Report

DIRECTOR GENERAL'S REQUIREMENTS - ACOUSTICS

Prince of Wales Hospital – Mental Health Intensive Care Unit (MHICU)
Health Infrastructure NSW

CONFIDENTIAL

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1. EXECUTIVE SUMMARY

It is proposed to construct a new facility to accommodate a Mental Health Intensive Care Unit (MHICU) at the Prince of Wales Hospital (PoW), Randwick, NSW.

The Director General has provided Requirements for the project. Director General Requirement (DGR) 12 states:

> *Provide a quantitative assessment of the potential demolition, construction, operation and traffic noise impacts of the project.*

It is understood that demolition works have commenced at the site. Therefore in terms of demolition and construction noise, this report is limited to a discussion and presentation of construction noise impacts only.

Construction Noise is assessed in this report according to Department of Environment, Climate Change and Water (DECCW) *Interim Construction Noise Guidelines* (ICNG) dated July 2009. Operational noise is assessed according to the requirements of Department of Environment, Climate Change and Water (DECCW) *Industrial Noise Policy* (INP, 2000). Road traffic noise is assessed according to the Department of Environment, Climate Change and Water (DECCW) *Environmental Criteria for Road Traffic Noise* (ECRTN, 1999).

Project Specific Noise Criteria for construction noise, operational noise and traffic noise have been established. A 3D computer noise model has been used to assess construction and operational noise and the outcome of the assessment is as follows:

Construction Noise:

The construction noise assessment has shown that in the absence of reasonable and feasible measures, exceedances of the established noise management levels are predicted to occur at nearby residential and hospital building receivers.

However, a conventional approach of establishing a 3.0 m site perimeter hoarding has proven to be largely ineffectual.

It is therefore recommended that construction noise impacts are mitigated, where possible by the implementation of localised hoardings or barriers between particularly noisy plant items and the most affected receivers. Examples of these receivers are Ronald MacDonald House, the CANTEEN/Palliative Care building, Sydney Children's Community Health Centre and residences at 1 and 2 St. Paul's Street and at 251 Avoca Street.

Excavation and construction noise impacts should also be mitigated by all other reasonable and feasible measures, and documented in a Construction Noise Management Plan (CNMP) for the site. Whilst not addressed in this report, the selected contractor should also be aware of and address potential construction-related vibration impacts upon patients, staff and vibration-sensitive equipment in the nearby hospital buildings.

Operational Noise

The operational noise assessment has focussed on mechanical plant (industrial) noise emissions from the site based on plant likely to be installed. This assessment has found that normal operation plant including Fan Coil Units and Condenser Units will comply with the established criteria. The final plant selections should be reviewed for conformance with the criteria set out in this report. Where plant arrangements or individual items deviate from those shown in this report, the substitute items should be reviewed by an appropriately qualified and experienced acoustic practitioner.

The operation of the untreated generator set (based on predicted sound power levels in the absence of manufacturer's data) results in significant exceedances of the daytime, evening and night-time criteria at all residential receivers. It also significantly exceeds the internal noise criteria at all nearby hospital buildings, particularly at the CANTEEN/Palliative Care building.

These exceedances will require investigation of significant mitigation measures.

It is recommended that manufacturer's data (in lieu of the predictions based on algorithms used in this report) be obtained for the final selection of generator to ensure the accuracy of any acoustic calculations undertaken during the design stage.

Road Traffic Noise

No additional road traffic is proposed as part of the proposed development and as such the increase in road traffic noise generated by traffic due to the new building will be nil. No further acoustic input is required to address road traffic noise impacts as a result.

2. INTRODUCTION

It is proposed to construct a new facility to accommodate a Mental Health Intensive Care Unit (MHICU) at the Prince of Wales Hospital (PoW), Randwick, NSW.

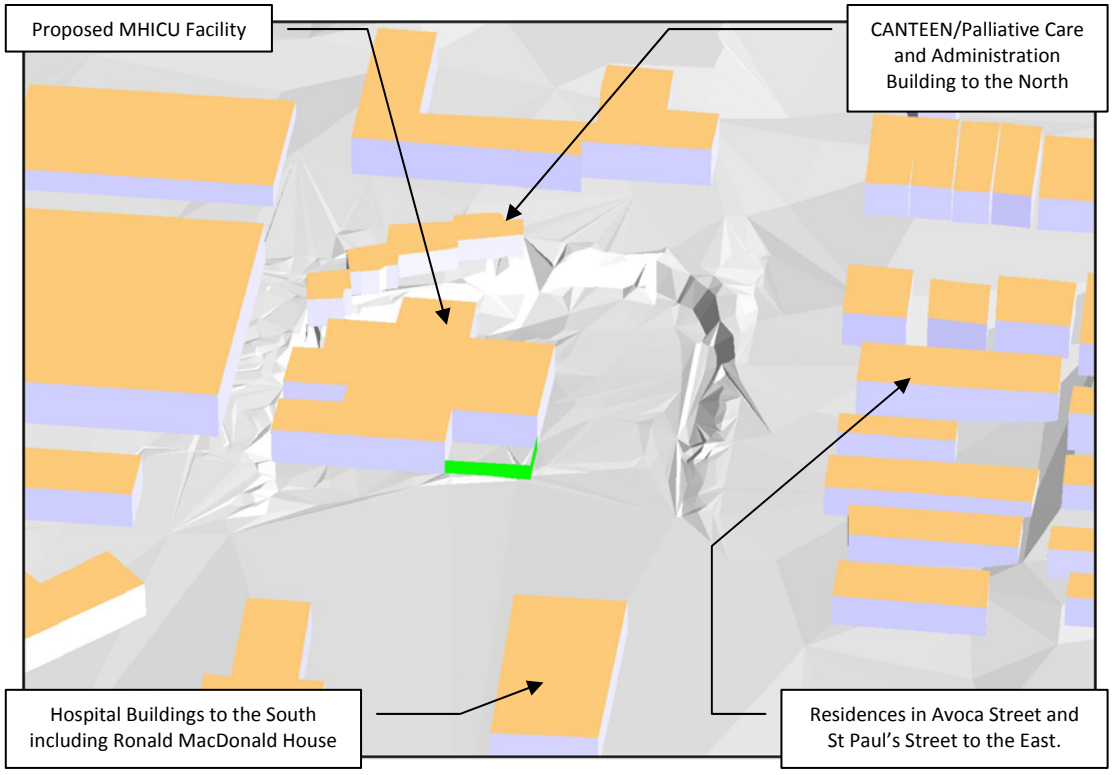
The proposed site for the facility is that previously occupied by the Coulter Hostel, adjacent to Avoca Street, north of Barker Street, Randwick. The Coulter Hostel building is in the process of being demolished to make way for the new development.

The proposed development site is bounded by existing hospital buildings and internal roads to the north, Avoca Street to the east, existing hospital buildings to the south (including *Ronald MacDonald House*) and existing hospital facilities to the west (including PoW Place Childcare). The nearest private residential premises are located on the opposite side of Avoca Street to the east of the site.

The proposed building comprises two (2) floors. The basement floor comprises Clinical Staff office accommodation, plant room and car parking, whilst the ground floor is occupied by the MHICU facility. Mechanical services items are located in the basement car park at high level and in a plant compound at the north east of the building.

A three-dimensional image from the computer noise model describing the proposed facility and its immediate surrounds is shown in Figure 1:

Figure 1: Three Dimensional Computer Model of the PoW MHICU Facility



2.1. Purpose of Report

The Director General has provided Requirements for the project. Director General Requirement (DGR) 12 states:

> *Provide a quantitative assessment of the potential demolition, construction, operation and traffic noise impacts of the project.*

The purpose of this report is to address DGR 12 as follows:

- Assess potential construction noise impacts by way of a Construction Noise Impact Statement (CNIS)
- Assess potential operational noise impacts by reviewing the proposed noise emitting mechanical plant items associated with the new facility
- Assess potential traffic noise impacts by assessing any additional traffic that will result from the operation of the new facility as an additional proportion of traffic currently using existing hospital facilities at the Randwick campus.

This report fulfils this purpose by:

- Identifying relevant input information including criteria, Standards and engineering inputs (noise data, geographic survey information and the like)
- Documenting NDY Sound's calculation methodology including identification of noise sources, nearest potentially affected receivers and calculation procedures
- Presenting potential construction, operation and traffic noise impacts arising from the proposed project
- Recommending in-principle noise controls to be considered by the project team (during the design phase) where exceedances of the established criteria and noise management levels are predicted.

3. BACKGROUND

3.1. Information Sources

1 Director General's Requirement 12

2 Department of Environment, Climate Change and Water (DECCW) *Interim Construction Noise Guidelines* (ICNG) dated July 2009

3 Australian Standard AS 2436-2010 *Guide to noise and vibration control on construction, demolition and maintenance sites*

4 Department for Environment Food and Rural Affairs (DEFRA, (UK)) *Update of noise database for prediction of noise on construction and open sites* dated 2005

5 Transport Infrastructure Development Corporation (TIDC) *Construction Noise Strategy, November 2007.*

6 Department of Environment. Climate Change and Water (DECCW) *Industrial Noise Policy* (INP, 2000)

7 Department of Environment. Climate Change and Water (DECCW) *Environmental Criteria for Road Traffic Noise* (ECRTN, 1999)

8 *AR_MHICU_DA_A 02_02 – Site Survey:* Issue 02 dated 21 December 2010

9 *AR_MHICU_DA_A 03_04– Site Analysis Plan:* Issue 04 dated 17 December 2010

10 *AR_MHICU_DA_D 00_09 – Floor Plan Ground Floor:* Issue 09 dated 21 December 2010

11 *AR_MHICU_DA_D 01_03 – Roof Plan:* Issue 03 dated 03 December 2010

12 *AR_MHICU_DA_D B1_08 – Floor Plan Lower Ground:* Issue 08 dated 21 December 2010

13 *AR_MHICU_DA_E 01_04 – Elevation East and South:* Issue 04 dated 21 December 2010

14 *AR_MHICU_DA_E 02_04 – Elevation West and North:* Issue 04 dated 21 December 2010

15 *AR_MHICU_DA_F 01_02 – Section A, B, C:* Issue 03 dated 21 December 2010

4. ASSESSMENT CONTROLS

4.1. Director General's Requirement 12

Director General Requirement (DGR) 12 states:

> *Provide a quantitative assessment of the potential demolition, construction, operation and traffic noise impacts of the project.*

Each of these assessments (construction, operation, and traffic) is informed by its own set of noise criteria as set out below.

4.2. Construction Noise

4.2.1. DECCW Interim Construction Noise Guideline

The Interim Construction Noise Guideline (ICNG) is aimed at managing noise from construction works regulated by the DECCW. It is also the *de facto* guideline for acoustic practitioners and other interested parties, used to assist in the assessment of noise emission from construction activities.

On this basis, the ICNG is used in this document to assess potential noise emission from proposed demolition and construction activities at MHICU.

