



CHAPTER 9 - NOISE AND VIBRATION



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9. Noise and vibration

This chapter provides a summary of the noise and vibration assessment. It describes the existing noise environment, identifies potential construction, operation and decommissioning impacts of the project, and provides measures to mitigate and manage the impacts identified.

The assessment predicted that for some construction scenarios, noise levels at several sensitive receivers could be above the construction noise management levels depending on the time of day. For transient activities, potential noise impacts could last for about one to two consecutive days as the various works progress along the project site. Most stationary activities have the potential to generate elevated noise levels for up to several weeks at each location with the exception of construction facilities, which would be used for the duration of construction.

Given the transient nature of most construction noise and the limited number of sensitive receivers close to the main noise generating activities on the construction right of way, noise impacts are not anticipated to be a significant issue for the project. Although construction noise levels may be above the noise management levels at some sensitive receivers for some construction scenarios, appropriate management measures, particularly for out-of-hours work, would be implemented to minimise potential impacts.

Construction vibration is not expected to impact sensitive receivers, and no significant noise and vibration impacts are expected during normal operations.

Further information is provided in Technical Report 5 (Noise and vibration).

9.1 Approach

9.1.1 Overview

The main potential noise and vibration impacts of the project would be noise during construction, associated mainly with works within the construction right of way, but also including the use of construction facilities, road and track works, and the use of construction access roads and tracks. A quantitative noise and vibration assessment has been carried out in accordance with relevant guidelines, in particular the *Interim Construction Noise Guideline* (DECC, 2009) as the key guidance for assessing and managing potential construction noise impacts in NSW. This includes defining relevant construction noise management levels for different receiver types for different periods of the day, and guidance for predicting, assessing and mitigating construction noise and vibration impacts. The potential for sleep disturbance during the nighttime has also been considered with reference to the *NSW Road Noise Policy* (DECCW, 2011) and *Noise Policy for Industry* (NSW EPA, 2017).

Potential vibration impacts during construction have been assessed based on the criteria provided in German Standard *DIN 4150-3:2016 Vibrations in buildings – Part 3: Effects on structures* (Deutsches Institut für Normung, 2016) and *Assessing Vibration: a Technical Guideline* (DEC, 2006). British Standard (BS) *BS 6472-1:2008 Guide to evaluation of human exposure to vibration in buildings* (British Standards Institute, 2008) is recognised by the guideline as the preferred standard for assessing human comfort vibration criteria.

The assessment has also considered the potential for road noise impacts with reference to the *NSW Road Noise Policy* (DECCW, 2011). Potential operational noise impacts have been assessed in accordance with the *Noise Policy for Industry* (NSW EPA, 2017).

An overview of the approach to the assessment is provided below. Further information is provided in section 2 of Technical Report 5 (Noise and vibration).

9.1.2 Methodology

Study area

The study area for the noise and vibration assessment consists of a two kilometre radius around the project site.

The study area is shown in Figure 2.1 of Technical Report 5 (Noise and vibration).

Key tasks

Tasks to characterise the existing environment and potential noise sources

This part of the assessment involved:

- identifying noise sensitive receivers in the study area
- undertaking attended short-term noise measurements at four locations representative of sensitive receivers – the location of noise monitoring locations is shown on Figure 3.2 of Technical Report 5
- determining noise and vibration management levels in accordance with relevant guidelines
- identifying potential noise and vibration sources during construction, operation and decommissioning
- defining construction scenarios and developing representative ‘worst-case’ construction scenarios (described below)
- identifying construction activities that would occur during and outside recommended standard working hours as defined by the *Interim Construction Noise Guideline* (DECC, 2009) (see section 3.5.2 for further information on the proposed project working hours for the project).

A total of 27 indicative construction scenarios (CS) were developed and assessed for the proposed working hours. The scenarios were developed to predict noise levels from both transient and stationary construction activities, as well as noise levels from transient works occurring close to each other. The construction scenarios are organised by activity groups and are described in further detail, together with likely construction plant and equipment, in section 2.4.1.3 of Technical Report 5. This information was used to predict maximum construction noise levels that may be experienced at sensitive receivers (as outlined below).

Impact assessment

This part of the assessment involved:

- modelling to conservatively predict noise levels during construction and operation
- modelling and assessing the potential for road traffic noise impacts during construction and operation
- assessing the potential for human comfort and structural vibration impacts
- assessing the significance of predicted noise and vibration levels by comparing them to the noise management levels
- identifying the potential cumulative impacts of construction occurring consecutively with other major projects
- qualitatively assessing potential impacts associated with decommissioning
- identifying feasible and reasonable measures to mitigate predicted noise levels above the management levels.

9.2 Noise and vibration criteria

An individual’s perception of noise is influenced by their environment. A noise level that is perceived to be loud in one situation may appear quiet in another. Figure 9.1 shows a comparison of noise levels from common sources. The decibel (dBA) scale measures sound intensity on a logarithmic scale, where a small increase in dBA represents a large increase in energy. For example, a sound at 60 dBA is 10 times more intense than one at 50 dBA, even though this would not be perceived as much louder.

A summary of the key criteria used to undertake the noise and vibration assessment is provided in this section. Further information on the criteria is provided in section 2 of Technical Report 5 (Noise and vibration).

