White City Development

Acoustics Report

Stage 2 Development Application

Prepared for: P + I Group

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Revision

Revision	Date	Comment	Prepared By	Approved By
01	21/04/2020	DRAFT - For Comment	CGW	ORFG
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1. Introduction

1.1 Scope

Stantec Engineers have been engaged by P+I Group to prepare an acoustic report for the Stage 2 Development Application for the White City Tennis Centre located at 30 Alma Street, Paddington. The Stage 1 DA was accompanied by an acoustic report written by AECOM in September 2015.

The proposed development repurposes the existing White City Tennis Centre to a multi-use sports and community venue. The scope of the Stage 2 DA is generally similar to the scope of the approved Stage 1, with some reductions as concerns the noise impact of the site. The facilities included in the Stage 2 DA are outlined below:

- Tennis courts
- Soccer field with grandstand
- Indoor and outdoor pool
- Multipurpose hard courts including weather screen
- Ancillary cafes and restaurants
- Club building
- Conserved Southern Grandstand building

The Stage 1 DA was approved by council subject to the following conditions (DA Assessment Report for DA438/2015/1 section 6.11):

> *Noise impacts to nearby residences from the football field… and new tennis courts could be appropriately managed (e.g. limit hours of operation and/or frequency of use) and include appropriate noise attenuation measures. These operational details will be subject to assessment under any future development application(s).*

This report addresses the acoustic impact of the facilities included within the Stage 2 DA scope, and recommends mitigation and management strategies to ensure continued community amenity. The scope of this report is as follows:

- Review of the noise logging conducted for the initial AECOM DA report
- Establishment of noise criteria for the project
- Assessment of the noise impact on sensitive receivers from sources including:
  - Tennis
  - Soccer (player and spectator noise)
  - Multipurpose courts
  - Outdoor swimming pool
  - Club building
  - Mechanical services
  - Traffic
- Recommendations for mitigating the cumulative noise impact of the development to levels acceptable to the community

1.2 Referenced Documents

The assessment has been prepared considering the following reports, policies and standards:

- White City Stage 1 Development Application Acoustic Assessment, AECOM, 2nd September 2015
- Joint Regional Planning Panel (JRPP) Development Application Assessment Report for DA438/2015/1
- Woollahra Council Development Control Plan (DCP), 2015
- Noise Policy for Industry (NPI), NSW EPA, 2017
- Road Noise Policy (RNP), NSW EPA, 2011
- AS/NZS 1055:2018 *Description and measurement of environmental noise*
- Sydney Cricket Ground (SCG) – Noise Management Plan, 2019
- UK Association of Noise Consultants and the Institute of Acoustics, *Joint Guidance on the Impact of COVID-19 on the Practicality and Reliability of Baseline Sound Level Surveying and the Provision of Sound and Noise Impact Assessments*

Noise data for various sports activities across the site has been taken from the following sources

- AS 2822:1985 (R2016) *Methods of Assessing and Predicting Speech Privacy and Speech Intelligibility*
- ANSI S3.5:1997 *Methods for Calculation of the Speech Intelligibility Index*
- Sport England, *Artificial Grass Pitch Acoustics - Planning Implications*, 2015
- Sport Scotland, *Siting of Synthetic Grass Pitches – Guidance on Noise and Floodlighting*, 2017
- Acoustical Society of America (ASA), *Referee whistles Part II – Outdoor sound power assessment*, 2019
- Bundesinstitut für Sportwissenschaft (BISp), *Ermittlung der Schallemissionen und Schallimmissionen von Sport- und Freizeitanlagen (German Federal Institute of Sport Science, Determination of sound emissions of leisure and sporting facilities),* 1992

The assessment has been prepared using the architectural drawing package issued by Cottee Parker Architects on the 2nd of December 2019.

This report is based on our understanding of the proposed project, application of the relevant state guidelines and professional experience within the acoustic field. Therefore, this report shall not be relied upon as providing any warranties or guarantees.

2. Site Description

2.1 Site Details

The site is that of the existing White City Tennis Centre located at 30 Alma Street, Paddington, as shown in Figure 2-1. It is bounded by Sydney Grammar owned fields to the north west, Walker Avenue to the north east, residential properties off Glenmore road to the south east, Glenmore road to the South, and Sydney Grammar School Edgecliff Preparatory School to the west.

The proposed development will expand the facilities of the existing White City Tennis Club to include a variety of indoor and outdoor recreation spaces. The layout of the proposed facilities is presented in Figure 2-2.

Figure 2-1: Aerial Photo of the Area Showing an Overview of the Site and Measurement Locations

Source: nearmap.com

Figure 2-2: Layout of Proposed Development

2.2 Sensitive Receivers

The noise sensitive receivers to the proposed White City Sports Precinct development site have been identified as the following:

- Residences of 2 to 24 Walker Avenue, Edgecliff
- Residences of 20 to 24 Alma Street, Paddington
- Residences of 400 Glenmore Road, Paddington
- Residences of 351 to 357 Glenmore Road, Paddington
- Residences of 77 to 81 Cambridge Street, Paddington
- Residences of 302 Glenmore Road, 1 to 5 Lawson Street, Paddington
- Sydney Grammar School Edgecliff Preparatory School

The existing noise environment around the site is that of a typical urban environment, with contribution at varying times from several existing sports facilities. Apart from the existing White City Tennis centre there are playing fields used for soccer or cricket to the north, northwest, and southeast of the site or neighbouring receivers.

2.3 Acoustic Issues

This report provides high level design advice for control of noise intrusion from the site to surrounding receivers. Specifically, the following sources of noise have been considered:

- Mechanical services
- Traffic
- Sports Activities
- Club community room and restaurants including licensed RSA venue

Further details will be developed during the detailed design stage of the development.

3. Noise Monitoring Program

3.1 Existing Noise Monitoring Data (AECOM)

Noise monitoring was conducted as part of the AECOM acoustic report which accompanied the Stage 1 DA. This monitoring was conducted in October 2014. The results of the monitoring are presented in the following sections, extracted from the AECOM report. It is the opinion of Stantec Engineers that despite the time elapsed since logging these background noise levels can be considered representative of the current noise environment.

3.1.1 *Unattended noise measurements*

AECOM conducted environmental noise monitoring at four (4) locations in the vicinity of the redevelopment site between Thursday 16 October 2014 and Thursday 23 October 2014. The loggers were set for sample periods of 15 minutes and continuously logged for monitoring period. Noise monitoring was conducted on the boundaries of the development site to determine existing background of the site and adjacent receivers and traffic noise levels. The locations of the unattended noise logging are as follows and are also presented in Figure 1.

- *Northern boundary of the site: adjacent to rear of residences of 22 and 24 Walker Avenue.*
- *Eastern boundary of the site: adjacent to rear of apartments of 400 Glenmore Road.*
- *Southern boundary of the site: across the road from residences of 351 Glenmore Road. Local traffic noise dominant.*
- *Western boundary of the site: adjacent to residence of 24 Alma Street. Local traffic noise and school activity noise from Sydney Grammar School Edgecliff Preparatory dominant.*

Figure 1 - Location map of unattended noise logging and operator attended measurements

The equipment used for site measurements is detailed below in Table 1.

Table 1 - Environmental noise monitoring equipment

Location	Equipment	Serial Number
Northern boundary	*ARL EL-215*	*194678*
Eastern boundary	*ARL EL-215*	*194535*
Southern boundary	*ARL EL-215*	*194688*
Western boundary	*Cirrus*	*061710*

Calibration of the meters was checked on site with a sound calibrator at the beginning and end of the measurement periods. No significant drifts in calibration were observed. All instrumentation employed during the noise measurements complies with the requirements of AS IEC 61672.1-2004 Electroacoustics - Sound level meters – Specifications and carries appropriate calibration certificates. The noise measurements have been conducted in general accordance with AS1055.1 – 1997.

The loggers measured the noise levels over the sample period and then determined LA10, LA90, LAmax, and LAeq levels of the noise environment. The LA10 and LA90 levels are the levels exceeded for 10% and 90% of the sample period respectively. The LAmax is indicative of the maximum noise levels due to individual noise events such as the pass-by of a heavy vehicle. The LA90 is taken as the background noise level. The LAeq level is the equivalent continuous sound level and has the same sound energy over the sample period as the actual noise environment with fluctuating sound levels.

The background noise level is defined by the EPA as 'the underlying level of noise present in ambient noise when all unusual extraneous noise is removed'. It can include sounds that are normal features of a location and may include birds, traffic, insects etc. The background noise level is considered to be represented by the LA90 descriptor. The noise levels measured at the proposed development site were analysed to determine a single assessment background level (ABL) for each day, evening and night period in accordance with the EPA's INP, for each monitoring location.

The graphical recorded outputs from the noise monitoring are given in Appendix B. The results used to develop the graphs given in Appendix B were also analysed to determine a single Assessment Background Level (ABL) for each day, evening and night period, in accordance with the NSW Industrial Noise Policy (INP).

The ABL is established by determining the lowest ten-percentile level of the LA90 noise data acquired over each period of interest i.e. day, evening and night. Table 2 presents individual ABLs for each day's assessment periods.

Table 2 - Existing background (LA90) and ambient (LAeq) noise levels

Measurement Date	L_{A90} Background Noise Levels, dB(A)			L_{Aeq} Ambient Noise Levels, dB(A)		
	Day	Evening	Night	Day	Evening	Night
Northern Boundary – rear of 24 Walker Ave, Edgecliff						
Thursday 16 October, 2014	*46*	*44*	*38*	*54*	*51*	*45*
Friday 17 October, 2014	*47*	*42*	*38*	*54*	*50*	*47*
Saturday 18 October, 2014	*44*	*43*	*39*	*55*	*55*	*47*
Sunday 19 October, 2014	*43*	*43*	*39*	*54*	*52*	*45*
Monday 20 October, 2014	*-*	*41*	*34*	*-*	*47*	*45*
Tuesday 21 October, 2014	*46*	*42*	*35*	*52*	*53*	*46*
Wednesday 22 October, 2014	*48*	*-*	*37*	*58*	*-*	*47*
Thursday 23 October, 2014	*48*			*56*		
RBL/Log Average	***46***	***42***	***38***	***55***	***52***	***46***
Eastern boundary - adjacent to rear of apartments of 400 Glenmore Road, Paddington						
Thursday 16 October, 2014	*18*	*42*	*37*	*61*	*55*	*43*

Measurement Date	L_{A90} Background Noise Levels, dB(A)			L_{Aeq} Ambient Noise Levels, dB(A)		
	Day	Evening	Night	Day	Evening	Night
Friday 17 October, 2014	42	40	36	55	52	43
Saturday 18 October, 2014	44	42	39	55	50	46
Sunday 19 October, 2014	43	43	38	54	53	44
Monday 20 October, 2014	-	40	32	-	53	41
Tuesday 21 October, 2014	44	41	34	53	55	42
Wednesday 22 October, 2014	45	-	36	55	-	46
Thursday 23 October, 2014	46			56		
RBL/Log Average	**44**	**41**	**36**	**56**	**53**	**44**
Southern boundary – opposite 351 Glenmore Road, Paddington						
Thursday 16 October, 2014	47	43	35	63	60	53
Friday 17 October, 2014	44	41	35	64	58	55
Saturday 18 October, 2014	42	43	37	62	59	54
Sunday 19 October, 2014	41	43	36	59	58	50
Monday 20 October, 2014	-	40	33	-	57	51
Tuesday 21 October, 2014	45	41	33	62	60	54
Wednesday 22 October, 2014	45	-	36	62	-	52
Thursday 23 October, 2014	46			62		
RBL/Log Average	**45**	**42**	**35**	**62**	**59**	**53**
Western boundary – 24 Alma Street, Paddington						
Thursday 16 October, 2014	52	47	42	59	54	50
Friday 17 October, 2014	52	45	41	60	53	50
Saturday 18 October, 2014	49	48	43	58	54	50
Sunday 19 October, 2014	49	47	42	57	56	49
Monday 20 October, 2014	-	44	38	-	51	50
Tuesday 21 October, 2014	51	46	40	59	56	51
Wednesday 22 October, 2014	53	-	42	63	-	52
Thursday 23 October, 2014	54			62		
RBL/Log Average	**52**	**46**	**42**	**60**	**54**	**50**

Notes:

- Day is defined as 7:00 am to 6:00 pm, Monday to Saturday and 8:00 am to 6:00 pm Sundays and Public Holidays.

- Evening is defined as 6:00 pm to 10:00 pm, Monday to Sunday and Public Holidays.

- Night is defined as 10:00 pm to 7:00 am, Monday to Saturday and 10:00 pm to 8:00 am Sundays and Public Holidays.

- Data were discarded due to adverse weather conditions influencing the measurement results.

3.1.2 *Attended noise measurements*

Attended noise measurements were undertaken to supplement the unattended noise measurements at representative receiver locations. Attended noise measurements were undertaken on Thursday 16 October 2014 and Thursday 23 October 2014 during the setup and retrieval of the noise loggers. Attended noise measurements were undertaken at the noise logging locations as indicated in Figure 1 above.

Attended noise measurements were undertaken using a Bruel & Kjaer 2270 sound level meter (Serial number: 3000860). The B&K 2270 sound level meter is designated as having Type 1 accuracy. All equipment used was calibrated before and after measurements with a drift in calibration not exceeding ± 0.5 dB. Additionally, all equipment used for this assessment were in their current National Association of Testing Authorities, Australia (NATA) certified in-calibration period (i.e. full 1/3 octave band calibration in the last 2 years).

The weather during the attended measurements was fine and did not affect the measurements. A summary of the attended noise measurement results is presented in Table 3 below.

Table 3 - Summary of attended noise measurements

Location	Date/Time	Measured Noise Levels, dB(A)				Comments
		L_{eq}	L_1	L_{10}	L_{90}	
Northern boundary	16 Oct 2014 12:28 pm – 12:43 pm	55	67	55	48	• Noise from activities on playing fields north of stormwater channel dominant during measurement • Intermittent noise from Maccabi tennis courts audible • Distant train passby noise just audible (no direct line of sight to train viaduct)
Eastern boundary	16 Oct 2014 1:20 pm – 1:35 pm	60	74	63	46	• Adjacent Maccabi tennis courts activity noise dominant • Distant traffic hum and construction site noise audible
Southern boundary	16 Oct 2014 1:56 pm – 2:11 pm	52	59	54	48	• Local traffic noise on Glenmore Road dominant

Western boundary	23 Oct 2014 10:39 am – 10:54 am	59	71	61	53	• School activity noise from adjacent school dominant
						• Bulldozer and tractor noise from adjacent Weigall Sportsground audible
						• Plane fly over noise approx. 68 – 73 dB(A)
						• Train passby on viaduct audible (direct line of sight to train viaduct)
						  ○ City-bound train passby has noticeable rattle and louder noise approx. 68 dB(A)
						  ○ Edgecliff-bound train passby noise approx. 60 dB(A)

3.1.3 *Octave Band Ambient Noise Levels*

The noise logger located at the western boundary (adjacent to 24 Alma Street, Paddington) was also configured to monitor 1/3 octave band noise levels. The octave band spectra associated with the RBLs between the hours of 7 am and 12 midnight and 12 midnight and 7 am for the noise monitoring period are presented below in Table 4.

