CHAPTER 16
NOISE

DISCLAIMER

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Subject to that declaration:

(a) in writing this document, Iron Road Limited has relied on information provided by specialist consultants, government agencies, and other third parties. Iron Road Limited has reviewed all information to the best of its ability but does not take responsibility for the accuracy or completeness; and

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16 Noise

The project area has a quiet rural character dominated by natural noise sources such as wind, insects and birds, with intermittent human-induced noise from road traffic and agricultural machinery. The proposed mine will introduce new noise sources to the project area, including blasting, excavation, materials handling, minerals processing, rail loading and train movements.

The impact of airblast noise (pressure waves produced by blasting and transmitted through the air) and ground vibration from blasting operations is addressed in Chapter 17 Blasting and Vibration, as separate assessment methods and criteria apply to blasting noise and vibration compared with noise sources addressed in this chapter.

This chapter describes how the introduction of these new noise sources would affect existing noise levels at sensitive receiver locations. It provides a comparison of the predicted levels against regulatory limits at these sensitive receiver locations. The design measures and management strategies that have been incorporated into the project to minimise noise are described. Risks associated with project-related noise sources that could reasonably occur as a result of uncertainty in the impact assessment process during construction, operation and closure of the proposed mine are also considered.

The Environmental Noise and Vibration Assessment technical report is provided in Appendix L.

The potential effects of noise from the project on terrestrial fauna are addressed in Chapters 11.

16.1 Applicable Legislation and Standards

The relevant legislation relating to environmental noise at the mine site is as follows:

- *Environment Protection Act 1993*
- *Environment Protection (Noise) Policy 2007* (the Noise Policy)

The Noise Policy dictates the relevant indicative noise levels (noise criteria which must be met) based on Development Plan zoning in which the noise source and sensitive receivers are located. An explanation of how the noise criteria for the project have been derived is provided in Section 16.1.2.

Further information regarding the requirements and relevance of the legislation is provided in Chapter 4 Statutory Framework.

16.1.1 Explanation of Noise Terms and Units

As explained in the *Guidelines for the Use of the Environment Protection (Noise) Policy 2007* (EPA 2009), noise is commonly defined as unwanted sound. Sound is produced by small fluctuations in air pressure. The loudness of a sound is predominantly related to the size of the fluctuations, but is also related to their frequency, or the rate at which they are produced.

The loudness of sounds can range from those which the human ear can just detect (the threshold of hearing) to those that exceed a threshold of pain. Given that sound is produced by changes in air pressure, the international standard unit of sound pressure is a pressure measurement, the micropascal (µPa).

The range between the faintest audible sound and the loudest sound the human ear can stand is so large (20 µPa to 63 million µPa) that it would be cumbersome to express sound pressure fluctuations in these units. Instead, this range is compressed by expressing the sound pressure level on a logarithmic scale, the unit of which is the more commonly known decibel (dB).

Given the logarithmic scale, a doubling of the sound pressure, say from 20 µPa to 40 µPa, produces an increase of 6 dB. In subjective terms, a 3 dB increase is often described as a just noticeable difference.

The frequency of a sound is the rate at which the fluctuations are produced per second. Practically all sounds contain a mixture of frequencies and the mix of frequencies affects the perceived loudness. A high-frequency sound (e.g. screeching or whistling) at the same sound pressure level as a low-frequency sound (e.g. thunder) will be perceived to be louder. This is because the human ear is most sensitive to mid-range and high frequencies and is less sensitive to the lower frequencies.

To ensure measured levels approximate the human response, a weighting scale is used. It is known as the 'A' scale and the units are referred to as 'A' weighted decibels and written as dB(A). The dB(A) scale discriminates between sounds in much the same way as people do. Some examples of typical sound levels in dB(A) are shown in Figure 16-1.

Additional explanation of noise and vibration terms is provided in the Glossary.

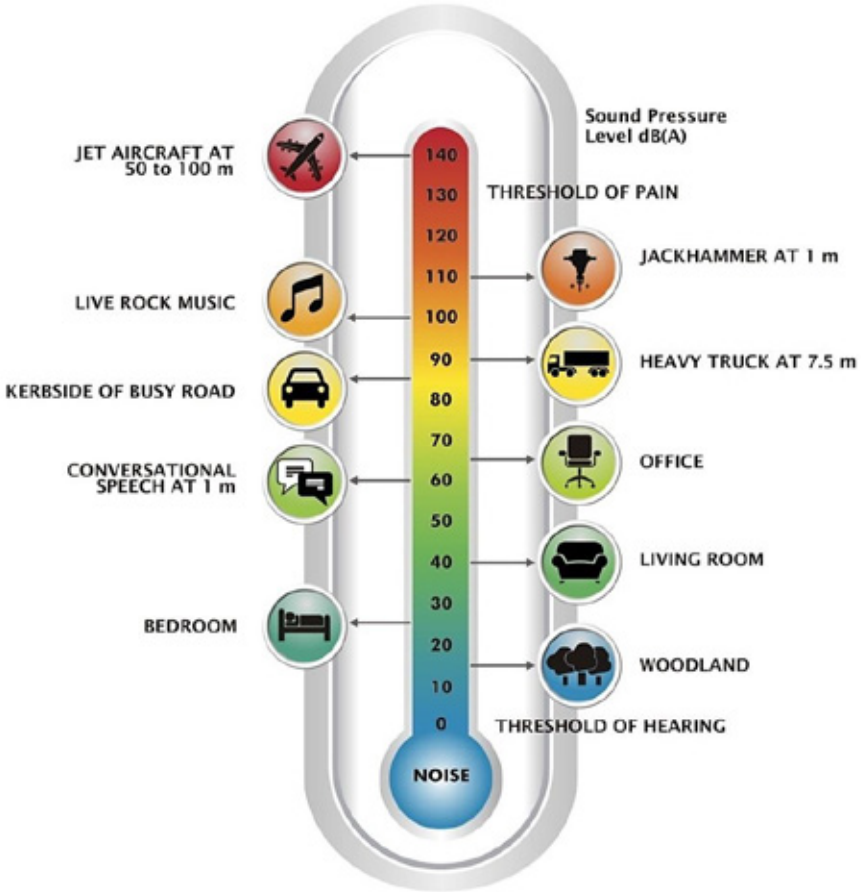

Figure 16-1 Some Examples of Typical Sound Levels in dB(A)

16.1.2 Noise Criteria

The relevant noise criteria for construction, operation and closure of the proposed mine have been derived in accordance with the Noise Policy and in consultation with the Department of State Development and Environment Protection Authority.

The construction noise limits detailed in Clause 23 of the Noise Policy do not apply to activities where development approval under the *Development Act 1993* is not required. The proposed mining lease is to be assessed pursuant to the *Mining Act 1971*, therefore Clause 23 of the Noise Policy does not apply. Therefore the construction noise criteria will be the same as for the mining operation and mine closure.

Indicative noise levels (noise criteria) are based on Development Plan zoning in which the noise source and sensitive receivers are located. The area covered by the proposed mining lease (the mine site) and the nearest sensitive receivers are located within the Primary Production Zone of the Wudinna Council Development Plan (DPTI 2012). A Primary Production Zone is considered a rural industry land use in the Noise Policy. The rural industry noise criteria applicable to sensitive receivers near the mine site are presented in Table 16-1.

There are also sensitive receivers within the township of Warramboo which are located within a Settlement Zone which is considered a residential land use in the Noise Policy. In accordance with the Noise Policy, the noise criteria relevant to the Settlement Zone is the average of the Primary Production Zone (within which the proposed mine site is located) and the Settlement Zone (within which Warramboo is located). The noise criteria applicable to sensitive receivers in Warramboo are also shown in Table 16-1.

Table 16-1 Noise Criteria Applicable to Sensitive Receivers within the Primary Production Zone and Settlement Zone

Period	Noise Criteria, $L_{Aeq, 15\ mins}$ dB(A) *
Primary Production Zone	
Day, 7am to 10 pm	57
Night, 10 pm to 7 am	50
Settlement Zone (Warramboo)	
Day, 7am to 10 pm	55
Night, 10 pm to 7 am	48

* Equivalent noise levels addressing the average noise exposure of a sensitive receiver measured over a 15 minute time period

16.1.3 Noise Character Penalty

Clause 14(3) of the Noise Policy requires a penalty be applied to the predicted noise level to account for specific acoustic characteristics if present (e.g. impulsive, low frequency, modulating, tonal). Due to the likely noise characteristics of the mine equipment, a noise character correction of 5 dB(A) is considered warranted, as per discussions with the EPA and has been applied to the predicted noise levels.

