ACOUSTICS AND AIR

ST MARYS DEVELOPMENT SITE
BASINS C & V6

NOISE & VIBRATION CONSTRUCTION IMPACTS

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PREPARED FOR

MARYLAND DEVELOPMENT COMPANY PTY LTD
LEVEL 14, TOWER THREE, INTERNATIONAL TOWERS SYDNEY
EXCHANGE PLACE, 300 BARANGAROO AVENUE
BARANGAROO NSW 2000

WILKINSON MURRAY

DOCUMENT CONTROL

Version	Status	Date	Prepared By	Reviewed By
A	Final	20 November 2019	Sam Demasi	John Wassermann

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GLOSSARY OF ACOUSTIC TERMS

Most environments are affected by environmental noise which continuously varies, largely as a result of road traffic. To describe the overall noise environment, a number of noise descriptors have been developed and these involve statistical and other analysis of the varying noise over sampling periods, typically taken as 15 minutes. These descriptors, which are demonstrated in the graph below, are here defined.

Maximum Noise Level (L_{Amax}) – The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.

L_{A1} – The L_{A1} level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the L_{A1} level for 99% of the time.

L_{A10} – The L_{A10} level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time. The L_{A10} is a common noise descriptor for environmental noise and road traffic noise.

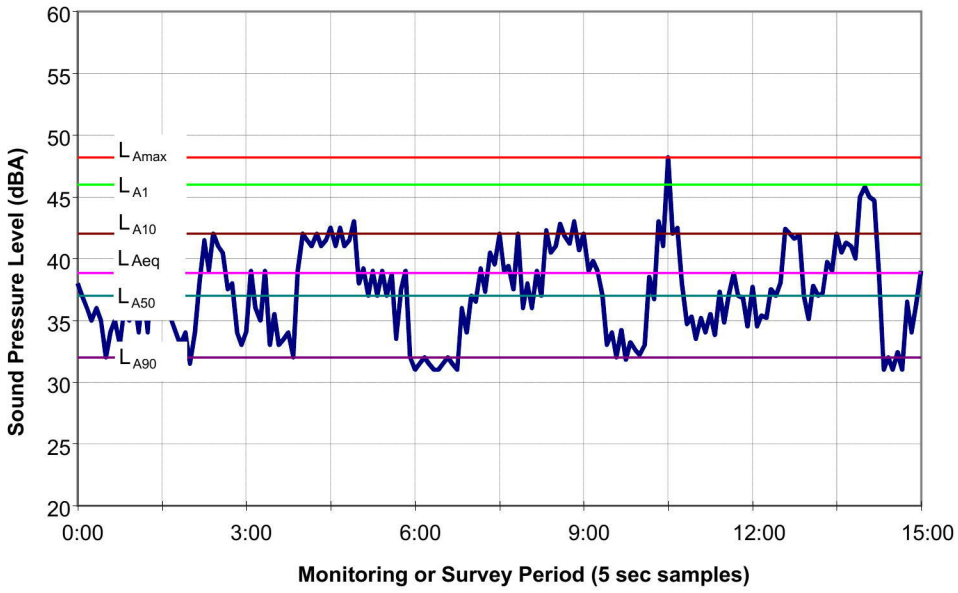
L_{A90} – The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

L_{Aeq} – The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.

ABL – The Assessment Background Level is the single figure background level representing each assessment period (daytime, evening and night time) for each day. It is determined by calculating the 10th percentile (lowest 10th percent) background level (L_{A90}) for each period.

RBL – The Rating Background Level for each period is the median value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period – daytime, evening and night time.

Typical Graph of Sound Pressure Level vs Time



GLOSSARY OF VIBRATION TERMS

Displacement – A vector quantity that specifies the change of position of a body or particle with respect to a reference frame.

Velocity – A vector quantity that specifies the time derivative of displacement.

Acceleration – Acceleration is rate of change of velocity with time usually along a specified axis, usually expressed in m/s^2.

Hertz (Hz) – Units in which frequency is expressed. Synonymous with cycles per second.

