

Environmental Noise Assessment - Fast Food, Service Station & Convenience Store

Corner of Neerabup Road & Key Largo Drive, Clarkson

Reference: 23088289-01A

Prepared for:
Clarkson Central Pty Ltd.

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CONTENTS

EXECUTIVE SUMMARY.....	i
1. INTRODUCTION.....	1
2. CRITERIA.....	3
2.1. Regulations 7, 8 & 9.....	3
2.2. Regulation 3.....	6
2.3. Regulation 14A	6
3. METHODOLOGY	7
3.1. Meteorological Conditions	7
3.2. Topographical Data.....	7
3.3. Ground Absorption	9
3.4. Source Sound Levels	9
4. RESULTS AND ASSESSMENT.....	11
4.1. Scenario 1 – Daytime Operations L_{A10}	11
4.2. Scenario 2 – Night-time Operations L_{A10}	13
4.3. Scenario 3 – Night-Time L_{Amax}	15
5. RECOMMENDATIONS	17

List of Tables

Table 2-1 Adjustments Where Characteristics Cannot Be Removed	3
Table 2-2 Baseline Assigned Levels	4
Table 2-3 Assigned Levels	5
Table 3-1: Modelling Meteorological Conditions	7
Table 3-2: Source Sound Power Levels, dB.....	9
Table 4-1: Scenario 1 Daytime Predicted Levels and Assessment, dB L_{A10}	11
Table 4-2: Scenario 2 Night-time Predicted Levels and Assessment, dB L_{A10}	13
Table 4-3: Scenario 3 Night-time Predicted Levels and Assessment, dB L_{Amax}	15
Table B-1: Percentage of Land Types within 100m and 450m Radii	21
Table B-2: Relevant Roads within 100m and 450m Radii.....	23
Table B-3: Influencing Factor Calculation, dB.....	23

List of Figures

Figure 1-1: Subject Site Location (Source: DPLH PlanWA)	1
Figure 1-2: Proposed Site Plan.....	2
Figure 3-1: 2D Overview of Noise Model	8
Figure 3-2: 3D Overview of Noise Model	8
Figure 4-1: Scenario 1 Daytime Noise Contour Plot (L_{A10})	12
Figure 4-2: Scenario 2 Night-time Noise Contour Plot (L_{A10})	14
Figure 4-3: Scenario 3 Night-time Noise Contour Plot (L_{Amax})	16
Figure B-1: Land Types within 100m and 450m Radii of R1	22
Figure B-2: MRWA Published Traffic Data	23

Appendices

Appendix A – Development Plans	18
Appendix B – Influencing Factor Calculation	20
Appendix C – Terminology.....	25

EXECUTIVE SUMMARY

Lloyd George Acoustics was engaged by Clarkson Central Pty Ltd. to undertake a noise assessment for a proposed fast food, service station with convenience store to be located at Corner of Neerabup Road & Key Largo Drive, Clarkson. This report considered noise emissions from the proposed fast food restaurant, service station with associated convenience store to surrounding properties by way of noise modelling of mechanical plant, fast food restaurant related speakers and car idling, air service equipment, deliveries, car doors closing, vehicles and fuel bowsers.

Noise emissions are predicted by way of computer noise modelling and assessed against assigned levels in accordance with the *Environmental Protection (Noise) Regulations 1997*.

The predicted noise levels are demonstrated to be compliant without the need for mitigation measures.

1. INTRODUCTION

Lloyd George Acoustics was engaged by Clarkson Central Pty Ltd. to undertake an environmental noise assessment for a proposed fast food restaurant and service station with convenience store to be located at Corner of Neerabup Road & Key Largo Drive, Clarkson (refer *Figure 1-1*) with the site plan shown in *Figure 1-2* and full Development Application (DA) plans provided in *Appendix A*.



Figure 1-1: Subject Site Location (Source: DPLH PlanWA)

The proposed fast food restaurant, service station and associated convenience store will be open 7 days a week, 24-hours a day. With regard to noise emissions, consideration is given to noise at neighbouring properties from mechanical plant, air servicing equipment, deliveries, vehicles and fuel bowsers, against the prescribed standards of the *Environmental Protection (Noise) Regulations 1997*.

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

2. CRITERIA

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

2.1. Regulations 7, 8 & 9

This group of regulations provide the prescribed standard for noise as follows:

“7. Prescribed standard for noise emissions

- (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; and*
 - (ii) *impulsiveness; and*
 - (iii) *modulation,**when assessed under regulation 9.*
- (2) *For the purposes of subregulation (1)(a), 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 at the point of reception.”*

Tonality, impulsiveness and modulation are defined in regulation 9 (refer *Appendix C*). Under regulation 9(3), *“Noise is taken to be free of the characteristics of tonality, impulsiveness and modulation 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(1)(a) after the adjustments in the table [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

* These adjustments are cumulative to a maximum of 15 dB.

The assigned levels (prescribed standards) for all premises are specified in regulation 8(3) and are shown in *Table 2-2*. The L_{A10} assigned level is applicable to noises present for more than 10% of a representative assessment period, generally applicable to “steady-state” noise sources. The L_{A1} is for short-term noise sources present for less than 10% and more than 1% of the time. The L_{Amax} assigned level is applicable for incidental noise sources, present for less than 1% of the time.

Table 2-2 Baseline Assigned 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 Premises	All hours	60	75	80
Industrial and Utility Premises	All hours	65	80	90

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

The influencing factor (IF), in relation to noise received at noise sensitive premises, has been calculated as between 7-8 dB, as determined in *Appendix B*. *Table 2-3* shows the assigned levels including the influencing factor and transport factor at the receiving locations.

