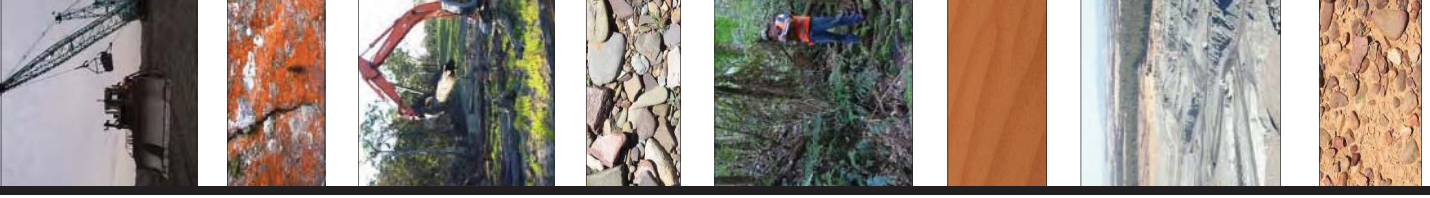

APPENDIX 8

global environmental solutions

Newstan Colliery

Noise Impact Assessment

Report Number 630.10002.0000R1

28 April 2011

Centennial Coal Company Limited
PO Box 1000
Toronto NSW 2283

Version: Revision 0

Newstan Colliery

Noise Impact Assessment

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EXECUTIVE SUMMARY

SLR Consulting Pty Ltd Australia (SLR Consulting has been commissioned by Centennial Newstan Pty Limited (Centennial Newstan) to undertake a Noise Impact Assessment (NIA) for the Newstan Colliery. The Newstan Colliery is located in Fassifern on the western side of Lake Macquarie, New South Wales.

Broadly, the objective of the noise assessment was to identify the potential impacts of noise from the operation of the Newstan Colliery surface facilities and to provide advice with regard to effective mitigation strategies where necessary.

An ambient noise monitoring program was undertaken by SLR Consulting. Ambient noise levels were monitored at two locations, considered to be representative of the nearest potentially affected receivers. The objective of this survey was to measure $L_{A90(period)}$ and $L_{Aeq(15minute)}$ noise levels at the nearest potentially affected residential locations during the day, evening and night-time periods to enable the determination of the project specific noise criteria for the Newstan Colliery.

Operational Noise Predictions

A computer model was used to predict noise emissions from the Newstan Colliery. Noise levels were predicted for the general operational scenario summarised in **Section 6.1.3** with the inclusion of the noise mitigation and management procedures detailed in **Section 2.4**.

Operational noise levels are predicted to meet the project specific noise criteria at all considered residential locations under calm and prevailing weather conditions with mitigation measures in place. However, a **2dBA** exceeded noise level over the project noise criteria under temperature inversion is predicted at residential location **NC3**. Since the operational scenario modelled is likely to represent an acoustically worst-case scenario, actual operational noise levels from the project are likely to be less than those predicted. In order to ensure Centennial Newstan complies with the project specific noise criteria at all nearby receptors during calm and prevailing meteorological conditions, Centennial Newstan will commit to installing a real time noise monitor on site to determine when noise criteria are approaching the noise limits. If noise from the site is approaching the noise criteria, Centennial Newstan will implement operational management measures to ensure the noise criteria is not exceeded.

Sleep Disturbance Assessment

The highest L_{Amax} noise level at any residential area is predicted to meet the recommended sleep disturbance noise goal at all nearest potentially affected residential receiver locations.

Vibration Assessment

It is noted that blasting is not proposed to occur for the life of the project. The main vibration generating activities will include the operation of mobile equipment such as the loader and trucks. Given the separation distance between mining operations and the nearest potentially affected residential locations vibration levels from these activities is predicted to be negligible and below levels for human perception at the nearest residential locations.

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1 INTRODUCTION

SLR Consulting has been commissioned by Centennial Newstan Pty Limited (Centennial Newstan) to conduct a Noise Impact Assessment (NIA) for the Newstan Colliery located in Fassifern on the western side of Lake Macquarie, New South Wales.

Broadly, the objective of the noise assessment was to conduct noise modelling of the existing and approved operations at the Newstan Colliery to identify the potential impacts of noise from its operations; and to provide recommendations with regard to noise management strategies and mitigation measures where necessary, with the aim of achieving the project specific noise criteria.

The NIA has been prepared with reference to Australian Standard AS 1055:1997 *Description and Measurement of Environmental Noise* Parts 1, 2 and 3 and in accordance with the Department of Environment, Climate Change and Water (DECCW) NSW Industrial Noise Policy (INP). Where issues relating to noise are not addressed in the INP, such as sleep disturbance, reference has been made to the NSW Environmental Noise Control Manual (ENCM) and the Environmental Criteria for Road Traffic Noise (ECRTN). Vibration impacts have been assessed with reference to the DECCW *Environmental Noise Management – Assessing Vibration: a technical guide*, DIN 4150 Part 3:1999 *Structural Vibration: effects of vibration on structures* and BS 6472-1:2008 *guide to evaluation of human exposure to vibration in buildings - Vibration sources other than blasting, 2008.*

2 PROJECT OVERVIEW

2.1 Overview of Site Operations and Location

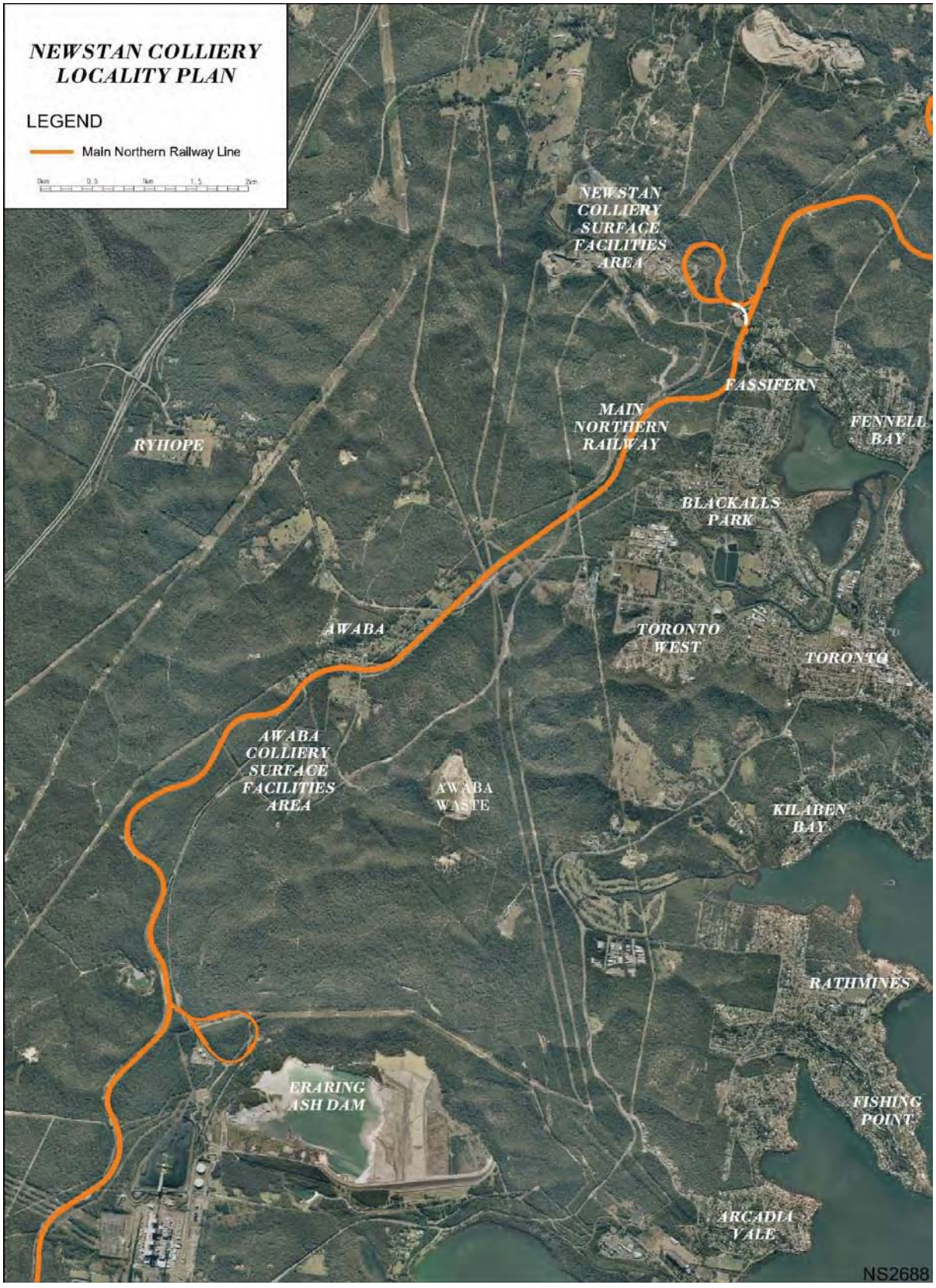
Newstan Colliery is an existing underground coal mine located adjacent to Miller Road in Fassifern on the western side of Lake Macquarie. Surface facilities include workforce amenities, mining support infrastructure, coal storage facilities, coal preparation plant (CPP) and coal handling plant (CHP) including a rail loop. The Newstan Colliery ceased underground mining production in 2009 however continues to handle and process coal from other Centennial Coal operations.

Product coal is either transported to the domestic export market through the rail loop or to the Eraring Energy power station by truck along an existing private haul road.

Newstan Colliery is located in gently undulating terrain bordered by vegetation. The site has an approximate elevation of 30 m at the surface facilities area and an approximate elevation of 72 m (highest point) at the Southern Reject Emplacement Area located to the west of the existing surface facilities area. The township of Fassifern is situated approximately 1.5 km southeast and Wakefield is approximately 2.6 km northwest of the site. The western shore of Lake Macquarie is approximately 1.7km southeast of the site.

Figure 1 shows the locality of Newstan Colliery.

Figure 1 Project Area



2.2 Sensitive Receivers

A number of residences and sensitive receivers are located in the area surrounding the Newstan Colliery. The nearest residences and sensitive receivers have been identified to be taken into account during the NIA. A list of the nearest sensitive receivers identified in the vicinity of the site and their respective distances from the site are presented in **Table 1** and **Figure 2**.

Table 1 Nearest Sensitive Receivers

Receiver ID	Location	Location (m, MSG)		Elevation (m, AHD)
		Easting	Northing	
NC1	Davis Dwelling 35 Jefferson Road, Wakefield	365779.69	6351882.42	40
NC2	Culgan Dwelling Miller Road, Fassifern	365720.07	6351115.49	58
NC3	Orrock Dwelling 4 Wallsend Road, Fassifern	367462.88	6349487.13	12.27
NC4	Phelps Dwelling 33 Narara Street, Fassifern	367399.3	6348880.39	26.91
NC5	Parnell Dwelling 51 Reynolds Street, Fassifern	366904.14	6348625.73	72.12
NC6	Fassifern Primary School	367580.77	6349693.87	10.93

Figure 2 Surrounding Sensitive Receiver Locations

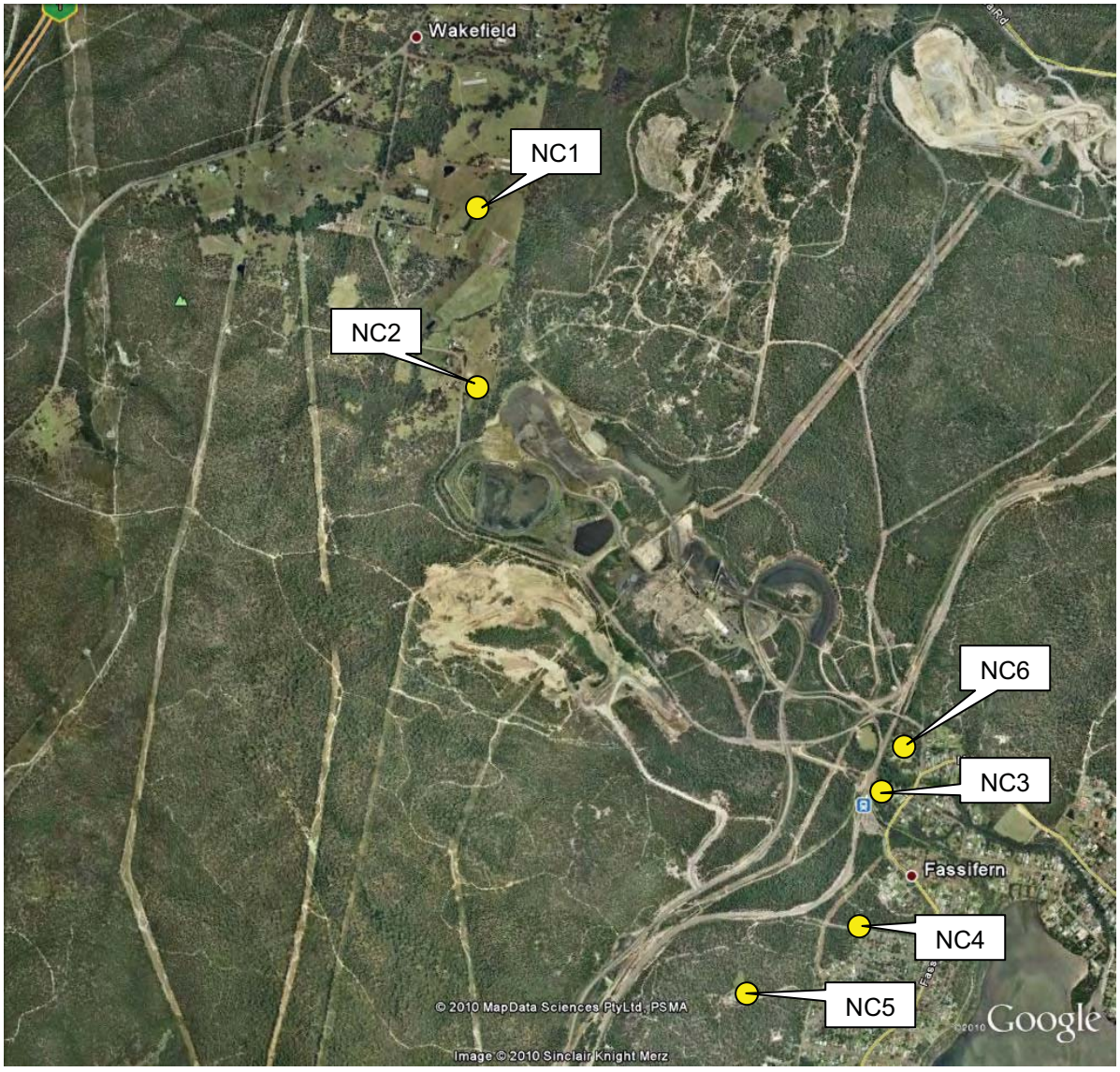


Image Source: Google Earth

2.3 Acoustically Significant Sources

2.3.1 Mining Operations

Where possible, noise measurements have been conducted of acoustically significant plant and equipment utilised during operations at the surface facilities. Sound power levels of such plant have been determined and utilised for the purpose of this NIA. Where on-site measurements could not be conducted sound power levels have been obtained from a SLR Consulting database of similar equipment. The relevant acoustically significant plant and equipment and the associated sound power levels are provided in **Table 2**. Also, **Table 3** provides the maximum onsite hourly haul road vehicle movements associated with Newstan Colliery.

Figure 3 illustrates the location of the plant and equipment associated with the existing and approved operations.