Decibel – Ratios of identical quantities are expressed in decibel or decibel or dB units. The number of dB is "ratiod" against some standard or reference value in terms of the base 10 logarithm of that ratio. In measuring acoustic or vibration power (as in PSD or ASD of random vibration), the number of dB = 10 log10 P/P_o. P_o, the reference level, equals 0dB. In measuring the more common voltage-like quantities such as acceleration, the number of dB = 20 log10 E/E_o, the reference level, equals 0dB.

Peak – Extreme value of a varying quantity, measured from the zero or mean value. Also, a maximum spectral value.

Peak-to-peak value – The algebraic difference between extreme values (as D = 2X).

Duration – Of a shock pulse is how long it lasts. Time is usually measured between instants when the amplitude is greater than 10% of the peak value.

Amplitude – The magnitude of variation (in a changing quantity) from its zero value. Always modify it with an adjective such as **peak, RMS, average**, etc. May refer to displacement, velocity, acceleration.

Crest factor – *Of an oscillating quantity.* The ratio of the peak value to the rms value.

VDV – The Vibration Dose Value is the accumulation of energy measured over a given time period, proportional to the root mean quad of acceleration. This is usually measured in each of the three axes of motion. In most cases, vibration tends to be higher in the Z (vertical) axis. This is measured with units of $m/s^{1.75}$.

PPV – Peak Particle Velocity is the instantaneous peak of the resultant vector sum of all three axes of motion. Results are expressed in terms of velocity normally mm/s.

Peak Acceleration – This is the peak acceleration level measured in each of the three axes of motion. In some cases, this can also be combined in a vector sum. This is measured in m/s^2.

Accelerometer – A sensor or transducer or pickup for converting acceleration to an electrical signal. Two common types are piezoresistive and piezoelectric.

Charge amplifier – An amplifier which converts a charge input signal (as from an accelerometer) into an output voltage; a charge-to-voltage converter.

Geophone – A sensor or transducer or pickup for converting velocity to an electrical signal.

1 INTRODUCTION

It is proposed to construct two detention basins (Basin C and Basin V6) to detain, treat and attenuate stormwater runoff from Village 3 and Village 6 that form part of the Jordan Springs development. The basins are located to the north-western extent of the St Marys Development Site (within Wianamatta Regional Park). The Basins would act as wetlands and act as water quality improvement basins with the provision for active stormwater detention during high flows.

Basin C will have a surface area of approximately 1.8 hectares and a notional depth of 1.7m, whereas Basin V6 will have a surface area of approximately 0.3 hectares and a notional depth of 1.6m.

Each basin is designed to contribute to the water quantity and quality management objectives under the *Sydney Regional Environmental Plan No. 30 – St Marys* (SREP 30) and Penrith City Council's (Council) Water Sensitive Urban Design Policy (December 2013). The basins will incorporate the features for both water quality treatment and detention including a drainage inlet point, low level culvert outlet, spillway with erosion protection and vegetated slopes to provide effective nutrient removal. An access track along the side of each basin with access ramps will be constructed for regular inspection and maintenance access.

Wilkinson Murray Pty Limited (WM) has been commissioned by Maryland Development Company Pty Ltd (MDC) to undertake a noise and vibration assessment as required by the Secretary's Environmental Assessment Requirements (SEAR) 1360, reissued 14 October 2019 to accompany an Environmental Impact Assessment (EIS). The relevant section of the SEAR is reproduced below:

> *"noise and vibration – including:*
>
> - *a description of all potential noise and vibration sources during construction and operation, including road traffic noise;*
> - *a noise and vibration assessment in accordance with relevant Environment Protection Authority guidelines; and*
> - *a description and appraisal of noise and vibration mitigation and monitoring measures"*

The Basins will not require mechanical assistance such as pumps to operate. Given that no operational noise sources have been identified, this assessment will focus on impacts during the construction stage only.

On this basis, and as required by the SEARS, Environmental Protection Authority (EPA) guideline documents have been considered in preparing this assessment as per below:

- *Interim Construction Noise Guideline* (ICNG);
- *Road Noise Policy* (RNP)*;*
- *Assessing Vibration: A Technical Guideline* (AVTG); *and*
- *Noise Policy for Industry* (NPfI).

