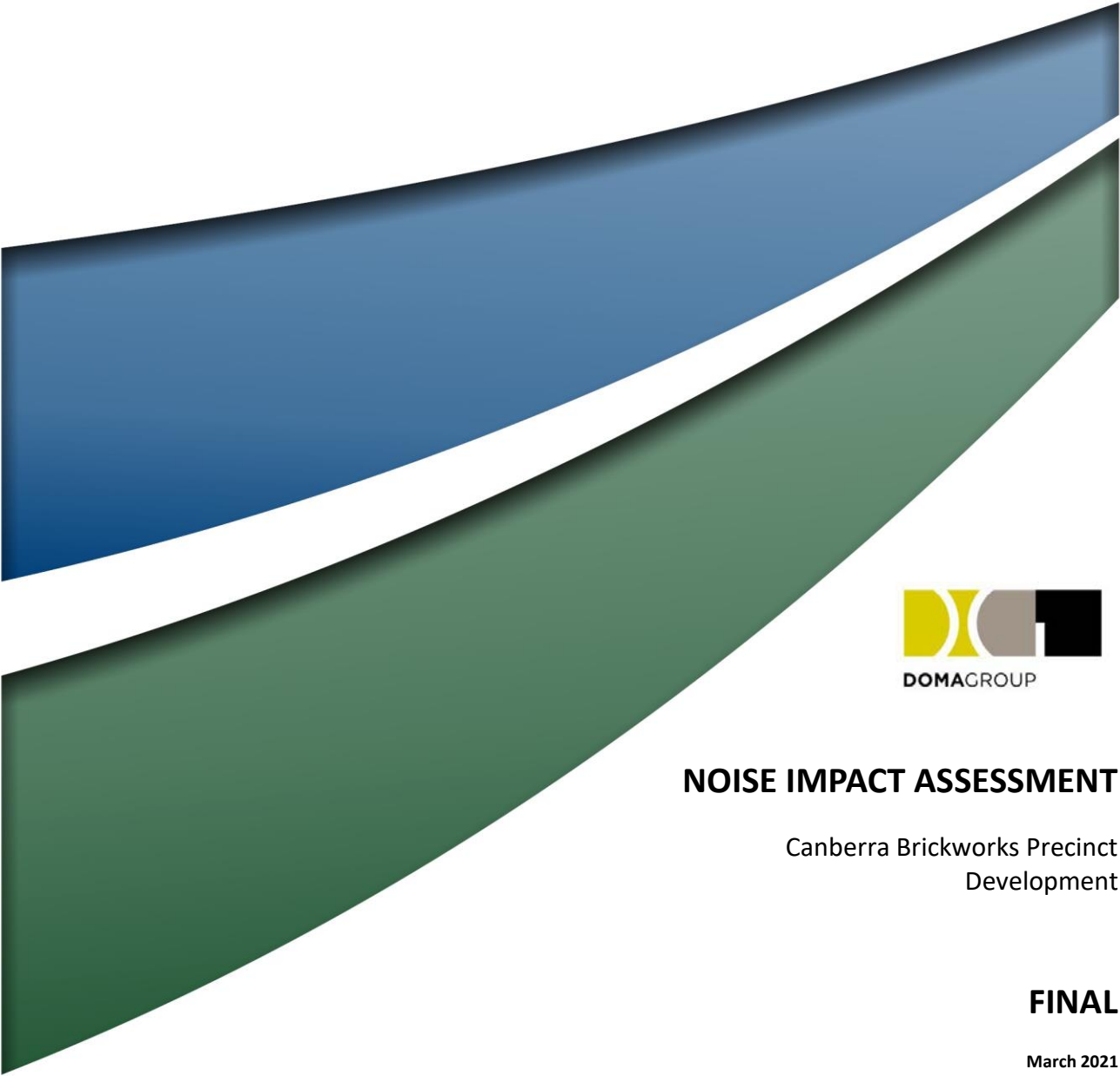


# **Attachment D**

Noise Impact Assessment





## **NOISE IMPACT ASSESSMENT**

Canberra Brickworks Precinct  
Development

**FINAL**

March 2021



## NOISE IMPACT ASSESSMENT

Canberra Brickworks Precinct Development

### FINAL

Prepared by  
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# 1.0 Introduction

The Canberra Brickworks Precinct (CBP) is located in south-west Yarralumla, Canberra, in the Australian Capital Territory (ACT). It is surrounded by residential development to the north and east; open landscape to the south; and a landscape buffer to the Royal Canberra Golf Club to the west. The Canberra Brickworks is of heritage significance within the ACT, as one of only three examples of industrial heritage in Canberra. The CBP is approximately 7 kilometres (km) from the Canberra Central Business District and 2 km south of Lake Burley Griffin. It is adjacent to Government House, the official residence of the Governor-General of Australia.

Based on the concept masterplan submitted during the tender process in 2017, the proposed redevelopment would include a maximum of 380 residential dwellings, surrounding re-purposed Canberra Brickworks buildings and recreational parkland. The entire development footprint would cover approximately 16.09 hectares (ha). The re-purposed heritage buildings would include limited retail and commercial space, including cafes, health and wellness facilities, and interpretive features focused on the history of the Canberra Brickworks.

This Noise Impact Assessment (NIA) describes the noise and vibration impacts associated with the construction and operation of the Brickworks Precinct in accordance with the requirements of the Environmental Protection Act 1997, the Environment Protection Regulation 2005, and other relevant guidelines and documents published by the Environment Protection Authority.

The NIA provides details of the potential noise emissions from the major construction activities during the development of the Precinct and the corresponding noise levels received in the surrounding areas. The NIA also includes details of the minimum noise mitigation and management strategies required by the ACT environment protection legislation, as well as additional noise controls that should be implemented if required and if reasonable and feasible.

The NIA also provides a prediction of road traffic noise levels received within the Precinct from traffic on nearby roads, and an assessment of current road traffic noise impacts against the ACT road traffic noise criteria.

A Noise Management Plan will also be required for the Precinct development. Recommendations are provided in this NIA for information that should be included in the Noise Management Plan.

Additionally, the NIA also provides relevant information and recommendations regarding the assessment of future developments within the Brickworks Precinct.

## 2.0 Noise Assessment Framework

### 2.1 Construction noise impact assessment

#### 2.1.1 Environmental Protection Guidelines for Construction and Land Development in the ACT

The objective of the *Environmental Protection Guidelines for Construction and Land Development in the ACT, 2011* is to ensure all building work that generates noise is conducted within the time periods detailed in Schedule 2 of the *Environment Protection Regulation (EP Reg), 2005*. The time periods presented in the guidelines from Table 2.3 Item 6 of the EP Reg are shown in **Table 2.1**.

**Table 2.1 Time restrictions for building work to manage noise impacts**

| Building Work Details                                 | Monday to Saturday | Sunday and Public Holidays                   |
|---|--------------------|--|
| Industrial, city and town centre areas                | 6am to 8pm         | 6am to 8pm                                   |
| Any other area when work completed within 2 weeks     | 7am to 8pm         | 8am to 8pm                                   |
| Any other area when work not completed within 2 weeks | 7am to 6pm         | Building work must not exceed Noise Standard |

Source: EP Reg Table 2.3 Item 6 (2005)

The adjoining land uses on all boundaries of the Brickworks Precinct are classified as noise Zone G in EP Reg Schedule 2 Part 2.1 Table 2.1. The Noise Standard for receivers on land adjoining the Brickworks Precinct is shown in **Table 2.2**. The Noise Standard applies at the shared boundary of the precinct and the adjoining land containing the receiver. The time restrictions in **Table 2.2** are based on the construction works' duration being longer than 2 weeks.

**Table 2.2 Noise Standard at the boundary of the development for construction noise impacts (for works longer than 2 weeks)**

| Noise Zone | Noise Standard, LA10(10 minutes <sup>1</sup> ) dB(A)                        |   |
|------------|---|---|
|            | Monday to Saturday (6pm to 10pm)<br>Sunday / Public Holiday (8 am to 10 pm) | 'Any other time'<br>Monday to Saturday (10pm to 7am)<br>Sunday / Public Holiday (10pm to 8am) |
| G          | 45  | 35  |

Source: EP Reg (2005) Table 2.2

Note: 1. The ACT *Noise Measurement Manual, 2009* recommends a period between 5 to 15 minutes where the measurement period for a time-varying sound source of 10 minutes would be more appropriate.

In addition to the restrictions outlined in **Table 2.1**:

- All relevant noise reduction measures mentioned in AS 2436 (see **Section 2.1.2**), as in force from time to time, must be implemented
- schedule noisy activities for the least sensitive times of the day such as mid-morning and mid-afternoon
- select machinery that produce less noise
- ensure machinery is well maintained.

## 2.1.2 Australian Standard 2436 – 2010 (R2016)

Australian Standard 2436-2010 (Reconfirmed 2016) *Guide to noise and vibration control on construction, demolition and maintenance sites* provides many recommendations for managing noise and vibration impacts from construction sites. Some of the standard noise control strategies from AS 2436 that are commonly employed on typical construction sites are described in **Section 7.0**.

## 2.2 Construction vibration assessment

There are no specific state-based legislation or guidelines regarding the assessment of ground vibration impacts in the ACT. It is therefore recommended that for this project, ground vibration impacts are assessed and managed based on the approach that is typically followed in NSW.

Vibration from construction activities has the potential to affect structures such as buildings and the human occupants within the buildings. Vibration affects structures and humans differently, consequently, there are distinct criteria applicable to these two types of receivers as described below.

### 2.2.1 Criteria for vibration effects on non-heritage structures

Criteria that are commonly used in NSW for the assessment of vibration effects on non-heritage building structures are given in British Standard 7385 (BS 7385) Part 2 *Evaluation and measurement of vibration in buildings* (1993). The criteria in BS 7385 are given in terms of peak component (x-, y- or z-axes separately) vibration velocity values from transient (impulsive) vibration events. The criteria for continuous vibration are recommended to be 50% lower than for impulsive vibration. It is considered that these criteria that are commonly used in NSW are suitable for use for the Brickworks Precinct development. The vibration criteria for the protection of structures and buildings from cosmetic damage (e.g., hairline cracks in drywalls, etc.) are given in **Table 2.3**.

**Table 2.3 Recommended vibration criteria for cosmetic damage to structures**

| Type of structure  | Peak Component Particle Velocity (mm/s)                           |  |   |
|--|---|--|---|
|  | 4 Hz - 15 Hz  | 15 Hz - 40 Hz                                | 40 Hz and above                         |
| <ul style="list-style-type: none"> <li>Un-reinforced or light framed structures</li> </ul>   | 15 - 20<br>(transient (impulsive) vibration)                      | 20 - 50<br>(transient (impulsive) vibration) | 50<br>(transient (impulsive) vibration) |
| <ul style="list-style-type: none"> <li>Residential or light commercial type buildings</li> </ul>                                     | 7.5 - 10<br>(continuous vibration)                                | 10 - 25<br>(continuous vibration)            | 25<br>(continuous vibration)            |
| <ul style="list-style-type: none"> <li>Reinforced or framed structures</li> <li>Industrial and heavy commercial buildings</li> </ul> | 50 (transient (impulsive) vibration)<br>25 (continuous vibration) |  |   |

## 2.2.2 Criteria for vibration effects on heritage structures

It is recognised that heritage structures may have special requirements to protect the structures from damage due to vibration. There are no criteria provided in ACT legislation or guidelines regarding the protection of heritage structures from vibration due to construction and/or operation of nearby developments. In New South Wales, the criteria given in the German Standard DIN 4150-3 is commonly used for protection of heritage structures. However, the criteria given in DIN 4150-3 is primarily intended for assessment of heritage residential buildings in European countries, which may be significantly more sensitive to damage from vibration than the former industrial buildings in the heritage area within the Brickworks Precinct.

Therefore, it is recommended that a site-specific set of vibration criteria be developed for the heritage structures in the Brickworks Precinct. These site-specific vibration criteria should be derived and recommended by a suitably qualified Structural Engineer and/or Heritage Consultant.

## 2.2.3 Criteria for vibration effect on human occupants within buildings

### Human perception of vibration

Criteria for the human perception of vibration from construction activities are given in *Assessing Vibration: A Technical Guideline*, NSW Department of Environment and Conservation (2006) (AVATG). The criteria in AVATG are given for continuous vibration, impulsive vibration and intermittent vibration. For continuous and impulsive vibration, the criteria are given in terms of root-mean-square (*rms*) vibration acceleration ( $m/s^2$ ) in the frequency range 1 - 80 Hertz (Hz). For intermittent vibration, the criteria are given in terms of vibration dose value (VDV), which is a parameter used for assessing the combined magnitude and the total duration of vibration impacts. It is recommended that the criteria for human perception of vibration given in the NSW Guideline are suitable for the assessment of the construction of the Brickworks Precinct.

The criteria given in AVATG for continuous or impulsive vibration relevant to the receivers in land use zones adjoining the Brickworks Precinct are given in **Table 2.4**. The frequency weightings are given in AVATG Appendix B3.

**Table 2.4 Recommended criteria for continuous and impulsive vibration for human comfort (weighted vibration acceleration  $m/s^2$ ) 1-80 Hz**

| Location                    | Assessment period <sup>1</sup> | Preferred values |               | Maximum values |               |
|-----------------------------|--------------------------------|------------------|---------------|----------------|---------------|
|                             |                                | z-axis           | x- and y-axes | z-axis         | x- and y-axes |
| <b>Continuous vibration</b> |                                |                  |               |                |               |
| Residences                  | Day                            | 0.010            | 0.0071        | 0.020          | 0.014         |
|                             | Night                          | 0.007            | 0.005         | 0.014          | 0.010         |
| <b>Impulsive vibration</b>  |                                |                  |               |                |               |
| Residences                  | Day                            | 0.30             | 0.21          | 0.60           | 0.42          |
|                             | Night                          | 0.10             | 0.071         | 0.20           | 0.14          |

Note: 1 Day-time period is 7am - 10pm. Night time period is 10pm - 7am.

The criteria for intermittent vibration given in AVATG for the relevant receivers in the area are shown in **Table 2.5**. The vibration dose value (VDV) is calculated using the frequency-weighted *rms* acceleration as described in AVATG.

**Table 2.5 Recommended vibration criteria for intermittent vibration (VDV m/s<sup>1.75</sup>)**

| Location   | Day-time period <sup>1</sup> |               | Night-time period <sup>1</sup> |               |
|--|------------------------------|---------------|--------------------------------|---------------|
|  | Preferred value              | Maximum value | Preferred value                | Maximum value |
| Critical Areas <sup>2</sup>                                      | 0.10                         | 0.20          | 0.10                           | 0.20          |
| Residences   | 0.20                         | 0.40          | 0.13                           | 0.26          |
| Offices, schools, educational institutions and places of worship | 0.40                         | 0.80          | 0.40                           | 0.80          |
| Workshops  | 0.80                         | 1.60          | 0.80                           | 1.60          |

Note: 1. Day-time period is 7am - 10pm. Night time period is 10pm - 7am.  
 2. Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. These criteria are only indicative, and there may be a need to assess intermittent values against the continuous or impulsive criteria for critical areas. Source: BS 6472–1992

## 2.3 Operation noise impact assessment

The Brickworks Precinct is classified in the *Territory Plan 2008* as a Commercial Zone, Class CZ6 – Leisure and Accommodation Zone. The *Territory Plan* Section 4.1: CZ6 - Leisure and Accommodation Zone Objectives and Development Table specifies that development proposals must comply with the Commercial Zones Development Code, which in turn requires that potentially noisy land uses to comply with the Noise Zone Standards as detailed in the EP Reg. The noise zones, noise standards and conditions are given in the EP Reg Schedule 2, Part 2.1 and Part 2.2. Table 2.1 in the EP Reg Schedule 2 Part 2.1 states that the noise zone for a leisure and accommodation zone is classified as Zone F. Table 2.2 in the EP Reg Schedule 2 Part 2.2 states that the noise standards for developments within Noise Zone F zones are the “*same as the noise standard for the adjoining noise zone with the loudest noise standard for the time period*”.

The adjoining land uses on all boundaries of the Brickworks Precinct are classified as noise Zone G in EP Reg Schedule 2 Part 2.1 Table 2.1. The noise standards for developments within Noise Zone G from the EP Reg Schedule 2 Part 2.2 Table 2.2 are shown in **Table 2.6**. As per EP Reg Schedule 2 Part 2.2 Table 2.2, these noise standards also apply to all developments within the Brickworks Precinct. The noise standards apply at the boundary of each development that emits noise.