Table 2 Newstan Colliery - Acoustically Significant Plant and Equipment

Plant and Equipment	Sound Power Level
SREA Operations	**dBA**
Traxcavator	101
Compactor	106
25t Excavator	103
Dozer	103
Coal Truck (8 wheel truck)	98
23t Excavator	101
7t Excavator	98
Dump Truck (2)	102
NREA Operations	
Loader	106
Dozer	103
23t Excavator	101
Coal Truck (8 wheel truck)	98
Coal Preparation Plant (CPP)	
Coal Preparation Plant	112
Coal Preparation Plant Compressor	104
Coal Preparation Plant Feed conveyor	109
Coking Bin	99[1]
Coal Handling Plant (CHP)	
Truck Loading at Bin	99[1]
Coal Handling Plant (CHP)	117
Reclaim Conveyor Transfer House	104[2]
4000t Bin	111
Conveyor Drift Drive	104[2]
Loader	106
Dozer	103
Reclaim Conveyor	110
Truck Tipping Load	102
Vent Fan (2)	93
Compressor House	101
Workshop (i.e. use of grinder)	104[3]
Coal Truck (8 wheel truck)	98
Rail Loop	
Coal Train Shunting	103
Loader (2)	106
Dozer	103
Coal Truck (8 wheel truck)	98

1 – Sound power level taken from measurements at Angus Place.
2 – Sound power level taken from measurements at Myuna.
3 – Sound power levels for these sources have been obtained from a SLR Consulting database

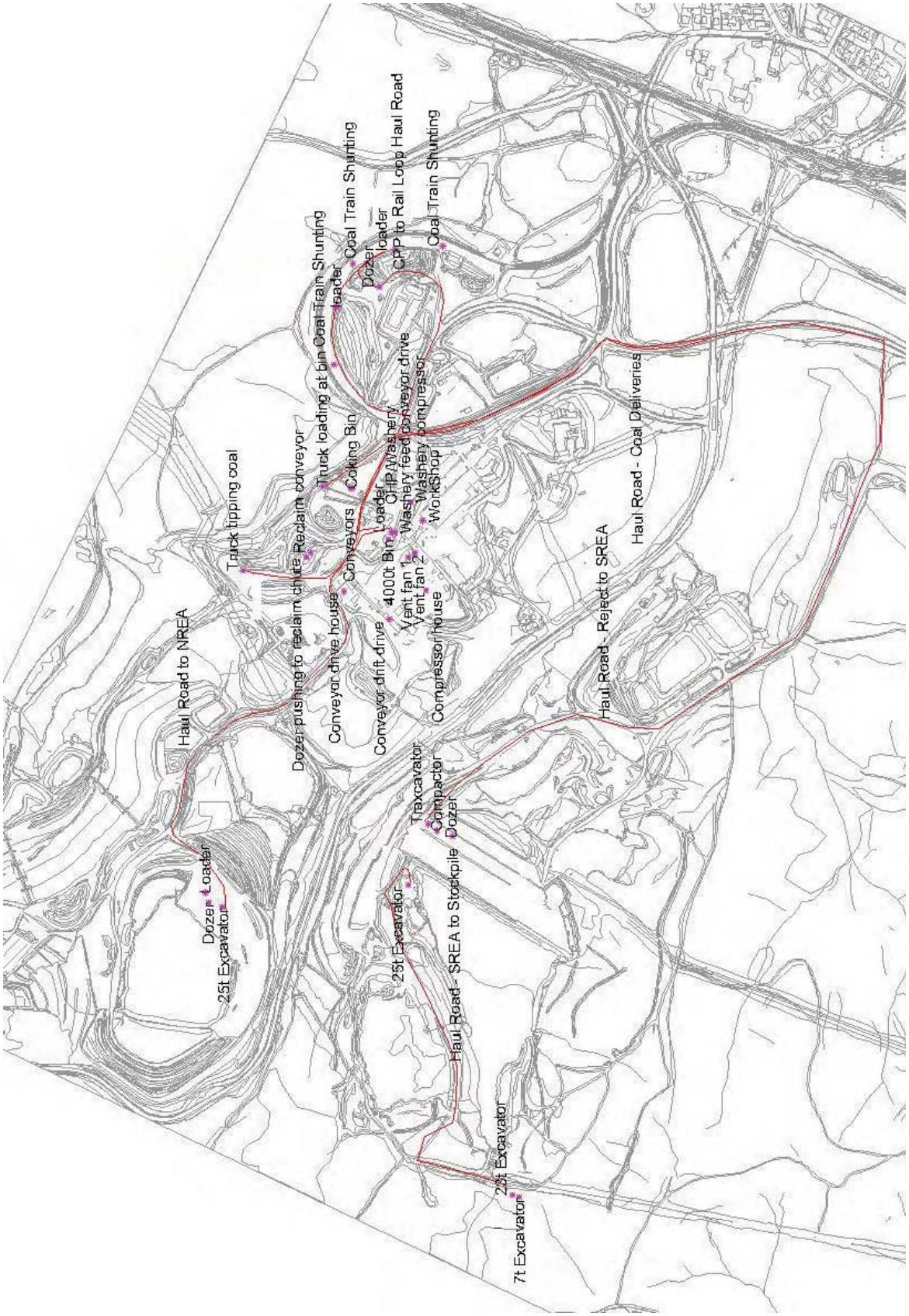
All other sound power level data presented here has been obtained from noise measurements undertaken at the project site.

It should be noted that the plant and equipment utilised underground is not anticipated to influence noise levels experienced at the nearest sensitive receptors and therefore plant and equipment used underground have not been considered as part of this NIA.

Table 3 Newstan Colliery Haul Road Vehicle Movements per Hour

Haul Road	Haul Road Vehicle Movements per Hour (one way traffic)			
	Morning Shoulder	**Day**	**Evening**	**Night**
	6am – 7am	**7am – 6pm**	**6pm – 10pm**	**10pm – 6am**
SREA	N/A	12	N/A	N/A
CPP to SREA	1.25	1.25	1.25	1.25
Coal Deliveries to CPP	7	7	7	7
CPP to NREA	1.25	1.25	1.25	1.25
CPP to Rail Loop	21	21	21	21

Figure 3 Location of Plant and Equipment



2.3.2 Construction

There are no changes proposed to the existing surface operations which would contribute to the acoustic environment. Therefore, no construction activities have been considered as part of this assessment.

2.4 Existing Noise Mitigation and Management Measures

Noise mitigation and management measures currently implemented at Newstan Colliery include the following:

- Standard work procedures and maintenance tasks to minimise noise emissions; and
- Partially Enclosed Coal Processing Plant and reclaim conveyor transfer house.

Recommended additional mitigation measures are contained in **Section 6.1.2**.

3 NOISE IMPACT ASSESSMENT PROCEDURES

3.1 General Objectives - Industrial Noise Policy

The Industrial Noise Policy (INP) was released in January 2000 and provides a framework and process for deriving noise criteria for consents and licences that enables the DECCW to regulate premises that are scheduled under the Protection of the Environment Operations Act, 1997 (POEO Act).

The specific policy objectives are:

- To establish noise criteria that would protect the community from excessive intrusive noise and preserve amenity for specific land uses.
- To use the criteria as the basis for deriving project specific noise levels.
- To promote uniform methods to estimate and measure noise impacts, including a procedure for evaluating meteorological effects.
- To outline a range of mitigation measures that could be used to minimise noise impacts.
- To provide a formal process to guide the determination of feasible and reasonable noise limits for consents or licences that reconcile noise impacts with the economic, social and environmental considerations of industrial development.
- To carry out functions relating to the prevention, minimisation and control of noise from premises scheduled under the POEO Act.

The INP provides two forms of noise criteria with the aim of achieving environmental noise objectives; one to account for intrusive noise which involves setting a noise goal relative to the existing acoustic environment and the other to protect the amenity of particular land uses.

For assessing intrusiveness, the background noise needs to be measured. The intrusiveness criterion essentially means that the equivalent continuous noise level of the source over any 15 minute period ($L_{Aeq(15minute)}$) should not be more than five (5) decibels above the measured background level (L_{A90}).

The amenity assessment is based on noise criteria specific to land use and associated activities. The criteria relate only to industrial-type noise and do not include road, rail or community noise. An extract from the INP that relates to the amenity criteria is given in **Table 4**.

Table 4 Amenity Criteria
Recommended L_{Aeq} Noise Levels from Industrial Noise Sources

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended $L_{Aeq(Period)}$ Noise Level (dBA)	
			Acceptable	Recommended Maximum
Residence	Rural	Day	50	55
		Evening	45	50
		Night	40	45
	Suburban	Day	55	60
		Evening	45	50
		Night	40	45
	Urban	Day	60	65
		Evening	50	55
		Night	45	50
	Urban/Industrial Interface (for existing situations only)	Day	65	70
		Evening	55	60
		Night	50	55
School classrooms - internal	All	Noisiest 1 hour period when in use	35	40
Hospital wards	All	Noisiest 1 hour period		
- internal			35	40
- external			50	55
Place of worship - internal	All	When in use	40	45
Area specifically reserved for passive recreation (eg National Park)	All	When in use	50	55
Active recreation area (eg school playground, golf course)	All	When in use	55	60
Commercial premises	All	When in use	65	70
Industrial premises	All	When in use	70	75

Note: Daytime 7.00 am to 6.00 pm; Evening 6.00 pm to 10.00 pm; Night-time 10.00 pm to 7.00 am, On Sundays and Public Holidays, Daytime 8.00 am - 6.00 pm; Evening 6.00 pm - 10.00 pm; Night-time 10.00 pm - 8.00 am.
The L_{Aeq} index corresponds to the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

If the measured existing noise level from industry approaches the criterion value, then noise levels from new industries need to be designed so that the cumulative effect does not produce noise levels that would significantly exceed the criterion. In this case, the amenity criteria provided in **Table 4** would need to be adjusted in accordance with the INP as per **Table 5**.

Table 5 Modification to Acceptable Noise Level (ANL)* to Account for Existing Levels of Industrial Noise

Total Existing L_{Aeq} noise level from Industrial Noise Sources	Maximum L_{Aeq} Noise Level for Noise from New Sources Alone, dBA
≥ Acceptable noise level plus 2 dBA	If existing noise level is *likely to decrease* in future acceptable noise level minus 10 dBA If existing noise level is *unlikely to decrease* in future existing noise level minus 10 dBA
Acceptable noise level plus 1 dBA	Acceptable noise level minus 8 dBA
Acceptable noise level	Acceptable noise level minus 8 dBA
Acceptable noise level minus 1 dBA	Acceptable noise level minus 6 dBA
Acceptable noise level minus 2 dBA	Acceptable noise level minus 4 dBA
Acceptable noise level minus 3 dBA	Acceptable noise level minus 3 dBA
Acceptable noise level minus 4 dBA	Acceptable noise level minus 2 dBA
Acceptable noise level minus 5 dBA	Acceptable noise level minus 2 dBA
Acceptable noise level minus 6 dBA	Acceptable noise level minus 1 dBA
< Acceptable noise level minus 6 dBA	Acceptable noise level

* ANL = recommended acceptable L_{Aeq} noise level for the specific receiver, area and time of day from **Table 4**

The NSW Department of Environment, Climate Change and Water (DECCW) has acknowledged that *"where early morning (5 am - 7 am) operations are proposed, it may be unduly stringent to expect such operations to be assessed against the night-time criteria - especially if existing background noise levels are steadily rising in these early morning hours".* For this reason, the morning shoulder period (6:00 am to 7.00 am) has been considered separately as part of this assessment.

3.2 INP Project Specific Criteria

The INP Project Specific Noise levels are the more stringent of either the amenity or intrusive criteria. The INP states that these criteria have been selected to protect at least 90% of the population living in the vicinity of industrial noise sources from the adverse effects of noise for at least 90% of the time. Provided the criteria in the INP are achieved, it is unlikely that most people would consider the resultant noise levels excessive.

In those cases where the INP project specific assessment criteria are not achieved, it does not automatically follow that all people exposed to the noise would find the noise unacceptable. In subjective terms, exceedances of the INP project specific assessment criteria can be generally described as follows:

- Negligible noise level increase <1 dB(A) (Not noticeable by all people)
- Marginal noise level increase 1 dB(A) to 2 dB(A) (Not noticeable by most people)
- Moderate noise level increase 3 dB(A) to 5 dB(A) (Not noticeable by some people but may be noticeable by others)
- Appreciable noise level increase >5 dB(A) (Noticeable by most people)

In view of the foregoing, **Table 6** presents the methodology for assessing noise levels which may exceed the INP project specific noise assessment criteria.

Table 6 Noise Impact Assessment Methodology

Assessment Criteria	Project Specific Criteria	Noise Management Zone	Noise Affectation Zone
Intrusive	Rating background level plus 5 dBA	≤ 5 dBA above project specific criteria	> 5 dBA above project specific criteria
Amenity	INP based on existing industrial level	≤ 5 dBA above project specific criteria	> 5 dBA above project specific criteria

For the purposes of assessing the potential noise impacts the project specific, management and affectation criteria are further defined as follows:

3.2.1 Project Specific Criteria

Most people in the broader community would generally consider exposure to noise levels corresponding to this zone acceptable.

3.2.2 Noise Management Zone

Depending on the degree of exceedance of the project specific criteria (1 dBA to 5 dBA) noise impacts could range from negligible to moderate. It is recommended that management procedures be implemented including:

- Prompt response to any community issues of concern;
- Noise monitoring on site and within the community;
- Refinement of on site noise mitigation measures and plant operating procedures where practical;
- Consideration of acoustical mitigation at receivers; and
- Consideration of negotiated agreements with property holders.

3.2.3 Noise Affectation Zone

Exposure to noise levels exceeding the project-specific criteria by more than 5 dB(A) may be considered unacceptable by some property holders and the INP recommends that the proponent explore the following:

- Discussions with relevant property holders to assess concerns and provide solutions; and
- Implementation of acoustical mitigation at receivers.

Negotiated agreements with property holders, where required.

3.3 Assessing Sleep Disturbance

The DECCW's Environmental Criteria for Road Traffic Noise (ECRTN) states that the relationship between maximum noise levels and sleep disturbance is not currently well defined. Criteria for assessing sleep disturbance has not been identified under the INP and hence, sleep arousal is assessed using the guidelines set out in the Environmental Noise Control Manual (ENCM) Chapter 19-3.

To avoid the likelihood of sleep disturbance the ENCM recommends that the $L_{A1(1minute)}$ noise level of the source under consideration should not exceed the background noise level (L_{A90}) by more than 15 dBA when measured outside the bedroom window of the receiver during the night-time hours (10.00 pm to 7.00 am).

3.4 Assessing Vibration

German Standard DIN 4150-3 1999 "*Structural Vibration Part 3: Effects of Vibration on Structures*" provides guideline criteria for evaluating the short and long-term effects of vibration on structures. In addition, the British Standard BS *6472-1:2008 guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting* and the DECCW interim guideline "*Assessing Vibration: A Technical Guideline"* dated February 2006, which provides guideline building vibration levels associated with a low probability of annoyance from occupants. Relevant vibration criteria are identified in **Table 7** and **Table 8**

Table 7 Vibration dose value ranges which might result in various probabilities of adverse comments within residential buildings

Place and time	Low probability of adverse comment $m/s^{1.75}$	Adverse comment possible $m/s^{1.75}$	Adverse comment probable $m/s^{1.75}$
Residential building 16 hours day*	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential building 8 hours night	0.13	0.26	0.51

Note: *Daytime is 7.00 am to 10.00 pm.
For offices and workshops, multiplying factors of 2 and 4 respectively should be applied to the above vibration does value ranges for a 16h day.

Table 8 Long-term Structural Vibration Velocity limits on Structures

Line	Type of Structure	Guideline values for velocity, v_i, in mm/s, of vibration in horizontal plane of highest floor, at all frequencies
1	Building used for commercial purposes, industrial buildings, and buildings of similar design	10
2	Dwellings and buildings of similar design and/or occupancy	5
3	Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are great intrinsic value (e.g. listed buildings under preservation order)	2.5

4 EXISTING ACOUSTICAL AND METEOROLOGICAL ENVIRONMENT

4.1 General Methodology

Ambient noise surveys were conducted to characterise and quantify the existing acoustical environment in the area surrounding the Newstan Colliery. A background monitoring survey was undertaken at two (2) residential locations on Miller Road, Wakefield (west of Newstan) and Miller Road, Fassifern (east of Newstan), considered representative of the nearest potentially-affected noise-sensitive receivers to the Newstan Colliery. The noise monitoring locations are shown in **Figure 4**.

The background noise monitoring consisted of continuous, unattended noise logging and operator attended noise surveys. The operator attended noise surveys help to define noise sources and the character of noise in the area and are, therefore, used to qualify unattended noise logging results.

All acoustic instrumentation employed throughout the monitoring programme has been designed to comply with the requirements of AS 1259.2-1990, “Sound Level Meters” and carries current NATA or manufacturer calibration certificates. Instrument calibration was checked before and after each measurement survey, with the variation in calibrated levels not exceeding ±0.5 dBA.

4.2 Operator-Attended Noise Monitoring

Operator attended noise measurements were conducted during the day, evening and night-time periods at both noise monitoring locations. The purpose of these surveys was twofold; to qualify the unattended noise logging results and to determine the contribution of existing industrial noise sources (including Newstan Colliery) to the total ambient noise environment.

Each noise survey was conducted over a 15 minute period using a B&K 2260 integrating sound level meter (S/N 2487418). The results of the operator-attended noise measurements are given in **Table 9**. Ambient noise levels given in the table include all noise sources such as road, rail, insects, birds, as well as any industrial operations.

During the operator attended noise surveys the weather conditions were warm, dry and calm during the daytime and cold, clear and calm during the evening and night-time. It is therefore considered likely that evening and night-time surveys were influenced by a temperature inversion.

