Lloyd George Acoustics
PO Box 717
Hillarys WA 6923
T: 9401 7770
www.lgacoustics.com.au

Environmental Noise Assessment

Fast Food Restaurant and Drive-Through

Part Lot 2076 Butler Boulevard, Butler

Reference: 21126981-01

Prepared for:
Shimal Realstar Pty Ltd

Association of Australasian Acoustical Consultants

Report: 21126981-01

Lloyd George Acoustics Pty Ltd

ABN: 79 125 812 544

PO Box 717
Hillarys WA 6923

www.lgacoustics.com.au

Contacts	General	Daniel Lloyd	Terry George	Matt Moyle
E:	info@lgacoustics.com.au	daniel@lgacoustics.com.au	terry@lgacoustics.com.au	matt@lgacoustics.com.au
P:	9401 7770	0439 032 844	0400 414 197	0412 611 330
Contacts	**Ben Hillion**	**Rob Connolly**	**Daryl Thompson**	**Hao Tran**
E:	ben@lgacoustics.com.au	rob@lgacoustics.com.au	daryl@lgacoustics.com.au	hao@lgacoustics.com.au
P:	0457 095 555	0410 107 440	0420 364 650	0438 481 207

Date:	Rev	Description	Prepared By	Verified
17-Dec-21	0	Issued to Client	Matt Moyle	Terry George

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1 INTRODUCTION

Lloyd George Acoustics was commissioned to undertake a noise assessment for a proposed restaurant development at Part Lot 2076 Butler Boulevard, Butler (subject site) – refer *Figure 1-1*.

While other commercial aspects are planned in the future (refer site plan in *Figure 1-2*), the assessment addresses the noise aspects of the restaurant only with future areas left vacant.

The most critical noise sensitive premises identified in this assessment are existing residences to the south.

Noise sources considered were those associated with mechanical plant, delivery vehicles, vehicle noise in the drive-through and parking areas as well as the speaker associated with the ordering system. Noise from this equipment was assessed against the prescribed standards of the *Environmental Protection (Noise) Regulations 1997* by way of noise modelling.

Figure 1-1 Subject Site Locality

Appendix B contains a description of some of the terminology used throughout this report.

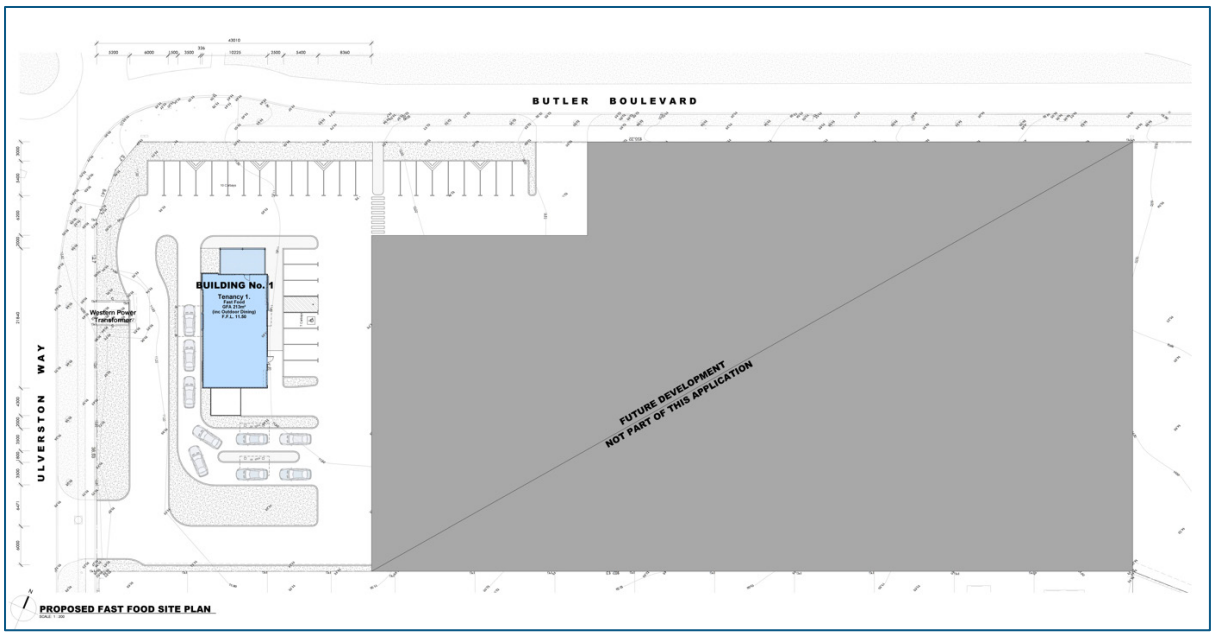

Figure 1-2 Overall Site Plan (From Development Application)

2 CRITERIA

Environmental noise in Western Australia is governed by the *Environmental Protection Act 1986*, through the *Environmental Protection (Noise) Regulations 1997* (the Regulations).

Regulation 7 defines the prescribed standard for noise emissions as follows:

"7. (1) Noise emitted from any premises or public place when received at other premises –

(a) Must not cause or significantly contribute to, a level of noise which exceeds the assigned level in respect of noise received at premises of that kind; and

(b) Must be free of –

i. tonality;

ii. impulsiveness; and

iii. modulation,

when assessed under regulation 9"

A "…noise emission is taken to significantly contribute to a level of noise if the noise emission … exceeds a value which is 5 dB below the assigned level…"

Tonality, impulsiveness and modulation are defined in Regulation 9. Noise is to be taken to be free of these characteristics if:

(a) The characteristics cannot be reasonably and practicably removed by techniques other than attenuating the overall level of noise emission; and

(b) The noise emission complies with the standard prescribed under regulation 7 after the adjustments of *Table 2-1* are made to the noise emission as measured at the point of reception.

Table 2-1 Adjustments Where Characteristics Cannot Be Removed

Where Noise Emission is Not Music			Where Noise Emission is Music	
Tonality	Modulation	Impulsiveness	No Impulsiveness	Impulsiveness
+ 5 dB	+ 5 dB	+ 10 dB	+ 10 dB	+ 15 dB

Note: The above are cumulative to a maximum of 15dB.

The baseline assigned levels (prescribed standards) are specified in Regulation 8 and are shown in *Table 2-2*.