The *ICNG* can be supplemented with reference to:

- Transport for NSW (TfNSW) – *Construction Noise and Vibration Strategy* – May 2018 (CNVS v4.0); and
- Department of Environment, Food and Rural Affairs (DEFRA) – *Update of Noise and Database for Prediction of Noise on Construction and Open Sites* - 2005.

The AVTG can be supplemented with reference to:

- British Standard BS5228-2 2009 – *Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration* (BS 5228-2).

Regarding risk of damage building, the following Standard is most appropriate:

- British Standard BS7385-2 1993 – *Evaluation and Measurement for Vibration in Buildings – Part 2: Guide to Damage Levels from Groundborne Vibration* (BS 7385-2).

The following documents were also referenced:

- Construction Traffic Management Plan (for discussion) of Basin C and Basin V6 at Jordan Springs, prepared by McLaren Traffic Engineering (Reference 190740.01DA, dated 14 November 2019).
- Noise and Vibration Assessment for Central Precinct – Bulk Earthworks (Project Application), prepared by Wilkinson Murray Pty Limited (Reference 14145-N, Ver B, dated September 2014).
- Noise and Vibration Assessment for St Marys Development Site – Basin I & B, prepared by Wilkinson Murray Pty Limited (Reference 14145-E-1, Ver A, dated October 2018).
- Operational and Construction Noise Impact Assessment for Links Road Upgrade, prepared by RCA Acoustics (Reference 13810-401/2, dated 20 November 2018).

Mr Sam Demasi is suitability qualified to prepare a Construction Noise & Vibration Management Plan. He is employed as an Associate of Wilkinson Murray with over 20 years' experience in the field of acoustics. He has been involved in many similar construction projects and prepared many construction noise and vibration management plans. He is a member of the Australian Acoustical Society (AAS).

A review of this report shall be undertaken by Mr John Wassermann, a Director of Wilkinson Murray with over 30 years' experience in the field of acoustics and air quality. He has been involved in many similar construction projects and prepared many construction impact statements and management plans. He is a member of the Australian Acoustical Society (AAS) and of Clean Air Society of Australia & New Zealand (CASANZ).

Wilkinson Murray is a member firm of the Association of Australasian Acoustical Consultants (AAAC).

2 SITE DESCRIPTION & SURROUNDING SENSITIVE RECEIVERS

The basins are located to the north-western extent of the St Marys Development Site (within Wianamatta Regional Park) at Llandilo, Sydney.

Penrith City Council is the local government.

Basin C will have a surface area of approximately 1.8 hectares and a notional depth of 1.7m, whereas Basin V6 will have a surface area of approximately 0.3 hectares and a notional depth of 1.6m. The main work locations between the two basins are separated by approximately 320m.

The immediate area around the basins is typically Regional Parkland. The closest residential receivers are typically single and double storey free standing houses in all locations. These residential receivers are likely to be impacted by on-site construction noise.

There are two routes available for the construction traffic (**Figure 5-1**). The receivers fronting Delany Circuit, will be most impacted. Construction traffic Route 1 will allow trucks up to 23m in length along Ninth Avenue and will pass Xavier College, a secondary school located at 1170 Ninth Avenue. This school is a sensitive receiver and likely to be impacted by construction traffic.

Figure 2-1 shows both basins and the surrounding area including the sensitive receivers. All sensitive receivers are single and double storey, free standing residential receivers and have a clear line of site to works unless a solid boundary fence exists.