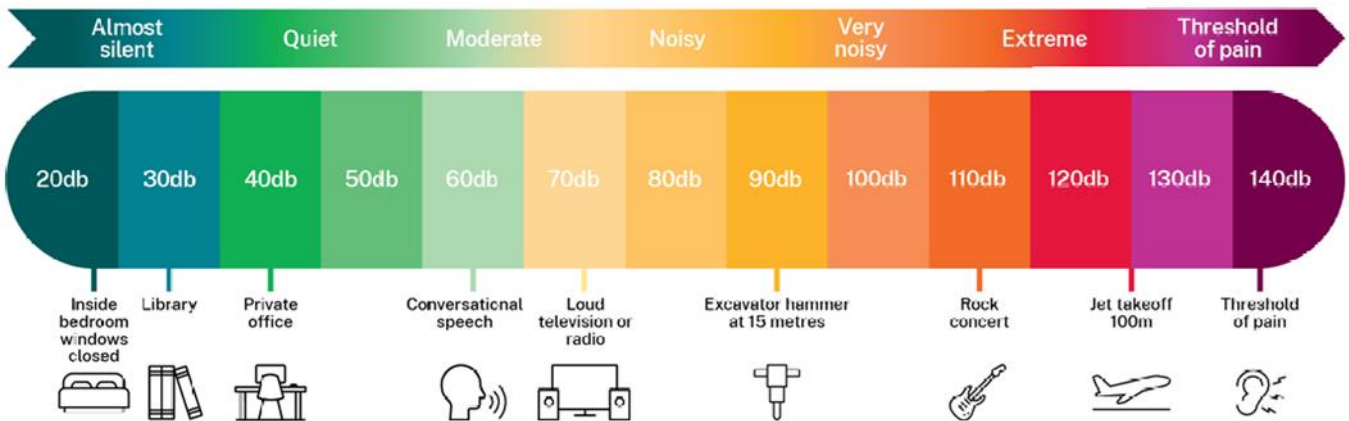


Figure 9.1 Noise level comparisons

9.2.1 Construction criteria

Construction noise management levels

Project-specific noise management levels were developed for sensitive receivers based on existing background noise levels (known as rating background levels) in the study area in accordance with the *Interim Construction Noise Guideline* (DECC, 2009). The study area (where sensitive receivers are present) is predominantly rural and the existing noise levels in the area were identified, as described in section 9.3.2, to be below the minimum rating background noise levels as outlined in the *Noise Policy for Industry* (NSW EPA, 2017). As such, the minimum rating background levels were adopted to provide the most conservative noise management levels for the assessment.

During recommended standard working hours (as defined in Table 9.1):

- the 'noise affected' noise management level (the point above which there may be some community reaction to noise) is the rating background level plus 10 dBA
- the 'highly affected' noise management level (the point above which there may be strong community reaction to noise) is 75 dBA.

Outside recommended standard working hours, the noise management level is the rating background level plus 5 dBA.

The project-specific noise management levels for residential receivers are shown in Table 9.1, together with their application to the proposed project working hours (defined in section 3.5.2). The project-specific noise management levels for non-residential receivers in the study area are provided in Table 9.2. Specified activities required during out-of-hours periods are discussed in chapter 3 (Project description).

Noise management levels are not mandatory limits. Where construction noise levels are predicted or measured to be above the noise management levels, feasible and reasonable mitigation measures are proposed to minimise noise impacts as described in section 9.7.

Where noise levels are predicted to be above the noise management levels, potential impacts are summarised using the approach from the *Construction Noise and Vibration Guideline (Roads)* (Transport for NSW, 2024). This guideline provides perception categories based on the difference between predicted noise levels and noise management levels to describe potential impacts at sensitive receivers. The noise perception categories are shown in Table 9.3.

Table 9.1 Project-specific construction noise management levels

Noise management level as per the <i>Interim Construction Noise Guideline</i>			Relevant proposed construction working hours category
Time period	Noise management level $L_{Aeq, 15min}$	Applicable times	
Recommended standard working hours	45 dBA (noise affected) 75 dBA (highly noise affected)	Monday to Friday – 7 am to 6 pm Saturday – 8 am to 1 pm	Project working hours
Outside recommended standard working hours	40 dBA (noise affected)	Saturday – 7am to 8am and 1pm to 6pm Sunday or public holidays – 8am to 6pm	Project working hours
	35 dBA (noise affected)	Monday to Saturday – 6am to 7am Sunday or public holidays – 6am to 8am	Project working hours
		Monday to Saturday – 6pm to 6am Sunday or public holidays – 6pm to 6am	Out-of-hours work

Table 9.2 Adopted construction noise management levels at non-residential receivers

Receiver type	Criteria (dBA)	Applicable times
Commercial	70	When in use
Industrial	75	
Community centre	50 ¹	
Passive recreation	60	
Active recreation	65	

Note: 1. As per the *Interim Construction Noise Guideline* (DECC, 2009), the community centre criteria has been derived with reference to the AS 2107 maximum preferred internal noise level for assembly halls up to 250 seats. A 10 dB addition has been made to convert the internal criteria to an external noise level, representative of the typical sound reduction through an open window.

Table 9.3 Construction noise perception categories

Noise perception category	Noise level range above noise management level	
	Standard hours	Outside of standard hours
Noticeable	Not applicable	1 dBA to 5 dBA above noise management level
Clearly audible	1 to 10 dBA above	5 to 15 dBA above
Moderately intrusive	10 to 20 dBA above	15 to 25 dBA above
Highly intrusive	More than 20 dBA above	More than 25 dBA above

Construction sleep disturbance

There is potential for sleep disturbance and awakening impacts where night works are located close to residential receivers. Where construction works are planned to extend over more than two consecutive nights, the *Interim Construction Noise Guideline* (DECC, 2009) recommends an assessment of sleep disturbance impacts.