With reference to Section 1.3 of the ICNG, the main objectives of the Guideline are to:

- Use *Noise Management Levels* (NML's) to identify construction noise sources or scenarios that require engineering controls or administrative management (The term *criteria* is specifically not used in the ICNG).
- Promote a clear understanding of ways to identify and minimise noise from construction works
- Focus on applying all *feasible* and *reasonable* work practices to minimise construction noise impacts (Refer to Section 3.2.2)
- Encourage construction to be undertaken only during the recommended standard hours unless approval is given for works that cannot be undertaken during these hours (Refer to Section 3.2.4)
- Streamline the assessment and approval stages and reduce time spent dealing with complaints at the project implementation stage
- Provide flexibility in selecting site-specific and reasonable work practices in order to minimise noise impacts

The sections below present important concepts and procedures to be followed in the application of the Interim Construction Noise Guideline:

4.2.2. Feasible and Reasonable

Two salient concepts in the ICNG are those of what are *feasible* and *reasonable* measures to minimise noise impacts (when noise management levels are predicted to be exceeded). The Guideline defines these concepts as follows:

Feasible

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

Reasonable

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

The regulatory authority may review the information on feasible and reasonable work practices provided by the proponent, and compare the practices against those applied on similar projects. The regulatory authority may negotiate additional work practices that it considers may also be feasible and reasonable.

4.2.3. Qualitative and Quantitative

A *Quantitative* assessment method is appropriate for this project as a quantitative procedure is stipulated by DGR 12.

4.2.4. Standard Construction Hours

As noted in Section 3.2, a main objective of the ICNG is to encourage construction to be undertaken only during the recommended standard hours. The ICNG standard construction hours are presented in Table 1.

Table 1: ICNG Standard Construction Hours

Work Type	Recommended Standard Hours of Work
Normal Construction	Monday to Friday 07:00 to 18:00 Saturday 08:00 am to 13:00 No work on Sundays or Public Holidays

The ICNG notes that the relevant authority (consent, determining or regulatory) may impose more or less stringent construction hours.

4.2.5. Applying the Guideline

The basic steps to follow in applying the Guideline and managing noise impacts from construction are as follows:

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

4.2.6. Quantitative Assessment Noise Management Levels – Residential Premises

The noise management levels for residential premises are presented in Table 2:

Table 2: Noise Management Levels (NMLs) – Residential Premises

Time of Day	Management Level $L_{Aeq\ (15min)}$	How to Apply
Recommended standard hours Monday to Friday 0700 to 1800	Noise affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq\ (15min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the affected noise level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
Recommended standard hours Monday to Friday 0700 to 1800	Highly noise affected 75 dB	The highly affected level represents the point above which there may be strong community reaction to the noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities occur, taking into account: 1. Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid morning or mid afternoon for works near residences 2. If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.

The term RBL means Rating Background Level and is defined in the DECCW Industrial Noise Policy (2000). The RBL is often interchangeable with the term 'background noise level'. In order to determine The RBL, unattended noise logging must be conducted. Refer to Section 5.

Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5m above ground level. This is in accordance with the ICNG requirements and based on an assumption that, if occupants of a residential premises are at home during the day, that they would mainly occupy the ground floor living areas. Noise levels would be higher at upper floors of exposed residences given typical shielding provided by fences, outbuildings, adjacent buildings and the like.

Should construction noise be shown to exceed the noise management level, then the measures shown for noise affected residences under the heading *How to Apply* in Table 2 shall be implemented by default. This includes the implementation of all feasible and reasonable work practices and informing affected residents.

Should noise levels be shown to exceed 75 dB $L_{Aeq\ (15min)}$ at residential premises, additional measures must be implemented. Principally, this involves further time restrictions or less noise-intensive work practices, perhaps in exchange for a longer construction duration.

4.2.7. Quantitative Assessment Noise Management Levels – Other Sensitive Land Uses

It is also necessary to establish construction noise management levels for noise-sensitive receivers within the hospital campus. These are based on the ICNG and identified in Table 3:

Table 3: Project Noise Management Levels – Other Sensitive Land Uses

Land Use	Management Level $L_{Aeq\ (15\ min)}$ (applies when properties are being used)
Hospital Wards and Operating Theatres	Internal Noise Level 45 dB
Classrooms at schools and other educational institutions All other nearby hospital building and care spaces – see text below	Internal Noise Level 45 dB

For the purpose of this assessment:

- Notwithstanding the diverse use of the buildings surrounding the construction site a single internal noise criterion of 45 dB L_{Aeq} has been adopted. Although there is no specific criterion for some of the nearby building types, it is likely that all nearby hospital and care buildings qualify as noise-sensitive areas and therefore warrant the application of this criterion. Examples of these are the palliative care building and the child care building.
- Nearby building facades offer an external to internal noise reduction of 20 dB. The weakest facade component is assumed to be residential quality glazing, with operable panes, a minimum of 4 mm float glass, with windows closed. The corresponding external noise management level at the facade of hospital buildings will be 65 dB $L_{Aeq\ (15min)}$ (45 dB + 20 dB). Should compliance testing be undertaken, measurements should be undertaken within the affected hospital building(s) and measured results assessed against the 45 dB $L_{Aeq\ (15min)}$ noise management level.
- It is assumed, as a worst case scenario, that all internal spaces of the hospital buildings with facades adjacent to the proposed development site are noise-sensitive areas.

4.3. Operational Noise

The primary aspect of operational noise of interest to this assessment is mechanical plant and equipment noise emission or *industrial noise.*

The assessment of industrial noise emission in NSW is undertaken according to the Industrial Noise Policy (INP, 2000) administered by the Department of Environment, Climate Change and Water (DECCW). The INP provides assessment methodologies, criteria and detailed information on the assessment of stationary mechanical plant items.

The INP criteria for industrial noise sources have two (2) components:

- Controlling **intrusive** noise impacts for residential receivers. Assessing intrusiveness generally requires noise measurements to quantify background (L_{A90}) noise levels at a location considered representative of the most potentially affected residential receiver(s). The intrusiveness criterion essentially means that the equivalent continuous noise level (L_{Aeq}) of the source(s) under consideration should be controlled to within 5 dB of the background noise level.

In order to determine the project intrusive noise criterion, it is necessary to undertake unattended noise logging near to the proposed development site. Refer to Section 5.

- Maintaining noise **amenity** for various categories of land use (including residential receivers and other sensitive receivers). The amenity criterion is based on the sensitivity of a particular land use to industrial-type noise. The cumulative effect of noise from industrial sources needs to be considered. The existing noise level from industrial sources is measured. If it approaches the amenity value for the land use, noise levels from new industrial-type noise sources need to be controlled so that the cumulative effect does not result in aggregate noise levels that would significantly exceed the criterion.

In order to determine the Amenity Criterion, it is necessary to assign an *Indicative Noise Amenity Area* to nearby residences. Nearby residences are considered to be in an *Urban* noise amenity area according to the definitions in the INP.

The INP criteria relevant to the MHICU project are detailed in Table 4:

Table 4: Industrial Noise Emission Criteria – INP Time Periods

Type of Receiver	Noise Level $L_{Aeq\ (15min)}$ dB re 20 µPa		
	Daytime 0700 – 1800	**Evening 1800 – 2200**	**Night-time 2200 – 0700**
Residential Premises Intrusiveness Assessment - Refer to Section 6.2	RBL + 5	RBL + 5	RBL + 5
Residential Premises Amenity Assessment	60	50	45
Hospital Ward -Internal -External	 35 (during noisiest one hour period when in use) 50 (during noisiest one hour period when in use)		
Active Recreation Area	55 (when in use)		

Note that the tabulated values are the *recommended acceptable* values. The *recommended maximum* values are 5 dB higher.

4.4. Traffic Noise

The DECCW document *Environmental Criteria for Road Traffic Noise* (ECRTN) is used to assess traffic noise impacts in NSW.

The ECRTN provides criteria for various categories of road traffic generating projects and developments that may be sensitive to road traffic noise impacts.

The ECRTN development category of relevance to the MHICU project is *Land use developments with potential to create additional traffic on collector road*, and the criteria for this land use category are presented in Table 5:

Table 5: ECRTN Criteria

Type of Development	Criteria		
	Day 0700 – 2200	**Night 2200 – 0700**	**Where criteria are already exceeded**
8. Land use developments with potential to create additional traffic on collector road	60 dB $L_{Aeq\ (1hr)}$	55 dB $L_{Aeq\ (1hr)}$	Where feasible and reasonable, existing noise levels should be mitigated to meet the noise criteria. Examples of applicable strategies include appropriate location of private access roads; regulating times of use; using clustering; using 'quiet' vehicles; and using barriers and acoustic treatments. In all cases, traffic arising from the development should not lead to an increase in existing noise levels of more than 2 dB.

In order to derive the traffic noise criterion for the project, it is necessary to determine existing traffic noise levels in the area. Refer to Section 4.5.

5. UNATTENDED NOISE SURVEY AND DATA ANALYSIS

5.1. Unattended Noise Logging

Unattended noise measurements have been conducted at 19 Eurimbla Avenue, Randwick during the period Friday 8th October 2010 to Friday 15th October 2010.

The equipment used was a Type 2 Acoustic Research Laboratories EL-215 environmental noise logger, serial number S/N 194639. The logger calibration was checked prior to, and after noise measurements, and calibration drift did not exceed 0.5 dB.

The noise logger was configured to record all relevant noise indices including background noise (L_{A90}) and equivalent continuous noise levels (L_{Aeq}). Samples were accumulated at 15 minute intervals. The noise logger response was set to *fast*.

It was not possible to conduct noise logging at a receiver near to the south east of the hospital campus due to a combination of demolition-related noise in the area and lack of willing participant residential premises. The noise environment at the Eurimbla Avenue premises is considered a reasonable approximation of receivers near to the south east of the hospital campus. The equipment location and other acoustically relevant items and locations are shown in Figure 2:

Figure 2: MHICU Unattended Noise Logger Location and Acoustically-Relevant Locations