**Table 2.6 Noise standards at the boundary of the development**

| Noise Zone | Noise Standard, LA10(10 minutes <sup>-1</sup> ) dB(A)                       |   |
|------------|---|---|
|            | Monday to Saturday (7am to 10pm)<br>Sunday / Public Holiday (8 am to 10 pm) | ‘Any other time’<br>Monday to Saturday (10pm to 7am)<br>Sunday / Public Holiday (10pm to 8am) |
| G          | 45  | 35  |

Source: EP Reg (2005) Table 2.2

Note: 1. The ACT *Environment Protection (Noise Measurement Manual)*, 2009 recommends a period between 5 to 15 minutes where the measurement period for a time-varying sound source of 10 minutes would be more appropriate.

### 2.3.1 Requirement for a Noise Management Plan

A Noise Management Plan (NMP) will need to be developed for the Brickworks Precinct.

Following is an extract from *Guidelines for the preparation of Noise Management Plans for development applications*

#### ***When is a NMP required for development applications?***

*NMPs may be required under the Territory Plan, the key statutory planning document in the ACT, which is directed by the Planning and Development Act 2007. Certain land uses in local, group, town and city centres and other areas specified in the Territory Plan will trigger a NMP under the development and precinct codes. Mixed use developments, multi-unit housing and single residential housing may also trigger a NMP under the development codes. Australian Standard/New Zealand Standard 2107:2016 Acoustics - Recommended levels and reverberation times for building interiors (AS/NZS 2107) establishes 'satisfactory' recommended design sound levels. A NMP must demonstrate that acoustic levels meet the relevant satisfactory standard for: multi-unit residential developments located within a commercial zone or adjacent to a commercial or industrial zone and multi-unit or single residential developments identified in a precinct code as being potentially affected by noise from external sources. Where development applications, including lease variations, propose commercial accommodation located in or adjacent to areas subjected to higher noise levels, the EPA will require NMPs to demonstrate that the acoustic levels within commercial accommodation sleeping areas meet AS/NZS 2107. The EPA may also require a NMP where the noise generated by a proposal may exceed the zone noise standards set in the Regulation at the boundary of the lease, or when the noise generated by a proposal may exceed the noise standards within other leases in the same complex.*

## 2.4 Road traffic noise assessment

### 2.4.1 Road traffic noise received within the precinct

There are no legislative requirements or guidelines for the undeveloped precinct to manage the received levels of road traffic noise within the precinct. However, as described in **Section 6.0**, development applications for future developments within the precinct may need to demonstrate that the external and/or internal road traffic noise within the future developments will be controlled to achieve the noise level criteria in the *Roads ACT Noise Management Guideline*, (2018).

### 2.4.2 Road traffic noise generated from within the precinct

The paved surfaces within the precinct will not be classified as Public Roads. Consequently, noise from vehicle movements within the precinct will not be assessable under the ACT road traffic noise legislation or guidelines.

## 2.5 Commercial Zones Development Code

The Commercial Zones Development Code includes a mandatory requirement that all potentially noisy uses listed must have a NMP prepared for that land use. The NMP must include details of the land use's construction, layout and siting that together will achieve adequate acoustic containment to ensure that the noise zone standards in the EP Reg are met. If the land use is a building, the construction details will be required to demonstrate that the proposed building construction materials will be able to achieve an

adequate level of acoustic isolation performance. In this case, the acoustic isolation performance that the building construction materials are required to achieve will depend not only on the building design itself but also on the presence and acoustic shielding benefit of any intervening structures between the noise source and the noise receiver(s).

This requirement of the Commercial Zones Development Code presents a unique challenge to the various commercial premises and outdoor recreation spaces in the Brickworks Precinct as a Development Application may be prepared for an individual development when other areas within the Brickworks Precinct may or may not yet have been developed. It is noted that some of the future buildings may have already been constructed, while others may not yet have been constructed or been approved for construction, in which case they would not be able to provide a physical obstruction to the propagation of noise from a venue which is producing amplified sound.

In the case of the Brickworks Precinct, it is considered that the acoustic designs of all proposed land uses should be permitted to assume that all other elements of the Brickworks Precinct have been developed to the full extent of the Master Plan. That is, while preparing a NMP for an individual Development Application for any type of proposed land use within the Brickworks Precinct, the acoustic designer should be permitted to assume that the acoustic shielding to be provided by all existing and future buildings, structures and terrain features in the Brickworks Precinct Master Plan can be included in the relevant acoustic calculations and/or modelling.

## 2.6 Other ACT Government publications

The ACT Government has published several other guidance documents that provide relevant information for noise assessment and acoustic design within the Brickworks Precinct. These include:

- Noise pollution law – Fact Sheet # 11, Environmental Defender’s Office (ACT), March 2010
- Snapshot: Noise in residential areas, ACT Government, December 2019
- Snapshot: Installation of air conditioners and evaporative coolers, August 2018
- Snapshot: Building and construction noise in the ACT, February 2019

A number of publications and resources available from <https://www.accesscanberra.act.gov.au/app/home/cityservices/noiseportal>

## 3.0 Construction Noise

### 3.1 Prediction methodology

Indicative noise levels from the construction of the precinct have been predicted using computer noise modelling. The noise modelling software used was Cadna/A and the model prediction methodology was CONCAWE. The assumed meteorological conditions were: atmospheric stability class 'D', wind speed 3 m/s, downwind (i.e., noise-enhancing) in all directions.

### 3.2 Construction activities

Construction activities associated with the development of the precinct, but excluding the development of any individual developments within the precinct, are expected to consist of the following major noise-generating activities:

- Bulk Earthworks
- Rock breaking
- Landscaping
- Road construction
- Water Feature and Park construction.

### 3.3 Construction noise sources

A variety of different noise-producing plant and equipment will be utilised at different areas of the project site during different phases of construction. Each area and each phase of demolition and construction will require a different sequence of activities, each of which will have an appropriate inventory of plant and equipment.

#### 3.3.1 Variation in noise emissions from construction activities

Construction noise levels received at nearby receivers from large construction sites are highly variable and are dependent on many factors.

Typically, construction noise impacts are estimated based on conservative assumptions such as:

- All noise sources operating continuously, or
- All construction noise sources operating simultaneously, or
- All noise sources operating in close proximity to each other, or
- All noise sources operating in close proximity to the nearest noise sensitive receiver(s), or
- Any combination of some or all of the above.

In reality, none of the above circumstances will ever occur simultaneously in the worst possible combination, however, there will be times (possibly brief) when a combination of factors occur together to



create short-term high noise emissions from the site which will likely cause short-term high noise levels at the nearby receivers. Such coincidental noise events are unavoidable on large complex construction sites, however, they are typically rare and usually brief in duration.

For instance, there will be times when there are a large number of noise sources in close proximity to a particular nearby receiver, and there will be other times when most of those same noise sources are located at very large distances away from that same receiver. If all of those noise sources were operating at full power in both of those circumstances, that receiver would experience two very different noise levels on those two occasions.

It is considered that the prediction of noise levels from construction sites is more correctly demonstrated by presenting a realistic range of noise levels that will very likely occur at various stages of the construction program.

### **3.3.2 Noise emissions of construction equipment**

The actual sound power levels of noise sources to be used on site is unknown and will depend on the individual plant to be used. However, an estimate of noise emissions from construction equipment can be obtained from Australian Standard AS 2436-2010 (2016) as shown in **Table 3.1**.

Table 3.1 Australian Standard 2436-2010(R2016) Table A1

| <b>TABLE A1</b>  |   |                     |  |
|--|---|---------------------|--|
| <b>TYPICAL SOUND LEVELS OF CONSTRUCTION PLANT AND EQUIPMENT*</b> |   |                     |  |
| Plant description  | A-weighted sound power levels $L_{wA}$ dB ref: $10^{-12}$ W |                     | A-weighted sound pressure levels $L_{pA}$ (mid-point) dB at 10 m |
|  | Typical or Range  | Typical (mid-point) |  |
| Asphalt paver  | 103-112   | 108                 | 80   |
| Asphalt rotomill   | 111   | 111                 | 83   |
| Backhoe  | 100-108   | 104                 | 76   |
| Backhoe with auger   | 100-111   | 106                 | 78   |
| Bulldozer  | 102-114   | 108                 | 80   |
| Cherry picker  | 105   | 105                 | 77   |
| Compactor  | 110-115   | 113                 | 85   |
| Compressor (silenced)  | 93-110  | 101                 | 73   |
| Concrete agitator truck  | 107-111   | 109                 | 76   |
| Concrete pencil vibrator   | 101-105   | 103                 | 75   |
| Concrete pump truck  | 103-113   | 108                 | 80   |
| Concrete saw   | 112-122   | 117                 | 89   |
| Concrete vibratory screed  | 115   | 115                 | 87   |
| Crane (mobile)   | 95-113  | 104                 | 76   |
| Crane (tower)  | 105   | 105                 | 77   |
| Excavator  | 97-117  | 107                 | 79   |
| Filtration unit (40 000 cfm)                                     | 109   | 109                 | 81   |
| Forklift   | 106   | 106                 | 78   |
| Front end loader   | 110-115   | 113                 | 85   |
| Generator (diesel)   | 84-113  | 99                  | 71   |
| Grader   | 105-115   | 110                 | 82   |
| Gritblaster (grit & nozzle air noise)                            | 129   | 129                 | 101  |
| Hand tools (electric)  | 95-110  | 102                 | 74   |
| Hand tools (pneumatic)   | 114-117   | 116                 | 88   |

*(continued)*

**TABLE A1 (continued)**

| Plant description                   | A-weighted sound power levels $L_{wA}$ dB ref: $10^{-12}$ W |                     | A-weighted sound pressure levels $L_{pA}$ (mid-point) dB at 10 m |
|-------------------------------------|---|---------------------|--|
|                                     | Typical or Range  | Typical (mid-point) |  |
| Jack hammers                        | 121   | 121                 | 93   |
| Loader (wheeled)                    | 99-111  | 105                 | 77   |
| Machine mounted hydraulic drill     | 110-115   | 113                 | 85   |
| Machine mounted percussive drill    | 116   | 116                 | 88   |
| Machine mounted pneumatic drill     | 110-121   | 116                 | 88   |
| Piling (bored)                      | 111   | 111                 | 83   |
| Piling (impact sheet) ( $L_{max}$ ) | 126-147   | 137                 | 109  |
| Piling (vibratory)                  | 116-133   | 125                 | 97   |
| Rock breaker                        | 118   | 118                 | 90   |
| Roller (vibratory)                  | 103-112   | 108                 | 80   |
| Scraper                             | 116   | 116                 | 88   |
| Spreader                            | 95  | 95                  | 67   |
| Truck (>20 tonne)                   | 107   | 107                 | 79   |
| Truck (dump)                        | 117   | 117                 | 89   |
| Truck (water cart)                  | 106-108   | 107                 | 79   |
| Vehicle (light commercial e.g. 4WD) | 100-111   | 106                 | 78   |
| Welder                              | 100-110   | 105                 | 77   |

\* Information in Table A1 has been derived from a combination of the following sources and further information can be obtained from them:

- AS 2436—1981 *Guide to noise control on construction, maintenance and demolition sites.*
- BS 5228-1, *Code of practice for noise and vibration control on construction and open sites. Noise.*
- DEFRA—Department for Environment Food and Rural Affairs (United Kingdom), Update of noise database for prediction of noise on construction and open sites-Phase 3: Noise measurement data for construction plant used on quarries, July 2006.

NOTE: The sound power data within the column marked 'Typical (mid-point)' can be used to calculate typical noise levels at the nominated assessment locations.

However, for this NIA, rather than predicting noise impacts from individual noise sources, it is considered that it would be more appropriate to predict noise emissions from a fleet of combined plant and equipment which would typically be working together in close proximity while developing specific elements or Stages of the precinct.

For this NIA it was considered appropriate to undertake the noise impact predictions using the typical construction fleets that are commonly used for the assessment of road construction projects in New South Wales. The Construction Noise and Vibration Guideline (CNVG) published by Transport for New South Wales (TfNSW) contains information that may be used to provide assessment recommendations for the Brickworks Precinct. The CNVG and its companion software, the Construction and Maintenance Noise and Estimator Tool (CMNET) (version 21/03/2017) provide typical sound power levels of construction fleets undertaking common construction activities. It is considered that these typical sound power levels of construction equipment commonly used in New South Wales are suitable for the purposes of providing indicative noise level predictions for this NIA.

Several construction activities have been modelled in several locations based on the expected construction works that will be required in different areas of the Brickworks Precinct, shown in **Table 3.2**.

The locations where noise-generating activities have been assumed in the modelling are shown in **Table 3.3** and Error! Reference source not found.. The component noise sources in each of the construction activities are shown in **Table 3.3**.

**Table 3.2 Modelled construction activities – locations**

| Area                               | Construction Activities - Noise Modelled [Scenario No.] |
|------------------------------------|---|
| Detached Single Residence (Blocks) | Clearing [1]  |
| Heritage Area                      | Clearing [2]  |
| Water Feature and Park             | Bulk Earthworks [3]                                     |
| Stage 1                            | Bulk Earthworks [4]; Drainage Infrastructure [5]        |
| Stage 2                            | Bulk Earthworks [6]; Drainage Infrastructure [7]        |
| Onsite Roads                       | Bulk Earthworks [8]; Local Road Works [9]               |

**Table 3.3 Modelled construction activities – component noise sources**

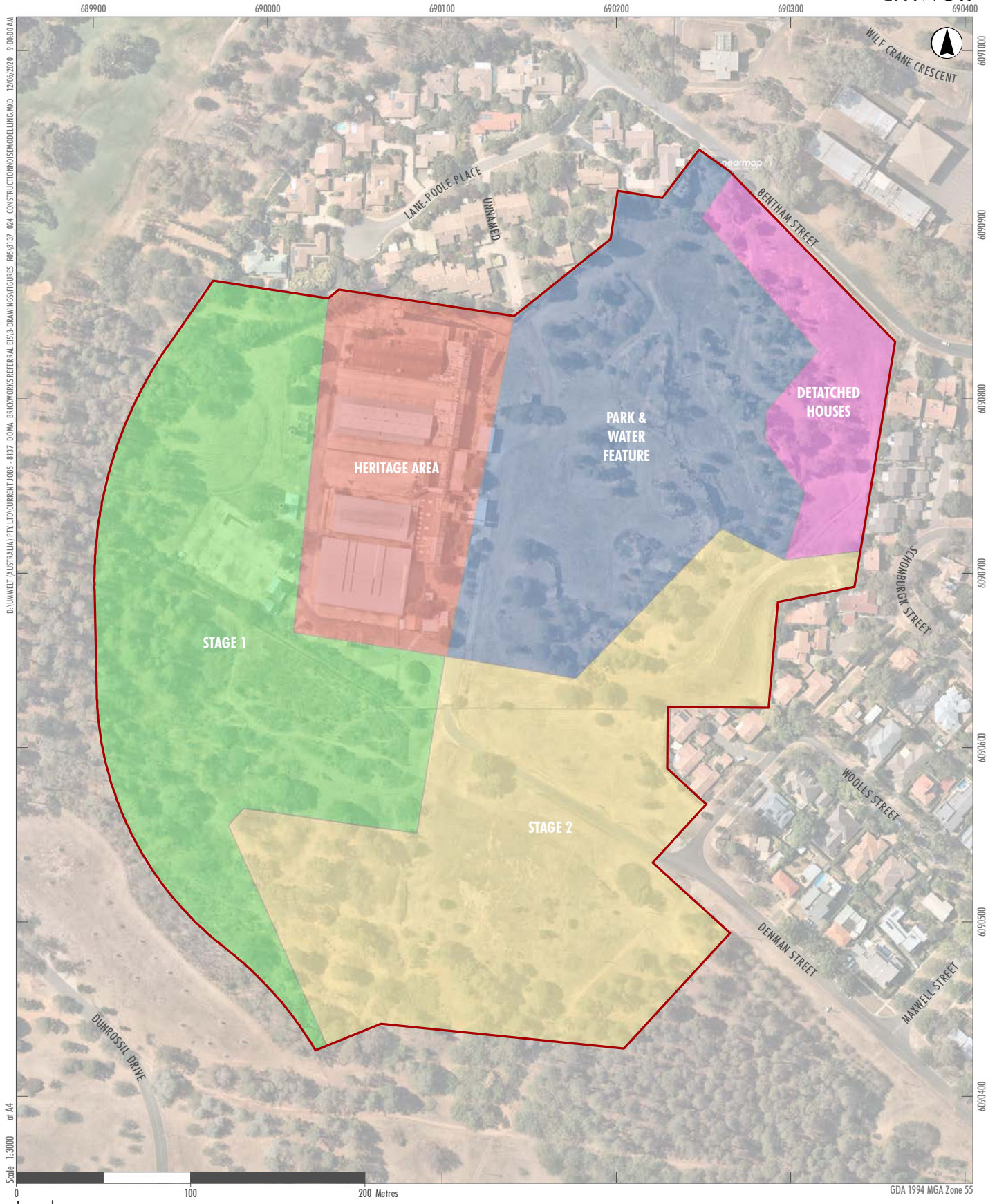
| Construction activity and associated plant and equipment | Sound Power Level, dB(A) ref: 10 <sup>-12</sup> W |                     |
|--|---|---------------------|
|  | Typical or Range                                  | Typical (mid-point) |
| <b>Site Clearing</b>                                     |   |                     |
| Bulldozer  | 102-114   | 108                 |
| Excavator  | 97-117  | 107                 |
| Chainsaw   | 114   | 114                 |
| Tub grinder/ mulcher 40-50hp                             | 116   | 116                 |
| Dump truck   | 110-117   | 114                 |
| <b>TOTAL (Estimated Range)</b>                           | <b>97 to 123</b>                                  | <b>120</b>          |

