ENVIRONMENTAL ASSESSMENT

Duralie Extension Project

APPENDIX C
NOISE AND BLASTING IMPACT ASSESSMENT

GLOUCESTER COAL

ResourceStrategies

HEGGIES
AUSTRALIA

REPORT 10-6173-R2

Revision 0

Appendix C
Duralie Extension Project
Noise and Blasting Impact Assessment

PREPARED FOR

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25 JANUARY 2010

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Duralie Extension Project

Noise and Blasting Impact Assessment

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DOCUMENT CONTROL

Reference	Status	Date	Prepared	Checked	Authorised
10-6173-R2	Revision 0	25 January 2010	Glenn Thomas	Mark Blake	Glenn Thomas

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C1 INTRODUCTION

C1.1 Assessment Requirements

Duralie Coal Pty Ltd (DCPL), a wholly owned subsidiary of Gloucester Coal Ltd (GCL), owns and operates the Duralie Coal Mine (DCM). Coal production commenced at the DCM in 2003 using conventional open pit mining methods. DCM run-of-mine ROM coal is loaded and railed to the Stratford Coal Mine (SCM) for washing. Blended product coal from the SCM is transported by rail to Newcastle. The DCM is located approximately 10 kilometres (km) north of the village of Stroud and approximately 20 km south of Stratford in the Gloucester Valley in New South Wales (NSW).

DCPL seeks approval to extend existing mining operations into additional open pit working areas with associated increased production of ROM coal up to approximately 3 million tonnes per annum (Mtpa) including the use of some additional mining equipment and increased coal rail transport (herein referred to as the Duralie Extension Project [the Project]). The Project would include the extension of the existing approved open pit in the Weismantel seam (Weismantel Extension open pit) and open pit mining operations in the Clareval seam (Clareval North West open pit). Heggies Pty Ltd (Heggies) has been engaged by DCPL to evaluate and assess the potential noise and blasting impacts associated with the Project.

The assessment has been prepared in accordance with the NSW Department of Planning (DoP) Director-General's Environmental Assessment Requirements (EARs) dated 5 November 2009 in relation to noise and blasting impacts. The relevant EARs for noise and blasting are reproduced below:

> • ***Noise & Blasting*** *- including the operational noise on-site and the potential off-site road and rail noise;*

In accordance with the EARs and the NSW Department of Environment, Climate Change and Water (DECCW) policy, the major sources of noise emissions may be grouped as follows:

On-site Intrusive Construction Noise

Project construction works including auxiliary dam embankment raising, development of new haul and internal roads and some infrastructure upgrades would be generally carried-out during the daytime through-out the Project life as required.

In accordance with the DECCW (2009) interim policy *Interim Construction Noise Guideline* (ICNG) mine construction activities are generally considered to be integral to mining operations. Therefore the construction works associated with Auxiliary Dam No.2 embankment lift have been modelled as a component of Project daytime operational activities in Year 3[1].

On-site Intrusive Noise Assessment

Three Project operational scenarios were selected for modelling of potential noise emissions. Project operations in Year 3 were assessed to simulate operations in the northern portion of the Weismantel Extension open pit (and also daytime Auxiliary Dam No. 2 construction activities). Year 5 was modelled to coincide with peak on-site mobile equipment and coal production, while Year 8 was assessed to coincide with operations in the northern portion of the Clareval North West open pit.

1 The first stage of the embankment lift of Auxiliary Dam No. 2 is scheduled to occur during Year 1 of the Project. However, construction activities have conservatively been included in the Year 3 model to simulate possible future lifts up to the dam's maximum height.

In all cases, train movements at the DCM rail spur were included in the assessment of on-site operating noise. An assessment of (construction and) mine operating noise impacts has been undertaken in accordance the *NSW Industrial Noise Policy* (INP) (NSW Environment Protection Authority [EPA], 2000) (and the associated INP Application Notes) (EPA, 2008) which provides non-mandatory procedures for setting acceptable $L_{Aeq(15minute)}$ intrusive (and $L_{Aeq[period]}$) amenity noise levels for various receiver areas and guidelines for assessing noise impacts from on-site (stationary) noise sources.

Cumulative Industrial Noise Amenity

The INP (EPA, 2000) also provides non-mandatory cumulative noise assessment guidelines that address existing and successive industrial development by setting acceptable (and maximum) cumulative $L_{Aeq(period)}$ amenity levels for all industrial (i.e. non-transport related) noise in a receiver area. Note, the INP does not set acceptable cumulative $L_{Aeq(15minute)}$ intrusive criteria for all industrial noise sources in a receiver area, but rather seeks to control cumulative noise via its amenity criteria (EPA, 2000).

The SCM is located approximately 20 km north of the DCM. The Project is the only significant industrial development located between the village of Stroud (approximately 10 km south of the DCM) and Wards River (approximately 5 km north of the DCM) and therefore the potential for cumulative industrial noise impacts is negligible and does not warrant any further consideration in this assessment.

On-site Open Pit Blasting

DCM blast design parameters and management practices remain generally unchanged by the Project. The Project would increase the blast frequency to three blasts per week on average over a year, however the actual number of blasts in any week would be dependent on mine production

The DECCW's *Assessing Vibration: A Technical Guideline* dated February 2006 does not address blast-induced effects, rather it focuses on vibration from other sources (e.g. construction piling activities). However, Australian Standard (AS) 2187.2 - 2006 *Explosives - Storage and use Part 2: Use of Explosives - Appendix J* does provide guidance on relevant procedures for assessing the blast-induced noise and vibration effects on buildings and their occupants.

The DECCW currently adopts the Australia and New Zealand Environment Council Committee (ANZECC) *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* dated September 1990 for assessing potential annoyance from blast emissions during daytime hours.

Off-site Road Transport Noise

The existing access road off The Bucketts Way would remain the DCM primary site access. DCM workforce traffic and traffic associated with deliveries along public roads would be modestly increased by the Project.

The NSW *Environmental Criteria for Road Traffic Noise* (ECRTN) (EPA, 1999) provides non-mandatory procedures for setting acceptable L_{Aeq} noise levels on arterial, collector and local roads and guidelines for assessing noise impacts from off-site road traffic.

Off-Site Rail Transport Noise

The Australian Rail Track Corporation Ltd (ARTC) controls and operates the North Coast Railway. Noise emissions from the railway are regulated via ARTC's Environmental Protection Licence (EPL) No 3142. A review of EPL 3142 requirements is presented together with an assessment of potential rail traffic noise impacts on communities neighbouring the North Coast Railway between the DCM and SCM. In addition, the DECCW has recently (October 2009) released *Environmental Assessment Requirements for Rail Traffic-Generating Developments* which are similar to (but not the same as) the ARTC's EPL noise goals.

C2 EXISTING DURALIE COAL MINE

C2.1 Overview of the existing DCM

Coal production commenced at the DCM in 2003 with mining of ROM coal using conventional open pit mining methods.

The DCM operations are supported by on-site facilities including a main infrastructure area, water management infrastructure/storages and rail infrastructure.

C2.2 Existing DCM Approvals

With respect to noise and blasting emissions, DCPL has consent to operate in accordance with the following approval requirements:

- Development Consent (DA 168/99) dated 5 February 1999 (as amended) (relevant sections attached as **Attachment CA-1**).
- EPL No 11701 (relevant sections attached as **Attachment CA-2**).

In addition, NSW Work Cover Dangerous Goods Licences describe noise specifications for individual equipment, for health and safety purposes.

C2.3 DCM Noise and Blasting Management Measures

DCM Noise Monitoring Program

The existing DCM Noise Monitoring Program (DCPL, 2007a) describes noise monitoring and management activities at the DCM. Operator attended noise monitoring at the DCM is undertaken at three locations[2] (as shown on the Land Ownership Plan - **Attachments CB-1a** and **CB-1b**) on a quarterly basis.

The Noise Monitoring Program includes a number of proactive mitigation measures including:

- Developing an awareness and understanding of noise issues through site inductions for all staff and contractors at the DCM.
- Avoiding the simultaneous use of significant noise generating equipment wherever possible.
- The noisiest activities being scheduled where practicable to the least sensitive times of the day.
- Monitoring weather conditions and where adverse conditions are experienced or predicted operational changes would be made to avoid or reduce noise impacts.
- Maintaining all machinery and plant used on-site and dedicated locomotives and rolling stock used off-site to minimise noise generation.

In addition to the above, the Noise Monitoring Program includes a number of specific noise mitigation measures and protocols for the receipt of and responses to noise-related complaints.

2 Or at nearby alternatives as determined by landholder access requirements.

DCM Blast Monitoring Program

The existing DCM Blast Monitoring Program (DCPL, 2007b) describes blast monitoring and management at the DCM. Ground vibration and airblast overpressure monitoring is undertaken at three locations as shown on the Land Ownership Plan (**Attachments CB-1a** and **CB-1b**). The Blast Monitoring Program also contains mitigation measures as described below:

- *Blast design addressing aspects including total charge size, instantaneous charge size, delay between hole explosive initiation, direction of initiation (taking into account potentially affected receivers), type and quantity of stemming material, geology etc;*
- *Evaluation and recording of the overpressure enhancing potential offered by adverse prevailing weather conditions, particularly low, dense cloud cover and strong winds. Blasting will not be undertaken if unacceptable environmental outcomes are anticipated;*
- *Adequate preparation of the blast floor (eg dozing/grading) to provide an even surface for drilling;*
- *Inspection of the blast floor to ensure that there is no significant geological weakness (eg fracturing from a previous blast) that may contribute to inadequate containment of explosive energy during blasting; and*
- *Maintaining the integrity of the stemming material such that it is not contaminated with foreign matter such as clay which may result in the explosive materials being insufficiently stemmed.*

In addition to the above, the Blast Monitoring Program includes protocols for the notification of blast events and the management of potential interactions between DCM blast events and other infrastructure (e.g. powerlines and roads).

C2.4 DCM Noise and Blasting Compliance Summary

Noise and blasting monitoring is conducted at the DCM in accordance with the DCM Noise Monitoring Program (DCPL, 2007a) and the DCM Blast Monitoring Program (DCPL, 2007b).

Monitoring undertaken since 2003 has demonstrated general compliance with noise and blasting criteria, with only occasional exceedances of criteria being recorded. A summary of the noise and blast compliance monitoring since 2003 is provided in **Table C-1**.

Table C-1 Summary of Noise and Blasting Compliance Monitoring

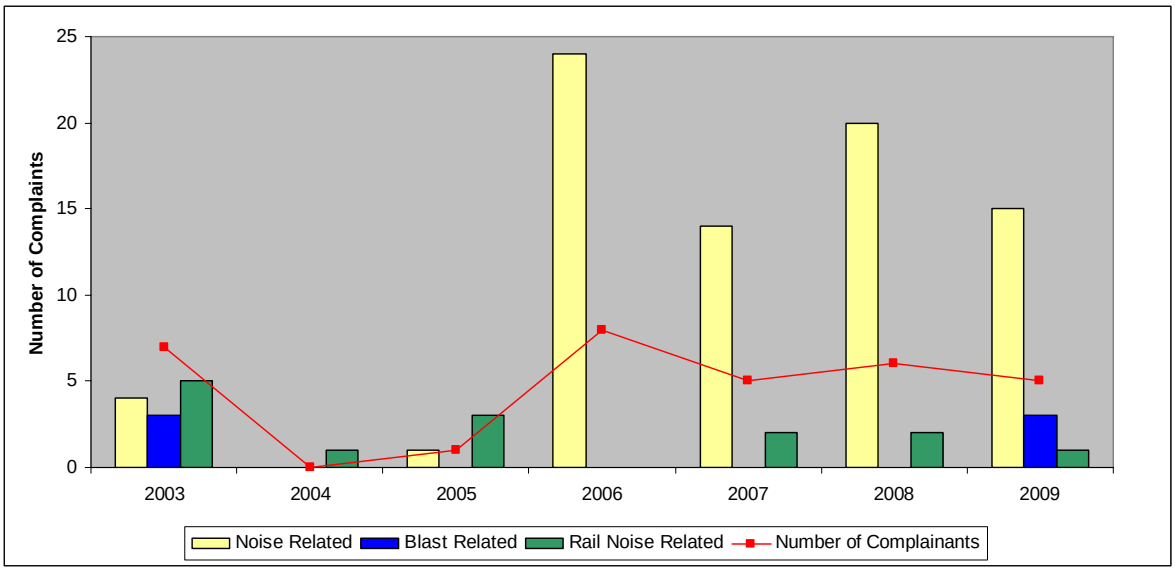
Year	Noise Compliance Statement	Blasting (overpressure) Compliance Statement	Blasting (vibration) Compliance Statement
2003	Compliant	Compliant	Compliant
2004	Compliant at all locations with the exception of site N1* where noise levels were recorded above criteria during one night in October 2004	One exceedance of blast criteria (120 A-weighted decibels [dBA]) at 'Doherty' (now GCL owned) in February 2004 - exceedance due to overburden face "blowout" One exceedance of blast criteria (120 dBA) at 'Doherty' (now GCL owned) in May 2004 - exceedance due to stemming ejection	Compliant
2005	Compliant at all locations with the exception of site N1 where noise levels were recorded marginally above criteria during one evening and above criteria during one night in April 2005* Compliant at all locations with the exception of site N1 which was recorded above criteria during one night and site N2 and site N3 which were recorded above criteria during one evening in October 2005	Compliant	Compliant
2006	Compliant at all locations with the exception of site N2 where noise levels were recorded marginally above criteria during one evening in April 2006	Compliant	Compliant
2007	Compliant at all locations with the exception of site AS1 where noise levels were recorded above criteria during one night in May 2007	Compliant	Compliant
2008	Compliant	Exceedances of blast criteria (120 dBA) at 'Holmes' in March, August and October 2008 - exceedances due to stemming failure and unfavourable wind conditions	Compliant
2009	Compliant	Compliant	Compliant

Source: *Duralie Coal Mine Annual Environmental Management Report* (DCPL, 2004 to 2009).
* Site N1 is located within DCPL owned lands. AS1 is an alternative site used as required.

C2.5 DCM Noise and Blasting Complaints Summary

DCPL maintains a complaints register in accordance with the DCM Environmental Management Strategy (DCPL, 2007d). DCM noise complaints generally relate to on-site mobile plant noise (e.g. haul truck and dozer noise). A summary of noise (including rail noise complaints related to the DCM but sourced from the SCM complaints register) and blasting (vibration/overpressure) complaints is provided on **Figure C-1**.

Figure C-1 Summary of Noise and Blasting Complaints Received at the DCM



Source: DCPL (2004-2009).

Figure C-1 indicates that whilst up to 24 noise-related complaints have been received in any one year, the number of complainants is relatively few (i.e. a maximum of eight). In 2009, 15 operational noise complaints have been received from five complainants to date. A total of 14 rail noise-related complaints have been received over seven years.

C3 DURALIE EXTENSION PROJECT

C3.1 Existing and Proposed Hours of Operation

The existing DCM and proposed Project operating hours are summarised in **Table C-2**.

Table C-2 Existing DCM and Proposed Project Hours of Operation

On-Site Operation	Existing DCM	Project
Periodic daytime civil construction works	Generally daytime (0700 hrs to 1800 hrs seven days per week)	Unchanged
Mine maintenance, operation, coal handling	24 hrs seven days per week	Unchanged
Blasting Operations	0900 hrs to 1700 hrs six days per week	0700 to 1900 hrs six days per week
Off-Site Operation		
Train Traffic	0700 hrs to 2200 hrs seven days per week[1]	Year 1 – 0700 hrs to 2200 hrs seven days per week[3] From Year 2 – 0700 hrs to 0200 hrs[2] seven days per week[3]
Road Traffic	24 hrs seven days per week	Unchanged

Note 1: Unless determined to be unavoidable by the ARTC and the rail haulage provider.
Note 2: Trains to depart from the DCM by 0200 hours.
Note 3: Sunday movements, where necessary, would generally be restricted to daytime only.

C3.2 Project Description

The Project General Arrangement has been designed to maximise the utilisation of existing infrastructure at the DCM as shown on **Attachment CB-2**. Project General Arrangements for Years 3, 5 and 8 are shown on **Attachments CB-3 to CB-5**. These general arrangements are based on planned maximum production and mine progression. The main activities associated with the development of the Project would include:

- Continued development of open pit mining operations at the DCM to facilitate a ROM coal production rate of up to approximately 3 Mtpa, including:
  - extension of the existing approved open pit in the Weismantel Seam to the north-west (i.e. Weismantel Extension open pit) within ML 1427 and MLA 1; and
  - open pit mining operations in the Clareval Seam (i.e. Clareval North West open pit) within Mining Lease (ML) 1427 and Mining Lease Application (MLA) 1 (**Attachment CB-2)**.
- Ongoing exploration activities within existing exploration tenements.
- Progressive backfilling of the open pits with waste rock as mining develops, and continued and expanded placement of waste rock in out-of-pit waste rock emplacements.
- Increased ROM coal rail transport movements on the North Coast Railway between the DCM and SCM in line with increased ROM coal production.
- Continued disposal of excess water through irrigation (including development of new irrigation areas within ML 1427 and MLA 1).
- Raising of the existing approved Auxiliary Dam No.2 from relative level (RL) 81 metres (m) to approximately RL 100 m to provide significant additional on-site storage capacity to manage excess water on-site.
- Progressive development of dewatering bores, pumps, dams, irrigation infrastructure and other water management equipment and structures.

- Development of new haul roads and internal roads.
- Upgrade of existing facilities and supporting infrastructure as required in line with increased ROM coal production.
- Continued development of soil stockpiles, laydown areas and gravel/borrow pits.
- Establishment of a permanent Coal Shaft Creek alignment adjacent to the existing DCM mining area.
- Ongoing monitoring and rehabilitation.
- Other associated minor infrastructure, plant, equipment and activities.

C3.3 On-site Blasting

The method of overburden material removal at the DCM is by drill and blasting techniques. A mixture of ammonium nitrate and fuel oil (ANFO) (dry holes) and emulsion blends (wet holes) would be used at an average powder factor of approximately 0.8 kilograms per bank cubic metre (kg/bcm). Blast sizes would generally remain unchanged by the Project and typically range from 50,000 bank cubic metres (bcm) up to 250,000 bcm.

The Project would increase the blast frequency to three blasts per week on average over a year, however the actual number of blasts in any week would be dependent on mine production. Blasting would only occur between the hours of 0700 hours and 1900 hours, six days per week (excluding public holidays or Sundays).

C3.4 Off-site Rail Transport

At the DCM ROM coal is loaded into wagons on a dedicated train that runs to the SCM on the North Coast Railway. At the SCM, the coal is unloaded and washed in the SCM Coal Handling and Preparation Plant. Rail transportation of ROM coal from the DCM to the SCM is currently undertaken between 0700 hours and 2200 hours. The locomotives currently used to transport ROM coal from the DCM are QR National 423 Class (1,120 kilowatts [kW], built 1967/69).

Rail loading and transport services are provided by a rail contractor who supplies a dedicated train service and co-ordinates all loading, unloading and train movements with the ARTC.

In order to facilitate the increase in ROM coal production, the total capacity of the DCM ROM coal train would be increased from approximately 2,000 tonnes (t) up to approximately 2,500 t. It is expected that the number of train movements would increase from approximately three movements per day to approximately four movements per day when averaged over an annual period.

In order to facilitate improved access to the ARTC network train paths and accommodate the additional train movements, the loading of train wagons and train departures would occur during the daytime, evening and night-time periods until 0200 hrs (**Table C-2**). The majority of train movements would be undertaken during daytime and evening periods where practicable. Sunday movements, where necessary, would generally be restricted to daytime only.

From approximately Year 2 of the Project, the existing locomotives (i.e. QR 423 Class) used at the DCM would be replaced with Chicago Freight Car Leasing Australia (CFCLA) GL Class (2,380 kW, built 2003/04) (or equivalent). In Year 1 of the Project, rail movements would not be conducted at night time (i.e. rail movements would occur between 0700 hours and 2200 hours in Year 1 as per the existing DCM).

C3.5 Off-site Road Transport

The existing access road off The Bucketts Way would remain the primary site access. The DCM has an existing workforce of approximately 120 people (including DCPL staff and on-site contractor's personnel). At full development, the Project operational workforce would be in the order of 135 people, including a mixture of direct GCL employees and contractors.

The current shift arrangements at the DCM would generally be retained. During the life of the Project, alternative shift configurations may be required to meet operational requirements.

C3.6 Project Site and Land Ownership

The Project site and surrounding area are shown on the Land Ownership Plan attached as **Attachments CB-1a** and **CB-1b**. A summary of the nearest potentially affected receivers and vacant land are presented in **Table C-3** including landholder names, receiver identification numbers (ID Nos.) and co-ordinates.

Table C-3 Nearest Potentially Affected Receivers and Vacant Land

ID No	Landholder	Duralie Coal EIS[1]	ENM Receiver Co-ordinates[2]		
			East (m)	North (m)	Elevation (m)
19 (1)	GCL (Former Weismantels Inn)		3107	9532	90
19 (3)	GCL		6351	12674	85
19 (4)	GCL (Mammy Johnson's Grave)		5920	4700	60
19 (6)	GCL	BG11	6565	3157	93
19 (7)	GCL		5898	13544	123
19 (8)	GCL		3247	9854	107
19 (9)	GCL		2899	9361	84
19 (10)	GCL		6791	7602	82
19 (11)	GCL		6787	7581	82
19 (12)	GCL		6223	13038	98
19 (13)	GCL		6930	5642	67
19 (14)	GCL		5658	3931	52
19 (16)	GCL		3539	9620	115
19 (17)	GCL	BG9	6755	7837	82
93	K.V. & P.M. Howard		3903	12994	88
94	B.V. & P.O. Howard		3434	12288	124
95	D.J. Smith & S. Ransley		4811	11947	114
100	K.S. Richards		5517	11961	86
101	K.M. & D.B. Holloway		5524	12560	76
104[3]	R. S. and R. Mudford		Vacant Land		
106	R.A. James		4615	12349	105
112	S.R. Hogeveen		1494	11244	109
113	C.W. & J.I. Edwards		1482	10925	105
115 (1)	P.W.M. & B.D. & G.O. & M.J. Moylan & S.C.M. Newton		1888	9431	76
115 (3)	P.W.M. & B.D. & G.O. & M.J. Moylan & S.C.M. Newton		1770	8945	77
115 (4)	P.W.M. & B.D. & G.O. & M.J. Moylan & S.C.M. Newton		2220	10125	104
116	G.R. Weismantel		4007	12150	106
117[3]	E.D. Holmes and L.M. Holmes		3796	10534	108
118	P.W.M. Moylan		Vacant Land		
120	M.J. & C.A. Mahony		2726	9534	87
122	S. White		Vacant Land		
123	J.L. Oleksiuk & K.P. Carmody		4806	11719	116
124 (1)[3]	A.J. and R.M.B. Bailey		4519	10670	88
124 (2)[3]	A.J. and R.M.B. Bailey		4752	10642	91

ID No	Landholder	Duralie Coal EIS[1]	ENM Receiver Co-ordinates[2]		
			East (m)	North (m)	Elevation (m)
125 (1)	T. & K. Zulumovski		4071	10423	103
125[4] (2)	T. & K. Zulumovski	BG15	3886	10092	106
126	H.L. and M.R. Hamann-Pixalu Pty Limited		5161	11616	98
127	A.J. Fisher-Webster		5198	11061	81
128[4]	D.R. and B. Hare-Scott		5880	9798	66
129[4]	J. Weismantel		5982	10275	78
130[4]	M.A. & J.M. Giudice		6075	10361	79
131 (1)	W.L. Relton		6261	11347	80
131 (2)[4]	A.T. Relton		6132	9704	80
139	M.S. Juttner		2975	8569	104
140	D.C. Bennett & D.M. Stark		8546	12058	77
142	P.A. Madden		2606	8287	63
143	P.G. & K.A. Madden		2526	8079	78
144	D.J. Wielgosinski		2481	7415	85
145	D.H. & S.W. Owens		2483	7234	90
146	M.A. Bragg		2510	6899	69
147	J.I. Edwards	BG3	2621	6566	55
148	D.J. McAndrew		2978	5105	70
149[3]	Hattam Pty Ltd	BG8	5918	8646	80
154	J.R. Morgan		8206	7193	132
155	M. & R. Guberina	BG10	8150	6834	130
156	T.R.J. & B. Hope		8737	6997	115
157	C.N. & S.D. Stephenson		8801	6916	115
158	B. Gilbert		Vacant Land		
160	P. & M.E. Kenney		9287	5008	102
167	M. & S.M. Ravagnani		3377	3863	52
168 (2)	V.R. & E.K. Schultz		3307	3885	53
168 (3)	V.R. & E.K. Schultz		3432	4102	60
168 (4)	V.R. & E.K. Schultz		3618	1820	53
168 (5)	V.R. & E.K. Schultz		3618	1897	48
169	R.D.K & N.L. Williams		3294	2576	55
172[3]	S.J. & J.E. Lyall		5979	2821	77
173[4]	S.M. Trigg, J.M. Trigg, M.J. Holland, B.J. Holland, M. Trigg & S.C. Trigg		5337	1825	49
175	R.J. & S.J. Woodley		5646	1908	100
177	W.J.Thompson		8502	4466	110
178	N.E. Hitchcock & E.E. Coldham		9447	4619	100.5
180 (1)	B.R. & G.J. & K.G. & K.J. & W.J. Thompson		8256	3302	100
180 (2)	B.R. & G.J. & K.G. & K.J. & W.J. Thompson		8242	3767	81
189	H.J. Gillard		8840	2217	72
194	J & CL Kellehear		1690	9688	84
204	M.C. Jones		3294	2576	56
216	D.M. Matcham		872	9732	93
220	T.G. Lindfield and Associates Pty Ltd		1309	8932	115
-[5]	The Bucketts Way		3337	9732	95

Note 1: *Duralie Coal Project Environmental Impact Statement* (Duralie Coal EIS) (DCPL, 1996) location reference.

Note 2: To convert to MGA coordinates add 395000 mE and add 642000 mN.

Note 3: Properties identified in the DCM Development Consent as being in the Noise Affectation Zone.

Note 4: Properties identified in the DCM Development Consent as being in the Noise Management Zone.

Note 5: Near-point to the Clareval North West open pit.

C4 EXISTING METEOROLOGICAL AND NOISE ENVIRONMENT

C4.1 Meteorological Environment

Section 5.3 of the INP (EPA, 2000) provides the following regarding wind effects:

> *Wind effects need to be assessed where wind is a feature of the area. Wind is considered to be a feature where source to receiver wind speeds (at 10 m height) of 3 m/s or below occur for 30 percent of the time or more in any assessment period in any season.*

An assessment of prevailing wind conditions was derived from the meteorological data recorded by DCM Automatic Weather Station (AWS). The dominant seasonal wind speeds and directions over a composite five year period (2003 to 2005 plus 2007 to 2008) are presented in **Attachment CC** for daytime (0700 hours to 1800 hours), evening (1800 hours to 2200 hours) and night-time (2200 hours to 0700 hours) in accordance with a methodology consistent with the requirements of the INP.

The prevailing winds less than (or equal to) 3 metres per second (m/s) with a frequency of occurrence greater than (or equal to) 30% and considered to be relevant to the DCM in accordance with the INP are presented in **Table C-4**.

Table C-4 Prevailing Wind Conditions in accordance with the INP

Season	**Winds ±45 degrees (°) 3 m/s with Frequency of Occurrence 30%**		
	Daytime	**Evening**	**Night-Time**
Annual	Nil	NNW	NNW
Summer	Nil	NNE	N
Autumn	Nil	NNW	NNW
Winter	Nil	NW	NNW
Spring	Nil	NNW	NNW

Section 5.2 of the INP (EPA, 2000) provides the following regarding temperature inversions:

> *Assessment of impacts is confined to the night noise assessment period (10.00 pm to 7.00 am), as this is the time likely to have the greatest impact - that is, when temperature inversions usually occur and disturbance to sleep is possible.*

> *Where inversion conditions are predicted for at least 30% (or approximately two nights per week) of total night-time in winter, then inversion effects are considered to be significant and should be taken into account in the noise assessment.*

An assessment of atmospheric stability conditions has also been prepared from the meteorological data recorded by the SCM AWS (in the absence of sigma theta data from the DCM AWS). The use of SCM data is considered to be appropriate given the proximity of the SCM to the DCM (approximately 20 km) and the generally similar topographic setting. This approach is also consistent with the INP, which generally requires weather data to be obtained from a source within 30 km of the subject location. The frequency of occurrence of atmospheric stability classes are presented in **Table C-5**, together with estimated Environmental Lapse Rates (ELR).

Table C-5 Atmospheric Stability Frequency of Occurrence - Winter Evening and Night-Time

Stability Class	Frequency of Occurrence					Estimated ELR °C/100 m	Qualitative Description
	Annual	Summer	Autumn	Winter	Spring		
A	0%	0%	0%	0%	0%	<-1.9	Lapse
B	0%	0%	0%	0%	0%	-1.9 to -1.7	Lapse
C	0%	0.0%	0%	0%	0%	-1.7 to -1.5	Lapse
D	40%	48%	35%	34%	44%	-1.5 to -0.5	Neutral
E	15%	16%	15%	15%	15%	-0.5 to 1.5	Weak inversion
F	40%	31%	45%	48%	37%	1.5 to 4	Moderate inversion
G	5%	6%	5%	3%	4%	>4.0	Strong inversion

°C = degrees Celsius.

In accordance with the INP, the frequency of occurrence of moderate (i.e. 1.5 to 4.0°C/100 m) winter temperature inversions is greater than 30% during the combined evening and night-time period and therefore requires assessment.

Noise Model Meteorological Parameters

The noise modelling meteorological parameters presented in **Table C-6** are based on analysis of the available DCM and SCM meteorological data sets. In this case, the observed meteorological conditions at the Project site are generally consistent with the default parameters presented in the Section 5 of the INP.

The site weather conditions are characterised by prevailing north north-westerly winds throughout the year. Moderate temperature inversions are also a feature of the area coinciding with the "down valley" north north-westerly drainage flow particularly during the cooler seasons.

Table C-6 Calm (neutral) and Noise Enhancing Meteorological Modelling Parameters

Period	Meteorological Parameter	Air Temperature	Relative Humidity	Wind Velocity	Temperature Gradient
Daytime	Calm	18°C	60%	0 m/s	0°C/100 m
Evening	Calm	14°C	70%	0 m/s	0°C/100 m
	Wind only	14°C	70%	NW 3 m/s, NNW 3 m/s, NNE 3 m/s	0°C/100 m
Night-time	Calm	10°C	90%	0 m/s	0°C/100 m
	Wind only	10°C	90%	NNW 3 m/s, N 3 m/s,	0°C/100 m
	Temperature Inversion only	10°C	90%	0 m/s	3°C/100 m
	Inversion plus Drainage flow[1]	10°C	90%	NNW 2 m/s	3°C/100 m

Note 1: North-northwest down valley drainage flow applicable to receivers with no intervening higher topography.

C4.2 Noise Environment

Given the existing operation of the DCM, it is appropriate to review the pre-mine background noise data (from 1995) to determine the relevant Rating Background Levels (RBLs) and noise amenity levels ($L_{Aeq(period)}$) in accordance with the INP procedures. In addition, supplementary ambient noise monitoring was conducted in November 2007 coinciding with DCM operations.

Background Noise August 1995

Comprehensive background noise surveys to characterise and quantify the pre-mine noise environment in the area surrounding the DCM were conducted in August 1995. The measurement methodology and analysis procedures are described in Volume IV Appendix 1b of the Duralie Coal EIS (DCPL, 1996). The unattended background noise logger data from each monitoring location, together with the on-site weather conditions are presented graphically on a daily basis in Heggies Report 5208-R1 *Baseline Background Noise Monitoring, Duralie Coal Project* dated 12 July 1996. The 1995 background noise surveys were undertaken in accordance with the *Environmental Noise Control Manual* (ENCM) (EPA, 1994), which preceded the INP.

The pre-mine background noise levels are summarised in **Table C-7** where daytime/evening was previously defined as 0700 hours to 2200 hours and night-time 2200 hours to 0700 hours.

Table C-7 Unattended Noise Monitoring Results 1995 (dBA re 20 µPa)

ID No.	Landholder	Duralie Coal EIS[1]	Minimum Repeated Background Level (MRBL)[2]		LAeq(period) Industrial Noise Only	
			Daytime/ Evening[3]	Night-time[3]	Daytime/ Evening	Night-time
-	Stroud Road	BG1	29	27	<39	<34
168 (3)	Schultz	BG2	27	26	<39	<34
147	Edwards	BG3	30	29	<39	<34
139	Juttner	BG4	26	25	<39	<34
-	Wards River	BG6	34	23	<39	<34
130	Giudice	BG7	27	24	<39	<34
149	Hattam PL	BG8	29	28	<39	<34
19 (17)	GCL	BG9	28	28	<39	<34
155	Guberina	BG10	30	29	<39	<34
19 (6)	GCL	BG11	29	30	<39	<34

Note 1: Duralie Coal EIS location reference.
Note 2: MRBL in accordance with ENCM procedures.
Note 3: In accordance with the ENCM (and now the INP) if the RBL is below 30 dBA then 30 dBA shall be the assumed RBL.
µPA = micro Pascal.

