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SYDNEY METRO TRAIN FACILITY (SMTF)

SSI-5931 OPERATIONAL NOISE AND VIBRATION REVIEW (ONVR)

REF: NWRLOTS-NRT-RTF-AV-RPT-105005-E

July 2016

Northwest Rapid Transit

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Executive Summary

Renzo Tonin & Associates (NSW) Pty Ltd, on behalf of Northwest Rapid Transit (NRT) has prepared this Operational Noise and Vibration Review (ONVR) for the final design stage of the Sydney Metro Northwest project (the 'Project'). This report addresses noise and vibration for the Sydney Metro Train Facility (SMTF, formerly Rapid Transit Rail Facility - RTRF) as approved under State Significant Infrastructure (SSI) 5931 [1]. The ONVR is a requirement of SSI 5931 Condition F4, and forms a key element of the operational management documents for the Project.

Separate ONVR's will be prepared for train operations between Epping Station and Cudgegong Road Station and other fixed facilities (in accordance with Project Approval SSI 5414 [2]) at a later date.

The Project Environmental Assessment [3], associated Submissions Report and Preferred Project Report [4] included detailed operational noise and vibration assessments which were reviewed by the NSW Department of Planning and Infrastructure (now NSW Department of Planning and Environment - DP&E) prior to the Minister for Planning and Infrastructure granting the Project Approval [1]. This ONVR builds on these previous environmental assessments of noise (air and ground-borne) and vibration including:

- Confirming the operational noise (air and ground-borne) and vibration objectives to manage noise and vibration impacts on adjoining development and other noise-sensitive receivers,
- Predicting the operational noise and vibration impacts at adjoining development based on the final design of the project,
- Identifying mitigation measures for controlling operational noise and vibration at source and at nearby sensitive receivers,
- Describing the procedures for operational noise and vibration complaints management once the Project is operational.

SMTF overview

The SMTF is located at the western most end of the Project, west of Tallawong Road and north of Schofields Road, Schofields.

The SMTF provides for the stabling, cleaning and maintenance of trains that will operate on the Sydney Metro Northwest including the operations control centre (OCC) and administration facilities. Bulk electrical supply equipment and substations are also located within the SMTF site.

Noise and vibration objectives

All operations and equipment associated with the SMTF are categorised as fixed facilities and in accordance with Condition F2 of SSI 5931, noise emissions are required to be assessed against the NSW *Industrial Noise Policy* (INP) [5].

Condition F3 of SSI 5931 requires vibration objectives for human exposure to be set in accordance with Department of Environment and Climate Changes (DECC) '*Assessing Vibration – A technical guideline*' [6].

While Condition F1 of SSI 5931 requires assessment of rail line components against the RING [7], in accordance with the RING, maintenance facilities and stabling yards are excluded and are to be assessed against the NSW Industrial Noise Policy (INP) [5] as per Condition C5 of SSI 5931.

There are no rail line components as part of the SMTF that are assessable against the Rail Infrastructure Noise Guideline (RING) [7] in accordance with Condition F1 of SSI 5931.

With regard to ground-borne noise, the SMTF does not include underground or in-tunnel rail infrastructure and subsequently ground-borne (internal) noise is not assessed within this ONVR.

Operational noise and vibration impact predictions

Noise and vibration impact predictions have been carried out for each facility and activity in accordance with the requirements of the applicable noise and vibration criteria.

Noise from the SMTF was carried out using 3D noise prediction software, incorporating all relevant design aspects, such as buildings, surrounding land topography, noise source locations and characteristics, operational procedures, and location of sensitive receiver locations etc. The noise model was used to establish where noise mitigation was required for the Project, and evaluate the effectiveness of noise mitigation measures.

Mitigation measures

Noise and vibration mitigation measures have been implemented into the design of SMTF with its associated buildings. In accordance with the relevant criteria, all feasible and reasonable measures have been implemented at source, or within the rail corridor so as to satisfy the noise and vibration objectives. Such mitigation measures include noise barriers around plant and equipment, low noise plant and equipment selection, acoustic attenuators, siting and positioning of noise sources away from sensitive receivers, and building envelope design considerations. In some cases, residual noise exceedances have required the consideration of at-property noise mitigation treatment of existing receiver properties and for future noise sensitive development surrounding the SMTF to incorporate noise mitigation measures. The specific at-property noise mitigation treatments will require consultation with the relevant property owners, and may include local barrier fences, provision of mechanical ventilation to allow windows/doors to remain closed and/or upgrade of some windows/doors.

The process of determining the feasible and reasonable noise mitigation treatment options is set out in this ONVR, along with the details of the final noise mitigation design for the Project.

Consultation and Independent verification

This ONVR is to be reviewed by relevant Government agencies and independently verified, as required by the conditions of approval set out in SSI-5931.

Next steps

Once the ONVR has been independently verified and submitted to DP&E, NRT will commence one-on-one consultation with property owners of existing dwellings that may be eligible for at-property noise mitigation treatments. Subject to a detailed property inspection, one or more of the following options will be offered based on the noise reduction required for individual properties:

- Property boundary fencing or other external screen walls, and/or
- Fresh air ventilation systems that allow existing windows and doors to be kept shut, sealing wall vents and upgrading window and door seals, and/or
- Upgraded windows and glazing, and solid core doors, on the exposed facade/s of masonry structures.

Further consultation between NRT, DP&E and TfNSW is also expected to be required to determine the expected noise exposure at any future development sites surrounding the SMTF, in order to permit others to assess and design for noise exposure upon the future uses.

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1 Operational noise and vibration overview

This Section of the ONVR provides an overview of this document and its purpose, the consultation process undertaken during the design process and lists the different environmental noise and vibration aspects associated with the Project.

1.1 Introduction

Renzo Tonin & Associates (NSW) Pty Ltd, on behalf of Northwest Rapid Transit (NRT) has prepared this Operational Noise and Vibration Review (ONVR) for the final design stage of the Sydney Metro Northwest ('Project'). This ONVR addressees SSI-5931, relating to the Sydney Metro Train Facility (SMTF, formerly the Rapid Transit Rail Facility - RTRF). This report forms a key element of the operational management documents for the Project.

Separate ONVR's will be prepared for train operations between Epping Station and Cudgegong Road Station and other fixed facilities at a later date.

The Project, which has been the subject of three State Significant Infrastructure (SSI) approvals, will deliver a new rapid transit high frequency single deck train system between the existing Chatswood Station and new Cudgegong Road Station. The Project as a whole includes eight new stations, a four kilometre elevated 'Skytrain' (viaduct) between Rouse Hill and Bella Vista, approximately 15.5 kilometres of tunnels from Bella Vista to Epping and conversion of the existing Epping to Chatswood Rail Link (ECRL). The SSI application for Stage 1 (SSI-5100) related to major civil construction works (EIS1) and was approved on 25 September 2012. The Stage 2 SSI application (SSI-5414) related to the new stations, rail infrastructure and systems works (EIS2) and was approved on 8 May 2013. The Stage 3 SSI Application (SSI-5931), for which this ONVR relates, applied to the Sydney Metro Train Facility (EIS3) and was approved on 15 January 2014.

The Project Environmental Assessments [8], associated Submissions Reports and Preferred Project Reports [4] included detailed operational noise and vibration assessments which were reviewed by the Department of Planning and Infrastructure (now Department of Planning & Environment - DP&E) prior to the Minister for Planning and Infrastructure granting the Project Approval. This ONVR builds on these previous environmental assessments and seeks to confirm the noise and vibration control measures that would be implemented for the Project in accordance with the requirements of the Minister for Planning's Conditions of Approval [1].

This ONVR outlines the operational noise and vibration objectives and project specific criteria, noise-modelling results, discussion of feasible and reasonable noise and vibration mitigation measures; and the location, type and timing of noise mitigation measures. In addition, the ONVR outlines the consultation strategy for seeking feedback from directly affected property owners and the procedures for operational noise and vibration complaints management following the completion and opening of the Project.

A compliance matrix which sets out how each of the relevant requirements has been complied with is provided in Section 1.3.

1.2 Project overview

Figure 1-1 presents an overview of the Sydney Metro Northwest alignment, the SMTF being located at the western end, after Cudgegong Road Station. Figure 1-2 presents the boundary of the SMTF, being the Project scope for this ONVR. The SMTF includes the train maintenance and stabling facility for the Sydney Metro Northwest as well as ancillary facilities such as power supply, substations, administration building and the operations control centre for the rail line.

Figure 1-1: Sydney Metro Northwest project overview

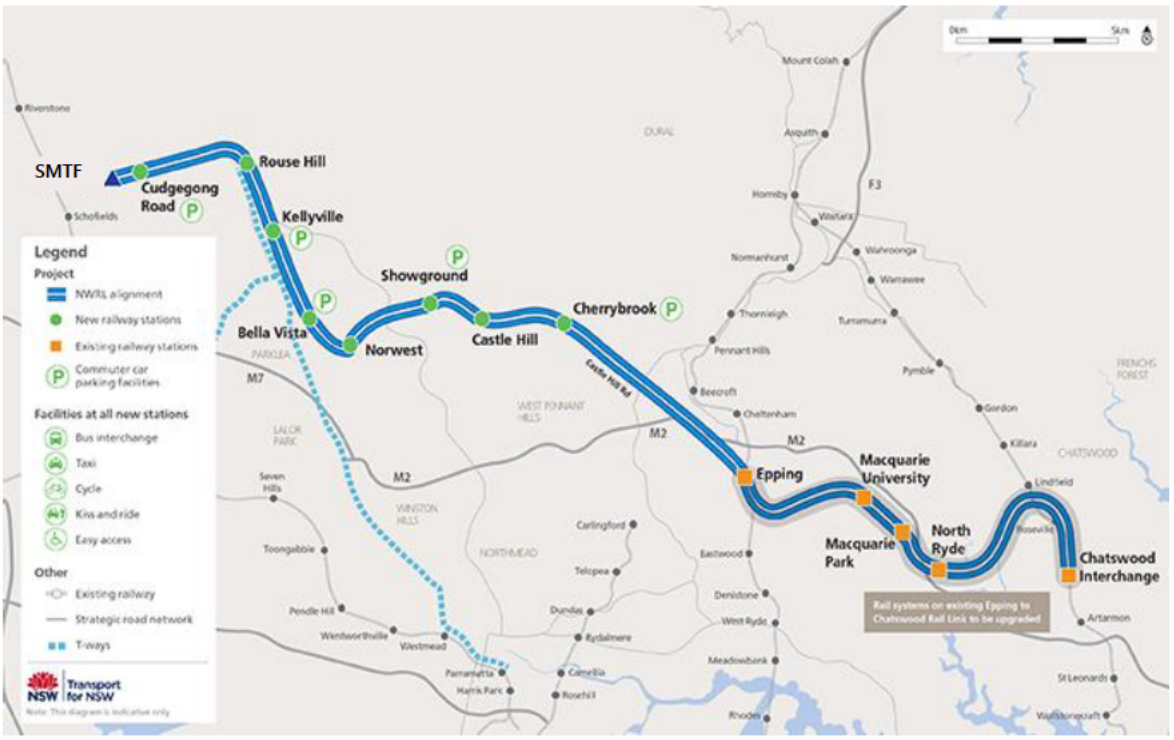


Figure 1-2: SMTF ONVR project boundary

1.3 Purpose

Broadly, the purpose of the ONVR is to:

- identify the operational noise (air and ground-borne) and vibration objectives to manage noise and vibration impacts on adjoining development and other noise-sensitive receivers,
- predict the operational noise and vibration impacts at adjoining development based on the final design of the project,
- identify mitigation measures for controlling operational noise and vibration at source and at nearby sensitive receivers,
- outline the consultation strategy that will be adopted for directly affected property owners, and
- describe the procedures for operational noise and vibration complaints management once the Project is operational.

More specifically, the ONVR has been prepared in accordance with the requirements of the SSI-5931 Approval. Additional requirements for the ONVR were also stipulated in Appendix 44 of the Project's Scope and Performance Requirements (SPR). The following table outlines the relevant requirements and identifies where in the ONVR they have been addressed.

Table 1-1: ONVR conditional requirements

Source	No.	Requirement	Report section
Ministers conditions (SSI 5913) [1]			
SSI 5931	C5.	The Rapid Transit Rail Facility is a stationary facility and shall be designed and operated with the objective of meeting operational noise levels derived from the NSW Industrial Noise Policy (INP) (NSW Government, 2000). Specific consideration shall be given to the following matters:	Section 3.1 and Section 5
		• the limiting of truck movements during night time periods (10pm to 7am);	Section 4.3.4
		• the design of the sheds and equipment for the train wash and wheel lathe facilities would include noise mitigation as required in order to comply with the acceptable noise criteria at the nearest noise sensitive receivers;	Sections 4.3.4, 4.3.7, 4.3.8
		• incorporation of silencers in the compressed air lines of the rolling stock to reduce noise associated with brake air release events; and	Section 4.3.2
		• investigate methods to minimise rolling stock auxiliary noise levels during procurement.	Section 4.3.2
	Operational noise and vibration criteria		
	F1.	Rail line components of the SSI shall be designed and operated with the objective of not exceeding the airborne and ground-borne noise trigger levels at existing development, at each stage of the SSI, as presented in the Rail Infrastructure Noise Guidelines (EPA, 2013).	Section 1.6.2
	F2.	Stationary components of the SSI shall be designed and operated with the objective of meeting operational noise levels derived from the NSW Industrial Noise Policy (EPA, 2000). Public announcement systems shall be designed and installed in accordance with best practice. Operational noise levels shall be reviewed within two years of commencement of operations and at any subsequent time as required by the Director General. The review shall have regard to the status of land use planning, any land use changes and the background noise environment within areas adjacent to the fixed facilities at the time of the relevant review. The Proponent shall submit the results of the review to the Director General. Any proposed changes to the operational noise levels as a result of the review shall be included in a revised ONVR.	Section 3.1 and Section 5
	F3.	The SSI shall be designed and operated with the objective of not exceeding the vibration goals for human exposure for existing sensitive receivers, as presented in Assessing Vibration: a Technical Guideline (DECC, 2006).	Section 3.2
	F4.	The Proponent shall prepare an Operational Noise and Vibration Review (ONVR) within six months of commencing construction unless otherwise agreed by the Director General to confirm noise (air and ground-borne) and vibration control measures that will be implemented for the SSI. The ONVR shall be prepared in consultation with the Department, the EPA and relevant councils and shall:	-
	F4 a.	identify the appropriate operational noise and vibration objectives and levels for receiving existing development, including sensitive receivers and critical working areas;	Section 2 and 3
	F4 b.	predict the operational noise and vibration impacts at receiving existing development based on the final design and operation of the SSI (this should include consideration of rail movements associated with future Tier 1 rail operations);	Section 5.1
	F4 c.	examine all feasible and reasonable noise and vibration mitigation measures, with a focus on source control and design;	Section 5.2 and 5.3

Source	No.	Requirement	Report section
	F4 d.	identify specific physical and other mitigation measures for controlling noise and vibration at the source and at the receiver (if relevant) including location, type and timing for the erection of permanent noise barriers and/or other noise mitigation measures'	Section 4.3
	F4 e.	include a consultation strategy to seek feedback from directly affected property owners on the noise and vibration mitigation measures; and	Section 6
	F4 f.	include procedures 'for operational noise and vibration complaints management, including investigation and monitoring (subject to complainant agreement).	Section 7
	F4	Where the noise and vibration objectives cannot be achieved, the assessment shall present an analysis of feasible and reasonable noise and vibration mitigation measures, and the 'best practice' achievable noise and vibration outcome for each activity. Noise from operations is not to exceed Project Specific Noise Levels (PSNLs) after the application of all feasible and reasonable mitigation measures unless the acceptability of impacts above the PSNL has been considered in accordance with Chapters 8 and 9 of the INP.	Section 5.2
		The ONVR is to be verified by an independent noise and vibration expert. The scope of the verification exercise undertaken by the noise and vibration expert is to be developed by the Proponent in consultation with the EPA. The verification will be undertaken at the Proponent's expense and the independent expert shall be approved by the Director General. The ONVR and independent review is to be submitted to the Director General prior to the commencement of the laying of rail track of the construction of physical noise mitigation structures, unless otherwise agreed to by the Director General.	Section 8
		The Proponent shall implement the identified noise and vibration control measures prior to operation and make it publicly available.	-
Revised Environmental Mitigation Measures			
OpNV8	The implementation of feasible and reasonable noise and vibration mitigation measures such as: The design of the sheds and equipment for the train wash and wheel lathe facilities would include noise mitigation as required in order to comply with the applicable noise criteria at the nearest noise sensitive receivers.		Sections 4.3.4, 4.3.7, 4.3.8
OpNV9	The implementation of feasible and reasonable noise and vibration mitigation measures such as: Investigate the option to incorporate silencers in the compressed air lines of the rolling stock to reduce noise associated with brake air release events.		Section 4.3.2
OpNV10	The implementation of feasible and reasonable noise and vibration mitigation measures such as: Investigate methods to minimise rolling stock auxiliary noise levels during procurement.		Section 4.3.2
OpNV14	Liaise with Planning Authorities and land development / delivery organisations to minimise the potential future land use conflict between the RTRF and future residential development in order minimise noise impacts on future residents.		Section 1.5, 2.3.2 and 5.4.
Scope and performance requirements (SPRs)			
SPR App44	3.2	Operational Noise and Vibration Review	
	3.2 a.	In addition to the requirements in Planning Approval 2, the ONVR must include:	
		(i) a tabulation of where all sensitive receivers will be positioned where they are within 100 m of the nearest track (or within 200m of the nearest stationary facility), and/or where the predicted ground-borne noise or vibration levels are within 5dB of the applicable criteria;	Section 2 and Appendix B (criteria) and Appendix F (predictions)

Source	No.	Requirement	Report section
		(ii) the tabulation must include a unique identification nomenclature for each receiver, with its planned distance to the nearest track (or stationary facility), receiver type, applicable criteria and predicted ground-borne noise and vibration levels, to be recorded.	Section 2 and Appendix B (criteria) and Appendix F (predictions)
	3.2 b.	The ONVR report must fully describe the design, assumptions, calculation process, mitigation strategy, maintenance strategy and other relevant factors to enable the ONVR to be independently verified by a noise and vibration expert.	Sections 4, 5 and 8
	3.2 c.	The ONVR report must describe and quantify the accuracy of the input parameters and predictions, how any inaccuracies are proposed to be resolved or have been resolved during the design process.	Section 4.4
	3.2 d.	The ONVR report must provide evidence that the noise and vibration prediction model has been validated via measurement and prediction on other rail projects.	Section 4.4

1.4 Operational noise and vibration assessment process

The operational noise and vibration assessment has been integral to developing the final design of the Project. The overall assessment process utilised for this Project is illustrated in Figure 1-3. Assessment documents are marked in 'green', consultation periods are marked in 'blue' and independent approvals are marked in 'pink'.

Figure 1-4 illustrates the iterative design review process which has been utilised to ensure that noise and vibration impact predictions feed into and influence design development at every phase. This ONVR has therefore been prepared to document the findings of this integrated design process. See Section 8 of this Report for further details on independent verification.

It should be noted that this Project's operational noise and vibration impact predictions have been extensively examined and independently assessed.

Figure 1-3: SMTF noise and vibration management process

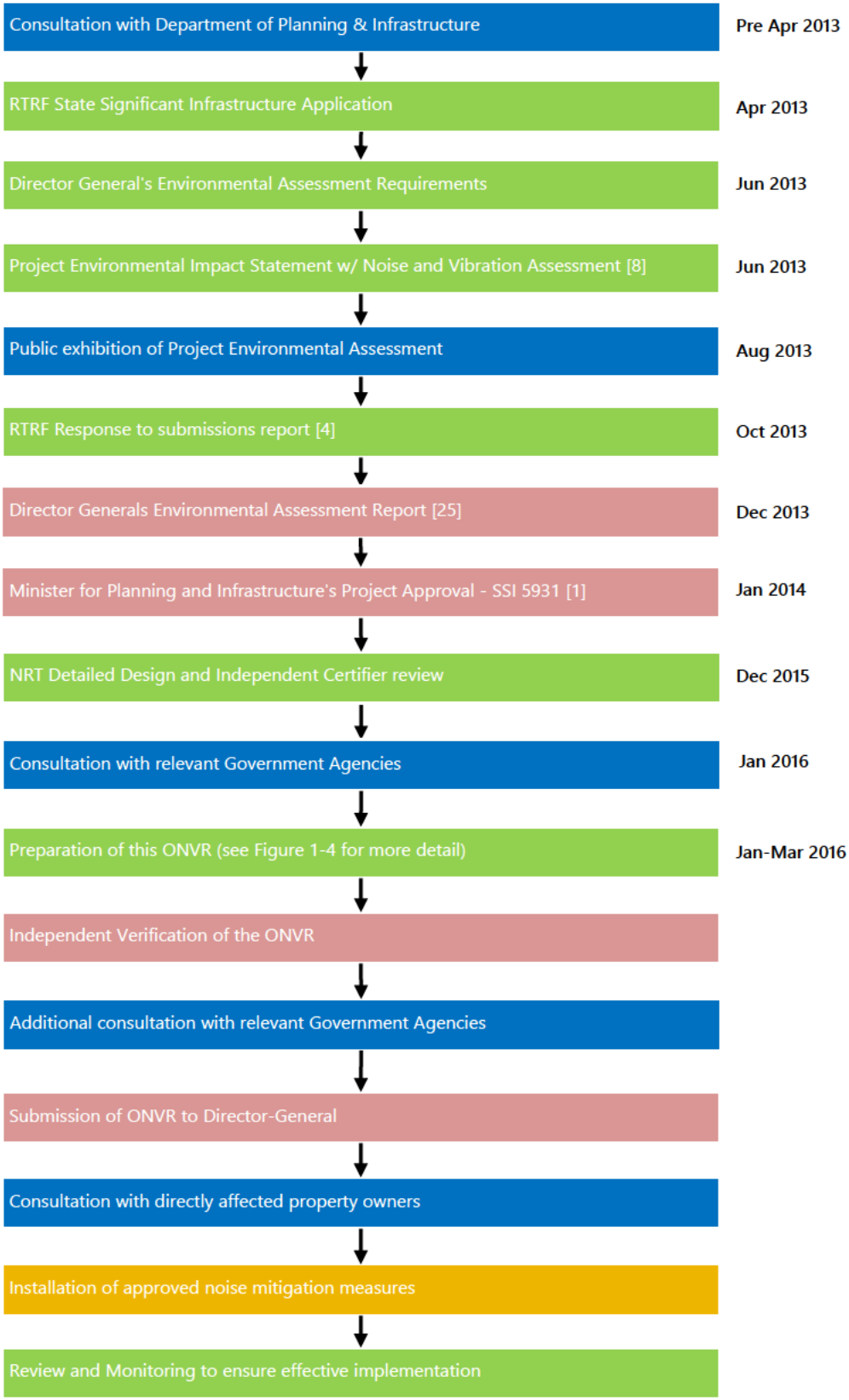
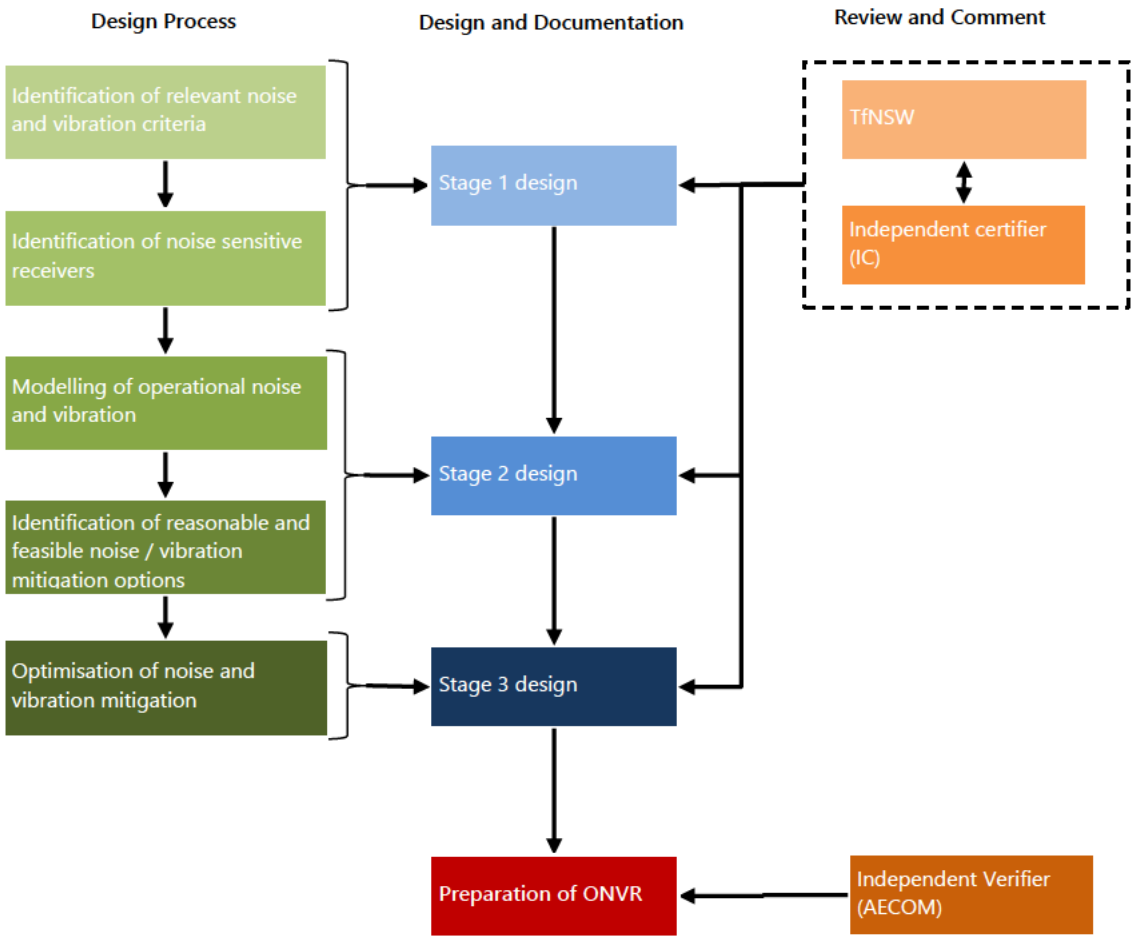


Figure 1-4:Noise and vibration assessment and design review process



1.5 Consultation and review

In accordance with the requirements of the ONVR, the DP&E and Transport for NSW (TfNSW) have been consulted during the development of the noise and vibration assessment and design of the SMTF. A specific meeting was held on 27 January 2016 with DP&E (Housing Land Release) and TfNSW to discuss the approach and outcomes of the noise and vibration assessment for the SMTF. TfNSW have also undertaken review of noise and vibration aspects of the Project continuously through the design development process. A critical component of this consultation has been the development of appropriate land use strategies for future land-use developments surrounding the SMTF. This is further discussed in Sections 2.3.2 and 5.4.

1.6 Operational noise and vibration aspects of the SMTF

1.6.1 Fixed facilities

The noise generating equipment and operations associated with the SMTF are categorised as fixed facilities, and in accordance with Condition F2 of SSI 5931, noise emission are required to be assessed against the NSW *Industrial Noise Policy* (INP) [5]. The SMTF includes:

- Maintenance operations,
- Stabling roads and associated train movements within the SMTF,
- train wash,
- wheel lathe,
- administration building mechanical equipment
- car park,
- bulk supply substation and traction substation.

1.6.2 Railway operations

In accordance with Condition F1 of SSI 5931, the rail line components are to be designed and operated with the objective of not exceeding the airborne and ground-borne noise trigger levels at existing development. Condition C5 of SSI 5931 however defines the SMTF as a fixed facility and therefore requires assessment against the NSW Industrial Noise Policy (INP) [5] only, and not the RING [7]. A separate ONVR will be prepared at a later date which will assess rail operations in accordance with SSI-5414.

1.7 Terminology

1.7.1 Noise and vibration terminology

A Glossary of the acoustic terminology used within this report is presented within APPENDIX A.

1.7.2 Track chainage and directions

Consistent with normal rail terminology, track chainages for the main alignment are referenced to 0 km at Central Station. Down and Up directions refer to trains travelling away from and towards Central Station, respectively. For the Sydney Metro Northwest the Down and Up sides of the corridor are the left-hand and right-hand sides, respectively, when facing towards the SMTF from Cudgegong Road Station.

The track chainages are illustrated on the Location Maps in APPENDIX B.

1.7.3 Types of noise and vibration

The most common form of noise experienced by people is termed 'airborne noise', indicating that it propagates between the source and receiver primarily through the air. This is the primary form of noise that occurs adjacent to surface railway tracks, roads and construction sites.

Ground-borne noise is the term used to describe the process where vibrational energy from the railway propagates through the ground, which transfers into the building walls and floors and re-radiates as noise which can be heard by occupants. Ground-borne noise has the potential to be evident where railway tracks are underground or in deep cuttings, where the air-borne noise path is not present or negligible.

In some cases, ground-borne vibration from a railway line can be felt by building occupants. Without appropriate controls, the vibration may also induce secondary effects such as the rattling of crockery and other loose fittings and furnishings, but is rarely of sufficient magnitude to cause direct damage to buildings.

1.8 Structure of this report

This report is structured as follows:

- **Section 2** provides an overview of sensitive receivers including residences and other land uses considered in this noise and vibration study.
- **Section 3** presents the Project specific criteria relevant to the surrounding sensitive receivers.
- The SMTF design and operational inputs relevant to the noise and vibration assessment are outlined in **Sectio**n 4.
- The results of noise modelling and assessment of reasonable and feasible mitigation measures in outlined in **Section 5.**
- Consultation with property owners being considered for at-property treatments is detailed in **Section 6.**
- The operational noise monitoring program is set out in **Section 7.**
- The independent verification process is outlined in **Section 8**.

