# 7. Assessment of key issues

## 7.7 Noise and vibration

This section provides a summary of the potential noise and vibration impacts that may be generated by construction and operation of the project and presents a proposed approach to the management of these impacts. **Table 7-99** outlines the SEARs that relate to noise and vibration and identifies where they are addressed in this EIS. The full assessment of noise and vibration impacts is provided in **Appendix K**.

Table 7-99 SEARs (noise and vibration)

| Secretary's requirement | Where addressed in this EIS |
|---|---|
| 11. Noise and vibration - Amenity | |
| 1. The Proponent must assess construction and operational noise and vibration impacts in accordance with relevant NSW noise and vibration guidelines. The assessment must cover typical and realistic construction and operation activities. The assessment must include consideration of: | Relevant guidelines are presented in **Section 7.7.1** and **Section 7.7.2**<br><br>Construction noise and vibration impacts are assessed in **Section 7.7.6,** while operational noise and vibration impacts are assessed in **Section 7.7.7** |
| a. Impacts on sensitive receivers including small businesses; | Sensitive receivers, including small businesses, are identified in **Section 7.7.5**<br><br>Impacts on sensitive receivers are presented in **Section 7.7.6** and **Section 7.7.7** |
| b. Noise impacts of out-of-hours works including proposed activities including utility works, justification for these activities, estimation of the number of out-of-hours activities required and timeframes for these activities; | Noise impacts of out-of-hours-works is assessed in **Section 7.7.6**.<br><br>Justification for activities is provided in **Section 7.7.3** and **Chapter 11** |
| c. Sleep disturbance; | Sleep disturbance is assessed in **Section 7.7.6** |
| d. The characteristics of noise and vibration, as relevant (for example, low-frequency noise); and | Characteristics of noise and vibration are typically brought into consideration for fixed operational facilities which may require modifying factors to be applied to account for low frequency or impulsiveness. This project does not have any fixed facilities. |
| e. How noise and vibration mitigation measures act to mitigate the effects of consecutive and cumulative construction impacts. | Noise and vibration environmental management measures are presented in **Section 7.7.9** |
| 2. The Proponent must demonstrate that blast impacts are capable of complying with the current guidelines, if blasting is required. | Blasting is not anticipated to be required during construction of the project. |
| 12. Noise and vibration – Structural | |
| 1. The Proponent must assess construction and operation noise and vibration impacts in accordance with relevant NSW noise and vibration guidelines. The assessment must include consideration of impacts on the structural integrity and heritage significance of items (including Aboriginal places and items of environmental heritage). | Relevant guidelines are presented in **Section 7.7.1** and **Section 7.7.2**<br><br>Construction noise and vibration impacts are assessed in **Section 7.7.6**, while operational noise and vibration impacts are assessed in **Section 7.7.7** |

| Secretary's requirement | Where addressed in this EIS |
|---|---|
| 2. The Proponent must demonstrate that blast impacts are capable of complying with the current guidelines, if blasting is required. | Blasting is not anticipated to be required during construction of the project. |

## 7.7.1 Policy and planning setting

The following policies and documents were used to guide the development and implementation of the noise and vibration impact assessment:

- Construction noise:
  - Interim Construction Noise Guideline (ICNG) (DECC, 2009a)
  - Construction Noise and Vibration Guideline (CNVG) (Roads and Maritime, 2016e)
  - Road Noise Policy (RNP) (NSW EPA, 2011)
- Construction vibration:
  - Assessing Vibration: a technical guideline (NSW EPA, 2006)
  - DIN 4150: Part 3-2016 Structural vibration – Effects of vibration on structures (Deutsches Institute fur Normung, 2016)
  - BS 7385 Part 2-1993 Evaluation and measurement for vibration in buildings Part 2 (BSI, 1993)
  - AS2107:2016 Acoustics – Recommended design sound levels and reverberation times for building interiors
- Operational traffic noise
  - RNP (NSW EPA, 2011)
  - Noise Criteria Guideline (NCG) (Roads and Maritime, 2015f) (including application notes)
  - Noise Mitigation Guideline (NMG), Roads and Maritime, 2015d)
  - Model Validation Guideline (Roads and Maritime, 2018f)
  - Environmental Noise Management Manual (ENMM) (RTA, 2001a)
  - Preparing an Operational Noise and Vibration Assessment (Roads and Maritime, 2011)
  - At-Receiver Noise Treatment Guideline (Roads and Maritime, 2017c)
- Operational noise from fixed facilities
  - Noise Policy for Industry (NSW EPA, 2017a)
- Construction and operation sleep disturbance guidance
  - RNP (NSW EPA, 2011)
  - Noise Policy for Industry (NSW EPA, 2017a).

The above documents are discussed further in the following sections, including how they were employed for the purpose of this assessment.

## 7.7.2 Assessment methodology

A summary of the approach carried out for the assessment of construction and operational noise and vibration impacts associated with the project is provided in the following sections. The detailed assessment methodology for noise and vibration is provided in **Appendix K**.

The assessment of the noise and vibration impacts of the project included the following key steps:

- Identification of noise sensitive receivers and noise catchment areas

- Development of a study area for the assessment, including construction traffic noise
- Background noise monitoring to determine existing noise levels
- A construction noise assessment to predict noise levels that may be generated by the project; including airborne noise, construction traffic noise, and vibration
- Calculation of road traffic noise changes associated for the different scenarios associated with the project eg 'Do Minimum' (without the project), 'Do Something' (with the project) for the opening year (2026) and ten years following opening (2036)
- Assessment of the cumulative impacts of the project and other known projects in the vicinity
- A sensitivity analysis of the operational road traffic noise assessment and noise modelling methodology to identify how sensitive the mitigation requirements for this project are to a change in predicted noise levels; the likely change in the predicted number of receivers that are considered eligible for consideration of property treatment was determined by applying a correction factor to the noise model predictions in 1 dBA increments
- Identification of environmental management measures to avoid, minimise and manage noise and vibration impacts during construction of the project, including initial identification of potential noise barrier requirements and areas where at-property treatments may need to be considered.

#### *Study area*

The noise assessment for the project investigated potential noise and vibration impacts on land in the local government areas of Penrith to the north, Liverpool to the south, and Fairfield to the north-east. The suburbs of Cecil Park and Cecil Hills are found to the east of the M12 Motorway, with Luddenham to the west. The operational footprint is close to a number of major existing road corridors, including the M7 Motorway, Elizabeth Drive, Mamre Road, Luddenham Road, and The Northern Road. The future Western Sydney Airport would be located to the south of the project.

The noise and vibration study area includes a mix of rural and suburban areas. Cecil Hills, Abbotsbury (suburban areas), Cecil Park and Mount Vernon (small-lot rural residential areas) are located in the eastern section of the project near the M7 Motorway and Elizabeth Drive. Kemps Creek, Badgerys Creek and Luddenham, in the western section of the project are sparsely populated and consist primarily of large rural lots.

The noise environment within the suburban areas is generally influenced by sources of road traffic noise from the M7 Motorway and Elizabeth Drive, particularly during the daytime period. During the evening and night-time periods, ambient noise levels typically decrease due to a reduction in the volume of road traffic on Elizabeth Drive and the M7 Motorway. The noise environment in the rural locations is generally influenced by environmental noises such as wind and insects.

Further detail on the existing noise conditions in the study area is provided in **Section 7.7.5.**

## 7.7.3 Construction noise and vibration assessment methodology

The construction noise and vibration assessment for the project considered the potential impacts associated with airborne and ground-borne noise and vibration, from construction activities and from construction traffic, and included the following key steps.

#### *Identify construction scenarios*

Identification of representative scenarios for the different construction locations and activities (see **Table 7-100**), based on a 'realistic worst case' and categorised into 'Peak impact' and 'Typical impact' works. Peak impact works (eg activities involving noise intensive equipment like rock-breakers or concrete saws). While 'Peak impact' works would be required at certain times in most locations, the noisiest works would

only last for relatively short periods throughout the overall works duration. The ‘Typical impact’ works represent typical noise emissions from the project when noise intensive equipment is not in use.

Consideration was given to both typical and reasonable worst-case construction activities, both when works would be near receivers and further away within the construction works area. Peak impact works represent the reasonable worst-case scenario, developed for the project as required under the Interim Construction Noise Guideline (ICNG). The scenario is conservative because it assumed all equipment expected to be used at a given site would be operating simultaneously, at a worst-case intensity, and with a worst-case orientation during a 15-minute period.

The worst-case or Peak impact scenario would not typically occur and therefore actual construction noise levels are likely to be lower. The Typical impact is a more realistic representation of actual construction noise levels which considers the type, number and operational intensity of plant and equipment associated with construction works based on experience with similar major transport infrastructure projects.

Table 7-100 Construction scenario descriptions

| ID | Scenario | Description |
|---|---|---|
| 1a | Ancillary facility establishment/ decommissioning – Peak impact | Before construction begins, the ancillary facilities would need to be prepared to allow construction works to occur. The works would vary depending on location and the existing conditions but could include:<br>• Minor clearing<br>• Minor earthworks<br>• Installation of office accommodation<br>• Utilities<br>• Amenities<br>• Secure perimeter fencing, including visual screening of construction ancillary facilities where necessary<br>High noise impact works would be required at certain times and would include the use of excavators and front end loaders. |
| 1b | Ancillary facility establishment/ decommissioning – Typical impact | |
| 2a | Ancillary facilities – Operation | The ancillary facilities would generally comprise:<br>• Temporary buildings (generally prefabricated) including offices and meeting rooms, amenities and first aid facilities (the size and number of office facilities at the main ancillary facilities would be greater than at the secondary ancillary facilities)<br>• Hardstand parking areas with sufficient space to accommodate the numbers of construction workers expected at any site<br>• Materials laydown, storage and handling areas, including purpose-built temporary structures as required<br>• Batching plants are currently proposed to be located at AF2 and AF3; the location of the batching plant was assumed to be in the middle of each ancillary facility; the location is considered indicative and would be confirmed as the project progresses<br>• Bridge construction support areas<br>• Workshops with appropriate safety and environmental controls for servicing plant and equipment. |
| 2b | Ancillary facilities – Stockpiling | |
| 2c | Ancillary facilities – Batching plant | |
| 3a | Utilities and drainage - including relocation of existing - Peak impact | The project would require the construction of new drainage infrastructure and alterations to existing drainage. Construction of drainage works would involve localised excavation, compaction and installation of drainage pipes and pits, and construction of table drains and temporary construction sediment basins.<br>High noise impact works would be required at certain times and would include the use of rock-breakers. |
| 3b | Utilities and drainage - including relocation of existing - Typical impact | |

| ID | Scenario | Description |
|---|---|---|
| 4a | Demolition - bridges and buildings (including breaker) | Certain buildings and structures within the construction footprint would require demolition and removal where they are not proposed to be used as ancillary facilities during construction. This includes:<br>• Buildings, sheds or farm infrastructure that fall within the construction footprint.<br>• A bridge crossing South Creek on private property.<br>Peak noise impact works would be required at certain times and would include the use of rock-breakers. |
| 4b | Demolition - bridges and buildings (no breaker) | |
| 5a | Clearing - Peak impact | Vegetation and topsoil would be stripped before earthworks are carried out. This is likely to involve:<br>• Removal of vegetation<br>• Topsoil stripping<br>Peak noise impact works would be required at certain times and would include the use of chainsaws and chippers. |
| 5b | Clearing - Typical impact | |
| 6a | Earthworks - Peak impact | Earthworks would be required along the entire length of the project for:<br>• Areas of new cut and fill along the construction footprint, including at all interchanges<br>• Construction of retaining walls<br>• Cut and fill or preparation of site for construction of all bridges<br>Peak noise impact works would be required at certain times and would include the use of dozers or graders. |
| 6b | Earthworks - Typical impact | |
| 6c | Earthworks - onsite truck haulage | Onsite haulage would be required to move spoil between areas of the site as required. These activities have the potential to cause impacts as the truck travel between the various sites within the construction footprint. |
| 7a | Bridge works - Peak impact (including piling) | Construction of the bridges would generally involve:<br>• Construction of foundations (piling)<br>• Construction of bridge piers<br>• Construction of bridge abutments and spill-throughs where required<br>• Installation of pre-cast concrete planks/girders and barriers<br>• Installation of the deck<br>• Installation of throw screens where required.<br>For the proposed bridge lifts occurring over existing roads, it is likely that these activities would be required to occur outside of standard hours to minimise traffic disruption. |
| 7b | Bridge works - Typical impact | |
| 7c | Bridge works - concrete works | |
| 7d | Bridge works - girder lifts over existing roads | |
| 8a | Road works - concrete works | Road works would generally include the surfacing and concrete/asphalt works associated with the construction of the road surface.<br>Road works involving the tie-in works to existing roads at the M7 Interchange, Elizabeth Drive at Airport Road, Wallgrove Road would likely be required to occur outside of standard hours. Additionally, works around the private access road along Luddenham Road, bike path connection into Elizabeth Drive near Mamre Road and utility access road would likely be required to occur outside of standard hours.<br>Peak noise impact works would be required at certain times and would include the use of concrete saws. |
| 8b | Road works - Typical impact | |
| 8c | Road works - tie-in works to existing roads | |
| 9a | Signage, lighting and landscaping - installation and finishing works | Finishing works are required to complete the project and include activities such as line marking, installing signs, etc<br>Installation and finishing work generally have no requirement for peak noise impact equipment. |

### *Determine likely construction schedule*

Where feasible and reasonable, construction activities would be carried out during standard construction hours (7.00am – 6.00pm Monday to Friday; 8.00am – 1.00pm Saturday; no work Sundays or public holidays).

Extended construction hours are proposed for the project, to add an extra hour at the start and end of each day Monday to Friday; and an earlier start and later finish on a Saturday afternoon (6.00am – 7.00pm Monday to Friday; 7.00am – 5.00pm Saturday; no work Sundays or public holidays).

The nature of the works means evening and night-time work would also be required at certain times to minimise impacts on road traffic and for safety reasons. Out-of-hours Works would be required to:

- Minimise unacceptable traffic impacts on and disruptions to the road network
- Minimise disturbance to surrounding landowners and commercial properties
- Ensure the safety of the construction workers, motorists and the general public.

It is anticipated that the following activities would be required to be completed out-of-hours:

- Maintenance of plant and equipment in the event of breakdown or emergencies
- Road tie-in works, temporary diversions and traffic switches at night, to minimise traffic disruption and potential safety issues
- Use of cranes to lift bridge beams and precast deck units over existing roads and/or under live traffic conditions
- Pavement works, temporary medians and line marking, where lane or road closures are required for safe working
- Use of construction ancillary facilities to support out-of-hours works
- Delivery of oversized material, plant and equipment
- Utility relocations in local and/or major roads, to minimise traffic disruptions and for safe working
- Other works, where it can be demonstrated that the works would have unacceptable amenity impacts on local sensitive receivers (such as schools, recreation areas, etc) if the works were carried out within construction hours.

Construction of the project would start in the first quarter of 2022, with completion expected by end of 2025. Decommissioning of all ancillary facilities may however extend into the first quarter of 2026. The indicative construction program for the project is shown in **Table 7-101**.

Table 7-101 Indicative construction schedule

| Work phase | 2022 | | | | 2023 | | | | 2024 | | | | 2025 | | | | 2026 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 |
| Ancillary facility establishment/ decommissioning | | | | | | | | | | | | | | | | | | | | |
| Ancillary facilities | | | | | | | | | | | | | | | | | | | | |
| Utilities and drainage - including relocation of existing | | | | | | | | | | | | | | | | | | | | |
| Demolition | | | | | | | | | | | | | | | | | | | | |
| Clearing | | | | | | | | | | | | | | | | | | | | |
| Earthworks | | | | | | | | | | | | | | | | | | | | |
| Bridge works | | | | | | | | | | | | | | | | | | | | |
| Road works | | | | | | | | | | | | | | | | | | | | |
| Signage, lighting and landscaping | | | | | | | | | | | | | | | | | | | | |

### *Construction noise modelling*

A noise model of the study area was used to predict noise levels from the construction works to all surrounding receivers. The model uses ISO 9613 algorithms in SoundPLAN software.

Local terrain, receiver buildings and structures were digitised in the noise model to develop a three-dimensional representation of the construction sites and surrounding areas.

The NSW Interim Construction Noise Guideline (ICNG) (DECC, 2009a) is used to assess and manage impacts from construction noise on residences and ‘other’ sensitive land uses in NSW. The ICNG contains procedures for determining project specific Noise Management Levels (NMLs) for sensitive receivers based on the existing background noise in the area.

The NMLs are not mandatory limits, however where construction noise levels are predicted or measured to be above the NMLs, feasible and reasonable work practices to minimise noise emissions are to be investigated. The following assessment criteria were adopted under the ICNG.

#### Residential receivers

The noise management levels (NML) for residential receivers set in accordance with the Construction Noise and Vibration Guideline are provided in **Table 7-102.** Construction noise impacts on residential receivers are assessed using these noise management levels, set with reference to time of day and background noise (Rating Background Level (RBL)). The RBL for each location was determined based on the quietest period of the day, evening or night assessment period in accordance with the Noise Policy for Industry (NSW EPA 2017a), above which reasonable and feasible noise mitigation needs to be considered.

Reasonable and feasible noise mitigation include site specific measures for noise management, mitigation and treatment measures such as construction noise barriers, acoustic sheds, acoustic enclosures, and restricted construction hours and activities.

There is also a highly noise affected level above which further mitigation needs to be considered, such as additional consultation and notification, additional respite periods, and alternative accommodation.

Table 7-102 Noise management levels at residential receivers

| Time of day | NML LAeq (15min) |
|---|---|
| Recommended standard construction hours:<br>• Monday to Friday 7am to 6pm<br>• Saturday 8am to 1pm<br>• No work on Sundays or public holidays | Noise affected<br>RBL + 10dB(A) |
| | Highly noise affected<br>75dB(A) |
| Outside recommended standard construction hours | Noise affected<br>RBL + 5dB (A) |

### Non-residential receivers

The noise management levels for non-residential receivers are provided in **Table 7-103**. These levels apply only during hours when the non-residential premises are being used.

The difference between an internal noise level and the external noise level is 10dB(A), which provides a conservative assumption that windows are open. Buildings where windows are fixed or cannot otherwise be opened may achieve a greater noise level performance.

Table 7-103 Noise management levels at other noise sensitive land uses

| Land use | NML LAeq(15minute) |
|---|---|
| Classrooms at schools and other education institutions | Internal noise level 45 dBA[1] |
| Places of Worship | Internal noise level 45 dBA[1] |
| Active recreation areas<br>(characterised by sporting activities and activities which generate their own noise or focus for participants) | External noise level 65 dBA |
| Passive recreation areas<br>(characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion) | External noise level 60 dBA |
| Commercial | External noise level 70 dBA |
| Industrial | External noise level 75 dBA |
| Public building (when in use) | Internal noise level 50 dBA[2] |
| Café (when in use) | Internal noise level 50 dBA[2] |

*[1]The criterion is specified as an internal noise level for this receiver category. As the noise model predicts external noise levels, it was conservatively assumed that all schools and places of worship have openable windows and external noise levels are therefore 10 dB higher than the corresponding internal level, which is generally considered representative of windows being partially open for ventilation. Hospital wards are assumed to have fixed windows with 20 dB higher external levels.*

*[2] It was conservatively assumed that these receivers have openable windows and external noise levels are therefore 10 dB higher than the corresponding internal level.*

### Sleep disturbance criteria

A night-time sleep disturbance ‘screening criterion’ noise goal of Rating Background Level (RBL) +15 dB(A) is used to identify the receivers where there is potential for sleep disturbance.

Where the sleep disturbance screening criterion is exceeded, further assessment is conducted to determine whether the ‘awakening reaction' level of $L_{Amax}$ 65 dB(A) would be exceeded and the likely number of these events. The awakening reaction level is the level above which sleep disturbance is considered likely.

