ATTACHMENT 2 **REVISED ACOUSTIC REPORT**

ACOUSTIC REPORT

FOR

CHILDCARE CENTRE

AT

LIGNITE AVENUE PIARA WATERS

20 November 2020

AES-890126-R01-2-20112020

Acoustic Engineering Solutions
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DOCUMENT CONTROL

Environmental Noise Impact Assessment

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EXECUTIVE SUMMARY

Acoustic Engineering Solutions (AES) has been commissioned by CU Building Group Pty Ltd to prepare an acoustic report as a supporting document for the development application of a proposed childcare centre at Lot 1832-1834 Lignite Avenue Piara Waters. The childcare centre is proposed to open 7 days a week excluding public holidays. This report presents an environmental noise impact assessment of the proposed childcare centre. The aim of this assessment is to determine whether or not the proposed childcare centre would comply with the Environmental Protection (Noise) Regulations 1997 (the Regulations).

An acoustic model is created and six worst-case operational scenarios are modelled:

Scenario 1 represents the worst-case operation of mechanical plant.

Scenario 2 represents the worst-case child-play activities for normal day care.

Scenario 3 represents the simultaneous operations of scenarios 1 and 2.

Scenario 4 represents the worst-case child-play activities for vacation care.

Scenario 5 represents the simultaneous operations of scenarios 1 and 4.

Scenario 6 represents short events to close a car door at a designed car bay.

Four neighbouring residential receivers are selected for the detailed assessments of noise impact. Noise levels are predicted for worst-case meteorological conditions. The predicted worst-case noise levels are adjusted for their dominant characteristics according to the Regulations, and then assessed against the noise criteria set by the Regulations. The compliance assessment concludes that full compliance is achieved for the proposed childcare centre.

TABLE OF CONTENTS

1.0 INTRODUCTION

A childcare centre is proposed to operate at Lot 1832-1834 Lignite Avenue Piara Waters, as shown in Figure 1 in APPENDIX A. An acoustic report is required for undertaking an environmental noise impact assessment to determine whether or not the proposed childcare centre would comply with the Environmental Protection (Noise) Regulations 1997 (the Regulations).

Acoustic Engineering Solutions (AES) has been commissioned by CU Building Group Pty Ltd (CU Building Group) to prepare the acoustic report.

1.1 THE PROPOSED CHILDCARE CENTRE

Figure 2 in APPENDIX A presents an aerial view of the proposed childcare centre and the surrounding area including the selected receivers. The childcare centre is accessed from Lignite Avenue and surrounded by residential premises.

Figure 3 in APPENDIX A presents the site layout. The childcare centre has one nursery room, two toddler rooms, a large Kindy room, a music room, a laundry, a kitchen and four toilets. Sixteen (16) car parking bays including a disability bay are located in the front yard. The outdoor playing area is in the fenced backyard.

The childcare centre building is a single level building. The external walls are double brick walls. The roof is colourbond sheets. Raked ceilings are designed to create a sense of space and visual interest. An insulation layer is placed between roof sheets and ceiling boards. All of the windows are glazed with safety glasses, which meet the requirements of NNC B1.4. All of the external doors are standard solid timber doors.

Solid boundary fences will be built except for the entrance to the car parking area, as shown in Figure 2, where black lines represent 1.8m solid fences, yellow line represents 2.1m solid fence and white line represents 1.2m solid fence with 600mm solid transparent panel above.

The childcare centre has a maximum capacity of 50 children. The centre does not provides food and the children bring their own lunch boxes. The kitchen is for preparing light snacks such as fruit platter or sandwich or baking muffin and biscuits. No regular food/materials deliveries are planned.

Children have both indoor and outdoor activities. The indoor activities include: storytelling, skill-plays, Chinese funs, music program, arts and crafts, building blocks, quiet readings, quite plays, phonic sessions. The outdoor activities are limited to 15 maximum. Children take turns for outdoor activities. The outdoor activities will be kept within the fenced backyard areas and include: sand pit, bicycle, balance board, cubby house.

The childcare centre is proposed to open:

- between 7am and 7pm on Monday to Friday excluding public holidays; and
- between 7am and 5pm on Saturday and Sunday for Vacation care (for 5-12 year-old).

During the opening hours all windows are fully closed and all external doors are fully closed except for entry or exit.

2.0 NOISE CRITERIA

Noise management in Western Australia is implemented through the Environmental Protection (Noise) Regulations 1997 (the Regulations). The Regulations set noise limits which are the highest noise levels that can be received at noise-sensitive (residential), commercial and industrial premises. These noise limits are defined as 'assigned noise levels' at receiver locations. Regulation 7 requires that "noise emitted from any premises or public place when received at other premises 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".

Table 2-1 presents the assigned noise levels at various premises.

Table 2-1: Assigned noise levels in dB(A)

Type of Premises Receiving Noise	Time of Day	Assigned Noise Levels in dB(A)[1]		
		$L_{A\,10}$	$L_{A\,1}$	$L_{A\,max}$
Noise sensitive premises: highly sensitive area	0700 to 1900 hours Monday to Saturday	45 + Influencing factor	55 + Influencing factor	65 + Influencing factor
	0900 to 1900 hours Sunday and public holidays	40 + Influencing factor	50 + Influencing factor	65 + Influencing factor
	1900 to 2200 hours all days	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	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

For highly noise sensitive premises, an "influencing factor" is incorporated into the assigned noise levels. The influencing factor depends on road classification and land use zonings within circles of 100 metres and 450 metres radius from the noise receiver locations.

[1] Assigned level L_{A1} is the A-weighted noise level not to be exceeded for 1% of a delegated assessment period.
Assigned level L_{A10} is the A-weighted noise level not to be exceeded for 10% of a delegated assessment period.
Assigned level L_{Amax} is the A-weighted noise level not to be exceeded at any time.

2.1 CORRECTIONS FOR CHARACTERISTICS OF NOISE

Regulation 7 requires that that "noise emitted from any premises or public place when received at other premises must be free of:

(i) tonality;

(ii) impulsiveness; and

(iii) modulation.

when assessed under Regulation 9".

If the noise exhibits intrusive or dominant characteristics, i.e. if the noise is impulsive, tonal, or modulating, noise levels at noise-sensitive premises must be adjusted. Table 2-2 presents the adjustments incurred for noise exhibiting dominant characteristics. That is, if the noise is assessed as having tonal, modulating or impulsive characteristics, the measured or predicted noise levels have to be adjusted by the amounts given in Table 2-2. Then the adjusted noise levels must comply with the assigned noise levels. Regulation 9 sets out objective tests to assess whether the noise is taken to be free of these characteristics.