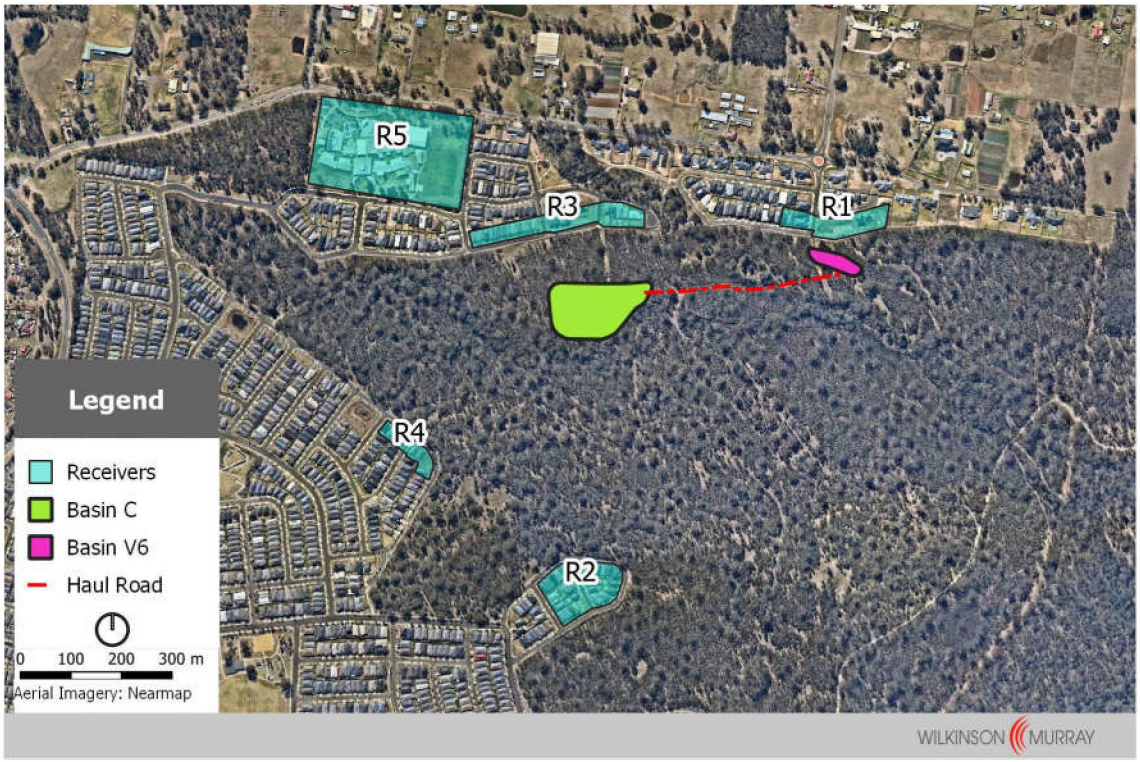
Table 2-1 provides as summary of the most relevant surrounding receivers. All receivers are located within Jordan Springs except for Xavier College, which is in Llandilo.

Table 2-1 Surrounding Receivers

Receiver ID	Address	Orientation	Approx distance to works
R1	Delany Circuit and Cerdon Place	North from Basin V6	40m (30m to access road)
R2	Izaac Circuit	South-west from Basin V6	720m
R3	Agnes Way and Bethany Circuit	North from Basin C	105m
R4	Matthew Bell Way	South-west from Basin C	320m
R5	Xavier College	North-west from Basin C	250m (active recreation area) 350m (classrooms)

Note: Xavier College is partially shielded from basin works by residential receivers

Figure 2-1 Site Location and Surrounding Receivers



Source: Nearmap (as modified by WM)

3 OVERVIEW OF CONSTRUCTION WORKS

3.1 Works Programme

The anticipated construction staging is provided in **Table 3-1**.

Table 3-1 Construction Staging and Duration

Stage	Duration
Site Establishment	2 weeks
Excavation & Haulage	12 weeks
Civil Works & Landscaping	16 weeks
Commissioning / Testing & Finishing	4 weeks

3.2 Hours of Work

In line with the *ICNG*, it is expected that Standard Construction Hours will be utilised:

- Monday to Friday 7:00am to 6:00pm;
- Saturday 8:00am to 1:00pm; and
- No work on Sunday and Public Holidays.

3.3 Construction Scenarios

In terms of noise and vibration, the main works can be divided into two main scenarios as summarised in **Table 3-2**, which includes the plant type, quantity and sound power level.

The worst-case 15-minute scenarios are assumed to occur at both basins simultaneously.