Figure 4 Noise Monitoring Locations

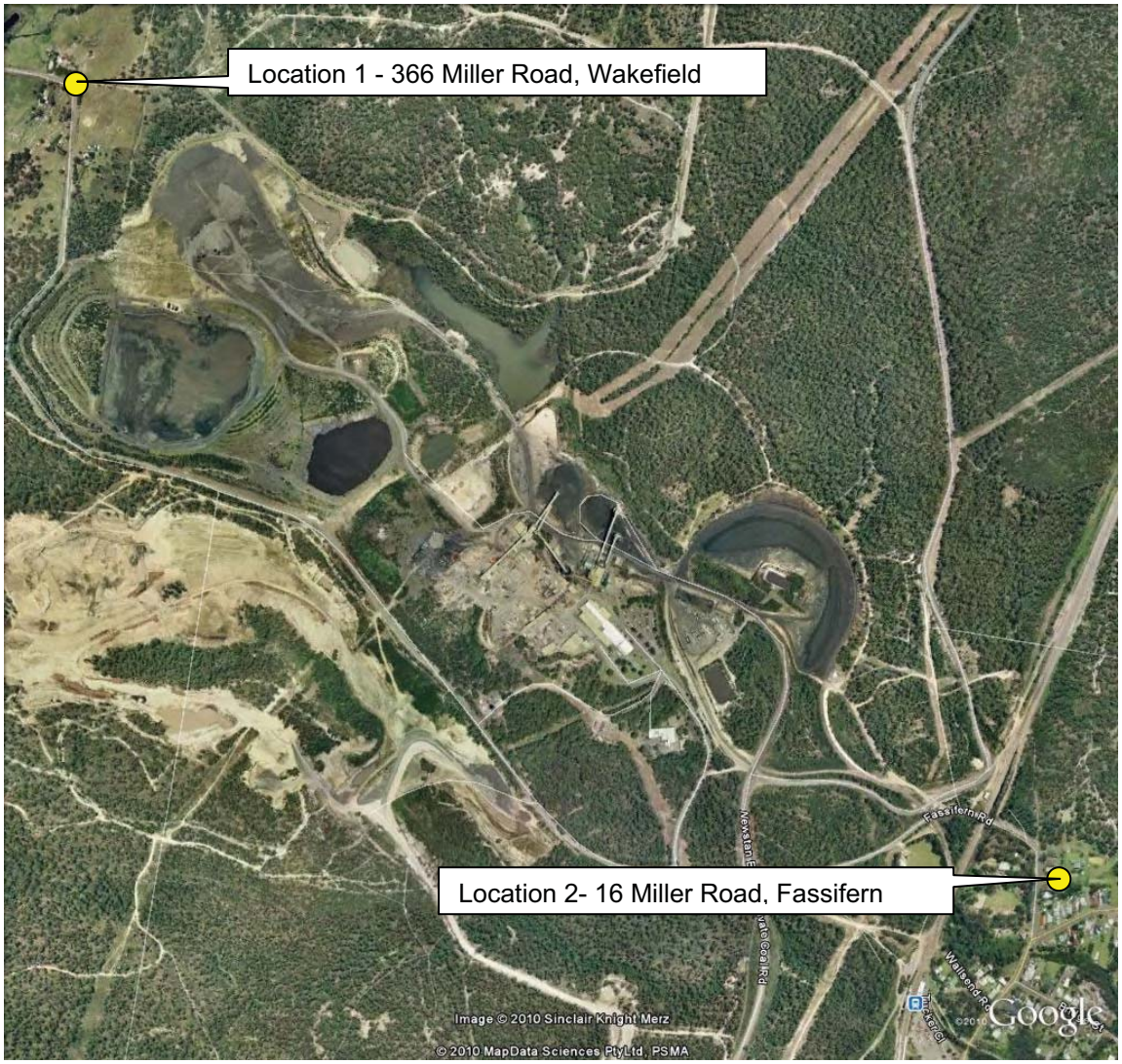


Image Source: Google Earth

Table 9 Operator Attended Noise Survey Results

Location	Date/ Start time/ Weather	Primary Noise Descriptor (dBA re 20 μPa)					Description of Noise Emission, Typical Maximum Levels LAmax (dBA)
		LAmax	LA1	LA10	LA90	LAeq	
Location 1 366 Miller Road, Wakefield	**Day** 14/09/2010 2:13pm Temp 23 °C Wind <2m/s SE	78	69	57	37	57	Road traffic ~ 65 to 78 Distant road traffic ~ 42 Dog barks ~ 57 Residential shouting ~ 47 to 48 Birdsong ~ 41 Insects ~ 51 Horn ~53 Leaf rustle ~ 40 Newstan Surface Operations just audible in lulls but not measureable (<35 dBA)
	Evening 15/09/2010 9.15pm Temp 13 °C Wind < 1m/s SE	75	64	51	39	52	Road traffic ~ 64 to 75 Distant road traffic (from Freeway) ~ 41 to 44 Dog barks ~ to 65 Crickets/Insects ~ 40 to 43 Leaf rustle ~ 42 Newstan Surface Operations inaudible
	Night 15/09/2010 10.06pm Temp 12 °C Wind Calm	85	66	42	56	36	Road traffic ~ 76 to 85 Distant road traffic (from Freeway) ~ 38 to 40 Crickets/insects ~ 38 to 40 Newstan Surface Operations inaudible
Location 2 16 Miller Road, Fassifern	**Day** 14/09/2010 1:50pm Temp 23 °C Wind <2m/s SSE	75	69	56	42	56	Road traffic ~ 58 to 75 Distant road traffic ~ 45 to 46 Vehicle banging ~ 49 Passenger train ~ 53 to 54 Birdsong ~ 40 to 53 Children at school ~ 44 School bell ~ 60 Coal trucks just audible on haul road ~ 45 Newstan Surface Operations inaudible
	Evening 15/09/2010 9.40pm Temp 12 °C Wind Calm	77	70	60	45	59	Road traffic ~ to 73 Passenger train ~ to 60 Freight train ~ 52 to 69 Train shunting ~ 53 to 62 Newstan Surface Operations low frequency (16, 31 & 40 Hz) hum audible up to 44
	Night 15/09/2010 10.28pm Temp 11 °C Wind Calm	88	60	48	36	54	Road traffic ~ to 65 Passenger train ~ to 60 Cricket/insects ~ 39 to 40 Distant road traffic ~ 41 to 42 Haul trucks on Eraring Haul Road ~ 44 to 52 Newstan Surface Operations - Reverse beeper just audible < 35 Trackslap just audible ~ 38 Fixed plant inaudible (ceased operations at 9.50)

Results of operator-attended noise surveys indicate that local and distant road traffic, the natural environment and residential activity are the main contributors to the ambient noise environment during the all monitoring periods at each monitoring location.

Fixed plant from Newstan Colliery operations were barley audible at 366 Miller Road, Wakefield during the daytime during lulls between road traffic. Also, Newstan Colliery operations were inaudible during the evening and night-time periods.

Furthermore, fixed plant from Newstan Colliery operations were audible at 16 Miller Road, Fassifern during the evening period and were inaudible during the day and night time periods.

We note that Newstan Colliery fixed plant operations ceased at 9:50pm during the attended noise monitoring but was operating during the unattended noise monitoring.

4.3 Unattended Continuous Noise Monitoring

Background noise levels were monitored by SLR Consulting. The objective of the background noise survey was to measure $L_{A90(period)}$ and $L_{Aeq(15minute)}$ noise levels at the nearest potentially affected residential locations during the day, evening and night-time periods to enable the determination of the intrusiveness and amenity criteria for the project.

Background noise levels were monitored at two separate locations, considered to be representative of the nearest potentially affected receivers, from Tuesday 14 September 2010 to Wednesday 22 September 2010, inclusive. Details of monitoring locations are provided in **Table 10** and **Figure 4**.

Table 10 Ambient Noise Monitoring Locations

Location	Address Location Description	Logger Serial No.
Location 1	366 Miller Road, Wakefield	16-306-039
Location 2	16 Miller Road, Fassifern	16-103-494

ARL Type EL316 noise loggers were used to monitor the ambient noise levels at each location. The noise loggers were programmed to record statistical noise level indices continuously in 15 minute intervals, including L_{Amax}, L_{A1}, L_{A50}, L_{A90}, L_{A99}, L_{Amin} and L_{Aeq}. Precautions were taken to minimise influences from extraneous noise sources and reflections from adjacent buildings.

Weather data for the survey period was obtained from the Bureau of Meteorology (BOM) weather station located at Cooranbong (approximately 15.5 km south west of the project site). Noise data corresponding to periods of rainfall and/or wind speeds in excess of 5 m/s (approximately 9 knots) were discarded in accordance with INP data exclusion methodology. A summary of the results of the background surveys is given in **Table 11**. Results are displayed graphically in **Appendix A** and **Appendix B**.

Table 11 Summary of Existing Ambient Noise Levels

Location	Period	Measured Background L_{A90} Noise Level	Adopted Rating Background Level	Estimated Existing Industrial (non-Newstan) Contribution L_{Aeq}
Location 1 366 Miller Road, Wakefield	Morning Shoulder	41 dBA	41 dBA	<49 dBA
	Day	36 dBA	36 dBA	<49 dBA
	Evening	39 dBA	36 dBA	<39 dBA
	Night	31 dBA	31 dBA	<34 dBA
Location 2 16 Miller Road, Fassifern	Morning Shoulder	40 dBA	40 dBA	<49 dBA
	Day	39 dBA	39 dBA	<49 dBA
	Evening	39 dBA	39 dBA	<39 dBA
	Night	30 dBA	30 dBA	<34 dBA

Note: Daytime 7.00 am to 6.00 pm; Evening 6.00 pm to 10.00 pm; Night-time 10.00 pm to 7.00 am
Morning Shoulder 6.00 am to 7.00 am
On Sundays and Public Holidays, Daytime 8.00 am to 6.00 pm; Evening 6.00 pm to 10.00 pm; Night-time 10.00 pm to 8.00 am

The L_{A90} represents the level exceeded for 90% of the interval period and is referred to as the average minimum or background noise level
L_{Aeq} - The equivalent continuous noise level is defined as the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

The background noise levels present in **Table 11** have not been affected from the existing Newstan Colliery activities and therefore are applicable levels to be used in the establishment of project specific noise criteria.

4.4 Effects of Meteorology on Noise Levels

4.4.1 Wind

Wind has the potential to increase noise at a receiver when it is light and stable and blows from the direction of the source of the noise. As the strength of the wind increases the noise produced by the wind will obscure noise from most industrial and transport sources.

Wind effects need to be considered when wind is a feature of the area under consideration (in accordance with the INP). Where wind blows from the source to the receiver at speeds up to 3 m/s for more than 30% of the time in any season, then wind is considered to be a feature of the area and noise level predictions must be made under these conditions.

In order to determine the prevailing conditions for the subject site, 12 months of weather data was obtained from a Bureau of Meteorology automatic weather station at Cooranbong, approximately 15.5km south west of the subject site.

It is relevant to note that due to the Newstan Colliery weather station not recording wind directions correctly, the Bureau of Meteorology weather station at Cooranbong was used in the assessment.

This data was analysed to determine the frequency of occurrence of winds of speeds up to 3 m/s in each season during the day, evening and night time periods. The results of the wind analysis for daytime, evening, and night-time winds are presented in **Table 12**, **Table 13** and **Table 14** respectively. In each table, the wind directions and percentage occurrence are those dominant during each season. The percentage occurrence figures provided in bold are those that exceed the 30% threshold.

Table 12 Seasonal Frequency of Occurrence of Wind Speed Intervals - Daytime

Period	Calm	Wind Direction	0.5 - 2 m/s	2 - 3 m/s	0.5 - 3 m/s
Summer	9.9%	S±45	7.4%	7.9%	15.2%
Autumn	20.4%	SSW±45	15.6%	6.8%	22.4%
Winter	22.8%	SW±45	17.6%	8.5%	26.1%
Spring	7.3%	ESE±45	4.7%	8.1%	12.8%

Table 13 Seasonal Frequency of Occurrence of Wind Speed Intervals - Evening

Period	Calm	Wind Direction	0.5 - 2 m/s	2 - 3 m/s	0.5 - 3 m/s
Summer	20.7%	ESE±45	14.1%	10.3%	24.3%
Autumn	61.0%	SW±45	11.4%	1.0%	12.5%
Winter	59.0%	NW±45	14.8%	3.7%	18.5%
Spring	30.6%	E±45	8.1%	6.1%	14.2%

Table 14 Seasonal Frequency of Occurrence of Wind Speed Intervals - Night

Period	Calm	Wind Direction	0.5 - 2 m/s	2 - 3 m/s	0.5 - 3 m/s
Summer	57.1%	SSW±45	15.7%	5.4%	21.1%
Autumn	76.0%	SW±45	10.9%	1.3%	12.1%
Winter	62.3%	W±45	12.0%	3.4%	15.4%
Spring	57.4%	NNW±45	8.4%	3.1%	11.6%

From the above weather data, significant wind (ie wind speed of up to 3 m/s) was recorded but not more than the assessment threshold of 30 % during the period between September 2009 and September 2010 and therefore prevailing wind condition was not considered in this assessment.

4.4.2 Temperature Inversion

Temperature inversions, when they occur, have the ability to increase noise levels by focusing sound waves. Temperature inversions occur predominantly at night during the winter months. For a temperature inversion to be a significant characteristic of the area it needs to occur for approximately 30% of the total night-time during winter, or about two nights per week.

Meteorological data was not available from the surrounding weather stations to allow the determination of the percentage occurrence of temperature inversions during winter nights. A worst case analysis was therefore undertaken and the occurrence of temperature inversion during the night-time period has been considered as part of this noise assessment. Default temperature inversion values, as defined in the INP, have been assumed during the night-time period.

5 PROJECT SPECIFIC NOISE CRITERIA

5.1 Operational Noise Design Criteria

The noise emission design criteria for the project have been established with reference to the INP outlined in **Section 3.1** of this report.

The acoustical environment typifies a suburban environment; "*an area that has local traffic with characteristically intermittent traffic flows or with some limited commerce or industry"* (INP). Therefore, the residences in the general area have been assessed as "suburban" receiver types.

The amenity criteria have been established using the results of ambient noise measurements. At both monitoring locations, the existing industrial L_{eq} noise levels are more than 6 dBA below the acceptable noise levels described in **Table 4** therefore, the amenity criteria is equal to the acceptable noise level (refer **Table 5**).

In accordance with the INP, the project specific noise levels reflect the most stringent noise level requirements from the noise levels derived from both the intrusive and amenity criteria. Applying the most stringent requirement as the project specific noise levels ensures that both intrusive noise is limited and amenity is protected.

The resulting operational project specific noise criteria for residences and sensitive receiver locations R1 to R6 (see **Figure 2**) will be based on LA90 and LAeq noise levels measured at Location 1 - 366 Miller Road, Wakefield and Location 2-16 Miller Road, Fassifern (see **Figure 4**). The noise environment at Location 1 - 366 Miller Road, Wakefield will most likely be assumed to be representative of the noise environments at Residences NC1 to NC2. Similarly the noise environment at Location 2 - 16 Miller Road, Fassifern will most likely be assumed to be representative of the noise environments at Residences NC3 to NC6.

The resulting operational project specific noise criteria for the project are shown in **Table 15**.

Table 15 Project Specific Noise Criteria

Location	Period	Measured Background Noise Level (LA90)	Adopted RBL LA90	Intrusiveness Criteria $L_{Aeq(15minute)}$	Amenity Criteria $L_{Aeq(Period)}$	Project Specific Noise Criteria $L_{Aeq(15min)}$
NC1 NC2	Morning Shoulder	41	41	46	48 dBA	**46 dBA**
	Day	36	36	41	55 dBA	**41 dBA**
	Evening	39	36	41	45 dBA	**41 dBA**
	Night	31	31	36	40 dBA	**36 dBA**
NC3 NC4 NC5	Morning Shoulder	40	40	45	48 dBA	**45 dBA**
	Day	39	39	44	55 dBA	**44 dBA**

	Evening	39	39	44	45 dBA	**44 dBA**
	Night	30	30	35	40 dBA	**35 dBA**
NC6	Noisiest 1-hour period when in use	N/A			35 dBA – School classroom internal	**35 dBA (School Classroom internal)**
	When in use				55 dBA School Playground	**55 dBA (School Playground)**

5.2 Sleep Disturbance Noise Goals

The relevant sleep disturbance noise goals for each residential area are provided in **Table 16**.

Table 16 Sleep Disturbance Noise Goals

Location	Period	Measured Background Noise Level (L_{A90})	Adopted RBL* L_{A90}	Sleep Disturbance Noise Goal
NC1 and NC2	Morning Shoulder	41 dBA	41 dBA	**56 dBA**
	Night	31 dBA	31 dBA	**46 dBA**
NC3, NC4, NC5	Morning Shoulder	40 dBA	40 dBA	**55 dBA**
	Night	30 dBA	30 dBA	**45 dBA**
NC6	N/A	N/A	N/A	**N/A**

* For the purposes of determining the relevant sleep disturbance noise goal the adopted RBL has been calculated such that the background noise level excludes the existing contribution of Newstan Colliery.

The Environmental Criteria for Road Traffic Noise (ECRTN) provides further guidance with regard to sleep disturbance and calls upon a number of studies that have been conducted into the effect of maximum noise levels on sleep. The DECCW policy document acknowledges that, at the current level of understanding, it is not possible to establish absolute noise level criteria that would correlate to an acceptable level of sleep disturbance. However, the ECRTN provides that maximum internal noise levels below 50 dBA to 55 dBA are unlikely to cause awakening reactions and one or two events per night, with maximum internal noise levels of 65 dBA to 70 dBA (inside dwellings) are not likely to significantly affect health and wellbeing.

5.3 Operational Vibration Goals

Table 7 & **Table 8** provide the relevant project specific operational vibration goals and would be applicable for Newstan Colliery.

6 ASSESSMENT OF NOISE IMPACTS

6.1 Operational Noise Modelling

6.1.1 Operational Noise Modelling Parameters

A computer model was used to predict noise emissions from operation of the Newstan Colliery. The operational noise modelling was undertaken using SoundPLAN v7 software, developed by Braunstein and Berndt Gmbh in Germany. A three-dimensional digital terrain map giving all relevant topographic information was used in the modelling process. The model used this map, together with noise source data, ground cover, shielding by barriers and/or adjacent buildings and atmospheric information to predict noise levels at the nearest potentially affected receivers.

Topographic contours and operational plans were supplied by Centennial Newstan for the purpose of modelling noise from the Newstan Colliery. Prediction of noise emission levels was carried out under calm and prevailing atmospheric conditions. Atmospheric parameters under which noise predictions were made are given in **Table 17**.

Table 17 Meteorological Parameters Considered for Noise Predictions

	Temperature	Humidity	Wind Speed	Wind Direction (degrees from north)	Temperature Inversion
Calm (All periods)	20°C	65%	n/a	n/a	n/a
Inversion (Night only)	10°C	90%	n/a	n/a	3°C/100m

Sound power levels of relevant plant and equipment have been obtained from measurements of plant already operating at the site or have been sourced from a SLR Consulting database of similar equipment.

Assumptions made in modelling noise emissions from the subject site include the following:

- All acoustically significant plant and equipment operates simultaneously;
- Mobile noise sources, such as delivery and product despatch trucks, were modelled at typical locations and assumed to operate in repetitive cycles; and
- All mitigation measures described in **Section 2.4** are implemented.

6.1.2 Noise Management and Mitigation

Noise emission levels have been predicted assuming that the existing noise management and mitigation measures described in **Section 2.4** are implemented. Additional noise management or mitigation measures have also been considered.

The recommended additional mitigation measures that have been included in the noise modelling are as followed:

Coal Preparation Plant (CPP)

Areas for consideration for further noise abatement in the CPP include:

- The sealing of openings in all the walls around the preparation plant, as required;
- The continuance existing plant external walls down to the ground level, as required;
- Fully enclosing exposed conveyors with the same Colorbond steel currently being used for the building and conveyors, as required; and

- Replace alsynite panels on eastern wall with Colorbond steel, as required.

Specific details on the implementation of the noise mitigation measures for the CPP will be implemented in consultation with specialist consultants to ensure any noise mitigation measures implemented are practical, feasible and achieve the required noise reduction levels.