16.2 Assessment Method

An environmental noise assessment was completed for the project which included noise modelling of construction and operation scenarios at the mine site. The assessment incorporated the following tasks:

- A review of the proposed mine layout and identification of noise sources and processes and determination of their corresponding Sound Power Levels.
- Identification of relevant noise criteria and standards.
- Identification of sensitive receivers that may be affected by construction and operation of the proposed mine.
- Review of metrological conditions in the project area.
- Establishment of existing noise conditions in the project area.
- Acoustic modelling using the SoundPlan computer model (a modelling package that is accepted and endorsed by numerous agencies nationally and internationally including the EPA) using the CONCAWE algorithm to predict noise levels due to construction works and the operation of the mine site.

- Comparison of the predicted noise levels at the closest noise sensitive receivers due to the proposed mine operation with the noise criteria derived in accordance with the Noise Policy.
- Modification of design or development of management measures to reduce predicted noise levels, if required.

For a more detailed description of the impact assessment methodology, refer to the Environmental Noise Assessment report provided in Appendix L.

16.3 Existing Environment

This section discusses the existing noise conditions and the location of sensitive receivers within the project area.

16.3.1 Existing Noise Environment

The area comprising the mine site is currently used for agricultural purposes, predominately cereal cropping and has largely been cleared of native vegetation. The existing noise environment is dominated by natural noise sources such as wind, insects and birds. Local road traffic and agricultural machinery also have an influence on background noise in some locations.

Background noise level measurements were performed at two locations (Plate 16-1 and Plate 16-2) within the mine site (SKM 2012), depicted on Figure 16-2, during a one week period between 4 and 11 February 2012 to determine the typical noise level generated by the exploration drilling operations.

Logger A (Plate 16-1) was located relatively close to the drilling locations to determine typical noise levels from these operations and Logger B (Plate 16-2) was located approximately 5 km from the drilling operations to determine the typical background noise levels. The noise levels at Logger B are considered to be representative of any potentially noise-affected premises. An example of levels recorded by Logger B is at Figure 16-3.

The measured background noise levels (L_{A90}), discounting the drilling noise and periods when wind speed was over 5 km/h, varied significantly, from levels as low as 16 dB(A) during the night-time period up to approximately 42 dB(A) during the day-time period (SKM 2012).

