



**Attachment B**  
**Acoustic Impact Assessment Report**  
**Addendum**

Your ref SSD 9103  
 Our ref 249368  
 File ref AC05

# ARUP

Level 5  
 151 Clarence Street  
 Sydney NSW 2000  
 Australia  
 t +61 2 9320 9320  
 d +61 2 9320 9724  
 f +61 2 9320 9321  
 samuel.grieve@arup.com  
 www.arup.com

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Dear Sir/Madam,

## New Macksville Hospital

This letter has been prepared in response to a request made by the NSW Department of Planning and Environment (DPE) regarding the SSD Noise and Vibration Assessment<sup>1</sup> prepared by Arup.

Noise predictions contained in this letter have been assessed against the NPI project noise criteria, reproduced as Table 1, established in the abovementioned document. It is noted that the below project noise criteria are yet to be approved.

Table 1: NPI project noise criteria

| Receiver  | Time Period | Project Noise Trigger Levels                              |                                                          |                                                |
|-----------|-------------|-----------------------------------------------------------|----------------------------------------------------------|------------------------------------------------|
|           |             | Intrusive Noise Trigger Levels, L <sub>Aeq,15min</sub> dB | Project Amenity Noise Levels, L <sub>Aeq,period</sub> dB | Sleep Disturbance, L <sub>Amax(night)</sub> dB |
| R1, R5-R8 | Day         | 47                                                        | 50                                                       | N/A                                            |
|           | Evening     | 46                                                        | 40                                                       | N/A                                            |
|           | Night       | 48                                                        | 35                                                       | 58                                             |
| R2-R4     | Day         | 40                                                        | 45                                                       | N/A                                            |
|           | Evening     | 35                                                        | 40                                                       | N/A                                            |
|           | Night       | 35                                                        | 35                                                       | 52                                             |

All noise predictions have been carried out utilising NSW EPA recognised computer noise model SoundPLAN v8.0. Inherent within every predictive noise model are assumptions relating to the assessment. It is noted, assumptions outlined in this letter are based on available data and representative of typical worst-case conditions and, therefore, actual operational noise levels are expected to be, for the most part, lower than those presented throughout the predicted results.

<sup>1</sup> Arup, *New Macksville Hospital—SSD9103 – Construction and Operational Noise and Vibration Assessment*, 18 May 20018.

## DPE

*A number of submissions raised concerns in relation to amenity impacts arising from the access road into the site. The RtS responds to the public submissions by stating the road is not subject of this application. The Department acknowledges the access road was approved by Council and does not form part of the application, however the proposed hospital will result in use of the access road throughout the evening and night and therefore potentially result in amenity impacts on the residents of Letitia Close. A breakdown of evening and night vehicular movements likely along this access road is to be provided and mitigation measures recommended to reduce impacts on these residences.*

And,

*Likely noise generated from traffic/parking/doors slamming etc, in the car park*

## Arup response

Predicted traffic generation data was obtained from the Traffic Impact Assessment<sup>2</sup>, and is reproduced below. For clarity, total trip generation for the New Macksville Hospital has been assessed applying different generation rates for two different departments. These departments are identified as; ‘Hospital’ and ‘Community Health Centre’. It is emphasised, both these departments form part of, and are located in, the New Macksville Hospital building.

### **Hospital**

*The hospital has been assessed on the basis of 80 Beds with 180 FTE staff by 2026/27. It has been assumed that all staff are day shift although it is understood that this staffing projection would encompass all shifts and as such assesses traffic as a worst-case scenario.*

- *Applying the RMS rate results in 98 trips in the peak hour*

### **Community Health Centre**

*The Study team has indicated that the site will also include a Community Health Centre with a gross floor area of 727 m<sup>2</sup>. The RTA Guide does not have a trip generation rate for this type of facility so the trip rate for an Extended Hours Medical Centre with a peak vehicle trip generation rate of 10.4 veh/hr/100 m<sup>2</sup> gross floor area has been adopted for the Community Health Centre.*

- *Applying this rate results in 76 peak hour trips*

***Total trip generation for the site is calculated at 98 + 76 = 174 peak hour trips (87 inbound, 87 outbound)***

The above traffic generation data provides peak hour trips for a given 24-hour period. It is assumed that the peak hour would occur during day-time (i.e. 7:00 am to 6:00 pm) hours. No guidance is provided in connection with peak hour trips for the evening (i.e. 6:00 pm to 10:00 pm) or night-time (10:00 pm to 7:00 am) hours.

