REVERB ACOUSTICS

Noise and Vibration Consultants

Noise Impact Assessment
New Mechanical Plant
Toronto Swim Centre
280 Awaba Road
Toronto NSW

October 2016

Prepared for Lake Macquarie City Council
Report No. 16-2008-R1

Building Acoustics - Council/EPA Submissions - Modelling - Compliance - Certification

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1 INTRODUCTION

Reverb Acoustics has been commissioned to conduct a noise impact assessment for refurbishment of Toronto Swim Centre, 280 Awaba Road, Toronto. The purpose of this assessment is to establish assessment criteria at nearby residential receivers and to provide noise limits for new plant.

The assessment was requested by Lake Macquarie City Council in support of and to accompany a Development Application for the project.

2 TECHNICAL REFERENCE / DOCUMENTS

Beranek, L.L and Istvan, L.V. (1992). *Noise and Vibration Control Engineering.* John Wiley and Sons, Inc.

Bies, D.A. and Hansen, C.H. (1996). *Engineering Noise Control: Theory and Practice*. London, E & F.N. Spon.

Gréhant B. (1996). *Acoustics in Buildings.* Thomas Telford Publishing.

Harris, C.M. (ed) (1957). *Handbook of Noise Control.* New York, McGraw-Hill.

Templeton, D. (1997). *Acoustics in the Built Environment.* Reed Education and Professional Publishing Ltd.

AS 1276.1-1999 *"Acoustics – Rating of sound insulation in buildings and of building elements. Part 1: Airborne sound insulation"*.

NSW Environment Protection Authority (2000). *Industrial Noise Policy*

A Glossary of commonly used acoustical terms is presented in Appendix A to aid the reader in understanding the Report.

3 EXISTING ACOUSTIC ENVIRONMENT

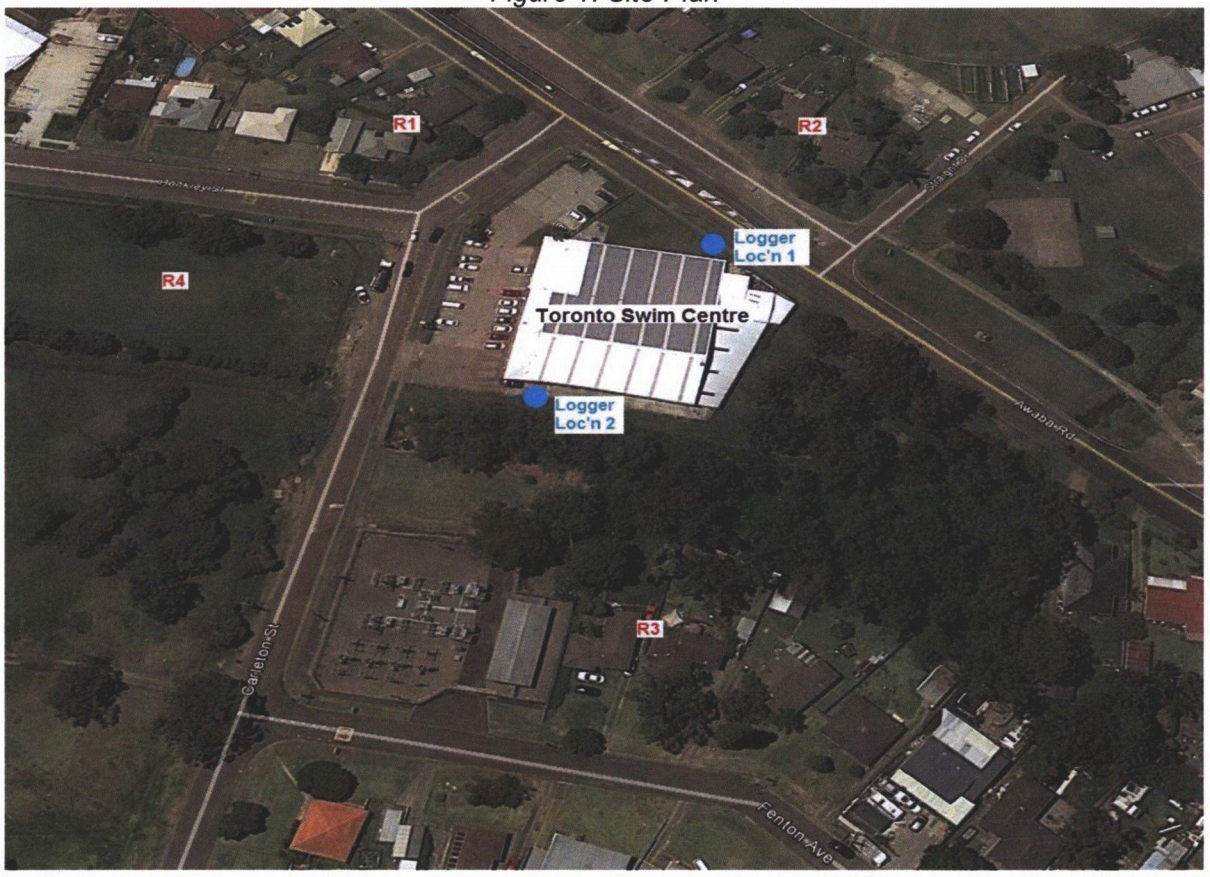
Consideration must be given to the extent of the existing acoustic environment and whether such levels are appropriate for the land use of the receiver area. As such, a background noise level survey was conducted using Type 1, Svan 949 environmental noise logging monitors, installed at the following locations (also See Figure 1):

Logger 1: North facade of Swim Centre and opposite residences across Awaba Road.
Logger 2: South facade of Swim Centre opposite residences to the south in Fenton Avenue.