Table 3-2 Construction Scenarios

Scenario	Estimated Plant	Quantity (worst-case 15-min)	Sound Power Level (typical)
Excavation & Haulage	Haulage Trucks	8 (4 in and 4 out)	107[1]
	Dozer (ie D9)	2	116[2,3]
	Excavator + bucket (ie 30t)	2	110[2,3]
Civil Works & Landscaping	Haulage Trucks/Delivery Trucks	2 (1 in and 1 out)	107[2,3]
	Excavator + bucket (ie 10t)	2	105[2,3]
	Vibratory Roller (ie 10t)	2	109[2,3]

Note: Sound power levels derived from:
1. Other similar projects/WM database
2. DEFRA
3. CNVS

4 EXISTING NOISE ENVIRONMENT & GOALS

4.1 Existing Noise Levels

The receivers impacted by onsite construction activities are near the Wianamatta Regional Park and the prevailing ambient noise is low.

Recent ambient noise surveys have been conducted by WM and others support this including:

- Assessment by WM for central precinct bulk earthworks;
- Assessment by WM for works associated with Basin I and Basin B; and
- Assessment by RCA for works associated with Links Road Extension.

A summary of the relevant logger locations from the above assessments is shown in **Table 4-1** and identified in **Figure 4-1**. The rating background level (RBL) for the day period (7:00am to 6:00pm) only is presented given that works will only occur within this time period.

Table 4-1 Existing RBLs – Day Period

Logger ID	Address	Deployed by	Monitoring Period	RBL
L1	158 Jubilee Drive, Jordan Springs	WM	15 – 27 June 2018	34
L2	20 Callistemon Circuit, Jordan Springs	WM	15 – 27 June 2018	30
L3	321 Ninth Avenue, Llandilo	WM	8 – 19 May 2014	34
L4	North of Dunheved Gold Club in Lendlease construction site facing Jordan Springs	RCA	14 – 25 September 2018	34

As can be seen from **Table 4-1**, the RBL varies from 30 to 34dBA. These levels are below the lowest RBL of 35dBA recognised by the *NPfI* for the day period. On this basis, the day RBL for receivers near the Wianamatta Regional Park is set to 35dBA.

Daily charts from the logging have not been included in this assessment given the minimum RBL day was not reached, however the charts from both WM projects and the RCA project can be provided upon request,

Figure 4-1 Location of Relevant Ambient Noise Logging

Source: Nearmap (as modified by WM)

4.2 Airborne Noise from On-site Construction

Criteria for noise from construction (including demolition) works are prescribed by the NSW Environment Protection Authority's (EPA) *Interim Construction Noise Guideline (the "Guideline")*. The Guideline presents a methodology for determining numerical criteria – or Noise Management Levels (NMLs) for the impacts of construction noise on residences and other land uses according to the scale of the project being considered.

The Noise Management Levels presented in the ICNG is presented in **Table 4-2**.

Table 4-2 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 or Public Holidays	Noise affected RBL + 10dBA	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq\ (15min)}$ 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 Standard Hours	Noise affected RBL + 5dBA	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 5dB(A) above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements see section 7.2.2.

Source – Table 2 of the Guideline

Other nearby sensitive receivers include Xavier College.

On the basis of the above, **Table 4-3** provides a summary of NMLs for all receiver types and for standard hours.

The NMLs are applied externally at a location just inside the boundary of a receiver.

Table 4-3 Project Specific Construction NMLs for Standard Hours

Receivers	Standard Construction Hours	
	Noise Affected Level $L_{Aeq,15min}$ – dB(A)	Highly Noise Affected Level $L_{Aeq,15min}$ – dB(A)
Residential	45	75
School (classrooms)	55[1,2]	75
School (external play areas)	65[2,3]	75

Note 1: External noise level assumes a 10dB difference between inside and outside
Note 2: NML applies when school is in use
Note 3: Active recreation area assumed

4.3 Traffic Noise Criteria

The *ICNG* does not include criteria to assess off-site traffic noise associated with construction. Nevertheless, the *RNP* provides a process to assess potential traffic noise impacts.

The *RNP* although normally applied to developments which result in indefinite increases in road traffic noise rather than temporary increases associated with construction projects, is considered by WMPL to be the most suitable guideline to assess potential impacts at residences.

