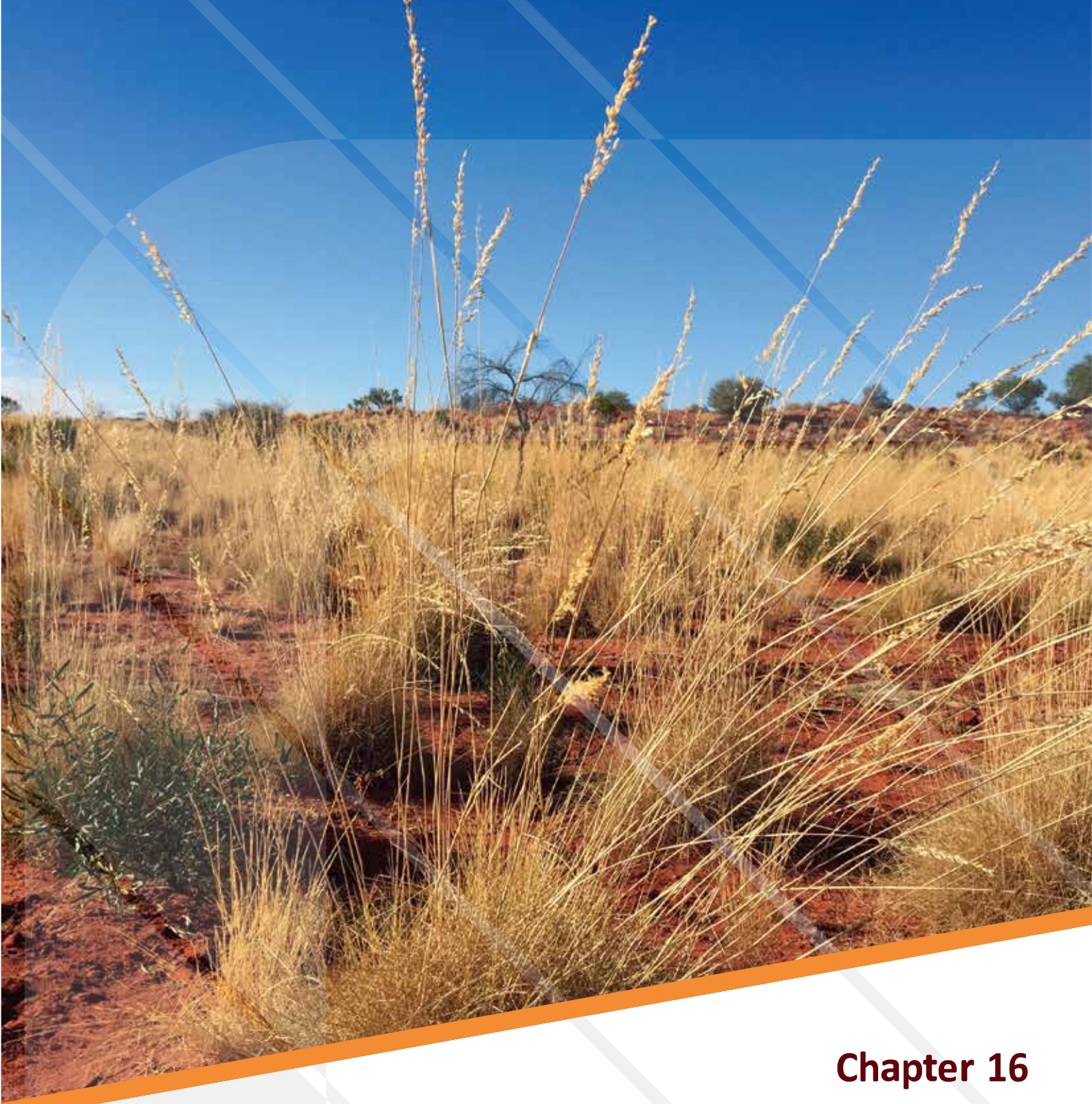




Chapter 16

Noise and Vibration



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Contents

Abbreviations	ii
16 Noise and Vibration	16-1
16.1 Introduction	16-1
16.2 Methodology.....	16-1
16.3 Existing environment.....	16-2
16.4 Assessment of risks during construction, operation and closure and rehabilitation	16-5
16.5 Mitigation and monitoring.....	16-7
16.6 Summary of risk assessment.....	16-8
16.7 Conclusion.....	16-8