## *Construction road traffic*

The noise impacts from construction traffic on public roads are assessed under the NSW EPA Road Noise Policy (RNP) and the Roads and Maritime Construction Noise and Vibration Guideline (CNVG).

Construction traffic volumes during the peak construction period (around 2024) were compared to the forecast traffic volumes during the same period (see **Section 7.2**).

The construction road traffic noise calculations were carried out using Calculation of Road Traffic Noise (CoRTN) (UK Department of Transport, 1988) calculations to predict the change in road traffic noise levels due to construction traffic.

The Noise Criteria Guideline (NCG) (Roads and Maritime, 2015f) defines Roads and Maritime’s interpretation of the RNP and details how criteria are applied to sensitive receivers. Under the NCG, where the predicted increase in noise levels is more than 2 dB(A) (eg due to construction traffic or a temporary re-routing of traffic), the predicted noise level is compared to the RNP road traffic noise criteria and noise mitigation options are determined based on reasonability and feasibility assessments in accordance with the Noise Mitigation Guideline (NMG). This would typically involve consideration of the time of day the works are taking place, and the type of road (ie freeway/arteria/sub-arterial road or local road).

Construction road traffic would access the construction footprint using public roads to each of the ancillary facilities, via the following (likely) routes:

- AF1, AF2/3 and AF4 would be accessed primarily via The Northern Road and Elizabeth Drive
- AF5 would be accessed via The Northern Road, Elizabeth Drive and Mamre Road
- Range Road, AF6, Wallgrove Road and AF9 would be accessed primarily via the M7 Motorway and Elizabeth Drive.

The construction traffic volumes provided in **Section 7.2** assume that 50 per cent of construction traffic would be travelling from the north and 50 per cent from the south (along the M7 Motorway and The Northern Road).

## *Construction vibration*

Construction vibration impacts of the project were assessed in terms of impacts on:

- Human comfort
- Building contents
- Building integrity or susceptibility to structural or cosmetic damage.

### Human comfort

Humans are sensitive to vibration such that they can detect vibration levels well below those presenting any risk of damage to a building or its contents. Criteria to avoid annoyance are therefore more stringent than those to prevent structural damage.

Human comfort vibration impacts were assessed using Vibration Dose Value (VDV) criteria from the NSW EPA's *Assessing Vibration: a technical guideline* (NSW EPA, 2006). VDV criteria are used to assess human comfort in occupied buildings, and the criteria differ based on the type of building and the types of activities a building is designed for. The categories of building types are:

- Critical working areas (eg operating theatres or precision laboratories where sensitive operations are performed)
- Residential
- Offices, schools, educational institutions and places of worship
- Workshops.

No critical working areas were identified in proximity of the project. However, this should be confirmed during the detailed design stage of the project or before construction begins.

The construction activities for the project are not expected to result in continuous or impulsive vibration impacts. It is noted that construction activities would be subject to refinement during detailed design.

### Building contents

Humans perceive vibration at levels well below those likely to cause damage to building contents. For most receivers, the human comfort vibration criteria are the most stringent and it is generally not necessary to set separate criteria for vibration effects on typical building contents.

Exceptions to this can occur with nearby buildings containing vibration sensitive equipment such as electron microscopes, which can have more stringent vibration requirements than those for human comfort. No such receivers were identified in the study area.

### Structural and cosmetic damage

The levels of vibration required to cause cosmetic or structural damage tend to be at least an order of magnitude (10 times) higher than those at which people can perceive vibration. Examples of damage that can occur includes cracks or loosening of drywall surfaces, cracks in supporting columns and loosening of joints.

Structural damage vibration limits are contained in British Standard BS 7385 and German Standard DIN 4150. BS 7385 recommends vibration limits that are judged to give a minimal risk of vibration induced damage to affected buildings. While BS 7385 is used to assess potential vibration impacts on heritage structures, the standard states that "a building of historical value should not (unless it is structurally unsound) be assumed to be more sensitive".

DIN 4150 also provides guideline vibration limits for different or particularly sensitive buildings and buried pipework. The values are more stringent than under BS 7385 and generally recognised to be conservative, and damage is not expected to occur where the values are complied with.

Heritage buildings and structures would be considered on a case-by-case basis but as noted in BS 7285 should not be assumed to be more sensitive to vibration unless structurally unsound. Where a heritage building is deemed to be sensitive, the more stringent DIN 4150 values can be applied.

### Minimum working distances

Minimum working distances for typical vibration intensive construction equipment are provided in the CNVG and are summarised in **Table 7-104**. The minimum working distances are for both cosmetic damage (from BS 7358 and DIN 4150) and human comfort (from the NSW EPA Vibration Guideline) and are based on empirical data which suggests that where works are further from receivers than the quoted minimum distances then impacts are not considered likely.

Table 7-104 Recommended minimum working distances for vibration intensive plant

| Plant item | Rating/Description | Minimum distance (metres) | | |
|---|---|---|---|---|
| | | Cosmetic damage | | Human response (NSW EPA Guideline) |
| | | Residential and light commercial | Heritage items | |
| Vibratory roller | < 50 kN (typically 1-2t) | 5 | 11 | 15 to 20 |
| | < 100 kN (typically 2-4t) | 6 | 13 | 20 |
| | < 200 kN (typically 4-6t) | 12 | 15 | 40 |
| | < 300 kN (typically 7-13t) | 15 | 31 | 100 |
| | < 300 kN (typically 13-18) | 20 | 40 | 100 |
| | < 300 kN (typically > 18t) | 25 | 50 | 100 |
| Small hydraulic hammer | 300 kg – 5-12t excavator | 2 | 5 | 7 |
| Medium hydraulic hammer | 900 kg – 12 to 18t excavator | 7 | 15 | 23 |
| Large hydraulic hammer | 1600 kg – 18 to 34t excavator | 22 | 44 | 73 |
| Vibratory pile driver | Sheet piles | 2 to 20 | 5 to 40 | 20 |
| Pile boring | ≤ 800 mm | 2 (nominal) | 5 | 4 |
| Jackhammer | Hand held | 1 (nominal) | 3 | 2 |

## 7.7.4 Operational noise and vibration assessment methodology

The operational noise assessment for the project considered the potential impacts associated with changes in traffic noise. The assessment included the following key steps:

- Identification of potentially affected noise sensitive receivers (for Noise Catchment Areas [NCAs])
- Confirmation of noise and vibration objectives with reference the Road Noise Policy and the Noise Criteria Guideline (Roads and Maritime, 2015f)
- Selection and definition of the road traffic noise scenarios to be modelled and compared (in this case ‘No Build’ (without the project) and ‘Build’ (with the project)
- Development and validation of an operational road traffic noise model. Existing traffic volumes were counted at the same time as the ambient noise monitoring was completed, and this data was used to model the existing situation and validate the operational road traffic noise model
- Calculation of road traffic noise changes for each scenario and for both the year of opening of the project and 10 years after opening
- Identification of environmental management measures to avoid, minimise and mitigate noise and vibration impacts during operation.

The forecast traffic data used in the operational noise assessment takes into account current and future road projects and anticipated land use changes. This allows for consideration of cumulative operational road traffic noise impacts from the project along with other sources of road traffic in the area.

The study area for the operational noise assessment extends to a distance of 600 metres from the centreline of the outermost traffic lane on each side of the project roads, as specified in the RNP and NCG. This distance is based on the limit of accuracy of currently approved road traffic noise models. The operational study area is hard cut at the project extents, as per Roads and Maritime's application of the NCG.

### *Noise model*

A noise model of the operational study area was used to predict noise levels from the operation of the project to all surrounding receivers. The model uses Calculation of Road Traffic Noise (CoRTN) (UK Department of Transport, 1988) algorithms in SoundPLAN software.

Local terrain, receiver buildings and structures were digitised in the noise model to develop a three-dimensional representation of the operational footprint and surrounding areas.

The 'No Build' scenarios use the existing road alignment geometry, with existing structures such as noise barriers and features within the operational footprint being included.

The 'Build' scenarios use the proposed design of the project which includes all new roads, widening works, proposed modifications to the access ramps and changes to existing ground levels such as cuttings and embankments.

All major roads in the operational study area were modelled together with major roads on the surrounding road network to determine the contributions from 'project' roads (where engineering changes are proposed) and 'non-project' existing roads (where no works are proposed) at individual sensitive receivers, as required by the NCG.

### *Operational noise criteria*

#### Road traffic noise – Residential receivers

Road traffic noise impacts on residential receivers are assessed using assessment criteria which are based on the type of road a residence is affected by the project. In some instances, residences may be exposed to noise from new and redeveloped roads or different functional classes of roads and the proportion of noise from each road is used to establish transition zone criteria.

In addition to road traffic noise which exceeds the assessment criteria, large increases in the level of noise can change the acoustic environment of a location, particularly for quieter areas. To address large increases in noise levels, relative increase criteria are used.

Where criteria for a particular road category are exceeded due to the project, reasonable and feasible mitigation is required.

A summary of the applicable road traffic noise criteria for residential receivers in accordance with the Noise Criteria Guideline (Roads and Maritime, 2015f) is presented in **Table 7-105**.

Table 7-105 Road traffic noise criteria for residential receivers (external)

| Road category | Type of project/land use | Assessment Criteria | |
|---|---|---|---|
| | | Daytime (7am – 10pm) | Night-time (10 pm – 7 am) |
| Freeway/ arterial/ sub-arterial roads | Existing residences affected by noise from new freeway/arterial/sub-arterial road corridors. | 55 $L_{Aeq(15hour)}$ | 50 $L_{Aeq(9hour)}$ |
| | Existing residences affected by noise from redevelopment of existing freeway/arterial/sub-arterial roads. | 60 $L_{Aeq(15hour)}$ | 55 $L_{Aeq(9hour)}$ |

| Road category | Type of project/land use | Assessment Criteria | |
|---|---|---|---|
| | | Daytime (7am – 10pm) | Night-time (10 pm – 7 am) |
| | Existing residences affected by both new roads and the redevelopment of existing freeway/arterial/sub-arterial roads in a Transition Zone. | 55-60 $L_{Aeq(15hour)}$ | 50-55 $L_{Aeq(9hour)}$ |
| | Existing residences affected by increases in traffic noise of 12dB(A) or more from new freeway/arterial/sub-arterial roads. | 42-55 $L_{Aeq(15hour)}$ | 42-50 $L_{Aeq(9hour)}$ |
| | Existing residences affected by increases in traffic noise of 12dB(A) or more from redevelopment of existing freeway/arterial/sub-arterial roads. | 42-60 $L_{Aeq(15hour)}$ | 42-55 $L_{Aeq(9hour)}$ |

*Note 1: The criteria assigned to the entire residence depend on the proportion of noise coming from the new and redeveloped road, as per the procedures in the Roads and Maritime NCG.*

*Note 2: The criteria at each facade are determined from the existing traffic noise level plus 12 dB.*

### Road traffic noise – Non-residential receivers

The Noise Criteria Guideline (Roads and Maritime, 2015f) also sets criteria for the assessment of road traffic noise on the internal and external areas of non-residential land uses, such as schools, hospitals, places of worship and recreation areas. For sensitive land uses such as schools, hospitals, places of worship and childcare centres the criteria was applied to internal areas to provide a conservative assessment of impacts.

It is generally accepted that most buildings provide a noise reduction of at least 10 dB(A) when windows are left 20 per cent open, without providing additional treatment. Therefore, where the noise goals are internal, a 10 dB(A) reduction from external noise levels to internal noise levels was adopted to allow an external assessment. The applicable criteria are shown in **Table 7-106**.

Table 7-106 Criteria for non-residential sensitive land uses

| Existing sensitive land use | Assessment Criteria, dB(A) | |
|---|---|---|
| | Daytime (7 am – 10 pm) | Night-time (10 pm – 7 am) |
| School classrooms | 40 $L_{Aeq,1hour}$ (internal) when in use | - |
| Hospital wards | 35 $L_{Aeq,1hour}$ (internal) | 35 $L_{Aeq,1\ hour}$ (internal) |
| Places of worship | 40 $L_{Aeq,1hour}$ (internal) | 40 $L_{Aeq,1\ hour}$ (internal) |
| Open space (active use) | 60 $L_{Aeq,15hour}$ (external) when in use | - |
| Open space (passive use) | 55 $L_{Aeq,15hour}$ (external) when in use | - |
| Childcare facilities | Sleeping rooms<br>35 $L_{Aeq,1hour}$ (internal)<br>Indoor play areas<br>40 $L_{Aeq,1hour}$ (internal)<br>Outdoor play areas<br>55 $L_{Aeq,1hour}$ (external) | - |
| Aged care facilities | Residential land use noise assessment criteria apply | Residential land use noise assessment criteria apply |

### Potential road traffic noise impacts on the surrounding road network

Where a project results in traffic redistribution, noise impacts can occur on the surrounding road network due to additional vehicles using certain routes after the project is complete. The NCG criteria are therefore to be applied to the surrounding road network where a road project generates an increase in road traffic noise of more than 2 dB on these routes.

#### *Noise mitigation*

The NMG describes the principles to be applied when reviewing noise mitigation, recognising that the NCG criteria are not always practicable and that it is not always feasible or reasonable to expect that they are achieved.

When evaluating if a receiver qualifies for consideration of additional noise mitigation the NMG considers how far above the criterion the noise level is, and by how much the noise level has increased. These considerations provide a feasible and reasonable approach to identifying eligible receivers.

The NMG provides three triggers where a receiver may qualify for consideration of additional noise mitigation. These are:

- Trigger 1 – the predicted 'Build' noise level exceeds the NCG controlling criterion and the noise level increase due to the project is greater than 2.0 dBA
- Trigger 2 – the predicted Build noise level is 5.0 dBA or more above the NCG controlling criterion and the receiver is significantly influenced by project road noise, regardless of the incremental impact of the project
- Trigger 3 – the noise level contribution from the road project is acute (daytime LAeq (15hour) 65 dBA or higher, or night-time LAeq (9hour) 60 dBA or higher) even if noise levels are dominated by a non-project road.

#### *Operational vibration criteria*

Vehicles operating on roadways are unlikely to cause vibration impacts at adjacent receivers unless there are significant road irregularities, such as can occur at poorly maintained bridge joints. As the new and upgraded roads in the operational study area would be designed and constructed to avoid irregularities, impacts from operational vibration are not expected and have not been assessed any further in this report.

## 7.7.5 Existing environment

The existing noise environment is dominated by a combination road traffic noise at locations in the vicinity of major roads, and general environmental noise (such as wind and insects) in the more rural locations.

The area around the project was summarised using ten NCAs which collectively make up the study area. The NCAs were selected to be representative of the varying land uses and noise environment of sensitive receiver locations around the project. The NCAs are shown in **Figure 7-101** and described in **Table 7-107**.

Table 7-107 Noise catchment areas and surrounding land uses

| NCA | Minimum distance[1] (m) | Description |
|---|---|---|
| NCA01 | 40 | This catchment area is located along Wallgrove Road and to the east of the M7 Motorway and extends south to Elizabeth Drive. Receivers in this catchment are largely residential with the nearest receiver located to the east of the project, however Western Sydney Parklands (passive recreation) covers a large portion to the catchment to the east of the M7 Motorway. Saints Peter and Paul Assyrian Church of the East are located in the west of the catchment. This catchment represents receivers adjacent to the M7 Motorway and in the suburban area of Abbotsbury where the noise environment is dominated by road traffic noise from the M7 Motorway and/or Elizabeth Drive. |
| NCA02 | 85 | This catchment area is located to the south of Elizabeth Drive and east of the M7 Motorway. It is primarily suburban residential with the nearest receivers located to the east of the project. Cecil Hills Public School is located in the north of the catchment and Cecil Hills High School in the south of the catchment. Head Start Long Day Care is located in the north of the catchment. An area of commercial use is located near Sandringham Drive and Feodore Drive. This catchment represents receivers in the suburban areas of Cecil Hills and Elizabeth Hills where the noise environment is dominated by road traffic noise from the M7 Motorway and/or Elizabeth Drive. |
| NCA03 | 440 | This catchment area is located to the north of Elizabeth Drive and west of the M7 Motorway, extending to the west of Mamre Road. It is set back from Elizabeth Drive and The M7 Motorway to represent receivers which are not adjacent to the existing major roads. The nearest receivers are located north of the project on Mamre Road. Do Re Mi Child Care Centre is located in the southwest of the catchment. This catchment represents receivers further from the project where the noise environment is likely to be dominated by road traffic noise from Mamre Road and/or distant road traffic noise from the M7 Motorway and Elizabeth Drive. |
| NCA04 | 90 | This catchment area is located to the north of Elizabeth Drive and west of the M7 Motorway and extends west to the intersection of Devonshire Road and Cross Street. It represents receivers along the eastern section of Elizabeth Drive and is primarily residential with the nearest receivers located adjacent the project on the north of Elizabeth Drive. Irfan College is located in the centre of the catchment adjacent to Elizabeth Drive. This catchment represents receivers close to the project where the noise environment is dominated by road traffic noise from Elizabeth Drive. |
| NCA05 | 60 | This catchment area is located to the south of Elizabeth Drive and west of the M7 Motorway and extends west to Kemps Creek. It primarily consists of the Western Sydney Parklands with no residential receivers. The Sydney International Shooting centre is located in the centre of the catchment. |
| NCA06 | 70 | This catchment area is located to the west of Kemps Creek and east of South Creek and extends to the north and south of Elizabeth Drive. It primarily consists of rural residential receivers. Kemps Creek Children's Cottage is located in the centre of the catchment. This catchment represents receivers close to the project where the noise environment is dominated by Elizabeth Drive, and those further from the project where the primary source of road traffic noise is likely to be the same section of Elizabeth Drive. |

| NCA | Minimum distance[1] (m) | Description |
|---|---|---|
| NCA07 | 100 | This catchment area is located to the west of Kemps Creek, east of Cosgroves Creek, and north of Elizabeth Drive. It is set back from Elizabeth Drive to represent receivers which are not adjacent to the existing major roads. This catchment primarily consists of rural residential receivers and a cluster of residential dwellings 500 metres to the north of the project. This catchment represents rural receivers where there is likely to be minimal influence on the noise environment from existing road traffic noise sources. |
| NCA08 | 420 | This catchment area is located along the western section of Elizabeth Drive to the west of South Creek and east of The Northern Road. This catchment is primarily rural residential. Part of this catchment is within the footprint of the future Western Sydney Airport. This catchment represents rural receivers where the primary source of road traffic noise is likely to be the western section of Elizabeth Drive. |
| NCA09 | 90 | This catchment area is located to the west of Cosgroves Creek, east of The Northern Road, and north of Elizabeth Drive. It is set back from Elizabeth Drive and The Northern Road to represent receivers which are not adjacent to the existing major roads. This catchment is primarily rural residential with the nearest receivers located adjacent to the project on the east of Luddenham Road. This catchment represents rural receivers where the primary source of road traffic noise is likely to be Luddenham Road. |
| NCA10 | 160 | This catchment area is located along The Northern Road. It is primarily rural residential with the nearest receivers located opposite the west end of the project to the west of The Northern Road. This catchment represents rural receivers where the primary source of road traffic noise is likely to be The Northern Road. |

*Note 1: Approximate minimum horizontal distance from the project to the nearest sensitive receiver.*

### *Noise and vibration sensitive receivers*

Receivers potentially sensitive to noise and vibration were categorised as residential dwellings, commercial/industrial buildings (including small businesses), or 'other' sensitive land uses which includes educational institutions, childcare centres, medical facilities, and places of worship.

A list of the noise sensitive receivers identified within the study area is provided in **Appendix K**.

