Jemena Northern Gas Pipeline Pty Ltd

Northern Gas Pipeline

Draft Environmental Impact Statement

CHAPTER 11 – AIR, NOISE AND VIBRATION

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11. AIR, NOISE AND VIBRATION

This chapter describes the air quality and background noise levels that characterise the existing environment within and surrounding the NGP Project footprint, and then assesses the potential for impacts to sensitive receptors from Project activities. Potential impacts associated with vibration emissions from construction activities are also considered.

Risks associated with these potential impacts were analysed and evaluated by specialist air and noise consultants using Jemena's environmental risk assessment process. The controls are described that will minimise these potential impacts and reduce the residual risks associated with air and noise emissions to As Low As Reasonably Practicable (ALARP).

The purpose of this chapter is to demonstrate that Jemena has fully considered all risks to sensitive receptors, and has effective management strategies in place to ensure that the control of these risks is properly addressed through each Project phase. The chapter also addresses greenhouse gas emissions and associated reporting requirements pursuant to the National Greenhouse Energy Reporting Act 2007 (NGER) (*Cth*). The content of this chapter has been developed specifically to address Section 5.9.1 and 5.9.3 of the *Terms of Reference for the preparation of an EIS for the Jemena NGP (EIS ToR)* (NTEPA, December 2015). Other risks identified through the risk assessment process are also discussed.

The information presented in this chapter is taken mainly from the Air Quality Assessment and Management Plan (Appendix V & W) and the Noise Assessment and Management Plan (Appendix T & U). Baseline noise monitoring was undertaken at seven locations within the Project footprint as part of the assessments. The air and noise studies were designed and undertaken by experienced and suitably-qualified consultants. Details of personnel involved in the assessments, their experience and qualifications are provided in Appendix D.

This chapter assesses the potential for the NGP to cause air, noise and vibration impacts that exceed the relevant assessment criteria. Where assessment criteria are exceeded, the subsequent impacts on ecological receptors, and human health and well-being, are further discussed in in Chapter 6 and Chapter 10 of this Draft EIS respectively.

The abbreviations, acronyms and terminology used throughout this chapter are defined in the Contents, Acronyms and Glossary component of this EIS.

11.1 EXISTING ENVIRONMENT

11.1.1 LOCAL METEOROLOGICAL CONDITIONS

The NGP Project is located in an area classified as having a semi-arid climate. A summary of meteorological conditions relevant to the assessment of air and noise risks is provided below. Further analysis of regional climatic conditions is located in Chapter 7.

Mean annual rainfall ranges from 400 mm to 474 mm based on historical data from the Bureau of Meteorology stations at Tennant Creek, Camooweal and Mount Isa. Average seasonal temperatures range from 17-20°C (minimum) to 32-33°C (maximum). Figure 11-1 presents measured wind roses for the three Bureau of Meteorological weather stations located close to the pipeline route.

The Tennant Creek wind rose showed wind conditions within the western part of the Project footprint, encompassing the Philip Creek Compressor Station (PCCS) and western sections of the pipeline route, are dominated by an easterly component. The eastern part of the Project footprint (as represented by

Camooweal and Mount Isa monitoring data), encompassing the Mount Isa Compressor Station (MICS) and eastern sections of the pipeline route, has wind conditions dominated by the southerly and south-easterly components. Overall, westerly winds are a minor feature along the length of the pipeline route. Calm conditions are noted to be relatively infrequent at Tennant Creek (1.3 per cent) but the proportion of calm increases towards Mount Isa (9.2 per cent).

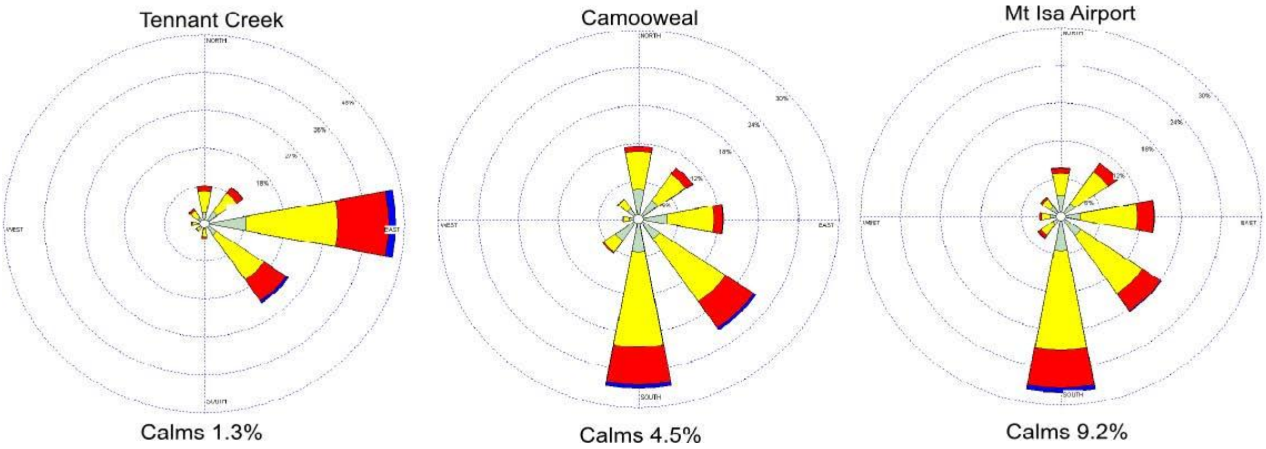


Figure 11-1. 2011-2015 BOM wind roses

11.1.2 EXISTING AIR EMISSION SOURCES

The pipeline predominantly traverses through remote areas where there are a limited number of anthropogenic air emission sources. For the majority of the route extending from Warrego to immediately west of the Mount Isa region, road traffic and unpaved surface emissions from nearby roads represents the nearest existing air emission sources with similar types of air emissions to the Project (i.e. carbon monoxide, nitrogen dioxide and particulate matter). These roads include the sealed Stuart Highway, Barkly Highway and other local unpaved roads.

At the eastern end of the Project footprint, the Mount Isa air shed is influenced by operations of the Mount Isa Mine. Air emissions from the mine include particulates from excavation activities and combustion emissions from operation of heavy machinery and processing equipment. Other key air emission sources closest to the Project are two power stations located on Powerhouse Road (east of Diamantina Development Road). These power stations have a potential to emit combustion products from gas turbine equipment.

11.1.3 BACKGROUND AIR QUALITY

The Queensland Department of Environment and Heritage Protection (DEHP) operates two air monitoring stations in the Mount Isa area (The Gap and Menzies stations). The Menzies Station monitors for sulfur dioxide only, while The Gap station monitors for sulfur dioxide, PM_{10} and metals. No other permanent monitoring stations are located in proximity to the Project footprint within Queensland or the Northern Territory.

The key air quality indicators identified for the Project are carbon monoxide (CO), nitrogen dioxide (NO_2) and particulate matter (TSP, PM_{10} and $PM_{2.5}$). For the purpose of assessing cumulative PM_{10} impacts, background PM_{10} data for the Mount Isa Gap Station has been referenced. Measured background concentrations at The Gap Station for the year 2015 were 24.2 mg/m^3 (24 hour).

TSP, $PM_{2.5}$, CO and NO_2 are monitored at a number of stations within Queensland and Northern Territory outside the Project air assessment study area. Monitoring stations are generally located in populated areas only and, as such, data representative of isolated rural areas, such as areas located along the majority of the pipeline route, is not available. The only air quality monitoring stations in the Northern Territory are located in Darwin (Winnellie) and Palmerston; these are too far away from the Project area to provide a reliable indicator of background air quality.

In the absence of site specific data, monitoring data from stations outside of the air quality assessment study area were used to provide an indicator of background concentrations that may be experienced in the Mount Isa area. Based on a review of the background data, the highest background concentrations identified were considered in the assessment:

- TSP – 36.3 µg/m^3 (annual)
- PM_{10} – 24.2 µg/m^3 (24-hour)
- $PM_{2.5}$ – 13.3 µg/m^3 (24-hour) and 4.5 mg/m^3 (annual)
- CO – 381.9 µg/m^3 (8-hour)
- NO_2 – 14.4 µg/m^3 (1-hour) and 10.4 (annual).

As a conservative approach, these background concentrations were adopted for the Mount Isa area and areas along the pipeline (rural areas). It is expected that the actual background concentrations in the rural areas will be lower than the concentrations used in the assessment.

The EIS ToR requires consideration of seasonal variations in air quality, such as smoke haze. In the absence of any air quality monitoring stations in proximity to the Project footprint within the Northern Territory, it is not possible to provide data in relation to local variations in seasonal air quality. The air quality monitoring stations in Darwin indicate that $PM_{2.5}$ levels are high during the dry season, which is linked to a combination of small scale local bush and grass fires and more distant large scale savannah fire activity (NTEPA 2015). Smoke haze is pushed over the Darwin region by the south-easterly winds that prevail in the dry season. Whilst smoke haze may occur over the Project area during the dry season (increasing background concentrations of $PM_{2.5}$), the influence of smoke on regional air quality in the Barkly region is likely to be substantially less than for the Darwin region; this is due to much lower fire frequencies that occur in the central parts of the Northern Territory compared to the north.

11.1.4 EXISTING NOISE SOURCES

Limited anthropogenic noise sources currently exist along the pipeline alignment and minimal ecological noise, other than birds and insects at dawn and dusk, is present. For the majority of the Project footprint, road traffic and residential noise emissions represent the nearest existing noise emission sources i.e. there is no industrial or other development that contributes to background noise.

Roads nearby to the Project footprint include the Stuart Highway, Barkly Highway, Diamantina Developmental Road and other local unpaved roads. While these local highways are considered to be the nearest noise emission sources potentially affecting sensitive receptors of the Project, they are still relatively remote from the nearest sensitive receptors to the pipeline route (i.e. Outstation 975 is 7.2 km south of the Barkly Highway, one pastoral homestead is more than 50 km from the Barkly Highway). The pastoral homestead is also located adjacent to an unpaved road which connects the Barkly Highway to the southern Sandover Highway. Based on site observations, this unpaved road is not highly trafficked.

At the eastern end of the pipeline and proposed MICS facility, the Mount Isa community is influenced by operations of the mine. Noise emissions from the mine include excavation activities, operation of heavy machinery and processing equipment and vehicular traffic. Besides the mine, other key noise sources closest to the Project's sensitive receptors are two power stations located on Powerhouse Road (east of

Diamantina Development Road). Baseline monitoring data (from site M7 – see below) indicate these power stations significantly influence the noise character of the nearby sensitive receiver areas.

11.1.5 BASELINE NOISE MONITORING RESULTS

Monitoring was conducted at seven locations to provide an indication of typical existing noise levels at the nearest noise sensitive receptors to the proposed pipeline and compressor facilities, and the construction footprint. Figure 11-2 shows the location of the monitoring sites and Table 11-1 presents a summary of noise monitoring results.

Table 11-1. Summary of background noise levels

	Median L_{Aeq}, 1 hour				Median min L_{A90}, 1 hour			
Site	Day 7am-6pm	Evening 6pm-10pm	Night 10pm-7am	Dawn 6am-7am	Day 7am-6pm	Evening 6pm-10pm	Night 10pm-7am	Dawn 6am-7am
MP1	36.1	39.6	33.3	33.5	21.1	26.5	18.1	19.8
MP2	37.5	36.5	34.6	37.0	21.9	29.3	32.5	32.7
MP3	40.9	52.1	41.4	41.0	26.8	49.1	28.1	29.4
MP4	40.7	49.8	46.2	38.1	28.7	34.3	29.1	29.3
MP5	42.3	49.2	41.3	42.1	31.5	36.6	30.3	35.3
MP6	41.9	44.1	48.9	41.0	29.4	33.8	31.0	31.3
MP7	39.7	46.0	48.2	51.2	34.0	39.4	38.0	36.9

11.1.6 SENSITIVE RECEPTORS

The pipeline route traverses primarily through isolated rural areas, thus limiting the number of sensitive receptors that could be affected by construction and operations. Potential air quality impacts from projects of this type are generally limited to within a 5 km radius. A conservative radius of influence for noise impacts in a rural area with very low background levels may be considered to be 10 km. Sensitive receptors located within 20 km of the pipeline route and facilities are detailed in Table 11-2.