The *Noise Policy for Industry* (NSW EPA, 2017) identifies an external screening criteria of 52 dBA L_{Amax} to assess the potential sleep disturbance impacts. Additionally, the *Noise Policy for Industry* refers to guidance in the *NSW Road Noise Policy* (DECCW, 2011), which indicates that:

- maximum internal noise levels below 50 to 55 dBA are unlikely to awaken people from sleep
- one or two noise events per night with a maximum internal noise level of 65 to 70 dBA are not likely to affect health and wellbeing significantly.

The internal noise level guidance was used to determine the external sleep disturbance and awakening criteria for the project (see Table 9.4).

Table 9.4 Sleep disturbance and awakening criteria

External L _{Amax} criteria ¹	Sleep disturbance likelihood
52 to 60 dBA	Noise levels are unlikely to awaken people from sleep
60 to 75 dBA	Noise levels may cause sleep disturbance and awakening impacts, though are unlikely to affect health and wellbeing significantly
>75 dBA	Noise levels may affect health and wellbeing significantly

Note: 1. Criteria developed from *NSW Road Noise Policy* (DECCW, 2011) and the *Noise Policy for Industry* (NSW EPA, 2017). Internal levels are typically 10 decibels (dB) lower than external noise levels with windows open. Where an internal criteria is presented, this has been converted to an external criteria by adding 10 dB to the internal criteria.

Construction road traffic noise

The potential impacts of construction traffic travelling on public roads are assessed in accordance with the *NSW Road Noise Policy* (DECCW, 2011). Where road traffic noise levels are predicted to increase by 2 dB or more and also go beyond the criteria in Table 9.5, feasible and reasonable mitigation and management measures would be considered to minimise potential impacts.

Table 9.5 Construction road traffic noise criteria

Road category	Type of development	Day (7am to 10pm) (dBA)	Night (10pm to 7am) (dBA)
Freeway/arterial/sub-arterial roads	Existing residence affected by additional traffic on arterial roads generated by land use developments	60 L _{Aeq} , 15hr	55 L _{Aeq} , 9hr
Local roads	Existing residences affected by noise from new local road corridors or by additional traffic on local roads generated by land use developments	55 L _{Aeq} , 1hr	50 L _{Aeq} , 1hr

Other construction criteria

A range of other construction criteria have been used in the assessment, including:

- human comfort vibration
- structural damage and vibration
- blasting overpressure and vibration.

Further information is provided in sections 2.5 and 2.6 of Technical Report 5 (Noise and vibration).

9.2.2 Operation noise criteria

The operational noise criteria for the project were determined in accordance with the *Noise Policy for Industry* (NSW EPA, 2017), which sets out two types of noise criteria. The intrusiveness noise level addresses short-term intrusive noise and its effects on residential receivers, and the amenity noise level addresses cumulative noise impacts to minimise amenity impacts. The project noise trigger levels are then determined by applying the more stringent criteria of the intrusiveness or amenity noise level. The project noise trigger levels for residential receivers are provided in Table 9.6.

Table 9.6 Operational noise trigger levels

Assessment period	Intrusiveness noise level $L_{Aeq,15\text{ min}}$ (dBA)	Project amenity noise level $L_{Aeq,15\text{ min}}$ (dBA) ^{1,2}	Project noise trigger level $L_{Aeq,15\text{ min}}$ (dBA)
Day	40	48	40
Evening	35	43	35
Night	35	38	35

Note: 1. The project amenity noise levels have been calculated by subtracting 5 dBA from the recommended amenity noise levels as the identified sensitive receivers are not impacted by more than four individual industrial noise sources.
 2. The *Noise Policy for Industry* (NSW EPA, 2017) recommends a 3 dBA addition to the $L_{Aeq,period}$ noise level to convert the amenity noise level to a $L_{Aeq,15\text{ min}}$.

9.3 Existing environment

9.3.1 Sensitive receivers

Noise sensitive land uses are defined based on the type of occupancy and the activities performed. A total of 78 sensitive receivers have been identified within the study area for the noise and vibration assessment. The majority are classified as residential receivers, with a small number of non-residential receivers in the town of Baan Baa. Identified receivers are shown on Figure 3.1 to Figure 3.3 of Technical Report 5 (Noise and vibration). Further details of identified sensitive receivers are provided in section 3.1 of Technical Report 5.

The nearest receiver (R001, on Towri Road, Boggabri) is located about 130 metres from the project site. Five receivers are located about 10 metres from the nearest road/access track proposed for use during construction.

9.3.2 Existing noise levels

Short-term attended noise monitoring was carried out at four locations close to sensitive receivers to quantify and characterise the existing ambient noise environment across the study area, as shown in Figure 3.2 of Technical Report 5 (Noise and vibration). A summary of the monitoring results is provided in Table 9.7.

Table 9.7 Summary of monitoring results

Monitoring location	Monitoring period	Measured noise level (dBA)		
		$L_{A90, 15\text{ min}}$	$L_{Aeq, 15\text{ min}}$	L_{Amax}
M1	9.15am to 10.10am	39	50	77
M2	9.32am to 10am	34	49	78
M3	10.43am to 11.40am	23	37	67
M4	10.54am to 11.30am	28	37	67

Three of the monitoring locations (M2 to M4) recorded a measured background level (L_{A90}) below 35 dBA, which is the minimum rating background noise level during the daytime period as outlined by the *Noise Policy for Industry* (NSW EPA, 2017).

Overall, the background noise environment was quiet, and it was considered appropriate to adopt the minimum rating background levels.

9.4 Construction impacts

9.4.1 Predicted noise levels

As described in section 9.1.2 the assessment used 27 worst-case construction scenarios to assess the potential impacts of construction.

