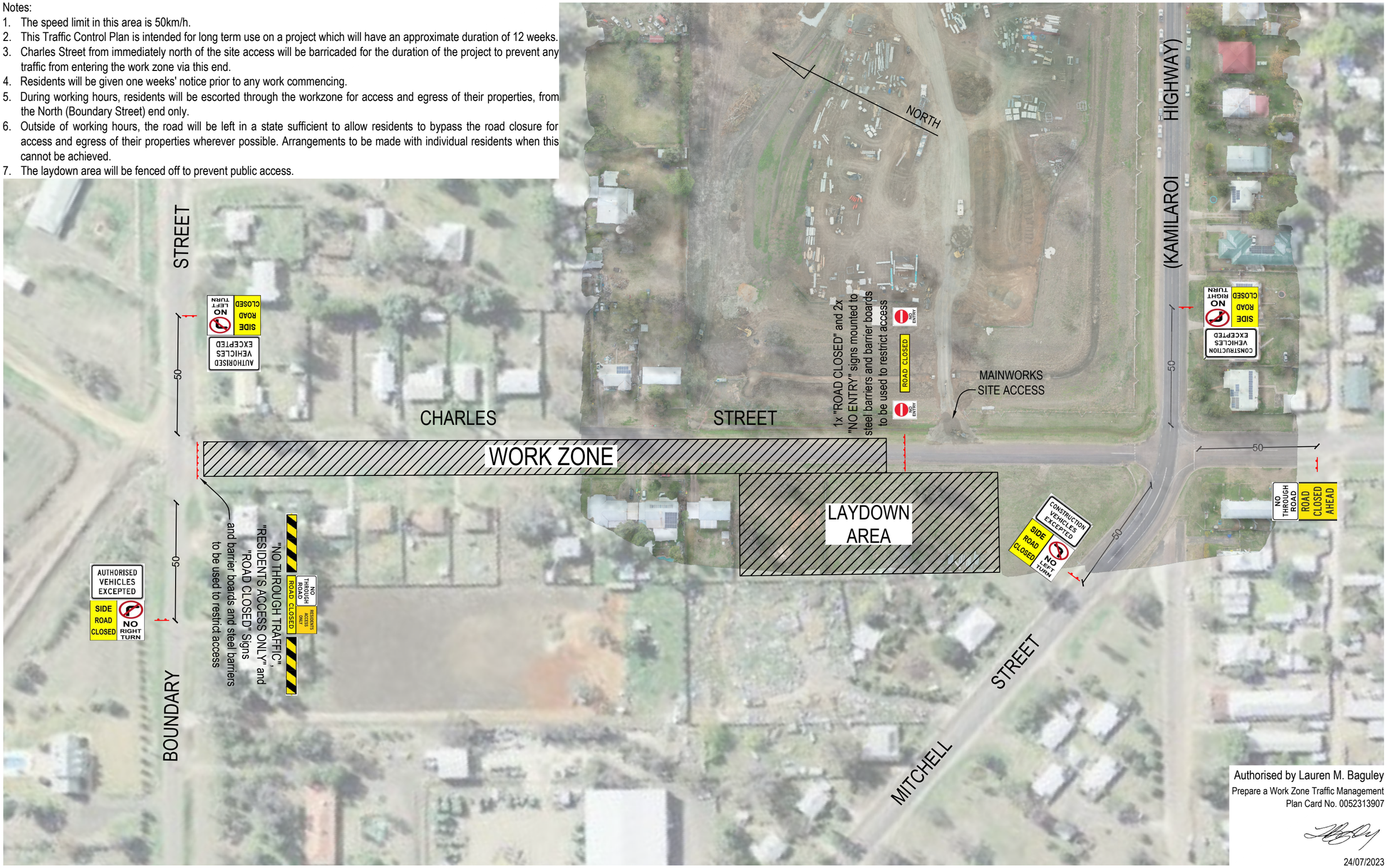
Appendix A

Traffic Guidance Scheme

Notes:

1. The speed limit in this area is 50km/h.
2. This Traffic Control Plan is intended for long term use on a project which will have an approximate duration of 12 weeks.
3. Charles Street from immediately north of the site access will be barricaded for the duration of the project to prevent any traffic from entering the work zone via this end.
4. Residents will be given one weeks' notice prior to any work commencing.
5. During working hours, residents will be escorted through the workzone for access and egress of their properties, from the North (Boundary Street) end only.
6. Outside of working hours, the road will be left in a state sufficient to allow residents to bypass the road closure for access and egress of their properties wherever possible. Arrangements to be made with individual residents when this cannot be achieved.
7. The laydown area will be fenced off to prevent public access.



Authorised by Lauren M. Baguley
Prepare a Work Zone Traffic Management Plan Card No. 0052313907

24/07/2023

Traffic Control Plan for Charles Street Roadworks Stage B Flood Mitigation Work (Stage 2)	
WTC-J155-TCPLAN-04-220921[1]	1 : 1,500 @ A3

WTC GROUP AUST PTY LTD ABN: 12 645 330 454
P (02) 6792 5157
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W www.wtcgroup.com.au

Wee Waa High School Project

Main Contractor : Built.

Rev.	Date	Revision Type	Dr. By	Ch. By
1	24/07/2023	Mainworks site access added	LB	CJ
0	21/09/2022	Original Issue	LB	CJ