For the Northern Territory portion of the Project footprint, potentially affected sensitive receptors include a small number of family outstations and a pastoral homestead (18 km east of MLV3). The nearest family outstation (No. 975) is 3.4 km south of the pipeline route. The pastoral homestead is located 3.5 km north of the pipeline route.

The closest receptors to the Phillip Creek Compressor Station (PCCS) are a number of Aboriginal family outstations (referred to as outstations 239, 248, 255 and 974). These receptors are between 28 km to 46 km from the PCCS.

An abandoned mine and camp is located 2 km west of the PCCS. The site has been closed for more than a decade and is designated contaminated land. Future occupation of the mining camp is unlikely in the future. Therefore, the site has not been considered as a potential sensitive receptor.

The Warrego compressor station adjacent to the proposed PCCS is noted to be in operation, however, does not constitute a sensitive receiver.

At the eastern end, the nearest sensitive receptors include a homestead south of Mt Isa and Mt Isa city. The homestead is approximately 2 km from the Mount Isa Compressor Station (MICS) and 1 km from the pipeline route. The nearest houses in the Mt Isa city area are approximately 2 km north-east of the MICS.

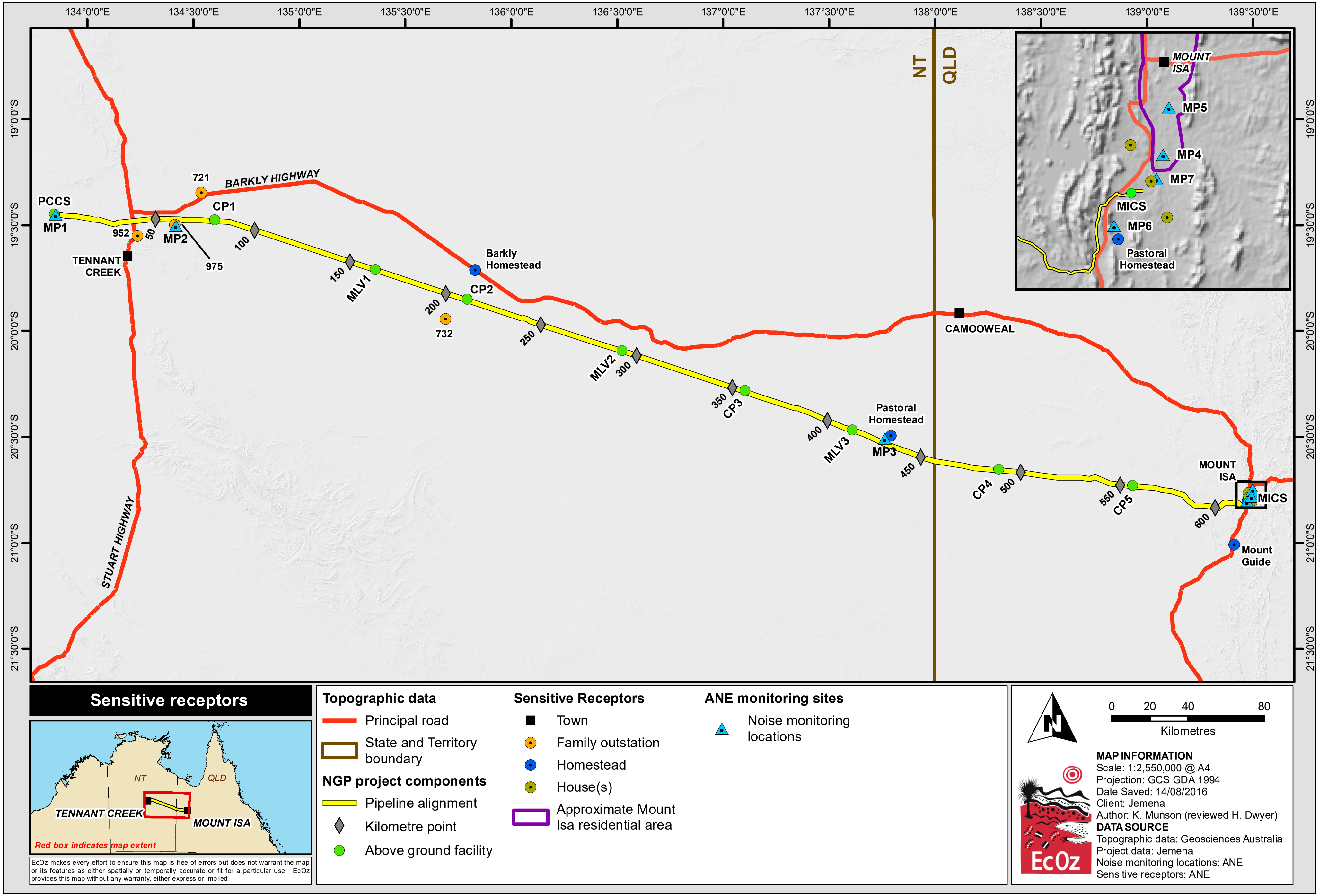
Table 11-2. Sensitive receptors within 20 km of the Project

Receptor	Distance from pipeline	Distance from nearest pipeline facility	Population/No. of dwellings
Tennant Creek	16.5km South	41.5km south-east of PCCS Facility 121 km west of MLV1	3,634*
Family Outstation 952	6.8km South	41.8km south-east of PCCS Facility 121km west of MLV1	3 houses
Family Outstation 975	3.4km South	60km east of PCCS facility 101km north-west of MLV1	2 houses
Family Outstation 721	14.8km north	73km east of PCCS facility 95km north-west of MLV1	8 houses
Family Outstation 732	12.4km south	44km south-east of MLV1	4 houses
Pastoral Homestead	3.5km north	18km east of MLV3	3 houses and a school
Homestead south of Mount Isa	1km east	2.5km south of MICS facility	Single house
Diamantina and Leichardt power stations residences (Powerhouse Road)	1.2km north-east	1.2km north-east of the MICS facility	9 houses
Mount Isa	1.8km north-east	1.8km north-east of MICS facility	City

**ABS 2014*

The noise and air quality assessment reports note that a number of sensitive ecological noise receptors could exist. Threatened species identified in Chapter 6 and Chapter 12 would be considered sensitive ecological receptors. Areas that may also be sensitive to noise impacts include river and creek crossings, and swamps that may occur in the lateritic sand plains and rises (between KP223 to KP350), as these habitat types often provide important refuge habitat for a range of native fauna.

The modelled zones of influence for ecological receptors (i.e. flora and fauna) presented in the noise and air assessment reports (see Appendix T and V respectively) were used to inform further assessment potential indirect impacts on ecological receptors (see Chapter 6 and Chapter 12).



Path: Z:\01 EcOz_Documents\04 EcOz Vantage GIS\JEMENA\EIS (NT)\01 Project Files\Ch11\Figure 11-2. Map of noise sensitive receptors and monitoring sites.mxd

Figure 11-2. Map of sensitive receptors and monitoring sites

11.2 AIR, NOISE AND VIBRATION RISK ASSESSMENT

Potential air, noise and vibration emission sources and associated risks were assessed using the procedures describe in the relevant technical reports (Appendix U and W). The complete environmental risk register – including air, noise and vibration risks – is documented in Appendix F.

The likelihood and consequences of the each potential impact relevant to air and noise were assessed in relation to the following objectives, which aim to fulfil the requirements of Section 5.9.1 and 5.9.3 of the EIS ToR respectively:

"Assess the impacts of the Project on air quality… which may arise from emissions of chemicals, particulates or biological materials…informed by meteorological information applicable to air quality in the project area….and outline measures for managing and monitoring the impacts of air quality."

"To prevent noise nuisance as a result of Project activities at sensitive receptors, and comply with the requirements of the NT Waste and Pollution Control Act."

The potential air, noise and vibration impacts and associated risks identified through the risk assessment process are further discussed below.

11.2.1 POTENTIAL IMPACTS

Assessment of risks associated with air, noise and vibration first involved identifying potential sources of emissions associated with the Project activities described in Chapter 2, and subsequent impacts that could occur in relation to reduced air quality, and increased noise and vibration. This chapter focuses on identifying potential sources of impacts, which are then used as contextual information for assessment of risks to sensitive receptors, specifically ecological receptors (refer Chapter 6) and human receptors (refer Chapter 10). The key references used were the EIS ToR (Appendix A), Project Description (Chapter 2) and the contextual information presented earlier in this chapter from the Noise and Air Quality Assessments (Appendix T and V).

The environmental risk assessment process identified the following potential impacts associated with air and noise emissions for the construction, operational and decommissioning phases of the Project.

11.2.1.1 Planning

Activities during the planning phase have potential to cause the following impacts relevant to air, noise and vibration:

- inadequate assessment of the air, noise and vibration risks, resulting in lost opportunities for impact avoidance and management.

11.2.1.2 Construction

Activities during the construction phase have potential to cause the following impacts relevant to air, noise and vibration:

- reduction in local air quality and nuisance and/or health impacts due to the emission of particulate (dust) and diesel exhaust
- noise and vibration emissions, and nuisance and/or health impacts and reduced community well-being, due to traffic and heavy vehicle movements for the transportation of personnel, machinery and materials.

- noise and vibration emissions, and nuisance and/or health impacts and reduced community well-being, due to the operation of mobile plant, equipment and vehicles
- intense or sudden noise and vibration due to blasting, and subsequent impacts on nearby residents.

11.2.1.3 Operations

Activities during the operations phase have potential to cause the following impacts relevant to air, noise and vibration:

- reduction in air quality caused by emissions of CO_2, CH4 and NO_2 from gas processing operations and venting
- increased continuous low level noise associated with operation of compressor facilities
- increased high volume noise due to gas flaring and venting at compressor facilities.

The Project will also produce Greenhouse Gas Emissions (GHG) associated with land clearing, compressor stations and gas processing. Details of emissions calculations are provided in Section 11.6.

For each of the above identified potential impact associated with air, noise and vibration emissions, associated risks in each Project phase are further discussed in the sections below.

11.2.1.4 Decommissioning

Activities during the decommissioning phase have potential to cause the following impacts relevant to air, noise and vibration:

- Assuming the pipeline is left in-situ, the main decommissioning risks are associated with possible temporary reduction in air quality caused by venting, and localised dust and exhaust emissions associated with removal of above-ground facilities.

These potential impacts are noted; however, no further assessment is undertaken in this chapter. Details of the decommissioning process and legislative requirements that will be applicable at the time (forecast to be in excess of 30 years from now) are not known with enough certainly to inform assessment of risk.

11.3 PLANNING PHASE RISKS

The planning phase for the Project extends across 2016 and the early part of 2017. This phase aims to establish the baseline air and noise relevant to the Project and identify any potential impacts to sensitive receptors. These activities are important to establish sufficient context for assessment of risks. Insufficient technical assessment has potential to result in inadequate assessment of risk. This risk is further discussed below.

11.3.1 INSUFFICIENT TECHNICAL ASSESSMENT

Context and assumptions

Air quality, noise and vibration modelling was undertaken to inform the assessment of risks from all Project phases. The modelling and risk assessment was based on the Project details available at the time, including location of infrastructure, proximity to sensitive receptors and construction and operational activities. Insufficient information for the modelling, inaccurate Project details, or inaccurate modelling, would lead to an inadequate risk assessment. This potentially influences the effectiveness and appropriateness of controls and mitigation measures proposed throughout this chapter, and hence potentially influences the impact on sensitive receptors.

Inherent risk

Based on the above background information and assumptions the inherent risk of inadequate assessment of risks is **MODERATE.** The inadequate assessment of risks would lead to lost opportunities for impact avoidance, and potentially inaccurate or inadequate mitigation and management measures. Controls that were implemented to reduce this risk are detailed below.

Controls

Specialist consultants, Air Noise Environment (ANE), were engaged to assess air and noise impacts associated with the Project. ANE specialise in air quality and acoustic assessments, and have a team of qualified and experienced staff who are suitably qualified to assess the air and noise impacts from the Project and develop management strategies and mitigation measures (refer to Appendix D for details on ANE's qualifications).