Table 4 - Octave band existing background (L90) noise levels

Time Period	*L_{90} Background Noise Level, dB*								
	Octave Band Centre Frequency, Hz								
	31.5	*63*	*125*	*250*	*500*	*1000*	*2000*	*4000*	*8000*
Western boundary – 24 Alma Street									
7:00 am to 12 midnight	*63*	*63*	*55*	*51*	*48*	*46*	*39*	*28*	*20*
12 midnight to 7:00 am	*53*	*52*	*46*	*45*	*41*	*36*	*28*	*16*	*15*

3.2 Comparison with AS/NZS 1055:2018

An estimation of the expected background noise levels for areas of various urban densities is presented in AS/NZS 1055.3:1997 *Description and measurement of environmental noise*. The levels for the appropriate category are in line with or greater than the levels recorded in 2014.

Noise Area Category	Description of Neighbourhood	Average background A-weighted sound pressure level, ($L_{A90,T}$)					
		Monday to Saturday			Sundays and Public Holidays		
		0700-1800	1800-2200	2200-0700	0900-1800	1800-2200	2200-0900
R3	Areas with medium density transportation or with some commerce or industry	55	50	45	55	50	45

3.3 Effect of COVID-19 on Noise Monitoring

Additional noise monitoring has been requested to confirm the relevance of the noise monitoring conducted for the AECOM report. The change in work and travel patterns caused by the COVID-19 pandemic have caused an associated change in the acoustic environment, particularly in urban and suburban areas.

The UK Association of Noise Consultants and the Institute of Acoustics issued the following advice regarding the effect of COVID-19 on environmental noise levels. Although this advice has been issued for a UK environment, the principle and general trends in the change of environmental noise levels are applicable to the Australian environment.

> *The COVID-19 outbreak presented new challenges in obtaining representative baseline sound levels because typical road, air and rail transport usage have been reduced by travel restrictions and social distancing measures. Other sound sources may also have been affected – for example, due to changes in operating patterns at industrial and commercial premises.*
>
> *For transport schemes, there will have to be a reliance on predicted sound levels to describe the baseline conditions, with a corresponding need to source flow/activity data. There are now many sources of transport data available and these should be used, where possible, along with previously made direct site measurements to describe baseline conditions.*
>
> *The acoustics professional will need to consider whether alternative sources of information in respect of sound levels can reasonably be used. Where appropriate, a case should be made regarding why the proposed alternative methods are suitable for a robust assessment, and should clearly set out the estimated uncertainties in the assessment.*

Liaison between acoustics professionals and relevant regulators is especially important during this period where characterising environmental sound climates cannot be undertaken in the conventional way. It is recognised that projects should be assessed on a case by case basis.

Due to the unexpected and unprecedented effect of the pandemic on normal activity, noise monitoring cannot be conducted at this time as it does not reflect the real world conditions which normally occur.

If required, further noise monitoring can be conducted by Stantec at a later time, when the acoustic environment has returned to normal. The LAeq, LA90, LA10, LAmax and any other relevant descriptors can be assessed.

4. Operational Noise Criteria

4.1 Environmental Noise Emission Criteria from NPI

The NSW Noise Policy for Industry (NPI) is used to limit increases in noise due to industrial development, to ensure the continued amenity of existing occupants. The NPI outlines two background and ambient criteria which the development must comply with, both requiring unattended noise logging data.

The noise intrusiveness criteria (NPI section 2.3) limits intrusive noise to nearby residential receivers, and the amenity noise criteria (NPI section 2.4) controls noise according to the type of land use adjacent to the development. Both criteria are defined for three periods per 24-hour day as follows:

- **Day**: 7:00 am to 6:00 pm, Monday to Saturday and 8:00 am to 6:00 pm Sundays and Public Holidays.
- **Evening**: 6:00 pm to 10:00 pm, Monday to Sunday and Public Holidays.
- **Night**: 10:00 pm to 7:00 am, Monday to Saturday and 10:00 pm to 8:00 am Sundays and Public Holidays.

The NPI criteria are applicable only to industrial noise emissions from the development, in this case the noise of mechanical services located on the clubhouse roof and standalone plantroom on the western side of the gym. Specifically, section 1.5 states that the policy "*does not apply to… noise from sporting facilities*". Criteria for sporting facilities have been addressed in section 4.4.

4.1.1 Intrusiveness Criteria

The NPI states the following:

"The intrusiveness of an industrial noise source may generally be considered acceptable if the level of noise from the source (represented by the L_{Aeq} descriptor), measured over a 15-minute period, does not exceed the background noise level by more than 5 dB when beyond a minimum threshold."

Consequently, the intrusiveness criteria can be summarised as follows:

$L_{Aeq,15minute} \leq$ Rating Background Noise Level (RBL) + 5 dB(A)

The intrusiveness criteria for each assessment location are presented below in Table 4-1. These criteria are based on the LA90 noise levels measured at each logger location.

Compliance with external criteria is assessed at the most noise affected point on, or within the residential property boundary. Compliance with internal criteria assumes a minimum 10dB façade loss. Note that as outlined in section 2.1 of the NPI, the intrusiveness criteria do not apply to non-residential receivers.

Table 4-1: NSW NPI Intrusiveness criteria LAeq(15 minutes) dB(A)

	Intrusiveness Criteria LAeq(15 minutes) (dB(A))		
Boundary	Day	Evening	Night
Northern (Walker Ave)	51	47	43
Eastern (Glenmore Rd)	49	46	41
Southern (Glenmore Rd and Lawson St)	50	47	40
Western (Alma St)	57	51	47

4.1.2 Amenity Criteria

The NPI states the following regarding the amenity criteria:

"To limit continuing increases in noise levels from application of the intrusiveness level alone, the ambient noise level within an area from all industrial noise sources combined should remain below the recommended amenity noise levels specified in Table 2.2 where feasible and reasonable. The recommended amenity noise levels will protect against noise impacts such as speech interference, community annoyance and some sleep disturbance…The ***recommended amenity noise level*** *represents the objective for* ***total*** *industrial noise at a receiver location, whereas the* ***project amenity noise level*** *represents the objective for noise from a* ***single*** *industrial development at a receiver location"*

The amenity noise levels (ANL) for the relevant receiver types are presented in Table 4-2 (Table 2.2 from the NPI).

Table 4-2: NSW NPI Amenity Noise Levels

Type of Receiver	Noise Amenity Area	Time of Day	Recommended ANL LAeq,period dB(A)
Residential	Urban[1]	Day	60
		Evening	50
		Night	45
School classroom – internal	All	Noisiest 1-hour period when in use	35
Active recreation area (e.g. school playground)	All	When in use	55

Note: 1. As defined in Table 2.3 in the NPI

The Project amenity noise level for each new source of industry is defined as:

Project amenity noise level for industry developments = recommended amenity noise level - 5 dB(A)

To convert the Amenity period assessment into a $L_{Aeq,15min}$ (for direct comparison with the Intrusiveness Criteria), an addition of 3 dB(A) is applied.

Amenity project noise trigger level = recommended amenity noise level ($L_{Aeq,\ period}$) - 5 dB(A) + 3 dB(A)

The amenity noise level criteria can be summarised as in Table 4-3.

Table 4-3: NSW NPI Amenity Noise Level Criteria

Type of Receiver	Time of Day	Amenity noise criteria LAeq,period dB(A)	Amenity noise criteria $L_{Aeq,15min}$ dB(A)
Residential	Day	60	58
	Evening	50	48
	Night	45	43
School classroom – external[1]	Noisiest 1-hour period when in use	45	43
Active recreation area (e.g. school playground)	When in use	55	53

Note: 1. Assumes a 10dB loss through the façade with open windows

4.1.3 Modifying Factor Adjustments

The NPI also states:

"Where a noise source contains certain characteristics, such as tonality, impulsiveness, intermittency, irregularity or dominant low-frequency content, there is evidence to suggest that it can cause greater annoyance than other noise at the same noise level."

In order to take into account the potential annoying character of the noise, an adjustment of 5 dB(A) for each annoying character aspect and cumulative of up to a total of 10 dB(A), is to be added to the measured value to penalise the noise for its potentially greater annoyance aspect. Table C1 of the NPI (see Table 4-4 below) provides procedures for determining whether an adjustment should be applied. None of the modifying factors were deemed relevant for this site.

Table 4-4: NSW NPI – Modifying factor corrections

Factor	Assessment / Measurement	When to Apply	Correction[1]	Comments
Tonal Noise	One-third octave or narrow band analysis	Level of one-third octave band exceeds the level of the adjacent bands on both sides by: - 5 dB or more if the centre frequency of the band containing the tone is above 400 Hz - 8 dB or more if the centre frequency band containing the tone is 160 to 400 Hz inclusive - 15 dB or more if the centre frequency of the band containing the tone is below 160 Hz	5 dB[2]	Narrow-band frequency analysis may be required to precisely detect occurrence.
Low Frequency Noise	Measurement of C-weighted and A-weighted level	Measure / assesses C- and A-weighted levels over same time period. Correction to be applied if the difference between the two levels is 15 dB or more	5 dB[2]	C-weighting is designed to be more responsive to low-frequency noise, especially at higher overall levels
Impulsive Noise	A-weighted fast response and impulsive response	If difference in A-weighted maximum noise levels between fast response and impulse response is greater than 2 dB	Apply difference in measured levels as the correction, up to a maximum of 5 dB.	Characterised by a short rise time of 35 milliseconds (ms) and decay time of 1.5 s.
Intermittent Noise	Subjectively assessed	Level varies by more than 5 dB	5 dB	Adjustment to be applied for night-time only.
Duration	Single-event noise duration may range from 1.5 min to 2.5 h	On event in any 24-hour period	0 to – 20 dB(A)	The acceptable noise level may be increased by an adjustment depending on duration of noise.
Maximum Adjustment	Refer to individual modifying factors	Where two or more modifying factors are indicated	Maximum correction of 10dB(A)[2] (excluding duration correction)	

Notes:
1. Corrections to be added to the measured or predicted levels.
2. Where a source emits tonal and low-frequency noise, only one 5 dB correction should be applied if the tone is in the low-frequency range.

4.1.4 Project Noise Trigger Levels (PNTL)

Following the calculation of amenity and intrusiveness noise criteria the NPI outlines a Project Noise Trigger Level (PNTL) which is assessed as the worst-case scenario of the intrusiveness and amenity criteria. Table 4-5 presents the Project Noise Trigger Level (PNTL) for the development. These criteria must be applied at the most affected receiver boundary.

Table 4-5: NSW NPI Project Noise Trigger Levels

Type of Receiver	Time of Day	Intrusiveness Noise Level LAeq,15min dB(A)	Amenity Noise Level LAeq,15min dB(A)	Criteria Adopted for PNTL
Northern Boundary – Walker Avenue				
Residential	Day	**51**	58	Intrusiveness
	Evening	**47**	48	Intrusiveness
	Night	**43**	**43**	Amenity/Intrusiveness
Eastern boundary - Glenmore Road				
Residential	Day	**49**	58	Intrusiveness
	Evening	**46**	48	Intrusiveness
	Night	**41**	43	Intrusiveness
Southern boundary – Glenmore Road and Lawson Street				
Residential	Day	**50**	58	Intrusiveness
	Evening	**47**	48	Intrusiveness
	Night	**40**	43	Intrusiveness
Western boundary –Alma Street				
Residential	Day	**57**	58	Intrusiveness
	Evening	51	**48**	Amenity
	Night	47	**43**	Amenity
Educational	When in use	-	**43**	Amenity
Active recreation area (School playground)	When in use	-	**53**	Amenity

4.2 Traffic Noise

The permissible increase in traffic noise on the surrounding streets due to the development is outlined in the NSW *Road Noise Policy*. As outlined in Table 2 of the Road Noise Policy Alma Street is classified as a local road and Glenmore Road is classified as a sub arterial road.

Table 3 and Table 4 of the Road Noise Policy present the permissible maximum traffic noise levels for all categories of roads. The criteria for residential receivers are reproduced in Table 4-6. The criteria for educational receivers are reproduced in Table 4-7. For residential receivers the assessment point is 1 metre from the affected façade and at a height of 1.5 metres from the ground.

The traffic noise criteria are assessed considering two time periods.

Table 4-6: Road traffic noise assessment criteria for residential land uses

Road Category	Type of project/land use	Assessment criteria - dB(A)	
Freeway/arterial/sub-arterial roads	Existing residences affected by **additional traffic** on existing freeways/arterial/sub- arterial roads generated by land use developments	$L_{Aeq(15hour)}$ 60 (external)	$L_{Aeq(9hour)}$ 55 (external)
Local roads	Existing residences affected by additional traffic on existing local roads generated by land use developments	$L_{Aeq(1hour)}$ 55 (external)	$L_{Aeq(1hour)}$ 50 (external)

Table 4-7: Road traffic noise assessment criteria for educational receivers

Existing sensitive land use	Assessment criteria - dB(A)		Additional consideration
	Day (7am – 10pm)	Night (10pm – 7am)	
School classrooms	$L_{Aeq, (1\ hour)}$ 40 (internal) when in use	-	Noise level criteria for spaces other than classrooms… may be obtained by interpolation from the 'maximum' levels shown in Australian Standard 2107:2000 (Standards Australia 2000).
Open space (active use)	$L_{Aeq(15\ hour)}$ 60 (external) when in use	-	Active recreation is characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion.

In addition to the above criteria, the Road Noise Policy specifies relative increase criteria for all categories including and above sub-arterial roads. The criteria as applied to Glenmore Road are presented in Table 4-8.

Table 4-8: Relative increase criteria sub arterial roads

Road Category	Type of Project/Development	Total traffic noise level increase – dB(A)	
		Day (7am – 10pm)	Night (10pm – 7am)
Sub-arterial roads	Land use development with the potential to generate additional traffic on existing road	Existing traffic LAeq,15h + 12dB (external)	Existing traffic LAeq,15h + 12dB (external)

In all cases the noise assessment criteria are more stringent than the relative increase criteria, and has been adopted for this assessment.

4.3 Responsible Service of Alcohol (RSA) Venues

The restaurant planned for the Northern Corner of the Clubhouse is to be an RSA venue, subject to the noise emission limits set by the Office of Liquor and Gaming Regulation (OLGR), under the requirements of the Woollahra Council DCP. The OLGR condition states that the L_{10} noise level emitted by licensed premises is not to exceed the background noise level in any octave band (between 31.5Hz and 8000Hz inclusive) by more than 5dB between 7am and midnight, and is to be inaudible in any habitable room in a nearby residence between midnight and 7am. The criteria are presented in Table 4-9 based on AECOM logging data.