### *Ambient noise surveys and monitoring locations*

In order to determine the existing noise levels of the noise and vibration study area, unattended noise monitoring was completed in June and July 2017 at 15 locations (**Figure 7-101**). The monitoring equipment was generally located at receivers which would have line-of-sight to the project or to existing major roads, within constraints such as accessibility, security and permission of landowners.

The noise monitoring equipment continuously measured existing noise levels in 15-minute periods during the daytime, evening and night-time periods for the survey period. All equipment carried current National Association of Testing Authorities (NATA) or manufacturer calibration certificates and the calibration was checked before and after each measurement.

Short-term attended noise monitoring was completed at each monitoring location. The attended measurements allow the contributions of the various noise sources at each location to be determined.

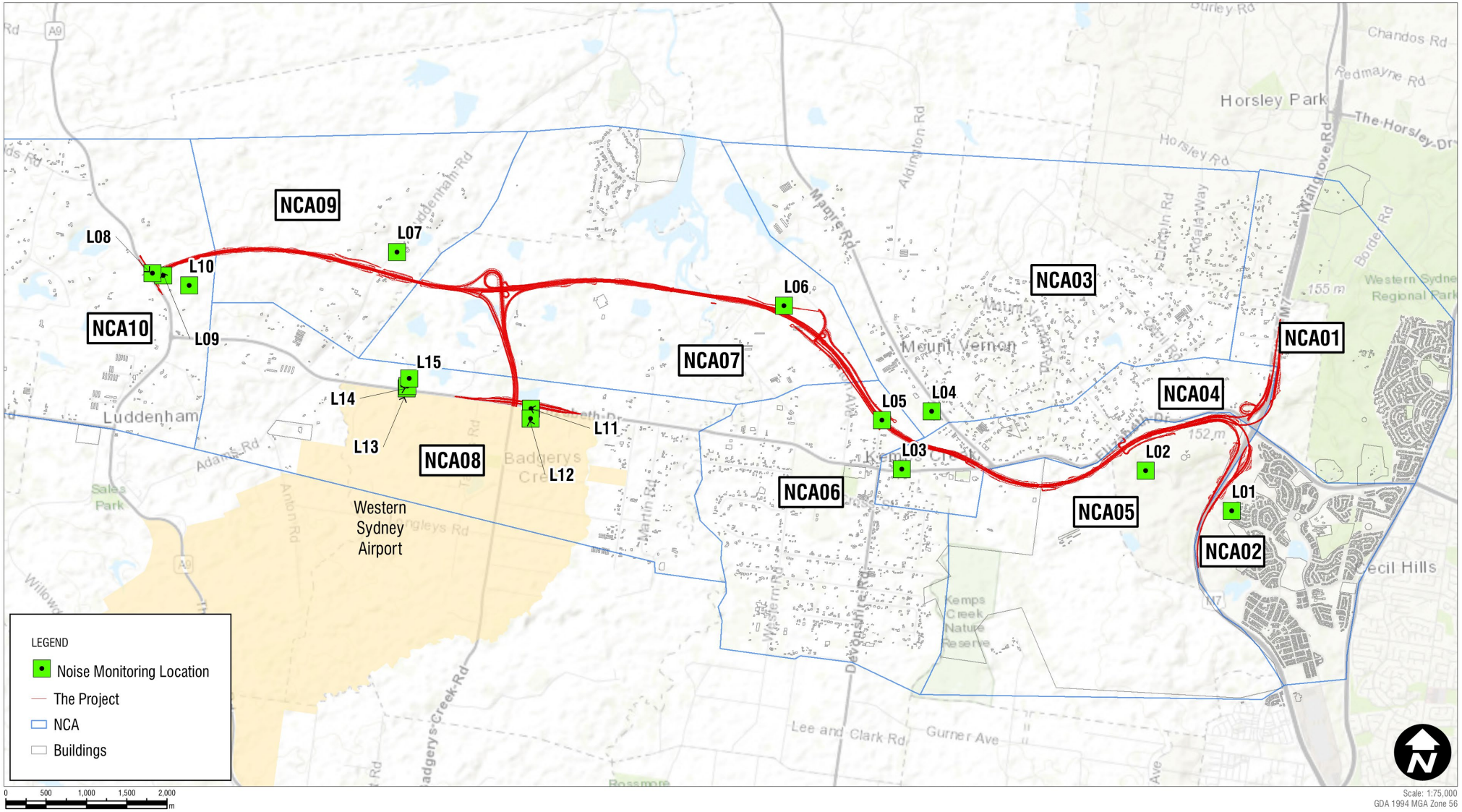



Figure 7-101 Receivers and noise monitoring locations

The results of the noise monitoring were processed with reference to the NSW EPA Noise Policy for Industry (NPfI) and Road Noise Policy (RNP) to exclude noise from extraneous events and/or data affected by adverse weather conditions, such as strong wind or rain, to establish representative existing noise levels for each NCA. Weather conditions recorded during the monitoring period were obtained from the Bureau of Meteorology (BoM) Automated Weather Station (AWS) located at Badgerys Creek, around 2.5 kilometres south of the study area.

A summary of the rated background levels for each of the noise monitoring locations shown in **Figure 7-101** is provided in **Table 7-108**.

Table 7-108 Summary of unattended noise monitoring results

| ID | Measured noise level (dBA) | | | | | | |
|---|---|---|---|---|---|---|---|
| | Background noise (RBL) – Periods based on extended construction hours[1] | | | | | Average noise level LAeq (period) – Periods based on Road Noise Policy[2] | |
| | Morning shoulder | Day | Evening | Evening shoulder | Night | Day 15 hour | Night 9 hour |
| L01 | 51 | 45 | 44 | 46 | 40 | 52 | 51 |
| L02 | 47 | 36 | 39 | 41 | 34 | 46 | 45 |
| L03 | 60 | 54 | 48 | 56 | 37 | 66 | 63 |
| L04 | 54 | 48 | 46 | 52 | 37 | 57 | 55 |
| L05 | 49 | 39 | 42 | 45 | 35 | 49 | 48 |
| L06 | 43 | 34 | 35 | 39 | 31 | 53 | 44 |
| L07 | 46 | 40 | 36 | 42 | 31 | 56 | 52 |
| L08 | 58 | 46 | 50 | 57 | 34 | 60 | 59 |
| L09 | 56 | 44 | 48 | 54 | 36 | 56 | 55 |
| L10 | 51 | 40 | 44 | 49 | 37 | 51 | 49 |
| L11 | 57 | 46 | 40 | 51 | 31 | 69 | 66 |
| L12 | 50 | 40 | 37 | 44 | 30 | 49 | 48 |
| L13 | 50 | 42 | 38 | 48 | 33 | 64 | 60 |
| L14 | 50 | 42 | 39 | 48 | 33 | 55 | 52 |
| L15 | 50 | 39 | 40 | 47 | 34 | 52 | 49 |

*[1]RBL periods are based on the extended construction hours: Morning shoulder is 6:00 am to 7:00 am Monday to Friday; Daytime is 7:00 am to 6:00 pm Monday to Saturday and 8:00 am to 6:00 pm Sunday and Public Holidays; Evening is 7:00 pm to 10:00 pm Monday to Friday and 6:00 pm to 10:00 pm Saturday, Sunday and Public Holidays; Evening shoulder is 6:00 pm to 7:00 pm Monday to Friday; Night-time is 10:00 pm to 6:00 am Monday to Friday, 10:00 pm to 7:00 am Saturday and 10:00 pm to 8:00 am Sunday and Public Holidays.*

*[2]LAeq periods are based on the Road Noise Policy: Daytime is 7:00 am to 10:00 pm; Night-time is 10:00 pm to 7:00 am.*

## 7.7.6 Assessment of potential construction impacts

### *Noise management levels*

Each NCA was assigned the RBL background noise level from the noise logger most representative of the noise environment in that NCA. The RBL for each NCA was used to determine the residential noise management level (NML) in accordance with methodology outlined in **Section 7.2.2** and in accordance with the ICNG and the Noise Policy for Industry. The NMLs for each NCA are presented in **Table 7-109**.

Table 7-109 Construction NMLs at residential receivers

| Noise catchment area (NCA) | Monitoring location | NML (LAeq(15minute) – dBA) | | | | | | Sleep disturbance screening criteria (RBL +15 dB) |
|---|---|---|---|---|---|---|---|---|
| | | Standard construction (RBL +10 dB) | Out-of-hours (RBL +5 dB) | | | | | |
| | | Daytime[1] | Morning Shoulder[2] | Daytime[3] | Evening[4] | Evening Shoulder[5] | Night-time[6] | |
| NCA01 | L01 | 55 | 50 | 50 | 49 | 49 | 45 | 55 |
| NCA02 | L01 | 55 | 50 | 50 | 49 | 49 | 45 | 55 |
| NCA03 | L05 | 49 | 44 | 44 | 44 | 44 | 40 | 50 |
| NCA04 | L03 | 64 | 59 | 59 | 53 | 53 | 42 | 52 |
| NCA05 | L02 | 46 | 41 | 41 | 41 | 41 | 39 | 49 |
| NCA06 | L05 | 49 | 44 | 44 | 44 | 44 | 40 | 50 |
| NCA07 | L06 | 44 | 39 | 39 | 39 | 39 | 36 | 46 |
| NCA08 | L14 | 52 | 47 | 47 | 44 | 44 | 38 | 48 |
| NCA09 | L07 | 50 | 45 | 45 | 41 | 41 | 36 | 46 |
| NCA10 | L09 | 54 | 49 | 49 | 49 | 49 | 41 | 51 |

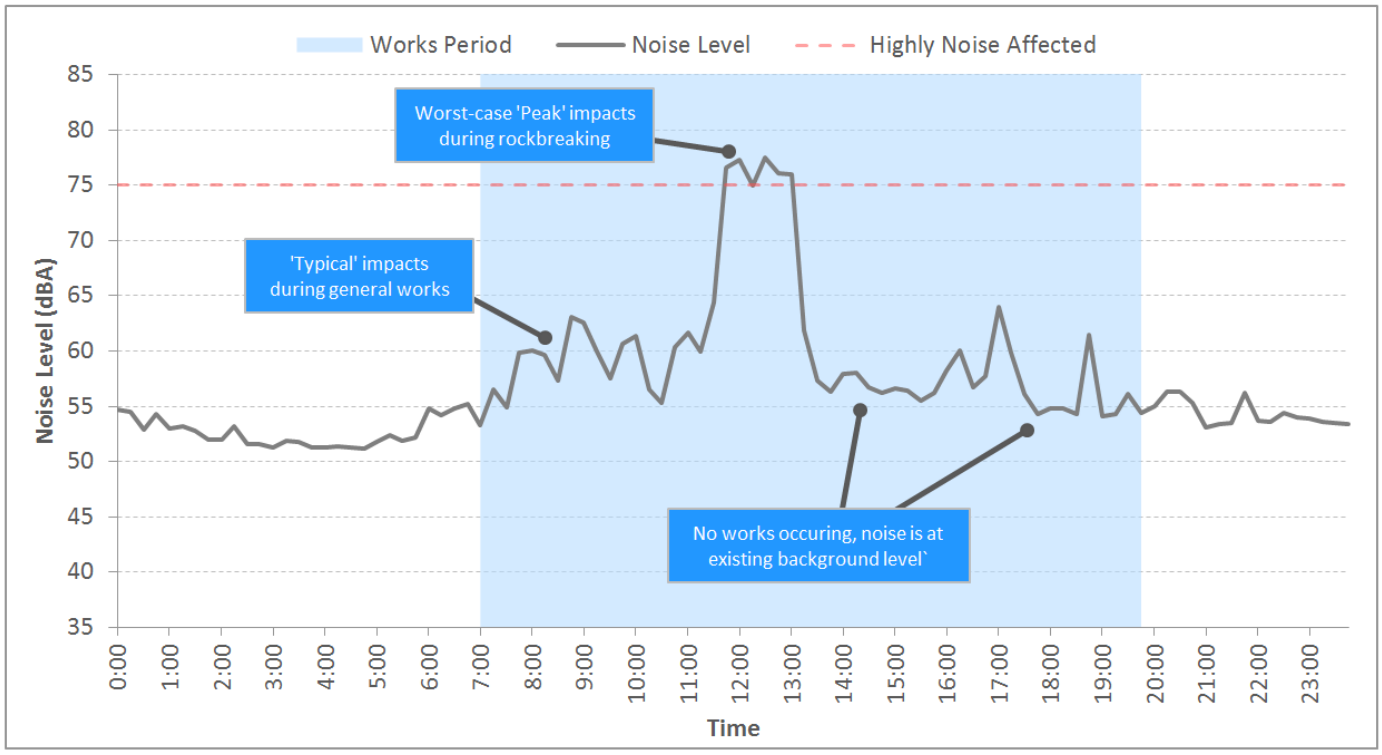
*Note 1: Daytime period is the standard construction hours of 7:00 am to 6:00 pm Monday to Friday and 8:00 am to 1:00 pm Saturday.*
*Note 2: Morning shoulder period is 6:00 am to 7:00 am Monday to Friday. Where the morning shoulder RBL is higher than the daytime RBL, the daytime RBL was adopted.*
*Note 3: Daytime OOH period is 7:00 am to 8:00 am and 1:00 pm to 6:00 pm Saturday, and 8:00 am to 6:00 pm Sunday and Public Holidays.*
*Note 4: Evening period is 7:00 pm to 10:00 pm Monday to Friday and 6:00 pm to 10:00 pm Saturday, Sunday and Public Holidays.*
*Note 5: Evening shoulder period is 6:00 pm to 7:00 pm Monday to Friday. Where the evening shoulder RBL is higher than the evening RBL, the evening RBL was adopted.*
*Note 6: Night-time period is 10:00 pm to 6:00 am Monday to Friday, 10:00 pm to 7:00 am Saturday and 10:00 pm to 8:00 am Sunday and Public Holidays.*

### *Predicted worst-case noise impacts*

#### Residential receivers

The construction noise impact assessment is based on the predicted noise impacts at the most affected receivers in each NCA and is representative of the worst-case situation where construction equipment is at the closest point to each receiver.

For most works, the construction noise impacts would frequently be lower than predicted as the worst-case situation is typically only apparent for a relatively short period when noisy equipment is in use. This concept is illustrated in **Figure 7-102** which shows noise levels measured next to major construction works during a period of 'peak impact' rock-breaking and shows how construction noise levels vary over the works period.




*Note 1 The measurement location was about 40 metres away from the works*

Figure 7-102 Example of indicative construction noise levels during rock-breaking

In the above example, while the worst-case noise levels result in highly noise affected impacts, they only last for part of the works period and the noise levels during 'Typical Impacts' are much lower. There are also periods when no works are occurring, and noise levels are at the existing background level (eg road traffic and general urban hum).

The following construction noise assessment shows the predicted noise impacts based on the exceedance of the NML, as per the three categories in **Table 7-110**. The likely subjective response of people affected by the impacts is also shown. The subjective response qualifies how people would actually experience a noise exceedance of the NML.

Table 7-110 Key to noise impacts

| Exceedance of NML | Symbol | Likely subjective response |
|---|---|---|
| No exceedance | · | N/A |
| 1 to 10 dB | ● | Marginal to minor |
| 11 to 20 dB | ♦ | Moderate |
| >20 dB | ■ | High |

The predicted construction noise impacts are presented for the most affected receivers in each NCA. Receivers which are further away from the works and/or shielded from view would have substantially lower noise impacts. A summary of the predicted construction noise impacts in each NCA for residential receivers during the extended construction hours (morning shoulder, standard daytime, and evening shoulder) is shown in **Table 7-111** to **Table 7-113**. A summary of the predicted construction noise impacts in each NCA for residential receivers for out-of-hours works (evening and night) is shown in **Table 7-114** and **Table 7-115**.

The assessment for residential receivers shows that:

- The highest impacts would be generally seen in the 'Peak Impact' scenarios, which is due to the use of noise intensive equipment such as rock-breakers or concrete saws. For most scenarios, the 'Peak Impact' works would however only be required for a relatively short period. Noise levels and impacts during the 'Typical Impact' works are lower and affect fewer receivers.
- The highest impacts at residential receivers are generally in catchments where receivers are located close to the construction footprint. This includes east of the M7 Motorway and north of Elizabeth Drive in NCA01, north of Elizabeth Drive near Salisbury Avenue in NCA06 and near Clifton Avenue in the north of the construction footprint in NCA07. Receivers in these catchments are however generally sparsely distributed, meaning the number of receivers with the highest impacts is typically relatively low.
- During the morning shoulder period, 'Peak' impacts would be seen for certain scenarios at the nearest receivers in NCA01, NCA06 and NCA07. 'Moderate' impacts are also predicted for a relatively large number of receivers to the east of the M7 Motorway and south of Elizabeth Drive in NCA02. Receivers in the rest of study area are generally further from the project and are therefore less affected.
  - As noted previously, works completed in the morning shoulder period are likely to be limited to relatively low noise impact works, with full construction generally being completed during standard daytime hours. In this case the impacts would be lower than predicted.
- During the standard daytime period, 'Peak' impacts are predicted in NCA01, NCA06 and NCA07 at the same receivers as for the morning shoulder period. A relatively small number of receivers are predicted to have 'moderate' impacts in the remaining areas where receivers are in close proximity to the construction footprint, such as east of the M7 Motorway and South of Elizabeth Drive in NCA02.
- During the night-time, construction works are only proposed in certain parts of the construction footprint (associated with bridges, roadworks and ancillary facilities), meaning only a small number of receivers are predicted to have 'Peak' impacts. The receivers are generally around Clifton Avenue and Salisbury Avenue in NCA06 and NCA07, due to the proximity of receivers to the construction footprint. 'Moderate' impacts are predicted east of the M7 Motorway in NCA02, along Elizabeth Drive in NCA04 and NCA06, and for receivers near Luddenham Road in NCA09. Compliant noise levels or 'minor' impacts are predicted for the rest of the study area.
- Batching plants were assessed as being in the middle of AF2 and AF3 which are both located adjacent the Western Sydney Airport access road. Noise levels are predicted to result in 'moderate' impacts at the nearest residential receivers to north of Elizabeth Drive in NCA07 during all periods. The locations of and activities within the batching plants are considered indicative and would be further assessed as part of detailed design.
- Stockpiling activities are predicted to have higher impacts than the batching plants, as the assessment assumes the works would occur across the entire ancillary facility and therefore maybe closer to the nearest some receivers.

- The worst-case impacts are typically in the following scenarios:
  - Scenario 3a, Utilities and drainage – peak impact
  - Scenario 4a, Demolition – peak impact
  - Scenario 5a, Clearing – peak impact
  - Scenario 6a, Earthworks – peak impact
  - Scenario 8a, Road works – concrete works
  - Scenario 8c, Road works – tie-in to existing roads
- Works that do not require highly intensive noise generating items of equipment generally result in considerably lower impacts.
- Given the location of the nearest receivers to the project, it is likely that there are several areas of the project where construction can occur with little or no impact on residential receivers due to the separation distances between the works and receiver.

Detailed noise level predictions and summaries of the number of receivers predicted to have 'minor', 'moderate' and 'high' impacts in each NCA are provided in **Appendix K**. Where impacts are predicted, the methods for controlling the impacts through the use of environmental management measures are discussed in more detail in **Section 7.7.9**.

The worst-case impacts are typically in the scenarios outlined in **Table 7-116** including the details of the types of noise intensive equipment typically used during these scenarios.

### Highly noise affected residential receivers

Residential receivers that are subject to noise levels of 75 dBA or greater are considered highly noise affected. Receivers can be highly noise affected when noise intensive equipment is being used close to residents.

The receivers which have potential to be highly noise affected during the worst-case impacts from the project are summarised in **Table 7-117** and shown in **Figure 7-103** and **Figure 7-104**. There would be no highly noise affected receivers during any other construction scenarios.

