ACOUSTICS AND AIR

ST MARYS DEVELOPMENT SITE - BASIN I & B

NOISE & VIBRATION ASSESSMENT

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PREPARED FOR

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DOCUMENT CONTROL

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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.

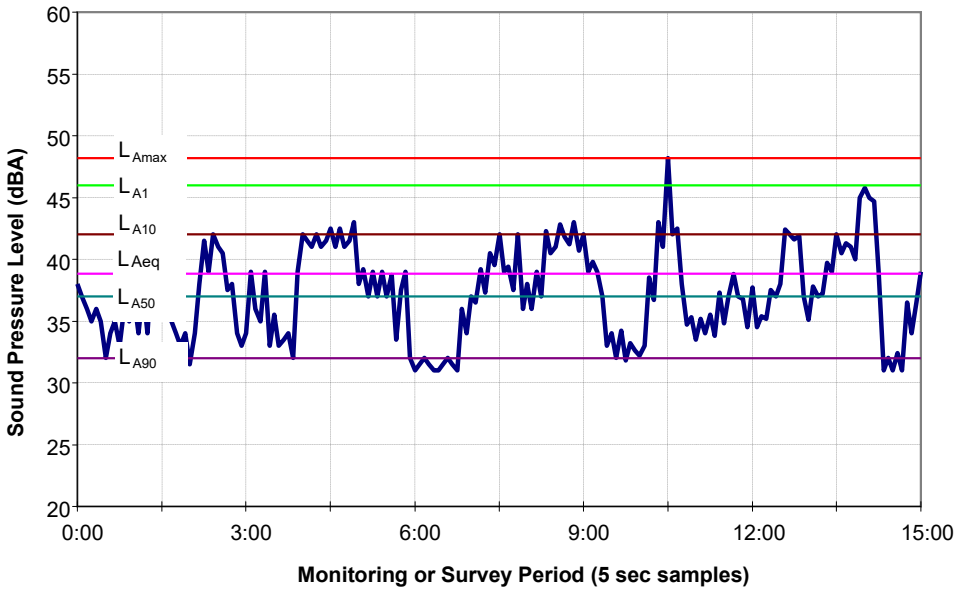
L_{A90} – The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

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



1 INTRODUCTION

Wilkinson Murray Pty Limited has been engaged by Cardno to provide a noise and vibration assessment of the proposed construction associated with dredging and remediation of two existing detention basins within the St Marys development site at Llandilo, Sydney.

This noise and vibration assessment evaluates potential impacts associated with construction activities in accordance with the following Environmental Protection Authority (EPA) guideline documents:

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

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 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).

2 SITE DESCRIPTION

Basins I and B are located within Wianamatta Regional Park in the Penrith Local Government Area (LGA) of the St Marys development site at Llandilo, Sydney. The work locations between the two basins are separated by approximately 2500m.

An aerial showing both basins and surrounding area is shown in **Figure 2-1**.

Although the latest imagery from *nearmap* has been reviewed, it is noted that construction work is occurring within various stages of Jordan Springs East. Depending on the final construction approval for each basin and project duration, additional residential receivers may be impacted by the construction works as proposed.

In the first instance, a buffer of 20m has been assumed between Basin B and the nearest residential receiver in Jordan Springs East. This buffer distance is the same as the distance between Basin I and the nearest existing residential receivers to the south.

Figure 2-1 Site Location

Source: nearmap (modified by WMPL)

2.1 Sensitive Receivers

The areas surrounding the project were divided into noise catchment areas (NCAs) based on each area's similar acoustic environment and land uses. The immediate surrounding area is dominated by residential receivers, typically single and double storey free standing houses. The potentially most impacted are considered in the following sections.

2.1.1 Basin I

All immediate receivers are residential, with the most impacted located in the following suburbs:

- Werrington Downs to the south, this area is denoted as Noise Catchment Area (NCA 01).
- Cambridge Gardens to the west (NCA 02).
- Jordan Springs to the north (NCA 04).

The residential receivers to the south and west are located closest to the works and are potentially the most impacted by on-site construction activities.