Plate 16-1 Logger A: near Murphy Road / Kimba Road Intersection

Plate 16-2 Logger B: near Lock Road, South of Kimba Road

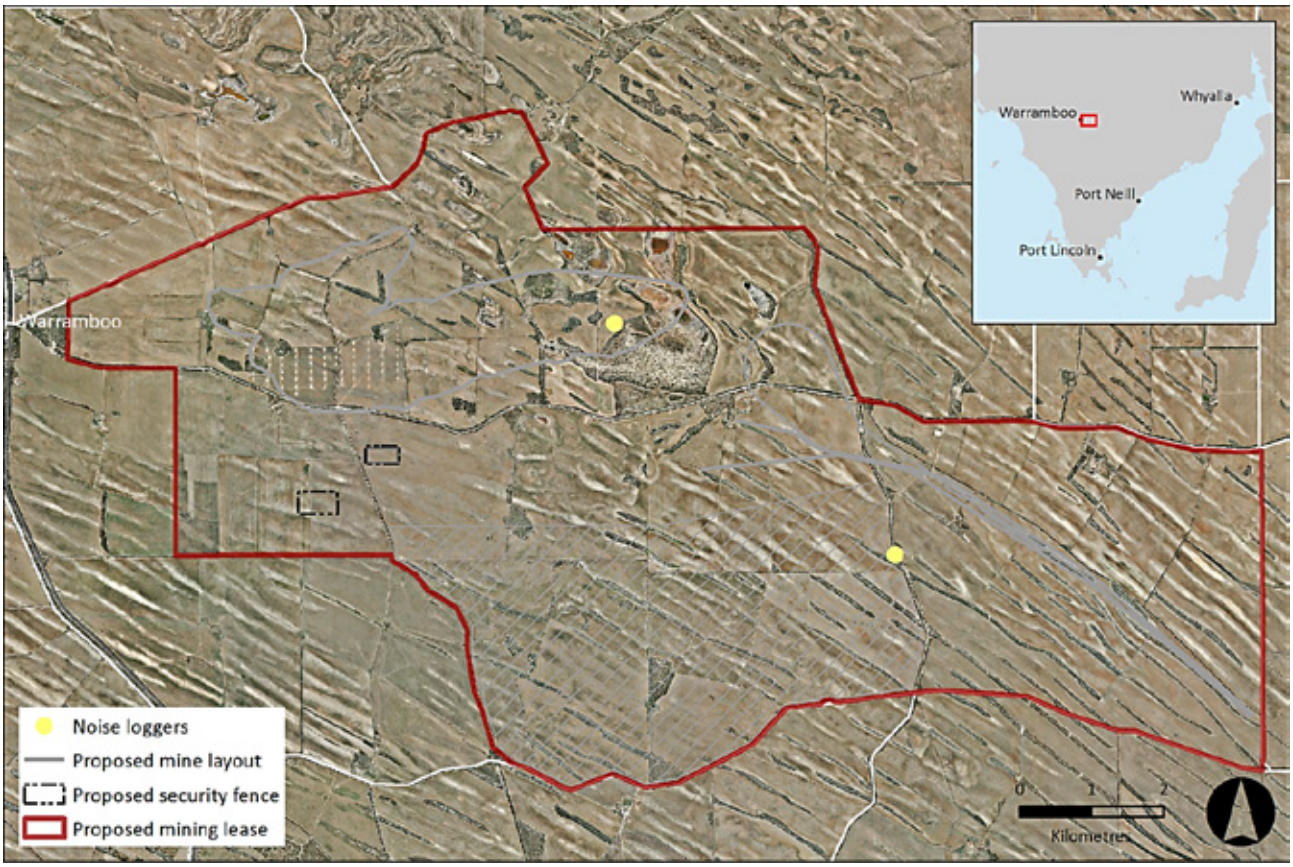

Figure 16-2 Location of Noise Loggers

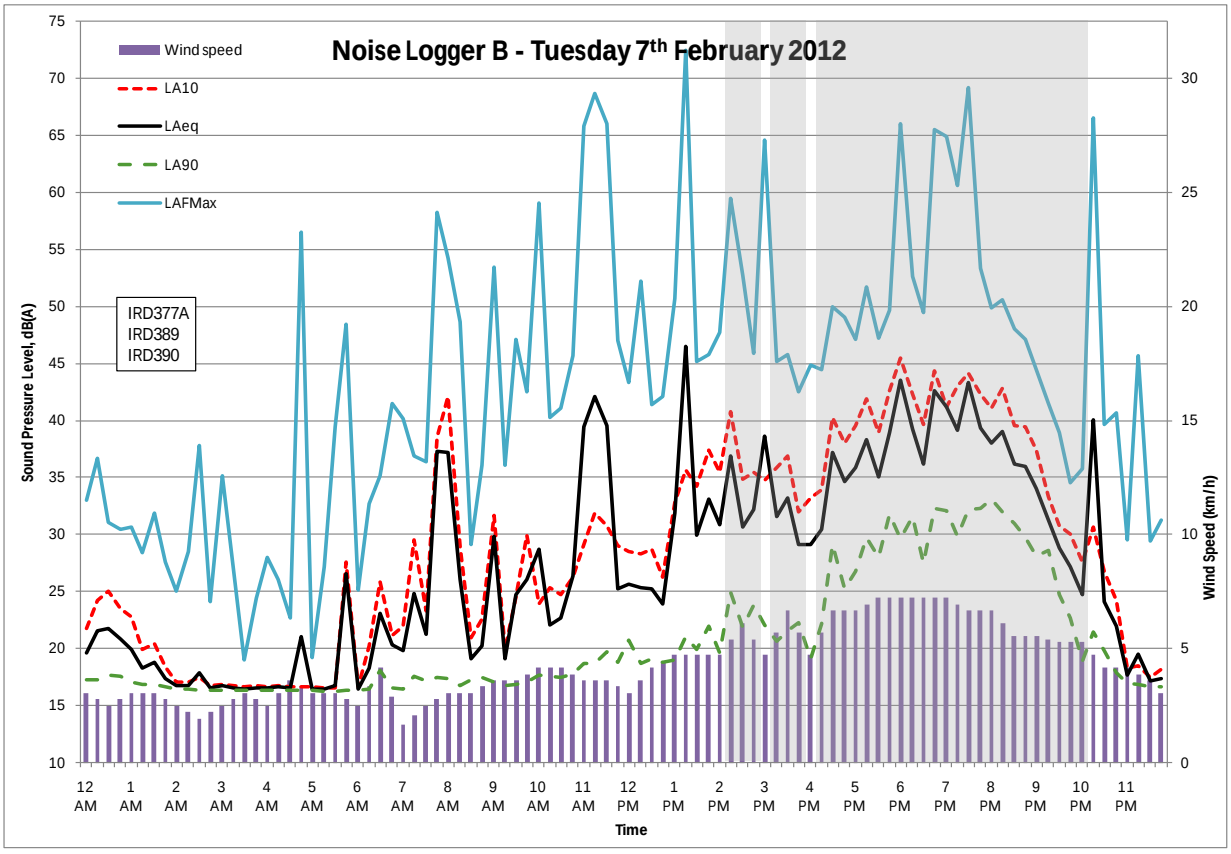

Figure 16-3 Noise Data from Logger B

16.3.2 Sensitive Receivers

Sensitive receivers include locations outside the mine site boundary where people live or work that may be affected by noise from the proposed mine. This includes dwellings, schools, hospitals, business premises or public recreational areas. Sensitive receivers may include derelict or uninhabitable dwellings or buildings as the site may have existing user rights which would allow re-development.

The locations of sensitive receivers have been primarily determined by desktop assessment of aerial imagery and are subject to field and community verification. As the sensitive receivers have been identified at different stages of the project they are not sequentially numbered, however the same sensitive receiver numbers are used for the same sites throughout the MLP and in the technical reports.

The sensitive receivers closest to the proposed mine are individual dwellings on agricultural properties located intermittently around the mine site boundary, as well as the small township of Warramboo located approximately 750 m west (refer to Figure 16-4).

Any residential buildings within the mine site were not taken into account in the noise assessment, due to the fact that the intent is for Iron Road or a subsidiary company to own all of the land within the mine site boundary prior to commencing works.

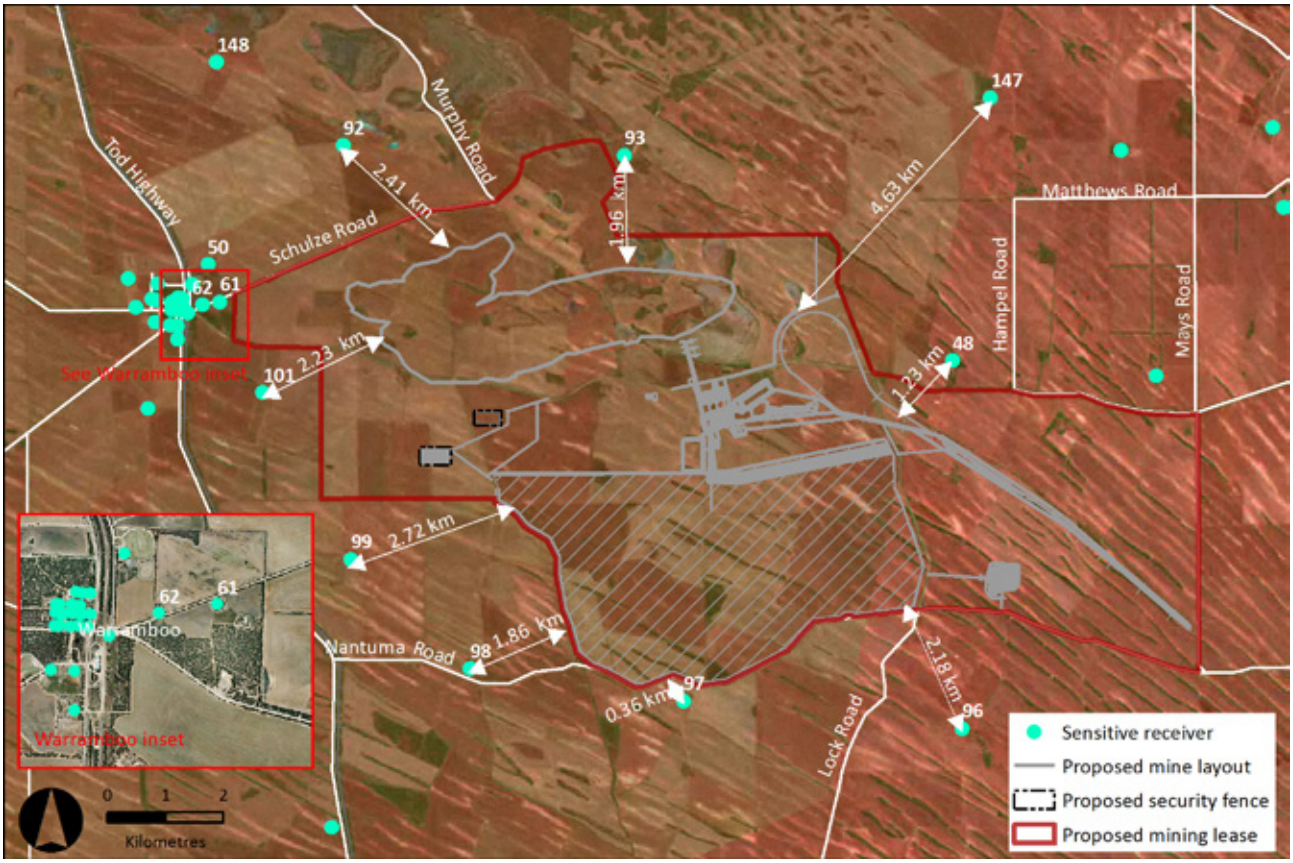

Figure 16-4 Distance from Sensitive Receivers to the Nearest Potential Noise Source

16.3.3 Summary of Key Environmental Values

The mine site is located in an area where sensitive receivers enjoy a high level of amenity due to minimal human-induced noise sources. Road traffic and agricultural machinery are the main sources of human-induced noise. The background noise levels vary and are dominated by natural noise sources. The quiet rural environment enjoyed by sensitive receivers is the key environmental value.

16.4 Context and Views of Affected Parties

The stakeholders relevant to noise include the local landowners and community, Wudinna DC, EPA and DSD. Some members of the local community have identified concerns about the potential effects on rural amenity and quality of life as a result of the noise from the 24 hour per day, 7 day a week operation of the mine site. Stakeholders are seeking the following outcomes in relation to noise:

- No noise impacts from operation of conveyor system during the night on rural amenity (IM_16_03).
- No noise from truck movements during mining operations impacting the amenity of local residents (IM_16_03).
- No noise from mine operation impacting stock (IM_16_01, IM_16_2, IM_16_03, IM_16_04, IM_16_05, IM_16_06, IM_16_09).
- No noise from construction of mine and supporting infrastructure impacting on amenity and human health (IM_16_07 and IM_16_08).
- No noise impacts on native fauna (refer to Chapter 11).
- No noise from train movements impacting on amenity and lifestyle enjoyment (IM_16_06).

All issues raised by stakeholders are presented in Chapter 5, Stakeholder Consultation and summarised in Table 5-8. Impacts and risks relevant to noise and potential issues identified by stakeholders are discussed below and summarised in Table 16-7. All impact events are presented in the Impact and Risk Register in Appendix C.