Table 2-2 Baseline Assigned Noise Levels

Premises Receiving Noise	Time Of Day	Assigned Level (dB)		
		L_{A10}	L_{A1}	L_{Amax}
Noise sensitive premises: highly sensitive area[1]	0700 to 1900 hours Monday to Saturday (Day)	45 + influencing factor	55 + influencing factor	65 + influencing factor
	0900 to 1900 hours Sunday and public holidays (Sunday)	40 + influencing factor	50 + influencing factor	65 + influencing factor
	1900 to 2200 hours all days (Evening)	40 + influencing factor	50 + influencing factor	55 + influencing factor
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays (Night)	35 + influencing factor	45 + influencing factor	55 + influencing factor
Noise sensitive premises: any area other than highly sensitive area	All hours	60	75	80
Commercial	All hours	60	75	80

1. ***highly sensitive area*** means that area (if any) of noise sensitive premises comprising —
   (a) a building, or a part of a building, on the premises that is used for a noise sensitive purpose; and
   (b) any other part of the premises within 15 metres of that building or that part of the building.

The influencing factor, applicable at the noise sensitive premises has been calculated as 5 dB for all noise sensitive locations, as shown in *Figure 2-1* and *Table 2-3*. The transport factor has been calculated as 2 dB, due to Butler Boulevard being considered a secondary road (> 6,000 vehicles per day – based on signal lane counts at Exmouth Drive interchange being approximately 7,000 vpd) within 100 metres of the noise sensitive premises.

As per the relevant Structure Plan map, the subject site itself is within Precinct B, which encourages a mix of office, commercial, consultancy, retail and residential type uses. The influencing factor calculation at the nearest residences is shown in *Table 2-3*. *Table 2-4* shows the assigned noise levels including the influencing factor and transport factor at the receiving locations.

Table 2-3 Influencing Factor Calculation

Description	Within 100 metre Radius	Within 450 metre Radius	Total
Industrial Land	0 %	0 %	0 dB
Commercial Land	35%	25 %	2.7 dB
Transport Factor			**2 dB**
Total			**5 dB**

Table 2-4 shows the assigned noise levels including the influencing factor at the receiving locations. The receiving noise sensitive premises are identified in *Figure 3-2*. The restaurant is proposed to operate from 10am to 12am midnight, 7-days a week.

Table 2-4 Assigned Noise Levels

Premises Receiving Noise	Time of Day	Assigned Level (dB)		
		L_{A10}	L_{A1}	L_{Amax}
Residences within 100m of Marmion Ave	0700 to 1900 hours Monday to Saturday (Day)	50	60	70
	0900 to 1900 hours Sunday and public holidays (Sunday)	45	55	70
	1900 to 2200 hours all days (Evening)	45	55	60
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays (Night)	40	50	60
Commercial	All hours	60	75	80

1. ***highly sensitive area*** means that area (if any) of noise sensitive premises comprising —
   (a) a building, or a part of a building, on the premises that is used for a noise sensitive purpose; and
   (b) any other part of the premises within 15 metres of that building or that part of the building.

It must be noted the assigned noise levels apply outside the receiving premises and at a point at least 3 metres away from any substantial reflecting surfaces.

It is further noted the assigned noise levels are statistical levels and therefore the period over which they are determined is important. The Regulations define the Representative Assessment Period (RAP) as *a period of time of not less than 15 minutes, and not exceeding 4 hours*, which is determined by an *inspector* or *authorised person* to be appropriate for the assessment of a noise emission, having regard to the type and nature of the noise emission. An *inspector* or *authorised person* is a person appointed under Sections 87 & 88 of the *Environmental Protection Act 1986* and include Local Government Environmental Health Officers and Officers from the Department of Environment Regulation. Acoustic consultants or other environmental consultants are not appointed as an *inspector* or *authorised person*. Therefore, whilst this assessment is based on a 4 hour RAP, which is assumed to be appropriate given the nature of the operations, this is to be used for guidance only.

Regulation 3 states the following with regards to vehicles:

(1) Nothing in these regulations applies to the following noise emissions —

(a) noise emissions from the propulsion and braking systems of motor vehicles operating on a road.

Since the development is open to the public, the carpark and associated like areas are considered to be a road and therefore vehicle noise (propulsion and braking) is not strictly assessed. However, vehicle propulsion noise in the drive-through area has been considered assessable in this report due to the 24-hour nature of the restaurant and the nature of the lanes being solely for food ordering purposes and not road access. Vehicle door closing noise is also assessable in any parts of the car park, as this does not form part of the 'propulsion or braking' systems.

Regulation 14A provides requirements for the collection of waste stating that this activity can also be exempt from having to comply with regulation 7 prescribed standards provided it is undertaken between 7am and 7pm Mondays to Saturdays and undertaken in the quietest reasonable manner.

3 METHODOLOGY

Computer modelling has been used to predict the noise emissions from the site. The software used was *SoundPLAN 8.2* with the ISO 9613 algorithms (ISO 17354 compliant) selected. These algorithms have been selected as they include the influence of wind and atmospheric stability. Input data required in the model are:

- Meteorological Information;
- Topographical data;
- Ground Absorption; and
- Source sound power levels.

3.1 Meteorological Information

Meteorological information utilised is provided in *Table 3-1* and is considered to represent worst-case conditions for noise propagation. At wind speeds greater than those shown, sound propagation may be further enhanced, however background noise from the wind itself and from local vegetation is likely to be elevated and dominate the ambient noise levels.

Table 3-1 Modelling Meteorological Conditions

Parameter	Night (1900-0700)	Day (0700-1900)
Temperature (°C)	15	20
Humidity (%)	50	50
Wind Speed (m/s)	Up to 5m/s	Up to 5m/s
Wind Direction*	All	All

* Note that the modelling package used allows for all wind directions to be modelled simultaneously.

It is generally considered that compliance with the assigned noise levels needs to be demonstrated for 98% of the time, during the day and night periods, for the month of the year in which the worst-case weather conditions prevail. In most cases, the above conditions occur for more than 2% of the time and therefore must be satisfied.

3.2 Topographical Data

Topographical data was adapted from *Google* and proposed plans. Existing buildings have also been included as these can provide barrier attenuation when located between a source and receiver as well as reflection paths. Parapets are assumed to be atop the restaurant building and 1.0 metres higher than the roof. A permeable fence is noted surrounding the service yard, and this was therefore not included as a solid barrier in the model - refer *Appendix A*.

