

6.6 Noise and vibration

Potential noise and vibration impacts have been assessed in *Noise and Vibration Technical Paper Great Western Highway Upgrade Medlow Bath* (Mott MacDonald, 2021d) (refer Appendix I). A summary of the potential construction and operational noise and vibration impacts is presented in this section, together with management measures to mitigate any negative impacts.

6.6.1 Methodology

Construction noise

The *Interim Construction Noise Guideline* (ICNG) (Department of Environment and Climate Change, 2009) details a process for the assessment and management of construction noise. The primary purpose of the construction noise assessment is to identify the potential for construction noise levels to exceed the acceptable noise management levels (NML) or highly affected level for sensitive receivers. NML are elevated from existing noise levels (and the levels vary, depending on if it is daytime, evening or night-time) but represent an increase in the noise level that is likely to be acceptable during construction.

In order to inform the NML for the proposal, long term noise monitoring was completed at four locations throughout Medlow Bath from Thursday 3 December to Monday 14 December 2020. The purpose of the monitoring was to measure the existing levels of traffic noise to assist in establishing criteria (refer Section 6.6.3), validating the noise model and to identify the rating background levels (RBLs) in support of the construction noise assessment.

Typical construction scenarios which assumed the number and type of equipment to be used were then modelled using SoundPLAN v8 software to compare the predicted noise levels during construction against the NML and highly affected noise level. It is noted that construction noise levels at sensitive receivers will depend upon the distance of the receiver to the works, the amount of shielding, if any, by topography or nearby structures, and the amount of noise generated by the construction activities. Construction traffic noise was also assessed.

Operational noise

Noise generated by road traffic operating on the proposed road upgrade has been modelled and assessed in accordance with the *NSW Road Noise Policy* (RNP) (Department of Environment, Climate Change and Water, 2011), the *Noise Mitigation Guideline* (Roads and Maritime Services, 2015c) and the *Noise Criteria Guideline* (Roads and Maritime Services, 2015a). To assess the potential impacts of the operational phase of the proposal on noise-sensitive receivers, the following steps were completed for both daytime and night-time scenarios:

- modelling of the existing environment as part of the validation process
- modelling of a 'do minimum (the year of opening 2026)' and a 'do something (the design operational year 2036)' scenarios for the purpose of establishing criteria
- modelling of road traffic noise levels for 10 years after opening (2036). These predictions were undertaken prior to optimisation of any noise barriers and aim to determine all receivers that qualify for consideration of noise mitigation.

The following factors were considered in assessing traffic noise impacts:

- traffic volume and proportions of heavy vehicles: measured traffic counts were used to validate the existing noise model and future traffic counts were sourced from modelling scenarios (refer Section 6.5)
- vehicle speed: the existing posted speed limit throughout the proposal area is 60 kilometres per hour and would remain at this speed in the future

- topographical information along and surrounding the proposal area
- road pavement surface types
- road gradient
- noise emission levels and source heights for different vehicle types
- building structures
- location of potentially affected receivers.

Road noise was modelled using UK Department of Transport, Calculation of Road Traffic Noise (CORTN) algorithm with noise source heights of 0.5 metres, 1.5 metres, and 3.6 metres above ground level. These heights represent the noise from light vehicles, combined engine/tyre noise from heavy vehicle and the exhaust noise from heavy vehicle.

6.6.2 Existing environment

Medlow Bath predominantly comprises residential properties, with the local noise environment controlled by traffic on the existing Great Western Highway and the Blue Mountains Line rail services. Both the road and rail line are freight routes, resulting in an appreciable noise contribution from trucks and diesel locomotives. Adjacent to Medlow Bath Station there is a pedestrian crossing. Trains are required to sound their horn at this location to warn pedestrians of their approach, which contributes to the local noise environment. The proposal would remove this pedestrian crossing and provide an alternate means of access (a pedestrian bridge elevated above the railway and highway), also removing the crossing noise events.

Existing background levels

Table 6-17 presents the rating background levels (RBLs) which are a measure of the existing noise level for each monitoring location, and which have been calculated in accordance with the *Noise Policy for Industry* (EPA, 2017).