16.5 Potentially Impacting Events

Considering the views and contexts of affected parties and the issues raised during technical studies, an assessment of Source, Pathway, Receptor (SPR) has been undertaken, as per the methodology outlined in Chapter 6, to determine which potential impact events are considered applicable to the proposed mine. Potential noise impact events associated with the construction, operation and closure of the proposed mine that have a confirmed SPR linkage include:

- Noise impacts to sensitive receivers from construction of surface infrastructure and pre-stripping (IM_16_07, IM_16_08).
- Noise impacts to sensitive receivers from excavation and in-pit materials handling, e.g. mobile fleet, drilling, excavators, mobile conveyors (IM_16_03, IM_16_04, IM_16_09).
- Noise impacts to sensitive receivers from surface materials handling, e.g. stacking and reclaiming of concentrate stockpile and train loading (IM_16_03, IM_16_05, IM_16_06, IM_16_11).
- Noise impacts to sensitive receivers from processing plant, e.g. crushing (IM_16_02).
- Noise impacts to sensitive receivers from the integrated waste landform, e.g. spreading of waste rock and tailings and earthworks (IM_16_01, IM_16_11).
- Noise impacts to sensitive receivers from closure activities, e.g. infrastructure removal and decommissioning (IM_16_10, IM_16_11).

The impact and risk register presented in Appendix C provides confirmation of the source pathway and receptor for each of the potential impact events (PIMs) listed above and therefore follows each through as actual impact events (IMs) with a complete impact and risk assessment.

For noise, one potential impact event is not considered further as there is no confirmed linkage between source, pathway and receptor, as demonstrated in Appendix C. These include noise impacts to sensitive receivers from the mine camp to local residents (PIM_16_12).

16.6 Control Measures to Protect Environmental Values

This section identifies design measures and management or control strategies which will be implemented to mitigate the level of impact and risk associated with noise as far as is reasonably practicable.

16.6.1 Design Measures

The following design measures have been incorporated to minimise the impacts and risks from noise as a result of the construction, operation and closure of the mine site:

- A reduced truck fleet will be needed for the proposed IPCC mining operation compared with conventional mining, therefore minimising noise from mobile equipment. The reduced mining fleet compared with conventional mining operations also assists to reduce annoying noise character such as track slap from bulldozers or similar machinery.
- Modular design of the processing plant, greatly reducing the amount of potentially noise generating construction activities as well as significantly reducing road traffic.
- Transfer stations and conveyor systems will be fully covered to minimise dust and noise.
- The train load-out facility will be fully enclosed to minimise dust and noise.
- Noise sources have been located as far as practicable from noise sensitive receivers.

16.6.2 Management Strategies and Commitments

In order to minimise and mitigate impacts of noise during construction, operation and closure activities, control and management strategies would be incorporated into the PEPR and implemented for relevant project phases. Key control and management strategies are outlined in Table 16-2.

Table 16-2 Control and Management Strategies: Noise

Control and Management Strategies	Project Phase[1]
Noisy equipment or processes are to be located in strategic locations so that their impact on nearby sensitive receivers will be minimised (e.g. work or processes will be performed at locations further away from residential buildings or behind barriers such as buildings etc.).	CO, OP, CL
Equipment will be shut off or throttled down whenever it is not in actual use.	CO, OP, CL
Noise reduction devices such as mufflers will be fitted and will operate effectively.	CO, OP, CL
Equipment will be serviced regularly and equipment in need of repair will not be used.	CO, OP, CL
Equipment will be operated and materials handled in a way as to minimise the impact of noise.	CO, OP, CL
Vehicles, locomotives and rail wagons will be regularly maintained.	OP
Establishment of a mobile continuous noise monitoring station to be located at strategic sites, as required, to allow model validation and continuous review of the noise emissions from the proposed mine into the local environment.	CO, OP
Continuous meteorological monitoring as required to support the noise monitoring system	OP
Real time reporting of noise measurements on a public internet site	OP
Operational procedures will be developed and implemented to avoid exceedences of noise limit criteria at the nearest noise sensitive receiver. The procedures will include directives such as all equipment not being used to be turned off and not left idling for long periods, noisier operations or processes to be performed the during day time period if feasible, etc.	OP
If required, feasible noise mitigation will be applied to significant noise sources or processes to reduce the overall noise level emission. These noise mitigation treatments may include the fitting of high acoustic mufflers to diesel engine equipment and plant, acoustics enclosures to high noise sources etc.	OP
If required, manufacturer noise mitigation packages will be fitted to noisy machinery such as excavators, haul trucks and drill rigs to reduce the overall noise level emission.	OP

[1]CO = Construction, OP = Operation, CL = Closure

16.7 Impact and Risk Assessment

This section identifies and assesses impacts and risks associated with noise as a result of the construction, operation and closure of the proposed mine. Impact events (confirmed by the presence of a source, pathway and receptor) are those which are predicted to occur as a result of the development, whilst risk events would not be expected as part of the normal operation of the project, but could occur as a result of uncertainty in the impact assessment process. Although the risks may or may not eventuate, the purpose of the risk assessment process is to identify management and mitigation measures required to reduce the identified risks to a level that is as low as reasonably practicable (ALARP). This assessment has been undertaken in accordance with the methodology outlined in Chapter 6.

Impact and risk events were identified through technical studies and stakeholder consultation. Impact events can include multiple sources, pathways or receptors and where practical have been discussed together to minimise duplication of information. Risks are events that would not be expected as part of the normal operation of the mine, but could occur as a result of either uncertainties with the impact assessment, or as a result of faults, failure of control strategies or unplanned events. A summary of impact and risk events relating to noise is presented in Table 16-7 at the end of this section (with Impact IDs). A complete register of impact and risk events by source, pathway and receptor is provided in Appendix C.

Impacts and risks are assessed following the application of the design measures outlined in Section 16.6. Where required, management measures are proposed to reduce the impact level. Through the adoption of design modification or specific mitigation measures, all identified impacts and risks were categorised as **low** and considered ALARP. The key environmental risks would be monitored through the environmental management program.

16.7.1 Construction Noise

The noise levels that may be generated during the construction stage of the proposed mining operation were modelled using noise levels for a range of typical construction equipment. Details of the noise modelling methodology and inputs are provided in Appendix L.

The noise levels for construction activities were modelled with the equipment all running simultaneously at normal operating condition under worst case weather conditions, e.g. dominate wind direction towards sensitive receiver and atmospheric temperature inversion conditions which trap noise. The scenario modelled therefore represents a conservative estimation of the noise at the nearest noise sensitive receiver locations.

The construction noise scenario (scenario 1) was modelled as follows:

- Surface work only for pre-stripping the Murphy South pit
- Construction of surface infrastructure to the southeast of the mine pit

Scenario 1 is considered to be generally representative of the construction works which will mainly comprise removal of overburden in Murphy South pit, construction of the processing plant, construction of the concentrate and waste rock handling infrastructure, construction of the rail loop and train out-load facility and general infrastructure works, including road building.

Table 16-3 Typical Construction Equipment and Sound Power Levels for the Construction Scenario (Scenario 1)

Construction Activity	Equipment	Number of Units	Overall Sound Power Level (dB(A))*
Mobile equipment	Concrete Batch Plant	1	111
	Tracked excavator – Liebherr 9800	7	114
	Haul Trucks – 360T Ultra Class	12	109
	Haul Trucks – 240T Class	2	109
	Caterpillar – CAT 944H Loader	1	115
	Bulldozer –CAT D11	6	117
	Bulldozer – CAT D10	4	117
	Dozer – Wheel	3	118
	Grader – 24M	6	113
	Grader – 16M	1	113
	Water Truck – 135KI	5	115
	Water Truck – 85KI	2	115
	Diesel Generators	3	102
	Pipe layers	4	117
	Cranes	3	114
Materials handling (pre-stripping)	Primary Crushers - 8.5 t/hr	1	124
	Primary Crushers - 7.5 t/hr	1	125
	Enclosed conveyors	Total length modelled 6,500 m	83
	Transfer stations	4	101
	Integrated landform stackers (waste rock / tailings)	1	97

*Additional details on sound power levels used in the noise modelling is provided in Appendix L.

Table 16-4 lists the predicted noise levels at the nearest sensitive receivers to the mine site for the construction scenario including the addition of a 5 dB(A) noise character penalty. Relevant noise criteria are shown in the final row. The modelled noise contours for this scenario are shown in Figure 16-5 and Figure 16-6 (scenario 1).