ANE completed a Noise Assessment and an Air Quality Assessment for the Project (see Appendix T and V respectively). The specific modelling tools are discussed below in relation to the relevant aspects of the assessment. Numerous scenarios were modelled to assess different influencing factors, and various Project scenarios. Modelling was conservative to ensure that worst-case scenarios were assessed and this information informed the assessment of air, noise and vibration risks and potential impacts on sensitive receptors.

ANE developed a Noise Management Plan and an Air Management Plan (Appendix U and W respectively) which summarise the key findings of the modelling and provide specific mitigation measures and management strategies to minimise risks associated with air, noise and vibration throughout the construction and operational phases of the Project. The mitigation strategies provided in these management plans have been incorporated into the Project's framework Environmental Management Plan (refer Chapter 13).

Should there be significant changes to Project activities (e.g. construction methodologies, the location of key infrastructure, and the nature and activities of operational infrastructure) the modelling will require revision to capture the changes and ensure that modelled results remain accurate. Any changes to the

outcomes of modelling will be addressed through revision and updates to the specific Noise Management Plan and Air Management Plan (Appendix U and W respectively).

Assessment of effectiveness

Specialist consultants completed the modelling in accordance with relevant legislation, regulations and Australian standards. The modelling of air and noise impacts was informed by the most relevant and accurate Project information, and will be revised if Project details change. These measures are considered effective in ensuring that risks are adequately assessed, and mitigation and management measures are informed by accurate modelling. The development of specific management plans by ANE is considered effective in ensuring controls are informed by modelling and comply with industry standards. Revision of the modelling and management plans to reflect any future Project changes is considered effective in ensuring the reports remain valid and accurate.

Residual risk

Subject to review occurring in the event of changes to the Project, the technical assessments are considered effective in reducing the residual risk of inadequate risks assessment to **LOW**.

11.4 CONSTRUCTION PHASE RISKS

The construction phase is when there will be a high level of activity with air and noise emissions occurring across the Project footprint. Consequently, it is the phase that will have the greatest chance of impacts to sensitive receptors. Construction phase risks are further discussed below.

11.4.1 REDUCTION IN AIR QUALITY

Context and assumptions

Air dispersion modelling was completed to assess the potential impacts of construction activity and operations on nearby sensitive receptors. Complete details of the air dispersion modelling methods and results are provided at Appendix V.

The key air emission sources associated with construction include excavation activity generating dust, and diesel exhaust fumes from heavy machinery. Collectively, these sources have a potential to emit particulate matter (TSP, PM_{10}, deposited dust), CO and NO_2 during the construction phase of the Project.

Modelling was undertaken utilising Ausplume to predict air emissions associated with excavation, drilling and blasting and diesel exhaust associated with construction phase activities. The air quality assessment was undertaken against criteria defined in the NEPM Air (1998), which provides ambient air quality standards for the protection of human health and well-being and the ambient air quality criteria defined in the Queensland Environment Protection Policy (EPP) (Air) 2008. A comparison of the NEPM Air and Queensland EPP (Air) indicates that air quality goals for pollutants relevant to the Project are similar under both pieces of legislation.

The modelling results for construction phases of the Project are summarised below; refer to Section 11.5.1 for operational phase modelling results. The main air emissions (in the form of particulates) will occur during excavation, drilling and blasting. It is noted that excavation activities will occur along the 622 km length of the pipeline route, whilst drilling and blasting will be confined to limited areas (hard rock locations only). To assess potential impacts from these activities, pollutant concentrations were predicted at various setback distances from a 5 km section of the construction ROW.

Diesel exhaust emissions will also be released from the operation of heavy machinery. Diesel exhaust includes CO, N_2O and particulate matter (TSP, $PM_{2.5}$ and PM_{10}). The amount of diesel exhaust fumes reaching a sensitive receptor will depend on the numbers of equipment operating simultaneously and the size of the equipment (which influences fuel burning). To provide an indication of potential pollutant concentrations, a worst-case scenario was modelled based on 10 items of heavy machinery operating simultaneously at a single location. Table 11-3, Table 11-4 and Table 11-5 present predicted ground level concentrations for the three modelled activities. For each activity source, results are provided as well as cumulative results which include the background air quality levels described in Section 11.1.2 and 11.1.3. Each table provides predictions at various setback distances including the nearest receptors to the construction pipeline. The nearest receptors for the purpose of modelling air quality impacts are Outstation 975, a pastoral homestead along the Barkly Highway and a homestead south of Mount Isa. It is noted that drilling and blasting will occur at certain sections of the pipeline only and, based on a review of the locations, one homestead south of Mount Isa and Outstation 975 are the nearest receptors to this activity (1 km and 3.4 km respectively).

Table 11-3. Excavation - predicted potential ground level concentrations

Distance from construction (m)	Predicted potential ground level concentrations	
	TSP µg/m^3 (Annual)	PM_{10} µg/m^3 (24-hour)
Source only		
1,000m (Mount Isa)	6.1	10.1
3,400m (Outstation 975)	1.6	6.0
3,500m (pastoral homestead)	1.5	6.0
Cumulative		
Background	36.3	24.2
1,000m (Mount Isa)	42.4	34.3
3,400m (Outstation 975)	37.9	30.2
3,500m (pastoral homestead)	37.8	30.2
Criteria	**90.0**	**50.0**

Table 11-4. Drilling and blasting - predicted potential ground level concentrations

Distance from construction (m)	Predicted potential ground level concentrations	
	TSP µg/m^3 (Annual)	PM_{10} µg/m^3 (24-hour)
Source only		
1,000m (Mount Isa)	4.9	10.7
3,400m (Outstation 975)	1.3	6.4
Cumulative		
Background	36.3	24.2
1,000m (Mount Isa)	41.0	34.9
3,400m (Outstation 975)	37.2	30.5
Criteria	**90**	**50**

Table 11-5. Diesel exhaust - Predicted potential ground level concentrations

Distance from construction (m)	Predicted potential ground level concentrations µg/m^3					
	CO (8-hour)	NO_2 (1-hour)	NO_2 (Annual)	PM_{10} (24-hour)	$PM_{2.5}$ (24-hour)	$PM_{2.5}$ (Annual)
Source only						
1,000m (Mount Isa)	62.4	189.0	0.8	1.4	1.4	0.1
3,400m (Outstation 975)	14.3	43.4	0.1	0.4	0.4	0.0
3,500m (pastoral homestead)	13.9	42.1	0.1	0.4	0.4	0.0
Cumulative						
Background	381.9	14.4	10.4	24.2	13.3	4.5
1,000m (Mount Isa)	444.3	203.4	11.2	25.6	14.7	4.6
3,400m (Outstation 975)	396.2	57.8	10.5	24.6	13.7	4.5
3,500m (Pastoral Homestead)	395.8	56.5	10.5	24.6	13.7	4.5
Criteria	**11,000**	**246**	**62**	**50**	**25**	**8**

The results of the construction modelling demonstrate compliance with the ambient air quality goals for construction activities. It is noted that diesel exhaust emissions from equipment will occur simultaneously with emissions from excavation activities. When these activities are considered together, compliance is still predicted, and the results confirm that the contribution of diesel exhaust to total PM_{10} concentrations is minimal compared to excavation activity.

The activities modelled represent the worst-case activities that would contribute to dust in the surrounding area. All other construction activities, which involve significantly less disturbance of dust and material (e.g. pipe laying, hydrostatic testing) are therefore also expected to comply with the relevant ambient air quality criteria.

Dust emissions from activities within the construction ROW and traffic movements on access tracks, whilst not anticipated to impact on sensitive receptors, will cause localised degradation of air quality. The construction workforce will receive the highest level of exposure to dust emissions; accordingly this risk will be specifically addressed through the Construction Constructor's Health and Safety Management System, which involves a series of risk assessment and mitigation procedures implemented to ensure workplace health and safety requirements are met (refer Chapter 10). People crossing the construction ROW and/or using the same access tracks as construction vehicles may also be exposed to dust emissions, however, due to the temporary nature of the exposure impacts, would be confined to nuisance and potential safety concerns associated with reduced visibility.

Inherent risk

Based on the above context and assumptions, the inherent risk to air quality, and resultant risk of impacts on sensitive receptors, is **MODERATE.** Analysis of this risk indicated that further controls can be practicably implemented to reduce impacts to air quality (see below).

Controls

The assessment of air emissions concluded that compliance with relevant criteria is expected during the construction phase of the Project, therefore no site-specific mitigation measures are proposed in proximity to sensitive receptors.

However, there is likely to be some short term exposure to particulate matter from dust generating activities, particularly for construction the workforce and ecological receptors. In order to ensure air quality impacts (nuisance, health related or ecological) are minimised during construction, routine air quality management measures will be implemented. The measures comprise dust suppression, speed limits on unsealed roads near sensitive receptors, requirements for covering loads which may emit dust during transport, and construction equipment maintenance programs.

A Traffic Management Plan will be implemented that will include traffic control requirements for unsealed roads, particularly those near sensitive receptors. All controls are detailed in the framework Environmental Management Plan (EMP - Chapter 13) and the Air Quality Management Plan (Appendix W), and will be implemented through the Construction Contractor's CEMP and Jemena's OEMP for the Project.

Assessment of effectiveness

The modelling indicates compliance with air quality criteria for both particulate matter and diesel exhaust emissions at the nearest sensitive receptors. In order to further reduce short term impacts associated with dust emissions, standard dust controls will be implemented. These are considered accepted industry practice and recommended in the *Code of Environmental Practice – Onshore Pipelines* (APIA 2013), and are therefore considered proven effective. The Construction Contractor has experience implementing these controls on other pipeline projects.

Residual risk

Subject to implementation of the above controls and ongoing monitoring and review in accordance with the environmental management framework described in Chapter 13, it is anticipated that the residual risk of a reduction in air quality from construction activities will be reduced to **LOW**.

11.4.2 INCREASED NOISE LEVELS

Context and assumptions

For the purposes of predicting impacts associated with noise on nearby sensitive receptors, noise predictions were undertaken for each stage of construction and operation. The predictive methods are in accordance with *ISO Standard 9613 (1996) Acoustics - Attenuation of sound during propagation outdoors*. Complete details of the noise modelling methods and results are provided at Appendix T.

Construction noise predictions were completed for a range of receptor distances between 20 m and 20 km; noise levels at a distance 8 km from the source were found to be negligible and have not been reported. The results of the noise predictions indicate noise levels decrease to between 30 - 40 dB(A) at a distance of 2 km from the construction footprint.

The nearest sensitive receptors to the construction activities, and the assessment criteria applied to each, are listed below:

- Outstation 975 - 3.4 km from pipeline (30 dB(A) criteria) (Northern Territory)
- a pastoral homestead - 3.5 km from pipeline (32 dB(A) criteria) (Northern Territory)
- Powerhouse Road houses, Mount Isa - 1.2 km from pipeline (39 dB(A) criteria) (Queensland)
- other houses in Mount Isa area - at least 1 km (34 dB(A) criteria) (Queensland).

Table 11-6 presents the radius of potential noise impacts in comparison to the day time criteria for specific receptor types. Receptors located within these distances have the potential to experience noise levels above the criteria (under worst-case meteorological conditions). The potential construction noise predictions take into account worst-case meteorology (source-to-receiver conditions and temperature inversions). Noise levels may be up to 5 dB lower under calm conditions (with a radius of influence up to 500 m less).

The modelling results indicate that for mainline construction activities in the Northern Territory, elevated levels of noise are not expected at any of the sensitive receptors. In Queensland a number of construction activities have the potential to result in elevated levels of noise at the homestead south-west of Mount Isa, generally within 2.5 km of the residence. Some noise impacts may also be felt by Powerhouse Road residences during ditching, padding and backfilling, hydrostatic testing and pipe transport, and associated with construction of the MICS. Potential impacts will be minimised through good communication with land-owners and residents.