Table 2-3 Assigned Levels

Premises Receiving Noise	Time Of Day	Assigned Level (dB)		
		L _{A10}	L _{A1}	L _{Amax}
+8 dB IF R1, R2 Noise sensitive premises: highly sensitive area ¹	0700 to 1900 hours Monday to Saturday (Day)	53	63	73
	0900 to 1900 hours Sunday and public holidays (Sunday)	48	58	73
	1900 to 2200 hours all days (Evening)	48	58	63
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays (Night)	43	53	63
+7 dB IF R3 Noise sensitive premises: highly sensitive area ¹	0700 to 1900 hours Monday to Saturday (Day)	52	62	72
	0900 to 1900 hours Sunday and public holidays (Sunday)	47	57	72
	1900 to 2200 hours all days (Evening)	47	57	62
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays (Night)	42	52	62
Commercial Premises	All hours	60	75	80

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

The assigned 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, 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 Water Environmental 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.

2.2. Regulation 3

“3. Regulations do not apply to certain noise emissions

- (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;”*

The service station car park is considered a road and therefore vehicle noise (propulsion and braking) is not assessed. Noise from vehicle car doors and refrigeration units on trucks however are assessed, since these are not part of the propulsion or braking system.

It is understood that bulk refuelling is done during the daytime and gravity fed (no pump) with the engine turned off. As such, this activity is not assessed as noise impact is considered negligible.

2.3. Regulation 14A

“14A. Waste Collection and Other Works

- (2) *Regulation 7 does not apply to noise emitted in the course of carrying out class 1 works if –*
- (a) *The works are carried out in the quietest reasonable and practicable manner; and*
 - (b) *The equipment used to carry out the works is the quietest reasonably available;*

class 1 works means specified works carried out between -

- (a) *0700 hours and 1900 hours on any day that is not a Sunday or a public holiday; or*
- (b) *0900 hours and 1900 hours on a Sunday or public holiday.*

specified works means -

- (a) *The collection of waste; or*
- (b) *The cleaning of a road or the drains for a road; or*
- (c) *The cleaning of public places, including footpaths, cycle paths, car parks and beaches;”*

In the case where specified works are to be carried out outside of class 1, a noise management plan is to be prepared and approved by the CEO.

3. METHODOLOGY

Computer modelling has been used to predict the noise emissions from the development to all nearby receivers. The software used was *SoundPLAN 9.0* with the ISO 9613 algorithms (ISO 17534-3 improved method) selected, as they include the influence of wind and are considered appropriate given the relatively short source to receiver distances. Input data required in the model are listed below and discussed in *Section 3.1* to *Section 3.4*:

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

3.1. Meteorological Conditions

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	Day (7.00am to 7.00pm)	Night (7.00pm to 7.00am)
Temperature (°C)	20	15
Humidity (%)	50	50
Wind Speed (m/s)	Up to 5	Up to 5
Wind Direction*	All	All

* The modelling package allows for all wind directions to be modelled simultaneously.

Alternatives to the above default conditions can be used where one year of weather data is available and the analysis considers the worst 2% of the day and night for the month of the year in which the worst-case weather conditions prevail (source: *Draft Guideline on Environmental Noise for Prescribed Premises*, May 2016). In most cases, the default conditions occur for more than 2% of the time and therefore must be satisfied.

3.2. Topographical Data

Topographical data was adapted from publicly available information (e.g. *Google*) in the form of spot heights and combined with the site plan.

Surrounding existing buildings and future proposed gymnasium to the southwest of development were also incorporated in the noise model, as these can provide noise shielding as well as reflection paths. All commercial buildings are assumed to be 5 metres high with no parapet wall. Single storey buildings are modelled with a height of 3.5 metres and any double storey buildings identified assumed to be 7.0 metres in height with receivers 1.4 metres above ground for each level.

No boundary fencing has been assumed in this noise modelling as the nearest residential noise sensitive receptors are two-storey and it would prove ineffective in this case.

Figure 3-1 shows a 2D overview of the noise model with the location of all relevant receivers and noise sources identified. Figure 3-2 shows a 3D view of the noise model.