Table 2-2: Adjustments for dominant noise characteristics

Adjustment where noise emission is not music. These adjustments are cumulative to a maximum of 15 dB.			Adjustment where noise emission is music	
Where tonality is present	Where Modulation is present	Where Impulsiveness is present	Where Impulsiveness is not present	Where Impulsiveness is present
+5 dB	+5 dB	+10 dB	+10 dB	+15 dB

2.2 VECHILE NOISE

Regulation 3(a) states that *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.

If it is open to public, a car park is considered to be a road and therefore vehicle noise (propulsion and braking) is not strictly assessed. However, noise from car door closing still requires assessment, as this does not form part of the propulsion or braking systems.

2.3 INFLUENCING FACTORS

Four closest residences are selected for the detailed assessment of noise impacts, as shown in Figure 2 in APPENDIX A.

Influencing factor varies from residence to residence depending on the surrounding land use. Armadale Road is classified as major roads. All of the selected residences are more than 100m but less than 450m from Armadale Road and therefore transport factors of 2dB apply.

Figure 4 in APPENDIX A presents the Armadale City planning scheme zone map. Neither industrial nor commercial premises are present within 450m of the selected residences. Therefore, the influencing factor is zero for all of the selected receivers. Table 2-3 presents the assigned noise levels for the selected residences.

Table 2-3: Assigned noise levels in dB(A)

Closest Residents	Assigned Noise Levels in dB(A)		
	L_{A10}	L_{A1}	L_{Amax}
Days[2] for Monday to Saturday Excluding Public Holidays			
All Receivers	47	57	67
Days[3] for Sunday and Public Holidays			
All Receivers	42	52	67
Nights[4]			
All Receivers	37	47	57

[2] 0700 to 1900 hours for Monday to Saturday.
[3] 0900 to 1900 hours for Sunday and public holidays.
[4] 2200 hours on any day to 0700 hours for Monday to Saturday and 0900 hours for Sunday and public holidays.

3.0 NOISE MODELLING

3.1 METHODOLOGY

An acoustic model is developed using SoundPlan v8.0 program, and the CONCAWE[5,6] prediction algorithms are selected for this study. The acoustic model is used to predict noise levels at the representative noise sensitive receiver locations and generate noise contours for the area surrounding the subject site.

The acoustic model does not include noise emissions from any sources other than from the proposed childcare centre. Therefore, noise emissions from the neighbouring premises, aircrafts, road traffic, animals etc are excluded from the modelling.

3.2 INPUT DATA

3.2.1 Topography

CU Building Group advised that the site and surrounding area are reasonably flat. Therefore a flat ground is assumed in the acoustic model with the ground absorption of 0.6.

The childcare building and the existing buildings in the close area are digitised to the acoustic model. The site boundary fences are also considered.

3.2.2 Noise Sensitive Premises

Four closest residences are selected for the detailed assessment of noise impact, as shown in Figure 2 in APPENDIX A.

3.2.3 Source Sound Power Levels

Table 3-1 presents the source sound power levels. The overall noise levels of mechanical plant were obtained from the provided information. The spectrum shapes were obtained from the AES database for similar equipment. The sound power level of a toddler-play was measured when three toddlers were talking and building wooden blocks (including noises from block collapsing and moment on table) in another childcare centre. The measured sound power levels of story-telling, bicycle-ride and water-play are lower than that of building wooden blocks. Therefore, the sound power level of building wooden blocks represents worst-case kid-play activities.

[5] CONCAWE (Conservation of Clean Air and Water in Europe) was established in 1963 by a group of oil companies to carry out research on environmental issues relevant to the oil industry.

[6] The propagation of noise from petroleum and petrochemical complexes to neighbouring communities, CONCAWE Report 4/81, 1981.

It was observed that a conversation became louder with the increase of child age. Therefore, noise is assumed to be 2dB higher from a kindy-play and 3 dB for a school (5 to 12 year old) kid-play. Noise from a baby is considered negligible. It is the AES experience that the noise from children playing is a broadband noise and does not contain any annoying characteristics (i.e. intrusive or dominant characteristics).

The sound power level of a piano playing with kid-dance was measured for another AES project. The sound power level of car-door closing is presented in L_{Amax} level.

Table 3-1: Sound power levels.

Equipment	Number	Overall Sound Power Levels in dB(A)
Air-Conditioner	3	67
Toilet Exhaust Fan	4	62
Washer	1	78[7]
Dryer	1	66[7]
Toddler Play		72
Kindy Play		74
School-kid Play		75
Dance with Piano Accompaniment		88
Car Door Closing L_{Amax}		88

3.3 METEOROLOGY

SoundPlan calculates noise levels for defined meteorological conditions. In particular, temperature, relative humidity, wind speed and direction data are required as input to the model. For this study the worst-case meteorological conditions[8] have been assumed, as shown in Table 3-2.

[7] Averaged over a whole processing.
[8] The worst case meteorological conditions were set by the EPA (Environmental Protection Act 1986) Guidance note No 8 for assessing noise impact from new developments as the upper limit of the meteorological conditions investigated.

Table 3-2: Worst-case meteorological conditions.

Time of day	Temperature Celsius	Relative Humidity	Wind speed	Pasquill Stability Category
Day (0700 --- 1900)	20° Celsius	50%	4 m/s	E
Night (2200 --- 0700)	15° Celsius	50%	3 m/s	F

3.4 NOISE MODELLING SCENARIOS

CU Building Group advised:

- A maximum capacity of 50 children is proposed for either the normal day-care during the WA schooling days or vacation care.
- The childcare centre is open:
  - between 7am and 7pm during the WA school days; and
  - between 7am and 5pm on weekend for vacation care (for 5-12 year old).
- The normal day-care during the WA schooling days include three groups: 8 babies, 12 toddlers and 30 kindies.
- For vacation care the outdoor activities and music session are allowed only after 9am on Sunday.
- During the opening hours all of the windows are fully closed and all of the external doors are fully closed except for child's entry or exit.
- All outdoor and indoor activities are supervised by the staffs. Children are not allowed to shout or swear within the centre.
- All of the outdoor activities are kept within the fenced backyard. Children take turns for outdoor activities. The outdoor activities are limited to 15 maximum.
- A music session occurs in the music room for 30 minutes each day with piano accompaniment.
- Three PUMY-P112YKMD-A (11.2kW) air-conditioning units will be installed and their condensers will sit on the roof.
- Four toilet exhaust fans will be located above the toilet roofs.
- The kitchen is used only for preparing light snacks such as fruit platter or sandwich or baking muffin and biscuits.
- A washer and a dryer are located in the laundry room.
- No regular food/materials deliveries are planned.
- Solid boundary fences will be built except for the entrance to the car parking area, as shown in Figure 2 in APPENDIX A where black lines represent 1.8m solid boundary fences, yellow line represents 2.1m solid boundary fence and white line represents 1.2m solid fence with 600mm solid transparent panel above.