The background noise levels in the vicinity of the Project site were typically around 30 dBA (or less), consistent with a relatively remote rural environment comprising agricultural and domestic activity together with seasonal fauna noise sources and with an absence of major industrial development and continuous transportation systems.

In accordance with the ENCM where the background level was found to be less than 30 dBA, the background level was set to 30 dBA.

Ambient Noise November 2007

Supplementary noise surveys to quantify ambient noise levels (i.e. all noise sources) and to estimate industrial noise only (i.e. in the absence of transport, natural and domestic noise) were conducted in November 2007. Five unattended noise loggers were installed at potentially affected receiver locations with respect to the Project site for a period of 14 days.

In order to support the unattended logger and to assist in identifying the character and duration of the noise sources, operator-attended daytime, evening, and night-time measurements were also conducted in the vicinity of the logging locations. The measurement methodology and analysis procedures are described in **Attachment CD**. The operator-attended measurement results are summarised in **Table C-8**.

Table C-8 Operator-Attended Noise Survey Results 2007 (dBA re 20 µPa)

ID No	Landholder	Measured LA90(15minute) All Noise Sources			Estimated LAeq(15minute) Industrial Noise Only[1]		
		Day	Evening	Night	Day	Evening	Night
124 (1)	Bailey	38	40	34	n/d	n/d	n/d
117	Holmes	-	45	43	-	<30	<30
172	Lyall	-	33	35	-	n/d	32
189	Gillard	29	39	41	n/d	n/d	<30

Note: n/d = Industrial noise not discernible.

The unattended ambient noise logger data from each monitoring location and the on-site weather conditions were analysed on a daily basis and presented graphically as statistical 24 hour ambient noise profiles in **Attachment CE-1 to CE-5**. The ambient noise data were then processed in accordance with the requirements of the INP to derive the ambient noise levels presented in **Table C-9**.

Table C-9 Unattended Noise Monitoring Results 2007 (dBA re 20 µPa)

ID No	Landholder	Measured RBL All Noise Sources			Measured LAeq(period)[1] All Noise Sources			Estimated LAeq(period)[1] Industrial Noise Only		
		Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
124 (1)	Bailey	34	37	36	48	52	50	<44	<39	<34
117	Holmes	34	37	37	52	49	47	<44	<39	<34
172	Lyall	34	36	34	48	48	45	<44	<39	<34
189	Gillard	31	35	34	46	54	51	<44	<39	<34

Note 1: Daytime 0700 hours to 1800 hours, Evening 1800 hours to 2200 hours and Night-time 2200 hours to 0700 hours.

During the monitoring period existing DCM operating noise was measurable and/or audible at some locations however the INP data analysis procedure generally minimises the potential for low level intrusive mine noise to influence resultant RBLs. Moreover, insect noise was common and likely to be a regular seasonal feature of the noise environment, particularly in the warmer months. However as demonstrated by the August 1995 dataset (coinciding with an absence of industrial noise) cooler season background noise levels with minimal influence from fauna noise are approximately 30 dBA. These cooler season noise levels were used for establishing RBLs.

Background Noise and Amenity Levels for INP Assessment Purposes

In view of the foregoing, the RBLs and noise amenity levels ($L_{Aeq(period)}$) are presented in **Table C-10**, which form the basis of establishing the Project-specific noise assessment criteria (**Section C5.3**).

Table C-10 Background Noise and Amenity Levels for Assessment Purposes (dBA re 20 µPa)

Receiver Area	Property Name	Estimated RBL[1] All Noise Sources			Estimated LAeq(period)[1, 2] Industrial Noise Only		
		Daytime	Evening	Night-time	Daytime	Evening	Night-time
Privately Owned	All residential receivers	30	30	30	<44	<39	<34

Note 1: Estimated RBLs and noise amenity levels in the absence of DCM operation.

Note 2: Daytime 0700 hours to 1800 hours, Evening 1800 hours to 2200 hours and Night-time 2200 hours to 0700 hours.

C4.3 Rail Traffic Noise

A rail traffic noise survey was incorporated into the programme of monitoring conducted in November 2007 to quantify the near-field rail traffic noise adjacent to the North Coast Railway. The measurement methodology and analysis procedures are described in **Attachment CD**. The unattended noise logger data and the on-site weather conditions were analysed on a daily basis and are presented graphically as statistical 24-hour ambient noise profiles in **Attachments CE-1 to CE-5**.

The rail traffic noise data were then analysed to derive the daytime/evening $L_{Aeq(15hour)}$, night-time $L_{Aeq(9hour)}$ and maximum pass-by noise levels as presented in **Table C-11**

Table C-11 Unattended Rail Traffic Noise Monitoring Results - November 2007 (dBA re µPa)

Free-Field Offset Distance	**Train Type**	**Pass-by Intrusive $L_{Aeq(15minute)}$**	**Pass-by Average Maximum**	**Pass-by 5% Exceedance Maximum**	**Daytime/ evening $L_{Aeq(15hour)}$**	**Night-time $L_{Aeq(9hour)}$[1]**
12 m	Passenger	65	90	95	64 dBA (approx. 123 pass-bys over 8 days; or mean 15 pass-bys per period)	57 dBA (approx. 31 pass-bys over 8 days; or mean 4 pass-bys per period)
12 m	General Freight	68	92	97		
12 m	DCM[1]	69	95	101		
12 m	SCM[2]	67	92	96		

Note 1: Duralie Coal Mine trains including locomotive type QR National 423 Class (1,120 kW, built 1967/69).

Note 2: Stratford Coal Mine trains including locomotive type Pacific National 82 Class (2,260 kW, built 1994/95).

The intrusive and maximum (i.e. average and 5% exceedance) pass-by noise measurement results indicate a moderate range from the four train types, which is well within the expected variation for railway traffic. The existing DCM ROM coal trains have higher intrusive and maximum noise levels than other trains on the North Coast Railway between the DCM and the SCM. As noted in **Section C3.4**, the existing DCM locomotives would be replaced by CFCLA GL Class locomotives in approximately Year 2 of the Project. The CFCLA GL Class locomotives are the same (or equivalent) model in operation at the SCM and are relatively quieter than the existing DCM trains.

Residences within 100 m of the North Coast Railway are shown on **Attachment CF**.

C5 NOISE ASSESSMENT METHODOLOGY

C5.1 Construction Noise

Project construction works would be limited, but would include auxiliary dam embankment raising, development of new haul and internal roads and associated infrastructure upgrades in line with increased ROM coal production would be generally carried-out during the daytime through-out the Project life as required.

In accordance with DECCW'S interim policy ICNG, mine construction activities are generally considered integral with the general mining operations. Therefore the construction works associated with Auxiliary Dam No. 2 embankment lift have been included in Year 3 mine operations.

C5.2 Sleep Disturbance Assessment Criteria

The INP does not specifically address sleep disturbance however the DECCW's Application Notes (**Attachment CG**) provides some guidance in relation to this complex matter.

The DECCW uses the ECRTN (Appendix B Section B5) sleep disturbance criterion of the $L_{A1(1minute)}$ not exceeding the $L_{A90(15minute)}$ (prevailing at the time) by more than 15 dBA as a guide to identify the likelihood of sleep disturbance. This means that where the criterion is met, sleep disturbance is not likely, but where it is not met, a more detailed analysis is required. The $L_{A1(1minute)}$ descriptor is meant to represent a maximum noise level measured under "fast" time response. The DECCW will accept analysis based on either $L_{A1(1minute)}$ or L_{Amax}.

A review of noise events from the approved DCM night-time operations indicates that the maximum (L_{Amax}) levels are typically less than 10 dBA above the $L_{Aeq(15minute)}$ intrusive level when measured at a receiver. Hence, if the $L_{Aeq(15minute)}$ criteria (i.e. background plus 5 dBA) are achieved then the DECCW's sleep disturbance criteria would also be met. This relationship enables the noise assessment process to focus on the setting and assessment of INP-based intrusive noise and amenity levels which aim to minimise annoyance at noise sensitive receiver locations.

Furthermore, the ECRTN's review of sleep disturbance research concludes that (i) the maximum *internal* noise levels below 50 to 55 dBA are unlikely to cause awakening reactions and (ii) one or two noise events per night, with maximum *internal* noise level of 65 to 70 dBA, are not likely to affect health and wellbeing significantly. As approvals conditions generally include external noise levels, an internal noise level can be conservatively transposed to an external noise level by adding 10 dBA (or 12.5 dBA when measured 1 m from the dwelling facade).

It follows, that an external $L_{A1(60second)}$ noise criteria of 50 to 55 dBA would appear conservatively lower than the ECRTN's conclusions in relation to this matter.

Therefore, it is considered that the INP-based intrusive criteria would be the controlling factor in determining compliance for the Project.

C5.3 Intrusive Noise and Amenity Levels Assessment Criteria

The DECCW has regulatory responsibility for the control of noise from "scheduled premises" (the DCM is a scheduled premises) under the NSW *Protection of the Environment Operations Act, 1997*. The procedure for assessing the potential impacts of the industrial noise sources is set out in the INP.

The INP assessment procedure for industrial noise sources has two components:

- Controlling intrusive noise impacts in the short-term.
- Maintaining noise level amenity for particular land uses over the medium to long-term.

The INP prescribes detailed calculation routines for establishing "Project-specific" $L_{Aeq(15minute)}$ intrusive criteria and $L_{Aeq(period)}$ amenity (i.e. non-transport related) criteria for a development at potentially affected noise sensitive and various other receiver areas. Ideally, the intrusive noise level should generally not exceed the background level by more than 5 dBA.

In addition, the DoP has previously advised that the noise impacts on vacant land are assessed on a "case by case" basis. For assessment purposes in this report vacant land is defined as a lot which may be permitted to have (but does not yet have) a dwelling and is therefore a potentially sensitive receiver in accordance with the INP. In the absence of a specific dwelling (or a known approved building Development Application) noise impacts are determined where exceedances are predicted over 25% of the vacant land area.

In accordance with Chapter 2 "Industrial Noise Criteria" of the INP and in conjunction with the INP's Application Notes, the Project-specific intrusive and amenity assessment criteria for residential and vacant land receiver areas are presented in **Table C-12**. These criteria are nominated for the purposes of assessing potential noise impacts from the Project.

Table C-12 Project-specific Noise Assessment Criteria (dBA re 20 µPa)

Receiver Area	Land Use	Intrusive $L_{Aeq(15minute)}$[1]			Amenity $L_{Aeq(period)}$[1]		
		Day	Evening	Night	Day	Evening	Night
Existing Dwellings	Rural Residential[2]	35	35	35	50	45	40
Potential Dwellings	Rural Vacant Land[3]						

Note 1: Daytime 0700 hours to 1800 hours, Evening 1800 hours to 2200 hours, Night-time 2200 hours to 0700 hours.
Note 2: At the most-affected point within 30 m of the residential area.
Note 3: Where exceedances are predicted over 25% of the vacant land area.

Rural amenity criteria are nominated in **Table C-12** in consideration of the generally rural nature of the area and following review of the *Great Lakes Local Environment Plan 1996*, which indicates that the majority of the area is Zone 1A (Rural Zone).

The intrusiveness criterion is met if the $L_{Aeq(15minute)}$ is less than or equal to the RBL plus 5 dBA, where the RBL is determined from monitoring data following the INP procedures discussed in **Section C4.2**. Thus, the most stringent Project-specific criterion for the Project would be the intrusiveness criterion (i.e. 35 dBA $L_{Aeq(15minute)}$) for daytime, evening and night-time periods.

The INP states that these criteria have been selected to preserve the amenity of 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, then most people would consider the resultant noise levels acceptable.

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

C5.4 Operational Noise Impact Assessment Methodology

In view of the foregoing, **Table C-13** presents the methodology for assessing operational noise against the INP Project-specific noise assessment criteria.

Table C-13 Project-specific Noise Assessment Methodology (dBA re 20 µPa)

Assessment Criteria	**Project-specific Criteria**	**Noise Management Zone**		**Noise Affectation Zone**
		Marginal	**Moderate**	
Intrusive LAeq(15minute)	RBL plus 5 dBA	1 to 2 dBA above Project-specific criteria	3 to 5 dBA above Project-specific criteria	> 5 dBA above Project-specific criteria

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

Noise Management Zone

Depending on the degree of predicted exceedance of the Project-specific criteria (1 to 5 dBA) potential noise impacts in the noise management zone could range from negligible to moderate (in terms of the perceived noise level increase). In addition to the noise mitigation measures included in the predictive modelling (**Section C6.2**), noise management procedures would include:

- Noise monitoring on-site and within the community.
- Prompt response to any community issues of concern.
- Refinement of on-site noise mitigation measures and operating procedures where practicable.
- Implementation of reasonable and feasible acoustical mitigation at receivers (which may include measures such as enhanced glazing, insulation and/or air-conditioning) at residences where noise monitoring shows noise levels from the mine are 3 to 5 dBA above Project-specific noise criteria.

Noise Affectation Zone

Exposure to noise levels greater than 5 dBA above Project-specific criteria may be considered unacceptable by some landowners. Management procedures for the noise affectation zone would include:

- Discussions with relevant land owners to assess concerns and define responses.
- Implementation of reasonable and feasible acoustical mitigation at receivers (which may include measures such as enhanced glazing, insulation and/or air-conditioning) at residences where noise monitoring shows noise levels from the mine which are >5 dBA above Project-specific noise criteria.
- Negotiated agreements with land owners where required.

C6 NOISE MODELLING METHODOLOGY AND MITIGATION MEASURES

C6.1 Noise Modelling Procedure

The Project noise model was prepared using RTA Software's Environmental Noise Model (ENM for Windows, Version 3.06), a commercial software system developed in conjunction with the (then) EPA (now DECCW). The acoustical algorithms utilised by this software have been endorsed by the Australian and New Zealand Environment Council and all State Environmental Authorities throughout Australia as representing one of the most appropriate predictive methodologies currently available.

Heggies has an existing ENM for the DCM that has been used for a number of assessments since mining commenced in 2003. The existing DCM noise model was modified to incorporate the significant noise sources associated with the proposed Project. The surrounding terrain and nearby potentially affected receivers (**Table C-3** and **Attachments CB-1a** and **CB-1b**) were also updated. The DCM noise model has been previously validated against noise monitoring results at nearby receivers.

The Project description was reviewed to determine representative scenarios to assess potential Project noise impacts. For the purposes of assessing noise impacts in accordance with INP requirements, the following scenarios were considered:

Year 3 Operations (refer to General Arrangement - Year 3 [Attachment CB-3]): Representative of approximately 2.4 Mtpa ROM coal production rate coinciding with mining in the northern extent of the Weismantel Extension open pit, the early stages of mining in the Clareval North West open pit operations together with active operations on the central portion of the waste rock emplacement. The daytime scenario included construction works associated with Auxiliary Dam No.2 embankment lift.

Year 5 Operations (refer to General Arrangement - Year 5 [Attachment CB-4]): Representative of approximately 3.0 Mtpa ROM coal production rate coinciding with the ongoing operation of the Weismantel Extension open pit, the northern extent of the Clareval North West open pit together with the northern advance of the active waste rock emplacement areas.

Year 8 Operations (refer to General Arrangement - Year 8 [Attachment CB-5]): Representative of approximately 2.5 Mtpa ROM coal production rate coinciding with the cessation of the Weismantel Extension open pit, the northern extent of the Clareval North West open pit together with the northern extent of operations on the waste rock emplacement.

The three operational noise modelling scenarios include all existing and proposed plant items operating concurrently to simulate the overall maximum energy equivalent (i.e. $L_{Aeq(15minute)}$) intrusive noise level. A large proportion of the mobile equipment is operated in repeatable routines and a relatively smaller proportion of the emissions emanate from continuous fixed plant items.

The L_{Aeq} SWLs given for each item of mobile equipment do not include noise emissions which emanate from alarms or communication 'horns'. In the event that alarm noise is considered to be a source of disturbance, the alarm noise level should be checked against the appropriate Australian Standard and/or requirements and the necessary mitigating action taken to achieve an acceptable noise reduction without compromising safety standards. It is noted that DCPL have installed broad-band "quacker" reversing alarms on the majority of the DCM mobile equipment fleet.

C6.2 Project Reasonable and Feasible Noise Mitigation

The predictive modelling involved the investigation of feasible and reasonable noise mitigation measures, particularly in relation to night-time operations. These mitigation measures are assumed to be implemented for the purposes of the predictive modelling. A number of iterative steps were taken to develop noise mitigation measures for the Project, including:

- Preliminary noise modelling of scenarios representative of the maximum noise emissions from the Project to identify areas of potential noise exceedances.
- Evaluation of various combinations of noise management and noise mitigation measures to assess their relative effectiveness.
- Adoption by DCPL of a range of noise management and mitigation measures (including low noise equipment and operational controls) to appreciably reduce noise emissions associated with the Project, including:
    - All additional mobile equipment necessary to meet Project increased ROM coal production to be current technology and low noise emission standard, including up to 16 new CAT 785XQ haul trucks and attenuation of new single items (i.e. dozer, excavator, drill and grader).
    - Two CAT 789 haul trucks to be operated during daytime only.
    - Waste rock emplacement activities on elevated/exposed portions of the waste rock emplacement to occur during daytime only.
- Restriction of the maximum height of the waste rock emplacement to approximately 110 mRL, consistent with the existing/approved height.

In addition to the above, Heggies investigated the installation of bunding at the DCM to control intrusive noise emissions. Bunding is not considered to be an effective noise reduction measure at the DCM for the following reasons:

- Options for bunding haul roads to reduce noise emissions are limited due to the orientation of the open pit mining operations and resulting haul roads (i.e. generally north-south). This orientation means that bunding between the haul roads and receivers to the north would be located at the northern extent of ML 1427 and MLA 1, which would in practice be a significant distance from potential Project related noise sources (up to 2 km).
- The sensitive receivers to the north of the DCM are located in an elevated and exposed position relative to the DCM open pit and haul road (i.e. there would be no intervening topography between the haul road and nearest receiver).
- On account of the above distances to any potential bund, the elevations of the nearest receiver locations and haul road, and the prevailing inversion conditions, barriers/bunds would provide minimal noise attenuation/mitigation effect.

The resulting noise mitigated daytime, evening and night-time Project operations can be generally described as follows:

- Daytime mining operations include coal and overburden mining and haulage, coal handling and stockpiling, rail loading and on-site train movement. The operational haul truck fleet typically comprises two CAT 789 trucks and up to sixteen low noise CAT 785XQ trucks operating on upper waste emplacement areas.
- Evening and night-time operations include coal and overburden mining and haulage, coal handling and stockpiling, rail loading and on-site train movement. The operational haul truck fleet would be up to sixteen low noise CAT 785XQ trucks.

C6.3 Sound Power Levels

The potential for machinery to emit noise is quantified as the sound power level (SWL) expressed in dBA re 1 picowatt (pW). At the receptor, the received noise is quantified as the sound pressure level (SPL) expressed in dBA re 20 µPa. The INP's energy equivalent (L_{eq}) assessment parameters has introduced greater mathematical rigour to the prediction of received noise levels as it enables the use of L_{eq} SWL as noise model inputs. In general terms, any variation in mine site L_{eq} SWL would produce a similar variation in the $L_{eq(15minute)}$ SPL at the receiver.

Equipment SWLs at the DCM have been the subject of ongoing measurements in accordance with the Noise Monitoring Program (refer **Section C2.3**) and DCPL have refined the SWLs for individual fleet items. Comparative equipment fleets are presented in **Table C-14** together with the overall mine site L_{eq} SWLs from the DCM as predicted in the Duralie Coal EIS, Duralie June 2009 Modification (DCPL, 2009) and the Project.

Table C-14 Duralie Coal EIS, Duralie June 2009 Modification and Project Equipment Fleets

Equipment Description	**Duralie Coal EIS Up to 1.8 Mtpa**		**June 2009 Modification Up to 1.8 Mtpa**		**Project Up to 3.0 Mtpa (Year 5)**		**Project Up to 2.5 Mtpa (Year 3, Year 8)**	
	No. of Items	**SWL (dB re 1 pW)**	**No. of Items**	**SWL (dB re 1 pW)**	**No. of Items**	**SWL (dB re 1 pW)**	**No. of Items**	**SWL (dB re 1 pW)**
Drills	1	116	1	117	1	115	1	115
Low Noise Drill	0	-	0	-	1	112	1	112
Excavators	3	121	3	122	2	121	2	121
Low Noise Excavator	0	-	0	-	1	121	1	121
Standard Haul Trucks	9	131	2	127	2[1]	125	2[1]	125
Low Noise Haul Trucks	0	-	8	124	16[2]	127	11[2]	125
Dozers	2	121	3	127	3	126	2	124
Low Noise Dozer	0	-	0	-	1	119	1	119
Loaders, Graders	2	118	1	115	1	113	1	113
Low Noise Grader	0	-	0	-	1	110	1	110
Water Cart, Scraper	2	121	1	117	2	121	2	121
Rotary Breaker	0	-	1	119	1	114	1	114
Coal Preparation Plant	1	122	0	-	0	-	0	-
Rail Loading and Train	1	114	1	114	1	115	1	115
Total SWL	**N/A**	**133**	**N/A**	**132**	**N/A**	**133**	**N/A**	**132**

Note 1: The daytime operational haul truck fleet includes the use of two existing CAT 789 haul trucks.

Note 2: The evening/night-time operational fleet includes up to sixteen low noise CAT 785XQ haul trucks only.

dB = decibel.

As shown above, the overall maximum SWL of the Project (133 dBA) introduces a marginal noise increase (approximately 1 dBA) by comparison with the approved Duralie April 2009 Modification (132 dBA) but remains consistent with the Duralie Coal EIS (133 dBA).

The focus of open pit mining operations (and consequently some of the noise sources) would however be located further to the north-west.

C7 MINE NOISE IMPACT ASSESSMENT

The sub-sections below presents the results of noise modelling for the Project.

C7.1 Daytime Operations Noise Assessment

The predicted Year 3, Year 5 and Year 8 daytime $L_{Aeq(15minute)}$ intrusive noise emissions at the nearest receivers are presented in **Table C-15**. The results are presented for receivers where the noise level is predicted to be 35 dBA (or greater) at some stage during the Project life.

The Year 5 daytime $L_{Aeq(15minute)}$ intrusive noise contours during calm conditions are presented as **Attachment CH-1**. Note, the calculation of the noise contours involves numerical interpolation of a noise level array. This means that in some cases the contour locations presented in **Attachment CH-1** differ from the values presented in **Table C-15** particularly where topographic effects are prominent.

Table C-15 Daytime $L_{Aeq(15minute)}$ Intrusive Noise Emissions (dBA re 20 µPa)

ID No	Landholder	Year 3 Calm	Year 5 Calm	Year 8 Calm
19 (1)	GCL (Former Weismantels Inn)	32	33	29
19 (3)	GCL	28	28	25
19 (4)	GCL	45	45	45
19 (6)	GCL	20	20	18
19 (7)	GCL	27	27	23
19 (8)	GCL	37	39	33
19 (10)	GCL	37	37	32
19 (11)	GCL	37	37	32
19 (12)	GCL	27	29	24
19 (13)	GCL	41	40	40
19 (14)	GCL	38	38	38
19 (16)	GCL	52	52	42
19 (17)	GCL	38	38	35
94	Howard	30	29	26
95	Smith & Ransley	32	33	26
100	Richards	30	33	29
101	Holloway	26	26	22
106	James	30	30	25
115 (4)	Moylan & Newton	26	27	22
116	Weismantel	31	32	27
117	Holmes	**41**[4]	**38**[3]	**36**[2]
120	Mahony	31	29	26
123	Oleksiuk & Carmody	34	**38**[3]	30
124 (1)	Bailey	**39**[3]	**41**[4]	33
124 (2)	Bailey	**39**[3]	**42**[4]	32
125 (1)	Zulumovski	**43**[4]	**47**[4]	**36**[2]
125 (2)	Zulumovski	**48**[4]	**51**[4]	**40**[3]
126	Hamann-Pixalu PL	33	**37**[2]	28
127	Fisher-Webster	33	33	29
128	Hare-Scott	**38**[3]	**36**[2]	**36**[2]
129	Weismantel	**37**[2]	**37**[2]	35
130	Giudice	**36**[2]	**36**[2]	35

Table C-15 Daytime LAeq(15minute) Intrusive Noise Emissions (dBA re 20 µPa) (Continued)

ID No	Landholder	Year 3 Calm	Year 5 Calm	Year 8 Calm
131 (1)	Relton	31	32	29
131 (2)	Relton	**37**[2]	**37**[2]	**38**[3]
144	Wielgosinski	24	25	23
146	Bragg	23	25	22
148	McAndrew	22	23	20
149[1]	Hattam PL	**43**[4]	**44**[4]	**40**[3]
155	Guberina	23	22	19
156	Hope	19	18	15
157	Stephenson	19	18	15
160	Kenney	11	11	10
167	Ravagnani	18	18	15
168 (2)	Schultz	19	18	16
168 (4)	Schultz	15	15	12
168 (5)	Schultz	15	15	12
169	Williams	17	16	14
172[1]	Lyall	28	26	25
173	Trigg & Holland	25	24	23
175	Woodley	17	17	15
177	Thompson	12	12	11
178	Hitchcock & Coldham	11	10	9
180 (1)	Thompson	12	12	10
180 (2)	Thompson	12	11	10
194	Kellehear	27	23	21
204	Jones	15	15	12
220	Lindfield & Associates PL	24	24	20

Note 1: Properties identified in the Development Consent as being in the Noise Affectation Zone.
Note 2: Marginal Noise Management Zone 1 to 2 dBA above 35 dBA (applies to privately-owner receivers only).
Note 3: Moderate Noise Management Zone 3 to 5 dBA above 35 dBA (applies to privately-owner receivers only).
Note 4: Noise Affectation Zone >5 dBA above 35 dBA (applies to privately-owner receivers only).

C7.2 Evening Operations Noise Assessment

The evening $L_{Aeq(15minute)}$ intrusive noise emissions to the nearest receivers are presented in **Table C-16**. The results are presented for receivers where the noise level is predicted to be 35 dBA (or greater) at some stage during the Project life.

Table C-16 Evening $L_{Aeq(15minute)}$ Intrusive Noise Emissions (dBA re 20 µPa)

ID No	Landholder	Year 3		Year 5		Year 8	
		Calm	Wind[5]	Calm	Wind[5]	Calm	Wind[5]
19 (1)	GCL (Former Weismantels Inn)	32	33	33	32	29	28
19 (4)	GCL	45	52	45	51	45	51
19 (3)	GCL	26	24	28	26	20	18
19 (6)	GCL	19	38	19	38	17	37
19 (7)	GCL	26	23	26	24	19	16
19 (8)	GCL	37	36	39	37	32	30
19 (10)	GCL	35	46	35	48	29	41
19 (11)	GCL	35	46	35	48	28	41
19 (12)	GCL	26	24	30	28	19	17
19 (13)	GCL	41	48	41	46	41	46
19 (14)	GCL	38	46	38	45	38	45
19 (16)	GCL	52	53	52	49	43	42
19 (17)	GCL	35	46	36	48	31	42
94	Howard	29	25	29	25	25	20
95	Smith & Ransley	31	28	33	30	23	20
100	Richards	29	27	33	31	23	20
101	Holloway	25	22	26	23	19	17
106	James	29	26	31	28	22	19
115 (4)	Moylan & Newton	26	25	26	25	22	21
116	Weismantel	30	26	33	30	24	20
117[1]	Holmes	**40**[3]	**37**[2]	**38**[3]	34	**37**[2]	34
120	Mahony	31	32	29	29	26	26
123	Oleksiuk & Carmody	33	31	**38**[3]	**37**[2]	25	22
124 (1)	Bailey	**39**[3]	**37**[2]	**41**[4]	**40**[3]	29	26
124 (2)	Bailey	**39**[3]	**37**[2]	**43**[4]	**41**[4]	29	26
125 (1)	Zulumovski	**42**[4]	**39**[3]	**47**[4]	**45**[4]	34	30
125 (2)	Zulumovski	**47**[4]	**44**[4]	**51**[4]	**48**[4]	**42**[4]	**37**[2]
126	Hamann-Pixalu PL	33	31	**37**[2]	35	25	22
127	Fisher-Webster	32	30	32	30	25	23
128	Hare-Scott	**36**[2]	**42**[4]	35	**43**[4]	32	34
129	Weismantel	**36**[2]	**40**[3]	**37**[2]	**41**[4]	30	30
130	Giudice	35	**40**[3]	**36**[2]	**40**[3]	30	29
131 (1)	Relton	30	29	32	34	25	23
131 (2)	Relton	35	**43**[4]	**36**[2]	**43**[4]	**34**	**38**[3]
144	Wielgosinski	23	**39**[3]	25	**39**[3]	22	**38**[3]
146	Bragg	23	**37**[2]	24	32	21	31
148	McAndrew	21	33	22	35	19	34
149[1]	Hattam PL	**39**[3]	**49**[4]	**41**[4]	**49**[4]	**38**[3]	**48**[4]
155	Guberina	21	35	22	**37**[2]	18	31
156	Hope	17	35	17	**36**[2]	15	30
157	Stephenson	17	35	18	**36**[2]	15	30
160	Kenney	11	35	11	33	10	29
167	Ravagnani	17	35	18	32	15	31
168 (2)	Schultz	18	35	18	35	15	34
168 (4)	Schultz	14	34	14	33	12	31

ID No	Landholder	Year 3		Year 5		Year 8	
		Calm	Wind[5]	Calm	Wind[5]	Calm	Wind[5]
168 (5)	Schultz	14	34	14	33	12	31
169	Williams	16	**36**[2]	16	35	13	33
172[1]	Lyall	26	**39**[3]	25	**38**[3]	24	**37**[2]
173	Trigg & Holland	24	**36**[2]	24	35	23	34
175	Woodley	16	34	16	33	14	32
177	Thompson	11	**36**[2]	12	31	11	27
178	Hitchcock &Coldham	10	35	10	34	9	31
180 (1)	Thompson	11	**36**[2]	12	35	11	33
180 (2)	Thompson	11	35	12	31	10	28
194	Kellehear	27	26	23	24	20	21
204	Jones	14	34	14	33	11	31
220	Lindfield & Associates PL	23	34	24	28	20	30

Note 1: Properties identified in the Development Consent as being in the Noise Affectation Zone.

Note 2: Marginal Noise Management Zone 1 to 2 dBA above 35 dBa (applies to privately-owned receivers only).

Note 3: Moderate Noise Management Zone 3 to 5 dBA above 35 dBA (applies to privately-owned receivers only).

Note 4: Noise Affectation Zone >5 dBA above 35 dBA (applies to privately-owned receivers only).

Note 5: Maximum predicted noise level resulting from the evening wind conditions.

The Year 5 evening $L_{Aeq(15minute)}$ intrusive noise contours during wind conditions are presented as **Attachment CH-2**. Note, the calculation of the noise contours involves numerical interpolation of a noise level array. This means that in some cases the contour locations presented in **Attachment CH-2** differ from the values presented in **Table C-16**, particularly where topographic effects are prominent.

C7.3 Night-time Operations Noise Assessment

The night-time $L_{Aeq(15minute)}$ intrusive noise emissions to the nearest receivers are presented in **Table C-17**. The results are presented for receivers where the noise level is predicted to be 35 dBA (or greater) at some stage during the Project life.

