

APPENDIX D – NOISE ASSESSMENT REPORT

Noise Measurement Services



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REPORT FOR **StruXi Design**

CONTACT **Jack Fraser**

Signed



Max Thorne
(Director)

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Contents

Executive Summary	4
Conclusions.....	4
Recommendations.....	4
1. Introduction	6
1.1 Development Site and Locality	6
1.2 Sensitive Receivers	8
2. Noise Criteria and Limits	9
2.1 Toowoomba Regional Planning Scheme v28.....	9
2.2 Environmental Protection (Noise) Policy 2008.....	10
2.3 Air Conditioning - Noise Emissions – EPA 1994	11
3. Noise Impact Assessment	12
3.1 Noise Sources	12
3.2 Acoustic Screening	13
3.3 Environmental Noise Calculations.....	14
3.3.1 Vehicle Movements	14
3.3.2 Parking Activity	15
3.3.3 Vocal Activity	16
3.3.4 Deliveries	17
3.4 Discussion	18
Appendix A: Development Plans	19
Appendix B: Environmental Noise Model	23
Appendix C: Glossary.....	28

Executive Summary

This Report is in response to a request from StruXi Design for noise assessment of a proposed beauty salon at 136 South Street, Centenary Heights (Lot 1 on RP44881). The site is with a Low-medium Density Residential Zone, adjacent to commercial and residential uses. The proposal is to remove the existing building, and construct a single storey commercial building for health and beauty activities. The purpose of this Report is to assess potential noise impacts upon nearby residential uses, and upon the adjacent child care centre. The following Standards and policy documents are referenced:

- *Toowoomba Regional Planning Scheme v28*
 - *Centre Activities Code*
 - *Environmental Standards Code*
- *Environmental Protection Act 1994*
- *Environmental Protection (Noise) Policy 2008*
- *Australian Standard AS1055:2018 – Acoustics - Description and measurement of environmental noise*

Conclusions

It is concluded that:

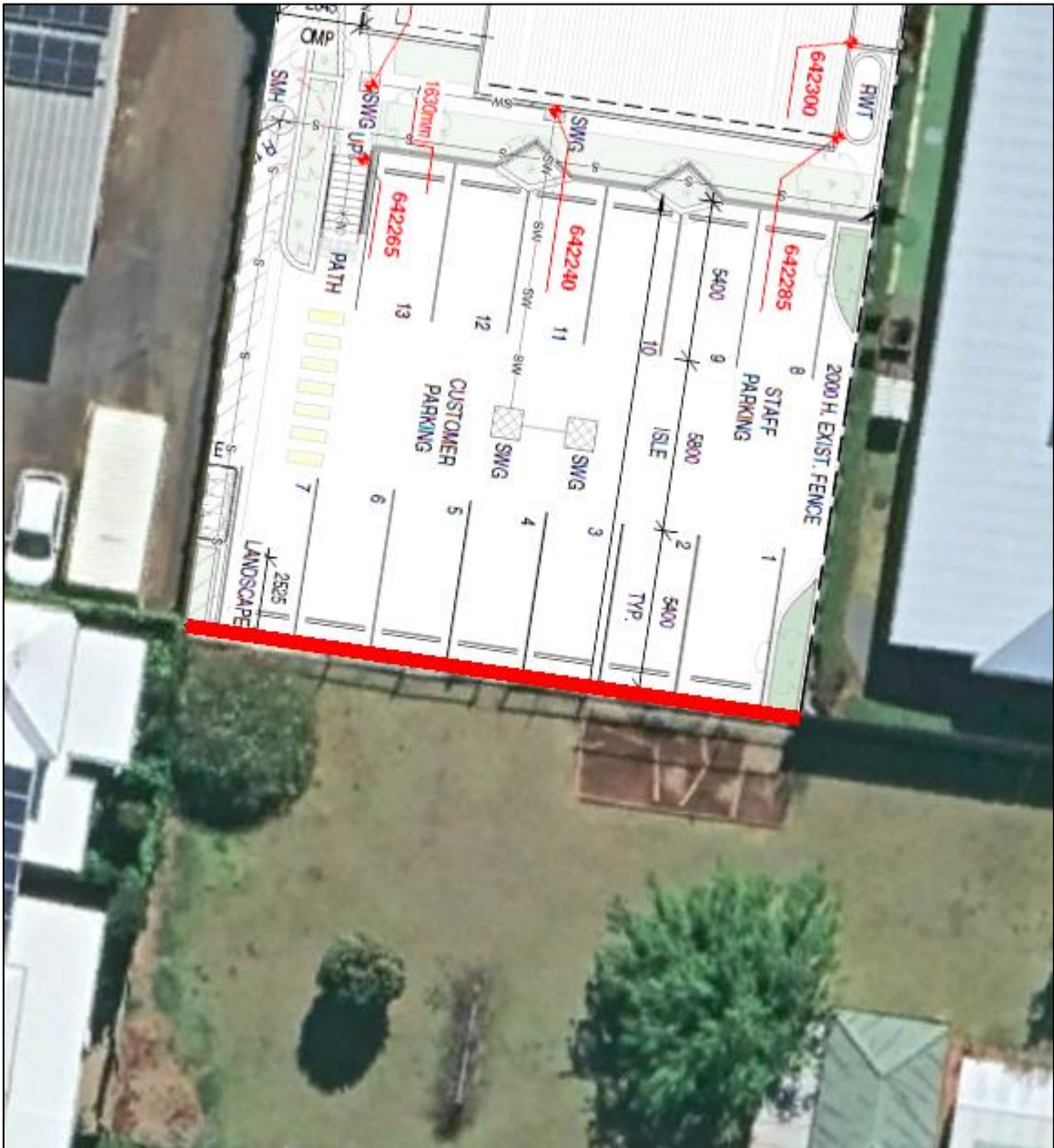
- Subject to the considerations and recommendations of this report, it is the opinion of this consultancy that the proposed development meet the requirements of the Toowoomba Regional Planning Scheme, and be otherwise compliant with relevant regulatory obligations.
- Subject to the recommended acoustic fencing, noise emissions from carpark activity are forecast to meet criteria at all receivers.
- The precise model(s) and siting of new air conditioning plant (if any) are yet to be determined. Detailed plant noise assessment can be conducted at the Building Approval stage, although criteria are considered readily achievable through appropriate plant selection and siting.

Recommendations

It is recommended that:

- Beauty salon activities be Approved for between 7am and 9pm daily.
- 1.8m high acoustic fencing be provided along the southern boundary, as shown in **Plate ES1** below. To effectively function as an acoustic barrier, fencing should be continuous and gap-free, with a density of not less than 12.5 kg/m².
- New air conditioning plant (if any) be selected, installed and – if necessary – screened to not exceed background levels at neighbouring noise sensitive uses.

Plate ES1: Showing the location of recommended 1.8m high acoustic fencing



1. Introduction

This Report is in response to a request from StruXi Design for noise assessment of a proposed beauty salon at 136 South Street, Centenary Heights (Lot 1 on RP44881). The site is with a Low-medium Density Residential Zone, adjacent to commercial and residential uses. The proposal is to remove the existing building, and construct a single storey commercial building for health and beauty activities. The purpose of this Report is to assess potential noise impacts upon nearby residential uses, and upon the adjacent child care centre. The following Standards and policy documents are referenced:

- *Toowoomba Regional Planning Scheme v28*
 - *Centre Activities Code*
 - *Environmental Standards Code*
- *Environmental Protection Act 1994*
- *Environmental Protection (Noise) Policy 2008*
- *Australian Standard AS1055:2018 – Acoustics - Description and measurement of environmental noise*

Proposed hours of operation are between 7am and 9pm daily.

1.1 Development Site and Locality

The development site and locality are presented in the following **plates**. Terms and definitions used in this Report are found in **Appendix C**.

Plate 1: Showing the development site (in blue) and locale (source: Google)



Plate 2: Showing zoning in the locale (Source: Toowoomba Regional Council)

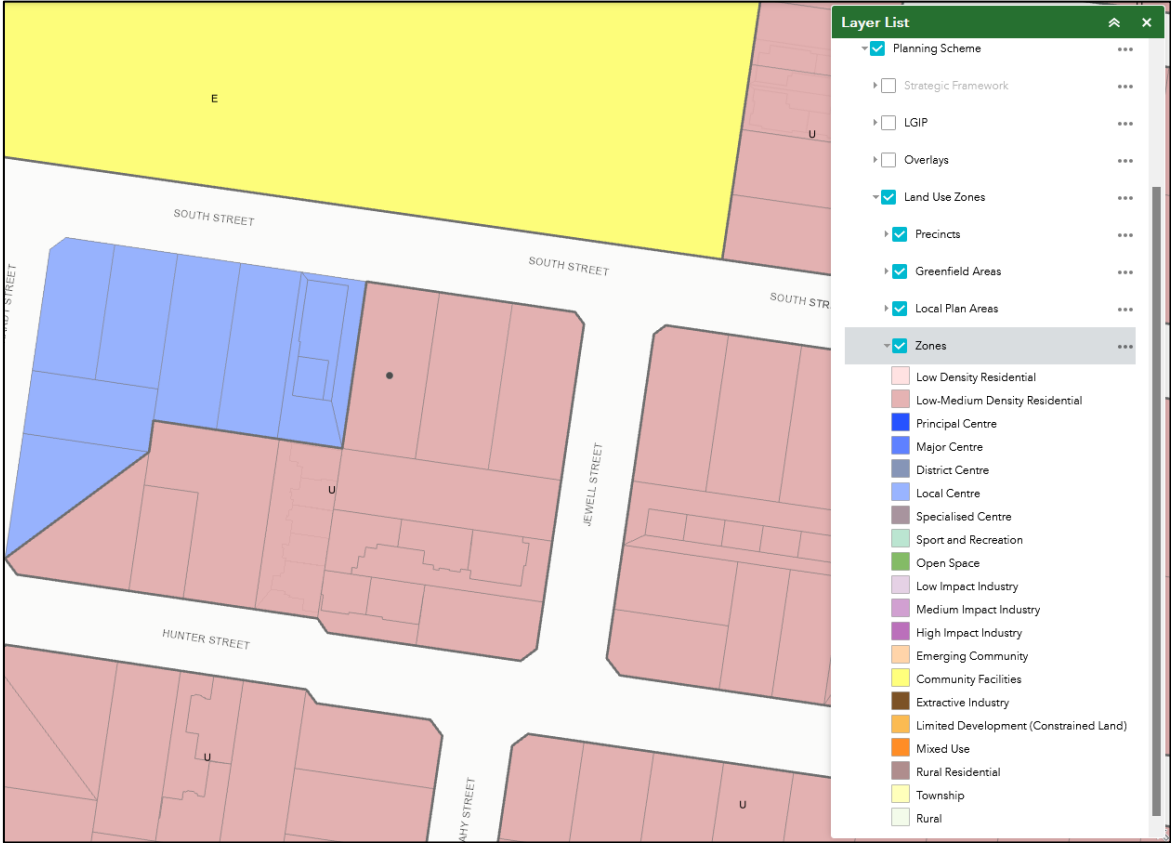


Plate 3: Showing development site plan (source: Google; client)



