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Dyno Nobel Asia Pacific Limited

Moranbah Ammonium Nitrate Project Noise Assessment Report

August 2006

Contents

Glossary	iii
Executive Summary	iv
1. Introduction	1
1.1 Project Description	1
1.2 Subject Site	1
1.3 Scope of Works	4
1.4 Assessment Methodology	4
1.5 Limitations	5
2. Existing Environment	6
2.1 Monitoring Locations	6
2.2 Receiver Locations	9
2.3 Meteorological Conditions	10
2.4 Attended Noise Monitoring Results	10
2.5 Unattended Noise Monitoring Results	12
3. Noise Criteria	14
3.1 Construction Noise Criteria	14
3.2 Operational Noise Criteria	14
3.3 Road Traffic Noise Criteria	15
4. Assessment of Potential Impacts	16
4.1 Construction Noise Assessment	16
4.2 Construction Vibration	17
4.3 Operational Noise Assessment	17
4.4 Road Traffic Noise Assessment	24
5. Recommended Mitigation Measures	25
5.1 Construction and Operational Noise	25
6. Conclusion	26
7. References	27

Table Index

Table 2-1	Sound Level Meter Details	9
Table 2-2	Meteorological Data for Moranbah	10
Table 2-3	Measured Noise Levels at Each Location, dB(A)	11
Table 2-4	Background $L_{A90,T}$ and $L_{Aeq,T}$ Noise Levels, dB(A)	11
Table 2-5	Unattended Noise monitoring results, dB(A)	12
Table 3-1	Project Specific Noise Levels – Residential receivers	15
Table 4-1	Predicted Plant Item Noise Levels, dB(A)	16
Table 4-2	Typical Vibration Levels – Construction Equipment	17
Table 4-3	Meteorological Conditions	18
Table 4-4	Sound Power Levels for Primary Operational Noise Sources - Ammonium Nitrate Facility dB(A)	19
Table 4-5	Sound Power Levels for Primary Operational Noise Sources – Power Generation Facility dB(A)	20
Table 4-6	Modelled Sound Pressure Levels, L_{Aeq} dB (A)	21
Table 4-7	Traffic Data (Site Number 4)	24

Figure Index

Figure 1:	Design Layout Details	2
Figure 2:	Noise Monitoring Locations	3
Figure 3:	Looking south from the monitoring location towards the MAC	6
Figure 4:	Looking northwest in the direction of the proposed AN plant	6
Figure 5:	Approximate location of attended noise measurement	7
Figure 6:	Looking down Colliery Street towards proposed site	7
Figure 7:	Approximate location of attended noise measurements	7
Figure 8:	Looking north west from location L2 towards the proposed site	7
Figure 9:	Looking towards the Enertrade gas compression station from Goonyella Road	8
Figure 10:	Existing environment within proposed site	8
Figure 11:	Existing environment within proposed site	8
Figure 12:	Scenario 1: Calm Condition Noise Contours dB(A)	22
Figure 13:	Scenario 2: Inversion Noise Contours dB(A)	23

Glossary

A-weighted	The overall level of sound is usually expressed in terms of dB(A), which is measured using a sound level meter with an “A-weighting” filter. This is an electronic filter having a frequency response corresponding approximately to that of human hearing.
CadnaA	Computer Aided Noise Abatement software used for calculating predicted noise emissions.
CoRTN	Calculation of Road Traffic Noise algorithm is published by the UK Department of Transport, 1998.
dB	Decibel, which is 10 times the logarithm (base 10) of the ratio of a given sound pressure to a reference pressure; used as a unit of sound.
dB(A)	Unit used to measure ‘A-weighted’ sound pressure levels.
Hz	The units for frequency are known as Hertz (Hz).
L _N	Statistical sound measurement recorded on the linear scale.
L _{AN}	Statistical sound measurement recorded on the “A” weighted scale.
L _{A10} (Time)	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L _{A10} (1 hour)	The L _{A10} level measured over a 1-hour period.
L _{A10} (18 hour)	The arithmetic average of the L _{A10} levels for the 18-hour period between 0600 and 2400 hours on a normal working day. It is a common traffic noise descriptor.
L _{Aeq} (Time)	Equivalent sound pressure level: the steady sound level that, over a specified period of time, would produce the same energy equivalence as the fluctuating sound level actually occurring.
L _{Aeq} (15 hr)	The L _{Aeq} noise level for the period 7 am to 10 pm. (Day and Evening).
L _{Aeq} (9 hr)	The L _{Aeq} noise level for the period 10 pm to 7 am. (Night).
L _{Aeq} (1 hr)	The L _{Aeq} noise level for a one-hour period. It represents the highest tenth percentile hourly A-weighted L _{eq} during the period 7 am to 10 pm, or 10 pm to 7 am, (whichever is relevant).
L _{A90} (Time)	The A-weighted sound pressure level that is exceeded for 90 per cent of the time over which a given sound is measured. This is considered to represent the background noise e.g. L _{A90} (15 min).
L _{AMax} (Time)	The maximum sound level recorded during a specified time interval.
L _{AMin} (Time)	The minimum sound level recorded during a specified time interval.
Linear	Sound levels measured without any weightings are referred to as “linear” and the units are expressed as dB(lin).
Rating Background Level (RBL)	<p>The overall single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period (as opposed to over each 24 hour period used for the assessment background level). This is the level used for assessment purposes. It is defined as the median value of:</p> <p>All the day assessment background levels over the monitoring period for the day; (7 am to 6 pm);</p> <p>All the evening assessment background levels over the monitoring period for the evening; (6 pm to 10 pm) or</p> <p>All the night assessment background levels over the monitoring period for the night. (10 pm to 7 am).</p>

Executive Summary

A noise assessment was undertaken by GHD Pty Ltd on behalf of Dyno Nobel Asia Pacific Limited (DN), as part of an Environmental Impact Statement (EIS), to assess the potential acoustic impacts for the construction and operation of a proposed Ammonium Nitrate Plant and associated power generation facility located on Goonyella Road, Moranbah, Queensland.

The basis of the noise assessment was to ascertain whether the proposed facility and power station would have an acoustic effect on the amenity of residences living in close proximity of the site and other industries in the vicinity, during both construction and operation.

The existing background and ambient noise environment in the vicinity of the proposed site has been determined by attended noise monitoring, in addition unattended noise monitoring data was provided by Maunsell. Detailed noise modelling was undertaken based on provided sound power levels of primary noise sources for the proposed facility.

Modelled results suggest that the noise levels generated by the facility and associated power station are well below the minimum planning noise levels and therefore it is considered no further mitigation measures or management plans are required for the operation of the facility.

Considering the existing noise environment and given the proximity of residential receivers to the site, construction noise is unlikely to have an adverse impact on the local noise environment. However, activities that cause excessive noise such as pile driving should be limited to Saturdays or business days between 6:30 am and 6:30 pm.

The traffic generation of the operations of the proposed facility is not expected to increase traffic noise significantly and should not have an effect on the amenity of residences in the area.