Table C-17 Night-time $L_{Aeq(15minute)}$ Intrusive Noise Emissions (dBA re 20 µPa)

ID No	Landholder	Year 3			Year 5			Year 8		
		Calm	Wind	Inv plus Drain[6]	Calm	Wind	Inv plus Drain[6]	Calm	Wind	Inv plus Drain[6]
19 (1)	GCL (Former Weismantels Inn)	32	31	36	33	30	36	29	27	33
19 (3)	GCL	27	23	35	29	26	37	20	17	31
19 (4)	GCL	45	52	53	45	52	52	45	52	52
19 (6)	GCL	19	39	40	19	38	39	18	38	39
19 (7)	GCL	26	23	34	27	24	35	20	16	30
19 (8)	GCL	37	34	42	40	36	44	33	29	42
19 (10)	GCL	35	45	46	36	47	49	29	40	42
19 (11)	GCL	35	45	46	35	47	48	29	40	42
19 (12)	GCL	27	23	36	31	27	36	20	16	30
19 (13)	GCL	41	47	49	41	45	47	41	44	46
19 (14)	GCL	39	47	47	39	46	47	39	46	46
19 (16)	GCL	52	51	56	53	48	56	43	41	47
19 (17)	GCL	35	45	47	36	47	49	31	41	42
94	Howard	30	25	33	30	25	**37**[2]	25	20	31
95	Smith & Ransley	32	27	**37**[2]	34	29	**40**[3]	24	19	35
100	Richards	30	27	**37**[2]	34	30	**40**[3]	23	20	35
101	Holloway	26	22	30	26	22	**36**[2]	20	16	24
106	James	30	26	**36**[2]	31	27	**39**[3]	22	18	27
115 (4)	Moylan & Newton	26	24	35	27	24	34	22	20	30
116	Weismantel	31	26	**39**[3]	33	29	**41**[4]	25	20	35
117[1]	Holmes	**41**[4]	**36**[2]	**44**[4]	**38**[3]	34	**46**[4]	**38**[3]	33	**42**[4]
120	Mahony	31	30	35	30	28	35	26	24	31
123	Oleksiuk & Carmody	34	30	**42**[4]	**39**[3]	**36**[2]	**43**[4]	26	22	**36**[2]
124 (1)	Bailey	**39**[3]	**36**[2]	**42**[4]	**42**[4]	**39**[3]	**46**[4]	29	26	33
124 (2)	Bailey	**39**[3]	**36**[2]	**44**[4]	**44**[4]	**40**[3]	**47**[4]	30	26	33
125 (1)	Zulumovski	**43**[4]	**38**[3]	**48**[4]	**48**[4]	**44**[4]	**51**[4]	34	30	**42**[4]
125 (2)	Zulumovski	**48**[4]	**43**[4]	**51**[4]	**51**[4]	**48**[4]	**54**[4]	**42**[4]	**37**[2]	**45**[4]
126	Hamann-Pixalu PL	33	30	**41**[4]	**38**[3]	35	**42**[4]	25	21	35
127	Fisher-Webster	32	29	**38**[3]	33	29	**42**[4]	26	22	31
128	Hare-Scott	**36**[2]	**37**[2]	**44**[4]	**36**[2]	**36**[2]	**45**[4]	33	31	**41**[4]
129	Weismantel	**36**[2]	35	**44**[4]	**37**[2]	**36**[2]	**45**[4]	30	28	**40**[3]
130	Giudice	35	34	**43**[4]	**37**[2]	35	**44**[4]	30	28	**40**[3]
131 (1)	Relton	30	28	**38**[3]	33	31	**41**[4]	25	22	**36**[2]
131 (2)	Relton	**36**[2]	**39**[3]	**43**[4]	**36**[2]	**38**[3]	**45**[4]	34	33	**43**[4]
144	Wielgosinski	24	32	31	25	31	31	23	30	30
146	Bragg	23	35	33	25	30	30	21	27	26
148	McAndrew	21	33	32	23	35	34	19	34	34
149[1]	Hattam PL	**39**[3]	**46**[4]	**49**[4]	**41**[4]	**46**[4]	**49**[4]	**39**[3]	**46**[4]	**48**[4]
155[5]	Guberina	22	34	28	22	33	28	19	30	23
156[5]	Hope	17	34	28	18	**36**[2]	29	15	30	23

ID No	Landholder	Year 3			Year 5			Year 8		
		Calm	Wind	Inv plus Drain[6]	Calm	Wind	Inv plus Drain[6]	Calm	Wind	Inv plus Drain[6]
157[5]	Stephenson	18	34	31	18	35	32	15	30	23
160	Kenney	11	35	29	11	33	28	10	27	24
167	Ravagnani	18	**36**[2]	**36**[2]	18	32	32	15	31	31
168 (2)	Schultz	19	33	33	19	33	33	16	32	32
168 (4)	Schultz	14	35	34	14	33	33	12	32	31
168 (5)	Schultz	14	35	34	15	33	33	12	31	31
169	Williams	16	**36**[2]	**36**[2]	16	35	34	13	31	31
172[1]	Lyall	26	**40**	**40**[3]	26	**39**[3]	**40**[3]	24	**38**[3]	**39**[3]
173	Trigg & Holland	25	**37**[2]	**37**[2]	24	**36**[2]	**37**[2]	24	35	35
175	Woodley	16	35	35	17	34	34	14	33	34
177	Thompson	11	**36**[2]	22	12	32	18	11	27	15
178	Hitchcock & Coldham	9	34	29	10	32	29	10	27	23
180 (1)[5]	Thompson	11	**37**[2]	30	12	35	27	11	34	21
180 (2)	Thompson	11	35	27	11	30	23	11	25	16
194	Kellehear	27	26	34	24	22	35	21	19	34
204	Jones	14	35	34	14	33	33	12	32	31
220	Lindfield & Associates PL	23	25	**36**[2]	24	24	**36**[2]	21	20	34

Note 1: Properties identified in the Development Consent as being in the Noise Affectation Zone.
Note 2: Marginal Noise Management Zone 1 to 2 dBA above 35 dBA (applies to privately-owned receivers only).
Note 3: Moderate Noise Management Zone 3 to 5 dBA above 35 dBA (applies to privately-owned receivers only).
Note 4: Noise Affectation Zone >5 dBA above 35 dBA (applies to privately-owned receivers only).
Note 5: Properties not subject to drainage flow due to intervening topography.
Note 6 Maximum predicted noise level resulting from inversion plus drainage flow or inversion only conditions.

The Year 5 night-time $L_{Aeq(15minute)}$ intrusive noise contours during temperature inversion (and drainage flow) are presented as **Attachment CH-3**. Note, the calculation of the noise contours involves numerical interpolation of a noise level array. This means that in some cases the contour locations presented in **Attachment CH-3** will differ from the values presented in **Table C-17** particularly where topographic effects are prominent.

C7.4 Summary of Operational Noise Results

In summary, the predicted noise levels show that:

- Compliance is generally determined by night-time noise levels, due to the noise enhancing meteorological conditions experienced at night-time.
- A total of 32 privately owned receivers exceed the Project specific criteria, including 17 receivers within the Noise Management Zone, and 15 receivers in the noise affectation zone.
- During the daytime, up to six privately owned receivers within the Noise Management Zone and six receivers in the noise affectation zone.
- During the evening, up to 14 privately owned receivers within the Noise Management Zone and eight receivers in the noise affectation zone.

- During the night-time, up to 13 privately owned receivers within the Noise Management Zone and 15 receivers in the noise affectation zone.

Table C-18 presents a summary of privately-owned receivers with predicted noise levels in exceedance of Project specific criteria.

Table C-18 Privately Owned Rural Receivers[1] with Noise Level Exceedances

	Noise Management Zone		Noise Affection Zone
Period	**1 dBA to 2 dBA above 35 dBA**	**3 dBA to 5 dBA above 35 dBA**	**> 5 dBA above 35 dBA**
Daytime	126 Hamann-Pixalu PL 129 Weismantel[2] 130 Giudice[2]	123 Oleksiuk & Carmody 128 Hare-Scott[2] 131 (2) Relton[2]	117 Holmes[3] 124 (1) Bailey[2] 124 (2) Bailey[2] 125 (1) Zulumovski 125 (2) Zulumovski[2] 149 Hattam PL[3]
Evening	126 Hamann-Pixalu PL 146 Bragg 155 Guberina 156 Hope 157 Stephenson 169 Williams 173 Trigg & Holland 177 Thompson 180 (1) Thompson	117 Holmes[3] 123 Oleksiuk & Carmody 130 Giudice[2] 144 Wielgosinski 172 Lyall[3]	124 (1) Bailey[2] 124 (2) Bailey[2] 125 (1) Zulumovski 125 (2) Zulumovski[2] 128 Hare-Scott[2] 129 Weismantel[2] 131 (2) Relton[2] 149 Hattam PL[3]
Night-time	94 Howard 101 Holloway 156 Hope 167 Ravagnani 169 Williams 173 Trigg & Holland 177 Thompson 180 (1) Thompson 220 Lindfield & Associates PL	95 Smith & Ransley 100 Richards 106 James 172 Lyall[3]	116 Weismantel 117 Holmes[3] 123 Oleksiuk & Carmody 124 (1) Bailey[2] 124 (2) Bailey[2] 125 (1) Zulumovski 125 (2) Zulumovski[2] 126 Hamann-Pixalu PL 127 Fisher-Webster 128 Hare-Scott[2] 129 Weismantel[2] 130 Giudice[2] 131 (1) Relton 131 (2) Relton[2] 149 Hattam PL[3]

Note 1: Refer to **Attachments CB-1a** and **CB-1b** for land ownership details.

Note 2: Properties identified in the existing DCM Development Consent (DA 168/99) as being in the Noise Management Zone.

Note 3: Properties identified in the existing DCM Development Consent (DA 168/99) as being in the Noise Affectation Zone.

C7.5 Vacant Land Noise Assessment

As discussed in **Section C5.3** , the DoP has previously advised that the noise impacts on vacant land are assessed on a "case by case" basis. **Table C-19** identifies those properties for all scenarios where exceedances of the $L_{Aeq(15\ minute)}$ intrusive noise level is predicted for more than 25% of vacant land.

Table C-19 Vacant Land with Project-specific Noise Level Exceedances

Assessment Period	**36 to 37 dBA**	**38 to 40 dBA**	**above 40 dBA**
Daytime	-	104 Mudford[1]	118 Moylan 122 White
Evening	140 Bennett & Stark 158 Gilbert	-	104 Mudford[1] 118 Moylan 122 White
Night-time	-	-	104 Mudford[1] 118 Moylan 122 White

Note 1: Properties identified in the Development Consent as being in the Noise Affectation Zone.

C7.6 Review of Existing DCM Noise Monitoring Program

It is recommended that the existing DCM Noise Monitoring Program (**Section C2.3**) be reviewed and revised for the Project to include:

- The noise mitigation and management measures included in the Project noise model.
- Revised locations for operator attended compliance monitoring.
- Establish reference location(s) for continuous off-site monitoring to assist with mine noise level management.
- Upgrade the on-site AWS to include measurement of sigma-theta.
- Undertake direct measurement of temperature inversions during periods of operator attended compliance monitoring in accordance with the methodology presented in **Attachment CI**.

C8 BLASTING IMPACT ASSESSMENT

C8.1 Australian Standard Criteria

AS 2187: Part 2-2006 "*Explosives - Storage and Use - Part 2: Use of Explosives*" provides guidance in assessing blast-induced ground (and structural) vibration and airblast effects on buildings and their occupants is presented in detail in Appendix J of AS 2187.

Recommended vibration limits are generally based on international standards (or studies) as presented in Appendix J Tables J4.5(A) and J4.5(B) of AS 2187, for human comfort and structural building damage respectively. Similarly, recommended human comfort and structural damage airblast limits are presented in Appendix J Tables J5.4(A) and J5.4(B) AS 2187, respectively.

C8.2 Human Comfort Noise and Vibration Criteria

Ground vibration and airblast levels which cause human discomfort are generally lower than the recommended structural damage limits. Therefore, compliance with the lowest applicable human comfort criteria generally ensures that the potential to cause structural damage is minimal.

The DECCW currently adopts the ANZECC *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* dated September 1990 for assessing potential annoyance from blast emissions during daytime hours, as follows:

- The recommended maximum level for airblast is 115 dB Linear.
- The level of 115 dB Linear may be exceeded on up to 5% of the total number of blasts over a period of 12 months. The level should not exceed 120 dB Linear at any time.
- The recommended maximum for ground vibration is 5 millimetres per second (mm/s), Peak Vector Sum (PVS) vibration velocity. It is recommended however, that 2 mm/s (PVS) be considered as the long-term regulatory goal for the control of ground vibration.
- The PVS level of 5 mm/s may be exceeded on up to 5% of the total number of blasts over a period of 12 months. The level should not exceed 10 mm/s at any time.

The ANZECC criteria are generally consistent with AS 2187: Part 2-2006 Appendix J Tables J4.5(A) and J5.4(A) with respect to vibration and airblast human comfort respectively.

C8.3 Building Damage Airblast Criteria

In relation to building damage airblast criteria AS 2187: Part 2-2006 Appendix J J5.4(B) recommends a maximum airblast of 133 dB Linear Peak (pkLinear).

C8.4 Building Damage Vibration Criteria

In relation to building damage vibration criteria AS 2187: Part 2-2006 Appendix J J4.5(B) is derived from British Standard 7385: Part 2-1993 *Evaluation and Measurement for Vibration in Buildings Part 2. Guideline to damage levels from ground borne vibration*. The standard sets guideline values for building vibration based on the lowest vibration levels above which damage has been credibly demonstrated. These levels have been established to give a minimum risk of vibration-induced damage, where minimal risk for a named effect is usually taken as a 95% probability of no effect.

Sources of vibration which are considered in the standard include blasting (carried out during mineral extraction or construction excavation), demolition, piling, ground treatments (e.g. compaction), construction equipment, tunneling, road and rail traffic and industrial machinery.

The recommended limits (guide values) for transient vibration to ensure minimal risk of cosmetic damage to residential and industrial buildings are presented numerically in **Table C-20** and graphically in **Figure C-2**.

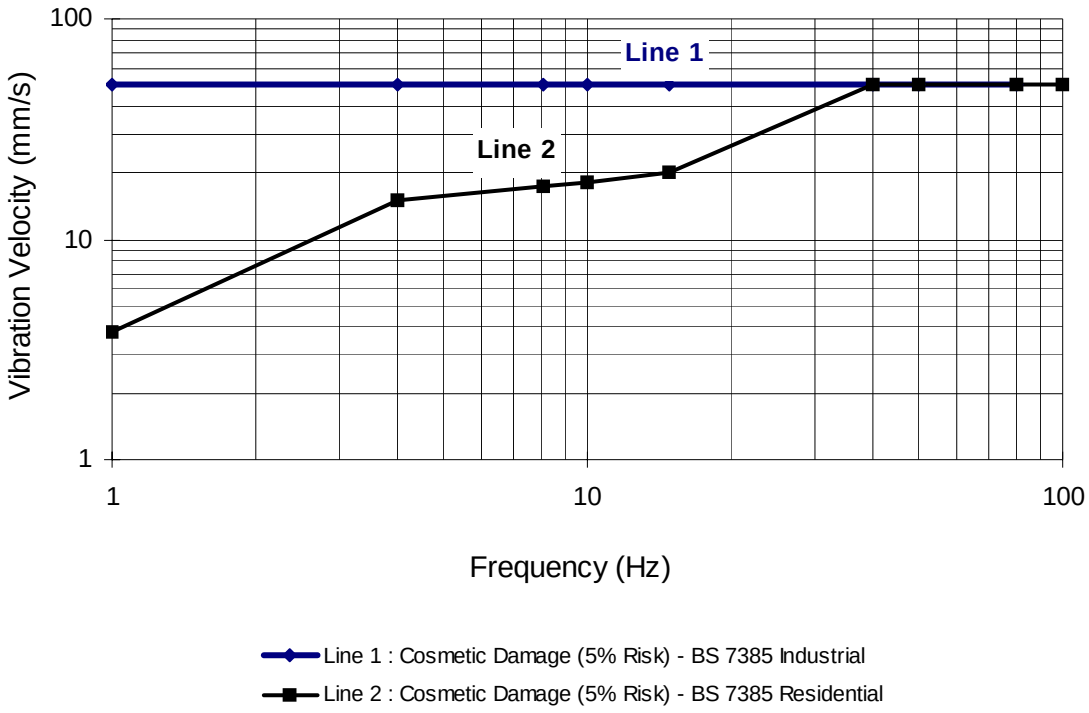
Table C-20 Transient Vibration Guide Values - Minimal Risk of Cosmetic Damage

Line	Type of Building	Peak Component Particle Velocity in Frequency Range of Predominant Pulse	
		4 to 15 Hz	15 Hz and Above
1	Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	-
2	Unreinforced or light framed structures Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

Hz - Hertz

The standard states that the guide values in **Table C-20** relate predominantly to transient vibration which does not give rise to resonant responses in structures, and to low-rise buildings.

Figure C-2 Graph of Transient Vibration Guide Values for Cosmetic Damage



The standard goes on to state that minor damage is possible at vibration magnitudes which are greater than twice those given in **Table C-20** and major damage to a building structure may occur at values greater than four times the tabulated values.

It is noteworthy that extra to the guide values nominated in **Table C-20**, the standard states that:

> *Some data suggests that the probability of damage tends towards zero at 12.5 mm/s peak component particle velocity. This is not inconsistent with an extensive review of the case history information available in the UK.*

Also that:

> *A building of historical value should not (unless it is structurally unsound) be assumed to be more sensitive.*

The Non-Aboriginal Heritage Assessment (Hertiage Management Consultants, 2009) (Appendix K of the Environmental Assessment [EA]) has identified the Former Weismantels Inn as an item of non-Aboriginal significance. The Former Weismantels Inn is located outside of the Project disturbance area but within approximately 600 m of the open pit operations. The building is owned by DCPL and is known to be in good condition. Based on the foregoing discussion a vibration damage assessment criterion of 10 mm/s (Peak Component Particle Velocity) would be applicable to the Former Weismantels Inn and all other residential receivers.

C8.5 Archaeological/Geological Vibration Damage Criteria

The Aboriginal Cultural Heritage Assessment (Kayandel Archaeological Services, 2009) (Appendix J of the EA) has identified the Mammy Johnson's Grave as a site of significance. The Mammy Johnson's grave is located outside of the Project disturbance area and approximately 1 km from the Project open pit mining operations.

There are no regulatory criteria nominated in Australia for the assessment of damage to archaeological/geological structures from vibration. Research however has been undertaken by the US Army Corps of Engineers into the effects of large surface blasts on the dynamic stability of nearby unlined tunnels of various diameters in sandstone and granite (*Blast Vibration Monitoring and Control* [Dowding, 1985]). The results of the research indicated that intermittent rock fall or observable damage was not observed until vibration levels exceeded 460 mm/s.

The German Standard DIN 4150-3 *Structural Vibration Part 3: Effects of Vibration on Structures* dated February 1999 does not specifically include criteria for assessing the "short-term" (i.e. blasting) effects of vibration on geological structures. However the DIN 4150-3 does include guideline vibration velocity of 80 mm/s for evaluating the effects of "short-term" vibration on buried clay and concrete pipework. The application of this criterion to geological structures is considered conservative and introduces a five-fold safety factor by comparison to the observable damage value of 460 mm/s (as described above).

Notwithstanding the above, the DoP has recently included the grave in Condition 8, Schedule 3 of the DCM Development Consent (DA 168/99), meaning the applicable vibration limit is 5 mm/s (with an allowable exceedance of 5% of the total number of blasts over a period of 12 months). This assessment includes consideration of both the 80 mm/s and 5 mm/s criteria for completeness.

C8.6 Roadway/Pavement Vibration Damage Criteria

The Bucketts Way is located approximately 600 m from the northern portion of the Weismantel Extension open pit. There are no regulatory criteria nominated in Australia for the assessment of damage to roadways or concrete pavements. Heggies recently conducted a literature review associated with concrete pavements which concluded that none of the United States, Swedish, Canadian or United Kingdom blasting studies, including those achieving 125 mm/s to 250 mm/s ground vibration, found cases of slab and pavement cracking. Asphalt roadways are relatively more flexible and less susceptible to cracking by comparison to concrete pavements. A very conservative roadway damage criterion of 125 mm/s has been applied to The Bucketts Way for this blast assessment.

C8.7 Proposed Open Pit Blasting Practices

Assessment of the potential ground-borne vibration and airblast emissions arising from overburden blasting has been based on the indicative Project blast design parameters presented in **Table C-21** and represent a continuation of the currently approved DCM blasting practices.

Table C-21 Indicative Project Blast Design Parameters

Parameter	Typical Ranges
Bench Height	15 to 25 m
Burden and Spacing	Shallow: 5.0 m x 6.0 m, Deep: 6.0 m x 7.0 m
Stemming	4 m (aggregate)
Hole Diameter	150 to 230 mm
Number of Holes	Typically between 800 and 1,300 holes
Holes per Delay	Typically 1 to 4 holes
Explosive Type	Wet product - Fortis Coal (Powergel) Moist/Dry - Fortan Coal (Energan - Heavy ANFO) Dry – ANFO
Maximum Instantaneous Charge (MIC)	MIC 400 kg to 1,500 kg

C8.8 Predicted Blast Emissions and Assessment

By adopting the suggested design, blast vibration and airblast emissions were predicted at the nearest residential receivers as presented **Table C-22** using the relevant formula presented in AS 2187.2 (2006) and Orica Blasting Guide Part 1 (January 2006), as follows:

$$PVS\ (50\%) = 1{,}140\ (R/Q^{1/2})^{-1.60}$$
$$PVS\ (5\%) = 3{,}272\ (R/Q^{1/2})^{-1.60}$$
$$SPL\ (50\%) = 164 - 24(\log(R) - \tfrac{1}{3}\log(Q))$$
$$SPL\ (5\%) = 172 - 24(\log(R) - \tfrac{1}{3}\log(Q))$$

where,

PVS = PVS vibration velocity (mm/s)
SPL = Peak airblast noise level (dB Linear)
R = Distance between charge and receiver (m)
Q = Charge mass per delay (kg)

Table C-22 Predicted Blast Emissions

ID No.	Landholder	Peak Particle Velocity Vibration[1] (mm/s)				Peak Linear Airblast[1] (dB re 20 µPa)			
		MIC 400 kg		MIC 1,500 kg		MIC 400 kg		MIC 1,500 kg	
		50%	5%	50%	5%	50%	5%	50%	5%
19 (16)	GCL	3	8	8	24	115	123	120	128
125 (2)	Zulumovski	2	5	5	16	112	120	117	125
19 (1)	GCL (Former Weismantels Inn)	2	5	5	15	112	120	116	124
19 (8)	GCL	2	5	5	13	111	119	116	124
139	Juttner	2	5	5	13	111	119	115	123
19 (9)	GCL	2	4	4	12	111	119	115	123
125 (1)	Zulumovski	1	4	4	10	109	117	114	122
120	Mahony	1	3	3	10	109	117	114	121
117	Holmes	1	3	3	9	108	116	113	121
142	Madden	1	3	3	8	108	116	112	120
124 (1)	Bailey	1	3	3	8	107	115	112	120
124 (2)	Bailey	1	3	3	7	107	115	112	120
149	Hattam PL	1	2	2	7	107	115	111	119
143	Madden	1	2	2	7	107	115	111	119
128	Hare-Scott	1	2	2	6	106	114	111	119

ID No.	Landholder	Peak Particle Velocity Vibration[1] (mm/s)				Peak Linear Airblast[1] (dB re 20 µPa)			
		MIC 400 kg		MIC 1,500 kg		MIC 400 kg		MIC 1,500 kg	
		50%	5%	50%	5%	50%	5%	50%	5%
131 (2)	Relton	1	2	2	5	105	113	110	118
115 (4)	Moylan & Newton	1	2	2	5	105	113	109	117
129	Weismantel	1	2	2	5	105	113	109	117
115 (1)	Moylan & Newton	1	2	2	5	105	112	109	117
144	Wielgosinski	1	2	2	5	104	112	109	117
127	Fisher-Webster	1	2	2	5	104	112	109	117
115 (2)	Moylan & Newton	1	2	2	5	104	112	109	117
115 (3)	Moylan & Newton	1	2	2	5	104	112	109	117
130	Giudice	1	2	2	5	104	112	109	117
145	Owens	1	2	2	4	104	112	108	116
194	Kellehear	0.5	1	1	4	103	111	108	116
146	Bragg	0.5	1	1	4	103	111	107	115
123	Oleksiuk & Carmody	0.4	1	1	3	102	110	107	115
126	Hamann-Pixalu PL	0.4	1	1	3	102	110	107	115
220	Lindfield & Associates PL	0.4	1	1	3	102	110	107	115
147	Edwards	0.4	1	1	3	102	110	107	115
19 (17)	GCL	0.4	1	1	3	102	110	107	114
19 (10)	GCL	0.4	1	1	3	101	109	106	114
19 (11)	GCL	0.4	1	1	3	101	109	106	114
116	Weismantel	0.4	1	1	3	101	109	106	114
131 (1)	Relton	0.3	1	1	3	101	109	106	114
113	Edwards	0.3	1	1	3	101	109	105	113
100	Richards	0.3	1	1	3	101	109	105	113
216	Matcham	0.3	1	1	3	101	108	105	113
94	Howard	0.3	1	1	3	100	108	105	113
100	Richards	0.3	1	1	3	100	108	105	113
112	Hogeveen	0.3	1	1	3	100	108	105	113
101	Holloway	0.3	1	1	2	99	107	104	112
19 (4)	GCL (Mammy Johnson's Grave)	0.2	1	1	2	-	-	-	-
-	The Bucketts Way	2	6	6	17	-	-	-	-

Note 1: Based on the indicative blast parameters presented in **Table C-21**.

The following assessments are derived from the predicted blast emissions and relevant assessment criteria presented above:

Building Damage Criteria - MIC 400 kg to 1,500 kg - 5% Exceedance

With a MIC of 400 kg, the blast emission levels are predicted to be below the building damage criteria of 10 mm/s (vibration) and 133 dB pkLinear (airblast) at all receivers including the heritage listed Former Weismantles Inn (**Table C-22**).

With a MIC of 1,500 kg, the airblast levels (MIC 1,500 kg) are predicted to be below the building damage criterion 133 dB pkLinear at all receivers and equal to or below the vibration velocity criterion of 10 mm/s except at six receivers (i.e. 19 [16], 125 [2], 19 [1], 19 [8], 139, 19 [9]) (**Table C-22**).

Human Comfort Criteria - MIC 400 kg to 1,500 kg - 5% Exceedance

With a MIC of 400 kg, the vibration velocities are below the 5 mm/s criterion at all receivers except at receiver 19 (16) (GCL) (**Table C-22**). The airblast levels (MIC 400 kg) are equal to or below the 115 dB pkLinear criterion at all receivers except at ten receivers (i.e. 19 [16] to 142 - refer to **Table C-22**).

With a MIC of 1,500 kg, the vibration velocities are predicted to be equal to or below the 5 mm/s criterion at all receivers except at 15 receivers (i.e. 19 [16] to 128 - refer to **Table C-22**). The airblast levels (MIC 1,500 kg) are equal to or below the 115 dB pkLinear criterion at all receivers except 26 receivers (i.e. 19 [16] to 194 - refer to **Table C-22**).

The recommended long-term regulatory target of 2 mm/s can be achieved from blasting (MIC 400 kg and 50% exceedance) at receivers beyond approximately 1 km. Similarly, 2 mm/s can be achieved from blasting (MIC 1,500 kg and 50% exceedance) at receivers beyond approximately 2 km.

Archaeological/Geological Damage Criteria - MIC 400 kg to 1,500 kg - 5% Exceedance

Vibration velocities are below the 80 mm/s archaeological/geological damage criterion and the current DCM Development Consent 5 mm/s criteria at the Mammy Johnson's Grave.

Roadway/Pavement Damage Criteria - MIC 400 kg to 1,500 kg - 5% Exceedance

Vibration velocities are below the 125 mm/s Roadway/Pavement damage criterion at The Bucketts Way.

C8.9 Flyrock Impact Assessment

Flyrock is any material ejected from the blast site by the force of the blast.

There are generally two main areas within the blast from which flyrock has the potential to be produced. These are at the blasthole collar (where the stemming length has not been optimised and the explosive column is too close to the upper surface of the rock mass creating crater effects - rifling) and at the face of the blast (where there could be less than optimum burden on a blasthole whereby the explosives gases are able to vent to atmosphere - blowouts, producing flyrock).

Flyrock would be managed through appropriate blast design in order minimise flyrock risk to the public using Durallie Road or nearby residential receivers.

In terms of collar ejection, the proposed stemming length of 4 m is considered acceptable for the proposed blasthole lengths and has been selected in order to totally contain the explosives and separate them from the collar of the blasthole. Aggregate would be used as the stemming material to contain the explosives within the blasthole.

Burden on the front-row blastholes would be checked in order to identify any areas of less than optimum burden and, if required, inert material (rather than explosives) would be placed at this location in the blasthole. Consequently, the latter situation in relation to flyrock would not occur.

Operational experience indicates that the majority of blasts result in either no flyrock or limited flyrock less than 50 m from the blast. Occasional anomalous blast events have resulted in flyrock being recorded around 100 m to 150 m from the blast.

We understand the NSW Department of Industry and Investment and the NSW Road Traffic Authority has previously permitted open pit blasting to be carried-out at distances 500 m (or greater) without the need for road closure and hence it is not expected that any management measures for The Bucketts Way would be required for the Project blasting. The section of Durallie Road within 500 m would be closed and public access restricted during blasting events by use of security gates.

C8.10 Review of Existing Blast Monitoring Program

In is recommended that the existing Blast Monitoring Program be reviewed and revised for the Project to include:

- Review of vibration and airblast monitoring locations, including provision of vibration monitoring at the Former Weismantles Inn.
- Development and ongoing review of “site laws” (i.e. site based prediction equations) for ground vibration and airblast overpressure.
- Safety control measures and notification procedures in relation to Durallie Road and nearby residential receivers as appropriate.
- Occupants of dwellings within 2 km of a proposed blast would be given the opportunity to be notified prior to all blast events for the Project.
- Establishment of an appropriate exclusion zone around blast events, including the positioning of sentries on public access points for privately owned properties within 500 m of a blast event.

C9 OFF-SITE ROAD TRANSPORT NOISE

C9.1 Traffic Noise Criteria

The Bucketts Way and Durallie Road are classified as sub-arterial and local roads, respectively, in accordance with the DECCW's ECRTN as presented in **Table C-233**.

Table C-23 NSW Environmental Criteria for Road Traffic Noise (dBA re 20 µPa)

Receiver Area	Road	Policy	Descriptor[1]	Noise Criterion
Between Stroud Road and Wards River	The Bucketts Way	Land use developments with the potential to create additional traffic existing on sub-arterials	Daytime LAeq(15hour)	60
			Night-time LAeq(9hour)	55
	Durallie Road	Land use developments with the potential to create additional traffic existing on local roads	Daytime LAeq(1hour)	55
			Night-time LAeq(1hour)	50

Note 1: Daytime 0700 hours to 2200 hours, Night-time 2200 hours to 0700 hours.

Note that in all cases where the nominated criteria are already exceeded, traffic associated with new development should not be permitted to lead to an increase in the existing noise traffic levels of more than 2 dBA. This can be achieved when the Project related percentage increase in existing light and heavy vehicle movements is no greater than 60%.

The DCM Access Road is a private road (but is not used for coal haulage) with a speed limit of 50 kilometres per hour (km/h). The DECCW's Application Notes recommends that private access roads form part of the Project site and therefore should be considered an intrusive noise source (rather than road traffic). This is particularly the case the access road is used for coal haulage (which is not the case for the existing DCM or the Project). Notwithstanding, the nearest potentially affected receiver (i.e. 168 [3] Shultz) to the DCM Access Road has been conservatively assessed for cumulative operational and traffic noise impacts.

C9.2 Traffic Noise Impact - The Bucketts Way

The existing and additional traffic movements on The Bucketts Way in the vicinity of the DCM Access Road are presented in **Table C-24**. For the purposes of noise impact assessment, the existing traffic and additional daily traffic together with the morning and afternoon peak hour flows are shown with the percentage change shown in brackets.

Table C-24 Existing and Additional Two-way Traffic Movements - The Bucketts Way

Time Period	Existing			Additional[1]			Cumulative (% change)		
	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total
DCM Traffic	212	28	240	26	8	34	238 (12%)	36 (29%)	274 (14%)
Non-DCM Traffic	1,131	245	1,376	215	56	271	1346 (19%)	301 (23%)	1647 (20%)
Daily - 24 hours	1,343	273	1,616	241	64	305	1584 (18%)	337 (23%)	1921 (19%)
Early Morning Peak Hour	96	20	116	18	4	22	115 (19%)	23 (19%)	138 (19%)
Afternoon Peak Hour	114	23	137	21	4	26	135 (19%)	28 (19%)	163 (19%)

Source: Appendix H of the EA.

Note 1: Additional non-DCM traffic incorporates an assumed baseline traffic growth.

In all cases, the anticipated increase in vehicle movements on The Bucketts Way is much less than 60% and therefore the corresponding increase in traffic noise would be well within 2 dBA, hence any traffic noise impacts that do arise are likely to be acceptable.

C9.3 Traffic Noise Impact - Durallie Road

Durallie Road is a local road providing access to a limited number of private properties. The anticipated increase in DCM vehicle movements on Durallie Road is less than 60% (Appendix H of the EA) and therefore the corresponding increase in traffic noise would be well within 2 dBA, hence any traffic noise impacts that do arise are likely to be acceptable.

C9.4 Cumulative Operational and Traffic Noise Impact - DCM Access Road

The existing and additional mine generated traffic movements are presented in **Table C-25**. For the purposes of noise impact assessment, the existing traffic and additional Project daily traffic together with the morning and afternoon peak hour flows are shown. The nearest potentially affected property relative to the DCM Access Road is receiver 168 (3) Schultz with an off-set distance of 190 m.

Table C-25 Existing DCM and Project related Two-way Traffic Movements

Time Period	Existing DCM			Additional Project		
	Light	Heavy	Total	Light	Heavy	Total
Daily - 24 hours	212	28	240	26	8	34
Early Morning Peak Hour	39	2	42	5[1]	1[1]	5
Afternoon Peak Hour	34	1	34	4[1]	0[1]	4

Source: Appendix H of the EA.