The predictions assume the worst-case scenarios are occurring at the closet location to each receiver and therefore present all highly noise affected receivers in one assessment. In reality, work would occur in isolated locations and the number of highly noise affected receivers during any single works period would be less than shown.

The majority of residential receivers are predicted not to be highly noise affected during the construction works. Seven receivers in total may be subject to construction noise levels above the highly noise affected threshold.

Impacted receivers are typically dwellings which are close to the project and have direct line-of-sight to the nearest works. While certain receivers are predicted to be highly noise affected, this would only occur when peak noise generating works are being carried out near particular residential receivers and would only be apparent for relatively short periods.

Table 7-111 Predicted construction noise exceedances for residential receivers – morning shoulder

| Period | ID | Scenario | Activity | NCA01 | NCA02 | NCA03 | NCA04 | NCA05 | NCA06 | NCA07 | NCA08 | NCA09 | NCA10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Morning Shoulder | 1a | Ancillary facility establishment | Peak impact | ♦ | ● | ● | ● | · | ● | ■ | · | · | ♦ |
| | 1b | | Typical impact | ● | ● | · | ● | · | · | ■ | · | · | ● |
| | 2a | Ancillary facility operations | Operation | ● | · | · | · | · | · | ■ | · | · | ● |
| | 2b | | Stockpiling | ● | ● | · | ● | · | · | ■ | · | · | ● |
| | 2c | | Batching plant | · | · | · | · | · | · | ♦ | · | · | · |
| | 3a | Utilities and drainage | Peak impact | ■ | ♦ | ♦ | ♦ | · | ■ | ■ | ♦ | ■ | ♦ |
| | 3b | | Typical impact | ♦ | ● | · | ● | · | ■ | ■ | ● | ● | ● |
| | 4a | Demolition | Peak impact | · | · | ♦ | ♦ | · | ■ | ■ | ● | ● | ♦ |
| | 4b | | Typical impact | · | · | · | ● | · | ♦ | ■ | · | · | ● |
| | 5a | Clearing | Peak impact | ■ | ♦ | ♦ | ♦ | · | ■ | ■ | ♦ | ♦ | ♦ |
| | 5b | | Typical impact | ♦ | ● | · | ● | · | ■ | ■ | ● | ● | ● |
| | 6a | Earthworks | Peak impact | ■ | ♦ | ♦ | ♦ | · | ■ | ■ | ♦ | ♦ | ♦ |
| | 6b | | Typical impact | ♦ | ● | · | ● | · | ■ | ■ | ● | ● | ● |
| | 6c | | Onsite truck haulage | · | · | · | · | · | · | ● | · | · | · |
| | 7a | Bridge works | Peak impact | · | ● | ● | ● | · | ● | ♦ | · | ● | · |
| | 7b | | Typical impact | · | ● | · | · | · | · | ● | · | · | · |
| | 7c | | Concrete works | · | ● | · | · | · | ● | ● | · | ● | · |
| | 7d | | Girder lifts | · | ● | · | · | · | · | · | · | · | · |
| | 8a | Road works | Concrete works | ♦ | ● | · | ● | · | ■ | ■ | · | ● | ● |
| | 8b | | Typical works | ♦ | ● | · | · | · | ■ | ■ | · | ● | ● |
| | 8c | | Tie-in works | ■ | ♦ | ● | ♦ | · | ● | ♦ | ♦ | ♦ | · |
| | 9a | Signage, lighting and landscaping | | ♦ | ● | ● | ● | · | ■ | ■ | ● | ♦ | ● |

**Key to impacts:** · No exceedance ● Marginal to minor (1 dB to 10 dB)
♦ Moderate (11 dB to 20 dB) ■ High (>20 dB)

Table 7-112 Predicted construction noise exceedances for residential receivers – standard daytime

| Period | ID | Scenario | Activity | NCA01 | NCA02 | NCA03 | NCA04 | NCA05 | NCA06 | NCA07 | NCA08 | NCA09 | NCA10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Standard Daytime | 1a | Ancillary facility establishment | Peak impact | ● | ● | ● | ● | · | · | ■ | · | · | ● |
| | 1b | | Typical impact | ● | · | · | · | · | · | ■ | · | · | ● |
| | 2a | Ancillary facility operations | Operation | · | · | · | · | · | · | ♦ | · | · | · |
| | 2b | | Stockpiling | ● | · | · | · | · | · | ■ | · | · | ● |
| | 2c | | Batching plant | · | · | · | · | · | · | ♦ | · | · | · |
| | 3a | Utilities and drainage | Peak impact | ■ | ♦ | ● | ♦ | · | ■ | ■ | ♦ | ♦ | ♦ |
| | 3b | | Typical impact | ● | · | · | · | · | ♦ | ■ | · | ● | · |
| | 4a | Demolition | Peak impact | · | · | ● | ● | · | ■ | ■ | · | · | ♦ |
| | 4b | | Typical impact | · | · | · | · | · | ● | ♦ | · | · | · |
| | 5a | Clearing | Peak impact | ■ | ♦ | ● | ♦ | · | ■ | ■ | ● | ♦ | ● |
| | 5b | | Typical impact | ● | · | · | · | · | ♦ | ■ | · | ● | · |
| | 6a | Earthworks | Peak impact | ♦ | ♦ | ● | ● | · | ■ | ■ | ● | ♦ | ● |
| | 6b | | Typical impact | ● | · | · | · | · | ♦ | ■ | · | ● | · |
| | 6c | | Onsite truck haulage | · | · | · | · | · | · | · | · | · | · |
| | 7a | Bridge works | Peak impact | · | ● | · | · | · | ● | ● | · | ● | · |
| | 7b | | Typical impact | · | · | · | · | · | · | · | · | · | · |
| | 7c | | Concrete works | · | · | · | · | · | · | · | · | · | · |
| | 7d | | Girder lifts | · | · | · | · | · | · | · | · | · | · |
| | 8a | Road works | Concrete works | ● | ● | · | · | · | ♦ | ■ | · | ● | · |
| | 8b | | Typical works | ● | ● | · | · | · | ♦ | ■ | · | ● | · |
| | 8c | | Tie-in works | ♦ | ● | ● | ♦ | · | · | ● | ● | ● | · |
| | 9a | Signage, lighting and landscaping | | ♦ | ● | · | ● | · | ♦ | ■ | · | ● | · |

**Key to impacts:** · No exceedance ● Marginal to minor (1 dB to 10 dB)
♦ Moderate (11 dB to 20 dB) ■ High (>20 dB)

Table 7-113 Predicted construction noise exceedances for residential receivers – evening shoulder

| Period | ID | Scenario | Activity | NCA01 | NCA02 | NCA03 | NCA04 | NCA05 | NCA06 | NCA07 | NCA08 | NCA09 | NCA10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Evening Shoulder | 1a | Ancillary facility establishment | Peak impact | ♦ | ♦ | ● | ♦ | · | ● | ■ | ● | ● | ♦ |
| | 1b | | Typical impact | ● | ● | · | ● | · | · | ■ | · | · | ● |
| | 2a | Ancillary facility operations | Operation | ● | · | · | ● | · | · | ■ | · | · | ● |
| | 2b | | Stockpiling | ● | ● | · | ● | · | · | ■ | · | · | ● |
| | 2c | | Batching plant | · | · | · | · | · | · | ♦ | · | · | · |
| | 3a | Utilities and drainage | Peak impact | ■ | ■ | ♦ | ■ | · | ■ | ■ | ♦ | ■ | ♦ |
| | 3b | | Typical impact | ♦ | ● | · | ● | · | ■ | ■ | ● | ♦ | ● |
| | 4a | Demolition | Peak impact | · | · | ♦ | ♦ | · | ■ | ■ | ● | ● | ♦ |
| | 4b | | Typical impact | · | · | · | ● | · | ♦ | ■ | · | · | ● |
| | 5a | Clearing | Peak impact | ■ | ♦ | ♦ | ■ | · | ■ | ■ | ♦ | ■ | ♦ |
| | 5b | | Typical impact | ♦ | ● | · | ● | · | ■ | ■ | ● | ♦ | ● |
| | 6a | Earthworks | Peak impact | ■ | ♦ | ♦ | ■ | · | ■ | ■ | ♦ | ■ | ♦ |
| | 6b | | Typical impact | ♦ | ● | · | ● | · | ■ | ■ | ● | ♦ | ● |
| | 6c | | Onsite truck haulage | ● | · | · | · | · | · | ● | · | · | · |
| | 7a | Bridge works | Peak impact | · | ♦ | ● | ● | · | ● | ♦ | · | ♦ | · |
| | 7b | | Typical impact | · | ● | · | · | · | · | ● | · | ● | · |
| | 7c | | Concrete works | · | ● | · | ● | · | ● | ● | · | ● | · |
| | 7d | | Girder lifts | · | ● | · | · | · | · | · | · | ● | · |
| | 8a | Road works | Concrete works | ♦ | ● | · | ● | · | ■ | ■ | ● | ♦ | ● |
| | 8b | | Typical works | ♦ | ● | · | ● | · | ■ | ■ | · | ♦ | ● |
| | 8c | | Tie-in works | ■ | ♦ | ● | ■ | · | ● | ♦ | ♦ | ♦ | · |
| | 9a | Signage, lighting and landscaping | | ♦ | ♦ | ♦ | ● | ♦ | · | ■ | ■ | ● | ♦ |

**Key to impacts:** · No exceedance ● Marginal to minor (1 dB to 10 dB)
♦ Moderate (11 dB to 20 dB) ■ High (>20 dB)

Table 7-114 Predicted construction noise exceedances for residential receivers – evening

| Period | ID | Scenario | Activity | NCA01 | NCA02 | NCA03 | NCA04 | NCA05 | NCA06 | NCA07 | NCA08 | NCA09 | NCA10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Evening | 1a | Ancillary facility establishment | Peak impact | · | · | · | · | · | · | · | · | · | · |
| | 1b | | Typical impact | ● | ● | · | ● | · | · | ■ | · | · | ● |
| | 2a | Ancillary facility operations | Operation | ● | · | · | ● | · | · | ■ | · | · | ● |
| | 2b | | Stockpiling | ● | ● | · | ● | · | · | ■ | · | · | ● |
| | 2c | | Batching plant | · | · | · | · | · | · | ♦ | · | · | · |
| | 3a | Utilities and drainage | Peak impact | · | · | · | · | · | · | · | · | · | · |
| | 3b | | Typical impact | · | · | · | · | · | · | · | · | · | · |
| | 4a | Demolition | Peak impact | · | · | · | · | · | · | · | · | · | · |
| | 4b | | Typical impact | · | · | · | · | · | · | · | · | · | · |
| | 5a | Clearing | Peak impact | · | · | · | · | · | · | · | · | · | · |
| | 5b | | Typical impact | · | · | · | · | · | · | · | · | · | · |
| | 6a | Earthworks | Peak impact | · | · | · | · | · | · | · | · | · | · |
| | 6b | | Typical impact | · | · | · | · | · | · | · | · | · | · |
| | 6c | | Onsite truck haulage | · | · | · | · | · | · | · | · | · | · |
| | 7a | Bridge works | Peak impact | · | ♦ | ● | ● | · | ● | ♦ | · | ♦ | · |
| | 7b | | Typical impact | · | ● | · | · | · | · | ● | · | ● | · |
| | 7c | | Concrete works | · | ● | · | ● | · | ● | ● | · | ● | · |
| | 7d | | Girder lifts | · | ● | · | · | · | · | · | · | ● | · |
| | 8a | Road works | Concrete works | ♦ | ● | · | ● | · | ■ | ■ | ● | ♦ | ● |
| | 8b | | Typical works | · | · | · | · | · | · | · | · | · | · |
| | 8c | | Tie-in works | ■ | ♦ | ● | ■ | · | ● | ♦ | ♦ | ♦ | · |
| | 9a | Signage, lighting and landscaping | | · | · | · | · | · | · | · | · | · | · |

**Key to impacts:** · No exceedance ● Marginal to minor (1 dB to 10 dB)
♦ Moderate (11 dB to 20 dB) ■ High (>20 dB)

Table 7-115 Predicted construction noise exceedances for residential receivers – night

| Period | ID | Scenario | Activity | NCA01 | NCA02 | NCA03 | NCA04 | NCA05 | NCA06 | NCA07 | NCA08 | NCA09 | NCA10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Night-time | 1a | Ancillary facility establishment | Peak impact | · | · | · | · | · | · | · | · | · | · |
| | 1b | | Typical impact | ♦ | ● | ● | ♦ | · | · | ■ | · | · | ♦ |
| | 2a | Ancillary facility operations | Operation | ● | ● | · | ♦ | · | · | ■ | · | · | ● |
| | 2b | | Stockpiling | ♦ | ● | ● | ♦ | · | · | ■ | · | · | ♦ |
| | 2c | | Batching plant | · | · | · | · | · | · | ♦ | ● | ● | · |
| | 3a | Utilities and drainage | Peak impact | · | · | · | · | · | · | · | · | · | · |
| | 3b | | Typical impact | · | · | · | · | · | · | · | · | · | · |
| | 4a | Demolition | Peak impact | · | · | · | · | · | · | · | · | · | · |
| | 4b | | Typical impact | · | · | · | · | · | · | · | · | · | · |
| | 5a | Clearing | Peak impact | · | · | · | · | · | · | · | · | · | · |
| | 5b | | Typical impact | · | · | · | · | · | · | · | · | · | · |
| | 6a | Earthworks | Peak impact | · | · | · | · | · | · | · | · | · | · |
| | 6b | | Typical impact | · | · | · | · | · | · | · | · | · | · |
| | 6c | | Onsite truck haulage | ● | · | · | ● | · | ● | ● | · | · | · |
| | 7a | Bridge works | Peak impact | · | ♦ | ● | ♦ | · | ♦ | ♦ | ● | ♦ | · |
| | 7b | | Typical impact | · | ● | · | ● | · | ● | ● | · | ● | · |
| | 7c | | Concrete works | · | ● | ● | ♦ | · | ● | ● | · | ● | · |
| | 7d | | Girder lifts | · | ● | · | ● | · | · | ● | · | ● | · |
| | 8a | Road works | Concrete works | ♦ | ♦ | ● | ♦ | · | ■ | ■ | ● | ♦ | ● |
| | 8b | | Typical works | · | · | · | · | · | · | · | · | · | · |
| | 8c | | Tie-in works | ■ | ♦ | ♦ | ■ | · | ● | ♦ | ■ | ■ | · |
| | 9a | Signage, lighting and landscaping | | · | · | · | · | · | · | · | · | · | · |

**Key to impacts:** · No exceedance ● Marginal to minor (1 dB to 10 dB)
♦ Moderate (11 dB to 20 dB) ■ High (>20 dB)

Table 7-116 Peak noise impact works

| Scenario | Activity | Indicative duration (weeks) | Comments on peak noise activities |
|---|---|---|---|
| Utilities and drainage | Peak impact | 35 | Rock-breakers and/or concrete saws would be used during extended working hours, where required for relatively short durations. |
| Demolition | Peak impact | 36 | Rock-breakers would be used during extended working hours only as required at specific locations for relatively short durations. |
| Clearing | Peak impact | 20 | Chainsaws and chippers would be used during extended working hours only as required for relatively short durations. |
| Earthworks | Peak impact | 80 | Peak noise generating equipment such as dozers would be required to move spoil during extended working hours only as required. |
| Road works | Concrete works | 30 | Concrete truck and concrete pump will be used for any concrete works required for the road and may be carried out during the night-time period as required. |
| Road works | Tie-in works | 48 | Concrete saws would be used at night-time only when works cannot take place during the daytime, eg during closure of surrounding roads. Concrete saws would be used for relatively short durations at a time. |

Table 7-117 Number of predicted highly noise affected residential receivers

| Scenario | Activity | NCA01 | NCA02 | NCA03 | NCA04 | NCA05 | NCA06 | NCA07 | NCA08 | NCA09 | NCA10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilities and drainage | Peak impact | 2 | - | - | 2 | - | 2 | 1 | - | - | - |
| Clearing | Peak impact | 1 | - | - | 1 | - | 1 | 1 | - | - | - |
| Earthworks | Peak impact | 1 | - | - | - | - | 1 | 1 | - | - | - |
| Road works | Tie-in works | 1 | - | - | 1 | - | - | - | - | - | - |

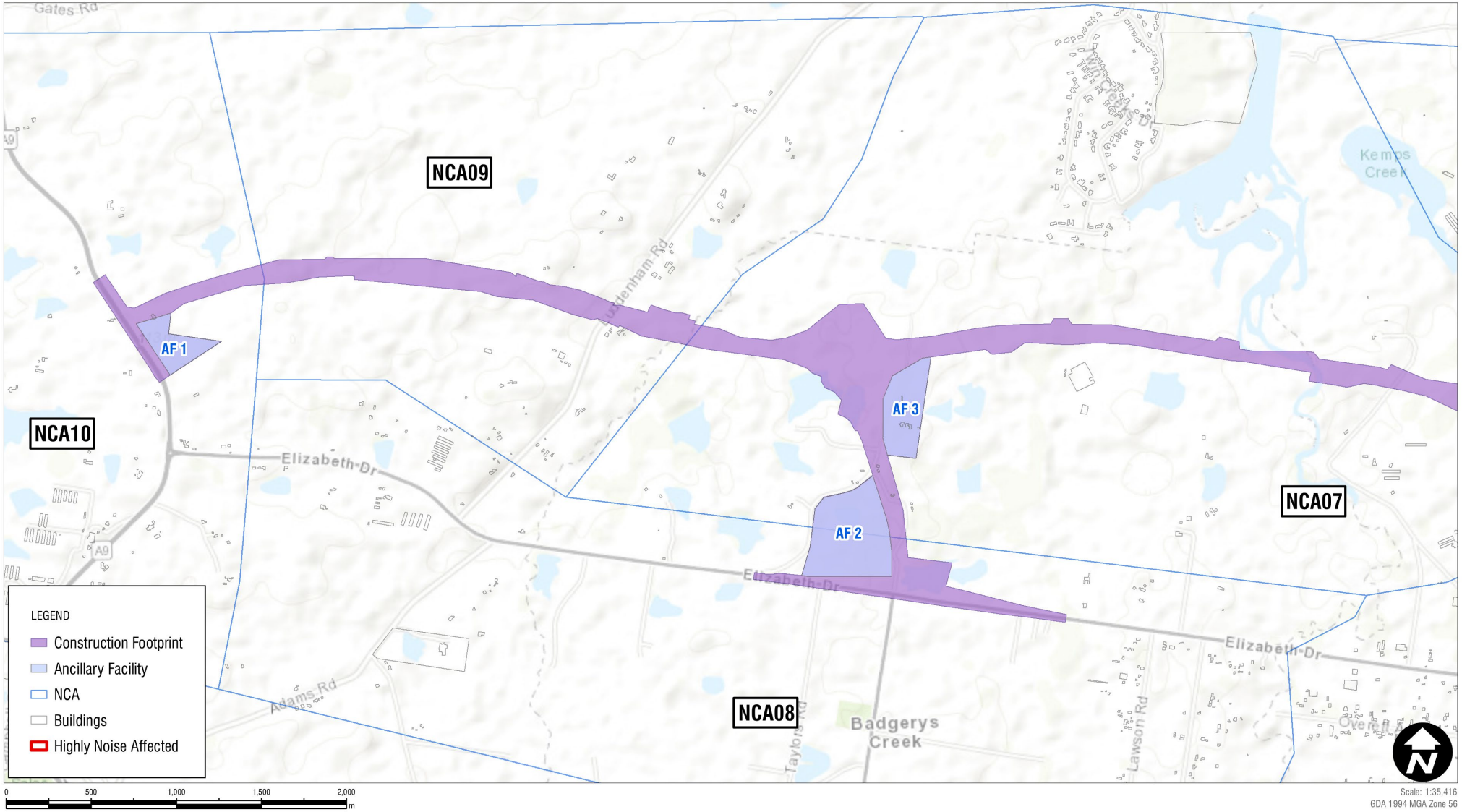



Figure 7-103 Highly noise affected residential receivers (all works)


Figure 7-104 Highly noise affected residential receivers (all works)

### Other sensitive receivers

There are several categories of ‘other’ sensitive receivers in the study area, including educational facilities, places of worship and outdoor areas.