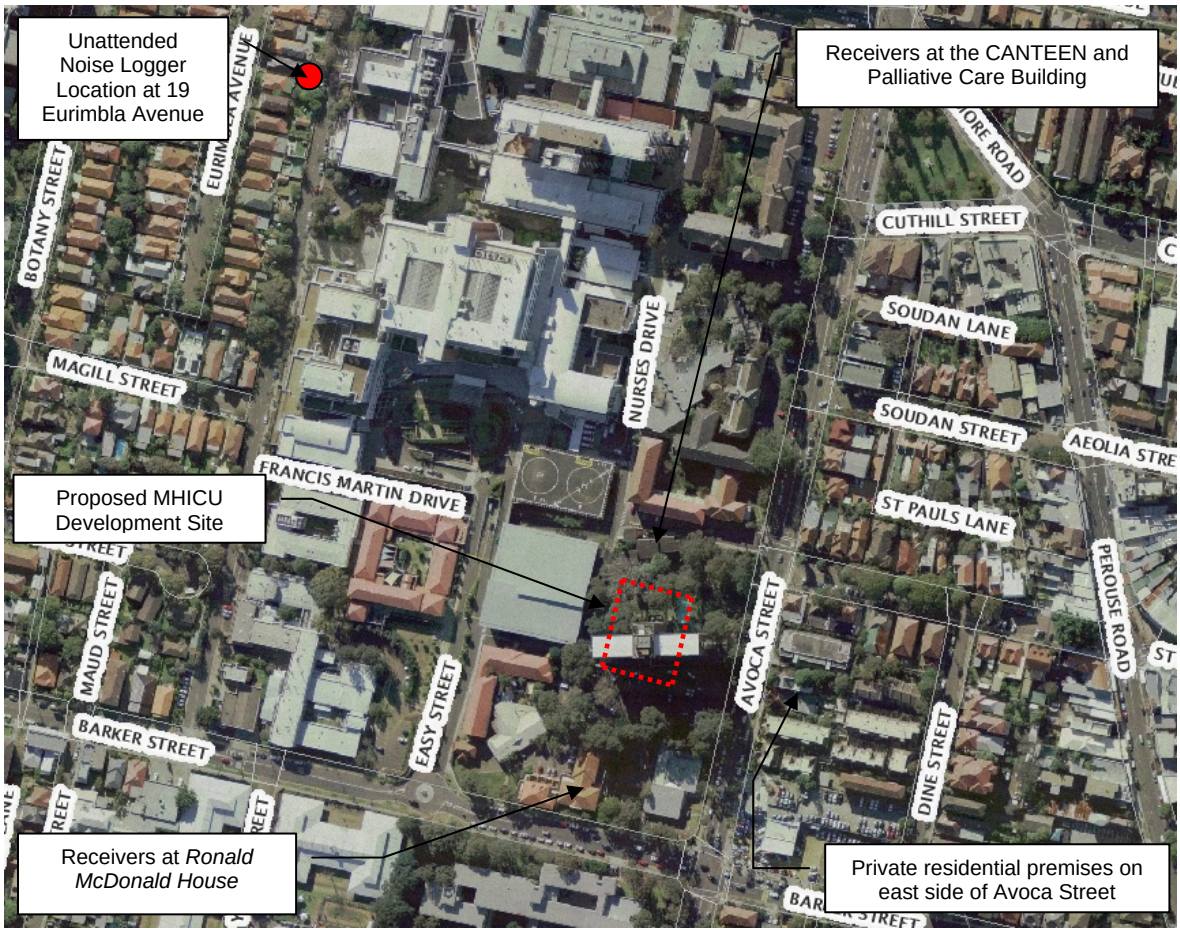


Image: Department of Lands

5.2. Weather Data

In order to verify that noise data was obtained during suitable meteorological conditions, half-hourly weather data was obtained from the Bureau of Meteorology (BOM) as follows:

- Rain and wind data from data from Sydney Kingsford Smith Airport (station 66037)

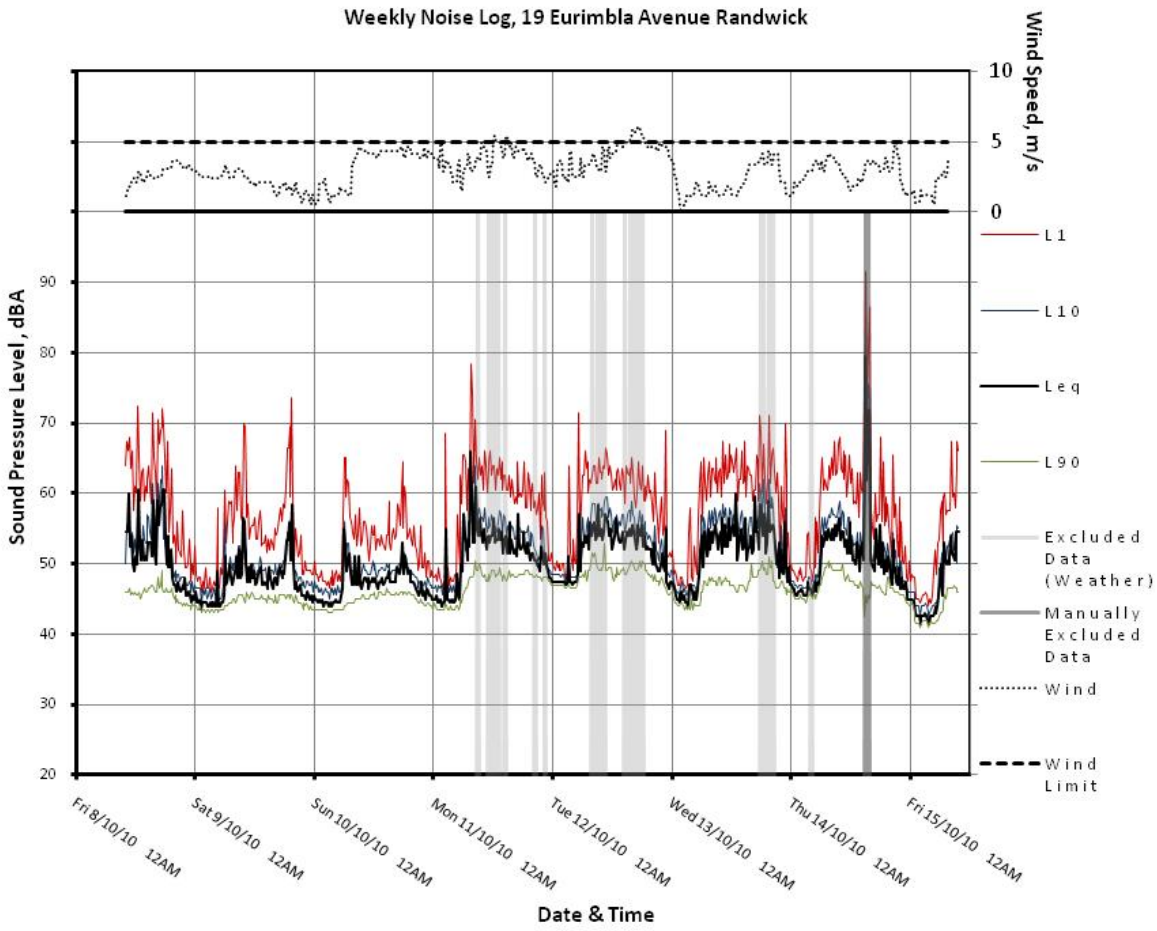
Noise data has been excluded from the processed results if:

- Rain was observed during the fifteen minute measurement period and/or
- Wind speed exceeded 5 m/s at the measurement height of 1.5 m above ground. Wind data obtained from the BOM is presented as the value at 10 m above ground, and these values are halved for the purpose of assessing wind speed at 1.5 m above ground.

5.3. Graphed Noise Levels

For reference, a weekly chart showing the graphed noise is shown in Figure 3. The background noise level is the lowest green line entitled L_{A90}:

Figure 3: Weekly Noise Logging Chart for MHICU



5.4. Measured Noise Levels – INP Time Periods

For the purpose of assessment against Industrial Noise Policy requirements, the measured data has been processed into time periods as follows:

- Daytime, 0700 to 1800
- Evening, 1800 to 2200
- Night-time, 2200 to 0700

The measured background (L_{A90}) and equivalent continuous (L_{Aeq}) noise levels during these defined time periods are presented in Table 6.

The L_{A90} background noise levels presented are Rating Background Levels, being the median of the lowest 10th percentile of the background L_{A90} samples in each daytime, evening and night-time measurement period and for each 24 hour period during the noise survey.

The L_{Aeq} noise levels presented are the logarithmic average of all the L_{Aeq} samples taken in each of the daytime, evening and night-time periods.

Table 6: Measured Noise Levels during Industrial Noise Policy Time Periods

Noise Metric	Measured Noise Level (dB re 20 µPa)		
	Daytime 0700 – 1800	**Evening 1800 – 2200**	**Night-time 2200 – 0700**
L_{A90}	46	46	44
L_{Aeq}	58	51	48

Based on observations on site, it is considered that the noise environment near to the proposed development site is comprised of *industrial* type noise sources and *road traffic* noise sources. It is our estimation that of the total measured $L_{Aeq\ (15min)}$ values tabulated above, the *industrial* noise source contribution is as follows:

- Daytime: 54 dB
- Evening: 48 dB
- Night-time: 48 dB

These values have been used to derive the industrial noise criteria for the site, as discussed in Section 6.2.

5.5. Measured Noise Levels – ECRTN Time Periods

Using the measured noise data, the $L_{Aeq\ (15min)}$ data has been processed as described in section C4 of the ECRTN to determine the existing $L_{Aeq\ (1hr)}$ road traffic noise level.

The daytime and night-time road traffic noise levels are reported in Table 7:

Table 7: Existing Traffic Noise Levels

Period	Road Traffic Noise Level $L_{Aeq\ (1hr)}$ dB
Daytime 0700 – 2200	56
Night-time 2200 – 0700	52

Note: The values reported in Table 7 are the highest one hour values as determined from the processed data, on the basis that there is no industrial noise contribution during that one hour period. The actual contribution due to traffic may be somewhat lower, but this is of no consequence to this assessment.

6. PROJECT CRITERIA AND NOISE MANAGEMENT LEVELS

6.1. Demolition and Construction Noise Management Levels

Given that proposed construction hours will occur during the recommended standard hours, it is necessary to derive a *noise affected* noise management level for the daytime period only.

Based on a measured daytime (0700 – 1800) RBL of 46 dB L_{A90} (Refer to Table 6), the corresponding *noise affected level* for residential premises affected by the proposed works is **56 dB $L_{Aeq\ (15min)}$**.

A summary of demolition and construction noise management levels is shown in Table 8:

Table 8: Project Specific Demolition and Construction Noise Management Levels

Land Use	Noise Management Level $L_{Aeq\ (15\ min)}$	Where Assessed
Residential	56	Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level.
Hospital and Classrooms	45[1]	Noise levels to be measured at any *internal* location.
Active Recreation Area	65	Noise levels to be measured at a height of 1.5 m above ground level.

Note 1: As discussed in Section 4.2.7, for the purpose of assessment in this report, determination of compliance with the noise affected level is based upon an outdoor noise level incident upon the facade of 65 dB $L_{Aeq\ (15min)}$.

6.2. Operational Noise Criteria

Based upon the measured and processed noise levels shown in Table 6, and that the noise environment at receivers near to the proposed development site are *Urban*; according to the definitions in the INP, the industrial Project Specific Noise Levels (PSNLs)for the MHICU project are summarised in Table 9.

Table 9: Project Specific Noise Levels

Type of Receiver	Noise Level $L_{Aeq\ (T)}$ (dB re 20 µPa)		
	Daytime 0700 – 1800	Evening 1800 – 2200	Night-time 2200 – 0700
Residential Premises Intrusiveness Assessment	51	51	49
Residential Premises Amenity Assessment	59	46	38
Residential Premises Project Specific Noise Level	51	46	38
Hospital Ward Amenity Assessment -Internal -External	 35 (during noisiest one hour period when in use) 50 (during noisiest one hour period when in use)		
Active Recreation Area Amenity Assessment	55 (when in use)		

$L_{Aeq(T)}$: T= $L_{Aeq\ (15\ minutes)}$: for the intrusiveness assessment and $L_{Aeq\ (Period)}$ for the Amenity Assessment, where Period equals the whole daytime, evening or night-time period.

6.3. Traffic Noise Criteria

Given that the existing one hour road traffic noise levels comply with the ECRTN criteria for *'land use developments with potential to create additional traffic on collector road'*, the project traffic noise criteria become:

- 60 dB $L_{Aeq\ (1hr)}$ (daytime)
- 55 dB $L_{Aeq\ (1hr)}$ (night-time)

7. CONSTRUCTION NOISE IMPACT STATEMENT

7.1. Methodology

A 3D computer noise model of the site has been prepared in order to assess construction-related airborne noise levels at the receivers identified in Section 0.

Using the *AR_MHICU_DA_A 02_01 – Site Survey* as a basis, a computer noise model of the site and immediate vicinity has been prepared in noise modelling software SoundPLAN V6.5, in which the *General Prediction Method* calculation method was implemented.

