Background Noise Measurement at Virgin Mary Coptic Orthodox Church

Prepared for:

Virgin Mary Coptic Orthodox Church

Calamvale QLD 4116

Project:	Background noise measurements
Project Number:	20250046
Location:	Calamvale, QLD
Client:	Virgin Mary Coptic Orthodox Church
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DOCUMENT CONTROL

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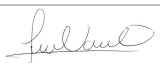
Prepared by:	Liz Valderrama	Environmental Engineer		03/12/2025
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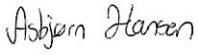
Approved by:	Asbjorn Hansen	Principal Engineer		13/10/2025
Comments:				

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1 EXECUTIVE SUMMARY

Matrix Acoustics Pty Ltd was commissioned by the Virgin Mary Coptic Orthodox Church to undertake noise measurements and assess potential noise emissions associated with the proposed air-conditioning system to be installed within the church lot boundary. The assessment included background noise monitoring, noise modelling, and the design of noise mitigation measures to demonstrate compliance with the noise limits set out in Section 440U of the Environmental Protection Act, which regulates air-conditioning noise emissions.

1.1 OPERATIONAL NOISE

This assessment has found that the project is predicted to comply with the applicable noise criteria for the air conditioning system operation with the inclusion of some mitigation measures.

The mitigation required is a noise barrier around the heat release units (HRUs). The noise barrier is required around all sides and is of approximate side dimensions of 7 m by 6 m, and minimum of 1.8 m in height. The noise barrier is required to have a surface density of at least 15kg/m^2. A double lapped hardwood paling fence with the pales being 12mm (24mm in total) thick achieves this specification. With this noise barrier in place, and with the two HRUs operating at half capacity, which is the most likely operational scenario, the predicted noise levels comply with the applicable criteria at all nearby sensitive receptors.

It is also expected that the installation of three Carrier units, which have lower sound power levels than the SMARDT units modelled, will comply with the same criteria. To ensure the accuracy and validity of the modelling outcomes, the A/C building must be constructed such that all joints and connections are fully sealed and free of acoustic weaknesses, other than the louver's gaps. Additionally, the HRUs noise barrier must remain continuous to achieve the required noise reduction.

1.2 EXISTING ENVIRONMENT

The existing acoustic environment was measured at the church site from Tuesday 16 September to Monday 22 September 2025. The noise logger was installed on a roof structure approximately 4 m from the nearest sensitive receptor.

The dominant noise source during the monitoring period was road traffic, with contributions from church construction works, students, pedestrians, and general environmental noise. Time periods influenced by adverse weather or loud construction activity were removed from the analysis. The resulting background noise levels were used to determine applicable noise limits in accordance with Section 440U of the Environmental Protection Act, which regulates noise emissions from air-conditioning equipment.

2 INTRODUCTION

Matrix Acoustics Pty Ltd was commissioned by the Virgin Mary Coptic Orthodox Church (the church) to conduct noise measurements and assess potential noise emissions from a proposed air conditioning system to be installed within the church lot boundary in Calamvale, Queensland.

As part of the development, the church plans to construct a dedicated enclosure (A/C building) to accommodate the air conditioning units. The air conditioning system also includes two heat release units (HRUs) that will serve the new church building. The objectives of this noise assessment are:

1. Establish the existing background noise levels at the location of the nearest sensitive receptor
2. Determine applicable noise criteria for this project, based on measured background noise levels
3. Develop a model to predict noise emissions from the proposed building housing the air conditioning system and the heat release units

Image 2-1 shows the proposed location for the air conditioning system at Virgin Mary Coptic Orthodox Church.

Image 2-1 Proposed location of the air conditioning system

3 NOISE CRITERIA

3.1 ENVIRONMENTAL PROTECTION ACT 1994

The Queensland Environmental Protection Act 1994 current as of 27 September 2024 prescribes noise criteria for the use of air conditioning equipment.

Section 440U of the EP Act states:

440U Air-conditioning equipment

1. *This section applies to premises at or for which there is air-conditioning equipment.*
2. *An occupier of the premises must not use, or permit the use of, the equipment on any day—*
   a. *before 7a.m, if it makes a noise of more than 3dB(A) above the background level; or*
   b. *from 7a.m. to 10p.m, if it makes a noise of more than 5dB(A) above the background level; or*
   c. *after 10p.m, if it makes a noise of more than 3dB(A) above the background level.*

It is typically accepted that where no specific noise metric is stated in the EP Act, the understood noise metric is the $L_{Aeq,15\ minute}$. This corresponds to a continuous noise level equivalent to the average noise energy over a 15-minute period using an A-weighted noise filter.

3.2 PROJECT SPECIFIC CRITERIA

The noise criteria for the air conditioning units at the church are presented in Table 3-1.

Table 3-1 Project criteria

Time	Noise level above background noise $L_{Aeq,15\ minute}$
7:00 am – 10:00 pm	5 dBA
10:00 pm – 7:00 am	3 dBA

4 AIR CONDITIONING SYSTEM

The Virgin Mary Coptic Orthodox Church has provided technical specifications for the proposed chiller units and drawings of the A/C building that will contain these units. Table 4-1 shows the acoustic specifications of the proposed chiller units. Based on the information provided, the plan is to install either two SMARDT units or three Carrier units within the A/C building and two heat release units.

Table 4-1 Modelled noise emission data of the chillers

Brand	Chiller model	Frequency data, (dB)						SPL, dB(A)	SWL, dB(A)
		125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz		
Carrier	Chiller - 30WGA 190A Condenserless scroll chiller	49	51	55	58	56	50	**62**	**78**
SMARDT	Chiller - WE035.1B.F4ADBA. F4AGBA.EN0	41	50	58	67	64	57	**69**	**84**

The installation of two SMARDT units will result in higher noise emissions compared to the installation of three Carrier units. Therefore, for the purposes of this assessment, the installation of two SMARDT units has been assumed to assess the worst-case noise impact.

The client supplied Matrix with the overall sound pressure level and sound power levels of the heat release units. A spectrum of a similar unit was assumed for the purposes of modelling. This spectrum was adjusted to match the overall sound power level of the proposed units. Table 4-2 shows the acoustic specifications of the proposed heat release units.

Table 4-2 Modelled noise emission data of the heat release units

Brand	Heat release units model	Frequency data, (dB)						SPL, dB(A)	SWL, dB(A)
		125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz		
Gunter	100% capacity - GFHV WD 090.2QF/14E-61	79	80	82	83	76	70	**61**	**94**
Gunter	50% capacity - GFHV WD 090.2QF/14E-61	80	81	83	84	77	71	**56**	**89**

4.1 A/C BUILDING

Appendix B shows the drawings of the proposed A/C building. This room will be built with different materials. Sound reduction index (Rw) used for these materials in the noise model are shown in Table 4-3.

Table 4-3 Rw for A/C building materials assumed in the model

Element/Material	Frequency band, (dB)							Rw, (dB)
	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	
Walls/Brick	32	36	37	32	40	48	55	**39**
Louvers	6	6	6	6	6	6	6	**7**
Doors/Steel	6	7	11	15	30	26	31	**20**
Roof/Steel	6	7	11	15	30	26	31	**20**

For the noise model it has been assumed that the A/C building has no gaps or acoustic weaknesses between the building elements other than the louver's gaps. All building elements are considered to be fully sealed and acoustically continuous to prevent sound leakage.

5 NOISE MEASUREMENTS

Unattended noise monitoring was undertaken from Tuesday 16th of September to Monday 22nd of September 2025. As this area is highly influenced by children, the noise logger was installed on a roof structure approximately 4m from the nearest sensitive receptor. The microphone was set at approximately 5 m above ground level; therefore, it is representative of a second-storey receiver position. The noise logger was set to record data in 15-minute intervals.