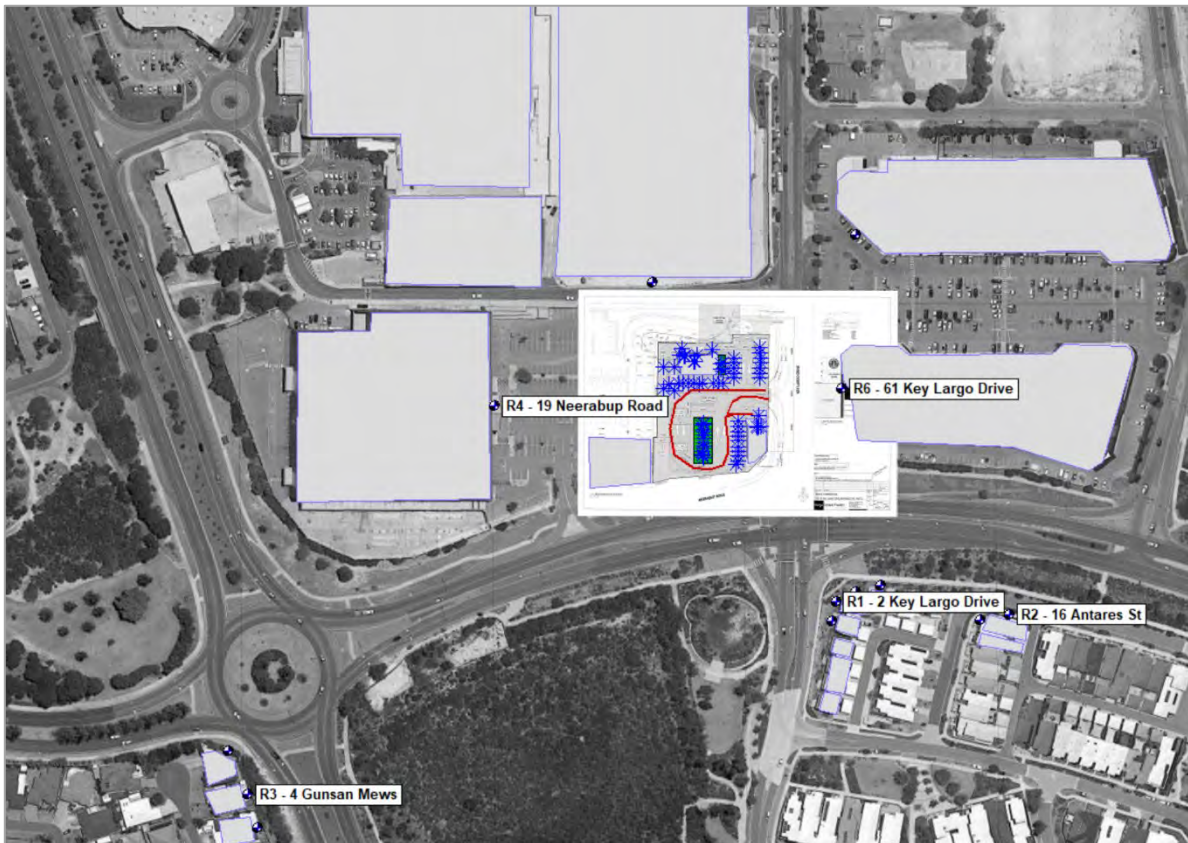


Figure 3-1: 2D Overview of Noise Model

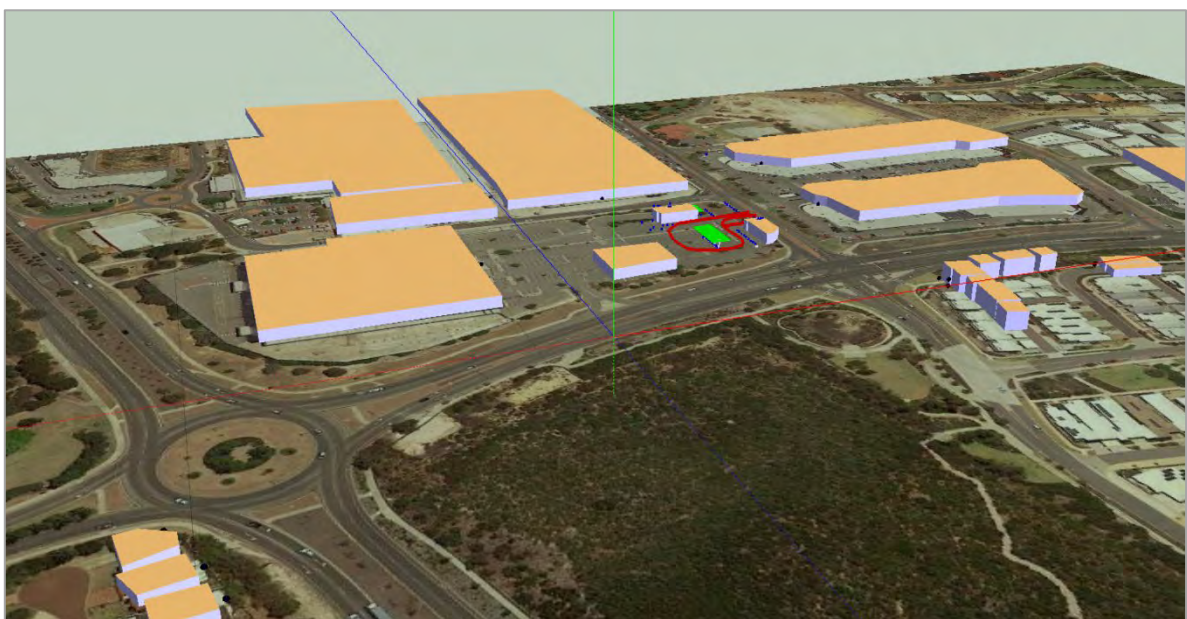


Figure 3-2: 3D Overview of Noise Model

3.3. Ground Absorption

The ground absorption has been assumed to be 0.0 (0%) for the roads and 0.4 (40%) elsewhere, noting that 0.0 represents hard reflective surfaces such as water and 1.0 represents absorptive surfaces such as grass.

3.4. Source Sound Levels

The source sound power levels used in the modelling are provided in *Table 3-2*.

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	
Fast Food									
Cars Idling in Drive-Thru x 6	81	78	74	72	74	74	67	64	79
Drive-Thru Speaker x 2	63	64	66	77	80	73	57	42	82
Pulford Silenced Compressor x 2	73	72	75	71	67	63	59	51	73
Alfresco Tables x 4	53	64	68	70	62	60	57	53	70
BOH KSF (PCD564DD)	92	93	89	80	79	78	78	76	87
BOH KEF (CD638)	75	74	70	61	61	56	57	53	67
TEF x 2 (MV254)	62	67	67	60	56	52	45	-	63
A/C Actron Air (CAY620T-6)	-	89	79	77	75	70	62	57	75
Cold Room (Patton PAK PEMS150)	72	74	75	74	70	67	65	61	76
Freezer Room (Patton PAK PCC5)	-	77	78	77	73	70	68	64	79
Servo / Convenience Store									
Pulford Silenced Compressor x 2	73	72	67	60	56	52	45	-	63
Fuel Bowsers x 8	-	65	68	65	67	65	59	50	71
Cold Room (Patton PAK PEMS150)	72	74	75	74	70	67	65	61	76
Freezer Room (Patton PAK PCC5)	-	77	78	77	73	70	68	64	79
EF x 3 (MV254)	62	67	67	60	56	52	45	-	63
A/C Actron Air (CAY620T-6)	-	89	79	77	75	70	62	57	75
Associated Services									
Air Service Alarm, L_{max}	-	-	-	-	-	91	96	92	99
Truck Start Up, L_{max}	108	102	98	96	96	92	88	85	100