LIST OF FIGURES

Figure 16-1 Cultural heritage exclusion zones (vibration assessment)	16-4
Figure 16-2 Ground vibration predictions for different charge masses and distances (average ground conditions)	16-6
Figure 16-3 Ground vibration predictions for different charge masses and distances (worst case ground conditions)	16-6

LIST OF TABLES

Table 16-1 Vibration limits for cosmetic damage (BS7385.2).....	16-1
Table 16-2 Mitigation and management measures (noise and vibration)	16-7
Table 16-3 Summary of risk assessment (noise and vibration)	16-8



ABBREVIATIONS

CEMP	Construction Environmental Management Plan
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
NT	Northern Territory
OEMP	Operational Environmental Management Plan
PFS	Pre-Feasibility Study
RCP	Rehabilitation Closure Plan
ToR	Terms of Reference



16 NOISE AND VIBRATION

16.1 Introduction

This chapter provides a review of potential noise and vibration impacts associated with the Proposal. This includes the consideration of noise and vibration associated with rock blasting during the construction of the proposed decline portal and tunnel and noise generated by mechanical equipment and traffic associated with the construction, operation, and closure and decommissioning of the Proposal. The potential for noise and vibration impacts on surrounding sensitive receptors (defined as residents, hospitals, schools, daycare facilities, elderly housing and convalescent facilities, as well as sites of cultural heritage importance) have been assessed and mitigation and management measures are identified to reduce potential impacts.

The assessment has been prepared in accordance with the Terms of Reference (refer to Appendix A).

16.2 Methodology

Given the distance to the nearest sensitive receptors from the proposed development footprint, a qualitative assessment was undertaken of noise impacts during construction, operation, and closure and rehabilitation of the Proposal. A quantitative assessment of vibration was, however, undertaken for the construction of the proposed decline portal and tunnel given the close proximity of sites of cultural heritage importance (rock structures considered sensitive receptors and demarcated as 'cultural heritage exclusion zones') within the area of the proposed Chandler Facility.

No vibration limits are available for rock structures, therefore, vibration impacts on the cultural heritage exclusion zones were assessed based on the Australian Standard AS2187.2 (2006) *Explosives – Storage and Use – Use of Explosives*. Table J4.4.2.1 of AS2187.2 recommends the limits of vibration for the prevention of cosmetic damage as per British Standard BS7385.2 *Evaluation and Measurement for Vibration in Buildings — Part 2: Guide to Damage Levels from Ground Borne Vibration*. The most conservative cosmetic damage criteria provided by BS7385.2 is for unreinforced or light framed structures which was conservatively adopted for the cultural heritage exclusion zone assessment (refer to Table 16-1). However, note that rock structures would withstand higher levels of vibration without experiencing any cosmetic damage.

Table 16-1 Vibration limits for cosmetic damage (BS7385.2)

Type of building	Peak component particle velocity in frequency range of predominant pulse	
	4 Hz to 15 Hz	15 Hz and above
Un-reinforced or light framed structure. Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above



Factors that significantly affect ground vibration from blasting are the:

- Maximum instantaneous charge per delay.
- Distance from the blast to the receiver.
- Geological conditions (which influence vibration propagation).

Blasting is non-linear in nature and variability in ground type and meteorological conditions makes it difficult to accurately predict ground vibration without site-specific measurement data or blast contractor parameters, therefore, conservative predictions have been undertaken. AS2187.2 recommends that ground vibration is estimated using the following equation:

$$V = K_G \left(\frac{R}{Q^{1/2}} \right)^{-B}$$

Where:

V	is the peak vector sum ground vibration peak particle velocity (mm/s)
R	is the distance from charge (metres)
Q	is the maximum instantaneous charge (kilograms)
B, K _G	is the ground constant.