2 Land use survey surrounding SMTF

2.1 Overview

A land use survey has been undertaken to confirm the location of sensitive receivers that are potentially impacted by noise and vibration from the Project.

In accordance with SPR Appendix 44 Clause 3.2 a. i), and as relevant to the SMTF, the following information has been established:

- A detailed land use survey carried out to identify potentially critical areas that are sensitive to operational noise (air and ground-borne) and vibration impacts, having regard to the type of land use.
- The land use report identifies the land use category and the associated operational noise and vibration criteria at all sensitive receivers potentially impacted by the Project.
- All receivers located within 200 m of the stationary facility are to be tabulated.
- The tabulation must include a unique identification nomenclature for each receiver, with its planned distance to the nearest track (or stationary facility), receiver type and applicable criteria.

2.2 Receiver ID nomenclature and methodology

Receivers were identified via a range of methods described below:

- Rail Alignment – The three-dimensional rail alignment of each track was provided by the NRT project team. Each track was converted into 5 m segments with the relevant track chainage assigned as a unique identifier for the start of each segment.
- A Cadastral Boundary layer, identifying the property boundaries of all parcels of land within the project area was provided by NRT.
- The most recent Aerial Photography from NearMap and/or Google Earth was utilised to locate buildings on each parcel of land. For the airborne noise modelling, the aerial imagery was utilised to digitise the buildings and locate them within the three-dimensional GIS database and noise modelling software. These resources were utilised to determine the number of floor levels for each building and the approximate building heights.
- Additional land use information was sourced from the EIS, discussions with local Councils, site visits from members of the project team and other information available in the public domain.

The following nomenclature has been adopted for receivers located within the database.

- Example Receiver ID: **25010-121U-OFF**
  where
  25010 represents the location of the centre of the building (track chainage), based on the down track
  121 represents the distance from the centre of the building to the nearest track centreline (in metres)
  U represents the direction of the nearest track (U for Up track and D for Down track)
  OFF represents the land use category (see below for receiver types)

The above nomenclature has been undertaken to generate a unique Receiver ID for each sensitive building, based on the coordinates of the geometric centre of the building. The following land use categories (receiver types) have been identified within the Project area:

- CHC - Child Care
- CIN - Cinema
- HOS - Hospital
- IND - Industrial
- OFF - Office (Commercial)
- PoW - Place of Worship
- RES - Residential
- RET - Retail
- SCH - School

Maps showing the various receivers and future land uses surrounding the SMTF are presented in APPENDIX B. An extract of the database identifying the sensitive receivers applicable to the current assessment are also provided in APPENDIX B. The table provides a summary of the following information:

The table provides a summary of the following information:

- Building ID
- Address / Lot Plan
- Land Use (Receiver Type)
- Nearest track and distance
- Noise and/or vibration assessment criteria

The predicted noise and/or vibration levels are presented in Appendix F.

2.3 Land uses

2.3.1 Existing development

The existing land use survey has found that the SMTF is surrounding by predominately residential land.

2.3.2 Future development

While future development sites are required to be considered in the assessment of environmental noise and vibration, the assessment is not strictly for the requirement of compliance via control at source, but to assist development of, and inform land use planning controls.

As outlined in the noise and vibration assessment carried out during the EIS stage [8], it was recommended that where possible, noise sensitive development such as residential development, be removed from the immediate vicinity of the SMTF. However, with the land surrounding the SMTF, particularly the eastern side of Tallawong Road being in close proximity to Cudgegong Road Station, many other positive planning outcomes are addressed by locating residential development in proximity to the SMTF.

While the acoustic design of the SMTF has been informed by the existing residential development, and all feasible and reasonable mitigation and maintenance measures have been adopted to minimise the source levels of noise and vibration, there are fewer options to control noise to the upper levels of multi-level residential developments, being above noise barriers and less shielded by intervening structures. Consultation with DP&E and TfNSW has therefore occurred in order to develop appropriate design responses for future noise sensitive development proposed around the SMTF, particularly with regard to Riverstone East North West Growth Centre [9].

Where residual noise impacts may result, particularly at upper levels of future development, NRT will consult further with DP&E, TfNSW and Blacktown Council to assist with the identification of any mitigation measures required by future development surrounding the SMTF.

2.3.3 Noise Catchment Areas (NCAs)

For the purpose of assessing noise, the residential areas surrounding the SMTF have been divided into Noise Catchment Areas (NCAs) to north, east, south and west, which describe areas of similar topographical and acoustic features. Figure B.1 in Appendix B presents the nominated NCAs used in the noise design along with other noise sensitive receivers that have been identified in the land use survey. Table 2-1 below summarises the NCAs identified for the SMTF design and provides a description of the typical land uses and dwelling types found in each catchment.

Table 2-1: SMTF Noise Catchment Areas (NCAs)

NCA	Location	Description of NCA	Approx. No residences[1]
RTF-01	South of Schofields Rd, between Cudgegong Road and east of Boundary Road. First 2 rows of houses only.	At the time of this report, NCA RTF-01 to the east of Ridgeline Drive is typically comprised of new single and double storey residential dwellings. West of Ridgeline Drive, typically scattered older style single storey rural residential properties. Part of the NCA falls within the Sydney Growth Centre's Alex Avenue Precinct. The Alex Avenue Precinct Indicative Layout Schedule [10] indicates that land to the west of Ridgeline Drive is zoned for low density residential or 'drainage' (wetland/ detention). A copy of the Alex Avenue Precinct Indicative Layout Plan is provided in Appendix B.	58
RTF-02	West of SMTF, between Schofields Road and Gordon Road.	Rural land with isolated residences. The Riverstone Precinct Indicative Layout Schedule [11] indicates that land is zoned for low to medium density residential or 'drainage' (wetland/ detention). A copy of the Riverstone Precinct Indicative Layout Plan is provided in Appendix B.	2
RTF-03	North of SMTF, west of Tallawong Road and north of Gordon Road.	NCA RTF-03 is currently comprised of existing rural residential lots. The NCA falls within the Sydney Growth Centre's Riverstone East Precinct, which was announced for release in March 2013. The Precinct Planning is currently at a detailed master planning preparation stage. An Indicative Layout Schedule is yet to be released. The [redacted] is located within this NCA at [redacted], Schofields.	12
RTF-04	North of SMTF, between Tallawong Road and Cudgegong Road.	NCA RTF-04 is currently comprised of existing rural residential lots. Lots along Tallawong Road are within the Sydney Growth Centre's Riverstone East Precinct (see RTF-03 above). Lots along Cudgegong Road are within the Sydney Growth Centre's Area 20 Precinct [12]. The Area 20 Precinct Indicative Layout Schedule [12] indicates that land to the east of Cudgegong Road and north of the SMTF is zoned for medium density residential, mixed use and 'conservation' land (Cudgegong Reserve). A copy of the Area 20 Indicative Layout Plan is provided in Appendix B.	18

Notes: 1. Dwelling counts based on Nearmap aerial photography dated December 2014.

2.4 Baseline noise monitoring

2.4.1 Measurement locations

Operational noise criteria for fixed facilities are established by reference to the existing noise environment without the subject development in operation. Baseline noise measurements are to be carried out at the nearest or most potentially affected locations surrounding a noise generating development. An alternative, representative location should be established where there are access restrictions or a safe and secure location cannot be identified. Furthermore, representative locations may be established in the case of multiple receivers as it is usually impractical to carry out measurements at all locations surrounding a site.

Long-term noise monitoring in accordance with Appendix B of the NSW Industrial Noise Policy (INP) [5] was carried out at the locations outlined in Table 2-2 and identified on Figure B.1 in Appendix B. The long-term noise monitoring methodology is detailed in Appendix C, and noise level-vs-time graphs of

the data are included in Appendix D. All monitoring was carried out prior to the commencement of construction.

Table 2-2: Baseline noise monitoring locations

ID	Address	Timeframe	Description
M_RTF01	[redacted], The Ponds	25 November - 2 December 2014	The monitor was located within 30 m of the residence. Free-field The EIS noise monitoring location was not considered representative of existing noise levels in NCA RTF-01. Additional noise monitoring was completed. The new noise monitoring location is considered representative of existing noise levels at receiver locations in NCA RTF-01.
BG25	[redacted], Rouse Hill	Present in EIS - 2011 [8]	The monitor was located within 30 m of the residence. Free-field The noise monitoring location is considered representative of existing noise levels at receiver locations in NCA RTF-02.
M_RTF03	[redacted] Rouse Hill	3-10 November 2014	The monitor was located within 30 m of the residence. Free-field The noise monitoring location is considered representative of existing noise levels at receiver locations NCA RTF-03 and RTF-04.

2.4.2 Measured noise levels

The measured noise levels were analysed in accordance with the INP for the following standard time periods:

- Day: 07:00-18:00 Monday to Saturday and 08:00-18:00 Sundays & Public Holidays
- Evening: 18:00-22:00 Monday to Sunday & Public Holidays
- Night: 22:00-07:00 Monday to Saturday and 22:00-08:00 Sundays & Public Holidays

The INP also outlines methods for assessing 'shoulder periods' being shorter periods on either side of a standard period, where the standard period noise levels are not representative.

Peak rail activities at the SMTF occur between 5am and 7am (see Table E1, Appendix E). It would be unduly stringent to assess these peak operations against the night-time criteria especially as existing background noise levels are rising steadily in these early morning hours. Therefore, consistent with the EIS, a matching shoulder period has been considered appropriate for the period between 5am and 7am. The RBL for the Shoulder Period has been determined in accordance with the INP and the associated INP Application Notes [13]. Table 2-3 presents the overall single Rating Background Levels (RBL) and representative ambient L_{eq} noise levels for each assessment period, determined in accordance with the INP.

Table 2-3: Long-term noise monitoring results, dB(A)

NCA	Noise monitoring location	Rating Background Level (RBL) L_{A90}				L_{Aeq} Ambient noise levels		
		Shoulder	Day	Eve	Night	Day	Eve	Night
RTF-01	M_RTF01 [redacted] The Ponds	38	43	44	32	58	56	51
RTF-02	BG25 [redacted] Rouse Hill	37	43	44	30	53	54	58
RTF-03	M_RTF03 [redacted] Rouse Hill	33	33	33	33	52	47	45
RTF-04	M_RTF03 [redacted] Rouse Hill	33	33	33	33	52	47	45

Notes:

Day: 07:00-18:00 Monday to Saturday and 08:00-18:00 Sundays & Public Holidays

Evening: 18:00-22:00 Monday to Sunday & Public Holidays

Night: 22:00-07:00 Monday to Saturday and 22:00-08:00 Sundays & Public Holidays

Shoulder: a 'Shoulder' period has been established for 05:00-07:00. The shoulder period rating background level is taken to be the mid-point between the rating background levels between the two assessment periods that are on either side of the shoulder period.

As required by the INP, the external ambient noise levels presented are free-field noise levels. [ie. no façade reflection]

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

3 Noise and vibration criteria

This Section of the ONVR outlines the noise and vibration criteria for operation of the SMTF.

3.1 NSW Industrial Noise Policy (INP)

The noise generating equipment and operations associated with the SMTF are categorised as fixed facilities, and in accordance with Condition F2 of SSI 5931, noise emissions are required to be assessed against the NSW *Industrial Noise Policy* (INP) [5]. The Project Approval conditions require that operational noise targets for fixed facilities and associated activities be identified in the ONVR.

The noise targets in the INP have been selected to protect at least 90 per cent of the population living in the vicinity of industrial noise sources from the adverse effects of noise for at least 90 per cent of the time. Provided the noise targets in the INP are achieved, then it is unlikely that most people would consider the resultant noise levels excessive. In those cases where the noise targets are not, or cannot be, achieved it does not automatically follow that those people affected by the noise would find the noise unacceptable.

The INP sets two separate noise targets to meet environmental noise objectives: one to account for 'intrusive' noise and the other to protect the acoustic 'amenity' of particular land uses (e.g. residential). The Intrusive Noise Target allows for controlled increases above the background noise levels and manages intrusive noise impacts in the short-term for residences. The Amenity Target is specific to land use and associated activities. It is designed to limit continuing increases in industrial noise sources and maintain noise level amenity for particular land uses, for example residential, educational, and recreational.

The INP defines three standard time periods for assessment being:

- Day 7am to 6pm,
- Evening 6pm to 10pm, and
- Night time 10pm to 7am.

However Section 3.3 of the INP, details situations where different assessment periods or 'shoulder' periods may be established. The example provided in the INP is that of early morning operations (5am to 7am), which may be proposed that occur during a period when the background noise level may be steadily rising. In such a case, it may not be considered reasonable to assess the early morning operations against a potentially more stringent night time noise criteria.

The Sleep Disturbance Targets specifically for night operations, have been determined in accordance with the Application Notes of the INP [13] and the NSW Environmental Criteria for Road Traffic Noise ('ECRTN') [14].

3.1.1 Intrusive noise criteria

According to the INP, the intrusiveness of a noise source may generally be considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (represented by the L_{Aeq} descriptor) does not exceed the background noise level measured in the absence of the source by more than 5dB(A).

The intrusiveness criterion is summarised as follows:

- $L_{Aeq,15minute}$ ≤ Rating Background Level (RBL) plus 5dB

3.1.2 Amenity noise criteria

The INP amenity criteria are designed to maintain noise level amenity for particular land uses, including residential and other land uses. The INP recommends base acceptable noise levels for various receivers, including residential, commercial, industrial receivers and other sensitive receivers in Table 2.1 of the INP (see Table 3-1). Noise from new sources need to be designed such that the cumulative effect does not produce levels that would significantly exceed the criterion.

Table 3-1: INP Amenity Criteria - Recommended L_{Aeq} Noise Levels from Industrial Noise Sources [NSW INP Table 2.1]

Type of receiver	Indicative noise amenity area	Time of day	Recommended $L_{Aeq(Period)}$ noise level	
			Acceptable	Recommended maximum
Residence	Rural	Day	50	55
		Evening	45	50
		Night	40	45
	Suburban	Day	55	60
		Evening	45	50
		Night	40	45
	Urban	Day	60	65
		Evening	50	55
		Night	45	50
	Urban/Industrial Interface - for existing situations only	Day	65	70
		Evening	55	60
		Night	50	55
School classrooms - internal	All	Noisiest 1 hour period when in use	35	40
Hospital ward - internal	All	Noisiest 1 hour period	35	40
- external			50	55
Place of worship - internal	All	When in use	40	45

Type of receiver	Indicative noise amenity area	Time of day	Recommended $L_{Aeq(Period)}$ noise level	
			Acceptable	Recommended maximum
Area specifically reserved for passive recreation (e.g. National Park)	All	When in use	50	55
Active recreation area (e.g. school playground, golf course)	All	When in use	55	60
Commercial premises	All	When in use	65	70
Industrial premises	All	When in use	70	75

Note:

Daytime 7.00 am to 6.00 pm; Evening 6.00 pm to 10.00 pm; Night-time 10.00 pm to 7.00 am

On Sundays and Public Holidays, Daytime 8.00 am - 6.00 pm; Evening 6.00 pm - 10.00 pm; Night-time 10.00 pm - 8.00 am.

The LAeq index corresponds to the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

3.1.3 Sleep disturbance

Noise emanating from project has been assessed for its potential to disturb sleep. The NSW EPA has made the following policy statement with respect to sleep disturbance [13]:

> *Peak noise level events, such as reversing beepers, noise from heavy items being dropped or other high noise level events, have the potential to cause sleep disturbance. The potential for high noise level events at night and effects on sleep should be addressed in noise assessments for both the construction and operational phases of a development. The INP does not specifically address sleep disturbance from high noise level events.*
>
> *Research on sleep disturbance is reviewed in the NSW Road Noise Policy. This review concluded that the range of results is sufficiently diverse that it was not reasonable to issue new noise criteria for sleep disturbance.*
>
> *From the research, the EPA recognised that the current sleep disturbance criterion of an LA1, (1 minute) not exceeding the LA90, (15 minute) by more than 15 dB(A) is not ideal. Nevertheless, as there is insufficient evidence to determine what should replace it, the EPA will continue to use it as a guide to identify the likelihood of sleep disturbance. This means that where the criterion is met, sleep disturbance is not likely, but where it is not met, a more detailed analysis is required.*
>
> *The detailed analysis should cover the maximum noise level or LA1, (1 minute), that is, the extent to which the maximum noise level exceeds the background 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. Other factors that may be important in assessing the extent of impacts on sleep include:*
>
> - *how often high noise events will occur*
> - *time of day (normally between 10pm and 7am)*

- *whether there are times of day when there is a clear change in the noise environment (such as during early morning shoulder periods).*

The LA1, (1 minute) descriptor is meant to represent a maximum noise level measured under 'fast' time response. The EPA will accept analysis based on either LA1, (1 minute) or LA, (Max).

In addition, reference is made to Appendix B of the NSW ECRTN [14], which summarises the findings of international research undertaken on sleep disturbance from noise (up until 2009) and concludes:

"Considering all of the foregoing information the following conclusions can be drawn:

- *Maximum internal noise levels below 50-55dB(A) are unlikely to cause awakening reactions.*
- *One or two noise events per night, with maximum internal noise levels of 65-70dB(A), are not likely to affect health and wellbeing significantly."*

In regard to external noise levels, the maximum internal noise level 55dB(A) referenced in the ECRTN is equivalent to 65dB(A) outside an open window. It is noted that a 10dB(A) reduction from outside to inside is common and typical noise reduction via an open window. The 65dB(A) external noise limit is consistent with the findings of Griefahn [15].

In summary, the sleep disturbance criteria of $L_{A1(1min)} \leq L_{A90(15min)} + 15dB(A)$ is to be used for initial assessment, however consideration is also given to the 'upper' limit criteria of 65dB(A) in accordance with the ECRTN. It is noted that the background $L_{A90(15minute)}$ noise level used for establishing the sleep disturbance criteria does not need to exclude other noise from the subject premise.

3.1.4 Established noise goals

Table 3-2 summarises the single Rating Background Levels (RBL) and relevant INP intrusiveness, amenity and sleep disturbance noise criteria applicable at land uses surrounding the SMTF. In regard to the noise amenity criteria, it is noted that no existing industrial noise contribution was identified at the nearest most potentially affected receiver locations and therefore no modification to the amenity targets as per Table 2.2 of the INP were required.

The established noise goals are based on the existing noise levels measured for the area, as described in APPENDIX C. Any change in noise level as a result of future growth in the area cannot be readily quantified. Therefore, these noise goals may be conservative, in particular for the day and evening periods in NCAs RTF-03 and RTF-04.

Table 3-2: SMTF operational noise targets, dB(A)

NCA	Location	Intrusive noise criteria $L_{Aeq(15\ min)}$				Amenity noise criteria $L_{Aeq(Period)}$				Sleep dist. $L_{A1(1min)}$
		Shldr	Day	Eve	Night	Shldr	Day	Eve	Night	
RTF-01	South of Schofields Rd, between Cudgegong Rd and east of Boundary Rd.	43	48	48	37	45	55	45	40	47
RTF-02	West of SMTF, between Schofields Rd and Gordon Rd.	42	48	48	35	45	55	45	40	45
RTF-03	North of SMTF, west of Tallawong Rd and north of Gordon Rd.	38	38	38	38	45	55	45	40	48
RTF-04	North of SMTF, between Tallawong Road and Cudgegong Road.	38	38	38	38	45	55	45	40	48
RTFO-01	[redacted]					40 (internal) when in use				-

Notes

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

Shldr: a 'Shoulder' period has been established for 05:00-07:00 Monday to Saturday and 05:00-08:00 Sundays & Public Holidays

Day: 07:00-18:00 Monday to Saturday and 08:00-18:00 Sundays & Public Holidays

Evening: 18:00-22:00 Monday to Sunday & Public Holidays

Night: 22:00-05:00 Monday to Sundays & Public Holidays

Where the Evening (or night) RBL is greater than Day RBL, Evening NML is based on Day NML, in accordance with INP guidelines.

3.1.5 SMTF Emergency equipment

Noise sources potentially operational during emergency situations only have been identified as:

- Fire pump room equipment
- Backup power diesel generator.

The fire suppression system is to be used in emergency situations only, and may be tested in the daytime only, approximately once every month for a period of approximately 15 minutes.

The back-up power diesel generator is to provide power under a catastrophic power failure scenario, during which the generator may run for up to 24 hours to support critical OCC functions. Generally, the generator would be operated for maintenance reasons for short periods of approximately 30 minutes during the day, every 3 or 6 months to confirm operational readiness. Given the system reliability requirements for the project, the likelihood of failure is anticipated to be low.

Emergency equipment is not included within the industrial sources assessed against the NSW INP [5]. The Minister's conditions do not outline any specific environmental noise criteria for the operation of emergency equipment however other Project requirements set out the following with regard to the near field noise emission from equipment in emergency mode:

The [operational criteria] do not apply to systems or components operating in emergency mode. In this situation, noise generated by the systems or their components must not exceed levels that affect speech intelligibility in egress paths, evacuation assembly areas, or operational or emergency control rooms or areas.

Noise from systems or components operating in emergency mode must not exceed 85dBA when measured at 1m from any air intake or discharge point, including internal registers and grilles.

The noise level requirement of 85dB(A) is consistent with Work Health Safety guidelines (WHS) for noise exposure, albeit that the WHS policy refers to exposure over an 8-hour period. Assessment has been made to a receiver location 1.5m above the ground level.

3.2 Assessing Vibration: a Technical Guideline

In accordance with the project requirements, operational vibration goals for the Project are provided in '*Assessing vibration: a technical guideline*' [16].

For the fixed facilities, vibration from continuous sources is required to be assessed against the following criteria. For residential and other vibration sensitive receivers (e.g. offices, schools, educational and places of worship), the guideline nominates 'preferred' vibration dose values and 'maximum' vibration acceleration values, as set out in Table 3-3.

Table 3-3: Preferred / maximum weighted RMS values for continuous vibration acceleration (m/s^2) 1-80Hz

Location	Assessment period[1]	Preferred values		Maximum values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
Critical areas[2]	Day- or night-time	0.005	0.0036	0.010	0.0072
Residences	Daytime	0.010	0.0071	0.020	0.014
	Night-time	0.007	0.005	0.014	0.010
Offices, schools, educational institutions and places of worship	Day- or night-time	0.020	0.014	0.040	0.028
Workshops	Day- or night-time	0.04	0.029	0.080	0.058

Notes: 1 - Daytime is 7.00 am to 10.00 pm and night-time is 10.00pm to 7.00 am

2 - Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. There may be cases where sensitive equipment or delicate tasks require more stringent criteria than the human comfort criteria specify above. Stipulation of such criteria is outside the scope of their policy and other guidance documents (e.g. relevant standards) should be referred to. Source: BS 6472-1992 [17]

There are no significant vibration generating equipment that would otherwise impact upon nearby receiver locations surrounding the fixed facilities. As such no specific vibration mitigation was required to be implemented into the design of the SMTF.

3.3 Rail infrastructure noise guideline (RING)

In accordance with Condition F1 of SSI 5931, the rail line components are to be designed and operated with the objective of not exceeding the airborne and ground-borne noise trigger levels at existing development. Condition C5 of SSI 5931 however defines the SMTF as a fixed facility and therefore requires assessment against the NSW Industrial Noise Policy (INP) [5] only, and not the RING [7].

4 Noise assessment inputs and procedures

4.1 Overview

The noise and vibration sources associated with normal operations of the SMTF include:

- Trains in stabling area including preparation for service, arrival and departure movements and internal cleaning,
- Maintenance and cleaning activity within the maintenance building,
- Train wash plant
- Wheel reprofiling using a double headed underfloor wheel lathe (UFWL)
- Mechanical equipment serving the Administration building, Maintenance building and Infrastructure Workshop,
- Electrical equipment, including substations and bulk supply.
- External graffiti cleaning and biological cleaning, as well as intermittent use of the low speed test track (535m) have not been included in the standard operational noise assessment of the SMTF. Where practical, it is recommended that use of these facilities not occur during the night time or early morning shoulder periods (10pm to 7am) for the purpose of noise management.

4.2 Design year

Condition F4(b) of SSI-5931 states that the ONVR shall '*predict the operational noise and vibration impacts at receiving existing development based on the final design and operation of the SSI (this should include consideration of rail movements associated with future Tier 1 rail operations)*'. It is noted that Tier 1 rail operations relate to single-deck rapid transit services, rather than Tier 2 (double-deck suburban train services) or Tier 3 (double-deck intercity train services) [18, pp. 1-7].

The capacity of the SMTF will expand over time, to accommodate additional trains that are forecast to operate on the Sydney Metro Northwest line, as well maintain metro trains that are proposed to operate on the expanded metro rail network. The current design of the SMTF is to provide stabling and maintenance for up to 37 sets of six-car trains. This is referred to as the 'Ultimate Design' year, being the ultimate capacity of the current design. The SMTF will however initially operate with a fleet size of 22 sets of six-car trains ('Initial design year,').

Future design augmentation within the current site boundary will be required to provide for the maintenance of up to 76 eight-car trains and stabling of up to 46 eight-car trains ('safeguarded capacity'). In addition, on-site car parking requirements will increase from 121 spaces to 228. Consideration of this 'Augmentation' scenario has been considered in-principle. Under operations for

Augmentation, the increase in L_{Aeq} noise levels is predicted to be between 2-3dB(A), assuming a proportional increase in train activity, car park movements and general operations.

We understand that Augmentation may also require 24-hour operation of the Train Wash Plant and extended operation of the Wheel Lathe. The assessment presented herein indicates that the Train Wash Plant is not dominant in comparison to other major sources, and while the Wheel Lathe is a primary contributor at [redacted], its operation would result in only marginal increases in the night time predicted noise level (less than 2dB(A)).

The land use planning changes proposed for the area surrounding the SMTF will result in a very different acoustic environment by Augmentation, compared with Ultimate design year. So as not to impose unfairly stringent noise mitigation and operational management measures on the SMTF, the assessment and design outcomes detailed in this report are based on Ultimate design year operations. It is noted that as the timing for expansion between Initial and Ultimate design year is not known, the acoustic design of the SMTF is conservatively based on existing background noise levels and Ultimate design year operations.

4.3 SMTF Operations

Noise emission from the SMTF will vary throughout the daytime, evening and night-time periods on the basis of train movements and operations, loads on mechanical equipment, and types of activities such as cleaning, maintenance and wheel lathe operation. For noise assessment and design purposes, it is necessary to develop noise modelling scenarios that accurately represent the proposed operations during the relevant assessment periods.

Typical worst-case scenarios have been established for the range of assessment time periods and key operational variations. Table E1 in Appendix E summarises the operational assumptions used for the purpose of noise mitigation design. The following discusses the basis of specific operating assumptions.

4.3.1 Stabling yard

1. The SMTF has been designed to stable up to 37 six-car train sets.
2. It has been conservatively assumed that all 37 train are stabled at the SMTF overnight. In practice, there is potential for some trains to be stabled overnight at underground stations. This has an acoustic benefit in that it reduces the number of trains requiring preparation in the early morning period.
3. While stabled at the yard, pantographs will be lowered and trains powered down.
4. Prior to trains departing for service, trains are powered and run through a series of test procedures to ensure they are ready for service. This process takes approximately 20 minutes per train, and is to occur in batches of 5 trains (for redundancy). The procedure involves:
    a. Raising of pantographs and operation of auxiliary converter (Constant Voltage Source - CVS)

b. Testing of electrical systems

c. Operation of air compressor

d. Operation of Heating, Ventilation and Air-conditioning (HVAC) (ventilation mode in morning / medium cooling in afternoon)

5. Once trains are prepared and ready for departure systems will remain on and idle.

6. Interior cleaning of trains will occur in the stabling yard and be carried out on a daily basis, 2 hours following morning peak, 2 hours following evening peak and 2 hours once all trains have returned from service at night [19].

7. Appendix E outlines the noise sources and modelling assumptions for the stabling yard.

4.3.2 Rolling stock

1. Noise from trains within the SMTF will predominately relate to auxiliary systems on the train, including HVAC, CVS and air compressors. Air compressors will typically operate only during start-up preparations, for a short period, until air reservoirs are full.

2. In accordance with Condition C5 of SSI-5931 silencers have been incorporated into the compressed air lines of the rolling stock to reduce noise from brake air release events. The noise level at 1m from the brake pipe is to be less than 85dB(A), which is a significant reduction when compared to current Sydney trains fleet. In addition, unlike the Sydney Trains fleet, brake pipe noise events will be limited as the brake pipe is not required to be vented during start-up procedures. The air reservoirs are required to be drained during preventative maintenance (PM03) [19], however this is to occur within the maintenance building.

3. In addition to the above, and in accordance with Condition C5 of SSI-5931, methods to minimise rolling stock auxiliary noise levels have been investigated. This has resulted in enclosure of the compressor and provision of attenuators to the compressor air dryer and HVAC supply air fan. Furthermore, the HVAC system has been design with multiple modes of operation, which vary in noise level, to ensure noise levels are minimised as far as practical according to operating load requirements. For example, the highest noise levels, associated with the 'High Cooling' mode, are unlikely to result in the SMTF, due to ambient temperature conditions and no internal heat load within the carriages (no passengers).

4. Door test procedures, required during start-up of trains, have also been modified to reduce noise emission from the SMTF, with the chimes and automated announcements not being sounded.

5. The HVAC operation will automatically adjust to external ambient temperatures and to meet Project specifications for customer comfort and internal temperature conditions of the train. These are considered as part of the noise modelling scenarios. The key assumptions are outlined:

a. External ambient temperatures are based on meteorological data for BOM Station 067105 Richmond RAAF for 1993 to 2015, as presented in Section 4.3.4,

b. For morning start up and departure (03:40 to 07:05), HVAC will operate in ventilation mode only – Mean 9am temperature all below 23 degrees.

c. For afternoon departures (15:20 to 16:55) HVAC may operate at medium cooling - Mean max temp and Mean 3pm temp. Temperatures above 30deg being 61 days (mean) annually. Note only 1dB increase for high cooling.

d. On trains return to the SMTF following service, HVAC will be in ventilation mode only (no passengers or staff)

e. For internal cleaning during the night period, HVAC will operate in ventilation mode only based on mean 9am temperature all below 23 degrees. Staff cannot override the programmed operation of the HVAC.