Description	Octave Band Centre Frequency (Hz)								Overall dB(A)
	63	125	250	500	1k	2k	4k	8k	
Truck Loading/Unloading, L_{max}	94	99	88	82	82	95	88	81	98
Slow Moving Truck, L_{max}	90	81	77	78	73	71	69	65	80
Truck/Car Door Closings, L_{max}	71	74	77	81	80	78	72	61	84
Refrigerated Truck 'Normal Mode', L_{max}	91	84	97	95	97	96	90	81	101
Refrigerated Truck' City Mode', L_{max}	81	74	87	85	87	86	80	71	91

The following is noted in relation to *Table 3-2*:

- Mechanical plant sound levels are estimated from previous projects;
- All mechanical plant is located at 1 metre above roof height;
- One Pulford Compressor is located at the Air/Water fill area and the other is located on the fuel filling pump, both 1.0m above ground level;
- Fuel bowsers, air service alarm and car doors are modelled as 1.0m above ground level;
- Refrigerated truck condenser and engine start-up are modelled at 2.5m above ground;
- A slow moving truck is placed as a line source following proposed fuel filling route and positioning;
- The refrigerant condenser is modelled in 'normal mode';
- Truck unloading is modelled at 1 metre above ground height;
- All noise sources are assumed to be L_{A10} unless noted otherwise;
- Abbreviations – AC: Air-conditioning, EF: Exhaust Fan, KEF: Kitchen Exhaust Fan, KSF: Kitchen Supply Fan, TEF: Toilet Exhaust Fan, BOH: Back of House.

4. RESULTS AND ASSESSMENT

Noise modelling was undertaken for the following scenarios:

- Daytime (L_{A10}) - Includes all L_{A10} noise sources of *Table 3-2*;
- Night-time (L_{A10}) - Includes all L_{A10} noise sources of *Table 3-2*, with the exception of 1 x fast food speaker and 2 x table noise sources in the alfresco area;
- Night-time (L_{Amax}) - Includes a refrigerated truck in the loading area, unloading and the refuelling delivery or another truck starting up, all car doors closing and air service alarm.

Note that for the nearby two-storey receivers that the worst case higher above ground height receiver predicted value is assessed as the worst-case scenario.

4.1. Scenario 1 – Daytime Operations L_{A10}

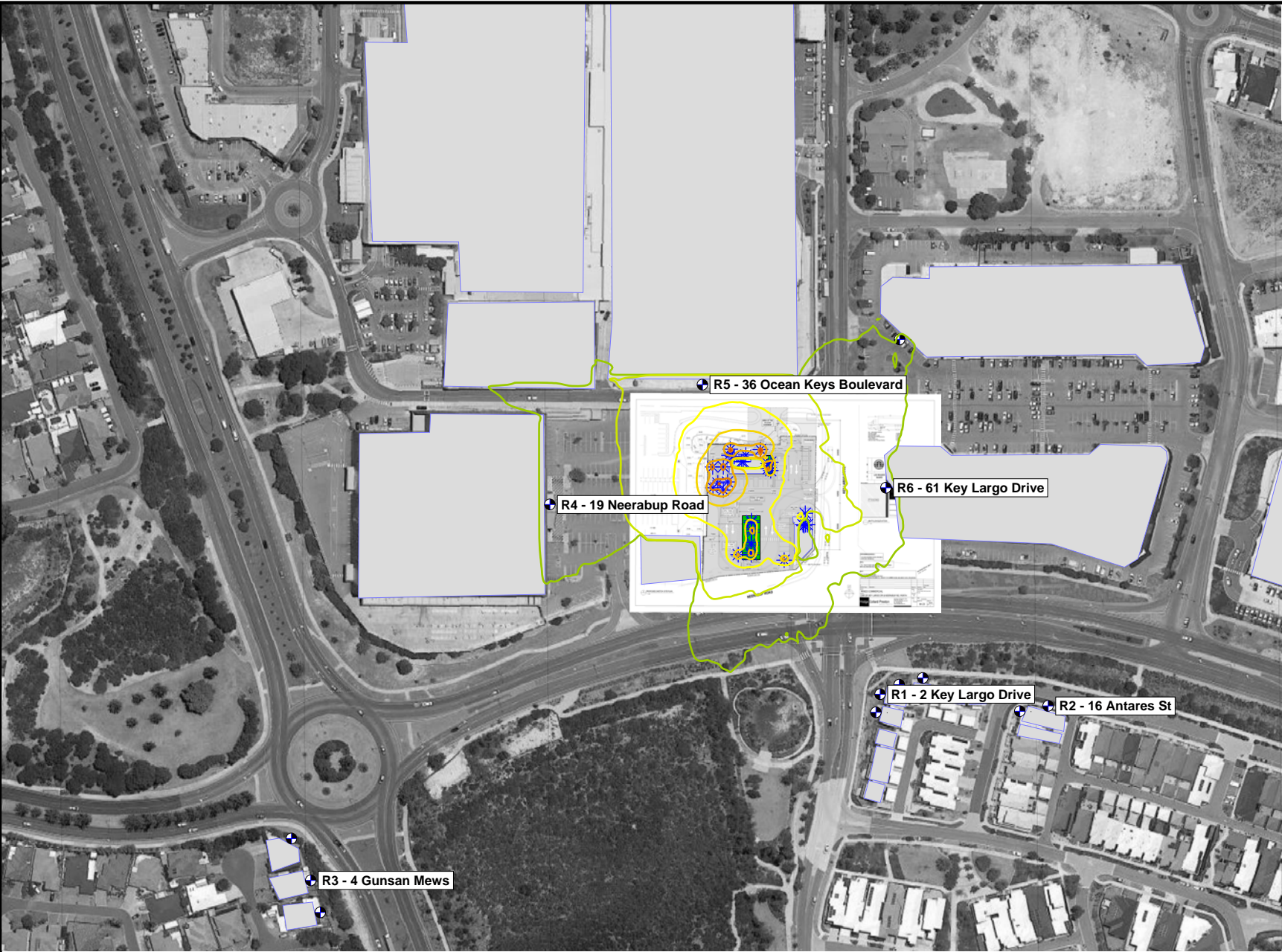
The results for normal daytime operations are provided in *Table 4-1*. A noise contour plot is also provided in *Figure 4-1* showing noise levels at ground floor. Given the number of different plant and likely background noise levels, no adjustments are applied for intrusive characteristics.