Table 6-17: Rating background level

Noise logging location (NL)	Daytime (7am – 6pm)	Evening (6pm – 10pm)	Night-time (10pm – 7am)
NL1 25 Delmonte Avenue, Medlow Bath	40	37	27
NL2 104 Great Western Highway, Medlow Bath	50	42	29
NL3 40 Railway Parade, Medlow Bath	49	41	29
NL4 5 Railway Parade, Medlow Bath	46	41	24

Noise sensitive receivers

Noise sensitive receivers were identified through aerial photography and visual inspection. Locations and occupancy of all receivers have been identified to classify each building as either residential, commercial, industrial, educational, and other non-sensitive uses. Noise catchment areas (NCA) are used to group receivers within a similar noise environment and define appropriate construction NML.

The assessment identified 320 buildings around the proposal area as receivers and these receivers and which were divided into two NCA (refer Table 6-18).

Table 6-18: Noise Catchment Areas (NCAs)

NCA	Location	Description
NCA01	East of Great Western Highway	To the east of the Great Western Highway, the receivers are generally residential, with a small number of guest houses dotted throughout the area. There is a single commercial building (a café) towards the northern end of Railway Parade. The remainder of the receivers are residential.
NCA02	West of Great Western Highway	On the western side, the Hydro Majestic Hotel is a prominent feature of Medlow Bath with other commercial premises to the south including a restaurant and store. There is also a car dealership to the north of the Hydro Majestic Hotel. The remainder of the receivers are residential.

Vibration sensitive receivers

The following vibration sensitive receivers (heritage items) have been identified in and around the proposal area:

- Medlow Bath Station
- Hydro Majestic Hotel
- Former Post and Telegraph Store, 1 Railway Parade
- Urunga, 1 Park Street
- Melbourne House, 2 Station Street
- Cosy Cot, 4 Station Street
- Shelaugh Cottage, 6 Station Street.

6.6.3 Potential impacts

Construction

Assessment criteria

Table 6-19 presents information from the ICNG on NML for residential receivers, including how to calculate and apply for construction noise assessments.

Construction noise

Table 6-19: Noise Management Levels (NML) for residential receivers

Time of day	Noise Management Level $L_{Aeq,15min}$	How to apply
Recommended standard hours: Monday to Friday: 7am to 6pm Saturday: 8am to 1pm	Noise affected RBL + 10 dBA	<p>The noise affected level represents the point above which there may be some community reaction to noise.</p> <p>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.</p> <p>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.</p>
No work on Sundays or Public Holidays	Highly noise affected 75 dBA	<p>The highly noise affected level represents the point above which there may be strong community reaction to noise.</p> <p>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:</p> <ul style="list-style-type: none"> 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.
Outside recommended standard hours	Noise affected RBL + 5 dBA	<p>A strong justification would typically be required for works outside the recommended standard hours.</p> <p>The proponent should apply all feasible and reasonable work practices to meet the noise affected level.</p> <p>Where all feasible and reasonable practices have been applied and noise is more than 5 dBA above the noise affected level, the proponent should negotiate with the community.</p>

Based on the RBLs for the proposal and the ICNG recommendations, NMLs for residential and non-residential receivers is established in Table 6-20 and Table 6-21, respectively.

Table 6-20: Construction noise management levels –residential land uses

Site NCA	Noise management level, $L_{Aeq,15min}$ dBA		
	Daytime	Evening	Night-time
01	50	42	35
02	51	46	35

Table 6-21: Construction noise management levels –non-residential land uses

Receiver type	External NML $L_{Aeq,15min}$
Industrial premises	75 dBA
Offices and retail offices	70 dBA

Sleep disturbance

Sleep disturbance noise goals have also been established for residential receivers. Sleep disturbance criteria for both NCAs are a screening level RBL + 15dB(A). Where construction works are planned to extend over more than two consecutive nights, the ICNG recommends that an assessment of sleep disturbance impacts should be completed. The sleep disturbance criteria for the NCAs are presented in Table 6-22.

Table 6-22: Sleep disturbance criteria – screening

NCA	External screening criteria Night ($L_{A1,1min}$) [$L_{A90,15min} + 15dB(A)$]
01	45 dBA
02	45 dBA

Construction vibration

Perceptible vibration can be an annoyance to building occupants, particularly if the duration or frequency of events is significant. Vibration criteria for human comfort is provided by *Assessing Vibration – A Technical Guideline* (Department of Environment and Conservation, 2006) and provides guidance in terms of continuous and impulsive vibration, and intermittent vibration. The vibration dose value criterion adopted for the proposal for human comfort is $0.2 \text{ mm/s}^{1.75}$ (between 7am and 10pm) and $0.13 \text{ mm/s}^{1.75}$ (between 10pm and 7am).