6. Trains will be predominately controlled automatically from the operations control centre and their speed will not exceed 25km/h (includes departure and arrival from the SMTF) [19]. Trains under manual control will be limited to 10km/h, with entry into maintenance building limited to 6km/h.

7. Appendix E outlines the noise sources and modelling assumptions for the rolling stock.

4.3.3 Rail track

1. The majority of rail track within the SMTF is to be formed on ballast

2. To reduce potential increase in noise caused flanging at the wheel-rail interface, wheel flange lubricators are fitted to the rolling stock.

3. Trackside lubricators are also installed at two locations, at the main branches accessing the stabling roads (~47+414) and maintenance building (~47+357).

4.3.4 Maintenance building

1. The Maintenance building includes:

   a. Five stabling roads including one for heavy cleaning, and one train lift.

   b. Train lift

   c. Loading area - Three overhead cranes for the lifting of train equipment such as HVAC, pantographs and bogie handling [19].

2. First line maintenance of trains including preventive, corrective maintenance, roof and underframe equipment change out will be carried out by MTS's in-house staff [19].

3. The scheduled and unscheduled maintenance of trains will be carried out on the service roads and lifting road in the Maintenance Building service roads and lifting road in the Maintenance Building [19].

4. Overhaul of trains including second line maintenance, remove and reinstall of major equipment, major repairs of on train equipment and overhaul of removed equipment and components will be contracted out [19].

5. Failure repair of major equipment such as bogies, traction motors, pantograph and air compressors etc. will be outsourced. Failure repairs of minor equipment or components which involve specific knowledge, tools and equipment will be outsourced to Original Equipment Manufacturers or their maintenance contractors [19].

6. Should heavy maintenance be proposed in the Maintenance building in the future, provision has been made for noisier works to be contained within bays along the northern side of the Maintenance building which can be readily upgraded through construction of internal partition walls, including additions to the external building envelope (internal skin), secondary roof and doors if required. Modification of the intake louvres may be required to accommodate the changes.

7. Heavy cleaning for each set will occur on an approximate monthly basis on the heavy cleaning road inside the Maintenance building [19]. Cleaning is proposed to take place between 10:00 to 14:00 and 19:00 to 23:00 with an average of 1.32 jobs per day [19]. Lighting and air-conditioning units may be turned on for the cleaning team [19].

8. The Maintenance building will accept deliveries to the loading dock between 7:00am and 10:00pm only. Delivery truck movements are not proposed to occur between 10:00pm and 7:00am in accordance with Minister's Condition C5 (SSI 5931).

9. The Maintenance building will be ventilated using assisted natural ventilation. A combination of smoke and ventilation fans on the roof, along with louvred ventilation openings along the sides of the building will assist in moving air through the building. These features have been incorporated into the noise model and form part of the acoustic design.

10. Heating and cooling to specific work areas will also be provided with the associated external mechanical equipment located on the rooftop of the Maintenance building. The locations have been positioned so as they are away from building edges and acoustically shielded as far as practical by the sawtooth roof form.

11. Appendix E outlines the noise sources and modelling assumptions for the Maintenance building.

4.3.5 Administration building

1. The Administration building will operate 24 hours per day, 7 days per week. For design purposes the only environmental noise sources associated with this building are mechanical plant and noise generated by car parking activities on site (mainly during shift changes).

2. The Administration Services building is located on the northern side of the Administration building and houses transformers and the back-up diesel generator for the Administration building. The generator is located close to Administration building as noted in the design (see Section 3.1.5).

3. Appendix E outlines the noise sources and modelling assumptions for the Administration building.

4.3.6 Car park

1. The car parking requirements relevant to the noise assessment for the Ultimate design year are outlined in Table 4-1 below.

2. Peak vehicle movements have been assessed as 30 one way trips (in or out) for a given 15-minute period. Conservatively, this has been applied to all assessment periods.

3. Noise from car park areas has been modelled using the German standard: RLS 90 model [20].

Table 4-1: SMTF Employment type mode share and parking provision estimates

Building	Potential Employee All Mode Trips (includes shared car journeys, public transport and walking etc)	Peak hour traffic generation for car journeys
Maintenance Building	35	21
Infrastructure Maintenance Area	38	23
Cleaners	30	13
Fire Control Centre	4	4
Administration Building	60	26
OCC	14	14
*Visitors	20	30
Total	201	121

4.3.7 Train Wash Plant

1. The single direction Train Wash Plant will be used from 07:00 to 15:00 and from 19:00 to 22:00, 7 days per week to meet Ultimate design operational requirements.

2. Potential future 24-hour operation of the Train Wash under Augmentation of the SMTF, will not significantly influence future noise emission from the site during the night time period.

3. The washing speed is set at 5 to 8km/h, and the entire washing cycle including car body washing, cab front washing and shunting is completed within 9 minutes [19].

4. Appendix E outlines the noise sources and modelling assumptions for the Train Wash building.

4.3.8 Under Floor Wheel Lathe

1. A double headed underfloor wheel lathe is to be installed within the Wheel Lathe building.
2. For the Ultimate design year scenario the wheel lathe is proposed to operate 8 hours per day, 7 days a week. The production rate is 5 passenger train wheelsets per 8-hour shift [19].
3. Use may extend to 16 hours per day when expanded to 46 eight car sets and (07:00 to 23:00), and 24-hour work days for full Augmentation.
4. The train is not operational during the lathing process and the train is moved using an electric train shunter.
5. Appendix E outlines the noise sources and modelling assumptions for the Wheel Lathe.

4.3.9 Infrastructure Workshop and Rail Store

1. The Infrastructure Workshop is proposed to be used during the 07:00 to 18:00 daytime period only.
2. General operational noise sources from the buildings are limited to mechanical plant equipment as detailed in Appendix E.

4.3.10 Distribution and Traction building

1. The Distribution and Traction building equipment will operate 24 hours per day, 7 days per week.
2. For acoustic design purposes the only environmental noise emission sources identified for this building are the transformers and reactor. Harmonic Filters form part of the DC Switchboard and are installed indoors in a purpose built switch room. Noise emission will therefore not be significant and has not been included in the noise model.
3. Noise emission from circuit breakers has not been included in the operational noise assessment as they occur under fault conditions, which are highly irregular events.
4. Appendix E outlines the noise sources and modelling assumptions for the Distribution and Traction building.

4.3.11 Bulk Supply building

1. The Bulk Supply equipment will operate 24 hours per day, 7 days per week.
2. For design purposes the only environmental noise emission source identified for this building is the bulk supply transformer. Harmonic Filters may be required and are yet to be confirmed.
3. Appendix E outlines the noise sources and modelling assumptions for the Bulk Supply building.

4.3.12 Fire pump room

1. On the basis of the specified equipment and building design outlined in Appendix E, noise levels are predicted to comply with the emergency noise requirements for the full perimeter of the building excluding louvre locations where noise levels are predicted to exceed the requirement by 3dB(A). The exceedance is predicted only for the operation of the diesel pump.

2. It is noted that the pump only operates in emergencies and is not part of the environmental noise model.

3. While a diesel pump with lower sound power will be sought during procurement, additional acoustic treatment of the building envelope is not considered reasonable or feasible for the limited operation of the pump. It is noted that the louvres have been positioned on the western and southern sides of the building so as to direct noise away from the most sensitive locations. It is understood that during operation, personnel will not be in close proximity to the building, particularly the facades comprising acoustic louvres.

4.4 Noise modelling

4.4.1 Environmental noise predictions

Environmental noise predictions were carried out using the CONCAWE [21] noise prediction algorithm as implemented within the CadnaA 3D noise modelling software (version 4.5.151). The CONCAWE algorithm predicts noise levels that take into account noise attenuation due to distance, ground topography, acoustic shielding from intervening elements, noise reduction of building envelope components, atmospheric absorption and meteorological conditions.

Predicted noise emissions are based on the sources and assumptions in Appendix E to ensure that cumulative noise impact from all sources within the SMTF has been taken into account. Results of noise predictions are presented in Appendix F, incorporating all noise mitigation and management design measures contained in this report.

4.4.2 Noise generation within buildings

Noise generation within buildings, including the Maintenance building, Wheel Lathe, Train Wash and components of the Administration Building roof top plant room were modelled within CadnaR 3D noise modelling software (version 2.2.105) prior to being incorporated into the CadnaA environmental noise model.

4.4.3 Meteorological conditions

In accordance with the INP, the noise assessment considers the effects of adverse meteorological conditions such as wind and temperature inversions. The noise enhancement from temperature inversion is required to be assessed when temperature inversions are predicted to occur more than 30%

of the time at night (18:00 to 07:00) in winter. Noise enhancement from wind is to be assessment when the source to receiver wind speed is between 0.5m/s and 3m/s for more than 30% of the time in any period and season.

The analysis related to the frequency of temperature inversions and wind effects was carried out by Todoroski Air Sciences using 2012 data extracted from the Riverstone CALMET - odour planning model at location: 305250, 6269650 (CALMET grid cell: 55, 30, being within the subject site),The analysis revealed the following:

- Temperature Inversions (Stability Class F) occurred for over 30% of the winter month night time periods based on both the 2012 data; and
- Assessable wind effects are based on the 16 cardinal directions of the windrose (ie, N, NNE, NE etc). Wind directions exceeding 30% of the time were identified for the night time period only, for the southerly direction (from 169° to 191°) during Autumn and Winter.

With the wind enhancement only being identified during the night time, assessment has been based on the worst case adverse weather condition is based on temperature inversion conditions, which extended to the evening INP assessment period. The following noise enhancing adverse meteorological effects were included in the noise model:

- Evening/ Night (18:00-07:00): Adverse meteorological temperature inversion conditions, i.e. temperature inversion (Stability Class F) with no drainage wind.

4.4.4 Temperature profiles

Temperature profiles sourced from Monthly Climate Statistics for 'RICHMOND RAAF' [067105] were used to determine the operational loads for train HVAC other mechanical equipment servicing the SMTF buildings. Data is based on long-term averages between 1993 and 2010/2015.

Additional detailed analysis of temperature profiles was carried out for the morning start-up period to confirm the operation mode of the train HVAC. It has been confirmed by the train designers that during start up procedures, the HVAC mode is established from the external ambient temperature. Half-hourly temperature data for 'RICHMOND RAAF' [067105] from January 2005 to end February 2016 was evaluated. The train HVAC is to operate in cooling mode at temperatures above 23°C. The following analysis has been calculated based on temperatures above 22°C, therefore including 22.5°C and above. The first trains are prepared at 3:47am with the last leaving at 7:10am.

Table 4-2: Detailed morning temperature profile information

Time	No. 30min periods >22°C in summer (Dec, Jan, Feb)	Total 30min periods	Percentage occurrence
3:30-4:30am	160	2104	8%
4:30-5:30am	139	2104	7%

Time	No. 30min periods >22°C in summer (Dec, Jan, Feb)	Total 30min periods	Percentage occurrence
5:30-6:30am	109	2104	5%
6:30-7:30am	132	2104	6%

The analysis indicates that trains may require cooling mode operation of the HVAC during the morning start-up, however this would occur for less than 10% of the time during the summer months. On this basis, it has not been considered part of normal operations for the noise and vibration assessment.

Table 4-3: Temperature profile information

Statistic Element	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Start Year	End Year
Mean maximum temperature (Degrees C) for years 1993 to 2015	30	29	26.9	23.9	20.6	17.9	17.5	19.8	22.8	25.2	26.9	28.5	1993	2015
Highest temperature (Degrees C) for years 1993 to 2015	46.4	43	40	34	28.3	26.2	25.4	31.3	35	40.1	45.3	43.7	1993	2015
Decile 9 maximum temperature (Degrees C) for years 1993 to 2015	37.3	35	31.5	28	24	21	20.5	24	28.7	32.2	35	35.4	1993	2015
Mean number of days >= 30 Degrees C for years 1993 to 2015	14.9	11.4	5.9	1	0	0	0	0.2	1.8	5.7	8.3	11.6	1993	2015
Decile 9 minimum temperature (Degrees C) for years 1993 to 2015	21	20.8	19.1	15.7	13	10.4	8.9	10	13.2	15.4	18.2	19.2	1993	2015
Mean 9am temperature (Degrees C) for years 1993 to 2010	22.1	21.3	19.1	17	13.1	10	8.9	11.4	15.4	18.3	19.2	20.9	1993	2010
Mean 3pm temperature (Degrees C) for years 1993 to 2010	28.5	27.4	25.8	23	19.7	17	16.5	18.7	21.5	23.5	25.2	27.5	1993	2010

Train HVAC operation	Ambient temperature range
Heating	Below 19 degrees
Ventilation	19 to 23
Medium Cooling	24 to 29
High Cooling	30 and above

5 Acoustic design outcomes

The noise mitigation and management measures recommended for incorporation into the SMTF design are presented in Appendix E. The advice provided is in respect of acoustics only.

5.1 Summary of predicted noise levels

Table F1 in Appendix F presents a summary of the predicted noise levels for the various operating scenarios outlined in Table E1.

The primary noise sources contributing to each of the predicted exceedances have also been identified in Tables F2 to F4 for the Shoulder, Day and Evening periods respectively for the locations where non-compliance is predicted.

In all cases, the primary contributors to predicted exceedances are noise sources not readily controlled through design of the SMTF buildings, including trains in the stabling area, truck movements, door openings (Maintenance building) and open ends of buildings (wheel lathe) etc.

5.2 Feasible and reasonable design measures

The assessment of feasible and reasonable mitigation measures is based on the guidance in Sections 1.4.5 and 7 of the NSW INP.

In this context **feasibility** relates to engineering considerations and what can practically be built, and **reasonableness** relates to the application of judgement in arriving at a decision, taking into account the following factors:

- noise mitigation benefits - amount of noise reduction provided, number of people protected
- cost of mitigation - cost of mitigation versus benefit provided
- community views - aesthetic impacts and community wishes
- noise levels for affected land uses – existing and future levels, and changes in noise levels

A range of noise mitigation measures have been considered as part of the noise mitigation design to protect noise sensitive receivers surrounding the SMTF. There are three categories into which these noise mitigation measures can fall:

- In-Corridor Treatment (at source);
- In-Corridor Treatment (between source and receiver); and
- At Property Treatment (at receiver).

The preferred noise mitigation treatment option is 'In-Corridor Treatment (at source)', such as building HVAC treatment, architectural attenuation measures, train subsystem noise control or changes to work

practises. Treatment 'at-source' reduces the level of noise before it even leaves the site, lowering the overall level of noise potentially generated by the SMTF, thus reducing the need for further noise mitigation measures.

The next preferred noise mitigation treatment option is 'In-Corridor Treatment (between source and receiver)', such as strategic placement of buildings or noise barriers. This mitigation option reduces the level of noise before it leaves the facility, thus reducing the noise impact in areas surrounding the facility. The offset to these mitigation measures is that there may be some visual impact or limitations on land use as a result.

The final noise mitigation option considered, when all other options have been exhausted, is 'At Property Treatment (at receiver)'.

Table 5-1 below summarises the noise mitigation options considered during the design development of all fixed facilities requiring noise mitigation, with comments on their feasibility and reasonableness with regard to this Project.

Table 5-1: Summary of noise mitigation options for SMTF

Noise mitigation option	Estimated noise benefit	Comments on feasibility/ reasonableness	Design result
In-corridor treatment (at source)			
Acoustic treatment of Administration plant room/s and Maintenance building	5 to 15 dB reduction in L_{Aeq} noise levels based on base design.	Reasonable cost, limited operational impact. Further improvements to the adopted design of the Maintenance building are not beneficial due to noise emission controlled through door openings.	Option adopted
Absorptive lining of underside of roof and / or walls in Wheel Lathe and Substation transformer bays.	Up to 5 dB(A) reduction in L_{Aeq} noise levels	Reasonable cost, limited operational impact.	Option adopted
Orientation of open side of Bulk Supply substation to provide shielding to receivers.	5 to 10 dB reduction in L_{Aeq} noise levels	Reasonable cost, limited operational impact.	Option adopted
No horn testing within Stabling Yard.	Minimum 40 dB reduction in L_{Amax} noise levels at 100 m from the Stabling Yard	Testing of horns not required due to automated train system.	Option adopted
Use shore supplies for air and power on stabled trains	Reduction in L_{Aeq} noise levels when trains stabled for long periods, however auxiliary systems will still be required for final train preparation, which is at its peak in the morning shoulder period.	Additional plant required at stabling facility. Minimal benefit at peak sensitive period.	Feasible but not reasonable
Noise reduction of train auxiliary systems.	Greatest benefit in the daytime period when HVAC is in cooling. <3dB(A) benefit depending on reduction achieved by all auxiliary systems. Would likely require reduction of all sub systems, including CVS, HVAC and compressor.	Noise from the CVS and compressor have been deemed fit with best practice and therefore overall benefit of lowering HVAC noise would be limited. The benefits would also be limited to the least sensitive daytime periods.	Option not adopted.

Noise mitigation option	Estimated noise benefit	Comments on feasibility/ reasonableness	Design result
Reduction of number of trains cleaned at one time.	<1 dB(A) if reduced from 9 to 6 trains.	Option would prolong cleaning period for only marginal noise benefit.	Option not reasonable
Limit preparation time for train sets prior to departure to less than 30 minutes	Reduction in L_{Aeq} noise levels during critical night and morning shoulder period by reducing the total number of trains in preparation at any one time (less overlap).	While batch start up is required for management of potential failure and ensure service requirements are met, the automated test procedure reduces preparation time from that required for standard train sets by approximately one-third. This has reduced the total number of trains otherwise required in preparation.	Option adopted
Outer stabling roads last trains to depart, first trains to return so that train sets act as noise barrier.	No significant reduction in L_{Aeq} noise levels to residential locations to the east of the SMTF.	The operators advise that this option would present an operational constraint that may not always be achievable.	Option not feasible
Limit operation of Train Wash and Wheel Lathe to 'Day ' and 'Evening' period only. No operation at night.	1-2 dB reduction in L_{Aeq} noise levels to residential receivers to the east under Ultimate design operations.	While providing only a marginal noise benefit, this option is reasonable and achievable for Ultimate design operations.	Option adopted
In-Corridor Treatment (between source and receiver)			
Strategic placement of buildings and structures	5 to 10 dB reduction in L_{Aeq} and L_{Amax} noise levels by using SMTF buildings & structures, e.g. Maintenance and Administration building from stabling yard to the north of site provide noise barrier to northern receivers	The potential noise reduction from the design and location of buildings and structures at all fixed facilities has been considered in the design development. Reasonable cost, low visual impact.	Option adopted
Placement of Train Wash in cutting	5 to 10 dB reduction in L_{Aeq} and L_{Amax} noise levels	Reasonable cost, low visual impact.	Option adopted
Noise barriers on perimeter of stabling yard/ car park/ loading dock area	Negligible benefit under adverse meteorological conditions to all receivers and to receivers to the east.	Receivers immediately to the north of the SMTF impacted by car park and loading dock operations identified as open space under future NWGC development. Reasonable cost, visual impact. Minimal effectiveness in terms of noise reduction particularly during temperature inversions.	Option not reasonable
Acoustic shed over stabling yard	15+ dB reduction in L_{Aeq} and L_{Amax} noise levels to receivers to the north, south and west but negligible benefit for receivers to the east.	High cost of construction; high level of noise reduction not required to meet noise goals.	Option not feasible or reasonable
Land use planning sympathetic with SMTF use.	5 to 10 dB reduction in L_{Aeq} and L_{Amax} noise levels if residential land use is located behind commercial or industrial buildings	Minimum impact on residential receivers. Low visual impact. Restriction of land use in vicinity of facility. Not within Project scope, but under consideration by Department of Planning as part of Sydney Growth Centres planning.	Option not adopted by Project.

Noise mitigation option	Estimated noise benefit	Comments on feasibility/ reasonableness	Design result
At Property Treatment (at receiver)			
At-property treatment of existing dwellings	Up to 15+ dB reduction is achievable in L_{Aeq} and L_{Amax} noise levels, depending on design requirements	Usually more cost-effective than installing noise barriers where receivers are well spaced apart. Residual treatment where noise barrier barriers have reached practical acoustic and engineering limits. Does not reduce noise levels outdoors. Considered appropriate for interim measure where current residential uses are to change to less noise sensitive uses.	Option adopted
At-property treatment of future dwellings	-	As outlined in Section 5.4, future noise sensitive development proposed as part of the Riverstone East and Area 20 NWGC, may require mitigation measures to be incorporated into the design of the future development. Objectives and controls have been incorporated into the Riverstone East Growth Centre DCP and similar controls would be required for Area 20.	Option adopted

5.3 At-property treatment

In accordance with the Project requirements the SMTF is to adopt a feasible and reasonable approach for the noise mitigation design, combining both physical noise mitigation and noise management measures, as follows:

Physical noise mitigation

Physical noise mitigation measures in the form of building designs and orientation, selection of low noise and acoustically treated mechanical equipment, broadband and ambient noise sensing alarms within the Maintenance building and localised noise barriers to equipment areas.

↓

Noise management measures

Noise emission from the RTRF will be managed through operational measures such as restricting heavy vehicle movements during the night time period, limiting train wash and wheel lathe to the day and evening period and no use of yard horns or other devices during movement of trains.

↓

At-property treatment

Any residual noise impacts (including sleep disturbance impacts) will be addressed through at-property noise mitigation treatment to ensure that the acoustic amenity of indoor areas is protected, in particular during the critical night and early morning shoulder periods.

At-property treatment may comprise:

- Property boundary fencing or other external screen walls
- Fresh air ventilation systems that allow existing windows and doors to remain closed
- Sealing of wall vents
- Upgrading window and door seals, and/or
- Upgraded windows and glazing and solid core doors on the exposed facades of masonry structures only. Upgrading of windows and doors typically provides negligible acoustic benefit for light-weight framed structures.

Table 5-2 summarises the noise mitigation options to achieve the operational noise goals. The recommendations are based on the information available and the noise level reductions assumed for each treatment option are based on conservative estimates. At-property treatments are likely to be either Option A or B.

Table 5-2: At-property noise mitigation options

Noise mitigation option	Exceedance of external criteria	At-property noise mitigation treatment description
NR	0	At property treatment not required

Noise mitigation option	Exceedance of external criteria	At-property noise mitigation treatment description
A	1 to 5 dB(A)	Property boundary fencing or other external screen walls; and/ or AC/ Mechanical Ventilation: Ducted air-conditioning with fresh air ventilation; or Split system air-conditioning with separate fresh air mechanical ventilation where ducted systems are not practical; or Fresh air mechanical ventilation, for example where air-conditioning exists at the property or preferred by property owner. The above is dependent on advice from air-conditioning / mechanical ventilation contractor for rooms requiring windows/doors to be closed for noise mitigation.
B	6 to 10 dB(A)	In addition to the above: Replace existing weather seals with acoustic seals (eg Q-Lon seals from Schlegel)
C	11 to 15 dB(A)	In addition to the above: Replace existing glazing with 6.38mm laminated glazing.

Given that the above details are unique for each dwelling, it is recommended that field inspections of each affected property be conducted as part of the final design stage of the Project in order to conduct detailed noise modelling to inside habitable rooms of each dwelling.

Noise modelling has revealed that for the current design and operational assumptions, the Project achieves compliance with the Project noise objectives for all locations with the exception of up to five properties.

Table 5-3 identifies all dwellings for consideration of at-property treatment. It is noted that the current analysis is considered conservative as it is based on Ultimate Design year operations without consideration of any natural increase in the ambient environmental in the area surrounding the SMTF.

Table 5-3: Properties considered for at-property noise mitigation treatment

NCA	ID	Receiver	Noise reduction required	Potential noise mitigation option
RTF-03	47490-230U-RES	[redacted] Rouse Hill	2 dB(A)	A
RTF-04	47365-079U-RES	[redacted] Rouse Hill	5 dB(A)	A
	47395-126U-RES	[redacted], Rouse Hill	5 dB(A)	A
	47390-152U-RES	[redacted] Rouse Hill	5 dB(A)	A
	47395-178U-RES	[redacted] Rouse Hill	1 dB(A)	A

It is reiterated that for the purpose of this assessment, selected treatment options (Options A) for each affected property are based on general information available and on conservative estimates of noise level reductions that can be expected for each treatment option.

5.4 Future development surrounding the SMTF

In the immediate proximity of the SMTF, medium to high density residential development is proposed within the Riverstone East and Area 20 North West Growth Centres [9, 22]. Following consultation between NRT, DP&E and TfNSW, it was identified that residential development, particularly upper levels

of higher density development, may be exposed to noise levels above those recommended in the NSW INP. However, it is considered that the likely noise exposure, even after future expansion of the SMTF, will be acceptable, provided that some mitigation measures and controls are incorporated into the design of the residential development. Accordingly, objectives and controls have been incorporated into the Riverstone East Growth Centre DCP to require consideration of noise emission from the SMTF in the design of the future development. Similar controls would also be required for development within the Area 20 Growth Centre that are located in proximity to the SMTF.

Notwithstanding the controls outlined, further consultation between NRT, DP&E and TfNSW will be required to determine the expected noise exposure at any future development site, in order to permit assessment and design of the future uses.

6 Consultation with affected property owners

6.1 Existing dwellings

Once the ONVR has been submitted to DP&E, consultation with owners of existing structures that require at-property noise mitigation treatment (as identified in Table 5-3) will commence.

As set out in Section 5.3, at-property treatments may comprise:

- Property boundary fencing or other external screen walls, and / or
- Fresh air ventilation systems, that allow existing windows and doors to be shut to all habitable rooms identified as potentially impacted by noise.

  [Note: The above is dependent on advice from mechanical ventilation contractor for rooms requiring windows/doors to be closed for noise mitigation. Air conditioning will not be provided by the Project in this case.]

Habitable rooms potentially impacted by noise may also require:

- Sealing of any wall vents,
- Replacement of existing weather seals on doors and windows with acoustic seals,
- Upgrade of doors and windows,

  [Note: Shall only be conducted on buildings with masonry construction because light frame structures will not achieve a significant noise benefit.]

It is noted that the above described treatments will only be offered to residences with rooms defined as 'habitable' (eligible for eg. bedrooms, living rooms, dining rooms etc.) having facades that are identified as potentially impacted by noise from the Project. The level of treatment to be offered to individual residences will depend on the noise reduction required and the location of habitable rooms.

It is also noted, that for a building to be eligible for upgraded windows, glazing and solid core doors, as described above in Item 4, it must be of masonry construction (eg brick or block work etc), because this higher level of noise mitigation treatment will not achieve a significant noise benefit for buildings of light frame construction.

Based on the approved ONVR, specific residences for treatment and the noise reduction required for each residence will be confirmed. Consultation with these property owners will involve:

- An initial letter sent to affected property owners, outlining the requirements of the property treatment, the level of treatment required for the subject property and next steps.
- A phone call to discuss whether the property owner will initially agree to a property inspection, which is required to determine the exact scope of the treatment to be provided.

- If the owner agrees to the inspection, NRT will arrange a time to measure up and record internal layouts.
- Specific property information will then be utilised to determine the most appropriate form of acoustic treatment for each eligible property, with input from NRT's acoustic consultant, Renzo Tonin and Associates, where required. Only treatments that are required to meet relevant noise criteria will be offered.
- A schedule of the designed treatment would be provided to the property owner. Should the owner agree to this treatment, the owner will be asked to sign a Deed of Release.
- Following receipt of the signed Deed of Release, NRT will liaise with the property owner to arrange a suitable time for the specific treatment to be installed.

Alternatively, if the property owner would like to arrange for the purchase and installation of the required treatment(s), NRT will provide a one off payment to cover the reasonable cost of the works (as estimated by NRT) following receipt of the signed Deed of Release.

Any queries relating to operational noise from residents that are not eligible to receive at-property treatments will be responded to through the Project complaints management process in accordance with the Community Liaison Plan.

6.2 Future development

As outlined in Section 5.4, further consultation between NRT, DP&E and TfNSW is expected to be required to determine the expected noise exposure at any future development sites surrounding the SMTF, in order to permit others to assess and design for noise exposure upon the future uses.

7 Operational noise monitoring program

7.1 Monitoring of noise emissions from the SMTF

In accordance with Minster for Planning and Infrastructure's Conditions of Approval Condition F2, operational noise levels shall be reviewed within two years of commencement of operations and at any subsequent time as required by the Director General. The review shall have regard to the status of land use planning, any land use changes and the background noise environment within areas adjacent to the fixed facilities at the time of the relevant review. NRT shall submit the results of the review to the Director General. Any proposed changes to the operational noise levels as a result of the review shall be included in a revised ONVR.

7.2 Operational noise complaint response procedures

The operator is committed to a strong program of customer engagement will be developed to encourage ongoing feedback that will be used in the continual improvement of the Sydney Metro Northwest services. As part of the Project requirements, the operator is to prepare an "Operational Phase Environmental and Sustainable Plan", which is to be provided 120 days prior to trial running. This document will provide further detail around the complaints management procedures, however the following principles are to be adopted:

- The public will be able to make enquiries and complaints through a number of channels, including:
  - phone lines operated by TfNSW on behalf of the NSW Government
  - website operated by TfNSW on behalf of the NSW Government using feedback mechanisms such as online forms, and
  - Operator email, for example info@northwestrail.com.au
  - Enquiries and complaints received by TfNSW in relation to the operation of Sydney Metro Northwest will be directed to the operator for response and action.
- All complaints are to be recorded and follow up actions documented
- All complaints will be investigated in order to establish the nature of the noise and vibration disturbance. At the discretion of the complainant(s) the operator shall contact the complaint,
- Following initial investigation of the complaint, an appropriate course of action will be determined and communicated with the complainant. This may involve:
  - Direct and prompt rectification of the cause of complaint where it is identified that the source of noise or vibration is not operating in accordance with the Project requirements,
  - Further investigation by a qualified acoustic consultant to quantify and assess the source of noise and/or vibration against the Project requirements,

- If the source is found to be non-compliant with the Project requirements, feasible and reasonable mitigation measures will be investigated.
- Where noise and/or vibration measures are determined to be required, a program for rectification works will be established and communication with the complainant.