Whilst the survey electronic data is presented in two dimensions, a sample of the surveyed RL heights and data from our library of survey information in the area have been entered into the model in order to sufficiently describe the site in three dimensions.

The computer noise model includes ground topography, buildings, fences, noise sources and receivers as required, to approximate the likely excavation and construction scenarios during each stage of the proposed works.

The computer noise model showing the work site and identification of individual receivers is shown in Figure 4:

Figure 4: Aerial Image of Site Showing Computer Noise Model Receiver Locations

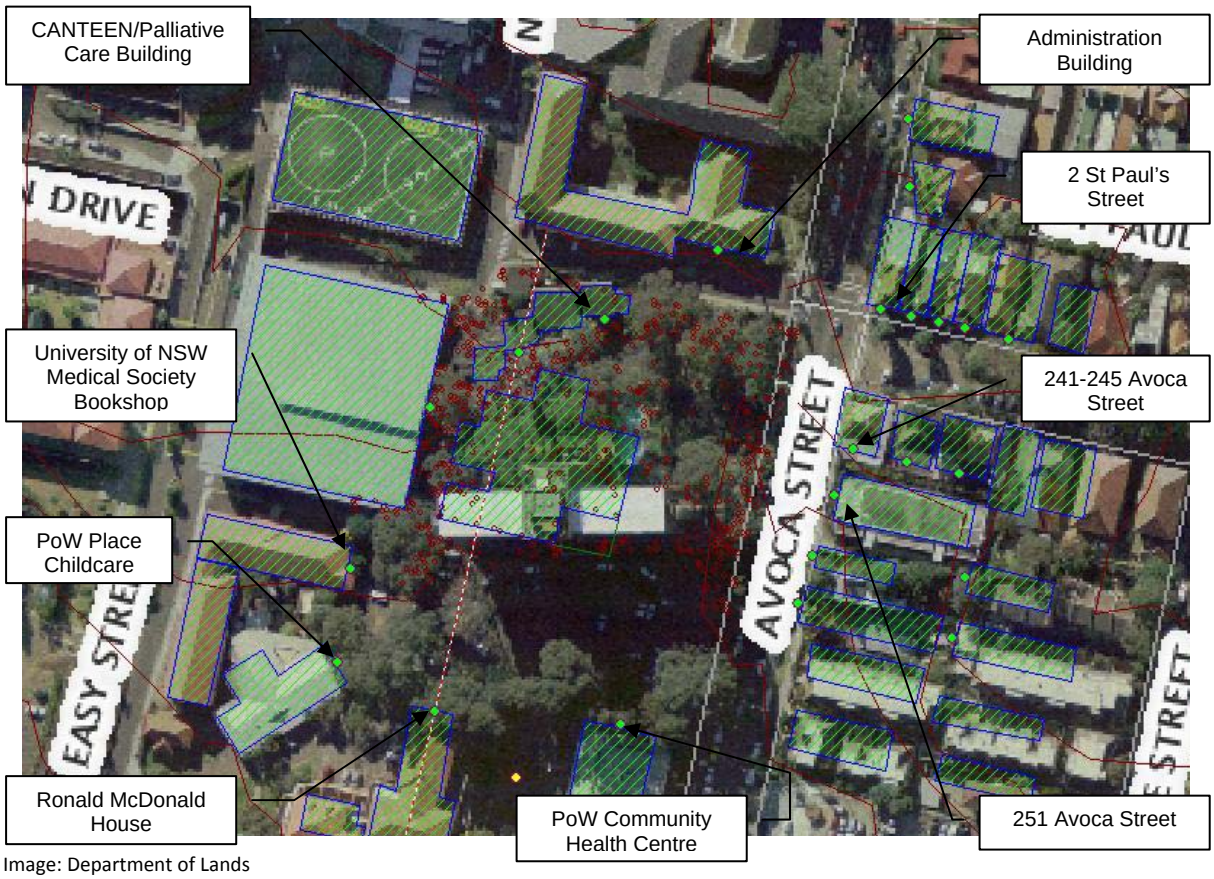


Image: Department of Lands

7.2. Identification of Sensitive Land Uses

The sensitive land uses identified as being the potentially most affected are:

- Residences on the eastern side of Avoca Street. For the purposes of this assessment, construction noise levels are assessed at:
  - 1 St Paul's Street
  - 2 St Paul's Street
  - 251 Avoca Street
- CANTEEN/Palliative Care Building to the North
- Administration Building to the North
- Ronald McDonald House to the South
- University of New South Wales Medical Society to the South West
- Prince of Wales Place Childcare to the South West
- Prince of Wales Community Health Centre
- The playground adjacent to the Ronald McDonald House and the Prince of Wales Community Health Centre.

7.3. Identification of Proposed Construction Hours

It is proposed to undertake the proposed works during the ICNG standard construction hours. Within the standard hours, particularly noisy activities may be scheduled around hospital activities (by negotiation with the hospital) or as otherwise recommended by this report.

7.4. Excavation and Construction Equipment Sound Power Levels

Sound power levels of the assumed excavation and construction equipment are presented in Table 10.

Table 10: Schedule of Equipment Sound Power Levels

Item	Sound Power Level (dB re 1 pW) at Octave Band Centre Frequency (Hz)							
	63	125	250	500	1000	2000	4000	8000
Excavation Stage								
Breaker Mounted on Excavator	116	116	114	117	111	111	108	104
Tracked Excavator	106	98	100	96	95	94	101	93
Articulated Dump Truck	113	115	105	103	104	101	97	90
Vibratory Plate	98	102	99	106	102	103	91	86
Mini Piling Rig	115	105	100	101	99	97	93	85

Item	Sound Power Level (dB re 1 pW) at Octave Band Centre Frequency (Hz)							
	63	125	250	500	1000	2000	4000	8000
Construction Stage								
Concrete Pump	112	104	98	99	101	101	94	86
Concrete Mixer Truck	111	102	94	97	98	106	88	83
Hand held hydraulic breaker	105	100	101	97	96	94	92	88
Hand held circular saw	97	103	105	102	99	98	102	97
Angle grinder	85	79	80	88	98	105	101	101
Hand held cordless nail gun	91	93	93	94	93	97	92	89
Diesel generator	105	100	92	88	87	85	82	70
4 axle truck pulling away	101	106	106	106	102	101	96	94

For the excavation stage, the assumed equipment has been modelled at a central location on the site and each large item of plant has been modelled at 2 m above the ground level.

The construction stage noise sources have been modelled at 1.5 m above the Basement Level slab of the partially-completed building, in a central location.

7.4.1. Predicted Noise Levels – No Mitigation

Noise levels have been predicted on the basis of a *worst case* 15 minute period during each stage. This assumes that the individual plant items operate for the whole 15 minute assessment duration. Procedures for quantifying the outcomes under less intensive periods are described below. Based on the inputs presented above, the construction noise levels shown in Table 11 have been calculated at all nearby noise-sensitive receivers.

The range of noise contributions from the lowest contributor to the highest contributor has been shown. In addition, the total contribution of all sources operating simultaneously and for the whole 15 minute period (a *worst case scenario*) is identified on the adjacent column.

Exceedances of the noise affected level are shown in red text. Exceedances of the *highly noise affected* level are shown in **bold red** text.

Table 11: Predicted Excavation and Construction Noise Levels with No Mitigation

Residential Receiver	Noise Level at Receiver $L_{Aeq\ (15min)}$ (dB re 20 µPa)							
	Excavation				Construction			
	NML	Typical Range	Worst Case	Highest Exceed.	NML	Typical Range	Worst Case	Highest Exceed.
1 St Paul's Street	56	50-67	68	12	56	25-57	62	6
2 St Paul's Street	56	52-70	71	15	56	29-60	64	8
251 Avoca Street	56	50-67	69	13	56	41-58	63	7
Administration Building	45	34-51	52	7	45	24-42	44	0
Prince of Wales Childcare	45	30-38	48	3	45	21-37	42	0
University of NSW Medical Society Bookshop	45	33-51	52	7	45	24-41	46	1
Ronald McDonald House	45	31-48	56	11	45	22-38	43	0
CANTEEN/Palliative Care	45	40-56	57	12	45	30-48	52	7
Sydney Children's Community Health Centre	45	33-52	58	13	45	23-40	45	0
Playground adjacent to Ronald McDonald House	65	50-66	67	2	65	40-58	63	0

Note that predicted noise levels for hospital buildings presented are internal noise levels with 20 dB subtracted from the predicted external level incident upon the facade to account for attenuation provided by a typical residential-type facade (with closed windows).

Results show that exceedances of the established NMLs are likely to occur at all residential premises and at hospital buildings during excavation work and at many receivers during construction work. Exceedances during the excavation stage are up to 15 dB. During the construction stage exceedances are fairly moderate, typically in the order of 6 to 8 dB at residences and up to 7 dB at the CANTEEN building. Predicted noise levels are such that all residences considered would be classified as *noise affected* by the ICNG.

It is noted that the INCG applies a 5 dB penalty to some of the excavation and construction equipment used in this assessment on the basis that these items cause additional annoyance based on tonality, percussive noise and other characteristics. Adding this penalty to the noise levels presented in Table 11 would materially alter the outcome at a very limited number of receivers, who may become highly noise affected (residences 1 and 2 St. Paul's Street).

As noted, the modelled scenarios assume that the construction equipment operates for the whole 15 minute assessment duration. In order to quantify the outcomes under periods of reduced activity, subtract the following amounts from the tabulated data:

- Equipment item operates for one half the time: Subtract 3 dB
- Equipment item operates for one third of the time: Subtract 5 dB
- Equipment item operates for one quarter of the time: Subtract 6 dB

Subtracting these values is expected to quantify excavation/construction noise levels over a typical day as distinct from noise levels during a 15 minute assessment period.

7.5. Noise Assessment – Airborne Noise

Given the predicted noise exceedances, particularly during the excavation works, it has been considered necessary to test feasible and reasonable mitigation measures to control airborne construction noise.