Residential receivers are also located:

- Further west, across The Northern Road, within the suburb of Cranebrook (NCA 03).
- Further east with the suburb of Jordan Springs East (NCA 07).

Other potentially sensitive receivers include:

- Boronia Village Park located to the north.

2.1.2 Basin B

All immediate receivers are residential, located in the following suburbs:

- Llandilo to the north (NCA 05).
- Jordan Springs East to the south (NCA 07).

The residential receivers identified above are closest to the works and are potentially the most impacted by on-site construction activities. It is noted that it will take at least 12 months for the various stages within Jordan Springs East to be completed and then residences move in. At this stage, it is assumed that the residential receiver within Jordan Springs East nearest to the works would be located 20m away.

Residential receivers are also located:

- Jordan Springs to the west (NCA 04).
- Ropes Crossing to the east (NCA 06).

2.2 Other Receivers

Other receivers that are located much further away than the more sensitive residential receivers include:

- Jordan Springs Shopping Centre.
- Dunheved Golf Course.
- St Marys Sewage Treatment Plant.
- Dunheved Business Park.

2.3 Project Description

The works are generally associated with dredging and remediation of two existing detention basins and will primarily include:

- Minor clearing works.
- Dredging/excavation works.
- Haulage.
- Compaction works.

2.4 Construction Methodology

2.4.1 Construction Hours

Consistent with EPA guidelines, it is proposed that the works will be constructed during the following (standard) hours:

- Monday to Friday 7:00am to 6:00pm
- Saturday 8:00am to 1:00pm
- Sunday and Public Holidays Works not permitted

2.4.2 Construction Programme

The current programme assumes that each basin will require a construction period of approximately 8 months and that there will be a short period of time where the construction of both basins will occur concurrently.

2.4.3 Construction Scenarios

Considering the project description, the relevant worst-case construction activities (to occur in a 15-minute period) used to predict worst-case impacts include:

- Haulage and dredging/excavation (airborne noise scenario 1)
    - 8 trucks (4 in and 4 out).
    - 2 excavators and 2 large dozers/scrapers.

The use of a hammer during excavation is considered unlikely given the shallow excavation proposed and that the upper geological strata is topsoil, sand and clay with weathered shale beginning at approximately 4m below ground level in some areas. However, in order to present a comprehensive study, the noise and vibration from a medium hammer is considered as a separate scenario.

- Haulage and dredging/excavation (airborne noise scenario 2)
    - 8 trucks (4 in and 4 out).
    - 1 excavators and 1 large dozers/scrapers and 1 excavator with a medium hydraulic hammer (<1t) attachment.

In terms of haulage, when using the local road network, the following roads will potentially be utilised depending on the final approved route(s) and assuming all options will lead either to the Great Western Highway or M4:

- Travelling across the site to the west:
  - Greenwood Parkway.
  - Lakeside Parade.
  - Jubilee Drive.
  - The Northern Road.
  - M4.
- Travelling across the site to the east:
  - Links Road (through commercial/industrial zone only).
  - Christie Street (through commercial/industrial zone only).
  - Forrester Road.
  - Mamre Road.
  - Great Western Highway.
  - M4.