1.2 Sensitive Receivers

The development site is adjacent to a Local Centre Zone, with existing commercial uses which are not considered noise sensitive. The most affected sensitive uses are therefore identified as the adjacent child care centre to the east, and residential uses to the south. Three receiver locations – referred to as R1 to R3 in this Report – have been assessed, representing the most affected locations of these sensitive uses. The locations of R1 to R3 are shown in **Plate 4** and **Table 1** below.

Plate 4: Showing sensitive receivers R1 – R3

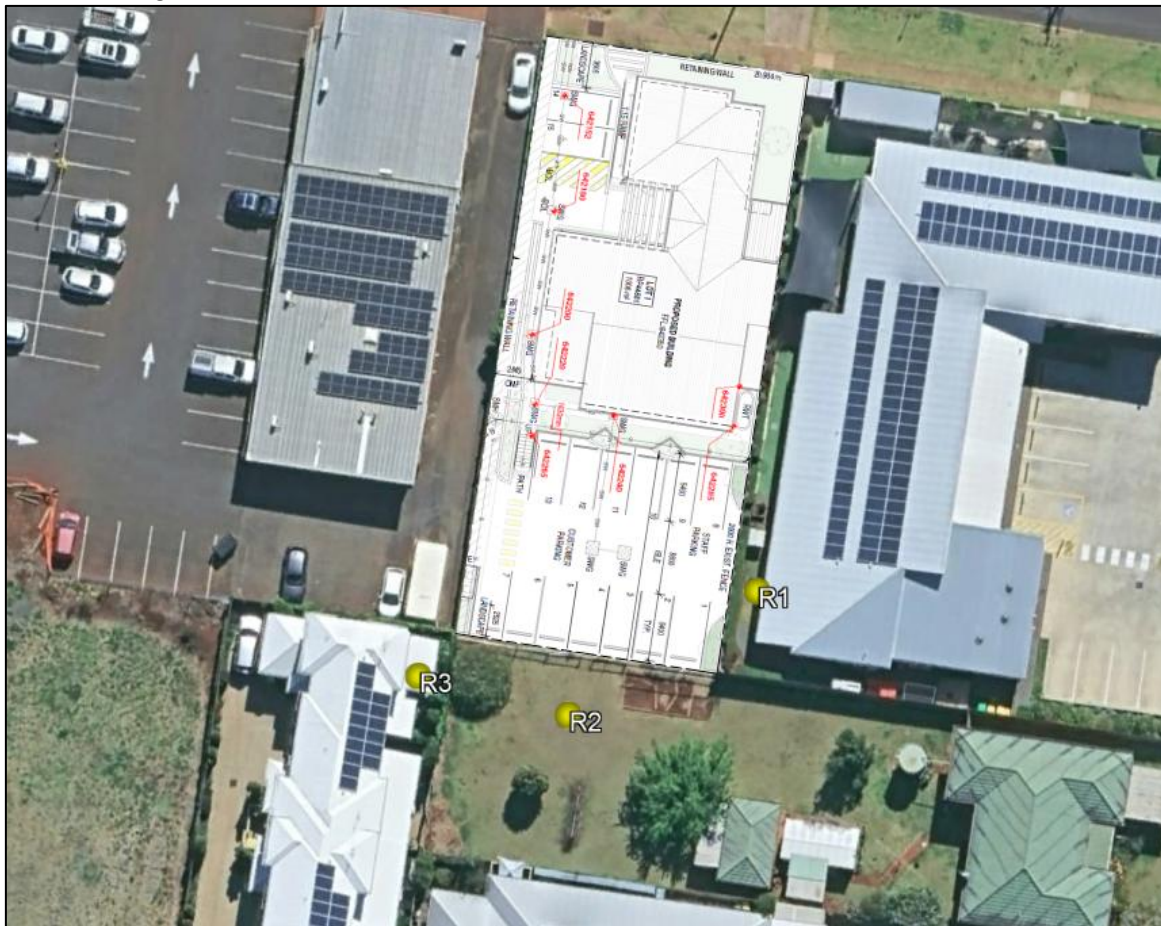


Table 1: Showing sensitive receivers R1 – R3 by Universal Transverse Mercator

Receiver	Address	Co-ordinates (UTM)		Receiver Height
		Easting	Northing	
R1	132 South Street	397914	6948787	1.5m
R2	1 Jewell Street	397899	6948777	1.5m
R3	Unit 5, 41 Hunter Street	397887	6948780	4.6m

2. Noise Criteria and Limits

2.1 Toowoomba Regional Planning Scheme v28

Under the Toowoomba Regional Planning Scheme, guidance regarding impacts from shop activities is contained within the Centre Activities Code (Part 9.3.1). The relevant Performance Outcome is reproduced in **Table 2** below.

Table 2: Centre Activities Code (in part)

Performance outcomes	Acceptable outcomes
PO ₁₉ Noise, vibrations and odour are adequately attenuated and managed so they do not cause environmental harm or nuisance, nor unreasonably affect the amenity of nearby sensitive land uses.	No acceptable outcome is nominated.

While no specific criteria are specified in the Centre Activities Code, further guidance is contained within the Environmental Standards Code (Part 9.4.2). The relevant Performance Outcomes is reproduced in **Table 3** below.

Table 3: Environmental Standards Code (in part)

Performance outcomes	Acceptable outcomes
PO₈ The generation of noise from the premises does not cause Environmental Harm or Nuisance to adjoining properties or other noise sensitive land uses. (a) Development: (i) is located in an appropriate zone; (ii) proposes best practice design and construction materials (in relation to noise attenuation); and (iii) proposes operational practices that will minimise noise nuisance for adjoining sensitive land uses.	AO_{8.1} The development will achieve the following noise levels (when measured at the nearest sensitive receiver): (a) Background (L₉₀) + 5dB(A) for variable noise between the hours of 7:00 am to 10:00 pm (measured at the façade of the sensitive land use); (b) Background + 3 dB(A) for variable noise between the hours of 10:00 pm and 7:00 am (measured within bedrooms assuming open windows); (c) Background (L₉₀) for continuous noise sources (measured at the facade of the sensitive land use between 7:00 am and 10:00 pm and within bedrooms assuming open windows from 10:00 pm – 7:00 am); and (d) maximum limit L_{Amax} 45 dB(A) inside dwellings; and The development will achieve the Acoustic Quality Objectives listed within the <i>Environmental Protection (Noise) Policy 2008</i>. HOWEVER AO_{8.2} Where a development is unable to meet noise levels specified in AO_{8.1} an acoustic assessment has been undertaken by a suitably qualified and skilled person which demonstrates that the development will not result in environmental nuisance at any existing or likely future residential premises (within a 10 year planning horizon).

It is noted that the site is located between a child care centre and commercial uses, which are identified as significant sources of noise, and features of the existing acoustic environment. Application of the residential Acoustic Quality Objectives as per the *Environmental Protection (Noise) Policy 2008* as limiting criteria is considered to provide suitable mitigation of noise impacts, and thereby satisfy Performance Outcome PO₈. The *Environmental Protection (Noise) Policy 2008* is discussed in **Section 2.2** below.

2.2 Environmental Protection (Noise) Policy 2008

The *Environmental Protection (Noise) Policy 2008* (EPP Noise 2008) establishes Acoustic Quality Objectives (AQO) to protect or enhance stated environmental values, as shown in **Table 4** below. The environmental values to be enhanced or protected under the policy are the qualities of the acoustic environment that are conducive to protecting the health and biodiversity of ecosystems; and the qualities of the acoustic environment that are conducive to human health and well-being, including ensuring a suitable acoustic environment for individual's to sleep, study and learn, to be involved in recreation including relaxation and conversation; and the qualities of the acoustic environment that are conducive to protecting the amenity of the community.

Table 4: Acoustic Quality Objectives from EPP (Noise) 2008 (in part)

Type of Occupancy / Activity	Recommended Acoustic Quality Objective		
RESIDENTIAL BUILDINGS	L _{Aeq,adj,1hr}	L _{A10,adj,1hr}	L _{A01,adj,1hr}
Dwelling, outdoors, daytime & evening	50	55	65
Dwelling, indoors, daytime & evening	35	40	45
Dwelling, indoors, night-time	30	35	40
Childcare centre or kindergarten, indoor play areas	35	-	-
Childcare centre or kindergarten, sleeping areas	30	-	-

It is noted that the AQO are to be progressively achieved over the long term, to meet the stated purpose of the Noise Policy:

- identifying environmental values to be enhanced or protected; and
- stating acoustic quality objectives for enhancing or protecting the environmental values; and
- providing a framework for making consistent, equitable and informed decisions about the acoustic environment.