Based on the provided information, the following six worst-case operational scenarios are modelled:

Scenario 1: Three air conditioners operate simultaneously with the four toilet exhaust fans plus the operations of a washer and a dryer in the laundry room.

Scenario 2: A music session is held for a group of toddlers in the music room simultaneously with:

15 kindies (7 play groups) play outdoors in the backyard;

15 kindies (7 play groups) play indoors (in the Kindy room); and

6 toddlers (3 play groups) play indoors (in a toddler room).

Scenario 3: Scenario 1 plus scenario 2. This scenario represents the worst-case operation for the normal day-care.

Scenario 4: A music session occurs for a group of (10) vacation care kids in the music room simultaneously with:

15 vacation care kids (7 play groups) play outdoors in the backyard; and

25 vacation care kids (12 play groups) play indoors.

Scenario 5: Scenario 1 plus scenario 4. This scenario represents the worst-case operation for vacation care.

Scenario 6: A car door is closed in a designed car parking bay. It represents very short events.

The mechanical plant and kid-play/conversations are modelled as point sources. The toilet exhaust outlets are assumed to be 0.3m above the toilet roofs while the air-conditioner condensers are 0.5m above the roof. The noise sources of toddlers are assumed to be 0.8m above the ground/floors while the noise sources of kindies are 0.9m above the ground. The noise sources of 5-12 year old kids are assumed to be 1.2m above the ground.

A car-door closing is modelled as a point source. The barrier effect of car bodies is not considered in the model and the predicted noise levels will be higher than the actual levels at the car body shadow areas.

Scenario 1 represents the worst-case operation of mechanical plant in the childcare centre. Scenario 2 represents worst-case child-play activities for the normal care days while scenario 4 represents worst-case kid-play activities for vacation care. Scenarios 1 and 6 could happen during both the day & night for vacation care but scenarios 2 to 5 occur for the day only.

4.0 MODELLING RESULTS

4.1 POINT MODELLING RESULTS

Table 4-1 presents the predicted worst-case A-weighted noise levels. For scenario 6 the predicted noise levels are the L_{Amax} levels. It is shown that for scenarios 1 and 6 the day and night-time noise levels are the same at every receiver. The highest noise level is predicted at R2 for scenarios 1 and 6 but at R1 for the other scenarios.

Table 4-1: Predicted worst-case noise levels in dB(A).

Receivers	Scenario 1		Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	
	Day	Night					Day	Night
R1	25.3	25.3	38.8	39.0	40.5	40.6	21.7	21.7
R2	29.2	29.2	24.1	30.4	24.1	30.4	44.8	44.8
R3	28.2	28.2	37.7	38.2	40.2	40.5	41.0	41.0
R4	25.7	25.7	33.8	34.4	36.7	37.1	37.1	37.1

The predicted noise levels include the contributions from:

- The piano (music) and kid-play activities for scenarios 2 and 4.
- The mechanical plant, piano (music) and kid-play activities for scenarios 3 and 5.

The mechanical noise and music levels do not change for scenarios 2 to 5. The difference among scenarios 2 to 5 is the change of noises from kid-play activities.

Table 4-2 presents a comparison between these contributions. It is shown that for both scenarios 3 and 5 the kid-play activities are the most dominant noise source at R1, R3 and R4 while the mechanical noise becomes dominant at R2. Music is insignificant and will be masked at all of the receiver locations.

Table 4-2: Noise contributions for scenarios 3 and 5.

Receivers	Mechanical	Music	Conversations	
			Scenario 3	Scenario 5
R1	25.3	4.9	38.8	40.5

Receivers	Mechanical	Music	Conversations	
			Scenario 3	Scenario 5
R2	29.2	0.0	24.1	24.2
R3	28.2	14.4	37.7	40.2
R4	25.7	10.6	33.8	36.8

4.2 NOISE CONTOURS

Figure 5 to Figure 10 in APPENDIX B presents the worst-case noise contours at 1.5m above the ground. These noise contours represent the worst-case noise propagation envelopes, i.e., worst-case propagation in all directions simultaneously.

Figure 10 is the L_{Amax} contours for the worst-case noise propagation.

5.0 COMPLIANCE ASSESSMENT

5.1 ADJUSTED NOISE LEVELS

According to Table 2-2, the predicted noise levels shown in Table 4-1 should be adjusted by:

- 5 dB if the noise received exhibits tonality; or
- 10 dB if the noise received is music.
- 10 dB if the noise received exhibits impulsiveness.

The noise radiation from the mechanical plant may have tonal components but not exhibit implusiveness. Therefore, a 5dB adjustment should apply to the predicted noise levels for scenario 1.

For scenarios 2 to 5, music is insignificant and will be masked and inaudible, as indicated in Table 4-2. Kid-play activities are the dominant noise sources for scenarios 2 and 4. The noises from kid-play activities do not contain annoying characteristics. No adjustment is required for the predicted noise levels in scenarios 2 and 4.

Table 4-2 indicates that for scenarios 3 and 5 the noises from kid-play activities are dominant at R1, R3 and R4 where the tonal components from the mechanical plant noise will be masked and inaudible. At R2 the mechanical noise is dominant. Therefore, for scenarios 3 and 5 no adjustment applies to the predicted noise levels at R1, R3 and R4 but a 5dB adjustment should apply at R2.

Scenario 6 considers the car-door closing noise only. The car-door closing noise may exhibit implusiveness and a 10dB adjustment applies.

Table 5-1 presents the adjusted worst-case A-weighted noise levels. The adjusted noise levels are expressed in ***bold italic***.

Table 5-1: Adjusted worst-case noise levels in dB(A).