Note 1: Estimated from existing traffic.

Traffic noise predictions were based on the methodology endorsed by the US Environmental Protection Agency Report 550/9-74-004 dated March 1974 with modifications based on equations in Appendix A-13 and certain amendments recommended in the UK Calculation of Road Traffic Noise (CORTN). The prediction methodology is generally conservative and takes into account vehicle volume, speed, type, pass-by duration and assumes no intervening barriers or topography with a 50% angle of view to the DCM Access Road (and no façade reflection for intrusive noise).

The predicted traffic noise and corresponding Year 5 Project operating noise levels are presented **Table C-26**. The cumulative noise level of 36 dBA is only marginally (1 dBA) above the intrusive criteria of 35 dBA with minimal noise impact.

Table C-26 Project Operating, Traffic and Cumulative Intrusive Levels - Receiver 168 (3) Schultz

Time Period	Project Operating Intrusive Level			Traffic Intrusive Level			Cumulative Intrusive Level			Project Specific Noise Level		
	Day-time	Evening	Night-time	Day-time	Evening	Night-time	Day-time	Evening	Night-time	Day-time	Evening	Night-time
Early Morning Peak	-	-	33	-	-	33	-		36[1]	-		35
Afternoon Peak	19	33	-	32	32	-	32	36[1]	-	35	35	

Note 1: Marginal exceedance of Project specific noise levels.

C10 OFF-SITE RAIL TRANSPORT NOISE

C10.1 Railway Noise Criteria

The ARTC controls and operates the North Coast Railway in NSW. Noise emissions from the railway are regulated via the ARTC's EPL (EPL No 3142) attached as **Attachment CJ**.

Section L6 of the EPL nominates general airborne noise limits at residential receivers as follows:

L6.1.1 General Noise Limits

It is an objective of this Licence to progressively reduce noise levels to the goals of 65 dB(A)Leq, (day time from 7am - 10pm), 60 dB(A)Leq, (night time from 10pm - 7am) and 85dB(A) (24 hr) max pass-by noise, at one metre from the façade of affected residential properties through the implementation of the Pollution Reduction Program.

The goals do not represent unobtrusive noise levels. Rather, the objectives recognise that railway operations are inherently noisy and represent a compromise between what may be desirable from a community point of view (i.e. maintaining amenity) and what is necessary to enable trains to continue to operate.

Based on the foregoing, the general noise limits for the North Coast Railway are presented in **Table C-27** and form the basis of guideline noise assessment criteria.

Table C-27 ARTC's Guideline Noise Assessment Criteria

Railway	Licence Holder	Descriptor	Rail Traffic Goal
North Coast Railway	ATRC EPL 3142	Daytime/evening $L_{Aeq(15hour)}$	65 dBA
		Night-time $L_{Aeq(9hour)}$	60 dBA
		Maximum Pass-by L_{Amax}	85 dBA

The DECCW has recently (October 2009) released "Environmental Assessment Requirements for Rail Traffic-Generating Developments", which are available via the DECCW website http://www.environment.nsw.gov.au/noise/railnoise.htm. Rail noise assessment trigger levels are provided in the DECCW requirements and are reproduced in **Table C-28** below.

Table C-28 DECCW Rail Noise Assessment Trigger Levels for Rail Traffic Generating Developments

Descriptor	Rail Traffic Goal
$L_{Aeq(24hour)}$	60 dBA
Maximum Pass-by L_{Amax} (95^{th} percentile)	85 dBA

Note: 95^{th} percentile equates to the 5% exceedance value.

The DECCW rail noise assessment trigger levels are similar to the ARTC's EPL noise goals, however the DECCW trigger levels have an averaging period of 24 hours, rather than day (15 hours) and night-time (9 hours) for the ARTC's goals. Potential rail noise from the Project has been assessed against both sets of criteria (i.e. ARTC's EPL and the DECCW requirements).

C10.2 Rail Traffic Movements

The existing, additional and cumulative 24 hour train movements are presented in **Table C-29** together with the estimated operating conditions on the portion of the North Coast Railway between the DCM and the SCM.

Table C-29 Existing, Additional and Cumulative 24 Hour Train Movements

Scenario	Train Type	Period	24 Hours Train Pass-bys		Train Length (m)	Train Speed (kph)
			Average	Peak		
Existing/Approved	Passenger trains	Monday to Saturday	6	6	205	60
		Sunday	6	6		
	Freight trains	Monday to Saturday	10	13	1500	60
		Sunday	11	11		
	SCM (Product Coal)	Monday to Saturday	5	10	760	60
		Sunday	5	10		
	DCM (ROM Coal)	Monday to Saturday	6	8	560	60
		Sunday	0	0		
Project Year 1	DCM (ROM Coal)	Monday to Saturday	6	8	560	60
		Sunday	0	0		
Project from Year 2	DCM (ROM Coal)	Monday to Saturday	8	10	600	60
		Sunday	0	0		

The calculation of the daytime/evening and night-time equivalent continuous noise levels and the maximum pass-by levels have been conducted using a computer prediction model developed by Heggies. This model has previously been accepted by the DoP and DECCW and has been further validated against the field measurements of rail noise on the North Coast Railway presented in **Section C4.3**.

The prediction model uses characteristic noise levels for the various sources (locomotive engine and exhaust noise as a function of throttle notch, wheel/rail noise as a function of train speed, and wagon type, etc.) at a fixed reference distance. The model then makes adjustments for the train length and distance from the track (assuming no barriers) and façade reflection (2.5 dBA).

Parameters including the $L_{Aeq(24hour)}$ and maximum pass-by levels can then be determined by summing the effects of the individual noise sources and by incorporating the number of train events as appropriate.

As noted in **Section C4.3**, the existing DCM locomotives would be replaced by CFCLA GL Class locomotives from Year 2 of the Project. The CFCLA GL Class locomotives are the same (or equivalent) in terms of noise in operation at the SCM and are relatively quieter than the existing DCM trains. During Year 1 of the Project, the existing trains would be used during the existing approved hours (i.e. no train movements at night-time). The rail traffic noise assessment presented below presents the noise levels for these two scenarios for the daytime/evening periods.

C10.3 Rail Traffic Noise Assessment – ARTC Criteria

The daytime/evening $L_{Aeq(15hour)}$ and maximum (5% exceedance) passby noise levels for the existing and approved rail traffic are presented in **Table C-30** together with cumulative trains (inclusive of Project) for Year 1 (existing trains) and for Year 2 onwards (following the introduction of CFCLA GL Class locomotives). Project train movements are considered on an average and peak basis.

Table C-30 Daytime/Evening Predicted Train Noise Emissions (dBA re 20 µPa)

Distance to Receiver[3]	Recievers	Existing and Approved Rail Movements[1] and Project Year 1			Cumulative Rail Movements[2] From Year 2 of the Project		
		Average LAeq(15hour)	Peak LAeq(15hour)	Pass-by Maximum	Average LAeq(15hour)	Peak LAeq(15hour)	Pass-by Maximum
0-20 m	Nil	65	66	96	64	65	93
20-40 m	R1-R3	62	63	90	61	62	87
40-60 m	R4-R12	60	62	87	60	61	83
60-80 m	R13-R33	59	60	84	58	60	81
80-100 m	R34-R35	58	60	82	58	59	79

Note 1: Rail traffic noise from existing passenger/freight trains and approved SCM and DCM coal trains.

Note 2: Rail traffic noise from existing passenger/freight trains, approved SCM coal trains and proposed DCM Project from Year 2.

Note 3: Train noise level calculated to the maximum distance within the receiver range.

The daytime/evening $L_{Aeq(15hour)}$ and maximum (5% exceedance) pass-by noise levels for the existing and approved rail traffic are presented in **Table C-30** together with cumulative trains (inclusive of Project). Project train movements are considered on an average and peak basis.

The following assessments are derived from the predicted rail traffic levels and the ARTC's guideline noise assessment criteria of daytime/evening 65 $L_{Aeq(15hour)}$ and maximum pass-by 85 dBA:

- The existing/approved peak $L_{Aeq(15hour)}$ rail noise is predicted to meet the 65 dBA criterion at a distance of 25 m (and greater). This would remain unchanged for Year 1.
- From Year 2, the existing/approved cumulative peak $L_{Aeq(15hour)}$ rail noise would decrease by approximately 1 dBA and meet the daytime 65 dBA criterion at a distance of 20 m (and greater).
- The existing/approved maximum pass-by noise level is predicted to meet the criterion of 85 dBA at a distance of 70 m (and greater). Approximately 22 receivers (R1 to R22 as shown on **Attachment CF**) are located within 70 m of the railway. This would remain unchanged during Year 1.
- A comparison of the existing/approved maximum pass-by rail noise with the cumulative level (from Year 2 of the Project) indicates that with the introduction of the CFCLA GL Class locomotives for DCM trains would decrease the maximum pass-by rail noise and meet the 85 dBA criterion at a distance of 50 m (and greater). Fifteen receivers (R8 to R22 as shown on **Attachment CF**) that previously exceeded the 85 dBA maximum pass-by criterion would meet the criterion as a result of the adoption of the CFCLA GL Class DCM train from Year 2.

The night-time $L_{Aeq(9hour)}$ and maximum (5% exceedance) pass-by noise levels for the existing and approved rail traffic are presented in **Table C-31** together with cumulative trains (inclusive of Project). Project train movements are considered on an average and peak basis. As no Project trains would operate at night-time during Year 1, this assessment applies from Year 2 of the Project.

Table C-31 Night-time Predicted Train Noise Emissions (dBA re 20 µPa)

Distance to Receiver[3]	Receivers	Existing and Approved Rail Movements[1]			Cumulative Rail Movements[2] From Year 2 of the Project		
		Average LAeq(9hour)	Peak LAeq(9hour)	Pass-by Maximum	Average LAeq(9hour)	Peak LAeq(9hour)	Pass-by Maximum
0-20 m	Nil	60	62	93	61	63	93
20-40 m	R1-R3	58	59	87	59	60	87
40-60 m	R4-R12	56	57	83	57	58	83
60-80 m	R13-R33	55	56	81	56	57	81
80-100 m	R34-R35	54	55	79	55	56	79

Note 1: Rail traffic noise from existing passenger/freight trains and approved SCM coal trains.

Note 2: Rail traffic noise from existing passenger/freight trains, approved SCM coal trains and proposed DCM Project from Year 2.

Note 3: Train noise level calculated to the maximum distance within the receiver range.

The following assessments are derived from the predicted rail traffic levels and the ARTC's EPL noise assessment criteria presented in **Table C-27**:

- The existing/approved peak $L_{Aeq(9hour)}$ rail noise is predicted to meet the 60 dBA criterion at a distance of 30 m (and greater). Two receivers (R1 and R2 as shown on **Attachment CF**) currently exceed the night-time 60 dBA criterion as a result of existing/approved peak rail movements. This would remain unchanged during Year 1 as no Project trains would run during the period 10.00 pm to 2.00 am.
- From Year 2, the existing/approved cumulative peak $L_{Aeq(9hour)}$ rail noise would increase marginally (up to 1 dBA) and meet the night-time 60 dBA criterion at a distance of 40 m (and greater). One additional receiver (R3 as shown on **Attachment CF**) located approximately 39 m from the railway is predicted to exceed the night-time 60 dBA $L_{Aeq(9hour)}$ criterion as a result of cumulative rail movements (inclusive of the Project).
- The existing/approved maximum pass-by rail traffic noise exceeds the 85 dBA criterion at a distance of 50 m (and greater). Approximately seven receivers (R1 to R7 as shown on **Attachment CF**) currently exceed the maximum pass-by criterion of 85 dBA as a result of existing/approved rail movements. This would remain unchanged for the Project.

C10.4 Rail Traffic Noise Assessment – DECCW Criteria

The $L_{Aeq(24hour)}$ and maximum (5% exceedance) pass-by noise levels for the existing and approved rail traffic are presented in **Table C-32** together with cumulative trains (inclusive of Project). Project train movements are considered on an average and peak basis.

Table C-32 Predicted Train Noise Emissions (dBA re 20 µPa)

Distance to Receiver[1]	Receivers	Combined Existing/Approved and Project Rail Movements - Year 1			Combined Existing/Approved and Project Rail Movements From Year 2		
		Average LAeq(24hour)	Peak LAeq(24hour)	Pass-by Maximum	Average LAeq(24hour)	Peak LAeq(24hour)	Pass-by Maximum
0-20 m	Nil	64	65	96	64	65	93
20-40 m	R1-R3	61	62	90	61	62	87
40-60 m	R4-R12	59	60	87	59	60	83
60-80 m	R13-R33	58	59	84	58	59	81
80-100 m	R34-R35	57	58	82	57	58	79

Note 1: Train noise level calculated to the maximum distance within the receiver range.

The following assessments are derived from the predicted rail traffic levels and the DECCW's rail noise assessment trigger levels presented in **Table C-28**:

- The existing/approved peak $L_{Aeq(24hour)}$ rail noise is predicted to meet the 60 dBA criterion at a distance of 60 m (and greater). Twelve receivers (R1 to R12 as shown on **Attachment CF**) currently exceed the $L_{Aeq(24hour)}$ 60 dBA criterion as a result of existing/approved peak rail movements. This would remain unchanged during Year 1 of the Project.
- From Year 2, the cumulative peak $L_{Aeq(24hour)}$ rail noise would be the same as the existing/approved situation. This is because whilst two additional train pass-bys would be introduced, CFCLA GL Class locomotives (or equivalent) would be used which are relatively quieter than the existing DCM trains.
- The existing/approved maximum pass-by rail traffic noise exceeds the 85 dBA criterion at a distance of 70 m (and greater). Approximately 22 receivers (R1 to R22 as shown on **Attachment CF**) currently exceed the maximum pass-by criterion of 85 dBA as a result of existing/approved rail movements.
- From Year 2, maximum pass-by rail traffic noise would exceed the 85 dBA criterion at a distance of 50 m. The existing situation where this criteria is currently exceeded is predicted to improve at fifteen residences (R8 to R22 as shown on **Attachment CF**) (i.e. exceedances would no longer occur) as a result of replacing the existing DCM locomotive with the CFCLA GL Class locomotive.

C11 SUMMARY OF FINDINGS

C11.1 Operating Noise Criteria

The INP prescribes detailed calculation routines for establishing "Project-specific" $L_{Aeq(15minute)}$ intrusive criteria and $L_{Aeq(period)}$ amenity (i.e. non-transport related) criteria for a development at potentially affected noise sensitive and various other receiver areas. Ideally, the intrusive noise level should generally not exceed the background level by more than 5 dBA.

In addition, the DoP has previously advised that the noise impacts on vacant land are assessed on a "case by case" basis. In the absence of a specific dwelling (or a known approved building Development Application) noise impacts are determined where exceedances are predicted over 25% of the vacant land area.

In accordance with Chapter 2 "Industrial Noise Criteria" of the INP in conjunction with the INP's Application Notes, the Project-specific intrusive and amenity assessment criteria for residential and vacant land receiver areas are presented in **Table C-33**. These criteria are nominated for the purposes of assessing potential noise impacts from the Project.

Table C-33 Project-specific Noise Assessment Criteria (dBA re 20 µPa)

Receiver Area	**Land Use**	**Intrusive $L_{Aeq(15minute)}$**			**Amenity $L_{Aeq(period)}$[1]**		
		Day	**Evening**	**Night**	**Day**	**Evening**	**Night**
Existing Dwellings	Rural Residential[2]	35	35	35	50	45	40
Potential Dwellings	Rural Vacant Land[3]						

Note 1: Daytime 0700 hours to 1800 hours, Evening 1800 hours to 2200 hours, Night-time 2200 hours to 0700 hours.

Note 2: At the most-affected point within 30 m of the residential area.

Note 3: Exceedance determined where predicted noise levels exceed the relevant criteria for more than 25% of the vacant land area.

The intrusiveness criterion is met if the $L_{Aeq(15minute)}$ is less than or equal to the RBL plus 5 dBA, where the RBL is determined from monitoring data following the INP procedures discussed in **Section C4.2**. Thus, the most stringent Project-specific criterion for the Project would be the intrusiveness criterion (i.e. 35 dBA $L_{Aeq(15minute)}$).

The INP states that these criteria have been selected to preserve the amenity of 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, then most people would consider the resultant noise levels acceptable.

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. Exceedances of 5 dBA or more are generally required before the impact becomes clearly noticeable and appreciable.

C11.2 Operating Noise Modelling and Mitigation

The existing DCM noise model was modified to incorporate the noise sources associated with the proposed Project. The surrounding terrain and nearby potentially affected receivers (**Table C-33** and **Attachments CB-1a** and **CB1-b**) were also included in the model. For the purposes of assessing noise impacts in accordance with INP requirements, the following mine operating scenarios were considered:

Year 3 Operations: Representative of approximately 2.4 Mtpa ROM coal production rate coinciding with the northern extent of the Weismantel Extension open pit, the early stages of mining in the Clareval North West open pit operations together with active operations on the central portion of the waste rock emplacement. The daytime scenario included construction works associated with Auxiliary Dam No. 2 embankment lift.

Year 5 Operations: Representative of approximately 3.0 Mtpa ROM coal production rate coinciding with the ongoing operation of the Weismantel Extension open pit, the northern extent of the Clareval North West open pit together with the northern advance of the active waste rock emplacement areas.

Year 8 Operations: Representative of approximately 2.5 Mtpa ROM coal production rate coinciding with the cessation of the Weismantel Extension open pit, the northern extent of the Clareval North West open pit together with the northern extent of operations on the waste rock emplacement.

The predictive modelling involved the investigation of feasible and reasonable noise mitigation measures, particularly in relation to night-time operations. These mitigation measures are assumed to be implemented for the purposes of the predictive modelling. A number of iterative steps were taken to develop noise mitigation measures for the Project, including:

- Preliminary noise modelling of scenarios representative of the maximum noise emissions from the Project to identify areas of potential noise exceedances.
- Evaluation of various combinations of noise management and noise mitigation measures to assess their relative effectiveness.
- Adoption by DCPL of a range of noise management and mitigation measures (including low noise equipment and operational controls) to appreciably reduce noise emissions associated with the Project, including:
  - All additional mobile equipment necessary to meet Project increased ROM coal production to be current technology and low noise emission standard, including up to 16 new CAT 785XQ haul trucks and attenuation of new single items (i.e. dozer, excavator, drill and grader).
  - Two CAT 789 haul trucks to be operated during daytime only.
  - Waste rock emplacement activities on elevated/exposed portions of the waste rock emplacement to occur during daytime only.
- Restriction of the maximum height of the waste rock emplacement to approximately RL 110 m, consistent with the existing/approved height.

The resulting daytime, evening and night-time Project operations can be generally described as follows:

- Daytime mining operations include coal and overburden mining and haulage, coal handling and stockpiling, rail loading and on-site train movement. The operational haul truck fleet typically comprises two CAT 789 trucks and up to sixteen low noise CAT 785XQ trucks operating on upper waste emplacement areas.
- Evening and night-time operations include coal and overburden mining and haulage, coal handling and stockpiling, rail loading and on-site train movement. The operational haul truck fleet would be up to sixteen low noise CAT 785XQ trucks

C11.3 Operating Noise Impact Summary

Based on the predicted daytime, evening and night-time $L_{Aeq(15minute)}$ intrusive noise emissions, the privately owned receivers where the Project-specific noise level of 35 dBA is anticipated to be exceeded are summarised in **Table C-34**.

Table C-34 Privately Owned Rural Receivers[1] with Noise Level Exceedances

	Noise Management Zone		Noise Affection Zone
Period	**1 dBA to 2 dBA above 35 dBA**	**3 dBA to 5 dBA above 35 dBA**	**> 5 dBA above 35 dBA**
Daytime	126 Hamann-Pixalu PL 129 Weismantel[3] 130 Giudice[3]	123 Oleksiuk & Carmody 128 Hare-Scott[3] 131 (2) Relton[3]	117 Holmes[2] 124 (1) Bailey[3] 124 (2) Bailey[3] 125 (1) Zulumovski 125 (2) Zulumovski[3] 149 Hattam PL[2]
Evening	126 Hamann-Pixalu PL 146 Bragg 155 Guberina 156 Hope 157 Stephenson 169 Williams 173 Trigg & Holland 177 Thompson 180 (1) Thompson	117 Holmes[2] 123 Oleksiuk & Carmody 130 Giudice[3] 144 Wielgosinski 172 Lyall[2]	124 (1) Bailey[3] 124 (2) Bailey[3] 125 (1) Zulumovski 125 (2) Zulumovski[3] 128 Hare-Scott[3] 129 Weismante[3]l 131 (2) Relton[3] 149 Hattam PL[2]
Night-time	94 Howard 101 Holloway 156 Hope 167 Ravagnani 169 Williams 173 Trigg & Holland 177 Thompson 180 (1) Thompson 220 Lindfield & Associates PL	95 Smith & Ransley 100 Richards 106 James 172 Lyall[2]	116 Weismantel 117 Holmes[2] 123 Oleksiuk & Carmody 124 (1) Bailey[3] 124 (2) Bailey[3] 125 (1) Zulumovski 125 (2) Zulumovski[3] 126 Hamann-Pixalu PL 127 Fisher-Webster 128 Hare-Scott[3] 129 Weismantel[3] 130 Giudice[3] 131 (1) Relton 131 (2) Relton[3] 149 Hattam PL[2]

Note 1: Refer to **Attachments CB-1a** and **CB-1b** for land ownership details.

Note 2: Properties identified in the existing DCM Development Consent (DA 168/99) as being in the Noise Affectation Zone.

Note 3: Properties identified in the existing DCM Development Consent (DA 168/99) as being in the Noise Management Zone.

The DoP has previously advised that the noise impacts on vacant land are assessed on a "case by case" basis. **Table C-35** identifies those properties for all scenarios where exceedances of the $L_{Aeq(15\ minute)}$ intrusive noise level is predicted for more than 25% of vacant land.

Table C-35 Vacant Land with Project-specific Noise Level Exceedances

Assessment Period	**36 to 37 dBA**	**38 to 40 dBA**	**above 40 dBA**
Daytime	-	104 Mudford[1]	118 Moylan 122 White
Evening	140 Bennett & Stark 158 Gilbert	-	104 Mudford[1] 118 Moylan 122 White
Night-time	-	-	104 Mudford[1] 122 White 118 Moylan

Note 1: Property identified in the Development Consent as being in the Noise Affectation Zone.

C11.4 Blasting Impact Summary

Blast design parameters and management practices remain generally unchanged by the Project. Potential blast emission impacts are assessed in accordance with the DoP's requirements with the impacts at receivers and sensitive sites summarised as follows:

Building Damage Criteria - MIC 400 kg to 1,500 kg - 5% Exceedance

With a MIC of 400 kg, the blast emission levels (MIC 400 kg) are predicted to be below the building damage criteria of 10 mm/s (vibration) and 133 dB pkLinear (airblast) at all receivers including the heritage listed Former Weismantles Inn (**Table C-22**).

With a MIC of 1,500 kg, the airblast levels (MIC 1,500 kg) are predicted to be below the building damage criterion 133 dB pkLinear at all receivers and equal to or below the vibration velocity criterion of 10 mm/s except at six receivers (i.e. 19 [16], 125 [2], 19 [1], 19 [8], 139, 19 [9]) (**Table C-22**).

Human Comfort Criteria - MIC 400 kg to 1,500 kg - 5% Exceedance

With a MIC of 400 kg, the vibration velocities are below the 5 mm/s criterion at all receivers except at receiver 19 (16) (GCL) (**Table C-22**). The airblast levels (MIC 400 kg) are equal to or below the 115 dB pkLinear criterion at all receivers except at ten receivers (i.e. 19 [16] to 142 - refer **Table C-22**).

With a MIC of 1,500 kg, the vibration velocities are predicted to be equal to or below the 5 mm/s criterion at all receivers except at 15 receivers (i.e. 19 [16] to 128 - refer to **Table C-22**). The airblast levels (MIC 1,500 kg) are equal to or below the 115 dB pkLinear criterion at all receivers except 26 receivers (i.e. 19 [16] to 194 - refer to **Table C-22**).

The recommended long-term regulatory target of 2 mm/s) can be achieved from blasting (MIC 400 kg and 50% exceedance) at receivers beyond approximately 1 km. Similarly, 2 mm/s can be achieved from blasting (MIC 1,500 kg and 50% exceedance) at receivers beyond approximately 2 km.

Archaeological/Geological Damage Criteria - MIC 400 kg to 1,500 kg - 5% Exceedance

Vibration velocities are below the 80 mm/s archaeological/geological damage criterion and the 5 mm/s criteria at the Mammy Johnsons Grave.

Roadway/Pavement Damage Criteria - MIC 400 kg to 1,500 kg - 5% Exceedance

Vibration velocities are below the 125 mm/s Roadway/Pavement damage criterion at The Bucketts Way.

C11.5 Road Traffic Noise Impact Summary

The existing access road off The Bucketts Way would remain the primary site access. Project workforce traffic and traffic associated with deliveries along public roads would be modestly increased by the Project and are therefore assessed in accordance with the DECCW's requirements.

Where the nominated criteria are already exceeded, traffic associated with the Project should not be permitted to lead to an increase in the existing traffic noise levels of more than 2 dBA. As a general rule, traffic noise associated with the Project would not increase the existing traffic noise levels by more than 2 dBA so long as the percentage increase in light and heavy vehicles movements for the Project is no greater than 60%.

In all cases, the anticipated increase in vehicle movements on The Bucketts Way and Durallie Road is less than 60% and therefore the corresponding increase in traffic noise well within 2 dB margin, hence any traffic noise impacts are likely to be acceptable.

C11.6 Rail Traffic Noise Impact Summary

The average and peak existing, additional and cumulative train movements and associated rail noise levels have been determined for communities neighbouring the North Coast Railway between the DCM and the SCM. The existing DCM locomotives would be replaced by CFCLA GL Class locomotives from approximately Year 2 the Project. The CFCLA GL Class locomotives are the same (or equivalent) model in operation at the SCM and are relatively quieter than the existing DCM trains.

The following assessments are derived from the predicted rail traffic noise levels and the DECCW's rail noise assessment trigger levels (60 dBA $L_{Aeq(24hour)}$ and maximum pass-by 85 dBA):

- The existing/approved peak $L_{Aeq(24hour)}$ rail noise is predicted to meet the 60 dBA criterion at a distance of 60 m (and greater). Twelve receivers (R1 to R12 as shown on **Attachment CF**) currently exceed the $L_{Aeq(24hour)}$ 60 dBA criterion as a result of existing/approved peak rail movements. This would remain unchanged during Year 1 of the Project.
- From Year 2, the cumulative peak $L_{Aeq(24hour)}$ rail noise would be the same as the existing/approved situation. This is because whilst two additional train pass-bys would be introduced, CFCLA GL Class locomotives (or equivalent) would be used which are relatively quieter than the existing DCM trains.
- The existing/approved maximum pass-by rail traffic noise exceeds the 85 dBA criterion at a distance of 70 m (and greater). Approximately 22 receivers (R1 to R22 as shown on **Attachment CF**) currently exceed the maximum pass-by criterion of 85 dBA as a result of existing/approved rail movements.
- From Year 2, maximum pass-by rail traffic noise would exceed the 85 dBA criterion at a distance of 50 m. The existing situation where this criteria is currently exceeded is predicted to improve at fifteen residences (R8 to R22 as shown on **Attachment CF**) (i.e. exceedances would no longer occur) as a result of replacing the existing DCM locomotive with the CFCLA GL Class locomotive.

The following assessments are derived from the predicted daytime/evening rail traffic levels and the ARTC's guideline noise assessment criteria 65 $L_{Aeq(15hour)}$ and maximum pass-by 85 dBA:

- The existing/approved peak $L_{Aeq(15hour)}$ rail noise is predicted to meet the 65 dBA criterion at a distance of 25 m (and greater). This would remain unchanged for Year 1.
- From Year 2, the existing/approved cumulative peak $L_{Aeq(15hour)}$ rail noise would decrease by approximately 1 dBA and meet the daytime 65 dBA criterion at a distance of 20 m (and greater).
- The existing/approved maximum pass-by noise level is predicted to meet the criterion of 85 dBA at a distance of 70 m (and greater). Approximately 22 receivers (R1 to R22 as shown on **Attachment CF**) are located within 70 m of the railway. This would remain unchanged during Year 1.
- A comparison of the existing/approved maximum pass-by rail traffic noise with the cumulative level (from Year 2 of the Project) indicates that with the introduction of the CFCLA GL Class locomotives for DCM trains would decrease the maximum pass-by rail noise and meet the 85 dBA criterion at a distance of 50 m (and greater). Fifteen receivers (R8 to R22 as shown on **Attachment CF**) that previously exceeded the 85 dBA maximum pass-by criterion would meet the criterion as a result of the adoption of the CFCLA GL Class DCM train from Year 2.

Similarly, the following assessments are derived from the predicted night-time rail traffic levels (from Year 2 of the Project) and the ARTC's rail noise assessment trigger levels of 60 dBA $L_{Aeq(9hour)}$ and maximum pass-by criteria of 85 dBA.

- The existing/approved peak $L_{Aeq(9hour)}$ rail noise is predicted to meet the 60 dBA criterion at a distance of 30 m (and greater). Two receivers (R1 and R2 as shown on **Attachment CF**) currently exceed the night-time 60 dBA criterion as a result of existing/approved peak rail movements. This would remain unchanged during Year 1 as no Project trains would run during the period 10.00 pm to 2.00 am.
- From Year 2, the existing/approved cumulative peak $L_{Aeq(9hour)}$ rail noise would increase marginally (up to 1 dBA) and meet the night-time 60 dBA criterion at a distance of 40 m (and greater). One additional receiver (R3 as shown on **Attachment CF**) located approximately 39 m from the railway is predicted to exceed the night-time 60 dBA $L_{Aeq(9hour)}$ criterion as a result of cumulative rail movements (inclusive of the Project).
- The existing/approved maximum pass-by rail traffic noise exceeds the 85 dBA criterion at a distance of 50 m (and greater). Approximately seven receivers (R1 to R7 as shown on **Attachment CF**) currently exceed the maximum pass-by criterion of 85 dBA as a result of existing/approved rail movements. This would remain unchanged for the Project.

SCHEDULE 3
SPECIFIC ENVIRONMENTAL CONDITIONS

ACQUISITION UPON REQUEST

1. Upon receiving a written request for acquisition from the landowner of the land listed in Table 1, the Applicant shall acquire the land in accordance with the procedures in conditions 8-10 of schedule 4.

Table 1: Land subject to acquisition upon request

22 - Holmes	59 - Hattam
36 - Doherty	60 – Gibson
53 - Lyall	106 – Mudford

Note: For more information on the numbering and identification of properties used in this consent, see Appendix 2.

NOISE

Noise Impact Assessment Criteria

2. The Applicant shall ensure that the noise generated by the development at any residence on privately-owned land, or on more than 25% of any privately-owned land, does not exceed the noise impact assessment criteria in Table 1 for the noise receiver location nearest to that residence or land.

Table 2: Noise impact assessment criteria

Day	Evening	Night		Land Number
$L_{Aeq(15\ minute)}$	$L_{Aeq(15\ minute)}$	$L_{Aeq(15\ minute)}$	$L_{A1(1\ minute)}$	
37	37	37	45	129S – Relton (new) 130(2) – Bailey 134 (1) – Zulomovski
36	36	36	45	7 – Holmes 129N – Relton (old) 130(1) – Bailey 132 – Weismantel John 133 – Guidice 135 – Hare-Scott
35	35	35	45	All other privately owned land excluding the land listed in Table 1

However, if the Applicant has a written negotiated noise agreement with any landowner of the land listed in Table 2, and a copy of this agreement has been forwarded to the Department and DECCW, then the Applicant may exceed the noise limits in Table 2 in accordance with the negotiated noise agreement.

Notes:

a) *Noise from the development is to be measured at the most affected point or within the residential boundary, or at the most affected point within 30 metres of a dwelling (rural situations) where the dwelling is more than 30 metres from the boundary, to determine compliance with the $L_{Aeq(15\ minute)}$ noise limits in the above table. Where it can be demonstrated that direct measurement of noise from the development is impractical, the Department and DECCW may accept alternative means of determining compliance (see Chapter 11 of the NSW Industrial Noise Policy). The modification factors in Section 4 of the NSW Industrial Noise Policy shall also be applied to the measured noise levels where applicable.*

b) *Noise from the development is to be measured at 1 metre from the dwelling façade to determine compliance with the $L_{A1(1\ minute)}$ noise limits in the above table. Where it can be demonstrated that direct measurement of noise from the development is impractical, the Department may accept alternative means of determining compliance (see Chapter 11 of the NSW Industrial Noise Policy).*

c) *Noise generated by the development in excess of the criteria in Table 2, whether on one or more occasions, constitutes an exceedance of the respective criterion regardless of Chapter 11 of the Industrial Noise Policy.*

d) *The noise emission limits identified in the above table apply under all meteorological conditions except for:*
   - *wind speeds greater than 3 metres/second at 10 metres above ground level; or*
   - *temperature inversions with a strength of greater than 3°C/100 m for all receivers, plus a source-to-receiver component drainage flow wind of greater than 2 m/s at 10 metres above ground level for those receivers where applicable.*

Land Acquisition Criteria

3. If the noise generated by the development exceeds the criteria in Table 3, the Applicant shall, upon receiving a written request for acquisition from the landowner, acquire the land in accordance with the procedures in conditions 8-10 of schedule 4.