AS2187.2 gives a site constant for a free face in average field conditions of K_G = 1,140 and B = 1.6. This value can vary from 1/5 times to four times depending on geological conditions and other factors. As such, predictions have been undertaken with average and worst case ground condition values.

16.3 Existing environment

This section describes the existing land use, infrastructure, geology, the location of sensitive receptors (including sites of cultural importance), and existing background noise within the proposed development footprint and vicinity (with emphasis on the area of the proposed Chandler Facility).

16.3.1 Existing land use and infrastructure

The proposed Chandler Facility and most of the Chandler Haul Road would be located within Maryvale Station (NT Portion 810), approximately 120 kilometres south of Alice Springs. The proposed Apirnta Facility, Henbury Access Road and a portion of the Chandler Haul Road would be located within Henbury Station (NT Portion 657), to the west of the proposed Chandler Facility (refer to Figure 1-1).

Land within Maryvale Station and Henbury Station is pastoral lease land governed under the NT *Pastoral Land Act*. As such, land within Maryvale Station and Henbury Station is used for pastoral activities (specifically for grazing cattle).



Nearby existing infrastructure includes the Central Australian Railway located approximately 30 kilometres to the west of the Chandler Facility. The proposed Apirnta Facility would be located adjacent to the Central Australian Railway. The Stuart Highway is located approximately 60 kilometres to the west of the proposed Apirnta Facility and 90 kilometres to the west of the proposed Chandler Facility (refer to Figure 1-1).

16.3.2 Geology

The geology within the area of the proposed Chandler Facility consists of a surface formation predominantly of fine silt stone and clay stone above the Langra Formation. The Langra Formation is predominantly coarse to fine sandstone and sits upon the Jay Creek Limestone Formation to a depth of approximately 560 metres.

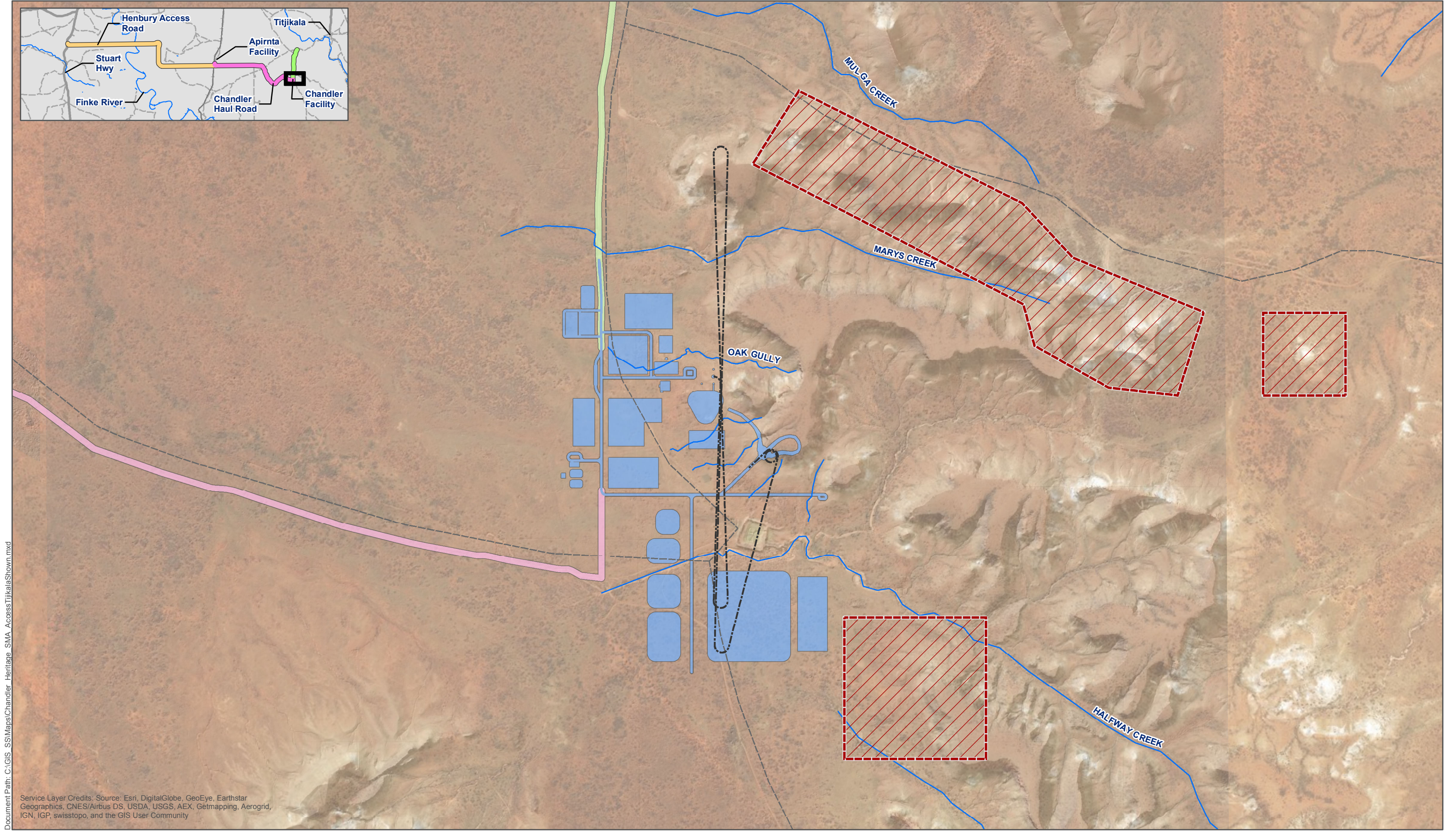
16.3.3 Sensitive receptors and sites of cultural heritage importance