Appendix B

Site Layout

Site Plan

RESTRICTED ACCESS TO PUMP

TRASH PUMP

NOTE NO GENERAL PEDESTRIAN ACCESS TO DESIGNATED VECHICLE ACCESS

5km

8km

AMBULANCE ACCESS

VEHICLE ACCESS

Lunch

Lunch

Change

First Aid

Toilets

Lunch

Site Office

PEDESTRIAN ACCESS

Charles St

George St

Mitchell St

EMERGENCY ASSEMBLY POINT

JUNIOR HALL

LEGEND

PROPOSED BUILDING

BUILDING WALKWAY

FLOW MANAGEMENT AREA - SEPARATE APPLICATION

PROPOSED TREES

various sourc

rmatio

inf

SCALE 1:500 0m 5 10 15 20 25 @A1

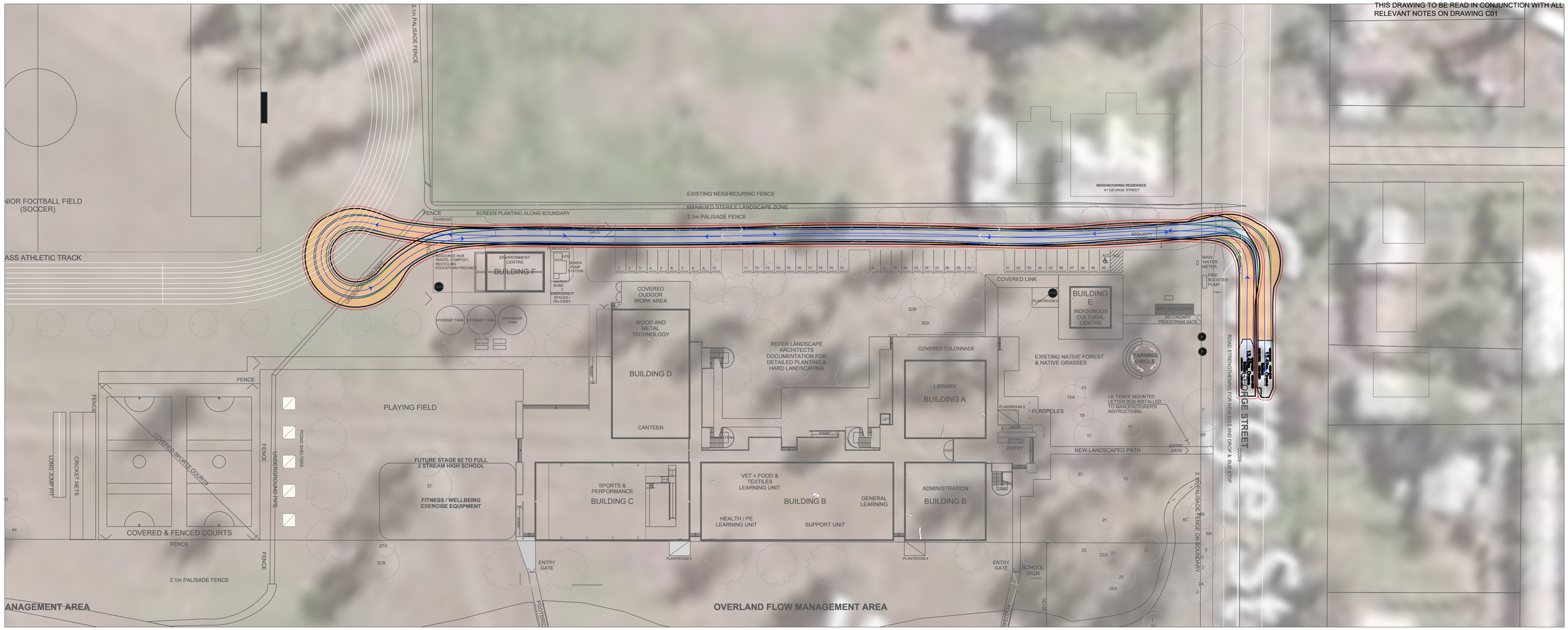
SK002	**Revision No.3** **Date: 19/07/23**	**SITE LAYOUT PLAN**	**PROJECT: Wee Waa High School**

Built

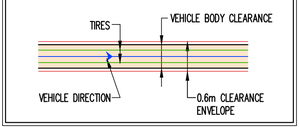
Appendix C

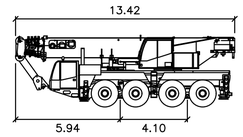
Swept Path Analysis

THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT NOTES ON DRAWING C01



SWEPT PATH LEGEND:





13.42m Crane

	meters
Width	: 3.83
Track	: 3.00
Lock to Lock Time	: 6.0
Steering Angle	: 14.4

VEHICLE PROFILE
13.4m CRANE

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

FileName: SK117.dwg - - USER: lalina - Plot File Created: Sep 29, 2022 - 1:50pm

A1 0 1 2 3 4 5 6 7 8 9 10

Rev	Description	Eng	Draft	Date
P2	PRELIMINARY	GC	LW	30.09.22
P1	PRELIMINARY	GC	GC	22.08.22

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Project
WEE WAA HIGH SCHOOL

Sheet Subject
SWEPT PATH ANALYSIS
13.4m CRANE

Scale : A1	Drawn	Authorised
1:500	GC	PY

Job No	Drawing No	Revision
211022	SKT17	P2

Plot File Created: Sep 29, 2022 - 1:50pm

Appendix D

Driver Code of Conduct

Safe Driving Policy for Wee Waa High School

Objectives of the Drivers Code of Conduct

- To minimise the impact of earthworks and construction on the local and regional road network;
- Minimise conflict with other road users;
- Minimise road traffic noise; and
- Ensure truck drivers use specified routes

To minimise the impact of earthworks and construction on the local and regional road network

- Always obey all applicable road rules and laws
- Drivers to obey road speed limit and reduce the speed while approaching nearby intersections (e.g. Mitchell Street/George Street). Heavy breaks can damage the roads
- Drivers should stay away from the surrounding local and narrow roads

Minimise conflict with other road users

- Drivers should be mindful of pedestrians and cyclists walking/cycling along Mitchell Street and George Street.
- Drivers should not obstruct access to any public roads, site entry, or pedestrian footpath
- Drivers should not park on either side of George Street. All heavy construction vehicles should be parked within the site
- Drivers should check their left and right twice while entering/exiting the site to ensure the safety of pedestrians, cyclists and vehicles on George Street is maintained
- Truck drivers must wait until a suitable gap in traffic allows them to assist trucks. The Roads Act does not give any special treatment to trucks leaving a construction site, the vehicles already on the road have the right-of-way.
- Drivers should obey the traffic controllers guide while accessing/egressing the site
- Drivers should be aware of the site's surrounding conditions including speed limits, other traffic controls and pedestrian routes. This can be done in the site induction
- Drivers should be aware of the restricted time for construction vehicle movements for the student's safety. The construction heavy vehicle movement is to be restricted between 8am to 9:30am and 2:30pm to 4pm on school days.

Minimise road traffic noise

- Drivers should reduce vehicle speed to reduce instances and severity of compression breaking
- No excessive or unnecessary use of horns, in particular outside of approved working hours
- Drivers should reduce speed when approaching speed humps or raised zebra crossings

Ensure truck drivers use specified routes

- Drivers should follow approved truck routes and they should stay away from narrow local roads as much as possible
  Copy of approved truck routes should be distributed to the truck drivers prior to travel to/from the site and drivers should follow these routes only

APPENDIX E - Construction Noise and Vibration Management Sub-Plan

Wee Waa High School (SSD 21854025)

Construction Noise and Vibration Management Sub-Plan

Project No.	P00145
Revision	003
Issued	01 November 2022
Client	Built

E-LAB Consulting

Where science and engineering inspire design.

Document QA and Revisions

ISSUE	DATE	COMMENTS	ENGINEER	REVIEWER
1	06/09/2022	For Review	Kanin Mungkarndee	Tom Candalepas
2	18/10/2022	For SSDA	Kanin Mungkarndee	Tom Candalepas
3	01/11/2022	For SSDA	Kanin Mungkarndee	Tom Candalepas
4				
5				

Confidentiality:

This document contains commercial information which has been prepared exclusively for the use by The Principal. The document in its entirety is confidential. No information contained in this document may be released in part or whole to any third party without the approval of the Author or The Principal.