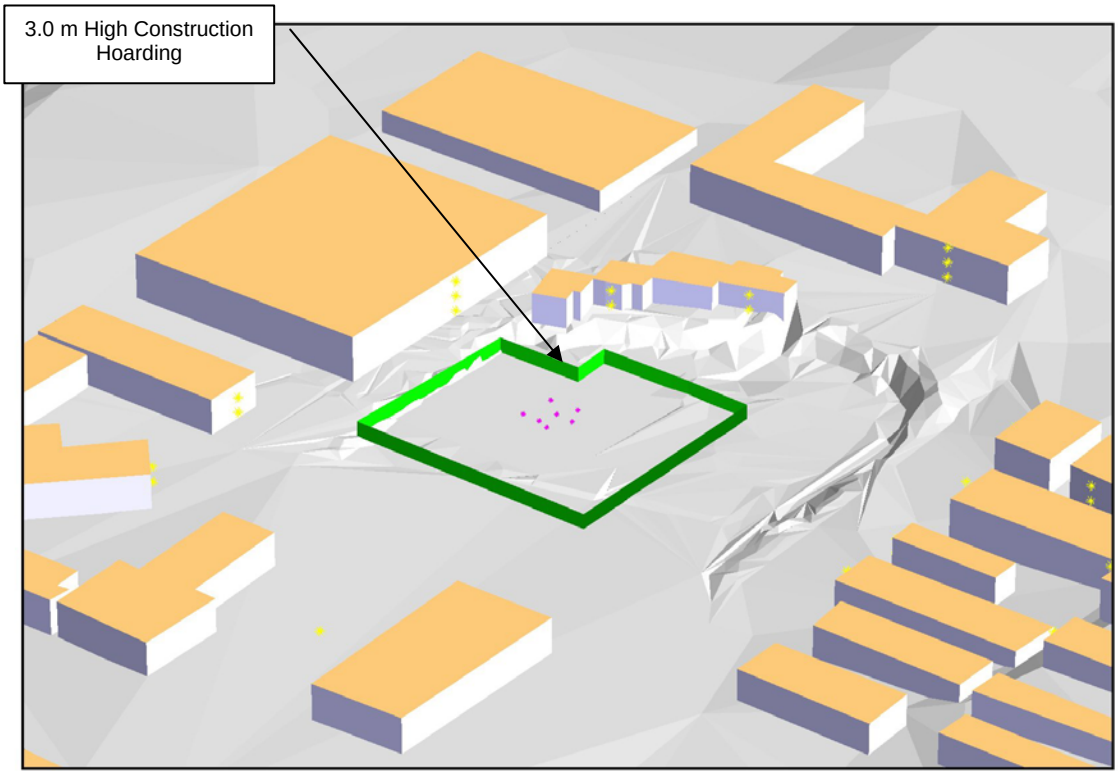
The following measure has been modelled:

- A **3.0 m construction hoarding** at the perimeter of the site.

The height of the barrier used in the calculations is based on previous experience and common feasible and reasonable practice.

An image from the computer noise model identifying the 3.0 m hoarding is presented in Figure 7.

Figure 5: 3D Image of Computer Model with 3.0 m Hoarding



This treatment has been modelled and results under this treatment scenario are presented in Table 12:

Table 12: Predicted Construction Noise Levels With Mitigation

Residential Receiver	Noise Level at Receiver $L_{Aeq\ (15min)}$ (dB re 20 µPa)							
	Excavation				Construction			
	NML	Typical Range	Worst Case	Benefit over untreated	NML	Typical Range	Worst Case	Benefit over untreated
1 St Paul's Street	56	50-67	68	0	56	25-57	62	0
2 St Paul's Street	56	52-70	71	0	56	29-60	64	0
251 Avoca Street	56	45-66	68	1	56	39-56	61	2
Administration Building	45	34-51	52	0	45	24-42	44	0
Prince of Wales Childcare	45	20-46	47	1	45	13-33	37	5
University of NSW Medical Society Bookshop	45	23-44	45	7	45	23-40	45	1
Ronald McDonald House	45	31-48	55	1	45	22-38	41	2
CANTEEN/Palliative Care	45	40-56	57	0	45	30-48	52	0
Sydney Children's Community Health Centre	45	33-50	57	1	45	23-37	43	2
Playground adjacent to Ronald McDonald House	65	50-66	61	6	65	31-46	51	12

A review of Table 12 shows that the 3.0 m hoarding at the site perimeter is largely ineffective. (The benefit provided for the playground is an exceptional and uncharacteristic case). This is due to the site perimeter barrier location being mid-way between the sources and receivers which is the least effective location for a barrier; and due to the elevated height of some receivers with respect to the noise sources.

Alternative reasonable and feasible measures will need to be tested and implemented during the works. An example of one possible alternative measure is localised barriers between particularly noisy activities during the construction stage and the most affected receivers. The most affected receivers that would benefit from localised hoardings around noisy plant items or activities are:

- Residences at 1 and 2 St. Paul's Street and at 251 Avoca Street
- Ronald MacDonald House
- CANTEEN/Palliative Care
- Sydney Children's Community Health Centre

Images showing a comparison of the untreated and treated noise outcomes are shown below:

Figure 6: Construction Noise Model Looking South East with No Mitigation

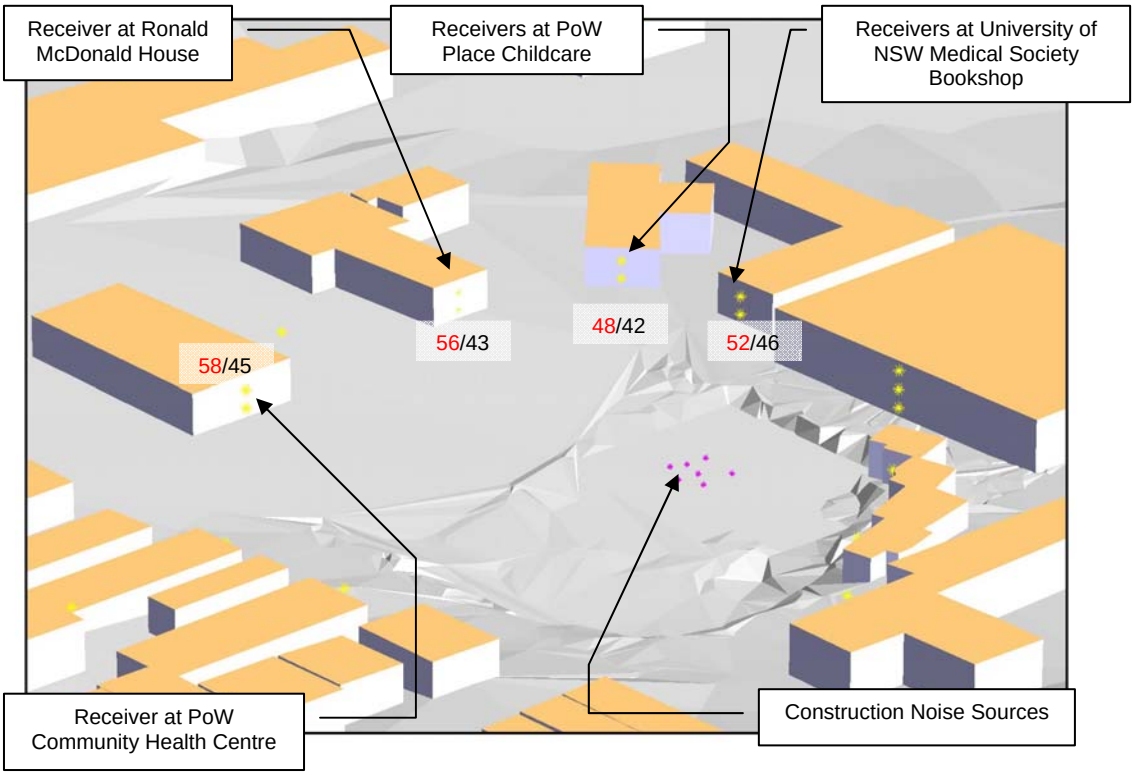
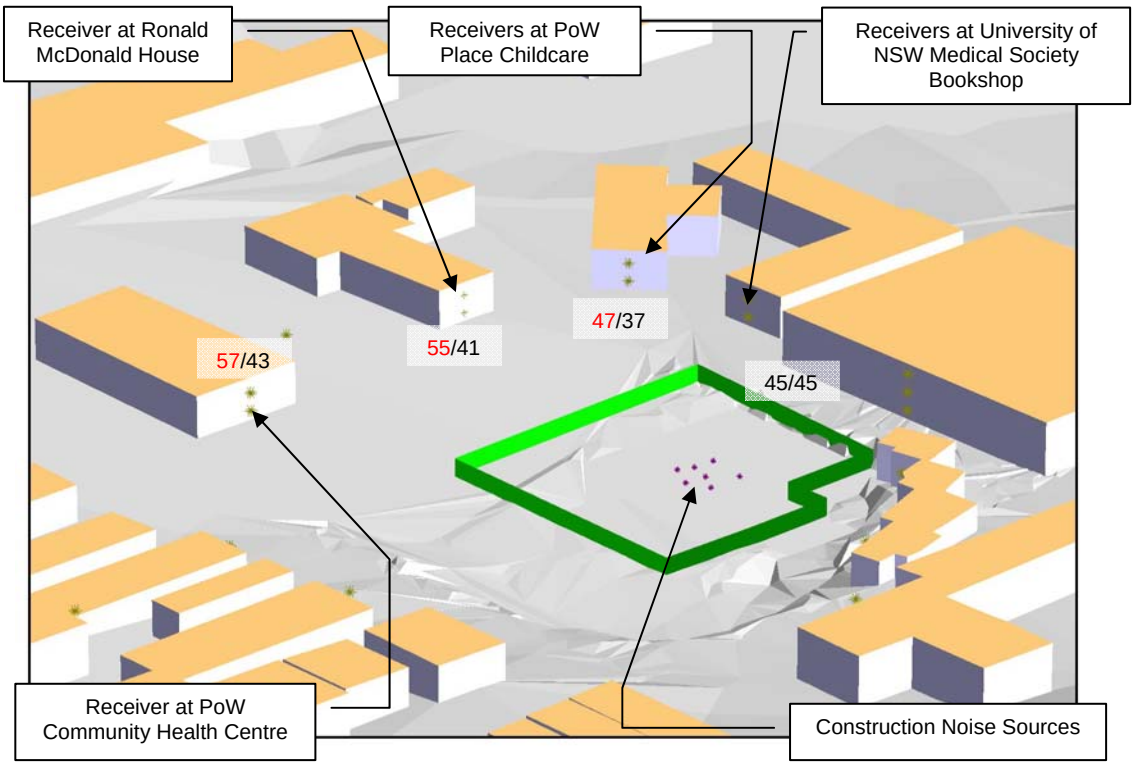


Figure 7: Construction Noise Model Looking South East with Mitigation



(Note results are shown for excavation/construction. Non-compliant outcomes are shown in red text).