The closest sensitive receptors to the proposed development footprint are located within the community of Titjikala (approximately 25 kilometres to the north-east of the proposed Chandler Facility and 56 kilometres from the proposed Apirnta Facility) (refer to Figure 1-1). Chambers Pillar and the Chambers Pillar Nature Reserve are also located approximately 15 kilometres to the west of the proposed Chandler Facility (refer to Figure 1-1).

Three sites of cultural heritage importance have been identified within the vicinity of the proposed development footprint. These sites consist of rock structures that have been demarcated as 'cultural heritage exclusion zones' and are located in the area of the proposed Chandler Facility (refer to Figure 16-1). At the nearest point, the proposed decline tunnel would be located approximately 200 metres from the northern-most cultural heritage exclusion zone. At this point, the decline tunnel would also be located at depth of approximately 400 metres below the ground surface (refer to Figure 16-1).

16.3.4 Existing background noise

The proposed development footprint is located within a rural area, primarily used for pastoral activities (specifically for grazing cattle). This land use is reflective of the existing background noise environment, with existing noise sources limited to those from cattle and some very light road traffic associated with pastoral activities. Noise is also generated by train movements along the Central Australian Railway and by traffic using the Stuart Highway.



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Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



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Coordinate System:
GDA 1994 MGA Zone 53

Legend

Proposed development footprint

- Access road to Titjikala
- Chandler Haul Road
- Chandler Facility

- Pastoral boundaries
- Cultural heritage exclusion zone
- Watercourse
- Existing track
- Portal and decline

Figure 16-1
Cultural heritage exclusion zones (vibration assessment)





16.4 Assessment of risks during construction, operation and closure and rehabilitation

This section presents the potential noise and vibration impacts during construction, operation and closure and rehabilitation of the Proposal. Mitigation measures to avoid or reduce these impacts are discussed in Section 16.5.

16.4.1 Rock blasting noise and vibration

Rock blasting of the proposed decline portal and tunnel would result in noise and vibration during construction of the Proposal. Due to distance, the noise generated during rock blasting would not be audible at sensitive receptors located within the community of Titjikala (the community of Titjikala is located approximately 25 kilometres to the north-east of the proposed Chandler Facility and 56 kilometres from the proposed Apirnta Facility).