Authorised by:

E-LAB Consulting

Tom Candalepas | Technical Director
BEng, CPEng, NER, MIEAust, MAAS, RPEQ

Acoustics & Vibration

Table of Content

1 INTRODUCTION

This Noise and Vibration Management Sub-Plan (CNVMSP) has been prepared by E-LAB Consulting (E-LAB) to accompany a State Significant Development Application (SSDA) for Wee Waa High School.

This CNVMSP provides:

- Criteria for the noise and vibration generated during development of Wee Waa High School
- A quantitative assessment of the airborne and ground-borne noise generated by the work for the proposed development and its impact on nearby receivers
- Strategies to mitigate the noise and vibration generated during the construction works phases
- Complaints handling and community liaison procedures

This assessment discusses the predicted impact of the construction noise and vibration generated by the construction equipment on the nearest most-affected receivers.

This report has been prepared with the following references:

- SSDA Conditions of Consent
- Interim Construction Noise Guideline, NSW DECC, 2009 (ICNG)
- Construction Noise and Vibration Strategy, Transport for NSW, 2018 (TfNSW CNS)
- Noise Policy for Industry, NSW EPA, 2017 (NPI)
- Assessing Vibration: A Technical Guideline, NSW DEC, 2006 (AVTG)
- AS 2436:2010 Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites (AS2436)
- British Standard BS 5228: Part 1:1997 Noise and Vibration Control on Construction and Open Sites (BS5228)
- British Standard BS 7358:1993 Evaluation and Measurement for Vibration in Buildings – Part 2: Guide to Damage Levels from Ground-borne Vibration (BS7358)
- German Standard DIN 4150-Part 3 Structural vibration in buildings – Effects on structures

The predicted noise levels are based on the proposed construction program and equipment lists provided in this report.

2 SSDA CONDITION

This report has been prepared in response to the requirements contained within the Wee Waa SSDA Conditions of Consent. Table 1 below summarises the SSDA requirements and outlines the appropriate mitigation measures and the corresponding section within this report where the mitigation has been considered.

Table 1: SSDA requirements and report section reference

ITEM	DESCRIPTION OF REQUIREMENT	SECTION REFERENCE (THIS REPORT)
B22	The Construction Noise and Vibration Management Sub-Plan must address, but not be limited to, the following: (a) be prepared by a suitably qualified and experienced noise expert	Tom Candalepas is a Technical Director of E-LAB and an experienced noise expert. Tom's relevant NSW qualifications include, BEng (Mechanical), CPEng, NER, MIEAust and is a member of the AAS. Refer to Appendix B for Tom's CV.
	(b) describe procedures for achieving the noise management levels in EPA's Interim Construction Noise Guideline (DECC, 2009);	Refer to Section 7.1 and 7.2
	(c) describe the measures to be implemented to manage high noise generating works such as piling, in close proximity to sensitive receivers;	Refer to Section 7.1 and 7.2
	(d) include strategies that have been developed with the community for managing high noise generating works;	Refer to Section 7.2.3
	(e) describe the community consultation undertaken to develop the strategies in condition B22(c)(d);	Refer to Section 7.2.3
	(f) include a complaints management system that would be implemented for the duration of the construction	Refer to Section 7.2.4
	(g) include a program to monitor and report on the impacts and environmental performance of the development and the effectiveness of the implemented management measures in accordance with the requirements of condition B19	Refer to Section 7.3.4
	(h) include a noise validation assessment that considers all equipment to be used and all mitigation measures to be implemented at the site. If predicted construction noise levels still exceed the calculated noise management levels, then further feasible and reasonable work practices and/or mitigation measure that should be applied to minimise noise levels.	Refer to Section 6 and 7

3 PROJECT DESCRIPTION

The proposed development involves the construction of a new high school with a capacity of up to approximately 200 students in a series of two-storey buildings, an Indigenous learning centre, sporting fields and associated civil and utilities works, with future capacity for 300 students subject to funding & service need.

As a summary, the development consists of:

- Two-stream high School catering for 200 students with the capacity to grow to 300 students subject to funding & service need.
- Two-storey built forms, fully accessible and equitable, including:
- General Learning spaces & Learning Support Unit
- Specialist spaces, including Art, Science, TAS, Hospitality, Performance
- Indigenous Cultural Centre
- Associated civil & utilities works
- Sporting Fields, & Outdoor Sports Courts
- 40 Carparking spaces, Bus Bays, Kiss & Drop
- Wayfinding & Signage
- Fencing and Security

The boundaries of the overall site are presented in Figure 1 below as a dashed red line.

4 SITE NOISE INVESTIGATIONS

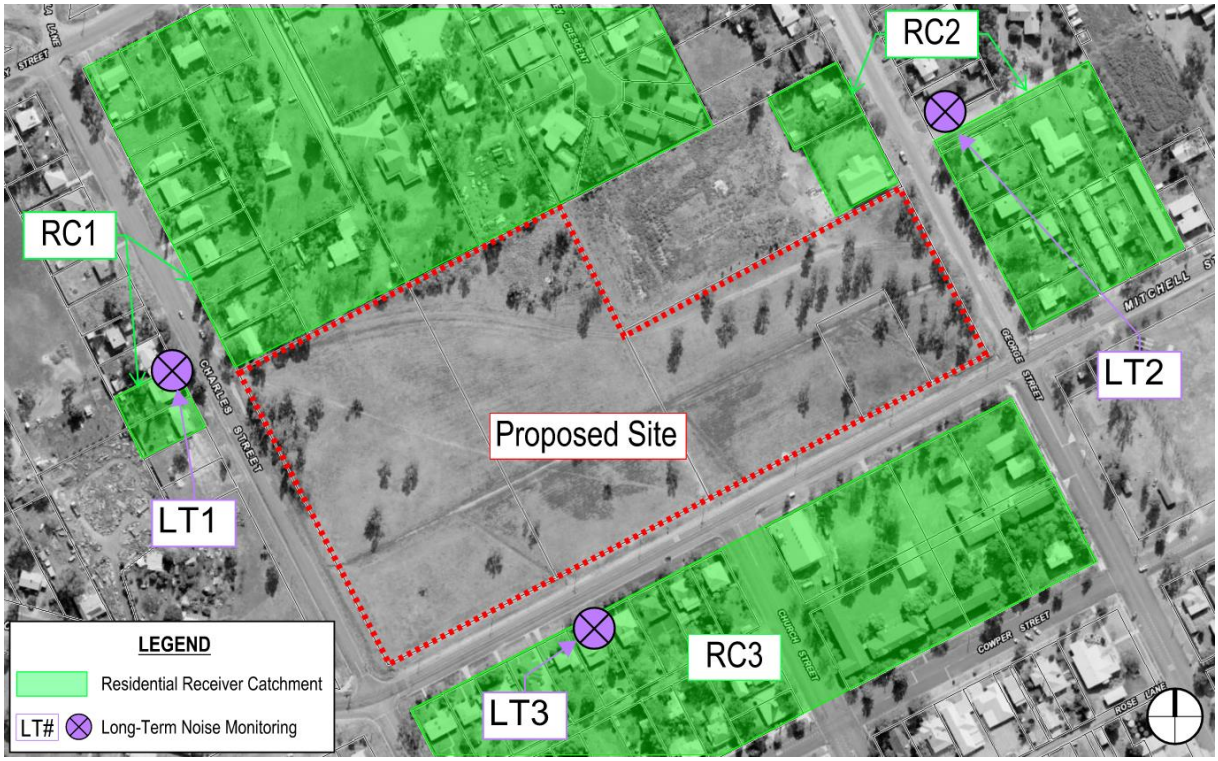
4.1 IMPLEMENTATION OF PREVIOUS NOISE MONITORING

