11 Airport construction and ground operations noise

Noise associated with airport operations would be generated from a number of on-site sources, including aircraft taxiing and the ground running of aircraft engines for maintenance testing. Other operational noise sources associated with the airport include airport traffic using the surrounding road network. Noise generated by airport construction activities both on-site and resulting from the movement of vehicles and equipment have also been assessed.

Monitoring was undertaken in areas surrounding the airport site to determine existing background noise levels and identify assessment criteria for the construction and operational phases of the proposed airport development. Dominant noise sources include road traffic noise and local industry, reflecting the predominantly rural residential nature of the area. Construction and operation of the proposed airport would introduce new noise sources.

The Airports (Environment Protection) Regulations 1997 provide the regulatory framework for noise generated at an airport site other than noise generated by aircraft in flight, landing, taking off or taxiing. These regulations include specific limits for certain activities, including construction activities, at certain times of the day and provide other more general principles to avoid offensive noise that intrudes on individual, community or commercial amenity. Although aircraft taxiing is not considered to be part of the ground-based noise regulatory framework established under the Airports (Environment Protection) Regulations, it has been included in this chapter for noise assessment purposes.

Noise during construction of the proposed airport would be largely confined within the airport boundary, although there would be some impacts on Luddenham and Badgerys Creek under worst case meteorological conditions. Construction vehicles would need to access the airport during the construction stage. Modelling indicates that the resulting increase in traffic noise would not be audible. Vibration and airblast levels have been assessed in the event that blasting is required during construction. The assessment identifies precautionary measures that would likely be required to avoid significant vibration and airblast levels at surrounding sensitive receivers. Vibration generated by other construction activities and equipment is unlikely to cause building damage outside the airport site.

The primary sources of ground-based noise during operations would be aircraft engine maintenance testing and taxiing. Under worst case meteorological conditions, noise associated with engine maintenance testing has the potential to exceed the noise criteria established for this assessment in Luddenham, Badgerys Creek, Bringelly, Wallacia and Greendale. The impact of noise from taxiing extends over a much smaller area and would primarily affect Luddenham. Noise criteria were also established for other non-residential land uses, such as educational and recreational uses. The assessment indicates that five educational institutions, three places of worship, two passive recreation areas and one active recreation area are predicted to be affected by noise levels above the assessment criteria.

During the operation of the Stage 1 development, road traffic generated by the airport would increase local noise levels. Apart from a section of the proposed M12 Motorway and Elizabeth Drive, noise level increases attributable to airport traffic would be less than 2 dBA. Any new road construction or realignments as part of the Western Sydney Infrastructure Plan (or other road improvements over time) would be subject to separate environmental assessment and approvals processes including any necessary noise mitigation.

Mitigation measures have been proposed to address noise during construction of the proposed airport. These include the implementation of a Noise and Vibration Construction Environmental Management Plan. Operation of the proposed airport would be subject to further detailed design including further analysis of the location of noise generating facilities and activities, and detailed consideration of practicable noise mitigation measures for engine maintenance testing.

11.1 Introduction

This chapter provides a review of the potential construction, road traffic and ground-based operational noise and vibration impacts associated with the proposed airport. This includes consideration of:

- construction activities, including the noise and vibration generated by construction activities and equipment, blasting (if required) and construction traffic accessing the airport site;
- ground running of aircraft engines for maintenance testing;
- taxiing of aircraft; and
- road traffic changes in the surrounding area as a result of airport operations.

This chapter draws upon a comprehensive assessment of these ground-based noise sources included as Appendix E2 (Volume 4). It addresses the requirements of the EIS guidelines issued by the Australian Government Department of the Environment.

Aircraft overflight noise and noise generated during take-offs and landings, including reverse thrust noise, are addressed separately in Chapter 10 and by the comprehensive assessment of aircraft overflight noise included in Appendix E1 (Volume 4). Appendix E1 (Volume 4) includes a description of the framework under which noise from aircraft in flight is managed in Australia.

11.2 Methodology

11.2.1 Construction noise and vibration assessment methodology

For assessment purposes, construction activities for the proposed Stage 1 development are assumed to occur in three major work phases:

- site preparation activities (including major earthworks);
- aviation infrastructure activities; and
- site commissioning activities.

The bulk earthworks component of construction is expected to generate the most noise and therefore has been used as the basis of a ‘worst case’ construction noise assessment.

To predict construction noise levels in the surrounding area, typical sound power levels of the plant likely to be used during major earthworks were incorporated in a CadnaA proprietary noise model. Worst case weather consistent with a temperature inversion was also incorporated in the model. Temperature inversions cause sound to be deflected back toward the ground resulting in higher noise levels at receivers. They tend to occur in the evening and at night and can extend into the morning under calm conditions. Temperature inversions tend to be more common during cooler months when the air at the surface is cooler than the air above and the ability of the ground surface to heat during the early morning is diminished.

An assessment of vibration during the construction phase included consideration of typical vibration generating plant, the distance to vibration-sensitive receivers and relevant guideline values set out in German Standard DIN 4150-3 *Structural Vibration: Effects of Vibration on Structures.* As construction might also involve the use of blasting, vibration and airblast noise levels generated from potential blasting activities were also assessed in relation to criteria recommended by the Australian and New Zealand Environment and Conservation Council.

11.2.2 Ground-based operations noise assessment methodology

Ground-based operations noise levels were predicted for the operation of the Stage 1 development based upon a demand of 10 million annual passenger movements, which is predicted to occur around five years after operations commence at the proposed airport. Noise levels were reported as A-weighted decibels (dBA), which is an expression of the relative loudness of sounds as perceived by the human ear. The following noise sources were considered:

- aircraft engine maintenance testing (or engine run-up) noise – it has been assumed that aircraft engine running would occur at a maintenance area nominally located in the western part of the airport site as shown in Figure 11–1. While the orientation of an aircraft during run-up would change depending on prevailing wind conditions, a conservative approach was adopted for this assessment by assuming that the emitted noise would be omnidirectional and at a level of 151 dBA. High power engine runs are expected to be relatively rare during Stage 1 operations and it has been conservatively assumed that no more than one run on full power would occur in a night and for no more than five minutes; and
- aircraft taxiing noise – the proposed aircraft taxi path is shown in Figure 11–1. A sound power level for each aircraft of 138 dBA has been assumed, being the highest level measured for aircraft taxiing at Brisbane Airport (B777, B747, B737, B717 and A330).

The assessment of noise impacts in this EIS has been based on aircraft types that are commonplace today, including the Boeing 747 and the Airbus A320. As indicated in Chapter 10, it is expected that quieter aircraft would be progressively introduced following the commencement of operations at the proposed airport, and consequently, the ground-based noise modelling is considered conservative. The Boeing 747 is the loudest aircraft anticipated to operate at the proposed airport and airlines are already beginning to retire it from regular passenger services.

Noise contours were generated for aircraft ground running and taxiing using CadnaA noise prediction software. Certain meteorological conditions such as temperature inversions and light winds may increase noise levels at nearby receivers, by focussing sound wave paths at a single point. Worst case weather consistent with a temperature inversion was assumed in the modelling conducted for this EIS. For engine run-up noise predictions, it was also assumed that there would be shielding from a maintenance building near the run-up area as shown on Figure 11–1.

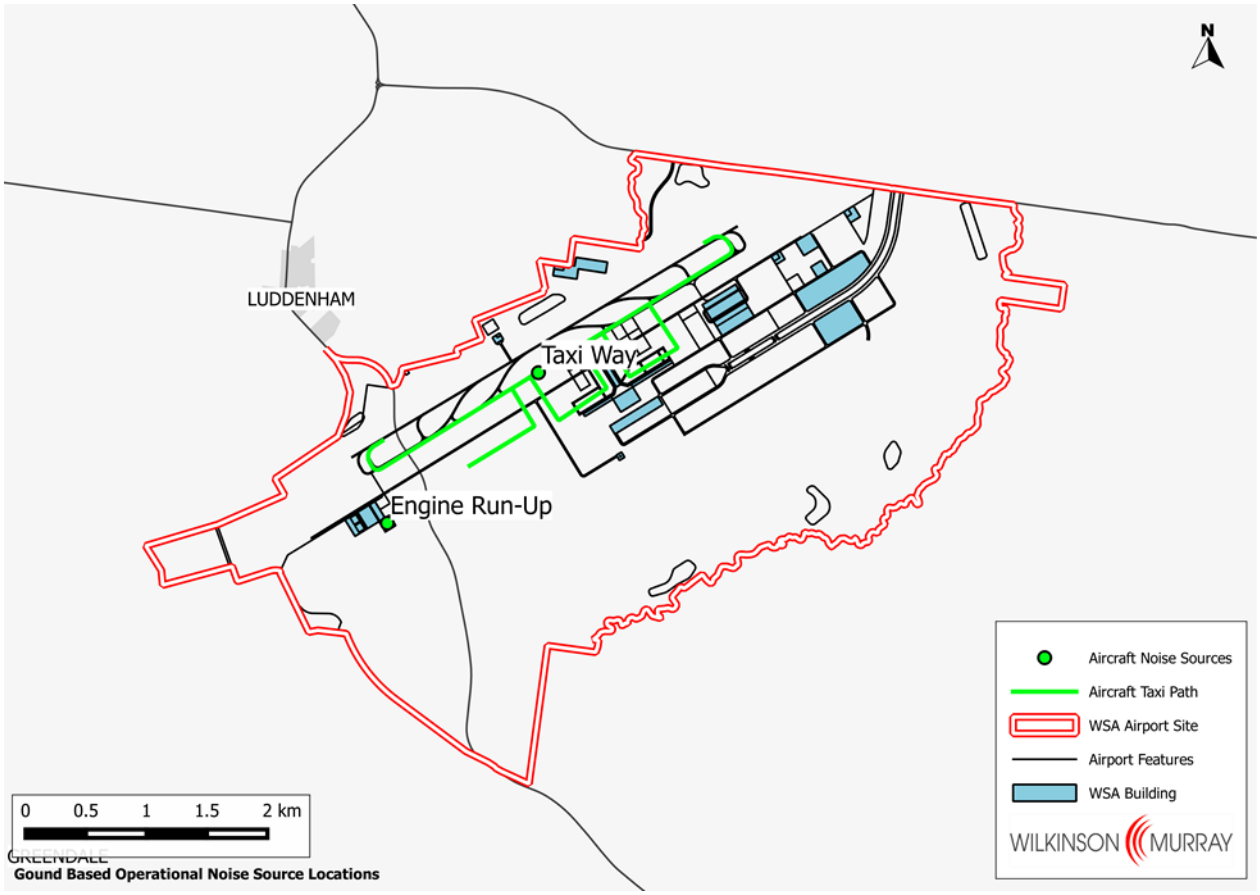


Figure 11–1 Ground-based noise source locations

Noise from vehicle movements and mechanical plant at the airport site has not been specifically assessed because it would be at a much lower level than that produced by the other operations. The use of auxiliary power units while aircraft are stationary at gates or stands has also not been assessed because aircraft are generally expected to be connected to mains power and preconditioned air when stationary at the proposed airport.