Receivers	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
R1	***30.3***	38.8	39.0	40.5	40.6	***31.7***
R2	***34.2***	24.1	***35.4***	24.1	***35.4***	***54.8***
R3	***33.2***	37.7	38.2	40.2	40.5	***51.0***
R4	***30.7***	33.8	34.4	36.7	37.1	***47.1***

5.2 COMPLIANCE ASSESSMENT

Both the mechanical plant and outdoor activities generate continuous noise emissions. Therefore, the assigned noise levels L_{A10} apply to scenarios 1 to 5.

Car door closing is a very short event. The noise from car door closing is predicted in L_{Amax} level and the assigned noise levels L_{Amax} apply to scenario 6.

The childcare centre opens for the day only (7am to 7pm) during the WA school days but for the day and night (7am to 9am) on Sunday for vacation care. Therefore, compliance assessment is required for the day-time operations on Monday to Saturday but for both the day and night-time operations on Sunday. No assessment is required for the evening.

5.2.1 Monday to Saturday

Table 5-2 presents compliance assessment for the day time (7am to 7pm) operations on Monday to Saturday. It is shown that the assigned noise levels are much higher than the adjusted noise levels at all receivers for all scenarios. This concludes that compliance is achieved for the proposed day-time operations on Monday to Saturday excluding public holidays.

Table 5-2: Compliance assessment for Monday to Saturday.

Receivers	Assigned Noise Levels L_{A10} in dB(A)	Adjusted Worst-case Noise Levels in dB(A)					Assigned Noise Levels L_{Amax} in dB(A)	Adjusted L_{Amax} in dB(A)
		S1	S2	S3	S4	S5		Scenario 6
R1	47	30.3	38.8	39.0	40.5	40.6	67	31.7
R2	47	34.2	24.1	35.4	24.1	35.4	67	54.8
R3	47	33.2	37.7	38.2	40.2	40.5	67	51.0
R4	47	30.7	33.8	34.4	36.7	37.1	67	47.1

5.2.2 Sunday

Vacation care is open for Sunday. Table 5-3 presents compliance assessment for the day time (9am to 5pm) operations for Sunday. It is shown that the adjusted noise levels are below the assigned noise levels at all receiver locations for all scenarios. This concludes that compliance is achieved for the proposed day-time operations on Sunday.

Table 5-3: Compliance assessment for Sunday.

Receivers	Assigned Noise Levels L_{A10} in dB(A)	Adjusted Worst-case Noise Levels in dB(A)			Assigned Noise Levels L_{Amax} in dB(A)	Adjusted L_{Amax} in dB(A)
		Scenario 1	Scenario 4	Scenario 5		Scenario 6
R1	42	30.3	40.5	40.6	67	31.7
R2	42	34.2	24.1	35.4	67	54.8
R3	42	33.2	40.2	40.5	67	51.0
R4	42	30.7	36.7	37.1	67	47.1

5.2.3 Night

The following opening hours are classified as the night according the Regulations:

- 7am to 9am on Sunday.

CU Building Group advised that during the above time-periods no outdoor activities and music session occur for vacation care. Therefore, scenarios 4 and 5 are excluded for the night-time compliance assessment.

Table 5-4 presents compliance assessment for the night-time operations. It is shown that that the adjusted noise levels are below the assigned noise levels at all receivers for scenarios 1 and 6. This concludes that compliance is achieved for the proposed night-time operations.

Table 5-4: Compliance assessment for the night.

Receivers	Assigned Noise Levels L_{A10} in dB(A)	Adjusted Worst-case Noise Levels in dB(A)	Assigned Noise Levels L_{Amax} in dB(A)	Adjusted L_{Amax} in dB(A)
		Scenario 1		Scenario 6
R1	37	30.3	57	31.7
R2	37	34.2	57	54.8

Receivers	Assigned Noise Levels L_{A10} in dB(A)	Adjusted Worst-case Noise Levels in dB(A)	Assigned Noise Levels L_{Amax} in dB(A)	Adjusted L_{Amax} in dB(A)
		Scenario 1		Scenario 6
R3	37	33.2	57	51.0
R4	37	30.7	57	47.1

It can be concluded from the above assessments that full compliance is achieved for the proposed operations of the childcare centre.

6.0 BOUNDARY FENCES

The predicted noise levels are obtained based on the assumption of solid boundary fences with no gaps and holes on the fence structures and between the fences and the ground. Without this assumption, full compliance cannot be achieved for the proposed operations. For this project, the boundary fences should achieve Rw 30 or above. Acceptable construction includes:

- Brick wall.
- Precast concrete (panel) wall.
- Hardifence.
- Double skin colorbond fence.
- Perspex fence.

The boundary fences can be a combination of different types of construction, for examples, a retaining wall with Perspex fence on the top.

APPENDIX A AERIAL VIEW

Figure 1: Piara Garden.

Figure 2: Aerial view of proposed childcare centre and surrounding area.