**Table 3.3 Continued**

| Construction activity and associated plant and equipment | Sound Power Level, dB(A) ref: 10 <sup>-12</sup> W |                     |
|--|---|---------------------|
|  | Typical or Range                                  | Typical (mid-point) |
| <b>Drainage Infrastructure</b>                           |   |                     |
| Backhoe  | 100-111   | 105                 |
| Mobile crane   | 95-103  | 104                 |
| Excavator  | 97-117  | 107                 |
| Concrete truck   | 107-111   | 109                 |
| Truck compressor   | 75  | 75                  |
| Vibratory roller   | 103-112   | 108                 |
| Road truck   | 107-108   | 107                 |
| <b>TOTAL (Estimated Range)</b>                           | <b>75 to 120</b>                                  | <b>115</b>          |
| <b>Bulk Earthworks</b>                                   |   |                     |
| Bulldozer  | 102-114   | 108                 |
| Scraper  | 110-116   | 113                 |
| Excavator  | 97-117  | 107                 |
| Hydraulic hammer (rock breaker)                          | 118-122   | 120                 |
| Grader   | 105-115   | 110                 |
| Dump truck   | 110-117   | 114                 |
| Compactor  | 106-115   | 110                 |
| Roller (large pad foot)                                  | 109   | 109                 |
| Water cart   | 106-108   | 107                 |
| <b>TOTAL (Estimated Range)</b>                           | <b>97 to 126</b>                                  | <b>124</b>          |
| <b>Local Road Works</b>                                  |   |                     |
| Bulldozer  | 102-114   | 108                 |
| Excavator  | 97-117  | 107                 |
| Front end loader   | 110-115   | 113                 |
| Scraper  | 110-116   | 113                 |
| Backhoe  | 100-111   | 105                 |
| Compactor  | 106-115   | 110                 |
| Dump truck   | 110-117   | 114                 |
| Road truck   | 107-108   | 107                 |
| Water cart   | 106-108   | 107                 |
| <b>TOTAL (Estimated Range)</b>                           | <b>97 to 124</b>                                  | <b>121</b>          |

Sources: NSW TfNSW Construction Noise and Vibration Guideline; Australian Standard 2436-2010(R2016) *Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites*.

To estimate the approximate range of noise emissions from each construction activity, each noise source has been assumed to be operating for 80% utilisation in any time period.



- Legend**
- Proposal Area
  - Modelled Construction Noise Sources**
  - Stage 1
  - Stage 2
  - Detached Houses
  - Heritage Area
  - Park & water Feature

**FIGURE 3.1**  
**Locations of Modelled Construction Noise Sources**

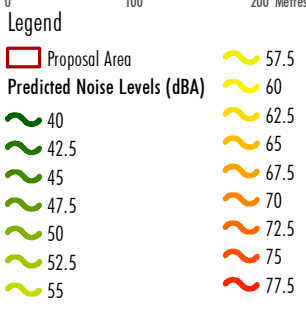
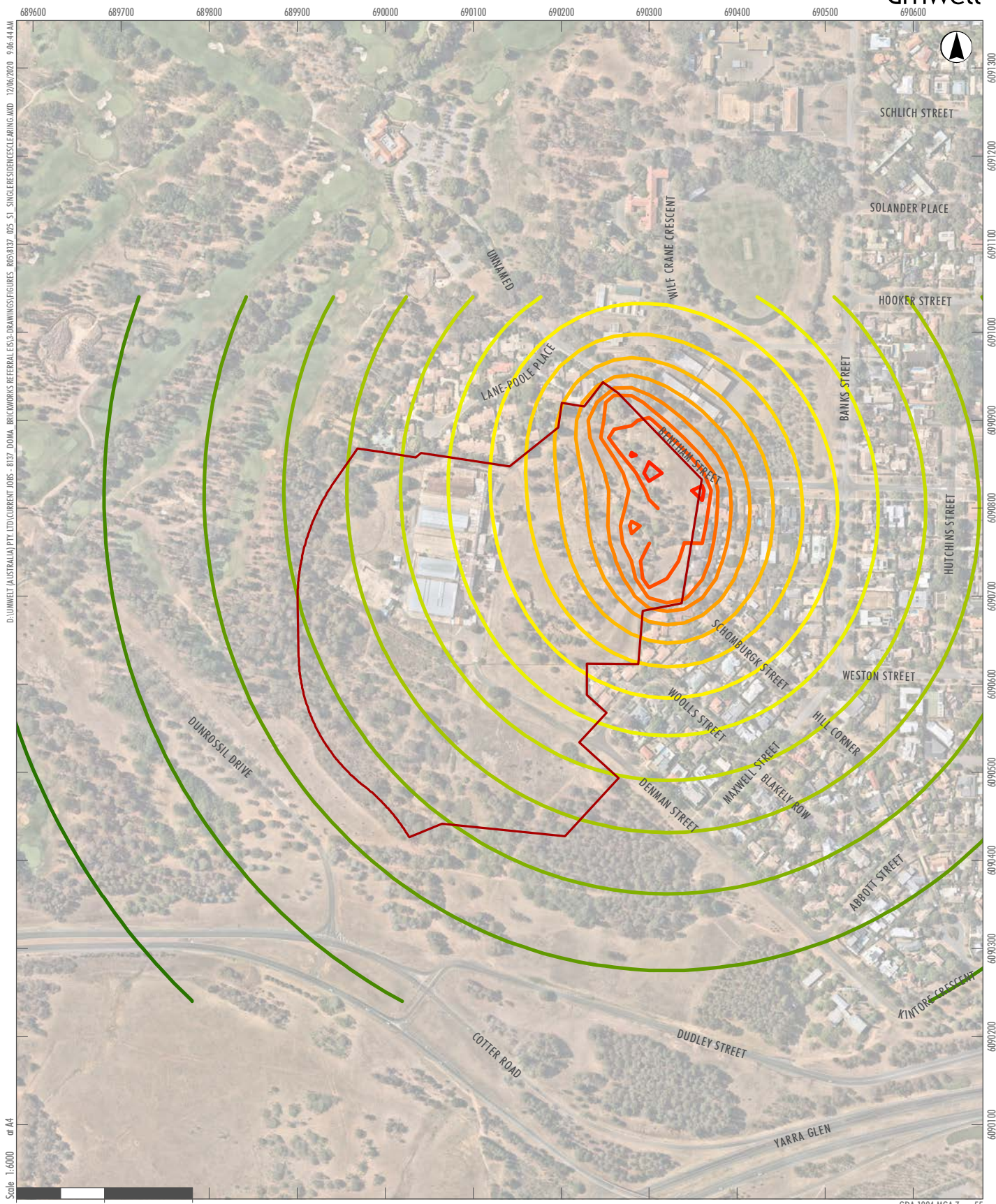
### 3.4 Construction noise levels

Construction noise level contours have been predicted for the nine (9) scenarios listed in the right column of **Table 3.3**. The predicted noise levels are the average of the noise impacts from construction works in the main areas of the precinct shown in the left column of **Table 3.3**, based on the total typical (mid-point) sound power level of the construction fleet. The actual noise impacts will vary continuously throughout the construction of each area, due to the changes in activity and the changes in locations of the various mobile construction noise sources. The construction noise contours presented in **Figures 3.2 to 3.10** have been predicted assuming a flat ground terrain model, and no acoustic shielding or reflections from structures such as buildings. The model, therefore, presents a conservative over-estimate of the noise propagation from the construction sites. However, the model's accuracy is more reliable in closer proximity to the construction areas where the closer receivers are usually the most relevant in regard to the assessment of noise impact.

**Figures 3.2 to 3.10** indicate the construction noise levels associated with the Brickworks Precinct development could exceed the objectives of the ACT Environmental Protection Guidelines for Construction and Land Development the EP Reg outlined in **Table 2.1** and **Table 2.2** subject to the methods of construction. However, the ACT *Environmental Protection Guidelines for Construction and Land Development* does not provide guidance on additional mitigation measures that could be implemented to manage both the short-term and long-term noise impacts from the construction activities. Therefore, recommendations to manage/mitigate the noise impacts from construction activities are provided in **Section 3.5**.

### 3.5 Construction noise mitigation

The EP Reg requires that the noise mitigation recommendations of AS 2436 be implemented for all construction sites. Adoption of all noise mitigation recommendations in AS 2436 can achieve a substantial reduction in noise impact at receivers from the construction of the Brickworks Precinct. The noise mitigation strategies described in AS 2436 should be considered by the Project as the minimum noise mitigation that should be implemented on site. Additional noise mitigation and management measures can and should be considered for high noise generating equipment or activities and if such additional noise controls are reasonable and feasible to implement, they should also be included in the NMP. For example, it is understood that rock breaking will likely be required during some construction activities. Rock breaking is typically a high noise generating activity. If additional noise controls for rock-breaking can be reasonably and feasibly implemented, the additional controls should be included in the Project NMP.