Impacts from vibration may also result in impacts to building structure (cosmetic damage). Of these considerations, the human comfort criteria are the more stringent and if compliance with human comfort criteria is achieved, it will follow that compliance is achieved for the building damage objectives.

The German Standard *Structural Vibration, Part 3: Effects of Vibration on Structures (DIN 4150-3)* identifies more stringent vibration levels for building damage and includes a category specifically for heritage buildings which would be applied for the proposal (refer Table 6-23). Further consideration would be given to heritage structures throughout the detailed design stage to ensure adequate mitigation and management measures are included in the construction strategy.

Table 6-23: Structural damage safe limits for building vibration DIN 4150-3

Structure type	Vibration frequency at foundation 1-10 Hz	Vibration frequency at foundation 1-10 Hz	Vibration frequency at foundation 1-10 Hz	Vibration at the horizontal plane of highest floor at all frequencies
Heritage building	3	3-8	8-10	8

Construction noise

The predicted noise impacts for the proposal are provided in Table 6-24. The table provides the highest noise level in each NCA, and the number of receivers which are predicted to exceed the NML in three bands. The number of highly affected receivers (ie noise levels above 75 dB(A)) is also presented. These impacts are also presented graphically in the form of noise contours in Appendix I.

Due to the small offset distance between the proposal and sensitive receivers, there would be exceedances of the NML during construction works. A small number of receivers would be highly affected at some point during the works. The noisiest stage is predicted to be vegetation clearing due to the operation of equipment like chainsaws, but which would last only two weeks.

Table 6-24: Summary of construction noise impacts per NCA

NCA	Maximum L _{Aeq} noise level dBA	No. of receivers exceeding NML 1-10 dBA	No. of receivers exceeding NML 11-20 dBA	No. of receivers exceeding NML >20 dBA	No. of highly affected receivers
Site preparation (six weeks)					
NCA01	72	136	59	7	0
NCA02	90	49	31	16	12
Site establishment (six weeks)					
NCA01	71	127	56	2	0
NCA02	89	48	29	13	12
Vegetation clearing (two weeks)					
NCA01	79	81	115	47	23
NCA02	97	23	46	38	24
Roadworks (70 weeks)					
NCA01	76	132	82	32	2
NCA02	94	41	37	28	16
Finishing works (ten weeks)					
NCA01	66	76	32	0	0
NCA02	97	37	16	17	11

Out of hours works and sleep disturbance

Two out of hours work scenarios were assessed as part of this proposal. These scenarios include road works, which is often required to be undertaken with traffic management measures outside peak periods, and the pedestrian bridge installation which also requires traffic management. Predicted noise impacts for out of hours works and sleep disturbance are presented in Table 6-25 and Table 6-26.

Road works taking place at night may cause major disturbances to the community, on this basis such activities should take place during daytime hours unless necessary. Where they must take place out of hours, the duration of works should be minimised.

Table 6-25: Out of hours construction noise impacts – night road works

NCA	L _{Aeq} NML dBA	Maximum L _{Aeq} noise level dBA	NML exceedance <5 dBA	NML exceedance 5-15 dBA	NML exceedance 15-25 dBA	NML exceedance >25 dBA	Highly noise affected
1	35	94	0	2	34	100	17
2	35	77	0	3	91	133	6

Table 6-26: Out of hours construction noise impacts – night pedestrian bridge installation

NCA	L _{Aeq} NML dBA	Maximum L _{Aeq} noise level dBA	NML exceedance < 5 dBA	NML exceedance 5-15 dBA	NML exceedance 15-25 dBA	NML exceedance >25 dBA	Highly noise affected
1	35	54	4	3	3	0	0
2	35	51	9	7	2	0	0

Construction traffic noise

The proposal is expected to have a maximum of 20 heavy vehicle deliveries and a workforce of 75 personnel. This has been assessed as an additional 40 heavy vehicle movements and 150 light vehicle movements during the daytime period. Existing traffic volumes are considered in Section 6.5 with more than 17,800 vehicles from combined light and heavy vehicles per day. Based on these additional traffic movements, the increase in noise from construction traffic is predicted to be less than 0.1 dB, and the additional movements would have a negligible impact on the local noise environment.

Construction vibration

Construction of the proposal has the potential for vibration impacts as a result of the use of vibration generating equipment such as jackhammers and vibratory rollers. Table 6-27 recommends the minimum working distances for various plant and equipment to meet human comfort and cosmetic building damage criteria. At the start of any vibration intensive works these distances would be checked and maintained on site to avoid any negative impacts.

