6254810	68	1480	South
R05	Residential (Dwelling)		300245	6255063	61	1590	South-west
R06a	Other Sensitive (Commercial)	Commercial receptors east, north-east and north of the substation site. They are situated approximately 160 to 480 metres from key substation noise generating sources.	299287	6256006	75	250	East
R06b	Other Sensitive (Commercial)		299367	6256127	75	250	East
R06c	Other Sensitive (Commercial)		299461	6256270	76	250	East
R06d	Other Sensitive (Commercial)		299656	6256619	78	480	North-east
R06e	Other Sensitive (Commercial)		299277	6256532	73	160	North
R07a	Other Sensitive (Commercial)	Commercial receptors south and south-west of the substation site. They are situated approximately 500 to 840 metres from key substation noise generating sources.	298955	6255526	72	500	South
R07b	Other Sensitive (Commercial)		298759	6255503	68	590	South
R07c	Other Sensitive (Commercial)		298582	6255479	68	690	South
R07d	Other Sensitive (Commercial)		298377	6255449	63	840	South-west

3.3 Rating Background Noise Levels

The Rating Background Noise Levels (RBL) for the daytime ($L_{90,\ 11\ hour}$), evening ($L_{90,\ 4\ hour}$) and night-time ($L_{90,\ 9\ hour}$) are presented in **Table 3.2** below for all potential noise-sensitive receptors, as established based on the AECOM, 2011 report and 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 **Chapter 4** of this report.

Table 3.2 Rating Background Noise Levels

ID	Receptor Type	Rating Background Noise Levels (RBL) in dBA		
		$L_{90,\ 11\ hour}$ (Daytime)	$L_{90,\ 4\ hour}$ (Evening)	$L_{90,\ 9\ hour}$ (Night-time)
R01	Residential (Dwelling)	37	34	32
R02	Residential (Dwelling)	37	34	32
R03	Residential (Dwelling)	34	34	32
R04	Residential (Dwelling)	34	34	32
R05	Residential (Dwelling)	34	34	32
R06a	Other Sensitive (Commercial)	34	34	32
R06b	Other Sensitive (Commercial)	34	34	32
R06c	Other Sensitive (Commercial)	34	34	32
R06d	Other Sensitive (Commercial)	34	34	32
R06e	Other Sensitive (Commercial)	34	34	32
R07a	Other Sensitive (Commercial)	34	34	32
R07b	Other Sensitive (Commercial)	34	34	32
R07c	Other Sensitive (Commercial)	34	34	32
R07d	Other Sensitive (Commercial)	34	34	32

4. PROJECT-SPECIFIC ASSESSMENT CRITERIA

This chapter 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 **Chapter 2**, the existing noise conditions in **Chapter 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 (commercial) 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): $L_{eq,\ 15\ minute}$ in dBA				HNML: $L_{eq,\ 15\ minute}$ in dBA[3]	Sleep Disturbance Criteria in dBA	
	Daytime Hours		Evening	Night	Daytime: Standard Hours Only	Night-time only	
	Standard	Non-standard				$L_{eq,\ 15minute}$	L_{max}
Residential (R01 / R02)	47	42	39	37	75	40	52
Residential (R03 to R05)	44	39	39	37	75	40	52
Commercial	70	70	70	70	-	-	-
Industrial	75	75	75	75	-	-	-

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. *Baseline noise data documented in the AECOM, 2011 report was suitable for re-use and all NML were established as per ICNG, 2009 requirements.*

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 $L_{eq,\ 15\ minute}$ in dBA			Recommended Amenity Noise Level $L_{eq,\ period}$ in dBA			Project Amenity Noise Level $L_{eq,\ 15\ minute}$ in dBA			PNTL $L_{eq,\ 15\ minute}$ in dBA[3]			Sleep Disturbance Criteria in dBA	
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	Night-time only	
													$L_{eq,\ 15\ minute}$	L_{max}
Residential (R01 / R02)	42	39	37	55	45	40	53	43	38	42	39	37	40	52
Residential (R03 to R05)	39	39	37	55	45	40	53	43	38	39	39	37	40	52
Commercial	-	-	-	65	65	65	63	63	63	63	63	63	-	-
Industrial	-	-	-	70	70	70	68	68	68	68	68	68	-	-

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. *NPI, 2017 'Suburban' Amenity Level adopted for residential receptors.*

5. CONSTRUCTION ASSESSMENT

This chapter 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 **Chapter 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