Long-term background and ambient noise monitoring for the development have been conducted and are presented within Day Design's *Acoustic Assessment Report* (with report no. 7284-1.1R Rev B, dated 5 November 2021, which was prepared to accompany the SSDA.

4.2 LOCATIONS

The site location, measurement positions (conducted by Day Design) and surrounding noise and vibration sensitive receivers are shown in Figure 1

Figure 1: Overview of the site, surrounding noise-sensitive receivers and measurement locations conducted by Day Design



4.3 LONG-TERM (UNATTENDED) NOISE SURVEYS

4.3.1 Background Noise

Long-term noise monitoring was conducted by Day Design (locations presented in Figure 1). Background noise levels and subsequent Rating Background Noise Level (RBL) have been established in accordance with the Noise Policy for Industry 2017.

The description of time of day is outlined within the Noise Policy for Industry and described as follows:

- Day – the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays
- Evening – the period from 6pm to 10pm
- Night – the remaining periods

Table 2: Unattended noise monitoring results (conducted by Day Design)

LOCATION	MEASURED RATING BACKGROUND NOISE LEVELS - dB(A)
LT1	39
LT2	39
LT3	40

5 PROJECT NOISE AND VIBRATION CRITERIA

5.1 CONSTRUCTION NOISE CRITERIA

5.1.1 Interim Construction Noise Guideline (ICNG)

In the absence of construction noise management levels at surrounding noise-sensitive receivers from council's DCS, the noise management levels outlined within the ICNG has been adopted for the assessment of noise emissions from the construction of the proposed redevelopment to use as a guideline for council.

Airborne Noise – Residential Receiver Catchments

The airborne noise criteria for surrounding residential receiver catchments (RC1, RC2 and RC3) have been extracted from Table 2 in the ICNG and is presented in Table 3 below.

Table 3: NSW ICNG construction noise criteria for surrounding residential receiver catchments (RC1, RC2 and RC3)

TIME OF DAY	MANAGEMENT LEVEL $L_{Aeq,15min}$[1]	HOW TO APPLY
Recommended Standard Hours: Monday – Friday 7am – 6pm Saturday 8am – 1pm No work on Sundays or 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 **$L_{Aeq,15min}$** 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 residences of the nature of works to be carried out, the expected noise levels and duration as well as contact details.
	Highly Noise Affected 75 dB(A)	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 in, taking into account: – 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) – If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.

TIME OF DAY	MANAGEMENT LEVEL $L_{Aeq,15min}$[1]	HOW TO APPLY
Outside Recommended Standard Hours	Noise Affected RBL + 5dB	▪ 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 the ICNG.

Note 1: Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30m of the residence. Noise levels may be higher at upper floors of the noise affected residence.

Ground-borne Noise – Residential Receiver Catchments

Ground-borne noise is noise generated by vibration transmitted through the ground into a structure, such as an excavator with a hydraulic hammer attachment, or impact/bore piling. The following ground-borne noise levels for residences have been extracted from Section 4.2 of the ICNG and indicate when management actions should be implemented.

- Evening (6pm to 10pm) – Internal Noise Level: $L_{Aeq,15min}$ 40 dB(A); and
- Night-time (10pm to 7am) – Internal Noise Level: $L_{Aeq,15min}$ 35 dB(A).

An assessment of ground-borne noise to these levels is only required when the ground-borne noise levels are higher than airborne noise levels, and for surrounding residential receiver catchments. The ground-borne noise levels are for evening and night-time periods only. The levels shall be assessed at the centre of the most affected habitable room.

5.2 CONSTRUCTION VIBRATION CRITERIA

It is important for vibration emissions from vibration-intensive equipment utilised during the works be managed to maintain appropriate levels of human comfort, and to avoid both cosmetic and structural damage. The vibration limits proposed in the ensuing sub-sections aid in achieving this outcome.

5.2.1 Human Comfort

The office of Environment and Heritage (OEH) developed a document, "Assessing vibration: A technical guideline" in February 2006 to assist in preventing people from exposure to excessive vibration levels from construction and operation of a development within buildings. The guideline does not however address vibration induced damage to structures or structure-borne noise effects. Vibration and its associated effects are usually classified as continuous, impulsive or intermittent.

Continuous and Impulsive Vibration

Structural vibration in buildings can be detected by occupants and can affect them in many ways including reducing their quality of life and also their working efficiency. Complaint levels from occupants of buildings subject to vibration depend upon their use of the building and the time of the day.

Maximum allowable magnitudes of building vibration with respect to human response are shown in Table 4. It should be noted that the human comfort for vibration is more stringent than the building damage criteria.

Table 4: Preferred and maximum weighted RMS values for continuous and impulsive vibration acceleration (m/s^2) 1-80 Hz

LOCATION	ASSESSMENT PERIOD[1]	PREFERRED VALUES		MAXIMUM VALUES	
		z-axis	x- and y-axes	z-axis	x- and y-axes
Continuous vibration					
Residences	Daytime	0.010	0.0071	0.020	0.014
	Night time	0.007	0.005	0.014	0.010
Offices, schools, educational institutions and places of worship	Day- or night time	0.020	0.014	0.040	0.028
Impulsive vibration					
Residences	Daytime	0.30	0.21	0.60	0.42
	Night time	0.10	0.071	0.20	0.14
Offices, schools, educational institutions and places of worship	Day- or night time	0.64	0.46	1.28	0.92

Note 1: Daytime is 7:00am to 10:00pm and night time is 10:00pm to 7:00am

Intermittent Vibration Criteria

Disturbance caused by vibration will depend on its duration and its magnitude. This methodology of assessing intermittent vibration levels involves the calculation of a parameter called the Vibration Dose Value (VDV) which is used to evaluate the cumulative effects of intermittent vibration. Various studies support the fact that VDV assessment methods are far more accurate in assessing the level of disturbance than methods which is only based on the vibration magnitude.