8 Independent verification of noise and vibration study

This Section of the ONVR outlines the independent verification of the operational noise and vibration impact assessment undertaken by a noise and vibration expert approved by the Director-General of the Department of Planning and Infrastructure

In accordance with the Minister for Planning and Infrastructures' Conditions of Approval the ONVR has been independently reviewed by a noise and vibration expert approved by the Director-General. AECOM were engaged to undertake this independent verification role. The AECOM team consists of:

- [redacted] - Principal Acoustic Engineer

The Director-General granted approval for AECOM to undertake this role on 10 February 2016.

The verification scope was developed in consultation with the EPA on 9 February 2016 as required by Condition F4 of SSI-5931. The scope includes:

- Review of background noise monitoring results and fixed facilities targets.
- Review of adopted noise and vibration criteria.
- Review of the adequacy of the methodology utilised.
- Review of modelling inputs and outputs.
- Review of the adequacy of the conclusions in relation to the potential extent of noise and vibration impact and the required mitigation.

A statement of verification has been prepared by AECOM and is attached in APPENDIX G.

9 Conclusion

This Operational Noise and Vibration Review (ONVR) has been prepared in accordance with the requirements of the Ministers Conditions Approval for State Significant Infrastructure SSI-5931, and additional requirements of the Project's Scope and Performance Requirements (SPRs) Appendix 44. The ONVR has been prepared in consultation with relevant the government agencies and has been independently peer reviewed.

This ONVR confirms the proposed noise and vibration mitigation measures that are to be implemented into the design and operation of the Sydney Metro Train Facility (SMTF) and discusses when these will be implemented and how they will be verified once the Project is operational. A complaints management procedure is also outlined for the ongoing management of noise and vibration from the SMTF.

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[22] NSW Planning & Environment, "Area 20 Precinct: Indicative Layout Schedule," August 2011. [Online]. Available: http://growthcentres.planning.nsw.gov.au/Portals/0/docs/Area%2020/A20_FINAL_ILP.pdf. [Accessed 2 March 2015].

[23] NSW Department of Planning, "Development near Rail Corridors and Busy Roads – Interim Guideline," NSW Department of Planning, Sydney, 2008.

[24] NSW Government, "State Environmental Planning Policy (Infrastructure)," Sydney, 2007.

[25] NSW Department of Planning & Infrastructure, "Director General's Environmental Assessment Report SSI13-5931," NSW Department of Planning & Infrastructure, 2014.

[26] R. Hoover and R. Keith, "Noise Control for Mechanical and Ventilations Systems," in *Encyclopedia of Acoustics V3 ed. Malcom J. Croker*, New York, John Wiley & Sons, Inc., 1997, pp. 1219-1241.

APPENDIX A Glossary of terminology

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

Adverse weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment period	The period in a day over which assessments are made.
Assessment point	A point at which noise measurements are taken or estimated. A point at which noise measurements are taken or estimated.
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L90 noise level (see below).
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of every day sounds: 0dB The faintest sound we can hear 30dB A quiet library or in a quiet location in the country 45dB Typical office space. Ambience in the city at night 60dB CBD mall at lunch time 70dB The sound of a car passing on the street 80dB Loud music played at home 90dB The sound of a truck passing on the street 100dBThe sound of a rock band 115dBLimit of sound permitted in industry 120dBDeafening
dB(A)	A-weighted decibels. The ear is not as effective in hearing low frequency sounds as it is hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter.
Frequency	Frequency is synonymous to pitch. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
HVAC	Heating, Ventilation and Air-conditioning equipment
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
INP	NSW Industrial Noise Policy [5]
L_{Max}	The maximum sound pressure level measured over a given period.
L_{Min}	The minimum sound pressure level measured over a given period.

L_1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L_{10}	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L_{90}	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
L_{eq}	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
REMMS	Revised Environmental Mitigation Measures determined during the Environmental Impact Assessment.
SEL	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound absorption	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound power level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise	Containing a prominent frequency and characterised by a definite pitch.

APPENDIX B Land use survey and receiver locations

Legend

- Monitoring locations
- Assessment locations
- Sydney Metro Train Facility (SMTF)
- Residential (NCAs)
- Recreational
- Worship

0 50 100 150 200 m

Consultant:
RENZO TONIN & ASSOCIATES
inspired to achieve
1/418A Elizabeth Street, SURRY HILLS NSW 2010
P: 02 8218 0500 F: 02 8218 0501

Client:
northwest rapid transit

Project:
SYDNEY METRO
NORTHWEST OTS

Description:
SYDNEY METRO TRAIN FACILITY (SMTF)
SSI-5931 OPERATIONAL NOISE AND VIBRATION REVIEW
MONITORING AND ASSESSMENT LOCATIONS

Figure No:	TG264-05-6413 (R3)	Created by:	THW
Scale:	1:5000 (Sheet 1 of 1)	Grid:	-
Date:	17.05.2016	Sheet	A3

Legend

- Monitoring locations
- Assessment locations
- Sydney Metro Train Facility (SMTF)
- Residential (NCAs)
- Recreational
- Worship

0 25 50 75 100 m

Consultant:

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1/418A Elizabeth Street, SURRY HILLS NSW 2010
P: 02 8218 0500 F: 02 8218 0501

Client:

northwest rapid transit

Project:

SYDNEY METRO
NORTHWEST OTS

Noise Levels are approximate due to interpolation of contours and should be used for reference only.
For information only and not for construction.

Description:

SYDNEY METRO TRAIN FACILITY (SMTF)
SSI-5931 OPERATIONAL NOISE AND VIBRATION REVIEW
MONITORING AND ASSESSMENT LOCATIONS

Figure No:	TG264-05-6413 (R3)	Created by:	THW
Scale:	1:2500 (Sheet 1 of 4)	Grid:	-
Date:	17.05.2016	Sheet	A3

Legend

- Monitoring locations
- Assessment locations
- Sydney Metro Train Facility (SMTF)
- Residential (NCAs)
- Recreational
- Worship

0 25 50 75 100 m

RENZO TONIN & ASSOCIATES
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P: 02 8218 0500 F: 02 8218 0501

northwest rapid transit

SYDNEY METRO
NORTHWEST OTS

Noise Levels are approximate due to interpolation of contours and should be used for reference only.
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SYDNEY METRO TRAIN FACILITY (SMTF)
SSI-5931 OPERATIONAL NOISE AND VIBRATION REVIEW
MONITORING AND ASSESSMENT LOCATIONS

Figure No:	TG264-05-6413 (R3)	Created by:	THW
Scale:	1:2500 (Sheet 2 of 4)	Grid:	-
Date:	17.05.2016	Sheet	A3

Legend

- Monitoring locations
- Assessment locations
- Sydney Metro Train Facility (SMTF)
- Residential (NCAs)
- Recreational
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0 25 50 75 100 m

Consultant:

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1/418A Elizabeth Street, SURRY HILLS NSW 2010
P: 02 8218 0500 F: 02 8218 0501

Client:

northwest rapid transit

Project:

SYDNEY METRO
NORTHWEST OTS

Noise Levels are approximate due to interpolation of contours and should be used for reference only.
For information only and not for construction.

Description:

SYDNEY METRO TRAIN FACILITY (SMTF)
SSI-5931 OPERATIONAL NOISE AND VIBRATION REVIEW
MONITORING AND ASSESSMENT LOCATIONS

Figure No:	TG264-05-6413 (R3)	Created by:	THW
Scale:	1:2500 (Sheet 3 of 4)	Grid:	-
Date:	17.05.2016	Sheet	A3

Legend

- Monitoring locations
- Assessment locations
- Sydney Metro Train Facility (SMTF)
- Residential (NCAs)
- Recreational
- Worship

0 25 50 75 100 m

Consultant:
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northwest rapid transit

Project:
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NORTHWEST OTS

Description:
SYDNEY METRO TRAIN FACILITY (SMTF)
SSI-5931 OPERATIONAL NOISE AND VIBRATION REVIEW
MONITORING AND ASSESSMENT LOCATIONS

Figure No:	TG264-05-6413 (R3)	Created by:	THW
Scale:	1:2500 (Sheet 4 of 4)	Grid:	-
Date:	17.05.2016	Sheet	A3

Legend

- Monitoring locations
- Assessment locations
- Sydney Metro Train Facility (SMTF)
- Residential (NCAs)
- Recreational
- Worship

0 25 50 75 m

Consultant:
RENZO TONIN & ASSOCIATES
inspired to achieve
1/418A Elizabeth Street, SURRY HILLS NSW 2010
P: 02 8218 0500 F: 02 8218 0501

Client:
northwest rapid transit

Project:
SYDNEY METRO
NORTHWEST OTS

Description:
SYDNEY METRO TRAIN FACILITY (SMTF)
SSI-5931 OPERATIONAL NOISE AND VIBRATION REVIEW
MONITORING AND ASSESSMENT LOCATIONS

Figure No:	TG264-05-6413 (R3)	Created by:	THW
Scale:	1:1500 (Sheet 1 of 1)	Grid:	-
Date:	17.05.2016	Sheet:	A3

Figure B.2: Riverstone East Draft Indicative Layout Plan [9]

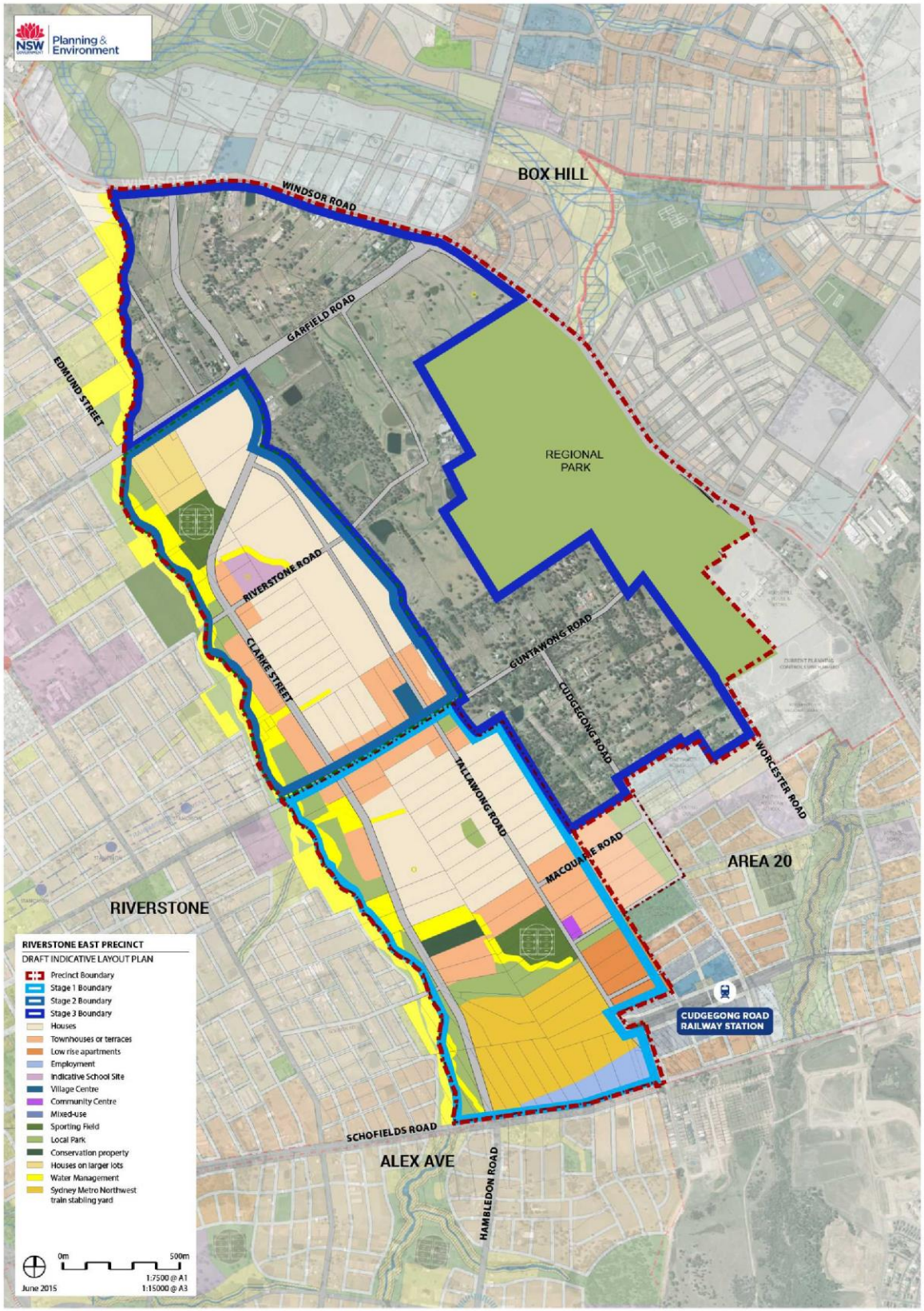

Figure B.3: Alex Avenue Indicative Layout Plan [10]

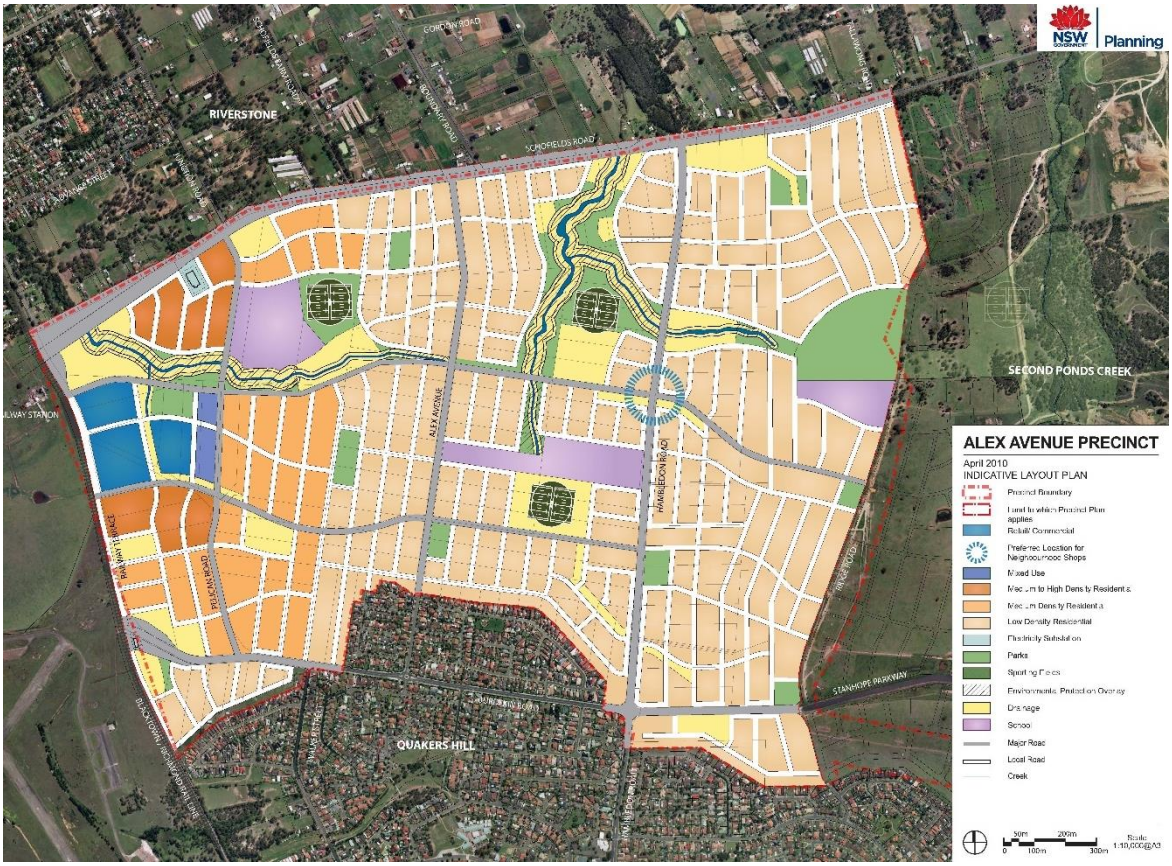

Figure B.4: Riverstone Precinct Indicative Layout Plan [11]

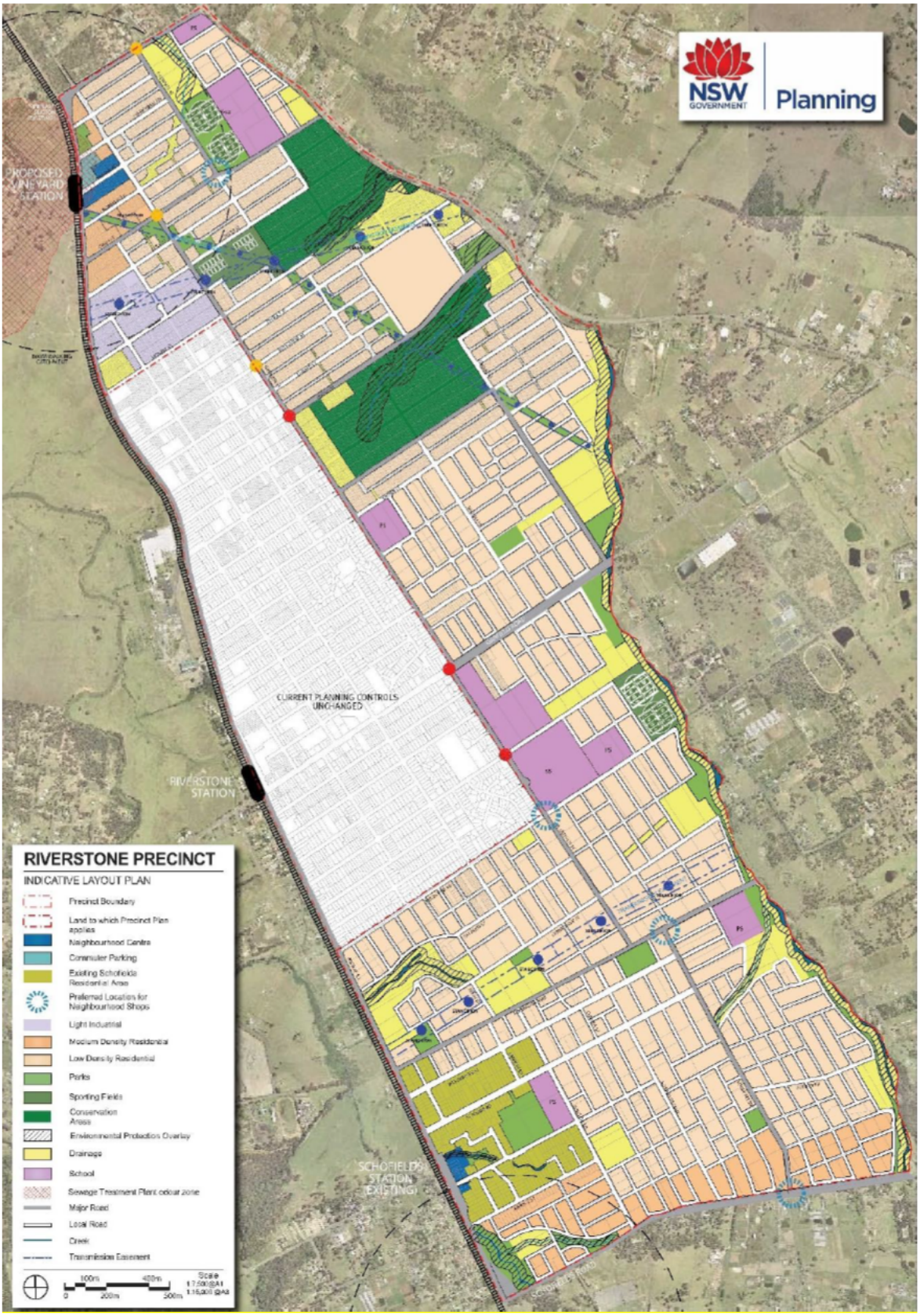

Figure B.5: Area 20 Precinct Indicative Layout Plan [22]

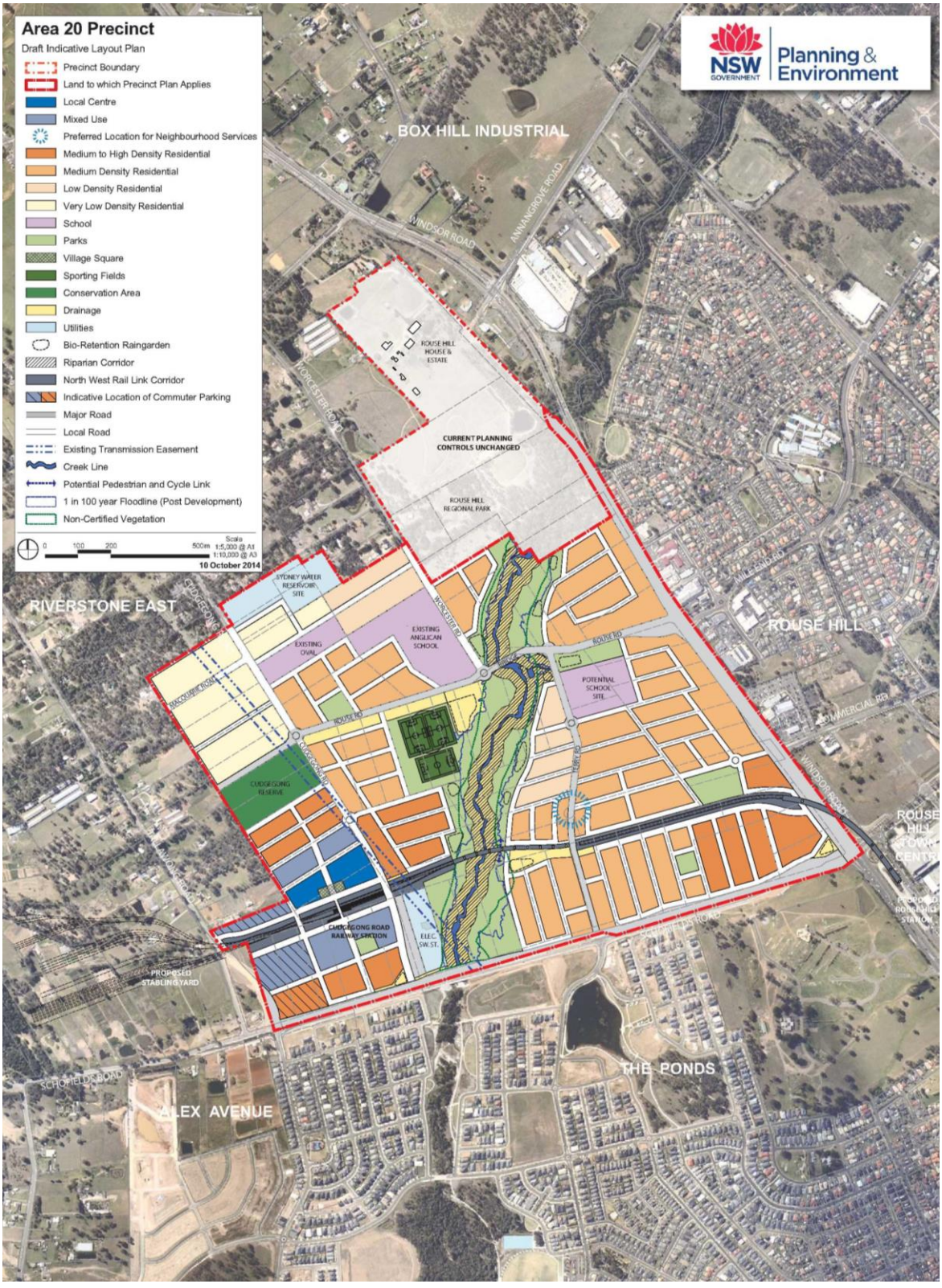

Table B-9-1: Land use survey summary

Receiver ID	NCA	Address	INP Project specific noise levels, dB(A)			
			Shoulder 05:00-07:00	Day 07:00-18:00	Evening 18:00-22:00	Night 22:00-05:00
48000-262D-RES	RTF-01	[redacted]Schofields	43	48	48	37
47290-325D-RES	RTF-01	[redacted], The Ponds	43	48	48	37
47340-307D-RES	RTF-01	[redacted] The Ponds	43	48	48	37
46880-351D-RES	RTF-01	[redacted]The Ponds	43	48	48	37
48180-228D-RES	RTF-01	[redacted] Schofields	43	48	48	37
46905-353D-RES	RTF-01	[redacted] The Ponds	43	48	48	37
48180-202D-RES	RTF-01	[redacted] Schofields	43	48	48	37
46920-353D-RES	RTF-01	[redacted], The Ponds	43	48	48	37
48180-176D-RES	RTF-01	[redacted] Schofields	43	48	48	37
46935-351D-RES	RTF-01	[redacted], The Ponds	43	48	48	37
46955-349D-RES	RTF-01	[redacted], The Ponds	43	48	48	37
46970-349D-RES	RTF-01	[redacted], The Ponds	43	48	48	37
46990-350D-RES	RTF-01	[redacted], The Ponds	43	48	48	37
47005-348D-RES	RTF-01	[redacted], The Ponds	43	48	48	37
47025-347D-RES	RTF-01	[redacted], The Ponds	43	48	48	37
47060-338D-RES	RTF-01	[redacted], The Ponds	43	48	48	37
47620-295D-RES	RTF-01	[redacted], The Ponds	43	48	48	37
47095-341D-RES	RTF-01	[redacted], The Ponds	43	48	48	37
47115-341D-RES	RTF-01	[redacted], The Ponds	43	48	48	37
47490-302D-RES	RTF-01	[redacted], The Ponds	43	48	48	37
47130-338D-RES	RTF-01	[redacted], The Ponds	43	48	48	37
47145-335D-RES	RTF-01	[redacted], The Ponds	43	48	48	37
47225-320D-RES	RTF-01	[redacted] The Ponds	43	48	48	37
47365-307D-RES	RTF-01	[redacted] The Ponds	43	48	48	37
47180-329D-RES	RTF-01	[redacted], The Ponds	43	48	48	37
48140-323U-RES	RTF-03	[redacted] Schofields	42	48	48	35
48180-119D-RES	RTF-02	[redacted], Schofields	42	48	48	35
47960-191U-RES	RTF-03	[redacted], Schofields	38	38	38	38
47490-230U-RES	RTF-03	[redacted] Rouse Hill	38	38	38	38
47950-243U-RES	RTF-03	[redacted] Schofields	38	38	38	38
48030-321U-RES	RTF-03	[redacted] Schofields	38	38	38	38
48030-321U-RES	RTF-03	[redacted] Schofields	38	38	38	38
47970-387U-RES	RTF-03	[redacted] Schofields	38	38	38	38
48180-465U-RES	RTF-03	[redacted] Schofields	38	38	38	38
48175-393U-RES	RTF-03	[redacted] Schofields	38	38	38	38
47505-309U-RES	RTF-03	[redacted] Rouse Hill	38	38	38	38

Receiver ID	NCA	Address	INP Project specific noise levels, dB(A)			
			Shoulder 05:00-07:00	Day 07:00-18:00	Evening 18:00-22:00	Night 22:00-05:00
47520-346U-RES	RTF-03	[redacted] Rouse Hill	38	38	38	38
47520-346U-RES	RTF-03	[redacted] Rouse Hill	38	38	38	38
47545-483U-RES	RTF-03	[redacted] Rouse Hill	38	38	38	38
48110-432U-PoW	-	[redacted] Schofields - [redacted]	38	38	38	38
47365-079U-RES	RTF-04	[redacted], Rouse Hill	38	38	38	38
46880-130U-RES	RTF-04	[redacted] Rouse Hill	38	38	38	38
47430-302U-RES	RTF-04	[redacted] Rouse Hill	38	38	38	38
47445-404U-RES	RTF-04	[redacted] Rouse Hill	38	38	38	38
47450-539U-RES	RTF-04	[redacted] Rouse Hill	38	38	38	38
47395-126U-RES	RTF-04	[redacted] Rouse Hill	38	38	38	38
47390-152U-RES	RTF-04	[redacted], Rouse Hill	38	38	38	38
47395-178U-RES	RTF-04	[redacted], Rouse Hill	38	38	38	38
46920-189U-RES	RTF-04	[redacted], Rouse Hill	38	38	38	38
47305-296U-RES	RTF-04	[redacted], Rouse Hill	38	38	38	38
46915-236U-RES	RTF-04	[redacted], Rouse Hill	38	38	38	38
46975-325U-RES	RTF-04	[redacted], Rouse Hill	38	38	38	38
47430-302U-RES	RTF-04	[redacted], Rouse Hill	38	38	38	38
47430-349U-RES	RTF-04	[redacted], Rouse Hill	38	38	38	38
47440-376U-RES	RTF-04	[redacted], Rouse Hill	38	38	38	38
47145-505U-RES	RTF-04	[redacted], Rouse Hill	38	38	38	38
47145-505U-RES	RTF-04	[redacted], Rouse Hill	38	38	38	38
47707-197D-RES	RTF-01	[redacted], The Ponds	42	48	48	37
47885-217D-RES	RTF-01	[redacted], Schofields	42	48	48	37

APPENDIX C Long-term noise monitoring methodology

C.1 Noise monitoring equipment

A long-term unattended noise monitor consists of a sound level meter housed inside a weather resistant enclosure. Noise levels are monitored continuously with statistical data stored in memory for every 15-minute period.