The predicted NML exceedances for ‘other’ sensitive receivers are summarised in **Table 7-118** and show that:

- Exceedances at ‘other’ sensitive receivers are limited to receivers in NCA01, NCA02, NCA04 and NCA05
- The closest School (Irfan College) located in NCA04 is likely to be subject to ‘moderate’ impacts during worst-case scenarios when noise intensive equipment is being used
- A minor 1 dB exceedance is predicted at Saints Peter and Paul Assyrian Church of the East located in NCA01 and at the Head Start Long Day Care Centre in Cecil Hills, located in NCA02
- Minor exceedances of up to 6 dB are predicted at two outdoor sensitive receiver areas (Kemps Creek Sporting and Bowling Club and Western Sydney Parklands) adjacent to the project in NCA04 and NCA05
- ‘Other’ sensitive receivers in the study area are not expected to be impacted by construction of the project.

The worst-case noise levels and the impacts on ‘other’ sensitive receivers would only be apparent for relatively short durations of the works.

The summary is for all NCAs on the project and shows the impacts in bands of 10 dB above the corresponding NML, separately by receiver type.

### Commercial receivers

A summary of the predicted construction noise impacts in each NCA for commercial receivers (including small businesses) is presented in **Table 7-119**, showing that:

- Minor impacts are seen in NCA05 during the ‘Peak impact’ scenarios for Ancillary facility establishment, Utilities and drainage, Clearing and Earthworks
- The worst-case impacts are seen in the ‘Peak impact’ scenarios, which is due to the use of noise intensive equipment. Noise levels and exceedances during the ‘Typical impact’ works do not exceed the noise management levels
- Other NCAs either have no commercial receivers or they are sufficiently distant from the construction footprint to be compliant with the noise goals
- No commercial receivers are predicted to have moderate or peak impacts.

### Sleep disturbance

Review of the predictions shows that the sleep disturbance screening criterion is likely to be exceeded when night works are occurring near residential receivers (see Section 5.6 of **Appendix K**).

The need for night-time works on consecutive nights is not fully understood at this stage of the project. Where night-time work is located close to residential receivers, a detailed assessment of the potential noise impacts would be carried out before the works being carried out and site-specific environmental management measures to control the impacts would be developed.

The requirements for night-time works would be determined as the project progresses. Sleep disturbance impacts would be dependent on a number of factors including the existing facade performance of affected residential receiver buildings. The likelihood of sleep disturbance impacts would be reviewed during detailed design.

Table 7-118 Overview of ‘other’ sensitive receiver daytime NML exceedances

| ID | Scenario | Activity | Educational NCA04 | | | Child care centre NCA02 | | | Place of worship NCA01 | | | Remaining[1] NCA04, NCA05 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Daytime | | | Daytime | | | Daytime | | | Daytime | | |
| | | | 1-10 dB | 11-20 dB | >20 dB | 1-10 dB | 11-20 dB | >20 dB | 1-10 dB | 11-20 dB | >20 dB | 1-10 dB | 11-20 dB | >20 dB |
| 1a | Ancillary facility establishment | Peak impact | 5 | - | - | - | - | - | - | - | - | - | - | - |
| 1b | | Typical impact | - | - | - | - | - | - | - | - | - | - | - | - |
| 2a | Ancillary facilities | Operation | - | - | - | - | - | - | - | - | - | - | - | - |
| 2b | | Stockpiling | - | - | - | - | - | - | - | - | - | - | - | - |
| 2c | | Batching plant | - | - | - | - | - | - | - | - | - | - | - | - |
| 3a | Utilities and drainage | Peak impact | - | 5 | - | 1 | - | - | 1 | - | - | 2 | - | - |
| 3b | | Typical impact | 2 | - | - | - | - | - | - | - | - | - | - | - |
| 4a | Demolition | Peak impact | - | - | - | - | - | - | - | - | - | - | - | - |
| 4b | | Typical impact | - | - | - | - | - | - | - | - | - | - | - | - |
| 5a | Clearing | Peak impact | 1 | 4 | - | - | - | - | - | - | - | 1 | - | - |
| 5b | | Typical impact | 2 | - | - | - | - | - | - | - | - | - | - | - |
| 6a | Earthworks | Peak impact | 3 | 2 | - | - | - | - | - | - | - | 1 | - | - |
| 6b | | Typical impact | 2 | - | - | - | - | - | - | - | - | - | - | - |
| 6c | | Onsite truck haulage | - | - | - | - | - | - | - | - | - | - | - | - |

| ID | Scenario | Activity | Educational NCA04 | | | Child care centre NCA02 | | | Place of worship NCA01 | | | Remaining[1] NCA04, NCA05 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Daytime | | | Daytime | | | Daytime | | | Daytime | | |
| | | | 1-10 dB | 11-20 dB | >20 dB | 1-10 dB | 11-20 dB | >20 dB | 1-10 dB | 11-20 dB | >20 dB | 1-10 dB | 11-20 dB | >20 dB |
| 7a | Bridge works | Peak impact | 1 | - | - | - | - | - | - | - | - | - | - | - |
| 7b | | Typical impact | - | - | - | - | - | - | - | - | - | - | - | - |
| 7c | | Concrete works | - | - | - | - | - | - | - | - | - | - | - | - |
| 7d | | Girder lifts | - | - | - | - | - | - | - | - | - | - | - | - |
| 8a | Road works | Concrete works | 1 | - | - | - | - | - | - | - | - | - | - | - |
| 8b | | Typical works | - | - | - | - | - | - | - | - | - | - | - | - |
| 8c | | Tie-in works | 1 | 4 | - | - | - | - | - | - | - | - | - | - |
| 9a | Signage, lighting and landscaping | | 5 | 5 | - | - | - | - | - | - | - | - | - | - |

*Note 1: Remaining refers to outdoor active recreation areas and outdoor passive recreation areas.*

*Note 2: Cell shading indicates highest predicted exceedance of NML for worst-case proposed operating period; green = minor (less than 10 dB), orange = moderate (11-20 dB), red = high (greater than 20 dB)*

Table 7-119 Predicted construction noise exceedances – commercial receivers

| Period | ID | Scenario | Activity | NCA01 | NCA02 | NCA03 | NCA04 | NCA05 | NCA06 | NCA07 | NCA08 | NCA09 | NCA10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| While in use | 1a | Ancillary facility establishment | Peak impact | · | · | · | · | ● | · | · | · | · | · |
| | 1b | | Typical impact | · | · | · | · | · | · | · | · | · | · |
| | 2a | Ancillary facility operations | Operation | · | · | · | · | · | · | · | · | · | · |
| | 2b | | Stockpiling | · | · | · | · | · | · | · | · | · | · |
| | 2c | | Batching plant | · | · | · | · | · | · | · | · | · | · |
| | 3a | Utilities and drainage | Peak impact | · | · | · | · | ● | · | · | · | · | · |
| | 3b | | Typical impact | · | · | · | · | · | · | · | · | · | · |
| | 4a | Demolition | Peak impact | · | · | · | · | · | · | · | · | · | · |
| | 4b | | Typical impact | · | · | · | · | · | · | · | · | · | · |
| | 5a | Clearing | Peak impact | · | · | · | · | ● | · | · | · | · | · |
| | 5b | | Typical impact | · | · | · | · | · | · | · | · | · | · |
| | 6a | Earthworks | Peak impact | · | · | · | · | ● | · | · | · | · | · |
| | 6b | | Typical impact | · | · | · | · | · | · | · | · | · | · |
| | 6c | | Onsite truck haulage | · | · | · | · | · | · | · | · | · | · |
| | 7a | Bridge works | Peak impact | · | · | · | · | · | · | · | · | · | · |
| | 7b | | Typical impact | · | · | · | · | · | · | · | · | · | · |
| | 7c | | Concrete works | · | · | · | · | · | · | · | · | · | · |
| | 7d | | Girder lifts | · | · | · | · | · | · | · | · | · | · |
| | 8a | Road works | Concrete works | · | · | · | · | · | · | · | · | · | · |
| | 8b | | Typical works | · | · | · | · | · | · | · | · | · | · |
| | 8c | | Tie-in works | · | · | · | · | · | · | · | · | · | · |
| | 9a | Signage, lighting and landscaping | | · | · | · | · | · | · | · | · | · | · |

**Key to impacts:** · No exceedance ● Marginal to minor (1 dB to 10 dB)
♦ Moderate (11 dB to 20 dB) ■ High (>20 dB)

### *Construction vibration*

The main sources of vibration during construction of the project would be associated with the use of vibratory rollers and rock breakers. A large vibratory roller produces noticeable vibration and is likely to be used throughout the construction of the project. Construction scenarios and activities that would require the use of vibratory rollers and rock breakers are outlined in **Table 7-120**. The assessment assumes that a vibratory roller is required across the study area and the assessment is summarised in **Figure 7-105** and **Figure 7-106**.

Table 7-120 Construction scenarios requiring the use of high vibratory sources

| Scenario | Activity | Vibratory source |
|---|---|---|
| Ancillary facility and establishment | Peak impact | Vibratory roller |
| | Typical impact | Vibratory roller |
| Utilities and drainage | Peak impact | Vibratory roller |
| | | Rock breaker |
| Earthworks | Peak impact | Vibratory roller |
| Road works | Tie-in to existing roads | Vibratory roller |
| Demolition | Bridges and buildings | Rock breaker |

The requirement for works which use vibration intensive equipment near vibration sensitive buildings, structures and assets would be reviewed during detailed design. It is expected that vibration impacts would be able to be controlled to avoid cosmetic and structural damage to all structures.

Where works are within the minimum working distances discussed in **Section 7.7.3**, detailed review of the required construction methods would be completed and attended vibration measurements would be required at the start of the works to determine the risk of exceeding the vibration objectives.

Vibration offset distances are based on the recommended minimum working distances for cosmetic damage and human response in **Table 7-104**.

#### Cosmetic damages

The distance between the construction works and the nearest sensitive receivers is generally sufficient for most buildings to be unlikely to suffer cosmetic damage. About 19 structures are however located within the recommended minimum working distance spread across NCA01, NCA04, NCA05, NCA06, NCA07 and NCA10 where receivers are located close to the works.

Where works are within the minimum working distances and considered likely to exceed the cosmetic damage objectives, construction works would not proceed unless:

- A different construction method with lower source vibration levels is used, where feasible
- Attended vibration measurements are carried out at the start of the works to determine the risk of exceeding of the vibration objectives.

Where buildings are potentially affected by vibration, building condition surveys would be completed before and after works.

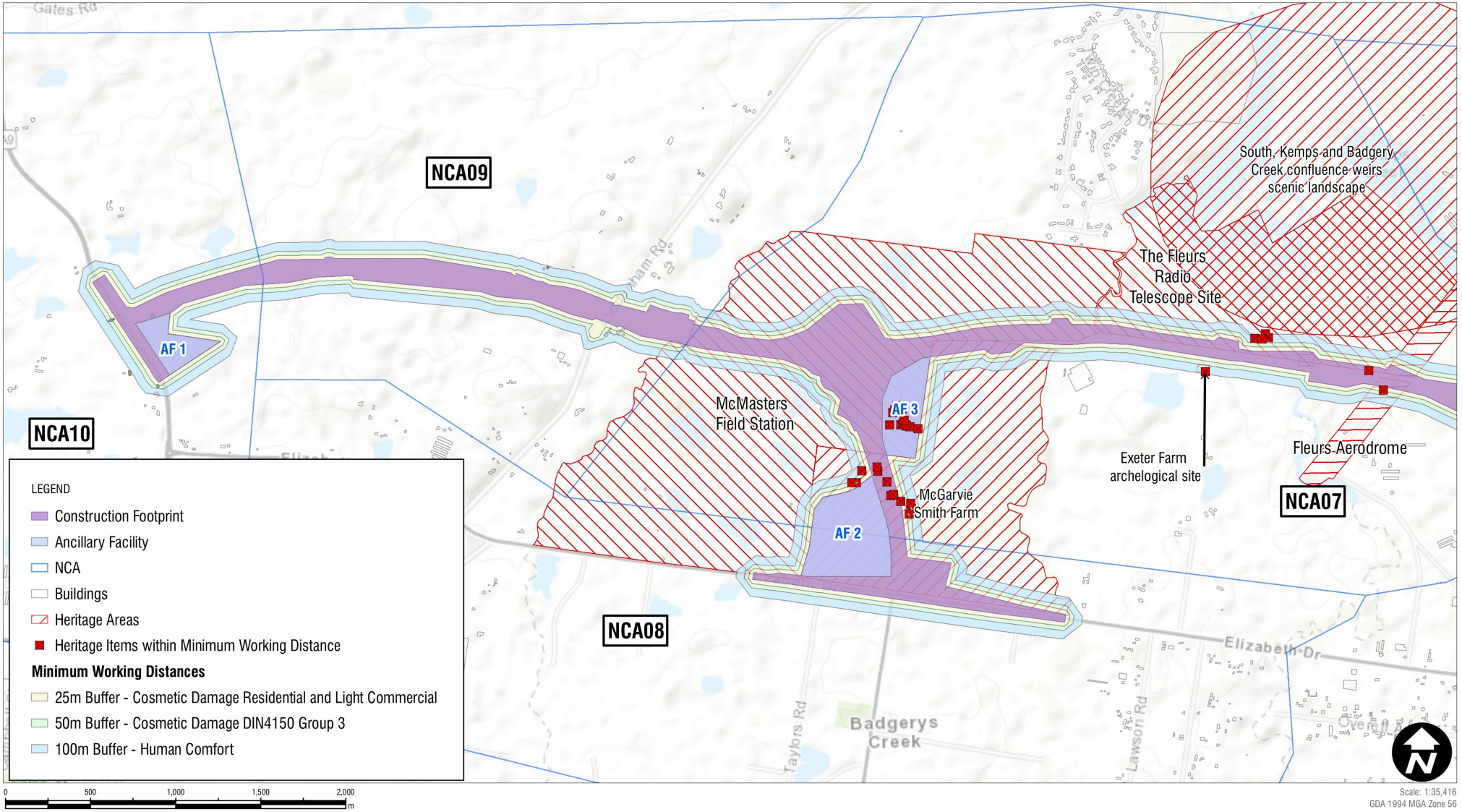



Figure 7-105 Construction vibration assessment

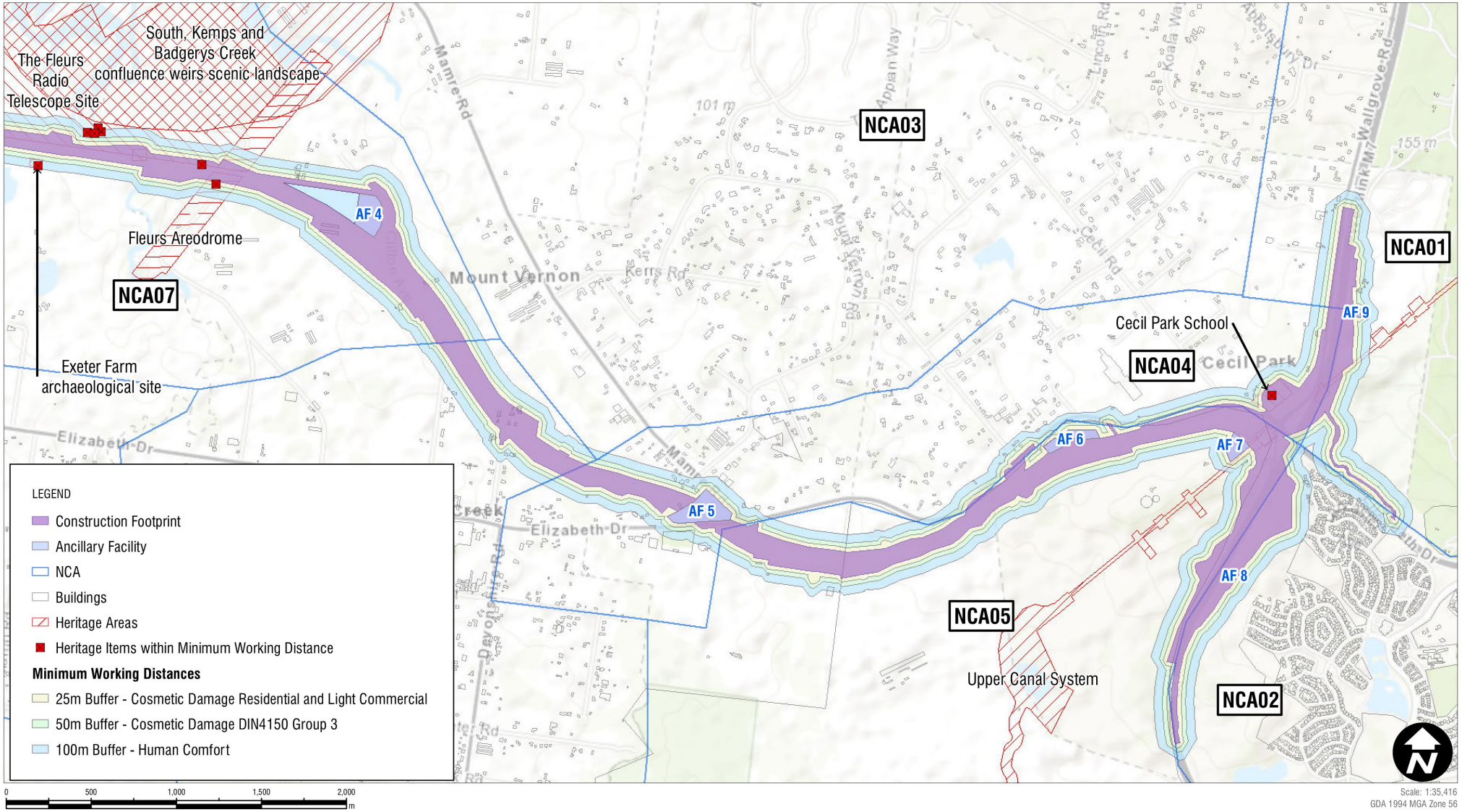



Figure 7-106 Construction vibration assessment

### Human comfort

Certain receivers which are near the construction footprint are within the human comfort minimum working distance and occupants of affected buildings may be able to perceive vibration impacts at times when vibration generating equipment is in use.

Where impacts would be perceptible, they would likely only be apparent for relatively short durations when equipment such as rock-breakers or vibratory rollers are in use nearby.

### Heritage structures

The non-Aboriginal heritage assessment for the project (see **Section 7.6**) has identified a number of non-Aboriginal heritage items that are located in the study area. Items that were deemed to be of heritage significance in the heritage report and are near the construction footprint are shown in **Figure 7-105** and **Figure 7-106**.

The Aboriginal heritage assessment for the project (see **Section 7.5**) has found that there are artefacts throughout the landscape within the study area. However, that assessment did not identify any Aboriginal heritage structures or items near the project construction footprint that would be susceptible to vibration impacts.

BS 7385 states that “a building of historical value should not (unless it is structurally unsound) be assumed to be more sensitive” and therefore buildings or structures should not be assumed to be sensitive to vibration on the basis of being classed a heritage item.

Heritage buildings are to be considered on a case by case basis and further investigation would be carried out during detailed design for all potentially affected structures. Where buildings or structures are considered sensitive to vibration, appropriate vibration criteria would be determined after detailed inspections were completed.

Heritage items with structures within the safe working distances for heritage items include:

- McGarvie-Smith farm
- McMasters field station
- Fleurs Aerodrome
- Former Cecil Park public hall
- Upper Canal (see below).