3.3 Ground Absorption

Ground absorption varies from a value of 0 to 1, with 0 being for an acoustically reflective ground (e.g. water or bitumen) and 1 for acoustically absorbent ground (e.g. grass). In this instance, a value 0.0 has been used for all road and car park areas and 0.6 for all other areas.

3.4 Source Sound Levels

Table 3-2 shows the sound power levels used in the modelling. The spectrum and overall levels are for individual point sources within the model. The general list of noise emissions considered in the assessment are:

- Mechanical Services (Air conditioning, ventilation systems, and refrigeration plant);
- Drive-through speaker noise;
- Vehicles (including deliveries) idling in drive through areas; and
- Car doors closing in parking bays.

Table 3-2 Source Sound Power Levels, dB

Description	Octave Band Centre Frequency (Hz)								Overall dB(A)
	63	125	250	500	1k	2k	4k	8k	
Refrig Condenser Package– L_{A10}	88	87	85	81	76	70	64	59	**82**
AC-1&2 Actron PCA233U Package Unit Low Speed – L_{A10}	-	71	71	70	67	62	61	56	**69**
AC-1&2 Actron PCA233U Package Unit High Speed – L_{A10}	-	76	75	74	71	66	65	60	**71**
Fan, Toilet and Kitchen – L_{A10}	80	78	74	71	62	64	63	53	**73**
Refrigerated Truck delivery – L_{A1}	100	91	87	88	83	81	79	75	**90**
Drive-Through Speaker – L_{A1}	62	64	66	77	80	73	57	42	**82**
Car Idling – L_{A10}	81	78	74	72	74	74	67	64	**79**
Car Door Closing – L_{Amax}	71	74	77	81	80	78	72	61	**84**

Modelled noise sources were based on file data for similar scaled restaurants. The locations of the noise sources are based on general locations on the site plan (refer *Appendix A*) noting the following:

- Exhaust and refrigeration plant are assumed to be roof mounted at 1.0m above building height in the noise model;
- Airconditioning plant are modelled within the designated plant yard area;
- For night-time scenarios, mechanical plant is modelled with low speed noise levels;
- Car door and all engine sources are modelled at 0.5m above ground;
- 4 to 9 vehicles are modelled idling in the Drive-Through queuing, ordering and waiting areas, depending on the calculation scenario (see below).

Noise modelling scenarios are:

1. Night L_{A10} – Consists of all mechanical plant operating on low speed mode and 4 vehicles idling in the drive-through areas;
2. Night L_{A1} – Consists of drive-through speaker noise, 9 vehicles idling, and low speed mechanical equipment, small delivery truck in designated bay;
3. Sunday Day L_{A10} – Includes all mechanical plant (at high speed). Also includes 9 vehicles idling in the drive-through areas including the waiting bay; and
4. Night L_{Amax} – Includes all mechanical plant described for the night scenario, and car door closures at parking bays.

A 2-D overview image of the noise model showing receivers and sources is included in *Figure 3-2*.

Figure 3-1 2D Image of Noise Model

4 RESULTS & ASSESSMENT

4.1 Scenario 1: Predicted Noise Night L_{A10}

The results of the L_{A10} Night scenario noise modelling are shown as a noise level contour plot in *Figure 4-1* and summarised below in *Table 4-1.* Refer to *Figure 3-2* for receiver locations positioned within the noise model.

Table 4-1 Predicted Night Noise Levels, dB L_{A10}

Location	Mechanical Plant	4 Drive-Through Vehicles	Combined	Critical Assigned Level, dB L_{A10}	Exceedence Amount
14 Millom St	21	28	29	**40**	*Complies*
16 Millom St	23	31	32	**40**	*Complies*
18 Millom St	24	32	32	**40**	*Complies*
20 Millom st	25	32	33	**40**	*Complies*
22 Millom St	25	33	33	**40**	*Complies*
24 Millom St	29	37	38	**40**	*Complies*
26 Millom St	29	37	38	**40**	*Complies*
28 Millom St	29	37	38	**40**	*Complies*
34 Millom St	27	35	35	**40**	*Complies*

Noise is most critical at residences to the south, along Millom Street. A worst case combined level of 38 dB L_{A10} is predicted with drive-through vehicles contributing the most to overall noise.

The noise from vehicles alone would not be considered tonal due to the number of vehicles and variation in engine sounds over a representative period, or when combined with mechanical plant noise, therefore no adjustments have been applied.

Summary Scenario 1: Compliance achieved at all receivers by at least 2 dB

Figure 4-1 Scenario 1 Noise, Night, dB L_{A10}

Predicted Noise level

	= 35
	= 40
	= 45
	= 50
	= 55

Legend

- Receiver
- Car/Mech Source

Scale 1:1200

0 5 10 20 30 m

Project No: 21126981
Consultant: MM
Date: 16/12/2021
Algorithm: ISO 9613
SoundPLAN Version: 8.2

Lloyd George Acoustics
PO Box 717
HILLARYS WA 6923
(08) 9401 7770

4.2 Scenario 2: Predicted Noise Night L_{A1}

The results of the Night L_{A1} scenario noise modelling are shown as a noise level contour plot in *Figure 4-2* and summarised below in *Table 4-2.*

Table 4-2 Predicted Night Noise Levels, dB L_{A1}

Location	Truck Delivery	Drive-Through Speaker	9 Drive-Through Vehicles	Combined[1]	Critical Assigned Level, dB L_{A1}	Exceedence Amount
14 Millom St	37	32	30	39	**50**	*Complies*
16 Millom St	38	34	33	41	**50**	*Complies*
18 Millom St	40	35	34	42	**50**	*Complies*
20 Millom st	41	36	35	43	**50**	*Complies*
22 Millom St	39	37	35	42	**50**	*Complies*
24 Millom St	41	40	39	45	**50**	*Complies*
26 Millom St	40	41	39	45	**50**	*Complies*
28 Millom St	28	39	36	41	**50**	*Complies*
34 Millom St	24	37	34	39	**50**	*Complies*

1. Combined level also includes the mechanical plant sources.

The worst-case calculated noise level for assessment purposes is 45 dB L_{A1} at 24 and 26 Millom Street. This noise level is evenly based on all three source types. The noise level complies for all locations.