Figure 8: Construction Noise Model Looking North West with No Mitigation

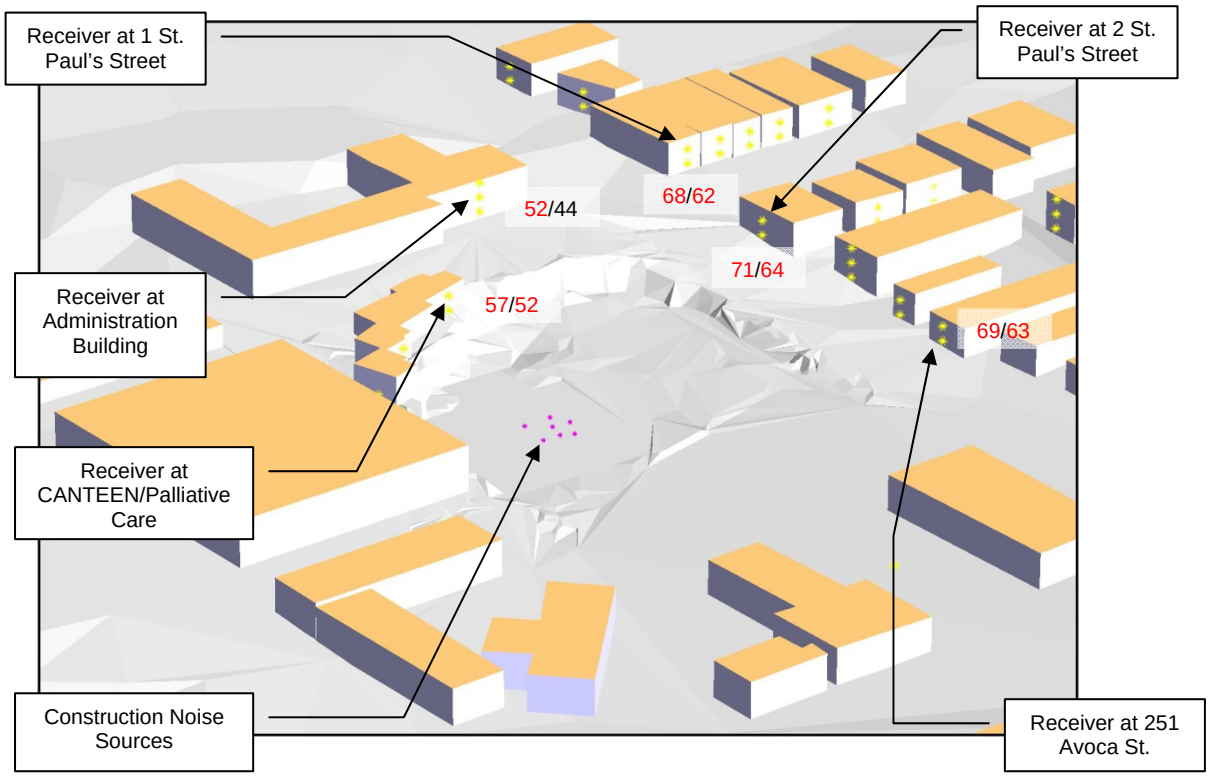
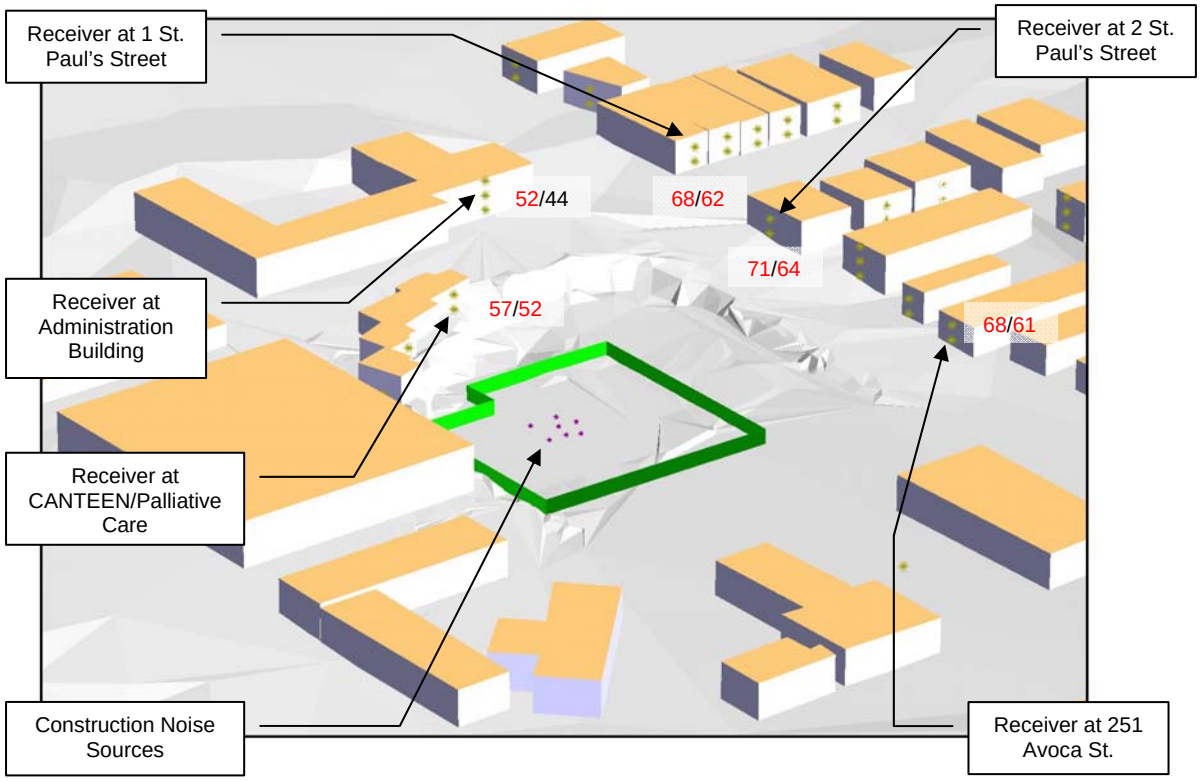


Figure 9: Construction Noise Model Looking North West with Mitigation



(Note results are shown for excavation/construction. Non-compliant outcomes are shown in red text).

7.5.1. Construction-Related Vehicle Noise

Construction-related vehicle activity has not been included as a stationary source in the demolition or construction scenarios. However, the potential noise impact of a loaded truck pulling away, and also a stationary truck outside of the construction compound (i.e. not afforded acoustic benefit provided by any construction hoarding) has been assessed at the nearest residential receivers.

- A loaded truck pulling away from the site will result in noise levels of 65 dB L_{Aeq} at the nearest residential receivers in Avoca Street.
- An idling truck will result in noise levels of 52 L_{Aeq} dB at the nearest residential receivers in Avoca Street.

The former value exceeds the established noise management level for the project.

There are generally no feasible measures to control noise emission due to trucks pulling out of the site (when the site is of a limited size and with limited vehicle entry and exit locations as is the case at the proposed development site). However, it is considered reasonable and feasible to switch stationary trucks off avoid prolonged periods of idling. This measure should be incorporated in any Construction Noise Management Plan (CNMP) for the works.

7.6. Summary of Airborne Construction Noise Impact

It has been demonstrated that a site perimeter hoarding of 3.0 minimum height would not be effective at controlling excavation and construction noise emission to nearby receivers.

Given that exceedances of the *noise affected level* are predicted to occur for some items of excavation and construction equipment (with the site perimeter hoarding in place), it is recommended that these exceedances be mitigated by all reasonable and feasible measures, and these measures should be documented in a Construction Noise Management Plan (CNMP) for the works prepared by a suitably qualified acoustic engineer.

Relevant measures are normally recommended once a contractor is engaged and their preferred equipment and work methods established. Refer to *Recommendations and Conclusions* in Section 10.1.

8. OPERATIONAL NOISE IMPACT STATEMENT

8.1. Methodology

A 3D computer noise model of the site has been prepared in order to assess operational airborne noise levels at the receivers identified above.

Using the *AR_MHICU_DA_A 02_01 – Site Survey* and proposed mechanical plant layouts as prepared by NDY Mechanical Engineers as a basis, a computer noise model of the site and immediate vicinity has been prepared in noise modelling software SoundPLAN v6.5. The *General Prediction Method* calculation method was implemented.

Whilst the survey electronic data is presented in two dimensions, a sample of the surveyed RL heights have been input into the model in order to sufficiently describe the site in three dimensions.

The computer noise model includes ground topography, buildings, fences, noise sources and receivers as required, to approximate the expected operational noise from plant items proposed by NDY mechanical engineers.

For this project, three mechanical services operational scenarios were evaluated:

- Daytime (including the INP defined period of evening, i.e. 0700 to 2200)
- Night-time (2200 to 1000)
- Emergency backup power generator operation

The reduced operation of mechanical plant at night-time is based upon advice from NDY mechanical engineers.

Images of the calculated noise contours to accompany this section are to be found in Appendix A.

8.2. Identification of Sensitive Land Uses

The sensitive land uses identified as being the potentially most affected are:

- Residences on the eastern side of Avoca Street. For the purposes of this assessment, construction noise levels are assessed at Number 1 St Paul's Street, 2 St Paul's Street and 251 Avoca Street
- The nearest facade of the CANTEEN/Palliative Care Building to the North
- The nearest facade of the Administration Building to the North
- The nearest facade of the Ronald McDonald House to the South
- The nearest facade of the University of New South Wales Medical Society to the South West
- The nearest facade of the Prince of Wales Place Childcare to the South West
- The nearest facade of the Sydney Children's Community Health Centre
- The playground adjacent to the Ronald McDonald House and the PoW Community Health Centre.

Mechanical plant noise sources are identified in Figure 10 and Figure 11. The receivers are the same receivers used to assess excavation/construction noise.

Figure 10: Computer Model looking South East showing Mechanical Plant Noise Sources

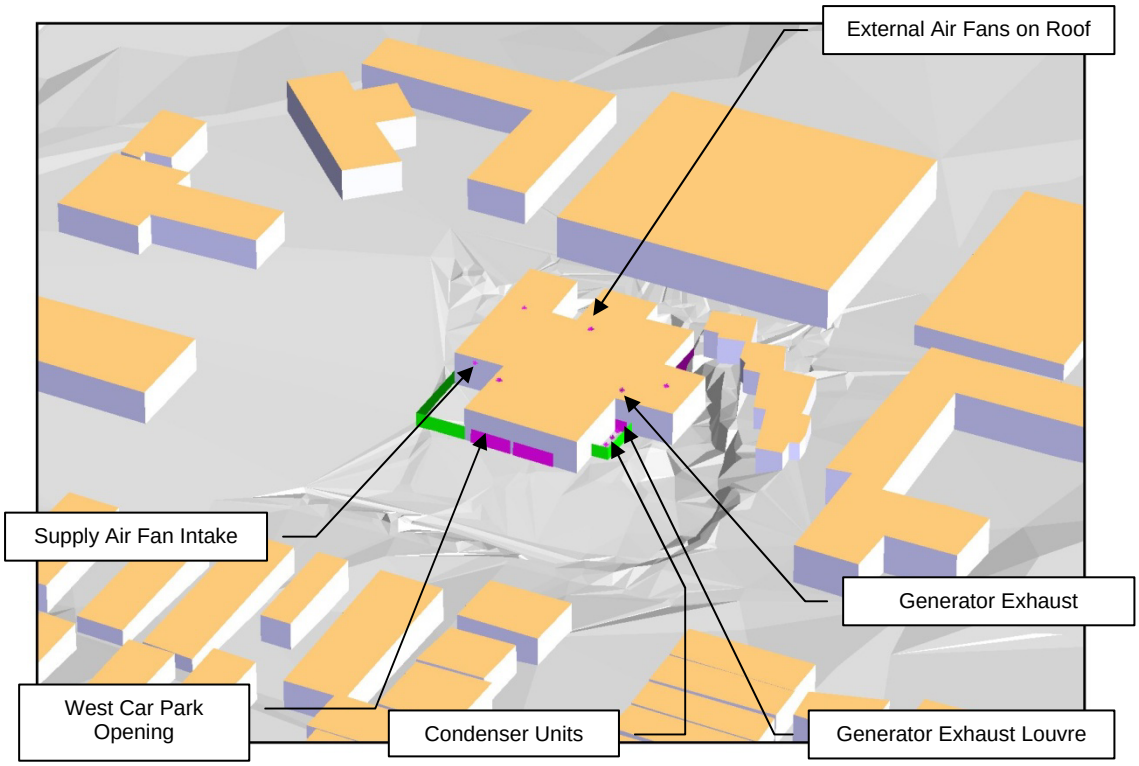
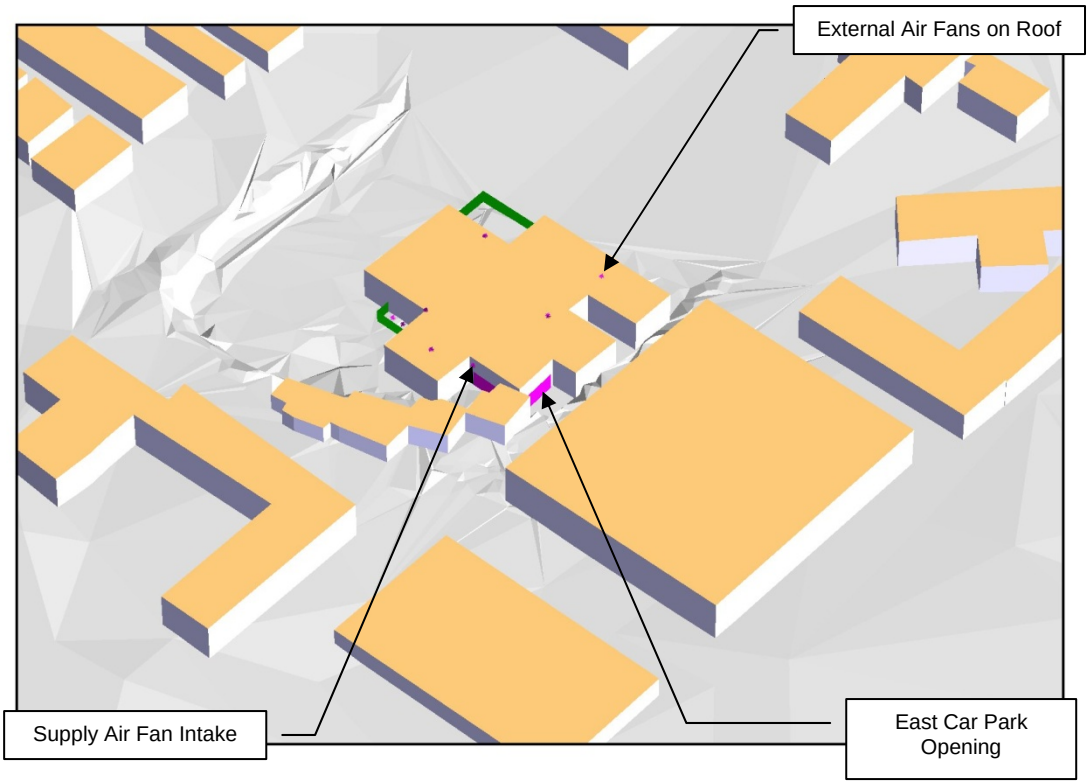