Table 3: Land acquisition criteria dB(A)

Day/Evening/Night $L_{Aeq(15\ minute)}$	*Land*
40	*All privately owned land, excluding the land listed in Table 1*

Note: Noise generated by the development is to be measured in accordance with the notes presented below Table 2 except for note c).

Additional Noise Mitigation Measures

4. Upon receiving a written request from:
   - a landowner of the land listed in Table 1 (unless the landowner has requested acquisition); or
   - the owner of any residence where subsequent noise monitoring shows the noise generated by the development is greater than, or equal to, $L_{Aeq(15\ minute)}$ 38 dB(A) (except where a negotiated noise agreement is in place),

   the Applicant shall implement additional noise mitigation measures such as double glazing, insulation, and/or air conditioning at any residence on the land in consultation with the landowner. These additional mitigation measures must be reasonable and feasible. If within 3 months of receiving this request from the landowner, the Applicant and the landowner cannot agree on the measures to be implemented, or there is a dispute about the implementation of these measures, then either party may refer the matter to the Director-General for resolution.

Continuous Improvement

5. The Applicant shall:
   (a) implement all reasonable and feasible noise mitigation measures;
   (b) investigate ways to reduce the noise generated by the development, including off-site rail noise and maximum noise levels which may result in sleep disturbance; and
   (c) report on these investigations and the implementation and effectiveness of these measures in the AEMR,

   to the satisfaction of the Director-General.

Monitoring

6. Prior to the end of December 2006, the Applicant shall prepare (and subsequently implement) a Noise Monitoring Program for the development, to the satisfaction of the Director-General. The Noise Monitoring Program must include quarterly attended noise monitoring, and a noise monitoring protocol for evaluating compliance with the noise impact assessment and land acquisition criteria in this consent.

BLASTING AND VIBRATION

Airblast Overpressure Criteria

7. The Applicant shall ensure that the airblast overpressure level from blasting at the site does not exceed the criteria in Table 4 at any residence on privately owned land.

Table 4: Airblast overpressure impact assessment criteria

Airblast overpressure level (dB(Lin Peak))	Allowable exceedance
115	5% of the total number of blasts over a period of 12 months
120	0%

SCHEDULE 3 - SPECIFIC ENVIRONMENTAL CONDITIONS

Ground Vibration Impact Assessment Criteria

8. The Applicant shall ensure that the ground vibration level from blasting at the site does not exceed the criteria in Table 5 at any residence on privately owned land and the grave known as Mammy Johnson's grave.

Table 5: Ground vibration impact assessment criteria

Peak particle velocity (mm/s)	Allowable exceedance
5	5% of the total number of blasts over a period of 12 months
10	0%

Blasting Hours

9. The Applicant shall only carry out blasting at the site between 9am and 5pm Monday to Saturday inclusive. No blasting is allowed on Sundays, public holidays, or at any other time without the written approval of the DECCW.

Blasting Frequency

10. The Applicant shall not carry out blasting associated with open cut mining more than 2 blasts per week on average over any 12 month period at the site without the written approval of the Director-General.

Operating Conditions

11. During the life of the development, the Applicant shall implement best blasting practice to:
(a) protect the safety of people, property, public infrastructure, and livestock; and
(b) minimise the dust and fume emissions from blasting at the development, particularly during adverse meteorological conditions,
to the satisfaction of the Director-General.

12. Prior to carrying out any blasting within 500 metres of a public road or railway, the Applicant must obtain approval from Council (in respect of public roads) and ARTC (in respect of the North Coast railway).

Public Notice

13. During the life of the development, the Applicant shall:
(a) notify the landowner/occupier of any residence within 2 km of any active, or planned, mining areas who registers an interest in being notified about the blasting schedule at the mine;
(b) operate a Blasting Hotline, or alternate system agreed to by the Director-General, to enable the public to get up-to-date information on the blasting schedule at the development; and
(c) advertise the blasting hotline number in a local newspaper at least 2 times each year,
to the satisfaction of the Director-General.

Property Inspections

14. Prior to the end of December 2006, the Applicant shall advise all landowners within 2 km of any planned active mining areas that they are entitled to a structural property inspection (unless such an inspection has already been undertaken).

15. If the Applicant receives a written request for a structural property inspection from any landowner within 2 km of any active, or planned, mining areas, the Applicant shall within 3 months of receiving this request:
(a) commission a suitably qualified, experienced and independent person, whose appointment has been approved by the Director-General, to inspect the condition of any building or structure on the land, and recommend measures to mitigate any potential blasting impacts; and
(b) give the landowner a copy of the property inspection report.

Property Investigations

16. If any landowner within 2 km of any active, or planned, mining areas claims that buildings and/or structures on his/her land have been damaged as a result of blasting at the development, the Applicant shall within 3 months of receiving this request:
    (a) commission a suitably qualified, experienced and independent person, whose appointment has been approved by the Director-General, to investigate the claim; and
    (b) give the landowner a copy of the property investigation report.

    If this independent property investigation confirms the landowner's claim, and both parties agree with these findings, then the Applicant shall repair the damages to the satisfaction of the Director-General.

    If the Applicant or landowner disagrees with the findings of the independent property investigation, then either party may refer the matter to the Director-General for resolution.

    If the matter cannot be resolved within 21 days, the Director-General shall refer the matter to an Independent Dispute Resolution Process (see Appendix 3).

Blast Monitoring Program

17. Prior to the end of December 2006, the Applicant shall prepare (and following approval implement) a detailed Blast Monitoring Program, to the satisfaction of the Director-General. The Blast Monitoring Program must include a protocol for evaluating blasting impacts on privately owned residences and public infrastructure (including the North Coast railway), and demonstrating compliance with the blasting criteria in this consent.

EPL NOISE LIMITS

L6 Noise Limits

L6.1 Operational noise from the premises must not exceed:

LOCATION	PERIOD	NOISE LIMITS
		Intrusive Criteria Leq(15 minute) dB(A)
SOUTHERN SITE (N1) – Boundary of Duralie Coal Mine controlled land adjacent to Johnson Creek Road	Day Evening & Night	35
S DOHERTY (N2)	Day Evening & Night	35
AJ AND DM HARRISON (N3)	Day Evening & Night	35

L6.2 Noise from the premises is to be measured at a distance within 30 metres of the locations identified in L6.1 to determine compliance with this condition.

L6.3 The noise emission limits identified in L6.1 apply for prevailing meteorological conditions (winds up to 3m/s), except under conditions of temperature inversions. Noise impacts that may be enhanced by temperature inversions must be addressed by:

(a) Documenting noise complaints received to identify any higher level of impacts or patterns of temperature inversions.
(b) Where levels of noise complaints indicate a higher level of impact then actions to quantify and ameliorate any enhanced impacts under temperature inversions conditions should be developed and implemented.

L6.4 Noise limits and monitoring required by this licence are varied to allow limit and monitoring of noise at an alternative site owned by a Mr & Mrs S Gibson located off Johnson's Creek Road as shown on map (noise monitoring sites September 2005 Duralie Coal Pty Ltd) supplied with the variation application dated 19 August 2005 as an alternative to the current site N1 listed in table L6.1 of this licence. This alternative site shall be listed and known as AS1. Noise limits and monitoring are varied under the following conditions (listed below) to allow limits and monitoring that currently apply to N1 to apply to AS1 but only whilst the conditions below are met.

- That a written agreement is in place at all times when this condition is in operation between the property owner and the licensee to allow monitoring of noise in accordance with this licence and the noise management plan.
- That the premises approved by this condition remains the nearest privately owned most noise effected residence or noise sensitive receiver to the northwest of the licensed premises.
- Monitoring is carried out in accordance with the EPA Industrial Noise Policy at the site.

Noise limits and monitoring required by this licence are varied to allow limit and monitoring of noise at an alternative site owned by a Mr T Jensen located Lot 2 DP 803291 off Bucketts way as shown on map (noise monitoring sites land ownership September 2006 Duralie Coal Pty Ltd) supplied with the variation application dated 16 October 2006 as an alternative to the current site N3 listed in table L6.1 of this licence. This alternative site shall be listed and known as AS3. Noise limits and monitoring are varied under the following conditions (listed below) to allow limits and monitoring that currently apply to N3 to apply to AS3 but only whilst the conditions below are met.

- That a written agreement is in place at all times when this condition is in operation between the property owner and the licensee to allow monitoring of noise in accordance with this licence and the noise management plan.
- That the premises approved by this condition remains the nearest privately owned most noise effected residence or noise sensitive receiver to the south of the licensed premises.
- Monitoring is carried out in accordance with the EPA Industrial Noise Policy at the site.

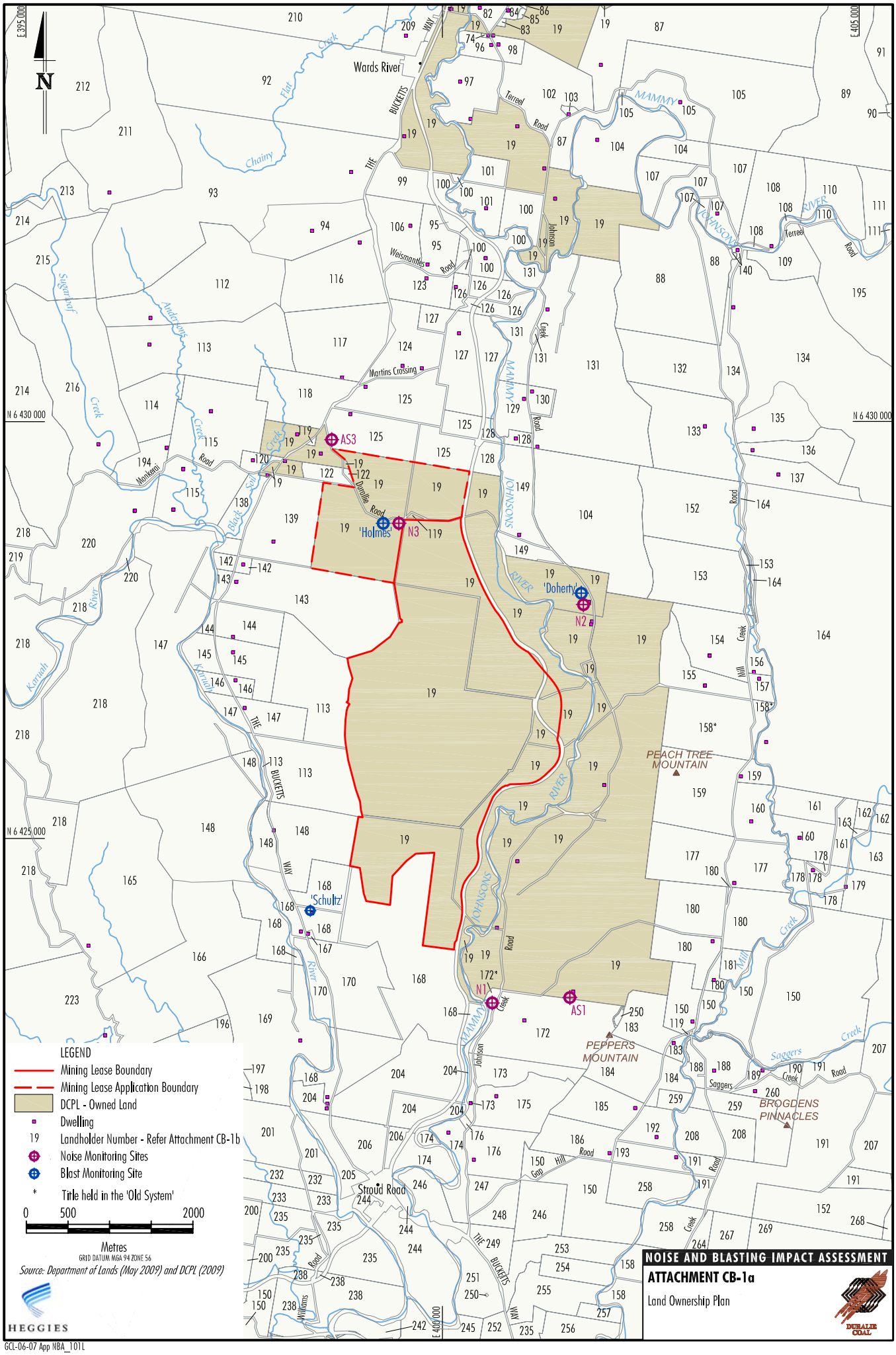
If any of the above conditions are not complied with all limits and monitoring are to revert back to the locations listed in table L6.1.

L7 Blasting

L7.1 Blasting in or on the premises must only be carried out between daylight hours, Monday to Saturday. Blasting in or on the premises must not take place on Sundays or Public Holidays without the prior approval of the EPA.

L7.2 The overpressure level from blasting operations carried out in or on the premises must not:
(a) exceed 115 dB(L) for more than 5% of the total number of blasts carried out on the premises within the 12 months annual reporting period; and
(b) exceed 120 dB(L) at any time
at any residence or noise sensitive location (such as a school or hospital) that is not owned by the licensee or subject of a private agreement between the owner of the residence or noise sensitive location and the licensee as to an alternative overpressure level.

L7.3 The ground vibration peak particle velocity from blasting operations carried out in or on the premises must not:
(a) exceed 5mm/second for more than 5% of the total number of blasts carried out on the premises within the 12 months annual reporting period; and
(b) exceed 10mm/second at any time
at any residence or noise sensitive location (such as a school or hospital) that is not owned by the licensee or subject of a private agreement between the owner of the residence or noise sensitive location and the licensee as to an alternative ground vibration level.



NOISE AND BLASTING IMPACT ASSESSMENT

ATTACHMENT CB-1a

Land Ownership Plan

DUNDAS COAL

19	Gloucester Coal Ltd
74	D. L. & D. W. Melmeth
82	S. A. & J. E.Wright
83	Cemetery
84	A.W. & C.M. Hart
85	R. A. & D. Shaw
86	J. Andersen
87	Pacific Property Investments Ltd
88	V. S. Edwards
89	D. J. Robertson
90	W. A. & J. A.Thomson
91	Hunter Water Corporation
92	Sejon No 4 Pty Ltd
93	K. V. & P. M. Howard
94	B. V. & P. O. Howard
95	D. J. Smith & S. Ransley
96	H. T. & M. B. Turnbull
97	S. W. Davis
98	I. D. Partelle & M. M. Ramsay
99	K. MacFarlane
100	K. S. Richards
101	K. M. & D. B. Holloway
102	W. R. Kerslake
103	G. L. Macedo
104	R. S. Mudford
105	R. M. Edwards
106	R. A. James
107	P. G. Spencer
108	A. G. & M. A. Tersteeg
109	R. J. Bathgate & M. L. Levey
110	G. W. Lewis & A. J. Moore
111	T. J. Somerville & C. D. Martin
112	S. R. Hogeveen
113	C. W. & J. I. Edwards
114	H. Paliokas
115	P. W. M. & B. D. & G. O. & M. J. Moylan & S. C. M. Newton
116	G. R. Weismantel
117	E. D. Holmes and L. M. Holmes
118	P. W. M. Moylan
119	Great Lakes Council
120	M. J. & C. A. Mahony
122	S. White
123	J. L. Oleksiuk & K. P. Carmody
124	A. J. & R. M. B. Bailey
125	T. & K. Zulumovski
126	H. L. & M. R. Hamann - Pixalu Pty Limited
127	A. J. Fisher-Webster
128	D. R. & B. Hare-Scott
129	J. Weismantel
130	M. A. & J. M. Giudice
131	W. L. Relton
132	A. T. Gorton
133	R. J. Gorton
134	Duzmen Pty Ltd
135	P. J. Ayliffe
136	D. P. Pickles
137	T. J. Lord
138	P. W. M. Moylan, B. D. Moylan, G. O. Moylan, S. C. M. Newton & M. J. Moylan
139	M. S. Juttner
140	D. C. Bennett & D. M. Stark
142	P. G. Madden
143	P. G. & K. A. Madden
144	D. J. Wielgosinski
145	D. H. & S. W. Owens
146	M. A. Bragg
147	J. I. Edwards
148	D. J. McAndrew
149	Hattam Pty Ltd
150	R. N. & T. E. Rumbel
152	D. M. Lowrey
153	L. & R. K. Paul
154	J. R. Morgan
155	M. & R. Guberina
156	T. R. J. & B. Hope
157	C. N. & S. D. Stephenson
158	B. Gilbert
159	T. R. Waterer
160	P. & M. E. Kenney
161	D. G. Hutchison
162	L. S. Miller
163	M. A. & C. H. Hockings & C. H. Willcox
164	Gorton Timber Co. Limited
165	ESOR Nominees Pty Limited
166	A. J. & A. L. Daniel
167	M. & S. M. Ravagnani
168	V. R. & E. K. Schultz
169	R. D. K. & N. L. Williams
170	I. K. & M. J. Schultz
172	S. J. & J. E. Lyall
173	S. M. Trigg, J. M. Trigg, M. J. Holland, B. J. Holland, M. Trigg & S. C. Trigg
174	D. C. Carroll
175	R. J. & S. J. Woodley
176	P. G. & L. J. Billett
177	W. J. Thompson
178	N. E. Hitchcock & E. E. Coldham
179	I. Mellar
180	B. R. & G. J. & K. G. & K. J. & W. J. Thompson
181	G. J. Thompson
183	M. H. & E. V. Elfick
184	B. J. & M. C. Gay
185	A. W. Raine & T. Hilleard
186	K. B. & J. N. Farnham
188	T. E. Rumbel
189	H. J. Gillard
190	B. Clayton
191	A. M. Mokeeff
192	S. & A. F. Vajda
193	N. & C. M. Smith
194	J. & C. L. Kellehear
195	Shulgin Investments Pty Ltd
196	E. D. Sanders
197	H. R. & D. A. Moorehouse
198	Aspenview Enterprises Pty Limited
200	G. J .& S. G.Trappel
201	I. G. Wilson
204	M. C. Jones
205	J. S. & K. L. Bratfield
206	D. E. Allen
207	P. Trenchev
208	C. A. Bowden
209	D. M. Chapman
210	Heatscape Pty Limited
211	B. & B. I. Irwin
212	P. & N. V. Makaroff
213	E. A. & P. Hillard
214	K. G. Sneddon
215	Monkerai Holdings Pty Limited
216	D. M. Matcham
218	D. K. & J. A. Holdings Pty. Limited
219	C. A. Olsen
220	T. G. Lindfield and Associates Pty. Limited
223	F., E., R., D. M. & G. Ferraro
232	I. G. Wilson
233	R. G. Wilson
235	M. J. Bratfield
238	H. R. Kerr
242	M. M. Gorton
244	R. R. & M. J. Lawrence
245	N. Curtis
246	P. & S. A. Margery
247	D. C. Hawkins
248	R. B. & J. M. Eastoe
249	P. Margery
250	Midcoast County Council
251	B. R. Warner
252	D. K. Pritchard
253	E. & J. A. Allan
254	D. N. & D. T. Young
255	J. P. Miles
256	M. I. Butler
257	P. R. Garland
258	G. K. & A. G. Brown
259	C. A. Bowen
260	D. & J. Roberts
264	K. Pepper & S. M. Lyall
267	D. L. & T. L. Fordham
268	Hudrow Pty Limited
269	The Minister for Forestry

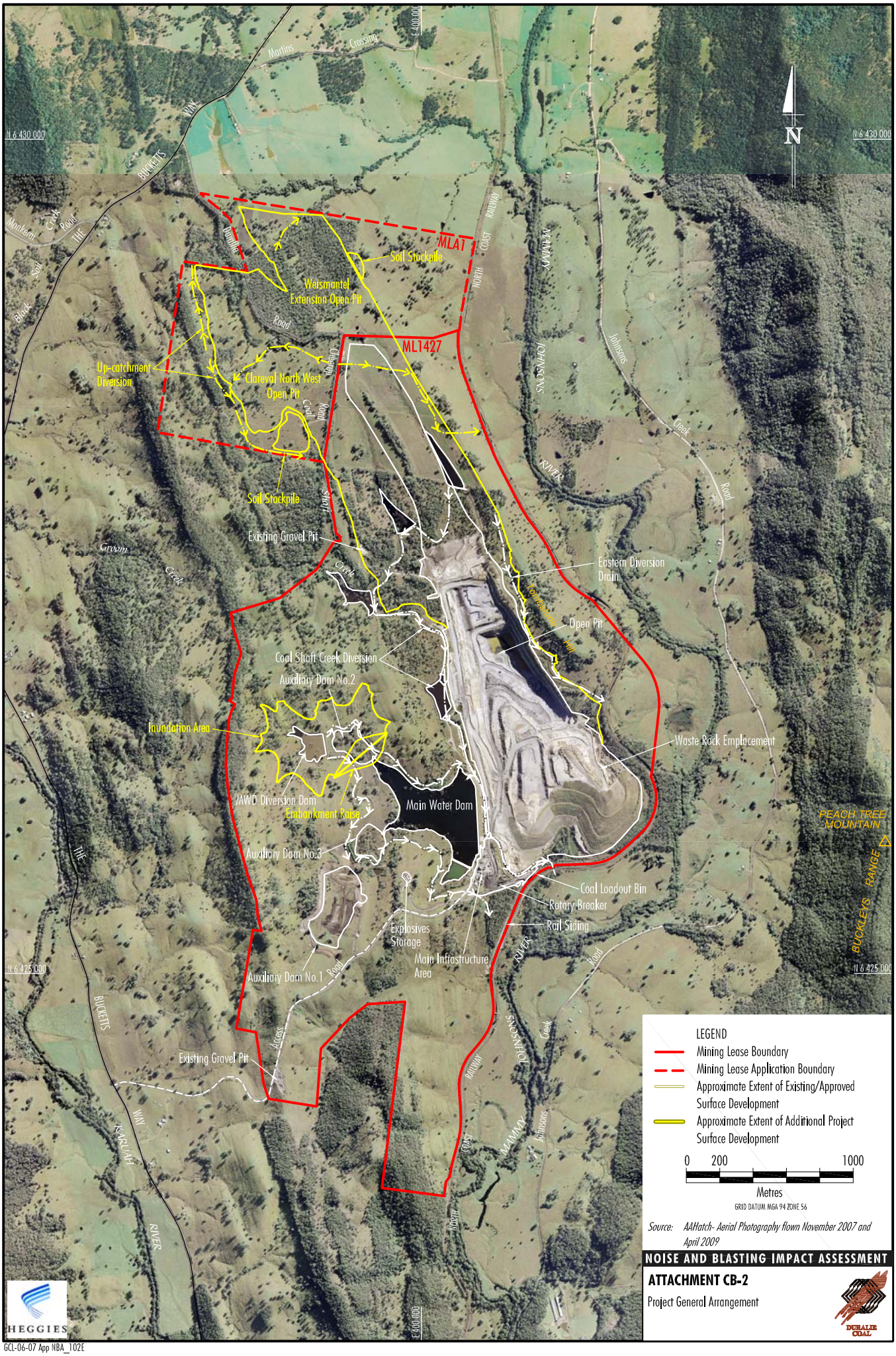
Source: DCPL (2009) and Department of Lands (2009)
Current as at 28 October 2009

DURALIE EXTENSION PROJECT

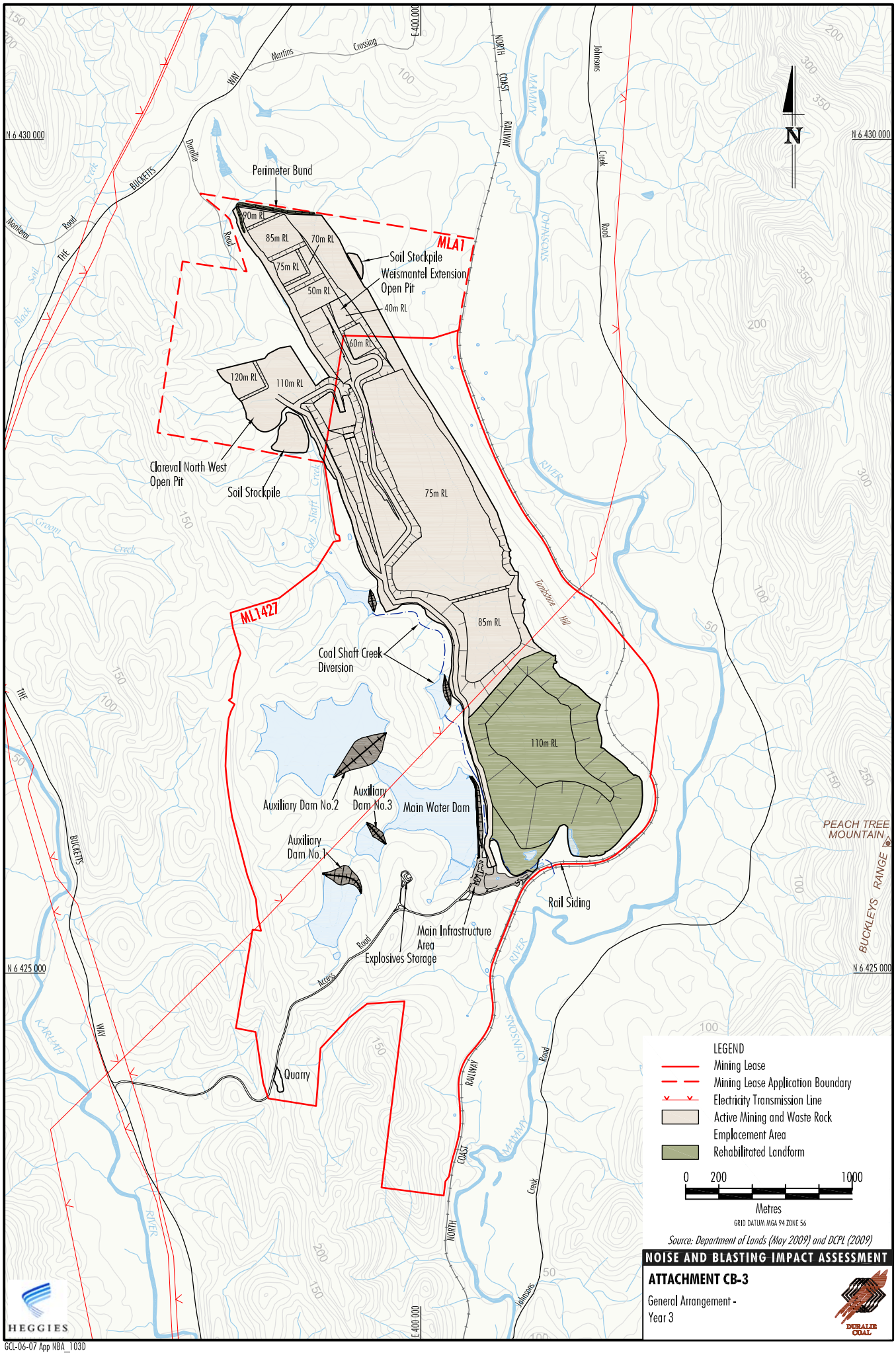
ATTACHMENT CB-1b
Relevant Land Ownership List

HEGGIES

DURALIE COAL



GCL-06-07 App NBA_102E



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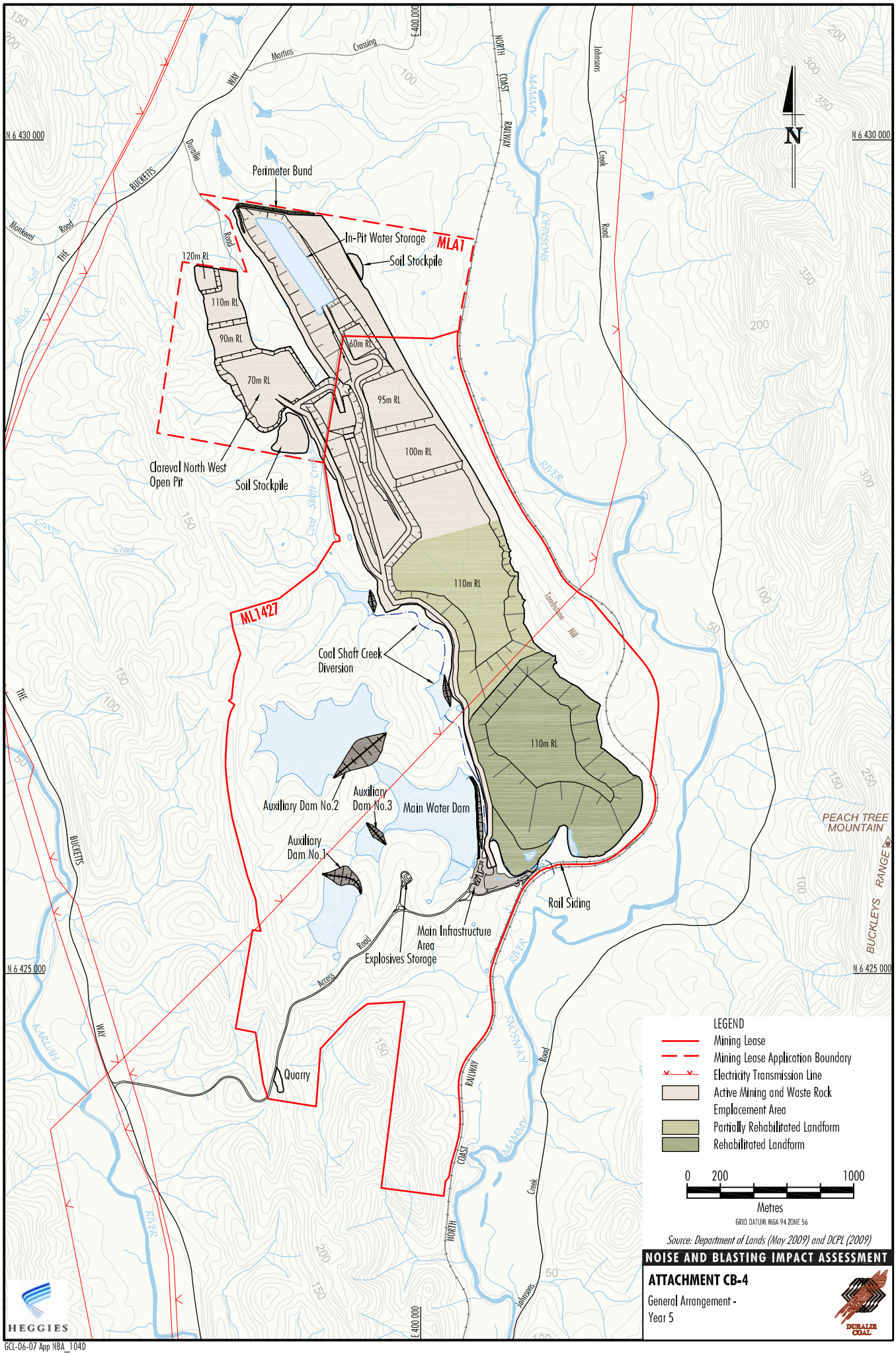

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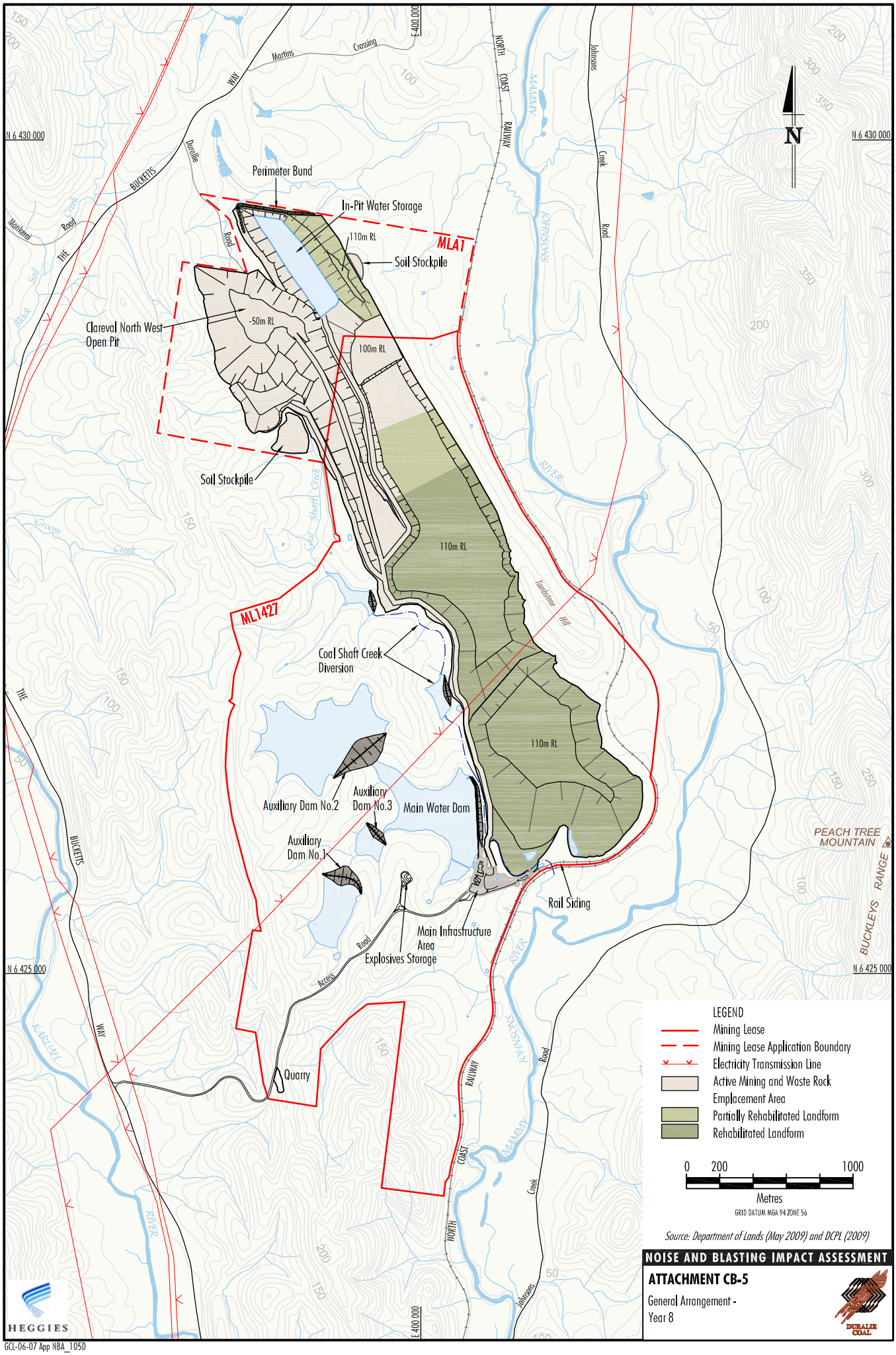


GCL-06-07 App NBA_105D

SITE-SPECIFIC WIND AND ATMOSPHERIC STABILITY CONDITIONS

Table 1 Seasonal Frequency of occurrence Wind Speed Intervals - Daytime

Period	Calm (< 0.5 m/s)	Wind Direction (± 45°)	Wind Speed		
			0.5 to 2 m/s	2 to 3 m/s	0.5 to 3 m/s
Annual	7.0%	N	15.8%	7.9%	23.6%
Summer	3.9%	NNE	16.8%	12.5%	29.3%
Autumn	9.7%	N	20.9%	7.8%	28.7%
Winter	9.2%	NNW	17.7%	5.6%	23.3%
Spring	5.2%	NNE	10.7%	8.0%	18.6%

m/s = metres per second. ° = degree.