Considering all the variety of development categories with within the *RNP*, the relevant criteria are summarised in **Table 4-4** and apply to all traffic, including the construction traffic.

Table 4-4 Road Traffic Noise Criteria – Residences – Daytime

Type of Development	Criteria (external)
	Daytime (07:00-22:00)
Existing residences affected by additional traffic on existing local roads generated by land use developments	55 ($L_{Aeq.\ 1hr}$)
Existing residences affected by additional traffic on existing freeways / arterial / sub-arterial roads generated by land use developments	60 ($L_{Aeq.\ 15hr}$)

In addition, for existing residences and other sensitive land uses affected by additional traffic on existing roads and where the criterion is exceeded, any increase in the total traffic noise level should preferably be limited to 2dB. The *RNP* considered that a 2dB increase is typically not noticeable.

It is worthy to note that the daytime period for on-site noise is between 7:00am and 6:00pm whereas for road traffic (along the road network), the day time period is defined as 7:00am and 10:00pm.

4.4 Construction Vibration Criteria

The two main effects of vibration that need to be considered for this project are:

- Effects whereby the occupants or users of a building are inconvenienced or possibly disturbed (human comfort); and
- Effects whereby the integrity of the building or the structure itself may be influenced (structural damage).

4.4.1 Human Comfort

The AVTG provides guideline values for continuous, transient and intermittent vibration events. Appendix C of that guideline provides criteria in different units. The most appropriate approach is to provide criteria in peak velocity as this parameter can be readily measured and predicted. Furthermore, the same parameter is used to assess building damage.

Acceptable values of human exposure to continuous vibration are dependent on the time of day and the activity taking place in the occupied space (e.g. workshop, office or residence). Guidance on preferred values for continuous vibration is set out in **Table 4-5**. Given the distance from works and proposed time, only criteria for residential receivers during daytime is considered. Furthermore, the more conservative continuous criteria are shown. In addition, guidance with respect to the effect of vibration is provided in **Table 4-6**.

Table 4-5 Criteria for Exposure to Continuous Vibration

Place	Time	Peak component particle velocity (mm/s)	
		Preferred	Maximum
Residences	Daytime	0.28	0.56

The information presented applies to the vertical direction as human response is usually most sensitive in that direction when considering vibration from typical construction activities.

Table 4-6 Guidance on Effects of Vibration Levels

Effect	Peak component particle velocity (mm/s)
Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.	0.14
Vibration might be just perceptible in residential environments.	0.30
It is likely that vibration of this level in residential environments will cause complaints but can be tolerated if prior warning and explanation has been given to residents.	1.0
Vibration is likely to be intolerable for any more than a very brief exposure to this level.	10.0

Note: Vibration level most applicable to the vertical direction.

4.4.2 Building Damage

BS 7385.2 sets guide values for building vibration based on the lowest vibration levels above which damage has been credibly demonstrated and uses a frequency dependent approach. These levels are judged to give a minimum risk of vibration-induced damage, where minimal risk for a named effect is usually taken as a 95% probability of no effect.

From this Standard, **Table 4-7** presents a conservative vibration damage screening level.

Table 4-7 Transient Vibration Guide Values - Minimal Risk of Cosmetic Damage

Type of building	Peak component particle velocity (mm/s)
Unreinforced or light framed structures Residential or light commercial type buildings	12.5

5 ASSESSMENT

This section provides an assessment of:

- Airborne noise from on-site construction activities.
- Airborne noise from off-site construction vehicle movements.
- Groundborne vibration from on-site construction activities.

5.1 Airborne Noise from On-site Construction Activities

Site related noise emissions were modelled with the CadnaA noise prediction software using the algorithm of ISO 9613. A representative 3-D model within the software was constructed of the site and surrounding receivers.

Factors that are addressed in the modelling are:

- source sound level emissions and locations;
- screening effects from buildings (modelled as individual buildings);
- receiver locations;
- noise attenuation due to geometric spreading;
- reflections (third order);
- ground absorption (50%, except 90% was used for the area within the Regional Park); and
- atmospheric absorption.