Table 16-4 Predicted Noise Levels from Construction (Scenario 1) at the Nearest Sensitive Receivers

Sensitive receiver IDs	Predicted $L_{Aeq,15mins}$ Sound Pressure Level (dB(A)) plus 5 dB(A) noise character penalty*	
	Day	Night
Sensitive receiver 48	46	46
Sensitive receiver 50	36	36
Sensitive receiver 61	37	38
Sensitive receiver 62	36	37
Sensitive receiver 92	39	39
Sensitive receiver 93	49	50
Sensitive receiver 96	36	36
Sensitive receiver 97	41	42
Sensitive receiver 98	37	38
Sensitive receiver 99	38	39
Sensitive receiver 101	40	41
Sensitive receiver 147	36	36
Sensitive receiver 148	31	32
Noise criteria	**57**	**50**

*Predicted sound pressure levels are rounded to nearest integer number

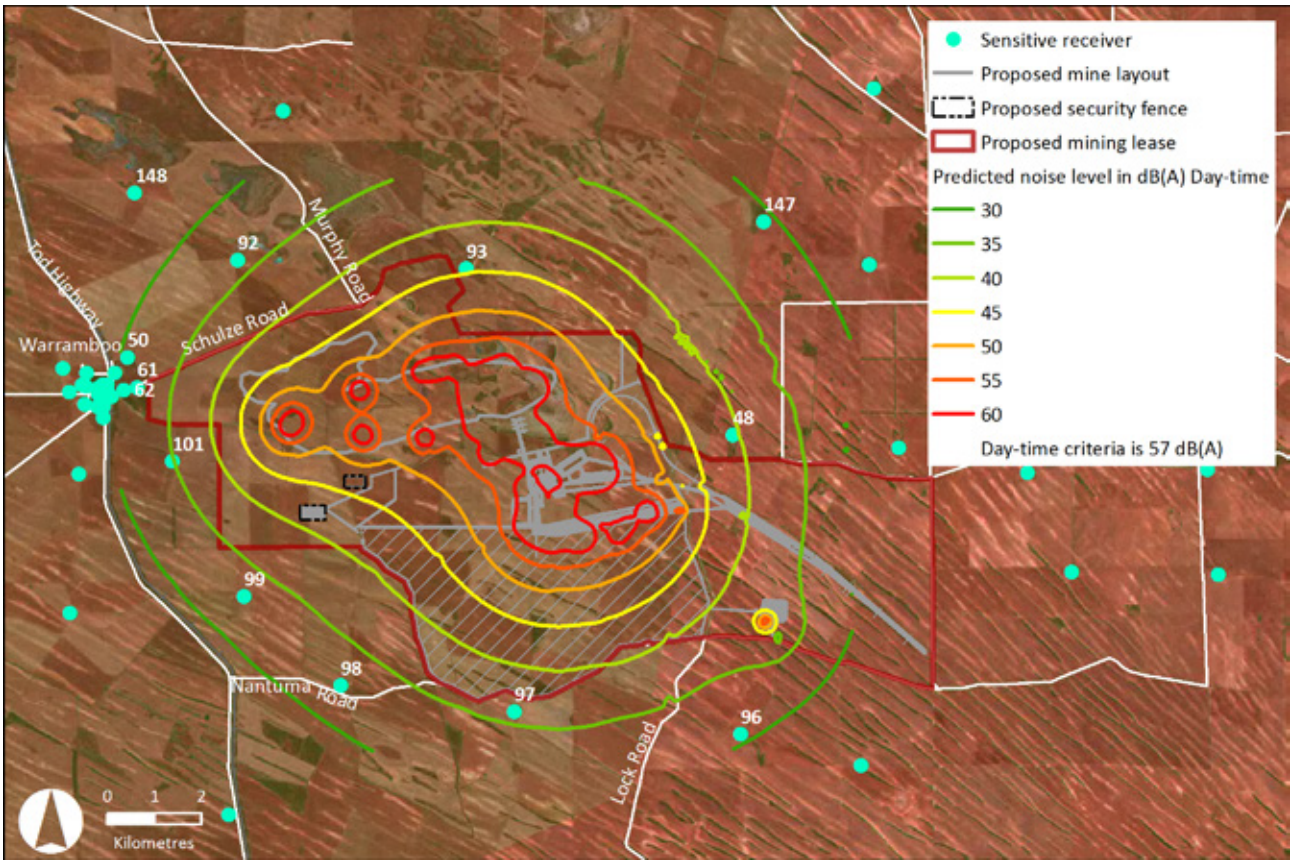

Figure 16-5 Predicted Construction Noise Contours for Proposed Mine Site (Scenario 1), Day $L_{Aeq,15mins}$

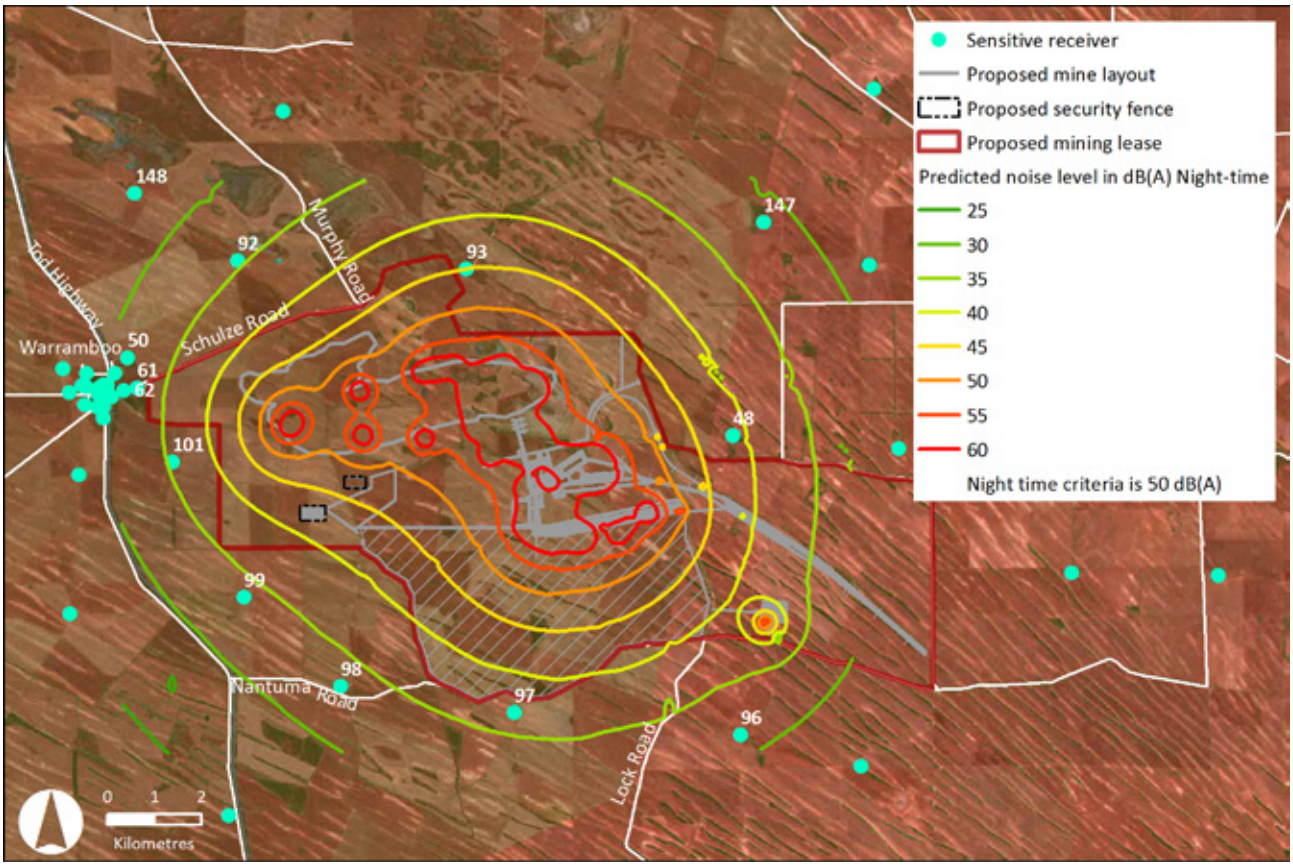

Figure 16-6 Predicted Construction Noise Contours for Proposed Mine Site (Scenario 1), Night $L_{Aeq,15mins}$

All predicted noise levels at the closest sensitive receivers for the construction scenario meet the relevant noise criteria therefore it is expected the impact of noise during the construction phase of the proposed mine will be **low**.