**FIGURE 3.2**  
**Predicted Noise Levels**  
**Construction Scenario 1**  
**Single Residences - Clearing**



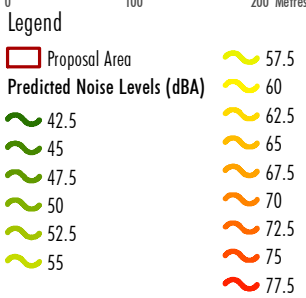
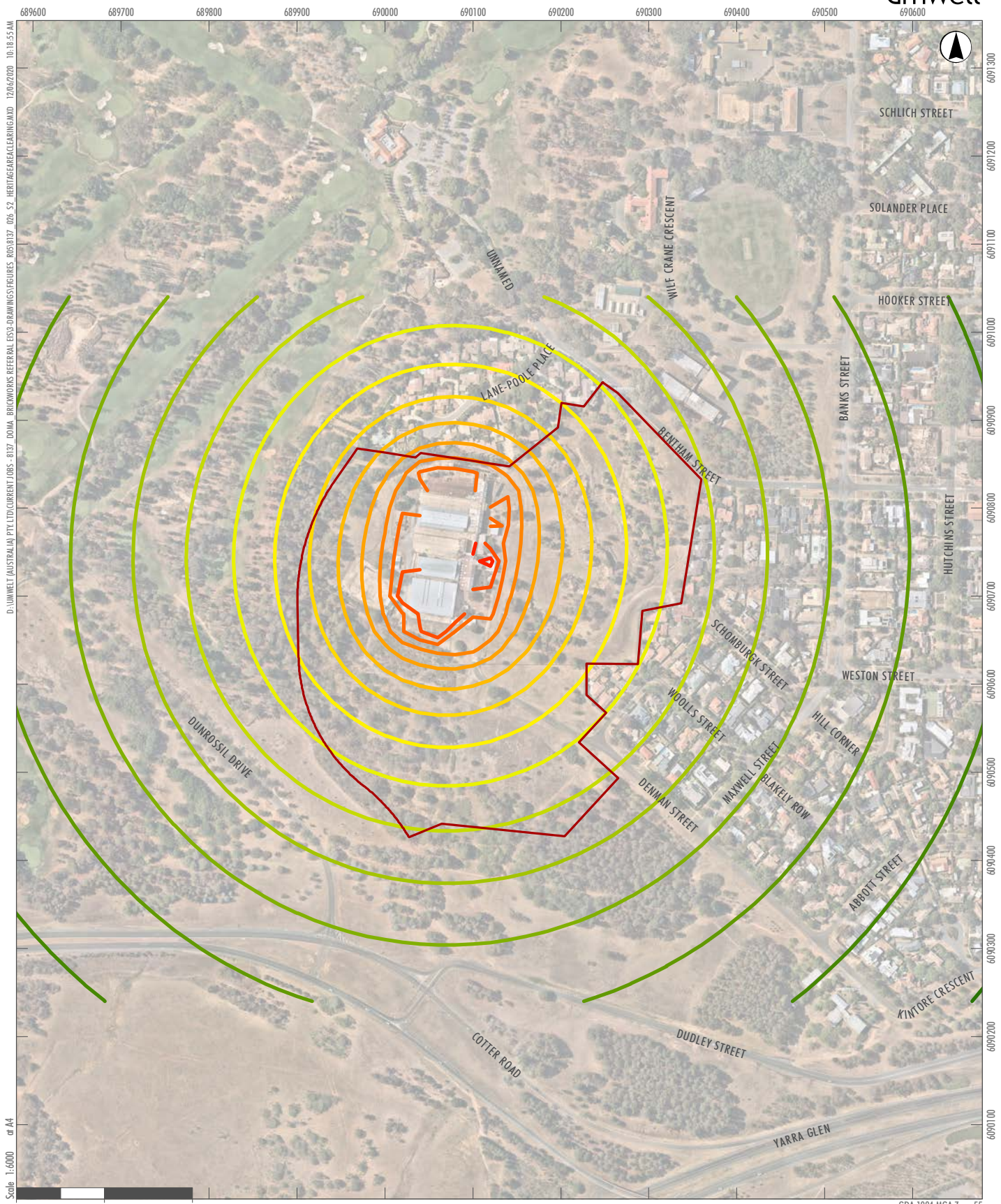
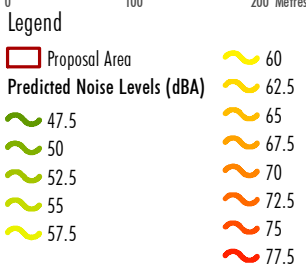
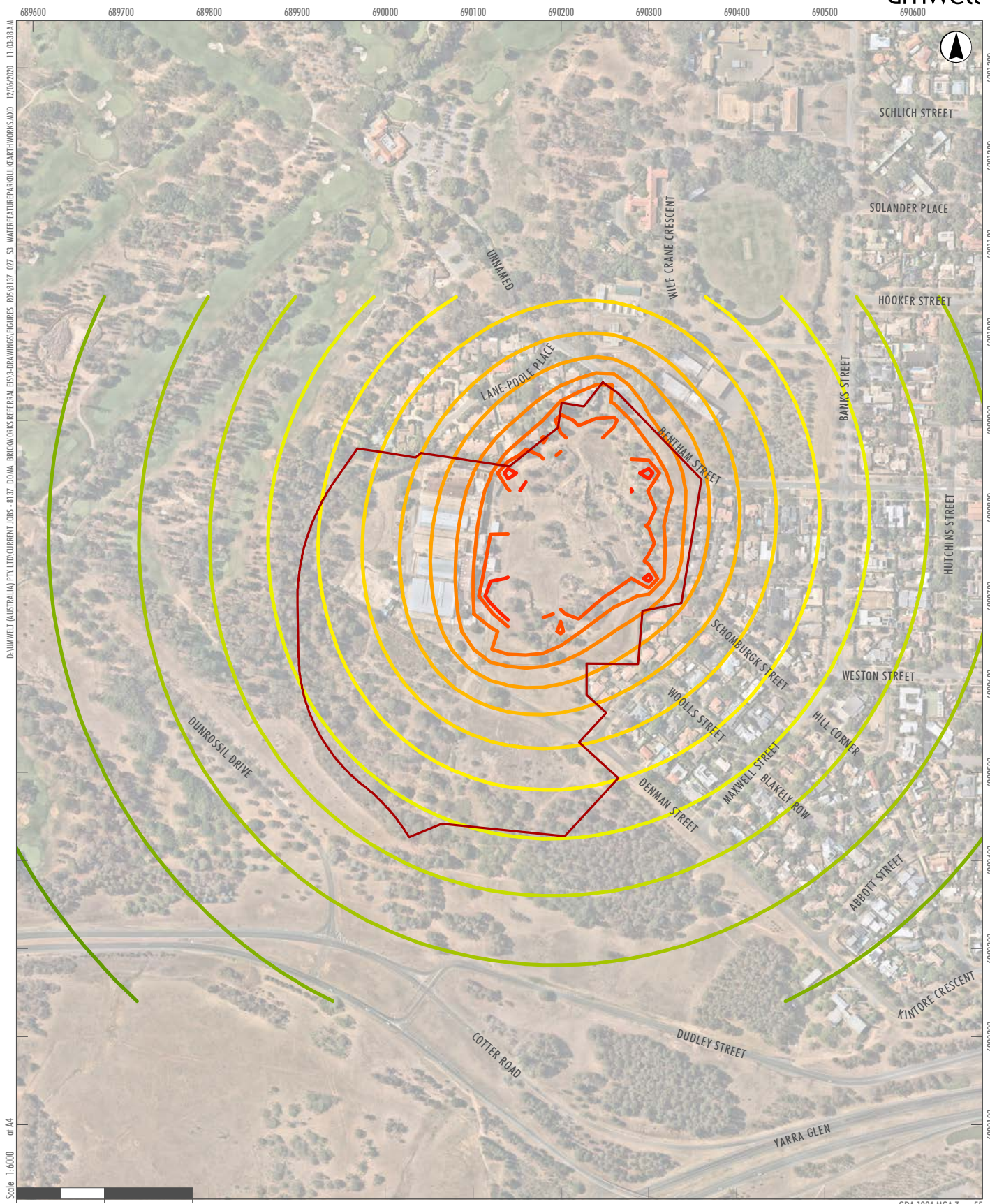
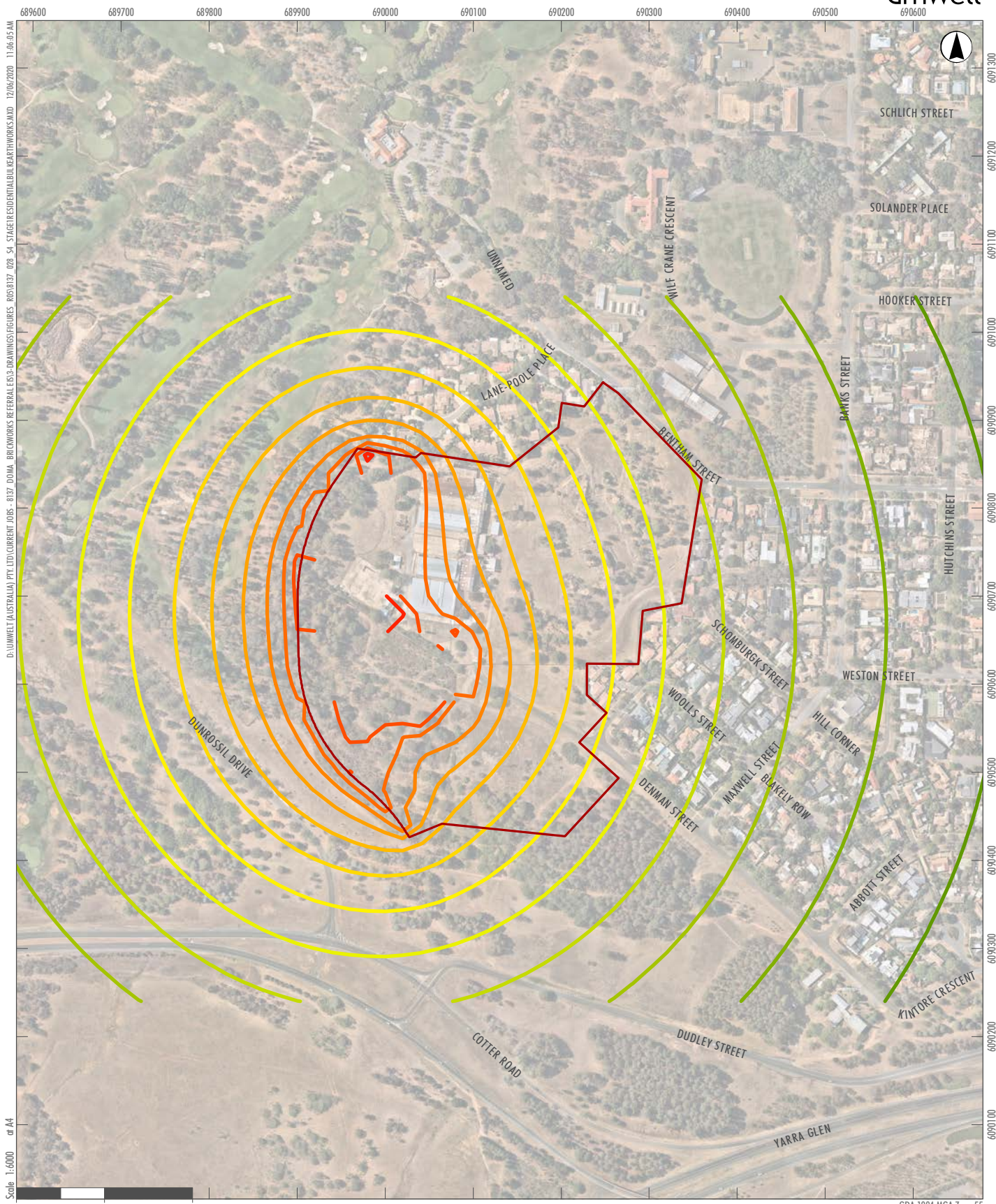


FIGURE 3.3

**Predicted Noise Levels  
Construction Scenario 2  
Heritage Area - Clearing**

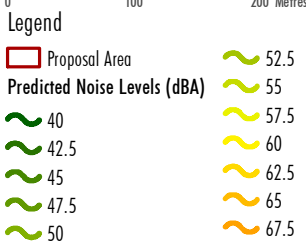
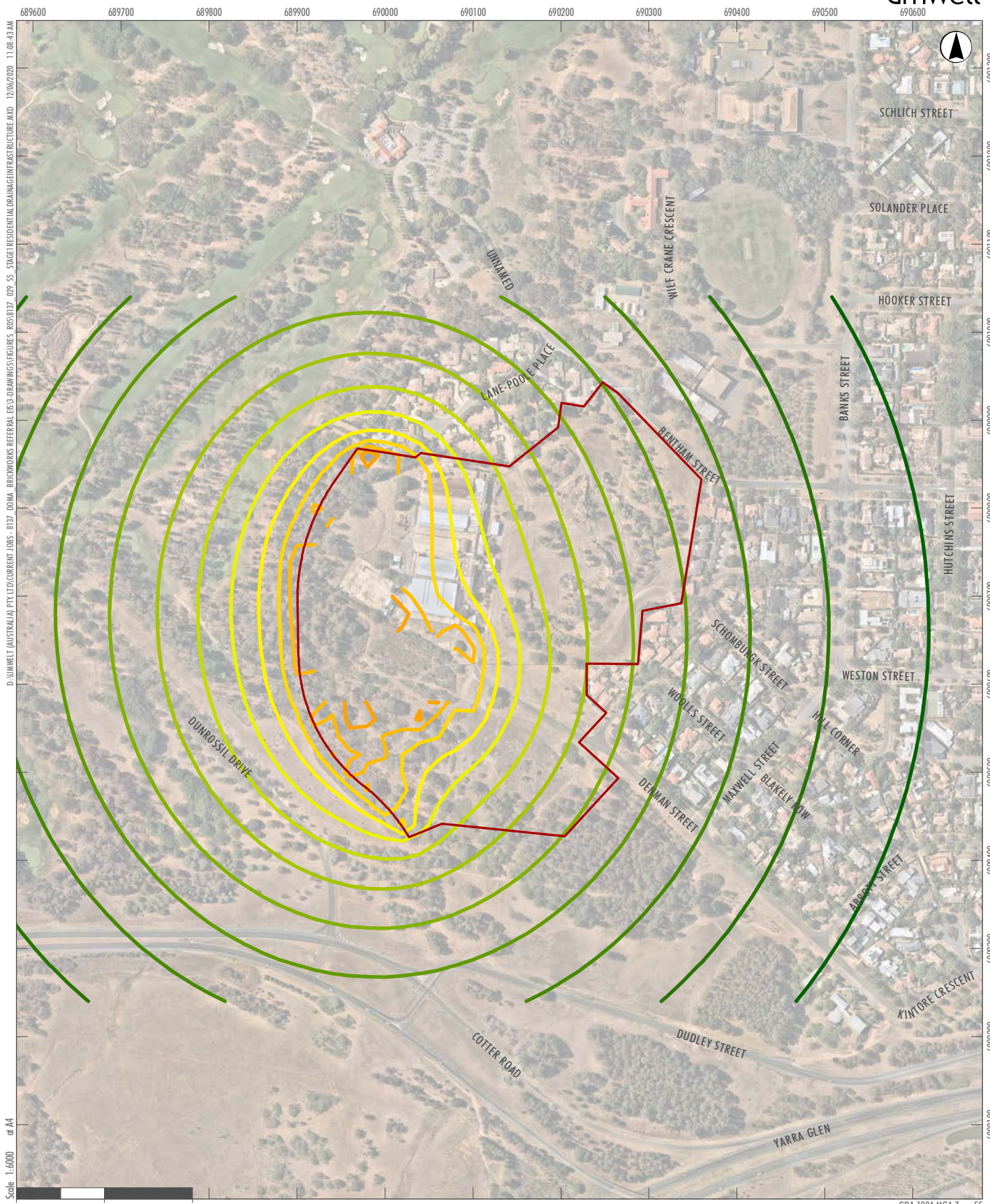


**FIGURE 3.4**  
**Predicted Noise Levels**  
**Construction Scenario 3**  
**Water Feature and Park – Bulk Earthworks**

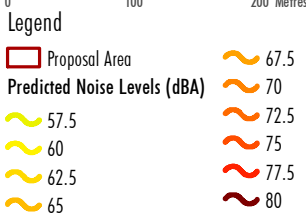
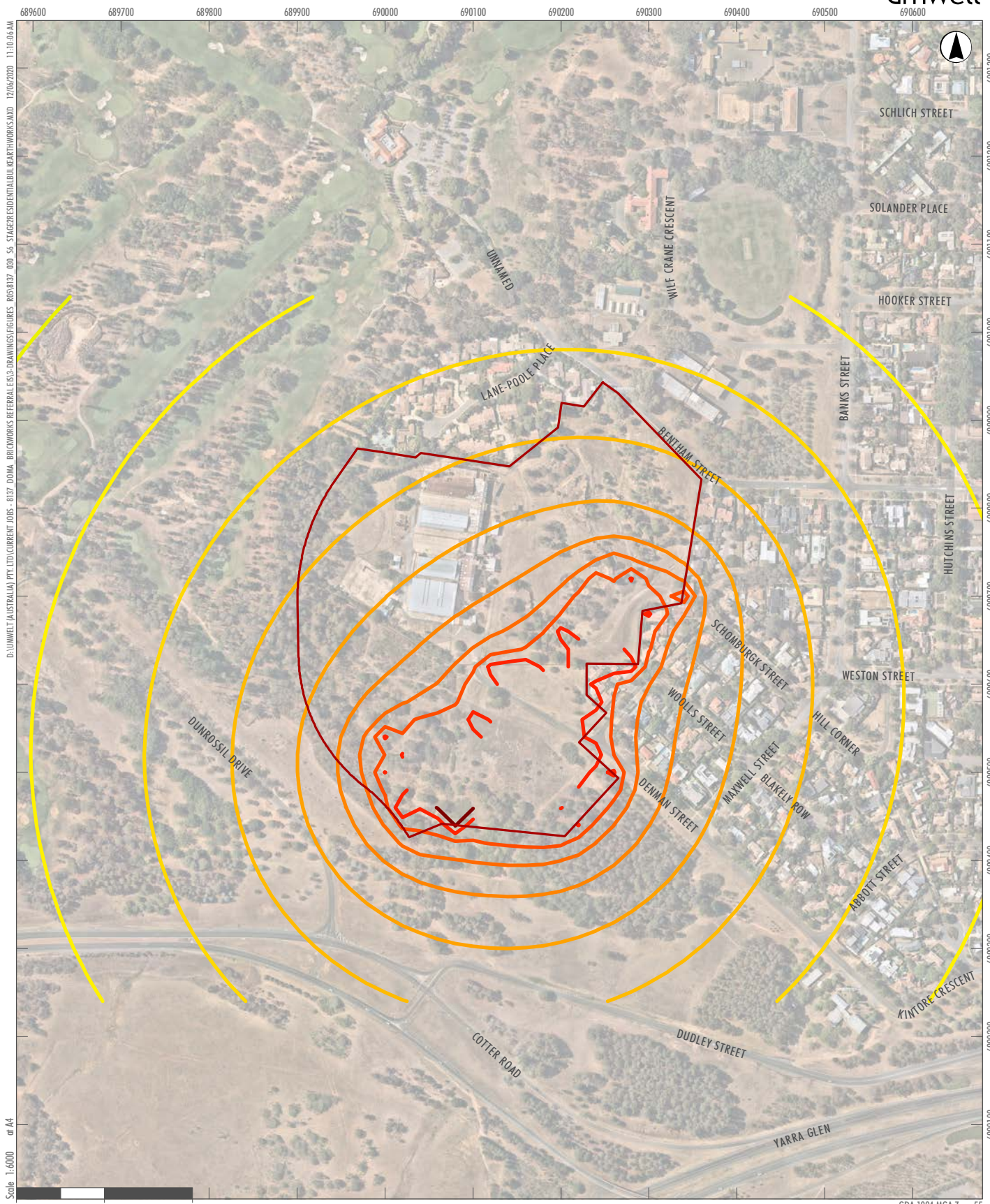


| Legend |               |
|--------|---------------|
|        | Proposal Area |
|        | 60            |
|        | 62.5          |
|        | 65            |
|        | 67.5          |
|        | 70            |
|        | 72.5          |
|        | 75            |
|        | 77.5          |