The assessment considered the potential for noise and vibration impacts at sensitive receivers associated with the following construction activities:

- **Transient activities** – these activities progress along the construction right of way, including clearing, grading and vegetation stockpiling, trenching, and backfilling.
- **Stationary activities** – these activities remain in one location for a period of time and include establishment of the Baan Baa construction compound, use of construction compounds and facilities, trenchless and trenched crossings, tie-ins and backfilling, construction of surface facilities, and hydrostatic testing.

Key potential impacts are summarised below.

Predicted impacts during transient construction activities

Table 9.8 shows the number of residential receivers predicted to experience noise levels above the noise management level (without the implementation of mitigation) for worst-case transient construction scenarios. These predictions are based on the noise management levels outlined in Table 9.1 and the perception categories in Table 9.3.

No noise levels above the highly noise affected noise management level (75 dBA) are predicted. Predicted noise levels for transient construction scenarios range between 38 and 61 dBA at the most affected receiver, with the highest predicted noise levels occurring during construction scenario CS3 (construction and/or upgrade of access tracks). Non-residential receivers are not predicted to experience noise levels above the noise management levels.

Due to the progression of transient construction activities, noise levels above the noise management levels at individual locations would be short term, typically lasting about one or two days each as the various works progress along the project site. Measures to manage potential noise impacts are provided in section 9.7. A summary of key findings in relation to the proposed working hours categories for the project is provided in the following pages.

Project working hours during recommended standard hours – Mon to Fri: 7am to 6pm, Sat: 8am to 1pm (noise management level of 45 dBA)

The number of residential receivers predicted to experience noise levels above the 45 dBA noise management level ranges from zero to six, depending on the construction scenario, as follows:

- The highest number of receivers experiencing noise levels above the noise management level (six receivers) are predicted for construction scenarios CS14 (trenching, lowering-in and backfilling activities occurring in close proximity) and CS6 (tree clearing and clearing grading in vegetated areas).
- All other construction activities are predicted to result in between one and four residential receivers experiencing noise levels above the noise management level, with the exception of surveying (CS1), non-destructive testing (CS9), and cathodic protection (CS15).
- Most predicted noise levels above the noise management level are within the 1 to 10 dBA range, which would be clearly audible. At most, two receivers (R001 and R005) may experience noise levels above the noise management level within the 10 to 20 dBA range during the noisiest activities, which would be moderately intrusive.

Project working hours outside recommended standard hours – Sat: 7am to 8am and 1pm to 6pm, Sun: 8am to 6pm (noise management level of 40 dBA)

The number of residential receivers predicted to experience noise levels above the 40 dBA noise management level ranges from zero to 10, depending on the construction scenario, as follows:

- The highest number of receivers experiencing noise levels above the noise management level (at 10 receivers) are predicted for construction scenario CS14 (trenching, lowering-in and backfilling activities occurring in close proximity).
- The highest number of receivers experiencing noise levels above the noise management level (at four receivers) in the ‘noticeable’ noise perception category (1 to 5 dBA above the noise management level) is predicted for five construction scenarios.
- The highest number of receivers experiencing noise levels above the noise management level (at six receivers) in the ‘clearly audible’ noise perception category (5 to 15 dBA above the noise management level) are predicted for construction scenario CS14 (trenching, lowering-in and backfilling activities occurring in close proximity).
- The highest number of receivers experiencing noise levels above the noise management level (at two receivers) in the ‘moderately intrusive’ noise perception category (15 to 25 dBA above the noise management level) are predicted for construction scenario CS14 (trenching, lowering-in and backfilling activities occurring in close proximity).

Project working hours outside recommended standard hours – Mon to Sat: 6am to 7am, Sun: 6am to 8am (noise management level of 35 dBA)

The number of residential receivers predicted to experience noise levels above the 35 dBA noise management level ranges from one to 21, depending on the construction scenario and implementation of mitigation. The highest number of receivers predicted to experience noise levels above the noise management level are predicted for construction scenario CS14 (trenching, lowering-in and backfilling activities occurring in close proximity). Of the predicted noise levels:

- The highest number of receivers experiencing noise levels above the noise management level (at 10 receivers) in the ‘noticeable’ noise perception category (1 to 5 dBA above the noise management level) are predicted for construction scenarios CS6 (tree clearing, grading and stockpiling occurring in close proximity in vegetated areas) and CS14 (trenching, lowering-in and backfilling activities occurring in close proximity).
- The highest number of receivers experiencing noise levels above the noise management level (at nine receivers) in the ‘clearly audible’ noise perception category (5 to 15 dBA above the noise management level) are predicted for construction scenario CS14 (trenching, lowering-in and backfilling activities occurring in close proximity).
- The highest number of receivers experiencing noise levels above the noise management level (at two receivers) in the ‘moderately intrusive’ noise perception category (15 to 25 dBA above the noise management level) are also predicted for seven construction scenarios.
- One receiver is predicted to experience noise levels above the noise management level in the ‘highly intrusive’ noise perception category (more than 20 dBA above the noise management level) for construction scenario CS3 (construction or upgrade of access tracks).

Out of-hours work – Mon to Sun: 6pm to 6am (noise management level of 35 dBA)

Non-destructive testing (CS9) may need to occur out of hours. For this scenario, two receivers are predicted to experience noise levels above the relevant noise management level (35 dBA). Of the predicted noise levels during these times:

- One receiver is predicted to experience noise levels in the ‘noticeable’ noise perception category (1 to 5 dBA above the noise management level).
- One receiver is predicted to experience noise levels in the ‘clearly audible’ noise perception category (5 to 15 dBA above the noise management level).

Work may also be undertaken out of hours where there are no affected receivers or in accordance with a negotiated agreement with affected receivers.