Note that the delivery truck is included in this scenario, being considered applicable to the L_{A1} assessment as the nature of the delivery is short term for a small-scale restaurant (as opposed to a supermarket which would have lengthier and more frequent deliveries). It assumes that a delivery is going on during a full drive-through of cars, which is a conservative worst case scenario. The noise is not considered to contain tonal characteristics when assessed over a representative period.

Summary Scenario 2: Compliance achieved at all receivers by at least 5 dB.

Figure 4-2 Scenario 2 Noise, Night, dB L_{A1}

Predicted Noise level

- = 45
- = 50
- = 55
- = 60
- = 65

Legend

- Receiver
- Car/Mech Source
- Delivery Truck

Scale 1:1200

0 5 10 20 30 m

Project No: 21126981
Consultant: MM
Date: 16/12/2021
Algorithm: ISO 9613
SoundPLAN Version: 8.2

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HILLARYS WA 6923
(08) 9401 7770

4.3 Scenario 3: Predicted Noise Sunday L_{A10}

The Sunday day time period includes a full drive-through area with nine (9) cars in total (all in queuing positions). Mechanical plant are operating at high speeds, however assigned levels are higher for noise sensitive premises at this time, compared to during the night. The results of the Sunday day L_{A10} scenario noise modelling are shown as a noise level contour plot in *Figure 4-3* and summarised in *Table 4-3.*

Table 4-3 Predicted Sunday Day Noise Levels, dB L_{A10}

Location	9 Drive-Through Vehicles	Mechanical Plant	Combined	Critical Assigned Level, dB L_{A10}	Exceedence Amount
14 Millom St	32	23	**33**	**45**	*Complies*
16 Millom St	34	25	**35**	**45**	*Complies*
18 Millom St	35	25	**35**	**45**	*Complies*
20 Millom st	36	26	**36**	**45**	*Complies*
22 Millom St	36	27	**37**	**45**	*Complies*
24 Millom St	40	30	**40**	**45**	*Complies*
26 Millom St	40	31	**41**	**45**	*Complies*
28 Millom St	39	30	**39**	**45**	*Complies*
34 Millom St	37	28	**37**	**45**	*Complies*

As with the Night L_{A10} assessment, noise from vehicles is dominant for most receivers. The Sunday day time scenario includes 9 drive-thru cars and mechanical plant on high speed mode, thus leading to increased combined levels. This combined noise level with mechanical plant, yields a worst case level of 41 dB L_{A10} at 26 Millom St. Again, noise would not be considered tonal given the idling vehicles are dominant and would all be idling at different speeds. The Sunday time period is compliant at all receivers with its assigned level of 45 dB L_{A10}.

Summary Scenario 3: Compliance achieved at all receivers by at least 4 dB.

Figure 4-3 Scenario 3 Noise, Sunday, dB L_{A10}

Predicted Noise level

	= 40
	= 45
	= 50
	= 55
	= 60

Legend

- Receiver
- Car/Mech Source

Scale 1:1200

0 5 10 20 30 m

Project No: 21126981
Consultant: MM
Date: 16/12/2021
Algorithm: ISO 9613
SoundPLAN Version: 8.2

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4.4 Scenario 4: Predicted Noise Night L_{Amax}

The results of the Night L_{Amax} scenario noise modelling are shown below in *Table 4-4.* The noise from car doors (non-cumulative) is shown graphically in *Figure 4-4.* Noise levels in this case are adjusted by + 10 dB for potential impulsive characteristics.

Table 4-4 Predicted Night Noise Levels, dB L_{Amax}

Location	Car Doors	Adjusted	Critical Assigned Level, dB L_{Amax}	Exceedence Amount
14 Millom St	31	**41**	**55**	*Complies*
16 Millom St	32	**42**	**55**	*Complies*
18 Millom St	33	**43**	**55**	*Complies*
20 Millom st	33	**43**	**55**	*Complies*
22 Millom St	32	**42**	**55**	*Complies*
24 Millom St	34	**44**	**55**	*Complies*
26 Millom St	34	**44**	**55**	*Complies*
28 Millom St	32	**42**	**55**	*Complies*
34 Millom St	31	**41**	**55**	*Complies*

Vehicle door noise is predicted to be up to an adjusted level of 44 dB L_{Amax} at the worst case receivers to the south, being residential premises at Millom Street. This is 11 dB below the most critical noise sensitive assigned level of 55 dB L_{Amax} and therefore compliant for all time periods.

Summary Scenario 4: Compliance achieved at all receivers by at least 11 dB.

Figure 4-4 Scenario 4 Noise, Car doors, dB L_{Amax}

Predicted Noise level

	= 40
	= 45
	= 50
	= 55
	= 60

Legend

- Receiver
- Car door Source

Scale 1:1200

0 5 10 20 30 m

Project No: 21126981
Consultant: MM
Date: 16/12/2021
Algorithm: ISO 9613
SoundPLAN Version: 8.2

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5 CONCLUSION

The potential noise impacts resulting from the proposed Fast Food Restaurant development at Part Lot 2076 Butler Boulevard, Butler have been assessed against the *Environmental Protection (Noise) Regulations 1997*. Compliance with the assigned levels has been demonstrated for all time periods for the surrounding land uses, therefore no further noise mitigation measures are necessary.

Regulation 14A provides requirements for the collection of waste stating that this activity can also be exempt from having to comply with regulation 7 prescribed standards provided it is undertaken between 7am and 7pm Mondays to Saturdays and undertaken in the quietest reasonable manner. Collection outside of these hours will require a separate noise management plan.

