PMDL Architecture & Design Pty Ltd

Pymble Ladies College, Aquatic & Fitness Centre

Masterplan Acoustic Impact Study

Report No. 20C-12-0186-TRP-266499-2

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EXECUTIVE SUMMARY

Vipac Engineers & Scientists Ltd. (VIPAC) has been commissioned by Pymble Ladies College to provide a report on the acoustic issues related to the Masterplan for the proposed upgrade of Pymble Ladies College, Avon Road, Pymble. The project involves upgrade of the existing playing field with a new undercover carpark, a new indoor aquatic and fitness centre, addition of a new dining facility and a healthcare centre.

An acoustic assessment of the proposed upgrade of the school facilities up has been carried out in accordance with the relevant noise policies and Australian Standards as detailed in Section 3.

A noise survey was conducted to measure the surrounding environmental noise and noise from outdoor sporting activity. Limiting noise criteria for school activities and mechanical plant/equipment have been determined based on NSW Industrial Noise Policy (see Section 4.3).

Noise issues related to the school upgrade have been considered. Issues related to noise emission from the new facilities upon the nearby sensitive receivers have been identified and discussed (see Section 5). In general, it is anticipated that any potential noise associated with the new facilities would not cause an increase in impact to the surround residential receivers. The selection of building facades (including glazing) and the acoustic attenuation measures for mechanical equipment would be designed to improve the amenity of the surroundings receivers.

During the detailed design a comprehensive acoustic assessment would be conducted to ensure that any acoustic measures required are appropriately incorporated.

In conclusion, our study indicates that acoustic issues related to the upgrade of these school facilities are not expected to create an adverse impact onto the surround residents.

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1 INTRODUCTION

Vipac Engineers & Scientists Ltd. (VIPAC) has been commissioned by PMDL to provide an acoustic assessment for the Master Plan of the proposed upgrade at Pymble Ladies College, Avon Road, Pymble.

The site is bound by Avon Road to the north and west, a golf club to the west and residential buildings to the south and south-east. The site plan is shown in Appendix B.

2 SITE & DEVELOPMENT DETAILS

The nearest receivers which have potential for noise impact are:

- Residents along the south east boundary. These dwellings are accessible/located to the north of Pymble Avenue.
- Residents to the west and south west. These dwellings are along Avon Road.

The school upgrade will comprise of:

- Stage 1: New aquatic and fitness centre.
- Stage 2: Raised Mollie Dive outdoor playing field with a parking level below.
- Stage 3: A new dining facility.
- Stage 4: A new health care centre.

The layout for the upgrade is shown in Figure 1.

The nature of the development and existing surroundings have been considered to determine the acoustic issues that have potential to impact on noise sensitive receivers. For this study, following noise issues have been identified and have been considered in the assessment:

- Noise emissions from the new buildings and the playing fields.
- Noise impact from mechanical services of the new facilities upon the surroundings.
- Noise impact issues upon the surrounding related to vehicle activity using the facilities.
- Potential impact from traffic activity noise associated with the new facilities.
- Construction activity noise.