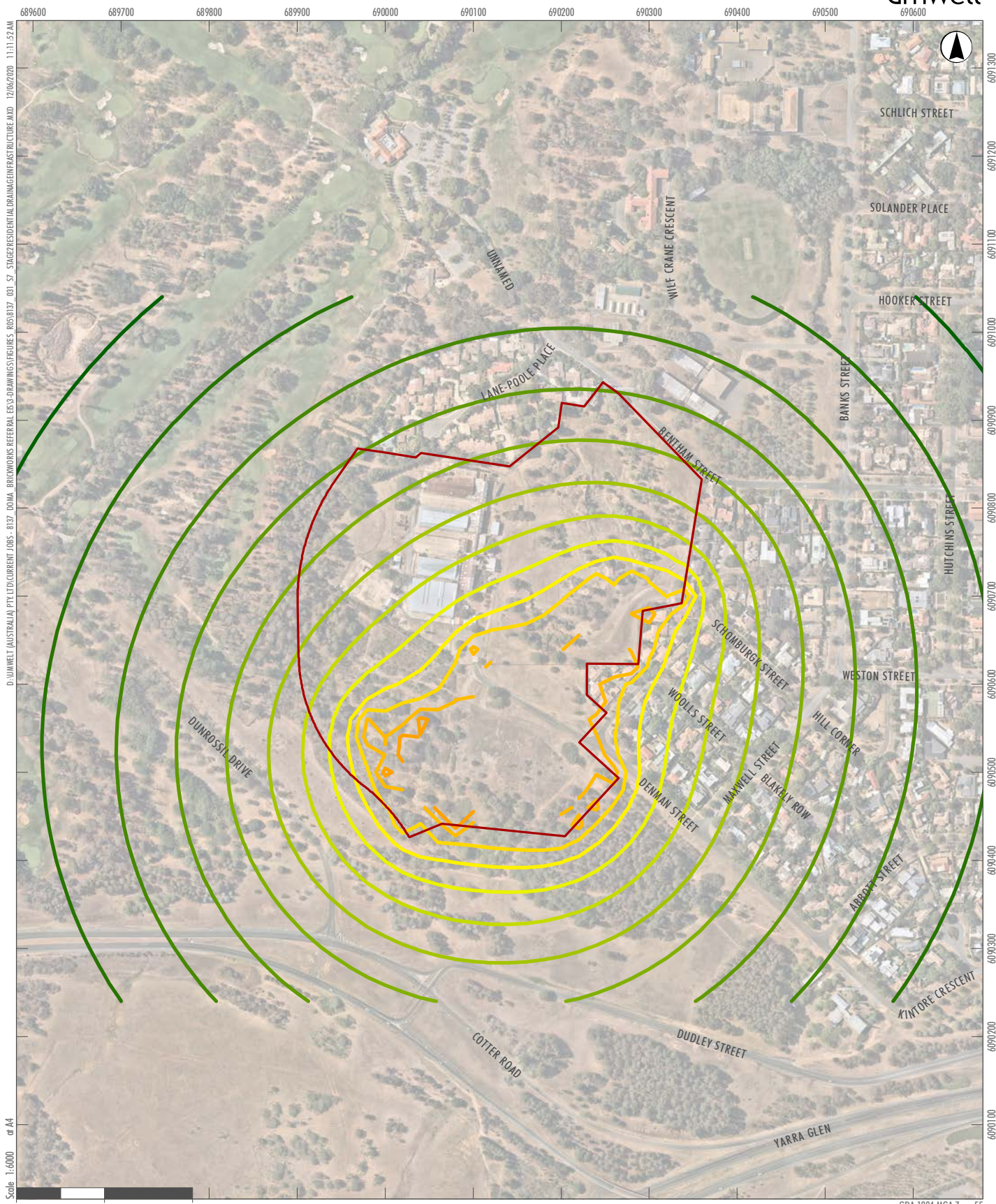
**FIGURE 3.5**  
**Predicted Noise Levels**  
**Construction Scenario 4**  
**Stage 1 Residential – Bulk Earthworks**



**FIGURE 3.6**  
**Predicted Noise Levels**  
**Construction Scenario 5**  
**Stage 1 Residential – Drainage Infrastructure**

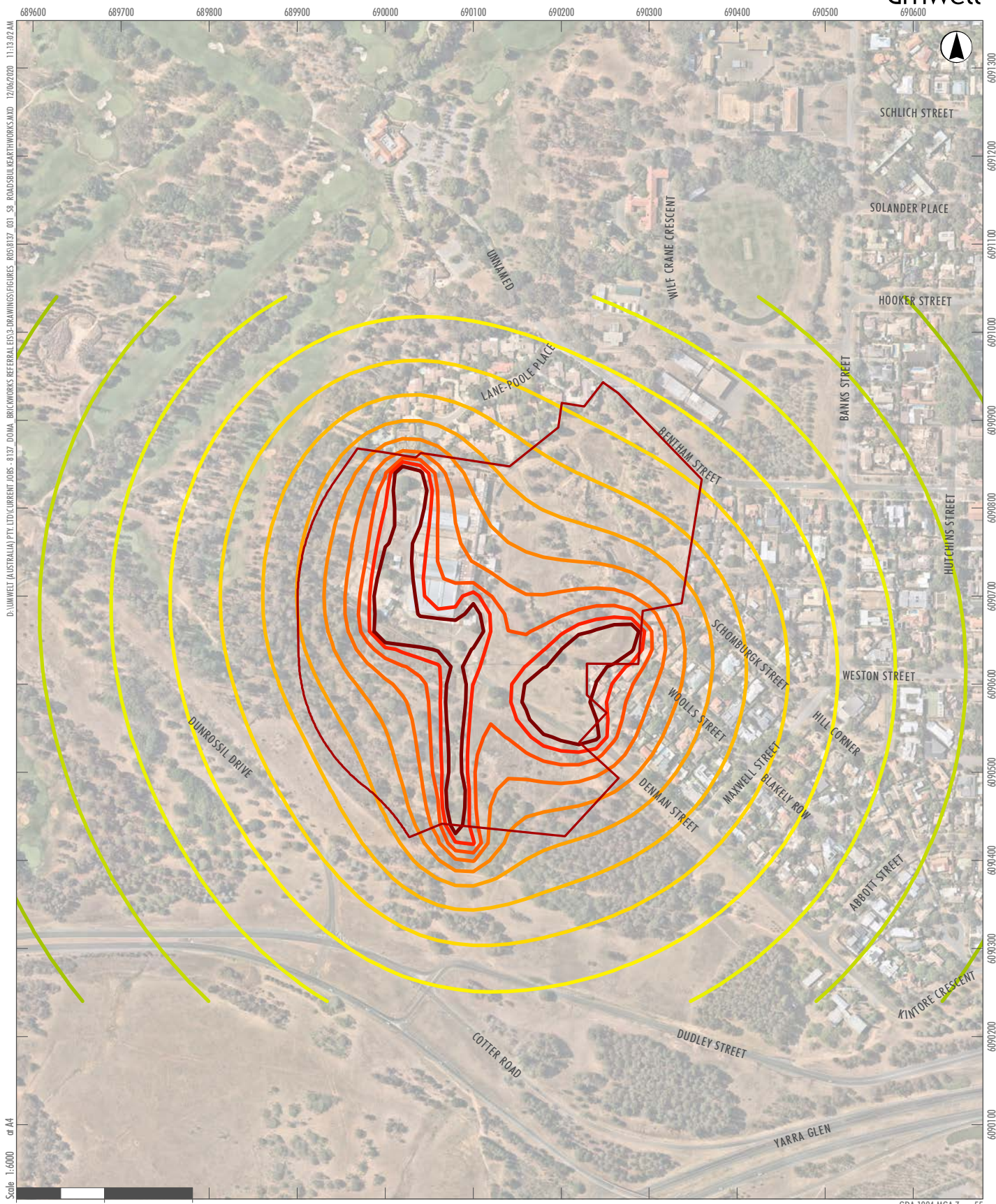


**FIGURE 3.7**  
**Predicted Noise Levels**  
**Construction Scenario 6**  
**Stage 2 Residential – Bulk Earthworks**



| Legend                       |               |
|------------------------------|---------------|
|                              | Proposal Area |
| Predicted Noise Levels (dBA) |               |
|                              | 40            |
|                              | 42.5          |
|                              | 45            |
|                              | 47.5          |
|                              | 50            |
|                              | 52.5          |
|                              | 55            |
|                              | 57.5          |
|                              | 60            |
|                              | 62.5          |
|                              | 65            |
|                              | 67.5          |

**FIGURE 3.8**  
**Predicted Noise Levels**  
**Construction Scenario 7**  
**Stage 2 Residential – Drainage Infrastructure**

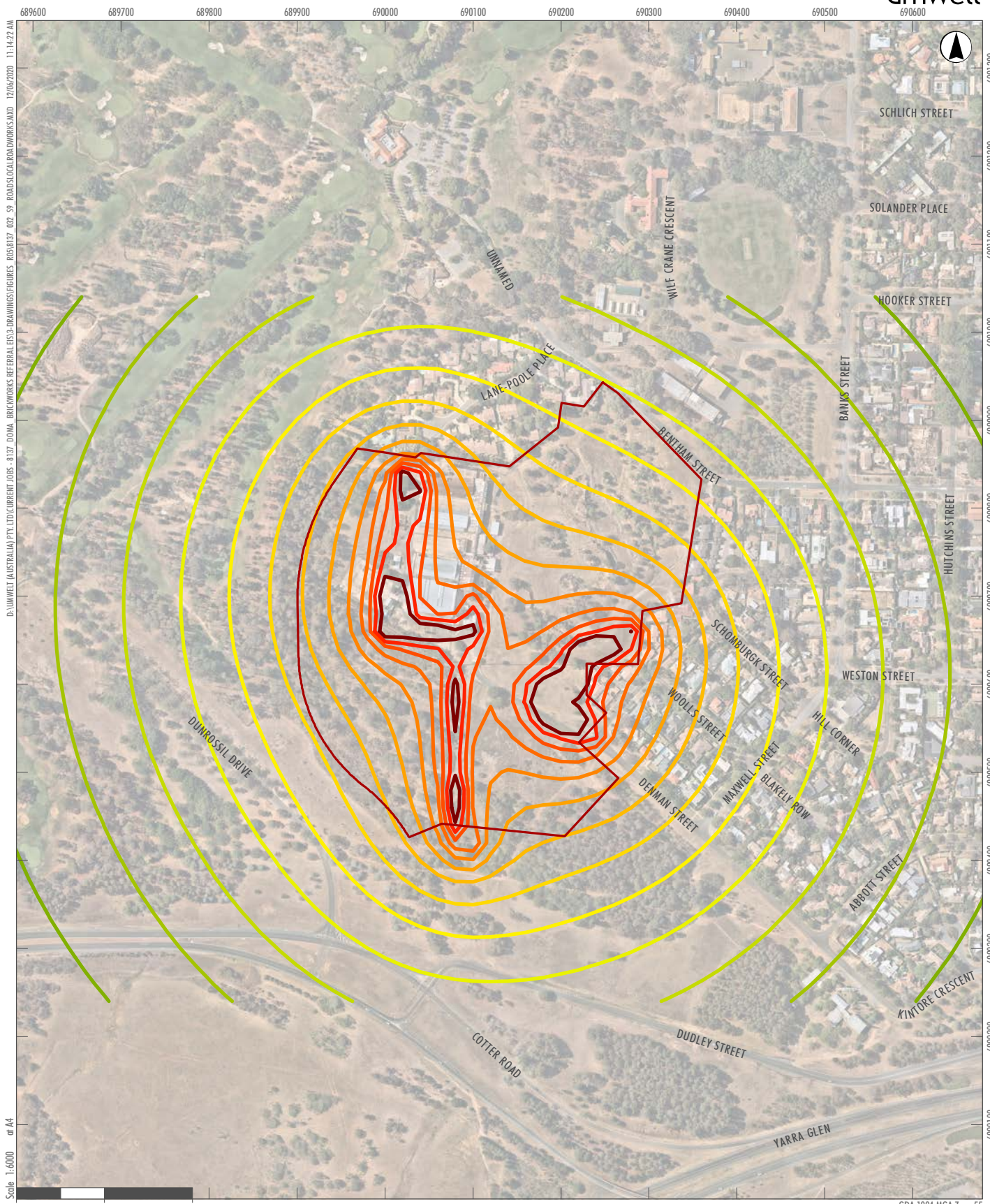


Scale 1:6000 or A4

| Legend |               |
|--------|---------------|
|        | Proposal Area |
|        | 65            |
|        | 67.5          |
|        | 70            |
|        | 72.5          |
|        | 75            |
|        | 77.5          |
|        | 80            |
|        | 52.5          |
|        | 55            |
|        | 57.5          |
|        | 60            |
|        | 62.5          |

FIGURE 3.9

Predicted Noise Levels  
Construction Scenario 8  
Roads - Bulk Earthworks



| Legend |               |
|--------|---------------|
|        | Proposal Area |
|        | 50            |
|        | 52.5          |
|        | 55            |
|        | 57.5          |
|        | 60            |
|        | 62.5          |
|        | 65            |
|        | 67.5          |
|        | 70            |
|        | 72.5          |
|        | 75            |
|        | 77.5          |
|        | 80            |

FIGURE 3.10

Predicted Noise Levels  
Construction Scenario 9  
Roads - Local Roadworks



### 3.5.1 High noise-generating activities

The construction plan includes the need for high noise-generating construction activities such as rock-breaking. Rock-breaking and similar high energy activities are typically high noise level producing activity. Noise impacts from high noise-generating activities on site can be managed in two ways:

1. Noise mitigation at the point of noise generation
2. Mitigation of noise propagation to receivers by locating the point of noise generation at a position which will provide high noise attenuation to receivers

Mitigation of high noise-generating activities such as rock breaking at the point of noise generation can be achieved using:

- Dampening or baffling of the hammer (see Error! Reference source not found.), and/or
- Partially enclosing the site with temporary noise barriers (see Error! Reference source not found.)

**Figure 3.11** Example of noise reduction treatment on a rock-breaking head fitted to an excavator



Source: [https://www.safesmartaccess.com.au//media/catalog/product/h/u/hushtec\\_rock\\_breaker\\_noise\\_reducer\\_1.jpg](https://www.safesmartaccess.com.au//media/catalog/product/h/u/hushtec_rock_breaker_noise_reducer_1.jpg) (accessed May 2020)

**Figure 3.12** Example of a temporary noise barrier



Source: [noisebarriers.com.au](http://noisebarriers.com.au) (accessed May 2020)

### **3.5.2 Noise Management Plan – management of construction noise**

The Noise Management Plan (NMP) to be prepared for the development of the Brickworks Precinct will need to address the requirement for mitigating high noise-generating activities, implementing additional airborne noise management measures and implementing the noise mitigation recommendations of AS 2436. The preparation of the NMP is discussed in **Section 7**.

## 4.0 Construction Vibration

Vibration impact at receivers from construction activities depend on many factors including:

- The size and power rating of the equipment causing the vibration
- The type of activity and utilisation of the equipment causing the vibration
- The distance between the source of vibration and the receiver
- The geology of the soil/rock through which the vibration is transmitted.

Due to the inherent variability of the above factors and other influences, it is generally not possible to accurately predict construction-based vibration levels for inclusion in a NIA prepared in support of a Development Application. However, the *Construction Noise and Vibration Guideline (CNVG) 2016* published by TfNSW contains information that may be used to provide assessment recommendations for the Brickworks Precinct. The CNVG and provide recommended minimum working distances from vibration generating plant and residential receivers. The TfNSW recommendations are reproduced in **Table 4.1**.

**Table 4.1 Recommended minimum working distances for vibration generating plant from residential sensitive receivers**

| Plant Item                     | Rating/Description                | Minimum Working Distance               |                |
|--------------------------------|-----------------------------------|--|----------------|
|                                |                                   | Cosmetic Damage (Residential Building) | Human Response |
| <b>Vibratory Roller</b>        | < 50 kN (Typically 1-2 tonnes)    | 5 m                                    | 15 m to 20 m   |
|                                | < 100 kN (Typically 2-4 tonnes)   | 6 m                                    | 20 m           |
|                                | < 200 kN (Typically 4-6 tonnes)   | 12 m                                   | 40 m           |
|                                | < 300 kN (Typically 7-13 tonnes)  | 15 m                                   | 100 m          |
|                                | > 300 kN (Typically 13-18 tonnes) | 20 m                                   | 100 m          |
|                                | > 300 kN (> 18 tonnes)            | 25 m                                   | 100 m          |
| <b>Small Hydraulic Hammer</b>  | (300 kg - 5 to 12t excavator)     | 2 m                                    | 7 m            |
| <b>Medium Hydraulic Hammer</b> | (900 kg – 12 to 18t excavator)    | 7 m                                    | 23 m           |
| <b>Large Hydraulic Hammer</b>  | (1600 kg – 18 to 34t excavator)   | 22 m                                   | 73 m           |
| <b>Vibratory Pile Driver</b>   | Sheet piles                       | 2 m to 20 m                            | 20 m           |
| <b>Pile Boring</b>             | ≤ 800 mm                          | 2 m (nominal)                          | 4 m            |
| <b>Jackhammer</b>              | Handheld                          | 1 m (nominal)                          | 2 m            |

**Table 4.1 Continued**

| Plant Item               | Rating/Description           | Minimum Working Distance               |                |
|--------------------------|------------------------------|--|----------------|
|                          |                              | Cosmetic Damage (Residential Building) | Human Response |
| <b>Profiler</b>          | Wirtgen W210                 | 4 m                                    |                |
| <b>Asphalt Paver</b>     | Vogele Super 1800-3          | 1 m                                    |                |
| <b>Steel Drum Roller</b> | Hamm HD70 (Oscillating Mode) | 2 m                                    |                |
| <b>Steel Drum Roller</b> | Hamm HD70 (Static Mode)      | 1 m                                    |                |

Source: CNVG Table 2 and CMNET 21/03/2017 version

The CNVG companion software, the *Construction and Maintenance Noise and Estimator Tool* (CMNET) (version 21/03/2017) can be used to provide recommended minimum working distances from vibration generating plant and residential receivers. It is recommended the noise management plan for the development of the Brickworks Precinct includes the regular review of activities that generate ground vibration and assess the potential for adverse impacts using CMNET.