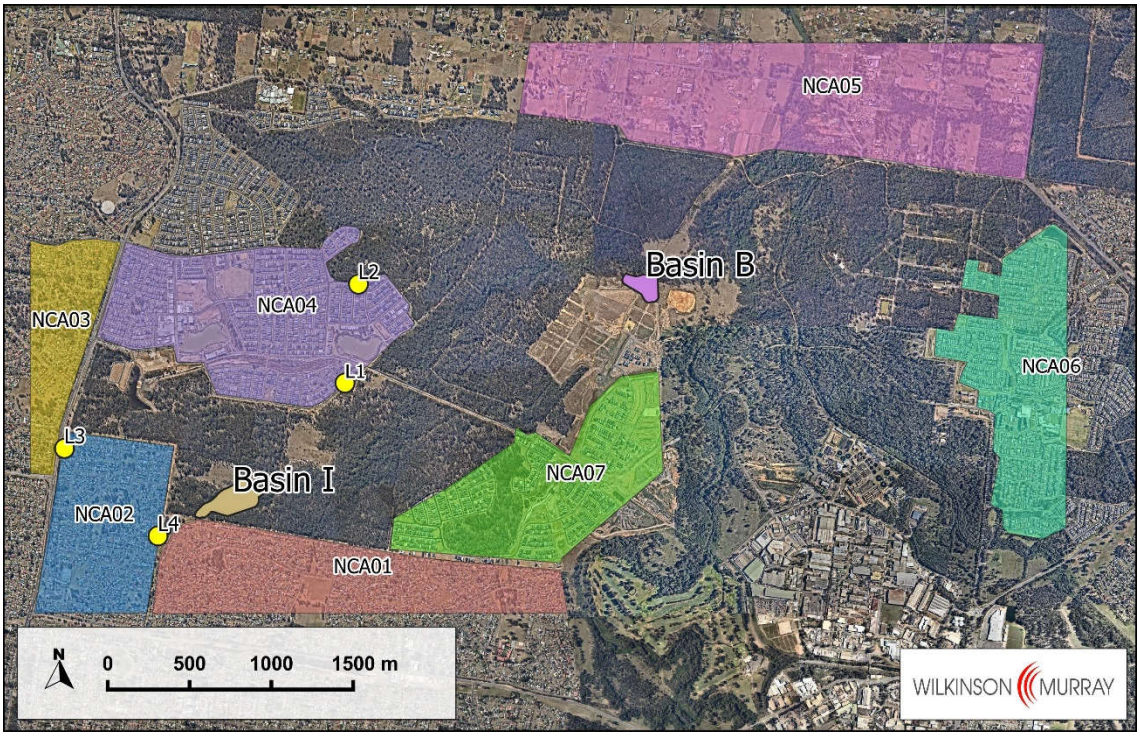
- Compacting (groundborne vibration scenario 1)
  - 1 vibratory roller (typically 15t).
- Excavation (groundborne vibration scenario 2)
  - 1 hydraulic hammer (typically <1t).

3 EXISTING NOISE ENVIRONMENT

3.1 Background Noise Levels

To establish existing noise levels in the area surrounding the site, unattended noise monitoring was conducted between 15 June and 27 June 2018. Four monitoring locations as shown in **Figure 3-1** and **Table 3-1** were selected and are considered representative of the existing ambient noise environment of the surrounding area. The aerial also shows the approximate location of both Basins and noise catchment areas.

Figure 3-1 Aerial Map Showing Noise Monitoring Locations and NCAs



Source: nearmap (modified by WMPL)

Table 3-1 Summary of Noise Monitoring Locations

Monitoring Location	Property Address	Position on Property
L1	158 Jubilee Drive, Jordan Springs	Front Yard
L2	20 Callistemon Circuit, Jordan Springs	Front Yard
L3	71 Newham Drive, Cambridge Gardens	Front Yard
L4	16 Huntingdon Parade, Cambridge Gardens	Back Yard

3.1.1 Noise Logger Description

The noise monitoring equipment used for these measurements consisted of an environmental noise logger (ARL215) set to A-weighted, fast response and a 15-minute logging interval. This equipment is capable of monitoring and storing noise level descriptors for later detailed analysis. The equipment calibration was checked before and after the survey and no significant drift was noted. All equipment used carry current NATA calibration certificates.

From the background noise levels (L_{A90}) the Rating Background Levels (RBLs) were determined using the methodology recommended in the NSW *Noise Policy for Industry (NPfI)*.

The existing ambient noise levels (only day is shown) are presented in **Table 3-2** below. Daily plots of the noise logger data are presented in **Appendix A**.

Table 3-2 Existing Ambient Noise Levels – Day Period

Monitoring Location	Address	Noise Level (dBA)		
		RBL	L_{Aeq}	$L_{Aeq,15hr}$
L1	158 Jubilee Drive, Jordan Springs	34	51	NA
L2	20 Callistemon Circuit, Jordan Springs	30	50	NA
L3[2]	71 Newham Drive, Cambridge Gardens	52	62	62
L4	16 Huntingdon Parade, Cambridge Gardens	37	68	NA

Note 1: RBL adjusted to minimum recommended values per *NPfI*. Unadjusted values in brackets.
Note 2: Logger location 3 was also used to establish existing traffic noise.
The $L_{Aeq,15hr}$ is displayed in the table for calculating traffic noise criteria.