1. Introduction

1.1 Project Description

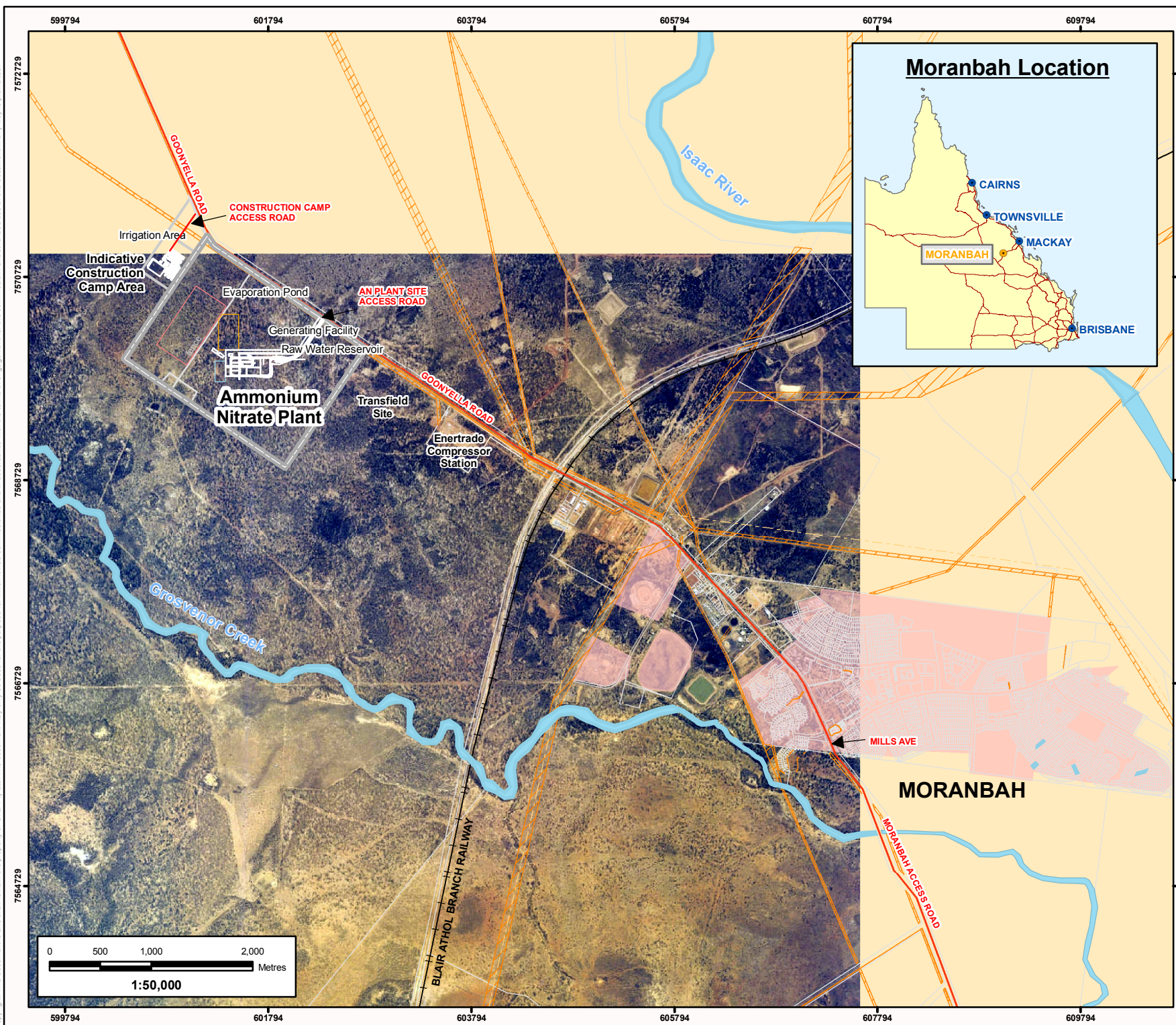
GHD were commissioned by Dyno Nobel Asia Pacific Limited (DN), as part of an Environmental Impact Statement (EIS), to assess the potential acoustic impacts for the construction and operation of a proposed ammonium nitrate plant (AN plant) located on Goonyella Road, Moranbah, Queensland. The assessment was to ascertain whether the proposed facility would have an acoustic effect on the noise amenity of residences within close proximity of the site, during both construction and operation. An emulsion plant is proposed on the subject site, which has also been included in this report, however is not expected to have significant noise generation to affect the noise amenity of residences in the area.

A power generation facility is also proposed for the ammonium nitrate site which has also been included in this assessment. Information obtained at the time of the assessment indicated the proposed power generation facility would consist of a 15 MW gas-fired generation facility to be located alongside the AN plant.

1.2 Subject Site

The proposed facility development is to be located on Goonyella Road, approximately 4 km North West of Moranbah. The proposed site layout is presented in Figure 1. Figure 2 illustrates the Site and the proposed development area where the facility is to be located.

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Date: 02-10-06 Rev C
Datum: GDA94 (MGA) Zone 55
Source: Base data sourced from the State of Queensland, Department of Natural Resources, Mines. All other infrastructure supplied by Dyno Nobel Asia Pacific Ltd.
File: G:\4115824\GIS\Maps\Final\MXD\fig1_Site_Location_RevC.mxd

Legend

- Ammonium Nitrate Plant Site
- Evaporation Pond
- Generating Facility*
- Raw Water Reservoir
- Cadastre
- Easements
- Developed Area
- Watercourse
- Major Road
- Railway
- Powerlines

*Generating Facility location is subject to detailed engineering.

Moranbah Ammonium Nitrate Plant

Environmental Impact Statement

Figure 1 Site Location



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Date: 02-10-06 Rev G
 Datum: GDA94 (MGA) Zone 55
 Source: Base data sourced from the State of Queensland, Department of Natural Resources, Mines. All other infrastructure supplied by Dyno Nobel Asia Pacific Ltd.
 File: G:\4115824\GIS\Maps\Final\MXD\fig2_Site_Infrastructure_RevG.mxd

Legend

- Ammonium Nitrate Plant Site
- Evaporation Pond
- Generating Facility*
- Raw Water Reservoir
- Cadastral
- Easements
- Watercourse
- Major Road
- Railway
- Water Pipeline
- Petroleum Pipeline

*Generating Facility location is subject to detailed engineering.