11.2.2.1 Revisions to engine run-up and taxiing modelling approach

Noise contours were prepared and incorporated in the draft EIS using the CadnaA proprietary computer modelling software including the prediction algorithms taken from ISO 9613-1:1993 *Acousitcs – Attenuation of Sound during Propagation Outdoors – Part 1: Calculation of the Absorption of Sound by Atmosphere* with the Concawe Class F stability.

Subsequent to publication of the draft EIS and during further analysis of ground running noise mitigation options, it was found that the ISO algorithm had led to unexpected and inconsistent results. Accordingly, the revised operational noise contours presented in this chapter have been prepared using CadnaA incorporating the Concawe prediction algorithm and Concawe Class F stability. The use of the Concawe algorithms results in the effects of ground absorption being taken into account more accurately.

11.2.3 Road traffic noise assessment methodology

The traffic and transport assessment presented in Chapter 15 modelled road traffic projections for major roads in the vicinity of the airport site both with and without the proposed airport. The traffic projections were used to calculate noise levels at typical distances from roads near the airport site using the 'Calculation of road traffic noise' procedure (CoRTN). CoRTN was developed by the United Kingdom Department of the Environment in 1988 and has been modified for Australian conditions and is extensively used for similar types of assessments.

11.3 Existing environments

Ambient noise levels in the vicinity of the airport site are reflective of the mostly rural residential character of the area, with dominant existing noise sources including road traffic and industry. Understanding the background noise environment is important as this is used to determine criteria against which the potential impacts associated with the construction and operation of the proposed airport can be assessed.

Background noise measurements were carried out at 11 locations selected to represent potentially affected areas over the period Monday 23 March to Thursday 2 April 2015. Additional measurements were conducted at Luddenham during March 2016. The background noise measurements were carried out in accordance with AS1055:1997 and are presented in Appendix E2 (Volume 4).

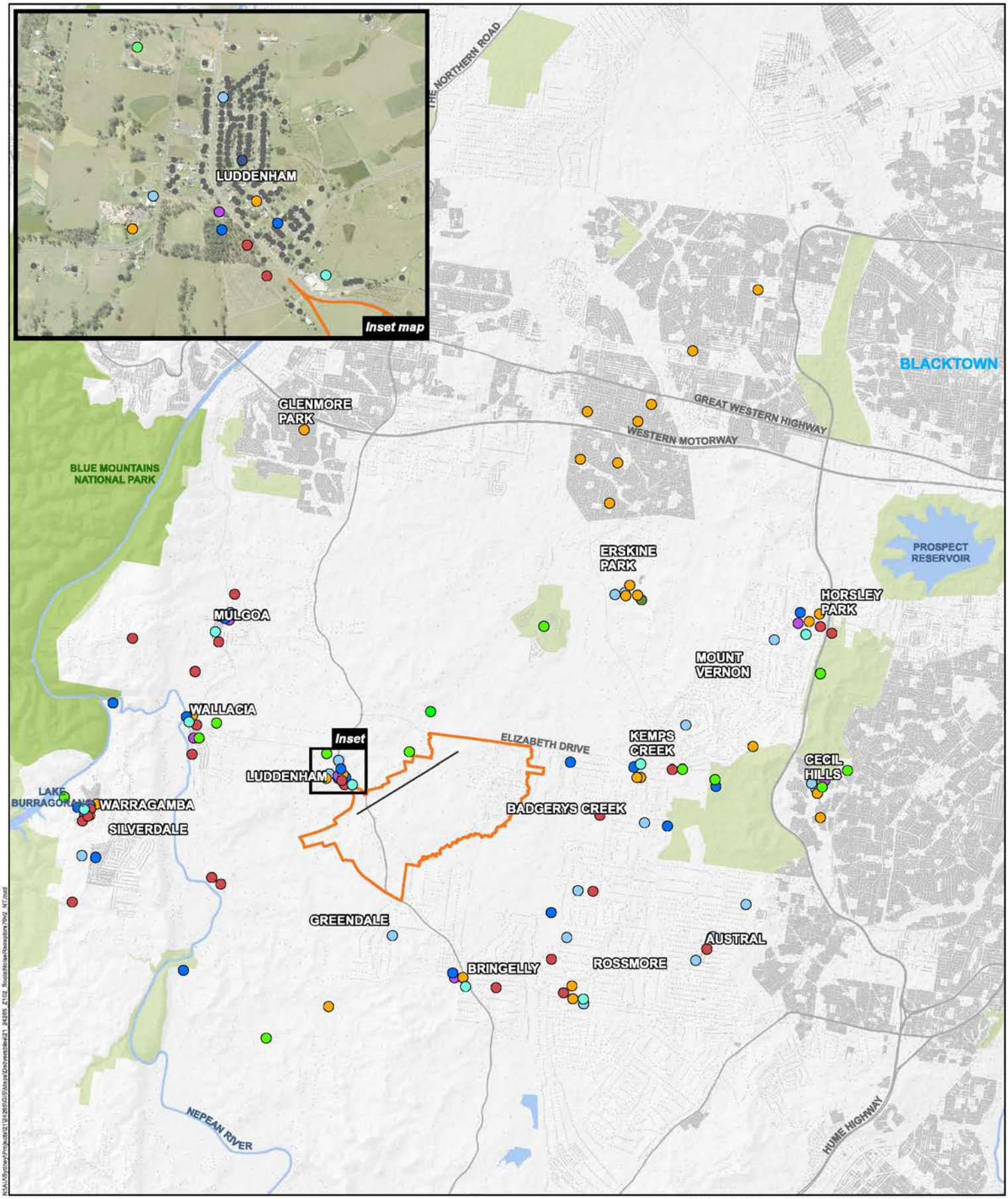
From the measurement data, the Rating Background Level (RBL) as defined in the NSW Industrial Noise Policy was determined for the selected locations. The respective RBL values are presented in Table 11–1.

Table 11–1 Rating background levels

Location	Measurement duration	Rating background level (dBA)		
		Day (7am – 6pm)	Evening (6pm – 10pm)	Night (10pm – 7am)
9 Harold Bentley Way, Glenmore Park	Mon 23/3/15 – Thu 2/4/15	39	42	38
16 Park Avenue, Springwood	Wed 25/3/15 – Thu 2/4/15	29	32	24
17 Blue Ridge Place, Orchard Hills	Mon 23/3/15 – Tue 31/3/15	34	38	36
25 Peter Pan Avenue, Wallacia	Mon 23/3/15 – Thu 2/4/15	37	34	28
27 Dwyer Road, Bringelly	Mon 23/3/15 – Thu 2/4/15	33	38	35
35 Ramsay Road, Rossmore	Fri 27/3/15 – Thu 2/4/15	35	37	35
54 Ridgehaven Road, Silverdale	Thu 26/3/15 – Thu 2/4/15	36	36	31
114 Mount Vernon Road, Mount Vernon	Mon 23/3/15 – Thu 2/4/15	34	35	33
120 Vincent Avenue, Mulgoa	Mon 23/3/15 – Tue 31/3/15	38	42	35
Twin Creeks Golf Club, 2 Twin Creeks Drive, Luddenham	Thu 26/3/15 – Thu 2/4/15	34	38	33
8 Wade Close, Luddenham	Mon 7/3/16 – Wed 16/3/16	35	36	34

According to the NSW Industrial Noise Policy, where the RBL has been measured as less than 30 dBA, it should be assumed to be 30 dBA for the purpose of setting noise criteria. This applies to the RBL at the Springwood and Wallacia locations.

Noise-sensitive receivers in the area around the proposed airport include residences, schools and other educational facilities, hospitals and other health care facilities. The identified sensitive receivers are shown in Figure 11–2.



LEGEND

- Airport site
- **Sensitive receivers**
  - Residential
  - Aged Care
  - Childcare
  - Community Centre
  - Education
  - Park
  - Recreation
  - Religious Facility
  - Shopping Centre
- Runway

Data Source: Please refer to "Digital Data Sources" on the second page of the EIS

Figure 11-2 - Sensitive Receivers surrounding the airport site

0 1 2 4 Kilometres

11.4 Regulatory framework, guidelines and criteria

11.4.1 Airports (Environment Protection) Regulations 1997

The Airports (Environment Protection) Regulations provide the regulatory framework for noise generated at an airport site other than noise generated by aircraft in flight, landing, taking-off or taxiing. The regulations provide for appointment of an airport environment officer at each airport to oversight the operation of the regulations.

Under the regulations, operators of an undertaking at an airport have a duty to take all reasonable and practicable measures to prevent the generation of 'offensive noise' or if prevention is not reasonable or practicable, to minimise the generation of offensive noise from the undertaking. Noise is considered 'offensive' if the noise is generated at a volume, in a way, or under a circumstance that, in the opinion of an airport environment officer, offensively intrudes on individual, community or commercial amenity. The regulations set out certain factors that an airport environment officer must take into account in forming this opinion. These factors include the volume, tonality and 'impulsive character' of the noise, the time of day and duration of the noise, background noise levels when the noise is generated, and the location of sensitive receptors (or commercial receptors if there is no affected sensitive receptor) in relation to the noise.

In forming this opinion, airport environment officers must also take into account the excessive noise guidelines in the regulations. The excessive noise guidelines set out specific indicators of excessive noise in relation to specific types of noise, such as noise from construction, road traffic and rail traffic.

In relation to ground-based engine running, there are no specific indicators; however, the regulations provide that noise should be generated consistently with the master plan for the airport (see below). Noise levels are to be determined using AS 1055.

In relation to other airport activities such as aircraft refuelling, aircraft repairs, operation of plant and machinery, embarkation or disembarkation of passengers and operation of audible alarms and warning systems, the guidelines provide that noise should not exceed background noise levels at the sensitive receptor site between 7.00 am and 10.00 pm by more than 5 dBA and between 10.00 pm and 7.00 am by more than 3 dBA.

The question of whether the measures taken by operators to prevent or minimise the generation of offensive noise are 'reasonable and practicable' is a judgment to be made by an airport environment officer. In making this judgment, the officer must have regard to the circumstances in which the noise is generated, the state of technical knowledge about preventing or minimising noise from the relevant kind of undertaking, and all measures that might practicably be used to prevent or minimise the noise.

11.4.1.1 Environment protection orders

Airport environment officers have the power to enforce compliance with the duty to avoid excessive noise by issuing an environment protection order. If an airport environment officer finds that an operator is in breach of the duty, the officer may make an environment protection order directing the operator to comply with the duty by taking particular action to prevent or minimise the excessive noise. Failure to comply with an environment protection order is a breach of the Regulations and an offence under the *Airports Act 1996*.