Logger location 3 was also used to establish existing traffic noise. An $L_{Aeq,15hr}$ of 62dBA was determined at this site.

The *NPfI* recommends that where the daytime RBL is calculated to be less than 35dBA, then it is set to 35dBA; and, where the evening or night time RBL is calculated to be less than 30dBA, then it is set to 30dBA. These levels have therefore been adopted in accordance with the *NPfI* to the minimum RBLs as set out in the Policy.

4 CONSTRUCTION NOISE & VIBRATION CRITERIA

The following section presents an assessment of potential impacts associated with the construction of the Proposal, conducted in general accordance with the *Interim Construction Noise Guideline (ICNG)*.

4.1 Airborne Construction Noise

The EPA released the *ICNG* in July 2009. The guideline provides construction noise management levels (NMLs) that assist in assessing the impact of construction noise.

For residences, the $L_{Aeq,15min}$ noise descriptor is used and the NMLs should not exceed the background noise by more than 10dBA during standard construction hours.

Outside the standard hours, where construction is justified, the NML would be background + 5dBA.

Table 4-1 details the *ICNG* NMLs and its application for residences. Given that only standard hours are proposed, NMLs outside these hours are not discussed any further.

Table 4-1 Construction Noise Management Levels at Residences

Time of Day	Management Level $L_{Aeq,15min}$ (dBA)	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 minimise noise. 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 proponent should consider very carefully if there is any other feasible and reasonable way to reduce noise to below this level. If no quieter work method is feasible and reasonable, and the works proceed, the proponent should communicate with the impacted residents by clearly explaining the duration and noise level of the works, and by describing any respite periods that will be provided.

For this project, other receivers, such as commercial and industrial are located much further from the works than residential. Given this, and the fact that the NMLs for residential receivers are much lower, this assessment does not discuss or assess such impact at these receivers.

Project-specific noise management levels for residential receivers are provided in **Table 4-2**.

Table 4-2 Daytime Construction Noise Management Levels

Relevant NCAs	NMLs $L_{Aeq(15min)}$
01	47
02	47
03	62
04	45
05	45
06	45
07	45

4.2 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 NMLs associated with "*road traffic noise applicable to existing residences affected by additional traffic on existing local roads generated by land use developments*" are most applicable. The relevant NMLs are summarised in **Table 4-3** and apply to all traffic, including the construction traffic.

Table 4-3 Road Traffic Noise Management Levels – Residences – Daytime

Type of Development	Noise Management Levels (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, 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.

4.3 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).
- Effects whereby the integrity of the building or the structure itself may be influenced (structural damage).

4.3.1 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, residence or a vibration-critical area).

Guidance on preferred values for continuous vibration is set out in **Table 4-4**. Given the distance from works and proposed time, only criteria for residential receivers during day time is considered. Furthermore, the more conservative continuous criteria are shown. In addition, guidance with respect to the effect of vibration is presented in **Table 4-5**.

Table 4-4 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 in **Table 4-5** is from BS 5228:2 and applies to the vertical direction as human response is usually most sensitive in that direction when considering vibration from typical construction activities.

Table 4-5 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 complaint 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.

4.3.2 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 4-6** presents a conservative vibration damage screening level.

Table 4-6 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 CONSTRUCTION NOISE ASSESSMENT

This section considers airborne construction noise from on-site activities including works at either basin and on-site haulage impacting receivers off-site. In terms of on-site haulage, the noise associated with truck movements is considered as part of the entire site noise from on-site activities. When these movements use the road network, they are assessed as road traffic noise (refer **Section 7**).

5.1 Construction Equipment and Associates Noise Levels

The following sections summarises the sound power levels associated with two main construction scenarios (considered to be typical worst-case) associated with haulage and dredging/excavation.