However, the Mid North Coast Local Health District (MNCLHD) has provided vehicular movements based on observations at the existing Macksville hospital. Observations have focused on evening and night-time hours and are presented below:

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<sup>2</sup> SECA Solution, *Macksville Hospital—Health Infrastructure—Traffic Impact Assessment*, Issue: Ver03/06052018, Ref: P0937, 7 May 2018.

***Night Staff (2200 - 0700)***

*Emergency Department 4*

*In Patients Unit 5*

*Maternity 3*

*Back of House 2*

***Total 14 (only coming to the Hospital of an evening not leaving until 7:30 am to 8:00 am)***

***Evening Staff (1330 - 2200)***

*Emergency Department 6*

*In Patient Units 14*

*Maternity 3*

*Back of House 4*

***Total 27 (Only leaving the Hospital at the end of shift at 2200)***

***Patients and Visitors***

*Maternity visits = 1 (potentially arrive and leave the same evening)*

*ED Visits = Max 10 (potentially arrive and leave the same evening)*

*IPU visits = 1 (potentially arrive and leave the same evening)*

*Patient Transport finish by 2100 = 0*

**Total 12**

It is noted, the hours provided by MNCLHD for evening staff (i.e. 1330 - 2200) overlap the Day and Evening time periods as defined in the NSW NPI. Therefore, evening staff vehicle numbers are assumed to occur after 6:00 pm to align with the NSW NPI.

The above vehicle movement data is summarised in Table 2.

Table 2: Summary of vehicle movements for the New Macksville Hospital

| Source                                                | Time                 | Staff               | Patients and visitors      | Total peak hour trips      |
|-------------------------------------------------------|----------------------|---------------------|----------------------------|----------------------------|
| Traffic Impact Assessment (predictions)               | Day <sup>2</sup>     | N/A <sup>1</sup>    | N/A <sup>1</sup>           | 87 arrival<br>87 departure |
| MNCLHD (observations of existing Macksville Hospital) | Evening <sup>3</sup> | 27 (departure only) | 12 (arrival and departure) | 12 arrival<br>39 departure |
|                                                       | Night <sup>4</sup>   | 14 (arrival only)   | 12 (arrival and departure) | 26 arrival<br>12 departure |

| Source | Time | Staff | Patients and visitors | Total peak hour trips |
|--------|------|-------|-----------------------|-----------------------|
|--------|------|-------|-----------------------|-----------------------|

Notes

1. Not applicable.
2. NSW NPI: 7:00 am to 6:00 pm.
3. NSW NPI: 6:00 pm to 10:00 pm.
4. NSW NPI: 10:00 pm to 7:00 am.

Table 3 summarises the representative sound power level assumed for each considered noise source.

Table 3: Assumed noise source sound power levels

| Description                                        | dB(A) | Sound Power Level, dB re 1 pW<br>Octave Band Centre Frequency, Hz |     |     |     |    |    |    |    |
|----------------------------------------------------|-------|-------------------------------------------------------------------|-----|-----|-----|----|----|----|----|
|                                                    |       | 63                                                                | 125 | 250 | 500 | 1k | 2k | 4k | 8k |
| Vehicle travelling, 50km/hr                        | 89    | 88                                                                | 85  | 85  | 85  | 86 | 78 | 70 | 63 |
| Vehicle accelerating from highway to access road   | 94    | 104                                                               | 105 | 91  | 89  | 86 | 85 | 83 | 78 |
| Vehicle accelerating in car park up-ramp, 10 km/hr | 68    | 78                                                                | 79  | 65  | 63  | 60 | 59 | 57 | 52 |
| Vehicle ignition                                   | 98    | 94                                                                | 96  | 85  | 86  | 93 | 93 | 91 | 86 |
| Vehicle door closing                               | 97    | 87                                                                | 90  | 92  | 93  | 93 | 89 | 87 | 82 |
| Person shouting                                    | 75    | 61                                                                | 54  | 59  | 73  | 72 | 66 | 58 | 42 |

As indicated in Table 2, the highest peak hour trips are expected to occur during the day. If predicted noise impacts concerning the day peak hour trips comply with the most onerous night-time criteria, no further assessment is deemed necessary. Therefore, Table 4 outlines the predicted quantity, speed/duration and location of each considered noise source for the day period (i.e. 7:00 am to 6:00 pm).