The Policy also sets recommended criteria for the control of background creep. To the extent that it is reasonable to do so, noise from an activity must not be—

- for noise that is continuous noise measured by LA90,T—more than nil dB(A) greater than the existing acoustic environment measured by LA90,T; or
- for noise that varies over time measured by LAeq,adj,T—more than 5dB(A) greater than the existing acoustic environment measured by LA90,T

Noise management strategies are required to the extent it is reasonable to do so. It is therefore concluded that the AQO are not intended to be necessarily limiting criteria, as reasonableness and equity are fundamental precepts of the policy. Application of the Noise Policy therefore requires consideration of the existing environment, although noise mitigation may be required to protect and enhance – as far as reasonable – acoustic values even where the AQO are exceeded by existing noise sources. In this instance, the site is located adjacent to commercial and child care uses, which are significant features of the existing environment. Application of the indoor AQO as limiting criteria therefore represents a high standard of protection of acoustic amenity in this context.

The 2008 policy has been superseded by the *Environmental Protection (Noise) Policy 2019*, although the Acoustic Quality Objectives are identical between the two revisions. The 2008 policy has therefore been applied as specified in the *Toowoomba Regional Planning Scheme Environmental Standards Code*.

Assessment to the more stringent indoor AQO requires consideration of the Noise Reduction (NR) that can be expected from transmission loss through the receiving building envelope. Australian Standard AS3671 references a NR of 10 dB(A) for Category 1 construction, representing standard construction with open doors and/or windows. This is supported by European¹ and Australian² research showing an expected range of 10-13 dB(A) for transmission loss through an open window. The indoor AQO has therefore been converted to external values assuming a Noise Reduction of 10 dB(A) from the receiving building envelope, representing an 'open window' scenario.

With this assumption, the indoor AQO are more stringent than the outdoor AQO. The design criteria as shown in **Table 4** below is therefore considered to represent a high standard of protection of acoustic amenity in the locality. As a conservative assumption, the AQO for 'sleeping areas' has been applied to the adjacent childcare centre.

Table 4: Summary of design criteria

Descriptor	Design Criteria*	
	Day/Evening	Night
Residential Uses		
L ₀₁	55	50
L ₁₀	50	45
L _{eq}	45	40
Childcare Centre or Kindergarten		
L _{eq}	40	40

* Converted to external values assuming 10 dB(A) of attenuation from the receiving building

2.3 Air Conditioning - Noise Emissions – EPA 1994

It is expected that conditioning equipment is to be installed, although the precise model(s) and siting is indeterminate. Independent of Council requirement, State plant noise requirements represent an ongoing responsibility, and are set out under the *Environmental Protection Act 1994*; in that Act noise from air conditioning or refrigeration plant must not exceed the following noise levels when measured as the LA₉₀ dB(A) level over a period of 15 minutes at an affected building:

- Between 10pm and 7am: 3 dB(A) above the background level
- From 7am to 10pm: 5 dB(A) above the background level

It is noted that applicable criteria are less stringent than the 'background plus 0' continuous noise criterion required under the *Toowoomba Regional Planning Scheme Environmental Standards Code*. It is therefore recommended that plant be selected, installed and – if necessary – screened to not exceed background levels at neighbouring sensitive uses. Detailed plant noise assessment can be conducted at the Building Approval stage (if desired) once specifications have been determined, although the criterion is considered readily achievable through appropriate design and construction.

¹ Locher et al., 'Differences between Outdoor and Indoor Sound Levels for Open, Tilted and Closed Windows', *International Journal of Environmental Research and Public Health*, 2018,15,149

² Ryan et al., "Noise Reduction through Façades with Open Windows", *ACOUSTICS 2011*, Gold Coast

3. Noise Impact Assessment

3.1 Noise Sources

The following sources of potentially intrusive noise emissions have been identified with the proposed gymnasium activities:

- Vehicle movements, represented by the L_{eq} descriptor
- Parking activity, represented by the L_{01} descriptor
- Customer vocal activity, represented by the L_{eq} descriptor
- Deliveries, represented by the L_{eq} descriptor
- Mechanical plant, represented by the L_{90} descriptor

The precise model(s) and siting of new air conditioning plant (if any) is yet to be determined. To ensure plant complies with both State and Council criteria, it is recommended that plant be selected, installed and (if necessary) screened to not exceed background levels at noise sensitive uses. Detailed plant noise assessment can be conducted – if required – at the Building Approval stage, once specifications can be determined.

The proposed beauty salon activities are predicted to generate minor levels of noise internally, and breakout through the building envelope is expected to be negligible. Accordingly, the dominant sources of potentially intrusive noise are identified as car park and customer activity, along with mechanical plant.

Potential noise emissions from the remaining sources have been forecast to receivers R1 to R3 using the environmental noise model presented in **Appendix B**. Design sound power levels have been sourced from the NMS database, and are considered representative of 'reasonable worst-case' scenarios. Design sound power levels are presented in **Table 5** below, while further discussion of the modelling scenarios is presented in **Section 3.3** below.

Table 5: Design sound power levels, as modelled

Name	Descriptor	Sound Power Levels in dB(Z)								Total in dB(A)
		63 Hz	125 Hz	250 Hz	500 Hz	1kHz	2 kHz	4 kHz	8 kHz	
Vehicle movements	L_{eq}	74	81	75	72	75	76	72	69	81
Parking activity	L_{01}	70	80	69	68	75	76	76	72	82
Deliveries	L_{eq}	61	66	67	71	72	66	62	56	75
Raised male voice*	L_{eq}	64	64	70	73	69	65	60	54	74
Sound Pressure Levels as 1m										
Vehicle movements	$L_{eq,1hr}$	66	73	67	64	67	69	65	62	73
Parking activity	L_{01}	63	73	61	61	67	68	68	64	74
Deliveries	L_{eq}	54	58	59	64	64	58	54	49	67
Raised male voice*	L_{eq}	56	56	63	65	62	57	52	46	66

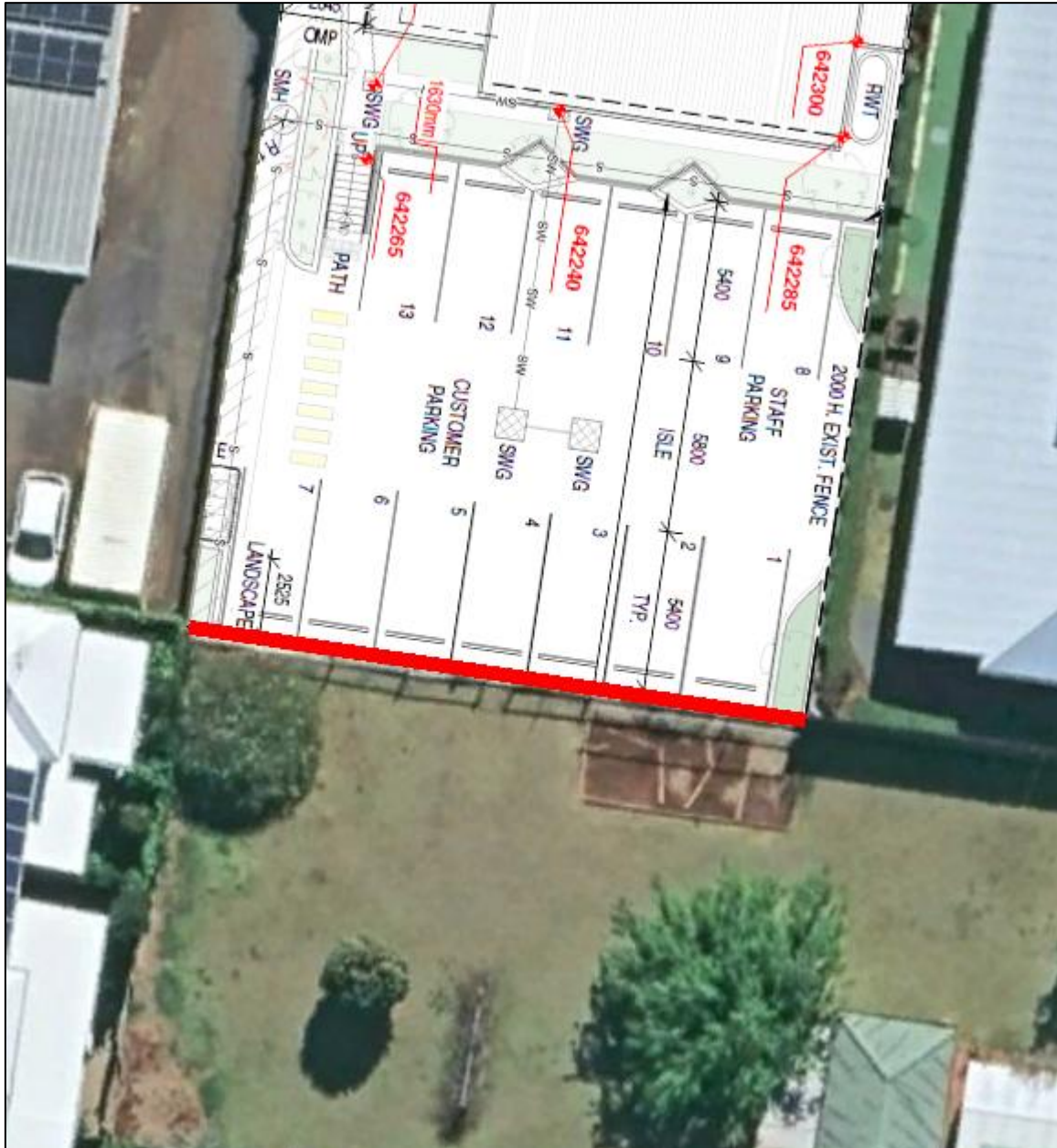
* While a raised male voice been adopted as a standard conservative assumption, it is expected that vocal activity would typically involve female voices. A raised female voice is predicted to be 3 dB(A) lower as compared to male.