The selected locations are representative of the acoustic environment in the receiver areas and are considered acceptable locations for determination of the background noise in accordance with Appendix B of the NSW Environment Protection Authorities' (EPA's) – Industrial Noise Policy (INP). Nearest residential receivers identified during our site visits are as follows:

R1. Residences approx. 40m NW of site across Carleton Street.
R2. Residences approx. 30m N of site across Awaba Road.
R3. Residences approx. 40m S of site in Fenton Avenue.
R4. Birabeen Public School.

Figure 1: Site Plan



Noise level measurements were carried out at both logger locations from 5 September to 12 September 2016. The instruments were programmed to accumulate environmental noise data continuously and store results in internal memory. The data were then analysed to determine 15 minute Leq and statistical noise levels using dedicated software supplied with the instruments. The instruments were calibrated with a Brüel and Kjaer 4230 sound level calibrator producing 94dB at 1kHz before and after the monitoring period, as part of the instrument's programming and downloading procedure, showing an error less than 0.5dB.

The following Tables show summaries of our noise level surveys, including the Assessment Background Levels (ABL's), for the day, evening and night periods. From these ABL's the Rating Background Level's (RBL's) have been calculated, according to the procedures described in the EPA's INP and by following the procedures and guidelines detailed in Australian Standard AS1055-1997, "Acoustics - Description and Measurement of Environmental Noise, Part 1 General Procedures". A full set of logger results are not shown, but available on request.

Table 1: Summary of Noise Logger Results Logger 1, dB(A)

Time Period	Background L90			Ambient Leq		
	Day 7am-6pm	Evening 6pm-10pm	Night 10pm-7am	Day 7am-6pm	Evening 6pm-10pm	Night 10pm-7am
5-6 Sept	47.9	41.3	36.2	65.7	62.2	59.8
6-7 Sept	50.1	42.0	36.7	66.3	62.4	60.2
7-8 Sept	50.6	39.9	36.2	66.5	63.1	59.8
8-9 Sept	50.5	44.1	36.4	66.8	64.2	60.6
9-10 Sept	52.6	46.0	37.0	67.5	65.7	59.3
10-11 Sept	49.1	41.4	36.5	65.8	62.1	57.4
11-12 Sept	47.9	39.7	37.7	66.1	62.8	61.1
RBL*	**50**	**41**	**37**	--	--	--
LAeq	--	--	--	**66**	**63**	**60**

Table 2: Summary of Noise Logger Results Logger 2, dB(A)

Time Period	Background L90			Ambient Leq		
	Day 7am-6pm	Evening 6pm-10pm	Night 10pm-7am	Day 7am-6pm	Evening 6pm-10pm	Night 10pm-7am
5-6 Sept	45.6	40.6	37.8	53.2	50.0	46.7
6-7 Sept	44.6	40.4	37.5	53.1	50.8	46.7
7-8 Sept	45.9	37.7	36.0	53.3	50.4	45.0
8-9 Sept	45.8	38.5	36.2	53.1	48.6	45.5
9-10 Sept	45.9	41.1	36.1	53.4	57.2	45.7
10-11 Sept	45.9	40.0	36.9	54.4	53.5	45.9
11-12 Sept	44.5	39.4	38.6	52.4	48.2	46.3
RBL*	**46**	**40**	**37**	--	--	--
LAeq	--	--	--	**53**	**52**	**46**

Site, weather and measuring conditions were all satisfactory during our noise surveys. We therefore see no serious reason to modify the results because of influencing factors related to the site, weather or our measuring techniques.

4 CRITERIA

Noise from industrial noise sources scheduled under the Protection of Environment Operations Act is assessed using the EPA's INP. However, local Councils may also apply the criteria for land use planning, compliance and complaints management. The INP specifies two separate criteria designed to ensure existing and future developments meet environmental noise objectives. The first limits intrusive noise to 5dB(A) above the background noise level and the other aims to protect against progressively increasing noise in developing areas, based on the existing (Leq) noise level from industrial noise sources. Project Specific Noise Levels are established for new developments by applying both criteria to the situation and adopting the more stringent of the two.