Appendix A

Site Plans

PROPOSED FAST FOOD DEVELOPMENT

LOCATION:PART LOT 2076, Butler Boulevard, Butler

FOR:SHIMAL REALSTAR PTY LTD BY: VEND PROPERTY

SK033
DEC 2021
00

7946

meyer shircore 55 YEARS
architects 1963|2018
Member Australian Institute of Architects

Suite 2, Ground Floor, 437 Roberts Road Subiaco WA 6008
PO Box 1294 Subiaco WA 6904
t: 08 9381 8511 e: msa@meyershircore.com.au

Location Plan
SCALE 1: 500

PROPOSED FAST FOOD DEVELOPMENT

LOCATION:PART LOT 2076, Butler Boulevard, Butler
FOR:SHIMAL REALSTAR PTY LTD BY: VEND PROPERTY

SK033
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01
1 : 500 @ B1

5 10 15 20 25 50

7946

meyer shircore 55 YEARS architects 1963|2018
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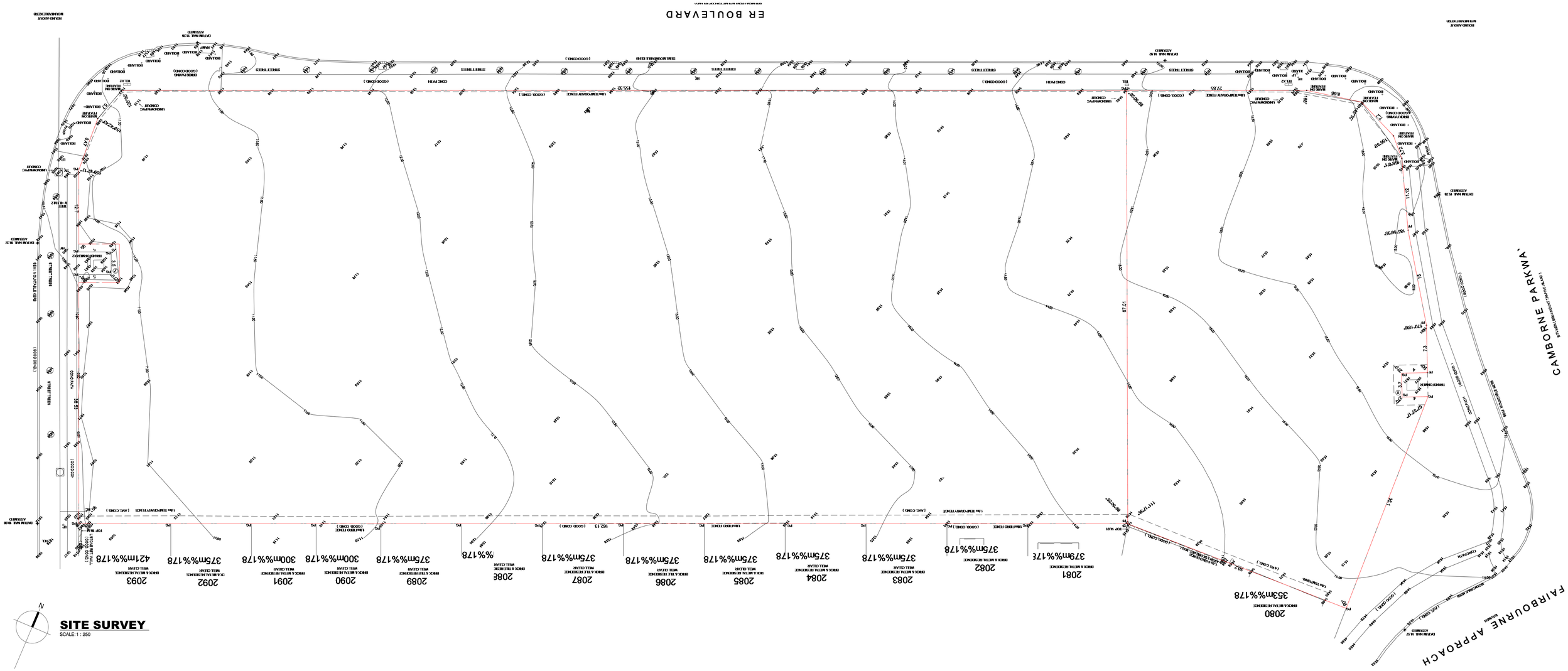
t: 08 9381 8511 e: msa@meyershircore.com.au



PROPOSED FAST FOOD DEVELOPMENT

LOCATION:PART LOT 2076, Butler Boulevard, Butler

FOR:SHIMAL REALSTAR PTY LTD BY: VEND PROPERTY

SK033
DEC 2021
03
1 : 250 @ B1

2.5 5 7.5 10 12.5 25

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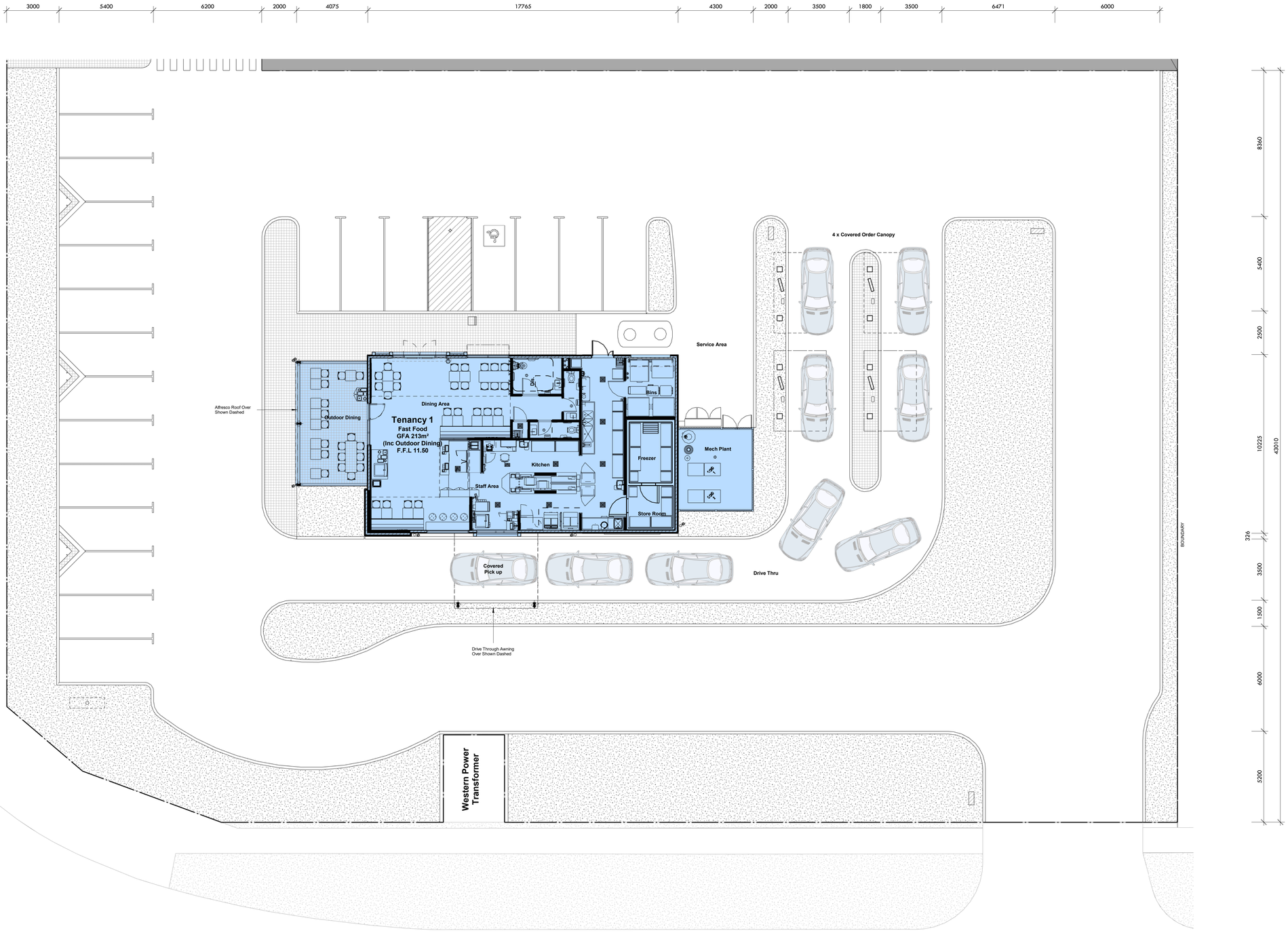
t: 08 9381 8511 e: msa@meyershircore.com.au