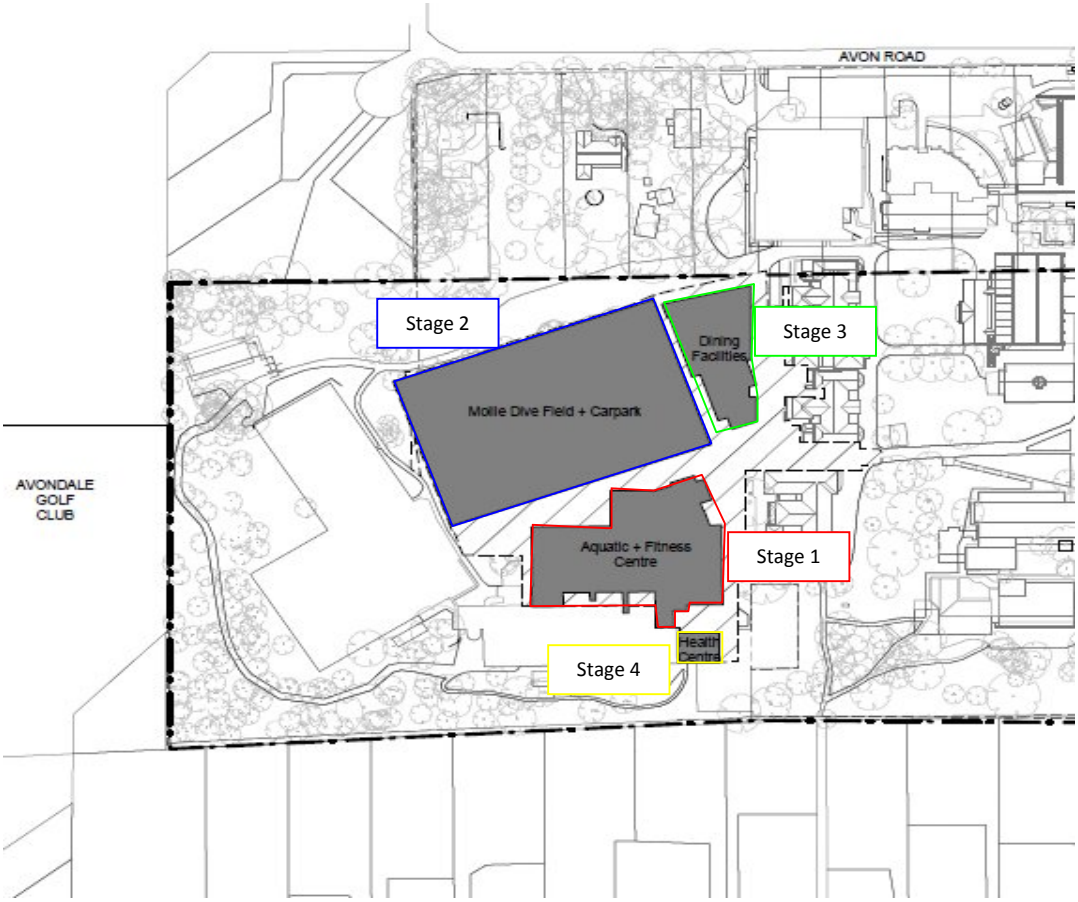

Figure 1: School upgrade layout

The school will operate between 8 am and 4 pm Monday to Friday. The existing sport facilities hours are as follows.

- Monday-Friday 5am to 8 pm.
- Saturday: 7am to 4 pm.

The future operational hours of the school and the new sports facilities for stage 1 works will remain as current.

3 NOISE ASSESSMENT CRITERIA

The following standards will be used in the assessment.

- Director General requirements;
- NSW OEH Industrial Noise Policy;
- NSW OEH Road Noise Policy;

- AS/NZ 2107:2000- Recommended design sound levels and reverberation times for building interiors;
- NSW OEH Interim Construction Noise Guidelines.

3.1 DIRECTOR GENERAL REQUIREMENTS

Condition 6 of the Director General's requires that:

Identify and provide a quantitative assessment of the main noise generating sources and activities at all stages of construction, and any noise sources during operation. Outline measures to minimise and mitigate the potential noise impacts on surrounding occupiers of land.

Relevant Policies and Guidelines:

- *NSW Industrial Noise Policy (EPA).*
- *Interim Construction Noise Guidelines (DECC).*

Where criteria have not been specified, we will consider the relevant Australian standards and OEH guidelines.

3.2 NSW OEH INDUSTRIAL NOISE POLICY

The procedures detailed in OEH Industrial Noise Policy has two requirements that must be met, namely:

- that the noise source not be 'intrusive'; and also
- that the 'amenity' of the nearby land be preserved.