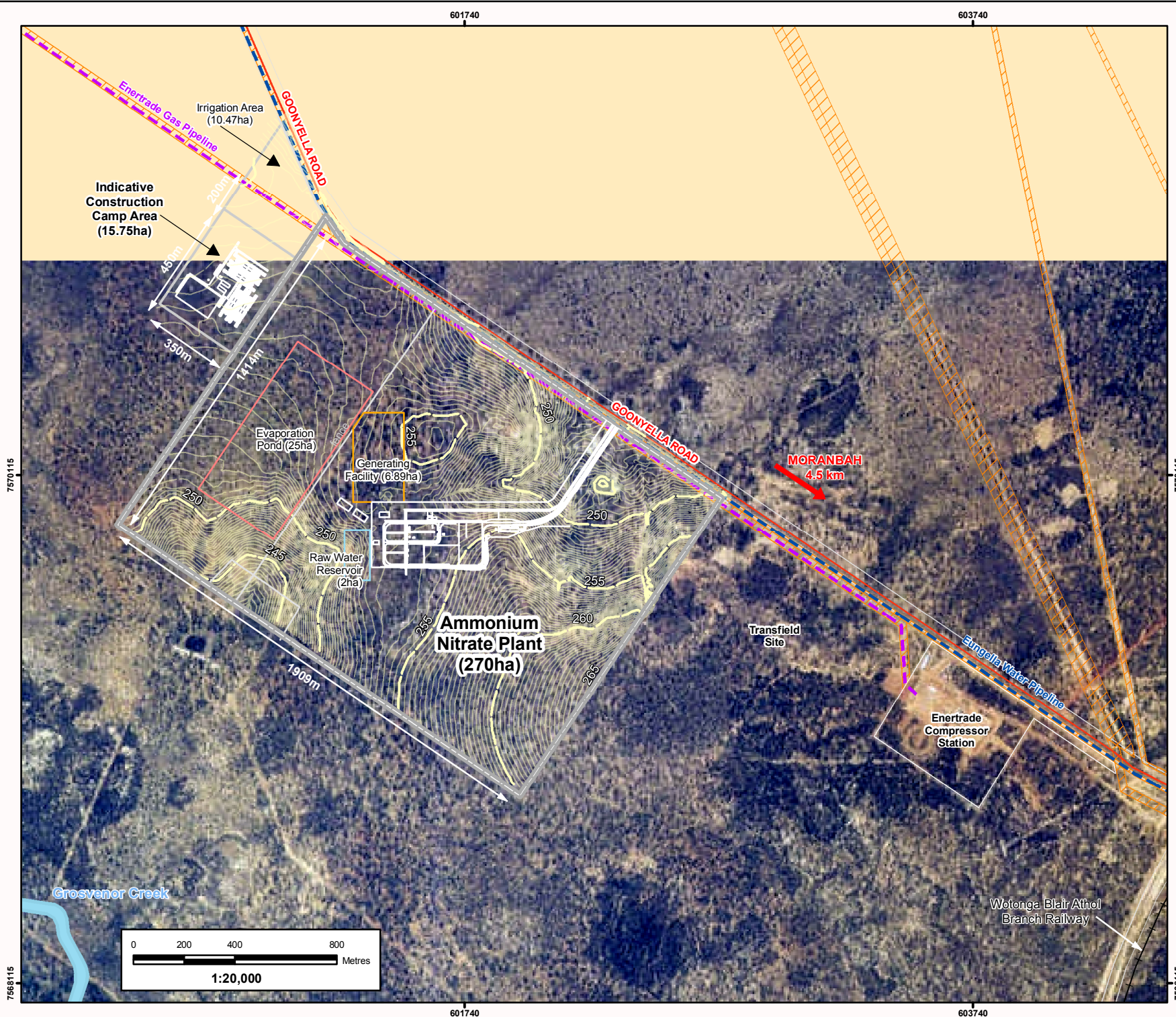
Moranbah Ammonium Nitrate Plant

Environmental Impact Statement

Figure 2
Site Infrastructure



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1.3 Scope of Works

The scope of works for the noise assessment comprised:

- » Review of supplied background data (i.e. Conceptual design drawings, proposed operation times and review of available traffic data);
- » Development of sampling methodology and identification of suitable monitoring locations through consultation with the client and site inspection;
- » Site inspection and noise monitoring assessment. This included:
 - Attended short-term background noise monitoring at three representative locations (in the vicinity of the proposed development area), of the ambient noise environment;
 - Attended short-term background noise monitoring at the site boundary;
 - Noise levels were recorded and assessed against the statistical parameters L_{Amax} , L_{Amin} , L_{A10} , L_{A90} , and L_{Aeq} ; and
 - Noise modelling was undertaken for this project to ascertain the acoustic contribution of the development with consideration to project specific noise goals;
- » Preparation of report with consideration to the Environmental Protection Agency's (EPA) "Environmental Protection (Noise) Policy 1997", "Noise Measurement Manual", "Planning for Noise Control Guideline" and the Department of Main Roads (DMR) "Road Traffic Noise Management: Code of Practice, January 2000" including:
 - A brief description of the project;
 - A brief description of the ambient noise environment;
 - A brief description of the items to be used on site likely to emit noise;
 - Location of the noise monitoring with respect to the proposed facility;
 - Based on monitoring results, establish project specific noise goals for the operation of the proposed facility;
 - Discussion of the noise monitoring and modelling results with relation to project specific noise goals and guidelines; and
 - Proposing possible in principle noise mitigation measures if the noise assessment suggests that project specific noise goals may be exceeded.

1.4 Assessment Methodology

The following steps were undertaken:

- » New noise sources identified, including plant noise sources;
- » Sensitive noise monitoring locations selected for short-term attended monitoring;
- » Site noise monitoring measurements undertaken;



- » Assessment of noise measurements made leading to the determination of background and various time related noise levels;
- » Compliance criteria for the proposed development were determined;
- » Undertake Computer Aided Noise Abatement (CadnaA) calculations and noise modelling to the nearest sensitive noise receptors;
- » Assessment of compliance; and
- » Where required comment on noise control options and requirements.

1.5 Limitations

This report has been prepared for DN. The purpose of the report is to provide an independent review of the proposed facility at Moranbah.

It is not the intention of the assessment to cover every element of the acoustical environment, but rather to conduct the assessment with consideration to the prescribed work scope.

The findings of the noise assessment represent the findings apparent at the date and time of the monitoring and the conditions of the area at that time. It is the nature of environmental monitoring that not all variations in environmental conditions can be accessed and all uncertainty concerning the conditions of the ambient noise environment cannot be eliminated. Professional judgement must be exercised in the investigation and interpretation of observations.

In conducting this assessment and preparing the report, current guidelines for noise were referred to. This work has been conducted in good faith with GHD's understanding of the client's brief and the generally accepted consulting practice.

No other warranty, expressed or implied, is made as to the information and professional advice included in this report. It is not intended for other parties or other uses.

2. Existing Environment

2.1 Monitoring Locations

A site inspection was conducted to determine appropriate noise monitoring locations for the assessment. The locations chosen were deemed as sites that were indicative of the local residential noise environment.

Attended monitoring was undertaken on the 27th and 28th of April, 2006 using a Svan 948 Sound Level Meter (SLM), within current calibration, to monitor the noise environment.

Unattended measurements have been sourced from Maunsell, which were undertaken between the 23rd and 29th of March, 2006.

Noise monitoring was undertaken at the following locations, which are depicted graphically in Figure 2, Section 1:

- » **Location 1 (L1):** Marley Accommodation Centre (MAC), miner's accommodation, situated south east of the proposed site. The accommodation is located at the end of an unnamed street. The site consists of single living quarters with shared amenities, car parking, and a package wastewater treatment plant. Adjacent to the accommodation is a workshop and storage area. The land northwest of the monitoring location is an area that is currently being developed, and has been cleared with some drainage and road infrastructure already constructed. Attended noise measurements were taken at the property boundary.