Table 4-9: OLGR Licensed Premises Criteria, LA10 (dB) (using AECOM noise logging)

Time Period	Octave Band Centre Frequency (Hz)									Overall (dB(A))
	31.5	63	125	250	500	1000	2000	4000	8000	
7am – Midnight	68	68	60	56	53	51	44	33	25	55
Midnight – 7am	53	52	46	45	41	36	28	16	15	42

4.4 Noise from Sports Activities

Woollahra Council does not provide formal criteria for compliance of noise emissions related to sports activities. As a guideline the noise management plan of the nearby Sydney Cricket Ground (SCG) has been used. The guideline outlines that noise at receivers from amplified speech systems should not exceed an LAmax of 60 dB(A). For this assessment this criterion has been applied to sports activities as well as any possible amplified speech systems.

Due to the transient nature of many noise events in sports activities, LAeq and LAmax have been used to assess both the steady state components of noise and the transient peak noise events. As there is no guiding criteria for the acceptable LAeq of sports activities, this has been qualitatively assessed to the existing LA90 and LAeq levels.

The SCG Noise Management Plan also states that:

> *"Sporting events will not commence before 0800 hours or finish after 2230 hours. Notwithstanding the above, events may continue until 2300 hours if an occurrence beyond the control of the SCGT delays the sporting event"*

5. Operational Noise Impact Assessment

5.1 Site Activities and Capacity

5.1.1 Existing Development

The existing development comprises of 20 tennis courts including centre courts surrounded by grandstands, with total capacity for approximately 5000 spectators.

5.1.2 Stage 1 DA Approval

While the scope of the Stage 2 DA submission is generally similar to the previously approved Stage 1 DA there are a number of key differences and reductions in scope. Changes relative to the Stage 1 DA that affect the acoustic impact arise as a consequence of:

1. No childcare centre: Childcare facilities are not included in this stage;
2. Smaller grandstand: The capacity of the grandstand overlooking the soccer field his reduced from 500 to 260 spectators.

Both of these changes reduce the acoustic impact of the Stage 2 DA as compared to the Stage 1 DA scope.

The Stage 1 DA was approved by council subject to the following conditions (section 6.11):

> *Noise impacts to nearby residences from the football field… and new tennis courts could be appropriately managed (e.g. limit hours of operation and/or frequency of use) and include appropriate noise attenuation measures. These operational details will be subject to assessment under any future development application(s).*

5.1.3 Stage 2 Proposed Development

The capacity of all venues predicted to contribute to the noise impact on the surrounding receivers is presented in Table 5-1. Although the grandstand adjacent to the soccer field can accommodate up to 260 spectators, the full capacity is highly unlikely to be utilised with the exception of soccer grand finals. Grand finals will occur at most once a year and in many years will not be hosted by White City, depending on the performance of teams within the league. The learn to swim pool is indoor (fully enclosed) and not expected to be audible at sensitive receivers.

Table 5-1: Capacity of Outdoor Venues

Space	Maximum Capacity (people)
Sports Facilities	
Tennis Courts	36
Soccer Field	25
Grandstand Seating (spectators)	260
Outdoor Pool	12-15
Multi-Purpose Courts (players and spectators)	50
Restaurant and Function Spaces	
Pool Deck Café (outdoor and indoor)	100
Club Restaurant and Bar (indoor)	60-80
Club Community Room (indoor)	280 (banquet mode)

Space	Maximum Capacity (people)
	450 (club meeting or lecture mode) 1000 (club and community special events)

The following operating hours have been proposed by P+I Group in the Operational Plan of Management with input from the sporting clubs.

Table 5-2: Proposed Operating Hours

Location	Facilities	Use of Space	Opening Hours	
			Mon.-Sat.	Sunday
Soccer Field	Soccer Field	Sports and community events	7am – 10pm[1]	7am-9.30pm[1]
Multi-purpose hard courts	Hard courts suitable for basketball, netball and futsal	Sports and community events	6am – 10pm	7am-10pm
Grass and Hard Tennis Courts	Tennis Courts	Sports and community events	6am – 10pm	10am-10pm
	Tennis Pro Shop		6am – 10pm	10am-10pm
Pools and Pool Deck	Outdoor deck area	Public, Club, community and events	6am – 12am	6am-10pm
	Learn To Swim Pool	Swimming lesson, hydrotherapy, exercise	6am-8pm	6am-6pm
	Lap Pool	Recreation, swimming lesson, hydrotherapy, exercise	6am-10pm	6am-8pm
Club Building	Restaurant (including bar)	Public, Club, community and events	9am – 12am[2]	10am-10pm
	GF, Mezzanine Floor Club		9am – 12am	10am-10pm
	L2 and L3 community space		9am – 12am[2]	10am-10pm
Southern Grandstand Building	Gym and Spa	Public, Club, community and events	5am-10pm	6am-8pm
	Pool deck Café		6.30am-12am	6.30am -10pm
	Community Space		8am-10pm	9am-1pm
Gardens and outdoor spaces	-	Community gardening & other uses	6am – 10pm	7am-10pm
Carpark and adjacent areas	-		Continuous	Continuous
Security	-	As required	Continuous	Continuous

Note: As part of the operational plan of management:

1. Use of the soccer field for large matches or matches with spectators will not occur outside the hours of 11am-7pm
2. Doors and windows will be shut after 10pm to reduce noise impacts on receivers

5.2 Operational Noise Sources

5.2.1 Mechanical services noise

External mechanical plant is located in two areas, primarily in a rooftop plantroom on the Club building, and smaller air handling plant in a plantroom on the west façade of the conserved south grandstand. The roof of the club house will house a centralised chiller and AHUs for servicing the Club building, and the plantroom off the south grandstand contains AHUs only. The Tennis Pro Shop will be serviced by a rooftop FCU.

5.2.2 Outdoor Sports Activities

Soccer Field

The proposed development converts several existing grass tennis courts, located to the north of the site, into a soccer field. The soccer field would replace 12 full size grass tennis courts, and 3 mini courts. The nearest receivers are the residences at 20-24 Walker Street.

The noise impact of the soccer field is a combination of the noise from players on the field and spectators in the grandstand. The noise effect of players on the field is anticipated to be predominately that of random calls and shouts from players, distributed evenly across the area of the field. For matches attended by significant numbers of spectators, the spectators will contribute noise from the 'babble' of general conversation and infrequent short periods of raised voices or shouting. Referee whistles and any speech amplification systems to be installed could also contribute to short term high impact noise events.

A landscape border is proposed along the stormwater channel adjacent to the soccer field.

Tennis Courts

The tennis courts are located on the eastern section of the site, closest to 400 Glenmore Road. The development adds three tennis courts to the west of the existing six courts, and relocates the two mini courts to the south of the existing courts. The total capacity of these courts is 36 players. Two of the three new tennis courts are raised approximately 3 metres above the ground level of the eastern boundary, which will reduce their noise impact to receivers on this boundary.

Noise impact from tennis courts is anticipated to be somewhat similar to the current situation, comprising some court noise, and players talking at conversational or raised voice level. The majority of the courts have a synthetic grass surface which will reduce the level of ball impact noise compared to hard surfaced courts.

Outdoor Pool

The outdoor pool is located in the centre of the development. The pool is designed for lap swimming and is not sufficiently deep to permit diving. The noise impact is expected to be steady state noise of general conversation and water noise. Transient events of louder voices could occur from time to time but are not anticipated to be a frequent occurrence.

Unlike the Stage 1 Concept DA, regenerated noise is unlikely to be a factor from use of the outdoor pool. Whereas the Stage 1 concept DA had above ground pools, both pool structures are now borne on a solid base, on grade.

The adjacent 'Learn to Swim' pool is fully enclosed and is not expected to contribute to the noise impact on the receivers.

Multipurpose Courts

The multipurpose court is located to the west of the site, and is expected to be predominantly used for basketball, netball and futsal. The nearest receiver is the outdoor play area of the Sydney Grammar preparatory school located on Alma Street. The courts are expected to accommodate a maximum of 50 players and spectators. The noise from the courts is expected to be steady state in nature with frequently occurring transient events such as ball bounces and raised voices.

The courts will include a weatherproof screen constructed of heavy vinyl or similar, which will cause some reduction in noise transmission to the school when in use.

5.2.3 Club Community Room and Restaurants

The development proposes two food and drink service venues. A café with indoor and outdoor seating is proposed on level one of the gym, and a restaurant and bar with a terrace is proposed on level two of the club building. A club community room is also proposed on level 2 of the club building. Intended uses of the club community room include community gatherings and functions. The operating hours and capacity of each venue are outlined in Section 5.1. The use of these venues for large gatherings is not expected to occur concurrently with significant sports events. Typical use will involve multiple small groups speaking at only conversational noise level. This is not anticipated to be audible to the receivers.

5.2.4 Traffic Noise

Based on the Stage 2 DA Traffic Impact Assessment authored by Ason, the anticipated traffic generation of the Detailed DA proposal is the same or lesser at all times of day as compared to the approved Stage 1 DA design. No change is expected to the level of traffic noise as compared to the previously approved Stage 1 Acoustic DA Report.

5.2.5 Carpark

The development includes undercover car parks beneath the gym building, and surface level parking near the club house. As per the Stage 1 DA, details of the proposed noise mitigation strategy should be determined during the design stage of the development.

5.3 Noise Modelling

Noise modelling has been prepared to assess compliance with NSW NPI criteria for mechanical services, and qualitatively assess the impact of sports noise from the site on the community.

Noise modelling of the detailed DA design and operating plan was conducted using SoundPLAN version 8.1, a comprehensive software package for estimating noise impacts from predetermined sources. The software is recognised by regulatory authorities around Australia and is endorsed by the NSW EPA for the use in development projects.

Using the software, a 3D model of the site and its surroundings was constructed. The model incorporates all operational sources of noise. Within the model, the effects of the environment (built and natural) on propagation of sound are taken into account to reliably estimate the resulting noise effects on the surrounding receivers. The analysis was conducted using neutral meteorological conditions.

5.3.1 Assumptions

Two assessments were conducted; one for compliance with the NSW NPI and one to assess the impact on the community of noise from sports activity. The NPI assessment considers only the effect of steady state noise sources (mechanical services). As sports noise is non-steady state in nature, the sports activity assessment considers events as single, instantaneous occurrences, and also their cumulative effect.

The following assumptions are common to both:

- All assessments have been performed to a spatial resolution of two metres squared.
- The predicted noise levels at the nearby sensitive receivers have been assessed with the acoustic recommendations as shown in Section 5.3.5 implemented.
- The noise levels were assessed considering neutral meteorological conditions.

In addition, the following specific assumptions apply:

NPI Assessment

- The noise impact is assessed at 1.5 metres above the ground level at each sensitive receiver. As the terrain is uneven, this corresponds to a different absolute height at each receiver.
- The assessment is based on the nominal selections for mechanical plant.
- The daytime, evening and night periods are defined as per the NPI (refer to section 4.1).

Sports Noise Assessment

- The cumulative effect of noise has been assessed using the LAeq descriptor, considering a 'reasonable' weekly worst case 15-minute period of activity.
- The effect of single high intensity events has been assessed using the LAmax descriptor.
- Noise levels at two heights have been presented, one at 1.5m above the soccer field and lower tennis court ground level, and one at 1.5m above the pool deck, hard court, and upper tennis court level.
- Less common events like annual grand finals are not assessed. Mitigation of these infrequent events will be achieved by appropriate management of community expectations around these events.

5.3.2 Source Sound Power Levels (SWL)

Two descriptors have been used to assess the impact of noise; LAeq and LAmax. The LAeq descriptor represents the level either of steady state noise or an 'average' noise level of a fluctuating noise source over a given period of time . The LAmax descriptor considers a single transitory 'peak noise' event.

NPI Assessment

The LAeq sound power level of all mechanical sources are presented in Table 5-3.

Table 5-3: Manufacturer Sound Power Levels of all mechanical sources LAeq

Noise Source	Nominal Unit	SWL (dB), Frequency (Hz)							Overall SWL (dB(A))
		63	125	250	500	1000	2000	4000	
Air Handling Units (2 each in south grandstand/Club plantrooms)	RadiPac K3G560-PC04-31	72	79	77	83	81	77	81	87
Club plantroom chiller	Trane RTMA S 210	101	97	92	88	85	83	77	91[1]
Pro Tennis Shop VRF	Daikin REYQ28THY1(E)	-	-	-	-	-	-	-	83[2]

Note:
1. The overall level provided in the catalogue does not match the spectrum levels presented in the catalogue. For assessment the worst case has been used.
2. Spectral levels not provided; assessment has been conducted using overall level only

Sports Noise Assessment

The cumulative impact of sports activities on the surrounding community has been assessed using the LAeq descriptor. Table 5-4 presents the 'average' sound pressure levels for all sports activity sources, considering a weekly worst case 15 minute period. The noise from sports activities is a combination of ball/pool noise and speech noise. All sources are point sources except where otherwise specified. The regularity of peak noise events has been accounted for in the LAeq levels.

Where sources are those of people speaking, sound pressure levels (SPL) for speech at different levels of voice effort are defined in AS 2822:1985 *Methods of Assessing and Predicting Speech Privacy and Speech Intelligibility*. These are presented as well as the associated sound power levels (SWL) in Table 5-5.

Table 5-4: Sound Power Levels of all sports activity sources

Noise Source	Reference	Overall SWL (dB(A))
Soccer Field	Sport Scotland[1]	63 (per m^2)
Referee whistle	ASA[2]	Included in LAmax model only[3]

Noise Source	Reference	Overall SWL (dB(A))
Grandstand, half of crowd speaking at conversational voice level	AS 2822	84.5 (total SWL as line source)
Tennis Court	BISp[2]/AS 2822	76
Lap Pool	BISp[2]/AS 2822	78
Multipurpose Hard Court	AS 2822	78

Note:
1. The Sport Scotland study measured the average LAeq of a soccer field across a variety of training and match activities of all age groups and genders
2. Refer to Section 1.2 for body represented by acronym
3. The effect on LAeq of infrequent whistle blows is included in the SWL of the soccer field

Table 5-5: AS 2822 LAeq of speech at different levels of voice effort

Noise Source	Reference	SPL (dB) @ Distance	Overall SWL (dB(A))
Conversational Voice (single person)	AS 2822	60 @ 1m	70.5
Raised Voice (single person)	AS 2822	66 @ 1m	76.5
Loud/Stage Voice (single person)	AS 2822	72 @ 1m	82.5
Shouting Voice (single person)	AS 2822	78 @ 1m	88.5

Weekly peak noise scenarios are assessed using the LAmax descriptor. The worst case scenario for each boundary is not likely to occur simultaneously, so four separate studies have been conducted assessing the worst case for each group of receivers. The scenarios are presented in Table 5-6.