Table 4-1: Scenario 1 Daytime Predicted Levels and Assessment, dB L_{A10}

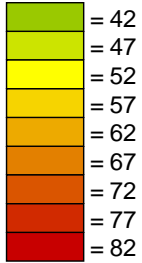
Receiver	Fast Food	Alfresco	Servo/Convenience Store	Bowsers & Air Compressor	Vehicle Related	Total	Assigned Day Level	Assigned Sunday Level	Assessment
R1 - 2 Key Largo Drive	35	18	32	29	31	38	53	48	Complies / Complies
R2 - Antares Street	28	20	28	24	20	32	53	48	Complies / Complies
R3 - Gunsan Mews	23	2	18	16	22	27	52	47	Complies / Complies
R4 - 19 Neerabup Road	38	11	27	29	38	41	60	60	Complies / Complies
R5 - 36 Ocean Keys Boulevard	46	16	29	28	45	48	60	60	Complies / Complies
R6 - 61 Key Largo Drive	40	30	39	25	35	43	60	60	Complies / Complies

From the above it is evident compliance is achieved.

Figure 4-1



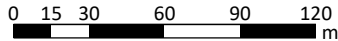
Predicted Noise level L_{A10} dB



Signs and symbols

- Point source
- Buildings
- Floating screen
- Point receiver

Scale 1:3000



Fast Food, Service Station with Convenience Store - Predicted Noise Levels

L_{A10} Noise Level Contours - Daytime Operations - No Penalty Applied for Intrusive Characteristics - 1.5m Above Ground



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4.2. Scenario 2 – Night-time Operations L_{A10}

The results for normal night-time operations are provided in *Table 4-2*. A noise contour plot is also provided in *Figure 4-2* showing noise levels at ground floor. Noise levels are adjusted by + 5 dB for potential tonal characteristics and assessed against the night-time L_{A10} assigned level.

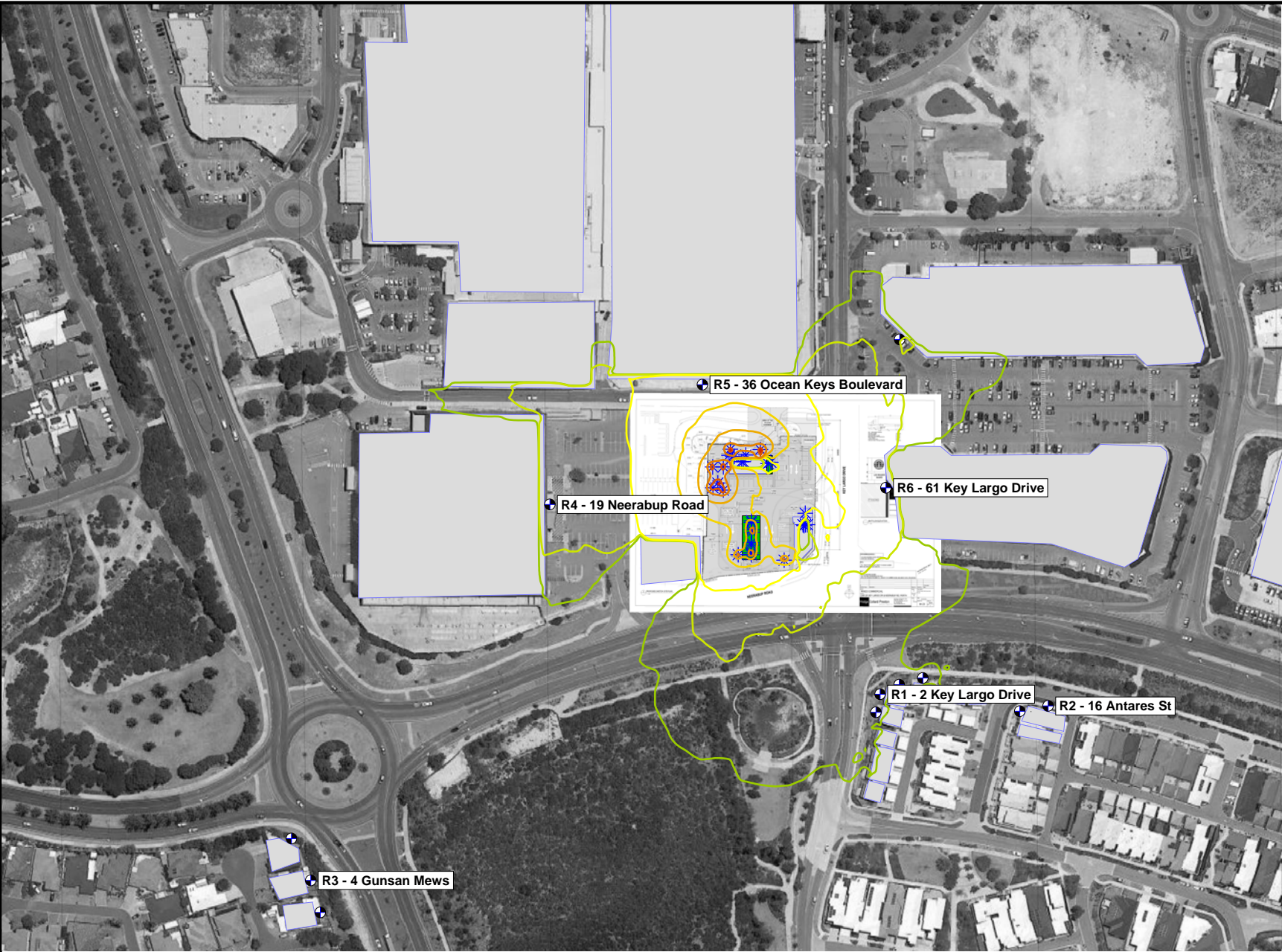
Table 4-2: Scenario 2 Night-time Predicted Levels and Assessment, dB L_{A10}