The intervening land between the receiver and the source (approximately 2.3 km away) is a new development, railway line, vegetated grazing land and an Enertrade Gas Compression Station (see Figure 2).



Figure 3: Looking south from the monitoring location towards the MAC



Figure 4: Looking northwest in the direction of the proposed AN plant

- » **Location 2 (L2):** The Grosvenor Accommodation Centre, located at the end of Colliery Street, Moranbah. The Centre includes single living quarters with shared amenities, predominantly used by miners in the area. Adjacent to the accommodation centre is a depot for sands and gravels with some light industrial blocks in the nearby area.

Attended noise measurements were undertaken, approximately 1m from the corner of the covered walkway used in the centre. The intervening land between the receiver and the proposed site (approximately 4 kilometres away) consists of a mixture of industry, recreation complexes (motocross track) and grazing land.



Figure 5: Approximate location of attended noise measurement



Figure 6: Looking down Colliery Street towards proposed site

- » **Location 3 (L3):** Sarchendon Drive, on the corner of an industrial storage/workshop facility, situated south east of the proposed site. Attended noise measurements were undertaken approximately 1m from the corner of the block. The intervening land between the receiver and the source (approximately 3.75 km away) is a mixture of rural, recreational and industry.



Figure 7: Approximate location of attended noise measurements



Figure 8: Looking north west from location L2 towards the proposed site

- » **Location 4 (L4) - long-term noise monitoring:** Long term noise monitoring has been undertaken in the study region by Maunsell over a period of 7 days. This monitoring was undertaken just off Goonyella Road, opposite Sarchendon Drive.
- » **Enertrade gas compression station:** The site is adjacent to Goonyella Road. Noise monitoring was undertaken near the entry gate to the facility. The intervening land between the receiver and the source (less than 1 km away) is rural land that may be used for grazing.



Figure 9: Looking towards the Enertrade gas compression station from Goonyella Road

- » **Proposed Site Boundary Locations:** Attended noise monitoring was undertaken at four locations along the proposed site boundary. The four locations were approximately in the middle of the respective property boundary.

The site consists of varying densities of vegetation. Cattle grazing is undertaken onsite, and there are several tracks for vehicle access.



Figure 10: Existing environment within proposed site



Figure 11: Existing environment within proposed site



15 minute sampling periods were undertaken at each attended location for all time periods. At the site boundaries and Enertrade site noise monitoring was only undertaken during the day time period. The SLM was calibrated before and after measurement and Table 2.1 provides details of the SLM.

Table 2-1 Sound Level Meter Details

Model	SVAN 948
Serial No.	8895
Type	Type 1
Calibration Date	22/04/2005 ¹
Time Interval	15 minutes
Frequency Weighting	A
Time Response	Fast
Engineering Units	dB(A) SPL re:20µPa

2.2 Receiver Locations

2.2.1 Residential Receivers

The nearest residential receivers correlate with the short-term monitoring locations L1 L2 as described in Section 2.1 of this report, with locations shown in Figure 2.

It was noted during the monitoring that there were several locations possibly being used for accommodation around Sarchenden Road. There were measurements undertaken adjacent to these premises, due to access and safety reasons.

Residential dwellings and lodging closer to the town of Moranbah consists of accommodation centres, motels and permanent dwellings.

The local noise environment is characterised by noise from industry and mines, from train movements and road traffic noise.

The separation distance from the site to the respective receivers are:

- » L1 – 2.3 km; and
- » L2 – 4 km.

¹ Note that calibration was undertaken in the field prior to any measurements taken on the instrument. Equipment calibration is also undertaken in the laboratory prior to sending equipment out for hire.

2.2.2 Industrial Receivers

The nearest potentially affected industrial receivers are:

- » Enertrade gas compression station;
- » Ergon Power station; and
- » Other industry such as maintenance and repair workshops, storage yards and other light industry.

The separation distance from the site to the respective receivers are:

- » L3 – 3.75 km; and
- » L4 – 3.75 km.

2.3 Meteorological Conditions

Daily weather observations for Moranbah were obtained for the 27th and 28th of April (Bureau of Meteorology). These can be seen in Table 2.2 below. During attended noise monitoring it was noted that the weather was fine and sunny, with slight to medium cloud cover at times. There was a slight breeze recorded during the evening time period though suitable for environmental noise measurements (<5m/s).

Table 2-2 Meteorological Data for Moranbah

Date	Temperature (min/max)		Rain	Evaporation	Wind	Pressure (9am)
27 th April	15.6	27.9	0	5.8	Calm	1017.6
28 th April	18.4	27.9	0	5.2	Calm	1015.4

2.4 Attended Noise Monitoring Results

Attended noise monitoring and observations indicates a noise environment typical of an industrial environment.

The L_{Amax} , L_{A10} , L_{A90} and L_{Aeq} noise levels for each 15-minute measurement are provided in Table 2.2².

The $L_{A90,T}$ and $L_{Aeq,T}$ day, evening and night levels for monitoring Locations 1,2 and 3, which upon completion of a site inspection are seen as representative of the local ambient environment are shown in Table 2.3.

² Refer to Glossary page for definition of these parameters

Table 2-3 Measured Noise Levels at Each Location, dB(A)

Location	Time	L _{Amax}	L _{A10}	L _{Aeq}	L _{A90}
Location 1	2:33 PM	59	45	42	38
	9:25 AM	70	51	49	41
	11:29 AM	61	49	47	43
	8:55 PM	57	53	49	44
	10:33 PM	59	47	45	41
Location 2	8:29 PM	64	47	45	42
	8:40 AM	66	52	50	44
	10:48 AM	74	53	54	45
	10:11 PM	68	46	46	42
Location 3	9:03 AM	86	57	62	40
	11:09 AM	82	57	57	44
	9:23 PM	58	44	43	39
	10:56 PM	69	48	48	41
North site boundary	3:07 PM	81	64	62	41
East site boundary	3:43 PM	61	44	41	35
South site boundary	4:24 PM	53	40	38	36
West site boundary	5:27 PM	64	49	47	43
Enertrade site	11:51 AM	71	64	62	59

Table 2-4 Background L_{A90,T} and L_{Aeq,T} Noise Levels, dB(A)

Period	Day 7 am to 6 pm		Evening 6 pm to 10 pm		Night 10 pm to 7 am	
	L _{A90}	L _{Aeq}	L _{A90}	L _{Aeq}	L _{A90}	L _{Aeq}
Noise Descriptor ³						
Location 1	38	47	44	49	41	45
Location 2 ⁴	42	48	42	46	42	46
Location 3	40	60	39	43	41	48

³ Minimum L_{A90} levels have been used where available

⁴ Evening measurements were not undertaken for location 2 due to time constraints. Night time measurements were therefore used for evening periods for the purpose of the assessment for location 2.