Table 5-6: LAmax Weekly Worst Case Scenarios

Boundary	Receivers	Simultaneously occurring events	SWL (dB(A))
North-eastern	Walker Street	Four players on soccer field with loud voice	82 (each speaker)
		Cheer from grandstand, three quarters of crowd cheering with loud voices (max. 50 people)	99.5 (total SWL of line source)
		Referee whistle on soccer field	85[1]
		One raised voice on one northmost tennis court	76
Eastern	400 Glenmore Road	Raised voices on three of nine tennis courts	76 (each speaker)
		One person shouting on one tennis court	88
		One person shouting at lap pool	88
Southern	351 to 357 Glenmore Road, 81 Cambridge Street	Shouting voices on two of three southmost tennis courts, raised voice on third southmost court	88 (each shouting speaker), 76
		Three loud voices on hard courts	82 (each speaker)
		One person shouting at lap pool	88

Boundary	Receivers	Simultaneously occurring events	SWL (dB(A))
Western	Edgecliff Preparatory School, 302 Glenmore Road, 1 to 5 Lawson Street	Three raised voices on hard courts	82 (each speaker)
		One person shouting at lap pool	88

Note: 1. A 'low effort' whistle blow as defined in the ASA study is expected for a community game with minimal crowd

5.3.3 Results

NPI Assessment

The predicted noise impact on the nearest sensitive receivers is presented in Figure 5-1 through Figure 5-5 . The expected levels as compared to the controlling Project Trigger Noise Levels (PNTL) are presented in Table 5-7. In all cases the most stringent criteria is the night time criteria. The current design is expected to comply with the NPI.

Table 5-7: NSW NPI Project Noise Trigger Levels – Southern Boundary

Boundary (Receiver)	Overall	PNTL (LAeq,15min, dB(A))	Complies (Y/N)
North eastern (residential)	<40	46	Y
Eastern (residential)	<40	41	Y
Southern (residential)	40	40	Y
Western (educational)	43	43	Y
Western (school playground)	43	53	Y