3.2 Acoustic Screening

To mitigate noise impacts from car park activity onto the nearest noise sensitive uses, it is recommended that 1.8m high acoustic fencing be provided along the southern boundary, as presented in **Plate 5** below.

Screening from this recommended fencing has been included – where applicable – in the environmental noise modelling presented in **Appendix B** and in **Section 3.3**. To effectively function as an acoustic barrier, fencing should be continuous and gap-free, with a density of not less than 12.5 kg/m². This can be achieved with overlapping timber palings (minimum 50% overlap), or other gap-free forms of construction that achieve the required density.

Plate 5: Showing the location of recommended 1.8m high acoustic fencing



3.3 Environmental Noise Calculations

3.3.1 Vehicle Movements

Calculations assume peak hour traffic movements of 26 trips/hr, representing two trips per hour per parking bay. Typical activity is understood to be significantly lower in general. Design sound power levels have been sourced from the Association of Australasian Acoustical Consultants *Guideline for Child Care Centre Acoustic Assessment v3*. Calculations assume an average speed of 15 km/hr, and a source height of 1.5m (representing dominant engine noise at low speeds). The moving line source locations – as modelled – are shown in **Plate 6** below, while calculation results are presented with criteria in **Table 6** following.

Plate 6: Showing vehicle moving line source locations, as modelled



Table 6: Noise emissions forecasts and criteria, vehicle movements. Levels are in dB(A)

Receiver	Descriptor	Forecast	Criteria		Assessment
			Day/Evening	Night	
R1	Leq,1hr	28	45	N / A	Pass
R2	Leq,1hr	29	45	N / A	Pass
R3	Leq,1hr	35	45	N / A	Pass

As shown above, noise emissions from vehicle movements are forecast well below criteria at all receivers.

3.3.2 Parking Activity

Potential noise emissions from parking activity – such as engine starts or car door closures – have been modelled from the worst-case locations as presented in **Plate 7** below. Design sound power levels have been calculated from measurements as per Harwood, M, “Carrying out noise assessments for proposed supermarket developments”, ACOUSTICS 2008, Geelong. It is expected that parking activity will be highly intermittent or sporadic, with significant periods of minimal or relative inactivity. Results from the environmental noise calculations are presented in **Table 7** following.

Plate 7: Showing parking noise source locations, as modelled

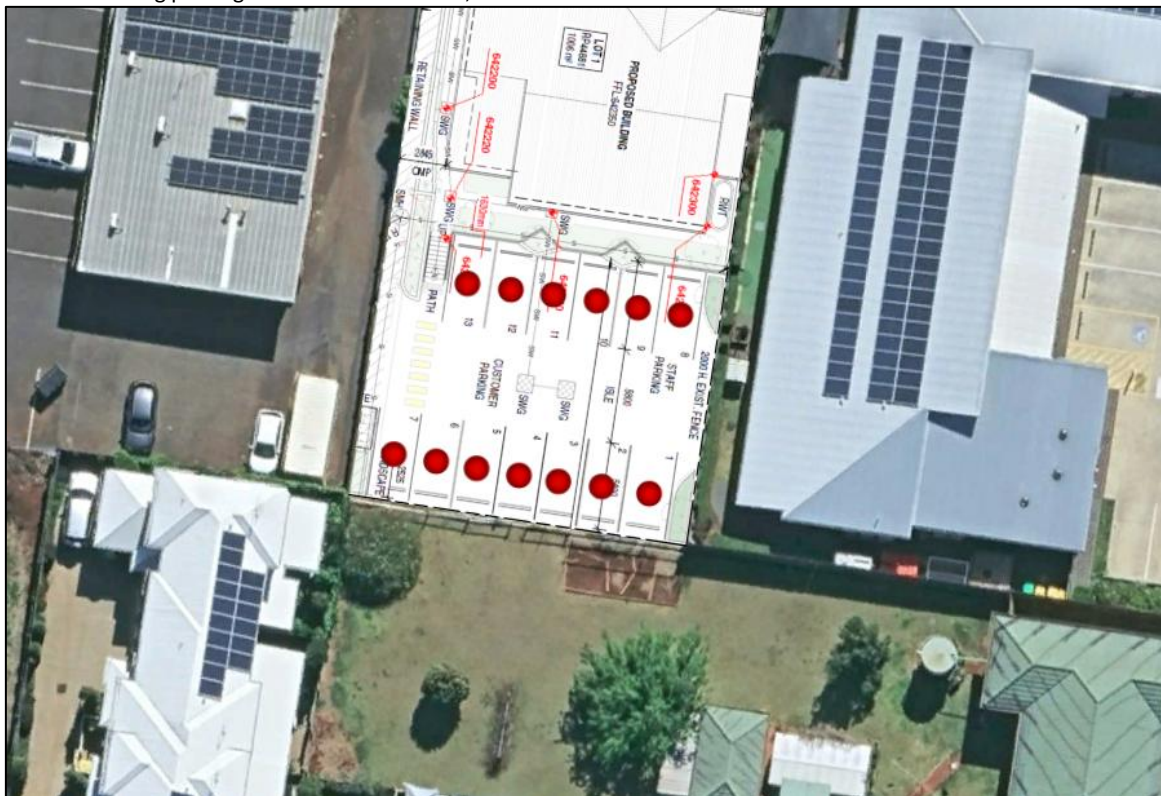


Table 7: Noise forecasts and criteria, parking activity. Levels are in dB(A)

Receiver	Descriptor	Forecast	Criteria		Assessment
			Day/Evening	Night	
R1	$L_{eq,1hr}$	41	55	N / A	Pass
R2	$L_{eq,1hr}$	41	55	N / A	Pass
R3	$L_{eq,1hr}$	52	55	N / A	Pass

As shown above, noise from parking activity is forecast to meet criteria at all receivers.

3.3.3 Vocal Activity

The development plans do not show designated outdoor areas, and vocal activity – such as talking/laughing – is expected to be intermittent if not sporadic and brief. This notwithstanding – and as a conservative design methodology – a continuous ‘raised male voice’³ has been assumed outside the building envelope (representing a phone call or cigarette break). The noise source location – as modelled – are presented in **Plate 8** below, with results from the environmental noise calculations presented in **Table 8** following

Plate 8: Showing vocal activity noise source location, as modelled

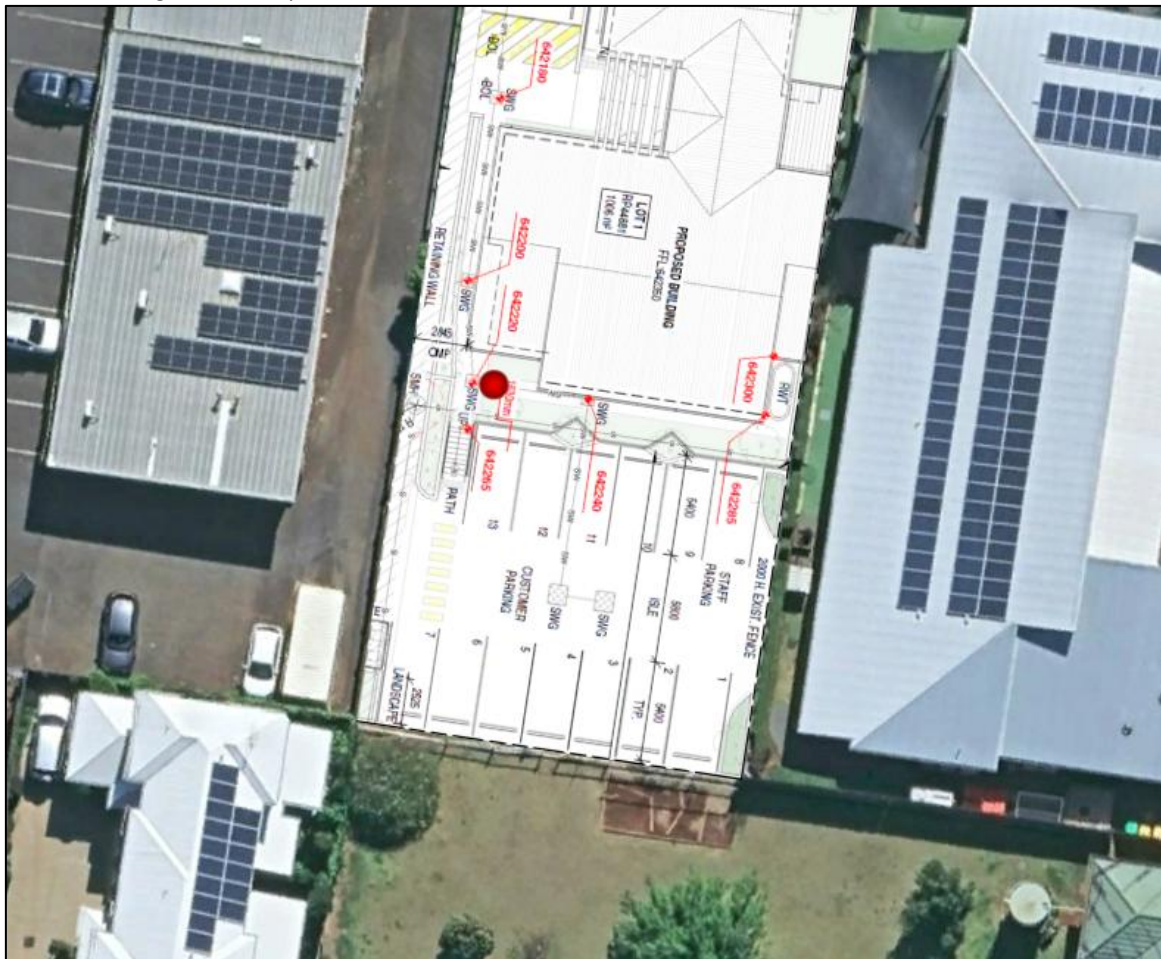


Table 8: Noise forecasts and criteria, vocal activity. Levels are in dB(A)

Receiver	Descriptor	Forecast	Criteria		Assessment
			Day/Evening	Night	
R1	$L_{eq,1hr}$	29	45	N / A	Pass
R2	$L_{eq,1hr}$	31	45	N / A	Pass
R3	$L_{eq,1hr}$	36	45	N / A	Pass

As shown above, noise from vocal activity is forecast well below criteria at all locations.