11.4.1.2 Monitoring

Under the regulations, the ALC is required to monitor the level of noise generated at the airport, in accordance with the environment strategy in the airport master plan. If monitoring discloses excessive noise, the ALC must give to the airport environment officer a written report about the excessive noise and the details of any remedial action being taken.

11.4.1.3 Master plan environment strategy obligations

The ALC will be required to include an environment strategy in its first draft master plan. The environment strategy must detail the sources of environmental impact associated with civil aviation operations at the airport; the monitoring to be carried out in connection with the environmental impact; and the measures to be carried out to prevent, control or reduce this impact. It is required to include the proposed systems of testing, measuring and sampling to be carried out for possible or suspected excessive noise. Procedures in relation to how and when engine run-ups can be undertaken would be established under the environment strategy. Each master plan, including the environment strategy, is subject to a public consultation process and requires approval from the Infrastructure Minister.

Table 11–2 includes key requirements from the Airports (Environment Protection) Regulations relevant to ground operations.

Table 11–2 Relevant Airports (Environment Protection) Regulations 1997 requirements

Reference	Subject	Provision
2.04	What is offensive noise	1. Noise that is offensive occurs when noise is generated at a volume, or in a way, or under a circumstance, that, in the opinion of an airport environment officer, offensively intrudes on individual, community or commercial amenity. 2. In forming an opinion, an airport environment officer must have regard to: a. the volume, tonality and impulsive character (if any) of the noise; and b. the time of day, and duration, of the noise; and c. background noise levels at the time the noise is generated; and d. the location, in relation to the source of the noise, of: i. sensitive receptors; or ii. if there is no affected sensitive receptor — commercial receptors; and e. the excessive noise guidelines in Schedule 4 of the regulations (see below).
4.06	General duty to prevent offensive noise occurring	3. The operator of an undertaking at an airport must take all reasonable and practicable measures: a. to prevent the generation of offensive noise from the undertaking; or b. if prevention is not reasonable or practicable — to minimise the generation of offensive noise from the undertaking An operator of an undertaking at an airport is complying with that duty if the noise meets the guidelines in Schedule 4 of the regulations (or any local standard set by or authorisation given by the Minister).
Schedule 4 – 2.02	Noise from construction, etc.	Noise generated from construction, maintenance or demolition of a building or other structure at an airport should not exceed 75 dB(A) at the site of a sensitive receptor.

Reference	Subject	Provision
Schedule 4 – 2.03	Noise from road traffic	Noise generated from road traffic should not exceed: a. 60 dB(A), calculated as the equivalent continuous A−weighted sound pressure level for a 24 hour period of measurement; and b. 55 dB(A), calculated as the equivalent continuous A−weighted sound pressure level for an 8 hour period of measurement from 22:00 hours on a particular day to 06:00 hours on the following day.
Schedule 4 – 2.05	Noise from ground−based aircraft operations	For ground−based aircraft operations, there are no indicators of noise that is excessive, but a number of considerations apply in determining whether noise is excessive. The environment strategy included in the master plan is required to identify sources of environmental impacts including noise and address measures to be carried out by the ALC for the purposes of preventing, controlling or reducing those impacts. The regulations identify specific considerations in relation to ground-based aircraft operations including: a. the distance between the source of the noise and the site of the sensitive receptor; and b. the background noise level; c. the time of day when the noise occurs; and d. if the noise source is an aircraft engine — the power setting of the engine.
Schedule 4 – 2.06	Noise from other airport operations	Noise generated from any of the following activities: a. aircraft refuelling; b. activities in connection with aircraft that do not involve the operating of an aircraft engine (for example, moving, maintaining or repairing aircraft); c. operation of plant or machinery; d. assembling of passengers or goods in connection with embarkation or disembarkation of aircraft; and e. operation of fixed audible alarm or warning systems. Noise generated from an activity should not exceed the background noise level at the sensitive receptor site: a. between the hours of 07:00 and 22:00 — by more than 5 dB(A); and b. between 22:00 hours of a day and 07:00 hours of the next day — by more than 3 dB(A).

11.4.1.4 Aircraft taxiing noise

Part 6 of the Airports Act and the Airports (Environment Protection) Regulations set out the framework which would regulate the generation of noise at the proposed airport, other than noise generated by aircraft in flight (including when landing, taking off or taxiing at the airport). While for noise assessment purposes taxiing is addressed in this chapter, it is not considered to be part of the ground-based noise regulatory framework established under the Regulations. This reflects the general division of responsibility for noise management between Airservices Australia and the ALC.

For aircraft taxiing, it is relevant to note that aircraft operating in Australia must meet noise standards specified in the Air Navigation (Aircraft Noise) Regulations 1984. As discussed in Section 10.2.5, these regulations ensure that aircraft using airports in Australia including the proposed Western Sydney Airport – whether in flight or on the ground – are compliant with internationally accepted noise standards and practices.

Although not consistent with the regulatory framework for this activity, considering aircraft taxiing as a ground-based noise source for assessment purposes provides a way of isolating and evaluating noise generated by taxiing, particularly given that taxiing operations have not been taken into account in the aircraft overflight assessment and associated noise exposure modelling (Chapter 10 and Appendix E1 (Volume 4)).

11.4.2 Construction noise criteria

As noted in Table 11–2, the Airports (Environment Protection) Regulations provide a guideline level of 75 dBA for construction noise measured at a sensitive receptor (see Schedule 4 – 2.02).

The NSW Department of Environment and Climate Change (DECC) Interim Construction Noise Guideline (DECC 2009) was also used for the purposes of this assessment. The Guideline recommends *noise management levels* to assist the management of noise on construction sites both during and outside standard construction hours (Monday to Friday, 7.00 am to 6.00 pm and Saturday 8.00 am to 1.00 pm). Where noise at sensitive receivers is expected to exceed noise management levels, implementation of reasonable and feasible noise mitigation is recommended and consultation with affected people is encouraged.

For works during standard construction hours, the noise management level is background plus 10 dBA for residential locations. For works outside of normal construction hours, the noise management level is background plus 5 dBA.

Based on the daytime background noise levels shown in Table 11–1, the residential noise management level for standard construction hours would be between 39 dBA and 49 dBA. For assessment of construction noise, a noise management level of 45 dBA may reasonably be adopted for all residential receivers. A noise management level of 40 dBA has been adopted for weekend works and early morning works (outside standard construction hours).

11.4.3 Construction vibration criteria

To protect buildings from vibration damage the most stringent vibration standard typically used in Australia is German Standard DIN 4150-3: *Structural Vibration: Effects of Vibration on Structures*. This standard recommends frequency based guideline values and the lowest and most conservative values are normally adopted, as shown in Table 11–3.

Table 11–3 Vibration damage guideline values (DIN 4150-3)

Type of structure	Guideline value, peak particle velocity (mm/s)
Dwellings and buildings of similar design	5
Vibration sensitive buildings (heritage)	3

11.4.4 Blasting criteria

During construction of the proposed Stage 1 development, it is possible that blasting may be carried out at particular locations where hard rock is encountered. During blasting, vibration is generated in the ground and may propagate to surrounding areas. Airblast is the pressure wave generated as the energy from a blast is released into the atmosphere. Both ground vibration and airblast may cause effects at nearby buildings.

The Australian and New Zealand Environment Conservation Council (ANZECC) guideline – *Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration* (ANZECC 1990) – recommends residential criteria for the assessment of vibration and airblast from blasting. These criteria are designed to protect the comfort of occupants of residential buildings. Table 11–4 summarises the criteria recommended by ANZECC.

Table 11–4 ANZECC recommended vibration and airblast criteria

Issue	Measure	Criterion for 95% of blasts	Criterion for 100% of blasts
Vibration	mm/s PPV	5	10
Airblast	dBL Peak	115	120

11.4.5 Ground operations noise criteria

The Airports (Environment Protection) Regulations provide a regulatory approach for ground-based operational noise. However, these regulations are not intended to provide a basis for the assessment of the impact caused by such noise and they do not set specific criteria for aircraft engine noise. As a consequence, this analysis uses the *NSW Industrial Noise Policy* (EPA 2000) as a basis for identifying noise assessment criteria. It is important to recognise in setting these criteria that the character of noise from ground-based activities at an airport is different to the character of noise from many other developments, such as industrial developments, which are regulated by the *NSW Industrial Noise Policy*. It is not intended that these criteria would be used for future regulation of the activities considered in this assessment.

11.4.5.1 Criteria for taxiing noise

The *NSW Industrial Noise Policy* intrusiveness criteria for residences apply to relatively continuous noise such as that produced by aircraft taxiing. The intrusiveness noise criteria used in relation to residential land uses were determined by adding 5 dBA to the measured background noise levels shown in Table 11–1. The criteria are presented in Table 11–5.

Table 11–5 Industrial Noise Policy intrusiveness criteria for residential locations relevant to aircraft taxiing noise

Location	$L_{Aeq,15\ min}$ noise criteria (dBA)		
	Day (7am–6pm)	Evening (6pm–10pm)	Night (10pm–7am)
9 Harold Bentley Way, Glenmore Park	44	47	43
16 Park Avenue, Springwood	35	37	35
17 Blue Ridge Place, Orchard Hills	39	43	41
25 Peter Pan Avenue, Wallacia	42	39	35
27 Dwyer Road, Bringelly	38	43	40
35 Ramsay Road, Rossmore	40	42	40
54 Ridgehaven Road, Silverdale	41	41	36
114 Mount Vernon Road, Mount Vernon	39	40	38
120 Vincent Avenue, Mulgoa	43	47	40
Twin Creeks Golf Club, 2 Twin Creeks Drive, Luddenham	39	43	38
8 Wade Close, Luddenham	40	41	39

By the time the proposed airport becomes operational, background noise levels in the surrounding area would have increased due to various factors including increased road traffic as well as associated residential and commercial development. This would, in turn, raise the value of the appropriate noise criteria for the assessment of airport operations noise. For this reason, and to allow easy interpretation of the operational noise contours, an overall intrusiveness noise criterion of 40 dBA averaged over 15-minute intervals ($L_{Aeq,15\ min}$) has been adopted as appropriate for residential locations in this assessment. Adopting a single, overall noise criterion will be conservative for some locations but is also consistent with the broad approach taken for similar EIS reports.

For other land uses, the taxiing noise criteria were determined by reference to the amenity criteria in the *NSW Industrial Noise Policy*. Table 11–6 provides the adopted noise criteria for taxiing.