Table 5: Acceptable vibration dose values for intermittent vibration ($m/s^{1.75}$)

LOCATION	DAYTIME[1]		NIGHT-TIME[1]	
	PREFERRED VALUE	MAXIMUM VALUE	PREFERRED VALUE	MAXIMUM VALUE
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80

Note 1: Daytime is 7:00am to 10:00pm and night time is 10:00pm to 7:00am

5.2.2 Cosmetic Damage

Structural vibration thresholds are set to minimize the risk of cosmetic surface cracks and lie below the levels that have the potential to cause damage to the main structure. Table 6 presents guide values for building vibration, based on the vibration thresholds above which cosmetic damage has been demonstrated outlined within BS7385-Part 2:1993. These values are evaluated to give a minimum risk of vibration-induced damage, where minimal risk for a named effect is usually taken as 95% probability of no effect.

Table 6: Transient vibration guide values for cosmetic damage – BS 7385-2:1993

TYPE OF BUILDING	PEAK PARTICLE VELOCITY IN FREQUENCY RANGE OF PREDOMINANT PULSE (PPV)	
	4 Hz TO 15 Hz	15 Hz AND ABOVE
Reinforced or framed structures Industrial or light commercial type buildings	50mm/s	N/A
Unreinforced or light framed structures Residential or light commercial type buildings	15mm/s	20mm/s (50mm/s at 40Hz and above)

5.2.3 Structural Damage

Ground vibration criteria is defined in terms of the levels of vibration emission from the construction activities which will avoid the risk of damaging surrounding buildings or structures. It should be noted that human comfort criteria are normally expressed in terms of acceleration whereas structural damage criteria are normally expressed in terms of velocity.

Most specified structural vibration levels are defined to minimize the risk of cosmetic surface cracks and are set below the levels that have the potential to cause damage to the main structure. Structural damage criteria are presented in German Standard DIN4150-Part 3 "Structural vibration in buildings – Effects on structures" and British Standard BS7385-Part 2: 1993 "Evaluation and Measurement for Vibration in Buildings". Table 7 indicates the vibration limits presented in DIN4150-Part 3 to ensure structural damage doesn't occur.

Table 7: Guideline value of vibration velocity, vi, for evaluating the effects of short-term vibration – DIN4150-3

LINE	TYPE OF STRUCTURE	VIBRATION VELOCITY, V_i, IN mm/s			
		FOUNDATION			PLANE OF FLOOR OF UPPERMOST FULL STOREY
		AT A FREQUENCY OF			
		LESS THAN 10HZ	10 TO 50HZ	50 TO 100HZ*	ALL FREQUENCIES
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
2	Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
3	Structures that, because of their particular sensitivity to vibration, do not correspond to those listed in lines 1 and 2 and are of great intrinsic value (e.g. buildings that are under a preservation order)	3	3 to 8	8 to 10	8
*For frequencies above 100Hz, at least the values specified in this column shall be applied					

5.2.4 Project Construction Vibration Limits

Table 8 indicates the vibration criteria for the surrounding sensitive receivers to the development.

Table 8: Acceptable vibration dose values for intermittent vibration ($m/s^{1.75}$)

RECEIVER	PERIOD	HUMAN COMFORT VIBRATION OBJECTIVES			BUILDING DAMAGE OBJECTIVES mm/s
		CONTINUOUS mm/s (RMS)		INTERMITTENT $m/s^{1.75}$ (VDV)	
		Z-AXIS	X- AND Y-AXIS		
RC1, RC2 and RC3	Day	10 - 20	7 – 14	0.20 – 0.40	5
	Night	7 - 14	5 – 10	0.13 – 0.26	

6 CONSTRUCTION NOISE AND VIBRATION ASSESSMENT

6.1 PROPOSED ACTIVITIES

In this assessment the noise and vibration impact from the main works have been considered, being the following stages:

- Bulk / detailed excavation and groundworks of the site (2 months)
- Piling and foundation works (1 month)
- Construction and assembly of structures (12 months)

All site work is to only occur during the approved hours of work within the SSDA Conditions of Consent, being:

- Monday to Friday: 7:00am to 6:00pm
- Saturday: 8:00am to 1:00pm
- Sunday and public holidays: no work

Work outside the above hours shall not be undertaken without the prior approval of the certifying engineer and council.

6.2 EXPECTED EQUIPMENT

The noise sources likely to be associated with the works listed in the previous section of this report are presented in Table 9. The equipment noise levels have been extracted from AS2436:2010 “Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites”.

Table 9: Cumulative impact – construction equipment noise levels

STAGES	ESTIMATED TIME	EQUIPMENT	SOUND POWER LEVEL – dB(A)
Excavation	2 Months	Excavators (30t)	103
		Excavators (15t)	101
		Dump trucks	107
Piling and Foundation	1 Month	Screw Piling Rig	108
		Excavators (15t)	101
		Concrete Pump	106
		Concrete Truck	103
		General Trucks	103
Construction	12 Months	Powered Hand Tools	102
		Franna Cranes	98
		Lifting Platforms	95
		General Trucks	103

6.3 NOISE MODELLING AND ASSUMPTIONS

To assess noise impact from the site during the demolition works, a noise model was prepared using commercial software SoundPLAN v8.2, which is a comprehensive software package for conducting three-dimensional complex noise propagation modelling. Using the software, a 3D model of the site and its surroundings was constructed including the nearby buildings, and the construction plant and equipment were positioned as noise sources. Within the model, the effects of the environment (built and natural) on propagation of sound were considered to reliably estimate the resulting noise effects on the surrounding noise sensitive receivers.

The noise model represents the reasonably 'worst-case' periods of activities, meaning that all the equipment of each stage is operating simultaneously during a 15-minute observation period.

The assumptions that were made within the assessment include the following:

- The predicted noise levels represent the worst-case scenario for each receiver
- The mitigation measures outlined in Section 7 are implemented
- Neutral weather conditions

6.4 PREDICTED NOISE LEVELS

The reasonably 'worst-case' predicted noise levels at surrounding noise-sensitive receivers have been presented in Table 10 and have been assessed to the ICNG construction noise management levels established in Section 5.1, during the approved hours of work. The noise contour maps produced by the three-dimensional noise propagation modelling are provided in Appendix A.