It is noted, the NSW NPI requires that intrusive noise impacts be assessed over a 15-minute assessment period. Therefore, it is appropriate to adjust the total peak hour trips, presented in Table 2, to reflect a 15-minute period (e.g.  $87 / 4 \approx 22$ ).

Table 4: Quantity, duration and location of noise sources—day time

| Noise source                                     | Quantity per 15-min                    | Speed/Duration                                       | Location                                 |
|--------------------------------------------------|----------------------------------------|------------------------------------------------------|------------------------------------------|
| Vehicle travelling, 50 km/hr                     | 22 vehicles enter,<br>22 vehicles exit | Travelling at 50 km/hr                               | Length of access road and parking lot    |
| Vehicle accelerating from highway to access road | 22 vehicles enter                      | 25 km/hr (entering access road from highway)         | 170 m (entering access road)             |
| Vehicle accelerating in car park up-ramp         | 22 vehicles exit                       | 10 km/hr (leaving hospital car park)                 | Length of parking lot (leaving hospital) |
| Vehicle ignition                                 | 22 ignitions start                     | 1.5 s for each ignition                              | Parking lot                              |
| Vehicle door closing                             | 352 vehicle doors closings             | 0.5 s for each door slam                             | Parking lot                              |
| Person shouting                                  | 8 people                               | Far corner of car park to hospital door at 2.5 km/hr | Parking lot                              |

Table 5 presents the predicted noise levels.

Table 5: Predicted noise levels—access road and parking lot operations

| Receiver | Address            | L <sub>Aeq, 15min</sub> dB <sup>1</sup> | L <sub>Amax</sub> dB <sup>2</sup> | Project noise criteria    |                                         |
|----------|--------------------|-----------------------------------------|-----------------------------------|---------------------------|-----------------------------------------|
|          |                    |                                         |                                   | Night L <sub>Aeq</sub> dB | Sleep Disturbance, L <sub>Amax</sub> dB |
| R1       | 28 Mattick Road    | 31                                      | 40                                | 35 <sup>3</sup>           | 58                                      |
| R2       | 64 Mattick Road    | 28                                      | 38                                | 35 <sup>4</sup>           | 52                                      |
| R3       | 73 Champions Lane  | 21                                      | 23                                | 35 <sup>4</sup>           | 52                                      |
| R4       | 41 Letitia Close   | 35                                      | 37                                | 35 <sup>4</sup>           | 52                                      |
| R5       | 51 Old Coast Road  | 31                                      | 34                                | 35 <sup>3</sup>           | 58                                      |
| R6       | 83 Old Coast Road  | 30                                      | 30                                | 35 <sup>3</sup>           | 58                                      |
| R7       | 133 Old Coast Road | 23                                      | 30                                | 35 <sup>3</sup>           | 58                                      |
| R8       | 4 Mattick Road     | 28                                      | 39                                | 35 <sup>3</sup>           | 58                                      |

Notes:

1. The predicted L<sub>Aeq, 15min</sub> noise levels represent the peak hour day-time noise levels adjusted to 15-minutes.
2. The predicted L<sub>Amax</sub> noise level represents the noise level for a single instance of the loudest noise source for each receiver. For example, for R1, the noise from a car ignition was found to be the loudest single noise source in the model and the noise level at the receiver was found to be 40 dB(A).
3. 9-hour assessment period as per the NSW NPI amenity criteria.
4. 15-minute assessment period as per the NSW NPI intrusive criteria.

Table 5 indicates that predicted L<sub>Aeq, 15min</sub> noise levels, representative of day peak hour trips, comply with the night-time project criteria and the sleep disturbance criteria. On this basis no further assessment is required for the access road and parking lot. However, the above predicted noise levels shall be utilised in a cumulative noise impact assessment below.

## DPE

*Likely noise generation of expected plant to be installed as part of the hospital.*

### Arup response

A significant proportion of the mechanical plant and equipment (i.e. AHUs, EAFs, RAFs, OAFs, Chillers, HWHs, Pumps, etc.) is in the lower ground plant room. The lower ground plant room is primarily underground except for the north elevation which is proposed to be a concrete blockwork wall. Despite the presence of two single and two double doors, noise within the lower ground plant room is considered sufficiently isolated from off-site receivers.