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). *This work will likely occur inside standard construction hours.*	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. *This work will likely occur inside standard construction hours.*	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. *Equipment delivery may be required outside standard construction hours.*	Total Lw of 113
Lmax	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. *Representative of any works occurring outside standard construction hours.*	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, $L_{eq,\ 15\ minute}$ and L_{max} noise levels (in dBA) have been predicted and then compared to the NML identified previously in **Chapter 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 Noise Levels in dBA: $L_{eq,\ 15\ minute}$ and L_{max}				Comparison to NML – Standard and Non-standard hours Presented as "CON 01 / CON02 / CON03" Results and the L_{max} scenario (far right column)				
	CON01	CON02	CON03	L_{max}	Daytime, standard hours	Daytime, non-standard hours	Evening, non-standard hours	Night-time, non-standard hours	52 dBA L_{max} Criteria, night only
R01	40	34	29	48	-7 / -13 / -18	-2 / -8 / -13	**1** / -5 / -10	**3** / -3 / -8	-4
R02	40	35	30	49	-7 / -12 / -17	-2 / -7 / -12	**1** / -4 / -9	**3** / -2 / -7	-3
R03	42	36	31	50	-2 / -8 / -13	**3** / -3 / -8	**3** / -3 / -8	**5** / -1 / -6	-2
R04	42	36	31	50	-2 / -8 / -13	**3** / -3 / -8	**3** / -3 / -8	**5** / -1 / -6	-2
R05	42	36	31	50	-2 / -8 / -13	**3** / -3 / -8	**3** / -3 / -8	**5** / -1 / -6	-2
R06a	62	56	52	69	-8 / -14 / -18	-8 / -14 / -18	-8 / -14 / -18	-8 / -14 / -18	-
R06b	65	59	54	71	-5 / -11 / -16	-5 / -11 / -16	-5 / -11 / -16	-5 / -11 / -16	-
R06c	66	60	55	72	-4 / -10 / -15	-4 / -10 / -15	-4 / -10 / -15	-4 / -10 / -15	-
R06d	55	49	45	62	-15 / -21 / -25	-15 / -21 / -25	-15 / -21 / -25	-15 / -21 / -25	-
R06e	68	62	58	74	-2 / -8 / -12	-2 / -8 / -12	-2 / -8 / -12	-2 / -8 / -12	-
R07a	53	47	43	60	-17 / -23 / -27	-17 / -23 / -27	-17 / -23 / -27	-17 / -23 / -27	-
R07b	52	46	41	59	-18 / -24 / -29	-18 / -24 / -29	-18 / -24 / -29	-18 / -24 / -29	-
R07c	47	41	36	54	-23 / -29 / -34	-23 / -29 / -34	-23 / -29 / -34	-23 / -29 / -34	-
R07d	45	39	34	53	-25 / -31 / -36	-25 / -31 / -36	-25 / -31 / -36	-25 / -31 / -36	-

1. *CON01 = Site Preparation and Establishment, CON02 = General Construction of Infrastructure, CON03 = Delivery of new equipment.*
2. *NML for R01 / R02 is 47 dBA / 42 dBA / 39 dBA / 37 dBA for daytime standard / daytime non-standard / evening / night-time. NML for R03 to R05 is 44 dBA / 39 dBA / 39 dBA / 37 dBA for daytime standard / daytime non-standard / evening / night-time. NML for R06a to R07d is 70 dBA for all periods.*

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 29 and 69 dBA (46 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 commercial receptor R06e (situated north of the site) and range between 58 and 68 dBA. The highest $L_{eq,\ 15\ minute}$ noise levels predicted at the most affected residential receptors (R04 and R05) range between 31 and 42 dBA.
- The highest predicted $L_{eq,\ 15\ minute}$ noise levels and worst-case impacts are associated with "site preparation and establishment" (CON 01) works. Predicted $L_{eq,\ 15\ minute}$ noise levels are substantial lower and fully compliant with NML at all receptors for both "general construction of infrastructure" (CON 02) and "equipment delivery" (CON 03) works. Predicted CON01 levels comply with daytime (standard hours) NML at all receptors but exceed the daytime non-standard, evening and night-time NML at residential receptors R01 to R05. These CON01 extent that these levels exceed criteria ranges between 1 and 5 dBA.
- Predicted L_{max} noise levels are below the night-time sleep disturbance criteria ($L_{max} \leq 52$ dBA) at all residential receptors.
- Predicted $L_{eq,\ 15\ minute}$ noise levels are also below daytime the HNML (for works within the recommended standard hours of construction) value of $L_{eq,\ 15\ minute} \leq 75$ dBA at all residential receptors.

5.2.3 Summary of Findings

The predicted noise levels identified 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 low to moderate 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 or non-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 evening and especially the night-time to limit impacts (if any) to the daytime period when people are generally less sensitive to construction noise. Evening and night-time works can however occur whilst maintaining 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 **Chapter 7**. They are designed to assist TransGrid in achieving compliance and minimise any residual impacts as far is commonly feasible, reasonable and safe to do so.