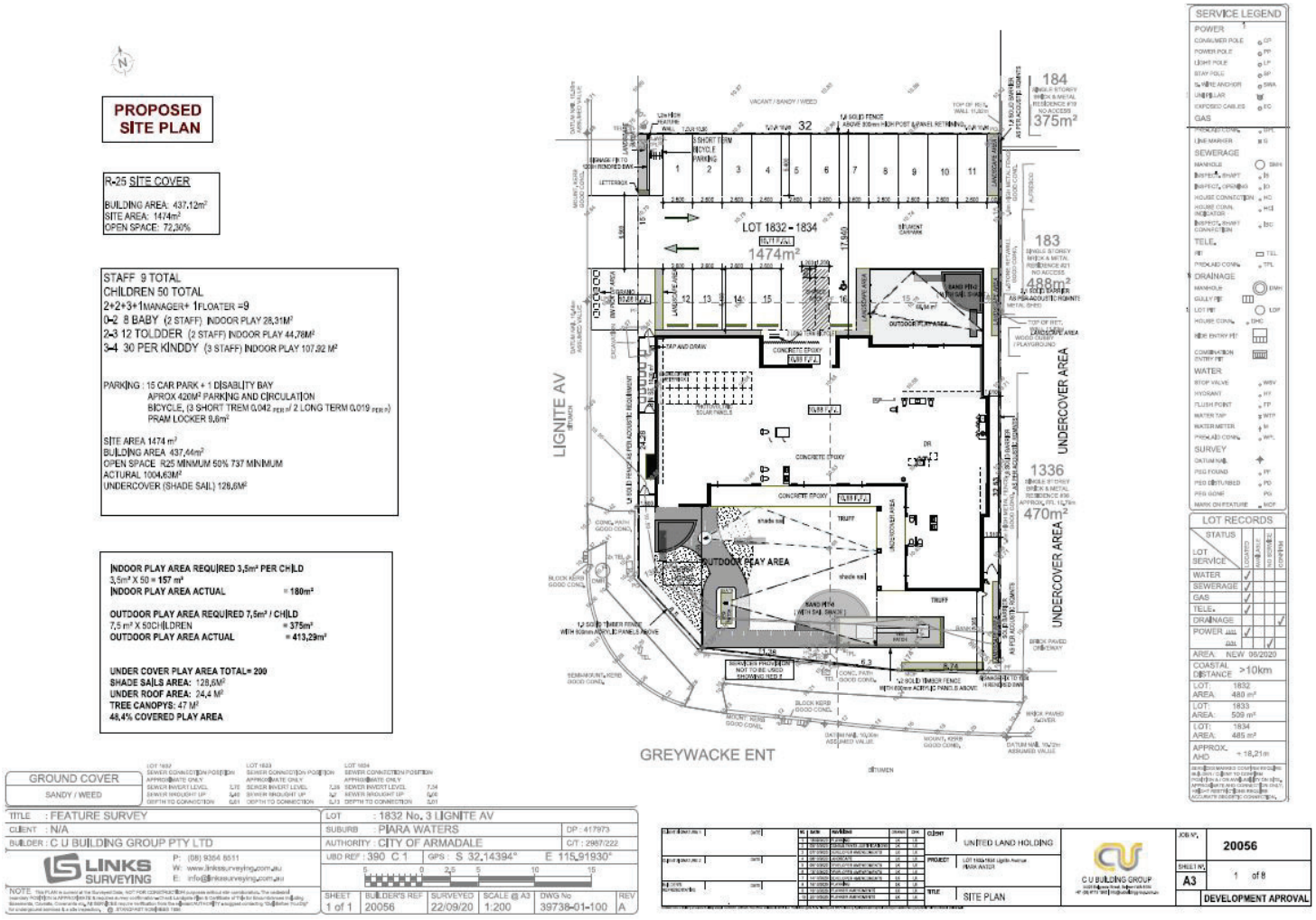

Figure 3: Site layout.

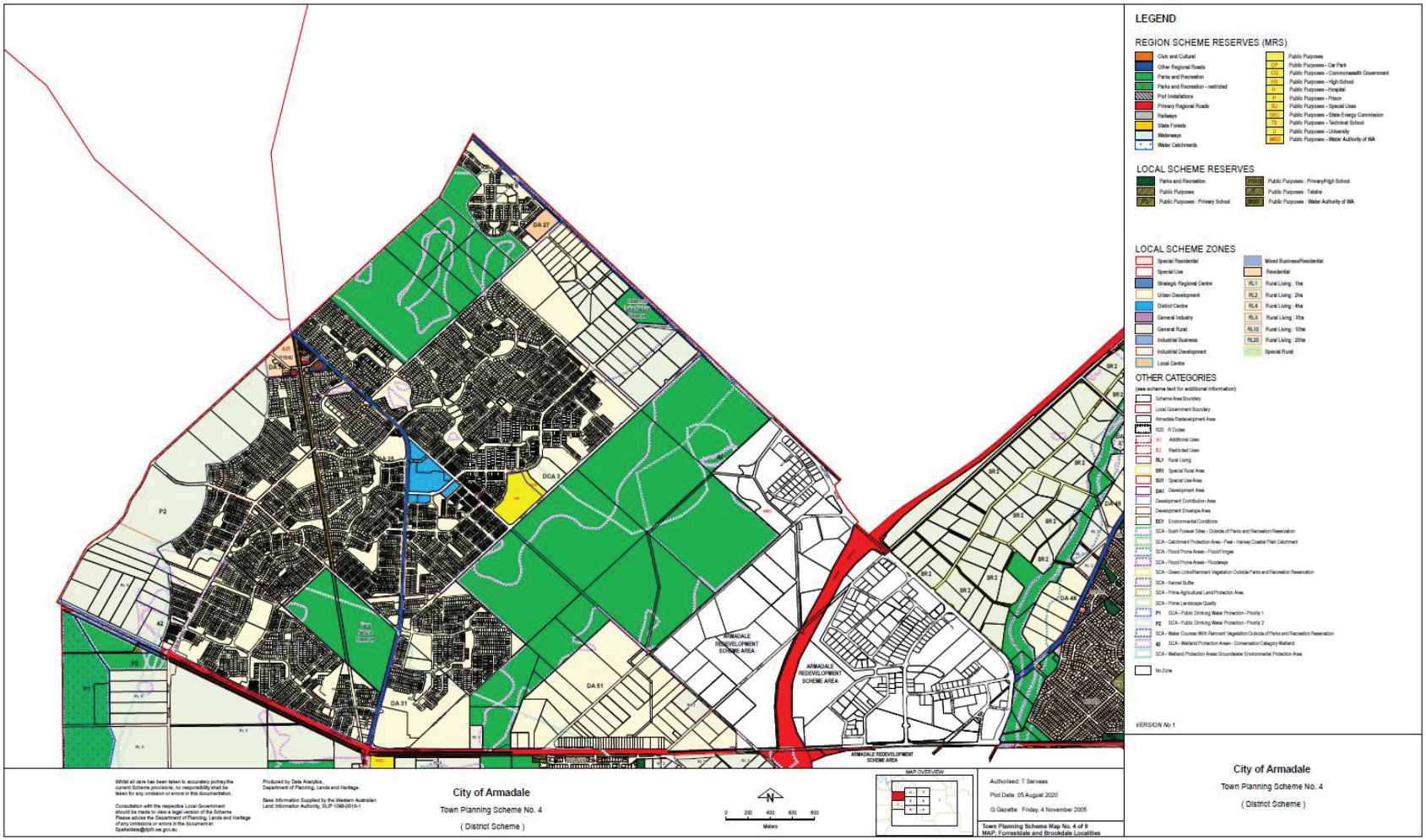

Figure 4: Zone map 4 of Armadale City Planning Scheme.