Similarly, items of mechanical plant and equipment located within ceiling voids (i.e. EAFs, RAFs, OAFs, FCUs, etc.) on all levels—despite connecting ductwork to an external inlet/outlet—are considered to have negligible noise contribution at off-site receiver locations. It is noted, spatial allowance has been made for acoustic attenuators on both supply and return side for all fans.

Therefore, the key items of mechanical plant and equipment considered in this assessment are in the three level 1 plant rooms in addition to the emergency backup generator located externally at ground level.

It is noted, two of the level 1 plant rooms (i.e. 01.PLT.038 and 01.PLT.043) are ‘enclosed’ and the other (i.e. 01.PLT.078) is open to sky. The ‘enclosed’ plant rooms contain louvres along the eastern façades for ventilation purposes. It is proposed to construct a plenum on the internal side of the louvre such that all AHUs and Fans may be ducted directly to the plenum. All remaining surface area of the ventilation louvre that is outside the span of the plenum shall be blanked off.

Therefore, the primary noise source concerning the two ‘enclosed’ level 1 plant rooms is via the plenum/louvre system. Noise breakout via the remaining solid plant room walls and roof are expected to be negligible at off-site receiver locations.

The level 1 plant room that is open to sky (i.e. 01.PLT.078) shall contain two cooling towers and six split system air-conditioning condenser units. Three-metre-high louvres are proposed around the external perimeter of the open to sky plant room. The primary noise source concerning this plant room is the two cooling towers.

Table 6 summarises the representative sound power level assumed for each considered noise source. However, the Construction Contractor is responsible for ensuring that the final equipment selection and associated noise mitigation measures are implemented to achieve project criteria.

Table 6: Assumed noise source sound power levels

| Description                                                 |        | dB(A) | Sound Power Level, dB re 1 pW<br>Octave Band Centre Frequency, Hz |     |     |     |    |    |    |    |
|-------------------------------------------------------------|--------|-------|-------------------------------------------------------------------|-----|-----|-----|----|----|----|----|
|                                                             |        |       | 63                                                                | 125 | 250 | 500 | 1k | 2k | 4k | 8k |
| Cooling tower (super low sound fan) full speed <sup>1</sup> |        | 92    | 99                                                                | 97  | 89  | 87  | 87 | 84 | 81 | 80 |
| AHU fan intake <sup>2</sup>                                 |        | 84    | 79                                                                | 76  | 85  | 80  | 77 | 77 | 73 | 69 |
| Fan <sup>3</sup>                                            | Inlet  | 94    | 90                                                                | 86  | 91  | 89  | 91 | 86 | 82 | 78 |
|                                                             | Outlet | 95    | 85                                                                | 88  | 93  | 90  | 90 | 89 | 82 | 76 |
| External condenser units <sup>4</sup>                       |        | 78    | 84                                                                | 78  | 79  | 77  | 71 | 66 | 61 | 55 |

| Description                             | dB(A) | Sound Power Level, dB re 1 pW<br>Octave Band Centre Frequency, Hz |     |     |     |    |    |    |    |
|-----------------------------------------|-------|-------------------------------------------------------------------|-----|-----|-----|----|----|----|----|
|                                         |       | 63                                                                | 125 | 250 | 500 | 1k | 2k | 4k | 8k |
| Emergency backup generator <sup>5</sup> | 91    | 93                                                                | 99  | 95  | 88  | 84 | 78 | 71 | 61 |

Notes:

1. Evapco (Model: USS 17-3K9, Motor: 15.00 kW, #Motors: 1, Speed: Full Speed). An adjustment of -3 dB has been applied to the cooling tower Sound Power Level to account for a maximum speed of 80%.
2. FANselect (Type: GR50C-ZID.GQ.CR, Airflow: 2,000 l/s). An empirical adjustment has been applied to the fan Sound Power Level to account for AHU components (i.e. heating/cooling coil and bag filters).
3. Fantech (Mode: AP0502AP5/14, Airflow: 2.2 m<sup>3</sup>/s.). Adjustments have been applied to the fan Sound Power Level to account for duct attenuation (i.e. 7 metres of 25 mm internal acoustic insulation).
4. Mitsubishi (Model: PUHY-P350YNW-A(-BS), Cooling Capacity: 40kW, Fan Motor Output: 0.46 × 2).
5. Capacity: 300kVA, Assumed Dimensions: 6L, 3W, 3H. Octave band centre frequency spectrum has been obtained from empirical calculations. The generator and external weatherproof acoustic enclosure shall be selected/designed to meet a continuous sound pressure level of 70 dB(A) at 1 metre.