Table 6-27: Minimum working distances

Plant item	Rating/description	Min working distance cosmetic damage (m)	Min working distance human comfort (m)
Vibratory roller	< 50 kN (typically 1 – 2 tonnes)	5	15 to 20
	< 100 kN (typically 2 – 4 tonnes)	6	20
	< 200 kN (typically 4 – 6 tonnes)	12	40
	< 300 kN (typically 7 – 13 tonnes)	15	100
	> 300 kN (typically 13 – 18 tonnes)	20	100
	> 300 kN (> 18 tonnes)	25	100
Small hydraulic hammer	300 kg (5 to 12 tonnes excavator)	2	7
Medium hydraulic hammer	900 kg (12 to 18 tonnes excavator)	7	23
Large hydraulic hammer	1,600 kg (18 to 34 tonnes excavator)	22	73
Vibratory pile driver	Sheet piles	2 to 20	20
Pile boring	≤ 800 millimetres	2	4
Jackhammer	Hand held	1	2

Construction work also has the potential to impact heritage structures from vibration. Table 6-28 provides a review of heritage structures and whether they may be impacted by vibration.

Table 6-28: Heritage structures and potential vibration impacts

Heritage structure	Distance to works (m)	Potentially vibration impacted
Medlow Bath Railway Station	18	Yes
Hydro Majestic Hotel	16	Yes
Hydro Majestic Hotel Heritage Wall	<5	Yes
Former Post and Telegraph Store, 1 Railway Parade	60	No
Urunga, 1 Park Street	60	No
Melbourne House, 2 Station Street	16	Yes
Cosy Cot, 4 Station Street	32	No
Shelaugh Cottage, 6 Station Street.	53	No

A range of heritage receivers have been identified which would require careful consideration with respect to vibration impact when planning works. Vibration monitoring and consideration of appropriate vibration generating equipment (such as vibratory rollers) would be required throughout the construction of the project.

Operation

Assessment criteria

The *Road Noise Policy* (RNP) (EPA, 2011) sets out criteria for assessment of noise from vehicles on public roads. The RNP sets out noise criteria for 'freeways', 'arterial', 'sub-arterial' and 'local' roads and provided in Table 6-29 and Table 6-30. The RNP considers the overall noise levels in the future, in addition to the change in noise due to the proposal. To achieve this, two scenarios were assessed: a 'do minimum' scenario; and 'do something' scenario. The difference between these two scenarios would be the impact of the proposal. For this, the year 2026 has been assessed as the year of opening and the year 2036 has been assessed as the design operational year.

Table 6-29: RNP criteria for existing residences (freeway/arterial/sub-arterial roads)

Type of project/land use	Day (7am-10pm)	Night (10pm-7am)
Existing residences affected by noise from redevelopment of existing freeway/ arterial/ sub-arterial roads	L _{Aeq,15hr} 60 dBA (external)	L _{Aeq,9hr} 55 dBA (external)
Existing residences affected by increases in traffic noise of 12 dB(A) or more from a freeway/ arterial/ sub-arterial road	Between L _{Aeq,15hr} 42-60 dBA (external)	L _{Aeq,9hr} 42-55 dBA (external)

Table 6-30: RNP criteria for non-residential residences

Receiver type	Existing sensitive land use	Day (7am-10pm)	Night (10pm-7am)
Non-residential	School classrooms	L _{Aeq,1hr} 40 (internal) when in use	
Non-residential	Hospital wards	L _{Aeq,1hr} 35 (internal)	L _{Aeq,1hr} 35 (internal)
Non-residential	Place of worship	L _{Aeq, (15 hour)} 40 (internal)	L _{Aeq, (15 hour)} 40 (internal)
Non-residential	Open space (active use)	L _{Aeq, (15 hour)} 60 (internal)	
Non-residential	Open space (passive use)	L _{Aeq, (15 hour)} 55 (internal)	
Non-residential	Childcare facilities	Sleeping rooms L _{Aeq, (1 hour)} 35 (internal) Indoor play areas L _{Aeq, (1 hour)} 40 (internal) Outdoor play areas L _{Aeq, (1 hour)} 55 (external)	Existing traffic L _{Aeq,9hr} + 12 dBA (external)

Operational noise – Great Western Highway

Noise level predictions for the year 2036 were calculated at the sensitive receivers identified within the proposal area and are presented in Appendix I. Almost all sensitive receivers are predicted to exceed the noise criteria by 5dBA or more, both with or without the proposal.