Predictions considered the typical worst-case scenarios and shortest distance between works and receivers. This approach presents the loudest 15-minute period and it is important to note that for that majority of the time such levels will be lower than presented in this report given that the distance between source and receiver will increase and construction intensity may decrease.

All predictions have been conducted at a receiver height of 1.5m above ground and where applicable the near and side boundary fences to a height of 1.8m have been modelled.

Based on the above, resultant noise levels at the potentially worst affected receivers for the two construction work scenarios identified have been predicted as shown in **Table 5-1**. A range of predicted noise levels is provided to account for these worst-case construction scenarios occurring at the closest and farthest locations from each identified receiver.

Table 5-1 Predicted Airborne Noise from On-site Construction Activities

Receiver	NML	Predicted $L_{Aeq, 15min}$ Noise Level (dBA)	
		Excavation & Haulage Scenario	Civil Works & Landscaping Scenario
R1. Delany Ct & Cerdon Pl	45	***65-75***	***58-69***
R2. Izaac Ct	45	***50-52***	43-45
R3. Agnes Wy & Bethany Ct	45	***58-65***	***52-59***
R4. Matthew Bell Wy	45	***50-54***	43-***47***
R5. Xavier College grounds	65	50-54	43-47
R5. Xavier College classrooms	55	48-52	41-45

Note: Values in bold italics exceed the NML.

Predictions at both the school grounds and classrooms show compliance with NMLs.

However, exceedances of the residential NML has been predicted, therefore all reasonable and feasible mitigation is to be assessed and implemented.

In the first instance, "standard" mitigation measures will need to be implemented. If NMLs are still exceeded after these mitigation measures are implemented, then specific additional mitigation measures will be assessed and implemented as required.

5.2 Airborne Noise from Off-site Construction Vehicle Movements

It is necessary to utilise the road network for deliveries and off-site haulage.

With reference to the construction traffic management plan, the following has been determined by WM that is relevant when assessing the noise from construction traffic off-site:

- Trucks up to 23m will travel along Delaney Circuit between the site access and Ninth Avenue and can travel along Ninth Avenue to/from The Northern Road. This forms part of Route 1 and is shown in **Figure 5-1**.
- Trucks up to 19m will travel along Delaney Circuit between the site access and Ninth Avenue and then along Ninth Avenue. This forms part of Route 2 and is shown in **Figure 5-1**.
- The worst-case scenario is when all movements (32 trucks (16 in and 16 out) per hour) access to and from the site via Delaney Circuit from the roundabout intersection with Ninth Avenue and Delaney Circuit.
- Delaney Circuit is a local road with a 50km/hr sign posted speed limit, 8m wide carriage way and typical 8m setbacks between the road edge and residential façades.
- All other roads along the route are classified sub-arterial or arterial, carry more traffic (including heavy vehicles) and have a greater setback to residential façade.

On the basis of the above, predictions have only been undertaken on the worst-case scenario as this will show the most impact. The calculations are based on *Calculation of Road Traffic Noise* (CoRTN) approach with the following assumptions:

- Speed of 50km/hr
- Angle of view of 150 degrees
- Façade correction of 2.5dB
- ARRB correction of -1.7dB
- 25% ground absorption
- 8m setback and 8m wide carriage way.
- 32 movements per hours (worst-case) associated with works occurring on both Basins simultaneously.

Predicted levels are summarised in **Table 5-2**.

Figure 5-1 Off-site Construction Traffic Routes

Source: McLaren Traffic Engineering (as modified by WM)

Table 5-2 Predicted Traffic Noise from Off-site Construction Vehicle Movements

Road	Calculated Level	Criteria
Delaney Circuit (local road)	61dBA $L_{Aeq,1hr}$	55dBA $L_{Aeq\ 1hr}$

An exceedance of 6dBA is predicted during a worst-case hour of off-site construction heavy vehicle movements passing residences along Delaney Circuit. Such levels will be noticeable but likely only to occur during the haulage stage, after which the movements and therefore noise levels associated with traffic along all roads for both routes will be lower. The haulage stage is expected to occur for approximately 12 weeks.