Receiver	Fast Food	Alfresco	Servo/Convenience Store	Bowers & Air Compressor	Vehicle Related	Total*	Assigned Level	Assessment
R1 - 2 Key Largo Drive	33	15	32	29	31	42	43	Complies
R2 - Antares Street	28	17	28	24	20	37	43	Complies
R3 - Gunsan Mews	22	-	18	16	22	31	42	Complies
R4 - 19 Neerabup Road	36	7	27	29	38	45	60	Complies
R5 - 36 Ocean Keys Boulevard	45	15	29	28	45	53	60	Complies
R6 - 61 Key Largo Drive	39	27	39	25	35	48	60	Complies

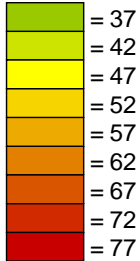
* Adjusted by + 5 dB for tonality

From the above it is evident compliance is achieved.

Figure 4-2



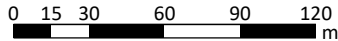
Predicted Noise level L_{A10} dB



Signs and symbols

- Point source
- Buildings
- Floating screen
- Point receiver

Scale 1:3000



Fast Food, Service Station with Convenience Store - Predicted Noise Levels

L_{A10} Noise Level Contours - Night-time Operations - No Penalty Applied for Intrusive Characteristics - 1.5m Above Ground



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4.3. Scenario 3 – Night-Time L_{Amax}

The results for night-time L_{Amax} scenario (refuelling truck start-up, refrigerated delivery, unloading, all car doors and air service alarm) are provided in *Table 4-3*. A noise contour plot is also provided in *Figure 4-3* showing noise levels at ground floor. Car door closing and truck loading/unloading noise levels are adjusted by + 10 dB for impulsiveness and air service alarms, truck engine start up and refrigerated truck compressor adjusted by + 5 dB for tonality and assessed against the night-time L_{Amax} assigned level.

Table 4-3: Scenario 3 Night-time Predicted Levels and Assessment, dB L_{Amax}

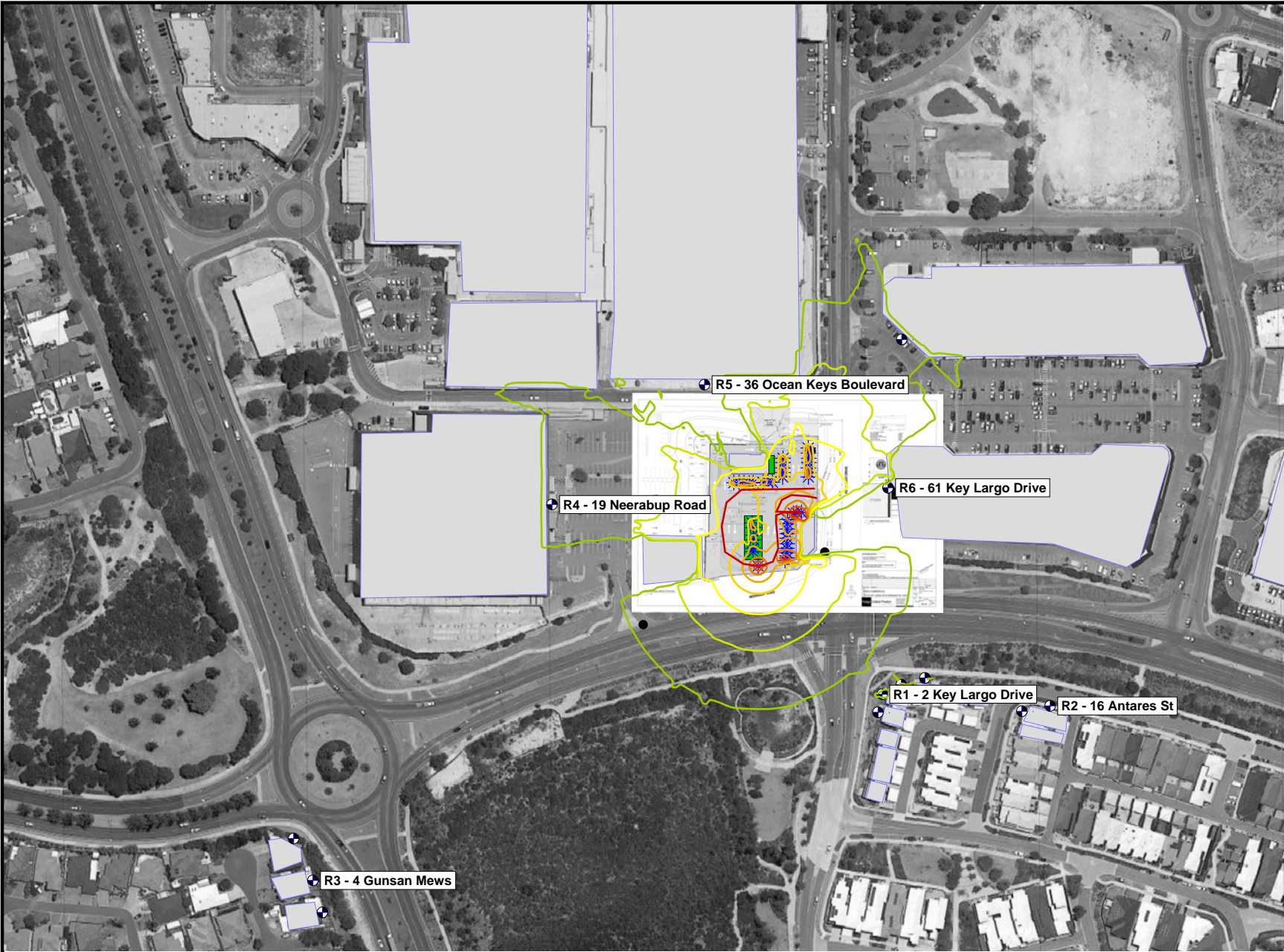
Receiver	Air Service Alarm*	Car Door Closing#	Truck Loading / Unloading #	Truck Refrigerated Compressor, Start up and Movement*	Maximum	Assigned Level	Assessment
R1 - 2 Key Largo Drive	38	44	48	55	55	63	Complies
R2 - Antares Street	37	40	47	50	50	63	Complies
R3 - Gunsan Mews	18	31	42	46	46	62	Complies
R4 - 19 Neerabup Road	43	46	59	56	59	80	Complies
R5 - 36 Ocean Keys Boulevard	42	49	47	53	53	80	Complies
R6 - 61 Key Largo Drive	39	52	50	55	55	80	Complies