Prior to the consideration of noise mitigation, a total of 13 residential receivers would experience noise levels above the relevant criteria and have been identified as qualifying for consideration for noise mitigation in accordance with guidelines set out in the *Noise Mitigation Guideline* (Roads and Maritime Services, 2015c). The exceedances identified above the relevant criteria are predominantly a result of the existing and future road traffic flows on the Great Western Highway and are not a direct result of the proposal.

At the Hydro Majestic Hotel (non-residential receiver), a noise level of 71 dBA during the daytime and 66 dBA during the night-time period has been predicted for the ‘do something scenario’. These noise levels are predicted to reduce by less than 2 dBA from the ‘do minimum scenario’. The RNP does not have noise criteria for hotels and in this situation operational road traffic noise levels are predicted to decrease as a result of the proposal.

Options for noise mitigation in the order of preference given in the RNP are:

- pavement design
- noise barriers
- at-property treatments.

The typical low noise pavement is stone-mastic asphalt and TfNSW recommends a correction factor of 0.0 dB for stone-mastic asphalt with a standard aggregate size of 10 millimetres. Given there is no acknowledged noise benefits, the standard low noise pavement is not recommended for the proposal. Options for noise barriers are not considered appropriate for the local environment given the village feel, several locally and state listed heritage items and views and high visual amenity along with existing space

constraints, and so at-property treatment would be investigated as part of detailed design to ensure operational noise levels are appropriately mitigated.

Operational noise – Bellevue Crescent U-turn bay

A U-turn bay is included in the design at Bellevue Crescent. The road has been assessed as a new local road, in accordance with the RNP. Vehicle movements would be generally slow speed throughout this area, with movements no greater than 10 kilometres per hour on average while using the bay itself. During the busiest one-hour period the traffic and transport assessment predicts 13 light vehicles and two heavy vehicles would use the U-turn bay in 2036. Traffic movements during 2026 and the night-time period are not available.

At the façade of the most affected receiver, 108 Great Western Highway, noise levels are predicted to be 54 dBA. Noise levels at the closest sensitive receiver, 3 Bellevue Crescent, are predicted to be 47 dBA during the busiest one-hour period. These predicted noise levels would comply with the daytime local road noise criteria of $L_{Aeq(1hour)}$ 55 dBA. While traffic volumes are not available for the night-time period, hourly night-time traffic volumes for 2036 are about 14 per cent of the daytime figures, which would yield noise levels about nine dB lower. Based on these volumes it is likely that night-time noise levels also comply with the night-time criteria of $L_{Aeq(1hour)}$ 50 dBA. Consideration of noise mitigation is not required for the operation of the U-turn bay.

Alternate Bellevue Crescent Option

At this stage of the design, only traffic volumes for the 2036 morning and afternoon peak periods are available for the alternate arrangement for Bellevue Crescent. The results of noise modelling indicate that three residential locations are predicted to exceed the applicable daytime noise criteria. Further analysis would be required during the detailed design stage to confirm the predicted noise levels during the night-time period. However, if this option was to proceed these three sensitive receivers would likely require consideration of additional noise mitigation measures. Low noise pavement and noise barriers would not be practicable in this location, and so at-property treatment would be investigated.

6.6.4 Safeguards and management measures

Table 6-31: Safeguards and management measures – Noise and vibration

Impact	Environmental safeguards	Responsibility	Timing	Reference
Construction noise and vibration	<p>A Noise and Vibration Management Plan will be prepared and implemented as part of the CEMP. The plan will generally follow the approach in the <i>Interim Construction Noise Guideline</i> (Department of Environment and Climate Change, 2009) and include the following:</p> <ul style="list-style-type: none"> the plan will consider potential vibration impacts associated with construction activities and would identify feasible and reasonable measures to mitigate these impacts, including safe working distances all potential significant noise and vibration generating activities associated with the activity feasible and reasonable mitigation measures to be implemented, taking into account <i>Beyond the Pavement 2020: Urban design approach and procedures for road and maritime infrastructure planning, design and construction</i> (TfNSW Centre for Urban Design, 2020) a monitoring program to assess performance against relevant noise and vibration criteria arrangements for consultation with affected neighbours and sensitive receivers, including notification and complaint handling procedures contingency measures to be implemented in the event of non-compliance with noise and vibration criteria stakeholder engagement will be a key feature of these measures, particular with key stakeholders such as the Hydro Majestic Hotel vibration sensitive receivers identified will require careful consideration when planning works and, dependent on the nature of the works, may require vibration monitoring throughout the proposal. 	Contractor	Detailed design / Pre-construction	Section 4.6 of QA G36 <i>Environment Protection</i>
Out of hours works	<p>As part of the Noise and Vibration Management Plan, an out-of-hours work protocol will be developed, including any requirements set under the EPL which defines:</p> <ul style="list-style-type: none"> all scheduled and planned out-of-hours activities any oversized and other deliveries needing to take place out-of-hours as required by the police or other authorities for safety reasons 	Contractor	Pre-construction/ Construction	Appendix I