In terms of construction traffic noise, the pastoral homestead located 3.5 km from the Project footprint could experience increased levels of noise. The unpaved road passing the homestead is not heavily trafficked, therefore, construction traffic will increase traffic volumes and consequently noise. Given the rapid rate of construction (3.5 - 5 km per day), the duration of impacts on the homestead would be minimal, and good communication with the residents will ensure the activities cause minimal disruption to their daily activities, health and well-being. Given the isolated nature of the majority of the pipeline route, and the use of construction camps along the ROW, increase in traffic from construction activities is unlikely to result in a significant increase in noise levels at any other sensitive receptors.

Table 11-6. Radius of potential impacts for construction activities

Construction activity	Radius of potential impact (m)			
	Outstations 30 dB(A) Criteria	Pastoral Homestead 32 dB(A) Criteria	Mount Isa 34 dB(A) Criteria	Powerhouse Road (Mt Isa) 39 dB(A) Criteria
Pipeline construction activities:				
Vegetation clearing	1,300	1,050	900	550
Row and site road preparation	2,300	2,000	1,700	1,150
Rock exposure and drilling	2,400	2,100	1,800	1,250
Ditching	3,000	2,600	2,300	1,650
Pipe stringing	1,000	850	700	450
Bending	2,000	1,700	1,500	1,000
Welding	2,200	1,900	1,600	1,100
Alignment and lowering	2,150	1,900	1,600	1,100
Padding and backfill	2,900	2,600	2,300	1,600
Tie-in	2,300	2,000	1,700	1,150
Clean-up	2,150	1,900	1,600	1,100
Cathodic protection	850	750	600	400
Hydrostatic testing	2,850	2,500	2,200	1,600
Road maintenance	2,100	1,800	1,600	1,050
Pipe transport	3,000	2,650	2,350	1,700
Nearest receptor distance to pipeline	**3.2km Outstation 975**	**3.5km**	**1.0km Homestead**	**1.2km**
Main line valve construction	2,300	2,000	1,800	1,200
Nearest receptor distance to MLVs	**32km Outstation 907**	**18km**	**2km Homestead; 7km Township**	**5.5 km**
Camp preparation	3,350	3,000	2,650	1,900
Nearest receptor distance to camps	**4.5km Outstation 975**	**9.5km**	**41km Homestead 43km Township**	**42.5km**
PCCS and MICS construction	3,200	2,850	2,500	1,800
Nearest receptor distance to Facilities	**28km Outstation 248**	**180km**	**2.6km Homestead**	**1.2km**

The potential for construction noise impacts on fauna is expected to be minimal given that the noisiest construction activities (excavation, drilling and blasting) will occur for relatively short periods of time in any given location; and the 65 dB(A) threshold screening criteria is only exceeded within 200 m of the construction activities (refer to Chapter 6).

For permanent nesting, roosting or colony areas which may be more sensitive to noise, the conservative assessment criteria of 12 dB(A) above existing LAeq levels was applied. Based on these criteria, construction activities could cause disturbance of noise sensitive fauna within distance up to 1 km from the construction ROW. Noise sensitive fauna are more likely to be affected by continuous noise that occurs in proximity to nesting, roosting or colony areas over extended periods (days/weeks), as opposed to short-term noise events associated with activities such as blasting. Refer to Chapter 6 for further detail.

Inherent risk

Based on the above context and assumptions, the inherent risk of general construction activities (i.e. traffic and operation of mobile plant, equipment and machinery) generating noise emissions that result in nuisance or health impacts on sensitive receptors is **LOW.**

The exception to this is blasting, which will result in intense and sudden noise near the blast sections. The inherent risk of noise impacts on sensitive receptors (particularly those near Mount Isa) as a result of blasting activities is **MODERATE.**

Analysis of the risks indicated that further controls can be practicably implemented to reduce impacts associated with noise and vibration (see below).

Controls

Controls provided in the Noise Management Plan (Appendix U) comprise strict management of night works (if required), regular liaison with potentially affected sensitive receptors, equipment selection and operating procedures. Traffic controls will be outlined in the Traffic Management Plan and will include avoidance of nigh time driving through populated places where possible, and selection of traffic routes away from sensitive receptors where available. All plant, machinery and equipment will be operated and maintained according to manufacturer's instructions to minimise noise emissions.

Avenues for complaints or feedback from residents in the area will be provided to allow investigation of opportunities to minimise noise impacts on sensitive receptors. All residents potentially impacted by construction noise emissions will be informed of the construction activities, operating hours and expected level and duration of noise emissions.

Controls are detailed in the framework EMP (Chapter 13), and will be implemented through the Construction Contractor's Project CEMP and Jemena's OEMP.

In relation to blasting noise emissions, a Blasting Management Plan will be developed and implemented that will outline controls for blasting (e.g. drill patterns, safety, debris control), timing of blasting (e.g. day time only near sensitive receptors) and requirements for communication of blasting activities with nearby residents who may be impacted by noise generated from blasting. As the construction will be progressive along the construction ROW, all noise impacts on sensitive receptors as a result of blasting will be short term and it is expected that standard blasting controls and communication with sensitive receptors will adequately mitigate this risk.

Controls to minimise blasting and associated noise impacts on fauna are outlined in Chapter 6.

Assessment of effectiveness

All proposed controls are in accordance with the *Code of Environmental Practice – Onshore Pipelines* (APIA 2013), and are therefore considered accepted industry standard and proven effective. The Construction Contractor has experience implementing these controls on other pipeline projects.

Residual risk

Subject to implementation of the above controls and ongoing monitoring and review in accordance with the environmental management framework described in Chapter 13, it is anticipated that the residual risk of noise emissions from construction activities will be reduced to **LOW**.

11.4.3 INCREASED VIBRATION LEVELS

Context and assumptions

In order to assess the potential impacts, predicted vibration levels at standard separation distances was reviewed against the relevant vibration criteria (Table 11-7). Complete details of the methodology for predicting vibration levels are provided at Appendix T.

Table 11-7. Predicted peak particle velocity from construction activities

Distance from source (m)	Predicted peak particle velocity (mm/s)					
	Roller	7 tonne compactor	Excavator	Piling	Loaded trucks (rough surfaces)	Loaded trucks (smooth surfaces)
10	6.00	7.00	4.00	12 – 30	5.00	1.00 – 2.00
20	2.12	2.47	1.41	4.20 – 10.6	1.77	0.35 – 0.71
30	1.15	1.35	0.77	2.30 – 5.80	0.96	0.19 – 0.38
40	0.75	0.88	0.50	1.50 – 3.80	0.63	0.13 – 0.25
50	0.54	0.63	0.36	1.10 – 2.70	0.45	0.09 – 0.18
60	0.41	0.48	0.27	0.82 – 2.04	0.34	0.07 – 0.14
70	0.32	0.38	0.22	0.65 – 1.62	0.27	0.06 – 0.11
80	0.27	0.31	0.18	0.53 – 1.33	0.22	0.05 – 0.09
90	0.22	0.26	0.15	0.44 – 1.11	0.19	0.04 – 0.07
100	0.19	0.22	0.13	0.38 – 0.95	0.16	0.03 – 0.06
150	0.1	0.12	0.07	0.21 – 0.52	0.09	0.02 – 0.03
Type	Continuous	Continuous	Continuous	Intermittent	Intermittent	Intermittent
Annoyance criteria	Residential 0.28 (preferred) / 0.56 (max) School 0.56 (preferred) / 1.1 (max)			-		
Building criteria	Residential 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					

The predicted vibration levels from pipeline construction activities (excluding blasting – see below) indicate compliance with the continuous preferred and maximum vibration criteria for locations at a separation distance of 80-90 m and 50-60 m, respectively. Predicted sensitive receptors are all well above 100 m in separation from the proposed construction alignment.

For intermittent vibration associated with haul vehicles and piling, it is difficult to provide an appropriate comparison with the relevant criteria (which is presented as a Vibration Dose Value (VDV) in m/s1.75). The calculation of a VDV requires both the overall weighted rms (root mean square) acceleration (m/s^2) typically obtained from on-site measurements and the estimated time period for vibration events. It is not proposed to include piling activities, however the piling PPV at 150 m is predicted to be within the maximum continuous criteria of 0.56 mm/s. This comparison with the continuous criteria (as a conservative approach) indicates that vibration levels associated with piling are not considered to be significant beyond these distances.

Blasting will occur at certain sections of the pipeline only and, based on a review of the locations in the Northern Terriory, a the Aboriginal outstation referred to as Outstation 975 is the nearest residential receptors (4 km from the proposed activities). The sections of the mainline requiring blasting range from 0.5-4.2 km in length and are located within KP28 to KP58 (Northern Territory) and KP589 to KP620 (Queensland). The length of the blast section is dependent on the type of rock under consideration. The predicted vibration and airblast overpressure levels are presented in Table 11-8 for various distances from blasting.

Table 11-8. Predicted potential vibration due to blasting

Distance from blast (m)	Predicted vibration level (mm/s)	Predicted airblast overpressure (dBL)a
40	4.9	144
100	1.1	132
400	0.1	115
1000 (House south of Mt Isa)	< 0.1	103
4000 (Outstation 975)	< 0.1	86
Criteria	5	115 dB (9 out of 10 consecutive blasts) 120 dB (any other blast)

[a] AS 2187.2 indicates that the site constant (Ka) for confined blasting overpressure predictions commonly varies between 10 and 100. A mid-value of 50 has been adopted in the absence of site specific data.

The predicted results indicate compliance with the blasting criteria by a significant margin at the nearest residential receptors.

The Noise Assessment (Appendix T) indicates that sensitive fauna could be affected by vibration and overpressure within 400 m of the blasting. The potential impact of vibration on sensitive ecological receptors is further discussed in Chapter 6.

Guidelines for structural damage to buried pipework and heritage buildings due to vibration was derived from the German Standard DIN 4150 -3 “Structural Vibration Part 3 – Effects of Vibration on Structures”. There is potential for damage to pipe structures where piling or rock breaking equipment is used within 10

m of the pipe. Prior to commencement of construction, utility infrastructure providers will be contacted to determine the location of any services and identify services which may be particularly susceptible to vibration impacts. The heritage risk assessment (Chapter 8) indicates there no known heritage structures occurring within this zone of impact.

Inherent risk

Blasting will result in intense and sudden vibration near the blast sections. The inherent risk of vibration impacts on sensitive receptors (particularly those near Mount Isa) as a result of blasting activities is **MODERATE.** Analysis of the risks indicated that further controls can be practicably implemented to reduce impacts associated with noise and vibration (see below).

Controls

A Blasting Management Plan will be developed and implemented that will outline controls for blasting (e.g. drill patterns, safety, debris control), timing of blasting (e.g. day time only near sensitive receptors) and requirements for communication of blasting activities with nearby residents who may be impacted by vibration generated from blasting. As the construction will be progressive along the construction ROW, all vibration impacts on sensitive receptors as a result of blasting will be short term and it is expected that standard blasting controls and communication with sensitive receptors will adequately mitigate this risk.

Note that controls to minimise blasting and associated vibration impacts on fauna are outlined in Chapter 6.

Assessment of effectiveness

All controls are in accordance with the *Code of Environmental Practice – Onshore Pipelines* (APIA 2013), and are therefore considered accepted industry standard and proven effective. The Construction Contractor has experience implementing these controls on other pipeline projects.

Residual risk

Subject to implementation of the above controls and ongoing monitoring and review in accordance with the environmental management framework described in Chapter 13, it is anticipated that the residual risk impacts from vibration associated with blasting will be reduced to **LOW**.

11.5 OPERATIONAL PHASE RISKS

Operation of the NGP will cause air and noise emissions, mainly around the compressor stations, and some above-ground pipeline facilities. Operational phase risks are discussed below.

11.5.1 REDUCTION IN AIR QUALITY

Context and assumptions

The key operational air emission sources are the compressor stations (MICS and PCCS). The emissions for PCCS have been considered by Jemena’s air quality consultant. Due to the remote location of PCCS and significant distance from the nearest receptor (over 28 km) air quality impacts are not expected at such a large separation distance.

The compressor stations have the potential to emit CO, nitrogen oxides (N_2O) and small amounts of CH_4 from gas processing. As the proposed equipment will be gas powered (as opposed to diesel powered), the potential for particulate emissions are expected to be negligible.

For the purpose of the operational assessment, meteorological modelling was undertaken using TAPM (The Air Pollution Model) and CALMET to predict localised meteorological conditions. The meteorological data derived from these models was used as an input for the CALPUFF dispersion modelling.