Table 7 outlines the predicted quantity, speed/duration and location of each considered noise source.

Table 7: Quantity, duration and location of noise sources

| Noise source                                  | Quantity per 15-min         | Speed/Duration                      | Location                                                       |
|-----------------------------------------------|-----------------------------|-------------------------------------|----------------------------------------------------------------|
| Cooling tower (super low sound fan) 80% speed | 2                           | 100% of 15-minute assessment period | Level 1 plant room open to sky (i.e. 01.PLT.078)               |
| AHU fan intake                                | 19                          | 100% of 15-minute assessment period | Level 1 plant room 'enclosed' (i.e. 01.PLT.038 and 01.PLT.043) |
| Fans                                          | 10 EAFs<br>5 OAFs<br>3 TEFs | 100% of 15-minute assessment period | Level 1 plant room 'enclosed' (i.e. 01.PLT.038 and 01.PLT.043) |
| External condenser units                      | 6                           | 100% of 15-minute assessment period | Level 1 plant room open to sky (i.e. 01.PLT.078)               |
| Emergency backup generator <sup>1</sup>       | 1                           | 100% of 15-minute assessment period | Ground level north of building.                                |

Table 8 presents predicted noise levels representative of standard operations (i.e. excluding emergency generator). Predicted results displayed below indicate compliance with the night-time project criteria at all considered receiver locations. It is noted, the predicted noise level at receiver location R1 is equal with the night-time criteria.

Table 8: Predicted noise levels — mechanical plant and equipment — standard operations

| Receiver | Address           | L <sub>Aeq, 15min</sub> dB | Night-time project criteria<br>L <sub>Aeq</sub> dB |
|----------|-------------------|----------------------------|----------------------------------------------------|
| R1       | 28 Mattick Road   | 35                         | 35 <sup>1</sup>                                    |
| R2       | 64 Mattick Road   | 34                         | 35 <sup>2</sup>                                    |
| R3       | 73 Champions Lane | 19                         | 35 <sup>2</sup>                                    |
| R4       | 41 Letitia Close  | 18                         | 35 <sup>2</sup>                                    |
| R5       | 51 Old Coast Road | 14                         | 35 <sup>1</sup>                                    |
| R6       | 83 Old Coast Road | 18                         | 35 <sup>1</sup>                                    |

| Receiver | Address            | L <sub>Aeq, 15min</sub> dB | Night-time project criteria<br>L <sub>Aeq</sub> dB |
|----------|--------------------|----------------------------|----------------------------------------------------|
| R7       | 133 Old Coast Road | 22                         | 35 <sup>1</sup>                                    |
| R8       | 4 Mattick Road     | 32                         | 35 <sup>1</sup>                                    |

Notes:

1. 9-hour assessment period as per the NSW NPI amenity criteria.
2. 15-minute assessment period as per the NSW NPI intrusive criteria.

Table 9 presents predicted noise levels for emergency operations (i.e. including emergency generator). Predicted results displayed below indicate compliance with the night-time project criteria at all considered receiver locations except for receiver location R1.

It is highlighted that emergency operations are not typical operating conditions. Testing of the generator is anticipated to occur approximately once a month during day-time hours when the project criteria is less onerous. Furthermore, it is reasonable to assume that building occupants will be indoors during night-time hours (i.e. 10:00 pm to 7:00 am). As such, the building envelope is expected to provide a minimum 5 dB reduction to the below predicted noise levels assuming a partially open window.

For the above reasons, and considering the guidance outlined in section 4 of the NSW NPI, the 1 dB predicted exceedance at receiver location R1 during emergency operations is considered negligible.