Long term noise monitoring was conducted using the following instrumentation:

Description	Type	Octave band data	Logger location(s)
EIS Logger (not completed by Renzo Tonin & Associates)	Type 2	Broadband Only	BG25
RTA 01	Type 2	Broadband Only	M_RTF03
RTA06 (NTi Audio XL2, with low noise microphone)	Type 1	1/1	M_RTF01

Notes: All meters comply with AS IEC 61672.1 2004 "Electroacoustics - Sound Level Meters" and designated either Type 1 or Type 2 as per table, and are suitable for field use.

The equipment was calibrated prior and subsequent to the measurement period using a Bruel & Kjaer Type 4231 calibrator. No significant drift in calibration was observed.

C.2 Meteorology during monitoring

Measurements affected by extraneous noise, wind (greater than 5m/s) or rain were excluded from the recorded data in accordance with the NSW INP. Determination of extraneous meteorological conditions was based on data provided by the Bureau of Meteorology (BOM), for a location considered representative of the noise monitoring location(s). However, the data was adjusted to account for the height difference between the BOM weather station, where wind speed and direction is recorded at a height of 10m above ground level, and the microphone location, which is typically 1.5m above ground level (and less than 3m). The correction factor applied to the data is based on Table C.1 of ISO 4354:2009 '*Wind actions on structures*'.

C.3 Noise vs time graphs

Noise almost always varies with time. Noise environments can be described using various descriptors to show how a noise ranges about a level. In this report, noise values measured or referred to include the L_{10}, L_{90}, and L_{eq} levels. The statistical descriptors L_{10} and L_{90} measure the noise level exceeded for 10% and 90% of the sample measurement time respectively. The L_{eq} level is the equivalent continuous noise level or the level averaged on an equal energy basis. Measurement sample periods are usually ten to fifteen minutes. The Noise -vs- Time graphs representing measured noise levels, as presented in this report, illustrate these concepts for the broadband dB(A) results.

APPENDIX D Noise logger graphs

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ww.renzotonin.com.au

[redacted], The Ponds

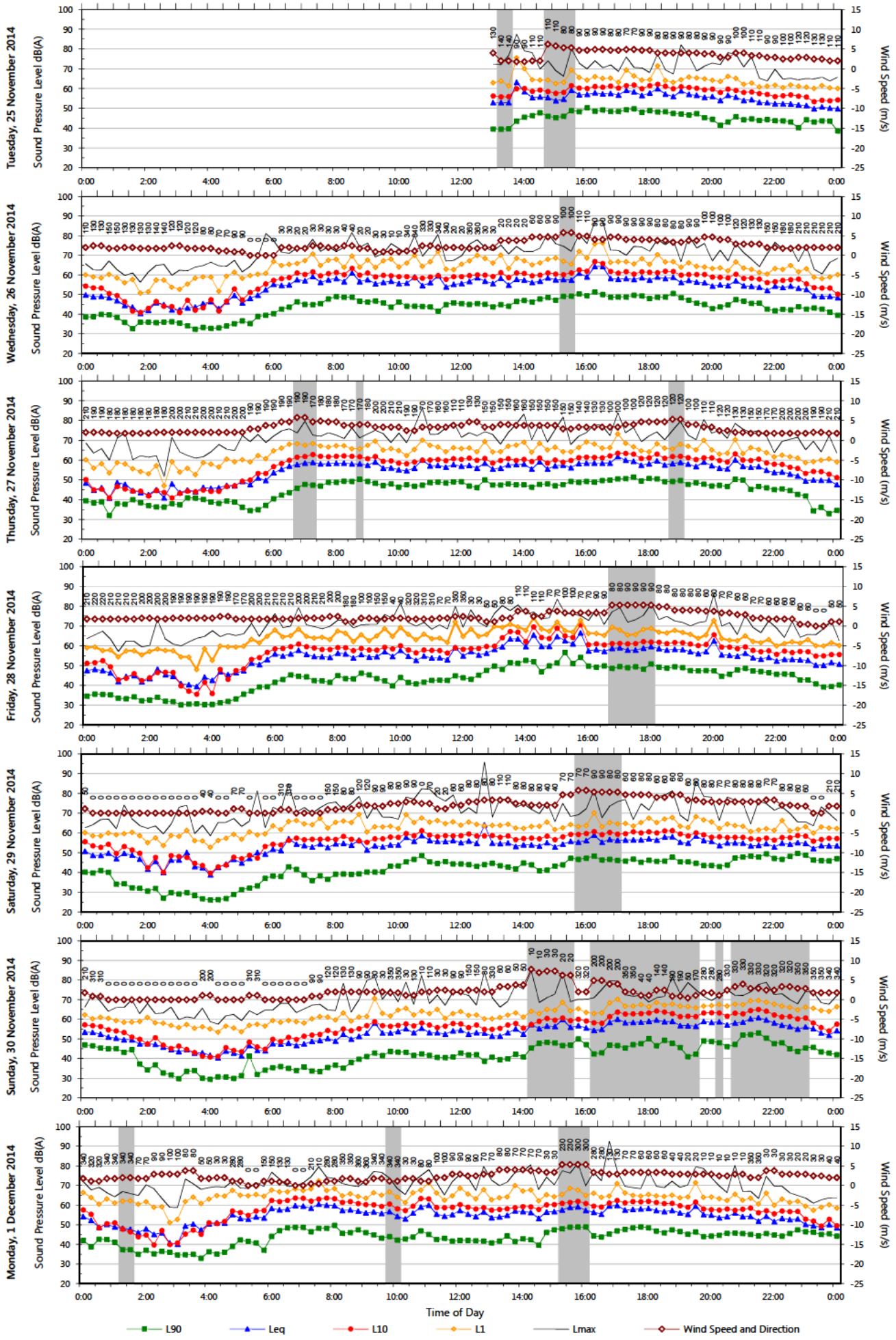
Background & Ambient Noise Monitoring Results - NSW 'Industrial Noise Policy', 2000						
	L_{A90} Background Noise Levels[5]			L_{Aeq} Ambient Noise Levels		
Date	**Day**	**Evening**	**Night**	**Day**	**Evening**	**Night**
Tuesday-25-November-2014	-	43.1	33.0	-	56.1	50.6
Wednesday-26-November-2014	44.0	42.6	36.1	58.3	56.1	49.9
Thursday-27-November-2014	46.9	45.2	30.6	57.8	57.3	50.7
Friday-28-November-2014	41.5	45.6	26.8	59.4	57.1	50.1
Saturday-29-November-2014	39.0	43.5	30.3	55.8	55.7	50.0
Sunday-30-November-2014	-	-	-	-	-	-
Monday-01-December-2014	41.6	44.2	-	57.2	55.6	-
Tuesday-02-December-2014	43.5	43.6	42.3	57.3	54.4	51.7
Wednesday-03-December-2014	-	-	-	-	-	-
Representative Weekday	**43.5**	**43.9**	**33.0**	**58.1**	**56.2**	**50.6**
Representative Weekend	**39.0**	**43.5**	**30.3**	**55.8**	**55.7**	**50.0**
Representative Week	**42.6**	**43.6**	**31.8**	**57.8**	**56.1**	**50.5**

Notes:

1. Day is taken to be 7:00am to 6:00pm
2. Evening is taken to be 6:00pm to 10:00pm.
3. Night is taken to be the remaining periods.
4. Rating Background Level (RBL) for L90 and logarithmic average for Leq
5. Assessment Background Level (ABL)
6. Rating Background Level (RBL) for L90 and logarithmic average for Leq

Unattended Monitoring Results

Location: [redacted] The Ponds

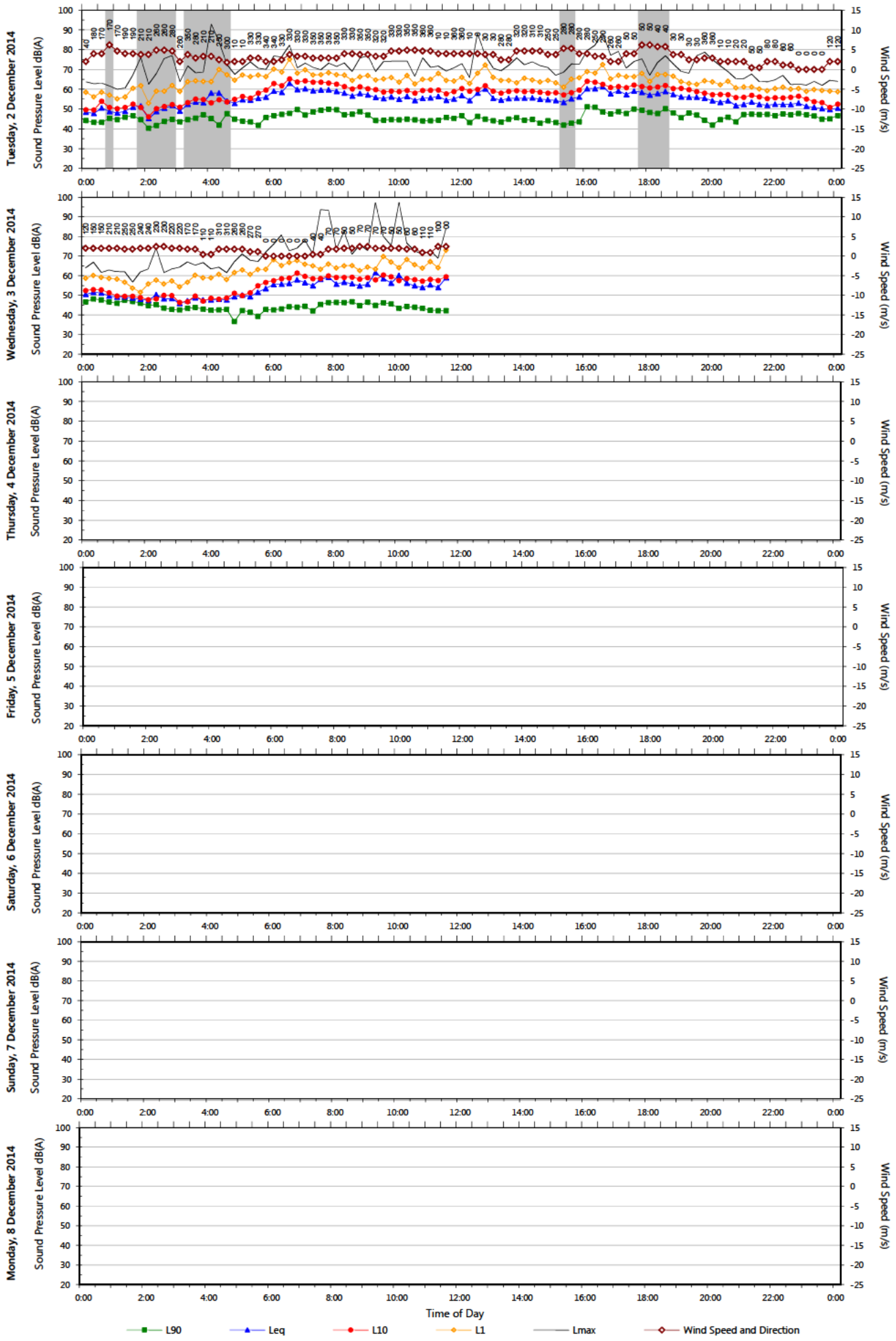


Data File: 2014-11-25_SLM_000_123_Rpt_Report.txt

Template QTE-05B (rev 109) Sydney Logger Graphs

Unattended Monitoring Results

Location: [redacted] The Ponds



Data File: 2014-11-25_SLM_000_123_Rpt_Report.txt

Template QTE-05B (rev 109) Sydney Logger Graphs

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ww.renzotonin.com.au

[redacted] Rouse Hill

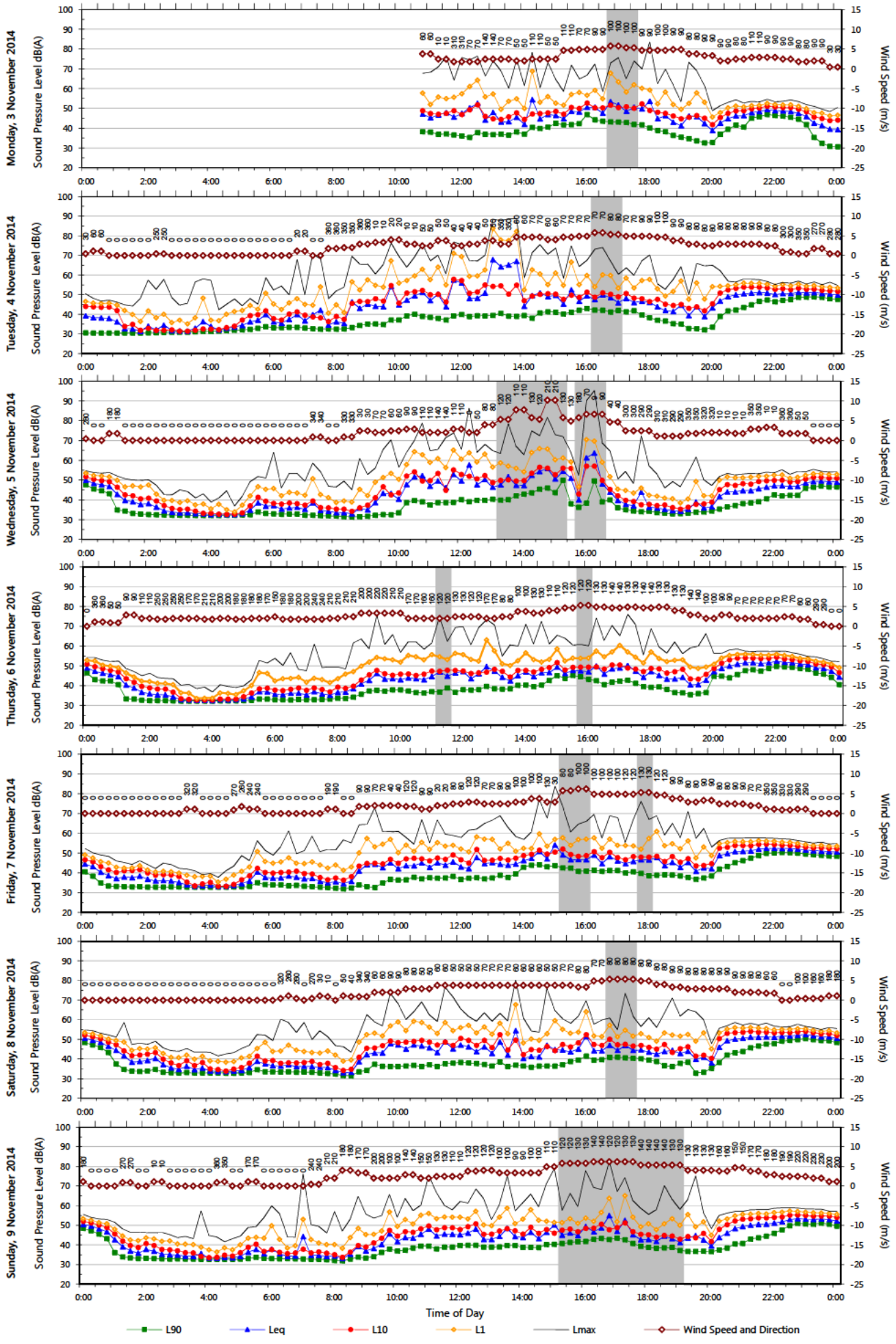
Background & Ambient Noise Monitoring Results - NSW 'Industrial Noise Policy', 2000						
	L_{A90} Background Noise Levels[5]			L_{Aeq} Ambient Noise Levels		
Date	**Day**	**Evening**	**Night**	**Day**	**Evening**	**Night**
Monday-03-November-2014	-	32.8	30.5	-	46.0	40.4
Tuesday-04-November-2014	32.7	32.7	32.1	57.0	47.8	45.3
Wednesday-05-November-2014	-	33.0	32.3	-	42.6	43.5
Thursday-06-November-2014	33.7	36.0	32.8	45.8	48.9	44.1
Friday-07-November-2014	32.6	37.5	32.9	45.6	49.0	46.1
Saturday-08-November-2014	32.8	33.3	32.7	45.7	48.0	45.8
Sunday-09-November-2014	-	-	33.1	-	-	48.0
Monday-10-November-2014	-	35.1	33.2	-	46.2	45.8
Tuesday-11-November-2014	-	-	-	-	-	-
Representative Weekday	**32.7**	**34.1**	**32.6**	**52.9**	**47.2**	**44.6**
Representative Weekend	**32.8**	**33.3**	**32.9**	**45.7**	**48.0**	**47.0**
Representative Week	**32.7**	**33.3**	**32.8**	**51.9**	**47.3**	**45.3**

Notes:

1. Day is taken to be 7:00am to 6:00pm
2. Evening is taken to be 6:00pm to 10:00pm.
3. Night is taken to be the remaining periods.
4. Rating Background Level (RBL) for L90 and logarithmic average for Leq
5. Assessment Background Level (ABL)
6. Rating Background Level (RBL) for L90 and logarithmic average for Leq

Unattended Monitoring Results

Location: [redacted] Rouse Hill

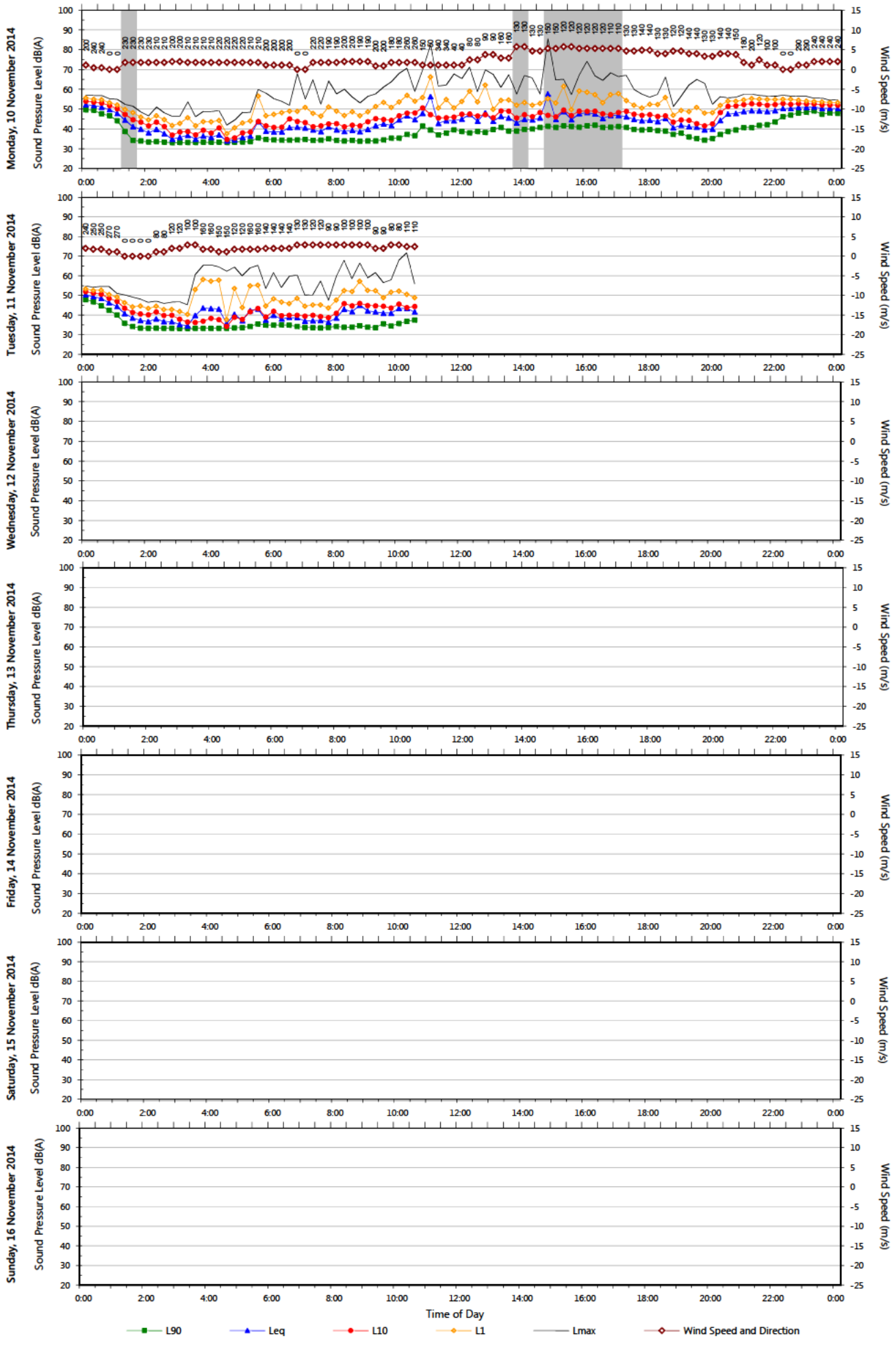


Data File: TG264-05 67 Tallawong Rd, Rouse Hill.txt

Template QTE-05B (rev 109) Sydney Logger Graphs

Unattended Monitoring Results

Location: [redacted] Rouse Hill



Data File: TG264-05 67 Tallawong Rd, Rouse Hill.txt

Template QTE-05B (rev 109) Sydney Logger Graphs

APPENDIX E SMTF noise and vibration design measures

Table E1: SMTF Operations

			No. of source events/items per typical worst-case 15-minute period								
			Early morning	Shoulder	Day			Evening			Night
Area	**Operation**	**Details / Source location**	**4am to 5am**	**5am to 7am**	**7am - 10am**	**10am - 12pm**	**12pm-6pm**	**6pm-8pm**	**8pm to 10pm**	**10pm-2am**	**2am to 4am**
Stabling	Train preparation	• Commences approx. 20 minutes prior to departure. • Conducted by remote control from the Administration Building. • Compressor on 5min for first 15min • HVAC on med cooling during day and vent/heating at other times • Door tests with chimes disabled - will not generate noise • Air reservoir pipe (not vented)	5 trains	5 trains	-	-	5 trains	-	-	-	2 trains (in TMF)
Stabling	Train awaiting departure	• Following 20 minute departure. • Compressor off • HVAC on low cooling during day and vent/heating at other times	No additional trains from startup	2 trains			2 trains				
Stabling	Train departing	Train travelling at slow speed/ Stabling Yard neck (average 15km/h) Controlled by train systems sources	2	5	-	-	5	-	-	-	2
Stabling	Train arriving	Train travelling at slow speed/ Stabling Yard neck (average 15km/h) Controlled by train systems sources	-	-	5	-	-	6	-	2	-
Stabling	Train cleaning (internal)	• Services take up to one hour per train set • Trains will be cleaned: - At the end of the morning peak; - At the end of the evening peak; - Once all trains have returned at night • Up to nine trains being cleaned at one time. • HVAC on low cooling during day and heat/vent other times.	-	-	-	9 trains	-	-	9 trains	-	9 trains
Stabling	Horn sounding	• Provided for emergency use only. Not used for standard operations.	0	0	0	0	0	0	0	0	0
Graffiti and Biocleaning	Cleaning	• Irregular and intermitent activity. • Limit to day and evening period.	0	0	1	1	1	1	1	0	0
Maintenance	Corrective & Preventative	• 4 roads occupied, no compressor, HVAC on vent • All eastern doors open during the day period (7am to 6pm), otherwise doors closed except during train entry/egress. Single door open during other periods. • It is recommended that doors remain closed wherever practical for noise management.	-	4 trains	4 trains	4 trains	4 trains	4 trains	4 trains	4 trains	4 trains
Maintenance	Corrective & Preventative	Impact wrench - Ingersoll-Rand 8049 operating in maintenance area	-	2	2	2	2	2	2	2	2
Maintenance	Train moving	• Train Warning Alarm - 2 x BBS-107 per road (1 train entering in 15 min period) - Ambient noise sensing. Noise level no more than 15dB(A) above ambient noise level. - On 5min in 15min period while train arriving/ departing shed	2	2	2	2	2	2	2	2	2
Maintenance	Heavy cleaning	• One road only • Door to cleaning road closed	-	-	1	1	1	1	1	-	-
Maintenance	Internal loading general	• Forklift - Maximum 5 tonne, operating in maintenance area - Broadband reverse alarm (quacker)	1	1	1	1	1	1	1	1	1
Maintenance	Train Lifting Equipment (TLE)	• 1 per road (assumed 1 operating in 15 min period)	1	1	1	1	1	1	1	1	1
Maintenance	Loading dock truck	Loading dock sources identified below: • Truck (semi-trailer) delivery - External movements between gate and Maintenance building • Truck park inside building	-	-	1	1	1	1	1	-	-
Maintenance	Loading dock forklift	• Forklift - Maximum 5 tonne, operating in maintenance area - Broadband reverse alarm (quacker)	-	-	1	1	1	1	1	-	-
Maintenance	General lifting	• Crane (electric) - Flashing light warning only, no alarm siren	1	1	1	1	1	1	1	1	1

			No. of source events/items per typical worst-case 15-minute period								
			Early morning	Shoulder	Day			Evening			Night
Area	**Operation**	**Details / Source location**	**4am to 5am**	**5am to 7am**	**7am - 10am**	**10am - 12pm**	**12pm-6pm**	**6pm-8pm**	**8pm to 10pm**	**10pm-2am**	**2am to 4am**
Maintenance	Roof chiller/VRVs/CRAC Noise reduction based on 50*log relationship with conservative correction	For a design day the typical loads peaking at up to 100% at 2PM and minimum of 30% at 6 AM are : - 0-20% zero - 20-40% 11hrs - 40-60%6hrs - 60-80% 8hrs - 80-100% 2 hrs	40% (-15dB)	40% (-15dB)	60% (-8dB)	80% (-3dB)	80-100%	80% (-3dB)	60% (-8dB)	40% (-15dB)	40% (-15dB)
Train wash	Train wash plant	• In use 7:00am to 3:00pm; 7:00pm to 10:00pm, 7 days/ week • Train Wash specification: the noise level emitted from the TWP while operating under the worst conditions shall not exceed 75 dB(A) when measured at a distance of 1 metre from any part of the Train Wash. This includes blowers to dry train after washing and does not include the noise reduction provided by the enclosure.	-	-	1	1	1	1	1	-	-
Wheel lathe	Under floor wheel lathe (UFWL) (8 hours per day)	• 8 hours, 7 days during Initial operations (7am - 11pm at Ultimate design) • Wheel Lathe specification: the noise level emitted from the Wheel Lathe under all working conditions shall not exceed 80 dB(A) when measured at a level of 1.5 m above floor level and at any point 3 m away from the Wheel Lathe	-	-	1	1	1	1	1	-	-
Wheel lathe	Train Shunter	• Electric Locomotive Train Shunter (details to be provided)	-	-	1	1	1	1	1	1	-
Infra Workshop and Rail Store	Intermittent sources	• Assumed day use only	-	-	Y	Y	Y	-	-	-	-
Admin building	Car park	• Light vehicles arriving or departing car park	30	30	30	30	30	30	30	30	30
Admin building	Mechanical - ac related equip.	For a design day the typical loads peaking at up to 100% at 2PM and minimum of 30% at 6 AM are : - 0-20% zero - 20-40% 11hrs - 40-60%6hrs - 60-80% 8hrs - 80-100% 2 hrs	40% (-15dB)	40% (-15dB)	60% (-8dB)	80% (-3dB)	80-100%	80% (-3dB)	60% (-8dB)	40% (-15dB)	40% (-15dB)
Bulk supply point	Transformer	60MVA power transformer	1	1	1	1	1	1	1	1	1
Bulk supply point	Harmonic filters	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC
Dist and traction sub	Power transformers	Traction substation external bay	2	2	2	2	2	2	2	2	2
Dist and traction sub	15MVA 33/11kV Transformer	Traction substation external bay	1	1	1	1	1	1	1	1	1
Dist and traction sub	0.65kVA 11/400V Transformer	Traction substation external bay	1	1	1	1	1	1	1	1	1
Dist and traction sub	Reactor	Traction substation external bay	1	1	1	1	1	1	1	1	1
Dist and traction sub	Harmonic filters	Located inside substation building.	-	-	-	-	-	-	-	-	-
Pad mount substations	LWA BLG Kiosk K3	• 11/0.4kV • Located north of Maintenance building	1	1	1	1	1	1	1	1	1
Pad mount substations	WORKSHOP Kiosk K4	• 11/0.4kV • Located east of Workshop building	1	1	1	1	1	1	1	1	1
Pad mount substations	ADMIN SERVICES Kiosk K1	• 11/0.4kV • Located in Administration Services	2	2	2	2	2	2	2	2	2
Pad mount substations	ADMIN SERVICES Isolating transformer	• Located in Administration Services area	1	1	1	1	1	1	1	1	1