Figure 5-1: NPI Assessment Walker Street

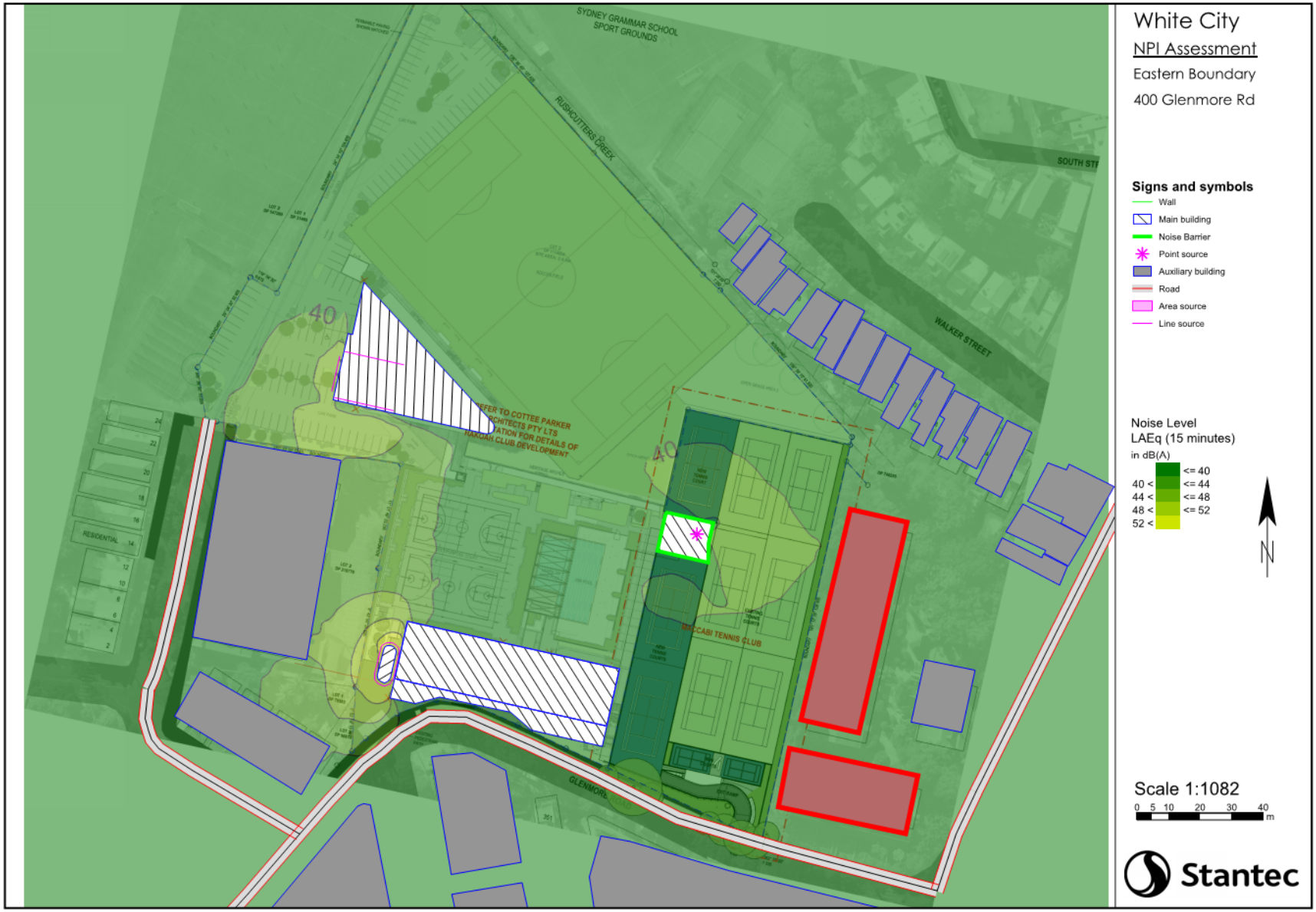


Figure 5-2: NPI Assessment 400 Glenmore Rd

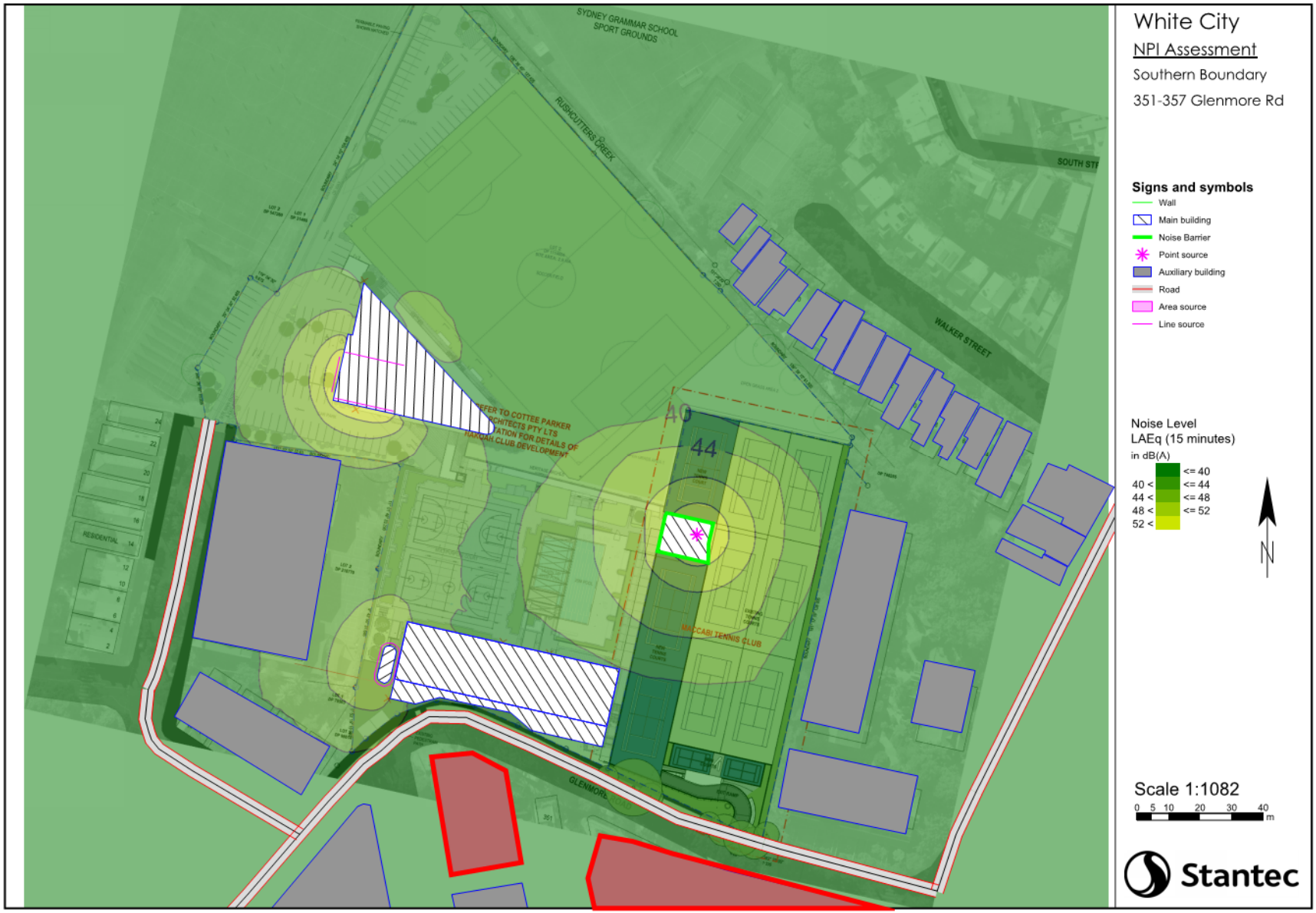


Figure 5-3: NPI Assessment 351-357 Glenmore Rd

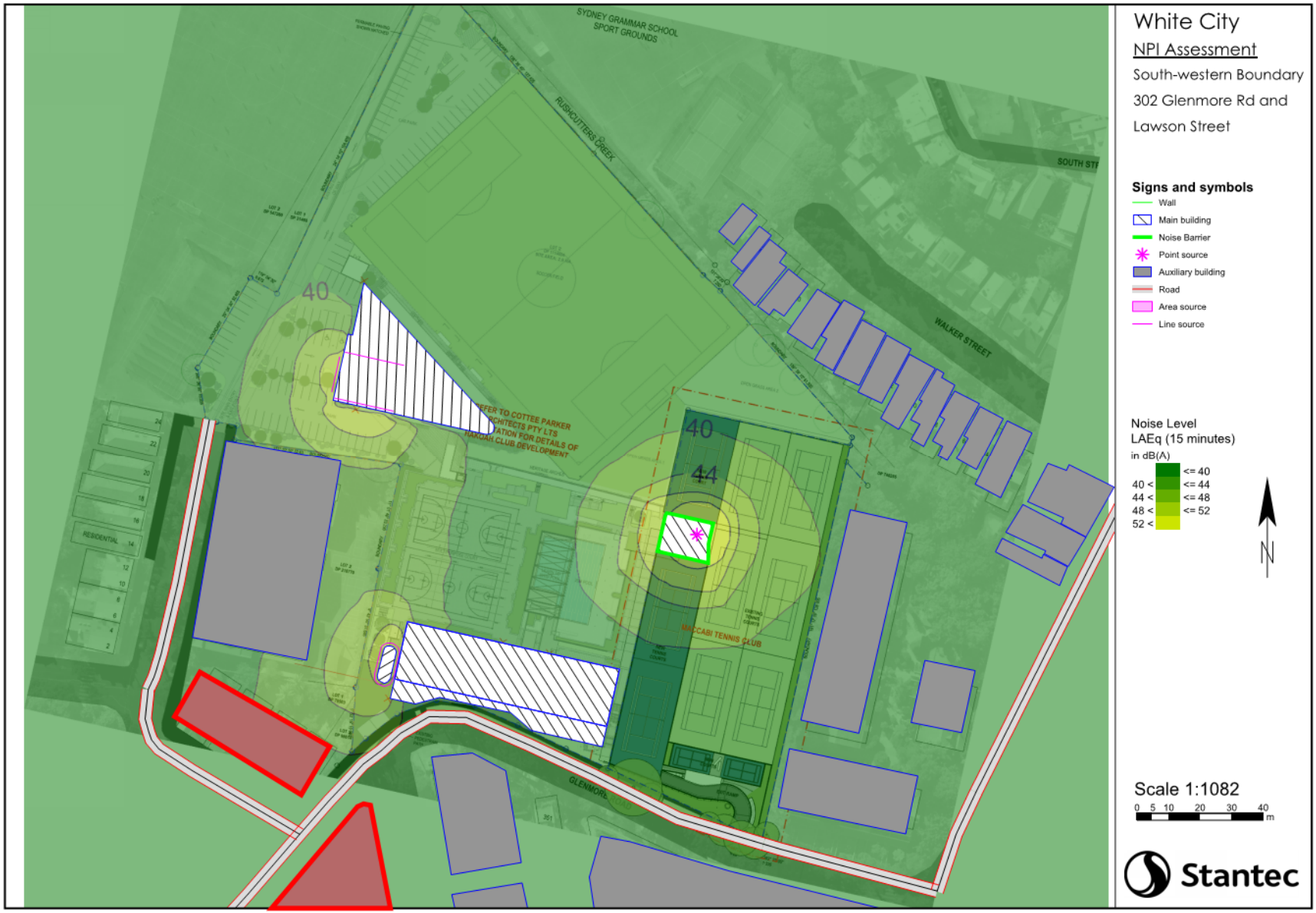


Figure 5-4: NPI Assessment 302 Glenmore Rd and Lawson Street

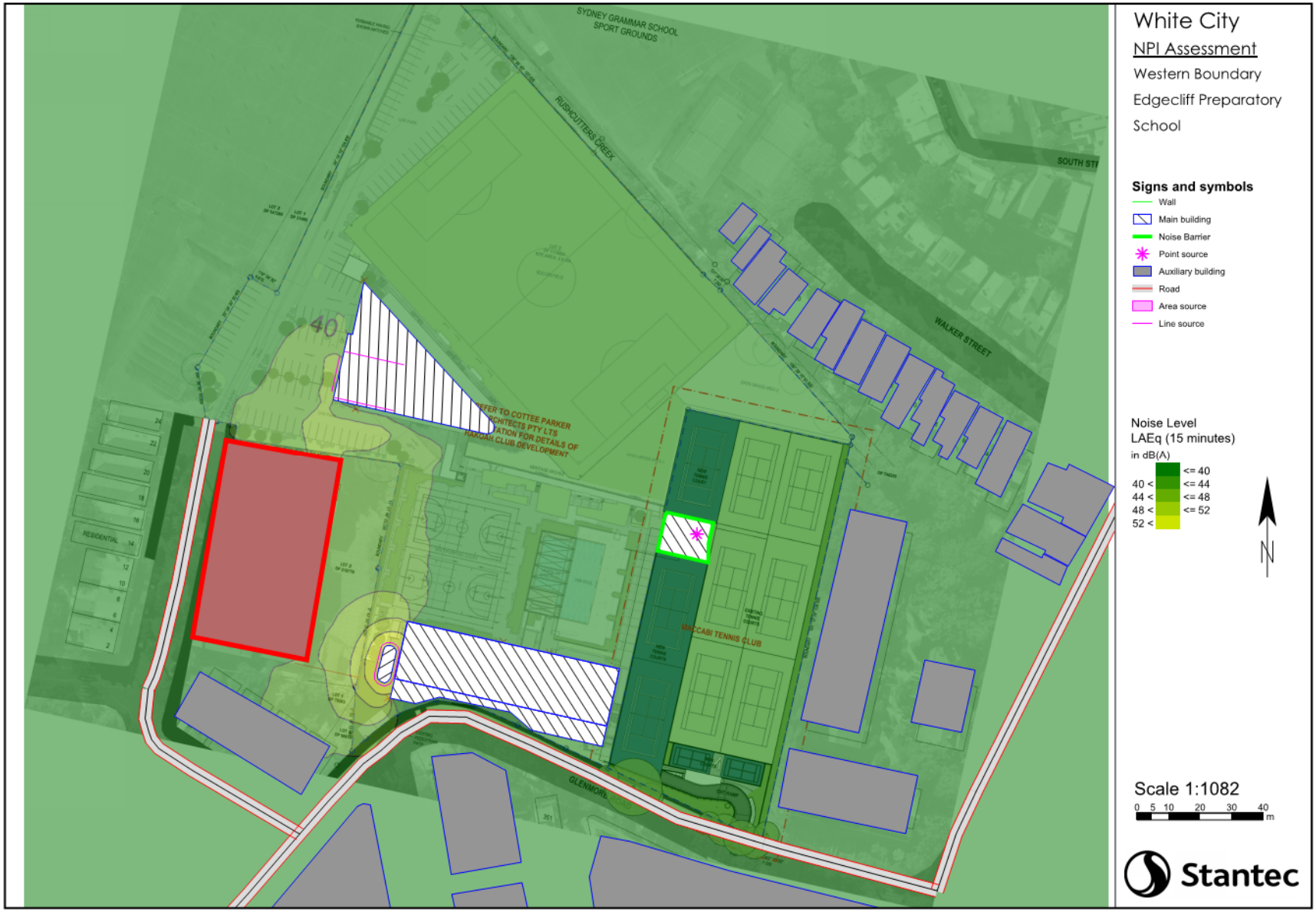


Figure 5-5: NPI Assessment Edgecliff Preparatory School

Sports Noise Assessment

Several studies have been performed based on the assumptions outlined in section 5.3.1. The average noise level at all boundaries has been assessed using the LAeq descriptor with the sound power levels presented in Table 5-4, and the peak noise scenario for each boundary has been assessed using the LAmax descriptor as outlined in Table 5-6. Where a receiver is affected by sources at both the height of the soccer field and pool deck, the noise effect at 1.5m above each of these levels is presented. The effect of a three metre tall barrier to reduce noise to the most affected receivers along Walker Avenue has also been presented (refer to section 5.3.5 for details). Detailed grid noise maps of all scenarios are presented in Appendix B.

Table 5-8 presents the 'average' LAeq noise level at each boundary and the contribution each source makes to that overall level. Values in grey contribute negligibly to the overall level of noise at the receiver. In all cases the presented values are those at the worst affected point along the receiver boundary.

The overall level is compared to the existing LAeq and LA90 levels in Table 5-9. A noise impact has been considered mild where the predicted noise contribution of the site is approximately equal to the existing LAeq, and moderate where the predicted contribution exceeds the existing LAeq by 3 dB or more. Contributions that are at or below the existing LA90 background noise level are not likely to be perceptible.

Table 5-8: Contribution from all sources to weekly worst case LAeq,15min

Boundary	Soccer Players	Grandstand	Tennis Court	Outdoor Pool	Hard Courts	Overall
North Eastern (Walker Ave) No Barrier	59	33	40	24	26	**59**
North Eastern (Walker Ave) Barrier	54	33	40	24	26	**54**
Eastern Boundary (400 Glenmore Rd)	50	31	46	32	30	**52**
Southern Boundary (Glenmore Rd)	44	22	36	27	26	**45**
Western Boundary (Edgecliff Preparatory School)	45	22	30	32	41	**46**

Table 5-9: Comparison of weekly worst case LAeq,15min with existing environment

Boundary	Overall	Existing LAeq (Day)	Existing LA90 (Day)	Impact
North Eastern (Walker Ave) No Barrier	**59**	55	46	Moderate
North Eastern (Walker Ave) Barrier	**54**	55	46	Mild
Eastern Boundary (400 Glenmore Rd)	**52**	56	44	Mild
Southern Boundary (Glenmore Rd)	**45**	62	45	No effect
Western Boundary (Edgecliff Preparatory School)	**46**	60	52	No effect

Table 5-10 and Table 5-11 present a similar analysis considering LAmax levels. Long term LAmax levels of the existing site are not available to directly compare results with, although attended measurements suggest that at some boundaries they are significantly higher than the LAeq (refer to section 3.1.2). In the absence of LAmax data the effect of the source has been considered mild where the LAmax level is approximately equal to the existing LAeq. Contributions which are below the LAeq of the area are not expected to be intrusive.

Table 5-10: Contribution from all sources to weekly worst case LAmax

Boundary	Soccer Players	Grandstand	Referee Whistle	Tennis Court	Outdoor Pool	Hard Courts	Overall
North Eastern (Walker Ave) No Barrier	46	48	54	32	-	-	**56**
North Eastern (Walker Ave) Barrier	45	48	44	32	-	-	**50**
Eastern Boundary (400 Glenmore Rd)	-	-	-	55	37	-	**56**
Southern Boundary (Glenmore Rd)	-	-	-	44	32	32	**45**
Western Boundary (Edgecliff Preparatory School)	-	-	-	-	37	49	**50**

Table 5-11: Comparison of weekly worst case LAmax with existing environment

Boundary	Overall	Existing LAeq (Day)	Existing LA90 (Day)	Impact
North Eastern (Walker Ave) No Barrier	**56**	55	46	Mild
North Eastern (Walker Ave) Barrier	**50**	55	46	No effect
Eastern Boundary (400 Glenmore Rd)	**56**	56	44	No effect[1]
Southern Boundary (Glenmore Rd)	**45**	62	45	No effect
Western Boundary (Edgecliff Preparatory School)	**50**	60	52	No effect

Note: 1. LAmax effect of tennis courts anticipated to be similar to impact of existing site

Considering only the sources associated with the soccer field, the modelling predicts a lesser noise impact from the estimated worst case LAmax scenario as compared to the estimated worst case LAeq scenario. For the purpose of this assessment the more conservative results should be considered as a basis for design, corresponding to the data measured by Sports Scotland and Sports England.

5.3.4 Discussion

While intermittent sources and speech sources typically cause more disturbance when compared to steady state sources, the occurrence of sports activity from the existing site and surrounds means the neighbouring receivers will already be somewhat accustomed to sports noise, reducing the impact of the development. The existing noise environment at all boundaries includes varying degrees of intermittent noise impacts from activity on the existing tennis courts. Additionally, there are sports fields operated by other parties to the north and north-west of the site, and Trumper oval to the south-east

of 400 Glenmore Road. Although the development will vary the sources and distribution of sports noise, the community is likely to be less sensitive to this change due to the existing level of intermittent sporting activity.

The most significant noise source of the development is the soccer field, and the most affected boundary is along Walker Avenue. Walker Avenue may currently experience a low level of soccer noise from the field to the north-west of 24 Walker Avenue and will be accustomed to the use of the White City tennis courts in the existing development. The intensity of the noise impact is likely to be somewhat greater through the use of the soccer field as compared to the tennis courts, however management of the scheduled use of the field can be employed to maintain acceptable levels of acoustic amenity.

Use of the grandstand for regular games with fewer than 50 attendees is not anticipated to be audible at receivers except where events such as goals occur. These events are not expected to occur with sufficient regularity to cause significant annoyance at the receivers as a result of spectators in the grandstand.

Finally, it is noted that the expected overall the impact of the development is less than what is allowed for in the existing use rights, based on the current capacity of the grandstands.

5.3.5 Mitigation Strategies

No changes to design are required to achieve compliance with the mandatory NPI criteria. There are no regulatory compliance requirements for the impact of sports noise on the community, but the following actions can be considered to reduce the effect on the community.

If a speech or music amplification system is installed it must not exceed an LAmax of 60dB(A) at the nearest boundary, as per the Sydney Cricket Ground Noise Management Plan. The system must be designed considering the directivity of the speakers, to reduce unnecessary noise spill. Amplification systems should not be used outside the hours of 11am-7pm, and should be avoided where it is not necessary.

To reduce the noise impact of soccer training and matches to the worst affected receivers along Walker street, a three-metre-high, solid, high-density, barrier can be considered for part of the North-eastern boundary, in the location shown in Appendix B. However, it is understood that this conflicts with other council requirements for visibility to the proposed Paddington Greenway, and avoiding obstruction to, or interference with flood drainage from the site.

Typical use of the club facilities is not anticipated to be audible at the sensitive receivers. Noise management protocols can be established for large events using the restaurant/bar and the community space in the Club. In the event that amplified music is being played in the evening, one such protocol can be to ensure external doors and windows are shut by 10pm. This includes the sliding doors to the terrace from the Club community space, which can be closed if there is music above a specified level.

6. Conclusion

Stantec Engineers were engaged by P+I Group to prepare an acoustic report for the Stage 2 Development Application for the development and expansion of the existing White City Tennis Centre located at 30 Alma Street, Paddington.

Based on the existing noise environment as outlined in Section 3, this report has provided criteria, and in-principle acoustic controls for the development.

The criteria discussed in Section 4 are a mixture of statutory and non-statutory criteria which aim to preserve the acoustic amenity of the surrounding receivers.

Section 5 details the predicted acoustic impact of the site, considering both industrial and non-industrial noise sources, and provides recommendations for compliance with the nominated criteria. No changes to the existing design are required for compliance with NPI criteria, and mitigation measures have been proposed to preserve community amenity with regard to sports noise. The noise impact of the site is dominated by the soccer field, although the effect is partially offset by the removal of tennis courts in this area. Less common events like annual grand finals have not been considered and appropriate community management of expectations around these events should be employed.

It is the opinion of Stantec Engineers that the development is not expected to generate an unacceptable level of noise provided that appropriate design considerations and mitigation measures are implemented. Even though no assessment can be considered as being thorough enough to preclude all potential environmental impacts, having given regard to the above listed conclusions, it is the finding of this assessment that the development application should not be refused on acoustic grounds.

The information presented in this report shall be reviewed if any modifications to the features of the development specified in this report occur, including and not restricted to selection of mechanical units, layout of equipment, modifications to the building and introduction of any additional noise sources.

Appendix A Glossary of Acoustic Terms

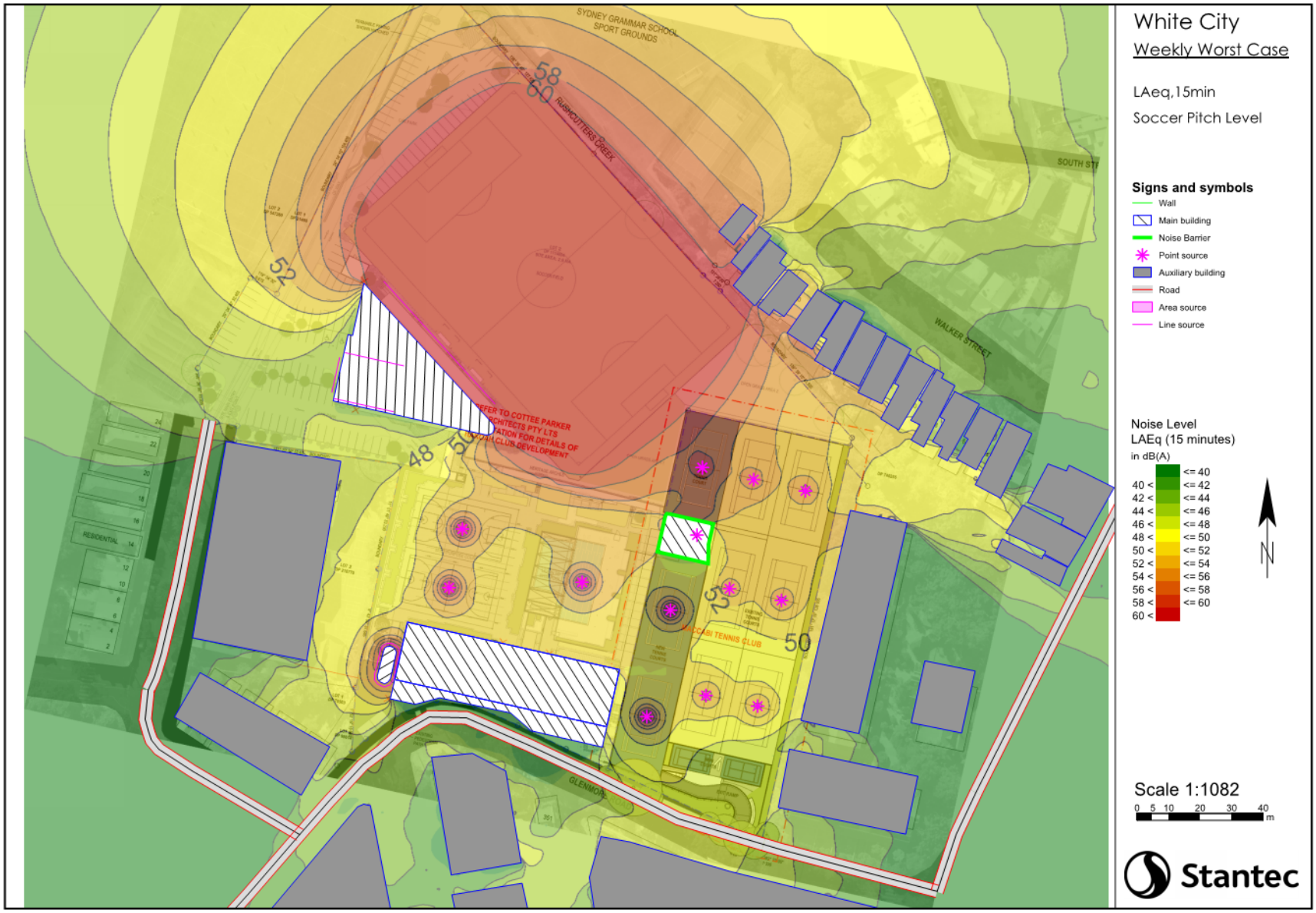
NOISE	
Acceptable Noise Level:	The acceptable LAeq noise level from industrial sources, recommended by the EPA (Table 2.1, INP). Note that this noise level refers to all industrial sources at the receiver location, and not only noise due to a specific project under consideration.
Adverse Weather:	Weather conditions that affect noise (wind and temperature inversions) that occur at a particular site for a significant period of time. The previous conditions are for wind occurring more than 30% of the time in any assessment period in any season and/or for temperature inversions occurring more than 30% of the nights in winter).
Acoustic Barrier:	Solid walls or partitions, solid fences, earth mounds, earth berms, buildings, etc. used to reduce noise.
Ambient Noise:	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment Period:	The period in a day over which assessments are made.
Assessment Location	The position at which noise measurements are undertaken or estimated.
Background Noise:	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L90 noise level.
Decibel [dB]:	The units of sound pressure level.
dB(A):	A-weighted decibels. Noise measured using the A filter.
Extraneous Noise:	Noise resulting from activities that are not typical of the area. Atypical activities include construction, and traffic generated by holidays period and by special events such as concert or sporting events. Normal daily traffic is not considered to be extraneous.
Free Field:	An environment in which there are no acoustic reflective surfaces. Free field noise measurements are carried out outdoors at least 3.5m from any acoustic reflecting structures other than the ground
Frequency:	Frequency is synonymous to pitch. Frequency or pitch can be measured on a scale in units of Hertz (Hz).
Impulsive Noise:	Noise having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent Noise:	Level that drops to the background noise level several times during the period of observation.
LAmax	The maximum A-weighted sound pressure level measured over a period.
LAmin	The minimum A-weighted sound pressure level measured over a period.