This policy sets out two separate noise criteria designed to ensure developments meet environmental noise objectives. The first criterion accounts for intrusive noise and the second criterion applies to protection of amenity of particular land uses. The development is assessed by applying both the amenity and intrusiveness criteria to the situation and adopting the more stringent of the two. This becomes the project specific noise levels. Applying the most stringent requirement as the Project Specific Noise Levels ensures that both intrusive noise is limited and the amenity is protected.

3.3 INTERNAL NOISE LEVEL DESIGN CRITERIA

To ensure that a building envelope protects against external noise intrusion such as mechanical services noise, the internal noise levels should be assessed in accordance with Australian Standard *AS/NZS 2107: 2000 Acoustics – Recommended Design Sound Levels and Reverberation times for Building Interiors (Table 1).*

The following Figure 2 presents the recommended values by AS/NZS 2107.

Table 1: Recommended design sound levels for building interiors, educational buildings

Type of occupancy/activity	AS2107 Recommended design sound level, L_{Aeq}, dBA	
	Satisfactory	Maximum
Gymnasiums,	45	55
Indoor pool hall (with coaching)	45	50
Dining hall	45	50
Kitchens & service areas	50	55
Health building consulting room	40	45
Office area	40	45

3.4 OEH NSW ROAD NOISE POLICY

Table 2 presents the OEH's road traffic noise assessment criteria for land use developments with potential to create additional traffic on existing roads. The external criteria are assessed at 1 metre from the affected residential building façades and at a height of 1.5 metres from the floor.

Table 2: Road traffic noise assessment for Residential Land Use.

Road Category	Type of project / land use	Assessment criteria, dB(A)	
		Day (7am - 10pm)	Night (10pm-7am)
Local roads	Existing residences affected by additional traffic on existing local roads generated by land use developments	$L_{Aeq, (1\ hour)}$ 55 (external)	$L_{Aeq, (1\ hour)}$ 50 (external)

Note: In cases where noise exceeds the above criteria:

1. The OEH recommends that "where feasible, existing noise levels should be mitigated to meet the noise criteria. In this regard the RNP states that for existing roads there is limited potential for noise control as the development is not linked to road improvements. It does however advise that applicable strategies include appropriate location of private access roads; regulating times of use; using clustering; using 'quiet' vehicles; and using barriers and acoustic treatments."
2. For existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level should be limited to 2 dB above that of the corresponding 'no build option'.

3.5 GUIDELINES FOR CONSTRUCTION NOISE

The following guidelines for The Interim Construction Noise Guideline was developed by the NSW Office of Environment & Heritage.

The Guideline presents two ways of assessing construction noise impacts – the quantitative method, which is generally suited to longer-term construction, and the qualitative method, which is generally suited to short-term works such as infrastructure maintenance. Using a quantitative as described in the guideline the noise criteria as presented in Table 3 would be adopted.

Table 3: Noise at Residences Using Quantitative Assessment

Time of day	Management level, $L_{Aeq(15min)}$	How to apply
Recommended standard hours Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays and Public Holidays	Noise affected RBL+10dB	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured $L_{Aeq\ (15\ min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75dBA	The highly noise affected level represents the point above which there may be strong community reaction to noise. • Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences. 2. if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended hours	Noise affected RBL+5dB	• A strong justification would typically be required for works outside the recommended standard hours. • The proponent should apply all feasible and reasonable work practices to meet the noise affected level. • Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community. • For guidance on negotiating agreements see section 7.2.2. of guideline.

4 NOISE SURVEY

4.1 NOISE MEASUREMENTS

Unattended noise monitoring was conducted on site for a period of five days between the 30th July and 3rd August 2012. The monitor was placed on the south boundary where the nearest residential neighbours are located.

The monitor internal software calculated and stored the L_n percentile noise levels for each 15 minute sampling period. Measurements were made of L_{Amin}, L_{Amax}, L_{A90}, L_{A10}, and L_{Aeq}, the results were stored in an internal memory and were later retrieved for detailed analysis.