6. OPERATIONAL NOISE ASSESSMENT

This chapter 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 **Chapter 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 Sydney West Substation includes five primary transformers, six capacitor banks, one Static Var Compensator (SVC), one SVC transformer and two SVC exhaust fans. As described in **Section 2.5.1**, standard and noise-enhancing meteorological conditions have been modelled for this scenario with no substantial difference in the predicted values.	1 x Transformer Lw: of 100 dBA 1 x Transformer Lw: of 91 dBA 1 x Transformer Lw: of 101 dBA 1 x Transformer Lw: of 101 dBA 1 x Transformer Lw: of 109 dBA 1 x Capacitor Bank Lw: of 75 dBA 1 x Capacitor Bank Lw: of 76 dBA 1 x Capacitor Bank Lw: of 75 dBA 1 x Capacitor Bank Lw: of 75 dBA 1 x Capacitor Bank Lw: of 77 dBA 1 x Capacitor Bank Lw: of 79 dBA 1 x SVC Lw: of 92 dBA 1 x SVC Tx Lw: of 88 dBA 1 x SVC Exh-fan Lw: of 74 dBA 1 x SVC Exh-fan Lw: of 78 dBA
02	This assessment scenario is associated with: **Proposed Operations** i.e. existing + new equipment. Existing + Proposed operations at the Sydney West Substation includes the concurrent operation of the five primary transformers, six capacitor banks, one SVC, one SVC transformer and two SVC exhaust fans with the addition of the BESS unit and its transformer. As described in **Section 2.5.1**, standard and noise-enhancing meteorological conditions have been modelled for this scenario with no substantial difference in the predicted values.	Existing operations **PLUS**: 1 x BESS Unit: 75 dBA at 1 metre 1 x BESS Tx: Lw of 95 dBA

1. Peak load transformer data was adopted from the AECOM, 2011 report.

6.2 Predicted Operational Noise Levels

Based on the noise modelling methodology described in **Chapter 2** of this report and the operational assessment scenarios and data presented in **Table 6.1** above, daytime, evening and night time $L_{eq,\ 15\ minute}$ 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 **6.3** 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.

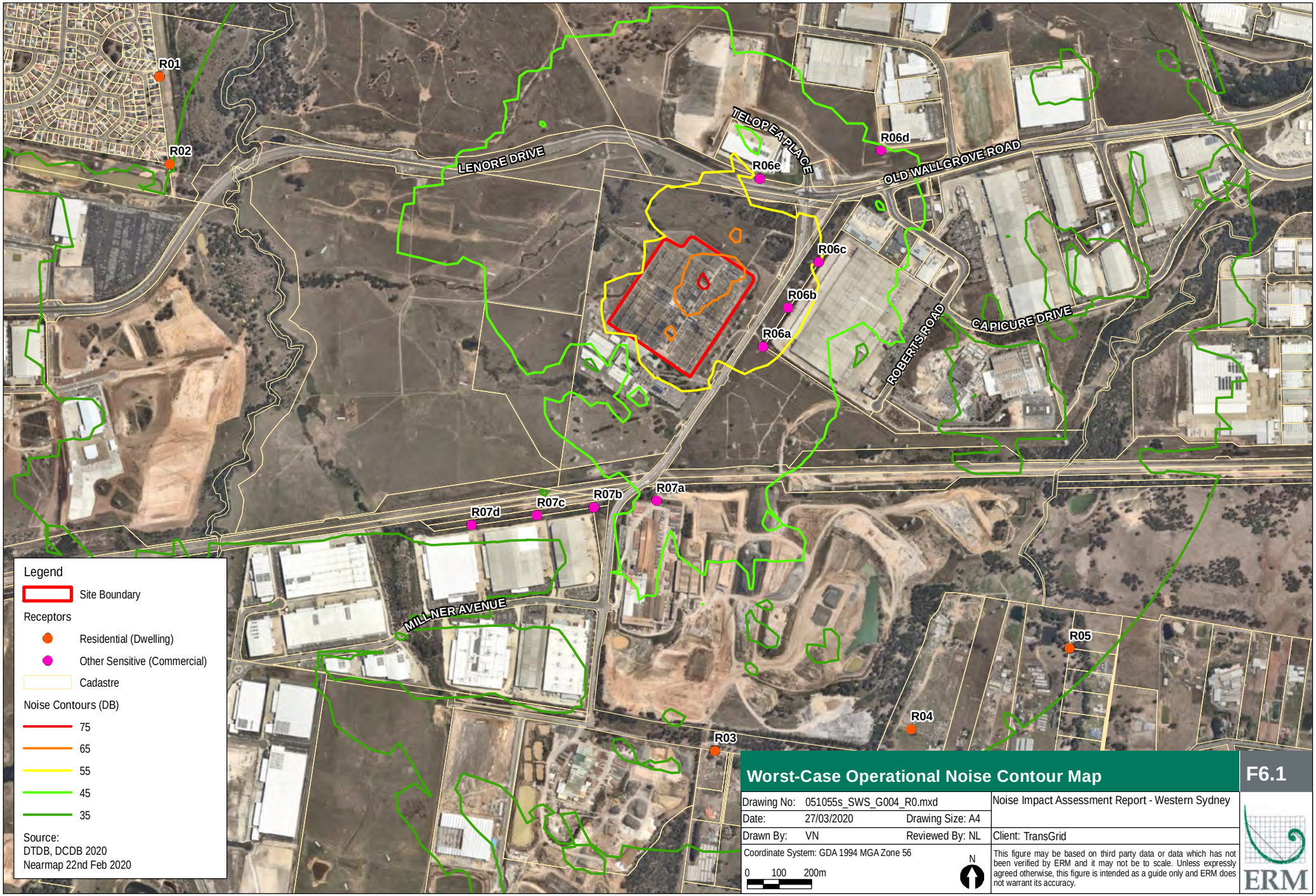
A noise contour map for the worst-case (night-time) conditions is presented in **Figure 6.1**.