## 5.0 Operational Noise

Noise from the operation of the Brickworks Precinct is assessable under the EP Reg. The receivers on land adjoining the Brickworks Precinct are classified as zone G in the EP Reg Schedule 2. Noise from the operation of the precinct that is not otherwise permitted by the EP Reg would be required to comply with the Noise Standards shown in **Table 2.6**.

### 5.1 Operational noise sources

The Brickworks Precinct by itself would normally generate little to no noise operational noise. Noise sources that may fall within the category of operation noise could include:

- Water pumping noise associated with the Water Feature
- Water falling noise from a fountain (if any) operating within the Water Feature
- Garden or grounds maintenance activities

#### 5.1.1 Garden or grounds maintenance noise

Noise from maintaining a garden or grounds on residential land, or on land other than residential land is listed in the EP Reg Schedule 2, Table 2.3, Column 2. Under the EP Reg Part 3, Division 3.2, Section 29, noise from garden or grounds maintenance is not taken to cause environmental harm if it complies with the conditions mentioned in the EP Reg Schedule 2, Table 2.3, Column 3 as shown in **Table 5.1**.

**Table 5.1 EP Reg Schedule 2 Noise Sources and Operating Limits**

| Column 1<br>Item | Column 2<br>Noise  | Columns 3<br>Conditions   |
|------------------|--|---|
| 3                | noise emitted in the course of maintaining a garden or grounds on residential land                 | (a) the noise is emitted- <ul style="list-style-type: none"> <li>i) between 7 am and 8 pm on Monday to Saturday; or</li> <li>ii) between 8 am and 8 pm on Sunday or a public holiday; and</li> </ul> (b) the equipment used is maintained and operated in accordance with the manufacturer's instructions   |
| 4                | noise emitted in the course of maintaining a garden or grounds on land other than residential land | (a) the noise is emitted- <ul style="list-style-type: none"> <li>i) between 7 am and 10 pm on Monday to Saturday; or</li> <li>ii) between 8 am and 10 pm on Sunday or a public holiday; and</li> </ul> (b) the equipment used is maintained and operated in accordance with the manufacturer's instructions |

Source: Extract from EP Reg Schedule 2, Table 2.3

## 6.0 Road Traffic Noise

There are no requirements to manage road traffic noise levels within the Brickworks Precinct for the protection of the undeveloped precinct, because an undeveloped parcel of land is not classified as a sensitive receiver according to the *Roads ACT Noise Management Guideline* (Section 4 Table 1.1).

The future individual developments and the future occupants of the existing buildings will be responsible for providing acceptable external and/or internal noise levels for Brickworks Precinct and adjoining areas in accordance with the requirements of the *Roads ACT Noise Management Guideline*. Future individual developments will require approval, and a Noise Impact Assessment (NIA) and/or a NMP will be prepared for each development application if required. Where applicable, the NIA and NMP of each future individual developments would need to address the potential for and the generation of road traffic noise.

Indicative road traffic noise level information that can be used as a guide for future development applications within the precinct is presented in **Section 8.2**.



## 7.0 Noise Management Plan

An underlying commitment for the preparation of the Brickworks Precinct development, as documented in the DOMA Request for Tender for the Sale & Development of the Canberra Brickworks Precinct (Returnable Schedule 05) is the preparation of a Noise Management Plan (NMP) for the development of the Brickworks Precinct. The information that will need to be included in the NMP for the development of the Brickworks Precinct is described below. It is noted that the NMP for the Brickworks Precinct will not need to address the noise assessment and management requirements for each of the future developments within the estate. However, the following information provides a guideline on the potential requirements of the NMPs that could be required for each future development within the Brickworks Precinct. Additional details on the requirements that could apply to each of the future developments within the Brickworks Precinct is provided in **Section 8**.

### 7.1 Guidelines for the preparation of Noise Management Plans for development applications

The *Guidelines for the preparation of Noise Management Plans for development applications* (EPA,2014) provides the following recommendations for the information to be provided in an NMP:

#### ***What should a NMP consider?***

*The EPA expects developers to introduce measures to attenuate (reduce) the noisiest use permitted by the lease, regardless of whether or not the proponent intends to use it. Many factors need to be considered when preparing a NMP, with these factors differing with each proposal. It is necessary to consider the following when preparing a NMP:*

- *The permitted noise standard under the Regulation for the site – all noise emitted from the site must comply with the noise standard at any point within the vertical plane of the site boundary. Where a residential development is proposed in an area with a noise standard higher than zone G, the development must meet the ‘satisfactory’ recommended design sound levels for residential buildings of AS/NZS 2107. Commercial accommodation developments should meet AS/NZS 2107 for sleeping areas.*
- *The activities currently carried out within the area – this is particularly relevant when considering a residential development in an area other than zone G (as defined in the Regulation).*
- *The permitted uses under the lease for the site – the NMP must address noise from all permitted uses identified as being noisy, regardless of whether the noisy permitted use is utilised. If a noisy use is permitted the noise must be attenuated.*
- *Noise sources – the NMP must include all sources of noise which may have an impact on the development and/or adjoining sites. The EPA has found noise from the following sources to be the subject of complaints: exhaust fans including both kitchen and underground car parks; garage roller doors; mechanical plant; and garbage collection among others. There are also noise sources associated with many proposals which, due to their occasional nature, are not normally included in acoustic modelling, such as public address systems, emergency warning systems, reversing beepers. These noise sources should be identified in the NMP, their likely impacts discussed, and comment provided on the potential use of alternative systems that can minimise their impact. The NMP should also identify and discuss low frequency (particularly where amplified music is identified as a noise source), tonal, impulsive and intermittent noise sources and their associated mitigation measures. The NMP should discuss both the protection of*

noise receivers from noise sources and the minimisation of noise generated at the noise source and outline appropriate noise reduction measures. Where the proposal includes a mixed-use site (i.e., residential and commercial), the NMP must address the impact of noise sources on other leaseholders within the same lease boundary, particularly residential dwellings. Note: The ACT is divided into noise zones. Noise Standards for these zones are set in the Environment Protection Regulation 2005. All noise emissions from a parcel of land must comply with the noise standards at any point within the vertical plane of the boundary. It can therefore be assumed that noise sources external to the parcel of land should not exceed the noise standards that apply to that land. The noise standards for the purposes of this document are taken to be expressed as  $LA_{10,T}$  where T is 10 minutes (i.e., for a multi-unit dwelling located within the city centre, the maximum noise source external to the dwelling should be 60 dB(A)  $LA_{10,10}$  minutes).

### **What should a NMP contain?**

At a minimum a NMP should contain:

- the name, qualification/experience of the person who prepared the report
- an adequate description of the project, including background history or relevant previous studies, scope of work, noise/vibration issues addressed, hours of operation
- a detailed site map that identified location of the noise sources, noise receiver locations (including existing and proposed residential areas), topographical data which may affect noise propagation, measurement or prediction locations and north point and scale
- relevant noise guidelines, policies or standards that have been applied, for example:
  - Environment Protection Regulation 2005
  - Noise Environment Protection Policy, Environment Protection Authority
  - Noise Measurement Manual, Environment Protection Authority
  - AS 2436-2010(R2016) Guide to noise control on construction, demolition and maintenance sites
  - AS/NZS 2107:2016 Acoustics – Recommended design sound levels and reverberation times for building interiors
  - AS 2670.2 Evaluation of human exposure to whole-body vibration - Continuous and shock-induced vibration in buildings (1 - 80Hz). [Note: This Standard has now been replaced by AS ISO 2631-2:2014]
- details of any noise monitoring undertaken
- noise predictions for the proposed activity including:—how noise levels for each activity or permitted use were determined – type of computer noise modelling software used – noise source locations and source heights – topography settings – meteorological conditions used – receiver locations—operating conditions of the building when predicting internal noise levels including a justification for those conditions (i.e., windows and doors open or closed).
- a comparison of noise predictions against noise criteria
- a discussion of proposed mitigation measures, the noise reduction likely and the feasibility and reasonableness of these measures
- how compliance can be determined practically.

## 7.2 Australian Standard 2436-2010(R2016)

AS 2436-2010(R2016) provides the following recommendations regarding noise management plans (Section 3.4)

*Noise and vibration management plans should describe the approaches that will be applied in consulting with, and notifying, the community. Noise and vibration management plans should also show a commitment to work practices, such as scheduling of activities and selection of equipment and procedures that will be implemented to minimize impacts and manage complaints.*

*A range of media should be used to notify the community before and during construction, including use of community meetings, individual contact and letterbox drops. Contact details for complaints and further information, including emergency phone numbers, should be readily available to the community.*

*In large projects, a community relations plan should be developed and implemented. Complaints should be recorded and managed in conformity with the plan to ensure prompt and fair response.*

Some of the standard noise control strategies commonly employed on typical construction sites described in AS 2436 are:

### **4.4.2 Adoption of universal work practices**

*Many noise and vibration complaints are due to preventable day-to-day activities that may be addressed by:*

- (a) Regular reinforcement (such as at toolbox talks) of the need to minimize noise and vibration.*
- (b) Regular identification of noisy activities and adoption of improvement techniques.*
- (c) Avoiding the use of portable radios, public address systems or other methods of site communication that may unnecessarily impact upon nearby residents.*
- (d) Developing routes for the delivery of materials and parking of vehicles to minimize noise.*
- (e) Where possible avoiding the use of equipment that generates impulsive noise.*
- (f) Minimizing the need for vehicle reversing (see Clause 3.5) for example, by arranging for one-way site traffic routes.*
- (g) Use of broadband audible alarms on vehicles and elevating work platforms used on site (see Clause 3.5).*
- (h) Minimizing the movement of materials and plant and unnecessary metal-on-metal contact.*
- (i) Minimizing truck movements.*
- (j) Scheduling respite periods.*

### **4.4.3 Community Consultation/Notification**

Noise and vibration management plans should describe the approaches that will be applied in consulting with, and notifying, the community.

#### **4.4.4 Plant and equipment**

In terms of both cost and results, controlling noise and vibration at the source is one of the most effective methods of minimizing the impacts from any work site activities. Work practices that will reduce noise or vibration at the source include:

- (a) Employing quieter techniques for all high noise activities such as rockbreaking, concrete sawing, and using power and pneumatic tools.
- (b) Choosing quieter plant and equipment based on the optimal power and size to most efficiently perform the required tasks.
- (c) Selecting plant and equipment with low vibration generation characteristics.
- (d) Operating plant and equipment in the quietest and most efficient manner.
- (e) Regularly inspecting and maintaining plant and equipment to minimise noise and vibration level increases, to ensure that all noise and vibration reduction devices are operating effectively.

#### **4.4.5 On site noise mitigation**

Practices that will reduce noise from the site include:

- (a) Maximizing the distance between noise activities and noise sensitive land uses.
- (b) Undertaking noisy fabrication work off-site where possible, e.g., with enclosed factory premises, where noise can be controlled.
- (c) Adopting alternatives to beeper reversing alarms (see Clause 3.5).
- (d) Maintaining any pre-existing barriers or walls on a demolition or excavation site as long as possible to provide optimum sound propagation control.
- (e) Constructing barriers that are part of the project design early in the project to afford mitigation against site noise.
- (f) Using temporary site building and material stockpiles as noise barriers. These can often be created using site earthworks and may be included as a part of final landscape design.
- (g) Installing purpose-built noise barriers, acoustic sheds and enclosures.

#### **4.4.6 Work scheduling**

Scheduling work during periods when people are least affected is an important way of reducing adverse impacts. The following scheduling aspects may reduce impacts:

- (a) Providing respite periods, including restricting very noisy activities such as rock hammering or piling to daytime, restricting the number of nights that after-hours work is conducted near residences, or by determining any specific requirements, particularly those needed for noise sensitive receivers such as schools and hospitals.

*(b) Scheduling activities to minimize impacts by undertaking all possible work during hours that will least adversely affect sensitive receivers (e.g., outside normal working hours for nearby workplaces; within normal working hours for nearby residences) and by avoiding conflicts with other scheduled events.*

*(c) Scheduling work to coincide with non-sensitive periods (i.e., work near schools during weekends or in school holidays).*

*(d) Scheduling noisy activities to coincide with high levels of neighbourhood noise so that noise from the activities is partially masked and not as intrusive.*

*(e) For specific works, such as tunnelling, stockpiling excavated tunnel material overnight and scheduling its removal during day-time hours or night-time where receivers are commercial, or it is more appropriate.*

*(f) Planning deliveries and access to the site to occur quietly and efficiently and organising parking only within designated areas located away from the sensitive receivers.*

*(g) Optimizing the number of deliveries to the site by amalgamating loads where possible and scheduling arrivals within designated hours.*

*(h) Designating, designing and maintaining access routes to the site to minimize impacts.*

*(i) Including contract conditions that include penalties for non-compliance with reasonable instructions by the principal to minimise noise or arrange suitable scheduling.*

#### **4.5 Control of Noise at Source**

Some ways of controlling noise at source are—

*(a) substitution (See AS 2436 Appendix C for examples);*

*(b) modification of existing equipment;*

*E.g., an acoustic shroud around the hammer head of excavator-mounted hydraulic rock breakers*

*(c) use and siting of equipment;*

*E.g., shut down equipment when not in use;*

*(d) regular and effective maintenance of equipment.*

#### **4.6 Controlling the Spread of Noise**

*If noisy processes cannot be avoided, then the amount of noise reaching the receiver should be minimized. Two ways of doing this are either to increase the distance between the noise source and the receiver or to introduce noise reduction measures such as screens. Physical methods to reduce the transmission of noise between the site works and residences, or other sensitive land uses, are generally suited to works where there is longer-term exposure to the noise. Practices that will reduce noise from the site include:*

*(a) Increasing the distance between noise sources and sensitive receivers.*

*(b) Reducing the line-of-sight noise transmission to residences or other sensitive land uses using temporary barriers (stockpiles, shipping containers and site office transportables can be effective barriers).*

*(c) Constructing barriers that are part of the project design early in the project to afford mitigation against site noise.*

*(d) Installing purpose-built noise barriers, acoustic sheds and enclosures.*

# 8.0 Future Developments within the Brickworks Precinct

## 8.1 Contamination remediation and encapsulation

It is understood that the primary means of disposal of contaminated material within the precinct is intended to be encapsulation in an as yet undetermined location in the eastern section of the Site. The works to provide this contamination remediation would be considered as 'Building Work' and would be assessable under the EP Reg Schedule 2, as shown in **Table 2.1** and **Table 2.2**. It is therefore anticipated the contamination remediation and encapsulation project would require its own Approval, and consequently, it would require its own Noise Impact Assessment and NMP.

## 8.2 Road traffic noise levels

### 8.2.1 Road traffic noise level criteria

Future developments within the Brickworks Precinct will need to consider the potential requirement to provide acoustic controls for road traffic noise levels received at the proposed developments from nearby roads. The noise level targets and options to provide noise control are described in *Roads ACT Noise Management Guidelines, 2018* Section 4 as follows:

#### **4. New Developments on Existing Roads**

*Proposed noise sensitive developments (refer to Table 1.1) located adjacent to arterial or major collector roads are to be planned, designed and constructed to standards that provide: external noise levels based on the existing conditions at the receiver below the maximum levels set out in Table 1.2, or; internal noise levels that meet the Australian Standard AS 2107.*

*Proposals for development of potentially noise sensitive land uses (refer to Table 1.1) adjacent to any existing arterial or major collector road will require an assessment against Table 1.2, guidelines contained in the table Schedule 1 provide guidance on achieving this.*

The above statement is summarised in Schedule 1 of the guideline, reproduced in **Table 8.1**, **Table 8.2** and **Table 8.3**.