The air quality assessment was undertaken against criteria defined in the NEPM Air (1998), which provides ambient air quality standards for the protection of human health and well-being and the ambient air quality criteria defined in the Queensland Environment Protection Policy (EPP) (Air) 2008. A comparison of the NEPM Air and Queensland EPP (Air) indicates that air quality goals for pollutants relevant to the Project are similar under both pieces of legislation.

The results of the air dispersion modelling for the PCCS are presented in Table 11-9, Table 11-10 and Table 11-11 for the PCCS and MICS facilities as maximum ground level concentrations across the modelling domain, and at the worst affected community receptors in the immediate surroundings. Note that worst affected community receptor data is only provided for the MICS facility (in Queensland) only as there are no sensitive receptors within 28 km of the PCCS facility.

The results indicate compliance with the human health and well-being criteria for all modelled pollutants.

Table 11-9. PCCS - Predicted potential maximum ground level concentrations - modelling domain

Compound	Maximum potential predicted GLC concentrations (µg/m^3)			Average time	Criteria (µg/m^3)
	Source only	Background	Cumulative		
CO	342.9	381.9	724.9	8-hour	11,000
NO_2	236.4	14.4	250.8	1-hour	250
NO_2	45.4	10.4	55.8	Annual	62

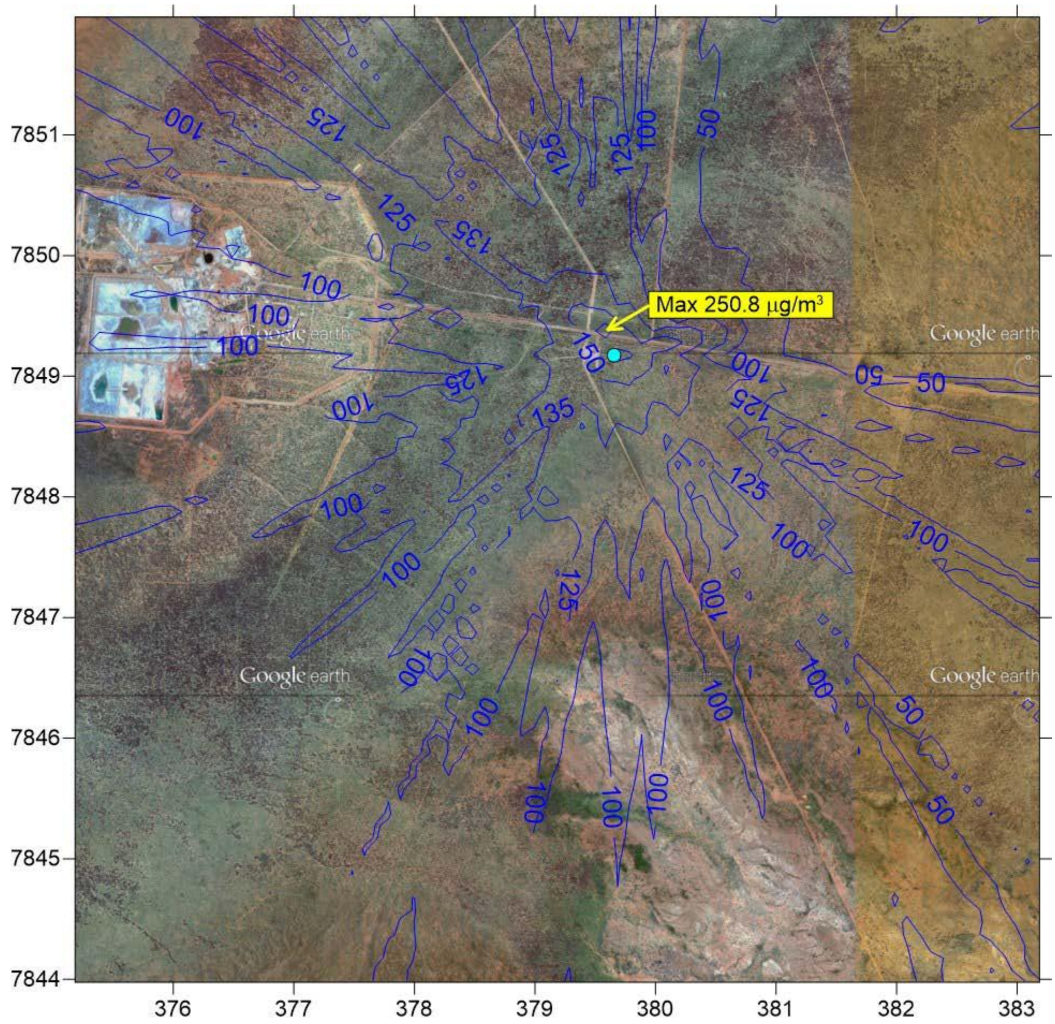
Table 11-10. MICS - Predicted potential maximum ground level concentrations - modelling domain

Compound	Maximum predicted GLC concentrations (µg/m^3)			Average time	Criteria (µg/m^3)
	Source only	Background	Cumulative		
CO	317.1	381.9	699.0	8-hour	11,000
NO_2	172.8	14.4	187.2	1-hour	250
NO_2	44.8	10.4	55.2	Annual	62

Table 11-11. MICS - Predicted maximum ground level concentrations - worst affected sensitive residential receptors

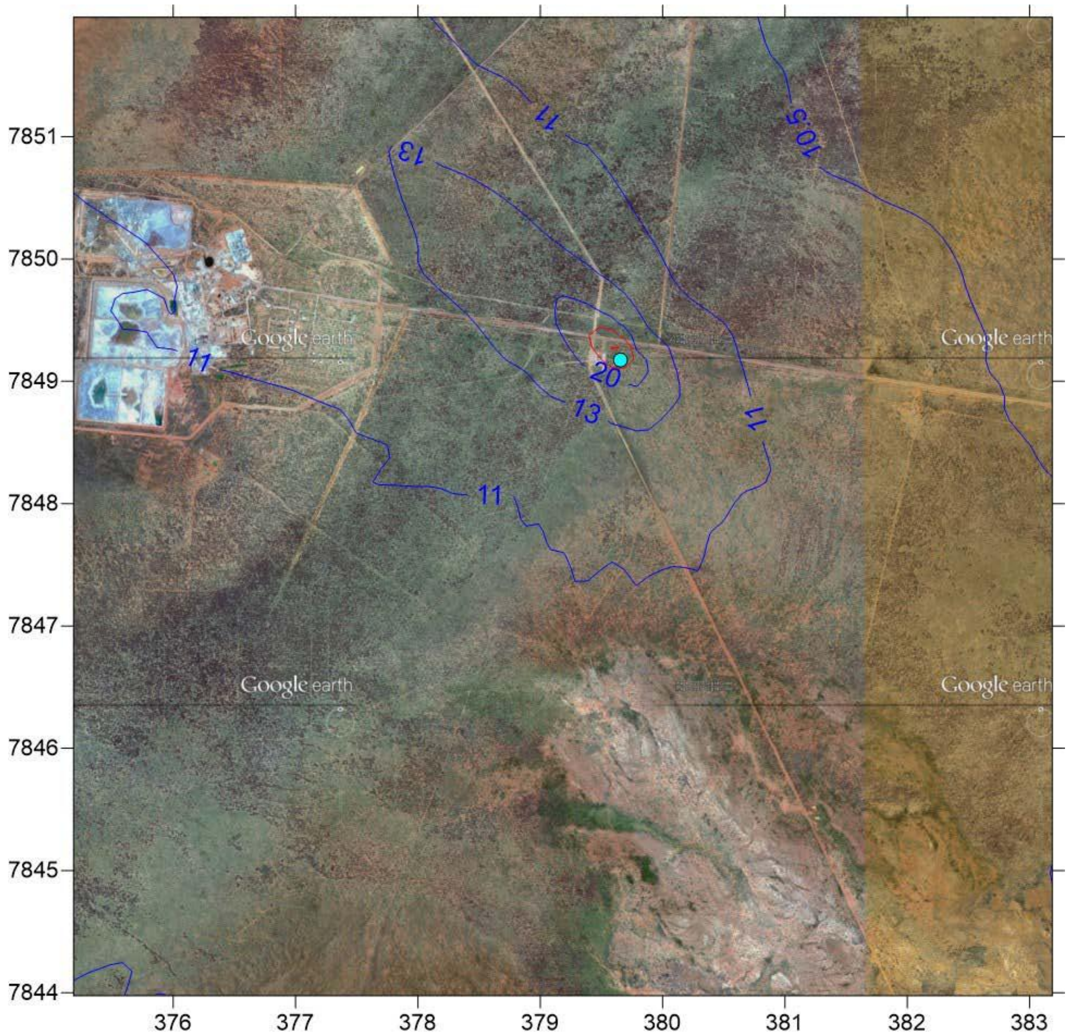
Compound	Maximum predicted GLC concentrations (µg/m^3)			Average time	Criteria (µg/m^3)
	Source only	Background	Cumulative		
CO	15.2	381.9	397.1	8-hour	11,000
NO_2	71.9	14.4	86.3	1-hour	250
NO_2	0.4	10.4	10.8	Annual	62

Predicted potential ground level concentration plots for NO_2 (1-hour) and NO_2 (annual) are provided in Figure 11-3 and Figure 11-4 for the PCCS, and Figure 11-5 and Figure 11-6 for the MICS. The NO_2 annual plot indicates an exceedance of the goal for ecosystem biodiversity and health in a small area surrounding the facilities. It is understood that, from available ecological survey information of the pipeline, there are no sensitive flora ecosystems (for which the criteria is applicable) directly around either the MICS or PCCS facility (refer to Chapter 6). Furthermore, the prediction methodology of annual concentrations is highly conservative by assuming a highly unlikely scenario where all compressor turbines, gas engine alternators and any heaters are operating simultaneously. This provides greater certainty that the air quality impacts associated with the operation of the Project are expected to be within the appropriate receptor air quality criteria.



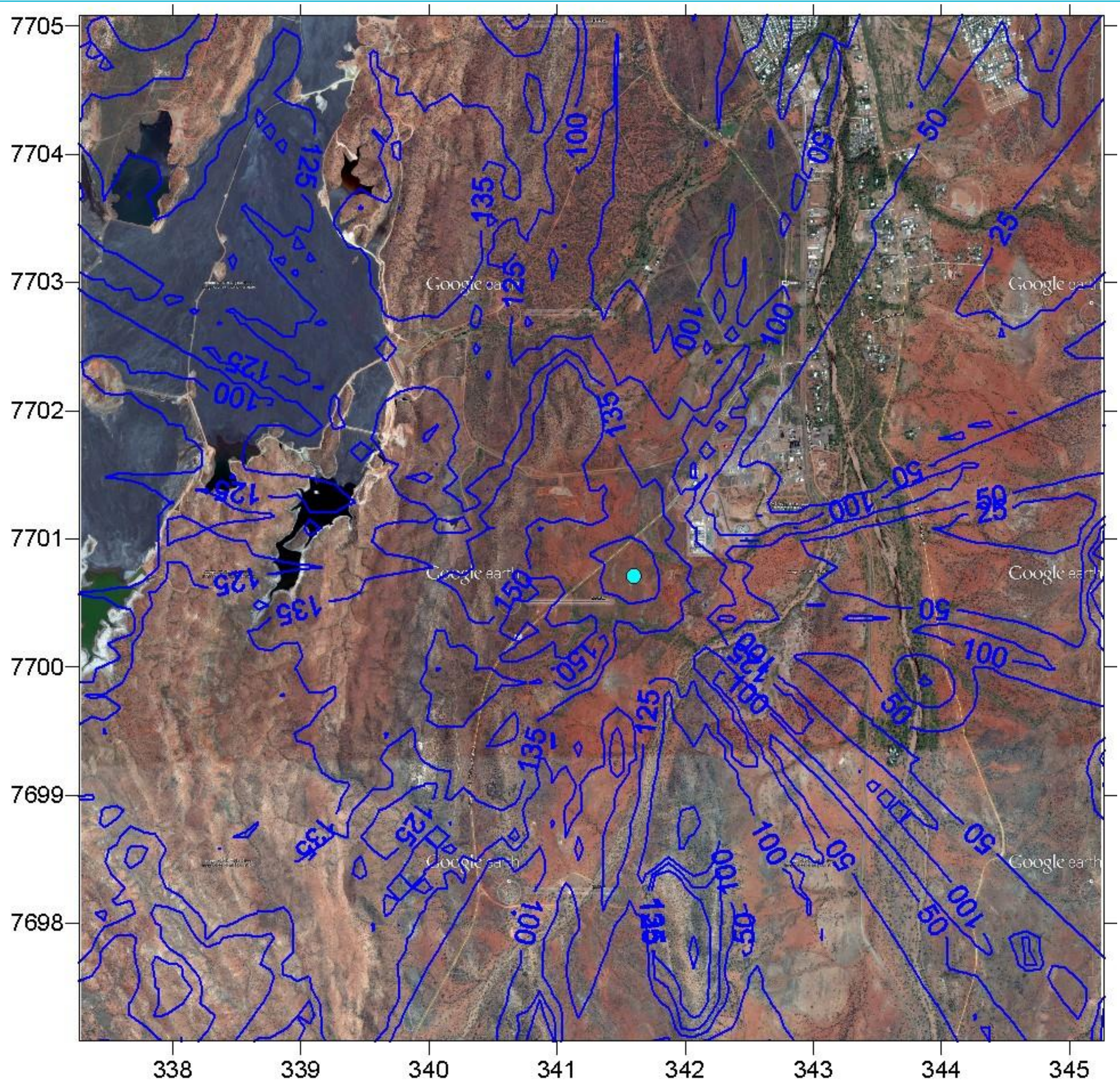
Averaging Time: 1-hour**; Units:** mg/m^3**; Criteria**: 250 mg/m^3