Attended noise measurements were also conducted to obtain the noise levels of the outdoor play. The measurements were made on 30th July at 3:45 pm when a number of players were playing on the fields. Measurement locations are shown in Figure 2.

4.2 INSTRUMENTATION

Measurements were conducted using the following equipment:

- Larson Davis Sound Level Meter LD870, Serial Number 1464.
- Bruel & Kjaer 2250 Sound Level analyser, Serial Number 2590541.
- Cirrus CRL 511E Sound Level Calibrator, Serial Number 21578.

The instruments were checked for calibration immediately before and after the measurements and there was no adverse deviation between the two. The instruments carry traceable calibration certificates.

The sound analysers are Type 1 and comply with the Australian standard AS1259.2: 1990.

4.3 AMBIENT NOISE LEVELS AND NOISE GOALS

For assessment purposes, the survey results were analysed in accordance with the OEH Industrial Noise Policy where the time periods are defined as:

- Day: 7am – 6pm
- Evening: 6pm – 10pm
- Night: 10pm – 7am

Using the unattended noise monitor data the ambient noise levels have been established. During the monitoring period, the weather was good, calm and dry. Table 4 presents a summary of ambient and background noise and Project Specific Levels for this site.

Table 4: Amenity Criteria, Intrusiveness Criteria and Project Specific Noise Levels at Noise Sensitive Receiver

All Values in dBA

Receiver Type	Period	LAeq	RBL	Recommended Acceptable LAeq1	Amenity Criteria	Intrusiveness Criteria	Project Specific Levels
Residential	Day	56	40	55	55	45	45
	Evening	50	38	45	45	43	43
	Night	45	32	40	40	37	37

Hence noise from mechanical plant equipment from the school should not exceed the Project Specific Noise Levels specified above.

5 ASSESSMENT

5.1 NOISE EMISSIONS FROM THE NEW FACILITIES (MASTERPLAN PROPOSALS)

The following are the potential noise sources from the operation of new facilities to the surrounding residential dwellings which need to be considered:

- Activities from the new indoor aquatic and fitness centres (stage 1).
- Sports activity on the Mollie Dive sports field (stages 1 to 4).
- Traffic activity noise and undercover carpark (stage 2).
- New dining facility and new Health care centre (stages 3 and 4).
- Operation of new mechanical services (stages 1 to 4).

In stage 1, the new facilities will be used by the students for teaching/training purposes and for sports tournaments/carnivals as part of their school activities. Subsequent stages which will be subject to separate DA consents, may seek to extend the use of facilities outside of the school community.

5.2 NOISE EMISSION FROM THE NEW AQUATIC & FITNESS CENTRE (STAGE 1 WORKS)

The new aquatic and fitness centre will be located to the north of the PE centre at the approximate location of the existing outdoor pool. The pool is currently located outdoors with external seating areas. The new pool and fitness facilities will be fully enclosed and will incorporate a new lap pool with spectator seating area, a learners pool, fitness studio and associated amenities.

1 Recommended Acceptable LAeq noise level for residence in suburban areas from Table 2.1 in EPA Industrial Noise Policy

Taking into consideration the attenuation effects of the external building envelope, laminated glazing (with good acoustic seals), shielding effect of the existing PE building and distance to the receivers, we would expect that any activity noise associated with the use of the aquatic centre would be controlled within the buildings and would therefore not be audible at the nearest receivers. Overall, we would expect that the new indoor facility will improve the acoustic amenity of the surrounding residential receivers.

5.3 NOISE EMISSIONS FROM MOLLIE DIVE SPORTS FIELD

As part of our noise survey, we visited the school during an after-school sports session. While players, trainers and instructors were on the fields, attended noise measurements were taken of activity on the sports fields at the boundary of the playing field.

Noise measurements were taken of students participating in various sports activity in the outdoor sports fields, these included:

- 15 students playing hockey on the main field.
- 12 trainers on the southern tennis courts.
- 30 volleyball players on the tennis court area.
- 4 players on the northern tennis court.