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PROPOSED FAST FOOD FLOOR PLAN

SCALE: 1 : 100

PROPOSED FAST FOOD DEVELOPMENT

LOCATION:PART LOT 2076, Butler Boulevard, Butler

FOR:SHIMAL REALSTAR PTY LTD BY: VEND PROPERTY

SK033
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05
1 : 100 @ B1

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0 1 2 3 4 5 10

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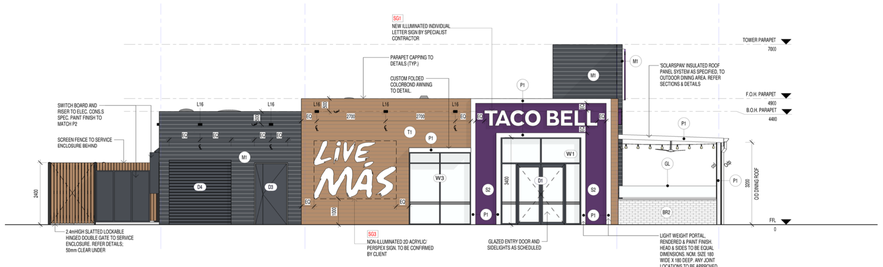
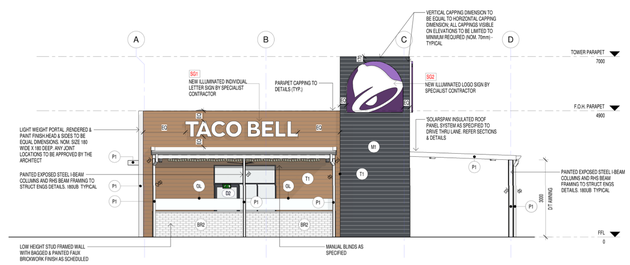


BUILDING 1 - EAST ELEVATION

SCALE: 1 : 100



BUILDING 1 - NORTH ELEVATION (BUTLER BOULEVARD)

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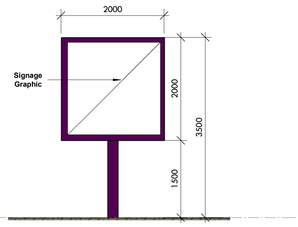

TENANT PYLON SIGN

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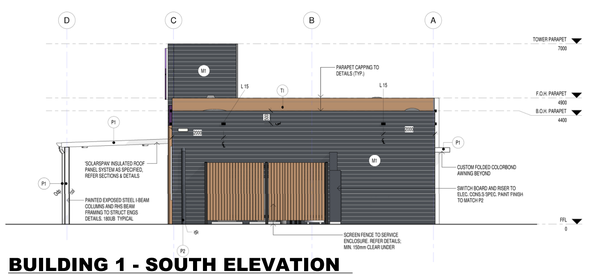

BUILDING 1 - SOUTH ELEVATION

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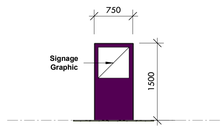
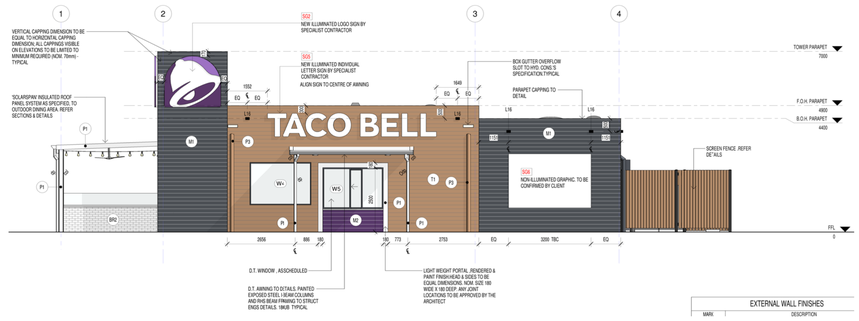


TENANT SIGN

SCALE: 1 : 50



BUILDING 1 - WEST ELEVATION (ULVERSTON WAY)