Table 6.2 Predicted Operational Noise Levels / Compliance: Existing Substation (Standard and Noise-enhancing MET)

ID	Scenario	PNTL: $L_{eq\ 15\ minute}$ in dBA	Predicted Operational Noise levels $L_{eq\ 15\ minute}$ in dBA			Comparison to PNTL (Predicted – Criteria) $L_{eq,\ 15\ minute}$ in dBA				Compliant?
		Daytime / Evening / Night	Day	Evening	Night	Day	Evening	Night	Sleep Disturbance	
R01	Existing Substation Operations *Standard and noise-enhancing meteorological conditions*	42 / 39 / 37	34	34	34	-8	-5	-3	-6	Yes
R02		42 / 39 / 37	34	34	34	-8	-5	-3	-6	Yes
R03		39 / 39 / 37	36	36	36	-3	-3	-1	-4	Yes
R04		39 / 39 / 37	36	36	36	-3	-3	-1	-4	Yes
R05		39 / 39 / 37	35	35	35	-4	-4	-2	-5	Yes
R06a		63 / 63 / 63	56	56	56	-7	-7	-7	-	Yes
R06b		63 / 63 / 63	56	56	56	-7	-7	-7	-	Yes
R06c		63 / 63 / 63	54	54	54	-9	-9	-9	-	Yes
R06d		63 / 63 / 63	44	44	44	-19	-19	-19	-	Yes
R06e		63 / 63 / 63	49	49	49	-14	-14	-14	-	Yes
R07a		63 / 63 / 63	48	48	48	-15	-15	-15	-	Yes
R07b		63 / 63 / 63	43	43	43	-20	-20	-20	-	Yes
R07c		63 / 63 / 63	42	42	42	-21	-21	-21	-	Yes
R07d		63 / 63 / 63	40	40	40	-23	-23	-23	-	Yes

Table 6.3 Predicted Operational Noise Levels / Compliance: Proposed Substation (Standard and Noise-enhancing MET)

ID	Scenario	PNTL: $L_{eq\ 15\ minute}$ in dBA	Predicted Operational Noise levels $L_{eq\ 15\ minute}$ in dBA			Comparison to PNTL (Predicted – Criteria) $L_{eq,\ 15\ minute}$ in dBA				Compliant?
		Daytime / Evening / Night	Day	Evening	Night	Day	Evening	Night	Sleep Disturbance	
R01	Proposed Substation Operations *Standard and noise-enhancing meteorological conditions*	42 / 39 / 37	34	34	34	-8	-5	-3	-6	Yes
R02		42 / 39 / 37	35	35	35	-7	-4	-2	-5	Yes
R03		39 / 39 / 37	37	37	37	-2	-2	0	-3	Yes
R04		39 / 39 / 37	36	36	36	-3	-3	-1	-4	Yes
R05		39 / 39 / 37	36	36	36	-3	-3	-1	-4	Yes
R06a		63 / 63 / 63	56	56	56	-7	-7	-7	-	Yes
R06b		63 / 63 / 63	56	56	56	-7	-7	-7	-	Yes
R06c		63 / 63 / 63	55	55	55	-8	-8	-8	-	Yes
R06d		63 / 63 / 63	46	46	46	-17	-17	-17	-	Yes
R06e		63 / 63 / 63	52	52	52	-11	-11	-11	-	Yes
R07a		63 / 63 / 63	48	48	48	-15	-15	-15	-	Yes
R07b		63 / 63 / 63	44	44	44	-19	-19	-19	-	Yes
R07c		63 / 63 / 63	42	42	42	-21	-21	-21	-	Yes
R07d		63 / 63 / 63	40	40	40	-23	-23	-23	-	Yes