Structures associated with these heritage items and near the construction site would be inspected before the start of vibration intensive works and a dilapidation survey carried out to confirm its sensitivity to vibration induced damage.

### Upper Canal

The Upper Canal System bisects the study area in the southwestern and northeast corner of the Elizabeth Drive and the M7 Motorway interchange and is listed on the State heritage register. While the canal itself is underground at the location where it crosses the study area, Tunnel Shaft 4 is located at the surface within the study area and can be observed from the M7 Motorway. Vibration intensive activities may occur near the canal tunnel including the construction of the bridge support piles crossing over the M7 Motorway, potential excavation of rock to make way for the M12 Motorway ramps, and vibratory rolling.

A reduction of the above vibration criteria by half to a peak particle velocity (PPV) of 25 mm/s is recommended. The condition of the canal would be confirmed by Roads and Maritime through a dilapidation survey before the detailed design stage of the project in order to determine appropriate vibration criteria.

The proposed construction methodology would use bored piles. Vibration from bored piles is comparatively low and it is unlikely that vibration would exceed the recommended criteria of 25 mm/s.

Rock-breaking, and vibratory rolling has the potential to exceed the recommended criteria of 25 mm/s and would require a more detailed assessment taking into account the actual distance from the vibration intensive activities to the canal as well as the ground conditions. In-situ monitoring would be used to establish site laws to confirm the site-specific vibration propagation to assess the impact of vibration.

#### Gas supply main

The Eastern Gas Pipeline is also located under the M7 Motorway and Elizabeth Drive Intersection. Vibration intensive activities could occur near the gas main pipeline including the bridge support piles crossing over the M7 Motorway, potential excavation of rock to make way for the M12 Motorway ramps, and vibratory rolling.

The gas supply pipeline is steel with a plastic coating. A vibration criterion of 50 mm/s was used as per the recommendations from DIN 4150.3 for buried masonry pipework. A reduction of this vibration criterion by half to a PPV of 25 mm/s is recommended.

Similar to the upper canal, bored piling is unlikely to result in vibration levels that exceed the recommended project criteria.

Rock-breaking and vibratory rolling has the potential to exceed the recommended criteria of 25 mm/s and would require a more detailed assessment taking into account the actual distance from the vibration intensive activities to the gas supply main as well as the ground conditions. In-situ monitoring would be used to establish site laws to confirm the site-specific vibration propagation to assess the impact of vibration.

### *Construction ground-borne noise*

Construction works can cause ground-borne noise impacts in nearby buildings when vibration generating equipment is in use. The majority of receivers are sufficiently distant from the works for ground-borne noise impacts on be minimal. Where residential receivers are located near construction works, airborne noise levels would typically be dominant over the ground-borne component.

### *Construction traffic noise*

Construction related traffic has the potential to temporarily increase road traffic noise levels at receivers which are located near the construction routes.

A comparison of the proposed construction traffic volumes to the forecast traffic volumes during the construction period was used to determine where increases in road traffic noise (ie a greater than 2.0 dB increase over the existing noise level) may be likely to occur.

The predicted increase in traffic noise due to additional construction traffic is outlined in **Table 7-121** and shows that construction traffic is unlikely to result in a noticeable increase in noise levels where vehicles use major roads. This is because of the high volumes of traffic that already use these routes.

Based on the proposed construction traffic routes and the forecast redistribution of traffic during construction, no noticeable increases in road traffic noise are predicted.

The assessment is summarised for the daytime period in **Figure 7-107** and for the night-time period in **Figure 7-108**.

Table 7-121 Predicted road traffic noise increase due to construction traffic

| Road | Section | Predicted construction traffic noise increase (dB) | |
|---|---|---|---|
| | | Scenario | Activity |
| M7 Motorway | South of the M7 Interchange | <0.5 | <0.5 |
| | Between On/Off Ramps to Elizabeth Drive and Wallgrove Road | <0.5 | <0.5 |
| | North of the M7 Interchange | <0.5 | <0.5 |
| M7 Motorway – Elizabeth Drive Interchange | Northbound Off Ramp to Elizabeth Drive | 0.5 | 0.5 |
| | Northbound On Ramp from Wallgrove Road | 1.0 | 0.6 |
| | Southbound Off Ramp to Elizabeth Drive | 0.8 | 1.2 |
| | Southbound On Ramp from Elizabeth Drive | 1.3 | 0.8 |
| Elizabeth Drive | East of the M7 Interchange | <0.5 | <0.5 |
| | Between M7 Interchange Road and Cecil Road | <0.5 | <0.5 |
| | Between Cecil Road and Duff Road | <0.5 | <0.5 |
| | Between Duff Road and Mamre Road | 0.5 | <0.5 |
| | Between Mamre Road and Devonshire Road | <0.5 | <0.5 |
| | Between Devonshire Road and Clifton Avenue | <0.5 | <0.5 |
| | Between Clifton Avenue and Western Road | 0.5 | <0.5 |
| | Between Western Road and Martin Road | 0.7 | 0.5 |
| | Between Martin Road and Western Sydney Airport Business Park East Access | 0.6 | 0.5 |
| | Between Western Sydney Airport Business Park East Access and Western Sydney Airport Business Park West Access | 0.7 | 0.7 |
| | Between Western Sydney Airport Business Park West Access and Adams Road | 0.7 | 0.6 |
| | Between Adams Road and Luddenham Road | 0.9 | 0.8 |
| | Between Luddenham Road and The Northern Road | 1.0 | 0.9 |
| Wallgrove Road | Between Elizabeth Drive and M7 northbound On Ramp | 1.1 | 1.0 |
| | North of the M7 northbound On Ramp | 0.6 | <0.5 |
| Clifton Avenue | North of Elizabeth Drive | <0.5 | <0.5 |
| The Northern Road | South of Elizabeth Drive | 1.3 | 1.0 |
| | Between Elizabeth Drive and the M12 Motorway | 0.5 | 0.5 |
| | North of the M12 Motorway | 0.5 | <0.5 |

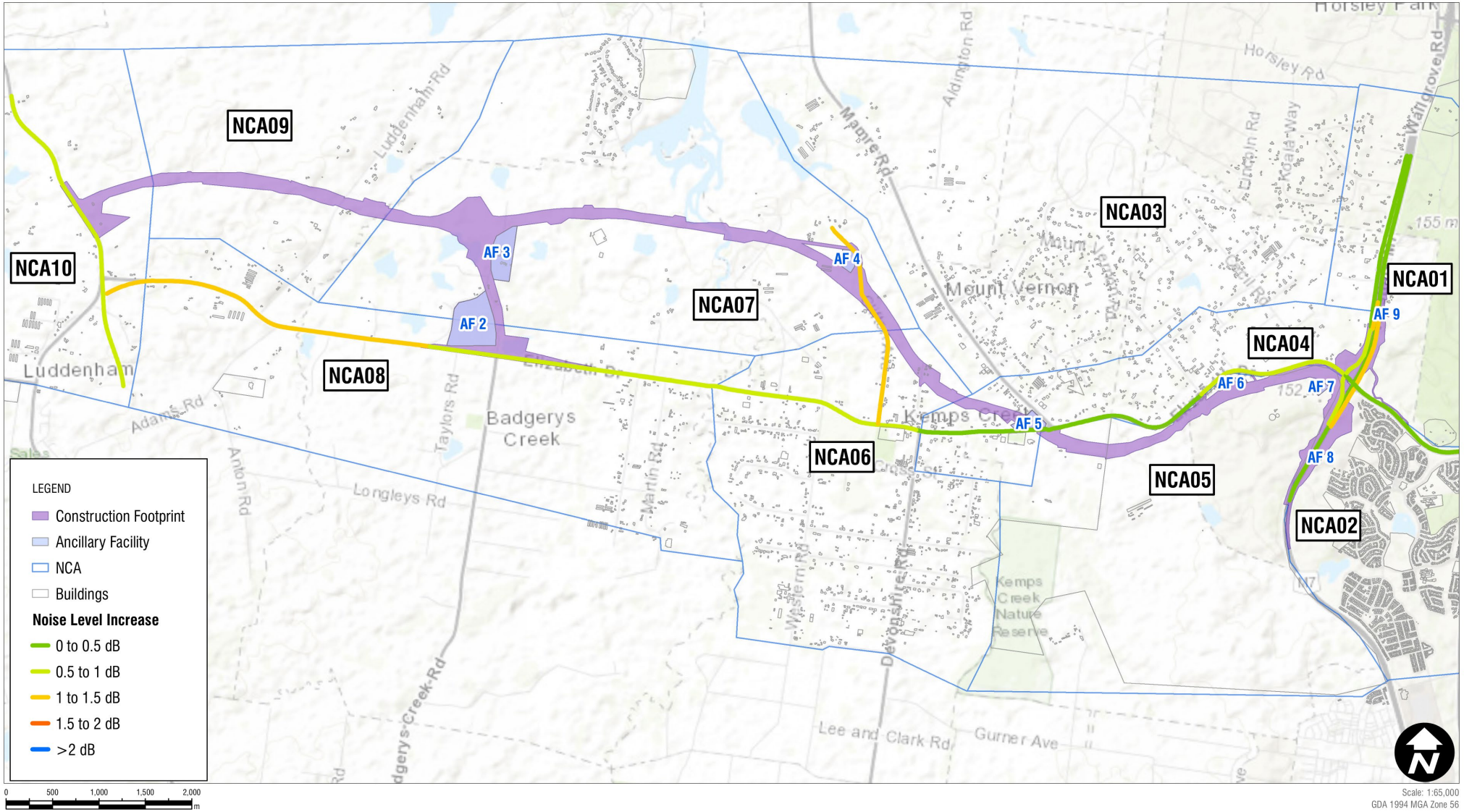



Figure 7-107 Predicted road traffic noise increase due to construction traffic – Daytime

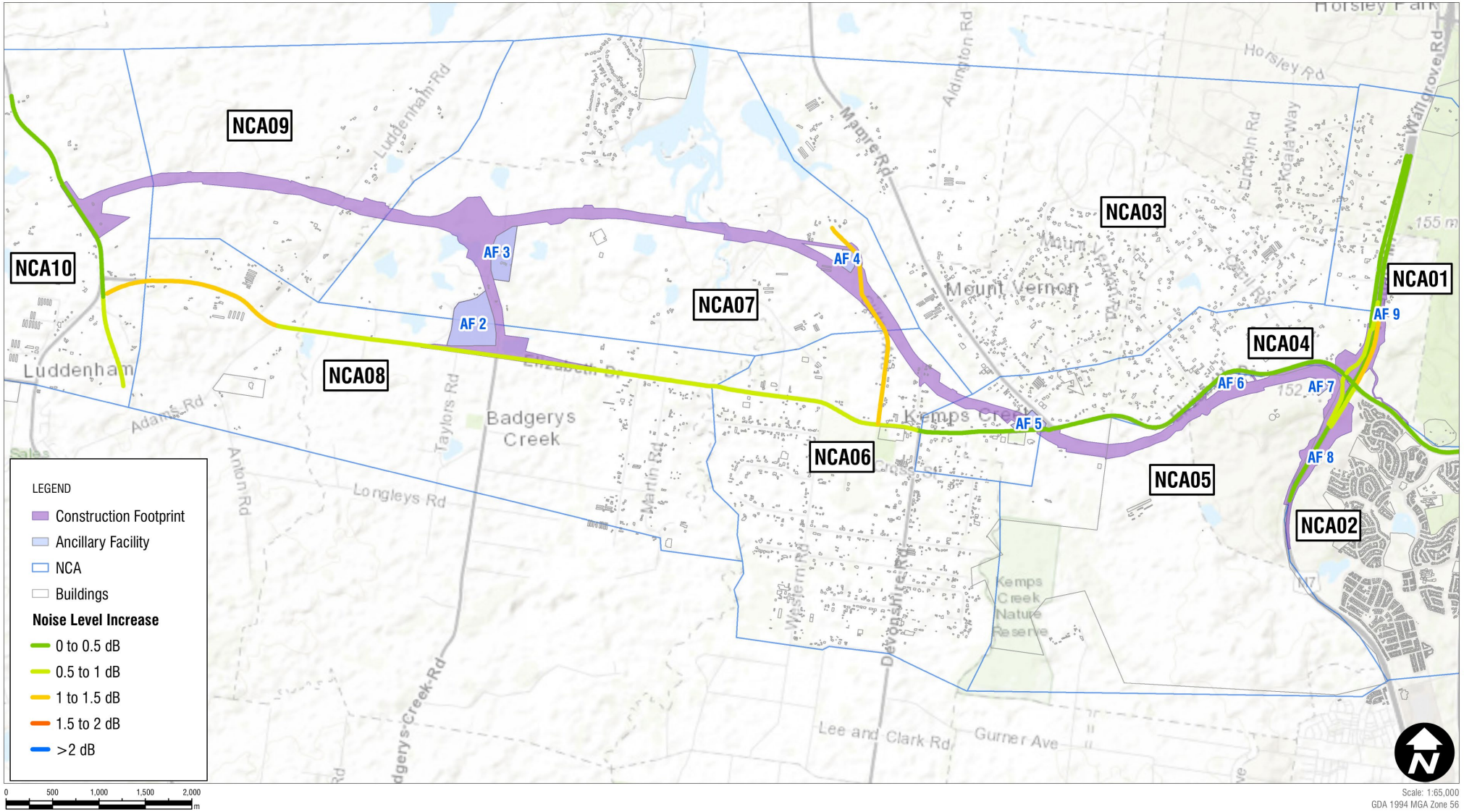



Figure 7-108 Predicted road traffic noise increase due to construction traffic – Night-time

## 7.7.7 Assessment of potential operational impacts

### *Operational road noise predictions*

The predicted operational road noise levels at residential receivers are summarised in **Table 7-122** for the 2026 at-opening and 2036 future design scenarios. The table summarises the worst-case change in noise levels in each NCA, which is typically receivers which are nearest to the project.

Operational noise impacts in the operational study area were predicted 'without mitigation' and compared to the NCG criteria. The 'without mitigation' noise predictions are used to identify receivers which qualify for consideration of additional noise mitigation, noting that receivers which are above the NCG criteria do not necessarily qualify for additional noise mitigation

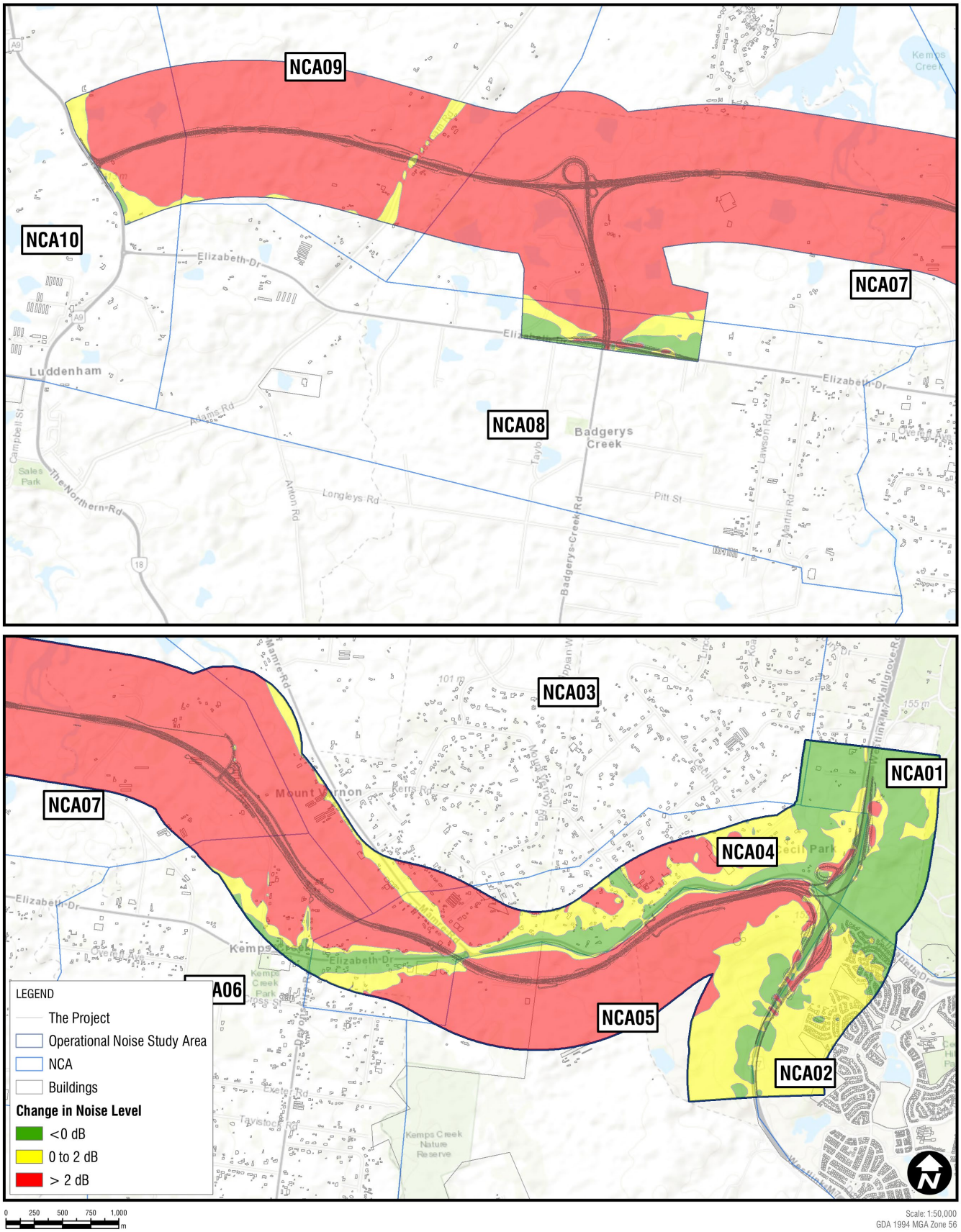
Table 7-122 Predicted worst-case changes in road traffic noise level in each NCA without mitigation (triggered residential receivers only)

| NCA | At- Opening 2026 | | | | | | Future Design 2036 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No build | | Build | | Change | | No build | | Build | | Change | |
| | Day | Night | Day | Night | Day | Night | Day | Night | Day | Night | Day | Night |
| NCA01 | 62 | 58 | 67 | 63 | 5 | 5 | 63 | 59 | 69 | 64 | 5 | 5 |
| NCA02 | 52 | 47 | 53 | 50 | 2 | 2 | 53 | 49 | 55 | 52 | 1 | 2 |
| NCA03 | 49 | 44 | 59 | 55 | 11 | 11 | 49 | 45 | 60 | 56 | 11 | 11 |
| NCA04 | 54 | 53 | 66 | 65 | 12 | 12 | 53 | 51 | 66 | 64 | 12 | 12 |
| NCA05 | - | - | - | - | - | - | - | - | - | - | - | - |
| NCA06 | 51 | 47 | 67 | 63 | 16 | 16 | 53 | 49 | 67 | 63 | 14 | 14 |
| NCA07 | 33 | 28 | 53 | 48 | 20 | 20 | 36 | 31 | 55 | 51 | 19 | 20 |
| NCA08 | - | - | - | - | - | - | - | - | - | - | - | - |
| NCA09 | 44 | 40 | 57 | 53 | 13 | 13 | 45 | 41 | 59 | 55 | 14 | 15 |
| NCA10 | 53 | 49 | 55 | 51 | 2 | 1 | 54 | 50 | 57 | 53 | 3 | 3 |

*Note 1: Results based on receiver predicted to experience the greatest change in noise between the build and no build scenarios and may not represent the highest predicted noise level within each NCA.*