There is risk that higher than predicted construction noise will cause more significant impact on sensitive receivers surrounding the mine site. Risks include:

- Failure by construction crews to implement noise control and management strategies, or inadequate control measures specified, which cause exceedances of construction-related noise. Noise monitoring and review would identify any noise exceedances early to ensure operational procedures to reduce noise are implemented. Therefore construction-generated noise due to failure or inadequacy of controls would be localised and may cause a short-term exceedance of noise criteria, therefore the consequence is categorised as **minor**. It is considered **possible** that noise controls would fail or be inadequate at some stage during the construction period. As the consequence is considered minor and likelihood as possible, the risk is considered to be **low**.
- Construction work undertaken in locations not anticipated in the construction scenario that was modelled. Construction work undertaken in locations where there is a reduced separation distance between the construction site and sensitive receiver(s) (compared with what has been assessed) could cause noise that impacts on the amenity of sensitive receivers; however, it would be localised and short term, therefore the consequence is categorised as **minor**. It is considered **possible** that construction work would be undertaken in locations not anticipated in the noise assessment at some stage during the construction period. With a consequence categorised as minor and likelihood categorised as possible, the risk is considered to be **low**.

16.7.2 Operational Noise

The operational noise level for the proposed mine was predicted based on three scenarios using noise levels for a range of typical mining equipment (refer to Table 16-5). The three modelled scenarios were:

- Scenario 2: Year 2-3 of mine operation
  - Murphy South Pit only in operation
  - Mine pit depth of 60 m
- Scenario 3: Year 15-18 of mine operation
  - Both Murphy South and Boo Loo mine pits operational
  - Depth of Murphy South pit of 460 m
  - Depth of Boo Loo pit of 60 m
- Scenario 4: Year 21-22 of mine operation
  - Both Murphy South and Boo Loo mine pits operational
  - Depth of Murphy South pit of 600 m
  - Depth of Boo Loo pit of 300 m

Scenarios 2 and 3 represent the 'noisiest' years of operation of the proposed mine. Scenario 2 represents the first time the mine will be fully operational (all plant and equipment in operation) following a staged ramp up over the first 2.5 years of mining. Scenario 3 represents the first year of full operations both mine pits.

Details of the noise modelling methodology and inputs are provided in Appendix L.

Noise modelling does not include rock drop noise from the stacker dispersal of waste material. As the combined tailings and waste rock streams will consist of material ranging in size from dust and gravel up to a maximum size of approximately 150 mm (i.e. no large rocks), it is expected that the noise impact of the stacking operation would be minimal. The waste material is a relatively acoustically 'damped' material and therefore the acoustic radiating efficiency is low. The noise generated by the tailings landing on the base dump would be audible in the 'near field' but would be acoustically masked by the general background noise at the distances of the noise sensitive receiver.

The noise levels for mine construction and operation were modelled with the equipment all running simultaneously at normal operating condition under worst case weather conditions, e.g. dominate wind direction towards sensitive receiver and atmospheric temperature inversion conditions which trap noise. The preliminary blasting plan specifies 20 drill rigs operating at an utilisation rate of 90% will be required; however, 27 drill rigs are included in the mining equipment fleet to allow equipment rotation and repairs. To represent a conservative (high) noise scenario, all 27 drill rigs working at 90% utilisation were modelled for the operational scenarios (scenarios 2, 3 and 4). All scenarios therefore present a conservative estimation of the noise at the nearest noise sensitive receiver locations.

Table 16-5 Typical Operation Equipment and Sound Power Levels

Operation Activity	Equipment	Number of Units	Overall Sound Power Level (dB(A))[1]
Mobile equipment	Tracked excavator – Liebherr 9800[2]	7	114
	Pipe Layer	4	117
	Haul Trucks – Liebherr 240T Class[2]	2	109
	Caterpillar – CAT 944H Loader	1	115
	Bulldozer – CAT D11	6	117
	Bulldozer – CAT D10	4	117
	Dozer –Wheel – CAT	3	118
	Grader – CAT 24M	6	113

Operation Activity	Equipment	Number of Units	Overall Sound Power Level (dB(A))[1]
	Grader – CAT 16M	1	113
	Water Truck – 135KI	5	115
	Water Truck – 85KI	2	115
	Drill Rig – D90K[3]	20	118.5
	Drill Rig – Atlas Copco PV271[4]	7	118.5
	Locomotives (Train load-out facility)	2	114
Process plant and concentrate handling	Primary Crushers - 8.5 t/hr	3	125
	Primary Crushers - 7.5 t/hr	3	124
	Semi Auto-genous Grinder (SAG) (22MW)	3	117
	Ball Mill (22 MW)	3	118
	Enclosed conveyors	Total lengths modelled: 24,750 m (Scenario 1) 32,800 m (Scenario 2) 35,100 m (Scenario 3 & 4)	83
	Transfer stations	16	101
	Integrated landform stackers (waste rock / tailings)	3	97
	Iron concentrate stacker	1	97
	Iron concentrate reclaimer	1	108
	Train load-out facility	1	114
	Sub Station (transformers)	10	85.5
	Groundwater de-watering pumps	11	95

Notes:

1. Additional details on sound power levels used in the noise modelling is provided in Appendix L.
2. The noise data used in the noise prediction modelling for the Leibherr 9800 excavators and haul trucks incorporate factory-fitted noise mitigation treatments – data supplied by manufacturer.
3. The noise data used in the noise prediction modelling to represent a Sandvik D90K drill was for an Atlas Copco PV 311 drill, with a noise mitigation package incorporated to achieve a 3 dB noise reduction on 'standard rig', which is considered representative and was supplied by Atlas Copco.
4. The noise data used in the noise prediction modelling for Atlas Copco PV271 drill was supplied by Atlas Copco – noise levels generated by a 'standard rig' without noise mitigation packages.

Table 16-6 presents the predicted noise levels at the nearest sensitive receivers to the mine site during the Operation phase scenarios, including the addition of a 5 dB(A) noise character penalty. The modelled noise contours for scenario 3 which represents the peak mining scenario with both mine pits in operation are provided in Figure 16-7 and Figure 16-8.

Table 16-6 Predicted Noise Levels from Mine Operations at the Nearest Sensitive Receivers

Sensitive Receiver ID	Predicted $L_{Aeq\ 15\ mins}$ Noise Levels Including 5 dB(A) Penalty Plus 5 dB(A) Noise Character Penalty *					
	Day-time			Night-time		
	Scenario 2	Scenario 3	Scenario 4	Scenario 2	Scenario 3	Scenario 4
48	47	45	45	48	45	45
50	37	38	35	38	39	35
61	38	43	32	39	43	33
62	37	42	31	38	42	32
92	40	41	40	40	42	40
93	47	46	44	48	47	45
96	35	33	34	35	34	34
97	40	39	40	41	40	41
98	36	35	37	47	36	37
99	40	36	36	40	37	37
101	40	45	37	41	45	38
147	38	34	34	39	35	35
148	32	32	30	33	33	32
Noise Criteria	**57**			**50**		

*Predicted sound pressure levels are rounded to nearest integer number.