The night-time noise levels are relatively high when compared to the day and evening levels. During night-time monitoring (after 10 pm) it was also noted mining noise being part of the ambient noise environment and is likely to contribute to the high night time levels.

Note that at location 2, the night-time noise measurements were undertaken in the late evening (i.e. before 10 pm).

2.5 Unattended Noise Monitoring Results

Unattended noise monitoring was undertaken at Location 4 by Maunsell between the 23/03/06 and the 29/03/06.

The $L_{A90,T}$ and $L_{Aeq,T}$ day, evening and night level averages for monitoring Location 4 are shown in Table 2.4.

Table 2-5 Unattended Noise monitoring results, dB(A)

Period	Day 7 am to 6 pm		Evening 6 pm to 10 pm		Night 10 pm to 7 am	
	L_{A90}	L_{Aeq}	L_{A90}	L_{Aeq}	L_{A90}	L_{Aeq}
23-Mar-2006	-	-	39	54	-	-
24-Mar-2006	45	59	40	54	34	57
25-Mar-2006	42	58	41	53	35	54
26-Mar-2006	42	58	41	54	35	54
27-Mar-2006	43	60	41	54	36	56
28-Mar-2006	44	60	40	55	34	57
29-Mar-2006	-	-	-	-	34	57
RBL/Average	43	59	41	54	34	56

The unattended night time background noise levels, measured at location 4, are significantly lower than the attended measurements and more representative of the night time period.

The more conservative measurements, that is the attended noise measurements, have been used for further assessment to determine the planning levels.

2.5.1 Existing Noise Environment

Field observations noted that the ambient noise environment at the monitoring locations were typically described by intermediate background noise levels with intermittent noise contributions from the following activities:

- » Traffic noise from Goonyella Road such as mining and other trucks, and general traffic;



- » Intermittent local industrial noise such as grinding and noise associated with moving equipment;
- » Local fauna such as birds and insects, as well as cattle; and
- » Other noise from leaves rustling.

The adjacent gas compressor plant, in particular the operational compressors, were not audible during field measurements, however measurements were undertaken during relatively calm weather conditions with favourable winds which did not highlight noise from that particular source.

The Blair Athol Railway line lies between the proposed site and nearest sensitive receptors, approximately 150m to the north west of monitoring location L1. Noise specifically from this source was not identified during the attended noise monitoring.



3. Noise Criteria

3.1 Construction Noise Criteria

There are no specific noise criteria for construction noise within the Queensland legislation (*Environmental Protection Act 1994*) or enforced by the Queensland Environmental Protection Agency (EPA), except for restrictions on the time that construction works may take place. The time restrictions are designed to strike a balance between protecting noise amenity and the need to start construction activities early in the morning.

General building work hours are restricted to certain times under Part 2A – Section 6W – “Building Work” of the Queensland *Environmental Protection Regulation 1998*. Under the regulation, no audible noise is permitted:

- » 6.30 pm to 6.30 am – Monday to Saturday; and
- » Sundays and public holidays.

Construction activity during these hours is not preferred but can usually occur provided construction noise is not substantially audible or intrusive inside a dwelling.

3.2 Operational Noise Criteria

The Queensland EPA provides guidance on the assessment of operational noise impacts within its guideline – *Planning for Noise Control* (PNC). The guidelines include both noise criteria that are designed to protect sensitive receivers from noise significantly louder than the background level and to limit the total noise level from all sources near a receiver, hence protecting the amenity.

The residential receivers are described as residence near an industrial area and predominantly surrounded by industry. A Z4 noise area category has been selected for determining the planning noise level (PNL).

The recommended planning noise levels proposed for the facility are presented in Table 3.1 for residences located at Location 1 and 2.

The external instantaneous maximum noise level, L_{Amax} , should not exceed 52 dB(A) during the night time period, assuming partially open windows.

Table 3-1 Project Specific Noise Levels – Residential receivers

Criterion	Location 1			Location 2		
	Day	Evening	Night	Day	Evening	Night
Measured Background, L_{A90}	38	44	41	42	42	42
Recommended Background, L_{A90} (PNC Table 1)	55	50	45	55	50	45
Adjusted Background, L_{A90} (PNC Table 2)	43	49	43	47	47	42
Measured Existing Level, L_{Aeq}	47	49	45	48	46	46
Recommended PNL, L_{Aeq} (PNC Table 3, Cat Z4)	60	55	50	60	55	50
Adjusted PNL, L_{Aeq} (PNC Table 3)	60	55	48	60	55	48
Project Specific Level, L_{Aeq}	46	52	46	50	50	45

3.3 Road Traffic Noise Criteria

Planning levels for a non-residential development should not exceed the internal sound levels for building interiors as specified in AS 2107:2000 at sensitive receivers.

External planning levels, taken from Schedule 1.2 of the Environmental Protection (Noise) Policy, at 1m from the sensitive receivers most exposed façade should not exceed the following:

- » 68 dB(A) for a state controlled road, assessed by the $L_{A10(18hr)}$ noise descriptor;
- » 63 dB(A) for a public road, assessed by the $L_{A10(18hr)}$ noise descriptor;
- » 60 dB(A) assessed by the maximum 1-hour $L_{Aeq(night)}$ noise descriptor; and
- » 80 dB(A) assessed by the single event L_{Amax} noise descriptor.

4. Assessment of Potential Impacts

4.1 Construction Noise Assessment

Typical noise levels produced by construction plant anticipated to be used on site were sourced from *AS 2436 – 1981 Guide to Noise Control on Construction, Maintenance and Demolition Sites* and from GHD's internal database. The power levels were then distance attenuated from the proposed construction site. Propagation calculations take into account sound intensity losses due to spherical spreading, with additional minor losses such as atmospheric absorption, directivity and ground absorption ignored in the calculations. As a result, predicted received noise levels are expected to slightly overstate actual received levels and thus provide a measure of conservatism. Received noise at each assessed distance, from each item of plant on site, is added (where appropriate) to determine the total received noise at that distance from construction activities.

Received noise produced by anticipated activities, during the construction of the upgraded facility is shown in Table 4.1 for a variety of distances, with no noise barriers or acoustic shielding in place and with each plant item operating at full power. The sound pressure levels shown are maximum levels produced when machinery is operated under full load.

Due to the distance between the construction works and the sensitive receiver it is unlikely that construction activities will be audible and cause nuisance to any residences. However, activities that cause excessive noise such as pile driving should be limited to Saturdays or business days between 6:30 am and 6:30 pm.

Table 4-1 Predicted Plant Item Noise Levels, dB(A)

Plant Activity	Distance of Source to Receiver (m)						
	50	250	500	750	1000	2000	4000
Crane 110	68	54	48	45	42	36	30
Backhoe 108	66	52	46	43	40	34	28
Compressor 100	58	44	38	35	32	26	20
Concrete Pump 109	67	53	47	44	41	35	29
Dump Truck 108	66	52	46	43	40	34	28
Water Tanker 109	67	53	47	44	41	35	29
Compactor 110	68	54	48	45	42	36	30
Pile Driving	88	74	68	62	56	50	44

4.2 Construction Vibration

Vibration generated by piling is expected to generate the most significant vibrations levels. Rolling activities and trucking movements are also expected to generate some levels of ground borne vibration. Table 4.2 outlines typical vibration levels for different plant activities sourced from the NSW RTA Publication Environmental Noise Management Manual.