Table 11–6 Noise criteria taxiing

Receiver type	Measure	Criterion dB(A)
Residential	$L_{Aeq,15min}$	40
School	$L_{Aeq,15min}$	50
Hospital	$L_{Aeq,15min}$	55
Place of worship	$L_{Aeq,15min}$	55
Passive recreation	$L_{Aeq,15min}$	55
Active recreation	$L_{Aeq,15min}$	60

11.4.5.2 Criteria for engine run-up noise

Engine run-up noise would be intermittent and subject to limitations during the night. It has been assumed that high power engine run-ups would occur for less than five minutes on any night. In this context, the night time residential criterion for these activities has been set as 5 dBA above the general *NSW Industrial Noise Policy* night time criterion for residential receivers. The criteria for other land uses have also been set at 5 dBA above the relevant amenity criteria. Table 11–7 provides the adopted noise criteria for engine run-ups.

Table 11–7 Noise criteria for aircraft engine run-up

Receiver type	Measure	Criterion dB(A)
Residential	$L_{Aeq,15min}$	45
School	$L_{Aeq,15min}$	55
Hospital	$L_{Aeq,15min}$	60
Place of worship	$L_{Aeq,15min}$	60
Passive recreation	$L_{Aeq,15min}$	60
Active recreation	$L_{Aeq,15min}$	65

11.4.6 Road traffic noise criteria

The *NSW Road Noise Policy* (DECCW 2011) recommends noise assessment criteria for residential and non-residential land uses affected by traffic generating developments. The policy indicates that an increase of up to 2 dBA represents a minor impact that is considered barely perceptible to the average person. This has been used as the reference point for the assessment of potential construction and operational road traffic noise.

11.5 Assessment of impacts during construction

11.5.1 Noise from construction works

Figure 11–3 to Figure 11–6 show the predicted worst case construction noise contours for construction sectors (east, north, north-west and south-west). These figures show the worst weather condition that may occur, represented by a temperature inversion early in the morning in winter. A still, isothermal weather condition was also modelled to represent the rest of a typical day. Construction noise contours for isothermal conditions are more confined to the airport site (see Appendix E2 (Volume 4)).

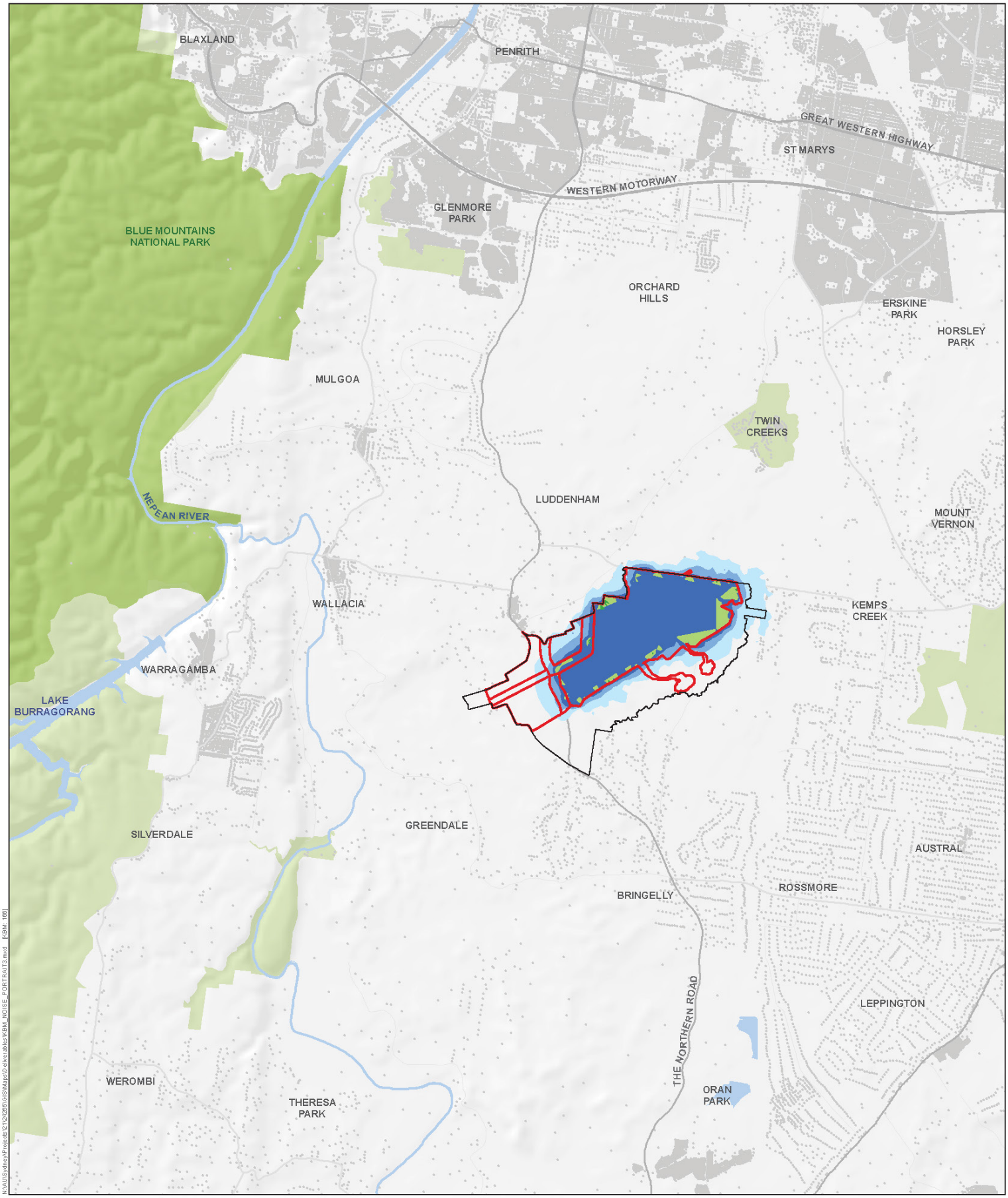
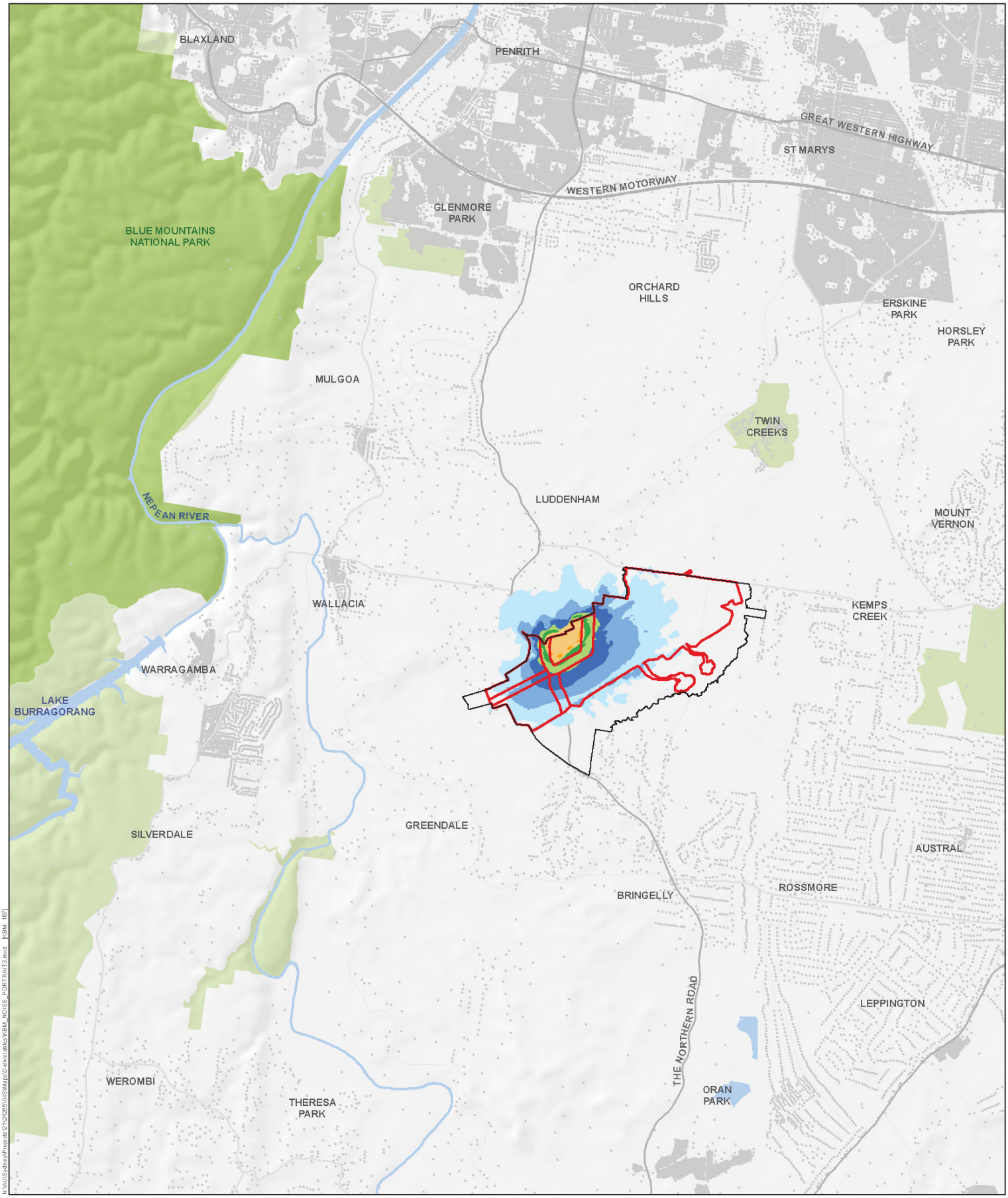


Figure 11-3 - East Sector Bulk Earthworks LAeq,15min Contours Temperature Inversion



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Data Source: Please refer to "Digital Data Sources" on the second page of the EIS

LEGEND

- Western Sydney Airport
- Buildings
- Greater Blue Mountains World Heritage Area
- Parks and reserves
- Construction areas