Table 5-1 Construction Scenarios and Associated Sound Power Levels

Scenario	Typical Sound Power Level (L_{Aeq} dBA)	Source
Scenario 1		
2 excavators and 2 large dozers/scrapers	120 (total)	WM Database
8 trucks (4 in and 4 out)	107 (each truck)	WM Database
Scenario 2		
1 excavator and 1 large dozers/scrapers	117 (total equipment)	WM Database
1 (1T) hammer	119[1]	TfNSW Strategy
8 trucks (4 in and 4 out)	107 each truck	WM Database

Note 1: As per *ICNG* a 5dB penalty is to be applied.

5.2 Predicted Construction Noise Levels

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 noise model are:

- equipment sound level emissions and location;
- screening effects from barriers;
- receiver locations;
- ground topography;
- noise attenuation due to geometric spreading;
- ground absorption; 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. Furthermore, the level will be lower for receivers within the same NCA located further away or shielded by other receivers.

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.

Table 5-2 and shows the predicted noise levels at the potentially worst affected receivers for the two construction work scenarios identified. Furthermore, it provides an indication of the impact of the various traffic routes (on-site only). The predictions are shown to one decimal place for the purposes of comparison between options only.

Figure 5-1 shoes the extent of the on-site haulage.

There are three options for Basin I and a single option for Basin B.

Figure 5-1 Aerial Map Showing On-site Traffic Routes

Source: nearmap (modified by WMPL)

Table 5-2 Predicted Worst-Case Construction Noise – Basin I

Receiver	Predicted $L_{Aeq, 15min}$ Noise Level					
	Basin + Route 01		Basin + Route 02		Basin + Route 03	
	Scenario 1	Scenario 2	Scenario 1	Scenario 2	Scenario 1	Scenario 2
NCA 01	***76*** (47)	***81*** (47)	***76*** (47)	***81*** (47)	***76*** (47)	***81*** (47)
NCA 02	***66*** (47)	***67*** (47)	***57*** (47)	***62*** (47)	***63*** (47)	***65*** (47)
NCA 03	53 (62)	54 (62)	40 (62)	45 (62)	40 (62)	45 (62)
NCA 04	***62*** (45)	***62*** (45)	***69*** (45)	***69*** (45)	***68*** (45)	***68*** (45)
NCA 05	<35 (45)	<35 (45)	<35 (45)	<35 (45)	<35 (45)	<35 (45)
NCA 06	<35 (45)	<35 (45)	<35 (45)	<35 (45)	<35 (45)	<35 (45)
NCA 07	***46*** (45)	***51*** (45)	***46*** (45)	***51*** (45)	***46*** (45)	***51*** (45)

Note: Values in bold italics exceed the NML and values in red bold italics are highly noise affected

Table 5-3 Predicted Worst-Case Construction Noise – Basin B

Receiver	Predicted $L_{Aeq, 15min}$ Noise Level	
	Basin + Route 01	
	Scenario 1	Scenario 2
NCA 01	<35 (47)	39 (47)
NCA 02	<35 (47)	<35 (47)
NCA 03	<35 (62)	<35 (62)
NCA 04	40 (45)	45 (45)
NCA 05	***47*** (45)	***52*** (45)
NCA 06	37 (45)	42 (45)
NCA 07	***52*** (45)	***53*** (45)
NCA 07 (future)	***82*** (45)	***87*** (45)

Note: Values in bold italics exceed the NML and values in red bold italics are highly noise affected
Note: NMLs are shown in brackets.
Note: NCA 07 (future) represents residences (not occupied for at least 12 months) located approximately 20m from works and without a solid 1.8m high boundary fence.

5.3 Discussion and Conclusion

Exceedances (as expected) of the NML are predicted for some of the NCAs as can be seen in **Table 5-2** and **Table 5-3**. Therefore, all reasonable and feasible mitigation is to be assessed and implemented.

Attention is required for the most impact receivers within NCA01 when Basin B works are occurring as predicted levels are above $L_{Aeq(15min)}$ 75dBA . Such receivers are classified as highly noise affected as per the ICNG. Although similar levels are expected within NCA07 during Basin I works, it is likely that these future residential receivers will not be occupied until Basin works are completed.

It is recommended that prior to works that the status of construction of future residences within NCA07 is confirmed.