³ Sound power levels as per the AAC Licensed Premises and Patron Noise Assessment Technical Guideline v3

3.3.4 Deliveries

It is understood that deliveries to the site will be sporadic, involving small rigid vehicles⁴. Design power levels include reversing alarms and refrigeration compressors, although delivery trucks or vans are not expected to typically include refrigeration. The delivery noise source location – as modelled – is presented in **Plate 9** below, with results of the environmental noise calculations presented in **Table 9** following.

Plate 9: Showing delivery noise source location, as modelled

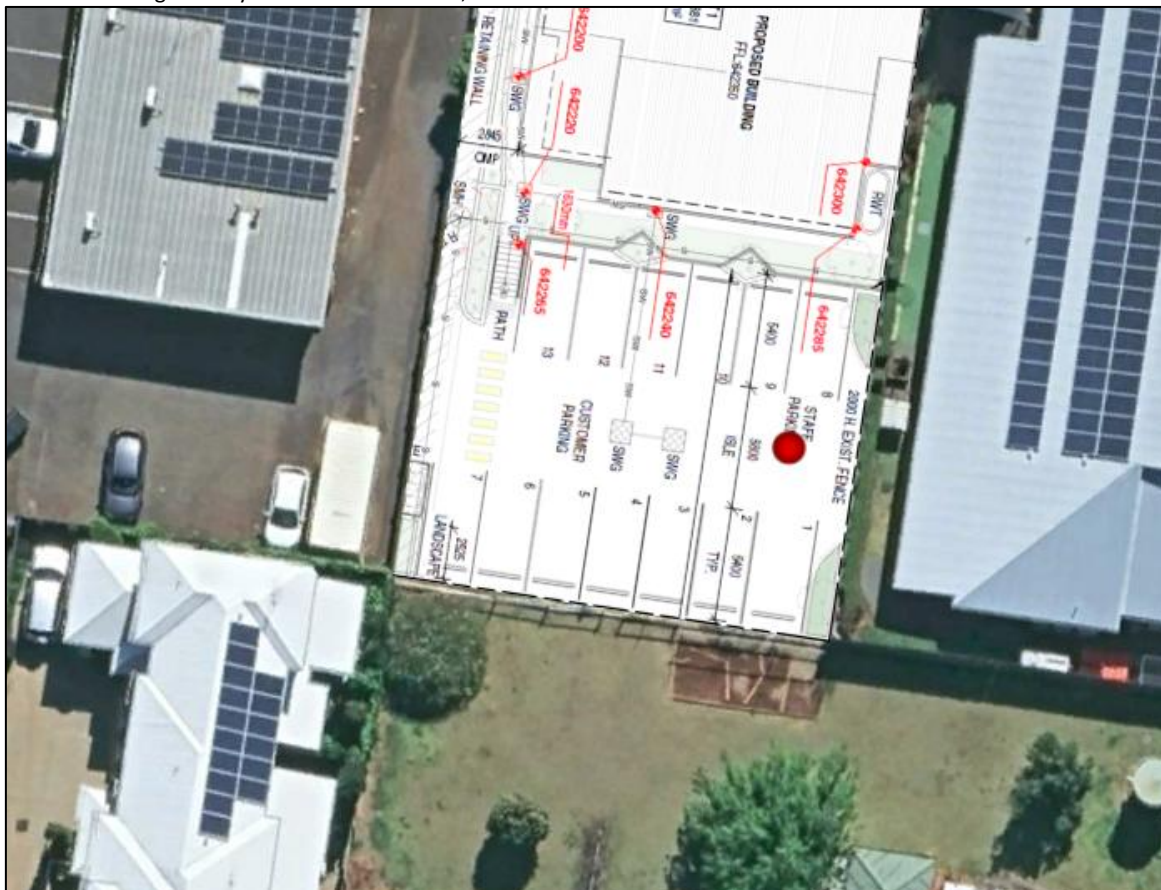


Table 9: Noise forecasts and criteria, deliveries. Levels are in dB(A)

Receiver	Descriptor	Forecast	Criteria		Assessment
			Day/Evening	Night	
R1	$L_{eq,1hr}$	38	45	N / A	Pass
R2	$L_{eq,1hr}$	34	45	N / A	Pass
R3	$L_{eq,1hr}$	37	45	N / A	Pass

As shown above, noise emissions from deliveries are forecast well below criteria at all locations.

⁴ Adopted design sound power level calculated from measurements of a 'Milko Truck' as per Harwood, M, "Carrying out noise assessments for proposed supermarket developments", **ACOUSTICS 2008**, Geelong

3.4 Discussion

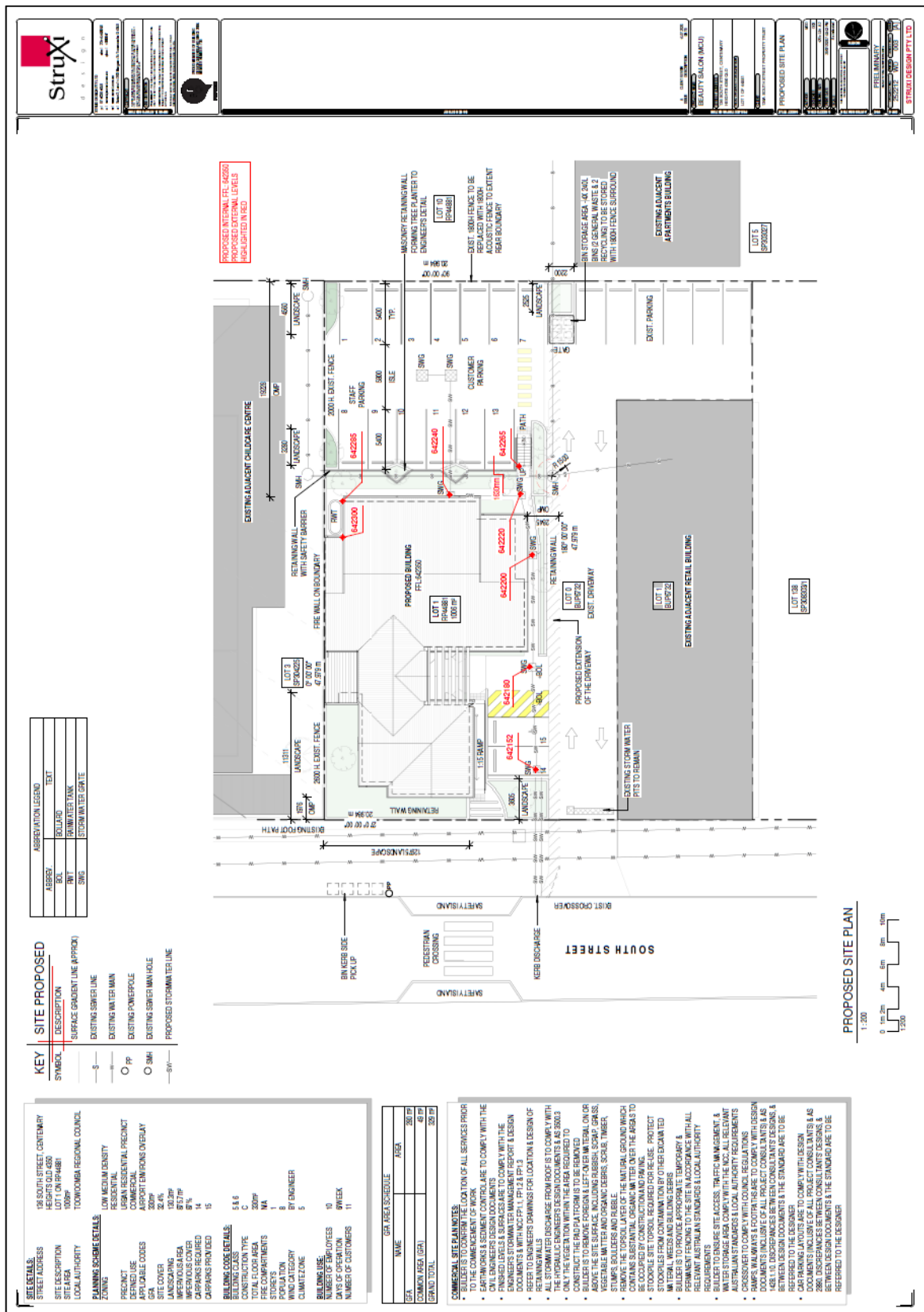
The proposed beauty salon represents low impact noise generation, with emissions generally controlled by car park activity which is intermittent and brief in nature. In context of the existing environment – which includes a local centre to the west, and child care centre to the east – the proposed activities are considered broadly consistent with community expectations for the area. Noise emissions are forecast to meet the Acoustic Quality Objectives at neighbouring uses, thereby protecting a desirable standard of acoustic amenity. On this basis, it is concluded that:

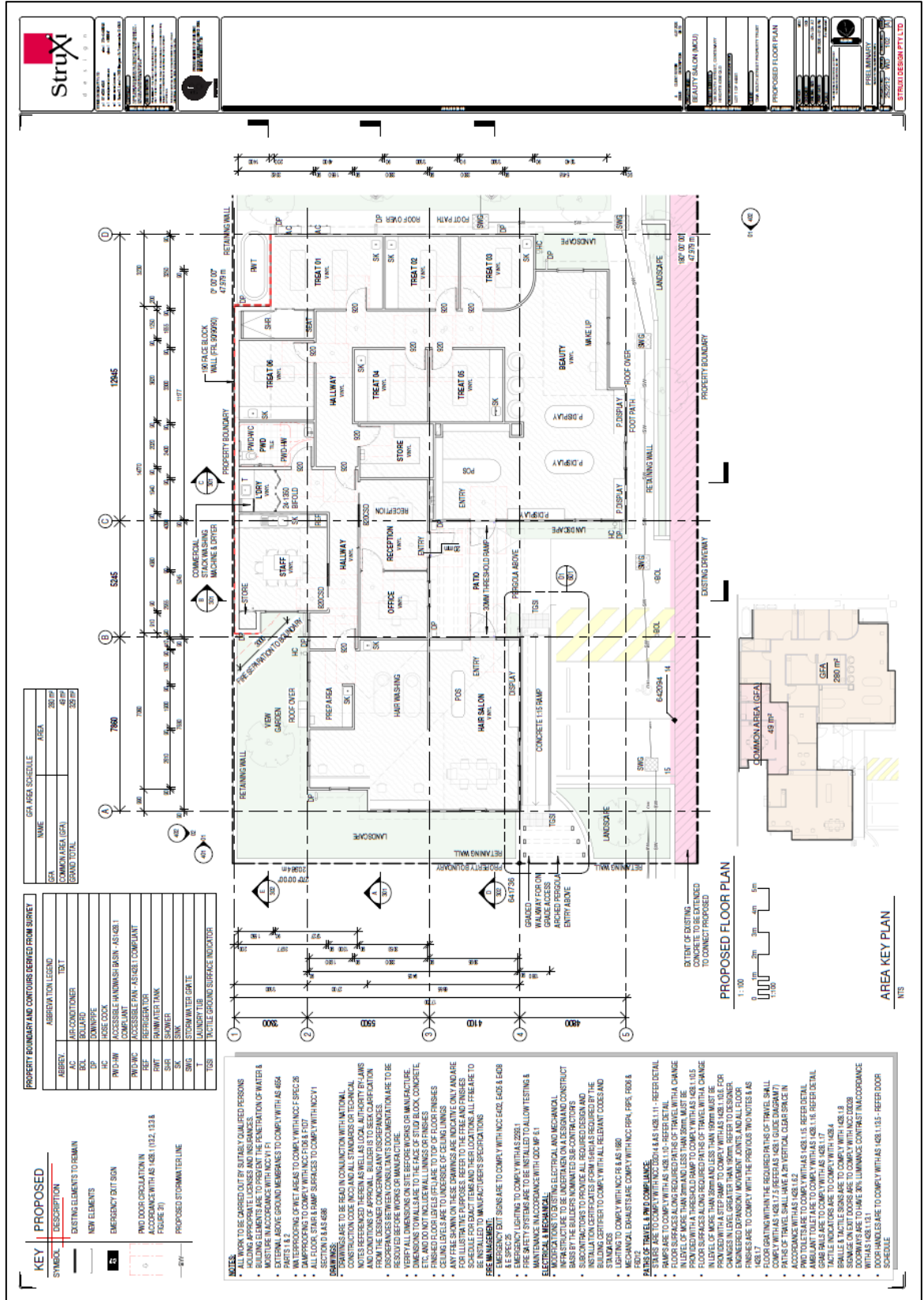
- Subject to the considerations and recommendations of this report, it is the opinion of this consultancy that the proposed development meet the requirements of the Toowoomba Regional Planning Scheme, and be otherwise compliant with relevant regulatory obligations.
- Subject to the recommended acoustic fencing, noise emissions from carpark activity are forecast to meet the relevant Acoustic Quality Objectives at all neighbouring properties.
- The precise model(s) and siting of new air conditioning plant (if any) are yet to be determined. Detailed plant noise assessment can be conducted at the Building Approval stage, although criteria are considered readily achievable through appropriate plant selection and siting.

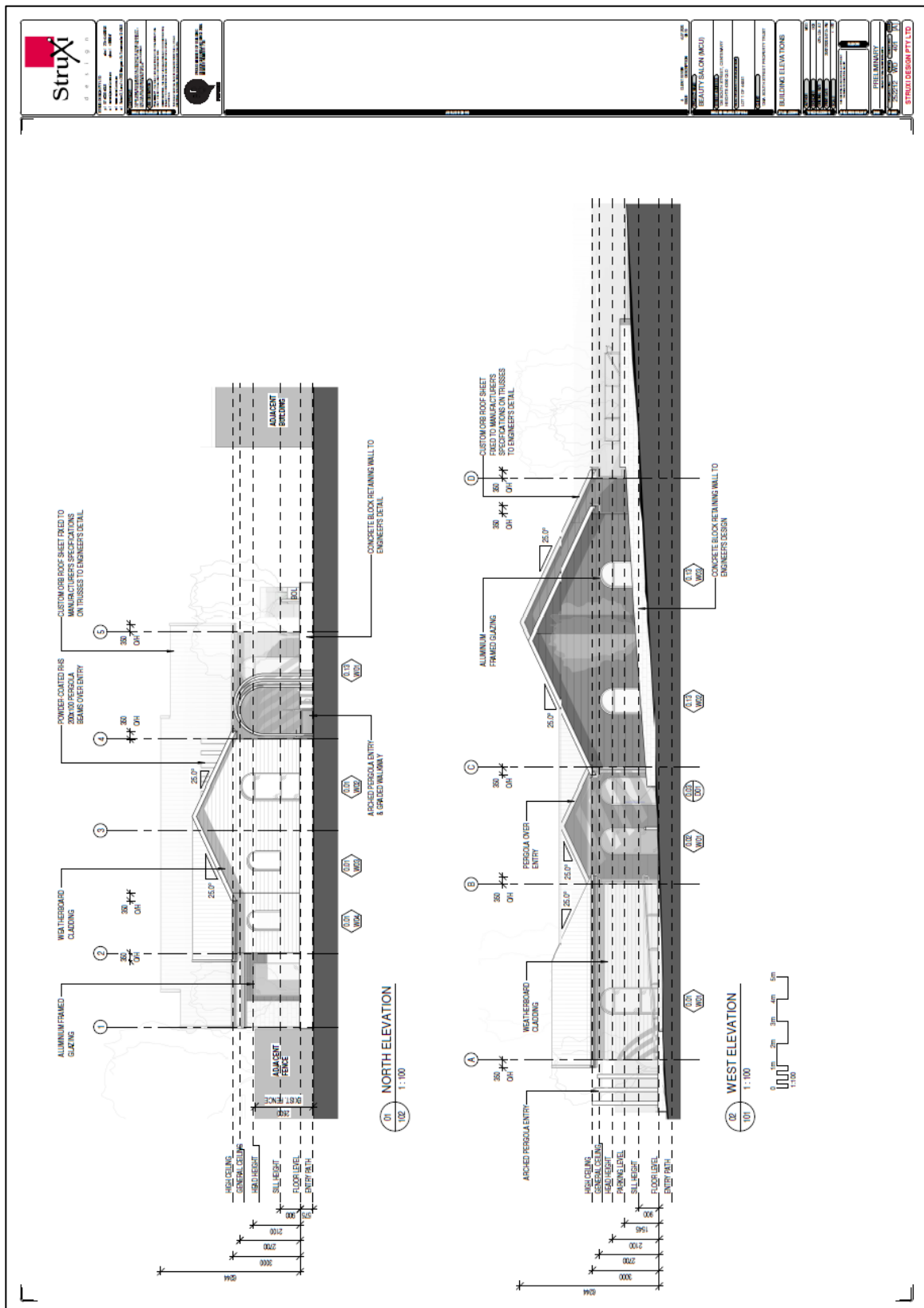
It is recommended that:

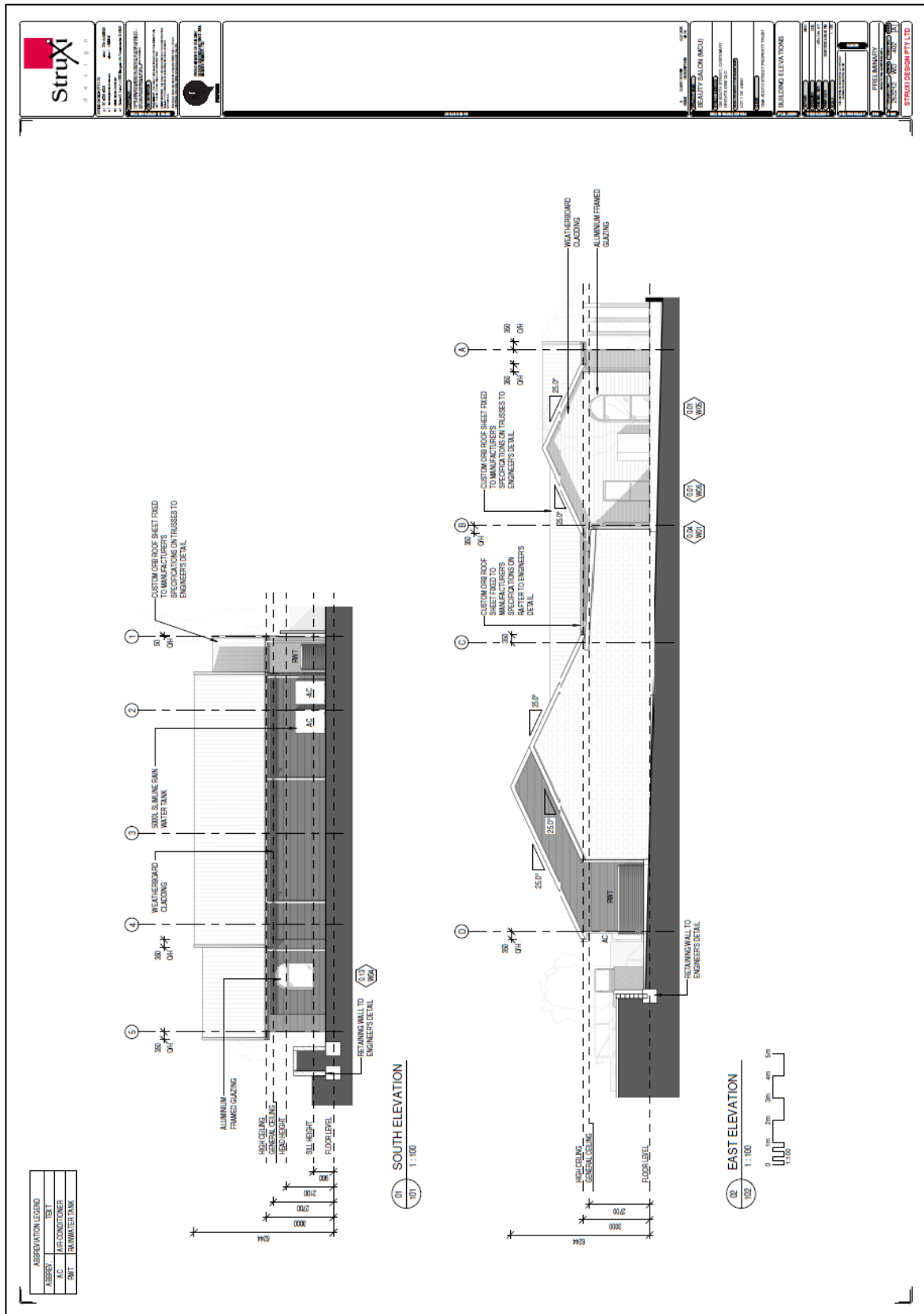
- Beauty salon activities be Approved for between 7am and 9pm daily.
- 1.8m high acoustic fencing be provided along the southern boundary, as shown in **Plate ES1** below. To effectively function as an acoustic barrier, fencing should be continuous and gap-free, with a density of not less than 12.5 kg/m².
- New air conditioning plant (if any) be selected, installed and – if necessary – screened to not exceed background levels at neighbouring noise sensitive uses.

Appendix A: Development Plans









Appendix B: Environmental Noise Model

Noise predictions been prepared with PEN3D, a software program implementing a prediction model based on the method described in Bies & Hansen, *ISO 9613-2 (1996) Acoustics – Attenuation of sound propagation outdoors Part 2: General Method of Calculation* and *CONCAWE*. The model takes into account meteorological factors, and predictions assume neutral conditions. The basic equation adopted is-

$$L_p = L_w - 20 \log_{10}(r) - 10 \log_{10}(4\pi) + AE$$

Where:

- L_p is the sound pressure level at an observer
- L_w is the sound power level of the source
- $20 \log_{10} r - 10 \log_{10}(4\pi)$ is the Distance attenuation (spherical)
- AE is the excess attenuation factors and is determined as the sum of the contributions

All prediction models have limits to their accuracy of prediction. This is due to the inherent nature of the calculation algorithms that go into the design of the models, the assumptions made in the implementation of the model, and the availability of good source sound power data. Various researchers have suggested that an un-calibrated model has an accuracy of ± 5 dB while a calibrated model has an accuracy of ± 2 dB. ISO 9613-2 has an estimated accuracy for broadband noise of ± 3 dB at 1000 metres. Calibration means that the model has been established with reference to measured sound levels at a receiver, known source levels and tightly defined propagation variables. Neutral meteorological and atmospheric conditions have been assumed. Topographic data was sourced from Toowoomba Regional Council. Design sound power levels – as modelled – are presented in **Table B1** below. Calculations results are presented in the **tables** and **plates** following.

Table B1: Design sound power levels, as modelled

Name	Descriptor	Sound Power Levels in dB(Z)								Total in dB(A)
		63 Hz	125 Hz	250 Hz	500 Hz	1kHz	2 kHz	4 kHz	8 kHz	
Vehicle movements	L_{eq}	74	81	75	72	75	76	72	69	81
Parking activity	L_{01}	70	80	69	68	75	76	76	72	82
Deliveries	L_{eq}	61	66	67	71	72	66	62	56	75
Raised male voice	L_{eq}	64	64	70	73	69	65	60	54	74
Sound Pressure Levels as 1m										
Vehicle movements	$L_{eq,1hr}$	66	73	67	64	67	69	65	62	73
Parking activity	L_{01}	63	73	61	61	67	68	68	64	74
Deliveries	L_{eq}	54	58	59	64	64	58	54	49	67
Raised male voice	L_{eq}	56	56	63	65	62	57	52	46	66

Table B2: Receiver point calculations, vehicle movements. Levels are in dB(A) $L_{eq,1hr}$

POINT CALCULATIONS				
Pen3D2000 V 1.9.32				
Project Code: 8397				
Project Description: Noise assessment of 136 South Street, Centenary Heights				
File:D:\VZ Drive\8397 136 South St, Centenary Heights - commercial\Model\8397 vehicles.PEN				
Monday 10 Aug, 2026 at 15:34:19				
Environmental Calculations (Moving Line Source)				
All moving line sources included. Line source segmentation angle: 10 degrees. Calculations for specified meteorology.				
Noise level results include the Leq (1 hour) of all noise sources				
Meteorology :Wind speed 0.0 (m/s) Wind direction 0 Mast height 10.0 (m) Temperature 20.0 (C) Temperature Gradient 0.0 (C/100m) Humidity 50.0 (%)				
Surface Roughness of terrain 0.023000000 (m) Zero plane offset 0.080000000 (m)				
Receptor	X Posn (m)	Y Posn (m)	Height (m)	Noise Level (dB(A))
R1	397914.0	6948787.0	1.5	28.1
R2	397899.0	6948777.0	1.5	29.0
R3	397887.0	6948780.0	4.6	35.1

Plate B1: Noise contours at 1.8m, vehicle movements. Levels are in dB(A) $L_{eq,1hr}$



Table B3: Receiver point calculations, parking activity. Levels are in dB(A) L_{01,1hr}

POINT CALCULATIONS					
Pen3D2000 V 1.9.32					
Project Code: 8397					
Project Description: Noise assessment of 136 South Street, Centenary Heights					
File:D:\Z Drive\8397 136 South St. Centenary Heights - commercial\Model\8397 parking.PEN					
Monday 10 Aug, 2026 at 11:41:45					
Environmental Calculations					
All point and line sources included. Line source segmentation angle: 10 degrees. Calculations for specified meteorology.					
Noise level results are the maximum of all the noise sources Noise level results incorporate the incoherent ground reflection algorithm					
Meteorology : Wind speed 0.0 (m/s) Wind direction 0 Mast height 10.0 (m) Temperature 20.0 (C) Temperature Gradient 0.0 (C/100m) Humidity 50.0 (%)					
Surface Roughness of terrain 0.023000000 (m) Zero plane offset 0.080000000 (m)					
Receptor	X Posn (m)	Y Posn (m)	Height (m)	Ground (m)	Noise Level (dB(A))
R1	397914.0	6948787.0	1.5	643.5	40.6
R2	397899.0	6948777.0	1.5	644.3	41.0
R3	397887.0	6948780.0	4.6	644.5	52.2

Plate B2: Noise contours at 1.8m, parking activity. Levels are in dB(A) L_{01,1hr}



Table B4: Receiver point calculations, vocal activity. Levels are in dB(A) $L_{eq,1hr}$

POINT CALCULATIONS					
Pen3D2000 V 1.9.32					
Project Code: 8397					
Project Description: Noise assessment of 136 South Street, Centenary Heights					
File:D:\12 Drive\8397 136 South St, Centenary Heights - commercial\Model\8397 voices.PEN					
Monday 10 Aug, 2026 at 11:42:50					
Environmental Calculations					
All point and line sources included. Line source segmentation angle: 10 degrees. Calculations for specified meteorology.					
Noise level results are the logarithmic addition of all the noise sources. Noise level results incorporate the incoherent ground reflection algorithm					
Meteorology: Wind speed 0.0 (m/s) Wind direction 0 Mast height 10.0 (m) Temperature 20.0 (C) Temperature Gradient 0.0 (C/100m) Humidity 50.0 (%)					
Surface Roughness of terrain 0.023000000 (m) Zero plane offset 0.080000000 (m)					
Receptor	X Posn (m)	Y Posn (m)	Height (m)	Ground (m)	Noise Level (dB(A))
R1	397914.0	6948787.0	1.5	643.6	29.2
R2	397899.0	6948777.0	1.5	644.2	30.9
R3	397887.0	6948780.0	4.6	644.5	36.2

Plate B3: Noise contours at 1.8m, vocal activity. Levels are in dB(A) $L_{eq,1hr}$