Table 9.8 Summary of noise levels above the noise management levels due to transient construction scenarios

Value	Noise level category above noise management level	Survey	Fencing	Construction and/or upgrade of access tracks	Tree clearing in vegetated areas	Clearing, grading and vegetation stockpiling	CS4 and CS5 occurring in close proximity in vegetated areas	Stringing and bending	Mainline welding	Non-destructive testing	Coating	Trenching	Lower In	Backfill	Trenching (CS11), lower in (CS12) and backfill (CS13) occurring in close proximity	Cathodic protection	Reinstatement & marker posts
		CS1	CS2	CS3	CS4	CS5	CS6	CS7	CS8	CS9	CS10	CS11	CS12	CS13	CS14	CS15	CS16
Highest predicted noise level (dBA)		38	54	61	54	54	56	53	51	40	50	55	56	56	58	43	52
Project working hours during recommended standard hours – Mon to Fri 7am to 6pm, Sat 8am to 1pm (Predicted noise level above the 45 dBA noise management level)																	
Number of residential receivers per perception category	1 to 10 dBA	0	2	1	1	2	5	2	2	0	2	2	3	3	4	0	2
	10 to 20 dBA	0	0	1	0	0	1	0	0	0	0	1	1	1	2	0	0
	>20 dBA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total number of receivers above noise management level		0	2	2	1	2	6	2	2	0	2	3	4	4	6	0	2
Project working hours outside recommended standard hours – Sat 7am to 8am and 1pm to 6pm, Sun 8am to 6pm (Predicted noise level above the 40 dBA noise management level)																	
Number of residential receivers per perception category	1 to 5 dBA	0	4	4	1	3	3	4	4	0	1	1	2	2	2	1	4
	5 to 15 dBA	0	3	1	1	5	5	2	2	0	2	5	5	5	6	0	2
	15 to 25 dBA	0	0	1	0	0	1	0	0	0	0	1	1	1	2	0	0
	>25 dBA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total number of receivers above noise management level		0	7	6	2	8	9	6	6	0	3	7	8	8	10	1	6

Value	Noise level category above noise management level	Survey	Fencing	Construction and/or upgrade of access tracks	Tree clearing in vegetated areas	Clearing, grading and vegetation stockpiling	CS4 and CS5 occurring in close proximity in vegetated areas	Stringing and bending	Mainline welding	Non-destructive testing	Coating	Trenching	Lower In	Backfill	Trenching (CS11), lower in (CS12) and backfill (CS13) occurring in close proximity	Cathodic protection	Reinstatement & marker posts
		CS1	CS2	CS3	CS4	CS5	CS6	CS7	CS8	CS9	CS10	CS11	CS12	CS13	CS14	CS15	CS16
Project working hours outside recommended standard hours – Mon to Sat 6am to 7am, Sun 6am to 8am (Predicted noise level above the 35 dBA noise management level)																	
Number of residential receivers per perception category.	1 to 5 dBA	1	2	4	2	4	10	1	2	1	3	2	3	3	10	1	3
	5 to 15 dBA	0	5	6	1	6	7	6	5	1	3	6	6	6	9	1	5
	15 to 25 dBA	0	2	1	1	2	2	1	1	0	1	2	2	2	2	0	1
	>25 dBA	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Total number of receivers above noise management level		1	9	12	4	12	19	8	8	2	7	10	11	11	21	2	9

Predicted impacts during stationary construction activities

The predicted number of residential receivers experiencing noise levels above the noise management levels (without the implementation of mitigation) are shown in Table 9.9 for worst-case stationary construction scenarios, according to the relevant noise management levels in Table 9.1 and the perception categories in Table 9.3.

No noise levels above the highly noise affected (75 dBA) noise management level are predicted.

Predicted noise levels for stationary construction scenarios range between 30 and 48 dBA at the most affected receivers, with the number of receivers affected depending on the type of works and timing. Non-residential receivers are not predicted to experience noise levels above the noise management levels. A summary of key findings as they relate to the proposed working hours categories for the project is provided below.

The duration of potential noise levels above the noise management levels for stationary works would vary depending on the construction activities. For example, construction of access tracks and crossings may take several days to weeks, while use of the construction facilities would continue throughout the construction phase described in section 3.5.1. Measures to manage potential noise impacts are provided in section 9.7.

Project working hours during recommended standard hours – Mon to Fri: 7am to 6pm, Sat: 8am to 1pm (noise management level of 45 dBA)

One receiver is predicted to experience noise levels above the noise affected noise management level (45 dBA) for construction scenarios CS20 (watercourse trenchless crossing) and CS23 (tie in and backfilling activities). The noise levels are predicted to be in the 'clearly audible' noise perception category (1 to 10 dBA above the noise management level).

Project working hours outside recommended standard hours – Sat: 7am to 8am and 1pm to 6pm, Sun: 8am to 6pm (noise management level of 40 dBA)

The number of residential receivers predicted to experience noise levels above the 40 dBA noise management level ranges from zero to two, depending on the construction scenario. Of these predicted noise levels:

- The highest number of receivers experiencing noise levels above the noise management level (at two receivers) in the 'noticeable' noise perception category (1 to 5 dBA above the noise management level) are predicted for construction scenario CS18 (operation of the construction facilities).
- The highest number of receivers experiencing noise levels above the noise management level (at one receiver) in the 'clearly audible' noise perception category (5 to 15 dBA above the noise management level) are predicted for construction scenarios CS20 (watercourse trenchless crossing – HDD) and CS23 (tie-ins and backfill).