In the first instance "standard" mitigation measures will be required 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.

The following typical mitigation measures are to be considered and will form part of a detailed *Construction Noise and Vibration Management Plan*.

- Ensure that all boundary fences for receivers within NCA01 and NCA02 are solid, continuous and at least 1.8m high.
- Allow for temporary localised barriers or bunds between the works and worst case impacted within NCA01. Barriers should be solid, continuous and at least 2.4m high and located close to the works. This aspect alone can reduce the impact a further 5dBA.
- 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.
- Inform all impacted residential receivers and in particular those in NCA01 when Basin I works are occurring.
- For works associated with Basin B, monitor the progress and occupation of the nearest residential receivers within Jordan Springs East.
- Prepare a community liaison plan that incorporates a complaints management procedure.

It is likely that additional mitigation in the form of respite periods may also need to be offered and can be negotiated with residential receivers after trial measurements following the implementation of all standard mitigations.

6 CONSTRUCTION VIBRATION ASSESSMENT

This section considers construction vibration (groundborne) from on-site vibration intensive activities impacting receivers off-site.

6.1 Vibration Intensive Activities

For this project the following vibration intensive activities may occur:

- Hydraulic hammer if rock is encountered – assumed an approximately 1t hammer.
- The use of a vibratory roller during the compaction phase – assumed an approximately 15t roller.

6.2 Estimate of Vibration Levels at Residences from Field Data

Table 6-1 summaries vibration levels at given distances from WMPLs database.

Table 6-1 Peak Vibration Velocity Levels versus Distance of Various Plant

Plant	Vibration Level at Given Distances (mm/s, peak component particle velocity)			
	5m	10m	15m	20m
15T Vibratory Roller	-	3.6	2.0	0.9
1T Hydraulic Hammer	2.8	1.0	0.5	0.35

The nearest residential receiver is located approximately 20m from these works and therefore the velocity impinging onto the building is predicted to be < 1mm/s.

6.3 Discussion and Conclusion

Vibration levels less than 1mm/s are estimated to impinge onto a typical residential building. This is well below the 12.5mm/s screening criterion. As a result, damage, even cosmetic is considered negligible and specific mitigation not necessary.

It is quite likely however that some of the building occupants could perceive vibration from such work activities. The impacts associated with human comfort are difficult to accurately predict, however complaints from such levels are not expected and the risk can be further reduced by effective communication to those most impacted by such works. Furthermore, if deemed necessary human comfort management levels can be met by equipment selection and by negotiating respite periods with those most impacted.

Notwithstanding the above, trial vibration measurements are recommended:

- to validate predictions;
- if any receiver is located less than 20m from such vibration intensive activities, and
- if alternate vibration intensive activities are proposed that are likely to result in higher vibration levels at residential receivers.

7 CONSTRUCTION TRAFFIC ASSESSMENT

This section considers the potential increase in road traffic noise from construction related haulage travelling on the local road network. The noise management levels specifically target roads with residential receivers.

7.1 Indicative Construction Road Traffic Numbers and Haulage Routes

We are advised that 13 truckloads per hour will be necessary to move the required amount of spoil for each Basin over a 10-hour period. To account for movements to and from the nominated disposal site, 26 movements (13 in and 13 out) per hour has been used when assessing a single basin. There will be a period of time when construction of both Basins will occur simultaneously and so a scenario of 52 movements has also been assessed.

The final haulage route(s) have not been finalised, however the noise due to increased traffic movement along the more sensitive local roads have been assessed. Roads categorised as sub-arterial or higher have not been assessed as for this project, the current daily vehicles are greater than 10,000 vehicles per day (vpd) and include at least 5% heavy vehicles.

Figure 7-1 and **Figure 7-2** show the route options using the local roads within Jordan Springs East for Basin I (2 options) and Basin B (3 options) respectively.

Figure 7-1 Aerial Map Showing Local Road Haulage Route Options – Basin I

Source: nearmap (modified by WMPL)

The local roads associated with this route include:

- Greenwood Parkway.
- Lakeside Parade.