Reclaim Conveyor Transfer House

Areas for consideration for further noise abatement in the reclaim conveyor transfer house include:

- The sealing of openings in all the walls around the conveyor transfer house, as required;
- The continuance existing plant external walls down to the ground level, as required;
- Fully enclosing exposed conveyors with the same Colorbond steel currently being used for the building and conveyors, as required; and
- Replace alsynite panels on eastern wall with Colorbond steel.

Specific details on the implementation of the noise mitigation measures for the conveyor transfer house will be implemented in consultation with specialist consultants to ensure any noise mitigation measures implemented are practical, feasible and achieve the required noise reduction levels.

Compressor House

Centennial Newstan will implement noise attenuation of the compressor house. Details of the noise attenuation of the compressor house will be developed in consultation with specialist consultants to ensure any noise mitigation measures implemented are practical, feasible and achieve the required noise reduction levels.

Noise bund

- A 6m high (top of noise wall RL 25) acoustic barrier is proposed for the south eastern side of the coal train rail loop (see **Figure 5**)

Figure 5 Proposed 6m noise bund – Coal Train Rail Loop

Night-time (10pm – 6am) Mobile Plant Management - Coal Train Surface Operations

- Restrict coal train surface operations during the night-time period to two (2) front end loaders.
- Avoid use of a dozer in this area during the night-time period.

Reversing Alarms on Onsite Mobile Plant

- It is recommended at that all mobile plant onsite are fitted with quacker type reversing alarms.

6.1.3 Operational Scenario - Noise Model Summary

The operational scenario modelled during each period is summarised in **Table 18**. A tick (✓) indicates that the equipment is in operation during the relevant period. A cross (×) indicates that the equipment is not in operation during the relevant period. Where there is a number in brackets following a tick, this represents the number of pieces of the equipment that has been considered in the noise model during the relevant period. It should be noted that the operational scenario modelled is likely to represent an acoustically worst-case scenario.

Table 18 Operational Scenario Considered in Noise Model

Plant and Equipment	Morning Shoulder	Day	Evening	Night
SREA Operations				
Traxcavator	✓	✓	×	×
Compactor	✓	✓	×	×
25t Excavator	✓	✓	×	×
Dozer	✓	✓	×	×
Coal Truck (8 wheel truck)	✓	✓	×	×
23t Excavator	✓	✓	×	×
7t Excavator	✓	✓	×	×
Dump Truck (2)	✓	✓	×	×
NREA Operations				
Loader	✓	✓	×	×
Dozer	✓	✓	×	×
25t Excavator	✓	✓	×	×
Coal Truck (8 wheel truck)	✓	✓	×	×
Coal Preparation Plant (CPP)				
Coal Preparation Plant	✓	✓	✓	✓
Coal Preparation Plant Compressor	✓	✓	✓	✓
Coal Preparation Plant Feed conveyor	✓	✓	✓	✓
Coking Bin	✓	✓	✓	✓
Coal handling Plant (CHP)				
Truck Loading at Bin	✓	✓	✓	✓
Coal Handling Plant	✓	✓	✓	✓
Reclaim Conveyor Transfer House	✓	✓	✓	✓
4000t Bin	✓	✓	✓	✓
Conveyor Drift Drive	✓	✓	✓	✓
Loader	✓	✓	✓	✓
Dozer	✓	✓	✓	✓
Reclaim Conveyor	✓	✓	✓	✓
Truck Tipping Load	✓	✓	✓	✓
Vent Fan (2)	✓	✓	✓	✓
Compressor House	✓	✓	✓	✓
Workshop (i.e. use of grinder)	✓	✓	✓	✓
Coal Truck (8 wheel truck)	✓	✓	✓	✓
Coal Train Surface Operations				
Coal Train Shunting	✓	✓	✓	✓
Loader (2)	✓	✓	✓	✓
Dozer	✓	✓	✓	✓
Coal Truck (8 wheel truck)	✓	✓	✓	✓

6.1.4 Operational Noise Modelling Results and Discussion

Noise emission levels were predicted from the proposed development for the typical operational scenario described in **Table 18** including the noise mitigation and management procedures described in **Section 2.4**.

Noise from all sources that contribute to the total noise from the site have been examined to identify characteristics that may cause greater annoyance (for example tonality, impulsiveness etc). The appropriate modifying factors, as outlined in the INP, have been applied where these characteristics are considered to be present. Noise levels predicted under existing operation with no mitigation and existing operations with mitigation at the nearest potentially affected residential locations are provided in **Table 19**. Mitigation measures are presented in **Section 6.1.2** Noise contour maps are provided in **Appendix C** for each meteorological with mitigation scenario considered.

Table 19 Predicted Noise Levels - Newstan Colliery

Location	Period	Predicted Noise Level $L_{Aeq(15minute)}$ (dBA) (No Mitigation except for what is in Section 2.4)		Predicted Noise Level $L_{Aeq(15minute)}$ (dBA) (With Mitigation detailed in Section 6.1.2)		Project Specific Noise Criteria (L_{Aeq})
		Calm	Temperature Inversion	Calm	Temperature Inversion	
NC1	Morning Shoulder	33	38	<30	34	**46 dBA**
	Day	33	N/A	<30	N/A	**41 dBA**
	Evening	32	N/A	<30	N/A	**41 dBA**
	Night	32	**38**	<30	33	**36 dBA**
NC2	Morning Shoulder	35	39	35	38	**46 dBA**
	Day	35	N/A	35	N/A	**41 dBA**
	Evening	<30	N/A	<30	N/A	**41 dBA**
	Night	<30	33	<30	30	**36 dBA**
NC3	Morning Shoulder	38	43	35	39	**45 dBA**
	Day	38	N/A	35	N/A	**44 dBA**
	Evening	38	N/A	35	N/A	**44 dBA**
	Night	**38**	**43**	35	**37**	**35 dBA**
NC4	Morning Shoulder	33	39	<30	34	**45 dBA**
	Day	33	N/A	30	N/A	**44 dBA**
	Evening	33	N/A	<30	N/A	**44 dBA**
	Night	33	**38**	<30	33	**35 dBA**
NC5	Morning Shoulder	31	36	<30	33	**45 dBA**
	Day	31	N/A	<30	N/A	**44 dBA**
	Evening	30	N/A	<30	N/A	**44 dBA**
	Night	30	35	<30	31	**35 dBA**
NC6	Morning Shoulder	N/A	N/A	N/A	N/A	N/A
	Day	37 (external)	N/A	35 (external)	N/A	**55dBA (School Playground)**
		<30 dBA (internal)		<30 dBA (internal)		**35dBA (internal)**
	Evening	N/A	N/A	N/A	N/A	N/A
	Night	N/A	N/A	N/A	N/A	N/A

Results presented in **Table 19** indicate that operational noise levels are predicted to meet the project specific noise criteria at all considered residential locations under calm and prevailing weather conditions with the mitigation measures in place. However, a **2dBA** exceeded noise level over the project noise criteria under temperature inversion with the additional mitigation measures in place is predicted at residential location **NC3**.

Since the operational scenario modelled is likely to represent an acoustically worst-case scenario, actual operational noise levels from the Newstan Colliery are likely to be less than those predicted.

In order to ensure Centennial Newstan complies with the project specific noise criteria at all nearby receptors during calm and prevailing meteorological conditions, Centennial Newstan will commit to installing a real time noise monitor on site to determine when noise criteria are approaching the noise limits. If noise from the site is approaching the noise criteria, Centennial Newstan will implement operational management measures to ensure the noise criteria is not exceeded.

6.1.5 Cumulative Noise Assessment

Potential cumulative noise impacts from existing and successive developments are embraced by the INP procedures by ensuring that the appropriate noise emission criteria (and consent limits) are established with a view to maintaining acceptable noise *amenity* levels for residences. Therefore, the cumulative impact of the proposed development with existing industrial noise sources has been assessed in the determination of the amenity levels at surrounding potentially noise sensitive areas.

6.2 Sleep Disturbance Analysis

In assessing sleep disturbance, typical L_{Amax} noise levels of acoustically significantly plant and equipment to be used at the Newstan Colliery (refer to **Table 20**) were used as input to the noise model. L_{Amax} noise level predictions were made at the nearest residential surrounding the Newstan Colliery under adverse weather conditions at night and the results are present in **Table 21**. The use of the L_{Amax} noise level provides a worst-case prediction since the $L_{A1(1minute)}$ noise level of a noise event is likely to be less than the L_{Amax}.

Table 20 L_{Amax} Sound Power Levels

Plant and Equipment	Sound Power Level
Coal Preparation plant (CPP)	**dBA**
Coal Preparation Plant	112
Coal Preparation Plant Compressor	114
Coal Preparation Plant Feed conveyor	111
Coking Bin	108
Coal Handling Plant (CPP)	
Truck Loading at Bin	107
Coal Handling Plant	120
Conveyor Drive House	107
4000t Bin	115
Reclaim Conveyor Transfer House	107
Loader	118
Dozer	109
Reclaim Conveyor	113
Truck Tipping Load	112
Vent Fan (2)	96
Compressor House	108
Workshop (i.e. use of grinder)	109
Truck and dog	102
Coal Train Surface Operations	
Coal Train Shunting	113
Loader (2)	118
Dozer	109
Coal Truck (8 wheel truck)	102

Table 21 Predicted Sleep Disturbance Noise Levels - Newstan Colliery

Location	Period	Predicted Sleep Disturbance Noise Level L_{max} (dBA)	Project Specific Noise Criteria ($L_{A1\ (1minute)}$)
NC1	Morning Shoulder	37	**56 dBA**
	Night	37	**46 dBA**
NC2	Morning Shoulder	31	**56 dBA**
	Night	31	**46 dBA**
NC3	Morning Shoulder	45	**55 dBA**
	Night	45	**45 dBA**
NC4	Morning Shoulder	39	**55 dBA**
	Night	39	**45 dBA**
NC5	Morning Shoulder	37	**55 dBA**
	Night	37	**45 dBA**
NC6	Morning Shoulder	N/A	N/A
	Night	N/A	N/A

The $L_{A1(1minute)}$ noise levels are predicted to be below the sleep disturbance noise goals specified in **Table 16** for night-time and morning shoulder period operation of the Newstan Colliery. This being the case, sleep disturbance is unlikely to occur at residential locations surrounding the Newstan Colliery.

6.3 Operational Vibration Assessment

6.3.1 Typical Equipment Vibration Levels

Typical vibration levels for the major vibration generating equipment use at the site are contained in **Table 22**.

Table 22 Typical Equipment Vibration Levels

Equipment	Peak Particle Velocity (PPV) at 10 m
Dozer	3 mm/s
Trucks (various)	<0.1 mm/s
Excavator digging	0.2 mm/s

6.3.2 Predicted Operational Vibration Levels

The main vibration generating activities at the Newstan Colliery will include the operation of mobile equipment such as the dozer, loader and trucks. Given the separation distance between mining operations and the nearest potentially affected residential locations vibration levels from these activities is predicted to be negligible and below levels for human perception at the nearest residential locations.

7 CONCLUSION

SLR Consulting has undertaken a Noise Impact Assessment for the Newstan Colliery located in Fassifern on the western side of Lake Macquarie, New South Wales.

Broadly, the objective of the noise assessment was to identify the potential impacts of noise from operation of the facility and to provide advice with regard to effective mitigation strategies where necessary.

Results presented in **Table 19** indicate that operational noise levels are predicted to meet the project specific noise criteria at all residential locations considered in the assessment with the exception of residential location **NC3**. Predictions were made for calm and prevailing weather conditions with the mitigation measures identified in **Section 6.1.2** in place. A **2dBA** exceedance of the project specific noise criteria under temperature inversion (with the additional mitigation measures in place) is predicted at residential location **NC3**.

Since the operational scenario modelled is likely to represent an acoustically worst-case scenario, actual operational noise levels from the project are likely to be less than those predicted.

In addition, L_{Amax} noise levels are predicted to meet the recommended sleep disturbance noise goal.

Operational vibration levels are predicted to meet the recommended project specific vibration goals.

Further mitigation measures other than those outlined in **Section 2.4** are considered to be required in relation to this project and are outlined in **Section 6.1.2**. In addition, a real time real time noise monitor will be installed on site to determine when noise criteria are approaching the noise limits. If noise from the site is approaching the noise criteria, Centennial will implement operational management measures to ensure the noise criteria is not exceeded.

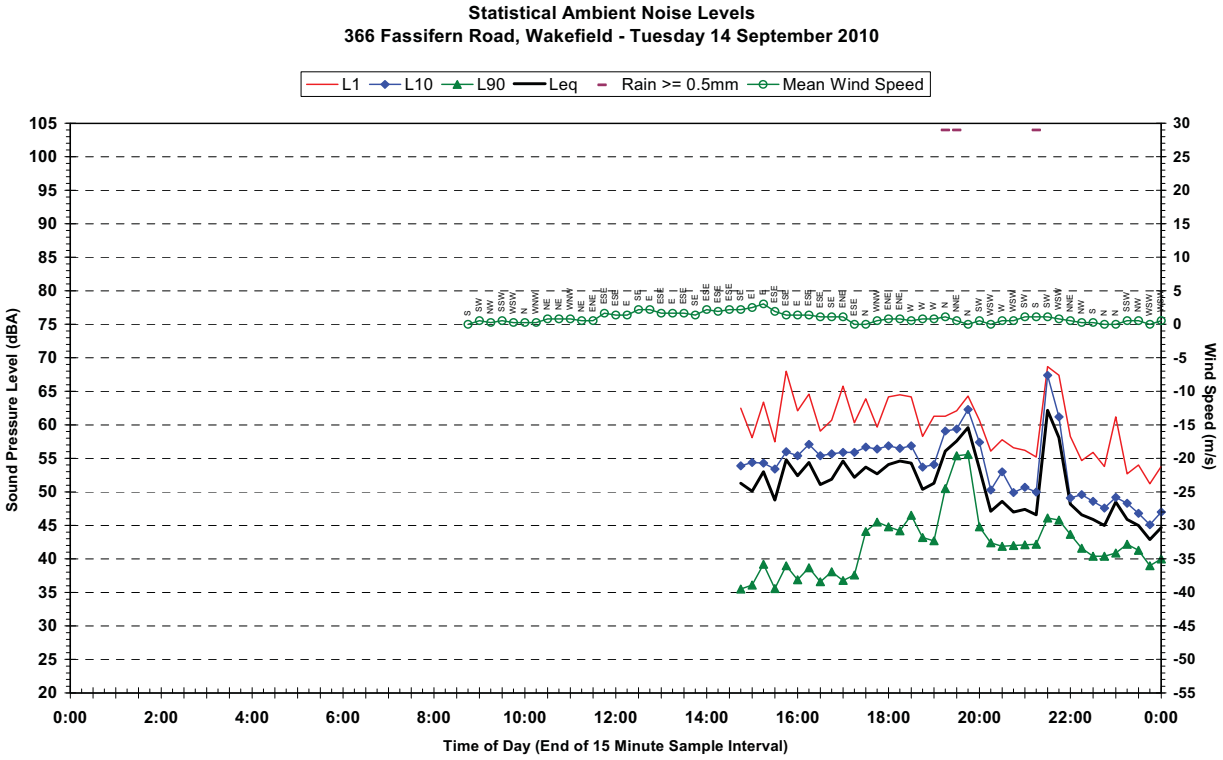
8 CLOSURE

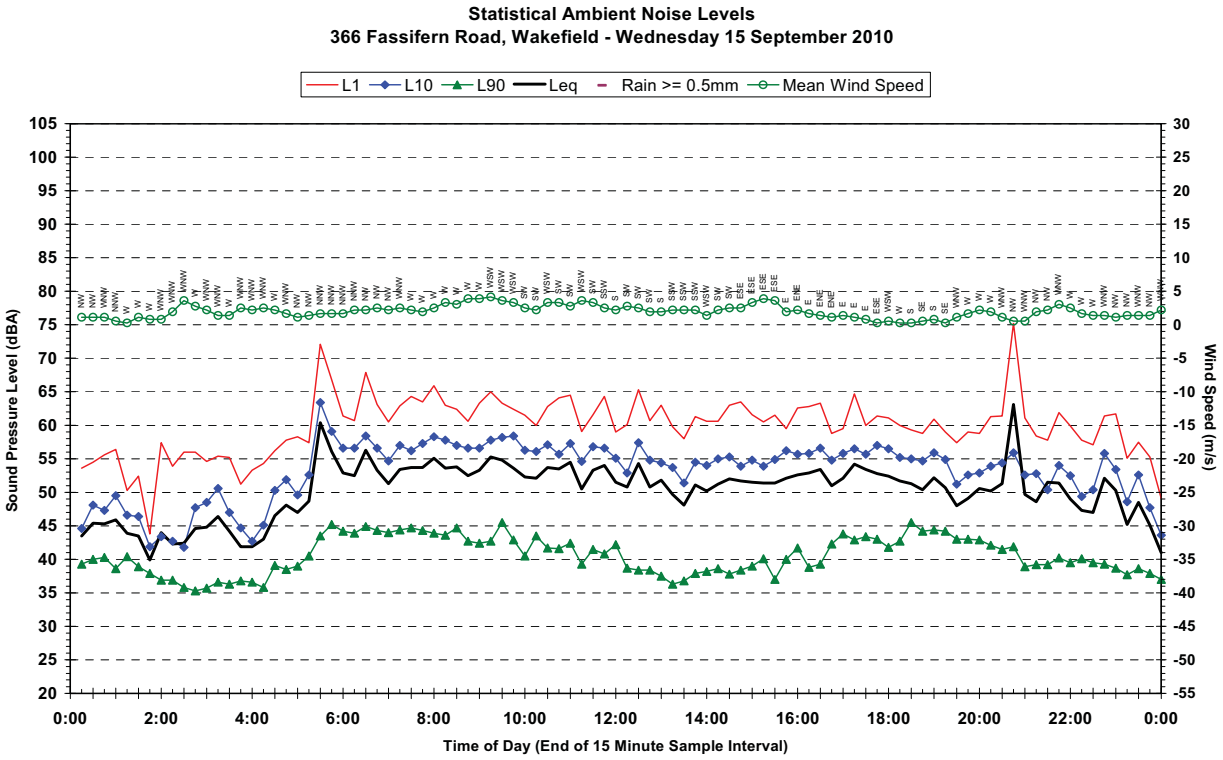
This report has been prepared by SLR Consulting Australia Pty Ltd with all reasonable skill, care and diligence, and taking account of the manpower and resources devoted to it by agreement with the client. Information reported herein is based on the interpretation of data collected and has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of Centennial Coal Company Limited. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR Consulting.