The existing L(A)eq for the receiver area is dominated by traffic on nearby roads, mechanical plant at the Swim Centre and the nearby sub-station during the day and evening. Reference to Table 2.1 of the INP shows that the area is classified as Suburban and industrial noise contributions are more than 6dB(A) below the recommended Leq, so the recommended Acceptable Noise Level (ANL) applies in this case, i.e. no ANL reduction required for industrial noise contributions.

Similarly, at night average industrial noise contributions are more than 6dB(A) below the recommended Leq, so the recommended Acceptable Noise Level (ANL) applies. The following Tables specify the applicable base objectives for new mechanical plant. In high traffic areas where the existing traffic noise levels are at least 10dB above the Acceptable Noise Level, the high traffic amenity criterion applies.

Table 3: - Base Noise Level Objectives – Receivers R1 and R2

Period	Intrusiveness Criterion	Amenity Criterion
Day	55 (50+5)	56 (66-10)
Evening	46 (41+5)	53 (63-10)
Night	42 (37+5)	50 (60-10)
Receiver Type: Suburban (See EPA's INP - Table 2.1)		

Table 4: - Base Noise Level Objectives – Receivers R3

Period	Intrusiveness Criterion	Amenity Criterion
Day	51 (46+5)	55
Evening	45 (40+5)	45
Night	42 (37+5)	40
Receiver Type: Suburban (See EPA's INP - Table 2.1)		

Project specific noise levels, determined as the more stringent of the intrusiveness criterion and the amenity / high traffic criterion, are as follows:

Receivers R1 and R2

Day **55dB LAeq,15 Minute** 7am to 6pm Mon to Sat or 8am to 6pm Sun and Pub Hol.
Evening **46dB LAeq,15 Minute** 6pm to 10pm
Night **42dB LAeq,15 Minute** 10pm to 7am Mon to Sat or 10pm to 8am Sun and Pub Hol.

Receivers R3

Day **51dB LAeq,15 Minute** 7am to 6pm Mon to Sat or 8am to 6pm Sun and Pub Hol.
Evening **45dB LAeq,15 Minute** 6pm to 10pm
Night **40dB LAeq,15 Minute** 10pm to 7am Mon to Sat or 10pm to 8am Sun and Pub Hol.

5 ANALYSIS

Council have requested that a limiting Sound Power Level (Lw) is calculated for tenderer's specification purposes. Reverse assessment methodology has been used to calculate the limiting Lw for proposed plant, as detailed below:

Criterion + Distance Loss to Nearest Receiver = Limiting Lw, dB(A)

Limiting Criterion at Receiver	=	40dB(A),Leq (night criterion – See Tables 3 & 4)
Distance to Nearest Receiver	=	30 metres
Distance Loss	=	38dB
Limiting Lw	=	78dB(A),Leq
Limiting SPL @ 3 metres	=	61dB(A),Leq

6 RECOMMENDATIONS AND CONCLUSION

6.1 New mechanical plant must satisfy the limiting noise levels detailed below:

Limiting Lw = 78dB(A),Leq **or** **Limiting SPL @ 3 metres = 61dB(A),Leq**

6.2 The contractor responsible for supplying and installing mechanical plant must provide evidence that installed plant meets noise emission limits specified in 6.1 above, or that noise control included with the plant is effective in reducing the sound level to the specified limit.

6.3 It is vitally important to select and install all plant, equipment, piping and ducting systems to ensure quiet and vibration free operation in compliance with the specified noise criteria. Replacement and/or modification will be necessary to all systems causing undue noise or vibration exceeding the specified criteria.

A design objective shall be regarded as achieved if sound levels meet the following requirements:

- The sound pressure level does not exceed that value corresponding to the specified design objective.
- The sound under consideration is free from specifically annoying characteristics (eg. tones, squeaks, pulsations etc).
- In all cases the noise levels shall be taken with all specified plant and equipment operating.

Providing the recommendations presented in this report are implemented, operation of new mechanical plant at Toronto Swim Centre will not have any long term adverse impact upon the acoustical amenity of nearby residents. We therefore see no acoustic reason why the proposal should be denied.

REVERB ACOUSTICS

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APPENDIX A
Definition of Acoustic Terms

Definition of Acoustic Terms

Term	Definition
dB(A)	A unit of measurement in decibels (A), of sound pressure level which has its frequency characteristics modified by a filter ("A-weighted") so as to more closely approximate the frequency response of the human ear.
ABL	*Assessment Background Level* – A single figure representing each individual assessment period (day, evening, night). Determined as the L90 of the L90's for each separate period.
RBL	*Rating Background Level* – The overall single figure background level for each assessment period (day, evening, night) over the entire monitoring period.
Leq	Equivalent Continuous Noise Level - which, lasting for as long as a given noise event has the same amount of acoustic energy as the given event.
L90	The noise level which is equalled or exceeded for 90% of the measurement period. An indicator of the mean minimum noise level, and is used in Australia as the descriptor for background or ambient noise (usually in dBA).
L10	The noise level which is equalled or exceeded for 10% of the measurement period. L_{10} is an indicator of the mean maximum noise level, and was previously used in Australia as the descriptor for intrusive noise (usually in dBA).