Project working hours outside recommended standard hours – Mon to Sat: 6am to 7am, Sun: 6am to 8am (noise management level of 35 dBA)

The number of residential receivers predicted to experience noise levels above the 35 dBA noise management level range from zero to four, depending on the construction scenario. Of these predicted noise levels:

- The highest number of receivers experiencing noise levels above the noise management level (at four receivers) are predicted for construction scenarios CS18 (operation of the construction facilities) and CS23 (tie-ins and backfill).
- The highest number of receivers experiencing noise levels above the noise management level (at three receivers) in the 'noticeable' noise perception category (1 to 5 dBA above the noise management level) are predicted for construction scenario CS19 (watercourse and road open cut).
- The highest number of receivers experiencing noise levels above the noise management level (at two receivers) in the 'clearly audible' noise perception category (5 to 15 dBA above the noise management level) are predicted for construction scenarios CS18 (operation of the construction facilities) and CS23 (tie-ins and backfill).

Out-of-hours work – Mon to Sun: 6pm to 6am (noise management level of 35 dBA)

Construction scenarios for trenchless crossings (CS20 and CS21) and hydrostatic testing (CS24) may involve out-of-hours work. Of the predicted noise levels:

- One receiver is predicted to experience noise levels above the noise management level in the 'noticeable' noise perception category (1 to 5 dBA above the noise management level) for construction scenario CS20 (watercourse trenchless crossing – HDD) at Little Sandy Creek.
- One receiver is predicted to experience noise levels above the noise management level in the 'clearly audible' noise perception category (5 to 15 dBA above the noise management level) for construction scenarios CS20 (watercourse trenchless crossing – HDD) and CS21 (road and rail trenchless crossing – auger).

Work may also be undertaken out of hours where there are no affected receivers or in accordance with a negotiated agreement with affected receivers.

Sleep disturbance

The *Interim Construction Noise Guideline* (DECC, 2009) recommends that sleep disturbance is assessed when it occurs over more than two consecutive nights.

The transient construction activities are predicted to be above the sleep disturbance screening criteria of 52 dBA L_{Amax} by up to 12 dB at six residential receivers. Of these levels:

- Five receivers are predicted to experience L_{Amax} noise levels between 53 and 58 dBA, which is unlikely to awaken people from sleep.
- One receiver is predicted to experience L_{Amax} noise levels of 64 dBA, which is not likely to affect health and wellbeing significantly.

However, due to the rate of work progression and the sequential scheduling of construction activities, sleep disturbance is unlikely to affect receivers for more than two consecutive early mornings.

Potential impacts of transient construction activities would be mitigated by limiting construction works to low impact noise activities between 6am and 7am Monday to Sunday, with the exception of the specified activities (see section 9.7).

Noise generated by stationary construction activities is predicted to be below the screening sleep disturbance criteria of 52 dBA L_{Amax} and no sleep disturbance impacts are anticipated.

Table 9.9 Summary of noise levels above the noise management levels due to stationary construction scenarios

Value	Noise level category above noise management level	Construction of Baan Baa compound	Operation of the construction facilities	Watercourse and road open cut	Watercourse trenchless crossing - HDD	Road and rail trenchless crossing - auger (24 hr/day)	Road and rail trenchless crossing - pipe rammer (day)	Tie ins and backfill	Hydrostatic testing	Cathodic protection system	Scraper station - construction	Scraper station - testing and commissioning
		CS17	CS18	CS19	CS20	CS21	CS22	CS23	CS24	CS25	CS26	CS27
Highest predicted noise level (dBA)		42	43	39	48	42	44	47	33	30	41	38
Project working hours during recommended standard hours – Mon to Fri 7am to 6pm, Sat 8am to 1pm (Predicted noise level above the 45 dBA noise management level)												
Number of residential receivers per perception category	1 to 10 dBA	0	0	0	1	0	0	1	0	0	0	0
	10 to 20 dBA	0	0	0	0	0	0	0	0	0	0	0
	>20 dBA	0	0	0	0	0	0	0	0	0	0	0
Total number of receivers above noise management level		0	0	0	1	0	0	1	0	0	0	0
Project working hours outside recommended standard hours – Sat 7am to 8am and 1pm to 6pm, Sun 8am to 6pm (Predicted noise level above the 40 dBA noise management level)												
Number of residential receivers per perception category	1 to 5 dBA	1	2	0	0	1	1	1	0	0	1	0
	5 to 15 dBA	0	0	0	1	0	0	1	0	0	0	0
	15 to 25 dBA	0	0	0	0	0	0	0	0	0	0	0
	>25 dBA	0	0	0	0	0	0	0	0	0	0	0
Total number of receivers above noise management level		1	2	0	1	1	1	2	0	0	1	0

Value	Noise level category above noise management level	Construction of Baan Baa compound	Operation of the construction facilities	Watercourse and road open cut	Watercourse trenchless crossing - HDD	Road and rail trenchless crossing - auger (24 hr/day)	Road and rail trenchless crossing - pipe rammer (day)	Tie ins and backfill	Hydrostatic testing	Cathodic protection system	Scraper station - construction	Scraper station - testing and commissioning
		CS17	CS18	CS19	CS20	CS21	CS22	CS23	CS24	CS25	CS26	CS27
Project working hours outside recommended standard hours –Mon to Sat 6am to 7am, Sun 6am to 8am (Predicted noise level above the 35 dBA noise management level)												
Number of residential receivers per perception category	1 to 5 dBA	1	2	3	1	0	0	2	0	0	2	2
	5 to 15 dBA	1	2	0	1	1	1	2	0	0	1	0
	15 to 25 dBA	0	0	0	0	0	0	0	0	0	0	0
	>25 dBA	0	0	0	0	0	0	0	0	0	0	0
Total number of receivers above noise management level		2	4	3	2	1	1	4	0	0	3	2

9.4.2 Vibration

Of the indicative construction machinery and plant considered by the assessment, the main potential sources of vibration are as follows:

- The bulldozer for works within the project site, excluding access tracks, which has the potential to generate vibration above the human comfort and structural damage vibration criteria if works occur within 135 metres and 10 metres of sensitive receivers and structures, respectively.
- The grader or excavator for road upgrade works, which has the potential to generate vibration above the human comfort and structural damage vibration criteria if works occur within 70 metres and five metres of sensitive receivers and structures, respectively.