**Table 8.1 Roads ACT Noise Management Guidelines Section 4 Schedule 1 Guidelines for new developments on existing roads**

| Objective   | Technique   | Criteria   |
|---|---|--|
| To protect occupants of developments from excessive levels of traffic noise | set-back of the building from the road<br>AND/OR<br>acoustic barrier between the building and the road (within the lessee land) | Maximum external traffic noise level at the development, as set out in Table 1.2 |
|   | OR<br>building design measures to provide acoustic insulation   | OR<br>Internal noise levels as set out in AS/NZS 2107 and AS 3671                |

**Table 8.2 Roads ACT Noise Management Guidelines Section 4 Table 1.1: Noise Sensitive Land Uses**

| Development Type   |  |
|--|--|
| Residential  | Community  |
| apartment<br>attached house<br>boarding house<br>caravan park/camping ground<br>detached house<br>guest house<br>retirement complex<br>special care establishment<br>special care hostel | childcare centre<br>community activity centre (except community halls)<br>educational establishment<br>health facility/ hospital<br>special dwelling |

As stated in the *Roads ACT Noise Management Guidelines, 2018*, the noise-sensitive developments may be planned, designed and constructed to achieve target noise levels either external to the building or internally within the building. In either case, the proposal for a noise-sensitive development will require an assessment against the target external noise levels in the *Roads ACT Noise Management Guideline, 2018* as shown in **Table 8.3**.

**Table 8.3 Roads ACT Noise Management Guidelines Section 4 Table 1.2: Maximum external traffic noise level (Target level) at the development, expressed as LAeq dB(A)**

| Land uses   | Target noise level dB(A) (inc. façade reflection) |
|---|---|
| Residential and community facilities day-time LAeq(15 hour) | 60  |
| Residential night-time LAeq(9 hour)                         | 55  |
| Commercial facilities                                       | 72  |

## 8.2.2 Predicted road traffic noise levels

Road traffic noise levels have been predicted as noise level contour maps throughout the Brickworks Precinct. The road traffic noise levels were calculated using the 3-dimensional environmental noise prediction software Cadna/A, using the modelling method *Calculation of Road Traffic Noise* (CoRTN) as modified for use in Australia. Road traffic noise levels were predicted as equivalent-continuous sound levels (LAeq) for the Day (7 AM to 10 PM) and Night (10 PM to 7 AM) time periods as defined in the *Roads ACT Noise Management Guidelines, 2018* to enable assessment against the target noise levels in **Table 8.3**.

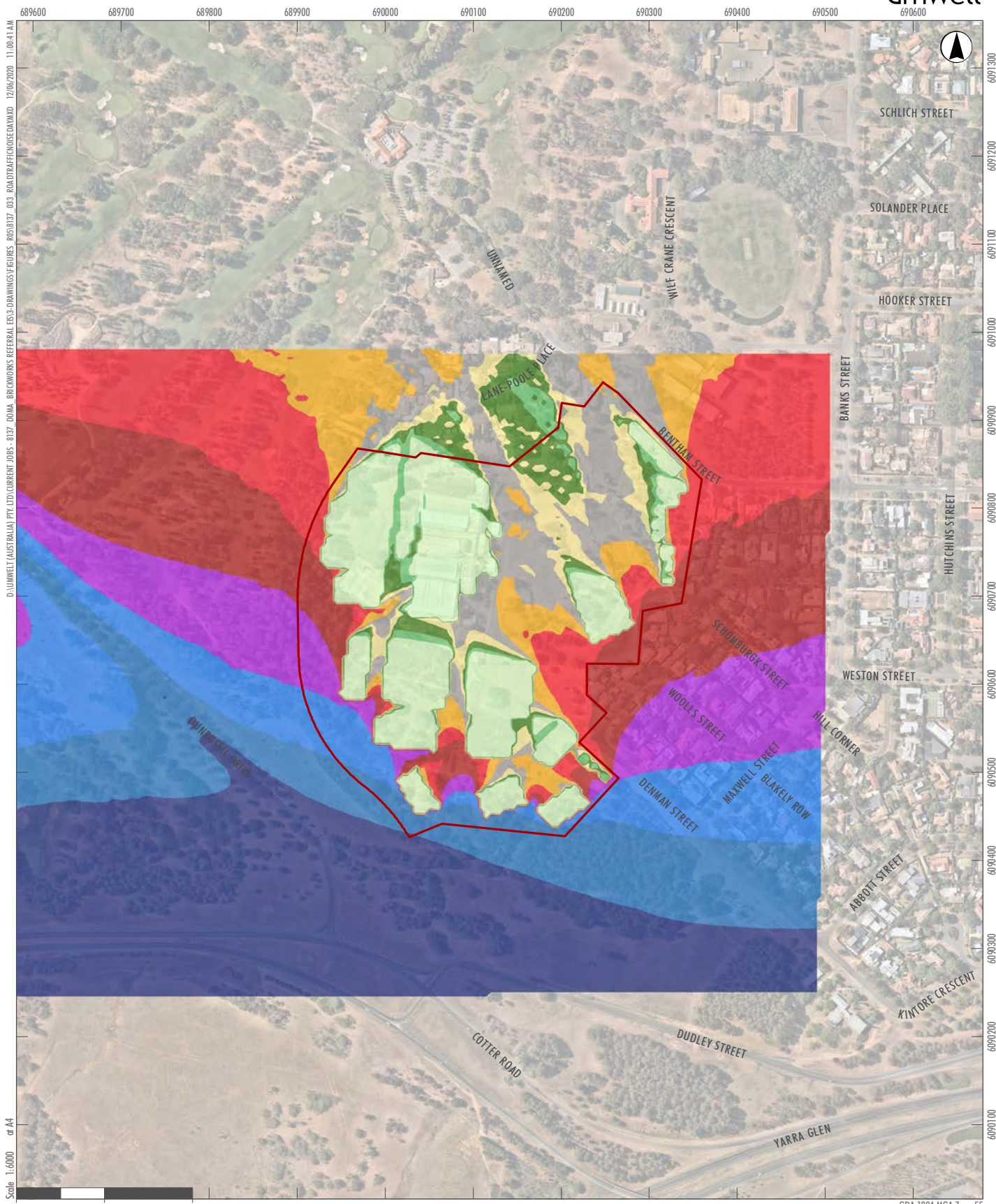
The traffic noise model was constructed using road and traffic volume data provided by the traffic consultant AECOM, shown in **Table 8.4**.



**Table 8.4 Traffic data used in road traffic noise modelling**

| Road                         | Number of Lanes | Speeds  | 7am – 10pm | 10 pm – 7 am | HV % |
|------------------------------|-----------------|---------|------------|--------------|------|
| Adelaide Avenue              | Two each way    | 80 km/h | 29566      | 2237         | 5.3% |
| Cotter Road                  | Two each way    | 80 km/h | 20240      | 1405         | 5.3% |
| Dunrossil Drive <sup>1</sup> | One each way    | 60 km/h | < 935      | < 65         | 1%   |
| Dudley Street                | One each way    | 60 km/h | 9104       | 421          | 5.3% |

Note: 1. Estimated data



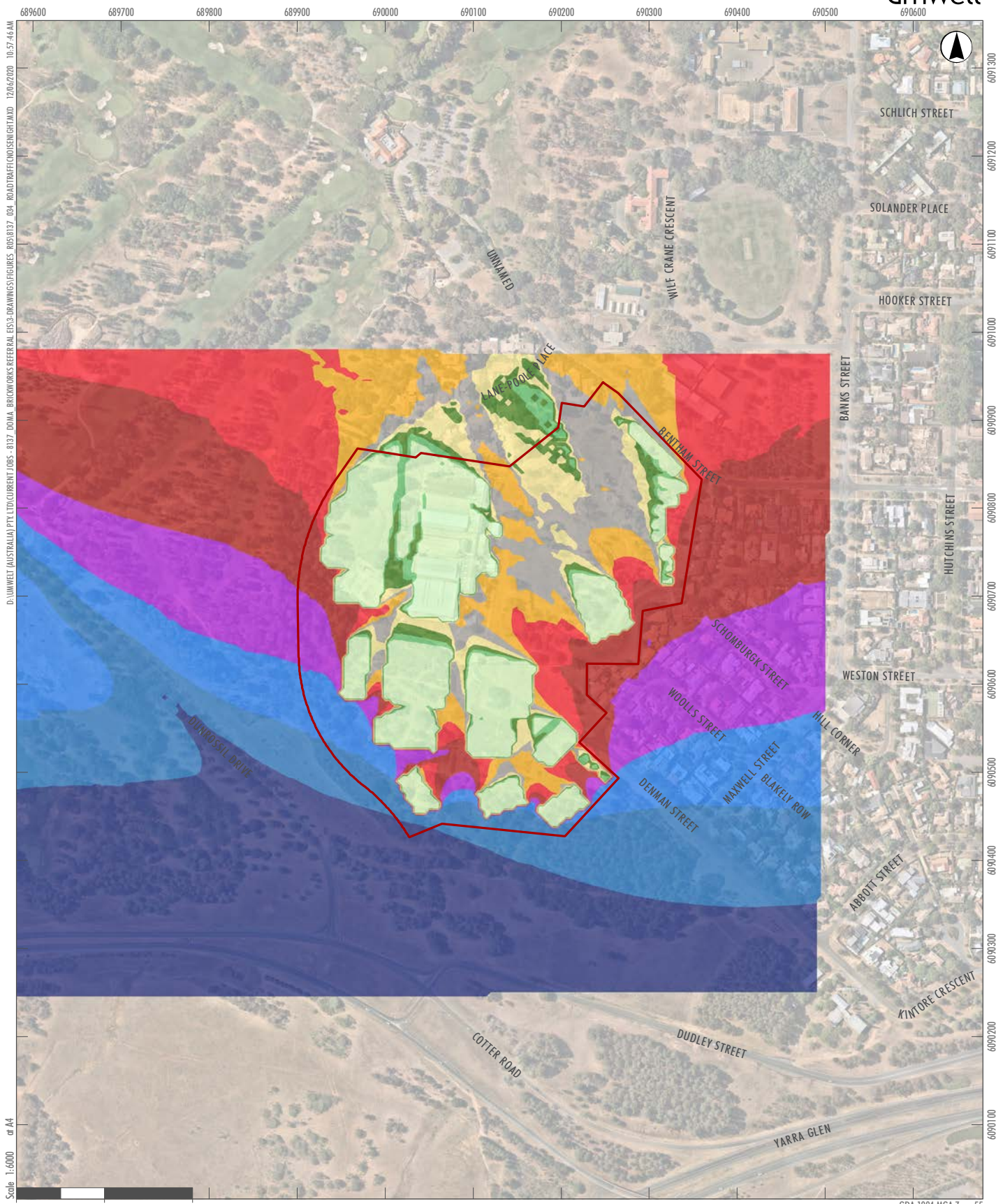
Scale 1:6000 or A4

0 100 200 Metres

**Legend**

|   |         |
|---|---------|
| <span style="border: 1px solid red; display: inline-block; width: 10px; height: 10px;"></span> Proposal Area                    | 46 - 48 |
| <span style="background-color: #f0e68c; display: inline-block; width: 10px; height: 10px;"></span> Predicted Road Traffic Noise | 48 - 50 |
| <span style="background-color: #ff69b4; display: inline-block; width: 10px; height: 10px;"></span> Day time $LA_{eq}$ (15 hour) | 50 - 52 |
| <span style="background-color: #90ee90; display: inline-block; width: 10px; height: 10px;"></span> <math>< 40</math>            | 52 - 54 |
| <span style="background-color: #32cd32; display: inline-block; width: 10px; height: 10px;"></span> 40 - 42                      | 54 - 56 |
| <span style="background-color: #2e8b57; display: inline-block; width: 10px; height: 10px;"></span> 42 - 44                      | 56 - 58 |
| <span style="background-color: #ffff00; display: inline-block; width: 10px; height: 10px;"></span> 44 - 46                      | 58 - 60 |
|   | > 60    |

**FIGURE 8.1**  
**Predicted Road Traffic Noise Levels – Day time period 7 AM to 10 PM  $LA_{eq}$ (15 hour)**



GDA 1994 MGA Zone 55

**Legend**

|   |  |
|---|--|
| <span style="border: 1px solid red; display: inline-block; width: 15px; height: 10px;"></span> Proposal Area                    | <span style="display: inline-block; width: 15px; height: 10px; background-color: #cccccc;"></span> 36 - 38 |
| <span style="display: inline-block; width: 15px; height: 10px; background-color: #ffcc00;"></span> Predicted Road Traffic Noise | <span style="display: inline-block; width: 15px; height: 10px; background-color: #ff9900;"></span> 38 - 40 |
| <b>Night time <math>LA_{eq}</math> (9 hour)</b>   | <span style="display: inline-block; width: 15px; height: 10px; background-color: #ff0000;"></span> 40 - 42 |
| <span style="display: inline-block; width: 15px; height: 10px; background-color: #90ee90;"></span> <math>< 30</math>            | <span style="display: inline-block; width: 15px; height: 10px; background-color: #800000;"></span> 42 - 44 |
| <span style="display: inline-block; width: 15px; height: 10px; background-color: #32cd32;"></span> 30 - 32                      | <span style="display: inline-block; width: 15px; height: 10px; background-color: #8a2be2;"></span> 44 - 46 |
| <span style="display: inline-block; width: 15px; height: 10px; background-color: #228b22;"></span> 32 - 34                      | <span style="display: inline-block; width: 15px; height: 10px; background-color: #1e90ff;"></span> 46 - 48 |
| <span style="display: inline-block; width: 15px; height: 10px; background-color: #ffff00;"></span> 34 - 36                      | <span style="display: inline-block; width: 15px; height: 10px; background-color: #4169e1;"></span> 48 - 50 |
|   | <span style="display: inline-block; width: 15px; height: 10px; background-color: #00008b;"></span> > 50    |

FIGURE 8.2

Predicted Road Traffic Noise Levels – Night time period 10 PM to 7 AM  $LA_{eq}$ (9 hour)

**Figure 8.1** indicates the road traffic noise levels at the nearest residential buildings from the arterial and collector roads identified in **Table 8.4** are predicted to marginally exceed the day-time  $L_{Aeq}(15 \text{ hour})$  criterion of 60 dB(A) (inc. façade reflection). The maximum predicted day-time  $L_{Aeq}(15 \text{ hour})$  noise level at the nearest receiver building is within the 58 to 60 dB(A) (free-field) band in **Figure 8.1**.

**Figure 8.2** indicates the road traffic noise levels at the nearest residential buildings from the arterial and collector roads identified in **Table 8.4** are predicted to be less than the night-time  $L_{Aeq}(9 \text{ hour})$  criterion of 55 dB(A) (inc. façade reflection). The maximum predicted night-time  $L_{Aeq}(9 \text{ hour})$  noise level at the nearest receiver building is within the 48 to 50 dB(A) (free-field) band in **Figure 8.2**.

The results of the road traffic noise assessment indicate that, with current traffic volumes and road configurations, noise mitigation such as noise barrier(s) and architectural acoustic treatments may be required to be implemented by the development for the residential buildings to control the external noise level generated by road traffic. The external road traffic noise levels may also be higher at higher floors within the proposed residential buildings.

## 8.3 Building construction acoustic design requirements

All proposed future developments within the Brickworks Precinct will be required to be designed and constructed in compliance with the acoustic performance requirements detailed in the BCA and the *Roads ACT Noise Management Guidelines*, Transport Canberra and City Services, 2018.

### 8.3.1 Building Code of Australia (National Construction Code Volumes 1 and 2)

The Australian Building Codes Board has published a Handbook of Sound Transmission and Insulation in Buildings. The Handbook provides non-mandatory advice for the design and construction of buildings regarding internal acoustics performance in relation to the *Building Code of Australia* (BCA). The Handbook states that the BCA does not address the issues such as noise entering the building from outside from any source for example from industrial processes, vehicle traffic, trains, aircraft or animals; or environmental noise emission from the building to surrounding areas.

### 8.3.2 Internal noise levels from road traffic

In accordance with the *Roads ACT Noise Management Guidelines*, a proposal for a noise-sensitive development [building] adjacent an arterial or major collector road may comply with the Guidelines by demonstrating that the building will be designed and constructed to achieve satisfactory levels of road traffic noise internally within the building. As discussed in Section 8.2, the traffic noise levels have been predicted to marginally exceed the external noise criteria at the nearest buildings therefore further assessment of the traffic noise is required during each phase. The satisfactory internal road traffic noise levels for different types of building occupancy are given in Australian/New Zealand Standard AS/NZS 2107-2016 *Acoustics – Recommended design sound levels and reverberation times for building interiors* (AS/NZS 2107) described in Section 8.3.3 below.