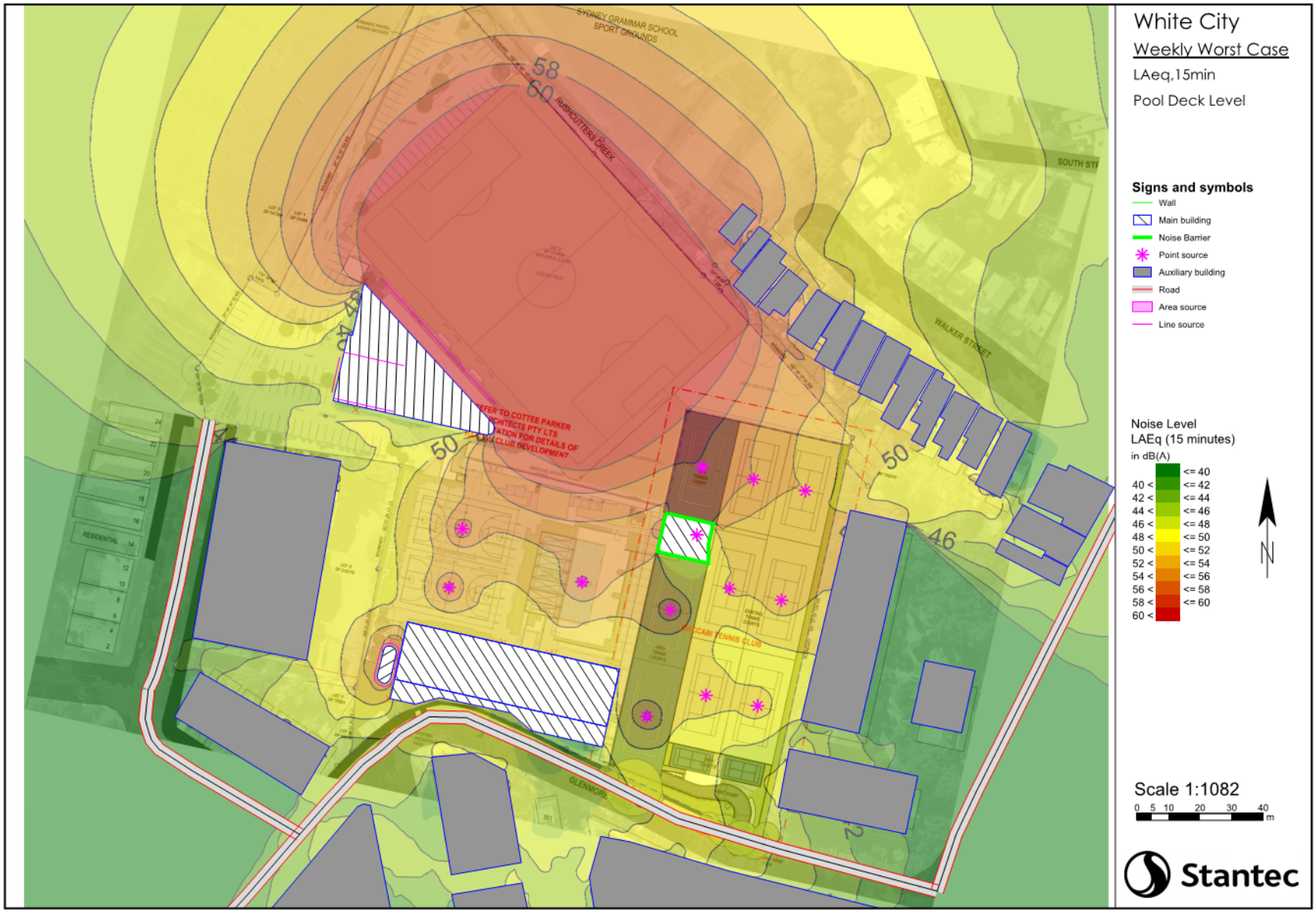
LA1	The A-weighted sound pressure level that is exceeded for 1% of the time for which the sound is measured.
LA10	The A-weighted sound pressure level that is exceeded for 10% of the time for which the sound is measured.
LA90	The A-weighted level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
LAeq	The A-weighted “equivalent noise level” is the summation of noise events and integrated over a selected period of time.
LAeqT	The constant A-weighted sound which has the same energy as the fluctuating sound of the traffic, averaged over time T.
Reflection:	Sound wave changed in direction of propagation due to a solid object met on its path.
R-w:	The Sound Insulation Rating R-w is a measure of the noise reduction performance of the partition.
SEL:	Sound Exposure Level is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
Sound Absorption:	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound Level Meter:	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound Pressure Level:	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound Power Level:	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise:	Containing a prominent frequency and characterised by a definite pitch.

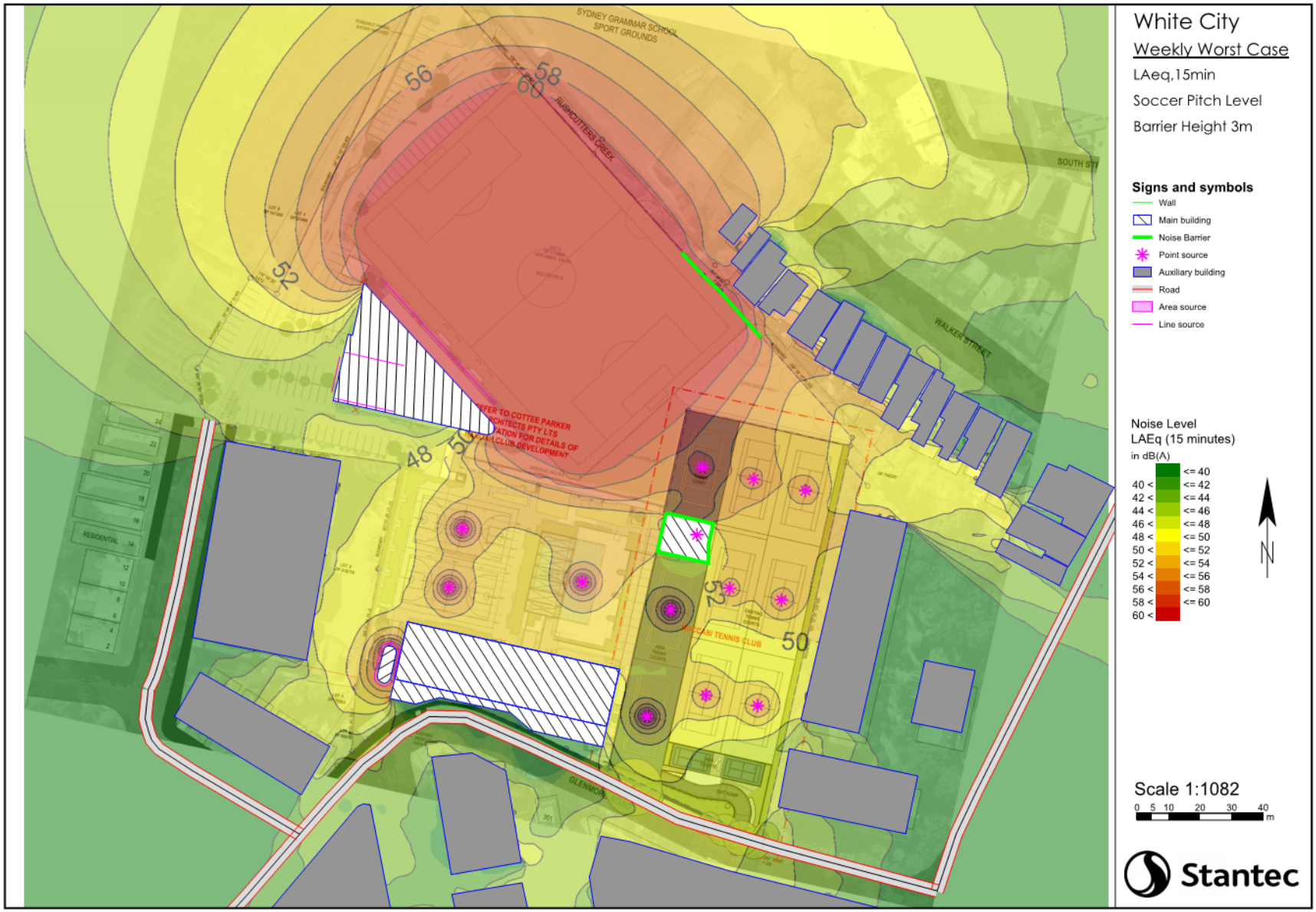
Appendix B Sports Noise Assessment Grid Noise Maps

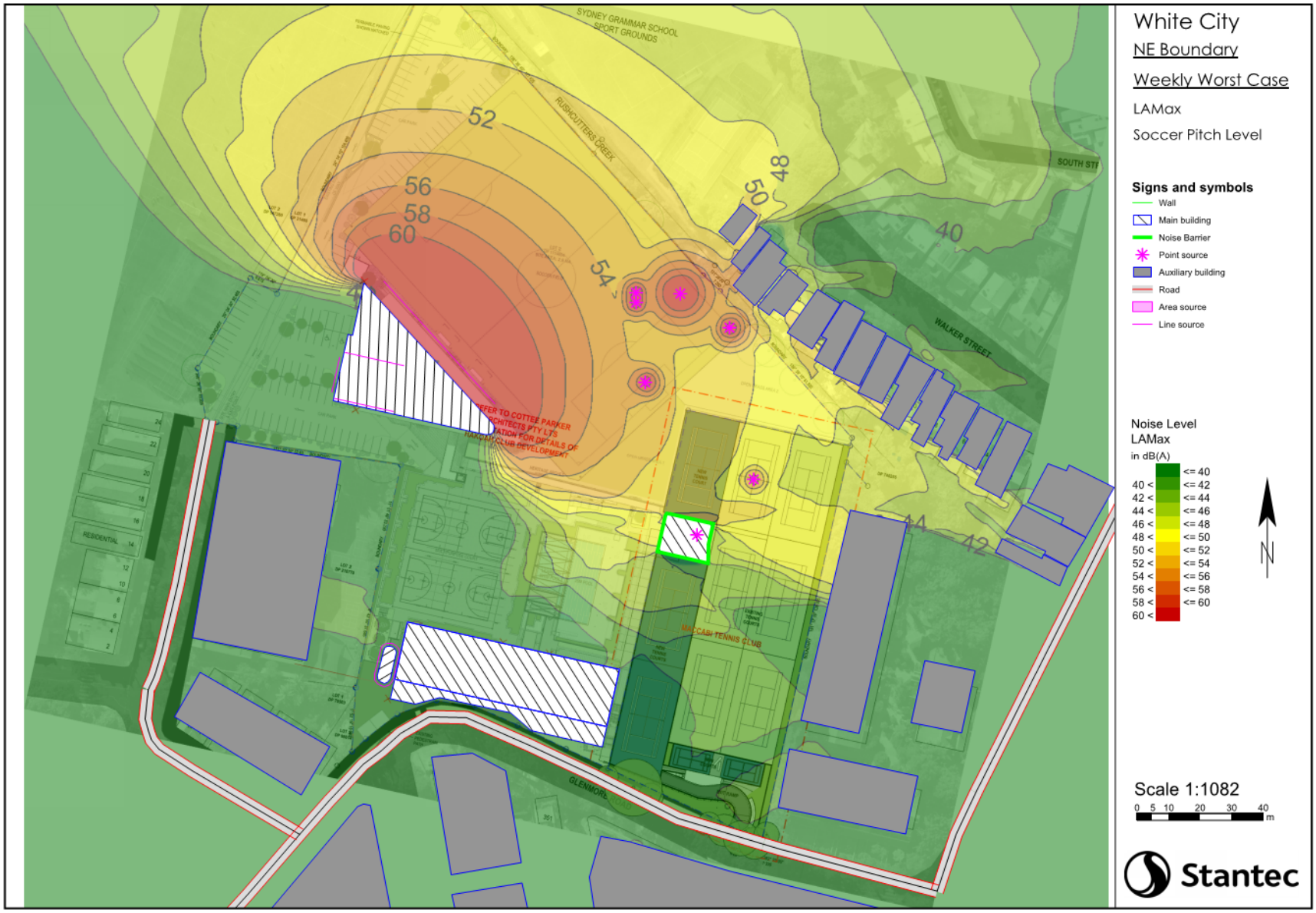
Refer to the following table for description of each plot:

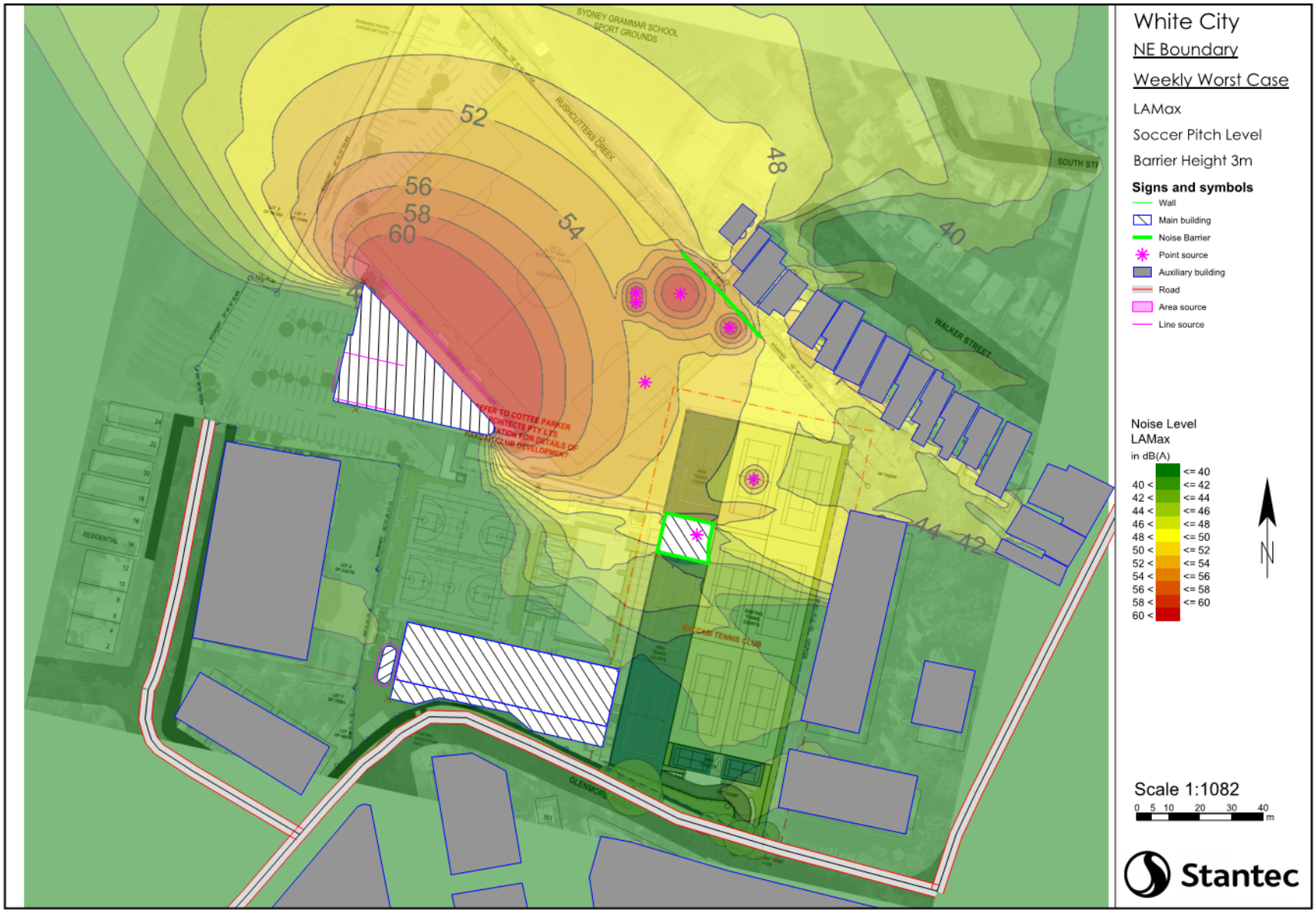
Page Number	Descriptor	Description of model	Sources Height
37	LAeq	All Boundaries Soccer Level Sources - No Barrier	1.5m above soccer field
38	LAeq	All Boundaries Pool Level Sources	1.5m above pool deck
39	LAeq	All Boundaries Soccer Level Sources - 3m Barrier	1.5m above soccer field
40	LAmax	North-eastern Boundary Soccer Level Sources - No Barrier	1.5m above soccer field
41	LAmax	North-eastern Boundary Soccer Level Sources - 3m Barrier	1.5m above soccer field
42	LAmax	Eastern Boundary Tennis Court Sources	1.5m above soccer field
43	LAmax	Eastern Boundary Tennis Court Sources	1.5m above pool deck
44	LAmax	Southern Boundary Tennis, Pool and Court Sources	1.5m above soccer field
45	LAmax	Southern Boundary Tennis, Pool and Court Sources	1.5m above pool deck
46	LAmax	Western Boundary Pool and Court Sources	1.5m above pool deck

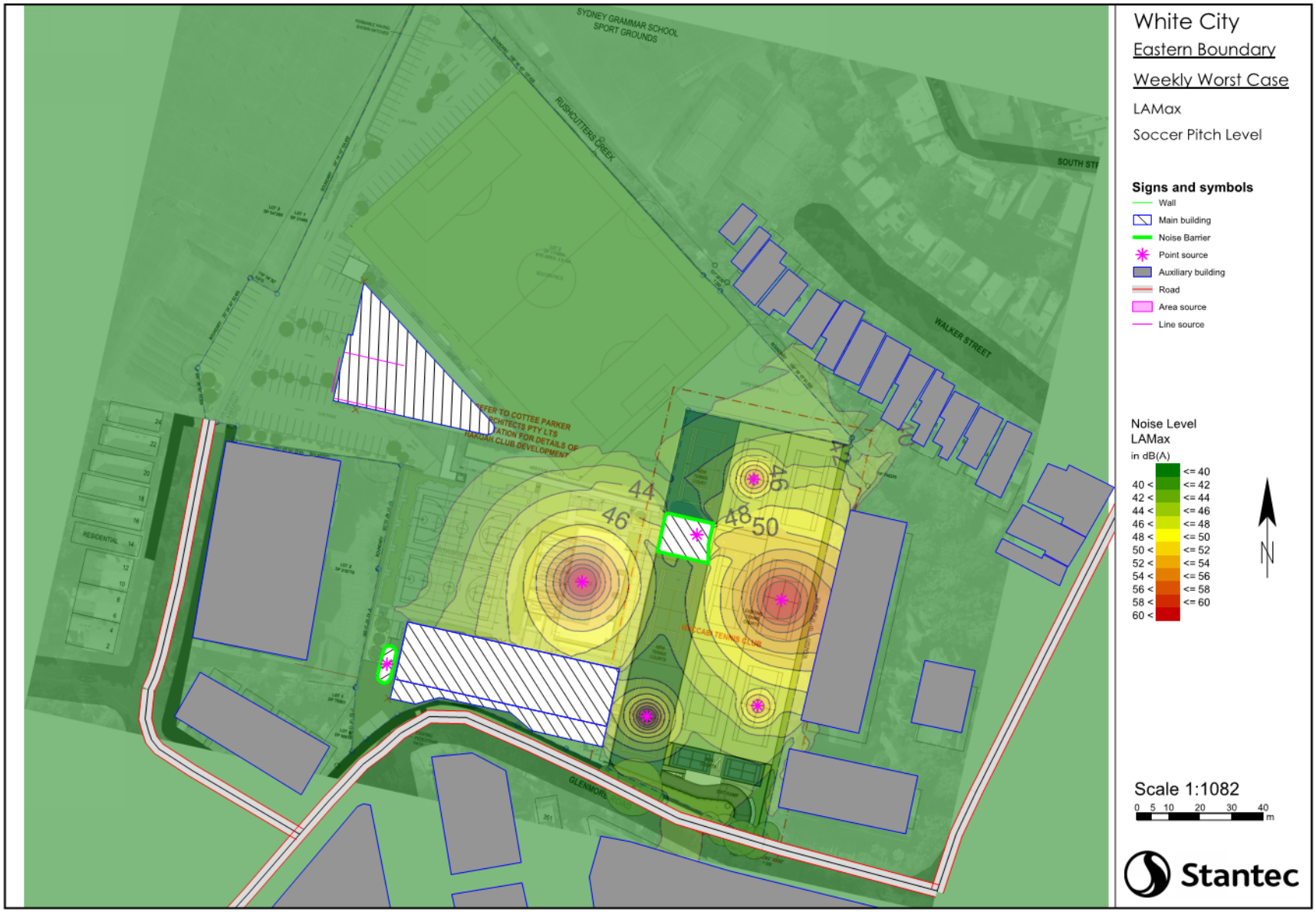

White City
Weekly Worst Case
LAeq,15min
Soccer Pitch Level
Signs and symbols
Wall
Main building
Noise Barrier
Point source
Auxiliary building
Road
Area source
Line source
Noise Level
LAEq (15 minutes)
in dB(A)
40 < <= 40
40 < <= 42
42 < <= 44
44 < <= 46
46 < <= 48
48 < <= 50
50 < <= 52
52 < <= 54
54 < <= 56
56 < <= 58
58 < <= 60
N
Scale 1:1082
0 5 10 20 30 40 m
Stantec
SYDNEY GRAMMAR SCHOOL SPORT GROUNDS
RUSHCUTTERS CREEK
WALKER STREET
SOUTH ST
RESIDENTIAL
GLENMORE
58
60
52
48
50
54

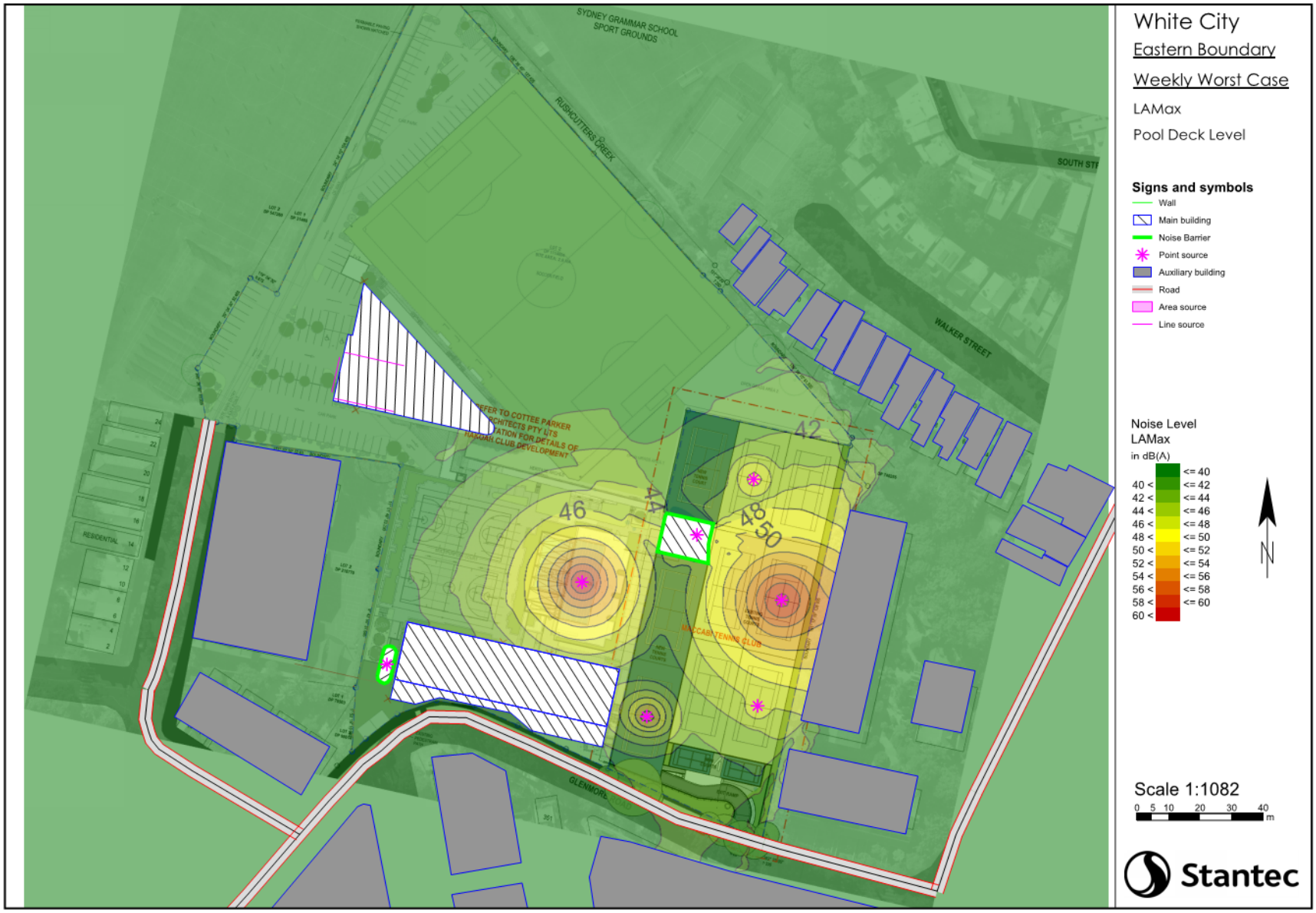

White City
Weekly Worst Case
LAeq,15min
Pool Deck Level
Signs and symbols
Wall
Main building
Noise Barrier
Point source
Auxiliary building
Road
Area source
Line source
Noise Level
LAEq (15 minutes)
in dB(A)
<= 40
40 < <= 42
42 < <= 44
44 < <= 46
46 < <= 48
48 < <= 50
50 < <= 52
52 < <= 54
54 < <= 56
56 < <= 58
58 < <= 60
Scale 1:1082
0 5 10 20 30 40 m
Stantec
SYDNEY GRAMMAR SCHOOL SPORT GROUNDS
RUSKCUTTERS CREEK
WALKER STREET
GLENMORE
58
60
50
46
48

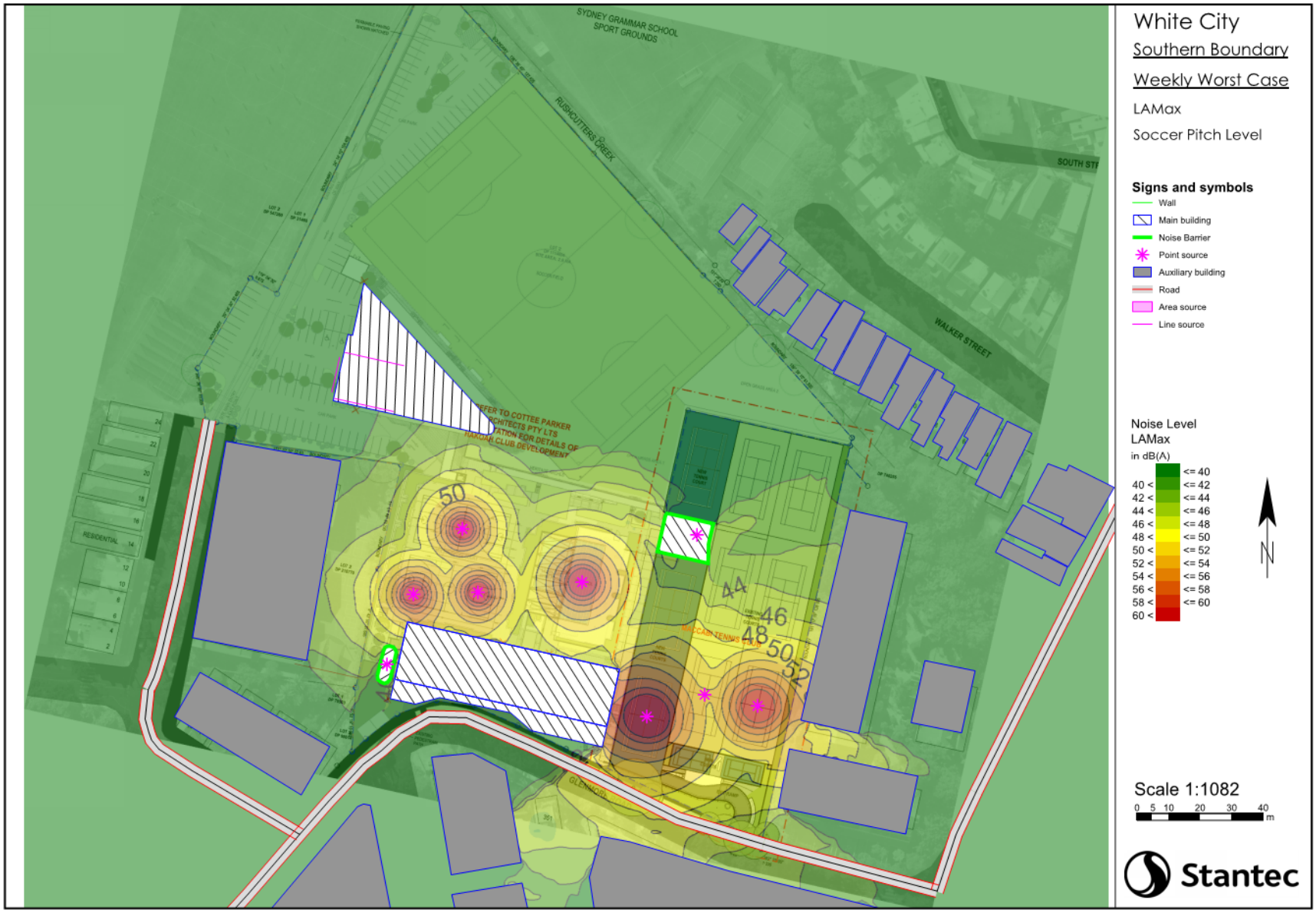

White City
Weekly Worst Case
LAeq,15min
Soccer Pitch Level
Barrier Height 3m
Signs and symbols
Wall
Main building
Noise Barrier
Point source
Auxiliary building
Road
Area source
Line source
Noise Level
LAEq (15 minutes)
in dB(A)
<= 40
40 < <= 42
42 < <= 44
44 < <= 46
46 < <= 48
48 < <= 50
50 < <= 52
52 < <= 54
54 < <= 56
56 < <= 58
58 < <= 60
Scale 1:1082
0 5 10 20 30 40 m
Stantec
SYDNEY GRAMMAR SCHOOL SPORT GROUNDS
RUSHCUTTERS CREEK
WALKER STREET
SOUTH ST
GLENMORE
RESIDENTIAL
56
58
60
52
48
50