Table 10: Predicted 'worst-case' noise levels at surrounding noise-sensitive receivers (with mitigation)

STAGE	RECEIVER CATCHMENT	PREDICTED NOISE LEVEL RANGE (dB(A) $L_{Aeq,15min}$)	NOISE MANAGEMENT LEVEL (dB(A) $L_{Aeq,15min}$)	NOISE MANAGEMENT LEVEL EXCEEDANCE (dB)	EXCEEDS HIGHLY NOISE AFFECTED LEVEL (YES / NO)
Excavation	RC1	46 – 54	49	0 – 5	No
	RC2	46 – 50	49	0 – 1	No
	RC3	46 – 54	50	0 – 4	No
Piling and Foundation	RC1	46 – 48	49	0	No
	RC2	46 – 56	49	0 – 7	No
	RC3	46 – 54	50	0 – 4	No
Construction	RC1	46 – 50	49	0 – 1	No
	RC2	46 – 58	49	0 – 9	No
	RC3	46 – 56	50	0 – 6	No

7 NOISE & VIBRATION MANAGEMENT STRATEGIES

7.1 PROJECT SPECIFIC RECOMMENDATIONS

7.1.1 Noise

In relation to noise impact at surrounding noise-sensitive receivers, predicted noise levels are expected to be under the "highly noise affected" levels from the ICNG during all stages of work.

Due to the relatively low background noise levels in the area, noise from project site works is predicted to exceed the "noise affected" management levels (between 0 – 9 dB), though these are during intensive activities (multiple works occurring simultaneously). Where works are not concentrated near the boundary of the site, noise levels at surrounding noise-sensitive receivers are expected to generally not exceed this management level.

Notwithstanding the above, the following noise mitigation strategies are recommended to protect the amenity of surrounding noise-sensitive receivers:

- At least a one-hour respite period, for example between 12:00pm – 1:00pm (or other period to coincide with construction workers lunch time(s)), should be offered per day during the most intensive periods of noisy activities. Limiting these activities outside of sensitive hours (e.g. no noisy works, such as piling, between 7:00am – 8:00am on weekdays) should also be considered.
- Frequent and proactive communication with the surrounding residents is also encouraged and shall be in accordance with the Community Consultation Strategy developed by School Infrastructure NW (SINSW). This will allow occupants of surrounding residents to arrange their schedules to accommodate possible noise sensitive activities (like online meetings and phone calls). More details regarding communication with the community can be found in Section 7.2.3

7.1.2 Vibration

There are generally no highly vibration intensive activities expected for the project site works. The method of piling has been selected to be screw piling, which is lower in vibration generation compared to alternative methods like vibratory or hammer piling.

Upon any complaints from surrounding residents, the following shall be undertaken:

- Vibration monitoring is recommended to be conducted at surrounding sensitive receivers (or at the location of complaint) in accordance with the monitoring program strategy proposed in Section 7.3
- Reasonable and feasible measures should be considered to lessen the impact, such as alternative methods or equipment for activities which are causing complaints to achieve the vibration levels required

To further diminish the vibration impact, the one-hour respite period, for example between 12:00pm – 1:00pm (or other period to coincide with construction workers lunch time(s)), recommended for noise mitigation shall also apply for vibration mitigation.

We recommend that dilapidation reports be prepared on surrounding sensitive receivers and buildings which will be in close proximity to heavy machinery. Guidance for this may be provided by the geotechnical engineer and controlled by ground composition.

7.2 GENERAL ACOUSTIC RECOMMENDATIONS

According to AS 2436 – 2010 “Guide to noise and vibration control on construction, demolition and maintenance sites” the following techniques could be applied to minimize the spread of noise and vibrations to the potential receivers.

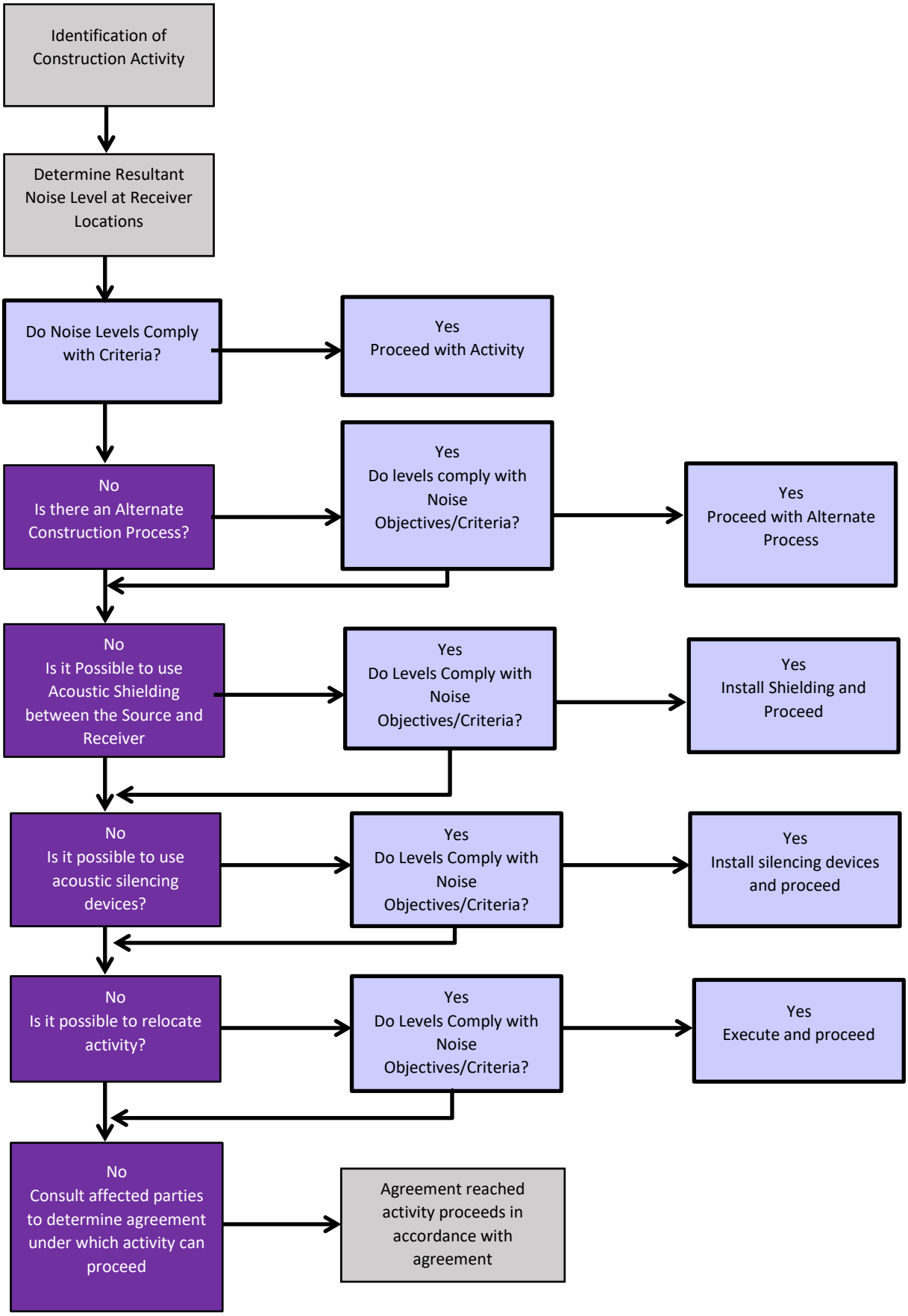
7.2.1 Noise

Figure 2 demonstrates the preferred order of actions taken to mitigate excessive construction noise emissions. If a process that generates significant noise levels cannot be avoided, the amount of noise reaching the receiver should be minimized. Two ways of achieving this are to either increase the distance between the noise source and the receiver or to introduce noise reduction measures such as screens. Practices that will reduce noise from the site include:

- Increasing the distance between noise sources and sensitive receivers.
- Reducing the line-of-sight noise transmission to residences or other sensitive land uses using temporary barriers (stockpiles, shipping containers and site office transportables can be effective barriers).
- Constructing barriers that are part of the project design early in the project to introduce the mitigation of site noise.
- Installing purpose-built noise barriers, acoustic sheds and enclosures.

Physical methods to reduce the transmission of noise between the site works and residences, or other sensitive land uses, are generally suited to works where there is longer-term exposure to the noise. A few of these methods have been introduced below.

Figure 2: Noise mitigation management flow chart



Screening

Hoarding: Another way of implementing screening is to build hoarding that includes a site office on an elevated structure. This option offers superior noise reduction when compared with a standard, simple hoarding. The acoustic performance is further enhanced when the hoarding is a continuous barrier.

General remarks:

In many cases, it is not practical to screen earthmoving operations effectively, but it may be possible to partially shield a construction plant at the early stages of the project with protective features required to screen traffic noise.

The usefulness of a noise barrier will depend upon its length, its height, its position relative to the source and the receiver, and the material of which it is made. A barrier designed to reduce noise from a moving source should extend beyond the last property to be protected by at least ten times the shortest distance from the said property to the barrier. A barrier designed to reduce noise from a stationary source should, where possible, extend beyond the direct line of sight between the noise source and the receiver by a distance equal to ten times the effective barrier height, which is the height above the direct line between source and receiver.

If the works are already predominantly located within nominally closed structures, careful consideration should be given to reducing noise breakout at any openings.

Cranes

For the early works construction phases, any cranage will be limited to mobile cranes where the engines are typically enclosed in an acoustically treated housing.

Reversing and warning alarms

Community complaints often involve the intrusive noise of alarms commonly used to provide a safe system of work for vehicles operating on a site. Beeper reversing alarm noise is generally tonal and may cause annoyance at significant distances from the work site.

There are alternative warning alarms capable of providing a safe system of work that are equal to or better than the traditional “beeper”, while also reducing environmental noise impacts. The following alternatives should be considered for use on construction sites as appropriate (and combined where appropriate):

- Broadband audible alarms incorporating a wide range of sound frequencies (as opposed to the tonal-frequency ‘beep’) are less intrusive when heard in the neighbourhood.
- Variable-level alarms reduce the emitted noise levels by detecting the background noise level and adjusting the alarm level accordingly.
- Proximity alarms that use sensors to determine the distance from objects, such as people or structures, and generate an audible alarm in cabin for the driver.
- Spotters or observers.

Selection of Alternate Equipment

As part of the Contractor’s Construction Methodology and Construction Management Plan, the noise and vibration impact of each equipment / machinery should be considered. Where feasible and practical, quieter equipment (lower Sound Power Level) shall be selected for the task. The Contractor can review the manufacturer’s equipment sound data or utilise AS2436:2010 “Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites” and the “Construction Noise Strategy, Transport for NSW, 2013” as guides in understanding what the typical Sound Power Levels are for alternative types of machinery.

Attended short-term noise measurements can also be conducted to either compare the noise levels of machinery, or to understand what the noise level at surrounding noise sensitive receivers are.

The same consideration shall be taken for vibration intensive machinery, which are expected to be only rock hammering and piling. Where feasible and practical, less vibration intensive equipment shall be selected for the task such as favouring pulverising and sawing methods rather than hydraulic hammering for rock breaking.

As with noise, attended short-term vibration measurements can be conducted at start of vibration intensive works to ensure vibration criteria (see Section 5.2) at surrounding receivers are not exceeded.

As a guide, the Contractor can also refer to AS2436:2010 “Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites” and the “Construction Noise Strategy, Transport for NSW, 2013” to use as a guide in understanding vibration intensive activities and their alternate methods, based on minimum working distances.

Machinery shall be selected based on the noise criteria and vibration criteria as presented in Section 5.1 and 5.2.

7.2.2 Vibration

Vibration can be more difficult to control than noise, and there are few generalizations that can be made about its control. It should be kept in mind that vibration may cause disturbance by causing structures to vibrate and radiate noise in addition to perceptible movement.

Impulsive vibration can, in some cases, provide a trigger mechanism that could result in the failure of building components that had previously been in a stable state. Vibrations can also trigger annoyance, which might get elevated into action by occupants of exposed buildings and should therefore be included in the planning of communication with impacted communities.

It should be remembered that failures, sometimes catastrophic, can occur as a result of conditions not directly connected with the transmission of vibrations, e.g. the removal of supports from retaining structures to facilitate site access. BS 7385-2 provides more information on managing ground-borne vibration and its potential effects on buildings. Where site activities may affect existing structures, a thorough engineering appraisal should be made at the planning stage.

General principles of seeking minimal vibration at receiving structures should be followed in the first instance. Predictions of vibration levels likely to occur at sensitive receivers are recommended when they are relatively close, depending on the magnitude of the source of the vibration or the distance associated. Relatively simple prediction methods are available in textbooks, codes of practice and standards, however, it is preferable to assess site transmission and propagation characteristics between source and receiver locations through measurements.

Guidance for measures available for the mitigation of vibration transmitted can be sought in more detailed standards, such as BS 5228-2 or policy documents, such as the NSW DEC *Assessing Vibration: A technical guideline*. Identifying the strategy best suited to the control of vibration follows a similar approach to that of noise: avoidance, control at the source, control along the propagation path, control at the receiver, or a combination of these. It is noted that vibration sources can include stationary plants (pumps and compressors), portable plants (jackhammers and pavement vibrators), mobile plants, pile-drivers, tunnelling machines and activities, and blasting, amongst others. Unusual ground conditions, such as a high water-table, can also cause a difference to expected or predicted results, especially when considering the noise propagated from piling.