Table 4-2 Typical Vibration Levels – Construction Equipment

Item	Peak Particle Velocity at 10m (mm/s)
Piling	12-30
Loader Breaking Kerbs	6-8
15 Tonne Compactor	7-8
7 Tonne Compactor	5-7
Roller	5-6
Pavement Breaker	4.5-6
Dozer	2.5-4
Backhoe	1
Jackhammer	0.5

Construction activity can result in varying degrees of ground vibration depending on the equipment and methods employed. Operation of construction equipment causes ground vibration which spread through the ground and diminish in strength with distance. Buildings founded on the soil in the vicinity of the construction site respond to these vibrations with varying results, ranging from no perceptible effects at the lowest levels, low rumbling and perceptible vibrations at moderate levels and slight building damage at the highest levels.

Ground vibrations from construction activities very rarely reach the levels that can damage structures, but they can achieve the audible and perceptible ranges in buildings very close to the site. As piling is proposed for the ground improvement stage of the project and there are no structures within at least 2 km of the work area, piling is not likely to result in any vibration risks to structures.

4.3 Operational Noise Assessment

Acoustic modelling was undertaken using Computer Aided Noise Abatement (CadnaA) to predict the effects of industrial noise generated by the proposed facility.

CadnaA is a computer program for the calculation, assessment and prognosis of noise exposure. CadnaA calculates environmental noise propagation according to ISO 9613-2 and road traffic noise according to CRTN, which was developed by the UK Department of Transport. Local topography, ground absorption and shielding objects are taken into account in the calculations.



Modelling results are based on available information provided and should only be used as a guide for comparative purposes.

The model took into account the sound power levels of the primary noise sources to be used at the facility, which were supplied from a similar ammonium nitrate facility located at Moura. The sound power levels supplied are the raw item levels and have had no mitigation measures implemented. In reality it is likely that this will not be the case due to Occupational Health and Safety (OH&S) regulations hence the results are conservative. Additionally, it was assumed that all noise sources are to operate continuously at any one time. At the time of modelling heavy vehicle traffic generation was not provided therefore it was assumed that three trucks would be operating continuously at any one time. Even with a conservative approach to modelling the results are not expected to impact on the local ambient environment due the distance of the residential receivers.

Modelling was also undertaken of potential noise generating sources from the proposed power generation facility. Modelling was undertaken of both the ammonium nitrate facility and the power generation facility operating simultaneously.

CadnaA noise prediction software considers topography, weather conditions, reflection, ground absorption, site sources and the location of the receiver areas to predicted received noise levels from the facility. The proposed development has been modelled based on available data. The location of the noise sources within the site was done with reference to site layout plans at the time of the assessment.

The surrounding areas of the site are predominantly soft soil and grassland therefore the ground effects were modelled with a ground absorption of 1 as specified in ISO 9613 – 2 for soft soil.

An F-Class temperature inversion with a 2m/s North Westerly drainage flow in the direction of the residence was modelled to assess worst case conditions.

The modelled scenarios meteorological conditions are shown in Table 4.3.

Table 4-3 Meteorological Conditions

	Scenario 1	Scenario 2
Meteorology	Calm Conditions	F-Class inversion
Temperature	20°C	20°C
Humidity	70%	70%

Primary noise generating equipment at the facility have been identified from a similar ammonium nitrate facility located at Moura, and their sound power levels have been provided in Table 4.4. Noise generating equipment associated with the power generation facility was sourced from information provided by the client at the time of the assessment. Sound power levels have been provided in Table 4.5. Heavy vehicle sound power levels were sourced from GHD's internal noise level database.

Table 4-4 Sound Power Levels for Primary Operational Noise Sources - Ammonium Nitrate Facility dB(A)

	Sound Power Level dB(A)										
Frequency (Hz)	31.5	63	125	250	500	1000	2000	4000	8000	A-weighted	Linear
Syngas Compressor	57.2	81.7	94.0	96.8	102.6	101.8	97.0	87.8	70.2	106.7	114.2
Refrigeration Engine and Compressor	51.5	57.5	82.0	98.0	102.2	97.9	102.0	89.0	73.7	106.6	110.3
Cooling Water Pump	52.8	63.3	72.9	87.5	95.9	100.8	100.9	87.1	73.5	104.7	105.7
Turbine Generator - Engine	51.4	66.2	84.1	81.5	85.8	91.0	95.6	96.1	76.5	99.9	103.5
Turbine Generator - turbine	53.8	56.2	94.1	88.1	91	94.5	96.8	97.1	75.5	102.4	111.0
Cooling Water Pump C	49.0	66.3	78.4	88.1	92.3	94.6	91.3	83.0	66.0	98.4	102.5
Air Separation Unit	52.5	76.6	81.9	86.4	105.6	102.3	105.3	101.3	76.9	110.1	112.0
Nitric acid compressor	56.1	64.9	77.1	85.8	95.7	104	114.8	120.8	99.6	121.9	120.9
Scrubber Fan	60.5	82.7	88.6	99.9	102.1	98.8	96.1	86.2	71.8	105.9	113.7
Forced Draft Fan	57.8	70.7	78.8	93.1	92.9	93.3	87.1	70.9	58.6	98.3	105.4
Fluidised bed cooler fan	50.8	74.5	85.6	94.8	99.2	96.0	93.0	80.0	72.6	102.5	108.6
Deairator Vent	48.2	65.2	83.2	94.7	108.5	110.6	101.2	100.1	89.0	113.3	115.0
Duel Fans	66.9	81.5	87.4	89.8	90.1	87.0	87.5	85.8	72.1	96.2	111.3
Heavy Vehicle [Typ. Height 3.5m]	105.3	102.2	101.4	101.7	103.7	95.6	93.3	89.4	85.4	103.3	110.4

Table 4-5 Sound Power Levels for Primary Operational Noise Sources – Power Generation Facility dB(A)

Frequency (Hz)	Height Modelled	63	125	250	500	1000	2000	4000	8000	A-weighted	Linear
Gas engine* – mechanical noise	1.5 m	62.4	88.1	89.8	95.3	99.3	98.6	97.3	107.6	111.8	
Gas Engine – exhaust noise	8.0 m	90.4	100.0	98.9	103.0	99.1	102.4	99.8	101.5	114.6	

Note * - Gas engine data was based on information provided by the client for a Caterpillar 3520 engine. Nine engines were modeled.



4.3.1 Modelled Operational Noise Results

Modelled sound pressure levels generated by the facility at the receiver locations for the different scenarios are summarised in Table 4.6.

Modelling incorporated significant noise generating activities and sources based on information provided from both the ammonium nitrate facility and power generation facility operating simultaneously.