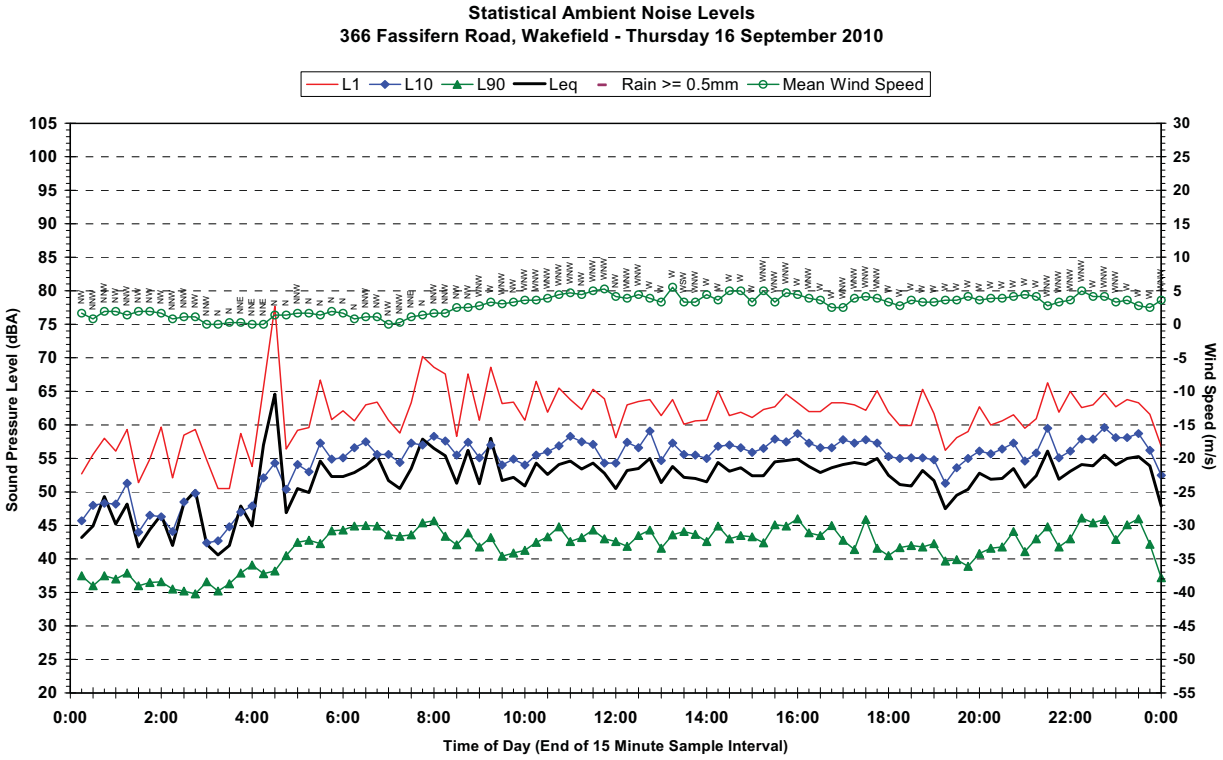
SLR Consulting disclaims any responsibility to the client and others in respect of any matters outside the agreed scope of the work.

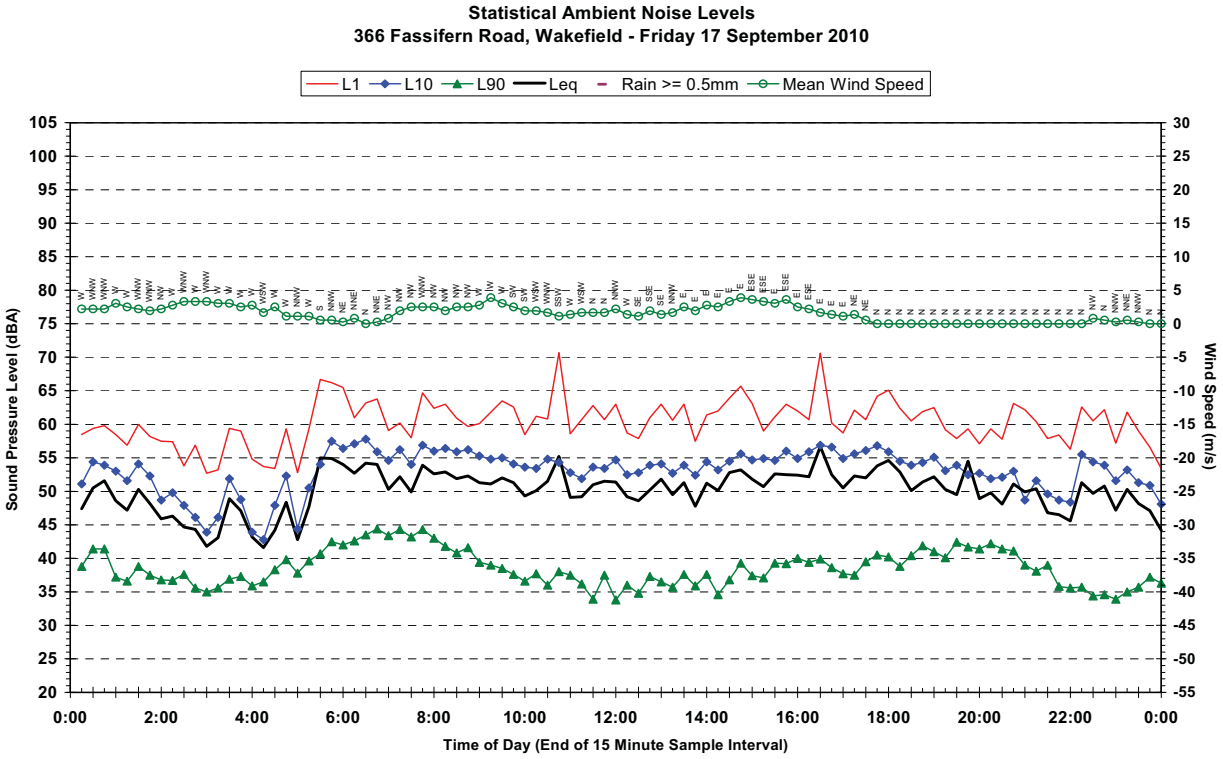
Statistical Ambient Noise Levels - 366 Fassifern Road, Wakefield



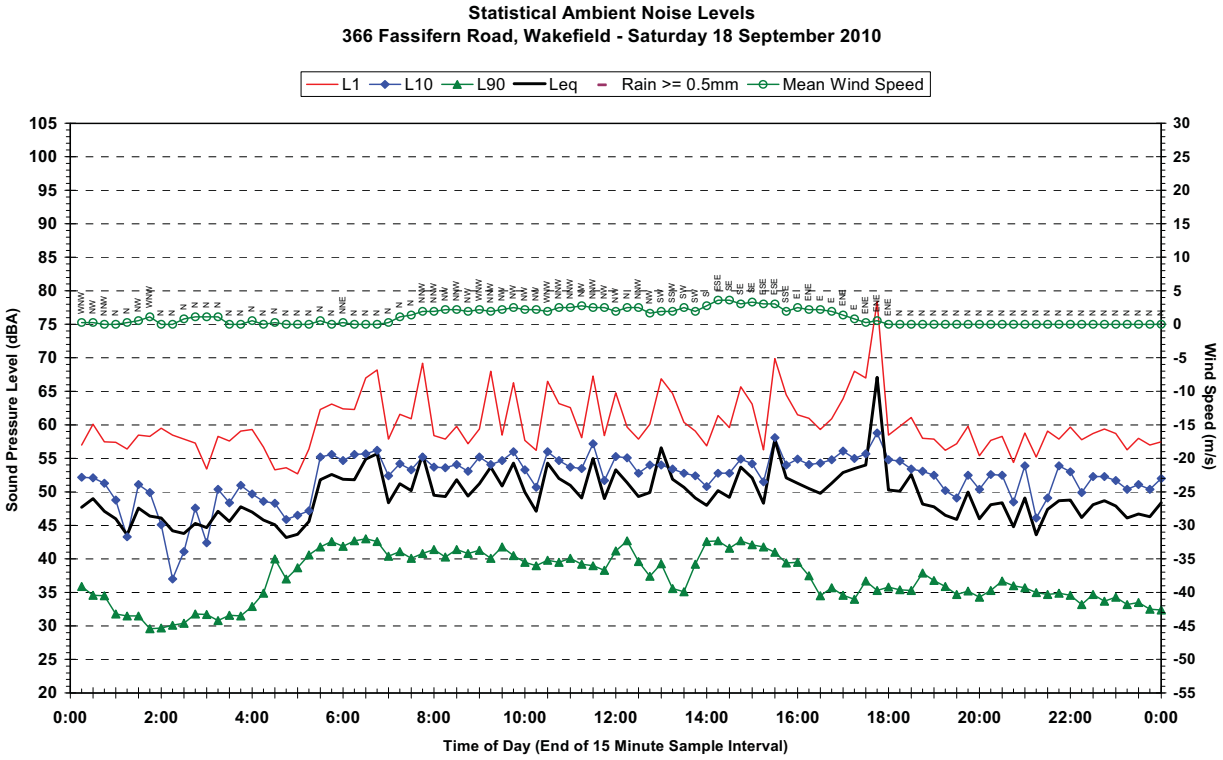


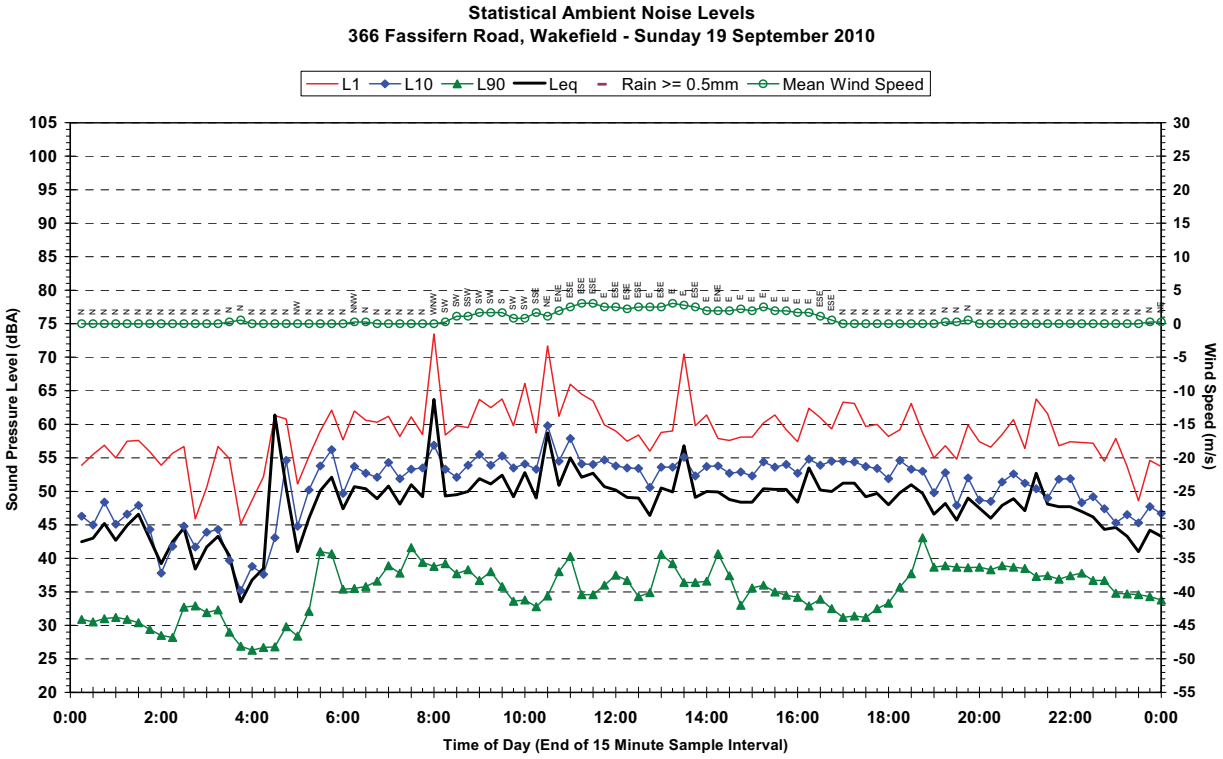
Statistical Ambient Noise Levels - 366 Fassifern Road, Wakefield



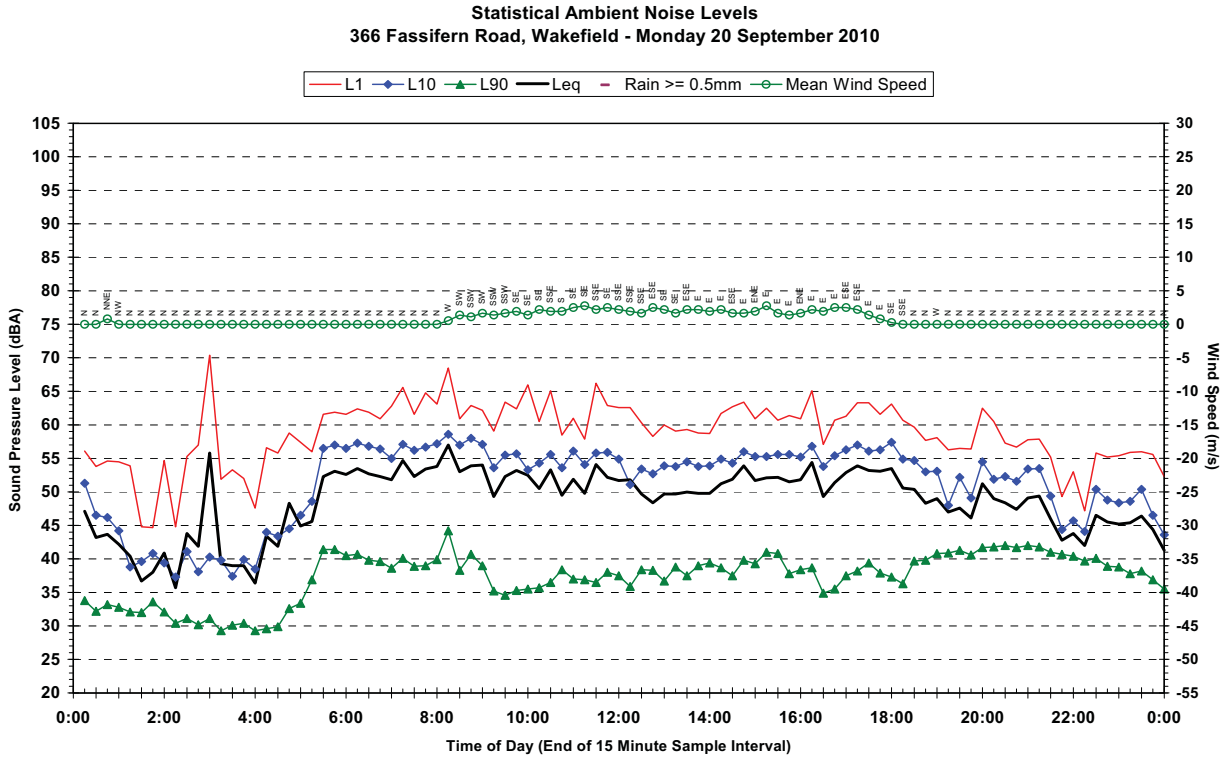


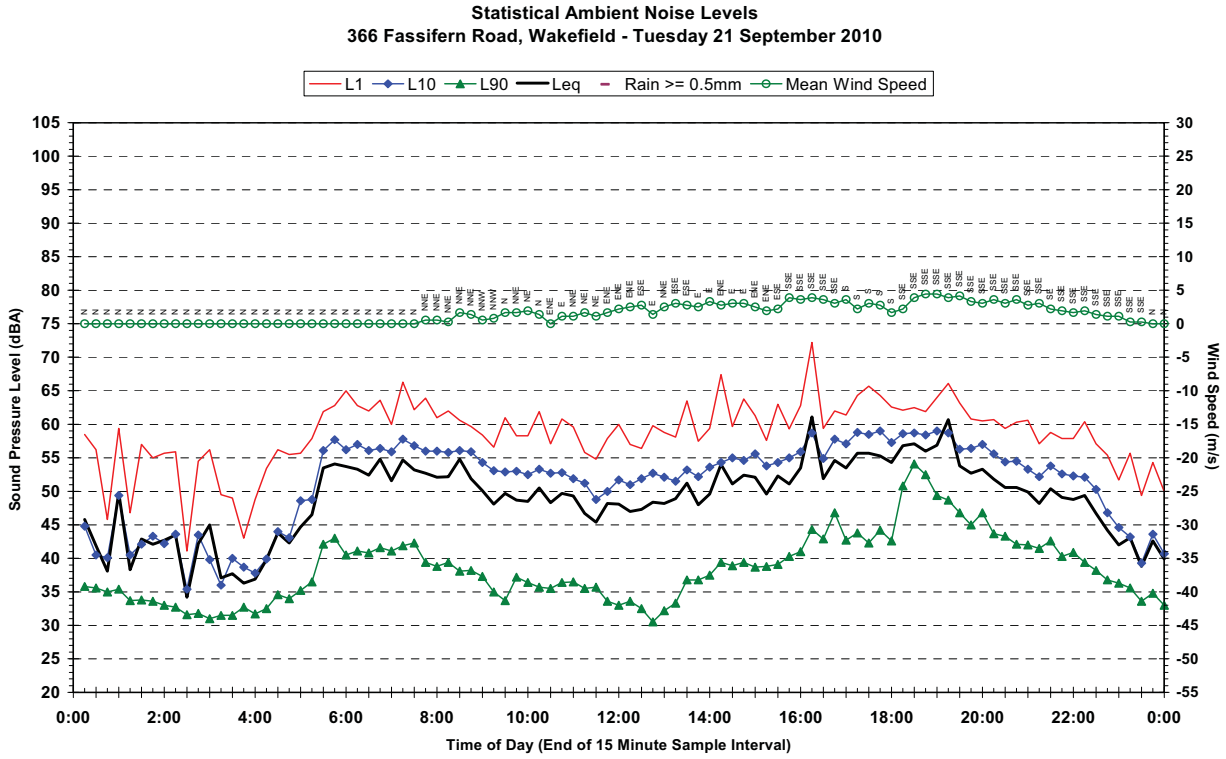
Statistical Ambient Noise Levels - 366 Fassifern Road, Wakefield