SCALE: 1 : 100

PROPOSED FAST FOOD DEVELOPMENT

LOCATION:PART LOT 2076, Butler Boulevard, Butler

FOR:SHIMAL REALSTAR PTY LTD BY: VEND PROPERTY

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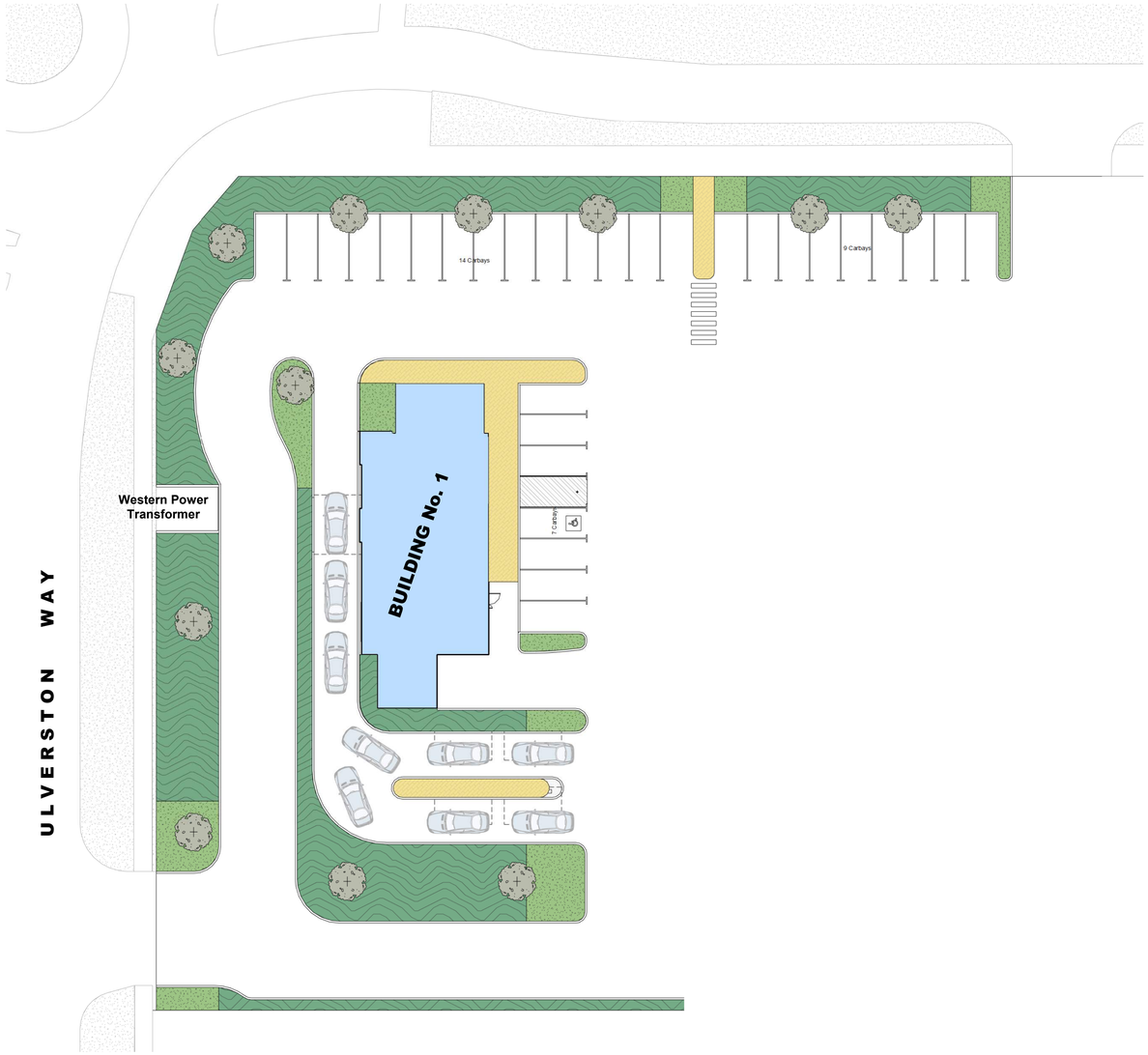
Suite 2, Ground Floor, 437 Roberts Road Subiaco WA 6008
PO Box 1294 Subiaco WA 6904
t: 08 9381 8511 e: msa@meyershircore.com.au



LANDSCAPE LEGEND

LOW PLANTING MIX
(Ground Cover & Shrubbery, Low Level to Unimpede Corner Sight)

LOW HEDING MIX
(Low to Medium Box Hedge Shrubbery)

BRICK PAVING

SELECTED TREE

TREE OPTIONS

Eucalyptus Torquata (Coral Gum)

-Small to medium sized native Western australian tree.
-Green grey foliage with distinctive Coral-pink flower.
-Can survive without irrigation once established.

Corymbia Ficifolia (Red-flowering Gum)

-Small to medium sized native Western australian tree.
-Dark green foliage with distinctive Red gum flower.
-Can survive without irrigation once established.

N

LANDSCAPE PLAN

SCALE: 1 : 200

PROPOSED FAST FOOD DEVELOPMENT

LOCATION:PART LOT 2076, Butler Boulevard, Butler
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Appendix B

Terminology

The following is an explanation of the terminology used throughout this report.

Decibel (dB)
The decibel is the unit that describes the sound pressure and sound power levels of a noise source. It is a logarithmic scale referenced to the threshold of hearing.

A-Weighting
An A-weighted noise level has been filtered in such a way as to represent the way in which the human ear perceives sound. This weighting reflects the fact that the human ear is not as sensitive to lower frequencies as it is to higher frequencies. An A-weighted sound level is described as L_A dB.

Sound Power Level (L_w)
Under normal conditions, a given sound source will radiate the same amount of energy, irrespective of its surroundings, being the sound power level. This is similar to a 1kW electric heater always radiating 1kW of heat. The sound power level of a noise source cannot be directly measured using a sound level meter but is calculated based on measured sound pressure levels at known distances. Noise modelling incorporates source sound power levels as part of the input data.

Sound Pressure Level (L_p)
The sound pressure level of a noise source is dependent upon its surroundings, being influenced by distance, ground absorption, topography, meteorological conditions etc and is what the human ear actually hears. Using the electric heater analogy above, the heat will vary depending upon where the heater is located, just as the sound pressure level will vary depending on the surroundings. Noise modelling predicts the sound pressure level from the sound power levels taking into account ground absorption, barrier effects, distance etc.

L_{ASlow}
This is the noise level in decibels, obtained using the A frequency weighting and the S (Slow) time weighting as specified in IEC 61672-1:2002. Unless assessing modulation, all measurements use the slow time weighting characteristic.

L_{AFast}
This is the noise level in decibels, obtained using the A frequency weighting and the F (Fast) time weighting as specified in IEC 61672-1:2002. This is used when assessing the presence of modulation only.