R01
R02
LENORE DRIVE
TELOPEA PLACE
R06e
R06d
OLD WALLGROVE ROAD
R06c
R06b
R06a
ROBERTS ROAD
CAPICURE DRIVE
R07a
R07b
R07c
R07d
MILLNER AVENUE
R05
R04
R03
Legend
Site Boundary
Receptors
Residential (Dwelling)
Other Sensitive (Commercial)
Cadastre
Noise Contours (DB)
75
65
55
45
35
Source:
DTDB, DCDB 2020
Nearmap 22nd Feb 2020
Worst-Case Operational Noise Contour Map
F6.1
Drawing No: 051055s_SWS_G004_R0.mxd
Noise Impact Assessment Report - Western Sydney
Date: 27/03/2020
Drawing Size: A4
Drawn By: VN
Reviewed By: NL
Client: TransGrid
Coordinate System: GDA 1994 MGA Zone 56
0 100 200m
N
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.
ERM

6.2.1 Discussion of Results

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

- Predicted $L_{eq,\ 15\ minute}$ noise levels for the existing substation operations are between 34 and 56 dBA, for standard and noise-enhancing meteorological conditions. The highest $L_{eq,\ 15\ minute}$ noise levels (56 dBA) are predicted at R06a and R06b both of which are commercial receptors. R03 and R04 are the closest and/or most affected residential receptors situated within the potential area of influence of the substation at which the highest $L_{eq,\ 15\ minute}$ noise levels (36 dBA) are predicted.
- Predicted $L_{eq,\ 15\ minute}$ noise levels for the proposed substation operations are again between 34 and 56 dBA, for standard and noise-enhancing meteorological conditions. The highest $L_{eq,\ 15\ minute}$ noise levels (56 dBA) are predicted at R06a and R06b both of which are commercial receptors. R03 and R04 are again the closest and/or most affected residential receptors situated within the potential area of influence of the substation at which the highest $L_{eq,\ 15\ minute}$ noise levels (37 and 36 dBA respectively) are predicted.
- Predicted $L_{eq,\ 15\ minute}$ noise levels for proposed operations are compliant with the NPI, 2017 for the daytime, evening and night-time periods at all receptors.
- 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 $L_{eq,\ 15\ minute}$ parameter is applicable to the assessment of sleep disturbance. Predicted $L_{eq,\ 15\ minute}$ noise levels for proposed operations are below the $L_{eq,\ 15\ minute}$ sleep disturbance criteria of 40 dBA at all applicable residential receptors. The sites night-time operations are compliant with the NPI, 2017 requirements.

Noise level measurements and analysis for annoying noise characteristics (e.g. tonality) were completed and documented in the AECOM, 2011 report. It concluded that annoying noise characteristics were not a feature of the substation's existing operation. Annoying noise characteristics associated with the BESS and its transformer are not considered a feature of the substation's proposed operation. These findings are consistent with other similar substations and equipment (with receptors situated at distances greater than 100 metres from emission sources) that have been assessed by the authors of this report.

6.2.2 Summary of Findings

The predicted noise levels identified above are as anticipated for the installation of the new BESS (and 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 approach or exceed criteria.

Based on the results and findings discussed above, recommended safeguards and/or provisions for monitoring are provided in **Chapter 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 chapter 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 **Chapter 5** of this report, predicted CON01 "site preparation and establishment" noise levels comply with ICNG, 2009 NML for works within the recommended standard hours of construction. Predicted levels do however have the potential to exceed the ICNG, 2009 residential receptor NML for works outside the recommended standard hours i.e. during the non-standard daytime (1PM to 6PM Saturdays and 8AM to 6PM Sundays/public holidays), the evening (6PM to 10PM) and night-time (10PM to 7AM Monday to Friday, and to 8AM Sundays/public holidays). Predicted noise levels for CON02 "general construction of infrastructure" and CON03 "delivery of infrastructure" are at or below the NMLs for all assessment periods and at all receptors.