Statistical Ambient Noise Levels - 366 Fassifern Road, Wakefield





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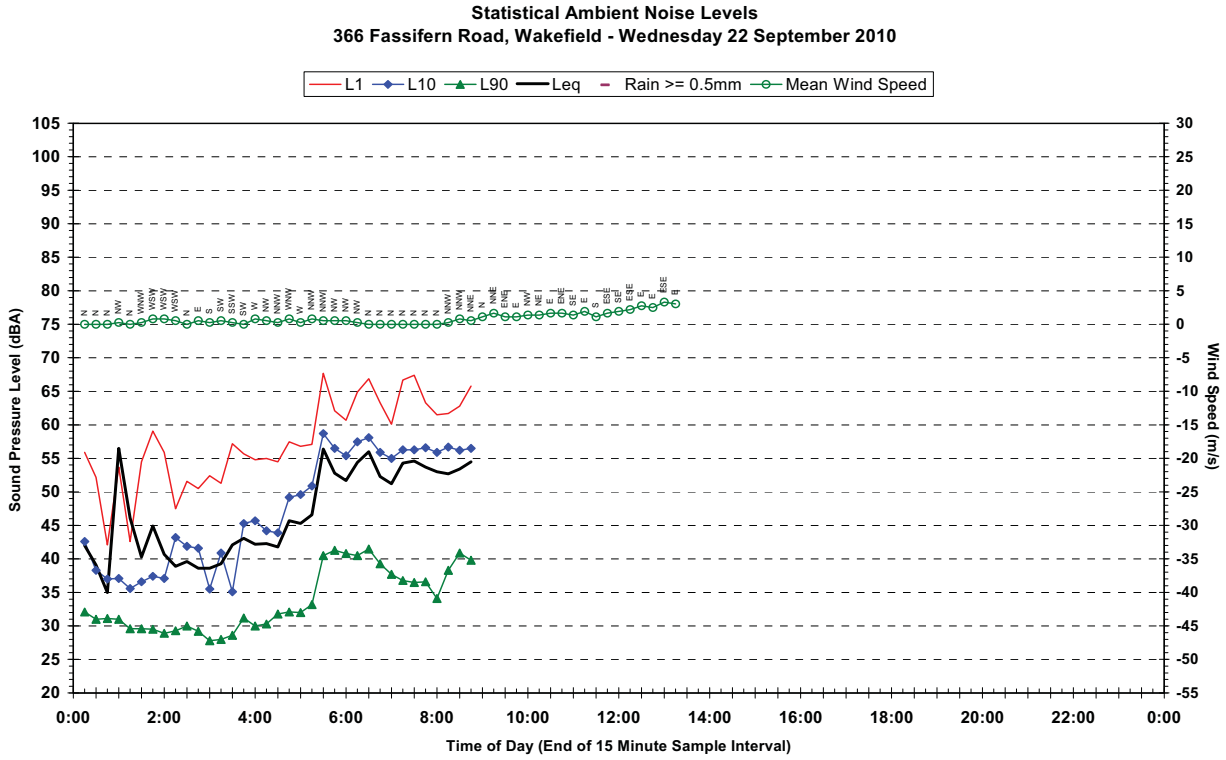
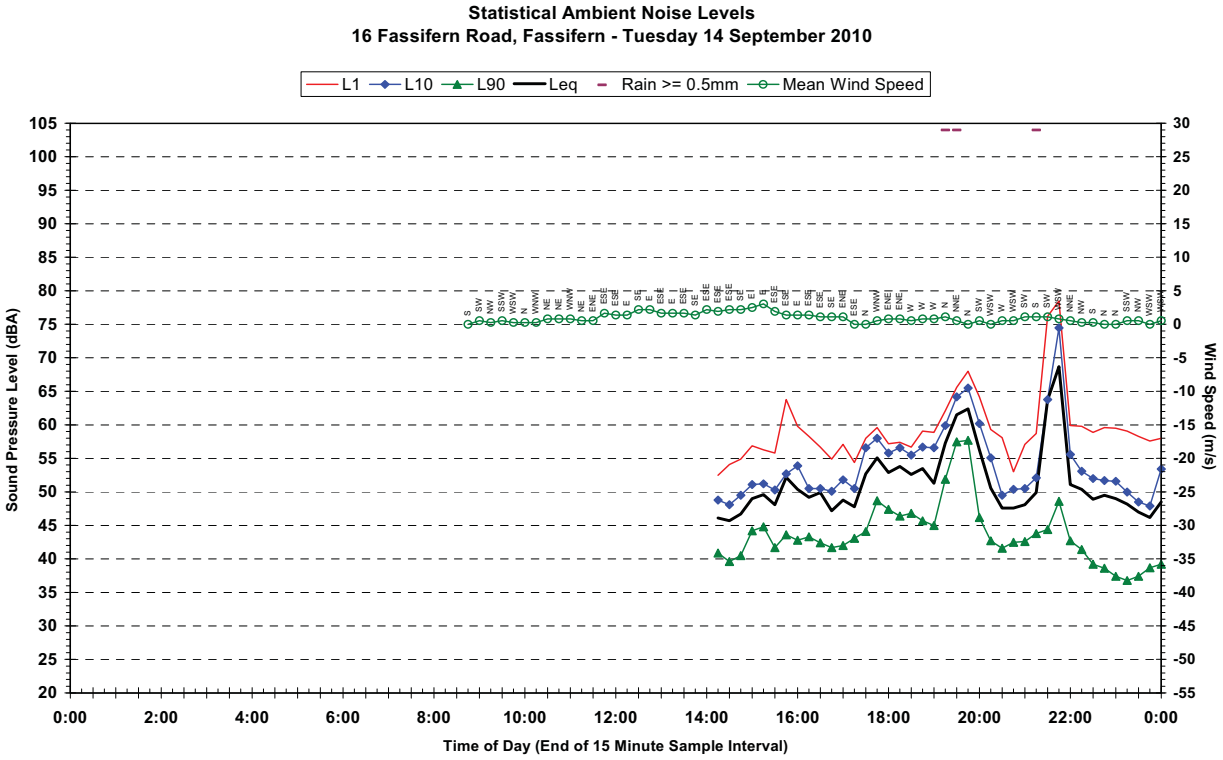
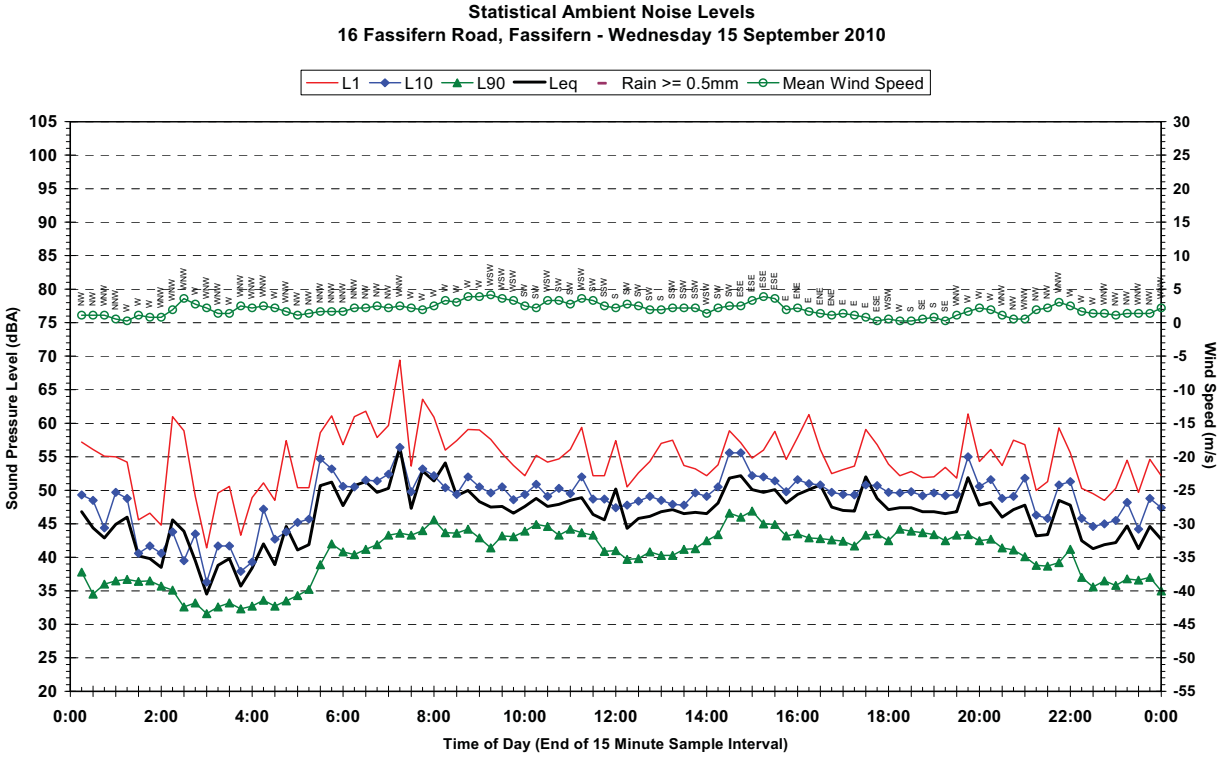
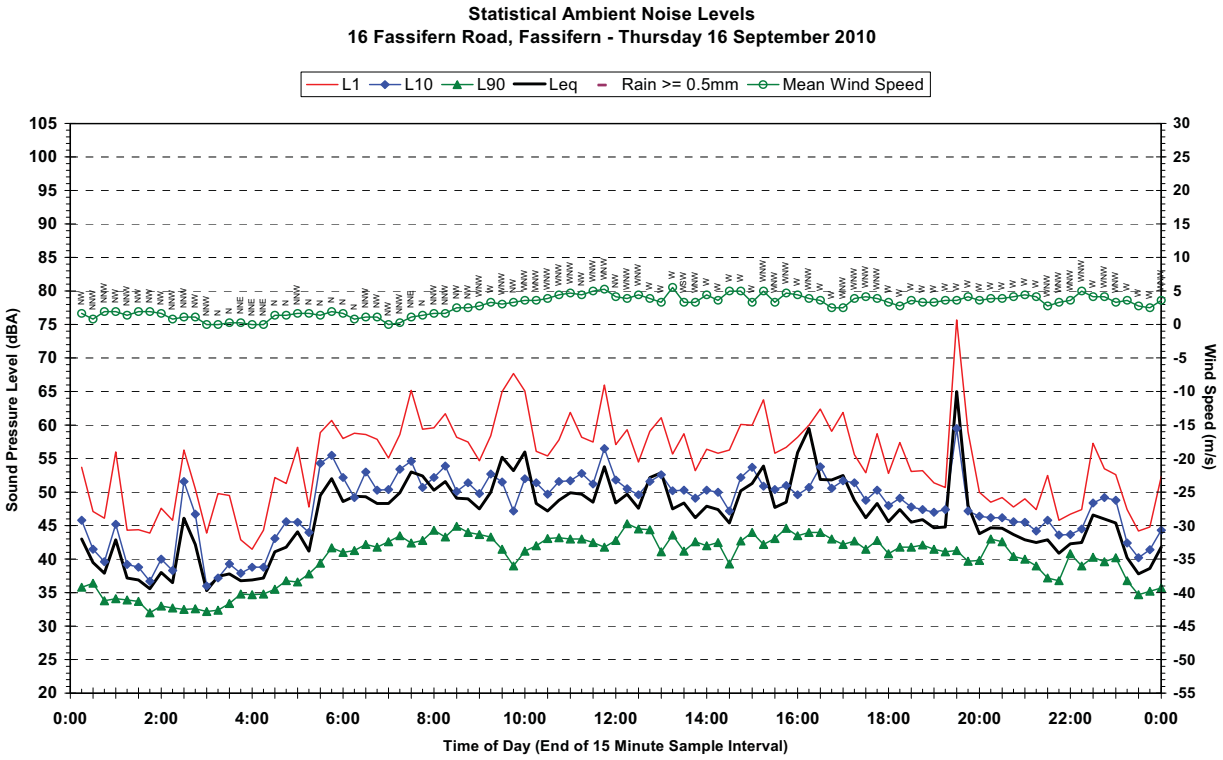


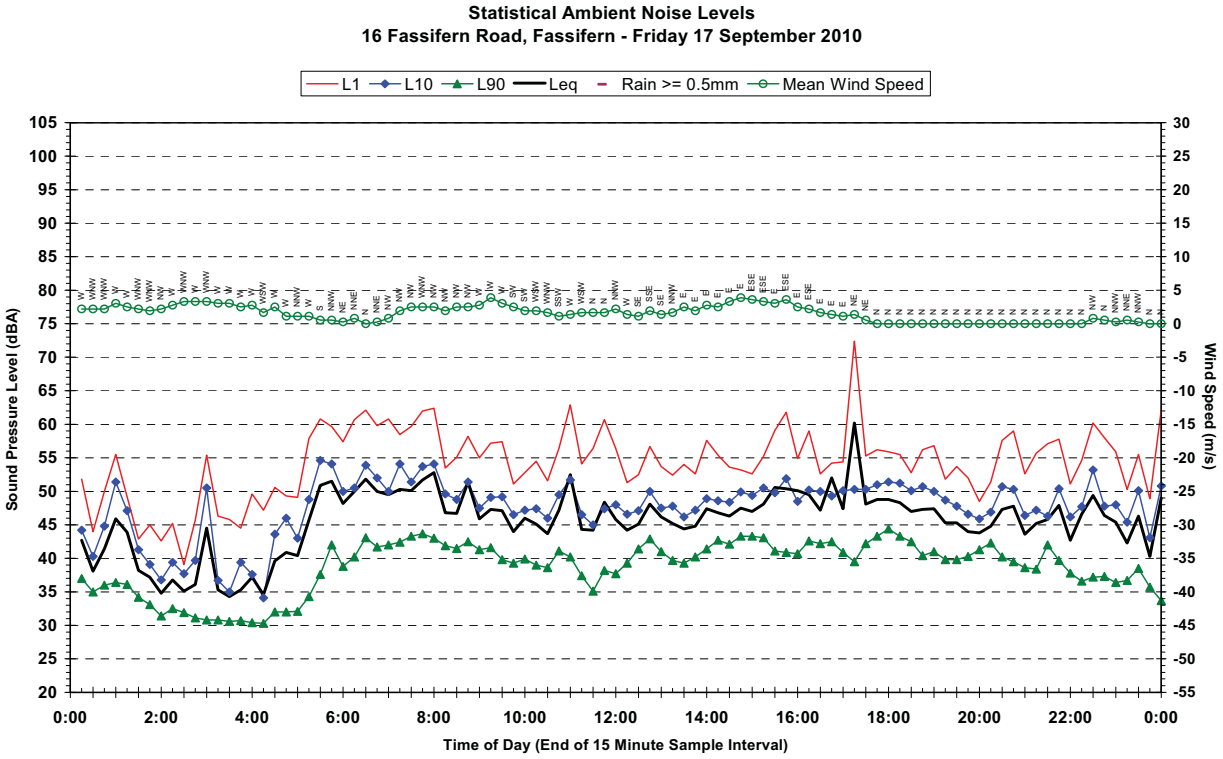
Statistical Ambient Noise Levels - 16 Fassifern Road, Fassifern