Table 4-6 Modelled Sound Pressure Levels, L_{Aeq} dB (A)

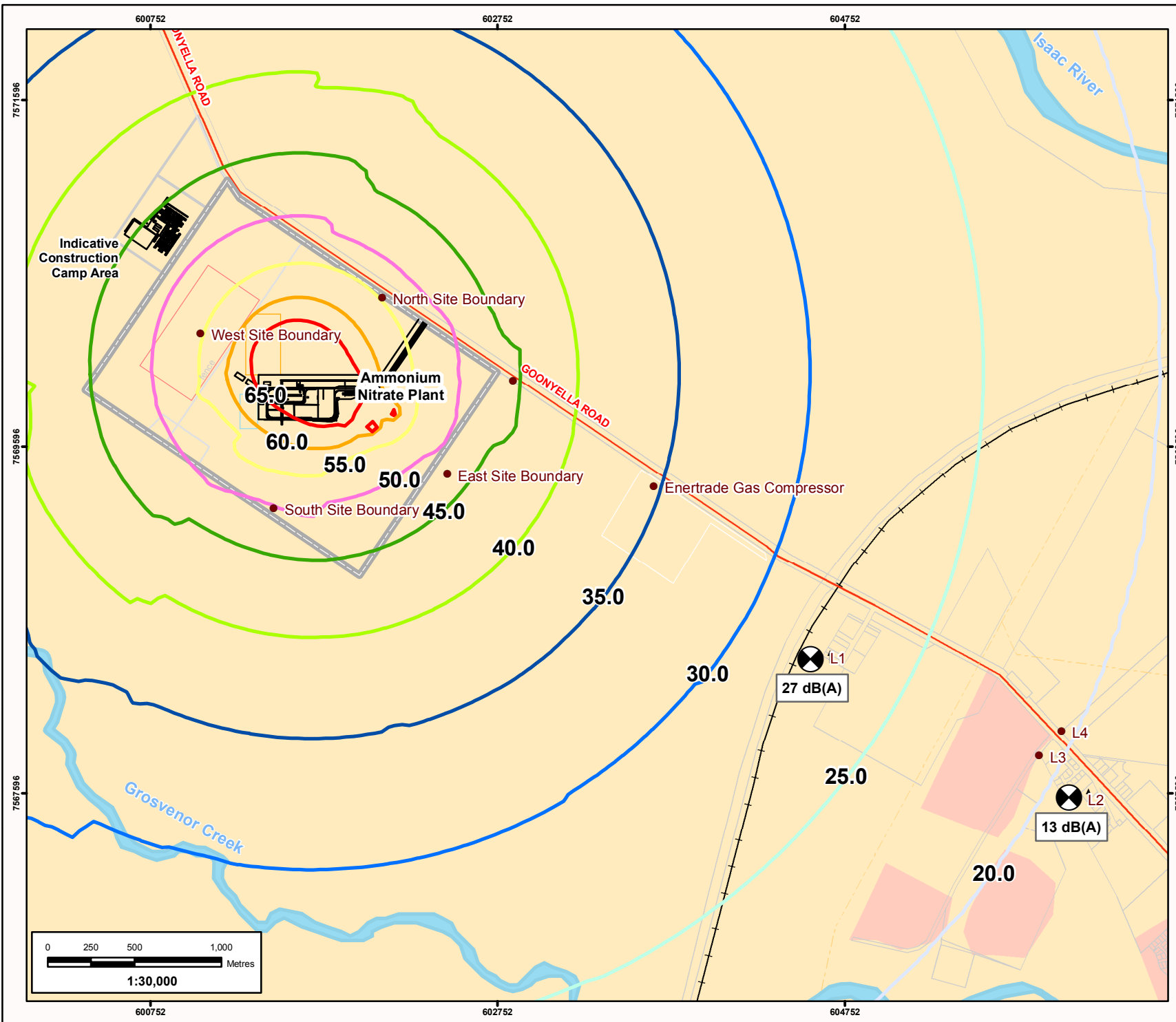
Receiver	Scenario 1 - Calm	Scenario 2 - Inversion
Location 1	27 dB (A)	33 dB(A)
Location 2	13 dB (A)	19 dB(A)

Noise level contour plots for each scenario are shown in Figures 12 and 13.

Modelled results suggest the noise levels generated by the facility and associated power station are well below the minimum planning noise levels and therefore based on the information provided and the modelled results no additional mitigation measures or management plans are recommended for the operation of the facility.

Additionally the predicted noise levels are well below the sleep disturbance criteria during operations.

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DYNO
Dyno Nobel



Date: 05-10-06 Rev A
Datum: GDA94 (MGA) Zone 55
Source: Base data sourced from the State of Queensland, Department of Natural Resources, Mines. All other infrastructure supplied by Dyno Nobel Asia Pacific Ltd.
File: G:\4115824\GIS\Maps\PDF\Appendices\Appendix 7.5.11 Noise\fig12_Site_Noise_Monitoring.mxd

Legend

- Ammonium Nitrate Plant Site
 - Evaporation Pond
 - Generating Facility*
 - Raw Water Reservoir
 - Noise Monitoring Locations
- Noise Contours
- | dB(A) | Contour Color |
|---------|---------------|
| > 40.00 | Light Green |
| > 45.00 | Green |
| > 50.00 | Pink |
| > 55.00 | Yellow |
| > 60.00 | Orange |
| > 65.00 | Red |

Noise assessment data taken at ground level (1.5m)
*Generating Facility location is subject to detailed engineering.