Figure 11-3. PCCS Facility - Predicted 1-hour Ground Level Nitrogen Dioxide Concentrations (Cumulative)



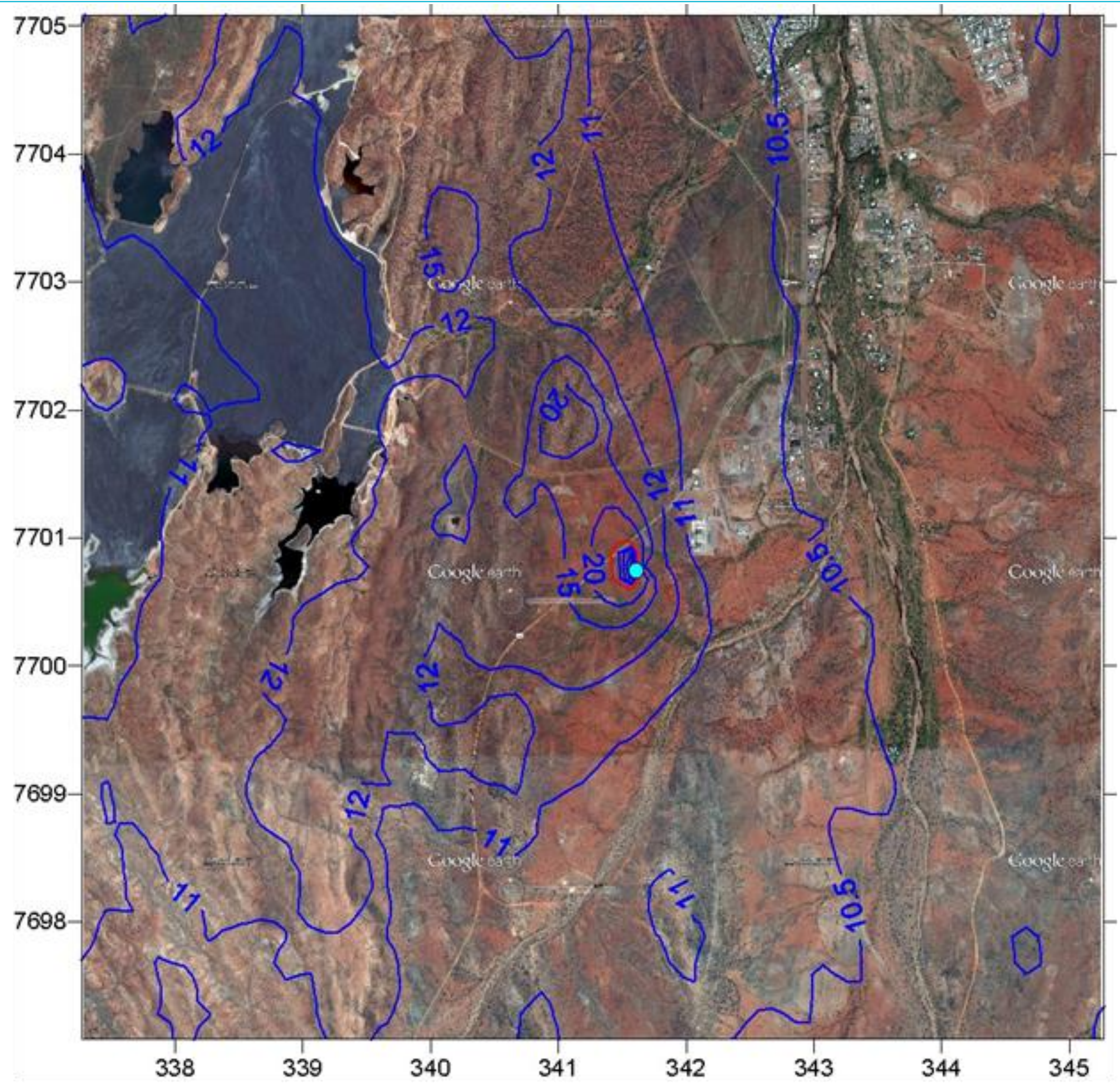
Averaging Time: Annual; **Units**: mg/m3; **Criteria**: 62 mg/m3 (health and well-being), 33 mg/m3 (health and biodiversity of ecosystems)

Figure 11-4. PCCS Facility - Predicted Annual Ground Level Nitrogen Dioxide Concentrations (Cumulative)



Averaging Time: 1-hour; **Units:** µg/m^3; **Criteria:** 246 µg/m^3

Figure 11-5. MICS Facility - Predicted 1-hour Ground Level Nitrogen Dioxide Concentrations (Cumulative)



Averaging time: Annual; **Units:** µg/m^3; **Criteria:** 62 µg/m^3 (health and well-being), 33 µg/m^3 (health and biodiversity of ecosystems)

Figure 11-6. MICS Facility - Predicted Annual Ground Level Nitrogen Dioxide Concentrations (Cumulative)

Inherent risk

Based on the above context and assumptions, the inherent risk of a reduction in air quality as a result of gas venting at compressor stations and MLV sites (which will result in methane emissions) and operation and maintenance of the PCCS and MICS facilities (which will result in combustion emissions) is **MODERATE**. Analysis of the risks indicated that further controls can be practicably implemented to reduce impacts associated with air quality (see below).

Controls

The operation of the PCCS and MICS facilities and MLV's will inherently result in emissions and impacts to air quality. These will be minimised through elevating emissions stacks at compressor stations, implementing the Air Quality Management Plan (see Appendix W), and developing and implementing an Inspection and Maintenance Program to ensure that all equipment operates efficiently and as per design. Routine monitoring and maintenance will be undertaken and recorded to track equipment operating parameters. Stack emissions testing will be undertaken as required by the applicable regulations.

The assessment of air emissions concluded that compliance with relevant criteria is expected at all sensitive receptors during the operational phase of the Project, therefore no site-specific mitigation measures are proposed in proximity to sensitive receptors.

Assessment of effectiveness

Modelling indicates adherence to air quality criteria at sensitive receptors, and no human health impacts are expected to occur as a result of the air quality emissions. This is due the separation distances between infrastructure and sensitive receptors, and the design of the compressor stations to incorporate elevated emissions stacks, which aids air dispersion and reduces air quality impacts at ground level. The additional routine maintenance measures are prescribed by industry standards and equipment manufacturer guidance, and therefore are expected to ensure that risks remain low for the duration of the Project.

Residual risk

Emissions of methane and combustion emissions from the operation and maintenance of compressor stations and MLV sites (methane emissions only) are inherent, and despite application of mitigation measures, operational activities will result in impacts to air quality in the direct vicinity of the sites MLVs and compressor stations. Due to the potential consequences associated with methane gas exposure (i.e. asphyxiation or explosion) it is not possible to reduce this risk to low; the residual risk is assessed as **MODERATE** but may be further reduced through mitigation and management of fire and explosion more generally (refer Chapter 10), which contribute to the elevated level of risk.

11.5.2 INCREASED NOISE LEVELS

Context and assumptions

Operational noise was modelled for the compressor station facilities (PCCS and MICS), and MLVs along the pipeline route. It is noted that under normal operations, vehicle movements to and from the compressor stations and MLV will generally be limited to a small number of personnel vehicles and maintenance vehicles. Therefore noise from vehicles accessing the sites was not considered in the noise assessment. The flare and gas venting system at the PCCS has been modelled at heights of 40 m and 15 m respectively, based on preliminary design details shown in Chapter 2.

Phillip Creek Compressor Station

Table 11-12 presents the predicted potential noise levels at fixed distances, including the boundary position, from the standard operations at the PCCS facility.

Table 11-12. Predicted potential noise levels from PCCS operations

Distance / location	Predicted LAeq,adj dB(A)	Predicted LCeq dB(C)	LCeq - LAeq[a] dB
Boundary	55.6	70.4	14.8
Existing compressor building	54.5	69.5	15.0
1km	39.7	57.1	17.4
2km	32.2	49.1	16.9
5km	22.4	33.6	11.2
10km	14.2	18.7	4.5
20km	9.8	10.7	0.9
Criteria	Sensitive 28 dB(A) Fauna 42 dB(A)	60 dB(C)	No greater than 20 dB

[a] LA_{eq} level is inclusive of noise source and minimum ambient noise level.

There are no existing sensitive residential receptors within 28 km of the proposed PCCS facility. An existing compressor station (Warrego Compressor Station) is located nearby on the Amadeus Gas Pipeline. Predictions up to 3 dB (A) higher are likely during the five hour compressor changeover period each week. Review of the predicted noise levels indicate, for the proposed exhaust muffler and nominal plant enclosure and inlet muffler to the gas turbine engines, reasonable and compliant noise levels beyond 2 km.

Some potential influence on ecological receptors, associated with normal operations, is predicted at distances up to 1 km from the PCCS facility (criteria - 12 dB (A) above background) (refer to Chapter 6).

Table 11-13 presents the highest predicted potential noise level at the nearest sensitive receptors for gas flaring at the PCCS facility.

Table 11-13. Predicted potential noise levels for gas flaring at the PCCS facility

Distance/location	Predicted $L_{Aeq,adj}$ dB(A)	Predicted L_{Ceq} dB(C)	L_{Ceq} - L_{Aeq} [a] dB
Boundary	61.3	76.4	15.1
Existing compressor building	59.7	75.1	15.3
1km	44.6	63.0	18.0
2km	36.9	57.6	18.5
5km	26.6	50.1	14.5
10km	18.0	43.2	8.1
20km	13.6	39.5	4.5
Criteria	Sensitive 30 dB(A) Fauna 65 dB(A) Fauna 42 dB(A)	60 dB(C)	No greater than 20 dB

[a] LAeq level is inclusive of noise source and minimum ambient noise level.

The flare has a small pilot flame in order to maintain process safety; however this does not provide a significant noise source. During the day, noise levels are predicted to comply with the relevant noise criteria at all surrounding sensitive receptors beyond 4 km. Based on this, for the currently proposed flare location, a noise level of 109 dB (A) (sound power level) and a height of 15 m are considered appropriate from an acoustic perspective given the existing surrounds. No sensitive receptors are located within 20 km and therefore compliance is predicted.

Table 11-14 presents the highest predicted potential noise level at the nearest sensitive receptors for gas venting at the PCCS facility. The predicted L_{AMax} noise levels for gas venting represent levels during the commencement of venting when noise levels are highest. Noise levels gradually decrease during the venting process as the pressure differential between the pipeline and atmosphere decreases. Predictions for L_{Aeq} have been made on the assumption that the maximum noise level is sustained for up to five minutes, and the remaining 10 minutes is at least 20 dB (A) lower.