No sensitive receivers are located within the above distances of the relevant construction activities. As such, no human comfort or structural damage vibration impacts are anticipated.

9.4.3 Road traffic noise

Construction traffic using arterial roads (Newell and Kamilaroi highways) would be below the road traffic noise criteria (see section 9.2.1) and no impacts are predicted.

Potential noise impacts of construction traffic using local roads and access tracks were assessed at various distances to identify receivers that could experience noise impacts. The assessment indicates construction traffic has the potential to generate noise levels above the road traffic noise criteria as follows:

- A total of 20 sensitive receivers may experience noise levels above 55 dBA criteria during the daytime.
- A total of 26 sensitive receivers may experience noise levels above the 50 dBA criteria during the nighttime, inclusive of the 20 sensitive receivers during the daytime. Local roads would be subject to low volumes of construction traffic during the nighttime period (10pm to 7am). The exception would be during the 6am to 7am period when the workforce is mobilising to site; however, where feasible, heavy vehicles would be scheduled to arrive after 7am on local roads.

Most of the potentially affected sensitive receivers are located along Baranbah Street, Baan Baa Road, Caloola Road, Towri Road and Curracabah Road. Feasible and reasonable noise mitigation and management measures will be implemented to minimise the potential for impacts (see section 9.7). Potential impacts would be temporary and largely limited to the main construction phase (see section 3.5.1).

9.4.4 Blasting

As described in section 3.4.2, controlled blasting may be used in hard rock terrain where the use of standard trenching machinery may not be feasible. The need for blasting would be confirmed based on further geotechnical investigations undertaken during detailed design and construction planning.

For a given surface blast, the distances at which the airblast overpressure criteria are exceeded are always greater than the distances at which the ground vibration criteria are exceeded. As a result, any potential impacts from blasting would be governed by the airblast overpressure rather than the ground vibration levels. The maximum instantaneous charge for any required blasting is expected to be in the order of one to 50 kilograms. Buffer distances ranging from 330 to 1,200 metres are predicted to be below the recommended maximum level for airblast overpressure defined by *Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration* (Australian and New Zealand Environment Council, 1990) for these charge levels. Within these buffer distances between one to nine receivers are located along the construction right of way.

It is noted that the blast design is the responsibility of the blasting contractor. Once the exact location and details of any blasting is known, the distance to the nearest receiver would be used to estimate the allowable charge mass that will not be exceeded. Should blasting be required, a blasting management plan will be prepared and implemented during construction (see section 9.7).

Blasting would be undertaken during the recommended standard working hours for blasting defined by the *Interim Construction Noise Guideline* (DECC, 2009) (see section 3.5.2).

9.5 Operation impacts

9.5.1 Operational noise

The main operational activity with the potential to generate noise is maintenance pipeline cleaning, which is conducted infrequently and involves controlled releases of residual gas. Noise from pipeline cleaning would comply with the most stringent criteria of 35 dBA at 110 metres after correcting for the short duration of 30 seconds over a $L_{Aeq,15min}$ assessment period. No receivers are located within this distance of scraper stations and no operational noise impacts are expected.

9.5.2 Road traffic noise

Occasional light vehicle movements would be generated during operation for routine inspections and maintenance. These movements would be infrequent and there would be no significant increase in traffic noise on the surrounding road network.

9.5.3 Vibration

Operation would not result in adverse human comfort or structural damage vibration impacts.

9.6 Decommissioning impacts

At project closure, the pipeline would be decommissioned as described in section 3.8, including compliance with the Pipelines Act and Regulation, AS 2885 and relevant guidelines and requirements. Activities with the potential to result in noise and vibration impacts (if inadequately managed) include:

- excavation of bell holes and cutting/capping pipeline sections, involving diesel-powered machinery similar to that used during construction
- removal of surface facilities and transport of materials, which would involve truck movements and equipment operation
- residual gas management, which may (depending on the outcomes of the safety management study and abandonment plan) involve controlled release or combustion using portable equipment
- general site works, including operation of machinery.

Potential noise impacts associated with decommissioning include:

- short-term increases in daytime noise levels during excavation and removal of surface facilities
- localised noise from residual gas management and diesel machinery operation.

These activities would use equipment comparable to that used during construction; however, decommissioning works would be less intensive than construction activities, involving fewer personnel, less equipment, and shorter durations of work at any given location (typically lasting less than one week). Although maximum noise levels may be similar to those experienced during construction, the potential impact would be reduced due to the limited scope and temporary nature of the works.

Measures to manage potential noise and vibration generating activities during decommissioning will be defined in the decommissioning environmental management plan, which will include a noise and vibration subplan adapted from the construction noise and vibration management plan. The plan will be developed in accordance with current regulatory and best practice requirements and tailored to the nature and location of decommissioning activities. Given the short duration, localised nature and lower intensity of decommissioning activities, and with implementation of the above processes and measures, no significant noise or vibration impacts are expected at sensitive receivers.

Further information about the approach to environmental management during decommissioning is provided in section 20.4 of the EIS.

9.7 Mitigation and management

9.7.1 Approach to mitigation and management

The main potential for noise impacts would occur during construction. The *Interim Construction Noise Guideline* (DECC, 2009) notes that, due to the nature of construction, some noise from construction is inevitable. During construction, there would be noise impacts at some receivers during certain times and during certain construction activities as described in section 9.4.