MEP SPECIFICATION									NOISE LEVEL REQUIREMENTS										
MEP Design ID	Item Description	Air flow L/s	Static pressure Pa	Duty/ Standby	Location	Serving	Brand	Model No.	Sound level description	Lp dB(A)*	Maximum L_W dB(A)	63Hz (LwZ)	125Hz (LwZ)	250Hz (LwZ)	500Hz (LwZ)	1kHz (LwZ)	2kHz (LwZ)	4kHz (LwZ)	8kHz (LwZ)
CH-RTF-AD2-01	Air Cooled Chiller - Screw compressor		Full Load	Duty	01L2001 PLANT		Carrier	30XA0352-A		75 @ 1m	95		96	95	92	91	84	79	
HP-RTF-AD2-01	Hot Water Heat Pump		Full Load @ 160	Duty	01L2001 PLANT		Carrier	30RQSY160A	Outlet Ducted		90		94	93	87	85	81	73	
									Radiated + Inlet	73 @ 1m	90		91	90	88	85	82	75	
CHWP-RTF-AD2-01&02	Chilled Water Pump	14	300000	1 x Duty, 1 x Standby	01L2001 PLANT	CH-RTF-AD2-01	Grundfos	CUE 5.5kW	Motor fan	65 @ xm									
HHWP-RTF-AD2-01&02	Hot Water Pump	3.5	300000	1 x Duty, 1 x Standby	01L2001 PLANT	HP-RTF-AD2-01	Grundfos	CUE 3kW	Motor fan	60 @ xm									
TEF-RTF-AD2-01	Main Toilet Exhaust Fan	1495	100	Duty	01L2001 PLANT	01GL042 WCM 01GL043 WCF 01GL044 AWC 01GL047 CLNRS CPD. 01L1046 WCM 01L1047 WCF 01L1048 AWC 01L1054 CLNRS CPD	Fantech	AP series ducted fan AP0564AP5/14	Inlet	57 @ 3m	78	79	81	76	75	73	70	67	56
									Outlet	60 @ 3m	80	78	85	76	76	75	73	70	63
EF-RTF-AD2-03	Minor Exhaust Fans	200	70	Duty	01L2001 PLANT	01GL038 RECYCLABLES	Fantech	TD-800/200SIL	Inlet	40 @ 3m	61	50	51	57	55	58	53	48	43
									Outlet	40 @ 3m	61	63	61	63	56	55	53	49	43
EF-RTF-AD1-05	Minor Exhaust Fans	400	70	Duty	01L1028 UTILITY	01L1028 UTILITY	Fantech	MMD356/2	Inlet	45 @ 3m	65	67	69	64	61	60	58	55	45
									Outlet	As inlet									
EF-RTF-AD1-06	Minor Exhaust Fans	400	70	Duty	01L1029 UTILITY	01L1029 UTILITY	Fantech	MMD356/2	Inlet	45 @ 3m	65	67	69	64	61	60	58	55	45
									Outlet	As inlet									
EF-RTF-AD2-07	Minor Exhaust Fans	40	70	Duty	01L2001 PLANT	01L1059 CLEANER	Fantech	JCE152-3SJK	Inlet	29 @ 3m	50	0	48	46	42	44	46	31	17
									Outlet	As inlet									
AHU-RTF-AD2-01	Air Handling Unit	1150	250	Duty	01L2001 PLANT		Carrier	39CQM	In-duct INLET		87	76	82	81	83	84	80	75	70
									In-duct OUTLET		88	87	87	83	83	84	80	75	70
									AIRBORNE		78	76	77	70	74	75	69	47	70
AHU-RTF-AD2-02	Air Handling Unit	2850	250	Duty	01L2001 PLANT		Carrier	39CQM	In-duct INLET		90	83	86	85	89	85	81	75	68
									In-duct OUTLET		90	94	91	87	89	85	81	75	68
									AIRBORNE		81	83	81	74	80	76	70	47	68
AHU-RTF-AD2-03	Air Handling Unit	2400	250	Duty	01L2001 PLANT		Carrier	39CQM	In-duct INLET		88	82	84	83	88	83	78	72	66
									In-duct OUTLET		88	93	89	85	88	83	78	72	66
									AIRBORNE		79	82	79	72	79	74	67	44	66
OU-RTF-AD2-01	DX split Outdoor Units			Duty	01GL054 CONDENSERS ROOM	CA-RTF-ADG-01	Daikin	RXS25 DX split outdoor unit RKS25K3V1B	Cooling	46 @ 1m	63	63	64	64	61	58	52	46	47
									Heating	47 @ 1m	64	67	68	65	62	60	54	47	39
VOU-RTF-ADG-01				Duty	01GL054 CONDENSERS ROOM	CA-RTF-ADG-02 CA-RTF-ADG-03 CA-RTF-ADG-04 CA-RTF-ADG-05 FCU-RTF-ADG-24	Daikin	REYQ10PY1	Cooling	58 @ 1m	74	77	78	76	73	68	62	59	52
EF-RTF-AD2-01&02	System Equipment Gas Suppression Exhaust Fan	1145	100	1 x Duty, 1 x Standby	01L2001 PLANT	01GL052 SYSTEMS EQUIP	Fantech	AP series ducted fan AP0504AP5/16	Inlet	59 @ 3m	80	75	79	73	76	75	73	68	59
									Outlet	60 @ 3m	81	74	76	80	74	77	73	68	64
TEF-RTF-ADG-02	Minor Toilet Exhaust Fan	120	70	Duty	01GL012 CORR	01GL009 WC 01GL010 AWC	Fantech	TD-500/150SIL	Inlet	40 @ 3m	60	51	49	57	59	55	53	45	43
									Outlet	41 @ 3m	62	61	51	62	61	57	49	43	39
EF-RTF-ADG-10&11	Minor Exhaust Fans	2640-530	150	1 x Duty, 1 x Standby	01GL017 CORR	01GL025 UPS 01GL027 SWITCHROOM	Fantech	AP0564GP6/25	Inlet	56 @ 3m	76	77	79	71	72	72	69	66	58
									Outlet	57 @ 3m	78	77	80	72	74	74	69	67	60
EF-RTF-ADG-12&13	Minor Exhaust Fans	100	100	1 x Duty, 1 x Standby	01GL019 GAS SUPPRESS	01GL019 GAS SUPPRESS	Fantech	TD-500/150	Inlet	39 @ 3m	59	0	48	56	57	54	53	45	38
									Outlet	As inlet									
OAF-RTF-ADG-05	Outside air fans	20		Duty	01GL007 OCC MAN.	CA-RTF-ADG-04	Fantech	JCE152-3SJK	Inlet	29 @ 3m	50	0	48	46	42	44	46	31	17
									Outlet	As inlet									
OAF-RTF-ADG-06	Outside air fans	40		Duty	01GL006 INCIDENT MAN.	CA-RTF-ADG-05	Fantech	TD-800/200N	Inlet	40 @ 3m	60	0	51	63	54	54	54	49	40
									Outlet	As inlet									
OAF-RTF-ADG-07	Outside air fans	100		Duty	01GL014 OCC MEET	FCU-RTF-ADG-24	Fantech	TD-800/200N	Inlet	40 @ 3m	60	0	51	63	54	54	54	49	40
									Outlet	As inlet									
OAF-RTF-ADG-08	Outside air fans	20		Duty	01GL013 OCC OFFICE	CA-RTF-ADG-02	Fantech	JCE152-3SJK	Inlet	29 @ 3m	50	0	48	46	42	44	46	31	17
									Outlet	As inlet									
OAF-RTF-ADG-09	Outside air fans	50		Duty	01GL008 OCC STAFF KITCHEN	CA-RTF-ADG-03	Fantech	TD-500/150	Inlet	39 @ 3m	59	0	48	56	57	54	53	45	38
									Outlet	As inlet									
SAF-RTF-ADG-01&02	Lift ventilation	0.26m3/s	100	1 x Duty, 1 x Standby	01GL041 TRAINING 1	01GL045 LIFT 01L1049 LIFT	Fantech	PCE356ER	Inlet	44 @ 3m	64	67	65	64	62	57	57	53	45
SAF-RTF-ADG-03&04	UPS & Switchroom ventilation	2640-530	50	1 x Duty, 1 x Standby	In the corridor outside 01GL016 CALL CENTRE	01GL025 UPS 01GL027 SWITCHROOM	Fantech	AP0564GP6/25	Inlet	56 @ 3m	76	77	79	71	72	72	69	66	58
									Outlet	57 @ 3m	78	77	80	72	74	74	69	67	60
MAINTENANCE BUILDING (MB)																			
VOU-RTF-MB-01	VRF OUTDOOR UNIT			Duty	ROOF PLATFORM GRIDS 04 TO 06	CA-RTF-MB-01, 02, 03, 04, 05, 06 & 07	Daikin	REYQ8PY1		58 @ 1m	74	76	78	77	72	68	61	59	53
VOU-RTF-MB-02	VRF OUTDOOR UNIT			Duty	ROOF PLATFORM GRIDS 04 TO 06	FCU-RTF-MB-01, 02 & 03	Daikin	REYQ14PY1		62 @ 1m	78	82	80	79	75	73	69	62	60
VOU-RTF-MB-03	VRF OUTDOOR UNIT			Duty	ROOF PLATFORM GRIDS 04 TO 06	FCU-RTF-MB-04, 05, 06, 07, 08, 09 & 10	Daikin	REYQ34PY1		63 @ 1m	83	80	80	79	73	68	62	55	49

MEP SPECIFICATION									NOISE LEVEL REQUIREMENTS									
MEP Design ID	Item Description	Air flow L/s	Static pressure Pa	Duty/ Standby	Location	Serving	Brand	Model No.	Sound level description	Lp dB(A)*	Maximum L_W dB(A)	63Hz (LwZ)	125Hz (LwZ)	250Hz (LwZ)	500Hz (LwZ)	1kHz (LwZ)	2kHz (LwZ)	4kHz (LwZ)	8kHz (LwZ)
VOU-RTF-MB-04	VRF OUTDOOR UNIT			Duty	GRD FLR ELECTRICAL WORKSHOP PLANT	CA-RTF-MB-09 & 10	Daikin	RXYMQ4AV4A	Cooling	50 @ 1m	78	82	80	79	75	73	69	62	60
									Heating	52 @ 1m	74	76	78	77	72	68	61	59	53
VOU-RTF-MB-05	VRF OUTDOOR UNIT			Duty	GRD FLR ELECTRICAL WORKSHOP PLANT	FCU-RTF-MB-11, 12 & 13	Daikin	RXYQ10TY1A		57 @ 1m	59	62	63	61	58	53	47	40	31
VOU-RTF-MB-06	VRF OUTDOOR UNIT			Duty	ROOF PLATFORM GRIDS 04 TO 06		Daikin	REYQ8PY1		58 @ 1m	74	76	78	77	72	68	61	59	53
VOU-RTF-MB-07	VRF OUTDOOR UNIT			Duty	ROOF PLATFORM GRIDS 04 TO 06		Daikin	REYQ8PY1		58 @ 1m	74	76	78	77	72	68	61	59	53
OU-RTF-MB-01&02	DX Outdoor Unit			1 x Duty, 1 x Standby	IU-RTF-MB-01		Daikin	RXM46PVMA P-Series	Cooling (H/SL)	47/44 @ 1m									
									Heating (H/SL)	48/45 @ 1m									
OU-RTF-MB-03&04	DX Outdoor Unit			1 x Duty, 1 x Standby	IU-RTF-MB-03		Daikin	RXM50PVMA P-Series	Cooling (H/SL)	47/44 @ 1m									
									Heating (H/SL)	48/45 @ 1m									
COU-RTF-MB-01&02	Data Room Air Conditioner		99.8	1 x Duty, 1 x Standby	ROOF PLATFORM GRIDS 04 TO 06	CRAC-RF-MB-01 &02	Liebert	LDF76 1 off	Vmax setting 81		86	84	85	87	82	80	77	74	72
AHU-RTF-MB-01	Air Handling Unit	4000		Duty	Main Depot		Carrier	39 G Galaxy 1319			85								
RCHP-RTF-MB-01	Air Cooled Reverse Cycle			Duty	AHU-RTF-MB-01		AHI Carrier	30RQSY160A	Outlet Ducted		90		94	93	87	85	81	73	
									Radiated + Inlet	73 @ 1m	90		91	90	88	85	82	75	
OAF-RTF-MB-01	Outdoor Air Supply Fan	90	100	Duty	4006 DUTY AND SUPERVISOR OFFICE		Fantech	TD-800/200N	Inlet	40 @ 3m	60		51	63	54	54	54	49	40
OAF-RTF-MB-02	Outdoor Air Supply Fan	145	100	Duty	4007 DCC		Fantech	TD-800/200SIL Lo speed	Inlet	40 @ 3m	61	50	51	57	55	58	53	48	43
									Outlet	40 @3m	61	63	61	63	56	55	53	49	43
									Outlet	41 @ 3m	62	61	51	62	61	57	49	43	39
OAF-RTF-MB-05	Outdoor Air Supply Fan	20	100	Duty	4004 FIRST AID		Fantech	JCE152-3SJK Lo speed	Inlet	29 @ 3m	50		48	46	42	44	46	31	17
OAF-RTF-MB-06	Outdoor Air Supply Fan	120	100	Duty	4112 MEET 1		Fantech	TD-500/150SIL Hi speed	Inlet	40 @ 3m	60	51	49	57	59	55	53	45	43
									Outlet	41 @ 3m	62	61	51	62	61	57	49	43	39
OAF-RTF-MB-07	Outdoor Air Supply Fan	120	100	Duty	4111 MEET 2		Fantech	TD-500/150SIL Hi speed	Inlet	40 @ 3m	60	51	49	57	59	55	53	45	43
									Outlet	41 @ 3m	62	61	51	62	61	57	49	43	39
OAF-RTF-MB-08	Outdoor Air Supply Fan	50	100	Duty	4119 KITCHEN		Fantech	TD-500/150 Lo speed	Inlet	39 @ 3m	59		48	56	57	54	53	45	38
OAF-RTF-MB-09	Outdoor Air Supply Fan	300	100	Duty	4120 DINING		Fantech	TD-1300/250SIL Hispeed	Inlet	47 @ 3m	67	58	59	71	63	61	59	55	52
									Outlet	53 @ 3m	74	56	62	70	72	71	62	51	48
									Breakout	35 @ 3m	56	54	48	57	46	54	46	36	38
OAF-RTF-MB-10	Outdoor Air Supply Fan	80	100	Duty	4117 OFFICE 7P		Fantech	TD-800/200N Lo speed	Inlet	40 @ 3m	60		51	63	54	54	54	49	40
OAF-RTF-MB-11	Outdoor Air Supply Fan	240	100	Duty	4118 MAINTENANCE OFFICE		Fantech	TD-1300/250SIL Lo speed	Inlet	42 @ 3m	63	61	56	66	59	56	54	50	47
									Outlet	49 @ 3m	69	55	60	66	68	66	56	46	42
									Breakout	31 @ 3m	52	55	48	51	43	50	41	31	33
OAF-RTF-MB-12	Outdoor Air Supply Fan	100	100	Duty	4110 CORRIDOR		Fantech	TD-500/150SIL Hi speed	Inlet	40 @ 3m	60	51	49	57	59	55	53	45	43
									Outlet	41 @ 3m	62	61	51	62	61	57	49	43	39
OAF-RTF-MB-13	Outdoor Air Supply Fan	50	100	Duty	4040 RS & STC ELEC WKS		Fantech	TD-500/150 Lo speed	Inlet	39 @ 3m	59		48	56	57	54	53	45	38
OAF-RTF-MB-14	Outdoor Air Supply Fan	50	100	Duty	4043 OH & POW WK		Fantech	TD-500/150 Lo speed	Inlet	39 @ 3m	59		48	56	57	54	53	45	38
OAF-RTF-MB-15	Outdoor Air Supply Fan	50	100	Duty	4044 ST & TUN WK/ST		Fantech	TD-500/150 Lo speed	Inlet	39 @ 3m	59		48	56	57	54	53	45	38
OAF-RTF-MB-18	Outdoor Air Supply Fan	20	100	Duty	4113 ROLLING STOCK MANAGER		Fantech	JCE152-3SJK Lo speed	Inlet	29 @ 3m	50		48	46	42	44	46	31	17
OAF-RTF-MB-19	Outdoor Air Supply Fan	20	100	Duty	4114 POWER SUPPLY MANAGER		Fantech	JCE152-3SJK Lo speed	Inlet	29 @ 3m	50		48	46	42	44	46	31	17
OAF-RTF-MB-20	Outdoor Air Supply Fan	20	100	Duty	4115 SIGNALS & COMMS MANAGER		Fantech	JCE152-3SJK Lo speed	Inlet	29 @ 3m	50		48	46	42	44	46	31	17
OAF-RTF-MB-21	Outdoor Air Supply Fan	20	100	Duty	4116 STATION BASE MANAGER		Fantech	JCE152-3SJK Lo speed	Inlet	29 @ 3m	50		48	46	42	44	46	31	17
OAF-RTF-MB-22	Outdoor Air Supply Fan	20	100	Duty	4170 EMU		Fantech	JCE152-3SJK Lo speed	Inlet	29 @ 3m	50		48	46	42	44	46	31	17
OAF-RTF-MB-23	Outdoor Air Supply Fan	20	100	Duty	4009 OFF IP		Fantech	JCE152-3SJK Lo speed	Inlet	29 @ 3m	50		48	46	42	44	46	31	17
OAF-RTF-MB-24	Outdoor Air Supply Fan	80	100	Duty	4010 OFF 8 SIGNALS		Fantech	TD-800/200N Lo speed	Inlet	40 @ 3m	60		51	63	54	54	54	49	40
OAF-RTF-MB-25	Outdoor Air Supply Fan	80	100	Duty	4011 OFF 8 P OH&P		Fantech	TD-800/200N Lo speed	Inlet	40 @ 3m	60		51	63	54	54	54	49	40
OAF-RTF-MB-26&27	Outdoor Air Supply Fan	120	100	1 x Duty, 1 x Standby	4057 SIGNAL COMMUNICATIONS		Fantech	TD-500/150SIL Hi speed	Inlet	40 @ 3m	60	51	49	57	59	55	53	45	43
									Outlet	41 @ 3m	62	61	51	62	61	57	49	43	39
TEF-RTF-MB-01	EXHAUST FAN	350	70	Duty	GL WCF AWC WCM		Fantech	TD2P800/200N	Inlet	51 @ 3m	72		63	74	65	65	67	60	52
TEF-RTF-MB-02	EXHAUST FAN	1730	70	Duty	L1 F CH RM, M CH RM, CLN ST		Fantech	AP0504AP5B003	Inlet	58 @ 3m	79	78	77	74	75	74	72	69	57
									Outlet	57 @ 3m	78	78	75	74	71	74	71	68	58
TEF-RTF-MB-03	EXHAUST FAN	70	70	Duty	02GL025 UNISEX		Fantech	TD-500/150 Lo speed	Inlet	39 @ 3m	59		48	56	57	54	53	45	38
EF-RTF-MB-01	EXHAUST FAN	720	70	Duty	02GL057 SIGNALS COMMUNICATION (FIRE SUPPRESS)		Fantech	APS0404AA5H005 APS0404AA5/19	Inlet	49 @ 3m	70	67	71	68	66	65	62	57	46
									Outlet	50 @ 3m	71	69	72	68	67	66	64	60	52
EF-RTF-MB-02 & 03	EXHAUST FAN	1320-265	150	1 x Duty, 1 x Standby	02GL048 MSB (OVER HEAT)		Fantech	AP0564GP6/10	Inlet	55 @ 3m	76	72	76	73	71	72	69	64	57
EF-RTF-MB-05	EXHAUST FAN	120	70	Duty	02GL043 CLEANERS STORE		Fantech	Unknown (most likely TD-2000/315SIL) Lo speed	Inlet	43 @ 3m	64	60	63	68	59	58	55	52	48
									Outlet	48 @ 3m	69	60	69	69	65	66	57	43	42
									Breakout	33 @ 3m	54	50	56	52	47	50	46	43	37
EF-RTF-MB-06	EXHAUST FAN	40	70	Duty	02L1050 STORE		Fantech	TD-350/125 Lo speed	Inlet	40 @ 3m	60		50	55	58	57	52	46	39
EF-RTF-MB-07&08	EXHAUST FAN	60	70	1 x Duty, 1 x Standby	02GL091 GAS BOTTLE STORE		Fantech	TD-800/200 Lo speed	Inlet	45 @ 3m	66		52	56	65	58	59	54	47
EF-RTF-MB-09&10	EXHAUST FAN	50	70	1 x Duty, 1 x Standby	02GL080 BATTERY MAINTENANCE	02GL080 BATTERY MAINTENANCE	Fantech	TD-800/200N Lo speed	Inlet	45 @ 3m	66		52	56	65	58	59	54	47
EF-RTF-MB-11	EXHAUST FAN	5180	70	Duty	02GL066 WELD SHOP	EXHAUST HOOD	Fantech	AP0714AP5/25	Outlet	67 @ 3m	88	88	89	84	83	83	81	79	73
EF-RTF-MB-12	EXHAUST FAN	360	70	Duty	02GL066 WELD SHOP	WELDING FUME EXTRACTION ARM	Fantech	AP0314AP5/25	Outlet	48 @ 3m	68	71	64	63	62	65	61	56	52
EF-RTF-MB-13	EXHAUST FAN	360	70	Duty	02GL066 WELD SHOP	WELDING FUME EXTRACTION ARM	Fantech	AP0314AP5/25	Outlet	48 @ 3m	68	71	64	63	62	65	61	56	52
EF-RTF-MB-15	EXHAUST FAN	1420	100	Duty	02GL082 PAINTING & EQUIPMENT AREA	SPRAY PAINT BOOTH	MN Spraybooths	Industrial open face spray booth		83 @ 1m	89	83	84	92	85	83	80	77	74

MEP SPECIFICATION									NOISE LEVEL REQUIREMENTS									
MEP Design ID	Item Description	Air flow L/s	Static pressure Pa	Duty/ Standby	Location	Serving	Brand	Model No.	Sound level description	Lp dB(A)*	Maximum L_W dB(A)	63Hz (LwZ)	125Hz (LwZ)	250Hz (LwZ)	500Hz (LwZ)	1kHz (LwZ)	2kHz (LwZ)	4kHz (LwZ)	8kHz (LwZ)
VEF-RTF-MB-01 to 08	Ventilation Exhaust Fan (Smoke Rated)	12500	152	Emergency use	MAIN WORKSHOP		Fantech	RSS1006CA12/35	Inlet	68 @ 3m	89	89	84	88	87	83	80	76	70
									Outlet	69 @ 3m	90	92	87	89	88	84	81	78	73
VEF-RTF-MB-01 to 08	Ventilation Exhaust Fan (Smoke Rated)	6287	38	Duty	MAIN WORKSHOP		Fantech	RSS1006CA12/35 (25Hz)	Inlet	54 @ 3m	74	73	74	77	70	68	66	63	56
									Outlet	54 @ 3m	75	76	76	77	72	68	67	64	59
ACFD-RTF-MB-01	AIR COMPRESSOR FILTER & DRYER			Duty	02L1071 PLANT ROOM		Champion	CSF30		74 @ 1m +/- 3dBA									
SAF-RTF-MB-01 & 02	SUPPLY AIR FAN	260	70	1 x Duty, 1 x Standby	CORRIDOR	LIFT SHAFT	Fantech	AP0314AP5/17	Outlet	45 @ 3m	65	65	64	68	60	58	57	53	48
SAF-RTF-MB-03 & 04	SUPPLY AIR FAN	1320 - 265	150	1 x Duty, 1 x Standby	MSB		Fantech	AP0564GP6/10	Outlet	55 @ 3m	76	72	76	73	71	72	69	64	57
DANGEROUS GOODS (DG)																			
EF-RTF-DG-01&02	EXHAUST FAN (DG RATED)	220	70	1 x Duty, 1 x Standby	DANGEROUS GOODS STORE CHEM	DANGEROUS GOODS STORE CHEM	Fantech	AP0314AP5/14	Inlet	45 @ 3m	66	60	62	68	63	60	57	50	40
									Outlet	44 @ 3m	65	65	64	68	60	58	57	53	48
EF-RTF-DG-03&04	EXHAUST FAN (DG RATED)	540	70	1 x Duty, 1 x Standby	DANGEROUS GOODS STORE NO. 1	DANGEROUS GOODS STORE NO. 1	Fantech	AP0404AP5/13	Inlet	50 @ 3m	71	68	72	69	67	66	63	58	47
									Outlet	51 @ 3m	72	70	73	69	68	67	65	61	53
EF-RTF-DG-05&06	EXHAUST FAN (DG RATED)	220	70	1 x Duty, 1 x Standby	DANGEROUS GOODS STORE NO. 2	DANGEROUS GOODS STORE NO. 2	Fantech	AP0314AP5/14	Inlet	45 @ 3m	66	60	62	68	63	60	57	50	40
									Outlet	44 @ 3m	65	65	64	68	60	58	57	53	48
INFRASTRUCTURE WORKSHOP (IW)																			
VOU-RTF-IW-01	VRV AIR CONDITIONING UNITS (OUTDOORS)			Duty	03GL013 AC PLANT	FCU-RTF-IW-01 TO 05	Daikin	RXYQ30TSY1A	Combination of RXYQ14 and 16TY1A	64 @ 1m	62	64	64	63	60	57	51	44	37
OU-RTF-IW-01	OUTDOOR UNIT (HOLD)			Duty		IU-RTF-IW-01	Daikin	RXM46PVMA	Heating	48 @ 1m	63	71	68	63	60	59	52	45	37
TEF-RTF-IW-01	EXHAUST FAN	805	100	Duty	03GL009 WC/SH/CH-M	03GL005 AWC 03GL007 WC/SH/CH-F 03GL009 WC/SH/CH-M	Fantech	PCD456ER	Inlet	46 @ 3m	67	77	76	67	64	59	57	55	51
EF-RTF-IW-01&02	EXHAUST FAN (DG RATED)	100	50	1 x Duty, 1 x Standby	03GL022 DNGR GOODS 1	03GL022 DNGR GOODS 1	Fantech	AP0314AP5/10	Inlet	45 @ 3m	66	60	62	68	63	60	57	50	40
									Outlet	44 @ 3m	65	65	64	68	60	58	57	53	48
ACFD-RTF-IW-01	AIR COMPRESSOR FILTER & DRYER			Duty	03GL019 MAIN STR	03GL019 MAIN STR	Champion	CSF15		67 @ 1m									
RAIL STORE (RS)																			
EF-RTF-RS-01&02	EXHAUST FAN (DG RATED)	100	50	Duty	04GL003 DANGEROUS GOODS STORE	04GL003 DANGEROUS GOODS STORE	Fantech	AP0314AP5/14	Inlet	45 @ 3m	66	60	62	68	63	60	57	50	40
									Outlet	44 @ 3m	65	65	64	68	60	58	57	53	48
SECURITY BUILDING (SB)																			
OAF-RTF-SB-01	OUTDOOR AIR FAN	20	70	Duty			Fantech	JCE152-3SJK (Lo speed)	Inlet	29 @ 3m	50		48	46	42	44	46	31	17
OAF-RTF-SB-02&03	OUTDOOR AIR FAN	30	70	1 x Duty, 1 x Standby			Fantech	JCE152-3SJK (Lo speed)	Inlet	29 @ 3m	50		48	46	42	44	46	31	17
TEF-RTF-SB-01	TOILET EXHAUST FAN	40	20	Duty			Fantech	HV-150AE	Inlet	37 @ 3m									
OU-RTF-SB-01	SPLIT OUTDOOR UNIT			Duty			Daikin	RZQ100KCV4A	Heating	53 @ 1m	68	65	72	70	65	61	56	51	45
									Cooling	51 @ 1m	66	66	70	68	63	59	55	50	44
OU-RTF-SB-02&03	SPLIT OUTDOOR UNIT			1 x Duty, 1 x Standby			Daikin	RXM20PVMA	Heating	47 @ 1m	73	77	79	75	71	67	60	58	51
									Cooling	46 @ 1m	76	82	80	79	75	70	66	61	60
WHEEL LATHE (WL)																			
OAF-RTF-WL-01	OUTDOOR AIR FAN	20	70	Duty	10GL003 OFFICE	10GL003 OFFICE	Fantech	JCE152-3SJK (Lo speed)	Inlet	29 @ 3m	50	0	48	46	42	44	46	31	17
TEF-RTF-WL-01	TOILET EXHAUST FAN	40	20	Duty	10GL004 WC	10GL004 WC	Fantech	HV-150AE	Inlet	37 @ 3m									
EF-RTF-WL-01	EXHAUST FAN	1000	150	Duty	10GL001 WHEEL LATHE	10GL002 PIT	Fantech	AP0564AP5/14	Inlet	61 @ 3m	82	75	82	79	79	78	74	66	59
									Outlet	62 @ 3m	83	77	79	79	82	76	75	72	68
OU-RTF-WL-01	SPLIT OUTDOOR UNIT			Duty	Outside 10GL003 OFFICE to the south	CA-RTF-WL-01	Daikin	RXS25K3V1B	Heating	43 @ 1m	62	68	67	64	60	57	48	44	39
									Cooling	42 @ 1m	60	60	60	61	59	54	46	40	36
ACFD-RTF-WL-01	AIR COMPRESSOR FILTER & DRYER			Duty	10GL001 WHEEL LATHE	10GL001 WHEEL LATHE	Champion	CSF11		67 @ 1m									
* - Details and conditions of sound pressure level measurements vary by manufacturer. Refer to manufacturers details.																			