Figure 7-2 Aerial Map Showing Local Road Haulage Route Options – Basin B

Source: nearmap (modified by WMPL)

The local roads associated with this route include:

- Greenwood Parkway.
- Lakeside Parade.
- Jubilee Drive.

7.2 Available Road Traffic Counts

We have not been provided with traffic volumes, and with reference to the Roads and Maritime Services (RMS) online "Traffic Volume Viewer" and a literature review of traffic assessments associated with other large projects confirms that all the identified freeway, arterial and sub - arterial roads have at least 10,000 vehicles movements (between 7:00am and 10:00pm) and at least 5% heavy vehicles.

In the absence of existing movements on local roads within Jordan Springs East, it is assumed that current traffic along these roads is low with negligible heavy vehicles. On this basis, the typical $L_{Aeq(1hr)}$ during the day is expected to be below 55dBA. Except for a single hour period, this assumption is supported by the noise logging conducted at Jubilee Drive.

7.3 Estimate of Road Traffic Noise Levels from Haulage

Considering a scenario where all traffic in a single day moves along the local roads within Jordan Springs East, predictions (refer **Table 7-1**) show that the noise management level of $L_{Aeq(1hr)}$ 55dBA will be exceeded for most situations. Calculations were undertaken using *Calculation of Road Traffic Noise (CORTN)* with the following assumptions:

- Speed of 50km/hr.
- Angle of view of 150 degrees.
- Façade correction of 2.5dB.
- ARRB correction of 1.7dB.
- 1.8m high barrier (Greenwood Parkway only).
- 25% ground absorption.
- 260 movements per day (works associated with a single basin).
- 520 movements per day (works associated with both basins occurring simultaneously).

Table 7-1 Predicted Traffic Noise Levels from Haul Truck Movements at Residences

Road	Calculated $L_{Aeq,1hr}$ Traffic Noise Level	
	260 movements	520 movements
Greenwood Parkway	54.0	***57.0***
Lakeside Parade	***63.0***	***66.0***
Jubilee Drive	***63.5***	***66.5***

Note: Prediction in bold italics indicates exceedance of noise management level of $L_{Aeq(1hr)}$ 55dBA.

7.4 Discussion and Conclusion

A review of predictions indicates the following:

- Construction of a single basin will result in an exceedance of $L_{Aeq(1hr)}$ 55dBA for residences along Lakeside Parade and Jubilee Drive by approximately 8.0 and 8.5dBA respectively.
- If both basins will be constructed simultaneously, the residences along all three local roads will experience noise levels above $L_{Aeq(1hr)}$ 55dBA, ranging from 3.0 to 11.5dBA.

These levels will be noticeable and considered significant where the exceedance is 8dBA or above. As a result, the following indicative mitigation is to be considered when selecting the final route(s) the measures form part of a construction noise and vibration management plan:

- Use the most direct and shortest route that will pass the least number of residential receivers.
- Share movements across different routes.
- Ensure that all trucks used are in good working order and the truck speed is minimised to between 40 to 50km/hr until at least a sub-arterial road is reached.

8 CONCLUSION

Wilkinson Murray Pty Ltd has prepared a noise and vibration construction assessment associated with dredging and remediation of two existing detention basins within the St Marys development site at Llandilo, Sydney.

The following main noise and vibration aspects have been considered:

- Groundborne vibration from on-site construction activities.
- Airborne noise from haulage on the local road network.
- Airborne noise 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.

In terms of impacts, the following can be concluded.

Groundborne Vibration

The risk of building damage is negligible from construction related vibration.

Vibration may still be perceived by the occupants of nearby buildings however, it can be effectively managed.

Construction Traffic

Construction traffic along the local roads within Jordan Springs East will result in an exceedance of the hourly noise management level by between 3.0 and up to 11.5dBA. Mitigation will be necessary to reduce the impact and mitigation is to be considered when selecting the final route(s).

Airborne Noise from the Site

This aspect results in the most significant impact with the nearest and most impacted receivers identified as highly noise affected (> $L_{Aeq(15min)}$ 75dBA). Mitigation is necessary to reduce impact and it is likely that even after mitigation is installed that the impact is still significant and additional mitigation measures are required.

APPENDIX A

NOISE MEASUREMENT RESULTS