A weather station was also installed during the monitoring period to collect relevant meteorological data. Data collected during periods of inclement weather were excluded from the analysis. Data contaminated by loud construction activities from the church were also excluded from the analysis. Image 5-1 shows the noise logger and weather station installed near the closest noise sensitive receptor. Note that the orange brick building is a church building and that the white building is the nearest noise sensitive receptor.

Image 5-1 Installed noise logger and weather station

The receptor south of the subject site is the Calamvale Community College, the receptor south-east of the subject site is a day care, receptors north, west and north-east of the subject site are residential receptors.

The dominant noise source was traffic noise from the nearest roads, especially Hamish Street. Other noise sources such as noise generated by students, pedestrians and noise from animals were also part of the acoustic environment. Church construction activities also occurred at the building adjacent to the noise monitoring site. Noise from the construction works is not considered a natural part of the acoustic environment and has as such been excluded from the analysis of the recorded noise levels.

5.1 INSTRUMENTATION

Table 5-1 presents the instrumentation used for the noise measurements. Calibration certificates can be provided on request.

Table 5-1 Acoustic test instrumentation

Equipment	Manufacturer and model	Serial number	Calibration dates
Sound level meter (logger)	Instralabs – KNM01	94e6860bb518	15/05/2024
Calibrator	Pulsar 105	72905	19/08/2025

5.2 MEASUREMENT PROCEDURE

Noise measurements were undertaken in accordance with the Queensland Noise Measurement Manual. A noise logger was installed for 7 days to record the noise levels from September 16th to September 22nd. The noise logger was placed at 4 m from the neighbouring property. The microphone was located approximately 5 m above the ground. Calibration of the noise monitor was undertaken before and after the noise measurement. No drift in the sensitivity of the noise monitor was recorded.

Image 5-2 shows the places where the proposed chillers building and the HRUs will be located, the noise measurement location and the nearest noise sensitive receptors.

Image 5-2 Noise monitoring location and nearest noise sensitive receptors

5.3 WEATHER

Most of the noise monitoring period was unaffected by inclement weather. Noise records were excluded from the noise analysis for the short periods of inclement weather.

5.4 UNATTENDED NOISE MEASUREMENTS RESULTS

The recorded noise levels are presented graphically in Appendix A. Table 5-2 presents the average L_{A90}, ABLs and the average L_{Aeq} measured during the monitored period. The table also shows the average, max, min and median values for each time period. It is noted that the median value of the corresponding day/evening/night ABLs corresponds to the RBLs, which will be used to determine the noise criteria for this Project.

Table 5-2 Noise results from unattended measurements

Measured Date	Average L_{A90}, dB(A)			Hourly L_{A90} 10th Percentile (ABL), dB(A)			Average L_{Aeq}, dB(A)		
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
16/09/2025	48	44	44	47	43	42	57	53	48
17/09/2025	46	45	44	44	44	41	54	53	49
18/09/2025	49	45	42	47	44	41	56	53	47
19/09/2025	46	46	42	44	44	42	55	53	47
20/09/2025	45	45	47	44	44	45	54	53	51
21/09/2025	48	45	45	47	44	42	55	52	49
22/09/2025	48	45	45	44	45	42	55	52	49
Average	47	45	44	45	44	42	55	53	48
Max	49	46	47	47	45	45	57	53	51
Min	45	44	42	44	43	41	54	52	47
Median	48	45	44	**44***	**44***	**42***	55	53	49

* RBL to be used for assessment purposes.

Table 5-3 shows the derived RBLs and the noise limits obtained from section 440U of the EP Act.

Table 5-3 RBLs and noise limits

Time	Day	Evening	Night
	7 am to 6 pm	6 pm to 10 pm	10 pm to 7 am
Rating Background Level (RBL)	44 dBA	44 dBA	42 dBA
Criteria (L_{Aeq})	49 dBA	49 dBA	45 dBA

6 NOISE ASSESSMENT

6.1 NOISE ASSESSMENT PERIODS AND NOISE DESCRIPTOR DEFINITION

The EP Act and the Noise Measurement Manual, define the background noise level as the L_{A90} noise descriptor. The Noise Measurement Manual outline the following periods in relation to the determination of noise background periods:

- Day: 7 am to 6 pm
- Evening: 6 pm to 10 pm
- Night: 10 pm to 7 am

Note that periods affected by inclement weather or loud church construction activities were removed for the determination of the background noise levels.

6.2 NOISE PREDICTION METHOD

For the noise impact assessment, SoundPLAN 9.1 noise prediction software was used to predict noise levels at the nearest noise sensitive receptors while the two SMARDT units are operating. The sound power levels shown in Table 4-1 were used in the noise model.

The ISO 9613-2:1996 Acoustics – *Attenuation of sound during propagation outdoors – Part 2: General method of calculation* noise predict methodology was used in the SoundPLAN software to predict the noise propagation from the noise sources.

6.3 MODELLED SCENARIOS

The noise model was used to predict noise levels at the nearest sensitive receptors. The model predicted noise levels for operational conditions, incorporating two SMARDT chiller units under consideration within the proposed new shed and two heat release units that will be located on the ground within the church boundary as shown in Image 5-2.

Preliminary modelling show that the operation of the chillers and heat release units would exceed the project noise criteria at the nearby receptors. To mitigate these impacts, a noise barrier around the heat release units has been designed. The noise barrier is required around all sides and is of approximate side dimensions of 7 m by 6 m, and minimum of 1.8 m in height. The noise barrier is required to have a surface density of at least 15kg/m^2. A double lapped hardwood paling fence with the pales being 12mm (24mm in total) thick achieves this specification.

The client has advised that the two HRUs will not operate simultaneously, as the site's thermal load is unlikely to exceed the capacity of a single unit. Nevertheless, two scenarios have been modelled to predict the noise levels associated with the AC system operation. Both scenarios incorporate the operation of two SMARDT chillers. However, scenario 1 includes two HRUs operating at full capacity with a 1.8m noise barrier around all sides, while scenario 2 includes the operation of two HRUs at half capacity with a 1.8m noise barrier around all sides.

6.4 NOISE MODEL PREDICTED RESULTS

Table 6-1 shows the predicted L_{Aeq} for scenarios 1 and 2, and noise limits compliance at the nearest noise sensitive receptors. Orange coloured numbers represent noise exceedances of night time criterion of 45 dBA (L_{Aeq}). No exceedances of the day/evening time criterion of 49 dBA (L_{Aeq}) are predicted for these scenarios.

Table 6-1 Noise model calculation results

Receptor ID	Address	Floor	Receptor type	Direction	Scenario 1 Predicted LAeq, dB(A)	Scenario 2 Predicted LAeq, dB(A)	Noise limit 7:00 am to 10:00 pm, LAeq dB(A)	Noise limit 10:00 pm to 7:00 am, LAeq dB(A)*
1	6 Skyland Street	GF	Residential	S	36	31	49	45
1	6 Skyland Street	F1	Residential	S	41	36	49	45
2	4 Skyland Street	GF	Residential	S	38	33	49	45
3	2 Skyland Street	GF	Residential	E	36	32	49	45
3	2 Skyland Street	F1	Residential	E	41	37	49	45
3	2 Skyland Street	GF	Residential	S	38	34	49	45
3	2 Skyland Street	F1	Residential	S	**49**	45	49	45
7	2 Nabeel Place	GF	Residential	S	**48**	44	49	45
7	2 Nabeel Place	F1	Residential	S	**49**	45	49	45
7	2 Nabeel Place	GF	Residential	W	**46**	41	49	45
7	2 Nabeel Place	F1	Residential	W	**46**	41	49	45
8	4 Nabeel Place	GF	Residential	W	**48**	44	49	45
8	4 Nabeel Place	GF	Residential	S	**46**	41	49	45
9	Calamvale Early learning centre	GF	Educational	N	45	40	49	45
9	Calamvale Early learning centre	GF	Educational	N	30	27	49	45
9	Calamvale Early learning centre	GF	Educational	N	**47**	42	49	45
9	Calamvale Early learning centre	GF	Educational	NW	**49**	44	49	45
10	Calamvale Community College	GF	Educational	N	41	36	49	NA
10	Calamvale Community College	F1	Educational	N	42	37	49	NA
11	Calamvale Community College	GF	Educational	NE	41	36	49	NA
11	Calamvale Community College	GF	Educational	NW	44	39	49	NA
12	Calamvale Community College	GF	Educational	N	44	39	49	NA

*Corresponds to the night time period noise limit, which is the most stringent for this project. Therefore, it is understood that if predicted noise levels comply with this noise limit, then, they will comply with the noise limits for day and the evening period. Night time noise criterion is not applicable for Calamvale Community College as this institution does not operate during this period of time.