The gas venting at the PCCS facility would occur during emergency or maintenance activities (approximately once every six months for a short duration) and would be restricted to daytime operation where possible. Noise levels have the potential to exceed the $LA_{eq,adj}$ short term criteria at a distance of up to 1.5 km, and the L_{Amax} criteria at distances of up to 2 km. Noise levels are predicted to be only marginally above the L_{Ceq} criteria at the neighbouring remnant compressor building site.

Given the infrequent occurrence, short duration and daytime scheduling of non-emergency gas venting, and the absence of sensitive receptors within a 20 km radius, this noise level is considered to be acceptable and in compliance with the adopted noise criteria at all existing sensitive receptors.

Table 11-14. Predicted potential noise levels for gas venting at the PCCS facility

Distance/location	Predicted	Predicted	Predicted	L_{Ceq} - L_{Aeq}[a]
Boundary	79.5	59.5	69.1	9.6
Existing compressor building	76.5	56.5	66.3	9.8
1km	61.3	41.3	52.6	11.3
2km	54.7	34.7	47.5	12.5
5km	43.5	23.5	39.6	4.6
10km	32.4	12.4	32.3	<0
20km	26.5	6.5	28.3	<0
Criteria	Short-term L_{Amax} 55 dB(A) Fauna 65 dB(A)	Short-term L_{Aeq} 37 dB(A)	60 dB(C)	No greater than 20 dB

[a] L_{Aeq} level is inclusive of noise source and minimum ambient noise level.

<u>Mount Isa Compressor Station</u>

Computational modelling of the MICS facility was completed to identify the sphere of influence of noise on the southern Mount Isa community and surrounds. Predictions of highest level of noise for each modelled scenario were completed for each receptor group identified in Figure 11-7.

Table 11-15 presents the predicted potential noise level at fixed distances, including the boundary position, from the standard operations at the MICS facility near Mount Isa. It should be noted that predictions assume a basic single skin metal plant enclosure and an inlet muffler with the intent to use the actual equipment in the finalised assessment. Where a more substantial plant building is provided (e.g. blockwork) or inlet silencers, lower noise emissions are expected.

Compliance with long term operating noise criteria is predicted for all identified sensitive receptors during normal operation of the proposed MICS facility plant.

Table 11-15. Predicted potential noise levels from MICS operations

Receiver group	Predicted $L_{Aeq,adj}$	Criteria Laeq,adj (day/ evening /	Predicted LCeq	L_{Ceq} - L_{Aeq}[a]
1. South-east of Mount Isa	18.8	34/34/32	38.5	4.4
2. Homestead south-west of Mount Isa	18.0	34/34/32	38.0	3.8
3. Powerhouse Road	35.1	39/39/37	54.6	17.1
4. Mount Isa township	31.8	34/34/32	50.6	6.8
5. Mount Isa township	18.5	34/34/32	38.2	4.5
6. Mount Isa township	18.6	34/34/32	38.4	4.2

Receiver group	Predicted LAeq,adj	Criteria Laeq,adj (day/ evening /	Predicted LCeq	LCeq - LAeq[a]
7. Mount Isa township	18.9	34/34/32	38.6	4.5
Criteria	-	-	60 dB(C)	No greater than 20 dB
[a] L_{Aeq} level is inclusive of noise source and minimum ambient noise level.				

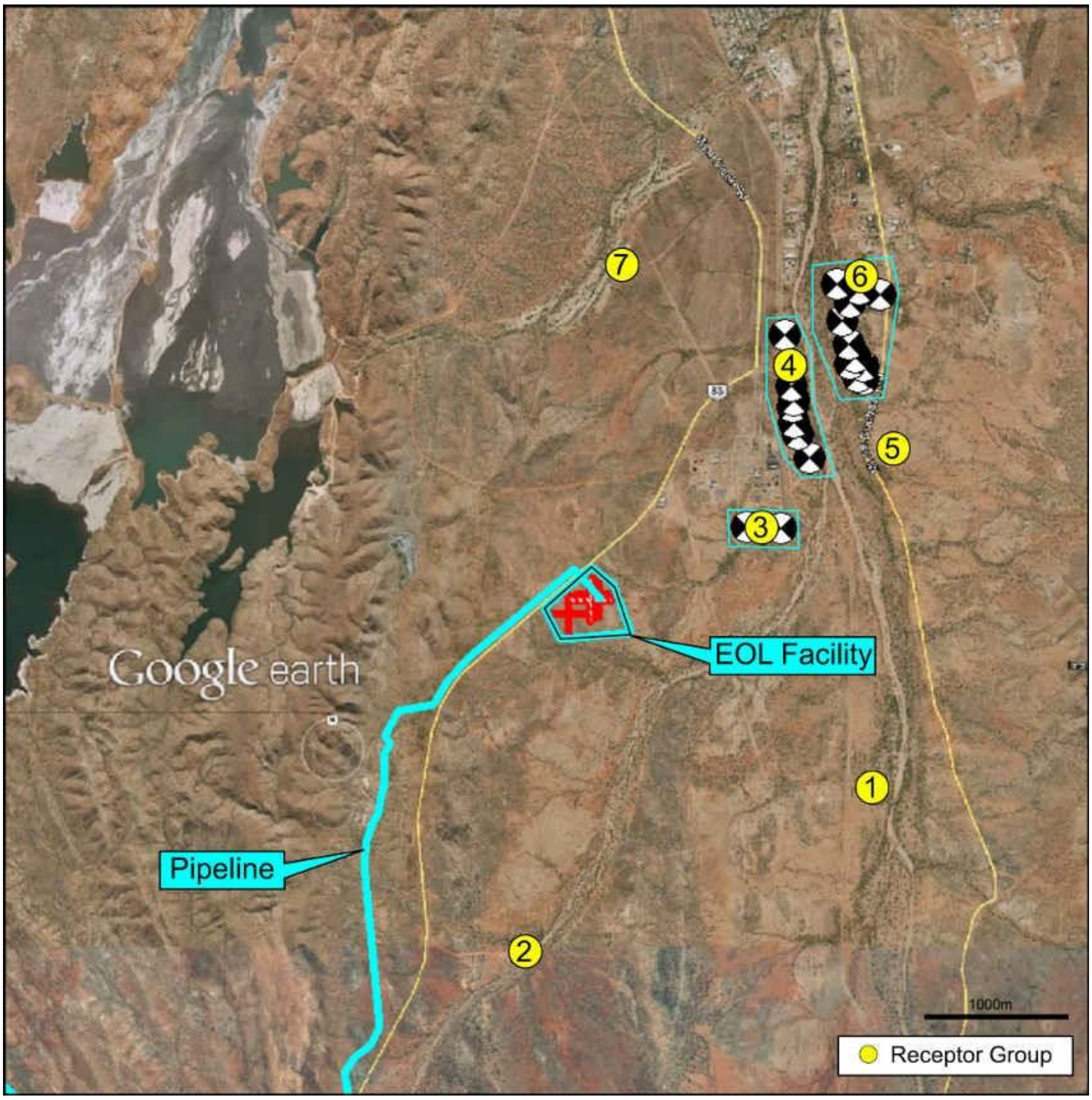


Figure 11-7. Southern Mount Isa receptor groups and MICS facility

Table 11-16 presents the highest predicted potential noise level at the nearest sensitive receptors for gas venting at the MICS facility. The predicted L_{AMax} noise levels for gas venting represent predicted potential noise levels during the commencement of venting when noise levels are highest. Noise levels gradually decrease during the venting process as the pressure differential between the pipeline and atmosphere decreases. Predictions for L_{Aeq} levels were made on the assumption that the maximum noise level is sustained for up to five minutes, and the remaining 10 minutes is at least 20 dB(A) lower.

Table 11-16. Predicted potential noise levels for gas venting at MICS facility

Distance/location	Predicted LAeq	Short term Criteria LAeq,adj	Predicted LAmax	Predicted LCeq	LCeq - LAeq[a]
1. South-east of Mount Isa	31.6	**39**	51.6	45.0	10.0
2. Homestead south-west of Mount Isa	31.9	**39**	51.9	45.3	10.3
3. Powerhouse Road	37.9	**44**	57.9	49.7	11.8
4. Mount Isa Township 6	27.4	**39**	47.4	39.2	4.2
5. Mount Isa Township14	21.1	**39**	51.1	44.6	9.6
6. Mount Isa Township15	20.6	**39**	50.6	44.4	9.4
7. Mount Isa Township	21.4	**39**	51.4	44.9	9.9
Criteria	-	-	55 dB(A)	60 dB(C)	No greater than 20 dB

[a] L_{Aeq} level is inclusive of noise source and minimum ambient noise level.

Gas venting at the MICS facility would only occur during emergency or maintenance activities (approximately once every six months for 15 minutes) and would be restricted to daytime operation where possible. Without mitigation, noise levels are predicted to exceed the L_{Amax} criteria, however are typically within the $_{LAeq,adj}$ short term criteria and L_{Ceq} criteria. Given the infrequent occurrence, short duration and daytime scheduling of non-emergency gas venting and the absence of sensitive receptors within close proximity this noise level is considered to be acceptable and in compliance with the adopted noise criteria at all existing sensitive receptors. To ensure compliance with all applicable noise criteria at all times, consideration will be given to include gas vent silencers or alternative nozzle design. A reduction of 3 dB(A) would be required to achieve compliance with the L_{Amax} criteria.

Main line valves

During operation of the MLV facilities gas venting may occur (e.g. through maintenance activities). Table 11-17 presents the highest predicted potential noise level at various separation distances from the MLV locations.

The predicted L_{AMax} noise levels for gas venting represent levels during the commencement of venting when noise levels are highest. Noise levels gradually decrease during the venting process as the pressure differential between the pipeline and atmosphere decreases. Predictions for L_{Aeq} were made on the assumption that the maximum noise level is sustained for up to five minutes, and the remaining 10 minutes is at least 20 dB(A) lower. The gas venting at the MLV facilities is an infrequent activity and would only occur during emergency or limited maintenance activities and, to further minimise potential impacts, maintenance venting would be restricted to daytime operation where possible.

Table 11-17. Predicted operational noise levels from gas venting at MLVs

Distance/location	Predicted L_{Amax}	Predicted L_{Aeq}	Predicted L_{Ceq}	L_{Ceq} - L_{Aeqa}
Boundary	79.5	59.5	69.1	9.6
1km	61.3	41.3	52.6	11.3
2km (Nearest sensitive receiver to MLV4)	54.7	34.7	47.5	12.5
5km	43.5	23.5	39.6	4.6
10km	32.4	12.4	32.3	<0
20km	26.5	6.5	28.3	<0
Criteria	Short-term L_{Amax} 55 dB(A)	Short-term L_{Aeq} 39 dB(A)	60dB(C)	No greater than 20 dB

[a] L_{Aeq} level is inclusive of noise source and minimum ambient noise level.

The nearest sensitive receiver to an MLV is a homestead in the Northern Territory located approximately 18 km west of the MLV3 site. For the MLV3 station, noise levels are predicted to be significantly below the adopted criteria and fully compliant at the nearest sensitive receiver.

The nearest sensitive receptors to MLV1 and MLV2 are 33 km or more from the respective facilities, and are predicted to be fully compliant. Some potential influence on ecological receptors is predicted at distances up to 5 km (12 dB(A) above background levels) for unsilenced gas venting. However, due to the short and very rare occurrence of gas venting at these sites, these activities are unlikely to permanently disturb colonies or established animal communities

Further detailed design is required to confirm operating noise levels for the MLV sites and any silencers, as a number of other factors need to be considered such as molecular weight, temperature and allowable pressure drop. These factors can also have an influence on the specified noise level and achievable reduction provided by a silencer, and need to be considered in further detail. Adjustments for tonality should be considered in defining the maximum allowable level. These issues will be addressed at the detailed design phase of the Project, when specific plant information is available.