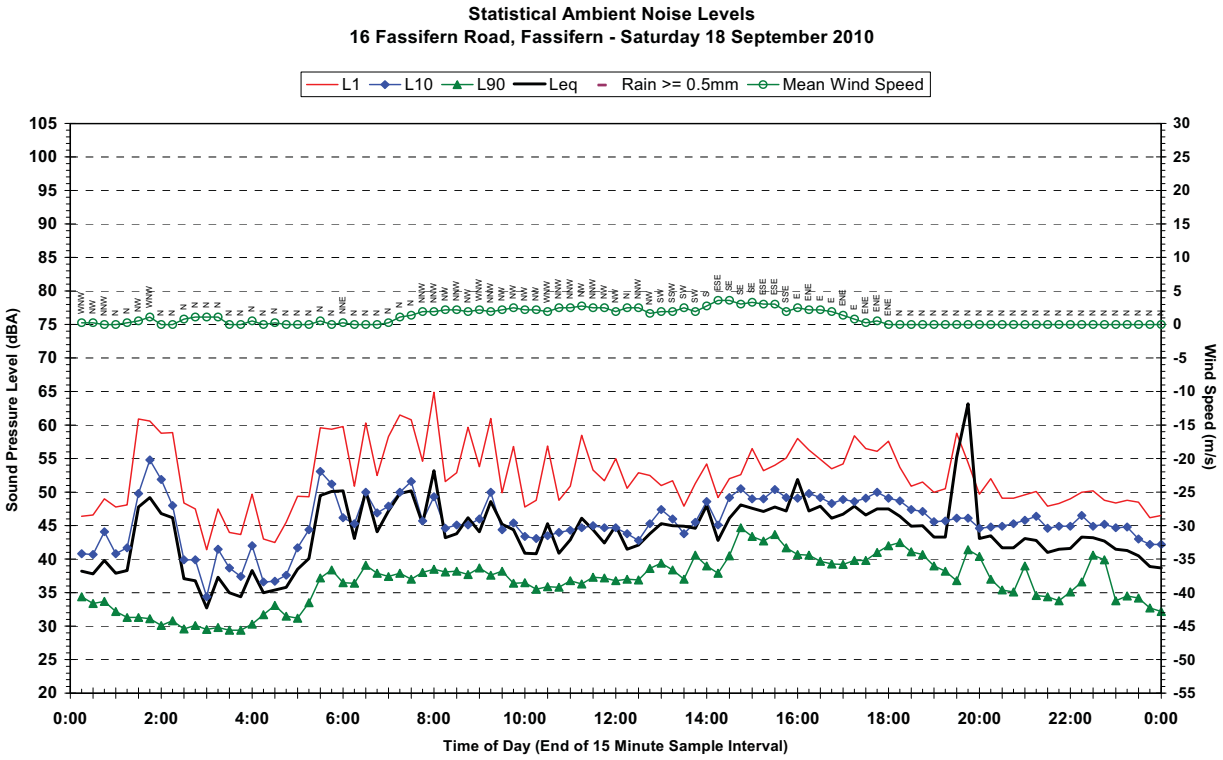


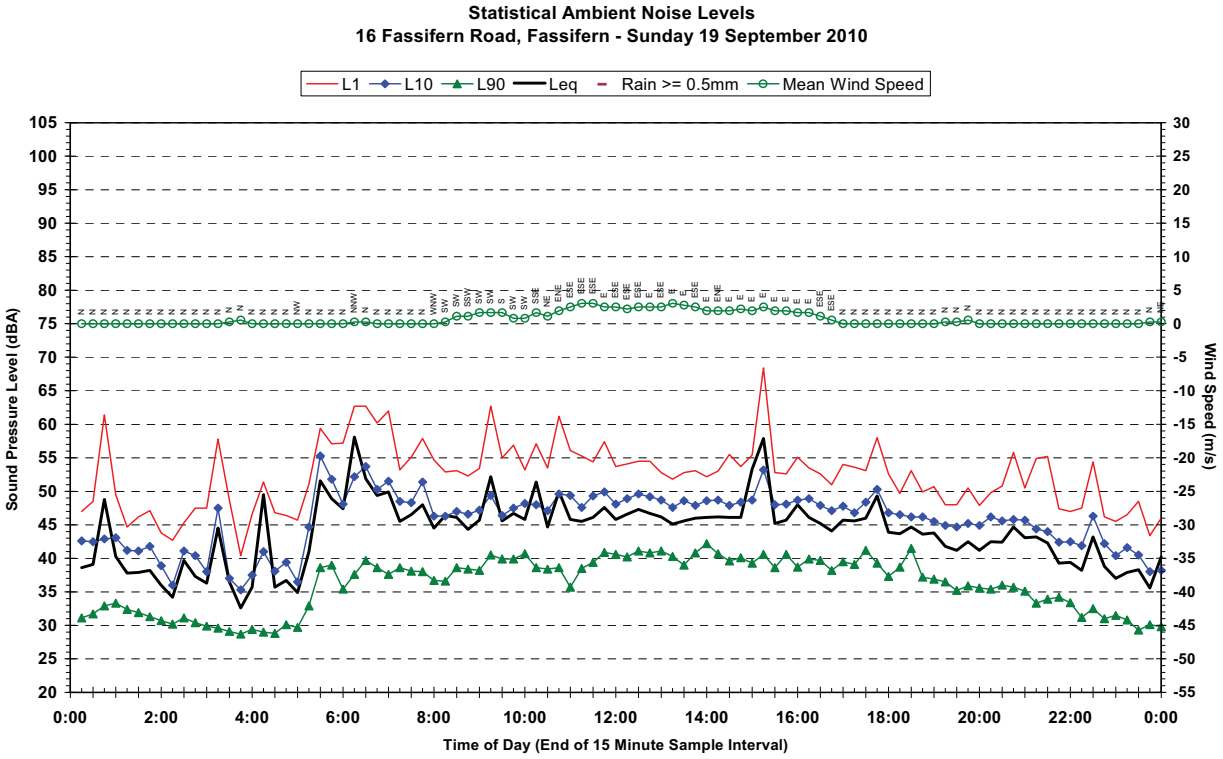
Statistical Ambient Noise Levels - 16 Fassifern Road, Fassifern



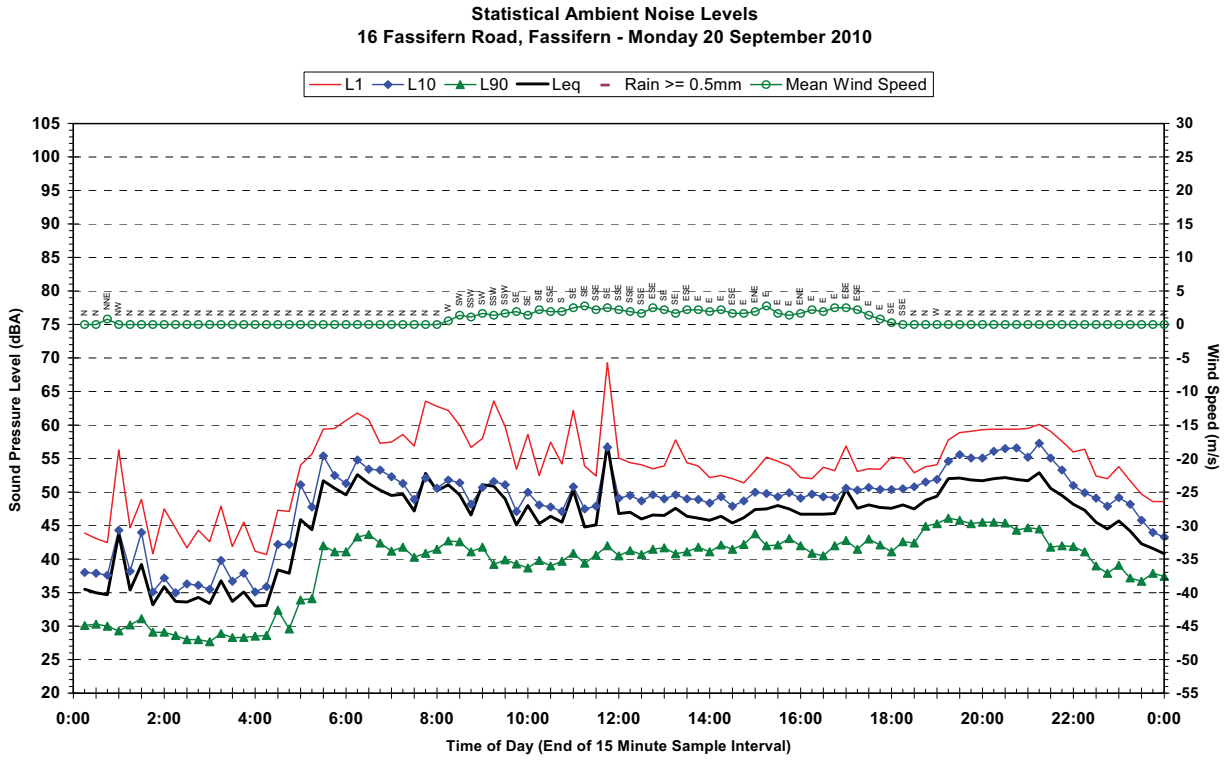


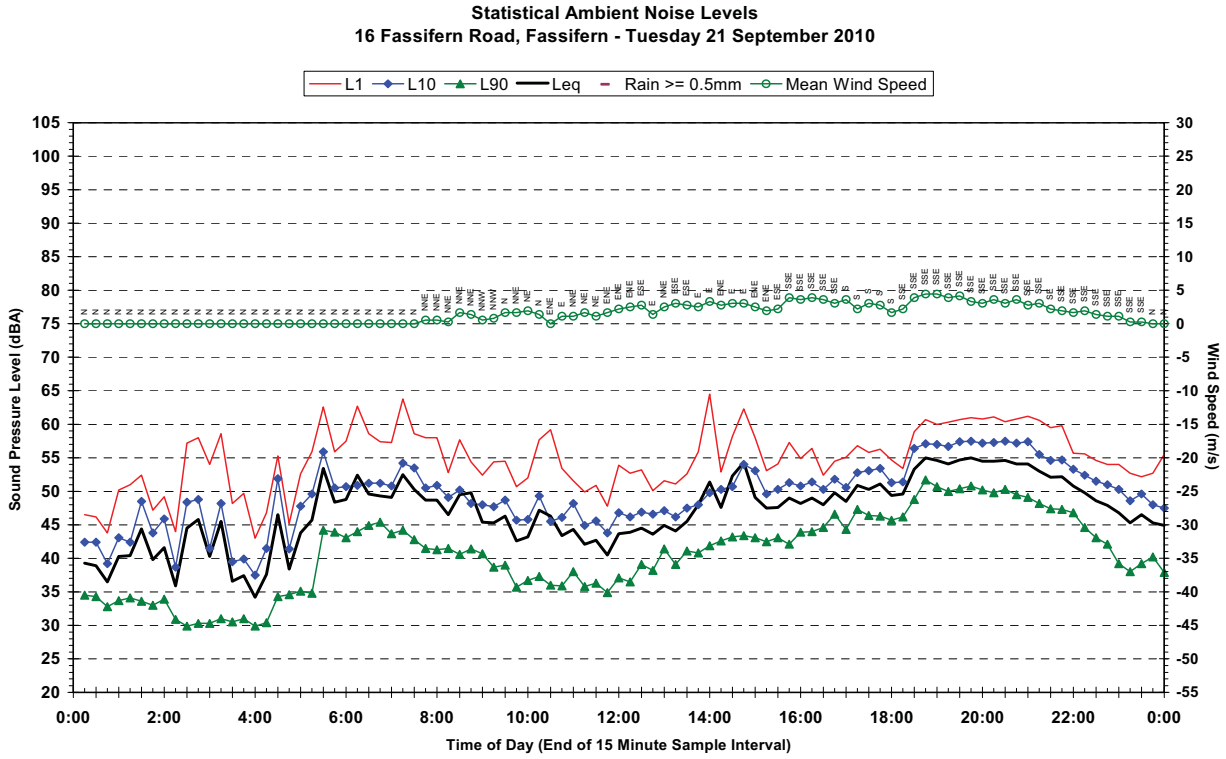
Statistical Ambient Noise Levels - 16 Fassifern Road, Fassifern



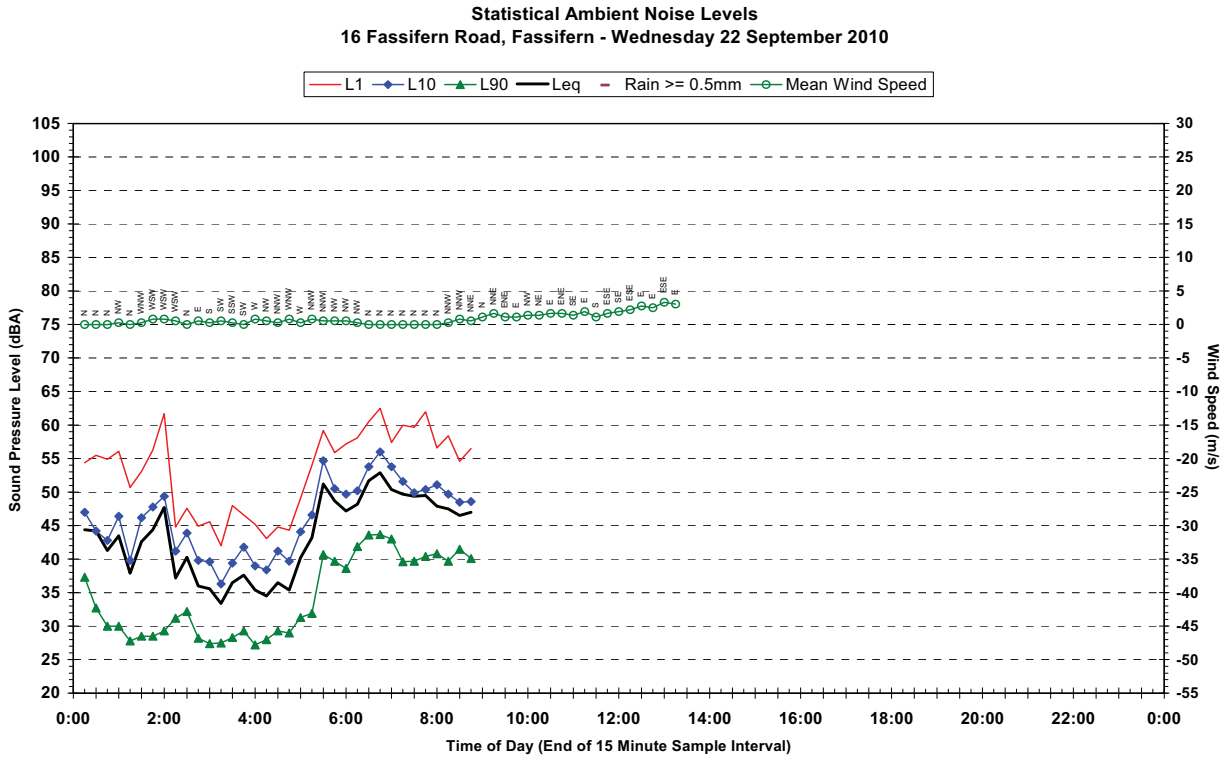


Statistical Ambient Noise Levels - 16 Fassifern Road, Fassifern



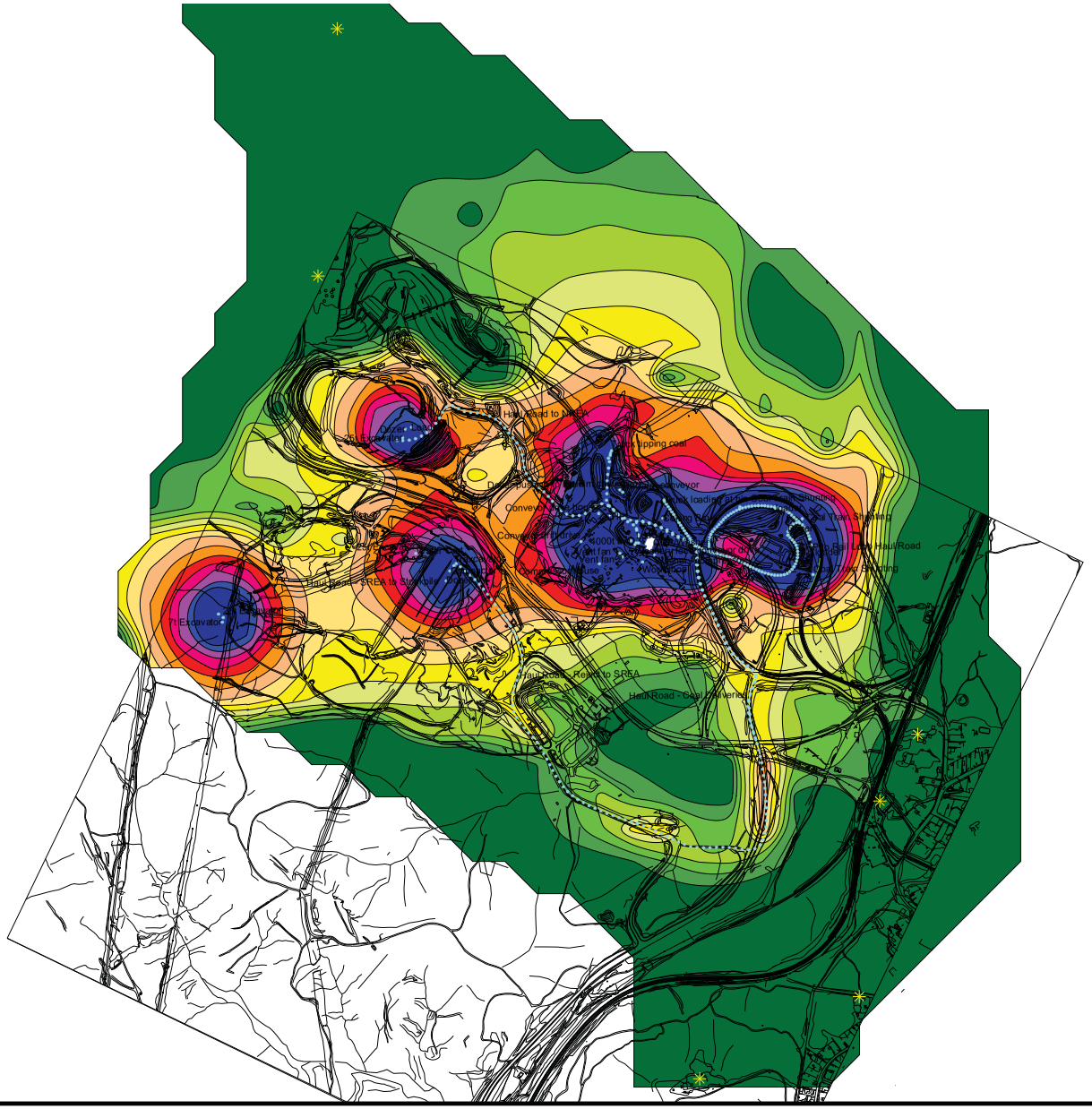


Statistical Ambient Noise Levels - 16 Fassifern Road, Fassifern



Appendix C - Morning Shoulder 6am -7am Calm Weather Conditions with Mitigation

Map 1 - LAeq dBA (15minute) - 1.5m above ground level - Existing Operation



Noise levels dB(A)

	< 35
35 <=	< 37
37 <=	< 39
39 <=	< 41
41 <=	< 43
43 <=	< 45
45 <=	< 47
47 <=	< 49
49 <=	< 51
51 <=	< 53
53 <=	< 55
55 <=	< 57
57 <=	< 59
59 <=	