The measurement results are presented in the following Table 5. Values have been rounded to the nearest 0.5 dB.

Table 5: Summary of outdoor play noise measurement levels

Source	Noise level, L_{eq}, dBA
Outdoor play noise (includes affects of ambient noise)	53.0

At the time of visit, there was various bird activity surrounding the south boundary that produced high levels of ambient noise. Where possible, the recorded noise level excludes the affected periods where bird noise was not present.

Subjectively, noise from playing fields was not easily audible, as it was comparable to the ambient levels. Noise from conversation of the players or instructors (on the tennis courts) was just audible at the boundary. Noise from the playing field was not audible as it was at a further distance and was shielded by the intermediate building.

It is expected that the use and activities associated with the new sports field will remain unchanged from current usage. The construction of new field may be elevated by 1-3m to allow for the new carpark underneath. However, in terms of noise it is our opinion that there will not be any increase in noise levels from activities on the field to nearby residents.

5.4 TRAFFIC NOISE AND UNDERCOVER CARPARK

As part of the Mollie Dive Field upgrade, a new undercover carpark will be constructed below the field to be used by the staff and the parents utilising the new sport facilities. Currently, parking for the sporting facilities are accessed via Avon Road with an off street drop off point. The existing open air carpark areas are located off street along Avon Road and at the western end of the sports field.

The proposed new carpark, that is to be constructed underneath the field has been designed to accommodate up to 232 vehicle parking spaces undercover and a reduction to the existing car park to the north-west from 57 to 36. The main acoustic concerns are related to the potential noise increase in vehicle activity along Avon Road and the use of the undercover carpark.

In stage 1, the activities associated with the new sports faculties are expected to remain unchanged from current usage hence current staff and parents (of students) who need to access the facilities would use existing access and parkings and therefore we would expect that vehicle activity along Avon Road would not increase and remain relatively unchanged. An increase if any is expected to comply with the noise increase requirements of NSW OEH Road Noise Policy as shown in Section 3.4. However, in stage 2 which will be subject to a separate DA assessment and consent, the school is considering extending the use of the facilities to outside the school community which may generate additional traffic activity along Avon Road.

Also, the new undercover carpark would allow the users to park within the school site away from the residents situated along Avon Road. A drop off zone located within the undercover carpark would also be a benefit in reducing any noise impacts to the residents located to the south-west.

Traffic Data provided in the Traffic Report (Colston, Budd, Hunt & Kafes Pty Ltd, Report dated August 2012) was used to assess the noise increase levels due to the generated traffic. The traffic report has conducted an assessment and provides data for traffic volumes on the existing surrounding local roads and the generated traffic. The data is related to the morning and afternoon peak hours. As the morning and afternoon peak traffic volumes are close, our analysis covers the morning peak only. A summary of generated traffic noise levels is presented in the following Table 6.

Table 6: Summary of generated traffic noise levels, am peak

Location	Existing traffic (vph)	Generated traffic (vph)	Increase in noise level, dBA	Permitted noise increase dBA	Complies (Yes/No)
Pacific Highway	5330	20	0.01	2	Yes
Beechworth Road	705	25	0.15	2	Yes
Livingstone Avenue	1260	35	0.11	2	Yes
Avon Road				2	Yes
-North of Pymble Ave	1075	35	0.14		
-East of Arilla Rd	710	35	0.2		
-West of Arilla Rd	340	60	0.7		
Arilla Road	870	35	0.17	2	Yes

The above calculations indicate that noise increase from the generated traffic is expected to be within the RNP limit therefore no acoustic treatment will be required.

5.5 THE NEW DINING FACILITIES

The new dining facility for PLC boarding school students is to be located at the northern end of the sports field, approximately 120 m from the south boundary. The dining facility is located close to the existing boarding houses to allow the students direct access into the facility.