Image 6-1 shows the predicted noise contours (L_{Aeq}) at the nearest sensitive receptors for the operation of two SMARDT chiller units within the shed and two HRUs at full operation capacity with a 1.8m noise barrier around all sides.

Image 6-1 Predicted L_{Aeq} at the nearest receptors for Scenario 1

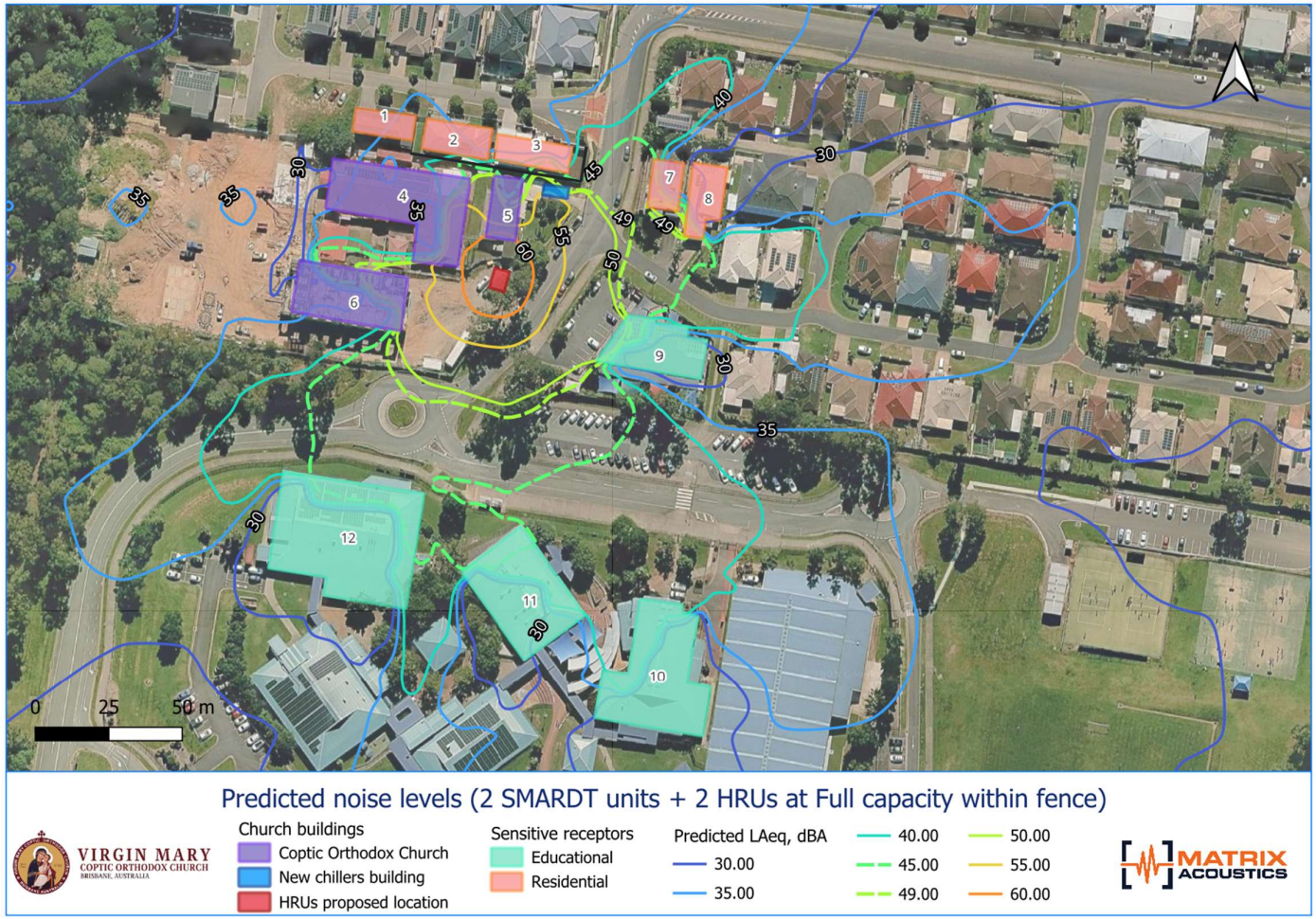
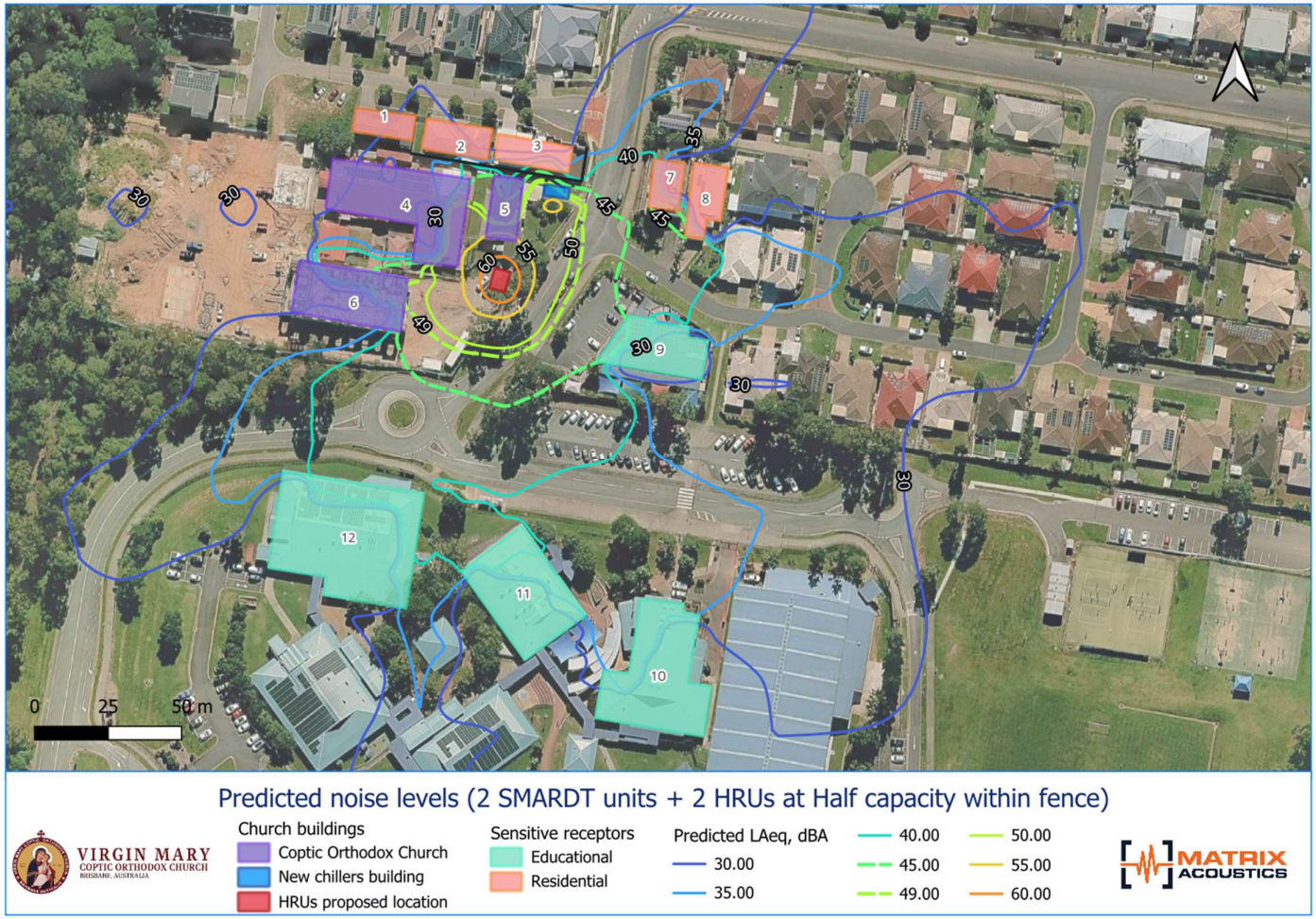