The cultural heritage exclusion zones have been treated as sensitive receptors with regards to ground vibration generated by rock blasting during construction of the proposed decline portal and tunnel. Ground vibration has been predicted for a range of charge masses for varying distances and assuming two cases: average and worst case ground conditions (refer to Figure 16-2 and Figure 16-3). Air-blast overpressure has not been assessed as the excavation would be undertaken at a depth of approximately 400 metres below the ground surface, which shields the pressure wave.

At the nearest point, the decline tunnel would be located approximately 200 metres from the northern-most cultural heritage exclusion zone. At this point, the decline tunnel would also be located at depth of approximately 400 metres below the ground surface (refer to Figure 16-1). As can be seen from the worst case ground vibration predictions, compliance with the most conservative BS7385.2 vibration limits for cosmetic damage is achieved for a charge mass of 100 kilograms. It is expected that much smaller charge masses would be used by the blast contractor (such as five kilograms). If a charge mass in excess of 100 kilograms were required, additional assessment would be undertaken to determine the potential impacts on cultural heritage exclusion zones within the area of the proposed Chandler Facility.

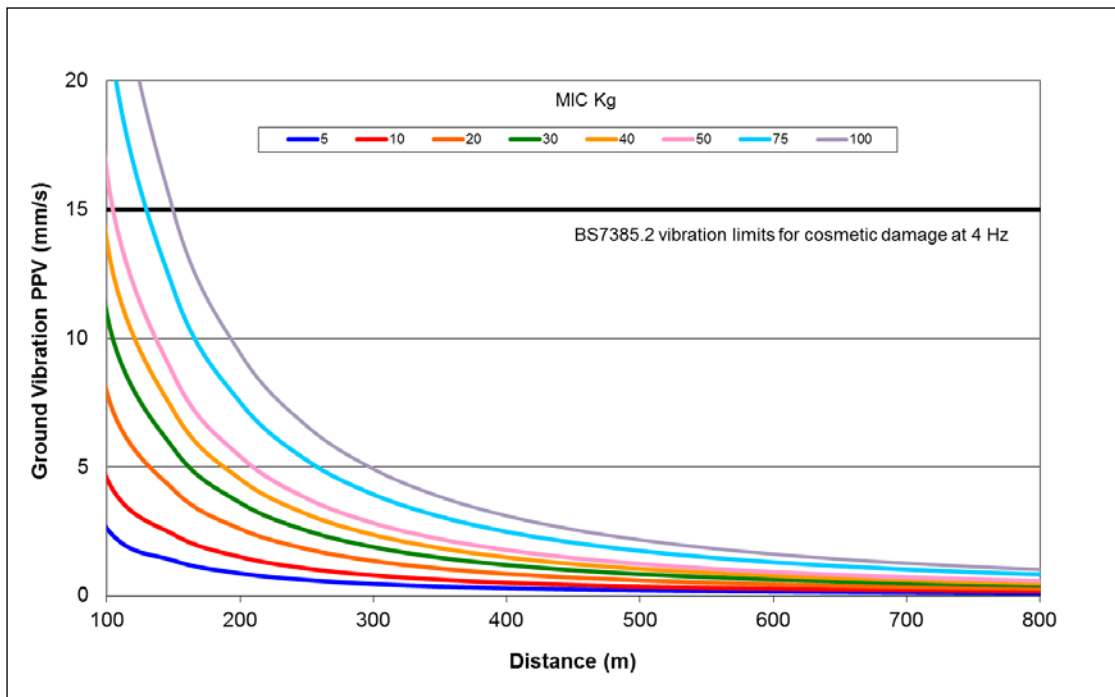


Figure 16-2 Ground vibration predictions for different charge masses and distances (average ground conditions)