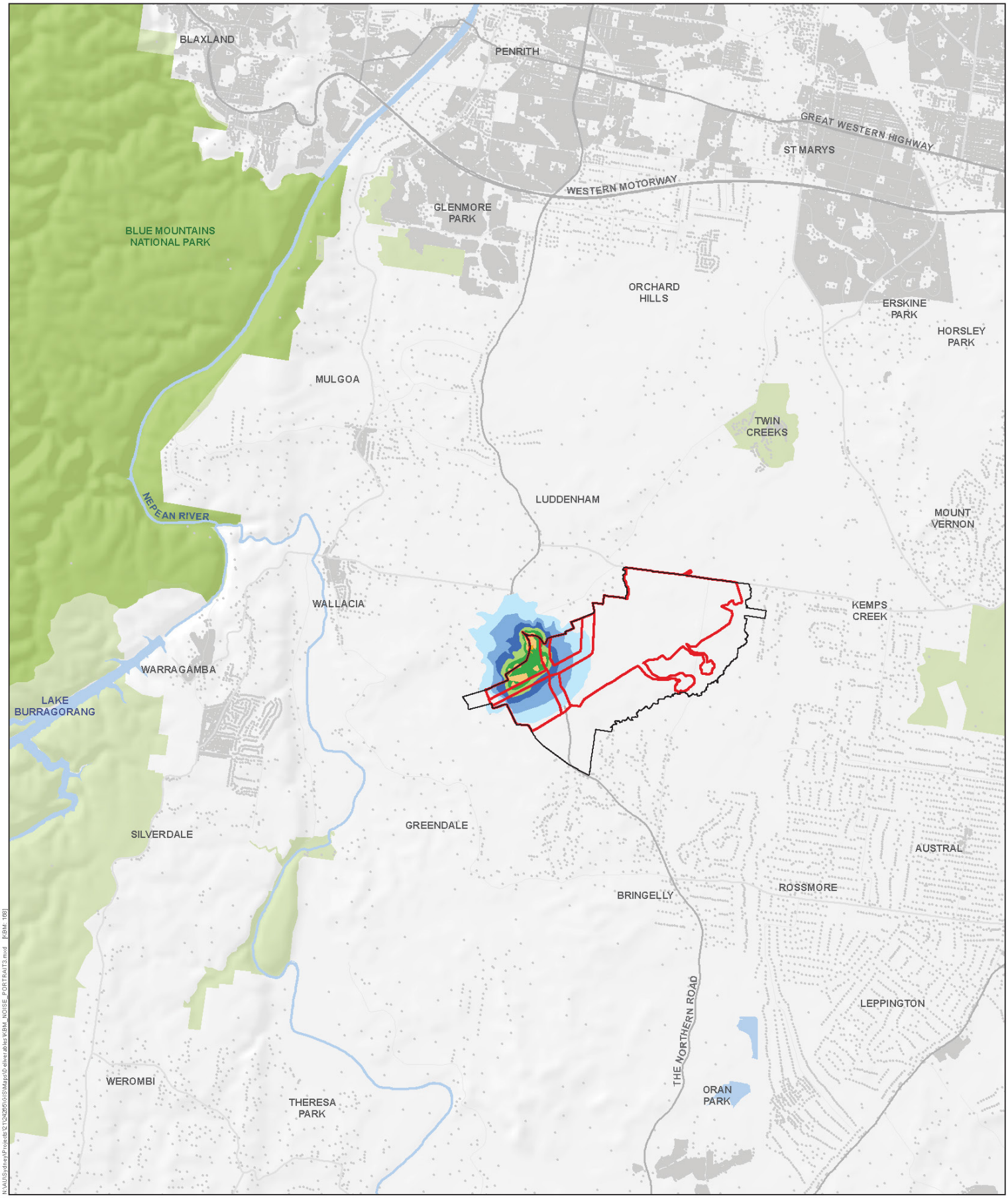
LAeq, 15 min

- 40-45 dBA
- 45-50 dBA
- 50-55 dBA
- 55-60 dBA
- 60-65 dBA
- 65-70 dBA
- >70 dBA

Figure 11-4 - North Sector Bulk Earthworks LAeq,15min Contours Temperature Inversion

0 0.75 1.5 3
Kilometres

N



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Data Source: Please refer to "Digital Data Sources" on the second page of the EIS

LEGEND

- Western Sydney Airport
- Buildings
- Greater Blue Mountains World Heritage Area
- Parks and reserves
- Construction areas

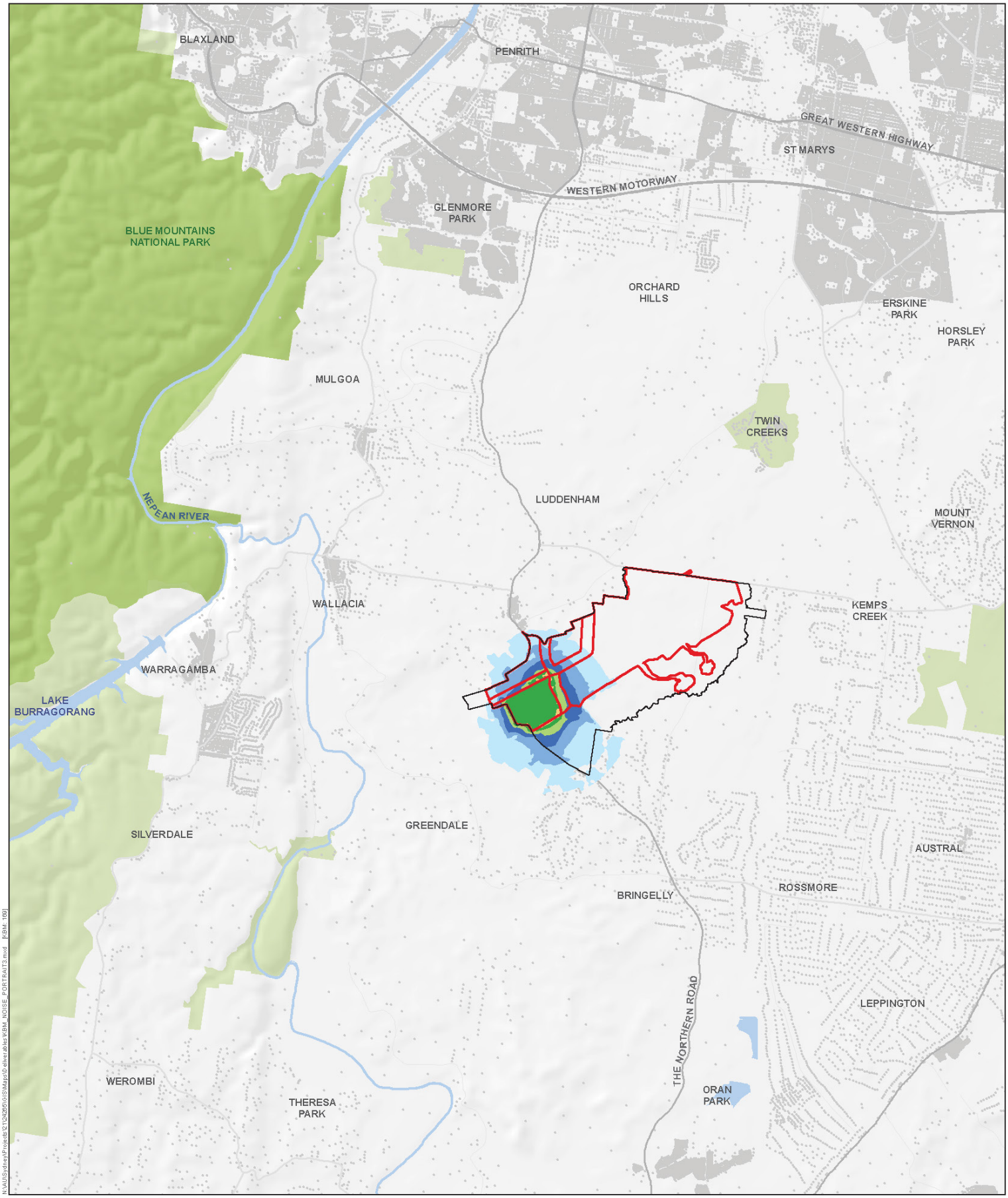
LAeq, 15 min

- 40-45 dBA
- 45-50 dBA
- 50-55 dBA
- 55-60 dBA
- 60-65 dBA
- 65-70 dBA
- >70 dBA

Figure 11-5 - North West Sector Bulk Earthworks LAeq,15min Contours Temperature Inversion

0 0.75 1.5 3
Kilometres

N



N:\AUS\Sydney\Projects\21\24265\GIS\Maps\10 eliverables\KBM_NOISE_PORTRAIT3.mxd (KBM, 16/9)

Data Source: Please refer to "Digital Data Sources" on the second page of the EIS

LEGEND

- Western Sydney Airport
- Buildings
- Greater Blue Mountains World Heritage Area
- Parks and reserves
- Construction areas

LAeq, 15 min

- 40-45 dBA
- 45-50 dBA
- 50-55 dBA
- 55-60 dBA
- 60-65 dBA
- >65 dBA

Figure 11-6 - South West Sector Bulk Earthworks LAeq,15min Contours Temperature Inversion

0 0.75 1.5 3
Kilometres

N

The estimated population likely to be affected by noise levels above the adopted noise management level during standard hours is shown in Table 11–8.

Table 11–8 Estimated residential population affected by levels above noise management level – standard construction hours (worst case temperature inversion)

Location	Noise management level	Estimated residential population affected above criterion
East section	45 dBA	0
North section	45 dBA	103
North-west section	45 dBA	199
South-west section	45 dBA	14

The estimated population likely to be affected by noise levels above the adopted noise management level outside standard hours is shown in Table 11–9.

Table 11–9 Estimated residential population affected by levels above noise management level – outside standard construction hours (worst case temperature inversion)

Location	Noise management level	Estimated residential population affected above criterion
East section	40 dBA	48
North section	40 dBA	527
North-west section	40 dBA	531
South-west section	40 dBA	140

Under worst case conditions, noise emissions arising from construction activities would be predominantly limited to the airport site and immediate surrounds. The airport site covers a broad area, and a range of management measures such as the placement of temporary noise barriers or exclusion buffers within the airport site may be adopted as required to mitigate disturbance to nearby receivers, particularly for construction activity outside of standard construction hours. It should be noted that the construction noise guideline level of 75 dBA in the Airports (Environment Protection) Regulations 1997 is met at all surrounding receivers.

11.5.2 Construction traffic noise

Construction traffic would use the nearby road network, with most traffic expected to access the site via Elizabeth Drive. Table 11–10 presents predicted noise increases along Elizabeth Drive as a result of construction traffic. Along all sections of Elizabeth Drive, the predicted increase in noise from construction traffic is less than 2 dBA. This change in noise level is unlikely to be perceptible.