APPENDIX B NOISE CONTOURS

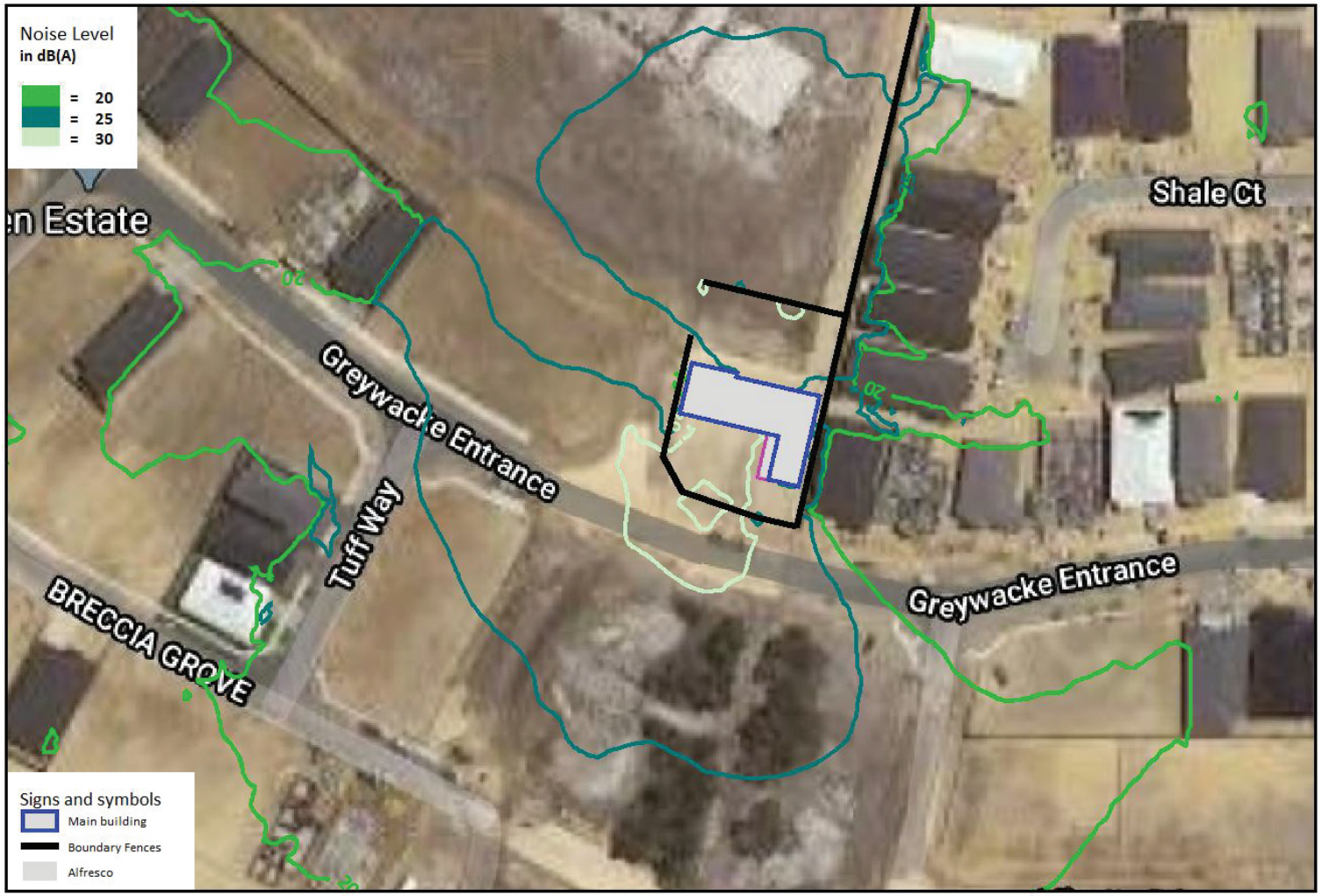

Figure 5: Worst-case noise level contour for scenario 1.

Figure 6: Worst-case noise level contour for scenario 2.