* Adjusted by + 5 dB for tonality

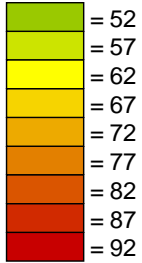
Adjusted by + 10 dB for impulsiveness

From the above, it is evident compliance is achieved.

Figure 4-3



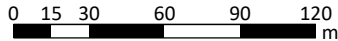
Predicted Noise level L_{Amax} dB



Signs and symbols

- Point source
- Buildings
- Floating screen
- Point receiver
- Point

Scale 1:3000



Fast Food, Service Station with Convenience Store - Predicted Noise Levels

L_{Amax} Noise Level Contours - Car Doors, Air Alarm, Delivery Events
 No Penalty Applied for Intrusive Characteristics - 1.5m Above Ground



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5. RECOMMENDATIONS

The assessment has demonstrated that noise from the proposed service station complies with the assigned levels, determined in accordance with the *Environmental Protection (Noise) Regulations 1997*, at all times.

To further minimise noise impacts, the following are provided for best practice:

- Deliveries:
 - All delivery vehicles are to be encouraged to have broadband type reversing alarms rather than standard tonal alarms;
 - Engines shall be turned off during delivery;
 - Deliveries are to be encouraged during the daytime rather than night-time;
- Air service alarm to be limited in sound level or a non-beeping type installed;
- Refrigeration trucks compressors to be set to 'City Mode' where possible before entering site;
- Any external music or the like shall be at low level and inaudible at noise sensitive premises;
- Mechanical plant:
 - Once the mechanical plant has been designed and selected, the noise levels shall be reviewed prior to Building Permit;
 - All exhaust fans shall be located inside the ceiling void and shall be axial fan type, allowing the incorporation of an attenuator if required;
 - All fans shall be variable speed drive so that maximum speed is only occurring when necessary with demand;
 - Air-conditioning shall have a 'night' / 'quiet' mode option, in case required for prior to 7.00am operation, subject to final detailed analysis;
 - All plant shall be selected for quiet operation;
 - All plant is to be appropriately vibration isolated to 95% isolation efficiency.
- Waste collection to be during the day, Mondays to Saturdays;
- Ensure that patronage noise in Alfresco area of fast food restaurant is kept to a reasonable level;
- Ensure that one fast food speaker is only utilised wherever feasible during night time periods;
- Car park drainage grates or similar to be plastic or metal with rubber gasket and secured to avoid excess banging.

Appendix A – Development Plans

Appendix B – Influencing Factor Calculation

The assigned levels combine a baseline assigned level with an influencing factor, with the latter increasing the assigned level on the basis of the existence of significant roads and commercial or industrial zoned land within an inner circle (100 metre radius) and an outer circle (450 metre radius) of the noise sensitive premises. The calculation for the influencing factor is:

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

where :

% Type A₁₀₀ = the percentage of industrial land within
a 100m radius of the premises receiving the noise

% Type A₄₅₀ = the percentage of industrial land within
a 450m radius of the premises receiving the noise

% Type B₁₀₀ = the percentage of commercial land within
a 100m radius of the premises receiving the noise

% Type B₄₅₀ = the percentage of commercial land within
a 450m radius of the premises receiving the noise

+ Transport Factor (maximum of 6 dB)

= 2 for each secondary road (6,000 to 15,000 vpd) within 100m

= 2 for each major road (> 15,000 vpd) within 450m

= 6 for each major road within 100m

The nearest noise sensitive premises are identified as:

- **R1 - 2 Key Largo Drive**
- R2 - Antares Street
- R3 - Gunsan Mews
- R4 - 19 Neerabup Road
- R5 - 36 Ocean Keys Boulevard
- R6 - 61 Key Largo Drive

Table B-1 shows the percentage of industrial and commercial land within the inner (100 metre radius) and outer (450 metre radius) circles of the noise sensitive premises, with this also shown on Figure B-1 for Receiver R1.

Table B-1: Percentage of Land Types within 100m and 450m Radii

Receiver	Land Type	Within 100m	Within 450m
R1, R2	Type A - Industrial and Utility	0	0
	Type B – Commercial	0	38
R3	Type A - Industrial and Utility	0	0
	Type B – Commercial	0	17



Figure B-1: Land Types within 100m and 450m Radii of R1

From the Main Roads WA Traffic Map (refer *Figure B-2*), *Table B-2* shows the relevant roads and their traffic counts within the inner (100 metre radius) and outer (450 metre radius) circles.