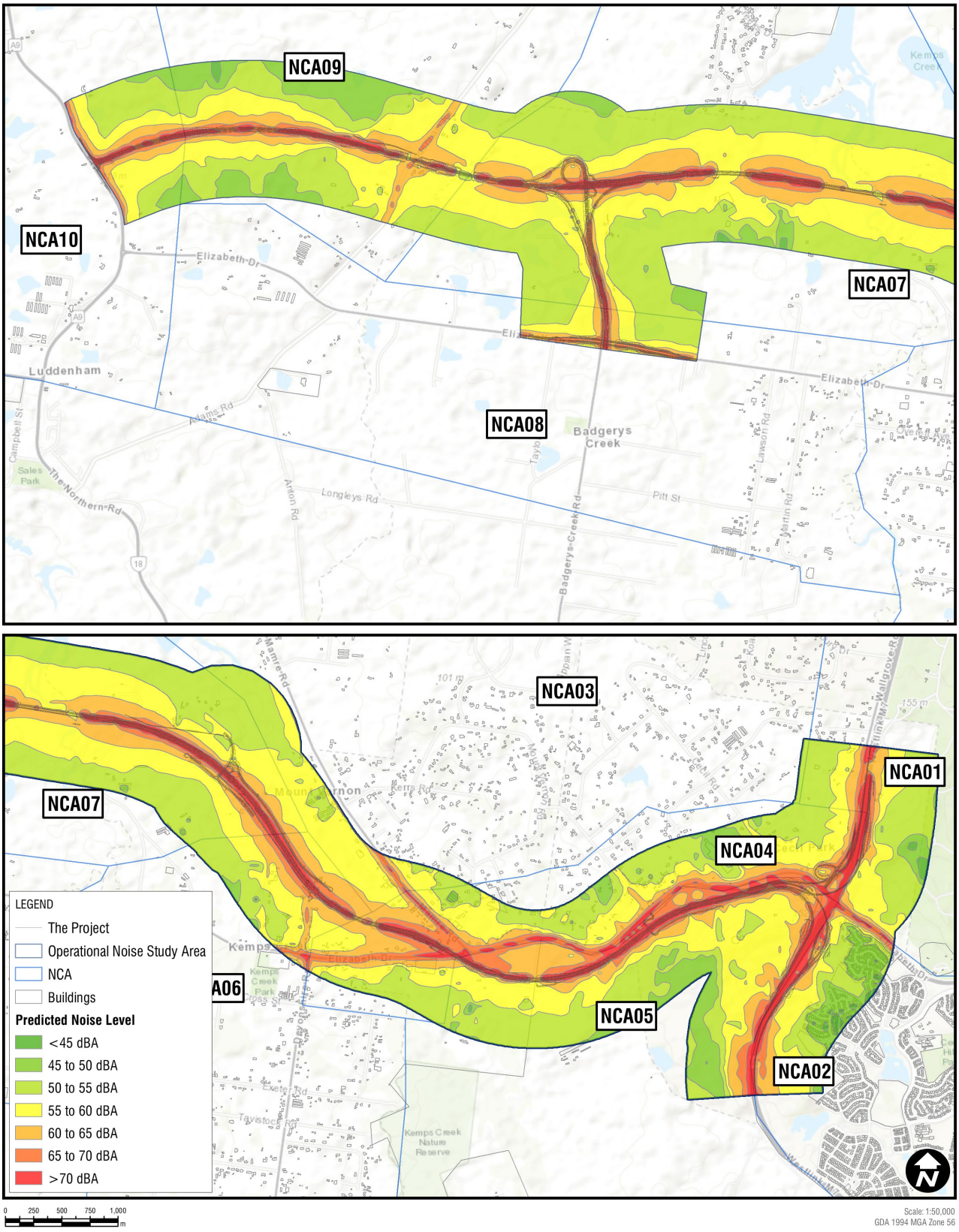
These results show increases in road traffic noise levels are predicted at receivers within most NCAs across the operational study area. In NCA01, NCA03 and NCA04, increases result from the alignment of the project being relatively close to receivers with the project impacting facades of houses which were previously not affected by road traffic noise. In NCA07 and NCA09 the project is being constructed in an area which has low existing road traffic noise levels and affects receivers which were previously not affected. There are no residential receivers within the operational study area in NCA05 and NCA08.

The time period in which the project is predicted to have the highest number of impacted receivers is the 2036 night-time scenario. The maps in **Figure 7-109** and **Figure 7-110** present the impacts for the controlling 2036 night-time scenario, while maps for the other time periods are included in **Appendix K**.




*Note 1: Predicted change in noise levels (Build minus No Build) are for 2036 night-time scenario at a height of 1.5 metres above local ground (ground floor level).*

Figure 7-109 Predicted change in operational noise without mitigation – 2036 Night-time




*Note 1: Predicted free field noise levels are for Build 2036 night-time scenario at a height of 1.5 metres above local ground (ground floor level)*

Figure 7-110 Predicted Build operational noise levels without mitigation – LAeq (9hour) – 2036 Night-time

### *Receivers considered for additional noise mitigation*

Where road traffic noise levels at receivers are predicted to be above the NCG criteria, the requirement for additional noise mitigation is determined using guidance from the Roads and Maritime NMG. For receivers that qualify for consideration of additional noise mitigation, potential noise mitigation measures are to be considered in the following order of preference:

- Quieter road pavement surfaces
- Noise mounds
- Noise barriers
- At-property treatments.

The NMG recognises that the NCG criteria are not always practicable and that it is not always feasible or reasonable to expect that they are achieved.

When evaluating if a receiver qualifies for consideration of additional noise mitigation the NMG considers how far above the criterion the noise level is and by how much the noise level has increased. These considerations provide a feasible and reasonable approach to identifying qualifying receivers.

The receivers which were identified as eligible for consideration of additional noise mitigation are detailed in **Table 7-123**. The table shows that a total of 262 receivers (183 individual buildings) are predicted to have exceedances of the operational road traffic noise criteria for the project and are therefore considered eligible for consideration of additional noise mitigation.

Table 7-123 Receivers considered for additional noise mitigation

| NCA | Number of receiver floors (multi-level building) | | Number of receiver buildings | |
|---|---|---|---|---|
| | Residential | Other | Residential | Other |
| NCA01 | 3 | - | 2 | - |
| NCA02 | 3 | - | 2 | - |
| NCA03 | 39 | - | 28 | - |
| NCA04 | 139 | 7 | 96 | 7 |
| NCA05 | - | 4 | - | 1 |
| NCA06 | 27 | - | 18 | - |
| NCA07 | 25 | - | 18 | - |
| NCA08 | - | - | - | - |
| NCA09 | 14 | - | 10 | - |
| NCA10 | 1 | - | 1 | - |
| All NCA's | 251 | 11 | 175 | 8 |
| | 262 | | 183 | |

The receivers which were identified as eligible for consideration of additional noise mitigation are shown in **Figure 7-111** to **Figure 7-113**.

Operational noise mitigation measures are discussed in **Section 7.7.9**.

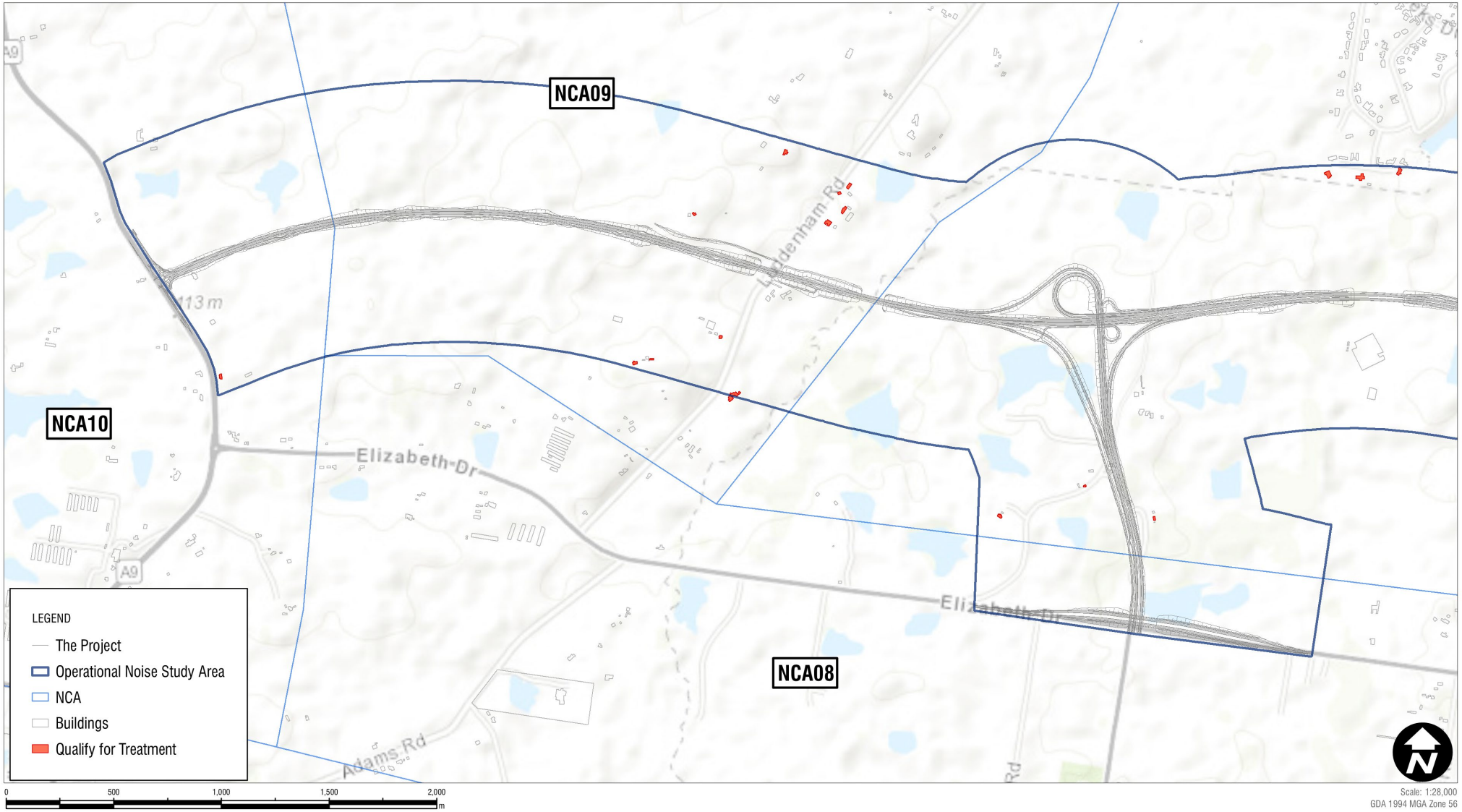



Figure 7-111 Receivers identified as eligible for consideration of additional mitigation

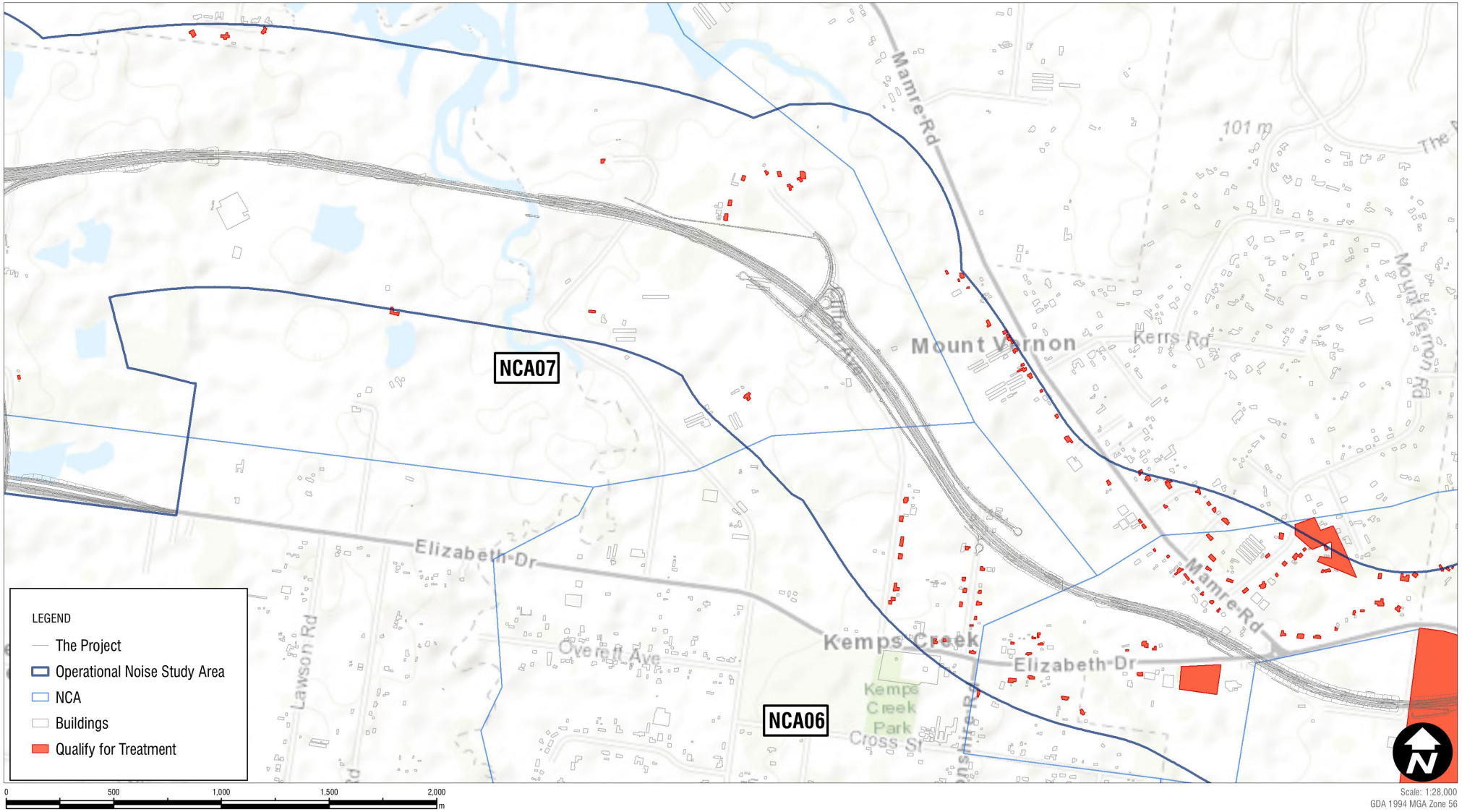



Figure 7-112 Receivers identified as eligible for consideration of additional mitigation

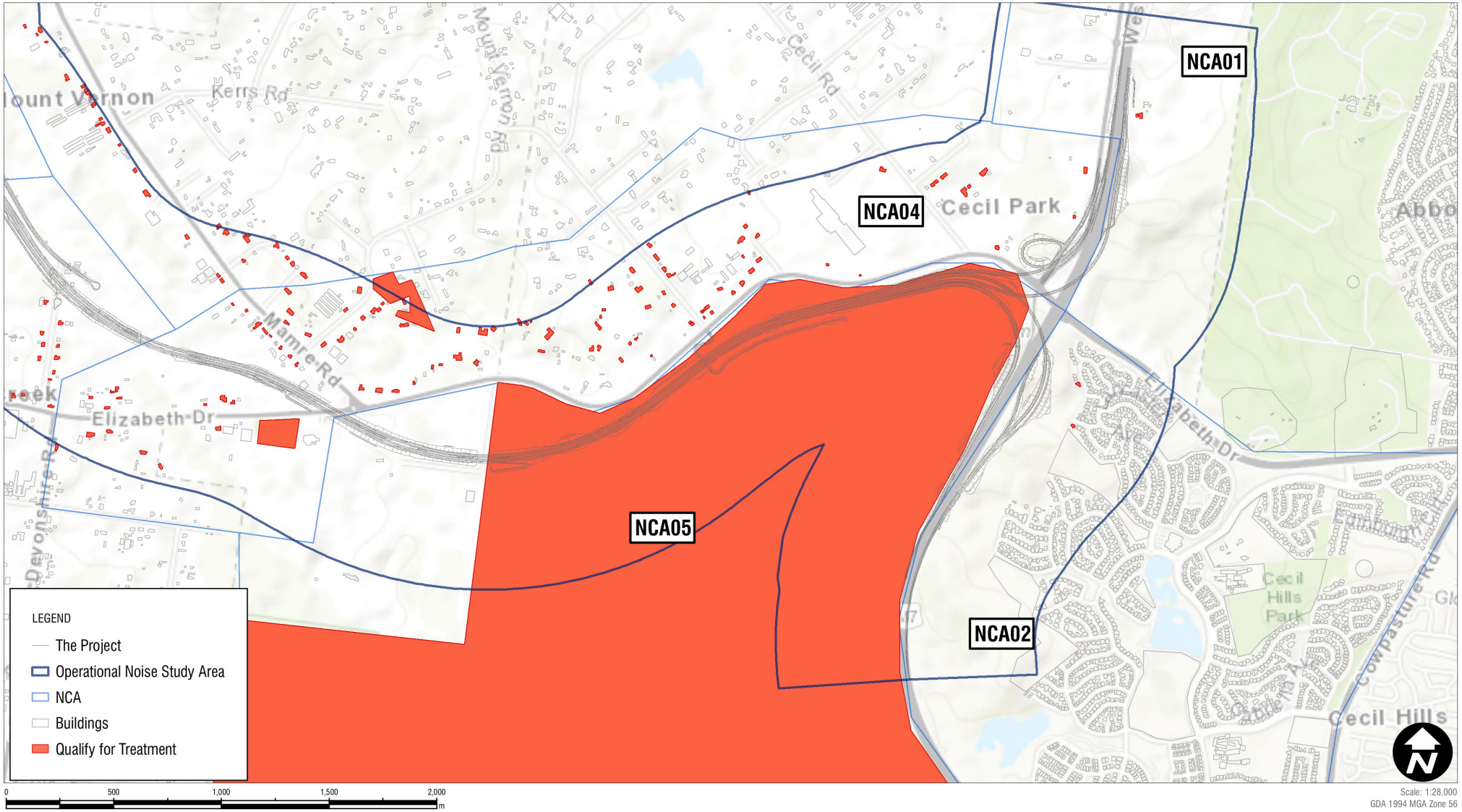



Figure 7-113 Receivers identified as eligible for consideration of additional mitigation

### *Sensitivity analysis*

Modelling indicated that an additional 15 receivers would be eligible for consideration of property treatment if a +1 dBA correction were to be added to the noise model predictions. A reduction of 19 receivers would be apparent if 1 dBA was subtracted from the noise model predictions.

## 7.7.8 Cumulative impacts

As discussed in **Section 7.7.7**, the forecast traffic data used in the operational noise assessment takes into account current and future road projects and anticipated land use changes. This allows for consideration of cumulative operational road traffic noise impacts from the project along with other sources of road traffic in the area. Therefore no further additional cumulative operational noise assessment was carried out for the project.

Cumulative construction noise impacts may arise from the interaction of construction and operation activities of the project and other approved or proposed projects in the area. When considered in isolation, specific project impacts may be considered minor. These minor impacts may be more substantial, however, when the impact of multiple projects on the same receivers is considered.

Projects which were assessed quantitatively and whose construction timeframes overlap with the project include The Northern Road upgrade and Western Sydney Airport. There are a number of other planned and potential road upgrade projects in the western Sydney area that may contribute to cumulative noise impacts. These projects are currently at varying stages of planning and no design or environmental assessment information is currently publicly available. There is potential for overlaps in construction timing between the project and some of these road upgrade works. Should this occur the cumulative impacts would be dependent on the timing, type and location of simultaneous construction activities.

Environmental management measures aimed at short-term construction works may be less effective where receivers are affected by longer term impacts. If several projects occur in the same area consecutively, there may be a combined effect due to the increased duration of impacts on nearby receivers. This effect is termed ‘construction fatigue’.