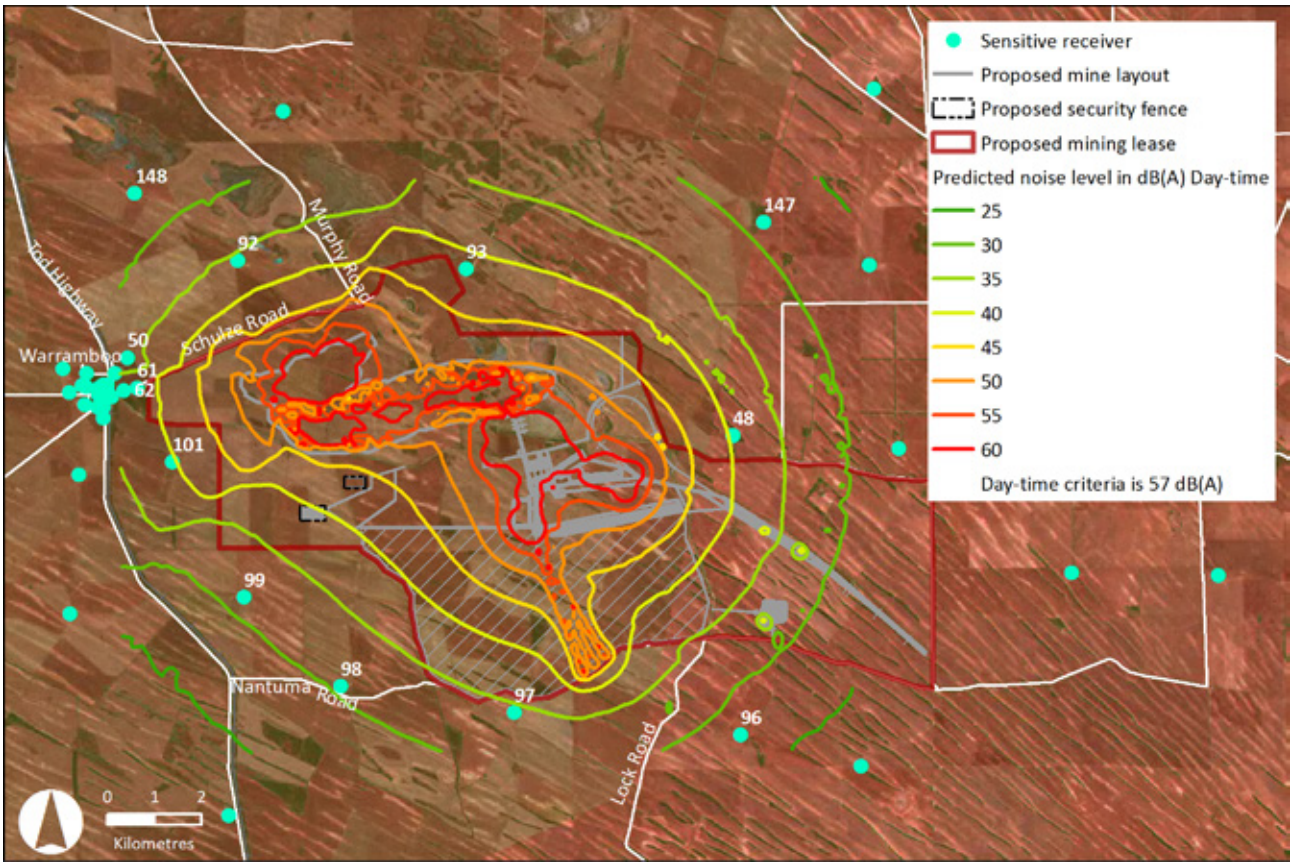

Figure 16-7 Predicted Operational Noise Contours for Proposed Mine Site (Scenario 3), Day $L_{Aeq,15mins}$

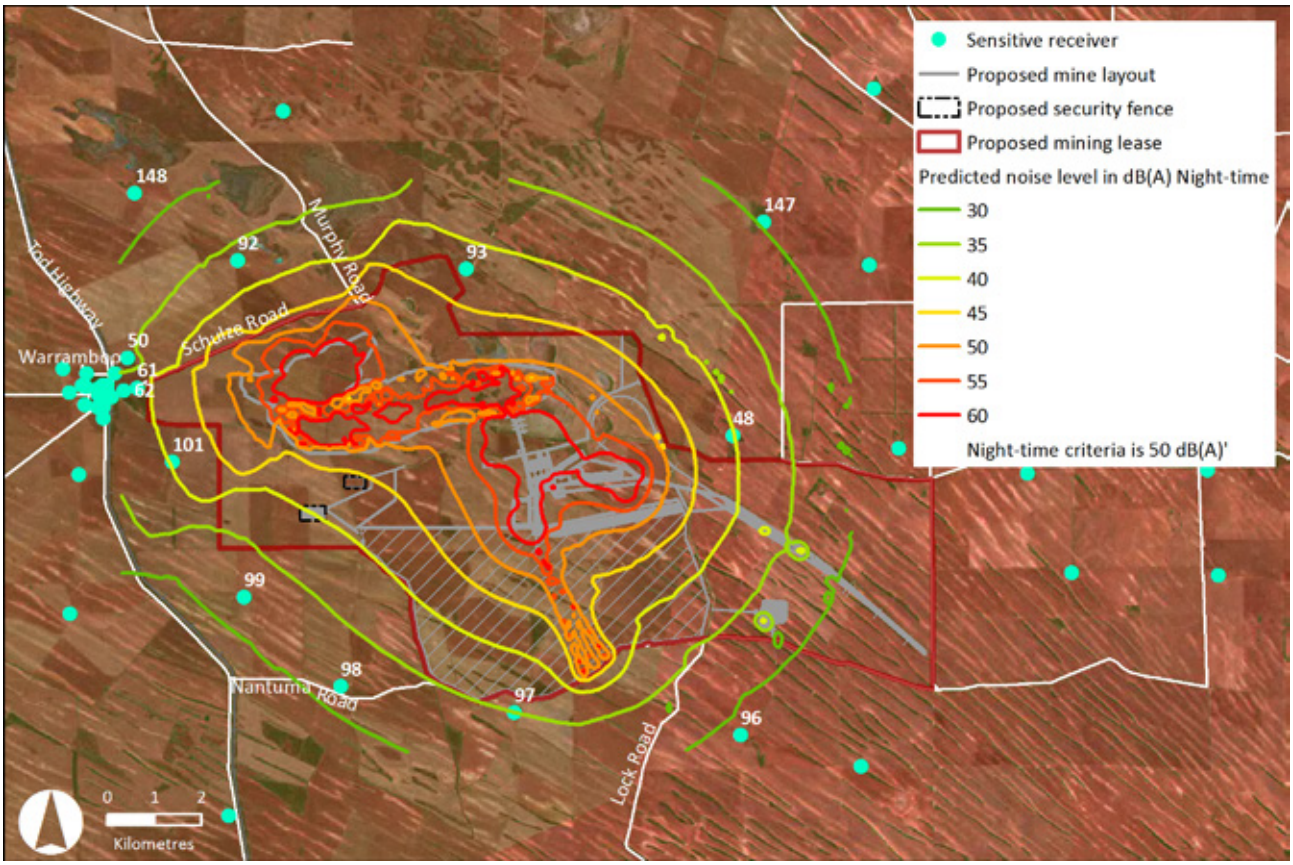

Figure 16-8 Predicted Operational Noise Contours for Proposed Mine Site (Scenario 3), Night $L_{Aeq,15mins}$

All predicted noise levels at the closest sensitive receivers are below the relevant noise criteria for all modelled scenarios, therefore it is expected the impact of noise from the operation of the mine site will be **low**.

Despite the predicted mine noise levels meeting the noise criteria and being assessed as a low impact, it is acknowledged that the mine noise will be audible and initially intrusive for some sensitive receivers who are used to a relatively quiet rural environment. For further discussion in relation to the impact of proposed mine on rural amenity, refer to Chapter 22 Social Environment.

There is risk that higher than predicted operational noise will cause more significant impact on sensitive receivers surrounding the mine site. Risks include:

- *Greater noise than predicted being generated by the operation of the proposed mine.*

  Based on the noise modelling results for all three scenarios of the mining operation, which predict the noise level for all sensitive receivers will meet the noise criteria, it is considered that if the mining operation generates more noise than predicted, noise levels may be exceeded at the closest sensitive receivers (e.g. sensitive receiver 48 or 93). To test a full range of scenarios, the mine noise model was re-run with the addition of two locomotives operating at full throttle on the railway line opposite sensitive receiver 48. Another scenario considered the IWL stackers operating at the closest position to sensitive receiver 97. In both cases, there was no exceedance of noise criteria.