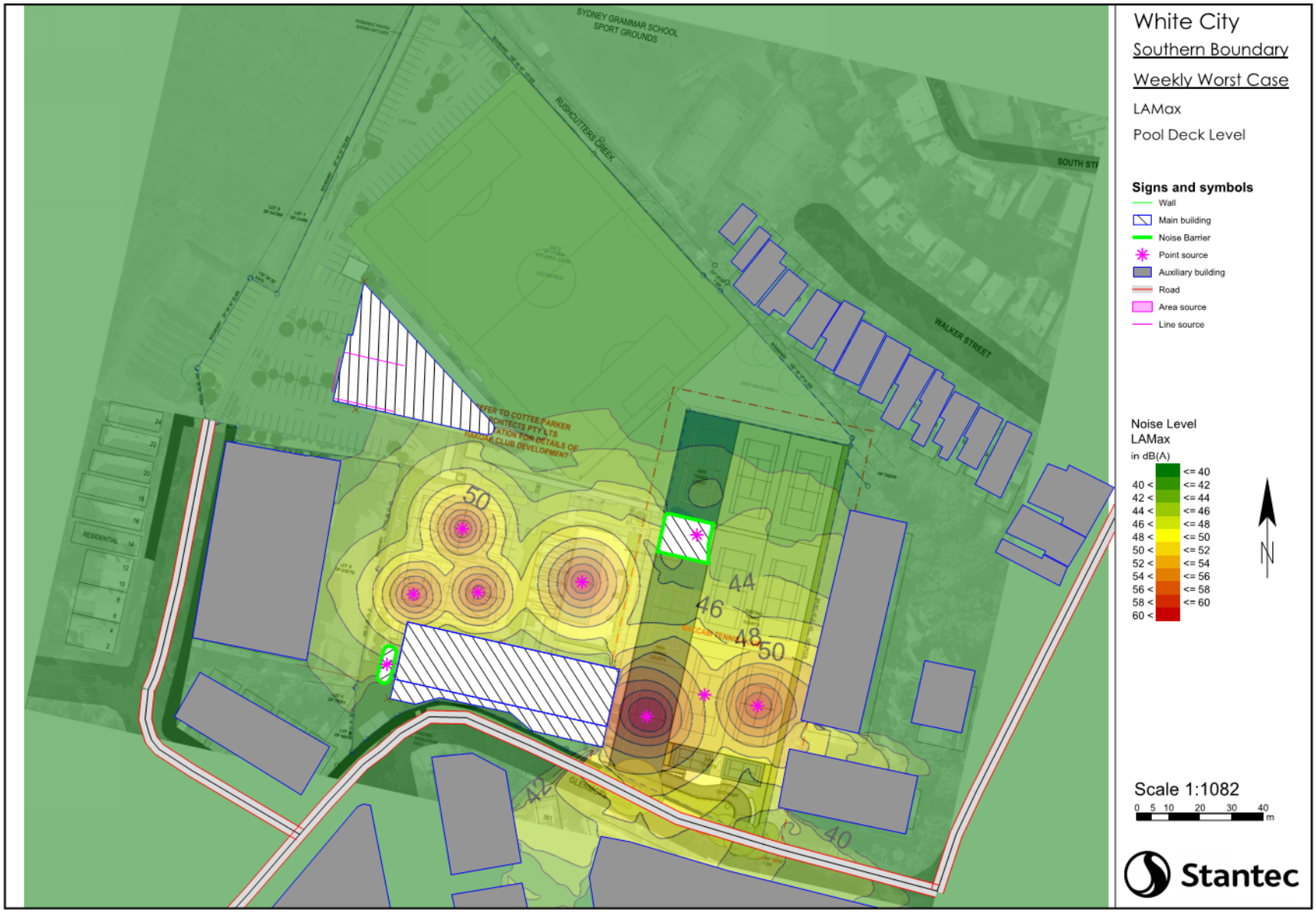

White City
NE Boundary
Weekly Worst Case
LAMax
Soccer Pitch Level
Signs and symbols
Wall
Main building
Noise Barrier
Point source
Auxiliary building
Road
Area source
Line source
Noise Level
LAMax
in dB(A)
<= 40
40 < <= 42
42 < <= 44
44 < <= 46
46 < <= 48
48 < <= 50
50 < <= 52
52 < <= 54
54 < <= 56
56 < <= 58
58 < <= 60
Scale 1:1082
0 5 10 20 30 40 m
Stantec
SYDNEY GRAMMAR SCHOOL SPORT GROUNDS
RUSKCUTTERS CREEK
SOUTH ST
WALKER STREET
GLENMORE
52
56
58
60
54
50
48
42
40


White City
NE Boundary
Weekly Worst Case
LAMax
Soccer Pitch Level
Barrier Height 3m
Signs and symbols
Wall
Main building
Noise Barrier
Point source
Auxiliary building
Road
Area source
Line source
Noise Level
LAMax
in dB(A)
<= 40
40 < <= 42
42 < <= 44
44 < <= 46
46 < <= 48
48 < <= 50
50 < <= 52
52 < <= 54
54 < <= 56
56 < <= 58
58 < <= 60
Scale 1:1082
0 5 10 20 30 40 m
Stantec
52
56
58
60
54
48
40
44
42
SYDNEY GRAMMAR SCHOOL SPORT GROUNDS
RUSSCUTTERS CREEK
WALKER STREET
GLENWORTH
RESIDENTIAL
REFER TO COTTEE PARKER ARCHITECTS PTY LTD'S DOCUMENTATION FOR DETAILS OF TARCOOLA CLUB DEVELOPMENT


White City
Eastern Boundary
Weekly Worst Case
LAMax
Soccer Pitch Level
Signs and symbols
Wall
Main building
Noise Barrier
Point source
Auxiliary building
Road
Area source
Line source
Noise Level
LAMax
in dB(A)
<= 40
40 < <= 42
42 < <= 44
44 < <= 46
46 < <= 48
48 < <= 50
50 < <= 52
52 < <= 54
54 < <= 56
56 < <= 58
58 < <= 60
Scale 1:1082
0 5 10 20 30 40 m
Stantec
SYDNEY GRAMMAR SCHOOL SPORT GROUNDS
RUSHCUTTERS CREEK
WALKER STREET
GLENMORE
MACCABI TENNIS CLUB
RESIDENTIAL
44
46
48
50


White City
Eastern Boundary
Weekly Worst Case
LAMax
Pool Deck Level
Signs and symbols
Wall
Main building
Noise Barrier
Point source
Auxiliary building
Road
Area source
Line source
Noise Level
LAMax
in dB(A)
<= 40
40 < <= 42
42 < <= 44
44 < <= 46
46 < <= 48
48 < <= 50
50 < <= 52
52 < <= 54
54 < <= 56
56 < <= 58
58 < <= 60
Scale 1:1082
0 5 10 20 30 40 m
Stantec
SYDNEY GRAMMAR SCHOOL SPORT GROUNDS
RUSHCUTTERS CREEK
WALKER STREET
GLENWORTH
RESIDENTIAL
46
47
48
50
42


White City
Southern Boundary
Weekly Worst Case
LAMax
Soccer Pitch Level
Signs and symbols
Wall
Main building
Noise Barrier
Point source
Auxiliary building
Road
Area source
Line source
Noise Level
LAMax
in dB(A)
<= 40
40 < <= 42
42 < <= 44
44 < <= 46
46 < <= 48
48 < <= 50
50 < <= 52
52 < <= 54
54 < <= 56
56 < <= 58
58 < <= 60
Scale 1:1082
0 5 10 20 30 40
m
Stantec
SYDNEY GRAMMAR SCHOOL SPORT GROUNDS
RUSHCUTTERS CREEK
WALKER STREET
RESIDENTIAL
50
46
48
50
52


White City
Southern Boundary
Weekly Worst Case
LAMax
Pool Deck Level
Signs and symbols
Wall
Main building
Noise Barrier
Point source
Auxiliary building
Road
Area source
Line source
Noise Level
LAMax
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40 < <= 42
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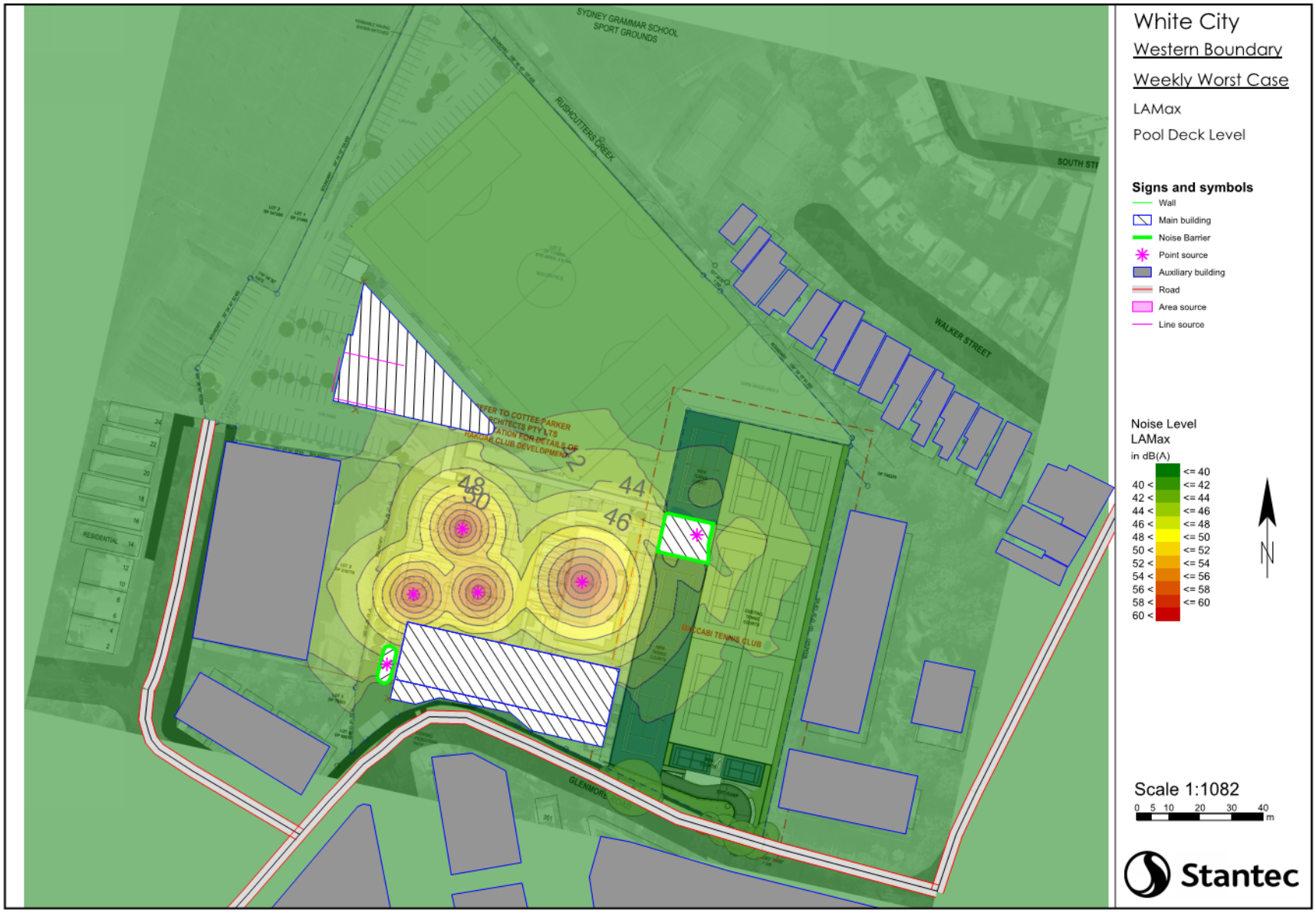
46 < <= 48
48 < <= 50
50 < <= 52
52 < <= 54
54 < <= 56
56 < <= 58
58 < <= 60
Scale 1:1082
0 5 10 20 30 40 m
Stantec
SYDNEY GRAMMAR SCHOOL SPORT GROUNDS
RUSKCUTTERS CREEK
WALKER STREET
SOUTH ST
RESIDENTIAL
50
44
46
48
50
42
40


White City
Western Boundary
Weekly Worst Case
LAMax
Pool Deck Level
Signs and symbols
Wall
Main building
Noise Barrier
Point source
Auxiliary building
Road
Area source
Line source
Noise Level
LAMax
in dB(A)
<= 40
40 < <= 42
42 < <= 44
44 < <= 46
46 < <= 48
48 < <= 50
50 < <= 52
52 < <= 54
54 < <= 56
56 < <= 58
58 < <= 60
Scale 1:1082
0 5 10 20 30 40 m
Stantec
SYDNEY GRAMMAR SCHOOL SPORT GROUNDS
RUSHCUTTERS CREEK
WALKER STREET
SOUTH ST
GLENMORE
MACCABI TENNIS CLUB
RESIDENTIAL
42
44
46
48
50

Design with
community in mind

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E sydney@wge.com.au

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