Impact	Environmental safeguards	Responsibility	Timing	Reference
	<ul style="list-style-type: none"> other tie-in, utility connection and intersection work that may need to take place out-of-hours for road user safety issues out-of-hours emergency work needed to prevent the loss of life, property, to prevent harm or as agreed under negotiation with EPA and affected sensitive receivers the record-keeping process for capturing agreed and emergency out-of-hours work. very noisy activities should, as much as practicable, be programmed for normal working hours. If the work cannot be undertaken during the day, it should be completed before 12:00am. In particular, there should be no jackhammering or saw cutting after midnight. 			
Construction noise and vibration	<p>All sensitive receivers (eg schools, local residents) likely to be affected will be notified at least seven days prior to commencement of any works associated with the activity that may have an adverse noise or vibration impact. The notification will provide details of:</p> <ul style="list-style-type: none"> the proposal construction period and construction hours contact information for project management staff complaint and incident reporting how to obtain further information. 	Contractor	Detailed design / Pre-construction	
Construction noise and vibration	<p>The following general mitigation measures will be applied as practicable:</p> <ul style="list-style-type: none"> limit work to daylight hours and only night works during notified road closures. perform noisy work during less sensitive time periods select low-noise plant and equipment ensure equipment has quality mufflers installed where practicable use smaller/lower capacity plant in reference to the safe working distances where possible, concentrate noisy activities at one location and move to another as quickly as possible vehicle movements outside construction hours, including loading and unloading operations, should be minimised and avoided where possible 	Contractor	Pre-construction / Construction	Section 6 of Appendix I

Impact	Environmental safeguards	Responsibility	Timing	Reference
	<ul style="list-style-type: none"> ensure equipment is well maintained and fitted with adequately maintained silencers use only necessary sized equipment implement worksite induction training, educating staff on noise sensitive issues and the need to make as little noise as possible consider alternatives, such as manually adjustable or ambient noise sensitive types (“smart” reversing alarms) and closed-circuit TV systems consider installing temporary construction noise barriers install noise-control kits for noisy mobile equipment and shrouds around stationary plant, as necessary. 			
Construction noise	Noise management controls will be implemented early in the work program to benefit receivers while the proposal is being built.	Contractor	Detailed design / Pre-construction	Appendix I
Construction noise and vibration	Where possible, plant will be located as far from residences as possible and behind site structures, barriers, screens and/or noise walls. Plan for the use of less noise/vibration equipment where reasonable and feasible.	Contractor	Pre-construction /Construction	Appendix I
Construction vibration	Any proposed works within the minimum safe working distances will be undertaken with concurrent vibration measurements to ensure the cosmetic damage criteria are not exceeded at sensitive receiver locations.	Contractor	Construction	Table 6-27 Appendix I
Construction vibration – heritage structures	Vibration resulting from construction and received at any heritage structure will be managed in accordance with <i>German Standard DIN 4150: Part 3 – 1999 Structural Vibration in Buildings: Effects on Structures</i> . Where required, monitoring will be undertaken to ensure guideline values are achieved, or additional vibration mitigation measures developed to manage risks.	Contractor	Construction	Table 6-23 <i>Structural Vibration, Part 3: Effects of Vibration on Structures (DIN 4150-3)</i> Appendix I
Operational noise	Architectural treatment will be investigated for properties where there are exceedances of the noise criteria. Based on the concept design, this will likely include fourteen residential properties:	Contractor	Detailed design	Appendix I

Impact	Environmental safeguards	Responsibility	Timing	Reference
	<ul style="list-style-type: none"> • 2 Station Street • 4 Station Street • 40 Great Western Highway • 50 Great Western Highway • 100 Great Western Highway • 102 Great Western Highway • 104 Great Western Highway • 106 Great Western Highway (proposed acquisition) • 108 Great Western Highway • 110-114 Great Western Highway • 116-118 Great Western Highway • 14 Delmonte Avenue • 122 Great Western Highway • 126 Great Western Highway. 			