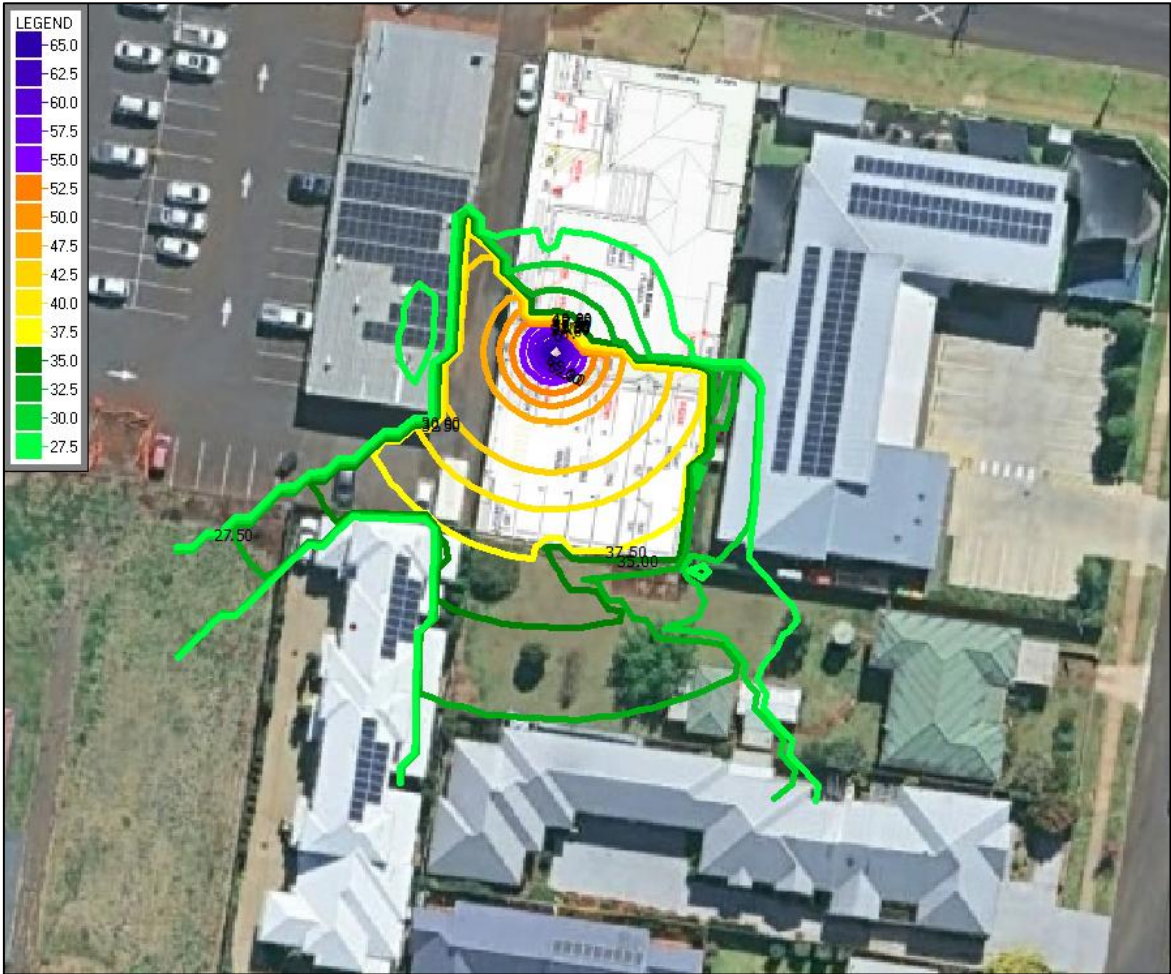
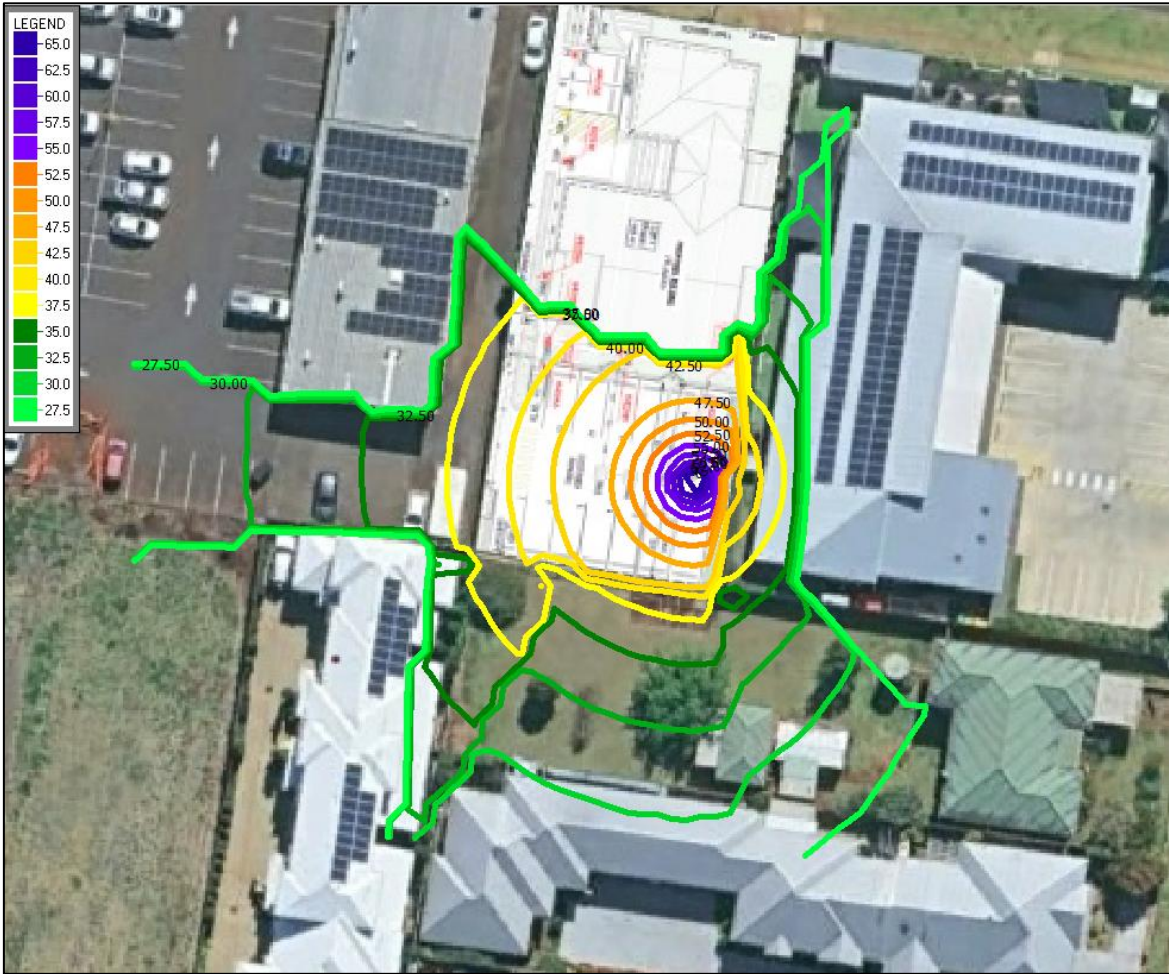


Table B5: Receiver point calculations, deliveries. Levels are in dB(A) $L_{eq,1hr}$

POINT CALCULATIONS					
Pen3D2000 V 1.9.32					
Project Code: 8397					
Project Description: Noise assessment of 136 South Street, Centenary Heights					
File:D:\IZ Drive\8397 136 South St, Centenary Heights - commercial\Model\8397 deliveries.PEN					
Monday 10 Aug. 2026 at 14:45:35					
Environmental Calculations					
All point and line sources included. Line source segmentation angle: 10 degrees. Calculations for specified meteorology.					
Noise level results are the logarithmic addition of all the noise sources. Noise level results incorporate the incoherent ground reflection algorithm					
Meteorology: Wind speed 0.0 (m/s) Wind direction 0 Mast height 10.0 (m) Temperature 20.0 (C) Temperature Gradient 0.0 (C/100m) Humidity 50.0 (%)					
Surface Roughness of terrain 0.023000000 (m) Zero plane offset 0.080000000 (m)					
Receptor	X Posn (m)	Y Posn (m)	Height (m)	Ground (m)	Noise Level (dB(A))
R1	397914.0	6948787.0	1.5	643.0	38.2
R2	397899.0	6948777.0	1.5	644.2	34.1
R3	397887.0	6948780.0	4.6	644.5	36.5

Plate B4: Noise contours at 1.8m, deliveries. Levels are in dB(A) $L_{eq,1hr}$



Appendix C: Glossary

“Peak” maximum level ($L_{Amax,T}$).

The peak maximum level is the absolute highest (1 second or less) sound level within the whole of the measurement time.

Event maximum sound pressure level ($L_{A\%,adj,T}$), L_{01}

The L_{01} level is calculated as the noise level equalled and exceeded for 1% of the measurement time, for example 9 seconds in any 15 minute interval. L_{01} is an appropriate level to characterise single events, such as from train bypass.

In this Report, the measured L_{01} levels for day/evening/night are not averaged but are arranged from low to high in the relevant day/evening/night interval and the value that is found at the 90th percentile (L_{10} of L_{01} sample) in the interval is recorded as its “ L_{01} ” level.

Average maximum sound pressure level ($L_{A\%,adj,T}$), L_{10}

The “ L_{10} ” level is an indicator of “steady-state” noise or intrusive noise conditions from traffic, music and other relatively non-impulsive noise sources. The L_{10} level is calculated as the noise level equalled and exceeded for 10% the measurement time, for example 90 seconds in any 15 minute interval. The measured L_{10} time-intervals for day/evening/night are arithmetically averaged to present the “average maximum” levels of the environment for day/evening/night. The level can be adjusted for tonality or impulsiveness.

Background sound pressure level ($L_{A90,T}$), L_{90}

Commonly called the “ L_{90} ” or “background” level and is an indicator of the quietest times of day, evening or night. The L_{90} level is calculated as the noise level equalled and exceeded for 90% the measurement time. The measured L_{90} time-intervals are arithmetically averaged to present the “average background” levels of the environment for day/evening/night. The level is recorded in the absence of any noise under investigation. The level is not adjusted for tonality or impulsiveness.

Equivalent Continuous or time average sound pressure level ($L_{Aeq,T}$), Leq

Commonly called the “ Leq ” level it is the logarithmic average noise level from all sources far and near. The maximum 1-hour levels within the day/evening/night time intervals are referenced for building design. The level can be adjusted for tonality.

Façade-adjusted level

A sound level that is measured at a distance of 1.0 metre from a wall or facade. The level is nominally 2.5 dB higher than the free-field level.

Free-field level

A sound level that is measured at a distance of more than 3.5 metres from a wall or facade.