Table B-2: Relevant Roads within 100m and 450m Radii

Receiver	Within 100m		Within 450m
	Major Road (+ 6 dB)	Secondary Road (+ 2 dB)	Major Road Not Within 100m
R1, R2	Neerabup Road (18,295 2020/21 #6038)	-	-
R3	Marmion Avenue (25,734 2021/22 #6741)	-	-

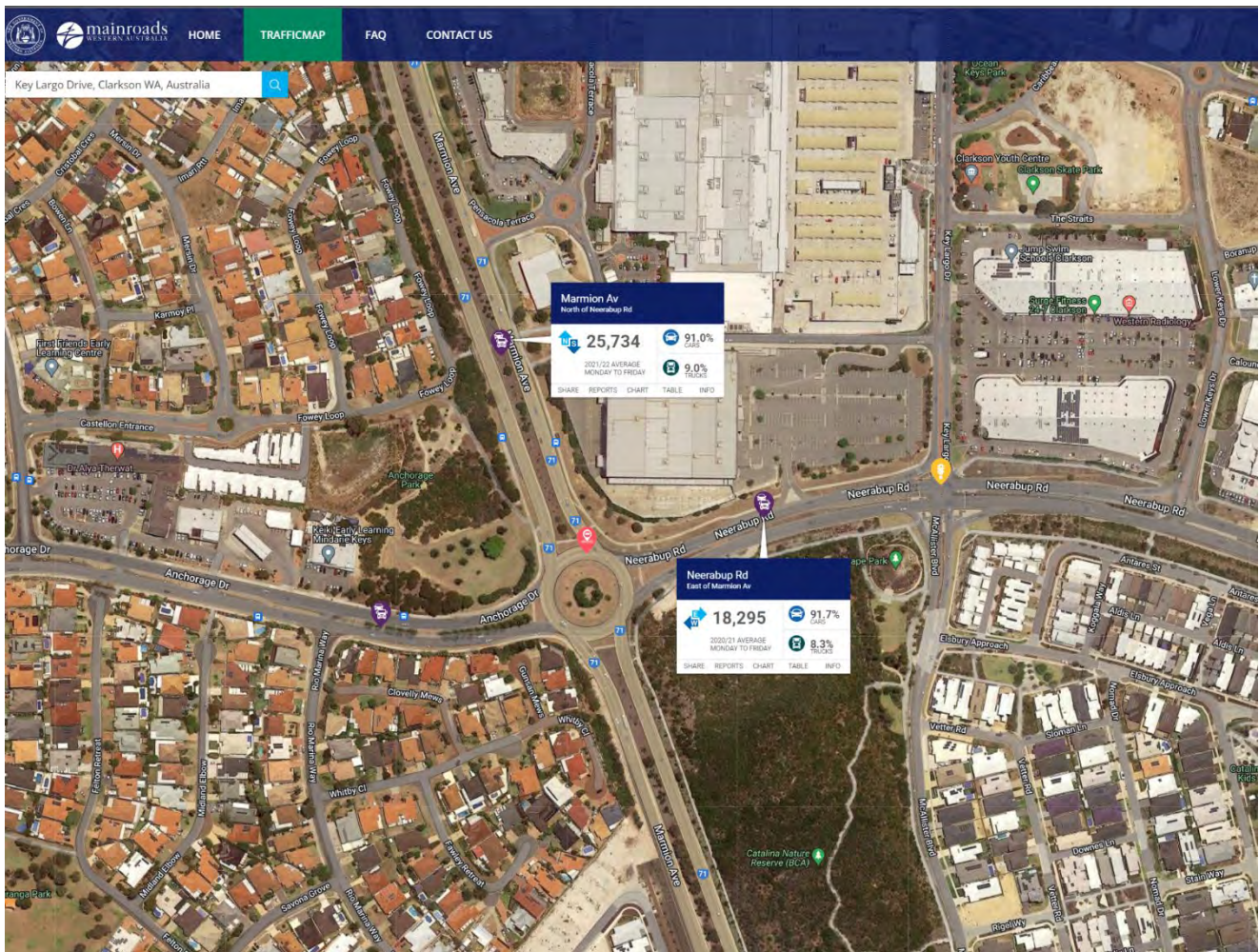


Figure B-2: MRWA Published Traffic Data

Table B-3 combines the percentage land types and Transport Factor to calculate the influencing factor.

Table B-3: Influencing Factor Calculation, dB

Receiver	Industrial Land	Commercial Land	Transport Factor	Total
R1, R2	0	1.9	6.0	8
R3	0	0.9	6.0	7

The influencing factor calculated in *Table B-3* is combined with those baseline assigned levels of *Table 2-2*, resulting in the project assigned levels provided in *Table 2-3*.

Appendix C – 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 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 level 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. 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. This is used when assessing the presence of modulation.

- **L_{APeak}**

This is the greatest absolute instantaneous sound pressure level in decibels using the A-frequency weighting.

- **L_{Amax}**

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

- **L_{A1}**

The L_{A1} level is the A-weighted noise level exceeded for 1 percent of the measurement period and is considered to represent the average of the maximum noise levels measured.

- **L_{A10}**

The L_{A10} level is the A-weighted noise level exceeded for 10 percent of the measurement period and is considered to represent the “intrusive” noise level.

- **L_{A90}**

The L_{A90} level is the A-weighted noise level exceeded for 90 percent of the measurement period and is considered to represent the “background” 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.

- **One-Third-Octave Band**

Means a band of frequencies spanning one-third of an octave and having a centre frequency between 25 Hz and 20000 Hz inclusive.

- **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.

- **L_{Amax} assigned level**

Means an assigned level, which, measured as a L_{ASlow} value, is not to be exceeded at any time.

- **L_{A1} assigned level**

Means an assigned level, which, measured as a L_{ASlow} value, is not to be exceeded for more than 1 percent of the representative assessment period.

- **L_{A10} assigned level**

Means an assigned level, which, measured as a L_{ASlow} value, is not to be exceeded for more than 10 percent 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; and
 - (b) is present for at least 10% of the representative assessment period; and
 - (c) is regular, cyclic and audible.

- **Impulsive Noise**

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

- a variation in the emission of a noise where the difference between L_{Apeak} and L_{Amax} 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.