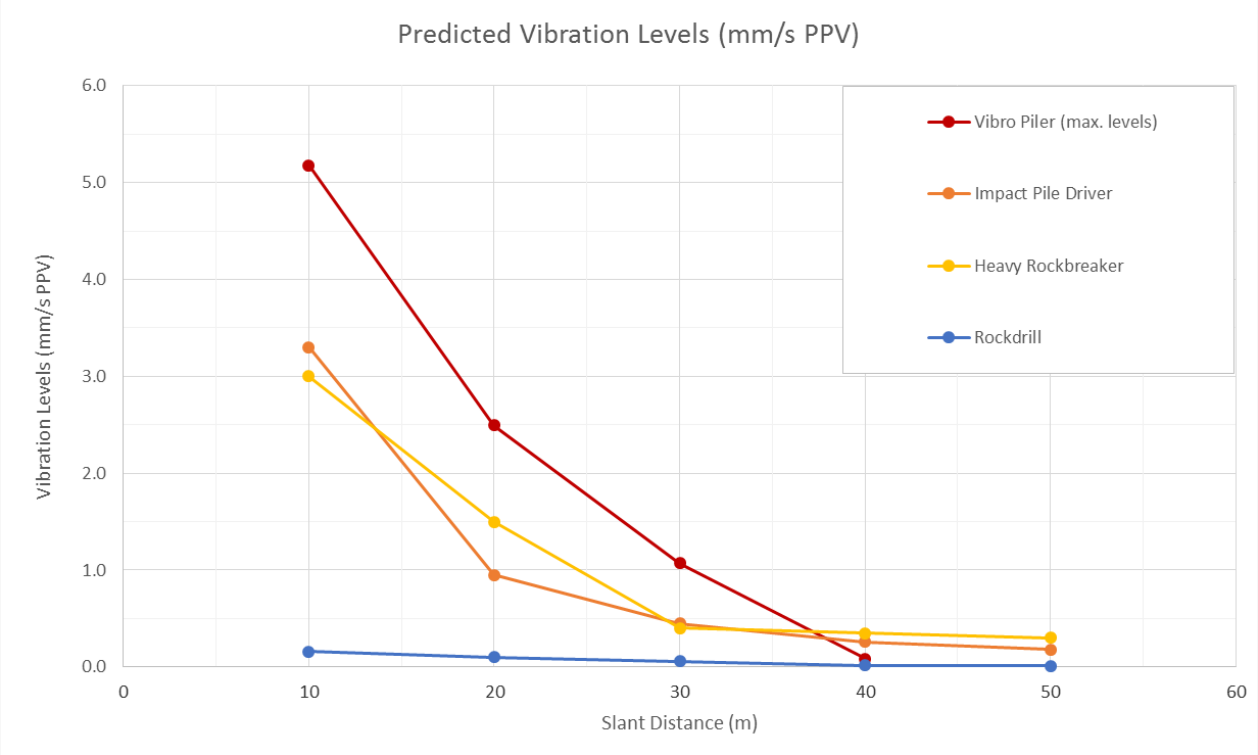
Table 11–10 Predicted construction traffic noise increases on Elizabeth Drive

Road	Location	Noise level increase (dB)	
		Day	Night
Elizabeth Drive	West of Mamre Road	0.6	1.1
	West of Devonshire Road	0.9	0.5
	West of Lawson Road	0.9	0.6

11.5.3 Construction vibration assessment

Vibration would be generated by specific construction plant as part of the proposed construction works. As a very conservative approach, and in the absence of an applicable Australian Standard, the most stringent vibration standard, the German Standard DIN 4150-3:1999 was used to assess building vibration damage. For this assessment, the lower guideline value applying to vibration sensitive buildings (3 mm/s) has been adopted as the threshold of damage from construction vibration.

Figure 11–7 shows vibration levels previously measured on construction sites at a range of distances for key vibration-generating plant. The vibration levels from impact piling during the construction works would likely generate the highest vibration levels.



Source: (Wilkinson Murray)

Figure 11–7 Previously measured vibration levels

The graph indicates that the 3 mm/s threshold value would not be exceeded beyond a distance of 20 metres from a vibration source, even when considering the piling method that would likely generate the highest vibration levels from the anticipated construction plant. Given that piling is expected to be used only for the construction of buildings at locations well within the proposed airport boundary, there would be no risk of damage from vibration occurring outside of the airport site.

Vibration may also be generated by the ripping of rock, but again the 3 mm/s guideline value is likely to be complied with inside the airport boundary and there is no risk of damage outside the airport boundary.

11.5.4 Blast vibration and airblast

Preliminary site investigations indicate that the Bringelly shale and Luddenham dyke at the airport site can be ripped. However, there are some thicker sandstone deposits throughout the site that may need to be blasted.

For an assumed sandstone thickness of up to 5 metres, an indicative blast design has been assumed for the purposes of assessment. The closest residential receiver would be approximately 150 metres from a potential blast site and has been used in the analysis to determine the worst case potential impact.

The vibration level from blasting depends upon the distance from the blast as well as the charge, measured as the maximum instantaneous charge (MIC). Historical blasting vibration measurements in sandstone have been used to develop a vibration prediction graph which is sufficient to allow an indicative analysis for the airport construction. Figure 11–8 shows the results of analysis of blasting vibration in sandstone rock which allows prediction of the upper end of vibration levels which may be expected.

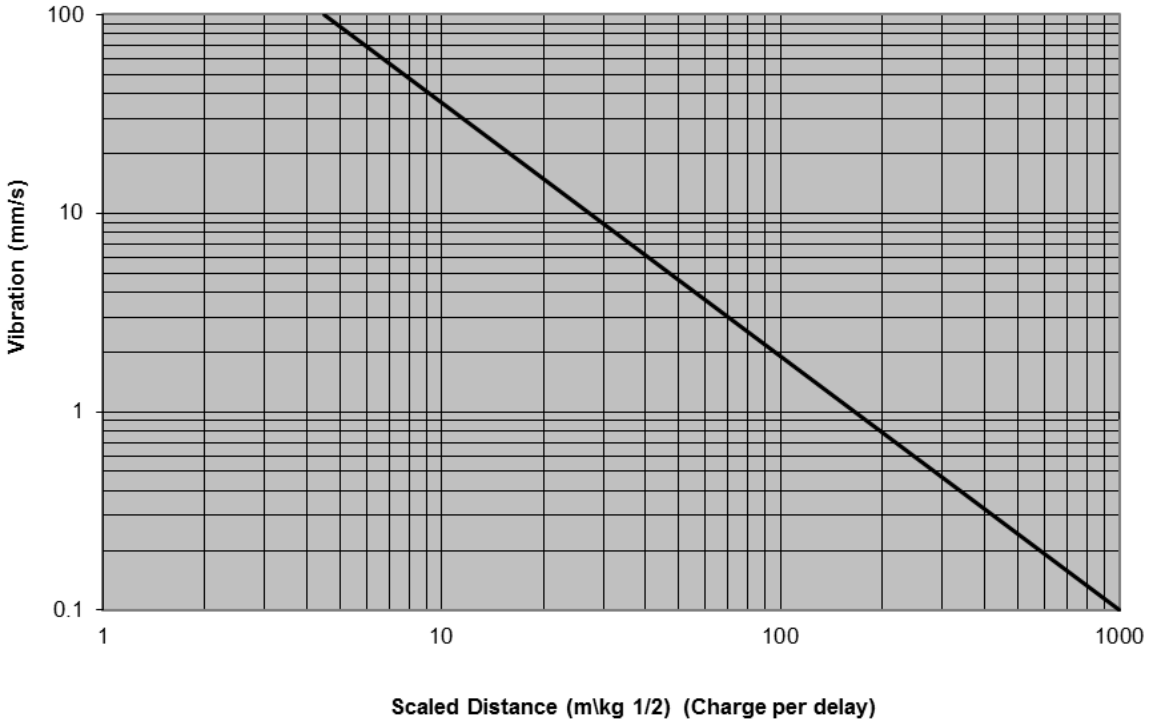


Figure 11–8 Vibration prediction curve for blasting in sandstone

Based on the graph, a vibration level of 3.5 mm/s is predicted 150 metres away at the nearest residence, based on an MIC of 5 kg (scaled distance 67 m/kg$^{0.5}$). It is concluded that to meet the ANZECC 95 per cent vibration criterion, a limitation to blast one hole per delay or to limit the MIC to 5 kg would be required. At distances greater than 150 m, these limitations could be relaxed.

Blasting delay (often called millisecond delay) is the interval of time between the ignition of two consecutive blasting charges. Delays are often used in blasting to ensure that all separate charges in the blast are not ignited simultaneously.

The airblast level depends on the distance from the blast and also the maximum charge fired at any instant in time (MIC). However, it also depends on the degree to which the charge is confined by the rock being blasted. If the charge is fully exposed, the blast will easily escape to the atmosphere, but if it is confined, it will be restrained in escaping. The degree of confinement is related to the depth of the charge below the surface (stemming depth) and the distance from the rock face to the charge (burden). Similar to the vibration prediction, historical blast monitoring and testing conducted has allowed the airblast prediction curve shown in Figure 11–9 to be developed. This shows the airblast level as a function of distance, MIC and burden.

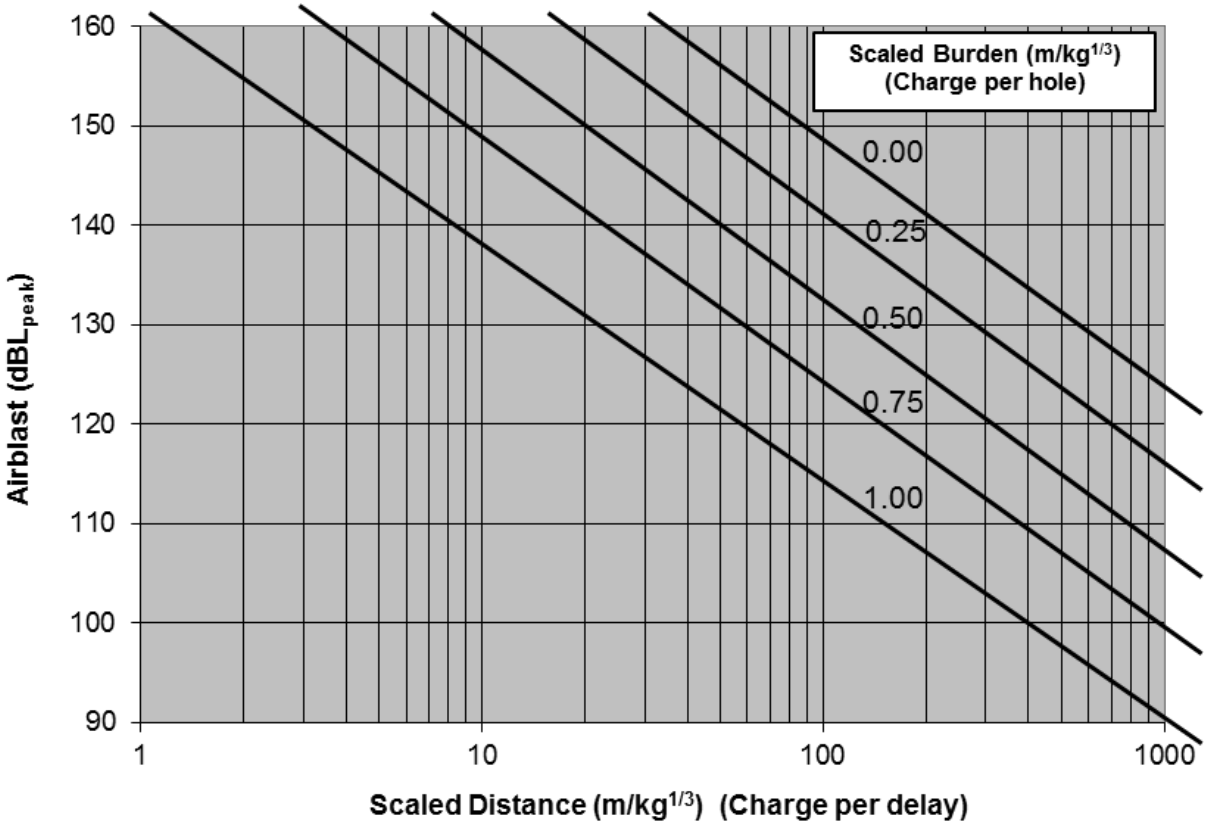


Figure 11–9 Airblast prediction curve for blasting

Based on the assumed blast design, an airblast level of 113 dBL is predicted at a distance of 150 m, representing the distance to the closest residential receiver. This indicates that the 115 dBL ANZECC 95% criterion can be complied with if the MIC is limited to 5 kg. However, it would also be necessary to ensure that the burden and stemming were maintained at no less than 2 m. Decibels linear (dBL) is a value representing the loudness of a sound at a specific time across all sound frequencies. This level is unweighted and is useful in measuring low frequency sound.