Table 2 Seasonal Frequency of occurrence Wind Speed Intervals - Evening

Period	Calm (< 0.5 m/s)	Wind Direction (± 45°)	Wind Speed		
			0.5 to 2 m/s	2 to 3 m/s	0.5 to 3 m/s
Annual	11.6%	NNW	18.8%	12.8%	31.6%
Summer	1.8%	NNE	14.8%	18.5%	33.3%
Autumn	17.1%	NNW	23.8%	11.7%	35.5%
Winter	19.0%	NW	26.2%	5.8%	31.9%
Spring	7.2%	NNW	13.7%	18.8%	32.4%

Table 3 Seasonal Frequency of occurrence Wind Speed Intervals - Night-Time

Period	Calm (< 0.5 m/s)	Wind Direction (± 45°)	Wind Speed		
			0.5 to 2 m/s	2 to 3 m/s	0.5 to 3 m/s
Annual	19.5%	NNW	28.7%	10.0%	38.7%
Summer	15.9%	N	28.0%	14.2%	42.1%
Autumn	24.6%	NNW	32.1%	9.3%	41.4%
Winter	21.0%	NNW	30.4%	4.6%	35.0%
Spring	17.0%	NNW	25.5%	12.8%	38.3%

Table 4 Summary

Season	Winds ±45° 3 m/s with Frequency of Occurrence 30%		
	Daytime	Evening	Night-Time
Annual	Nil	NNW (31.6%)	NNW (38.7%)
Summer	Nil	NNE (33.3%)	N (42.1%)
Autumn	Nil	NNW (35.5%)	NNW (41.4%)
Winter	Nil	NW (31.9%)	NNW (35.0%)
Spring	Nil	NNW (32.4%)	NNW (38.3%)

Table 5 Frequency of Occurrence of Atmospheric Stability Classes – Evening & Night-time

Stability	Frequency of Occurrence (%)					Estimated ELR °C/100 m	Qualitative Description
	Annual	Summer	Autumn	Winter	Spring		
A	0	0	0	0	0	<-1.9	Lapse
B	0	0	0	0	0	-1.9 to -1.7	Lapse
C	0	0	0	0	0	-1.7 to -1.5	Lapse
D	40	48	35	34	44	-1.5 to -0.5	Neutral
E	15	16	15	15	15	-0.5 to 1.5	Weak inversion
F	40	31	45	48	37	1.5 to 4	Moderate inversion
G	5	6	5	3	4	>4.0	Strong inversion
F+G	45	36	50	51	41		Moderate to strong inversion

Note: ELR = Environmental Lapse Rate. °C = degrees Celsius. m = metre.

BACKGROUND NOISE MONITORING RESULTS NOVEMBER 2007

Overview of Methodology

A noise monitoring programme was conducted in November 2007 to quantify background noise levels (i.e. all noise sources) and to estimate industrial noise only (i.e. in the absence of transport, natural and domestic noise) at four representative residential receiver areas in the vicinity of Duralie in relation to the proposed Project.

In order to supplement the unattended logger measurements and to assist in identifying the character and duration of the noise sources, operator-attended daytime, evening, and night-time surveys were also conducted at all the vicinity of the logging locations. The background noise monitoring programme was implemented in accordance with AS 1055-1997 *Acoustics-Description and Measurement of Environmental Noise* and the *NSW Industrial Noise Policy* (INP) (New South Wales Environment Protection Authority, 2000).

One unattended logger was installed near the train to quantify the existing noise level associated with the transport of coal.

Instrumentation and Measurement Parameters

All acoustic instrumentation employed throughout the noise monitoring programme has been designed to comply with the requirements of Australian Standard (AS) 1259.2-1990 *Sound Level Meters* and carries current National Association of Testing Authorities (NATA) or manufacturer calibration certificates.

A description of instrumentation, designated type and serial numbers is shown in **Table CD-1**.

Table CD-1 Acoustic Instrumentation Schedule

Ref/Landholder	Description	Instrumentation	Logger Type[1, 2]
124 (1) Bailey	Adjacent Entrance Gate	194631	2
117 Holmes	Adjacent Entrance Gate	193410	2
172 Lyall	Adjacent Entrance Gate	194626	2
189 Gillard	Adjacent Entrance Gate	16-203-505	1
n/a Wards River	15 m from railway	194630	2

Note 1: Noise levels less than 29 A-weighted decibels (dBA) may have a signal to noise ratio less than 5 dBA for a logger Type 1.
Note 2: Noise levels less than 31 dBA may have a signal to noise ratio less than 5 dBA for a logger Type 2.
m = metres

All instrumentation was programmed to record continuously the noise exceedance levels in 15 minute intervals including the L_{Amax}, L_{A1}, L_{A10}, L_{A50}, L_{A90}, L_{A99}, L_{Amin} and the L_{Aeq}. Instrument calibration was conducted before and after each measurement survey, with the variation in calibrated levels not exceeding ±0.5 dBA.

Weather Monitoring Station

Meteorological data was obtained from the two permanent automatic weather stations located at the Stratford and Duralie Mines.

Unattended Background Noise Monitoring Results

The unattended background noise logger data from each monitoring location, together with the on-site weather conditions were analysed on a daily basis.

The statistical noise exceedance levels (L_{AN}) are the levels exceeded for N% of the interval period. 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. The L_{A10} is the level exceeded for 10% of the time and is usually referred to as the average maximum noise level. The L_{Aeq} is the equivalent continuous sound pressure level and represents the steady sound level which is equal in energy to the fluctuating level over the interval period.

Prior to further analysis, the background noise data from each location which correlated with periods of unstable weather (e.g. rainfall greater than 0.5 millimetres [mm] or wind speed greater than 5 metres per second [m/s]) were discarded. The acceptable background noise data was then processed in accordance with the INP "Appendix B - Applying the Background Noise Policy" to derive the Monday to Sunday background noise levels presented in **Table CD-2**.

Table CD-2 Unattended Noise Logger Results 2007 (dBA re 20 µPa)

Ref/Landholder	Measured RBL All Noise Sources			Measured LAeq(period)[1] All Noise Sources			Estimated LAeq(period)[1] Industrial Noise Only		
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
124 (1) Bailey	34	37	36	48	52	50	<44	<39	<34
117 Holmes	34	37	37	52	49	47	<44	<39	<34
172 Lyall	34	36	34	48	48	45	<44	<39	<34
189 Gillard	31	35	34	46	54	51	<44	<39	<34
19 GCL	32	36	33	65	62	56	<44	<39	<34

Note 1: Daytime 0700 hours to 1800 hours, Evening 1800 hours to 2200 hours and Night-time 2200 hours to 0700 hours.
RBL = rating background level.
µPa = micro Pascal.

Operator-Attended Background Noise Survey Results

Operator-attended noise surveys of 15 minutes duration were conducted with a precision integrating sound level meter in order to qualify the results obtained with the unattended noise loggers. During the attended noise surveys, the operator identified the character and duration of acoustically significant background noise sources. Wherever applicable the operator quantified local traffic flow and made a qualitative assessment of the prevailing weather conditions.

The daytime, evening and night-time operator-attended noise survey for all four residential monitoring locations are presented below:

124 (2) Bailey

Date/Start Time Weather		Primary Noise Descriptor (dBA re 20µPa)					Typical maximum Levels LAmax - dBA
		Leq	L1	L10	L50	L90	
Night 20/11/07 2300 hrs 5 Okta Wind at 10 m: 2.6 m/s N	Ambient	37	44	39	36	34	Dogs barking 41 Insects (constant) 36-37 Vehicles 45 Wind 30-37 Cows discernible
	Industrial	Not discernable					
Day 21/11/07 1418 hrs Wind at 10 m: 1.8 m/s E	Ambient	45	52	49	41	38	Traffic 46-55 Insects 38-53 Birds 39-51 Plane 40-42 Ducks discernible Horses discernible
	Industrial	Not discernable					
Evening 29/11/07 1823 hrs 8 Okta Wind at 10 m: 1.6 m/s NNE	Ambient	50	58	54	47	40	Motorbike 54 Birds 53-63 Insects discernible Highway 42
	Industrial	Not discernable					

BACKGROUND NOISE MONITORING RESULTS NOVEMBER 2007

117 Holmes

Date/Start Time Weather		Primary Noise Descriptor (dBA re 20μPa)					Typical maximum Levels LAmax - dBA
		Leq	L1	L10	L50	L90	
Night 21/11/07 0038 hrs 0 Okta Wind at 10 m: 2 m/s N	Ambient	44	47	45	44	43	Insects / frogs 45-46 Dogs 30-38 Mine rumble audible Plane 45 Sheep discernible
	Industrial	Estimated Mine L_{Aeq} <20 dBA					
Evening 29/11/07 1839 hrs 8 Okta Wind at 10 m: 2 m/s N	Ambient	60	75	56	48	45	Birds 47 Highway 53-79 Dumping 30-40 Industrial noise audible Dog discernible Insects/frogs discernible Cow discernible
	Industrial	L_{Aeq} dominated by traffic and birds Industrial noise contribution <30 (probably the work on the rail line)					

172 Lyall

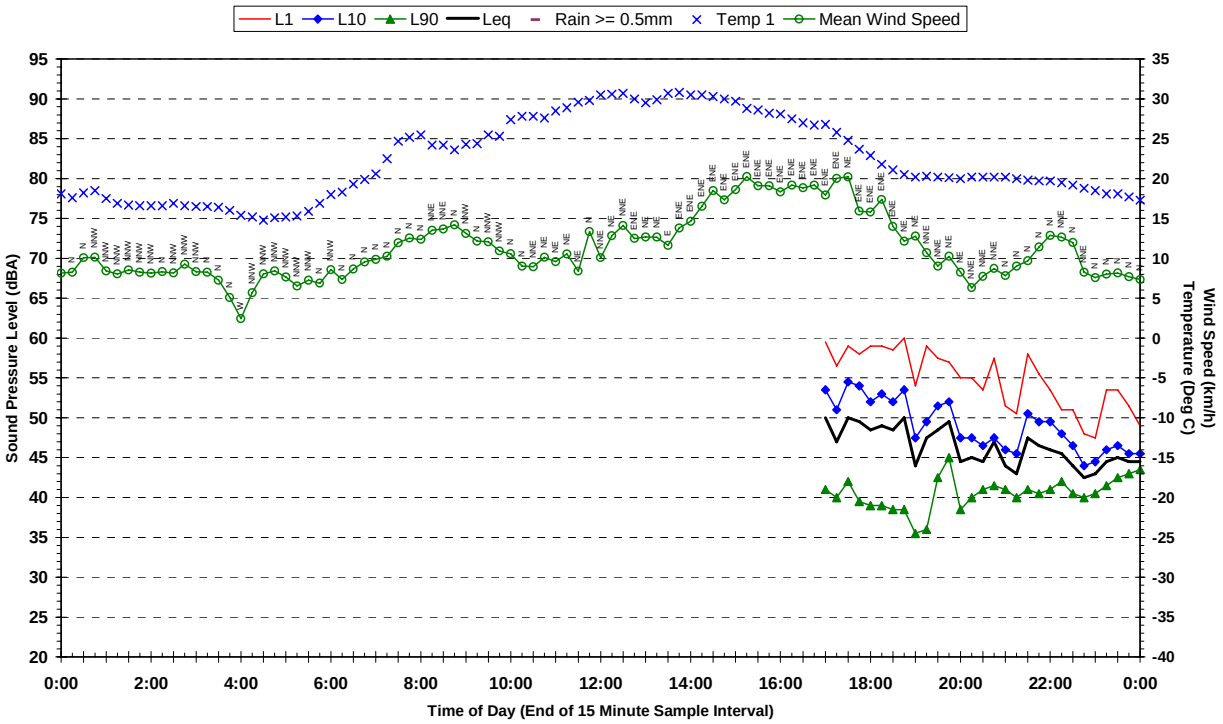
Date/Start Time Weather		Primary Noise Descriptor (dBA re 20μPa)					Typical maximum Levels LAmax - dBA
		Leq	L1	L10	L50	L90	
Night 20/11/07 2330 hrs 0 Okta Wind at 10 m: 2.5 m/s N	Ambient	37	44	39	36	35	Mine trucks 33-37 Insects 39 Cows 37-52 Reversing alarms 38-40 Dogs barking 37 Truck dumping 38-46 Dozer discernible
	Industrial	Measured Mine L_{Aeq} 32 dBA					
Evening 29/11/07 1757 hrs 8 Okta Wind at 10 m: 1.9 m/s NE	Ambient	45	52	46	37	33	Birds 40-53 Wind in trees discernible Dogs barking discernible Sheep discernible Plane 43-51 Insects 32-35 Car pass-by 69 Cows 44
	Industrial	**Not discernable**					

189 Gillard

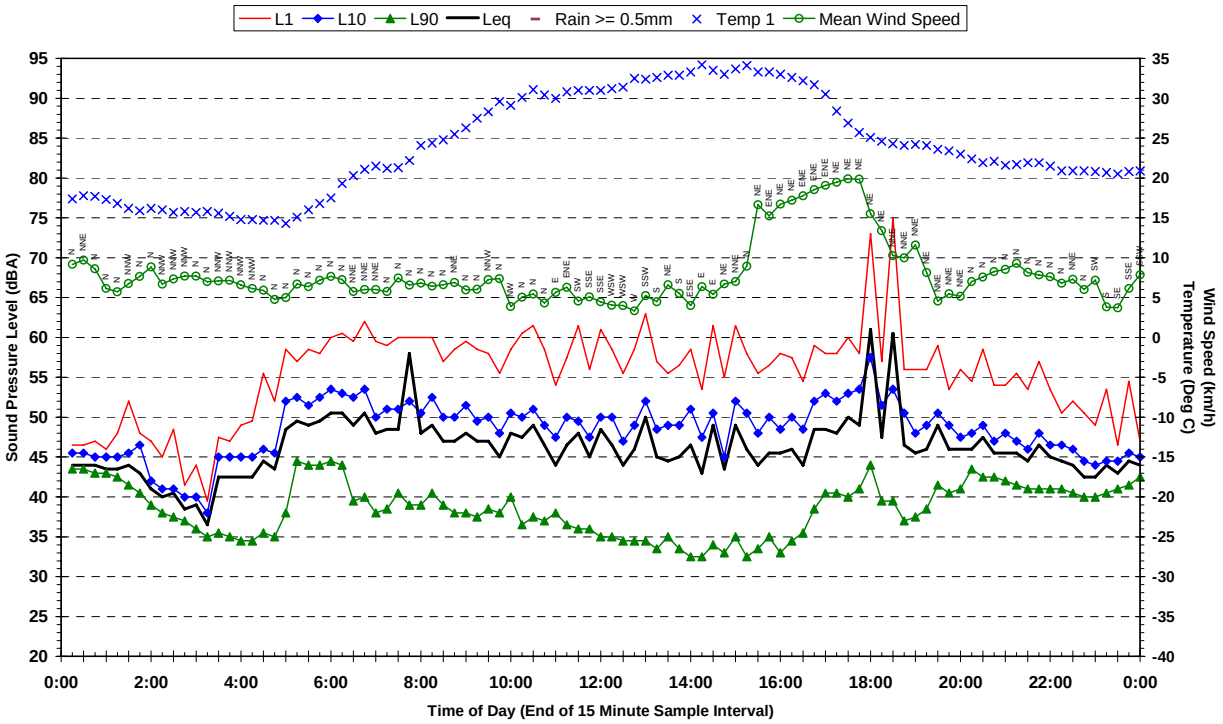
Date/Start Time Weather		Primary Noise Descriptor (dBA re 20μPa)					Typical maximum Levels LAmax - dBA
		Leq	L1	L10	L50	L90	
Evening 20/11/07 1834 hrs Wind at 10 m: 3.9 m/s NE	Ambient	43	53	44	41	39	Birds 39-49 Wind 44-57 Cows 53-60 Dog 44
	Industrial	Not discernable					
Night 21/11/07 0005 hrs 0 Okta Wind at 10 m: 3 m/s N	Ambient	44	48	45	43	41	Insects 45-50 Mine trucks audible Reversing alarms audible
	Industrial	Estimated Mine L_{Aeq} <20 dBA					
Day 29/11/07 1452 hrs 8 Okta Wind at 10 m: 2.4 m/s NW	Ambient	41	53	42	32	29	Birds 42-52 Plane audible Storm 43-51 Car pass-by 36
	Industrial	Not discernable					