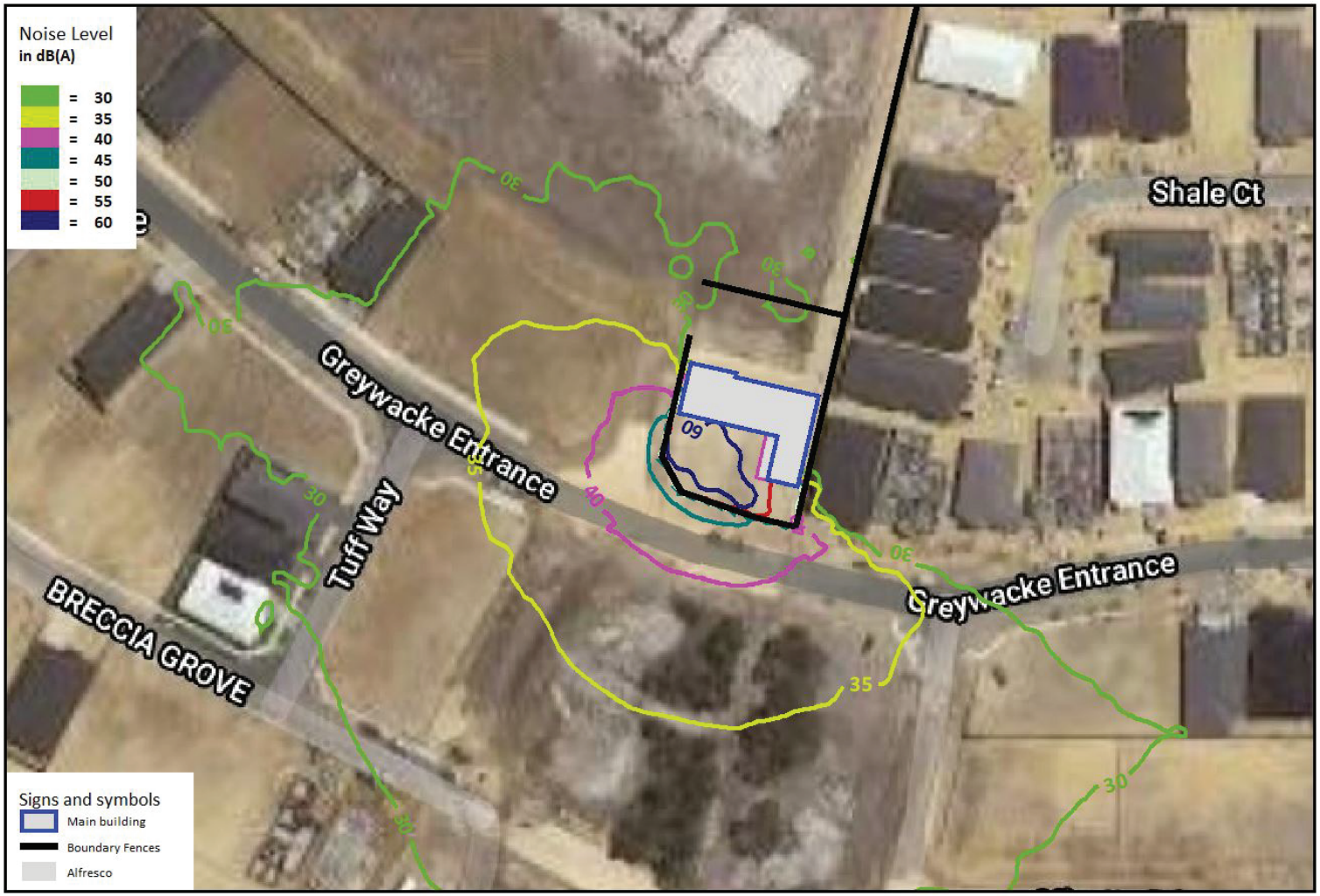

Figure 7: Worst-case noise level contour for scenario 3.

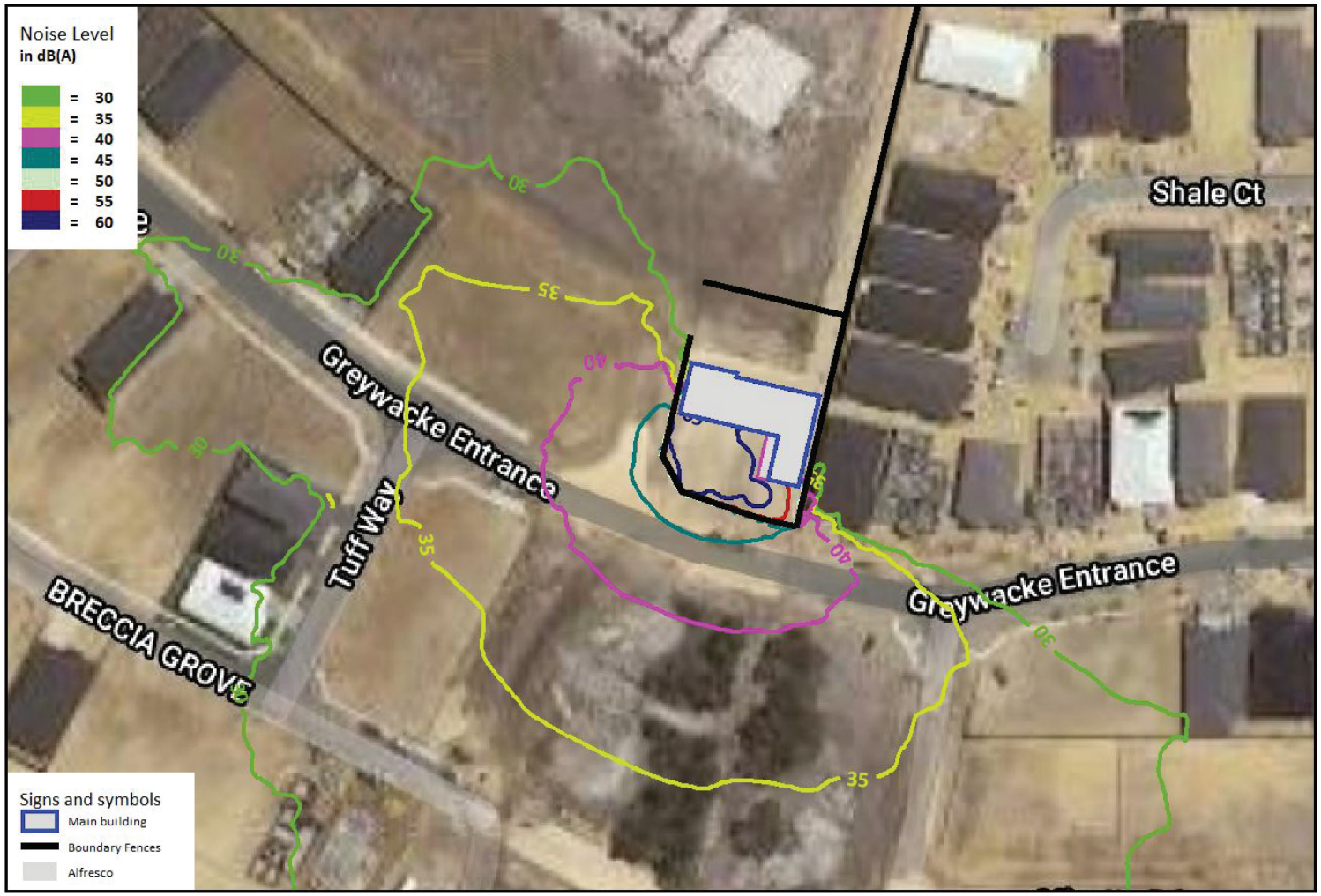

Figure 8: Worst-case noise level contour for scenario 4.