Potentially the dining facility could be used upto 10pm, and as such the envelope of the building, which includes the façade, roof and glazing would be designed to attenuate any internal activity noise to the nearby residents.

5.6 NEW HEALTHCARE CENTRE

The new health care centre will be located adjacent to the existing PE Centre and will comprise of consulting rooms and offices. The healthcare centre generally involves low noise generating activities. Considering the low internal noise generation levels and the attenuation provided by the building envelope, it is expected that there would not be any noise impact due to its use.

5.7 MECHANICAL SERVICES NOISE

At this preliminary stage, the design and selection of the mechanical plant has not been finalised therefore a noise impact assessment for mechanical equipment is not possible. A noise assessment should be conducted once the mechanical plant is finalised at the detail design stage. Noise emissions from air conditioning systems and mechanical plant such as

exhaust, ventilation and supply air fans must be controlled to acceptable noise levels as shown in Table 4.

The new mechanical plant and equipment associated with the facilities would typically include:

- The new aquatic and fitness centre has a main pool and AHU plantroom, a backwash tank room and a smaller plantroom to serve the fitness studio and offices all located on the lower level of the centre.
- The new dining facility is expected to have the mechanical services equipment such as extractions fans (kitchen, toilet, etc), refrigeration plant and AHU/ condensers.
- The new health centre would typically have air-conditioning condensers and small extractions fan.

Once the selection of plant equipment that is to serve the facilities have been designed/finalised, acoustic attenuation measures can be incorporated to ensure that noise emission are adequately treated to meet the required NSW INP noise limits.

Typical acoustic amelioration measures for mechanical services are outlined below (but not necessarily limited to):

- Construction of acoustic enclosures and plantrooms to contain noisy plant equipment.
- Design and selection of acoustic louvers and attenuators at ventilation openings.
- Location of plant equipment away from noise sensitive receivers.
- The extraction systems to be constructed such that the outlet is either shielded from the noise sensitive premises and/or is pointing in a direction at least 90 degrees away from the nearest residences.
- Achieving no direct 'line of sight' path between the nearest residences and all the major plant equipment, extraction and air conditioning systems.

5.8 CONSTRUCTION NOISE AND VIBRATION

A site specific noise management plan should be prepared ahead of construction and local residents notified of the nature and extent of the works. As a guide the following work practices and procedures are to be considered:

- Adherence to the NSW OEH recommended preferred hours for construction and deliveries. These are:
  - Monday to Friday: 7am to 6pm.
  - Saturday: 8am to 1pm.
  - No work on Sundays and Public Holidays.
- Turn off plant that is not being used;

- Avoid demolition of existing buildings using rock breakers, but rather demolish structures using jaw crushers and saws;
- Consider using bored piling instead of impact piling to reduce noise;
- Where possible organise the site so that delivery trucks and haulage trucks only drive forward to avoid the use of reversing alarms;
- Truck drivers are to be informed of site access routes, acceptable delivery hours and minimising extended periods of engine idling;
- Regularly inspect and maintain equipment to ensure it is in good working order. Also check the condition of mufflers;
- When selecting equipment ensure where feasible and reasonable it has the most effective mufflers, enclosures and low-noise tool bits and blades. Always seek the manufacturer's advice before making modifications to plant to reduce noise;
- Locate noisy plant away from potentially noise-affected areas or behind barriers, such as sheds or walls;
- Construct purpose built barriers or screens where required;
- Table 7 is an excerpt from Australian Standard 2436:2010 Appendix E 'Noise Sources, remedies and their effectiveness', presenting possible noise reductions from various control mechanisms.

Table 7: Relative Effectiveness of Various Forms of Noise Control AS2436: 2010[2]

Control by	Noise Reduction Possible in Practice, dB(A)
Distance	Approximately 6 for each doubling of distance
Screening	Normally 5 to 10, maximum 15
Enclosure	Normally 15 to 25, maximum 50
Silencing	Normally 5 to 10, maximum 20

Before and after the construction activities, we recommend consideration is given to carrying out dilapidation reporting to a selection of existing residential and commercial receiver buildings, which are adjacent to the site.