11.6 Assessment of impacts during operation

11.6.1 Ground-based operations noise

Figure 11–10 and Figure 11–11 show predicted noise exposure contours associated with engine run-up and taxiing activities. These figures have been updated based on new noise modelling conducted since release of the draft EIS. As outlined in Section 11.2, use of the Concawe prediction algorithm results in the effects of ground absorption being more accurately represented.

The contours indicate that under worst case conditions and in the absence of operational controls (e.g. restriction of engine run-ups), ground-based operations noise has the potential to extend over a large area surrounding the airport site. Table 11–11 shows the estimated population predicted to be affected by noise above the adopted assessment criteria.

Table 11–11 Estimated residential population affected by ground-based operations noise

Noise type	Noise criterion	Estimated residential population affected above criterion
Engine run-up	45 dBA	4,471
Taxiing	40 dBA	1,610

Under worst case meteorological conditions, noise associated with engine maintenance testing has the potential to affect Luddenham, Badgerys Creek, Bringelly, Wallacia and Greendale.
Figure 11–10 shows the effect of shielding to the west of the airport site by an aircraft maintenance building, the size and location of which are taken from the revised draft Airport Plan. The predicted noise exposure from aircraft taxiing extends over a much smaller area and would primarily affect Luddenham.

The predicted impact of ground-based operations noise on other noise sensitive uses surrounding the airport site is summarised in Table 11–12.

Table 11–12 Noise impact of ground-based operations on other uses

Noise type	Building/land use type	Criterion	Number affected (above criterion)
Engine run-up	Educational institutions	55 dBA	5
	Hospitals	60 dBA	0
	Places of worship	60 dBA	3
	Passive recreation	60 dBA	2
	Active recreation	65 dBA	1
Taxiing	Educational institutions	50 dBA	0
	Hospitals	55 dBA	0
	Places of worship	55 dBA	0
	Passive recreation	55 dBA	0
	Active recreation	60 dBA	0

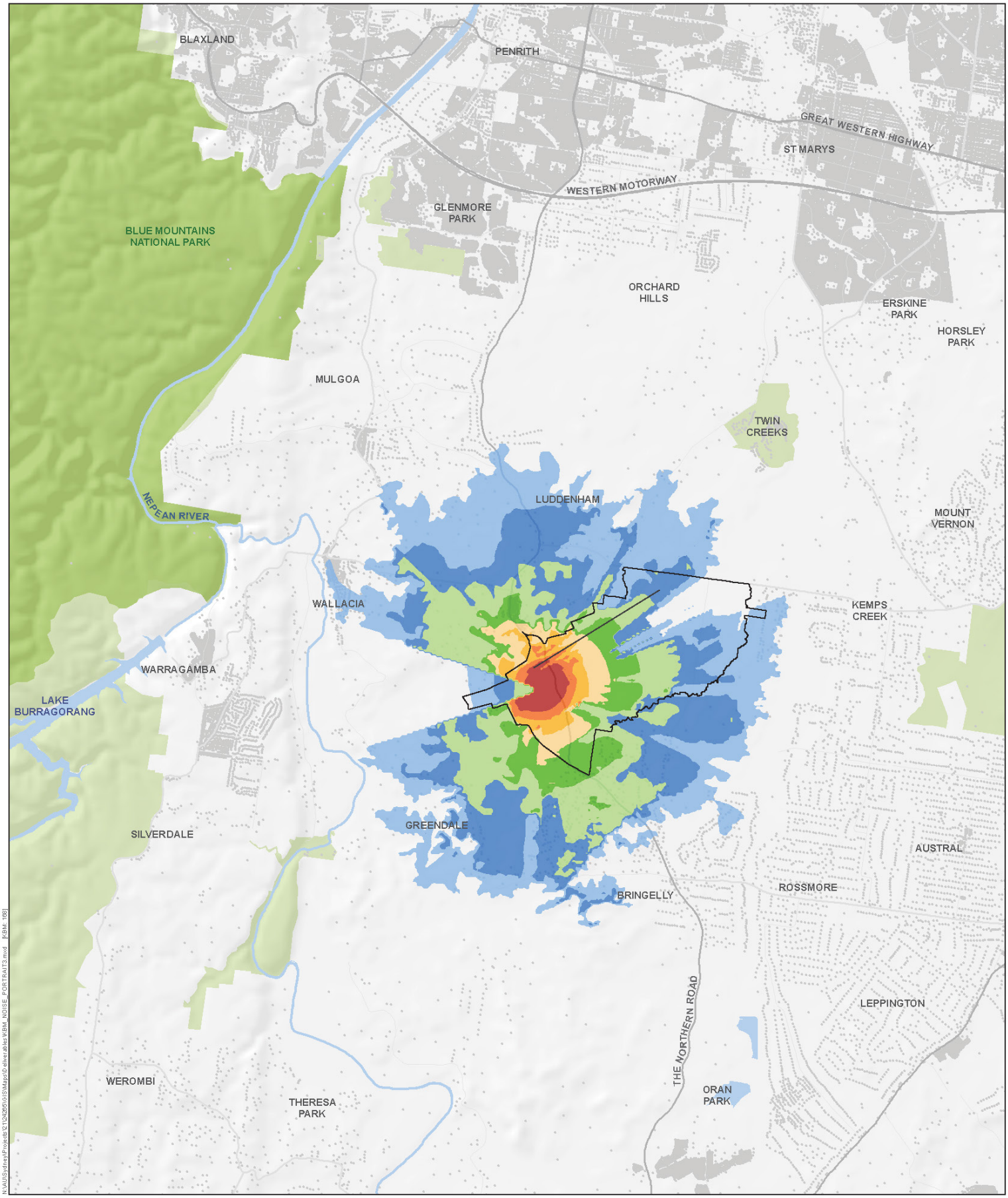
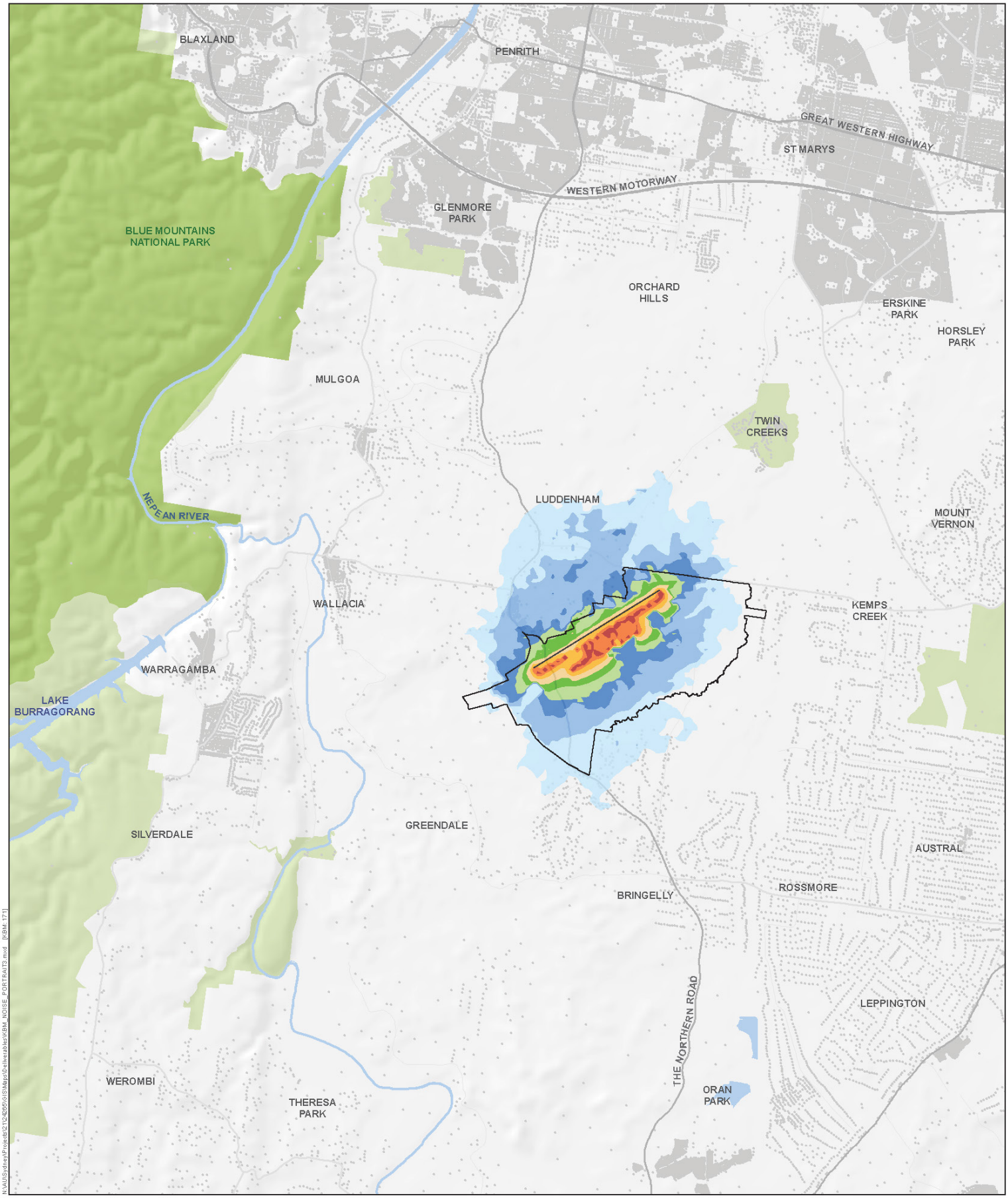


Figure 11-10 - Engine run-up noise contours - worst case Stage 1 operations



Data Source: Please refer to "Digital Data Sources" on the second page of the EIS

LEGEND

- Western Sydney Airport
- Runway
- Buildings
- Greater Blue Mountains World Heritage Area
- Parks and reserves

LAeq, 15min

- 40-45 dBA
- 45-50 dBA
- 50-55 dBA
- 55-60 dBA
- 60-65 dBA
- 65-70 dBA
- 70-75 dBA
- 75-80 dBA
- >80 dBA

0 0.75 1.5 3
Kilometres

N

Figure 11-11 - Taxiing noise contours - worst case Stage 1 operations

11.6.2 Road traffic noise

As explained in Section 11.2.3, road traffic noise levels for the road network around the airport site were calculated using the traffic projections discussed in Chapter 15 and the CoRTN procedure.