UNATTENDED NOISE LOGGER RESULTS NOVEMBER 2007 - 117 HOLMES

Statistical Ambient Noise Levels
117 Holmes - Tuesday 20 November 2007

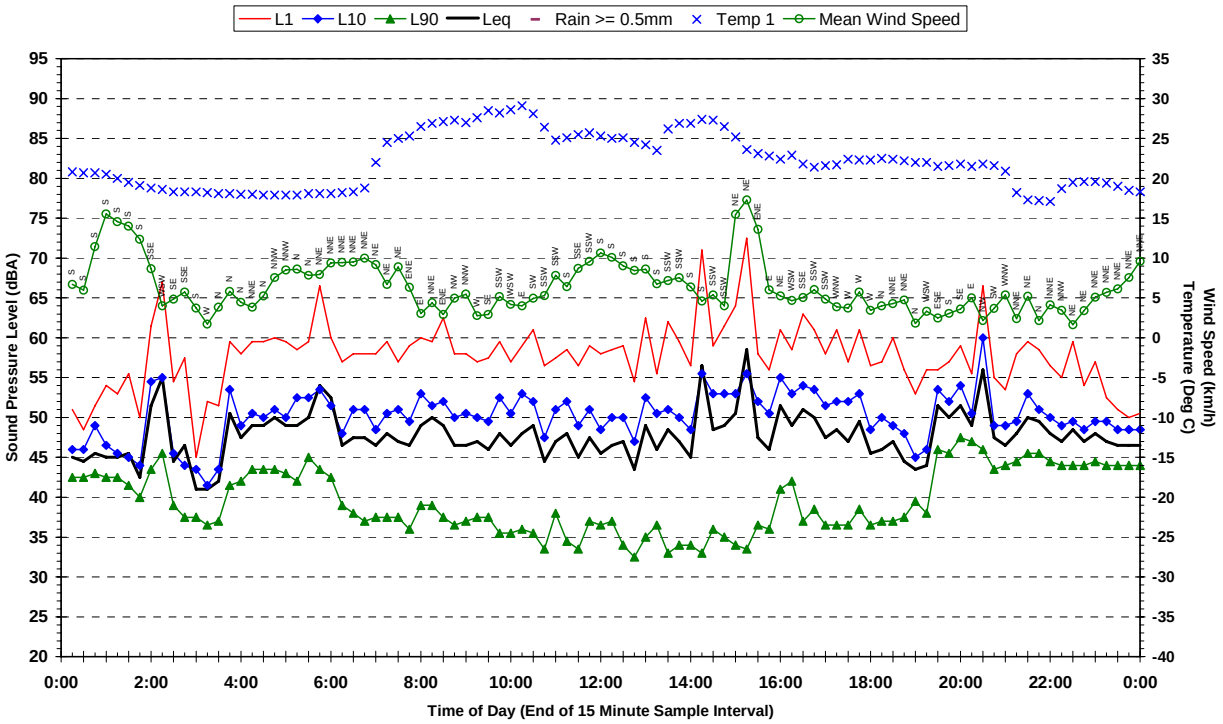


Statistical Ambient Noise Levels
117 Holmes - Wednesday 21 November 2007

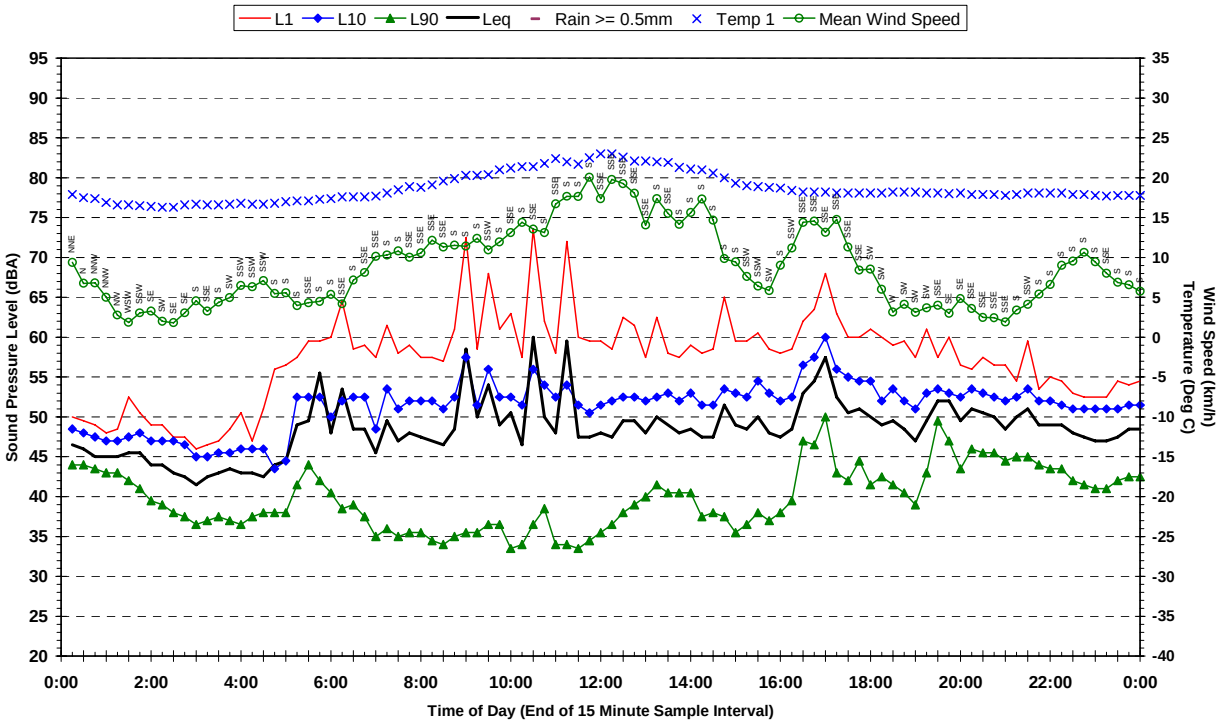


UNATTENDED NOISE LOGGER RESULTS NOVEMBER 2007 - 117 HOLMES

Statistical Ambient Noise Levels
117 Holmes - Thursday 22 November 2007

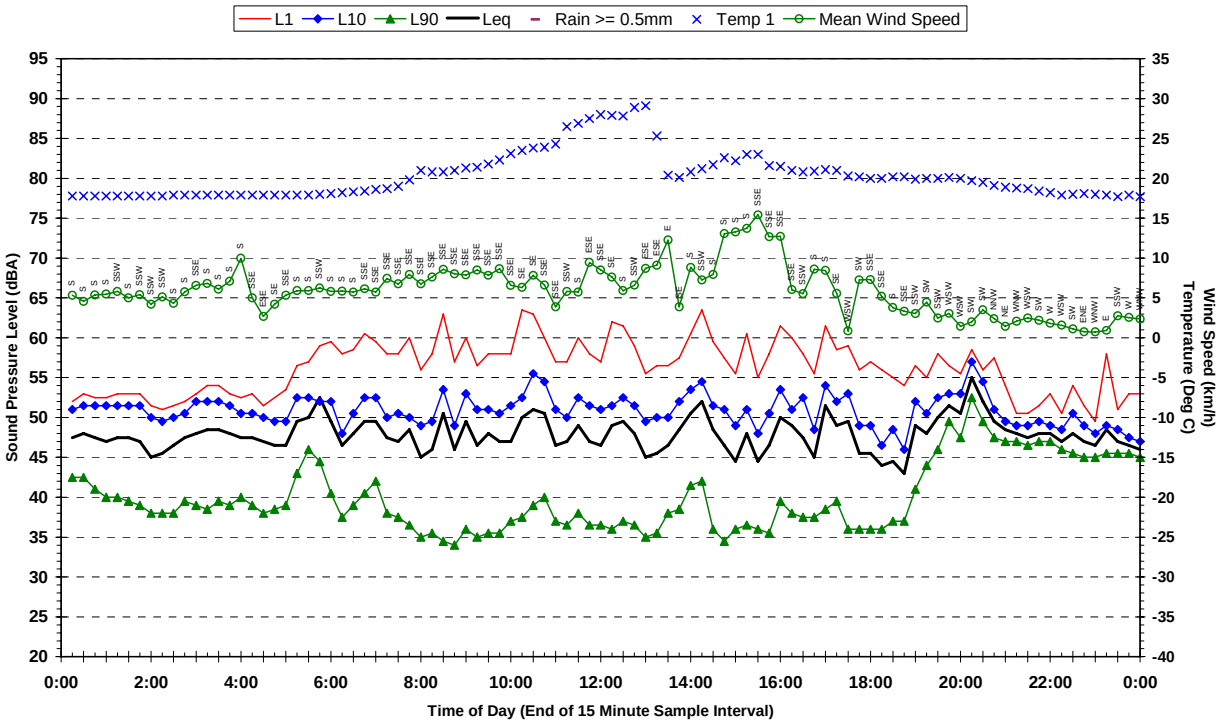


Statistical Ambient Noise Levels
117 Holmes - Friday 23 November 2007

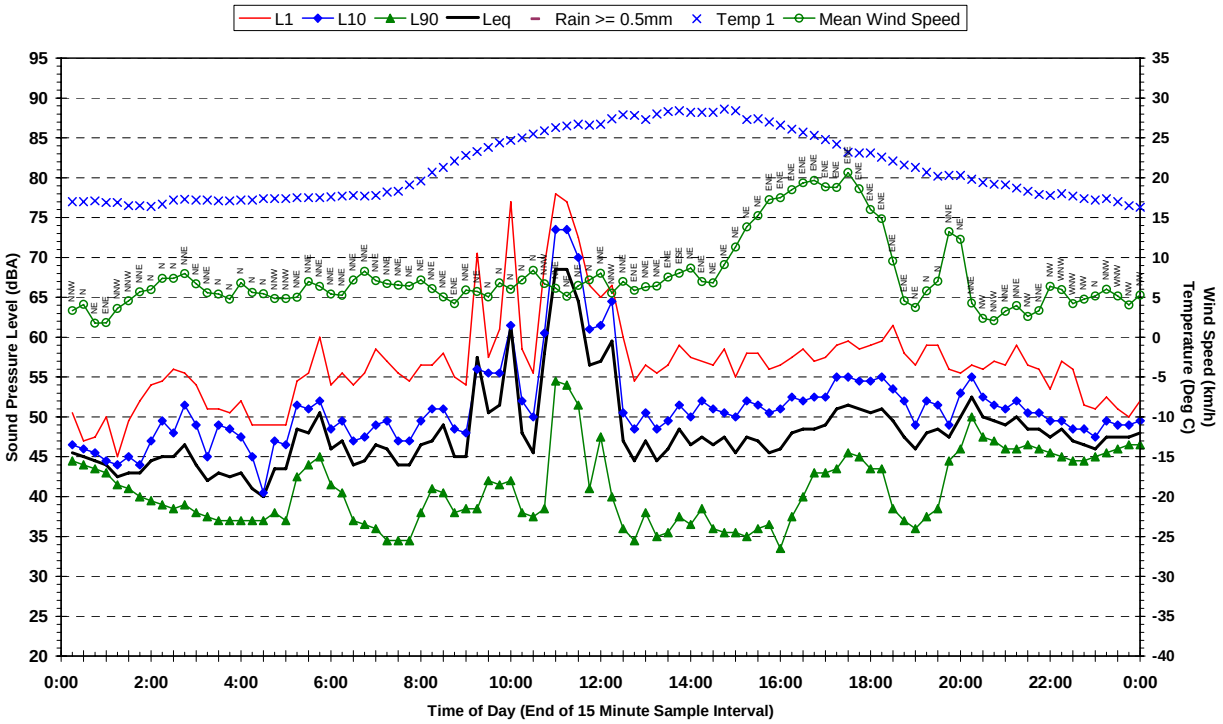


UNATTENDED NOISE LOGGER RESULTS NOVEMBER 2007 - 117 HOLMES

Statistical Ambient Noise Levels
117 Holmes - Saturday 24 November 2007

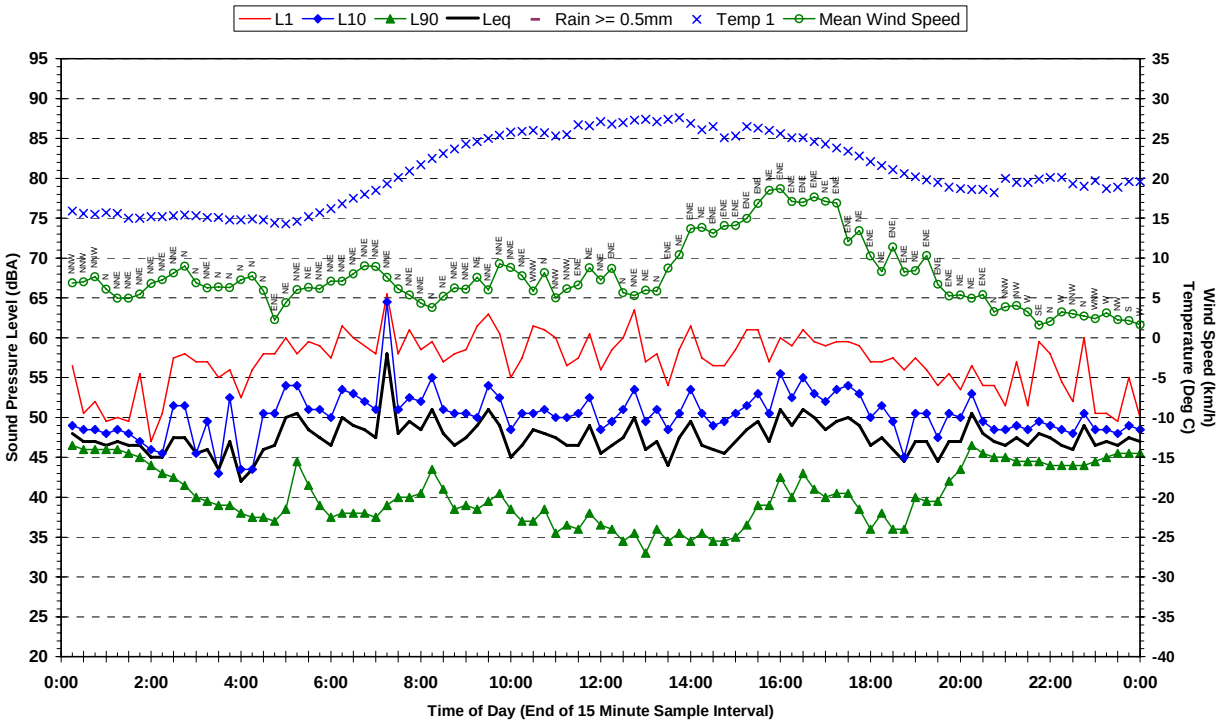


Statistical Ambient Noise Levels
117 Holmes - Sunday 25 November 2007

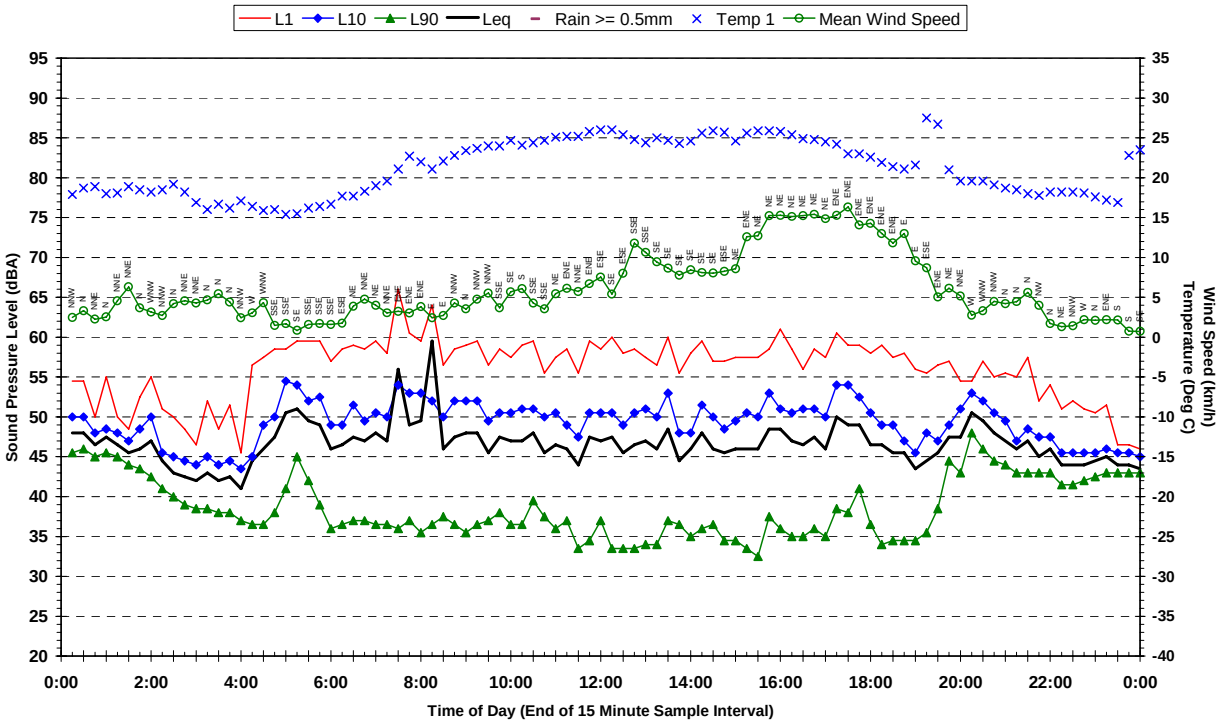


UNATTENDED NOISE LOGGER RESULTS NOVEMBER 2007 - 117 HOLMES

Statistical Ambient Noise Levels
117 Holmes - Monday 26 November 2007

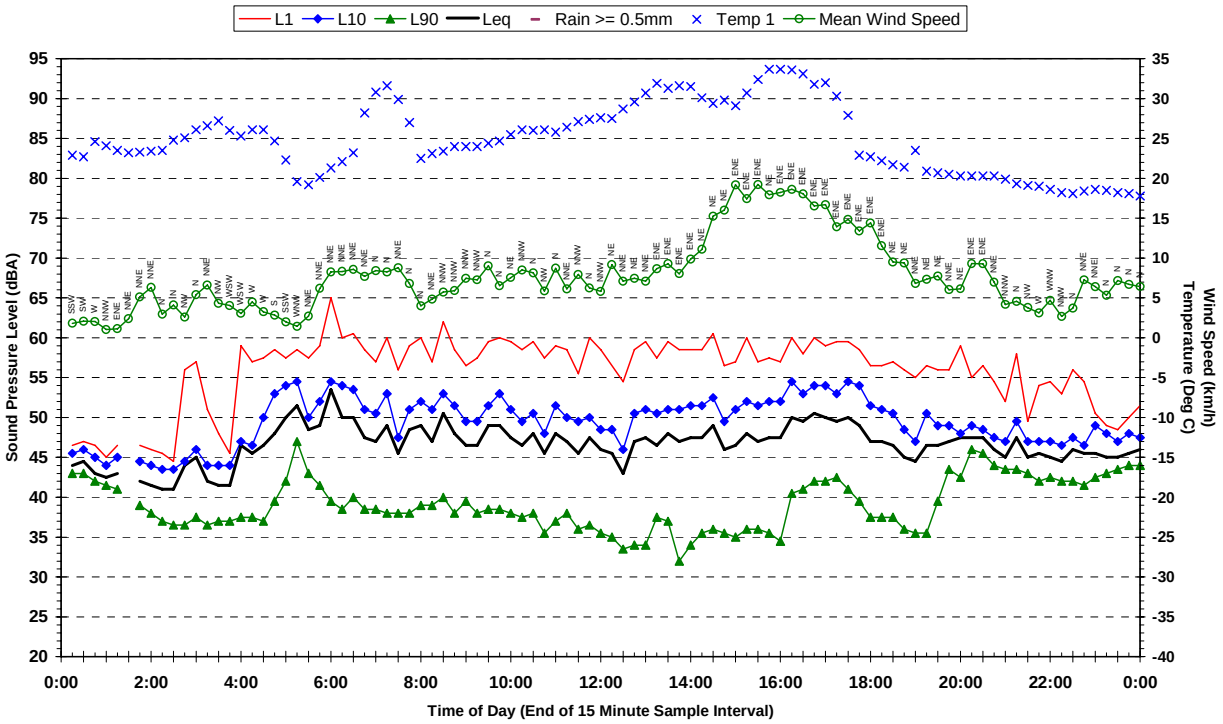


Statistical Ambient Noise Levels
117 Holmes - Tuesday 27 November 2007

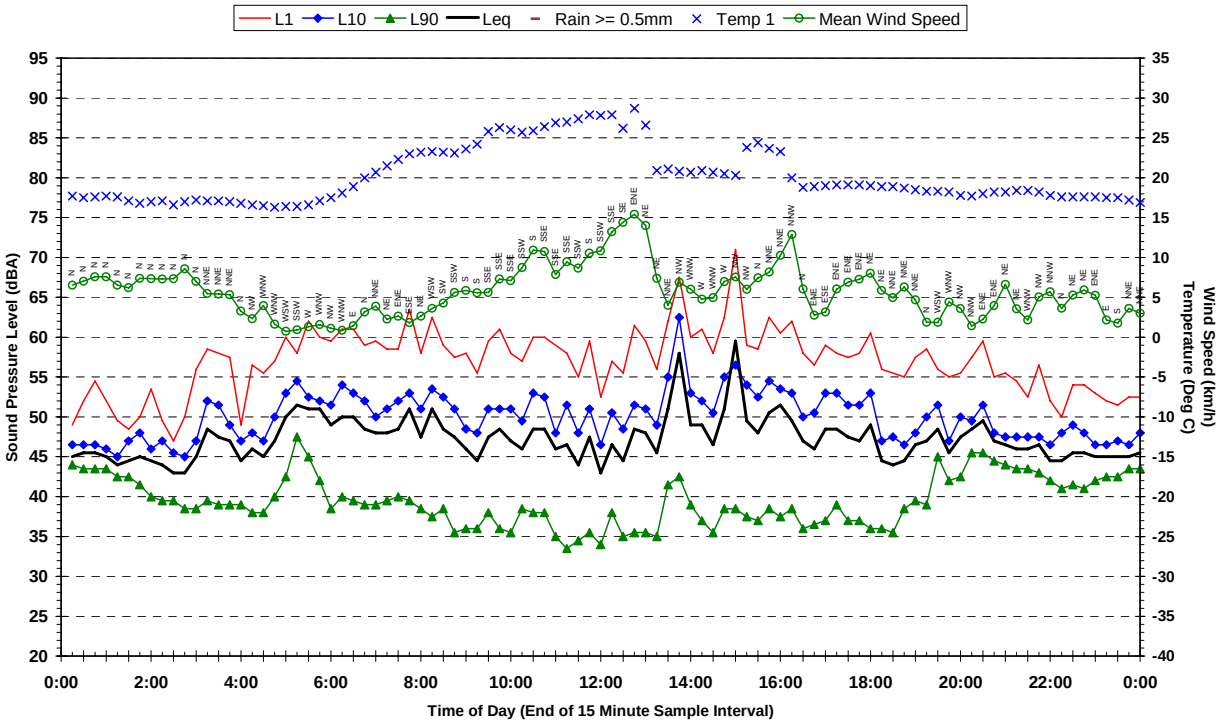


UNATTENDED NOISE LOGGER RESULTS NOVEMBER 2007 - 117 HOLMES

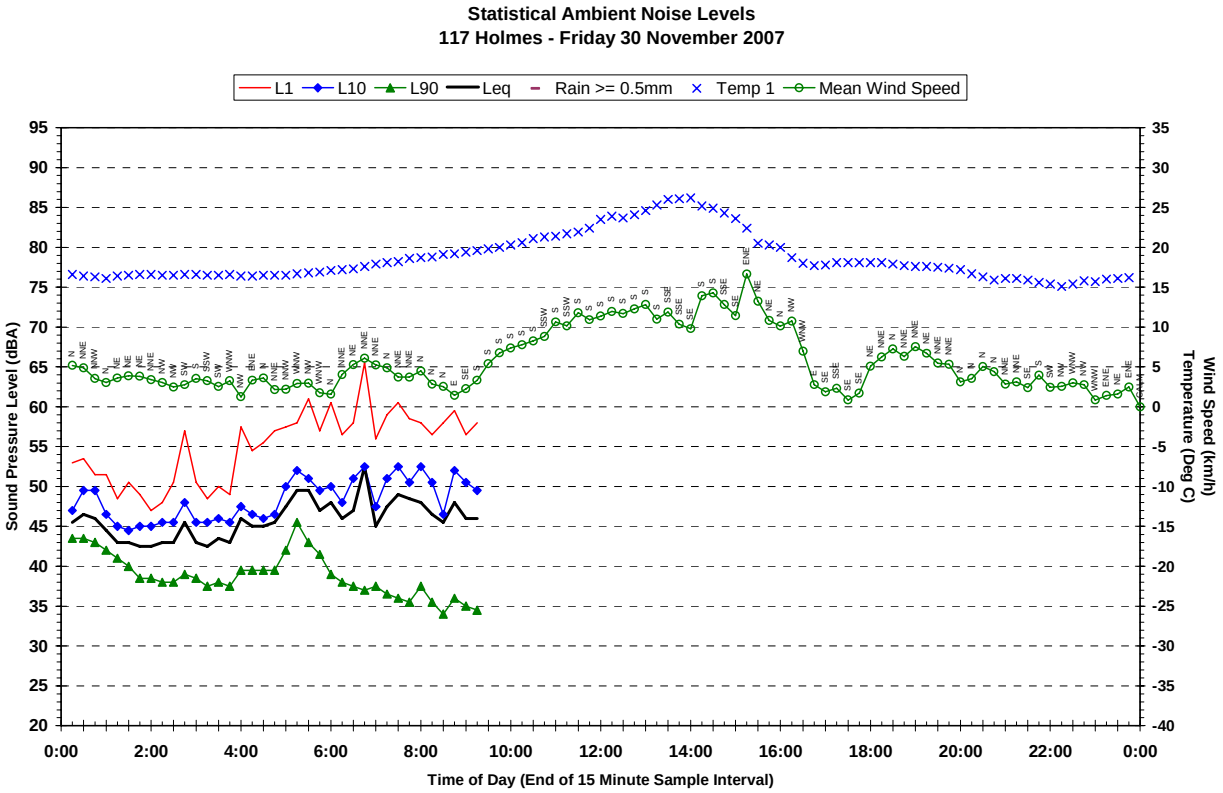
Statistical Ambient Noise Levels
117 Holmes - Wednesday 28 November 2007