Where receivers are affected by extended impacts from more than one project, it may be necessary to consider additional environmental management measures to minimise the impacts.

The potential consecutive impacts from the M12 Motorway and other major projects in the area would be investigated further as the project progresses when detailed construction planning is developed. Specific additional management measures designed to address potential consecutive impacts would be developed and used to minimise the impacts as far as practicable, in consultation with the affected community. This may include adjustments to the environmental management measures to ensure receivers which are impacted by long-term construction works receive additional mitigation measures, where appropriate. Management measures are provided in **Section 7.7.9**.

### *Cumulative construction noise*

Concurrent construction works over two or more projects could theoretically increase the worst-case noise levels in this report by around three dB where works are a similar distance from a particular receiver. However, the likelihood of worst-case noise levels being generated by two sets of works at the same time is considered low.

The likely impact of concurrent works on the project would be an increase in the number of 15-minute periods where noise impacts would be apparent. In practice, construction noise levels in any one location would vary and would be frequently much lower due to construction phasing moving works around and, in many cases, only a few items of equipment being used at any one time.

The potential cumulative impacts from construction of the M12 Motorway and other nearby major projects were evaluated by determining locations where noise levels from the individual projects (ie the M12 Motorway project, The Northern Road upgrade and Western Sydney Airport) are likely to be above the standard daytime NML.

Areas where cumulative construction noise impacts may occur are shown in **Figure 7-114**. These are indicated by the areas where the indicative noise levels (transparent shading) overlap. The impact areas are based on the construction noise impact assessments prepared for each project, combined with the worst-case predicted impacts from the M12 Motorway project.

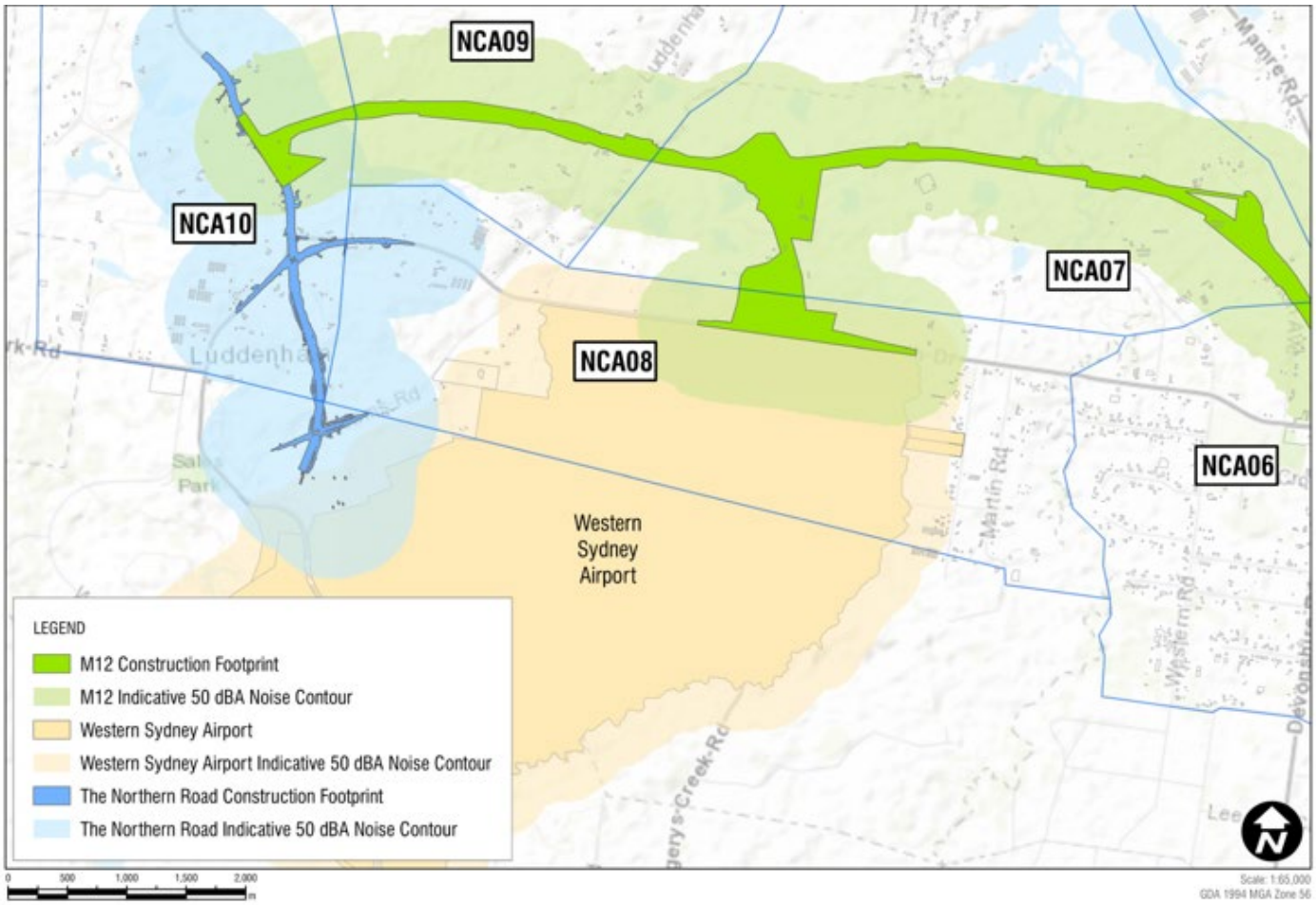



Figure 7-114 Areas of potential cumulative and consecutive impacts

Around five residential receivers (primarily in NCA08) located to the east of the Western Sydney Airport access road have the potential to be influenced by simultaneous works occurring at the Western Sydney Airport and the M12 Motorway project, as shown in **Figure 7-114**. For receivers in close proximity to the M12 Motorway, noise levels would generally be dominated by construction activities from this project, with worst-case noise levels predicted to be up to 63 dBA compared to 40-45 dBA from bulk earthworks associated with the Western Sydney Airport. In these circumstances, the environmental management measures used to control construction noise from the M12 Motorway would be considered sufficient to control the cumulative noise impacts from the M12 Motorway and the Western Sydney Airport.

Around eight residential receivers (located in NCA10) may be potentially impacted by cumulative construction noise from the project and The Northern Road upgrade, if works occur within the same area. Where works simultaneously occur, the construction activities associated with The Northern Road are likely to dominate the construction noise levels, as the worst affected receivers are generally closer to The Northern Road.

Where receivers are further from The Northern Road and closer to the M12 Motorway, construction noise levels are likely to be dominated by the M12 Motorway construction activities. In these circumstances, the environmental management measures used to control noise from the project would be sufficient to control noise at these receivers.

Where receivers are set back from both The Northern Road and the M12 Motorway, a theoretical increase of noise levels up to around three dB for concurrent works could occur. However, this would be considered to be a worst-case scenario.

### *Cumulative construction traffic*

Construction related traffic from the construction of The Northern Road upgrade, Western Sydney Airport and the M12 Motorway has the potential to temporarily increase road traffic noise levels at receivers due to the use of same roads for construction traffic.

The existing and forecasted construction traffic volumes from the project as well as the construction traffic reported in the Western Sydney Airport EIS and The Northern Road EIS was used to determine where potentially noticeable increases in cumulative road traffic noise (ie a greater than 2.0 dB increase over the existing noise level) are likely to occur.

It was assumed that construction traffic from nearby projects would access Elizabeth Drive via the M7 Motorway. The traffic was divided with an equal split of vehicles travelling northbound and southbound on the M7 Motorway. It was assumed that construction traffic would travel along Elizabeth Drive until reaching the respective construction footprints.

The cumulative construction traffic is unlikely to result in a noticeable increase in noise levels along the proposed haulage routes due to the high volumes of traffic that currently use these routes.

Potential road traffic noise increases of up to 1.6 dB during the night-time are predicted for the access ramps to the M7 Motorway. It should however be noted that the traffic volumes on Wallgrove Road and the M7 Motorway would be higher and would likely be the dominate source in the area, masking any potential increase in noise from these ramps.

Based on the proposed construction traffic routes and the forecast redistribution of traffic during construction, no noticeable increases in road traffic noise are predicted.

### *Cumulative impacts from other projects*

Other projects with the potential to result in cumulative noise impacts are currently at varying stages of planning and no design or environmental assessment information is currently publicly available. A qualitative discussion for each project is provided below.

#### Sydney Metro Greater West

Construction timeframes for the Sydney Metro Greater West are likely to have some overlap with the construction of the project. During any timeframes where construction activities are concurrent, increased construction noise impacts may be likely. This will be dependent on the specific construction locations and the different construction activities. For example, should Sydney Metro construction works be focused on the southern (ie Macarthur) end of the corridor while the project is under construction, cumulative impacts would be negligible.

Cumulative impacts associated with the construction of the project and the Sydney Metro Greater West would be considered in the environmental assessment prepared for the Sydney Metro Greater West.

### Other road network upgrades

Planned and potential road upgrade projects in the western Sydney area that may contribute to cumulative noise impacts include the Elizabeth Drive upgrade and Mamre Road upgrade. These projects are currently at varying stages of planning and no design or environmental assessment information is currently publicly available.

The timing for construction of the above projects has not yet been announced. However, there is potential for overlaps in construction timing between the project and some of these road upgrade works. Should this occur the cumulative impacts would be dependent on the timing, type and location of simultaneous construction activities. An assessment of cumulative noise impacts would be carried out during the environmental impact assessments for each project. The assessment would outline the process for managing construction schedules across the various projects to ensure adequate respite periods are provided to affected receivers.

### Growth Areas

The Western Sydney Aerotropolis, the South West Growth Area and Western Sydney Employment Area would be developed by individual developers at varying timeframes. Each will be subject to their own environmental assessments, based on the scale and potential impact of each project. The project would traverse the South West Growth Area and service the Western Sydney Aerotropolis, and indirectly, the Western Sydney Employment Area. The project would serve and facilitate the growth by providing increased road capacity and reducing congestion and travel times in the area.

The timing for the construction of developments within the above-mentioned growth areas has not yet been announced. There is potential of overlaps in construction timing between some developments and the project. Should this occur, the cumulative impacts would be dependent on the timing, type and location of simultaneous construction activities. An assessment of cumulative noise impacts would be carried out during the site-specific environmental impact's assessments for each project.

## 7.7.9 Environmental management measures

#### *Operational noise management measures*

Road traffic noise levels should be reduced to meet the NCG noise criteria through the use of feasible and reasonable mitigation. An assessment of operational mitigation measures in **Appendix K** forms a preliminary feasible and reasonable assessment to inform the detailed design stage of the project. A summary of the preliminary assessment for noise barriers is provided below.

### In-corridor mitigation – noise barriers

Noise barriers (in the form of walls or mounds) can provide noise reductions and also reduce both external and internal noise levels. Noise barriers are typically most efficient when receivers are located at ground floor level. As the height of a receiver increases, the noise reduction from barriers is seen to reduce due to line-of-sight over the top of the barrier.

Noise barriers can however introduce a number of potential negative aspects, including changes to property access, aesthetic impacts, overshadowing, drainage, increased opportunities for graffiti, restriction of line-of-sight and views, maintenance access and safety concerns.

At this early stage in the project, the barrier analysis has used the predicted noise levels from the concrete road surface scenario, as this results in the highest road traffic noise levels and represents a worst-case assessment.

The noise barrier analysis carried out as part of the noise and vibration assessment (**Appendix K**) identifies that four of the six indicative noise barriers considered may potentially provide a reasonable noise benefit. This is a preliminary assessment and is subject to a detailed reasonable and feasible assessments.

Design factors, such as cost to benefit ratio, constructability, and overhead power line clearance may result in these barriers being considered unfeasible and/or unreasonable. In addition, other considerations from a community perspective may include:

- Potential visual or urban design impacts
- Potential overshadowing impacts
- Potential community safety/crime prevention considerations such as isolated walkways
- Form of future development in the area
- Preferences of the local community as identified during community consultation.

The noise barriers identified as potentially reasonable would be considered in conjunction with other mitigation measures for their feasibility and reasonability during the detailed design stage of the project.

Further details regarding the noise barrier assessment and optimisation results are provided in Annexure D of **Appendix K**.

The environmental management measures that would be implemented to minimise the noise and vibration impacts of the project, along with the responsibility and timing for those measures, are presented in **Table 7-124**.

Table 7-124 Environmental management measures (noise and vibration)

| Impact | Reference | Environmental management measure | Responsibility | Timing |
|---|---|---|---|---|
| General construction noise and vibration | NV01 | A construction noise and vibration management plan (CNVMP) will be prepared for the project to mitigate and manage noise and vibration impacts during construction. The CNVMP will be implemented for the duration of construction of the project and will:<br>• Identify nearby sensitive receivers<br>• Include a description of the construction activities equipment and working hours<br>• Identify relevant noise and vibration performance criteria for the project and license and approval conditions.<br>• Include modelling results showing construction noise impacts based on detailed design information<br>• Outline standard and additional mitigation measures from the Construction Noise and Vibration Guideline (CNVG) (Roads and Maritime 2016e) and information about when each will be applied<br>• Outline requirements for the development and implementation of an Out-of-hours Work Protocol | Contractor | Prior to construction and during construction |

| Impact | Reference | Environmental management measure | Responsibility | Timing |
|---|---|---|---|---|
| | | • Outline requirements for noise and vibration monitoring that will be carried out to monitor project performance associated with the noise and vibration criteria<br>• Describe community consultation and complaints handling procedures in accordance with the Community Communication Strategy to be developed for the project<br>• Outline measures to manage noise impacts associated with heavy vehicle movements both on and offsite<br>• Outline measures to minimise cumulative construction impacts and the likelihood for 'construction fatigue' from concurrent and consecutive projects in the area<br>• Outline requirements to minimise and manage construction fatigue, in consultation with the community. | | |
| | NV02 | Measures to minimise and manage construction fatigue are to be investigated through the planning of construction staging | Contractor | Detailed design, prior to construction and during construction |
| | NV03 | Detailed noise assessments will be carried out for ancillary facilities with the potential to involve high noise generating activities (including batching plant operations). The assessments will consider the proposed site layouts and noise generating activities that will occur at the facilities and assess predicted noise levels against the relevant noise management criteria.<br>The assessments will also consider the requirement for appropriate noise mitigation within ancillary facilities and adjacent to construction works, depending on the predicted noise levels. Any mitigation measures required will be implemented before the start of activities that generate noise and vibration impacts. | Contractor | Prior to construction |

| Impact | Reference | Environmental management measure | Responsibility | Timing |
|---|---|---|---|---|
| | NV04 | Monitoring will be carried out at the start of high noise and vibration activities to confirm that actual noise and vibration levels are consistent with the noise and vibration impact predictions. Where mitigation measures were included, measurements will be carried out to confirm the effectiveness.<br>Where the monitoring identifies higher levels of noise and vibration compared to predicted levels, or where mitigation is shown to be ineffective against measured noise and vibration levels, additional mitigation measures will be identified and implemented to appropriately manage impacts where feasible and reasonable. | Contractor | Construction |
| | NV05 | Where reasonable and feasible, receivers identified as requiring at-property treatment for operational noise mitigation will be identified and offered treatment before construction activities begin that are likely to impact them. | Roads and Maritime / Contractor | Prior to construction |
| Vibration impacts | NV06 | Activities that generate vibration will be managed to avoid impacts on structures and sensitive receivers. This includes implementing appropriate safe working distances where practicable. | Contractor | Prior to construction and during construction |
| | NV07 | The use of alternatives to vibration generating equipment will be considered where vibration impacts are predicted. | Contractor | During construction |
| | NV08 | Where works are within the minimum working distances and considered likely to exceed the cosmetic damage objectives (as shown in Figure 7-3 of **Appendix K**), construction works will not proceed unless:<br>• A different construction method with lower source vibration levels is used, where feasible<br>• Attended vibration measurements are carried out at the start of the works to determine the risk of exceeding the vibration objectives. | Contractor | During construction |
| | NV09 | Building Condition Surveys will be offered in writing to property owners before construction where there is a potential for construction activities to cause structural or cosmetic damage. A comprehensive report will be prepared by a suitably qualified professional before the relevant works begin and will comprise a written and photographic condition. | Contractor | Prior to construction |

| Impact | Reference | Environmental management measure | Responsibility | Timing |
|---|---|---|---|---|
| Vibrations impacts on the Upper Canal System and Gas Pipelines | NV10 | Surveys will be carried out to confirm the existing condition of the WaterNSW Upper Canal System and Jemena high pressure gas pipelines to determine appropriate vibration criteria. This will also include consideration of distances from the vibration intensive activity (piling, rock-breaking and vibratory rolling), as well as ground conditions.<br>A vibration criterion of a peak particle velocity (PPV) will be determined in consultation with the relevant utility/service providers.<br>In-situ monitoring will be carried out to confirm the vibration levels and assess the impact of vibration. Where the monitoring identifies exceedances in the relevant criteria, or where impacts are identified, additional mitigation measures will be identified and implemented to appropriately manage impacts. | Roads and Maritime / Contractor | Detailed design and during construction |
| Vibration impacts on heritage structures | NV11 | The following structures have the potential to be within the safe working distances for sensitive structures (Group 3 from DIN 4150):<br>• Item 1: McGarvie Smith Farm<br>• Item 2: Fleurs Radio Telescope Site<br>• Item 4: Upper Canal System<br>• Item 6: McMaster Field Station<br>• Item 7: Fleurs Aerodrome<br>A detailed survey will be completed to determine the potential for vibration impacts and to define appropriate criteria for each heritage item.<br>Vibration monitoring will be carried out when vibration intensive tasks are occurring within the minimum working distances to heritage structures.<br>Where the monitoring identifies exceedances in the relevant criteria, or where impacts are identified, additional mitigation measures will be identified and implemented to appropriately manage impacts. | Contractor | Prior to construction and during construction |

| Impact | Reference | Environmental management measure | Responsibility | Timing |
|---|---|---|---|---|
| Construction traffic noise | NV12 | Construction vehicle movements (both on and offsite) will be managed to minimise noise impacts. Where feasible, this will include (but not be limited to):<br>• Establishment and use of internal haul routes, or existing major roads where this is not feasible<br>• Restriction of heavy vehicle movements to standard construction hours<br>• Locating traffic marshalling areas away from residences to minimise noise impacts from idling vehicles<br>• Instructing workers on the operation of heavy vehicles entering and exiting the site to minimise noise. | Contractor | During construction |
| Cumulative construction impacts | NV13 | The likelihood of cumulative construction noise impacts will be considered during detailed design when detailed construction schedules of other projects are available.<br>Construction works will be scheduled with the aim of minimising concurrent works near sensitive receivers where possible in consultation with managers of other nearby projects that are likely to result in a cumulative impact.<br>This will include the coordination of respite between the various construction projects where receivers are likely to experience concurrent construction impacts where feasible.<br>Coordination between project teams would be carried out throughout construction. | Contractor | Prior to construction and during construction |
| Operational noise and vibration | NV14 | Operational noise and vibration mitigation measures will be identified in an Operational Noise and Vibration Review (ONVR).<br>Requirements for mitigation measures, including quieter noise pavements, noise barriers, and at-property treatments, will be reviewed as part of the ONVR and as the detailed design progresses. The implementation of treatments will be carried out in accordance with Roads and Maritime Noise Mitigation guidelines (2015d). | Contractor / Roads and Maritime | Detailed design, during construction and prior to operation |

| Impact | Reference | Environmental management measure | Responsibility | Timing |
|---|---|---|---|---|
| | NV15 | Within 12 months of start of operation of the project, actual operational noise performance will be compared to predicted operational noise performance. The need for additional mitigation or management measures to address identified operational performance issues and meet relevant operational noise criteria will be assessed and implemented where feasible and reasonable. | Roads and Maritime | During operation |