Table 11–13 shows the change in noise level expected as a result of airport traffic on surrounding roads. In general, the noise level increase is less than 2 dBA except during the night time on Elizabeth Drive (west of Lawson Road) and a section of the M12 (west of Mamre Road). However, given the nature of development setbacks from these roads, in the order of 75 metres, the predicted noise level increases at residential dwellings will still be low.

Table 11–13 Road traffic noise level increases due to proposed airport

Road	Location	Noise level increase (dB)	
		Day	Night
Mamre Road	North of Elizabeth Drive	1.2	0.4
	North of Mount Vernon Road	0.4	-0.4
	North of Abbotts Road	0.6	-0.4
	North of Bakers Lane	0.4	-0.4
	North of Erskine Park Road	0.5	-0.4
	North of Luddenham Road	0.6	-0.3
	North of Banks Drive	0.0	0.0
Luddenham Road	South of South Creek	0.2	0.1
	South of Twin Creeks Golf Club	0.7	-0.5
Elizabeth Drive	West of Mamre Road	0.5	0.1
	West of Devonshire Road	0.7	0.3
	West of Lawson Road	1.9	2.1
	West of Badgerys Creek Road	0.7	0.3
	West of Adams Road	0.7	0.3
	West of The Luddenham Road	0.4	-0.2
Camden Valley Way	West of M7	0.2	-0.2
	West of Croatia Avenue	0.2	-0.2
	West of Talana Drive	0.1	-0.2
	South of Bringelly Road	0.6	-0.3
Bringelly Road	West of Cowpasture Road	0.2	-0.2
	Bringelly Road east of Edmondson Avenue	0.2	-0.2
	Bringelly Road west of Fourth Avenue	0.1	-0.2
	Bringelly Road west of King Street	0.1	-0.2

Road	Location	Noise level increase (dB)	
		Day	Night
	West of Allenby Road	0.1	-0.2
	West of Kelvin Park Drive	0.1	-0.2
Adams Road	South of Elizabeth Drive	0.3	-0.2
	West of Anton Road	0.3	-0.2
	West of Jamison Street	0.3	-0.1
Erskine Park Road	North of Explorers Way	0.2	-0.2
	North of Bennet Road	0.3	-0.2
	North of Lenore Drive	0.3	-0.2
	East of Mamre Road	0.4	-0.3
The Northern Road	North of Homestead Road	0.0	-0.1
	South of Glenmore Parkway	0.1	0.0
	North of Kings Hill Road	0.2	-0.1
	North of Littlefields Road	0.2	0.0
	North of Elizabeth Drive	0.1	0.2
	North of Park Road	0.2	-0.1
	North of Adams Road	-0.7	-0.8
	North of Badgerys Creek Road	0.5	-0.3
	North of Bringelly Road	0.4	-0.3
	North of Carrington Road	0.1	0.0
	North of Northern Road	0.3	-0.2
	North of Cobbity Road	0.2	-0.2
	North of Hillside Drive	0.3	-0.2
	North of The Old Northen Road	0.3	-0.3
	North of Camden Valley Way	1.2	-0.5
Narellan Road	West of Hume Highway	0.3	-0.4
	West of Hartley Road	0.2	-0.4
	West of Camden Bypass	0.4	-0.4
	East of Camden Valley Way	0.4	-0.4
Wallgrove Road	North of Wonderland Drive	0.6	-0.4
	North of Old Wallgrove Road	0.2	-0.2
	North of Redmayne Road	0.1	0.0

Road	Location	Noise level increase (dB)	
		Day	Night
	North of Horsley Drive	0.1	-0.1
	North of Elizabeth Drive	0.3	-0.3
M7	South of M4	1.9	0.1
	South of Old Wallgrove Road	1.6	0.2
	North of Redmayne Road	0.8	0.0
	North of Elizabeth Drive	1.4	0.0
	North of Cowpasture Road	1.3	0.0
	North of Hoxton Park Road	1.5	0.1
	North of Kurrajong Road	1.6	0.2
	North of Camden Valley Way	1.6	0.2
	North of Brooks Road	1.2	0.0
	North of Campbelltown Road	0.9	0.0
M31	North of Narellan Road	0.9	0.0
M4	West of M7	0.9	-0.1
	West of Roper Road	0.6	-0.2
	West of Mamre Road	0.5	-0.2
	East of The Northern Road	0.6	-0.3
	West of The Northern Road	0.5	-0.3
M12	West of M7	0.0	1.0
	West of Mamre Road	0.6	2.4
	West of Airport Access	0.3	1.9

11.7 Mitigation and management measures

Table 11–13 outlines the broad mitigation and management measures that are proposed to address noise associated with ground operations, airport construction and airport generated road traffic. These mitigation measures will be addressed as part of the Construction Environmental Management Plan (CEMP) to be approved prior to Main Construction Works and the Operational Environmental Management Plan (OEMP) to be approved prior to commencement of operations as described in Chapter 28 (Volume 2b).

All major airports have procedures which restrict the time and location for engine run-ups to limit noise impacts and ensure they are conducted safely. The proposed airport is expected to have similar procedures which would limit the circumstances and manner in which night time engine runs would be conducted. Restricting the amount of high power engine runs at night would

substantially reduce the impact of engine ground running noise. Alternate locations for the run-up facility may also be considered during detailed design.

It may also be practicable to construct barriers near the run-up area, or design surrounding buildings to provide greater noise shielding from these activities. As described in Appendix E2 (Volume 4), reductions of around 10 dBA could be achieved with provision of a purpose-built ground running enclosure at least 10 metres high, but moderate residual impacts would still occur under worst case meteorological conditions. Night time high power engine run-ups occur infrequently at major airports in Australia. The provision of an enclosure for conducting engine runs is not currently proposed, but could be further considered if noise from this activity results in unacceptable night time noise impacts based on operational experience.

Table 11–14 Mitigation and management measures – aircraft ground operations, airport construction and airport road traffic noise

Issue	Mitigation/management measure	Timing
Construction Noise and Vibration CEMP	A Noise and Vibration CEMP will be approved prior to commencement of Main Construction Works for the proposed airport. The Noise and Vibration CEMP will: • ensure, where feasible, that noise emissions comply with the construction noise guidelines in Schedule 4 of the AEPR; • identify construction activities which are predicted to exceed any noise management levels set for the proposed airport and develop proposed actions, such as notification of affected receivers; • ensure that vibration and airblast from rock blasting and other construction activities comply with relevant vibration damage guideline values in German Standard DIN 4150-3 and vibration and airblast criteria in ANZECC 1990, to protect the amenity of local residents and avoid building damage; • determine noise and vibration monitoring, reporting and response procedures; • describe specific mitigation treatments, management methods and procedures to be implemented to control noise and vibration during construction; • describe construction timetabling to minimise noise impacts, including time and duration restrictions, respite periods and frequency; • describe procedures for notifying residents of construction activities likely to affect their amenity through noise and vibration; and • define contingency procedures to be implemented in the event of non-compliance and/or noise complaints.	Pre-construction Construction

Issue	Mitigation/management measure	Timing
Operations ground-based noise	A Noise OEMP will be prepared and implemented for managing ground-based aircraft and other noise. The Noise OEMP will at a minimum: • record the noise abatement procedures and noise management measures developed for the airport through the airspace and flight path design process as a baseline for these procedures and measures; • identify noise mitigation measures proposed to be implemented for ground-based noise generating activities, including: ▪ aircraft engine ground running rules, including any proposed restrictions on the timing, location and power intensity of engine runs, and any related safety requirements; ▪ opportunities to refine the location and design of airport features to reduce noise impact; and ▪ other measures to address excessive noise where noise mitigation by physical features (e.g. noise barriers) is deemed ineffective. • provide the outcomes of additional noise modelling and assessment conducted during the detailed airport design phase to: ▪ update and refine the noise exposure modelling undertaken for this EIS; ▪ inform the development of additional noise mitigation measures; and ▪ test the effectiveness of any proposed noise mitigation measures and identify any residual excessive noise levels in areas surrounding the airport site. • describe the measures taken to minimise the use of auxiliary power units (APUs), including the provision of fixed electrical ground power units and preconditioned air at aircraft gates and any measures to minimise APU use by stationary aircraft at other locations on the airport; • detail how noise emissions will be taken into account when considering onsite development proposals, both for the construction and operational phases of those developments; • detail any noise amelioration actions proposed to mitigate offsite noise exposure that cannot be managed appropriately by operational and other onsite mitigation measures; • describe stakeholder engagement undertaken with affected residences and other stakeholders regarding potential noise impacts, and potential mitigation and amelioration measures; • describe the procedures for managing enquiries and complaints about noise impacts from ground-based airport activities; and • describe the procedures for monitoring and managing observed breaches in ground running rules, including those for registering, investigating, reporting, instigating and responding to such incidents.	Pre-operation Operation

11.8 Conclusion

Noise during the construction of the proposed airport would be largely confined within the airport boundary, although there would be some impacts on the Luddenham and Badgerys Creek areas. While heavy and light vehicles would need to access the airport site during the construction stage, the resulting increase in traffic noise would not be significant. Vibration generated by the use of typical construction plant would not cause building damage.

Preliminary assessment results indicate that if blasting is to be carried out within 150 metres of residences, the maximum charge should be restricted to no more than 5 kg and the charge confined so that it does not easily escape to the atmosphere. Further more detailed analysis of blast vibration and airblast would be required prior to the commencement of blasting to ensure appropriate blasting management measures are adopted to protect residential amenity and building integrity.

Noise from ground-based operations would be generated primarily by aircraft engine run-ups and taxiing. Modelling conducted for this EIS using the Concawe algorithms shows that under worst case meteorological conditions, noise associated with engine runs has the potential to affect residences and other sensitive receivers in Luddenham, Badgerys Creek, Bringelly, Wallacia and Greendale. The impact of noise from taxiing is predicted to extend over a much smaller area and would primarily affect Luddenham.

During operation of the proposed airport, road traffic noise level increases in the surrounding area from airport-generated traffic are predicted to be insignificant for the majority of roads; however, an increase greater than 2 dBA is predicted for a section of Elizabeth Drive and a section of the proposed M12 Motorway. Any major new road construction or realignments associated with the Western Sydney Infrastructure Plan would be subject to separate applications and approvals by the relevant authorities, including any noise mitigation required.

Mitigation and management measures have been proposed to address noise associated with ground operations, construction and airport-generated road traffic.