The magnitude and extent of potential impacts associated with these elevated CON01 noise levels is best described as low during the daytime and low to moderate during the evening/night-time but as anticipated for the construction works and activities required, and the distance offsets to nearby receptors. Impacts associated with CON02 and CON03 noise levels are best described as low for all time periods. L_{max} noise levels are predicted to comply with sleep disturbance criteria at all residential receptors and as such low impacts are anticipated. It is also understood that works outside the ICNG, 2009 recommended standard hours are not proposed, however some works may be unavoidable with essential tasks, for example, being timed to correlate with system planning outages.

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 and noisy 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; and

- 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.
- 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 **Chapter 6**, all predicted operational $L_{eq,\ 15\ minute}$ 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 demonstrated with the assumption that the proposed new BESS would achieve a noise level of 75 dBA at 1 metre and its transformer would achieve a Sound Power Level (L_W) of 95 dBA. On this basis the following safeguards and provisions are provided:

- During equipment procurement, ensure that the new BESS achieves the operational noise level of 75 dBA at 1 metre and its transformer achieves a L_W of 95 dBA or better. Based on discussions with TransGrid and the authors of this report, these values 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.

8. CONCLUSION

This noise impact assessment was completed on behalf of TransGrid for the proposed installation of a grid-scale BESS and associated transformer at the existing 330/132kV Sydney West Substation located at 200 Old Wallgrove Road, Eastern Creek in NSW.

The assessment was conducted to achieve a scope of works that allowed for the 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 **Chapter 1** whilst the overall assessment methodology is presented in **Chapter 2** of this report.

A previous assessment has been conducted for the substation as documented in the AECOM, 2011 report. Existing background noise levels of the area were reviewed and adopted from the AECOM, 2011 report as reproduced in **Chapter 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 **Chapter 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, 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 **Chapter 5** and **Chapter 6** of this report.

The construction noise assessment identified that predicted noise levels for some scenarios have the potential to exceed the ICNG, 2009 residential receptor NML, especially during the evening (6PM to 10PM) and night-time (10PM to 7AM Monday to Friday, and to 8AM Sundays/public holidays). These predicted noise levels and associated impacts are 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 magnitude and extent of worst-case potential impacts are best described as low during the daytime and low to moderate during the evening/night-time.

It was 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 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

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**

TransGrid Sydney West Substation Acoustics Assessment report, dated 19 September 2011 and prepared by AECOM (AECOM, 2011)

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 20μPa 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 x 10^{-5} Pascals, Pa) with the “A-weighting” curve applied and adopting the relevant acoustical or statistical noise level parameter e.g. $L_{eq,\ 15\ minute}$, $L_{eq,\ 1hour}$ or $L_{90,\ 9\ Hour}$.

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 L_{A90} 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 L_{A90} or L_{Aeq} 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 L_{A90} 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.
- **L_{eq}** - this level represents the equivalent or average noise energy during a measurement period. The $L_{eq,\ 15\ min}$ 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. $L_{10,\ 15\ minute}$) as required.
- **$L_{AF90,\ 15\ min}$** - 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.
- **$L_{AF90,\ period\ (day/evening/night)}$** – 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.
- **$L_{AF90,\ (shoulder\ period)}$** - 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.
- **L_N** - the percentile sound pressure level exceeded for N% of the measurement period calculated by statistical analysis.
- **L_{10}** - the noise level exceeded for 10 per cent of the time and is approximately the average of the maximum noise levels.
- **L_{90}** - the noise level exceeded for 90 per cent of the time and is approximately the average of the minimum noise levels. The L_{90} 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 (L_P)** - the level of sound pressure; as measured at a distance by a standard sound level meter with a microphone. This differs from L_W 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 $L_{Aeq,\ 15\ min}$ 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 L_{Aeq} 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 $L_{Aeq,\ period\ (traffic)}$ 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
WBVG	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 as 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
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	Noise affected Rating Background Level (RBL) + 10 dBA	The noise affected level represents the point above which there may be some community reaction to noise. ■ Where the predicted or measured $L_{eq, 15\ minute}$ 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.
	Highly noise affected 75 dBA	The highly noise affected level represents the point above which there may be strong community reaction to noise. ■ Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: ■ times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours (OOH) - All other times including Public Holidays	Noise affected Rating Background Level (RBL) + 5 dBA	■ 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, $L_{Aeq,\ 15\ minute}$ (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 $L_{eq,\ 15\ minute} \leq 75$ dBA.
- Offices, retail outlets: external $L_{eq,\ 15\ minute} \leq 70$ 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): $L_{eq,\ 15\ minute}$ 40 dBA (internal).
- **Night-time** (10 pm to 7 am): $L_{eq,\ 15\ minute}$ 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:

$L_{Aeq,\ 15min}$ = rating background noise level + 5 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 ($L_{Aeq,15min}$ 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 ($L_{Aeq, period}$ 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 All	 Noisiest 1-hour Noisiest 1-hour	 35 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 <35dBA	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: ■ 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:

- $L_{eq,15\ minute}$ 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 $L_{AF90,\ 15\ min}$ 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 LW Value	NPI Penalty, dBA	Total LW Value	Source	Noise Source Term Data Spectral Data in dBA									
									31.5Hz	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	LW Total, dBA
CON01	Site Preparation and Establishment (generally standard hours only)	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 TfNSW 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**	**-**	**83.9**	**99.7**	**110.5**	**114.4**	**116.3**	**117.8**	**116.6**	**109.3**	**101.8**	**123.0**
CON02	General Construction of Infrastructure (generally standard hours only)	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**	**-**	**79.2**	**96.1**	**105.7**	**107.7**	**110.3**	**111.7**	**110.5**	**105.9**	**97.3**	**117.1**
CON03	Delivery of Infrastructure (generally standard hours only, some out of hours work may be required)	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	-	96.0	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**	**-**	**73.3**	**90.6**	**99.8**	**103.4**	**106.2**	**106.5**	**106.1**	**101.6**	**92.7**	**112.5**
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							Individual Noise Source Term Data Spectral Data in dBA									
Substation	ID	Description	Status	Sound Power Level of Asset (LW)	Reduced Noise Specification Required (Y/N)	Reduced Noise Specification (Lw)	Comment	31.5Hz	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	LW Total dBA
Sydney West 330kV	Tx1	No. 1 Transformer	Existing	**93.12**	No	n/a	No Tx bay walls but incl. fans (Lw from AECOM 2011 Assessment)	48.96	70.83	88.41	85.78	89.25	79.73	74.10	68.76	56.05	**93.12**
Sydney West 330kV	Tx2	No. 2 Transformer	Existing	**83.54**	No	n/a	No Tx bay walls but incl. fans (Lw from AECOM 2011 Assessment)	47.02	60.86	73.38	79.49	77.99	75.58	70.23	65.92	56.74	**83.54**
Sydney West 330kV	Tx3	No. 3 Transformer	Existing	**89.46**	No	n/a	No Tx bay walls but incl. fans (Lw from AECOM 2011 Assessment)	50.36	66.40	82.51	85.95	83.40	77.04	74.92	67.14	54.91	**89.46**
Sydney West 330kV	Tx4	No. 4 Transformer	Existing	**90.46**	No	n/a	No Tx bay walls but incl. fans (Lw from AECOM 2011 Assessment)	47.65	63.86	86.61	84.73	84.18	77.35	74.63	68.29	55.45	**90.46**
Sydney West 330kV	Tx5	No. 5 Transformer	Existing	**96.33**	No	n/a	No Tx bay walls but incl. fans (Lw from AECOM 2011 Assessment)	53.97	66.17	77.62	88.04	94.97	85.62	79.37	65.74	58.55	**96.33**
Sydney West 330kV	Tx1	No. 1 Transformer	Existing	**100.00**	No	n/a	No Tx bay walls but incl. fans (Lw from AECOM 2011 Assessment), increased load	55.84	77.71	95.29	92.66	96.13	86.61	80.98	75.64	62.93	**100.00**
Sydney West 330kV	Tx2	No. 2 Transformer	Existing	**91.00**	No	n/a	No Tx bay walls but incl. fans (Lw from AECOM 2011 Assessment), increased load	54.48	68.32	80.84	86.95	85.45	83.04	77.69	73.38	64.20	**91.00**
Sydney West 330kV	Tx3	No. 3 Transformer	Existing	**101.00**	No	n/a	No Tx bay walls but incl. fans (Lw from AECOM 2011 Assessment), increased load	61.90	77.94	94.05	97.49	94.94	88.58	86.46	78.68	66.45	**101.00**