6 CONCLUSION

An acoustic assessment of the proposed upgrade of the school facilities up has been carried out in accordance with the relevant noise policies and Australian Standards as detailed in Section 3.

[2] Table C3.

A noise survey was conducted to measure the surrounding environmental noise and noise from outdoor sporting activity. Limiting noise criteria for school activities and mechanical plant/equipment have been determined based on NSW Industrial Noise Policy (see Section 4.3).

Noise issues related to the school upgrade have been considered. Issues related to noise emission from the new facilities upon the nearby sensitive receivers have been identified and discussed (see Section 5). In general, it is anticipated that any potential noise associated with the new facilities would not cause an increase in impact to the surround residential receivers. The selection of building facades (including glazing) and the acoustic attenuation measures for mechanical equipment would be designed to improve the amenity of the surroundings receivers.

During the detailed design a comprehensive acoustic assessment would be conducted to ensure that any acoustic measures required are appropriately incorporated.

In conclusion, our study indicates that acoustic issues related to the upgrade of these school facilities are not expected to create an adverse impact onto the surround residents.

APPENDIX A - ARCHITECTURAL DRAWINGS

The acoustic assessment carried out in this report was based on the following drawings supplied by PMDL architects.

Drwg No.	Date/Issue		Description
DA001	Jan 2012	-	Cover sheet & locality plan
DA002	Jan 2012	-	Locality plan
DA003	Jan 2012	-	Overall site analysis 1
DA004	Jan 2012	-	Overall site analysis 2
DA007	Jan 2012	-	Overall staging plan
DA010	Jan 2012	-	Overall ground level site plan
DA011	Jan 2012	-	Overall upper level site plan
DA012	Jan 2012	-	Overall lower level site plan