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MEP Design ID	Item Description	Air flow L/s	Static pressure Pa	Duty/ Standby	Location	Serving	Brand	Model No.	INSERTION LOSS	no detail	no detail2	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
	Acoustic louvre				Admin plant room	Walls	Sound Attenuators Australia/IAC Acoust c	AL1H				3	7	9	13	15	16	15	14
	Acoustic louvre				Fire pump room	pump room	Sound Attenuators Australia/IAC Acoustic	AL2H				8	11	16	22	27	29	27	24

Table E3: SMTF Additional noise sources

Report ref: NWRLOTS-NRT-RTF-AV-RPT-105005-E

SPECIFICATION DETAIL				NOISE LEVEL REQUIREMENTS									
Item/Area	Sub Item	Details	Sound level description	Max Lp dB(A)*	Maximum Lw dB(A)	63Hz (LwZ)	125Hz (LwZ)	250Hz (LwZ)	500Hz (LwZ)	1kHz (LwZ)	2kHz (LwZ)	4kHz (LwZ)	8kHz (LwZ)
Train	HVAC High cooling	2 x every car. Operates 30 deg ambient and above.	External		86	83	86	88	84	81	77	71	64
Train	HVAC Medium Cooling	2 x every car. Operates 24 deg to 29 deg ambient	External		85	82	85	87	83	80	76	70	63
Train	HVAC Half Cooling	2 x every car	External		82	79	82	84	80	77	73	67	60
Train	HVAC Low Cooling	2 x every car	External		81	78	81	83	79	76	72	66	59
Train	HVAC Ventilation	2 x every car. Operates ambient temp up to 23 deg	External		78	75	78	80	76	73	69	63	56
Train	HVAC Heating	2 x every car. No louder than ventiliation mode	External		78	75	78	80	76	73	69	63	56
Train	CVS	2 x set, car 1 and 6	External		83		82	80	80	78	75	66	
Train	APU Compressor	2 x set, car 1 and 6. Noise level when operating Operating for 5min in 15min period. Spectra from A-Sets	External		92	97	91	84	90	89	82	77	76
Train	Total train on MED COOLING - No comp				96	93	97	98	94	91	87	81	74
Train	Total train in VENTILATION - No comp				91	86	91	91	88	86	82	75	67
Train	Brake Pipe venting	2 x set, car 1 and 6 Venting occurs during maintenance only in Maintenance building	External	85dB(A) @ 1m	93								
Train	Door tests during preparation	Electonic test only Do not generate noise		-	-								
Train	Horn	Used for emergency purpose only. Not used for general operations and movement in the RTRF		-	-								
Maintenance building	Train lift	When operating To operate for 120 sec in any 15 minute period Per lift on lifting road		75dB(A) @ 1m	83								
Maintenance building	Impact wrench	2 x Ingersoll -Rand 8049			90								
Maintenance building	Train warning alarm	2 x BBS-107 per road Ambient noise sensing			110								
Maintenance building	Forklift	2 x Maximum 5 tonne with Broadband reverse alarm (quacker)			90								
Maintenance building	Truck idling	Steady state source - no correction for duration			96								
Maintenance building	Truck moving	Per m/ Lw - 10km/h, LAeq15minute			68								
Train wash	Wash plant	When operating The noise level emitted from the TWP while operating under the worst conditions shall not exceed 75 dB(A) when measured at a distance of 1m from any part of the Train Wash. This includes blowers to dry train after washing and does not include the noise reduction provided by the enclosure.	Reverberant field	75dB(A) @ 1m									

SPECIFICATION DETAIL				NOISE LEVEL REQUIREMENTS								
Item/Area	Sub Item	Details	Sound level description	Max Lp dB(A)*	Maximum Lw dB(A)	63Hz (LwZ)	125Hz (LwZ)	250Hz (LwZ)	500Hz (LwZ)	1kHz (LwZ)	2kHz (LwZ)	4kHz (LwZ)	8kHz (LwZ)
Wheel lathe	Single head underfloor lathe	The noise level emitted from the Wheel Lathe under all working conditions shall not exceed 80 dB(A) when measured at a level of 1.5m above floor level and at any point 3 m away from the Wheel Lathe	Reverberant field	80dB(A) @ 3m	98								
Wheel lathe	Shunter	Electric shunter	Electric shunter										
Electrical	ADMIN SERVICES Kiosk K1	11/0.4kV			65	68	70	65	65	59	54	49	42
Electrical	LWA BLG Kiosk K3	11/0.4kV			70	73	75	70	70	64	59	54	47
Electrical	Workshop Kiosk K4	11/0.4kV			75	78	80	75	75	69	64	59	52
Electrical	Admin services isolating transformer				70	73	75	70	70	64	59	54	47
Traction substation	Power transformers	2 off in external bay			62	65	67	62	62	56	51	46	39
Traction substation	Transformer	1 x 15MVA 33/11kV in external bay			70	73	75	70	70	64	59	54	47
Traction substation	Transformer	1 x 0.65kVA 11/400V in external bay			60	63	65	60	60	54	49	44	37
Traction substation	Reactor	1 in external bay			63	66	68	63	63	57	52	47	40
Traction substation	Harmonic Filters				TBC								
Bulk supply	Transformer	60MVA power transformer Sound power level will be 85dB (A) at no-load, 100% Ur volts. Assumed 88 dB(A) under load.			88	91	93	88	88	82	77	72	65
Bulk supply	Harmonic Filters	TBC			TBC								
Fire pump room	Electric Pump and motor((mergency use)	45kW, IE2, 2 pole motor NK 65-250/251 A2-F-B-E-BQQE	Case radiated	78dB(A) @ 1m	94								
Fire pump room	Diesel pump and motor (Emergency use)	Motor - 43kW @ 2700RPM Pump - NK 65-250/270 Y1-F-B-E-BQQE	Case radiated	110dB(A) @ 1m	126								
		Motor - 43kW @ 2700RPM Pump - NK 65-250/270 Y1-F-B-E-BQQE	Exhaust with attenuator	85dB(A) @ 1m	93								
Backup generator		Noise level specification 1m from unit		85dB(A) @ 1m									

Table E5: Noise and Vibration Requirements and Verification - SMTF MEP Mitigation measures

Report ref: NWRLOTS-NRT-RTF-AV-RPT-105005-E

MEP Specification			MEP NV Requirements		
Relevant equipment	Location	Serving	Case radiated noise	Discharge side of unit	Intake side of unit
ADMINISTRATION BUILDING (AD)					
CH-RTF-AD2-01	01L2001 PLANT	FCUs	Acoustic louvres to plantroom - Refer Table E5	2.5m long, 100mm lined circular duct on each fan to roof discharge	Acoustic louvres to plantroom - Refer Table E5
HP-RTF-AD2-01	01L2001 PLANT	FCUs	Acoustic louvres to plantroom - Refer Table E5	3m long, 50mm lined rectangular duct on each fan to roof discharge	Acoustic louvres to plantroom - Refer Table E5
CHWP-RTF-AD2-01	01L2001 PLANT	CH-RTF-AD2-01	Acoustic louvres to plantroom - Refer Table E5	Acoustic louvres to plantroom - Refer Table E5	Acoustic louvres to plantroom - Refer Table E5
CHWP-RTF-AD2-02 (Standby)	01L2001 PLANT	CH-RTF-AD2-01	Acoustic louvres to plantroom - Refer Table E5	Acoustic louvres to plantroom - Refer Table E5	Acoustic louvres to plantroom - Refer Table E5
HHWP-RTF-AD2-01	01L2001 PLANT	HP-RTF-AD2-01	Acoustic louvres to plantroom - Refer Table E5	Acoustic louvres to plantroom - Refer Table E5	Acoustic louvres to plantroom - Refer Table E5
HHWP-RTF-AD2-02 (Standby)	01L2001 PLANT	HP-RTF-AD2-01	Acoustic louvres to plantroom - Refer Table E5	Acoustic louvres to plantroom - Refer Table E5	Acoustic louvres to plantroom - Refer Table E5
TEF-RTF-AD2-01	01L2001 PLANT	01GL042 WCM 01GL043 WCF 01GL044 AWC 01GL047 CLNRS CPD. 01L1046 WCM 01L1047 WCF 01L1048 AWC 01L1054 CLNRS CPD	Acoustic louvres to plantroom - Refer Table E5	Acoustic louvres to plantroom - Refer Table E5	Acoustic louvres to plantroom - Refer Table E5
EF-RTF-AD2-03	01L2001 PLANT	01GL038 RECYCLABLES	Acoustic louvres to plantroom - Refer Table E5	Acoustic louvres to plantroom - Refer Table E5	Acoustic louvres to plantroom - Refer Table E5
EF-RTF-AD1-05	01L1028 UTILITY	01L1028 UTILITY	Locate the fan above the CAC39 ceiling tiles	Provide acoustically insulated ductwork (50mm insulation) for a minimum length of 1m	Provide acoustically insulated ductwork (50mm insulation) for a minimum length of 1m. Provide acoustically insulated return air plenum and cushion head. Provide acoustically insulated circular flexible ductwork for a minimum length of 1m.
EF-RTF-AD1-06	01L1029 UTILITY	01L1029 UTILITY	Locate the fan above the CAC39 ceiling tiles	Provide acoustically insulated ductwork (50mm insulation) for a minimum length of 1m	Provide acoustically insulated ductwork (50mm insulation) for a minimum length of 1m. Provide acoustically insulated return air plenum and cushion head. Provide acoustically insulated circular flexible ductwork for a minimum length of 1m.
EF-RTF-AD2-07	01L2001 PLANT	01L1059 CLEANER	Acoustic louvres to plantroom - Refer Table E5	No acoustic treatment required	No acoustic treatment required
AHU-RTF-AD2-01	01L2001 PLANT	01L1032 OFFICE SOUTH ZONE	Acoustic louvres to plantroom - Refer Table E5	ATT-RTF-AD2-01 - Acoustic attenuator equivalent to Fantech RT17E (1800mm long with 47% free area) within the plant room. Provide acoustically insulated ductwork (50mm insulation) for the entire length of the supply air ductwork after the attenuator. Install a false ceiling (solid plasterboard) above 01L1042 OFFICE. REASON: duct breakout noise in 01L1042 OFFICE.	Provide acoustically insulated ductwork (50mm insulation) for the entire length. Provide acoustically insulated cushion head. Provide acoustically insulated circular flexible ductwork for a minimum length of 1m.
AHU-RTF-AD2-02	01L2001 PLANT	01L1032 OFFICE CENTRAL ZONE	Acoustic louvres to plantroom - Refer Table E5	ATT-RTF-AD2-02 - acoustic attenuator equivalent to Fantech RT22F (2100mm long with 53% free area) within radial bend inside the plant room. Provide acoustically insulated ductwork (50mm insulation) for the entire length of the supply air ductwork after the attenuator. Provide acoustically insulated circular flexible ductwork for a minimum length of 2m. A solid plasterboard is to be added with a gap of a minimum 100mm from the secondary ceiling type CL-306. REASON: duct breakout noise in 01L1001 LOBBY. (refer Table E5)	Provide acoustically insulated ductwork (50mm insulation) for the entire length. Provide acoustically insulated cushion head. Provide acoustically insulated circular flexible ductwork for a minimum length of 1m. Encase return air ductwork above Boardroom with 13mm plasterboard, independant from duct and internally lined with bulk insulation.

MEP Specification			MEP NV Requirements		
Relevant equipment	**Location**	**Serving**	**Case radiated noise**	**Discharge side of unit**	**Intake side of unit**
AHU-RTF-AD2-03	01L2001 PLANT	01L1032 OFFICE NORTH ZONE	Acoustic louvres to plantroom - Refer Table E5	Install acoustic attenuator Fantech RT17D (1500mm long with 47% free area) within the plant room. Provide acoustically insulated ductwork (50mm insulation) for the entire length of the supply air ductwork after the attenuator. Install second ceiling (solid plasterboard) to cover all services above 01L1044 INT 1. Minimum 100mm above finished ceiling. REASON: duct breakout noise in 01L1044 INT 1. (refer Table E5)	Provide acoustically insulated ductwork (50mm insulation) for the entire length. Provide acoustically insulated cushion head. Provide acoustically insulated circular flexible ductwork for a minimum length of 1m.
COU-RTF-ADG-01	01GL054 CONDENSERS ROOM	CRAC-RTF-ADG-01 CRAC-RTF-ADG-02	Refer ARCH details in Table E5	Refer ARCH details in Table E5	Refer ARCH details in Table E5
COU-RTF-ADG-02	01GL054 CONDENSERS ROOM	CRAC-RTF-ADG-01 CRAC-RTF-ADG-02	Refer ARCH details in Table E5	Refer ARCH details in Table E5	Refer ARCH details in Table E5
COU-RTF-ADG-03	01GL054 CONDENSERS ROOM	CRAC-RTF-ADG-03 CRAC-RTF-ADG-04	Refer ARCH details in Table E5	Refer ARCH details in Table E5	Refer ARCH details in Table E5
COU-RTF-ADG-04	01GL054 CONDENSERS ROOM	CRAC-RTF-ADG-03 CRAC-RTF-ADG-04	Refer ARCH details in Table E5	Refer ARCH details in Table E5	Refer ARCH details in Table E5
OU-RTF-AD2-01	01GL054 CONDENSERS ROOM	CA-RTF-ADG-01	Refer ARCH details in Table E5	Refer ARCH details in Table E5	Refer ARCH details in Table E5
VOU-RTF-ADG-01	01GL054 CONDENSERS ROOM	CA-RTF-ADG-02 CA-RTF-ADG-03 CA-RTF-ADG-04 CA-RTF-ADG-05 FCU-RTF-ADG-24	Refer ARCH details in Table E5	Refer ARCH details in Table E5	Refer ARCH details in Table E5
EF-RTF-AD2-01	01L2001 PLANT	01GL052 SYSTEMS EQUIP	Locate the fan above the CAC39 ceiling tiles	Provide acoustically insulated ductwork (50mm insulation) for a minimum length of 2m	Provide acoustically insulated ductwork (50mm insulation) for a minimum length of 2m
EF-RTF-AD2-02 (Standby)	01L2001 PLANT	01GL052 SYSTEMS EQUIP	Locate the fan above the CAC39 ceiling tiles	Provide acoustically insulated ductwork (50mm insulation) for a minimum length of 2m	Provide acoustically insulated ductwork (50mm insulation) for a minimum length of 2m
TEF-RTF-ADG-02	01GL012 CORR	01GL009 WC 01GL010 AWC	Locate the fan above the CAC39 ceiling tiles	No acoustic treatment required	Provide acoustically insulated ductwork (50mm insulation) for a minimum length of 1m to each air grilles
EF-RTF-ADG-10	01GL017 CORR	01GL025 UPS 01GL027 SWITCHROOM	Locate the fan inside swithroom.	Operate on VSD. Provide 1m of 50mm internaly lined duct to intake side before lined plenum.	Operate on VSD. Provide acoustically insulated ductwork (50mm insulation) from fan to first inlet (2m).
EF-RTF-ADG-11 (Standby)	01GL017 CORR	01GL025 UPS 01GL027 SWITCHROOM	Locate the fan inside swithroom.	Operate on VSD. Provide 1m of 50mm internaly lined duct to intake side before lined plenum.	Operate on VSD. Provide acoustically insulated ductwork (50mm insulation) from fan to first inlet (2m).
EF-RTF-ADG-12	01L1019 GAS SUPPRESS	01L1019 GAS SUPPRESS	No acoustic treatment required	No acoustic treatment required	No acoustic treatment required
EF-RTF-ADG-13 (Standby)	01L1019 GAS SUPPRESS	01L1019 GAS SUPPRESS	No acoustic treatment required	No acoustic treatment required	No acoustic treatment required
OAF-RTF-ADG-01	01GL022 OCC MECH	CRAC-RTF-ADG-01	No acoustic treatment required	No acoustic treatment required	No acoustic treatment required
OAF-RTF-ADG-02 (Standby)	01GL022 OCC MECH	CRAC-RTF-ADG-02	No acoustic treatment required	No acoustic treatment required	No acoustic treatment required
OAF-RTF-ADG-05	01GL007 OCC MAN.	CA-RTF-ADG-04	Locate the fan above the CAC39 ceiling tiles	Provide acoustically insulated circular flexible ductwork for a minimum length of 1m	No acoustic treatment required
OAF-RTF-ADG-06	01GL006 INCIDENT MAN.	CA-RTF-ADG-05	Locate the fan above the CAC39 ceiling tiles	Provide acoustically insulated ductwork (50mm insulation) for a minimum length of 1m. Provide acoustically insulated circular flexible ductwork for a minimum length of 2m	No acoustic treatment required
OAF-RTF-ADG-07	01GL014 OCC MEET	FCU-RTF-ADG-24	Locate the fan inside OCC MECH	No acoustic treatment required	No acoustic treatment required
OAF-RTF-ADG-08	01GL013 OCC OFFICE	CA-RTF-ADG-02	Locate the fan above the CAC39 ceiling tiles	Provide acoustically insulated circular flexible ductwork for a minimum length of 1m	No acoustic treatment required
OAF-RTF-ADG-09	01GL008 OCC STAFF KITCHEN	CA-RTF-ADG-03	Locate the fan above the CAC39 ceiling tiles	Provide acoustically insulated circular flexible ductwork for a minimum length of 1m	No acoustic treatment required
SAF-RTF-ADG-01 & 02	01GL041 TRAINING 1	01GL045 LIFT 01L1049 LIFT	Locate the fan above the CAC39 ceiling tiles.	Provide acoustically insulated ductwork (50mm insulation) to all duct work from fan to lift shaft.	Provide acoustically insulated ductwork (50mm insulation) to all duct work and return plenum.
SAF-RTF-ADG-03	In the corridor outside 01GL016 CALL CENTRE	01GL025 UPS 01GL027 SWITCHROOM	Locate the fan above the CAC39 ceiling tiles	Operate on VSD. Provide acoustically insulated ductwork (50mm insulation) from fan to first supply grill (4m).	Operate on VSD. Provide 1m of 50mm internaly lined duct to intake side before lined plenum.
SAF-RTF-ADG-04 (Standby)	In the corridor outside 01GL016 CALL CENTRE	01GL025 UPS 01GL027 SWITCHROOM	Locate the fan above the CAC39 ceiling tiles	Operate on VSD. Provide acoustically insulated ductwork (50mm insulation) from fan to first supply grill (4m).	Operate on VSD. Provide 1m of 50mm internaly lined duct to intake side before lined plenum.
LIFT SHAFT RELIEF AIR GRILLES	PLANT ROOM	LIFT SHAFT	N/A	Provide 50mm internally lined duct from grille to plantroom external louvre	N/A
MAINTENANCE BUILDING (MB)					
VOU-RTF-MB-01	ROOF PLATFORM GRIDS 04 TO 06		Operate on VSD	Operate on VSD	Operate on VSD

MEP Specification			MEP NV Requirements		
Relevant equipment	Location	Serving	Case radiated noise	Discharge side of unit	Intake side of unit
VOU-RTF-MB-02	ROOF PLATFORM GRIDS 04 TO 06		Operate on VSD	Operate on VSD	Operate on VSD
VOU-RTF-MB-03	ROOF PLATFORM GRIDS 04 TO 06		Operate on VSD	Operate on VSD	Operate on VSD
VOU-RTF-MB-06	ROOF PLATFORM GRIDS 04 TO 06		Operate on VSD	Operate on VSD	Operate on VSD
VOU-RTF-MB-07	ROOF PLATFORM GRIDS 04 TO 06		Operate on VSD	Operate on VSD	Operate on VSD
VOU-RTF-MB-04	02GL059 A/C PLANT	02GL059 A/C PLANT	No acoustic treatment required	Min 50mm acoustically lining to disharge ductwork.	No acoustic treatment required
VOU-RTF-MB-05	02GL059 A/C PLANT	02GL059 A/C PLANT	No acoustic treatment required	Min 50mm acoustically lining to disharge ductwork.	No acoustic treatment required
AHU-RTF-MB-01	Rooftop btw Grids 11-12 and B-C	Main Depot	Operate on VSD	Provide acoustically insulated ductwork (50mm insulation) for a minimum length of 5m from the fan	Provide acoustically insulated ductwork (50mm insulation) for a minimum length of 5m from the fan
OAF-RTF-MB-01	02GL006 DUTY AND SUPERVISOR	02GL006 DUTY AND SUPERVISOR	CAC39 ceiling tiles provided. See ARCH.	Provide acoustically insulated circular flexible ductwork for a minimum length of 2m	Min 1m lined duct to inlet side.
OAF-RTF-MB-02	02GL007 DCC	02GL007 DCC	CAC39 ceiling tiles provided. See ARCH.	Provide acoustically insulated circular flexible ductwork for a minimum length of 2m	Min 1m lined duct to inlet side.
OAF-RTF-MB-03	02GL008 1ST LINE MAINTENANCE OFFICE	02GL008 1ST LINE MAINTENANCE OFFICE	CAC39 ceiling tiles provided. See ARCH.	Provide acoustically insulated circular flexible ductwork for a minimum length of 2m	Min 1m lined duct to inlet side.
OAF-RTF-MB-04	02GL005 OFFICE 1P	02GL005 OFFICE 1P	CAC39 ceiling tiles provided. See ARCH.	Provide acoustically insulated circular flexible ductwork for a minimum length of 1m	No acoustic treatment
OAF-RTF-MB-05	02GL004 FIRST AID	02GL004 FIRST AID	CAC39 ceiling tiles provided. See ARCH.	Provide acoustically insulated circular flexible ductwork for a minimum length of 1m	No acoustic treatment
OAF-RTF-MB-06	02GL012 MEET 1	02GL012 MEET 1	CAC39 ceiling tiles provided. See ARCH.	No acoustic treatment required	Min 1m lined duct to inlet side.
OAF-RTF-MB-07	02GL011 MEET 2	02GL011 MEET 2	CAC39 ceiling tiles provided. See ARCH.	No acoustic treatment required	Min 1m lined duct to inlet side.
OAF-RTF-MB-08	02GL019 KITCHEN	02GL019 KITCHEN	CAC39 ceiling tiles provided. See ARCH.	No acoustic treatment required	Min 1m lined duct to inlet side.
OAF-RTF-MB-09	02GL020 DINING	02GL020 DINING	CAC39 ceiling tiles provided. See ARCH.	No acoustic treatment required	Min 1m lined duct to inlet side.
OAF-RTF-MB-10	02L1017 OFFICE 7P	02L1017 OFFICE 7P	CAC39 ceiling tiles provided. See ARCH.	No acoustic treatment required	Min 1m lined duct to inlet side.
OAF-RTF-MB-11	02L1018 MAINTENANCE OFFICE	02L1018 MAINTENANCE OFFICE	CAC39 ceiling tiles provided. See ARCH.	No acoustic treatment required	Min 1m lined duct to inlet side.
OAF-RTF-MB-12	02GL010 CORRIDOR	02GL010 CORRIDOR	CAC39 ceiling tiles provided. See ARCH.	No acoustic treatment required	Min 1m lined duct to inlet side.
OAF-RTF-MB-13	02GL040 RS & STC ELEC WKS	02GL040 RS & STC ELEC WKS	Installed above plasterboard or fibre cement ceiling - CL-302/CL-303	No acoustic treatment required	Min 1m lined duct to inlet side.
OAF-RTF-MB-14	02GL041 OH & POW WK	02GL041 OH & POW WK	Installed above plasterboard or fibre cement ceiling - CL-302/CL-303	No acoustic treatment required	Min 1m lined duct to inlet side.
OAF-RTF-MB-15	02GL042 ST & TUN WK/ST	02GL042 ST & TUN WK/ST	Installed above plasterboard or fibre cement ceiling - CL-302/CL-303	No acoustic treatment required	Min 1m lined duct to inlet side.
OAF-RTF-MB-18	02L1013 ROLLING STOCK MANAGER	02L1013 ROLLING STOCK MANAGER	CAC39 ceiling tiles provided. See ARCH.	Provide acoustically insulated circular flexible ductwork for a minimum length of 1m	No acoustic treatment
OAF-RTF-MB-19	02L1014 POWER SUPPLY MANAGER	02L1014 POWER SUPPLY MANAGER	CAC39 ceiling tiles provided. See ARCH.	Provide acoustically insulated circular flexible ductwork for a minimum length of 1m	No acoustic treatment
OAF-RTF-MB-20	02L1015 SIGNAL & COMMS MANAGER	02L1015 SIGNAL & COMMS MANAGER	CAC39 ceiling tiles provided. See ARCH.	Provide acoustically insulated circular flexible ductwork for a minimum length of 1m	No acoustic treatment
OAF-RTF-MB-21	02L1016 STATION BASE MANAGER	02L1016 STATION BASE MANAGER	CAC39 ceiling tiles provided. See ARCH.	Provide acoustically insulated circular flexible ductwork for a minimum length of 1m	No acoustic treatment
OAF-RTF-MB-22	02L1070 EMU	02L1070 EMU	CAC39 ceiling tiles provided. See ARCH.	Provide acoustically insulated circular flexible ductwork for a minimum length of 1m	No acoustic treatment
OAF-RTF-MB-23	02GL058 COMMS	02GL058 COMMS	CAC39 ceiling tiles provided. See ARCH.	Provide acoustically insulated circular flexible ductwork for a minimum length of 1m	No acoustic treatment
OAF-RTF-MB-24	02GL010 OFF 8P -SIGNALS	02GL010 OFF 8P -SIGNALS	CAC39 ceiling tiles provided. See ARCH.	Provide acoustically insulated ductwork (50mm insulation) for a minimum length of 1m from the fan. Provide acoustically insulated circular flexible ductwork for a minimum length of 2m	Min 1m lined duct to inlet side.
OAF-RTF-MB-25	02GL011 OFF 8P -OH&P	02GL011 OFF 8P -OH&P	CAC39 ceiling tiles provided. See ARCH.	Provide acoustically insulated ductwork (50mm insulation) for a minimum length of 1m from the fan. Provide acoustically insulated circular flexible ductwork for a minimum length of 2m	Min 1m lined duct to inlet side.
TEF-RTF-MB-01	02GL002 CORRIDOR outside 02GL024 LOBBY	02GL020 AWC 02GL021 LOBBY 02GL022 WCM 02GL023 WCF 02GL024 LOBBY	CAC39 ceiling tiles provided. See ARCH.	Provide minimum 2m of acoustically lined 50mm duct from fan.	Provide acoustically insulated ductwork (50mm insulation) for a minimum length of 1m from the fan. Provide acoustically insulated circular flexible ductwork for a minimum length of 1m to each of the air grilles.
TEF-RTF-MB-02	02L1029 MALE CHANGE	02L1025 AWC 02L1026 WCF 02L1027 FEMALE CHANGE 02L1028 WCM 02L1029 MALE CHANGE	CAC39 ceiling tiles provided. See ARCH.	Provide minimum 2m of acoustically lined 50mm duct from fan.	Provide acoustically insulated ductwork (50mm insulation) for a minimum length of 2m from the fan before the junction. Provide acoustically insulated circular flexible ductwork for a minimum length of 1m to each of the air grilles.
TEF-RTF-MB-03	02GL025 UNISEX	02GL025 UNISEX	CAC39 ceiling tiles provided. See ARCH.	No acoustic treatment required	Provide acoustically insulated circular flexible ductwork for a minimum length of 1m to the air grille

MEP Specification			MEP NV Requirements		
Relevant equipment	**Location**	**Serving**	**Case radiated noise**	**Discharge side of unit**	**Intake side of unit**
SAF-RTF-MB-01 & 02	CORRIDOR	LIFT SHAFT	Locate the fan above the CAC39 ceiling tiles.	Provide acoustically insulated ductwork (50mm insulation) to all duct work from fan to lift shaft.	Provide acoustically insulated ductwork (50mm insulation) to all duct work and return plenum.
EF-RTF-MB-01	02GL057 SIGNAL COMMUNICATION	02GL057 SIGNAL COMMUNICATION	No acoustic treatment required	Provide acoustically insulated ductwork (50mm insulation) for a minimum length of 1m from the fan	Provide acoustically insulated ductwork (50mm insulation) for a minimum length of 2m from the fan
EF-RTF-MB-02&03	02GL048 MSB	02GL048 MSB	No acoustic treatment required	Provide acoustically insulated ductwork (50mm insulation) for a minimum length of 2m from the fan	Provide acoustically insulated ductwork (50mm insulation) for a minimum length of 1m from the fan.
SAF-RTF-MB-03&04	02GL048 MSB	02GL048 MSB	No acoustic treatment required	Provide acoustically insulated ductwork (50mm insulation) for a minimum length of 1m from the fan.	Provide acoustically insulated ductwork (50mm insulation) for a minimum length of 1m from the fan.
EF-RTF-MB-05	02GL043 CLRNS STR	02GL043 CLRNS STR	Installed above plasterboard ceiling CL-303. See Table E5	No acoustic treatment required	Provide acoustically insulated circular flexible ductwork for a minimum length of 1m to the air grille.
EF-RTF-MB-06	02L1050 STORE	02L1050 STORE	Installed above plasterboard ceiling CL-303. See Table E5	No acoustic treatment required	Provide acoustically insulated ductwork (50mm insulation) for a minimum length of 1m from the fan.
EF-RTF-MB-07 & 08	02GL091GAS BOTTLE STORE	02GL057 COMMS	No acoustic treatment required	Provide acoustically insulated ductwork (50mm insulation) for a minimum length of 1m from the fan.	Provide acoustically insulated ductwork (50mm insulation) for a minimum length of 1m from the fan.
EF-RTF-MB-09 & 10	02GL080 BATTERY MAINTENANCE	02GL080 BATTERY MAINTENANCE	No acoustic treatment required	Provide acoustically insulated ductwork (50mm insulation) for a minimum length of 1m from the fan.	Provide acoustically insulated circular flexible ductwork for a minimum length of 1m to the air grille
EF-RTF-MB-11	02GL066 WELD SHOP	EXHAUST HOOD	Fan located inside maintenance building, and to allow lined duct either side.	Provide 4m of 50mm internally lined ductwork from fan to roof discharge.	Internal criteria 70-75dB(A) for weld shop. Provide 2m of 50mm internally lined ductwork before intake to weld shop
EF-RTF-MB-12 & 13	02GL066 WELD SHOP	WELDING FUME EXTRACTION ARM	Fan located inside maintenance building, and to allow lined duct either side.	Provide 2m of 50mm internally lined ductwork from fan to roof discharge.	Internal criteria 70-75dB(A) for weld shop. Provide 1m of 50mm internally lined ductwork before intake to weld shop
EF-RTF-MB-15	02GL082 PAINTING & EQUIPMENT AREA	SPRAY PAINT BOOTH	Encase fan with 13mm plasterboard or 9mm FC sheet and bulk insulation, independent of fan.	Provide 4m of 50mm internally lined ductwork from fan to roof discharge.	Internal criteria 70-75dB(A) for weld shop. Provide 2m of 50mm internally lined ductwork before intake to weld shop
VEF-RTF-MB-01	Various locations on the roof of the Maintenance Building	Cleaning and Maintenance Tracks	No acoustic treatment required	No acoustic treatment required	No acoustic treatment required
VEF-RTF-MB-02	Various locations on the roof of the Maintenance Building	Cleaning and Maintenance Tracks	No acoustic treatment required	No acoustic treatment required	No acoustic treatment required
VEF-RTF-MB-03	Various locations on the roof of the Maintenance Building	Cleaning and Maintenance Tracks	No acoustic treatment required	No acoustic treatment required	No acoustic treatment required
VEF-RTF-MB-04	Various locations on the roof of the Maintenance Building	Cleaning and Maintenance Tracks	No acoustic treatment required	No acoustic treatment required	No acoustic treatment required
VEF-RTF-MB-05	Various locations on the roof of the Maintenance Building	Cleaning and Maintenance Tracks	No acoustic treatment required	No acoustic treatment required	No acoustic treatment required
VEF-RTF-MB-06	Various locations on the roof of the Maintenance Building	Cleaning and Maintenance Tracks	No acoustic treatment required	No acoustic treatment required	No acoustic treatment required
VEF-RTF-MB-07	Various locations on the roof of the Maintenance Building	Cleaning and Maintenance Tracks	No acoustic treatment required	No acoustic treatment required	No acoustic treatment required
VEF-RTF-MB-08	Various locations on the roof of the Maintenance Building	Cleaning and Maintenance Tracks	No acoustic treatment required	No acoustic treatment required	No acoustic treatment required
ACFD-RTF-MB-01	02L1071 PLANT ROOM		Acoustic louvres AL1H. Louvres as per ARCH-701	Acoustically line exhaust ducts to roof cowl, with minimum 2m of 50mm internally lined duct. Acoustic enclosure around compressor required for environmental noise control (as full height wall grille identified).	Acoustically line exhaust ducts to roof cowl, with minimum 2m of 50mm internally lined duct. Acoustic enclosure around compressor required for environmental noise control (as full height wall grille identified).
COU-RTF-MB-01	ROOF PLATFORM GRIDS 04 TO 06	CRAC-RTF-MB-01	Equipment operate on VSD	Equipment operate on VSD	Equipment operate on VSD
COU-RTF-MB-02	ROOF PLATFORM GRIDS 04 TO 06	CRAC-RTF-MB-02	Equipment operate on VSD	Equipment operate on VSD	Equipment operate on VSD
CH-RTF-MB-01	ROOF PLATFORM GRIDS 10 TO 12		Equipment operate on VSD	Equipment operate on VSD	Equipment operate on VSD
DANGEROUS GOODS (DG)					
EF-RTF-DG-01 & 02	11GL001 CHEM STR	11GL001 CHEM STR	Criteria set as 65dB(A) for unoccupied storage area. No acoustic treatment required	No acoustic treatment required	No acoustic treatment required
EF-RTF-DG-03 & 04	11GL002 DG1	11GL002 DG1	Criteria set as 65dB(A) for unoccupied storage area. No acoustic treatment required	No acoustic treatment required	No acoustic treatment required
EF-RTF-DG-05 & 06	11GL003 DG2	11GL003 DG2	Criteria set as 65dB(A) for unoccupied storage area. No acoustic treatment required	No acoustic treatment required	No acoustic treatment required
INFRASTRUCTURE WORKSHOP (IW)					
VOU-RTF-IW-01	03GL013 AC PLANT	03GL013 AC PLANT	No acoustic treatment required	No acoustic treatment required	No acoustic treatment required
OU-RTF-IW-01	03GL013 AC PLANT	IU-RTF-IW-01	No acoustic treatment required	No acoustic treatment required	No acoustic treatment required