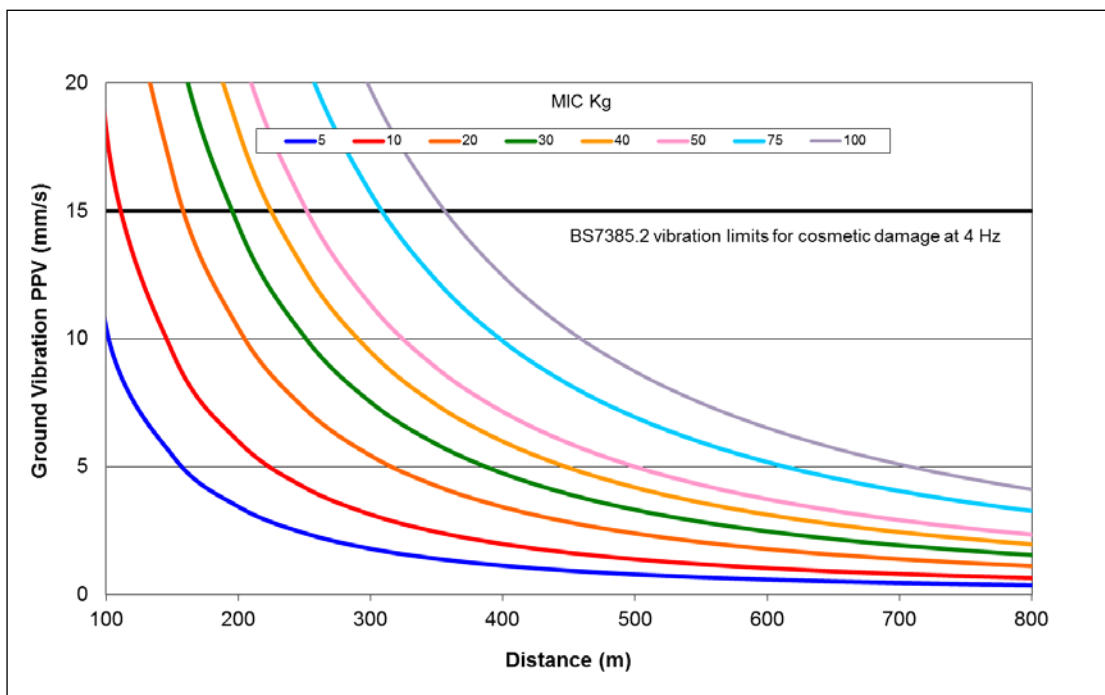


Figure 16-3 Ground vibration predictions for different charge masses and distances (worst case ground conditions)

16.4.2 Mechanical equipment noise

The use of mechanical equipment would result in noise during construction operation, and closure and rehabilitation of the Proposal. Due to distance, the noise generated from mechanical equipment would not be audible at sensitive receptors located within the community of Titjikala.



16.4.3 Traffic noise

Access to the proposed Apirnta Facility would be via the Stuart Highway and the proposed Henbury Access Road. Access to the proposed Chandler Facility would be via the proposed Chandler Haul Road. No residents or communities have been identified along the transportation route (the closest sensitive receptors to the proposed development footprint are located within the community of Titjikala). As such, there would be no impacts to sensitive receptors from transportation noise associated with construction, operation, or closure and rehabilitation of the Proposal.

16.5 Mitigation and monitoring

No mitigation or monitoring measures would be required given that there would be no noise or vibration impacts on sensitive receptors (including sites of cultural heritage importance) in the vicinity of the proposed development footprint during construction, operation, and closure and rehabilitation of the Proposal. Despite this, residents within the community of Titjikala would be informed of the nature of the proposed works undertaken during construction of the Proposal. Contact details to register noise and/or vibration complaints would also be provided to residents within the community of Titjikala.

If a charge mass in excess of 100 kilograms were required for rock blasting of the decline portal and tunnel, additional assessment would be undertaken to determine the potential vibration impacts on cultural heritage exclusion zones within the area of the proposed Chandler Facility.

Mitigation and management measures proposed to minimise noise during construction, operation, and closure and rehabilitation of the Proposal in order to safeguard workers from occupational noise are listed in Table 16-2. These measures would be incorporated into the CEMP, OEMP and/or RCP for the Proposal.