Mitigation measures have been developed with the aim of minimising or mitigating noise and vibration impacts. Key measures are described below and detailed in section 9.7.2.

The CEMP will include a noise and vibration management plan to provide the framework for managing and mitigating potential construction noise and vibration impacts in accordance with the *Interim Construction Noise Guideline*. The plan will define the processes, responsibilities and management measures that will be implemented during construction to manage noise and vibration. Further information on the CEMP is provided in chapter 20 (Approach to environment management and mitigation).

As described in section 3.5.2, it is proposed to undertake work outside the recommended standard working hours defined by the *Interim Construction Noise Guideline*. Measures to minimise potential impacts during the project working hours outside of recommended standard working hours are provided in Table 9.10. These include limiting construction activities between 6am and 7am Monday to Sunday to low impact noise activities where noise levels are predicted to be above the noise management level at sensitive receivers, excluding specified activities as defined in section 3.5.2. Low impact noise activities are construction activities that cause $L_{Aeq,15min}$ noise levels of no more than 5 dBA above the rating background level at any residence in accordance with the *Interim Construction Noise Guideline*.

An out-of-hours work protocol will be prepared as part of the construction noise and vibration management plan to identify the process for considering, managing and approving work outside the project working hours.

9.7.2 List of mitigation measures

Measures that will be implemented to address potential impacts on noise and vibration are listed in Table 9.10.

Table 9.10 Noise and vibration mitigation measures

Impact/issue	Ref	Mitigation measures	Timing
Construction noise and vibration management	NV1	<p>A construction noise and vibration management plan will be prepared and implemented as part of the CEMP. The plan will generally follow the approach outlined in the <i>Interim Construction Noise Guideline</i> (DECC, 2009) and will identify:</p> <ul style="list-style-type: none"> potentially high noise and vibration generating activities associated with construction measures to manage identified impacts a monitoring program to validate predicted noise levels and assess performance against relevant noise and vibration criteria arrangements for consultation with affected sensitive receivers, including notification and complaint handling procedures an out-of-hours work protocol (mitigation measure NV3). 	Pre-construction, construction

Impact/issue	Ref	Mitigation measures	Timing
Construction activities outside of recommended standard hours (project working hours and specified activities)	NV2	<p>The following requirements will be implemented to manage potential noise impacts:</p> <ul style="list-style-type: none"> A seven-day respite period will be implemented following the 21-day mobilisation period, excluding specified activities as defined in Table 3.4 of the EIS. Only low impact noise activities (construction activities that cause $L_{Aeq,15min}$ noise levels of no more than 5 dBA above the rating background level at any residence in accordance with the <i>Interim Construction Noise Guideline</i> (DECC, 2009)) will be permitted between 6am and 7am on Monday to Sunday, excluding specified activities as defined in Table 3.4 of the EIS. Work will not be undertaken between and including Christmas and New Year's Day, during the Easter public holidays, or on ANZAC Day. 	Construction
Out-of-hours work	NV3	An out-of-hours work protocol will be developed as part of the construction noise and vibration management plan to define the process for managing out-of-hours work (i.e. work outside the project working hours). The protocol will include implementing feasible and reasonable measures and communication requirements in accordance with Santos' communication procedures.	Pre-construction
Construction road traffic noise	NV4	<p>Where compliance with the road traffic noise criteria in the <i>NSW Road Noise Policy</i> (DECCW, 2011) is unable to be achieved, feasible and reasonable noise mitigation and management measures will be included in the construction noise and vibration management plan, including:</p> <ul style="list-style-type: none"> reducing heavy vehicle speeds on local roads and access tracks managing driver behaviour via inductions, toolbox talks and minimising the use of engine compression brakes minimising heavy vehicle movements on local roads during the morning (6am to 7am) where practicable. 	Pre-construction
Blasting	NV5	<p>The need for blasting will be confirmed during detailed construction planning. In the event that blasting is required, the blast parameters will be designed, and allowable charge mass confirmed, to achieve the airblast overpressure and ground vibration requirements of the <i>Technical Basis for Guidelines to Minimise Annoyance Due to Blasting Overpressure and Ground Vibration</i> (Australian and New Zealand Environment Council, 1990). This will include trial blasting and airblast/vibration monitoring to confirm site-specific constraints and refine safe blasting distances.</p> <p>If blasting is required, a blasting management plan will be prepared and implemented as part of the construction noise and vibration management plan. The plan will define:</p> <ul style="list-style-type: none"> allowable charge mass detonation methods and debris control timing of blasting and periods of relief (if required) safety requirements. 	Pre-construction
Trenchless construction using a pipe rammer	NV6	If trenchless construction is undertaken using a pipe rammer, construction will be paused outside project working hours, where practicable, if sensitive receivers are predicted to experience noise levels above the noise management level.	Construction
Operational noise	NV7	Routine inspections, maintenance and pipeline cleaning will be scheduled during recommended standard working hours as defined by the <i>Interim Construction Noise Guideline</i> (DECC, 2009).	Operation

Impact/issue	Ref	Mitigation measures	Timing
Decommissioning noise	NV8	<p>A noise and vibration management plan will be included in the decommissioning environmental management plan and implemented during decommissioning to minimise the potential for impacts on sensitive receivers. Measures in the plan will include, but not be limited to:</p> <ul style="list-style-type: none"> • scheduling noisier activities during standard hours where feasible • arrangements for consultation with affected sensitive receivers, including notification and complaint handling procedures • measures to manage potential noise impacts • monitoring noise levels where required to ensure compliance with relevant noise criteria. 	Decommissioning