Figure 11 Computer Model looking North East showing Mechanical Plant Noise Sources



8.3. Mechanical Services Noise Levels

Sound power levels for the mechanical services items, as proposed by NDY mechanical engineers, are presented in Table 13. These are based on manufacturer data and verified by NDY Sound prediction algorithms. The sound power at car park openings has been calculated assuming concrete finishes are present throughout the car park.

Table 13: Schedule of Equipment Sound Power Levels

Item of Plant	Sound Power Level (dB re 1pW) at Octave Band Centre Frequency (Hz)							
	63	125	250	500	1000	2000	4000	8000
Supply Air Fans								
SAF-01	80	76	73	70	70	66	65	59
SAF-02	81	79	75	72	65	65	64	54
SAF-03	83	76	76	73	73	69	68	62
SAF-04	80	76	73	70	70	66	65	59
Exhaust Fans								
EF-1	81	79	75	72	63	65	64	54
EF-2	81	79	75	72	63	65	64	54
EF-3	81	79	75	72	63	65	64	54
EF-4	84	84	78	70	67	65	63	62
Condenser Units								
CU-1	75	77	74	71	67	62	58	54
CU-2	75	77	74	71	67	62	58	54
CU-3	75	77	74	71	67	62	58	54
Car park Fan Coil Units								
FCU-G-01	72	68	68	67	66	62	58	54
FCU-G-02	72	68	68	67	66	62	58	54
FCU-G-03	72	68	68	67	66	62	58	54
FCU-G-04	71	67	67	66	65	61	57	53
FCU-G-05	71	67	67	66	65	61	57	53
FCU-G-06	71	67	67	66	65	61	57	53
FCU-G-07	80	76	76	75	74	70	66	62
FCU-G-08	80	76	76	75	74	70	66	62
FCU-G-09	71	67	67	66	65	61	57	53
FCU-G-10	71	67	67	66	65	61	57	53
FCU-G-11	71	67	67	66	65	61	57	53
FCU-G-12	74	70	70	69	68	64	60	56

Item of Plant	Sound Power Level (dB re 1pW) at Octave Band Centre Frequency (Hz)							
	63	125	250	500	1000	2000	4000	8000
FCU-G-13	72	68	68	67	66	62	58	54
Total Lw at West Openings	73	69	69	68	65	60	56	52
Total Lw at East Openings	73	69	68	66	64	60	56	52
Generator								
Intake and Case Radiated Noise	105	106	106	106	104	102	99	94
Combustion Exhaust Noise	120	126	122	114	110	104	94	86

In the absence of manufacturer's published octave band sound power data for the proposed 100 kVA generator set, The generator sound power levels have been predicted based on its power and several other characteristics. The sound power levels were calculated using the following equation:

$$L_w = 90 + 10\log kW + A + B + C + D \quad dB$$

Where kW is the power of the generator and A, B, C and D are sound power level adjustments as described in Table 14. The power of the 100 kVA generator is taken to be approximately 90 kW. It is likely the predicted sound power values are slightly conservative.

Table 14: Sound Power Level Correction Terms

Correction Term	Condition	dB
A	600-1500 rpm	-1
B	Diesel fuel	0
C	In-line cylinders	0
D	Inlet type	0

The octave band sound power level adjustments used for the intake and case radiated noise and combustion exhaust noise are presented in Table 15.

Table 15: Sound Power Level Octave Band Correction Values

Source	Sound Power Level (dB re 1pW) at Octave Band Centre Frequency (Hz)							
	63	125	250	500	1000	2000	4000	8000
Air Intake and Case Radiated	4	3	3	3	5	7	10	15
Combustion Exhaust	-3	-9	-5	3	7	13	23	31

8.4. Predicted Noise Levels

The noise levels due to normal operation (no generator) were evaluated at the nearest receivers. Three operational scenarios have been modelled as described in Section 8.1.

8.4.1. Residential Receivers – No Generator

Based on the inputs presented above, the operating noise levels shown in Table 16 have been calculated at residential premises.

Table 16: Predicted Operational Noise - Residential Receivers

Receiver Location	Noise Level $L_{Aeq\ (15min)}$ (dB re 20 µPa)					
	Daytime		Evening		Night-time	
	Criterion	Predicted	Criterion	Predicted	Criterion	Predicted
1 St Paul's Street	51	32	46	32	38	30
2 St Paul's Street	51	35	46	35	38	34
251 Avoca Street	51	31	46	31	38	29

8.4.2. Hospital and Playground Receivers – No Generator

Predicted noise levels at the existing hospital and playground receivers are presented in Table 17.

Table 17: Predicted Operational Noise - Hospital and Playground Receivers

Receiver Location	Noise Level $L_{Aeq\ (15min)}$ (dB re 20 µPa)					
	Daytime		Evening		Night-time	
	Criterion	Predicted	Criterion	Predicted	Criterion	Predicted
Administration Building	35	14	35	14	35	13
Prince of Wales Childcare	35	10	35	10	35	3
University of NSW Medical Society Bookshop	35	12	35	12	35	7
Ronald McDonald House	35	11	35	11	35	6
CANTEEN/Palliative Care	35	22	35	22	35	21

Receiver Location	Noise Level $L_{Aeq\ (15min)}$ (dB re 20 µPa)					
	Daytime		Evening		Night-time	
	Criterion	Predicted	Criterion	Predicted	Criterion	Predicted
Sydney Children's Community Health Centre	35	13	35	13	35	8
Playground adjacent to Ronald McDonald House	55	29	n/a	n/a	n/a	n/a

Note that noise levels for hospital buildings are internal noise levels with 20 dB subtracted from the predicted external noise level to account for attenuation provided by a typical residential-quality facade with (closed) operable windows.

8.4.3. Residential Receivers – With Generator

Based on the inputs presented above, including the emergency backup power generator (untreated), the operational noise levels shown in Table 18 have been calculated at residential premises. Exceedances of the established project criteria are shown in red text. For daytime operation, a comparison also needs to be made with the (lower) evening criterion.

Table 18: Predicted Operational Noise - Residential Receivers

Receiver Location	Noise Level $L_{Aeq\ (15min)}$ (dB re 20 µPa)					
	Daytime		Evening		Night-time	
	Criterion	Predicted	Criterion	Predicted	Criterion	Predicted
1 St Paul's Street	51	63	46	63	38	63
2 St Paul's Street	51	66	46	66	38	66
251 Avoca Street	51	65	46	65	38	65

8.4.4. Hospital and Playground Receivers – With Generator

Predicted noise levels at the existing hospital and playground receivers due to the operation of all sources including the emergency backup power generator (untreated), are presented in Table 19. Exceedances of the 'hospital wards and operating theatres' internal criterion of 35 dB and the active recreation area (playground) criterion of 55 dB are shown in red text.

Table 19: Predicted Operational Noise - Hospital and Playground Receivers

Receiver Location	Noise Level $L_{Aeq\ (15min)}$ (dB re 20 µPa)					
	Daytime		Evening		Night-time	
	Criterion	Predicted	Criterion	Predicted	Criterion	Predicted
Administration Building	35	47	35	47	35	47
Prince of Wales Childcare	35	41	35	41	35	41
University of NSW Medical Society Bookshop	35	46	35	46	35	46
Ronald McDonald House	35	43	35	43	35	43
CANTEEN/Palliative Care	35	57	35	57	35	57
Sydney Children's Community Health Centre	35	44	35	44	35	44
Playground adjacent to Ronald McDonald House	55	59	n/a	n/a	n/a	n/a

8.5. Summary of Operational Noise Impact

For residential receivers, predicted noise levels due to the operation of normal mechanical services reveal no exceedances. For other land uses normal mechanical plant operational scenarios show a trend of compliance with the internal noise criterion.

The operation of the untreated generator results in exceedances at all receiver locations. Exceedances of up to 28 dB are predicted at residential premises during the night-time period and up to 22 dB inside the CANTEEN and Palliative Care buildings.

These are significant exceedances and application of detailed acoustic design advice and a suite of mitigation measures will be required during the detailed design stage. Refer to Section 10.2.2.

9. TRAFFIC NOISE IMPACT STATEMENT

There is no proposed increase in traffic volume due to the new building; therefore the increase in road traffic noise generated by traffic due to the new building will be nil, i.e. 0 dB.

Therefore road traffic noise impact due to the operation of the proposed new hospital facility complies with the project noise requirements and no further acoustic input is required as a result.

10. RECOMMENDATIONS AND CONCLUSIONS

10.1. Construction Noise

The construction noise assessment has shown that in the absence of reasonable and feasible measures, exceedances of the established noise management levels are predicted to occur at nearby residential and hospital building receivers.

Therefore, a solid, imperforate construction hoarding of 3.0 m height at the perimeter of the site has been investigated to determine excavation and construction noise levels under a 'treated' scenario.