Table 16-2 Mitigation and management measures (noise and vibration)

ID	Outcome	Mitigation/management measure	Timing
NV.1	Workers safeguarded from occupational noise.	Prepare Noise Management Plan (in accordance with the NT <i>Work Health Safety Act</i>) prior to construction and incorporate into the CEMP, OEMP and/or RCP for the Proposal.	Pre-construction
NV.2	Workers safeguarded from occupational noise.	Select mobile mechanical equipment to minimise noise emissions and ensure equipment is appropriately maintained to ensure excessive noise is not generated.	Construction, operation, closure and rehabilitation
NV.3	Workers safeguarded from occupational noise.	Check noise emission levels of all critical items of mobile mechanical equipment for compliance with noise limits appropriate to those items prior to the equipment going into regular service.	Construction, operation, closure and rehabilitation
NV.4	Workers safeguarded from occupational noise.	Where practicable, operate mechanical equipment at low speed/power and switch off when not being used rather than leave idling for prolonged periods of time.	Construction, operation, closure and rehabilitation
NV.4	Workers safeguarded from occupational noise.	Provide appropriate training for operators in order to raise their awareness of potential noise problems	Construction, operation,



ID	Outcome	Mitigation/management measure	Timing
		and to increase their use of techniques to minimise noise emissions.	closure and rehabilitation
NV.5	Workers safeguarded from occupational noise.	Where practicable, optimise the layout and positioning of noise-producing equipment and activities on-site to minimise noise emission levels.	Construction, operation, closure and rehabilitation
NV.6	Workers safeguarded from occupational noise.	Ensure workers wear and maintain appropriate PPE.	Construction, operation, closure and rehabilitation
NV.7	Workers safeguarded from occupational noise.	Where noise from a particular activity is identified, measures to mitigate the impact would be investigated, implemented and recorded.	Construction, operation, closure and rehabilitation

16.6 Summary of risk assessment

A summary of the risk assessment undertaken for noise and vibration during construction, operation, and closure and rehabilitation of the Proposal is provided in Table 16-3.

Table 16-3 Summary of risk assessment (noise and vibration)

Hazard	Pre-mitigated risk			Post-mitigated risks			Risk outcome
	Likelihood	Consequence	Risk ranking	Likelihood	Consequence	Risk ranking	
Blasting activities result in increased noise levels	Almost certain	Insignificant	High	Likely	Insignificant	Medium	Risk reduced
Blasting activities result in vibration	Almost certain	Major	Extreme	Unlikely	Major	Medium	Risk reduced
Blasting activities result in vibration on known items of cultural heritage significance	Possible	Major	High	Remote	Major	Medium	Risk reduced
Construction and operation noise	Almost certain	Moderate	High	Possible	Minor	Medium	Risk reduced

16.7 Conclusion

The closest sensitive receptors to the proposed development footprint are located within the community of Titjikala (approximately 25 kilometres to the north-east of the proposed Chandler Facility and 56 kilometres from the proposed Apirnta Facility). Due to distance, there would be no noise impacts to sensitive receptors from rock blasting of the proposed decline portal and tunnel, nor would there be noise impacts from the use of mechanical equipment or from traffic during construction, operation, and closure and rehabilitation of the Proposal. There would also be no vibration impacts from rock blasting of the proposed decline portal and tunnel to sites of cultural heritage importance (demarcated as 'cultural heritage exclusion zones') within the area of the proposed Chandler Facility.

No mitigation or monitoring measures would be required given that there would be no noise or vibration impacts on sensitive receptors or on sites of cultural heritage importance in the vicinity of the proposed development footprint during construction, operation, and closure and rehabilitation



of the Proposal. If, however, a charge mass in excess of 100 kilograms were required for rock blasting of the decline portal and tunnel, additional assessment would be undertaken to determine the potential vibration impacts on cultural heritage exclusion zones within the area of the proposed Chandler Facility.

Mitigation and management measures would be implemented in order to minimise noise during construction, operation, and closure and rehabilitation of the Proposal to safeguard workers from occupational noise. This would include the preparation of a Noise Management Plan that would be prepared in accordance with the NT *Work Health Safety Act*.