APPENDIX B – SITE PLAN

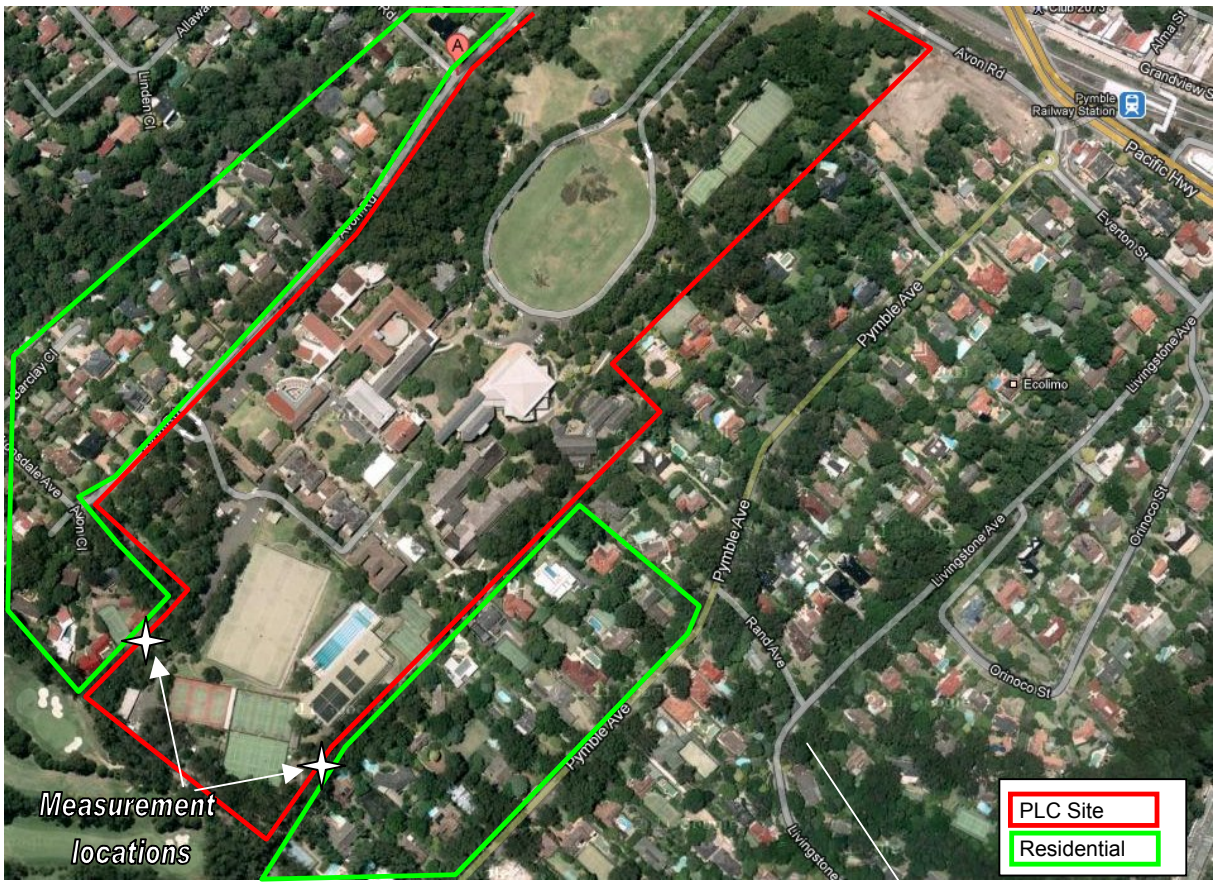

Figure 2: Site plan and measurement locations

APPENDIX C - GLOSSARY OF ACOUSTIC TERMS

Decibel, dB:

Unit of acoustic measurement. Measurements of power, pressure and intensity. Expressed in dB relative to standard reference levels.

dB(A):

Unit of acoustic measurement weighted to approximate the sensitivity of human hearing to sound frequency.

Sound Pressure Level, L_P (dB), of a sound:

20 times the logarithm to the base 10 of the ratio of the r.m.s. sound pressure to the reference sound pressure of 20 micro Pascals. Sound pressure level is measured using a microphone and a sound level meter, and varies with distance from the source and the environment.

Sound Power Level, L_W (dB), of a source:

10 times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power of 1 Pico Watt. Sound power level cannot be directly measured using a microphone. Sound power level does not change with distance. The sound power level of a machine may vary depending on the actual operating load.

Ambient Sound:

Of an environment: the all-encompassing sound associated with that environment, being a composite of sounds from many sources, near and far.

Percentile Level - L_{90}, L_{10}, etc:

A statistical measurement giving the sound pressure level which is exceeded for the given percentile of an observation period, e.g. L_{90} is the level which is exceeded for 90% of a measurement period. L_{90} is commonly referred to as the **"background"** sound level.

$L_{AEQ,T}$:

Equivalent continuous A-weighted sound pressure level. The value of the A-weighted sound pressure level of a continuous steady sound that, within a measurement time interval T, has the same A-weighted sound energy as the actual time-varying sound.

R_W – Weighted Sound Reduction Index:

A new single number quantity for airborne sound insulation rating which replaces STC. STC has been traditionally used for the classification of partitions and to define acoustical requirements in the Building Code of Australia.

For majority of partitions, the value for R_w will be similar to the value for STC. Partitions with particularly poor performance at 100Hz may have lower values for R_w than for STC. Conversely, partitions with poor performance at 4kHz may have higher values for R_w than for STC.

STC - Sound Transmission Class:

Of a partition separating two enclosed spaces: a single number evaluation of its ability to attenuate sound passing between the two spaces. STC takes into account the sound transmission loss in each band of a specified set of one-third octave bands.

Reverberation time (RT60)

Defined as the time required, in seconds, for the average sound in a room to decrease by 60 decibels after a source stops generating sound.

T_{mf}

Is the arithmatic average of reverberation times in the 500Hz, 1kHz and 2kHz octave bands.