MEP Specification			MEP NV Requirements		
Relevant equipment	**Location**	**Serving**	**Case radiated noise**	**Discharge side of unit**	**Intake side of unit**
TEF-RTF-IW-01	03GL009 WC/SH/CH-M	03GL005 AWC 03GL007 WC/SH/CH-F 03GL009 WC/SH/CH-M	Locate fan above flush plasterboard ceiling	No acoustic treatment required	No acoustic treatment required
EF-RTF-IW-02 & 03	03GL022 DNGR GOODS 1	03GL022 DNGR GOODS 1	Criteria set as 65dB(A) for unoccupied storage area. No acoustic treatment required	1m lined duct.	1m lined duct.
ACFD-RTF-IW-01	03GL019 MAIN STR	03GL019 MAIN STR	Intermittent use within building. AS2107:2000 not applicable.	Intermittent use within building. AS2107:2000 not applicable.	Intermittent use within building. AS2107:2000 not applicable.
RAIL STORE (RS)					
EF-RTF-RS-01 & 02	04GL003 DANGEROUS GOODS STORE	04GL003 DANGEROUS GOODS STORE	Criteria set as 65dB(A) for unoccupied storage area. No acoustic treatment required	No acoustic treatment required	No acoustic treatment required
SECURITY BUILDING (SB)					
OAF-RTF-SB-01	12GL001 SEC	12GL001 SEC	Locate fan above flush plasterboard ceiling	Provide acoustically insulated circular flexible ductwork for a minimum length of 1m to the split cassette indoor unit	No acoustic treatment required
OAF-RTF-SB-02	12GL002 FIRE CONTROL ROOM	12GL002 FIRE CONTROL ROOM	No acoustic treatment required	Provide acoustically insulated circular flexible ductwork for a minimum length of 1m to the split cassette indoor unit	No acoustic treatment required
OAF-RTF-SB-03 (Standby)	12GL002 FIRE CONTROL ROOM	12GL002 FIRE CONTROL ROOM	No acoustic treatment required	Provide acoustically insulated circular flexible ductwork for a minimum length of 1m to the split cassette indoor unit	No acoustic treatment required
TEF-RTF-SB-01	12GL005 WC	12GL005 WC	No acoustic treatment required	No acoustic treatment required	No acoustic treatment required
OU-RTF-SB-01	Outside 12GL003 MESS ROOM to the south	IU-RTF-SB-01	No acoustic treatment required	No acoustic treatment required	No acoustic treatment required
OU-RTF-SB-02	Outside 12GL002 FIRE CONTROL ROOM to the south	IU-RTF-SB-02	No acoustic treatment required	No acoustic treatment required	No acoustic treatment required
OU-RTF-SB-03 (Standby)	Outside 12GL002 FIRE CONTROL ROOM to the south	IU-RTF-SB-03	No acoustic treatment required	No acoustic treatment required	No acoustic treatment required
WHEEL LATHE (WL)					
OAF-RTF-WL-01	10GL003 OFFICE	10GL003 OFFICE	Locate fan above CAC39 ceiling tiles	Provide acoustically insulated circular flexible ductwork for a minimum length of 1m to the split cassette indoor unit	No acoustic treatment required
TEF-RTF-WL-01	10GL004 WC	10GL004 WC	No acoustic treatment required	No acoustic treatment required	No acoustic treatment required
EF-RTF-WL-01	10GL001 WHEEL LATHE	10GL002 PIT	No acoustic treatment required	Provide acoustically insulated ductwork (50mm insulation) for a minimum length of 2m from the fan	Provide acoustically insulated ductwork (50mm insulation) for a minimum length of 2m from the fan
OU-RTF-WL-01	Outside 10GL003 OFFICE to the south	CA-RTF-WL-01	No acoustic treatment required	No acoustic treatment required	No acoustic treatment required
ACFD-RTF-WL-01	10GL001 WHEEL LATHE	10GL001 WHEEL LATHE	Intermittent use within building. AS2107:2000 not applicable.	Intermittent use within building. AS2107:2000 not applicable.	Intermittent use within building. AS2107:2000 not applicable.
GENERAL - INTERNAL RIGID DUCT INSULATION	ALL LOCATIONS		Perf metal faced insulation (Non-mylar lined)	Perf metal faced insulation (Non-mylar lined)	Perf metal faced insulation (Non-mylar lined)

Table E5: SMTF Architectural Mitigation Measures

ARCH SPECIFICATION				NV Requirement		
Building	**Room ID**	**Element**	**Element ID**	**Description**	**RW (ctr)**	**NRC**
Maintenance		Main walls	EL-207A	Kingspan (KS1000 MR) 80mm	27(-3)	-
Maintenance		High Walls	-	Spandek 0.48 mm (1 layer) EL-211, 120mm airspace filled with bulk fibreglass insulation 14 kg/m^3, Spandek 0.48 mm (1 layer) EL-211	27(-3)	-
Maintenance		Roof	RF-003	RO-201 - Klip lok 700 0.48 mm (1 layer), 130mm airspace filled with bulk fibreglass insulation 14 kg/m^3 (INS-301), EL-214-0.48 mm non-perf profiled metal(1 layer). Underside lined with IN-105 (50mm acoustic insulation equivalent to Polymax Absorb HD50) held in place open wire mesh.	27(-3)	0.85
Maintenance		Doors	EL-207B	Kingspan (KS1000 MR) 80mm	22(-4)	-
Maintenance		Glazing - north facade	GL-210	Fixed framed - 6.38mm laminated glass	28(-3)	-
Maintenance		Glazing - saw tooth light panels & south facade	EL-301	12m Danpalon Multicell	20(-3)	-
Maintenance		Wall Ventilator	LV	Air grills along northern and southern wall, as per architectural drawings. 1m x 2m louvres every second column (18m centres)	-	-
Maintenance	02GL040 RS & STC ELEC WKS	Ceiling	CL-303	13mm plasterboard ceiling	25	-
Maintenance	02GL041 OH & POW WK	Ceiling	CL-303	13mm plasterboard ceiling	25	-
Maintenance	02GL042 ST & TUN WK/ST	Ceiling	CL-303	13mm plasterboard ceiling	25	-
Maintenance	02GL043 CLRNS STR	Ceiling	CL-303	13mm plasterboard ceiling	25	-
Maintenance	02L1050 STORE	Ceiling	CL-302	13mm plasterboard ceiling	25	-
Maintenance	02L1071 PLANT ROOM	Louvres	LV-103	IAC Acoustic/Sound Attenuators Australia ALH1 300mm deep acoustic louvre	See Table E4	-
Administration	Plant room	External walls (above roof line)	EL-206A	Kingspan (KS1000 MR) 80mm	27(-3)	-
Administration	Plant room	Walls below roof line		1 x 13mm fire-rated plasterboard / 150mm steed stud with 75mm fibreglass ins (14kg/m3) / 1 x 13mm fire-rated PB / 1 x 9mm FC lining	55	
Administration	Plant room	Roof	RF-003	RO-201 - Klip lok 700 0.48 mm (1 layer), 130mm airspace filled with bulk fibreglass insulation 14 kg/m^3 (INS-301), EL-214-0.48 mm non-perf profiled metal(1 layer). Underside lined with IN-105 (50mm acoustic insulation equivalent to Polymax Absorb HD50) held in place open wire mesh.	27(-3)	0.85
Administration	Plant room	Plant room louvres	LV-103	IAC Acoustic/Sound Attenuators Australia ALH1 300mm deep acoustic louvre	See Table E4	-
Administration	CRAC External plant deck	Barriers	-	2.4m high walls North and east perimeter wall of enclosure. Blockwork walls with acoustically absorptive finish to internal face of plant enclosure walls such as 50mm Pyrotech Reapor	27(-3)	0.85
Administration	CRAC External plant deck	CRAC units		Mounted no higher than 450 above ground		
Train wash	Train wash	Walls	EL-207C & D GL-210	Kingspan (KS1000 MR) 80mm 6 mm float glazing	27(-3)	-
Train wash	Train wash	Roof	EL-207A	Kingspan (KS1000 MR) 80mm	27(-3)	-
Train wash	Train wash	Roof ventilators	RO-301	4 x roof vents	-	
Train wash	Train wash	East West openings	-	Opening minimised as far as practical. 4800 as per architectural drawings.	-	-
Wheel lathe	Building 10	Walls	EL-207A	Kingspan (KS1000 MR) 80mm	27(-3)	-
Wheel lathe	Building 10	Roof	RF-002	RO-201 Klip lok 700 0.48 mm (1 layer), 130mm airspace filled with bulk fibreglass insulation 14/kg/m3, RS-201 Klip lok 700 0.48 mm (1 layer). Underside lined with 50mm acoustic insulation equivalent to Polymax Absorb HD50 - held in place with acoustic retaining wire	27(-3)	0.85
Wheel lathe	Building 10	Roof Ventilators	-	3 x 900 throat vents	-	-
Wheel lathe	Building 10	Doors	-	Open, as per architectural drawings.	-	-
Wheel lathe	Building 10	Glazing	EL-301	12m Danpalon Multicell	20(-3)	-
Wheel lathe	Lathe Pit - 10GL002	Pit wall internal lining		Acoustic lining of pit walls 50mm Pyrotek Reapor.		0.9
Distribution and Traction Sub	Transformer bays	Transformer bay walls		Acoustic lining of transformer bays with acoustic insulation equivalent to Polymax Absorb HD50 or 50mm Pyrotech Reapor. Where protective sheeting is required for the insulation, perforated metal having minimum 11% open area equivalent to Stramit Acoustic Panel System	-	0.85
Distribution and Traction Sub	Transformer bays	Roof over bays	RS-201	Klip lok 700 0.48 mm (1 layer). Underside underside lined with 50mm acoustic insulation equivalent to Polymax Absorb HD50 - held in place with roof safety mesh	20(-3)	0.85
Distribution and Traction Sub	Transformer bays	Doors	-	Air grills along SE, NE and NW sides of transformer room	-	-
Distribution and Traction Sub	Transformer bays	Louvres	-	Standard weather louvres	-	-
Bulk Supply		Wall surrounding Bulk Supply		Blockwork wall as per architectural drawings	30	-

ARCH SPECIFICATION				NV Requirement		
Building	Room ID	Element	Element ID	Description	RW (ctr)	NRC
Fire pump room	Fire pump room	Doors	GL-001, GL-001		32	-
Fire pump room	Fire pump room	Louvres	LV-01 15-GL, LV-02 15-GL	ALH2 Acoustic louvre, 600 deep - 1200 x 3000 on southern façade (western end) - 1200 x 3000 on western facade (centre)	See Table E4	-
Fire pump room	Fire pump room	High sectiono fo walls	EL211	High section of wall to be minimum 9mm fibre cement sheeting.	30	-
Fire pump room	Fire pump room	Roof Vents	RO-302B	Standard roof ventilator,min 2.5m from building edge.	-	-

APPENDIX F Predicted noise levels from SMTF operations

Table F1: SMTF Environmental noise predictions with adverse met conditions - L_{Aeq}

Report ref: NWRLOTS-NRT-RTF-AV-RPT-105005-E

			Shoulder		Day			Evening			Night			
					10am-12pm			8pm - 10pm - PSNL						
Receiver ID	NCA	Address	5am-7am	PSNL Shldr	10am-12pm	No trucks	PSNL Day	8pm-10pm	No Trucks	Evening	10pm-2am	2am-4am	4am-5am	PSNL NIGHT
48000-262D-RES	RTF-01	[redacted] Schofields	34	43	38	38	48	36	36	48	26	35	33	37
47290-325D-RES	RTF-01	[redacted] The Ponds	28	43	31	30	48	30	29	48	25	28	27	37
47340-307D-RES	RTF-01	[redacted] The Ponds	31	43	34	34	48	32	32	48	27	31	30	37
46880-351D-RES	RTF-01	[redacted] The Ponds	19	43	21	21	48	21	21	48	16	18	18	37
48180-228D-RES	RTF-01	[redacted] Schofields	28	43	29	29	48	29	29	48	22	28	27	37
46905-353D-RES	RTF-01	[redacted] The Ponds	18	43	21	20	48	21	21	48	16	18	18	37
48180-202D-RES	RTF-01	[redacted] Schofields	28	43	30	30	48	29	29	48	22	28	27	37
46920-353D-RES	RTF-01	[redacted] The Ponds	19	43	21	21	48	21	21	48	17	18	18	37
48180-176D-RES	RTF-01	[redacted] Schofields	30	43	33	32	48	31	31	48	23	31	29	37
46935-351D-RES	RTF-01	[redacted] The Ponds	19	43	22	22	48	22	22	48	17	19	19	37
46955-349D-RES	RTF-01	[redacted] The Ponds	19	43	21	21	48	22	22	48	17	19	19	37
46970-349D-RES	RTF-01	[redacted] The Ponds	19	43	22	22	48	22	22	48	17	19	19	37
46990-350D-RES	RTF-01	[redacted] The Ponds	20	43	22	22	48	22	22	48	18	20	19	37
47005-348D-RES	RTF-01	[redacted] The Ponds	19	43	22	21	48	22	22	48	17	19	19	37
47025-347D-RES	RTF-01	[redacted] The Ponds	21	43	23	23	48	23	23	48	18	20	20	37
47060-338D-RES	RTF-01	[redacted] The Ponds	21	43	24	24	48	24	24	48	19	21	21	37
47620-295D-RES	RTF-01	[redacted] The Ponds	35	43	39	39	48	37	37	48	30	36	35	37
47095-341D-RES	RTF-01	[redacted] The Ponds	21	43	24	24	48	24	24	48	19	21	21	37
47115-341D-RES	RTF-01	[redacted] The Ponds	23	43	26	26	48	25	25	48	20	23	22	37
47490-302D-RES	RTF-01	[redacted] The Ponds	34	43	38	38	48	36	36	48	30	35	34	37
47130-338D-RES	RTF-01	[redacted] The Ponds	23	43	26	26	48	26	26	48	21	23	23	37
47145-335D-RES	RTF-01	[redacted] The Ponds	24	43	27	27	48	26	26	48	21	24	23	37
47225-320D-RES	RTF-01	[redacted] The Ponds	26	43	28	28	48	28	28	48	23	26	25	37
47365-307D-RES	RTF-01	[redacted] The Ponds	34	43	37	37	48	35	35	48	30	34	33	37
47180-329D-RES	RTF-01	[redacted] The Ponds	25	43	28	28	48	27	27	48	22	25	25	37
48140-323U-RES	RTF-03	[redacted] Schofields	25	38	29	27	38	31	26	38	24	25	25	38
48180-119D-RES	RTF-02	[redacted] Schofields	27	42	30	29	48	30	29	48	24	28	27	35
47960-191U-RES	RTF-03	[redacted] Schofields	31	38	37	35	38	38	32	38	31	31	31	38
47490-230U-RES	RTF-03	[redacted] Rouse Hill	39	38	40	40	38	40	39	38	39	39	39	38
47950-243U-RES	RTF-03	[redacted] Schofields	30	38	35	33	38	37	31	38	30	30	30	38
48030-321U-RES	RTF-03	[redacted] Schofields	27	38	31	29	38	33	28	38	27	27	27	38
48030-321U-RES	RTF-03	[redacted] Schofields	26	38	30	28	38	32	27	38	26	26	26	38
47970-387U-RES	RTF-03	[redacted] Schofields	27	38	30	28	38	32	28	38	27	27	27	38
48180-465U-RES	RTF-03	[redacted] Schofields	25	38	28	27	38	29	25	38	23	24	24	38
48175-393U-RES	RTF-03	[redacted] Schofields	24	38	28	26	38	30	25	38	24	24	24	38
47505-309U-RES	RTF-03	[redacted] Rouse Hill	35	38	38	37	38	38	36	38	35	35	35	38
47520-346U-RES	RTF-03	[redacted] Rouse Hill	34	38	37	36	38	37	35	38	33	34	34	38
47520-346U-RES	RTF-03	[redacted] Rouse Hill	32	38	35	33	38	35	32	38	31	31	32	38
47545-483U-RES	RTF-03	[redacted] Rouse Hill	28	38	31	29	38	32	29	38	27	28	28	38
48110-432U-PoW	-	[redacted] Schofields	24	38	27	25	38	29	25	38	23	24	24	38
47365-079U-RES	RTF-04	[redacted] Rouse Hill	39	38	43	42	38	41	40	38	36	39	39	38
46880-130U-RES	RTF-04	[redacted] Rouse Hill	21	38	23	23	38	23	22	38	19	20	20	38
47430-302U-RES	RTF-04	[redacted] Rouse Hill	34	38	37	36	38	37	35	38	34	34	34	38
47445-404U-RES	RTF-04	[redacted] Rouse Hill	30	38	33	32	38	33	31	38	30	30	30	38
47450-539U-RES	RTF-04	[redacted] Rouse Hill	27	38	29	28	38	30	27	38	26	26	27	38
47395-126U-RES	RTF-04	[redacted] Rouse Hill	36	38	42	39	38	43	39	38	35	37	36	38

			Shoulder		Day			Evening			Night			
					10am-12pm			8pm - 10pm - PSNL						
Receiver ID	NCA	Address	5am-7am	PSNL Shldr	10am-12pm	No trucks	PSNL Day	8pm-10pm	No Trucks	Evening	10pm-2am	2am-4am	4am-5am	PSNL NIGHT
47390-152U-RES	RTF-04	[redacted] Rouse Hill	38	38	43	41	38	43	39	38	36	37	37	38
47395-178U-RES	RTF-04	[redacted] Rouse Hill	34	38	39	37	38	39	35	38	32	33	33	38
46920-189U-RES	RTF-04	[redacted] Rouse Hill	23	38	25	25	38	25	25	38	21	23	22	38
47305-296U-RES	RTF-04	[redacted] Rouse Hill	28	38	32	31	38	33	30	38	27	28	28	38
46915-236U-RES	RTF-04	[redacted] Rouse Hill	23	38	25	25	38	25	24	38	20	22	22	38
46975-325U-RES	RTF-04	[redacted] Rouse Hill	26	38	29	29	38	29	28	38	23	26	26	38
47430-302U-RES	RTF-04	[redacted], Rouse Hill	33	38	36	35	38	36	34	38	33	33	33	38
47430-349U-RES	RTF-04	[redacted], Rouse Hill	32	38	36	35	38	36	33	38	32	32	32	38
47440-376U-RES	RTF-04	[redacted], Rouse Hill	32	38	35	34	38	34	32	38	31	32	32	38
47145-505U-RES	RTF-04	[redacted], Rouse Hill	27	38	29	28	38	30	27	38	24	26	26	38
47145-505U-RES	RTF-04	[redacted], Rouse Hill	19	38	20	20	38	21	20	38	17	19	19	38
47707-197D-RES	RTF-01	[redacted], The Ponds	36	43	39	39	48	38	38	48	30	37	35	37
47885-217D-RES	RTF-01	[redacted] Schofields	35	43	39	39	48	37	37	48	27	36	34	37

Table F2: SMTF Predicted Noise Levels - SHOULDER 5am-7am

RECEIVER ID	47490-230U-RES	47365-079U-RES
ADDRESS	[redacted] Rouse Hill	[redacted] Rouse Hill
CRITERIA	38	38
TOTAL PREDICTED LAeq15minute	38.8	39
Substation	4	30.4
Bulk Supply	35.8	14.9
Other site buildings	-10.5	-7.9
Train Wash		
Wheel Lathe		
STABLING AREA	20	37.5
ROAD 15A (no comp)		
ROAD 15A	12.5	30.6
ROAD 15B (no comp)		
ROAD 17A (no comp)	12.2	28.2
ROAD 17B (no comp)		
ROAD 19A	12.9	30
ROAD 19B	9	27.7
ROAD 21A (no comp)	10.3	27.6
ROAD 21B (no comp)		
ROAD 23A	11.4	29.5
ROAD 23A (no comp)		
ROAD 23B	9.4	27.4
ROAD 23B (no comp)		
Departure-Arrival	5.9	23.8
Shoulder Departure-Arrival	5.9	23.8
Day Departure-Arrival		
Evening Departure-Arrival		
Night Departure-Arrival		
MAINTENANCE BUILDING	31.6	29.3
Louvres	21.8	-3.2
Doors West_Open		
Doors West_Closed	-12.1	-13.4
Doors-East_Open		
Doors-East_Closed (single open)	26.1	27.1
Roof	23.6	22.6
Walls	20.8	15.9
MECH	27.3	20.5
Truck (LD)		
ADMINISTRATION	33.6	26
Roof Plant Room	25.9	19.8
Roof Ducted Plant (Not required)	12.4	9.2
Admin Services (BLG 16)	14.8	11.5
Critical Air Conditioners	9.2	9.7
Backup Generator		
Car Park	32.7	24.5

Table F3: SMTF Predicted Noise Levels - DAY No Trucks

RECEIVER ID	47490-230U-RES	47365-079U-RES	47395-126U-RES	47390-152U-RES	47395-178U-RES
ADDRESS	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Rouse Hill	Rouse Hill	Rouse Hill	Rouse Hill	Rouse Hill
CRITERIA	38	38	38	38	38
TOTAL PREDICTED $L_{Aeq15minute}$	40.0	42.1	39.0	40.9	36.8
Substation	2.6	30.3	30.7	27.4	20.1
Bulk Supply	35.8	13.7	22	21.2	21.5
Other site buildings	-13.7	-11.2	-13.4	-13.7	-14.4
Train Wash	3.6	26.4	24.8	23	14.7
Wheel Lathe	21.9	28	31.8	28.9	22.7
STABLING AREA	23.6	40.5	32.9	36.5	32.6
ROAD 15A (no comp)					
ROAD 15A	15.9	33	25.3	30.2	26.1
ROAD 15B (no comp)					
ROAD 17A (no comp)	16.7	32.2	22.8	29.1	24.6
ROAD 17B (no comp)					
ROAD 19A	16.5	32.3	23	28.4	24.3
ROAD 19B	11.5	28.8	24.1	24.1	20
ROAD 21A (no comp)	14.5	31.5	22.4	27.3	23.1
ROAD 21B (no comp)					
ROAD 23A	14.4	31.7	22.7	26.3	23.7
ROAD 23A (no comp)					
ROAD 23B	11.2	28.2	18.6	25.1	21.6
ROAD 23B (no comp)					
Day Departure-Arrival	11.4	31.6	27.5	25.3	22
MAINTENANCE BUILDING	34.5	33.3	31.6	36.5	24.1
Louvres	18.6	-5.4	16.7	12.6	-0.1
Doors West_Open	-4.2	-5.8	-5.6	-7.2	-7.2
Doors West_Closed					
Doors-East_Open	31.1	30.2	26.4	35.5	17.7
Doors-East_Closed (single open)					
Roof	23.2	21.7	21.3	21.4	15.3
Walls	19.5	14.2	17.6	18.2	9.3
MECH	30.8	29.6	28.8	28.8	22
Truck (LD)					
ADMINISTRATION	34.6	28.4	31.4	32.2	33.6
Roof Plant Room	29.4	25.2	26.9	27.2	28.4
Roof Ducted Plant (Not required)	27.3	24.2	25.9	26.2	26.5
Admin Services (BLG 16)	21.3	18.7	19.6	22.8	30.2
Critical Air Conditioners	19.9	18.5	18.9	22.7	30.1
Backup Generator					
Car Park	32.7	24.5	29	29.8	27.4

Table F4: SMTF Predicted Noise Levels - EVENING - No Trucks

RECEIVER ID	47490-230U-RES	47365-079U-RES	47395-126U-RES	47390-152U-RES
ADDRESS	[redacted] Rouse Hill	[redacted] Rouse Hill	[redacted] Rouse Hill	[redacted] Rouse Hill
CRITERIA	38	38	38	38
TOTAL PREDICTED $L_{Aeq15minute}$	39.3	39.6	38.6	38.5
Substation	4	30.4	30.7	27.5
Bulk Supply	35.8	14.9	23.2	21.9
Other site buildings	-10.5	-7.9	-10.1	-10.4
Train Wash	5.6	26.5	25.2	23.6
Wheel Lathe	22.9	29.2	33.3	30.1
STABLING AREA	19.3	36.8	30.9	32.4
ROAD 15A (no comp)	11.2	28.6	22.2	25.8
ROAD 15A				
ROAD 15B (no comp)	7.2	25.3	23	17.4
ROAD 17A (no comp)	12.2	28.2	18.3	25.2
ROAD 17B (no comp)	7.5	25.3	22.1	19.7
ROAD 19A				
ROAD 19B	9	27.7	23.4	22.5
ROAD 21A (no comp)	10.3	27.6	18	23.1
ROAD 21B (no comp)	7.4	24.9	18.7	20.7
ROAD 23A				
ROAD 23A (no comp)	10	27.4	17.9	22
ROAD 23B				
ROAD 23B (no comp)	7.1	24.7	14.6	21.2
Evening Departure-Arrival	7.1	26.2	22.4	20.4
MAINTENANCE BUILDING	32.5	31.2	30.1	32.8
Louvres	21.8	-3.2	20.4	16.1
Doors West_Open				
Doors West_Closed	-12.1	-13.4	-13.3	-14.7
Doors-East_Open				
Doors-East_Closed (single open)	26.1	27.2	21.4	30.4
Roof	23.6	22.6	22.1	22
Walls	20.8	15.9	19.4	19.8
MECH	29.4	27.6	27.3	27.3
Truck (LD)				
ADMINISTRATION	34.2	27.7	30.8	31.5
Roof Plant Room	28.1	23.4	25	25.1
Roof Ducted Plant (Not required)	24.4	21.2	22.9	23.2
Admin Services (BLG 16)	20.1	19.1	19	21.3
Critical Air Conditioners	18.2	18.7	18.1	21.1
Backup Generator				
Car Park	32.7	24.5	29	29.8

APPENDIX G Independent verifier statement

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17 May 2016

[redacted]
Environment Manager
Northwest Rapid Transit

Dear [redacted]

Sydney Metro Northwest
Operational Noise and Vibration Report - Independent Review

AECOM Australia Pty Ltd (AECOM) has reviewed Renzo Tonin and Associates' (RT&A) Operational Noise and Vibration Review (ONVR) (Document ref: NWRLOTS-MRT-RTF-AV-RPT-105005-D) for the Sydney Metro Train Facility (SMTF) dated 17 May 2016. All comments have been addressed by RT&A and AECOM confirms that the ONVR meets all of the Minister's Conditions of Approval (SSI-5931).

It is noted that Northwest Rapid Transit's (NRT) scope of work does not include consideration of the Augmentation. It is recommended that Transport for New South Wales considers how these requirements would be managed.

Yours faithfully

[redacted]

[redacted]