Image 6-2 shows the predicted noise contours (L_{Aeq}) at the nearest sensitive receptors for the operation of two SMARDT chiller units within the shed and two HRUs at half operation capacity with a 1.8m noise barrier around all sides.

Image 6-2 Predicted L_{Aeq} at the nearest receptors for Scenario 2



7 RESULTS ANALYSIS

7.1 UNATTENDED NOISE MEASUREMENTS

The noise levels recorded by the noise monitor are shown in Appendix A. The grey shaded areas are the time periods that were excluded due to inclement weather conditions or loud church construction activities.

The noise measurements and calculated RBLs were used to determine the noise limits for this Project. Noise charts in Appendix A show that the L_{Aeq} during the monitored periods is consistently exceeding the applicable noise limits. L_{Aeq} noise levels were observed to be primarily influenced by traffic on nearby roads, along with children playing around and natural sounds such as wind and birds.

7.2 NOISE MODEL RESULTS

The SWLs provided for the chiller and heat release units were incorporated into the noise model to predict noise levels at the nearest sensitive receptors. For Scenario 1, where two HRUs operate at full capacity, the model predicted a noise level of 49 dBA L_{Aeq} at the closest sensitive receptor, located approximately 4 m from the proposed chiller building. For Scenario 2, with two HRUs operating at half capacity, the predicted noise level at the same receptor was 45 dBA L_{Aeq}.

As shown in Table 6-1, for scenario 1, the predicted L_{Aeq} noise levels from the operation of two SMARDT chiller units contained within the proposed A/C building and two HRUs operating at full capacity with a 1.8m noise barrier around all sides are expected to comply with the applicable noise limits for day/evening time period at all sensitive receptors. However, the night time noise limit is predicted to be exceeded at 4 sensitive receptors.

Table 6-1 shows that for scenario 2, the predicted L_{Aeq} noise levels from the operation of two SMARDT chiller units contained within the proposed A/C building and two HRUs operating at half capacity with a 1.8m noise barrier around all sides are expected to comply with the applicable noise limits for day, evening and night time period at all sensitive receptors.

Given that the predicted L_{Aeq} noise levels from the operation of two SMARDT chiller units contained within the proposed shed are expected to comply with the applicable noise limits, it is reasonable to expect that the installation of three Carrier units, which have lower SWL, will also comply with the applicable noise criteria.

8 CONCLUSION

This assessment has found that the project is predicted to comply with the applicable noise criteria for the air conditioning system operation with the inclusion of some mitigation measures.

The mitigation required is a noise barrier around the HRUs. The noise barrier is required around all sides and is of approximate side dimensions of 7 m and 6 m, and minimum of 1.8 m in height. The noise barrier is required to have a surface density of at least 15kg/m^2. A double lapped hardwood paling fence with the pales being 12mm (24mm in total) thick achieves this specification.

With the addition of this noise fence, and the two HRUs operating at half capacity, the air conditioning operation is predicted to comply with the applicable noise criteria at all receptors. During nighttime period, the HRUs shall operate at no more than 50% capacity to avoid noise exceedances at the nearest receptors.

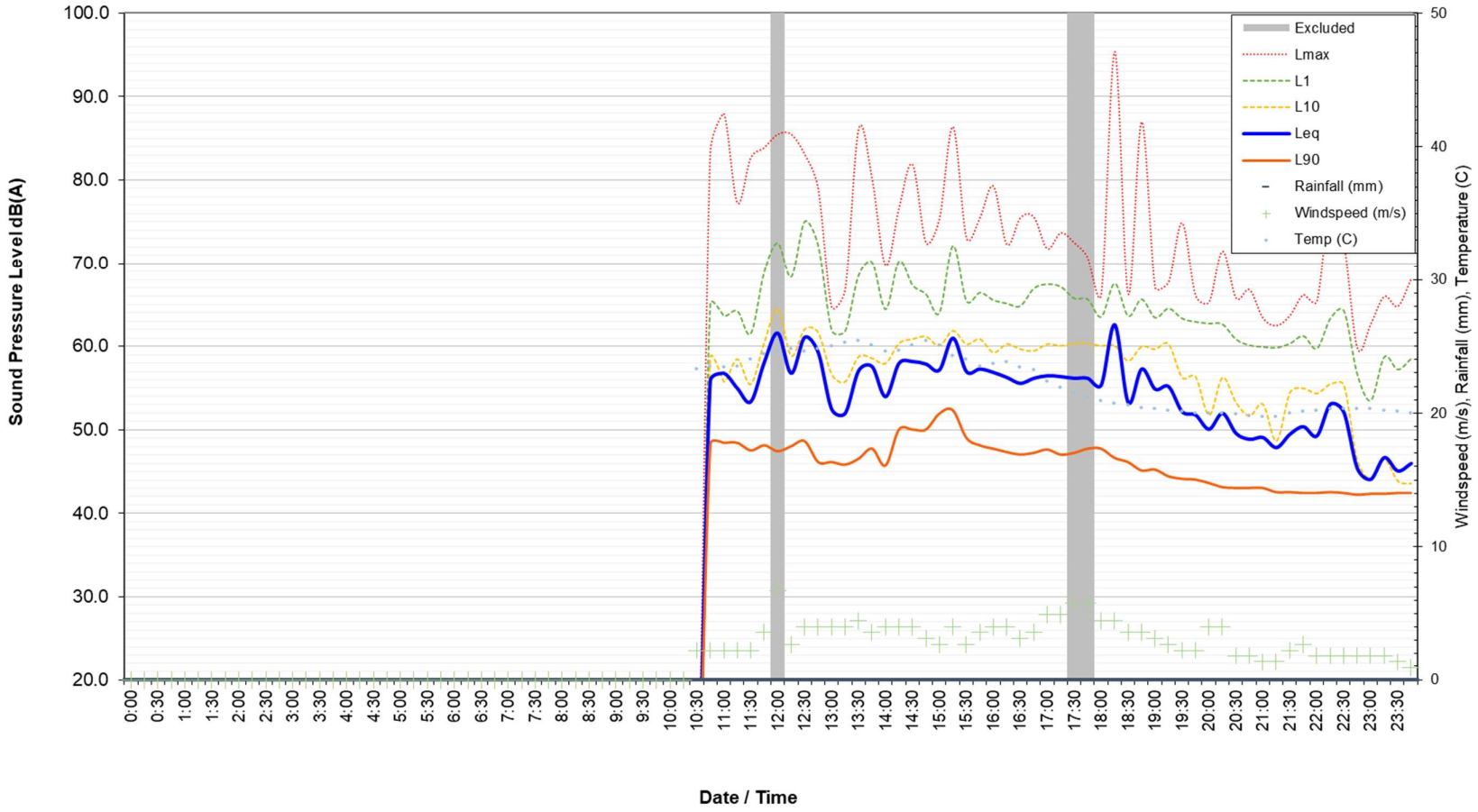
9 APPENDIX A – MONITORED NOISE LEVEL CHARTS