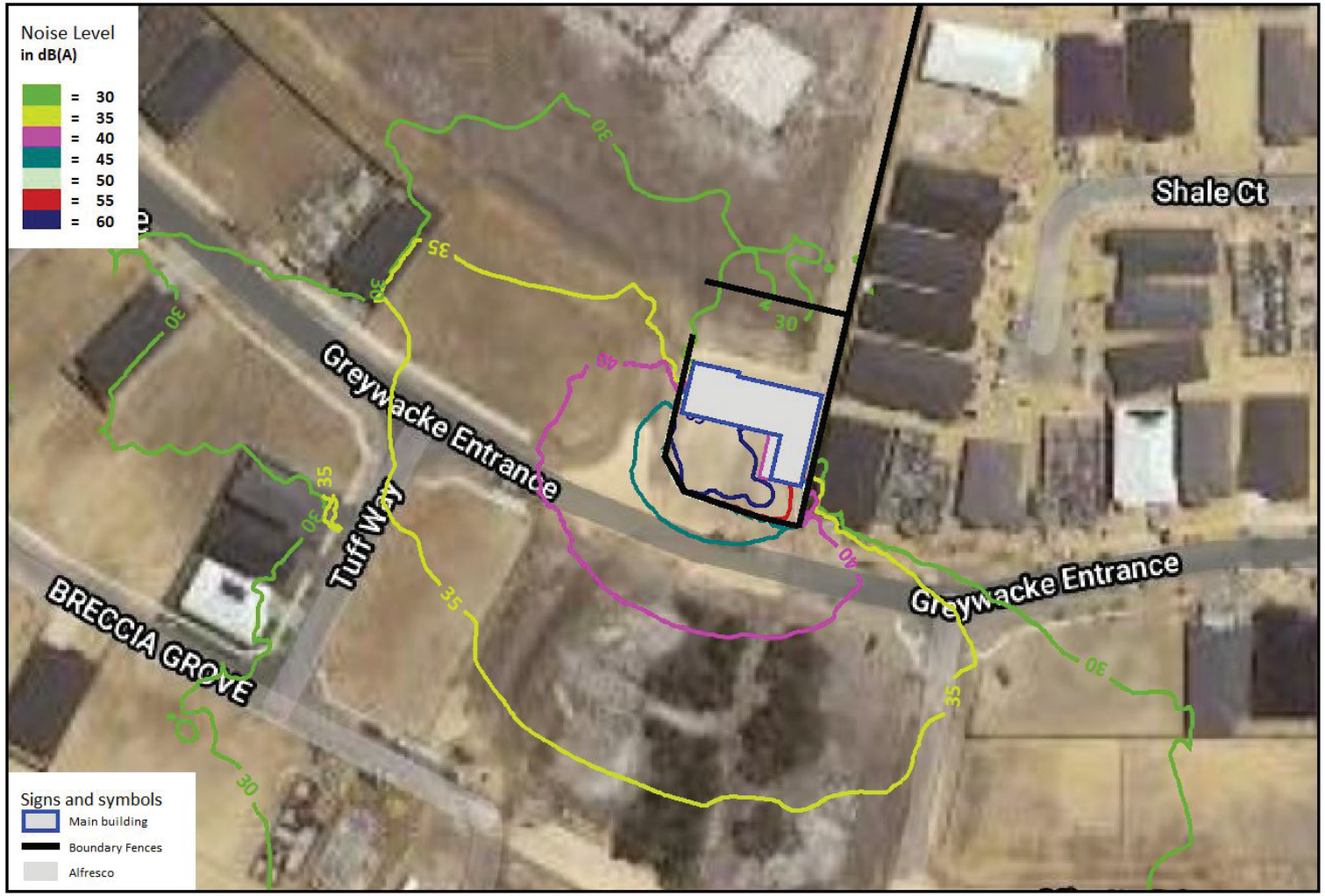

Figure 9: Worst-case noise level contour for scenario 5.

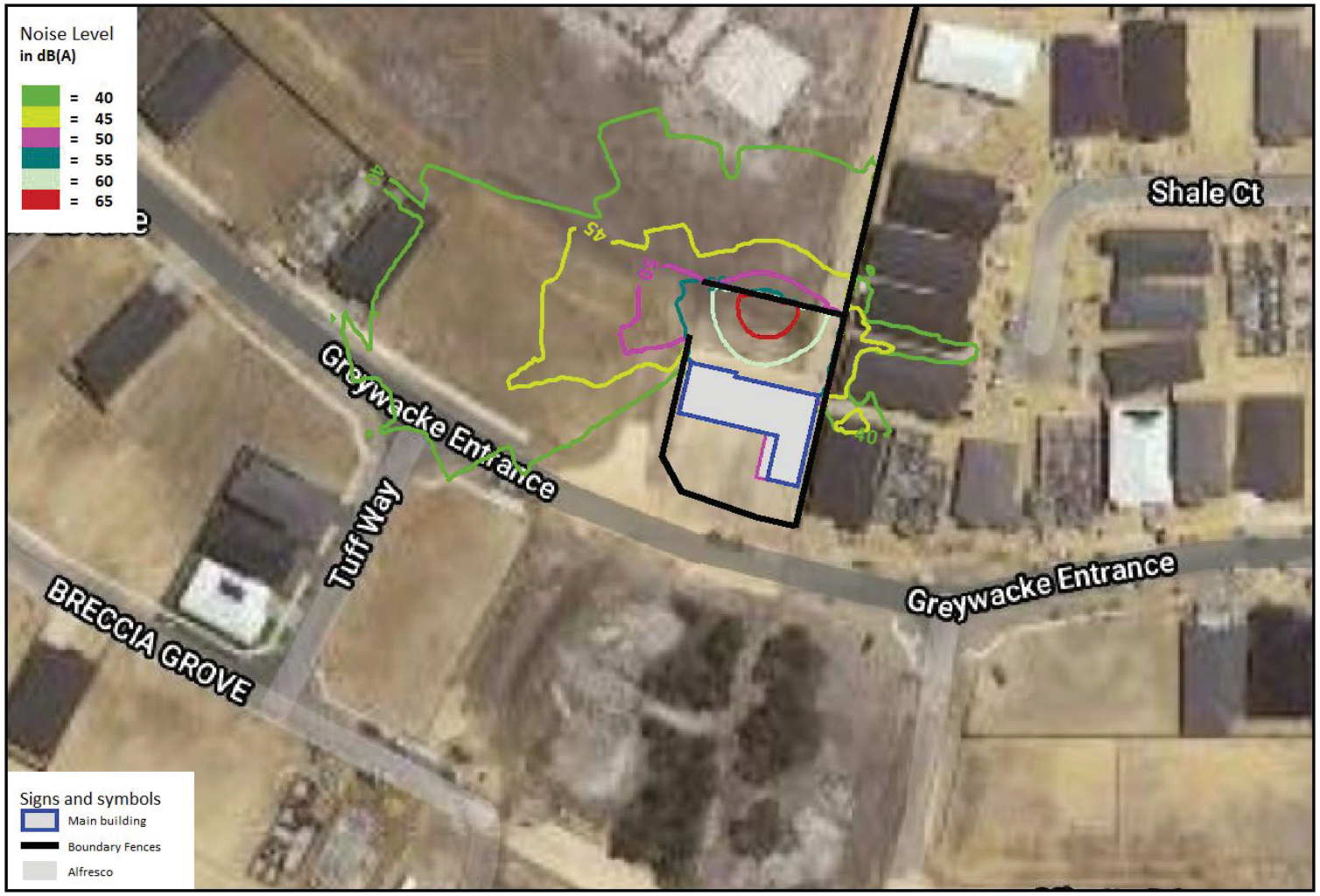

Figure 10: Worst-case noise level contour for scenario 6.