7.2.3 Community Consultation to be Undertaken

The builder shall directly contact adjacent noise sensitive receivers and provide them with the following information:

- The contact details for a nominated representative in order to make noise / vibration complaints
- Explain the timeframe for the construction works and the proposed activities, i.e. the proposed start / stop dates of work and a description of the noise producing equipment that will be used
- Notify the noise sensitive receivers and relevant local / state authority in a timely manner should there be any need for an extension to the proposed arrangements
- Provide them with a copy of this report as approved by the relevant local / state authority
- Where noise is demonstrated as being compliant with criteria, this should not limit the proponent in undertaking further additional reasonable and feasible steps to reduce noise emissions.

Further, a Community Consultation Strategy (CCS) document is being developed by School Infrastructure NSW (SINSW) which will also provide mechanisms to facilitate communication between the Applicant, the relevant Council and the community during the design and construction of the development.

The builder shall also ensure that community consultant is being undertaken in accordance with the CSS once this has been fully developed and finalised.

7.2.4 Complaint Handling Procedures and Community Liaison

To assist in the management of noise and vibration complaints various procedures are to be followed. These include:

- Clearly visible signage identifying any key personnel along with their contact details to be erected along the perimeter of the building site including:
    - A 24-hour contact name, phone number and email address provided for the resident to address any complaint. The signage will declare; "For any enquiry, complaint or emergency relating to this site at any time please contact…"
- Give complaints a fair hearing
- Relevant local / state authority should be notified of the nature and details of complaints received (time, complainant etc.) and what remedial action has taken place, if any
- Have a documented complaints process, including an escalation procedure so that if a complaint is not satisfied there is a clear path to follow
- Call back as soon as possible to keep people informed of action to be taken to address noise problems. Call back at night time only if requested by the complainant to avoid further disturbance
- Implement all feasible and reasonable measures to address the source of the complaint
- A register is to be kept by the contractor to keep a record of complaints and detail any information associated with them. The contents of the register will include:
    - The name and the address of the complainant
    - Time and date of the complaint
    - The nature of the complaint (Noise/Vibration)
    - Subsequent details
    - Remedial action undertaken

The contents of the register will be maintained and updated on a monthly basis with any new complaint without delay. The complaints will be reported to both the relevant local / state authority and the Contractor. The investigation of the complaint and any remedial actions will be performed by the builder and/or client representative on a monthly basis. In the event of noisy works scheduled, the builder will notify residents 5 business days in advance.

In addition to the above, complaint handling and community liaison shall also be in accordance with the procedures outlined in Section 4.1 and 6.5 within the SINSW CSS.

7.2.5 Site Induction Process to be Undertaken

A site induction process is to be included as part of the Contractor's Construction Management Plan for the induction of employees, sub-contractors, visitors, etc.

This Construction Management Plan shall be referred to for details of site induction.

7.2.6 Construction Traffic Route Process to be Undertaken

The assessment and planning of construction traffic route is to be in accordance with the Construction Traffic and Pedestrian Management Sub-Plan (CTPMSP) prepared for the development and included as part of the Contractor's Construction Management Plan and selected, where feasible and practical, to minimise disruption and intrusiveness to surrounding noise sensitive receivers.

7.3 NOISE & VIBRATION MONITORING STRATEGY

7.3.1 General Methodology

Monitoring may be in the form of regular checks by the builder or indirectly by an acoustic consultant engaged by the builder and in response to any noise or vibration complaints. Where noise and vibration criteria are being exceeded or in response to valid complaints, noise and / or vibration monitoring should be undertaken. This would be performed inside the premises of the affected property and on site adjacent to the affected receivers.

Monitoring is to be undertaken by an experienced noise and vibration monitoring professional or an acoustic consultant. The results of any noise or vibration monitoring are to be provided to the relevant party or person in a timely manner allowing the builder to address the issue and respond to the complaints.

Noise and vibration monitoring can take two forms:

- Short-term monitoring
- Long-term monitoring

Both of these approaches are elaborated below.

7.3.2 Short-term Monitoring

Short-term monitoring consists of attended monitoring when critical stages of the construction are occurring. This normally provides real-time assistance and guidance to the subcontractor on site, telling them when the noise and vibration criteria are exceeded. Thus, the selection of alternative method on construction or equipment selection is allowed in order to minimise noise and vibration impacts.

Short-term monitoring may also be undertaken prior to start of works to ensure noise levels emitted from machinery and equipment are within the manufacturer's tested data / tolerance. This check can be implemented periodically throughout the construction program as a maintenance routine to ensure machinery and equipment stay within the manufacturer's data / tolerance and are not faulty.

7.3.3 Long-term Monitoring

Similarly, to short-term monitoring, long-term monitoring provides real-time alerts to the builder / site manager when the noise and vibration criteria are exceeded. Instead of someone being on site measuring, noise and vibration loggers are used.

Typically, the noise and vibration loggers stay on site for a period of several months for the critical construction stages of the project, such as the demolition and excavation phases.

Both methodologies are complementary and normally used simultaneously providing a significant amount of data via the long-term monitoring, but also providing information on the sources of noise and vibration generating exceedances via the short-term or attended monitoring.

Long-term noise monitoring reports shall be prepared and presented in accordance with the recommendations of the NSW ICNG (Section 8.2 of the ICNG).

7.3.4 Noise & Vibration Monitoring Programme

Based on the predicted noise levels which indicate no exceedances to the "highly noise affected" level and general exceedances (0-9dBA) to the "noise affected" level during intensive works, the following noise monitoring strategy may be considered and determined based on equipment selections. We note that the sound power levels presented in Table 9 are estimates and monitoring may be required if noisier equipment is used.

A monitoring programme is proposed in Table 11. The monitoring programme is to be carried out during the most noise / vibration intensive periods during each construction phase as agreed with the Acoustic Engineer and Contractor.

Refer to Figure 3 for the recommending monitoring type and locations. Locations shall be discussed and agreed between the Acoustic Engineer and Contractor prior to start of works and shall be reviewed regularly as construction works progress.

Figure 3: Proposed monitoring locations

Table 11: Monitoring programme

LOCATION REFERENCE	MONITORING RECOMMENDED[1]
N1	Noise
N2	Noise
N3	Noise

Note 1: Monitoring to be considered and determined based on equipment selection and community consultation

8 CONCLUSION

This CNVMSP has been prepared by E-LAB to accompany a State Significant Development Application (SSDA) for Wee Waa High School in accordance with Condition B22 of the SSDA Conditions of Consent.

The details of the noise and vibration modelling and assessment undertaken to predict the impacts on sensitive receivers have been presented in Sections 6.

To reduce the noise and vibration impacts on the sensitive receivers, noise and vibration mitigation measures have been proposed in Section 7.

The information presented in this report shall be reviewed if any modifications to the features of the development specified in this report occur, including and not restricted to selection of equipment/machinery and modifications to the construction program.