With the implementation of operational noise monitoring and management procedures it is expected the impact of greater than expected noise levels would be localised and cause a minor short-term exceedance of the noise criteria, for which the consequence is categorised as **minor**. As the noise modelling represents a conservative scenario (as the modelling included all equipment operating simultaneously under worst case weather conditions) it is considered **unlikely** that operational noise will be higher than predicted. Due to the consequence being considered minor and likelihood being unlikely, the risk is considered to be **low**.

- *Excessive noise due to mine operational equipment or failure of controls.*

  Based on the noise modelling results for all three scenarios of the mine operation, which predicts the noise level for all sensitive receivers will meet the noise criteria, it is considered that if the mine operation generates more noise than predicted, the noise level may exceed the noise criteria at the closest sensitive receivers (e.g. sensitive receiver 48 or 93). However with the implementation of operational noise monitoring and management procedures it is expected the impact would be localised and cause a minor short-term exceedance of the noise criteria, for which the consequence is categorised as **minor**. As the noise modelling represents a conservative scenario (as the modelling included all equipment operating simultaneously under worst case weather conditions) it is considered **unlikely** that operational noise will be higher than predicted. Due to the consequence being considered minor and likelihood being unlikely, the risk is considered to be **low**.

16.7.3 Closure Noise

Noise modelling was not undertaken for closure activities; however, closure activities are expected to involve less intensive use of equipment and therefore generate less noise than each of the scenarios modelled. Based on this, it is expected that closure noise at the closest sensitive receivers will be below the relevant noise criteria for all modelled scenarios, therefore it is expected the impact of noise from mine closure will be **low**.

There is risk that noise due to closure activities will be greater than predicted causing more significant impact on sensitive receivers surrounding the mine site. Risks include:

- *Greater noise than expected being generated by mine closure activities within the mine site.*

  As only the closest sensitive receivers would be impacted by greater than expected mine closure noise, it is considered a localised and short-term exceedance of the noise criteria for which the consequence is categorised as **minor**. As the noise modelling represents a conservative scenario (as the modelling included all equipment operating simultaneously under worst case weather conditions) it is considered **unlikely** that closure noise will be higher than predicted. Due to the consequence being considered minor and likelihood being unlikely, the risk is considered to be **low**.

- *Excessive noise due to mine closure equipment or controls failure.*

  As only the closest sensitive receivers would be impacted by greater than expected mine closure noise, it is considered a localised and short-term exceedance of the noise criteria for which the consequence is categorised as **minor**. As the noise modelling represents a conservative scenario (as the modelling included all equipment operating simultaneously under worst case weather conditions) it is considered **unlikely** that closure noise will be higher than predicted. Due to the consequence being considered minor and likelihood being unlikely, the risk is considered to be **low**.

16.7.4 Summary of Impacts and Risks

With the implementation of design and management measures, all residual impacts have been categorised as low. Similarly, all risks have been reduced to a level that is considered to be ALARP and not warrant specific control measures, other than standard environmental management controls. A summary of each of the identified impacts and risks associated with noise at the mine site is presented in Table 16-7.

Table 16-7 Impact and Risk Summary: Noise

Impact ID	Impact Event	Level of Impact [1]	Level of Risk [2]
IM_16_07 IM_16_08	Noise impacts on nearby sensitive receivers during construction.	Low	Low
IM_16_01 IM_16_02 IM_16_03 IM_16_04 IM_16_05 IM_16_06 IM_16_09	Noise impacts on nearby sensitive receivers during operation.	Low	Low
IM_16_10 IM_16_11	Noise impacts on nearby sensitive receivers during closure.	Low	Low

Notes:

1. Impact events are expected to occur are part of the project. Level of impact is assessed post control strategies, as per the impact assessment methodology provided in Chapter 6.

2. Level of risk reflects the risk that the assessment of impact is incorrect due to uncertainties in the assessment method, the control strategies, or in assumptions used. Risk is assessed post control strategies, as per the risk assessment methodology provided in Chapter 6.

16.7.5 Justification and Acceptance of Residual Impact and Risk

With the implementation of design and operational management measures, all impacts associated with noise are considered to be low. Similarly, all risks have been reduced to a level of low or medium. The impacts and risks are considered to be as low as reasonably practicable.

16.8 Proposed Outcome(s) and Criteria

In accordance with the methodology presented in Chapter 6, outcomes have been developed for all impact events with a confirmed linkage between source, pathway and receptor. Each outcome is supported by measureable assessment criteria that will be used to assess compliance against the proposed outcomes during the relevant phases (construction, operation, closure) of the mining operation. Proposed outcomes and measurement criteria have been developed for each of the impact events identified with a confirmed linkage and these are presented in Table 16-8. Outcomes for the entire project are presented in Appendix C.

Table 16-8 Outcomes and Assessment Criteria: Noise

Proposed Outcome	Impact ID	Impact Event	Draft Outcome Measurement Criteria	Draft Leading Indicator Criteria
Noise from construction, operation and closure activities meets the noise limits determined in accordance with the *Environment Protection (Noise) Policy* and zoning specified in the Wudinna District Council Development Plan at the date the proposed Mining Lease is granted.	IM_16_07 IM_16_08	Noise impacts on nearby sensitive receivers during construction.	Noise generated from the mine site during mining operations and closure activities, measured for or at, sensitive receivers in accordance with the *Environment Protection (Noise) Policy 2007*, does not exceed the following noise limit (averaged over 15 minutes), at those sensitive receivers: - 57 dB(A) between the hours of 7am and 10pm and 50 dB(A) between the hours of 10pm and 7am within a Primary Production Zone (as delineated in the Wudinna District Council Development Plan at the time of granting the Lease). - 55 dB(A) between the hours of 7am and 10pm and 48 dB(A) between the hours of 10pm and 7am within a Settlement Zone (as delineated in the Wudinna District Council Development Plan at the time of granting the Lease). The above noise levels may only be exceeded if the Director of Mines: - is satisfied, on the basis of information provided to him by an acoustic engineer, that the noise from the mining operation will not cause an adverse impact at the sensitive receiver due to the existing influence of ambient noise, or the limited duration and/or frequency of occurrence of the activity and - provides prior approval for the exceedance. Noise measurements will be 'adjusted' in accordance with the relevant EP noise policy by the inclusion of a penalty for each characteristic where tonal/modulating/impulsive/low frequency characteristics are present.	All noise complaints acknowledged in 48 hours and closed out within 14 days to the satisfaction of the complainant or as agreed with the Director of Mines. A Trigger Action Response Plan will be implemented which will include continuous noise monitoring.
	IM_16_01 IM_16_02 IM_16_03 IM_16_04 IM_16_05 IM_16_06 IM_16_09	Noise impacts on nearby sensitive receivers during operation.		
	IM_16_10 IM_16_11	Noise impacts on nearby sensitive receivers during closure.		

16.9 Findings and Conclusion

The assessment of noise impacts due to the proposed mine (other than due to blasting) has identified sensitive receivers potentially affected by noise sources associated with the project, determined predicted noise levels at sensitive receiver locations and compared them with regulatory criteria.

The assessment of construction noise indicated that the impact is expected to be low, as the construction noise scenario modelling demonstrates that construction can be managed to meet the applicable noise criteria at all sensitive receivers by managing the location, timing and type of construction activities in accordance with the PEPR.

The assessment of operation noise indicated that the impact is expected to be low, as the modelling for all three operation scenarios demonstrates that operations can be managed to meet the applicable noise criteria at all sensitive receivers by managing operation activities in accordance with the PEPR.

The assessment of closure noise impacts indicated that the impact is expected to be low and can be managed to meet the applicable noise criteria at all sensitive receivers by managing closure activities in accordance with the PEPR.

The noise modelling represents a conservative scenario as the modelling included all equipment operating simultaneously under worst case weather conditions, whereas in practice the use of equipment will vary and weather conditions will not always propagate noise.

Despite the predicted mine noise levels meeting the noise criteria and being assessed as low impact, it is acknowledged that the mine noise will be audible and initially intrusive for some sensitive receivers used to a relatively quiet rural environment. For further discussion in relation to the impact of the proposed mine on rural amenity, refer to Chapter 22 Social Environment.

Outcomes proposed ensure that Iron Road will manage the impacts and risks associated with noise to a level which is within the regulatory limits and is as low as reasonably practicable.

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