5.3 Groundborne Vibration from On-site Construction Activities

The only vibration intensive activity identified for this project will be associated with compacting works during the Civil Works and Landscaping construction scenario. During this scenario it is assumed that a vibratory roller in the order of 10t capacity will be used. The roller could be operating within 40m of a residential receiver during works on Basin V6. A distance of 105m is expected when such works occur at Basin C.

Table 5-3 summaries vibration levels at given distances from data previously measured by WM from a 15t roller (HAMM3414 smooth drum) operating on hard soil over clay. The data collected is representative of the nominally 10t roller proposed to operate for this project given the similar capacity and similar ground type.

Table 5-3 Vibratory Roller Peak Vibration Velocity Levels Versus Distance

	Vibration Level at Given Distances (mm/s, peak component particle velocity (vertical))			
	5m	**10m**	**20m**	**30m**
Measurement Set 1 (Eastwood)	-	3.6	2.0	0.9

Based on the above data, and applying a line of best fit, the typical vibration level expected at 40m would be in the order of 0.3mm/s. This prediction is for a vibration level in the ground, just outside the nearest residential receiver.

This vibration level is well below the trigger for building damage for a typical residential building.

If such levels are continuous in nature then a level of 0.3mm/s is virtually the same as 0.28mm/s (preferred human comfort limits) and below the maximum of 0.56mm/s as applicable to residential receivers. It is worthy to note that rollers regularly traverse across a site in sections off 50m or more and so it is quite probable that levels of 0.3mm/s are likely only to occur for short durations and only when a vibratory roller is used in close proximity to residential receivers.

With reference to the BS5228:2, a vertical vibration level of 0.3mm/s corresponds to:

"vibration might be just perceptible in residential environments"

6 CONCLUSION

Wilkinson Murray Pty Ltd has prepared a noise and vibration construction assessment associated with the construction of two detention basins (Basin C and Basin V6) located to the north-western extent of the St Marys Development Site (within Wianamatta Regional Park).

The following main noise and vibration aspects have been considered:

- Airborne noise from on-site construction activities.
- Airborne noise from off-site construction vehicle movements.
- Groundborne vibration from on-site construction activities.

From our assessment, it is necessary that a detailed construction noise and vibration management plan is prepared once a contractor has been secured and the construction approach finalised. This is to include the construction traffic off-site.

In terms of impacts, the following can be concluded:

Airborne Noise from the Site

Exceedances of the residential NML has been predicted, therefore all reasonable and feasible mitigation is to be assessed and implemented. It is likely that even after mitigation is installed that the impact is still significant and additional mitigation measures are required.

The following typical mitigation measures are to be considered:

- Allow for initial attended noise measurements in the form of site trials when worst case scenarios occur and begin works as far from residential receives as possible so that impacts and mitigations for the residential receivers closer can be confirmed.
- A solid barrier fence (constructed from 18mm thick ply or acoustically similar) approximately 40m in length on either side of the access to the site. The barrier shall be a minimum of 1.8m in height and to be located on the roadside. The need for this can be determined following initial noise measurements.
- Ensure that plant locations particular associated with Basin V6 are located as far from nearby residential receivers as practical and not concentrated in one location where possible.
- Inform all impacted residential receivers and in particular those in R1 when Basin V6 works are occurring.
- Prepare a community liaison plan that incorporates a complaints management procedure.

Construction Traffic

Construction traffic along the local road Delaney Circuit is likely to exceed the hourly noise criterion by up to 6dBA.

Given the exceedance, the following indicative mitigation is to be considered:

- All trucks used are in good working order and the truck speed is minimised to between 40 to 50km/hr until at sub-arterial/arterial road is reached.
- The access and Delaney Circuit is well maintained to limit, potholes and the like.
- Respite hours along Ninth Avenue (Route 1) during school drop-offs and pick-ups.
- Alternate access for light construction vehicles or use of a mini bus.
- Continued communication with impacted residences, particularly along and near Delaney Circuit near the site access.

Groundborne Vibration

It can be concluded that the risk of damage (even cosmetic) is considered negligible at the predicted vibration levels and that there is a low risk that vibration limits associated with human comfort would be triggered when a 10t roller is used at Basin V6 and a negligible risk when a 10t roller is used at Basin C.