Signs and symbols

- Point source
- Industrial building
- Point receiver
- Wall

N

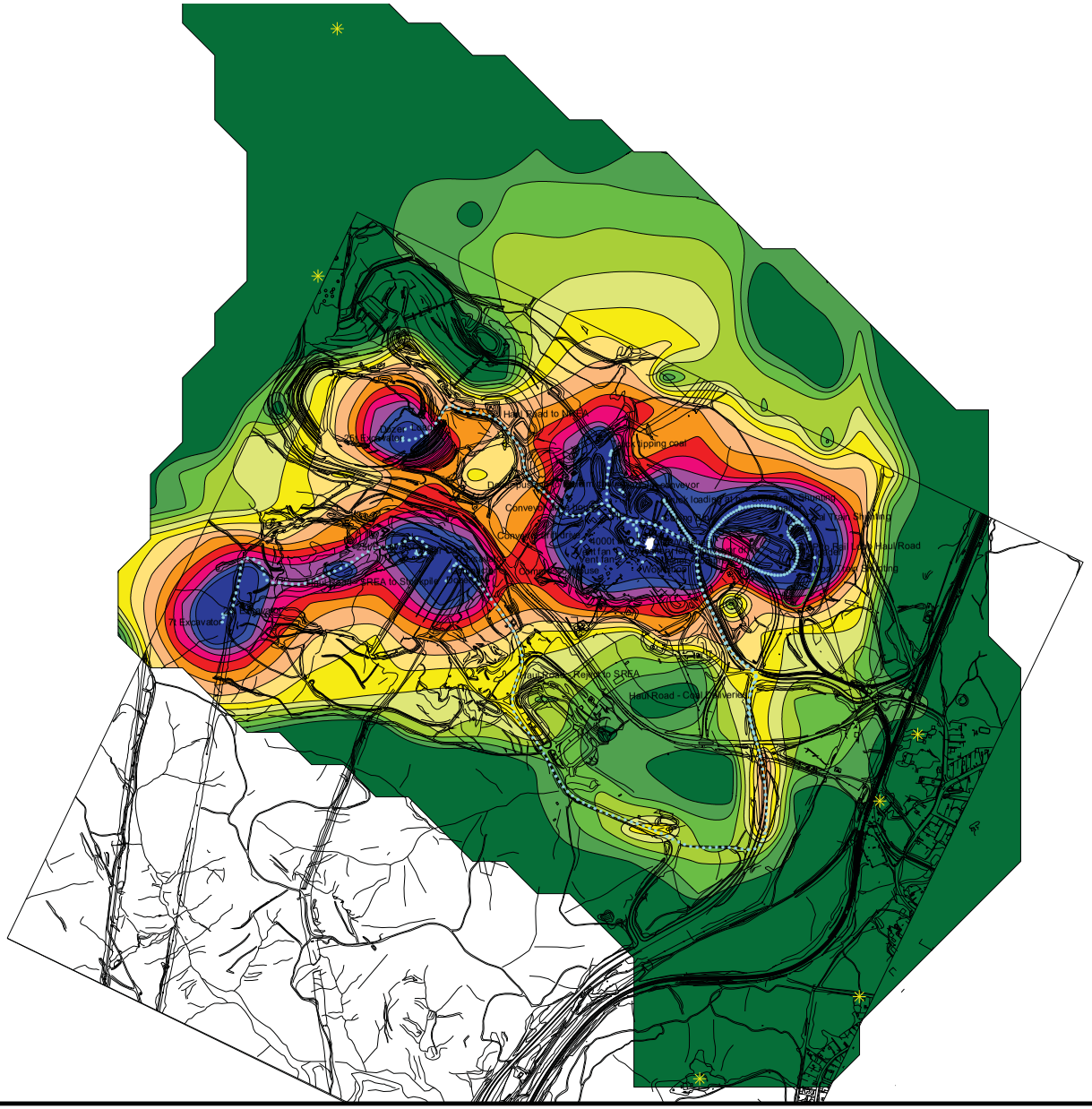
Length Scale 1:21000

0 100 200 400 600 800 m

SLR

Appendix C - Day Time 7am -6pm Calm Weather Conditions with Mitigation

Map 2 - LAeq dBA (15minute) - 1.5m above ground level - Existing Operation



Noise levels dB(A)

	< 35
35 <=	< 37
37 <=	< 39
39 <=	< 41
41 <=	< 43
43 <=	< 45
45 <=	< 47
47 <=	< 49
49 <=	< 51
51 <=	< 53
53 <=	< 55
55 <=	< 57
57 <=	< 59
59 <=	

Signs and symbols

- Point source
- Industrial building
- Point receiver
- Wall

N

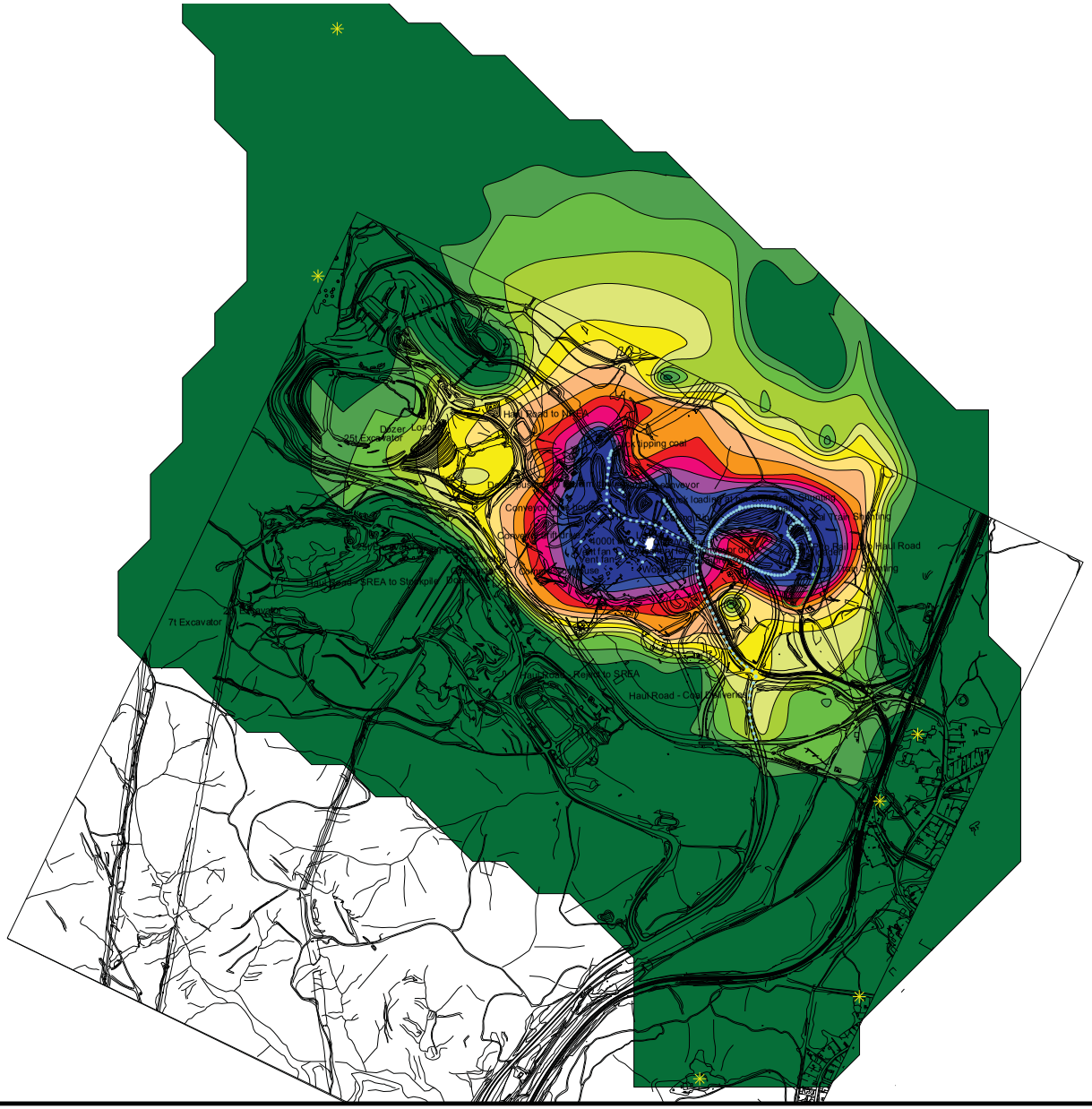
Length Scale 1:21000

0 100 200 400 600 800 m

SLR

Appendix C - Evening 6pm -10pm & Night 10pm - 6am Calm Weather Conditions with Mitigation

Map 3 - LAeq dBA (15minute) - 1.5m above ground level - Existing Operation



Noise levels dB(A)

	< 35
35 <=	< 37
37 <=	< 39
39 <=	< 41
41 <=	< 43
43 <=	< 45
45 <=	< 47
47 <=	< 49
49 <=	< 51
51 <=	< 53
53 <=	< 55
55 <=	< 57
57 <=	< 59
59 <=	

Signs and symbols

- Point source
- Industrial building
- Point receiver
- Wall

N

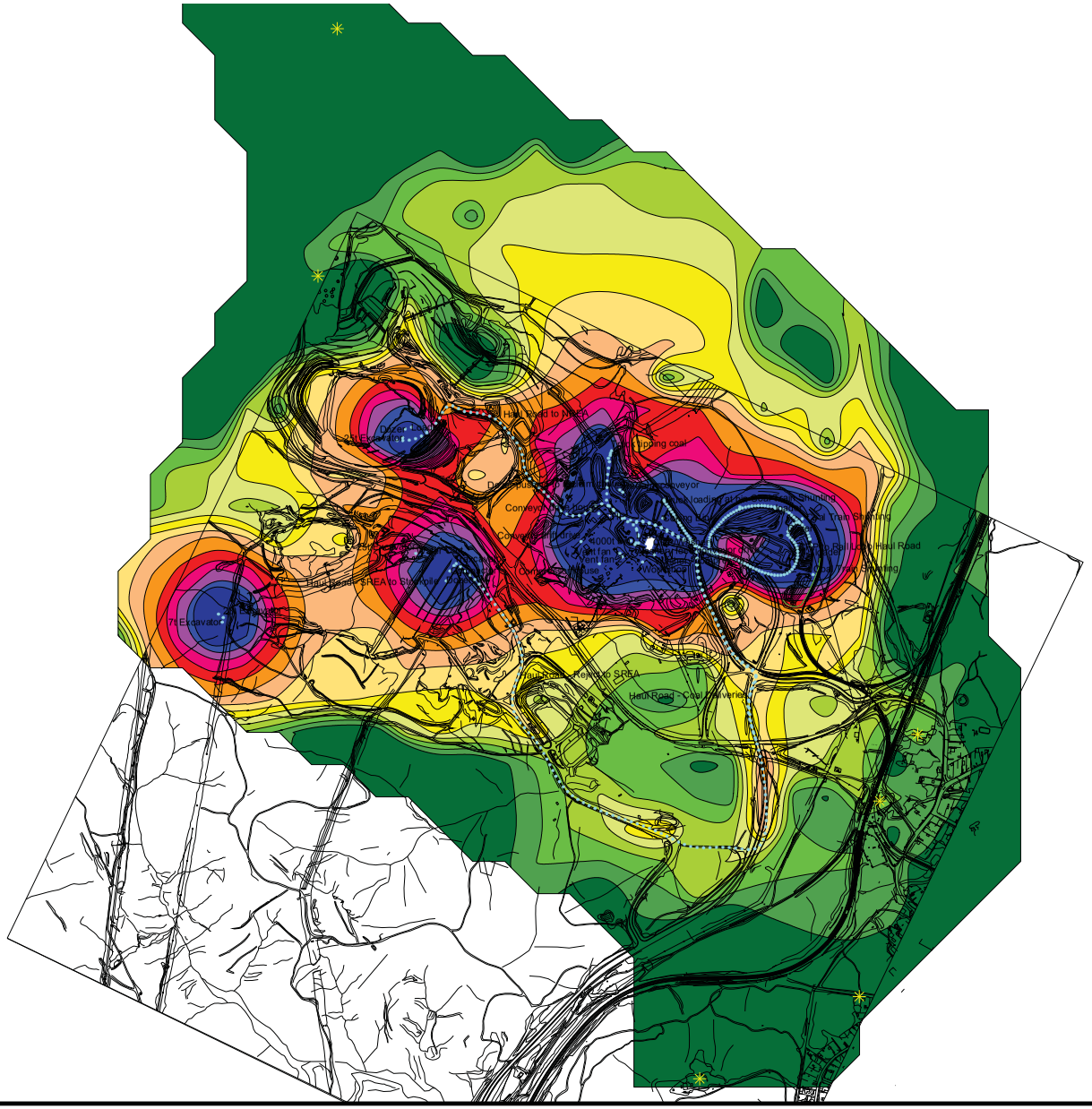
Length Scale 1:21000

0 100 200 400 600 800 m

SLR

Appendix C - Morning Shoulder 6am - 7am Temperature Inversion Weather Conditions with Mitigation

Map 4 - LAeq dBA (15minute) - 1.5m above ground level - Existing Operation



Noise levels dB(A)

	< 35
35 <=	< 37
37 <=	< 39
39 <=	< 41
41 <=	< 43
43 <=	< 45
45 <=	< 47
47 <=	< 49
49 <=	< 51
51 <=	< 53
53 <=	< 55
55 <=	< 57
57 <=	< 59
59 <=	

Signs and symbols

- Point source
- Industrial building
- Point receiver
- Wall

N

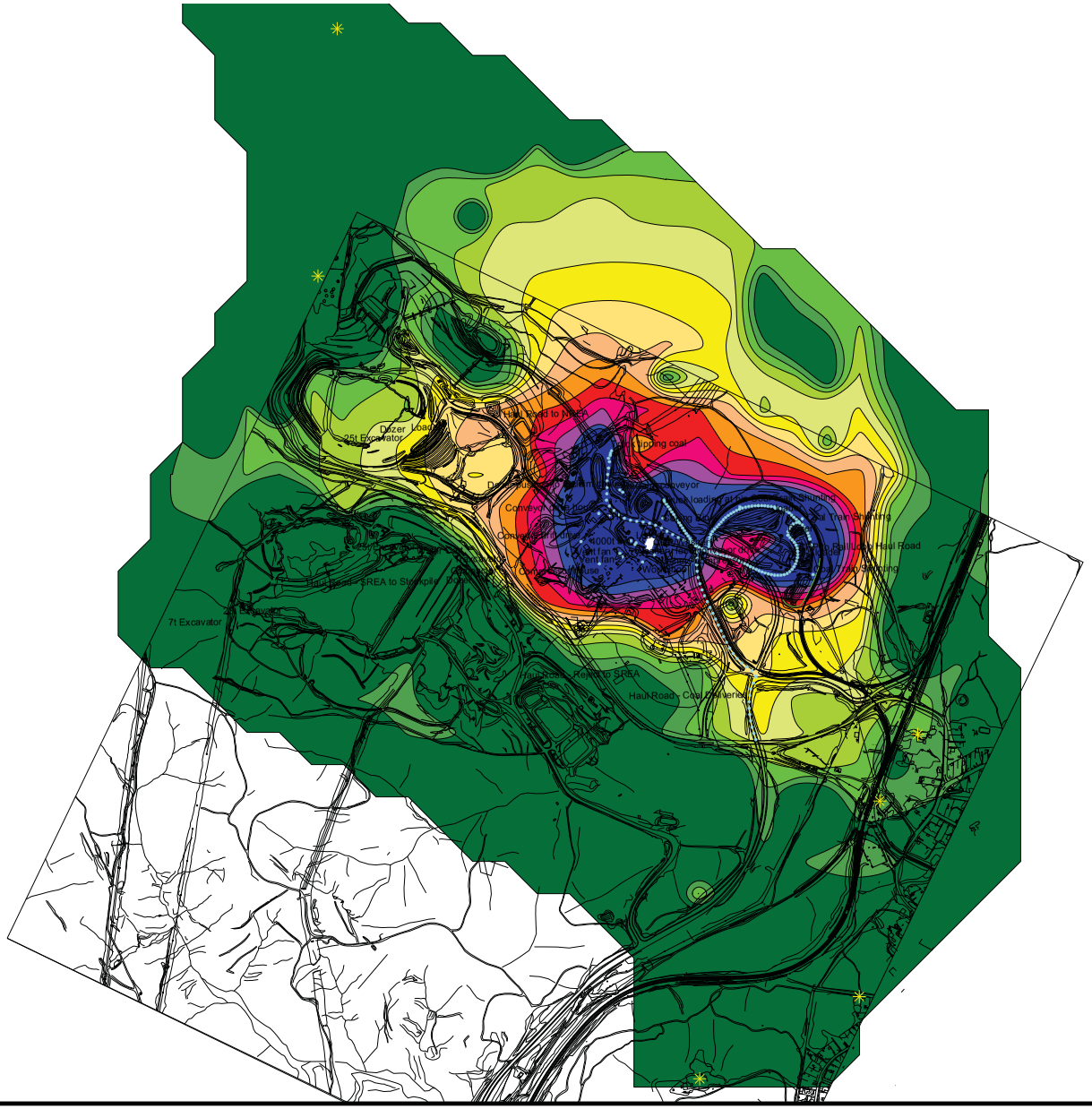
Length Scale 1:21000

0 100 200 400 600 800 m

SLR

Appendix C - Night-time 10pm - 6am Temperature Inversion Weather Conditions with Mitigation

Map 5 - LAeq dBA (15minute) - 1.5m above ground level - Existing Operation



Noise levels dB(A)

	< 35
35 <=	< 37
37 <=	< 39
39 <=	< 41
41 <=	< 43
43 <=	< 45
45 <=	< 47
47 <=	< 49
49 <=	< 51
51 <=	< 53
53 <=	< 55
55 <=	< 57
57 <=	< 59
59 <=	

Signs and symbols

- Point source
- Industrial building
- Point receiver
- Wall

N

Length Scale 1:21000

0 100 200 400 600 800 m

SLR