The outcome of this investigation is that the site perimeter barrier is ineffective at controlling excavation and construction noise emission to both residential and hospital receivers. This is due to the barrier being located at the mid-point between sources and receivers (the least effective location for a barrier) and the elevated nature of some receivers above the development site.

It is therefore recommended that an alternative strategy of localised temporary hoardings and barriers around particularly noisy items of plant, to shield noise emission to the most affected receivers (identified in Section 7.5) is considered. Working behind stockpiles of spoil is one means of achieving this.

The predicted exceedances of the established criteria should also be mitigated by all other reasonable and feasible management measures, subject to the guidance in the DECCW *Interim Construction noise Guideline* and documented in a Construction Noise Management Plan for the site.

Such measures would include:

- Use the quietest available equipment for a given task, using the manufacturers published data if available or legislated data for certain items such as mobile compressors.
- Using the quietest practicable method for a particular task.
- Use alternatives to tonal reversing alarms as these are often the cause of significant annoyance even if the overall noise level may be compliant.
- Consult with affected neighbours about scheduling activities to minimise noise impacts.

In order to accurately define the hospital spaces that may be affected by the works and the corresponding extent of reasonable and feasible mitigation measures, the CNMP should include an audit of the nearby hospital spaces, to determine the use of the space (and therefore sensitivity to construction noise) the performance of the hospital building facade glazing (as it may be improved compared to that assumed in this report). A reduced number of noise sensitive hospital receivers may lessen the imposition of the reasonable and feasible measures selected in the CNMP.

10.1.1. Construction Vibration

An assessment of construction-related vibration is not required by the DGR. However, the potential impact of such vibration, including impact upon vibration-sensitive hospital equipment as well as patients and staff should be considered by the selected contractor prior to undertaking works.

Controlling construction-related vibration includes the determination of minimum safe work distances to hospital buildings and selection of the least vibration-intensive methods and/or plant for a particular activity. These should be formalised in a Construction Noise Management Plan (CNMP) for the works.

10.2. Operational Noise

10.2.1. Normal Operation Plant

An operational noise assessment has shown that the likely operation scenarios of mechanical plant and equipment will result in compliance with the established project specific noise.

Should reselection of mechanical plant items take place, the substitute items should be reviewed for conformance with the criteria established in this report.

It is recommended that acoustic design advice be sought during the design development, detailed design and construction stages of the project.

10.2.2. Generator Operation

The operation of the untreated generator set (based on predicted sound power levels in the absence of manufacturer's data) results in significant exceedances of the daytime, evening and night-time criteria at all residential receivers. It also significantly exceeds the internal noise criteria at all nearby hospital buildings, particularly at the CANTEEN/Palliative Care building.

These exceedances will require investigation of significant mitigation measures including but not limited to:

- Selection of a unit with lower sound power levels than the values used in this study
- Lining of the generator room with acoustically absorptive finishes
- Providing an acoustically-designed room to house the generator with all constructions optimised for noise control
- Silencers on the intake and exhaust air supply prior to the intake point in the car park and exhaust point to the north east of the building
- Muffler(s) on the combustion exhaust
- Barriers to shield the intake and exhaust points from the most noise affected receivers

All best practice measures applicable to generator installation should also be considered such as spring isolation mounts.

It is recommended that manufacturer's data be obtained for the final selection of generator to ensure the accuracy of any acoustic calculations undertaken during the design stage.

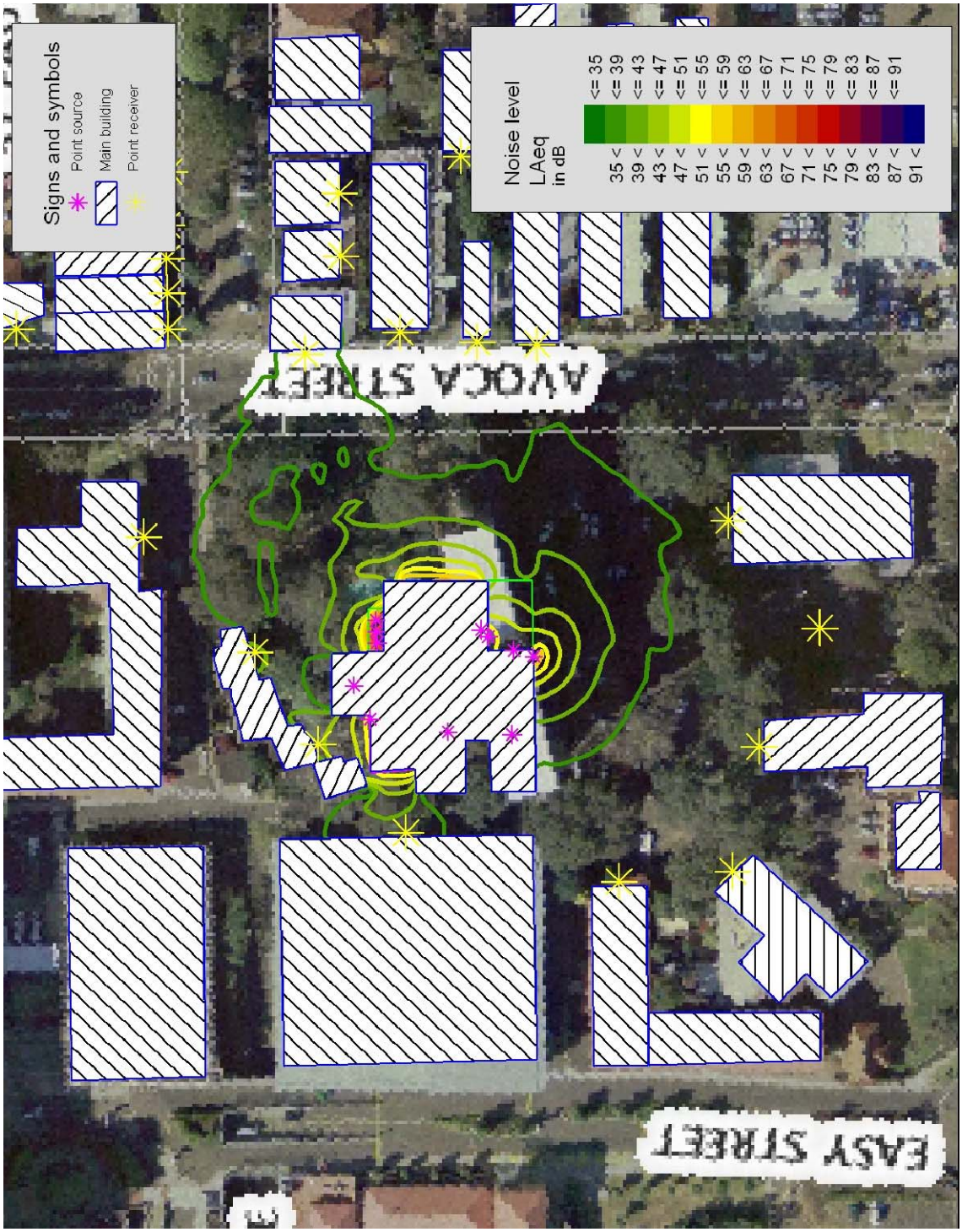
10.3. Traffic Noise

There is no proposed increase in traffic volume due to the new building; therefore the increase in road traffic noise generated by traffic due to the new building will be nil, i.e. 0 dB.

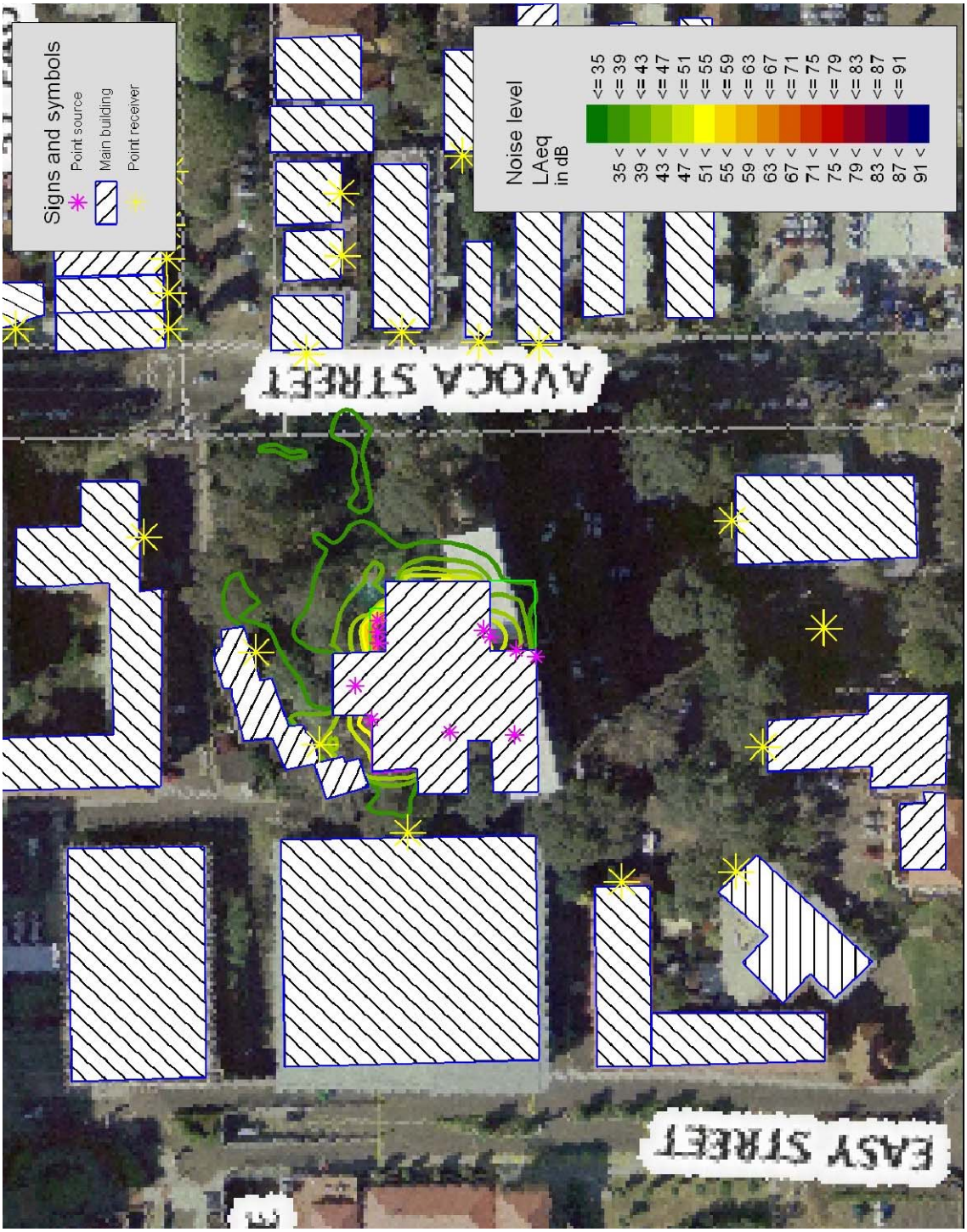
It is therefore deemed that road traffic noise impact due to the operation of the proposed new hospital facility complies with the project noise requirements and no further acoustic input is required as a result.

APPENDIX A – OPERATIONAL NOISE CONTOURS

DAYTIME OPERATION – NO GENERATOR



NIGHT-TIME OPERATION - NO GENERATOR



GENERATOR OPERATION