PROJECT: Virgin Mary Coptic Orthodox Church Air conditioning

CLIENT: Virgin Mary Coptic Orthodox Church

Ambient Noise Levels

Tuesday 16 September 2025

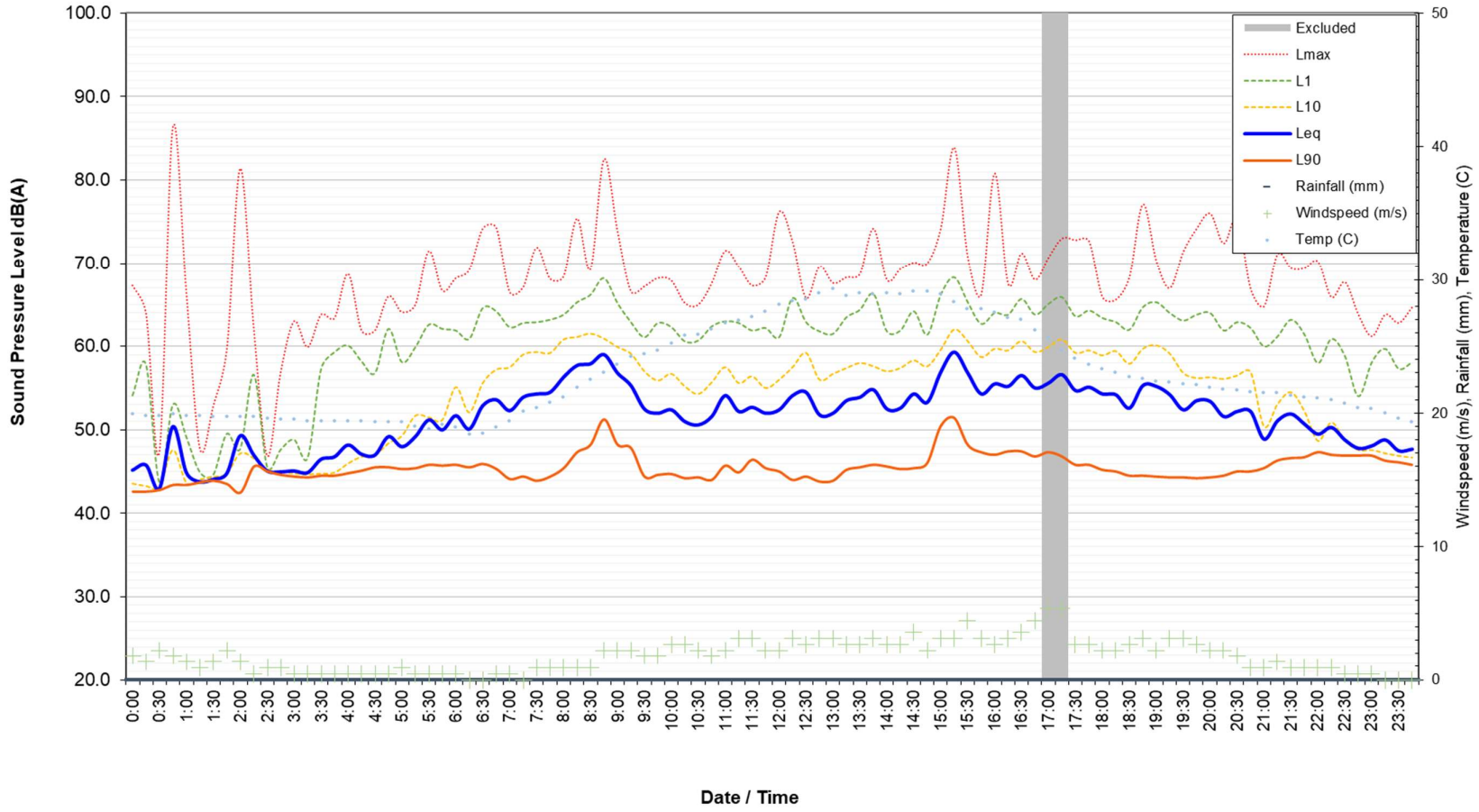


PROJECT: Virgin Mary Coptic Orthodox Church Air conditioning

CLIENT: Virgin Mary Coptic Orthodox Church

Ambient Noise Levels

Wednesday 17 September 2025

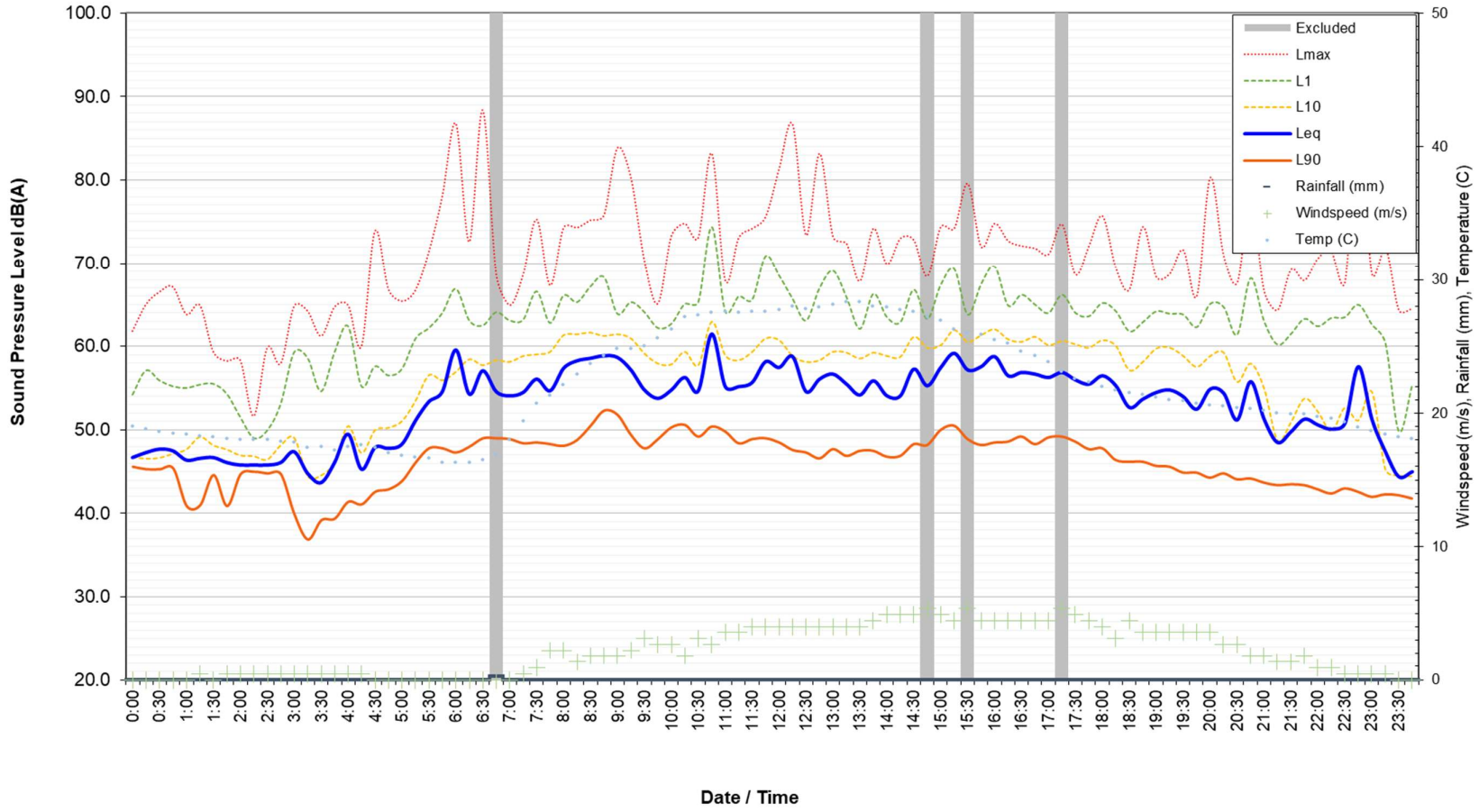


PROJECT: Virgin Mary Coptic Orthodox Church Air conditioning

CLIENT: Virgin Mary Coptic Orthodox Church

Ambient Noise Levels

Thursday 18 September 2025

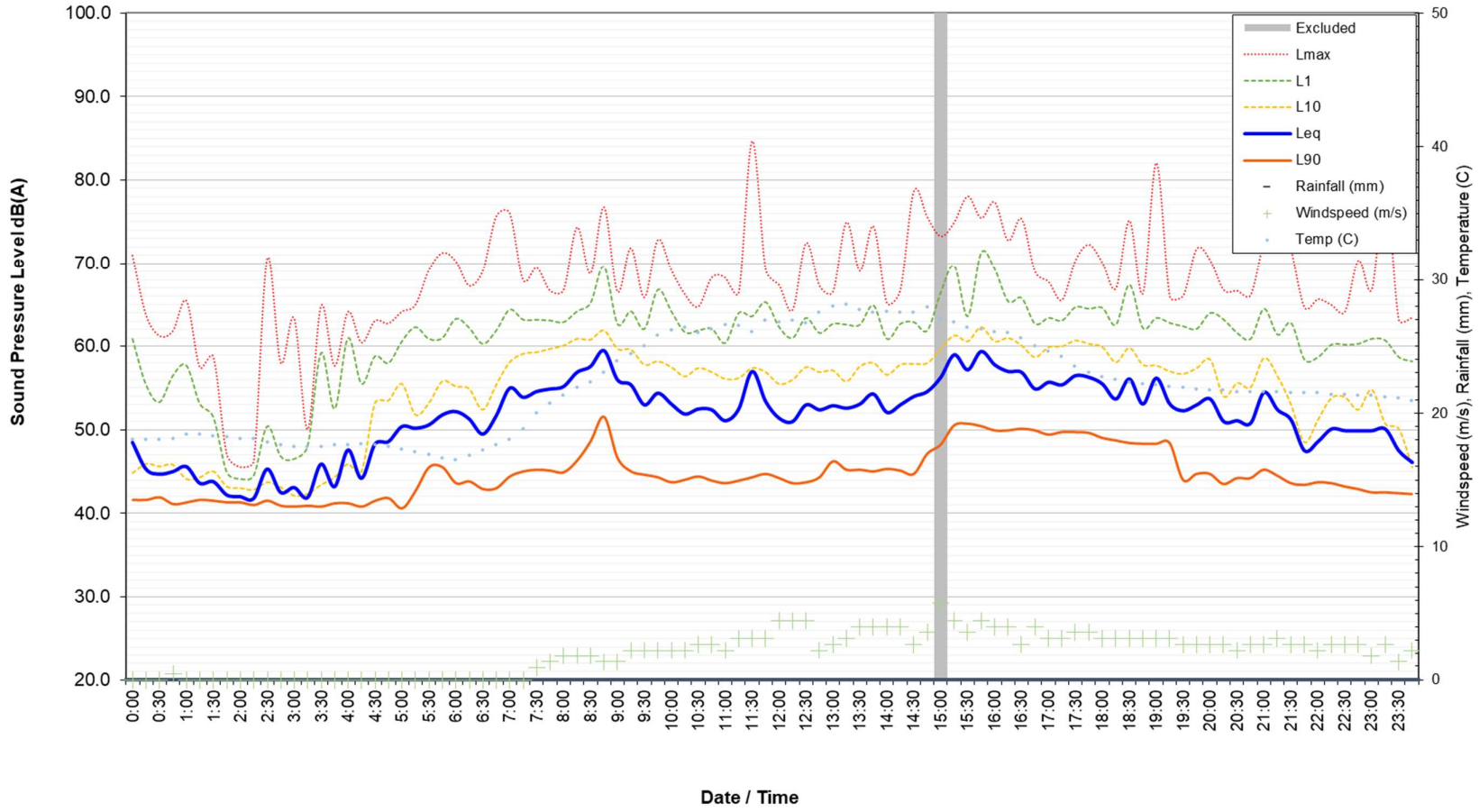


PROJECT: Virgin Mary Coptic Orthodox Church Air conditioning