Table 9: Predicted noise levels — mechanical plant and equipment — emergency operations

| Receiver | Address            | L <sub>Aeq, 15min</sub> dB | Night-time project criteria<br>L <sub>Aeq</sub> dB |
|----------|--------------------|----------------------------|----------------------------------------------------|
| R1       | 28 Mattick Road    | 36                         | 35 <sup>1</sup>                                    |
| R2       | 64 Mattick Road    | 34                         | 35 <sup>2</sup>                                    |
| R3       | 73 Champions Lane  | 20                         | 35 <sup>2</sup>                                    |
| R4       | 41 Letitia Close   | 18                         | 35 <sup>2</sup>                                    |
| R5       | 51 Old Coast Road  | 17                         | 35 <sup>1</sup>                                    |
| R6       | 83 Old Coast Road  | 21                         | 35 <sup>1</sup>                                    |
| R7       | 133 Old Coast Road | 23                         | 35 <sup>1</sup>                                    |
| R8       | 4 Mattick Road     | 33                         | 35 <sup>1</sup>                                    |

Notes:

1. 9-hour assessment period as per the NSW NPI amenity criteria.
2. 15-minute assessment period as per the NSW NPI intrusive criteria.

The above noise predictions concerning the access road/car park and the mechanical plant and equipment have been assessed in isolation. However, it is necessary to assess the aggregate noise impacts from the New Macksville Hospital as per the NSW NPI.

Accordingly, Table 10 displays the cumulative predicted noise level associated with the access road/car park and the mechanical plant and equipment. Predicted results displayed below indicate compliance with the night-time project criteria at all considered receiver locations except for receiver location R1. For reasons previously outlined, the 1 dB predicted exceedance is considered negligible.

Table 10: Predicted noise levels — aggregate noise impacts — standard operations

| Receiver | Address            | Access road<br>and parking<br>lot<br>$L_{Aeq, 15min}$ dB | Mechanical<br>plant and<br>equipment<br>$L_{Aeq, 15min}$ dB | Aggregate<br>$L_{Aeq, 15min}$ dB | Night-time<br>project criteria<br>$L_{Aeq}$ dB |
|----------|--------------------|----------------------------------------------------------|-------------------------------------------------------------|----------------------------------|------------------------------------------------|
| R1       | 28 Mattick Road    | 31                                                       | 35                                                          | 36                               | 35 <sup>1</sup>                                |
| R2       | 64 Mattick Road    | 28                                                       | 34                                                          | 35                               | 35 <sup>2</sup>                                |
| R3       | 73 Champions Lane  | 21                                                       | 19                                                          | 23                               | 35 <sup>2</sup>                                |
| R4       | 41 Letitia Close   | 35                                                       | 18                                                          | 35                               | 35 <sup>2</sup>                                |
| R5       | 51 Old Coast Road  | 31                                                       | 14                                                          | 31                               | 35 <sup>1</sup>                                |
| R6       | 83 Old Coast Road  | 30                                                       | 18                                                          | 30                               | 35 <sup>1</sup>                                |
| R7       | 133 Old Coast Road | 23                                                       | 22                                                          | 26                               | 35 <sup>1</sup>                                |
| R8       | 4 Mattick Road     | 28                                                       | 32                                                          | 33                               | 35 <sup>1</sup>                                |

Notes:

1. 9-hour assessment period as per the NSW NPI amenity criteria.
2. 15-minute assessment period as per the NSW NPI intrusive criteria.

**DPE**

*Suggested ways to mitigate these noise generating activities if required.*

**Arup response**

Recommended mitigation measures have been outlined below. However, the Construction Contractor is responsible for ensuring that the final equipment selection and associated noise mitigation measures are implemented to achieve project criteria.

**Cooling towers:**

- Selected such that peak operational speed does not exceed 80% capacity.
- Select the lowest fan noise option and, where available, a water basin silencer shall be included.
- An attenuator shall be installed on each tower discharge. Attenuator specifications shall be confirmed by the Construction Contractor after final selection of the cooling tower.

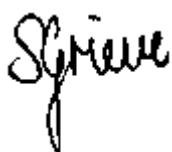
**Level 1 Plant Rooms**

- Blank off all unnecessary surface area of ventilation louvres in the two 'enclosed' level 1 plant rooms (i.e. 01.PLT.038 and 01.PLT.043). This will require input from the mechanical engineer to ensure adequate ventilation requirements.
- Blank off all unnecessary surface area of the perimeter louvre around the plant room that is open to sky (i.e. 01.PLT.078). This will require input from the mechanical engineer to ensure adequate ventilation requirements.

**Emergency Generator**

- When operating, the packaged generator set shall meet a continuous sound pressure level of 70 dB(A) at 1 metre.

Yours sincerely



Samuel Grieve  
Senior Acoustician