### 8.3.3 Australian Standard/New Zealand Standard 2107-2016

AS/NZS 2107 nominates a range of design internal sound levels within occupied spaces for various types of buildings. AS/NZS 2107 does not specify which types of noise sources that the internal design sound levels apply to.

### 8.3.3.1 Design sound levels within commercial occupancies in the precinct Heritage Area

As the future commercial uses within the precinct’s Heritage Area are currently unknown, the recommended internal design sound levels for individual occupancies within the precinct’s Heritage Area will need to refer to the appropriate guidance in Table 1 of AS/NZS 2107.

### 8.3.3.2 Design sound levels within residential buildings

AS/NZS 2107 provides recommended internal design sound levels for different types of residential accommodation buildings. For houses and apartments, AS/NZS 2107 provides guidance for buildings in areas with elevated ambient noise levels such as inner-city areas, entertainment districts or near major roads, and it also provides guidance for buildings in areas with lower ambient noise levels such as suburbs or near minor roads.

In the Brickworks estate Master Plan, the detached single-occupancy residential buildings are proposed to be located in areas that would be classified in AS/NZS 2107 as suburbs or near minor roads. The multi-unit apartment buildings are located relatively near Adelaide Avenue and Cotter Road, which are both major roads.

On this basis, the design sound levels for different types of occupied spaces within the different types of residential buildings in the Brickworks Precinct are shown in **Table 8.5**.

**Table 8.5 Recommended AS/NZS 2107 design sound levels in residential buildings in the Brickworks Precinct**

| Type of occupancy/activity                       | Design sound level (L <sub>Aeq,t</sub> ) range, dB(A) |                       |
|--|---|-----------------------|
|  | Single-occupancy detached houses                      | Multi-unit apartments |
| Apartment common areas (e.g., foyer, lift lobby) | n/a   | 45 to 50              |
| Living areas                                     | 30 to 40  | 35 to 45              |
| Sleeping areas (night-time)                      | 30 to 35  | 35 to 40              |
| Work areas                                       | 35 to 40  | 35 to 45              |

### 8.3.4 Australian Standard 3671-1989

AS 3671-1989 *Acoustics - Road traffic noise intrusion - Building siting and construction* (AS 3671) provides advice on the location and construction of buildings near major roads to provide adequate acoustic isolation performance of the external building envelope to achieve target noise levels within the building. The construction materials and designs of building elements recommended within AS 3671 the industry standard best practice at the time of publication of the Standard. Contemporary building construction materials and designs are now available that can achieve similar or better acoustic performance. AS 3671 allows buildings to be constructed with bespoke acoustic designs to achieve the recommended design noise levels.

## 8.4 Noise assessment and management requirements

A NIA and/or NMP may be required to be developed in support of a development application for future individual developments within the Brickworks Precinct. If a NIA and/or an NMP is requested by the Approval Authority to support the development application, it may need to address the noise impacts and management from the construction as well as the operational phases of the development. If an NMP is

required to support a development application, it should be prepared following the guidance given in *Guidelines for the Preparation of Noise Management Plans for Development Applications*, Environment Protection Authority, 2014. Some of the requirements of the Guidelines are reproduced in **Section 7.1** above.

## **8.4.1 Residential developments within the Brickworks Precinct**

### **8.4.1.1 Operational noise from residential developments**

The noise standards defined in the EP Reg apply to residential land uses, with some limitations. The noise standards do not apply to human sounds or typical domestic sounds. The noise standards would typically apply only to mechanical and/or electrical noise from sources such as:

- Air-conditioners or ventilation fans
- Pool pumps
- Garage roller doors
- Garbage collection

For these types of noise sources, the noise standards shown in **Table 2.6** would usually apply. However, for multi-unit developments, as stated in the EP Reg Part 3 Division 3.1 Section 24 (2) (a), *if the compliance point for noise emitted from a unit is a point in any of the other units in the units plan, the noise standard for the unit is 5 dB(A) below the noise standard that would otherwise apply.*

### **8.4.1.2 Noise received at residential developments**

As described in **Section 2.3.1**, a NMP may be required under the development and precinct codes for multi-unit housing and single residential housing within the Brickworks Precinct. For residential developments within the Brickworks Precinct that are potentially affected by noise from external sources (for example, commercial noise) the NMP would need to demonstrate that the acoustic design of occupied dwellings would meet the 'satisfactory' design sound levels in Australian Standard/New Zealand Standard 2107:2016 *Acoustics - Recommended level and reverberation times for building interiors* internally within dwellings.

In the case of road traffic noise received at proposed developments, as described in the *Roads ACT Noise Management Guidelines* Section 4 Schedule 1, the developer may choose whether to control the road traffic noise to achieve the target external road traffic noise level (for example, by the construction of noise barriers) or to achieve the AS/NZS 2107 target internal noise levels using architectural acoustic treatments to the receiver building(s)' external envelope, or by a combination of both types of treatments.

### **8.4.1.3 Construction noise from construction of residential developments**

The restrictions for noise from building work during construction of future developments within the precinct are detailed in Schedule 2 of the EP Reg, as shown in **Table 8.6**.

**Table 8.6 Time restrictions for building work to manage noise impacts**

| Building Work Details                                 | Monday to Saturday | Sunday and public holidays                   |
|---|--------------------|--|
| Industrial, city and town centre areas                | 6am to 8pm         | 6am to 8pm                                   |
| Any other area when work completed within 2weeks      | 7am to 8pm         | 8am to 8pm                                   |
| Any other area when work not completed within 2 weeks | 7am to 6pm         | Building work must not exceed Noise Standard |

Source: EP Reg (2005)

The Noise Standard for receivers on land adjoining the Brickworks Precinct are shown in **Table 8.7**. The Noise Standard applies at the shared boundary of the precinct and the adjoining land containing the receiver. The time restrictions in **Table 8.7** are based on the construction works' duration being longer than 2 weeks.

**Table 8.7 Noise Standard at the boundary of the development for construction noise impacts**

| Noise Zone | Noise Standard, LA10(10 minutes <sup>1</sup> ) dB(A)                        |   |
|------------|---|---|
|            | Monday to Saturday (6pm to 10pm)<br>Sunday / Public Holiday (8 am to 10 pm) | 'Any other time'<br>Monday to Saturday (10pm to 7am)<br>Sunday / Public Holiday (10pm to 8am) |
| G          | 45  | 35  |

Source: EP Reg (2005) Table 2.2

In addition to the restrictions outlined in **Table 8.6**:

- All relevant noise reduction measures mentioned in Australian Standard 2436-2010 (Reconfirmed 2016) *Guide to noise and vibration control on construction, demolition and maintenance sites (AS 2436)*, as in force from time to time, must be implemented
- schedule noisy activities for the least sensitive times of the day such as mid-morning and mid-afternoon
- select machinery that produce less noise, and
- ensure machinery is well maintained.

#### **Australian Standard 2436 -2010(R2016)**

AS 2436 provides many recommendations for managing noise and vibration impacts from construction sites. Some of the standard noise control strategies commonly employed on typical construction sites are described in **Section 7.2**.

### **8.4.2 Commercial developments within the Brickworks Precinct**

Potentially noisy land uses within the precinct will be required to comply with the applicable Rules (R23) in the Territory Plan 2008 – Commercial Zones Development Code, Element 6: Noise, as shown in **Table 8.8**.

**Table 8.8 Territory Plan 2008 – Commercial Zones Development Code, Element 6: Noise – Rules**

| Rules   |
|---|
| 6.1 Potentially noisy uses  |
| <p>R23</p> <p>This rule applies to any of the following:</p> <ul style="list-style-type: none"> <li>a) club</li> <li>b) drink establishment</li> <li>c) emergency services facility</li> <li>d) hotel</li> <li>e) indoor recreation facility</li> <li>f) industry (except light industry)</li> <li>g) indoor entertainment facility</li> <li>h) outdoor recreation facility</li> <li>i) restaurant.</li> </ul> <p>Development complies with a noise management plan prepared by a suitably qualified person and endorsed by the Environment Protection Authority (EPA).</p> <p>The noise management plan will detail the proposed design, siting and construction methods that will be employed to ensure compliance with the Noise Zone Standard as detailed in the Environment Protection Regulation 2005, based on the estimated noise levels when the facility is in use.</p> <p>Note: A condition of development approval may be imposed to ensure compliance with the endorsed noise management plan.</p> |

The Commercial Zones Development Code imposes the rule that any potentially noisy development within the precinct of the types a) to i) listed in **Table 8.8** will require a noise management plan which will demonstrate how the development will achieve compliance with the Noise Zone Standard. As the Brickworks Precinct land is zoned as Commercial Zone CZ6, the entire precinct is classified as Noise Zone F in the EP Reg Schedule 2, Parts 2.1 and 2.2. Table 2.2 in the EP Reg Schedule 2 Part 2.2 states that the noise standards for developments within Noise Zone F zones are the “*same as the noise standard for the adjoining noise zone with the loudest noise standard for the time period*”.

The adjoining land uses on all boundaries of the Brickworks Precinct are classified as noise Zone G in EP Reg Schedule 2 Part 2.1 Table 2.1. As per EP Reg Schedule 2 Part 2.2 Table 2.2, these noise standards also apply to all developments within the Brickworks Precinct. The noise standards applicable to all potentially noisy developments within the precinct will be as shown in **Table 8.9**. The noise standards apply at the boundary of the development that emits the noise.

**Table 8.9 Noise standards at the boundary of the development**

| Noise Zone | Noise Standard, LA10(10 minutes <sup>1</sup> ) dB(A)                        |   |
|------------|---|---|
|            | Monday to Saturday (7am to 10pm)<br>Sunday / Public Holiday (8 am to 10 pm) | ‘Any other time’<br>Monday to Saturday (10pm to 7am)<br>Sunday / Public Holiday (10pm to 8am) |
| G          | 45  | 35  |

Source: EP Reg (2005) Table 2.2

It is important to note that the Noise Zone Standards will apply to noisy individual developments within the Brickworks Precinct only during operation of the individual development.



Noise emissions during the construction of the development are not required to comply with the noise standards in the EP Reg Table 2.2 provided the noise occurs within the time restrictions shown in **Table 8.10** (from **Table 2.1**).

**Table 8.10 Noise restrictions for building work - EP Reg (2005) for the Brickworks Precinct**

| Monday to Saturday | Sunday and public holidays                   |
|--------------------|--|
| 7am to 6pm         | Building work must not exceed Noise Standard |

## 9.0 Conclusions and Recommendations

### 9.1 Construction noise

The predicted construction noise levels indicate that construction noise during development of the precinct will be audible in the surrounding areas. It is recommended that all construction activities with the potential to create noise be restricted to within the hours 7 am to 6 pm Monday to Saturday, except public holidays. It is anticipated that some construction activity may be required from time to time outside of standard construction hours, these works will require approval from the regulatory authorities.

#### Construction Vibration

For the assessment of vibration at residential buildings for potential structural damage, it is recommended that the criteria that are commonly used in New South Wales (NSW) be adopted for all developments within the Brickworks Precinct. The relevant criteria are given in British Standard 7385 Part 2 – *Evaluation and measurement of vibration in buildings*, 1993.

For the assessment of human perception of vibration within buildings, it is recommended that the criteria that are commonly used in NSW be adopted for all developments within the Brickworks Precinct. The relevant criteria are given in the NSW *Assessing vibration: a technical guideline*, NSW Department of Environment and Conservation, 2006.

It is recommended that a site-specific set of vibration criteria be developed for the heritage structures in the Brickworks Precinct. These site-specific vibration criteria should be derived and recommended by a suitably qualified Structural Engineer.

### 9.2 Road traffic noise

The predicted road traffic noise levels within the precinct due to traffic on nearby roads, based on current traffic volumes and road configurations, are expected to marginally exceed the target external road traffic noise levels at the nearest buildings to the road.

When development applications are prepared for the future development stages within the Precinct, if an assessment of road traffic noise impacts is required for an application, it is recommended that contemporary road traffic noise modelling be undertaken at the time to confirm the predicted noise levels with updated traffic volumes and road configurations.

### 9.3 Preparation of noise management plan

It is recommended that the NMP for development of the Brickworks Precinct be prepared in accordance with the *Guidelines for the preparation of Noise Management Plans for development applications* (EPA, 2014).

The NMP should address the mitigation and management of noise during the construction phase and the operation of the Precinct. The NMP should clearly specify that “operation” of the Precinct excludes noise from any construction or operation of the future developments within the Precinct.

## **9.4 Recommended assumptions for future development applications**

### **9.4.1 Developments outside the Brickworks Precinct**

Regarding the assessment of operational noise impacts for proposed developments outside the Brickworks Precinct, it is considered and recommended that all future noise impact assessments and noise management plans to be prepared should be undertaken assuming that all buildings in the Brickworks Precinct Master Plan have been completed and are fully occupied with residential and/or commercial occupants as per the Master Plan. For acoustics impact assessment purposes, this should include consideration of:

- The sensitive receivers located within land uses adjoining the Brickworks Precinct.
- The sensitive receivers in all existing (at the time of the future DA) and expected future buildings within the precinct as proposed in the Master Plan.
- The sound propagation acoustic shielding and reflections caused by the physical structures of the expected future buildings within the Brickworks Precinct as proposed in the Master Plan.

### **9.4.2 Developments within the Brickworks Precinct**

In the case of the future development stages within the Brickworks Precinct, it is considered that the acoustic designs of all proposed land uses should be permitted to assume that all other elements of the Brickworks Precinct have been developed to the full extent of the Master Plan. That is, while preparing a Noise Management Plan for an individual Development Application for any type of proposed land use within the Brickworks Precinct, the acoustic designer should be permitted to assume that the acoustic shielding to be provided by all existing and future buildings, structures and terrain features in the Brickworks Precinct Master Plan can be included in the relevant acoustic calculations and/or modelling. The road traffic noise modelling that has been provided in this NIA for the Brickworks Precinct has been undertaken assuming that all buildings shown in the Master Plan have been constructed and are thereby providing acoustic shielding and reflections that should be taken into account when designing the acoustic isolation performance of the external facades of all of the buildings in the Brickworks Precinct.

## 10.0 References

A Resident's Guide to Sound in Mixed Use Areas

<https://www.accesscanberra.act.gov.au/app/home/cityservices/noiseportal> (accessed 28 May 2020)

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Assessing Vibration: A Technical Guideline, NSW Department of Environment and Conservation, 2006

Australian Capital Territory Environment Protection (Noise Measurement Manual) Approval 2009 (No 1)

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Australian Standard/New Zealand Standard 2107:2016 Acoustics – Recommended design sound levels and reverberation times for building interiors, Standards Australia/Standards New Zealand, 2016

Australian Standard 2436-2010(R2016) Guide to noise and vibration control on construction, demolition and maintenance sites, Standards Australia, 2016

Australian Standard 3671-1989 – Acoustics – Road Traffic noise intrusion- Building siting and construction, Standards Australia, 1989

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Calculation of Road Traffic Noise (CoRTN), UK Department of Transport (Welsh Office), 1988

Construction Noise and Vibration Guideline, Transport for New South Wales (Roads and Maritime Services), April 2016

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Environmental Protection Act 1997

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Guidelines for the Preparation of Noise Management Plans for Development Applications, Environment Protection Authority, February 2014

ISO 2631-2:2003 Mechanical vibration and shock – Evaluation of human exposure to whole-body vibration – Part 2: Vibration in buildings (1 Hz to 80 Hz), International Organization for Standardization, 2003

National Construction Code Volumes 1 and 2 / Building Code of Australia

Noise pollution law – Fact Sheet # 11, Environmental Defender's Office (ACT), March 2010

Preliminary (Geotechnical) Site Investigation for the Canberra Brickworks, SMEC Ref: 3002369, 8 November 2013

Territory Plan 2008, version R234, Published 28 February 2020, Effective 28 February 2020

- 4.1 CZ6 – Leisure and Accommodation Zone Objectives, Effective 19 August 2016
- 4.2 Commercial Zones Development Code, Effective 21 February 2020
- 10.1 Suburb Precinct Maps and Codes - Yarralumla Precinct Map and Code, Effective 14 December 2012