CLIENT: Virgin Mary Coptic Orthodox Church

Ambient Noise Levels

Friday 19 September 2025

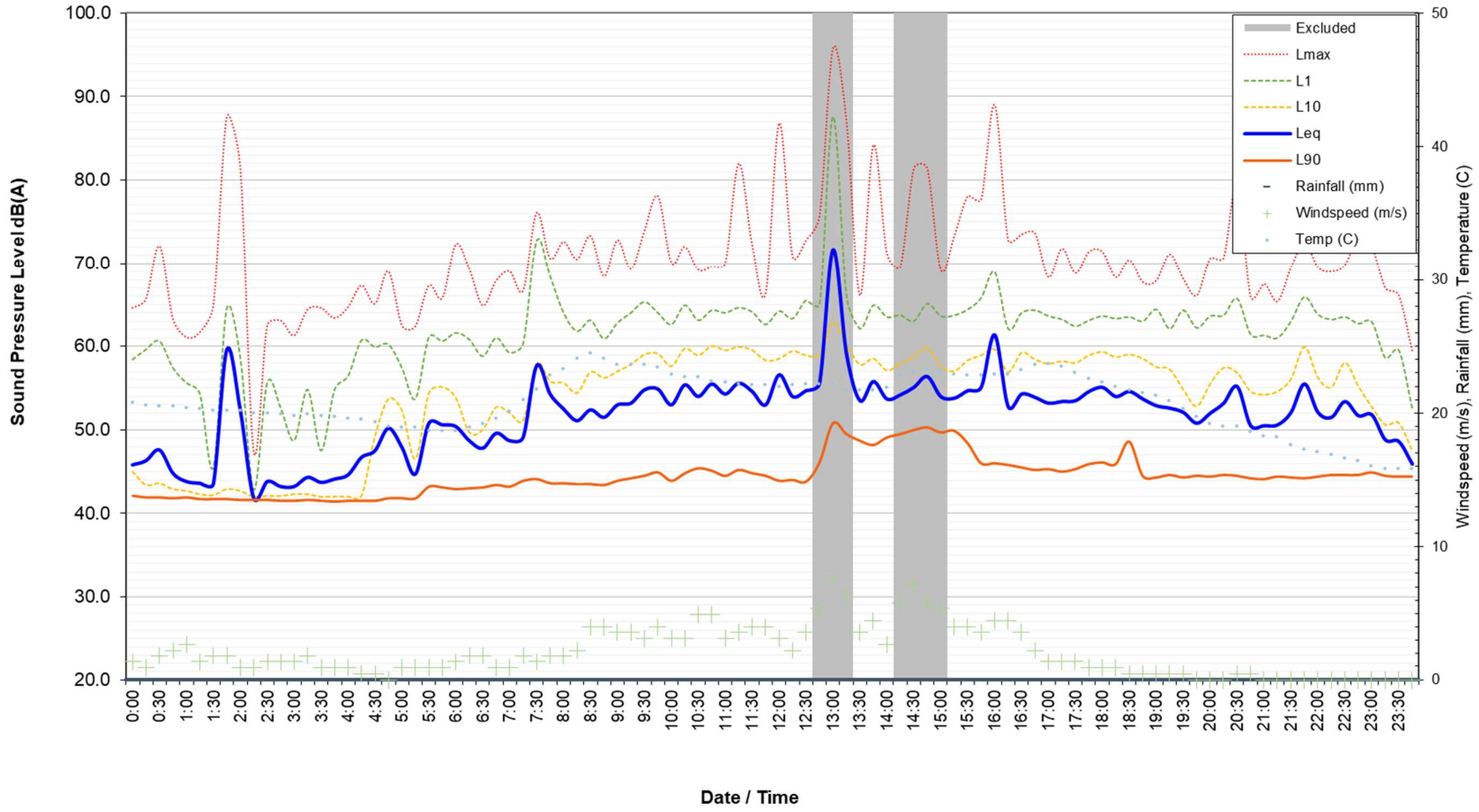


PROJECT: Virgin Mary Coptic Orthodox Church Air conditioning

CLIENT: Virgin Mary Coptic Orthodox Church

Ambient Noise Levels

Saturday 20 September 2025

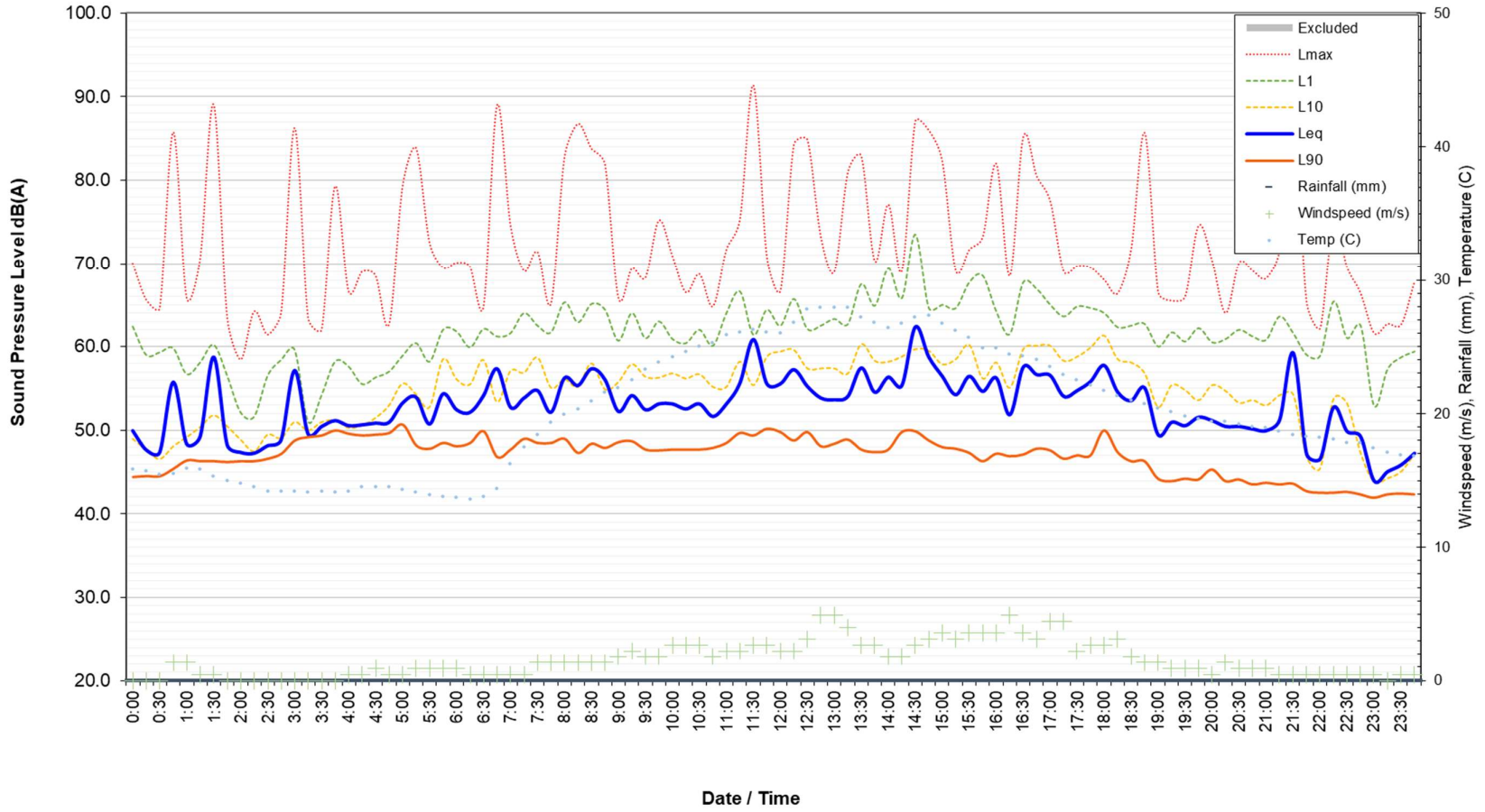


PROJECT: Virgin Mary Coptic Orthodox Church Air conditioning

CLIENT: Virgin Mary Coptic Orthodox Church

Ambient Noise Levels

Sunday 21 September 2025

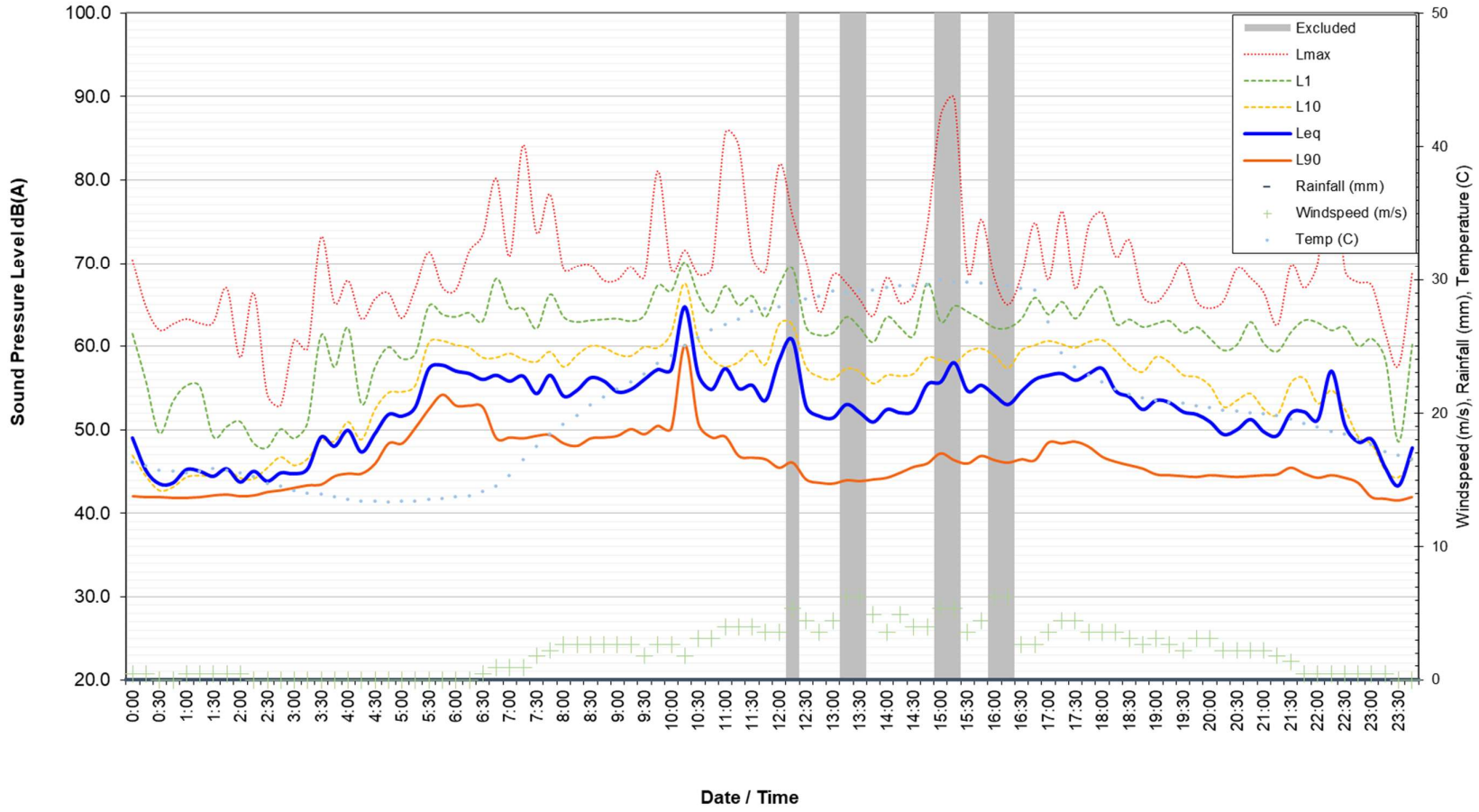


PROJECT: Virgin Mary Coptic Orthodox Church Air conditioning