L_{APeak}
This is the greatest absolute instantaneous sound pressure in decibels using the A frequency weighting as specified in IEC 61672-1:2002.

L_{Amax}
An L_{Amax} level is the maximum A-weighted noise level during a particular measurement.

L_{A1}
An L_{A1} level is the A-weighted noise level which is exceeded for one percent of the measurement period and is considered to represent the average of the maximum noise levels measured.

L_{A10}
An L_{A10} level is the A-weighted noise level which is exceeded for 10 percent of the measurement period and is considered to represent the "*intrusive*" noise level.

L_{Aeq}
The equivalent steady state A-weighted sound level ("equal energy") in decibels which, in a specified time period, contains the same acoustic energy as the time-varying level during the same period. It is considered to represent the "average" noise level.

L_{A90}
An L_{A90} level is the A-weighted noise level which is exceeded for 90 percent of the measurement period and is considered to represent the "*background*" noise level.

One-Third-Octave Band
Means a band of frequencies spanning one-third of an octave and having a centre frequency between 25 Hz and 20 000 Hz inclusive.

L_{Amax} assigned level
Means an assigned level which, measured as a $L_{A\ Slow}$ value, is not to be exceeded at any time.

L_{A1} assigned level
Means an assigned level which, measured as a $L_{A\ Slow}$ value, is not to be exceeded for more than 1% of the representative assessment period.

L_{A10} assigned level
Means an assigned level which, measured as a $L_{A\ Slow}$ value, is not to be exceeded for more than 10% of the representative assessment period.

Tonal Noise
A tonal noise source can be described as a source that has a distinctive noise emission in one or more frequencies. An example would be whining or droning. The quantitative definition of tonality is:

the presence in the noise emission of tonal characteristics where the difference between -

(a) the A-weighted sound pressure level in any one-third octave band; and

(b) the arithmetic average of the A-weighted sound pressure levels in the 2 adjacent one-third octave bands,

is greater than 3 dB when the sound pressure levels are determined as $L_{Aeq,T}$ levels where the time period T is greater than 10% of the representative assessment period, or greater than 8 dB at any time when the sound pressure levels are determined as $L_{A\ Slow}$ levels.

This is relatively common in most noise sources.

Modulating Noise
A modulating source is regular, cyclic and audible and is present for at least 10% of the measurement period. The quantitative definition of modulation is:

a variation in the emission of noise that —

(a) is more than 3 dB $L_{A\ Fast}$ or is more than 3 dB $L_{A\ Fast}$ in any one-third octave band;

(b) is present for at least 10% of the representative.

Impulsive Noise
An impulsive noise source has a short-term banging, clunking or explosive sound. The quantitative definition of impulsiveness is:

a variation in the emission of a noise where the difference between $L_{A\ peak}$ and $L_{A\ Max\ slow}$ is more than 15 dB when determined for a single representative event;

Major Road
Is a road with an estimated average daily traffic count of more than 15,000 vehicles.

Secondary / Minor Road
Is a road with an estimated average daily traffic count of between 6,000 and 15,000 vehicles.

Influencing Factor (IF)

$$= \frac{1}{10}(\%\ \text{Type A}_{100} + \%\ \text{Type A}_{450}) + \frac{1}{20}(\%\ \text{Type B}_{100} + \%\ \text{Type B}_{450})$$

where:

$\%\ \text{Type A}_{100}$ = the percentage of industrial land within a 100m radius of the premises receiving the noise

$\%\text{TypeA}_{450}$ = the percentage of industrial land within a 450m radius of the premises receiving the noise

$\%\ \text{Type B}_{100}$ = the percentage of commercial land within a 100m radius of the premises receiving the noise

$\%\text{TypeB}_{450}$ = the percentage of commercial land within a 450m radius of the premises receiving the noise

+ Traffic Factor (maximum of 6 dB)

= 2 for each secondary road within 100m

= 2 for each major road within 450m

= 6 for each major road within 100m

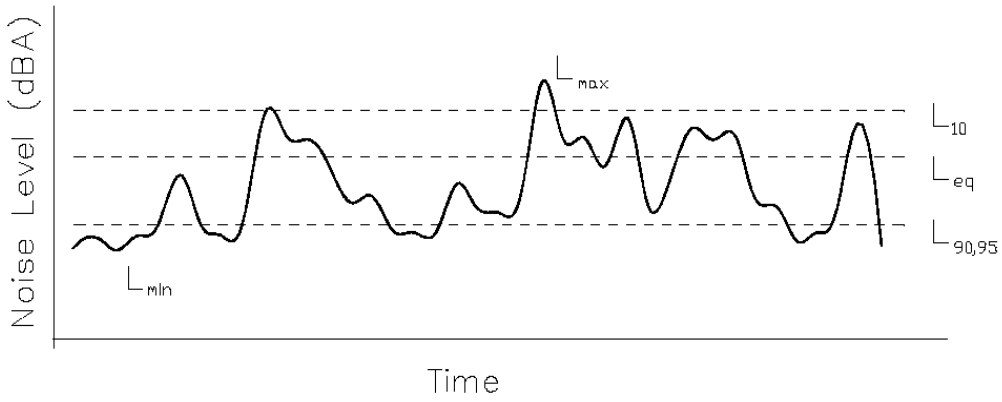
Representative Assessment Period
Means a period of time not less than 15 minutes, and not exceeding four hours, determined by an inspector or authorised person to be appropriate for the assessment of a noise emission, having regard to the type and nature of the noise emission.

Background Noise
Background noise or residual noise is the noise level from sources other than the source of concern. When measuring environmental noise, residual sound is often a problem. One reason is that regulations often require that the noise from different types of sources be dealt with separately. This separation, e.g. of traffic noise from industrial noise, is often difficult to accomplish in practice. Another reason is that the measurements are normally carried out outdoors. Wind-induced noise, directly on the microphone and indirectly on trees, buildings, etc., may also affect the result. The character of these noise sources can make it difficult or even impossible to carry out any corrections.

Ambient Noise
Means the level of noise from all sources, including background noise from near and far and the source of interest.

Specific Noise
Relates to the component of the ambient noise that is of interest. This can be referred to as the noise of concern or the noise of interest.

Chart of Noise Level Descriptors



Typical Noise Levels