Inherent risk

Based on the above context and assumptions the inherent risk of a noise emissions (and resultant impacts on community) from the operation and maintenance of the MICS facility, and gas flaring and venting at the PCCS and MICS facilities, is **MODERATE.**

The inherent risk of noise emissions associated with the operation of the PCCS facility is **LOW,** due to the large separation distance (>28 km) between the PCCS and sensitive receptors.

Analysis of the risks indicated that further controls can be practicably implemented to reduce impacts associated with noise (see below).

Controls

In order to minimise noise emissions from the PCCS and MICS facilities an Inspection and Maintenance Program will be implemented to ensure that all equipment operates as per design. In relation to planned

venting, operating procedures will dictate this activity will only occur during testing every six months for a 15 minute period. The typical frequency of gas venting is much less than that defined by the short-term noise criteria specified by the Queensland EHP model conditions for petroleum activities. Nevertheless, given the proximity to a larger population of affected sensitive receptors in the Mount Isa area, the Noise Assessment recommended mitigation of noise from gas venting at the MICS facility.

Design of the facilities will incorporate recommended flow and nozzle diameters, or additional silencers, as recommended in the Noise Management Plan (refer to Appendix U).

Jemena will implement the following additional measure at the MICS for the operational phase of the Project, as recommended in the Noise Assessment:

- provision of silencer or alternative nozzle at MICS facility venting to achieve a sound power level of 130 dB(A) or less

Avenues for complaints or feedback from residents in the area will be provided to allow investigation of opportunities to minimise noise impacts on sensitive receptors.

Assessment of effectiveness

Modelling indicates compliance with noise criteria at sensitive receptors for all operational activities, with the exception of short term glaring and venting noise from the MICS. The installation of an additional silencer as part of the design process is expected to reduce the short-duration minor exceedances of modelled noise assessment criteria associated with gas venting at the MICS to below the assessment criteria; this avoids impacts on the residents of Powerhouse Road near Mount Isa.

The controls that will be implemented to reduce noise impacts from operational activities have been recommended by specialist consultants ANE, and are considered accepted industry practice and compliant with relevant regulations and standards. Effective implementation of these controls, and ongoing monitoring and maintenance, are expected to be effective in minimising impacts of noise emissions.

Residual risk

Noise emissions from the operation and maintenance of facilities, and gas flaring and venting, are inherent, and despite application of mitigation measures, operational activities will result in noise impacts within modelled spheres of influence around the compressor stations. In recognition of this, the residual risk remains **MODERATE.** However, the risk to sensitive receptors in the Northern Territory is **LOW** as all receptors are located outside of the modelling zone of potential operational noise impacts.

11.6 GREENHOUSE GAS EMISSIONS

Annual greenhouse gas (GHG) emissions during construction and operation were estimated based on the methods outlined in the National Greenhouse Energy Reporting Act 2007 (NGER) (*Cth*) and associated technical guidelines. Complete details of the methodology and results are provided at Appendix V.

Table 11-18 presents a summary of the estimated total Scope 1 and 2 emissions during Year 1, Year 2 and for subsequent operations of the Project. Year 1 includes construction only (including land clearing activities); Year 2 includes construction and commissioning in the first half of the year and operation in the second half.

Based on the estimated potential emissions presented above, the proposed gas pipeline is expected to trigger the NGER reporting threshold for a single facility of 25 kilotonnes CO_2-e (25,000 tonnes CO_2-e) of greenhouse gases and 100,000 MJ of energy consumed.

The NGP is expected to trigger the NGER reporting threshold for greenhouses gases from a single facility. Jemena will report GHG emissions in accordance with the NGER framework requirements.

Table 11-18. Estimated potential greenhouse gas emissions

Year of project	Scope 1		Scope 2		Total emissions (tonnes CO_{2-e})
	Energy usage (GJ)	Emissions (tonnes CO_{2-e})	Energy usage (GJ)	Emissions (tonnes CO_{2-e})	
Fuel gas only					
Year 1	136,810	9,604	-	-	9,604
Year 2	929,093	72,229	19,656	4,313	76,542
Annual Operation	1,689,985	103,462	39,312	8,627	112,089

The extent of GHG emissions that will occur from land clearing will be minimised by confining clearing to a 30 m wide construction corridor and relatively small footprints for above-ground facilities. The majority of the areas cleared during the construction phase will be reinstated and rehabilitated to achieve the rehabilitation acceptance criteria prescribed in the NGP Environmental Authority issued under the *EP Act (Qld)*. Details of the reinstatement and rehabilitation process are provided in the framework EMP (Chapter 13).

There are opportunities for further reducing GHG emissions during the construction phase by:

- minimising clearing of vegetation along the pipeline ROW
- encouraging re-vegetation of the pipeline ROW
- minimising the use of fuel by selecting fuel efficient plant and equipment, operating vehicles and machinery in a fuel efficient manner e.g. turning off idling equipment, and selecting construction techniques that utilise lower amounts of fuel.
- sourcing supplies locally (thereby minimising transportation emissions to get product to site).

Opportunities for reducing GHG emissions during the operational phase include:

- implementation of a regular maintenance regime to minimise the potentials for gas leakage along the pipeline and at facilities
- investigate the use of biofuels in plant and equipment
- implementation of a regular maintenance regime for gas engine alternators and compressor turbines to ensure they are operating at peak efficiency.

11.7 MITIGATION AND MANAGEMENT

The Project, due to its remote location, generally avoids impacts on sensitive receptors associated with air and noise emissions. Therefore, site-specific management measures are not proposed for the majority of the Project footprint. The exception to this is the Project components near Mount Isa, in particular the MICS, where some site-specific mitigation of noise emissions, in particular during venting, is required to reduce impacts to an acceptable level at all times.

The mitigation measures that will be implemented to minimise air and noise emissions related to the construction and operation of the NGP will be a combination of:

- Specific measures recommended by the air and noise specialists (ANE) (refer to the Noise Management Plan and Air Quality - Appendix U and W respectively)
- Routine air quality and noise management measures as prescribed in the *Code of Environmental Practice – Onshore Pipelines (APIA 2013)*.

These measures are considered to be industry best-practice and have been implemented on numerous pipeline projects across Australia. Therefore there is a high level of confidence the mitigation measures will be effective.

Detailed management and mitigation measures are provided in the framework Environmental Management Plan (Chapter 13), which cross-references the Air Management Plan and Noise Management Plan.

The Construction Contractor will incorporate all controls relevant to air, noise and vibration management into the Construction Environmental Management Plan (CEMP) and associated procedures, which will be finalised prior to the commencement of construction activities. In addition to the CEMP, the following specific management plans will be developed for the construction phase to manage and mitigate potential impacts air and noise impacts:

- Blasting Management Plan
- Traffic Management Plan.

Operational mitigation and management measures are outlined in the ANE management plans (Appendix U and W) and have been incorporated into Section 13.10 and 13.11 of Chapter 13 Environmental Management Plan. Jemena will incorporate these controls into the Operational Environmental Management Plan (OEMP), which will be finalised prior to commencement of operations.

Decommissioning air and noise risks were assessed as low based on the assumption that the pipeline is decommissioned in situ. Decommissioning risks will be re-assessed prior to that phase and any identified risks relevant to air, noise or vibration will be addressed by Jemena in an approved plan subject to the regulatory requirements applicable at that time.

11.8 SUMMARY AND RESIDUAL RISK – AIR QUALITY

Key air emissions for the Project include dust (particulate matter) from earthworks and diesel exhaust emissions gases during construction, and gas combustion emissions from the operation of gas engine alternators and compressor turbines at the MICS and PCCS facilities. Assessment undertaken against the relevant ambient air quality criteria for the key air quality indicators, as defined in the *NEPM Air* and the *Qld EPP (Air)*, indicates that construction and operation of the Project is expected to have a minor contribution to pollutant concentrations in the surrounding area.

Overall, air pollutant concentrations (both source and cumulative) are predicted to be compliant with relevant air quality criteria. The potential for air quality impacts will be further minimised by adopting the various air quality management measures outlined herein, and described in more detail in the Framework EMP (Chapter 13). The residual risk profile for air quality is shown below:

PROJECT PHASE	Low	Moderate	Significant	High	Extreme
PLANNING	1	0	0	0	0
CONSTRUCTION	1	0	0	0	0
OPERATIONS	0	2	0	0	0

11.8.1 PLANNING PHASE RESIDUAL RISKS

Planning phase risks relate only to the potential for inadequate or inaccurate assessment of risks due to either insufficient or inaccurate Project information, or inadequate modelling. This risk has been reduced to ‘Low’ through engaging specialist air and acoustic consultants to undertake modelling based on the most accurate Project information available. The modelling will be revised if Project details change.

11.8.2 CONSTRUCTION PHASE RESIDUAL RISKS

The mitigation measures prescribed in the Air Quality Management Plan (refer Chapter 13) are expected to be effective in reducing all construction air quality risks to ‘Low’.

11.8.3 OPERATIONAL PHASE RESIDUAL RISKS

The following potential impacts remain a ‘Moderate’ risk for the operational phase:

- reduction in air quality (flammability risks)
- reduction in air quality (nuisance and health impacts).

Emissions of methane and combustion emissions from the operation and maintenance of compressor stations and MLV sites (methane emissions only) are inherent, and despite application of mitigation measures, operational activities will result in impacts to air quality in the direct vicinity of the sites MLVs and compressor stations. Due to the potential consequences associated with methane gas exposure (i.e. asphyxiation or explosion) it is not possible to reduce this risk to low; the residual risk is assessed as **MODERATE** but may be further reduced through mitigation and management of fire and explosion more generally (refer Chapter 10), which contribute to the elevated level of risk.

11.8.4 GREENHOUSE GAS EMISSIONS

Greenhouse gas emissions for the Project are primarily categorised as Scope 1 emissions and are associated with land clearing and diesel and gas combustion. There is a potential for Scope 2 emissions should the MICS facility utilise mains power. GHG emissions are estimated to be above the National Greenhouse and Energy Reporting thresholds for CO_2-e emitted and energy consumed.

11.9 SUMMARY AND RESIDUAL RISK – NOISE AND VIBRATION

Noise generation during construction is mainly associated with excavation and blasting activities along the construction ROW, with traffic not expected to represent a significant noise source to impact on sensitive receptors (mainly due to the remoteness of the access routes from sensitive receptors). The modelling of potential noise impacts on sensitive receptors from construction activities indicates that a number of construction activities have the potential to result in elevated levels of noise at a homestead south-west of Mount Isa; additionally, some impact is likely on Powerhouse Road residences during ditching, padding and backfilling, hydrostatic testing and pipe transport. The potential for noise impacts on these receptors will be minimised by adopting the various management measures outlined herein, and described in more detail in the framework EMP (Chapter 13).

During operations, compliance with long term operating noise criteria is predicted for all identified sensitive receptors during normal operation of the proposed PCCS and MICS facilities. Some minor short-term exposure is expected to the Powerhouse Road residences associated with gas venting at the MICS facilities. The potential for noise emissions will be further minimised by adopting the various air quality management measures outlined herein and described in more detail in the framework EMP (Chapter 13), and the risk assessment indicates that through mitigation all risks are reduced to Low – no residual significant impacts are predicted.

Due to separation distances greater than 150 m from any sensitive areas, vibration impacts are unlikely to cause any significant impact.

The residual risk profile for noise and vibration is shown below:

PROJECT PHASE	Low	Moderate	Significant	High	Extreme
PLANNING	1	0	0	0	0
CONSTRUCTION	3	0	0	0	0
OPERATIONS	1	3	0	0	0

Planning phase residual risks

Planning phase risks relate only to the potential for inadequate or inaccurate assessment of risks due to either insufficient or inaccurate project information, or inadequate modelling. This risk has been reduced to ‘Low’ through engaging specialist air and acoustic consultants to undertake modelling based on the most accurate project information available. The modelling will be revised if NGP Project details change.

Construction phase residual risks

The mitigation measures prescribed in the Noise Management Plan (refer Appendix U) are expected to be effective in reducing construction air quality risks to ‘Low’.

Operational phase residual risks

The following potential impacts remain a 'Moderate' risk for the operational phase:

- high volume noise potentially occurring any time (at PCCS and MICS)
- continuous elevated low frequency noise.

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