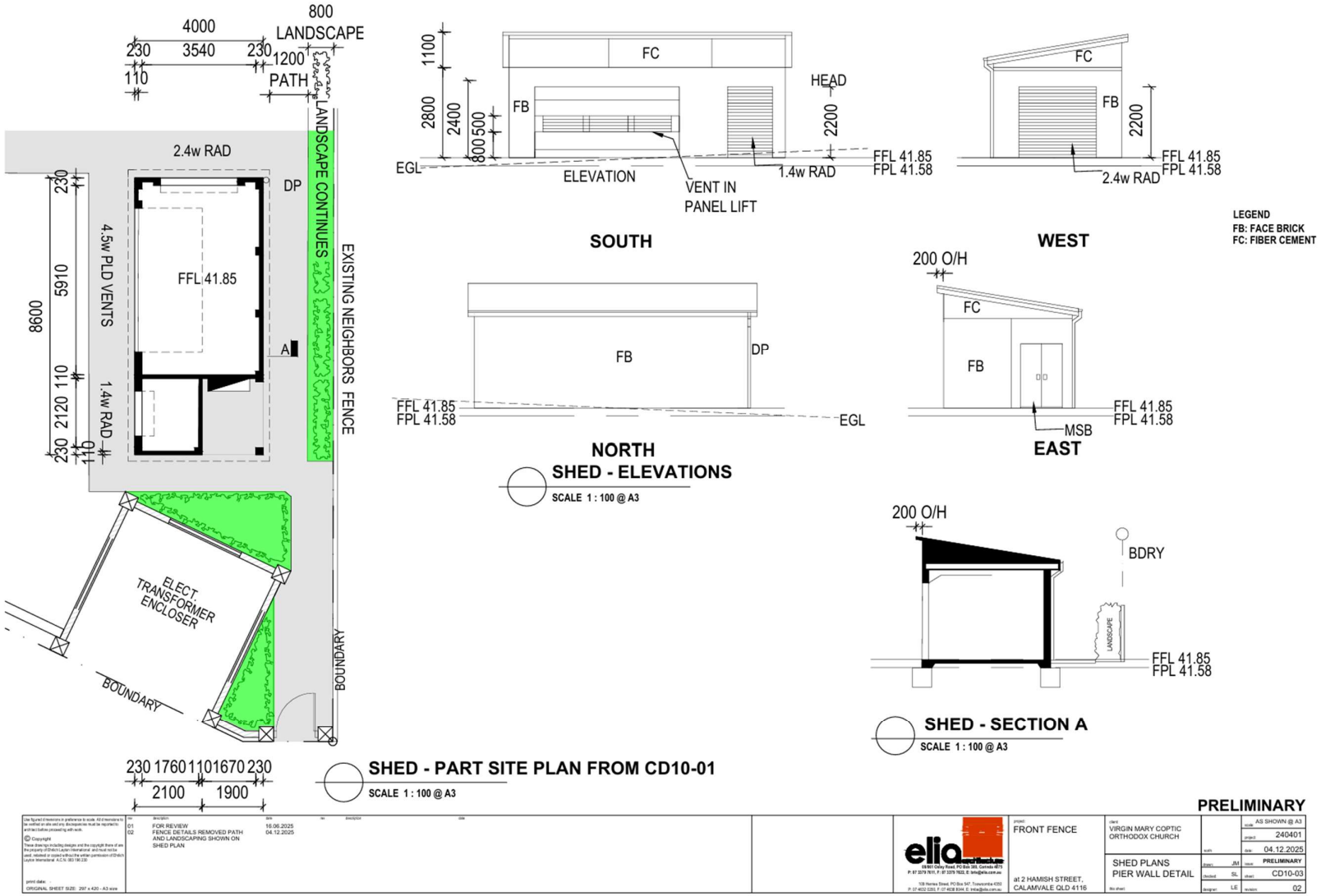
CLIENT: Virgin Mary Coptic Orthodox Church

Ambient Noise Levels

Monday 22 September 2025



10 APPENDIX B – PROPOSED A/C BUILDING


4000
230
3540
230
800
LANDSCAPE
1200
PATH
110
LANDSCAPE CONTINUES
EXISTING NEIGHBORS FENCE
2.4w RAD
DP
230
8900
5910
4.5w PLD VENTS
FFL 41.85
A
110
2120
1.4w RAD
230
ELECT. TRANSFORMER ENCLOSER
BOUNDARY
BOUNDARY
230 1760 110 1670 230
2100
1900
SHED - PART SITE PLAN FROM CD10-01
SCALE 1 : 100 @ A3
1100
2800
2400
800
500
FC
FB
HEAD
2200
EGL
ELEVATION
VENT IN PANEL LIFT
1.4w RAD
FFL 41.85
FPL 41.58
SOUTH
FC
FB
2200
2.4w RAD
FFL 41.85
FPL 41.58
WEST
LEGEND
FB: FACE BRICK
FC: FIBER CEMENT
FB
DP
FFL 41.85
FPL 41.58
EGL
NORTH
200 O/H
FC
FB
FFL 41.85
FPL 41.58
MSB
EAST
SHED - ELEVATIONS
SCALE 1 : 100 @ A3
200 O/H
BDRY
LANDSCAPE
FFL 41.85
FPL 41.58
SHED - SECTION A
SCALE 1 : 100 @ A3
PRELIMINARY
01 FOR REVIEW 16.06.2025
02 FENCE DETAILS REMOVED PATH AND LANDSCAPING SHOWN ON SHED PLAN 04.12.2025
© Copyright
print date:
ORIGINAL SHEET SIZE: 297 x 420 - A3 size
elia
FRONT FENCE
at 2 HAMISH STREET, CALAMVALE QLD 4116
VIRGIN MARY COPTIC ORTHODOX CHURCH
SHED PLANS PIER WALL DETAIL
AS SHOWN @ A3
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04.12.2025
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