Sydney West 330kV	Tx4	No. 4 Transformer	Existing	**101.00**	No	n/a	No Tx bay walls but incl. fans (Lw from AECOM 2011 Assessment), increased load	58.20	74.41	97.16	95.28	94.73	87.90	85.18	78.84	66.00	**101.01**
Sydney West 330kV	Tx5	No. 5 Transformer	Existing	**109.00**	No	n/a	No Tx bay walls but incl. fans (Lw from AECOM 2011 Assessment), increased load	66.64	78.84	90.29	100.71	107.64	98.29	92.04	78.41	71.22	**109.00**
Sydney West 330kV	CB1	No. 1 Capacitor Bank	Existing	**75.00**	No	n/a	Lw from AECOM 2011 Assessment	37.15	56.80	74.12	65.62	57.78	57.22	54.59	51.04	51.27	**75.00**
Sydney West 330kV	CB2	No. 2 Capacitor Bank	Existing	**76.00**	No	n/a	Lw from AECOM 2011 Assessment	37.40	57.35	75.33	62.45	62.46	59.49	55.72	53.27	51.10	**76.00**
Sydney West 330kV	CB3	No. 3 Capacitor Bank	Existing	**75.00**	No	n/a	Lw from AECOM 2011 Assessment	37.15	56.80	74.12	65.62	57.78	57.22	54.59	51.04	51.27	**75.00**
Sydney West 330kV	CB5	No. 5 Capacitor Bank	Existing	**75.00**	No	n/a	Lw from AECOM 2011 Assessment	37.15	56.80	74.12	65.62	57.78	57.22	54.59	51.04	51.27	**75.00**
Sydney West 330kV	CB6	No. 6 Capacitor Bank	Existing	**77.00**	No	n/a	Lw from AECOM 2011 Assessment	35.29	46.99	61.88	67.40	67.66	74.72	67.32	61.63	58.63	**77.00**
Sydney West 330kV	CB7	No. 7 Capacitor Bank	Existing	**79.00**	No	n/a	Lw from AECOM 2011 Assessment	37.29	48.99	63.88	69.40	69.66	76.72	69.32	63.63	60.63	**79.00**
Sydney West 330kV	SVC	Static Var Compensator (SVC)	Existing	**92.00**	No	n/a	Lw from AECOM 2011 Assessment	61.56	76.27	89.49	85.09	81.39	81.44	76.07	69.44	63.60	**92.00**
Sydney West 330kV	SVC Tx (Fans)	Transformer for SVC	Existing	**88.00**	No	n/a	Lw from AECOM 2011 Assessment	56.01	70.45	78.16	76.83	82.27	83.92	79.03	70.08	56.56	**88.00**
Sydney West 330kV	SVC (Exh-Fan #1)	No. 1 SVC Building Exhaust Fan	Existing	**74.00**	No	n/a	Lw from AECOM 2011 Assessment	29.20	51.72	71.22	68.11	66.83	55.22	48.92	43.10	31.34	**74.00**
Sydney West 330kV	SVC (Exh-Fan #2	No. 2 SVC Building Exhaust Fan	Existing	**78.00**	No	n/a	Lw from AECOM 2011 Assessment	33.20	55.72	75.22	72.11	70.83	59.22	52.92	47.10	35.34	**78.00**
Sydney West 330kV	BESS	BESS Facade (North)	NEW	**96.51**	No	n/a		63.05	88.92	80.36	94.61	88.25	72.24	67.81	66.53	64.73	**96.51**
Sydney West 330kV	BESS	BESS Facade (East)	NEW	**92.51**	No	n/a		59.05	84.92	76.36	90.61	84.25	68.24	63.81	62.53	60.73	**92.51**
Sydney West 330kV	BESS	BESS Facade (South)	NEW	**96.51**	No	n/a	50MW/70MWh Battery Energy Storage System (BESS) specification = 75 dBA at 1 metre. Emitting façade sources and roof source Lw calibrated to specification in model	63.05	88.92	80.36	94.61	88.25	72.24	67.81	66.53	64.73	**96.51**
Sydney West 330kV	BESS	BESS Facade (West)	NEW	**92.51**	No	n/a		59.05	84.92	76.36	90.61	84.25	68.24	63.81	62.53	60.73	**92.51**
Sydney West 330kV	BESS	BESS Roof	NEW	**103.01**	No	n/a		69.55	95.42	86.86	101.11	94.75	78.74	74.31	73.03	71.23	**103.01**
Sydney West 330kV	BESS (Tx)	BESS Transformer	NEW	**95.00**	No	n/a	BESS 132kV Transformer specification = Lw of 95dBA	50.84	72.71	90.29	87.66	91.13	81.61	75.98	70.64	57.93	**95.00**

ERM has over 160 offices across the following countries and territories worldwide

Argentina
Australia
Belgium
Brazil
Canada
China
Colombia
France
Germany
Hong Kong
Hungary
India
Indonesia
Ireland
Italy
Japan
Kazakhstan
Kenya
Malaysia
Mexico
The Netherlands
New Zealand
Panama
Peru
Poland
Portugal
Puerto Rico
Romania
Russia
Singapore
South Africa
South Korea
Spain
Sweden
Taiwan
Thailand
UAE
UK
US
Vietnam

ERM's Sydney Office

Level 15, 309 Kent Street
Sydney NSW 2000
Australia

Telephone +61 2 8584 8888
Facsimile +61 2 9299 7502

www.erm.com

The business of sustainability

ERM