Moranbah Ammonium Nitrate Plant

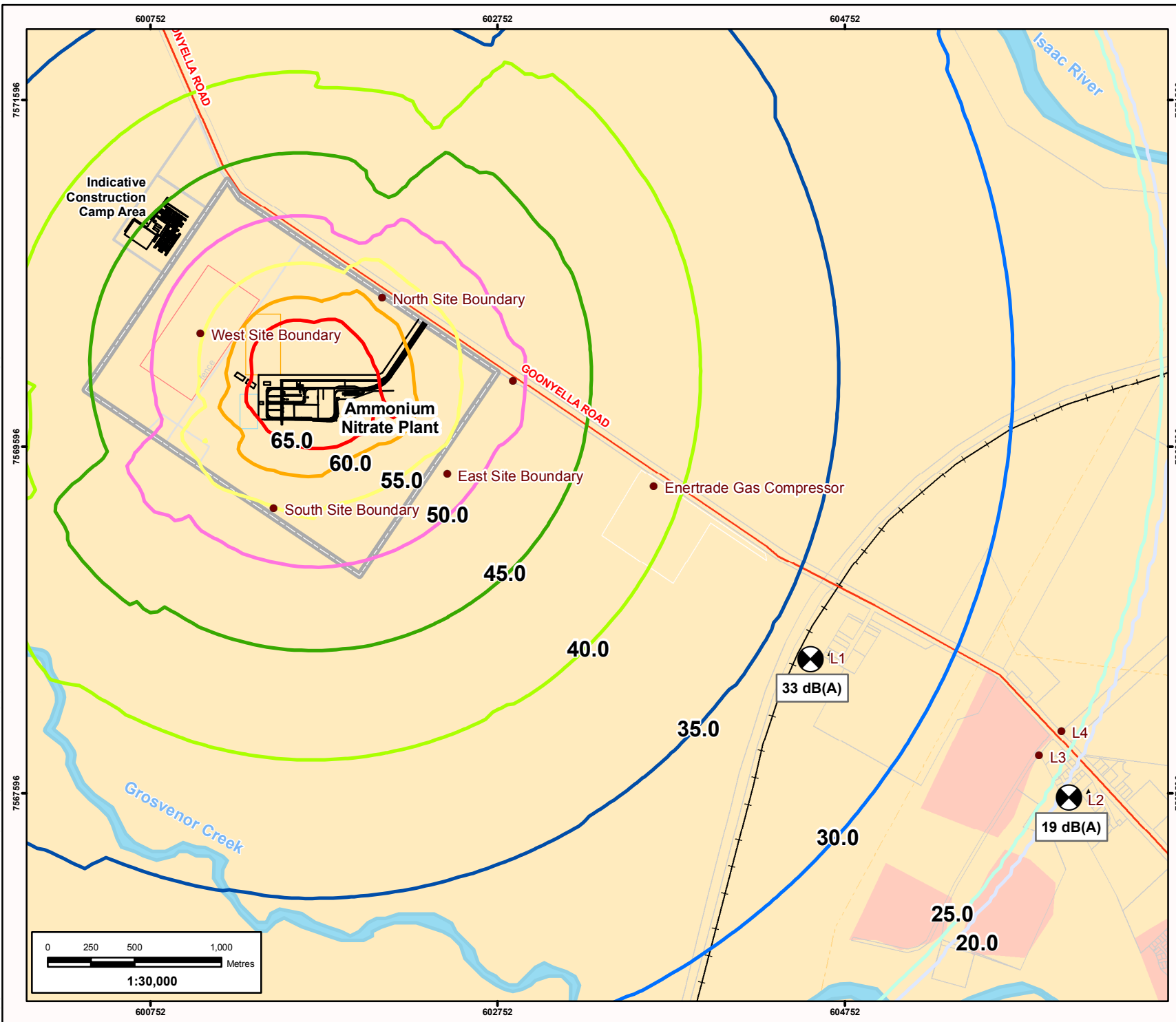
Environmental Impact Statement

Figure 12 Neutral Noise Weather Conditions



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Date: 02-10-06 Rev A
Datum: GDA94 (MGA) Zone 55
Source: Base data sourced from the State of Queensland, Department of Natural Resources, Mines. All other infrastructure supplied by Dyno Nobel Asia Pacific Ltd.
File: G:\4115824\GIS Maps\Final\MXD\fig34_Site_Noise_Monitoring_Inversion.mxd

Legend

- Ammonium Nitrate Plant Site
- Evaporation Pond
- Generating Facility*
- Raw Water Reservoir
- Noise Monitoring Locations

Noise Contours	dB(A)
> 40.00	> 40.00
> 45.00	> 45.00
> 50.00	> 50.00
> 55.00	> 55.00
> 60.00	> 60.00
> 65.00	> 65.00

Noise assessment data taken at ground level (1.5m)
*Generating Facility location is subject to detailed engineering.

Moranbah Ammonium Nitrate Plant

Environmental Impact Statement

Figure 13
F-Class
Inversion (2 m/s)



4.4 Road Traffic Noise Assessment

Existing traffic counts have been supplied along Goonyella Road for 5 locations between chainage 0.36 km and 21.4 km. The traffic generated by the proposed ammonium nitrate facility is likely to have the biggest noise impact on residential receivers on the sections of road with the lowest existing traffic levels. Therefore traffic count site number 4 at chainage 21.3 was used as the basis of the assessment as it is in the vicinity of the MAC accommodation (Location 1) and has the lowest existing traffic counts.

Calculation of Road Traffic Noise⁵ (CoRTN) implemented in CadnaA was used to determine the increase in traffic noise due to the proposed facility. The increase in traffic noise at the most sensitive receiver is predicted to be less than 0.5 dB(A). Therefore the traffic generation of the operations of the proposed facility is not expected to increase traffic noise significantly and should not have an effect on the amenity of residences in the area.

Traffic data can be seen in Table 4.7.

Table 4-7 Traffic Data (Site Number 4)

AADT*	1591
%CV**	14
Generated CV's per day	38 (Two ways)
Generated staff traffic per day	80 (Two ways)
Increase in traffic emission dB(A)	0.4

Note - *AADT = average annual daily traffic

**CV = commercial vehicle

⁵ CoRTN algorithm is published by the UK Department of Transport, 1998.



5. Recommended Mitigation Measures

5.1 Construction and Operational Noise

Construction and operational noise is not likely to have an impact on the local ambient environment.

While construction and operational noise is unlikely to be an issue, to minimise noise emissions during construction and operations, the following management and mitigation measures are available to ameliorate likely noise impacts:

- » All combustion engine plant, such as generators, compressors and welders should be checked to ensure they produce minimal noise with particular attention to residential grade exhaust silencers;
- » Vehicles will be kept properly serviced and fitted with appropriate mufflers. The use of exhaust brakes will be eliminated, where practicable;
- » Where practical, all vehicular movements to and from the construction site must be made only during normal working hours;
- » Where practical, machines will be operated at low speed or power and will be switched off when not being used rather than left idling for prolonged periods;
- » Activities that cause excessive noise such as pile driving should be limited to Saturdays or business days between 6:30 am and 6:30 pm;
- » Machines found to produce excessive noise compared to industry best practice will be removed from the site or stood down until repairs or modifications can be made; and
- » Where practical, impact wrenches will be used sparingly with hand tools or quiet hydraulic torque units preferred.

With regard to potential traffic noise, by keeping plant related vehicles serviced, fitted with mufflers and eliminating exhaust brake usage, noise due to trucking activity associated with the operation and construction of the proposed development can be significantly mitigated.



6. Conclusion

Modelled results suggests that the noise levels generated by the facility and associated power generation facility are well below the minimum planning noise levels and therefore no further mitigation measures or management plans are recommended for the operation of the facility.

Due to the distance between the site and the nearest residential noise receivers and the unlikely scenario that all of the construction machinery would be operating at full power at the same time over a 15 minute period, it is unlikely for construction noise to impact on the amenity of residences in the area, therefore no further mitigation measures are recommended for the construction of the facility. However, activities that cause excessive noise such as pile driving should be limited to Saturdays or business days between 6:30 am and 6:30 pm.

The traffic generation of the operations of the proposed facility is not expected to increase traffic noise significantly and should not have an effect on the amenity of residences in the area.

Therefore based on the information provided and assessment of results it is expected that the facility and associated power generation facility can meet its relevant noise goals.



7. References

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	E Milton	G Collins		G Collins		22/06/06
1	E Milton	G Collins		G Collins		06/07/06
2	E Milton	G Collins		G Collins		07/08/06
3	E Milton	L Gibson		L Gibson		14/08/06