Statistical Ambient Noise Levels
117 Holmes - Thursday 29 November 2007

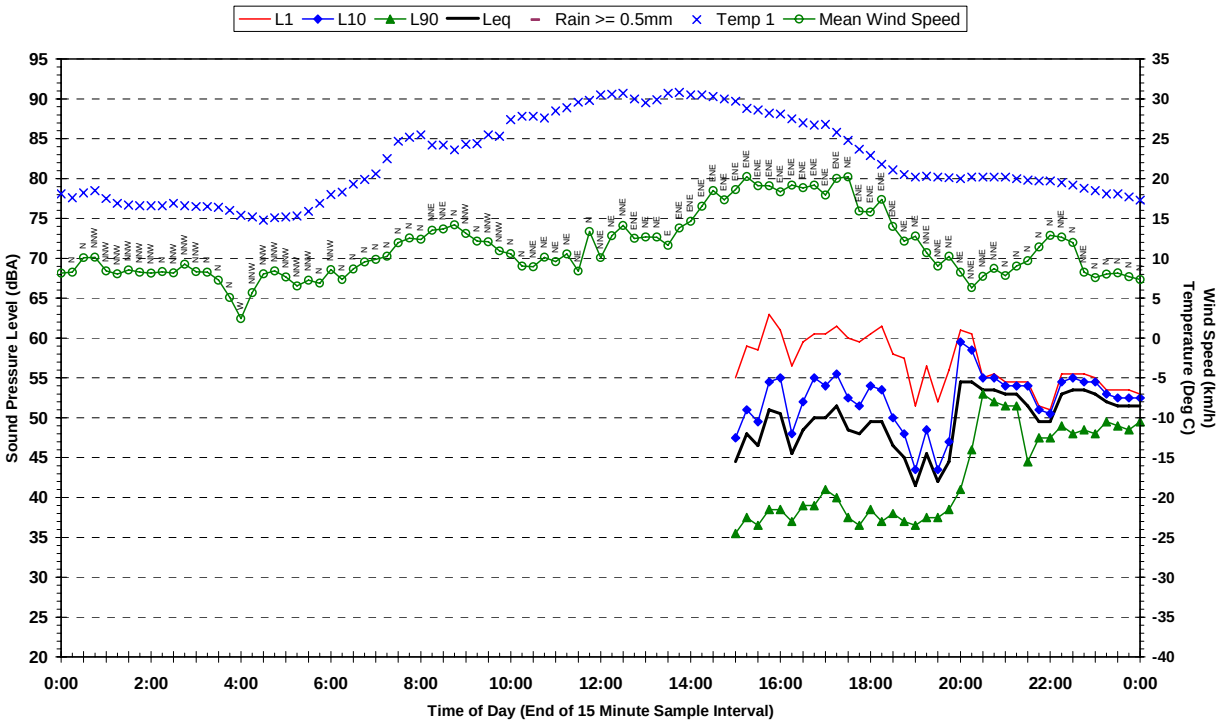


UNATTENDED NOISE LOGGER RESULTS NOVEMBER 2007 - 117 HOLMES

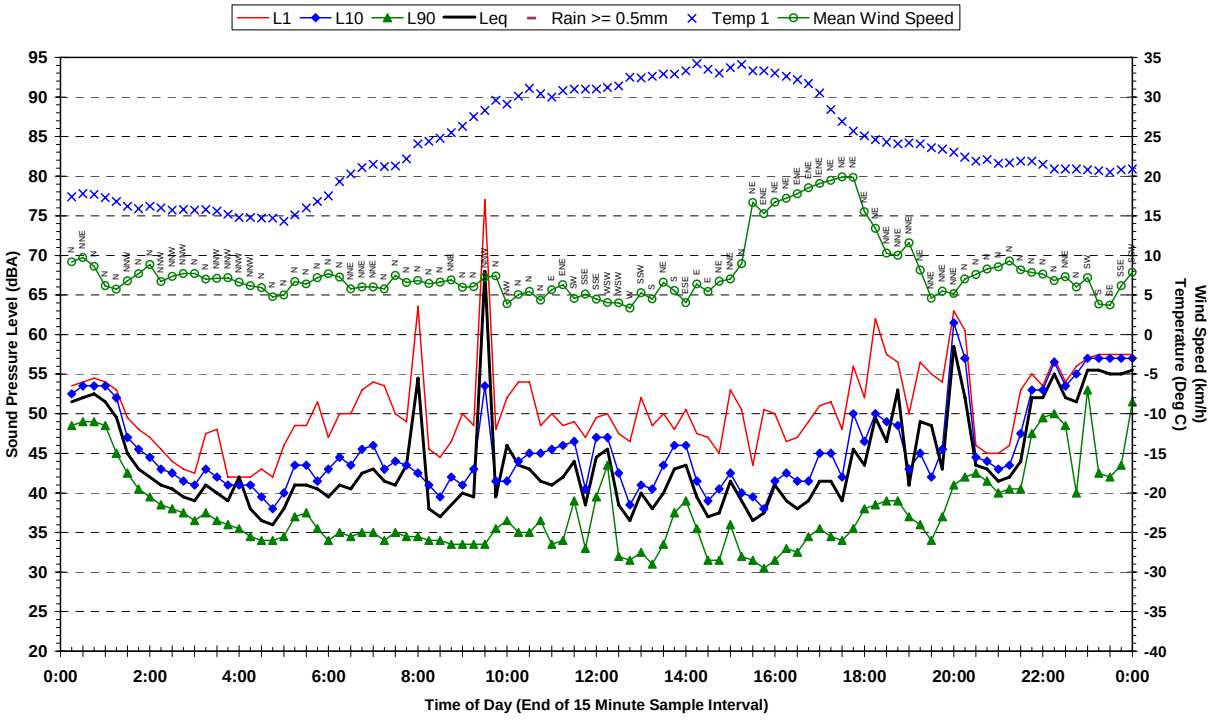


UNATTENDED NOISE LOGGER RESULTS NOVEMBER 2007 - 124 (1) BAILEY

Statistical Ambient Noise Levels
124 (1) Bailey - Tuesday 20 November 2007

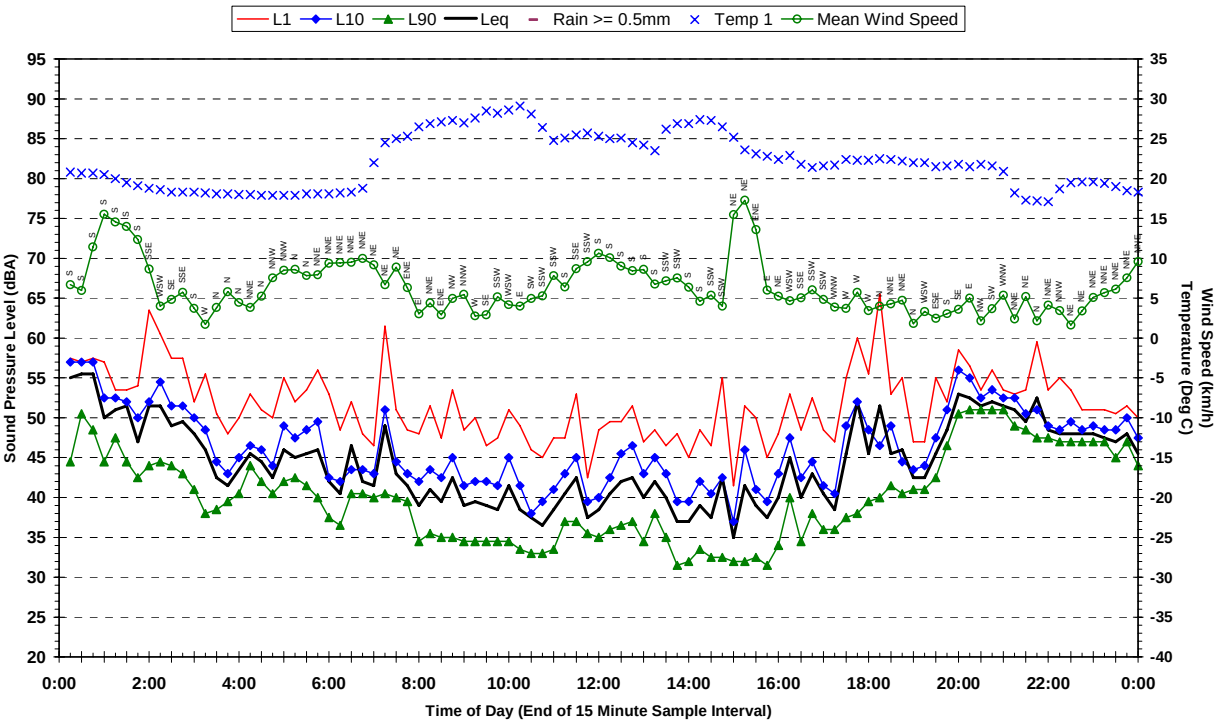


Statistical Ambient Noise Levels
124 (1) Bailey - Wednesday 21 November 2007

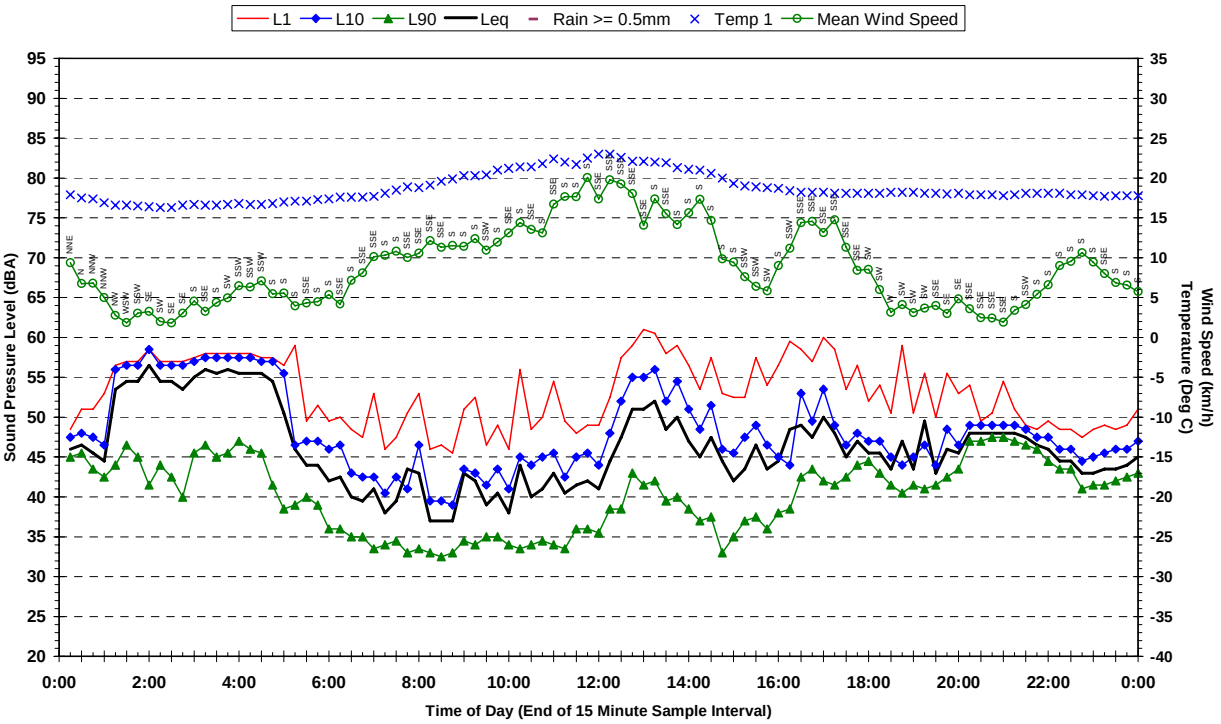


UNATTENDED NOISE LOGGER RESULTS NOVEMBER 2007 - 124 (1) BAILEY

Statistical Ambient Noise Levels
124 (1) Bailey - Thursday 22 November 2007

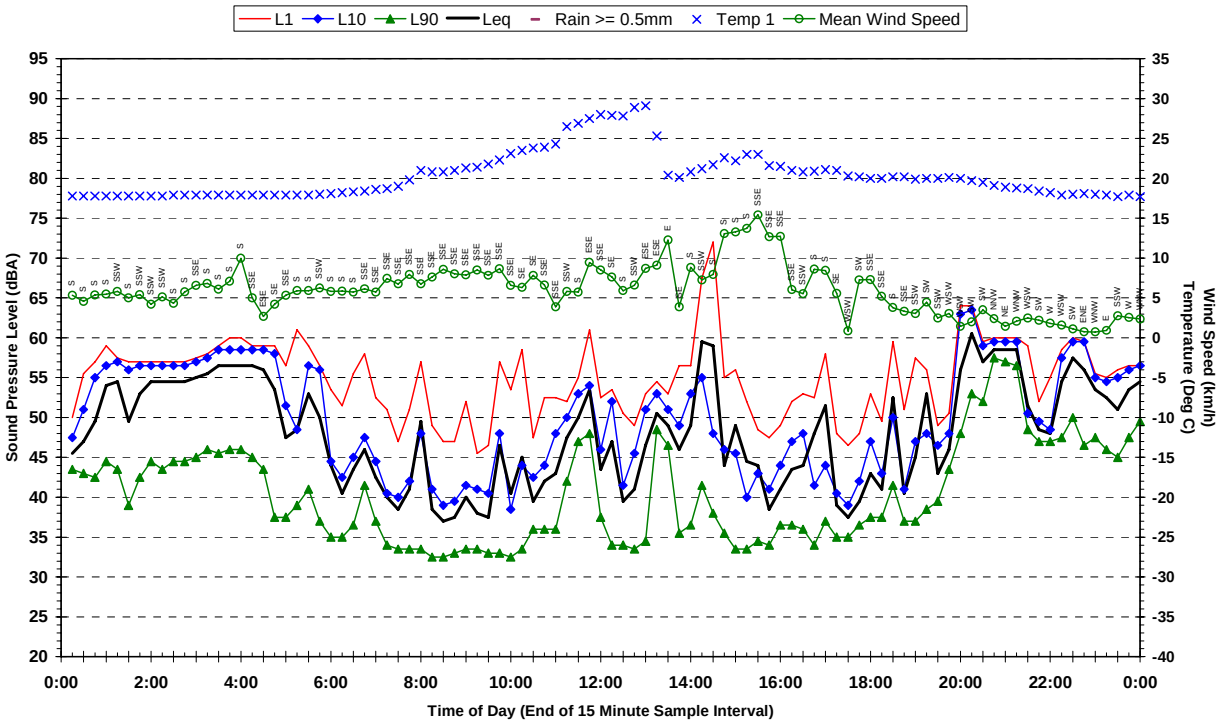


Statistical Ambient Noise Levels
124 (1) Bailey - Friday 23 November 2007

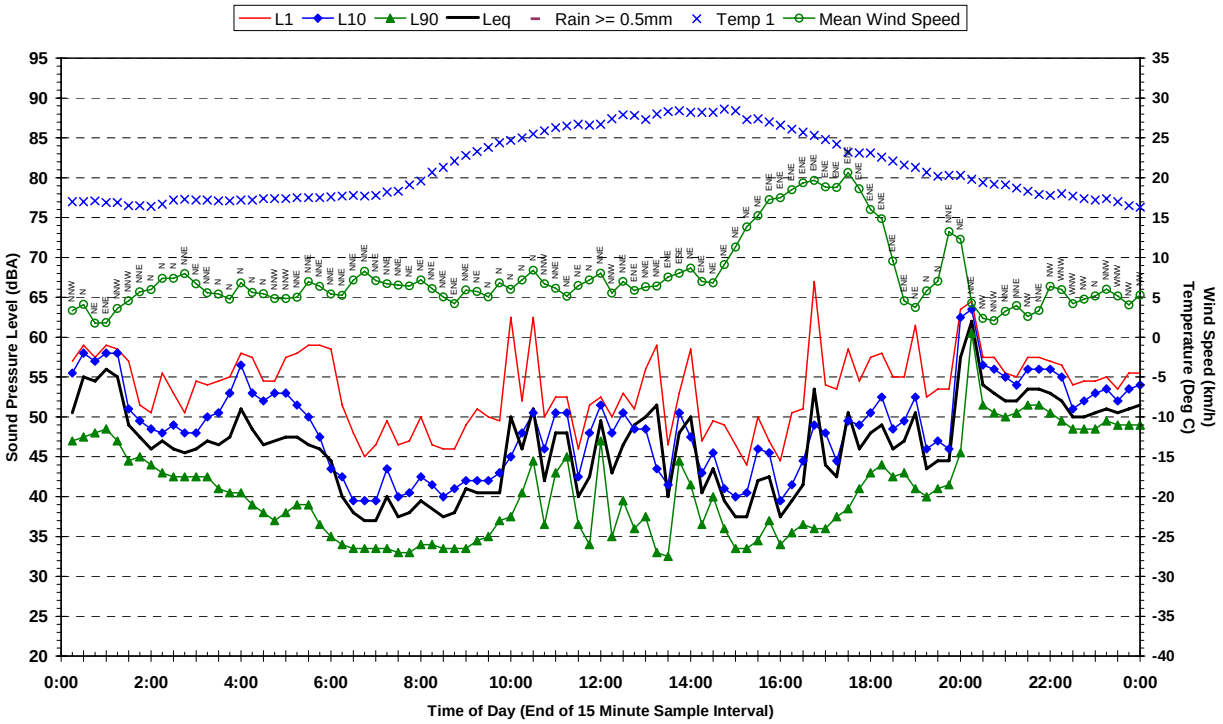


UNATTENDED NOISE LOGGER RESULTS NOVEMBER 2007 - 124 (1) BAILEY

Statistical Ambient Noise Levels
124 (1) Bailey - Saturday 24 November 2007

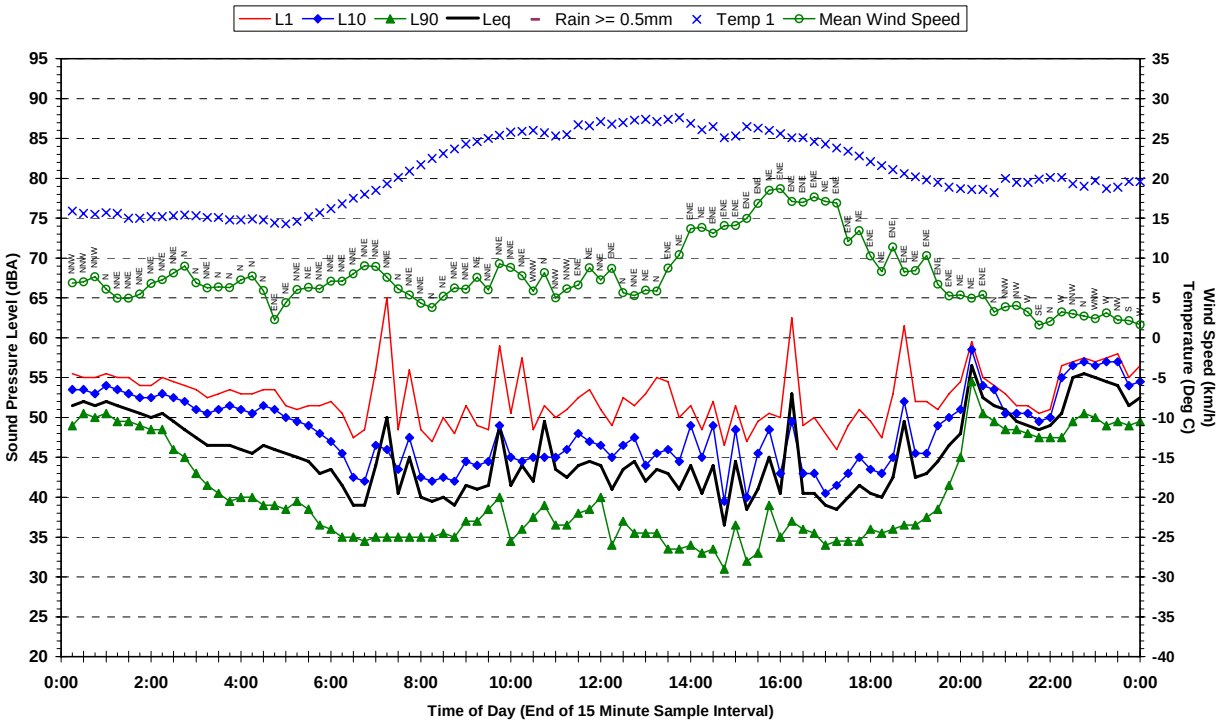


Statistical Ambient Noise Levels
124 (1) Bailey - Sunday 25 November 2007

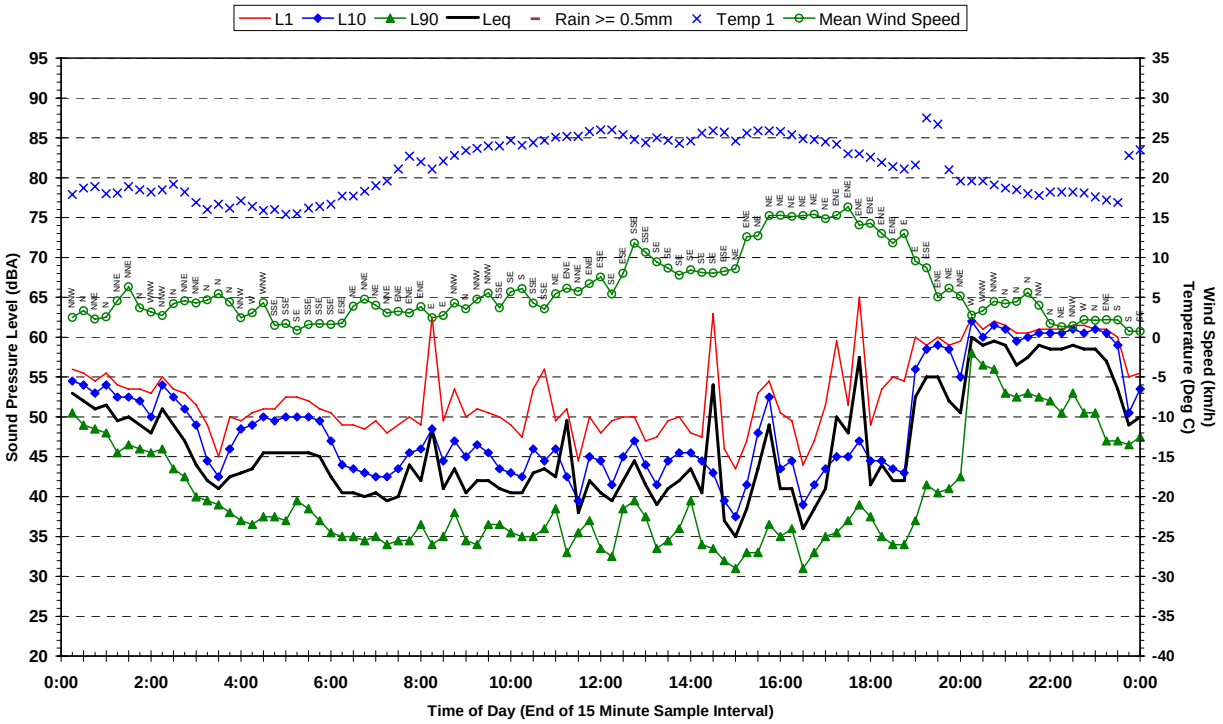


UNATTENDED NOISE LOGGER RESULTS NOVEMBER 2007 - 124 (1) BAILEY

Statistical Ambient Noise Levels
124 (1) Bailey - Monday 26 November 2007

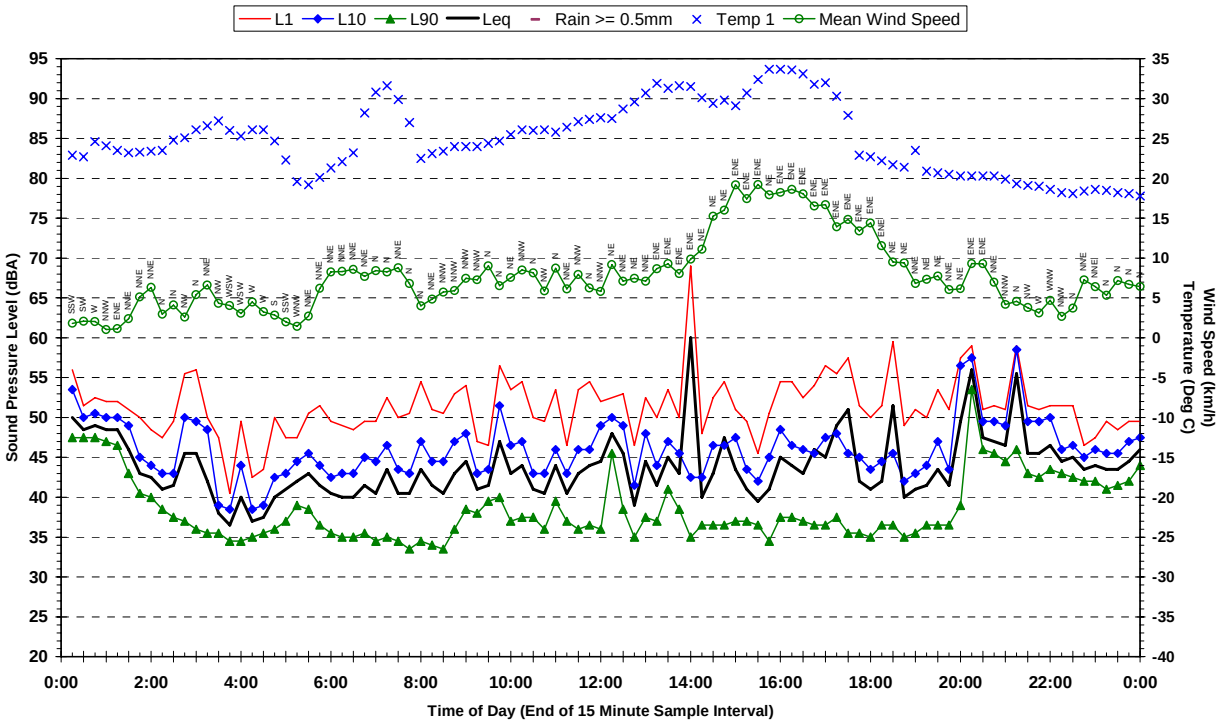


Statistical Ambient Noise Levels
124 (1) Bailey - Tuesday 27 November 2007

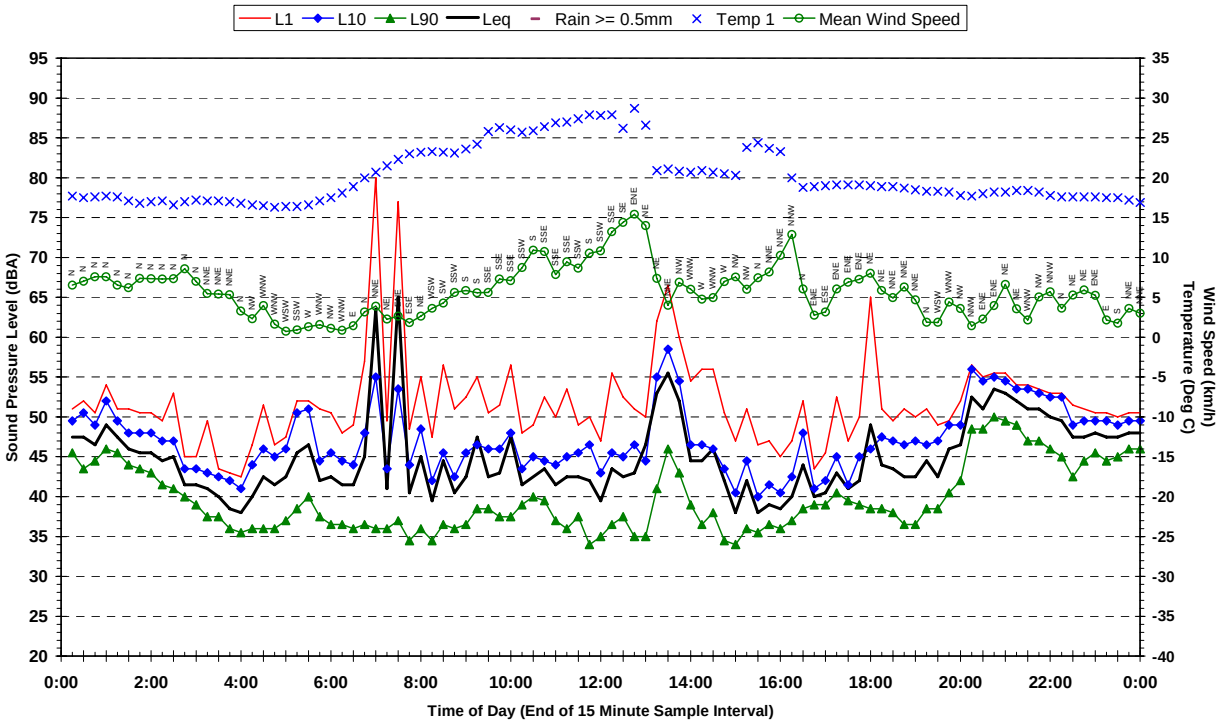


UNATTENDED NOISE LOGGER RESULTS NOVEMBER 2007 - 124 (1) BAILEY

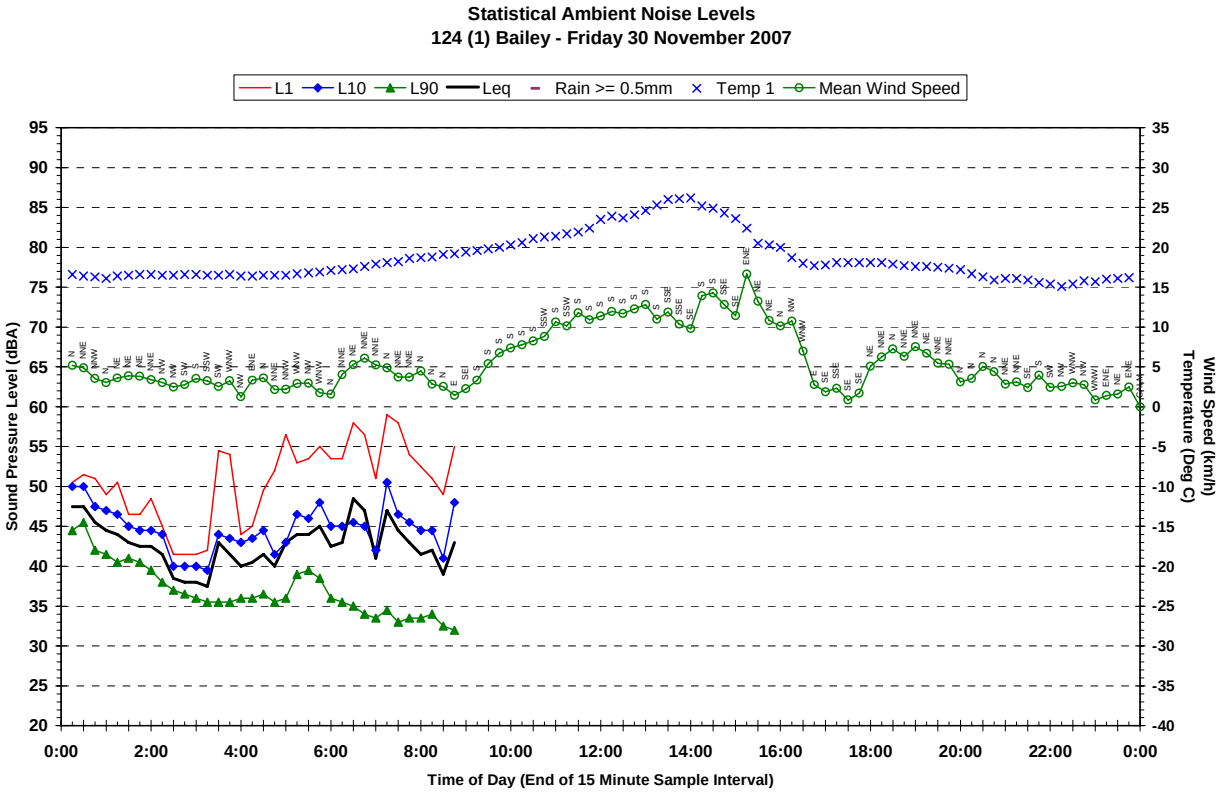
Statistical Ambient Noise Levels
124 (1) Bailey - Wednesday 28 November 2007



Statistical Ambient Noise Levels
124 (1) Bailey - Thursday 29 November 2007

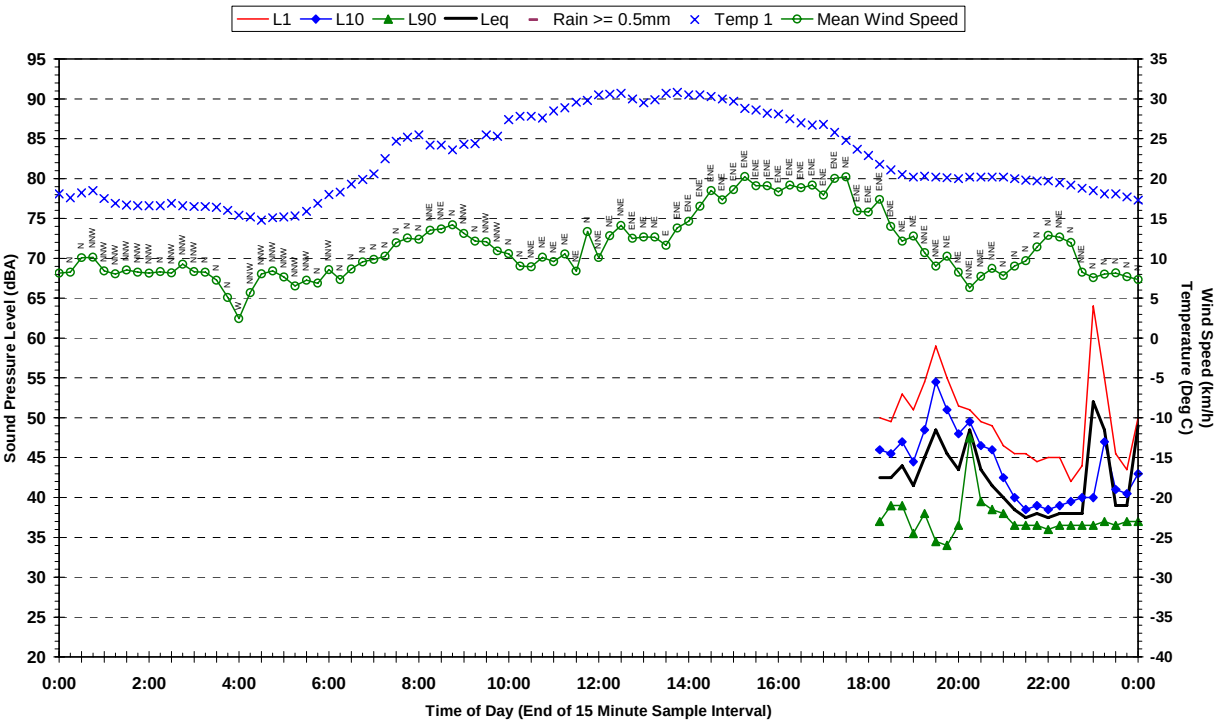


UNATTENDED NOISE LOGGER RESULTS NOVEMBER 2007 - 124 (1) BAILEY

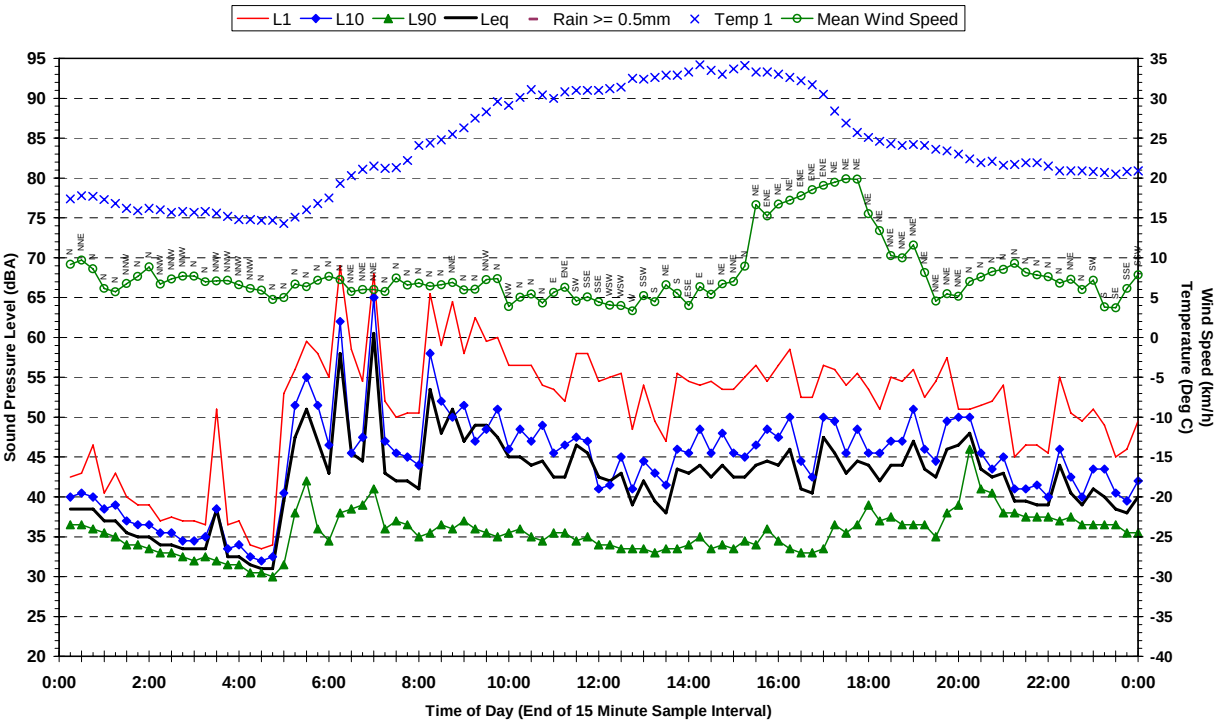


UNATTENDED NOISE LOGGER RESULTS NOVEMBER 2007 - 172 LYALL

Statistical Ambient Noise Levels
172 Lyall - Tuesday 20 November 2007

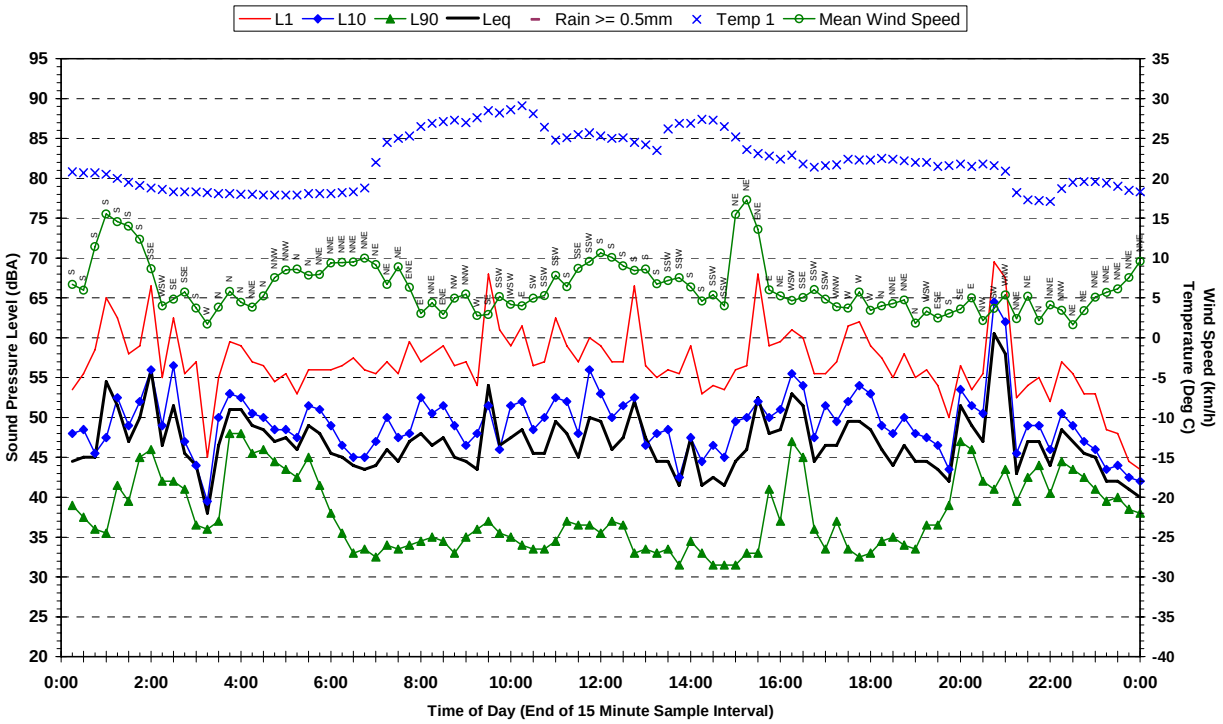


Statistical Ambient Noise Levels
172 Lyall - Wednesday 21 November 2007

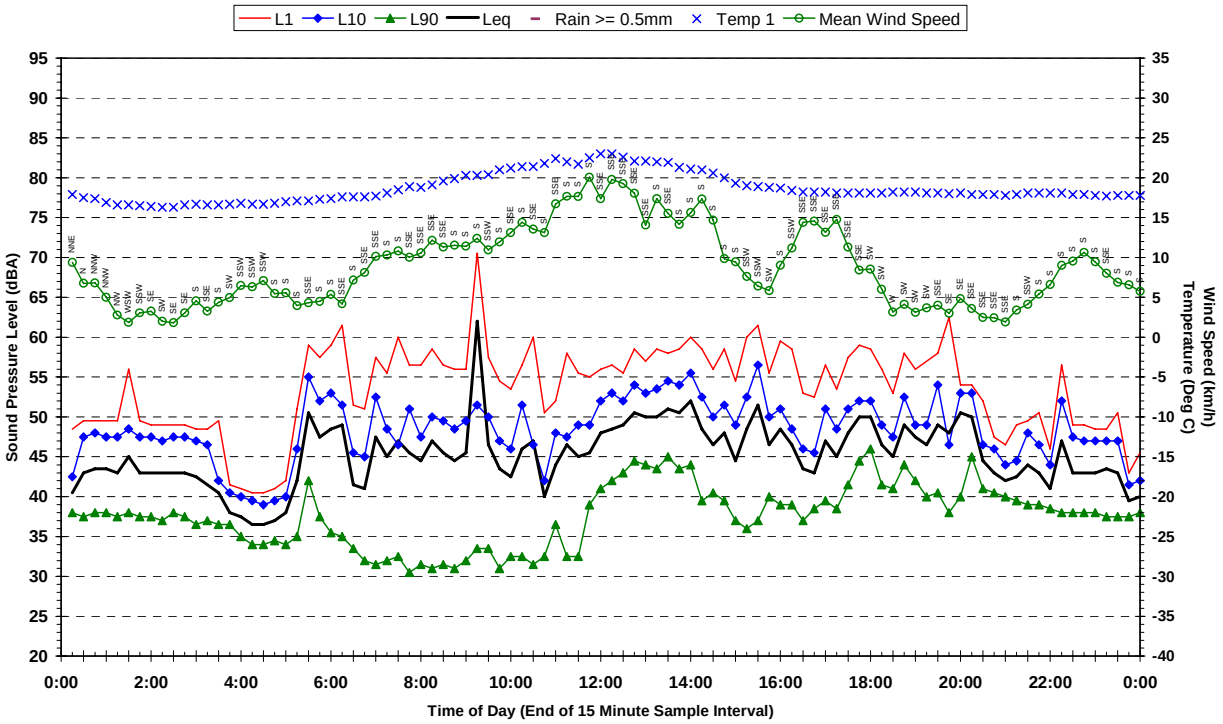


UNATTENDED NOISE LOGGER RESULTS NOVEMBER 2007 - 172 LYALL

Statistical Ambient Noise Levels
172 Lyall - Thursday 22 November 2007

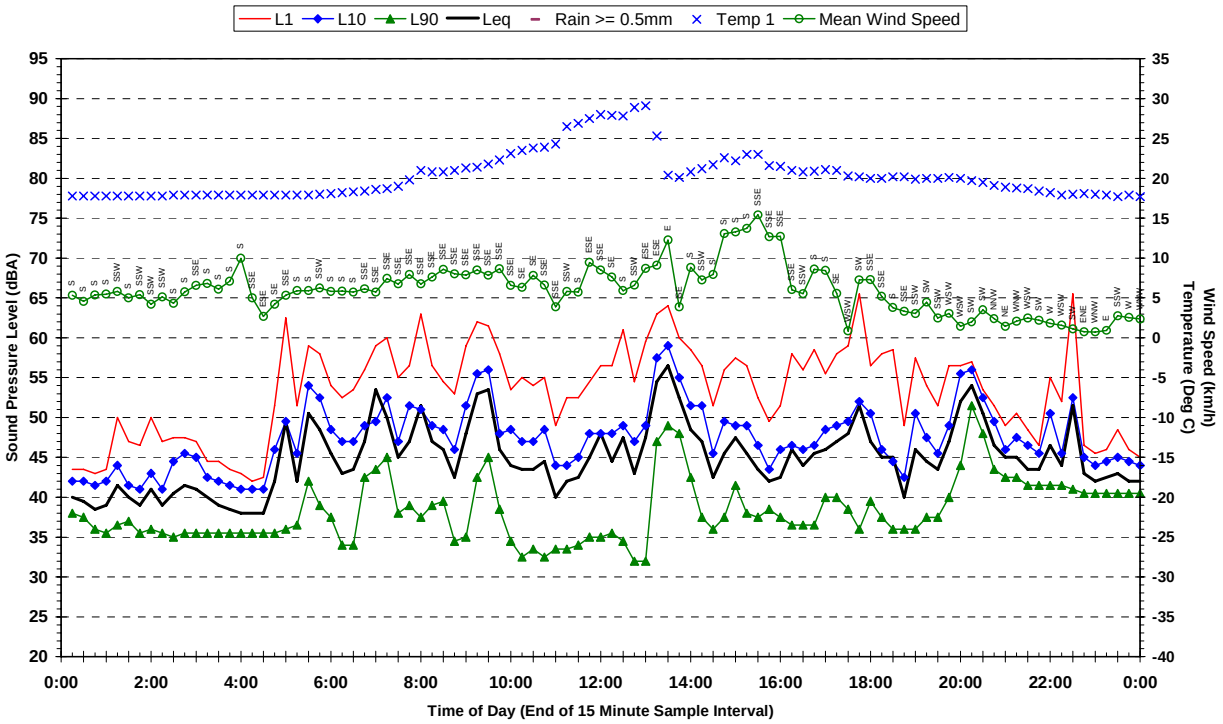


Statistical Ambient Noise Levels
172 Lyall - Friday 23 November 2007

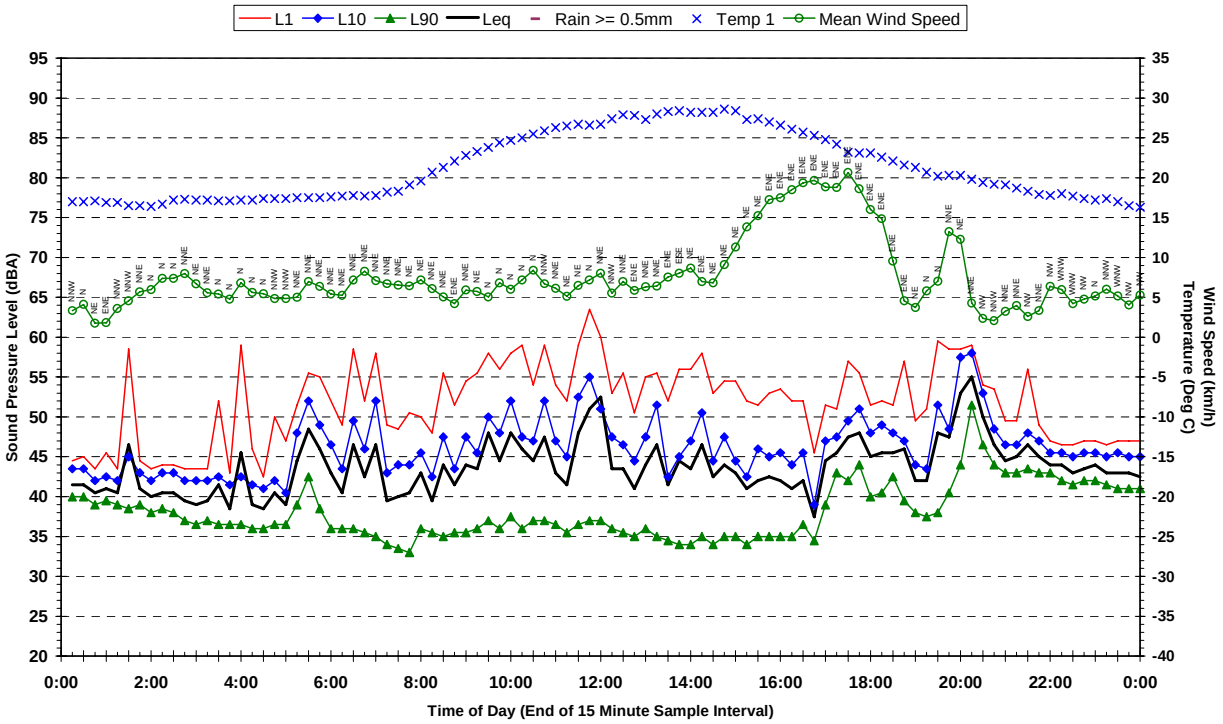


UNATTENDED NOISE LOGGER RESULTS NOVEMBER 2007 - 172 LYALL

Statistical Ambient Noise Levels
172 Lyall - Saturday 24 November 2007

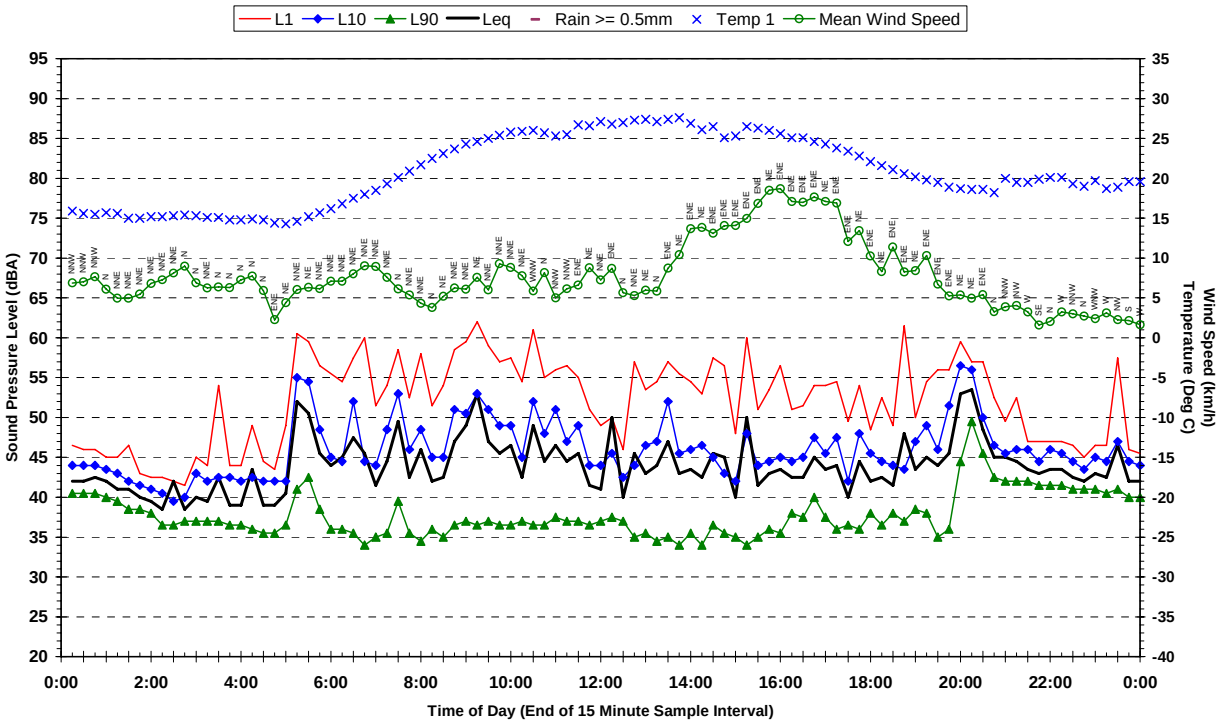


Statistical Ambient Noise Levels
172 Lyall - Sunday 25 November 2007

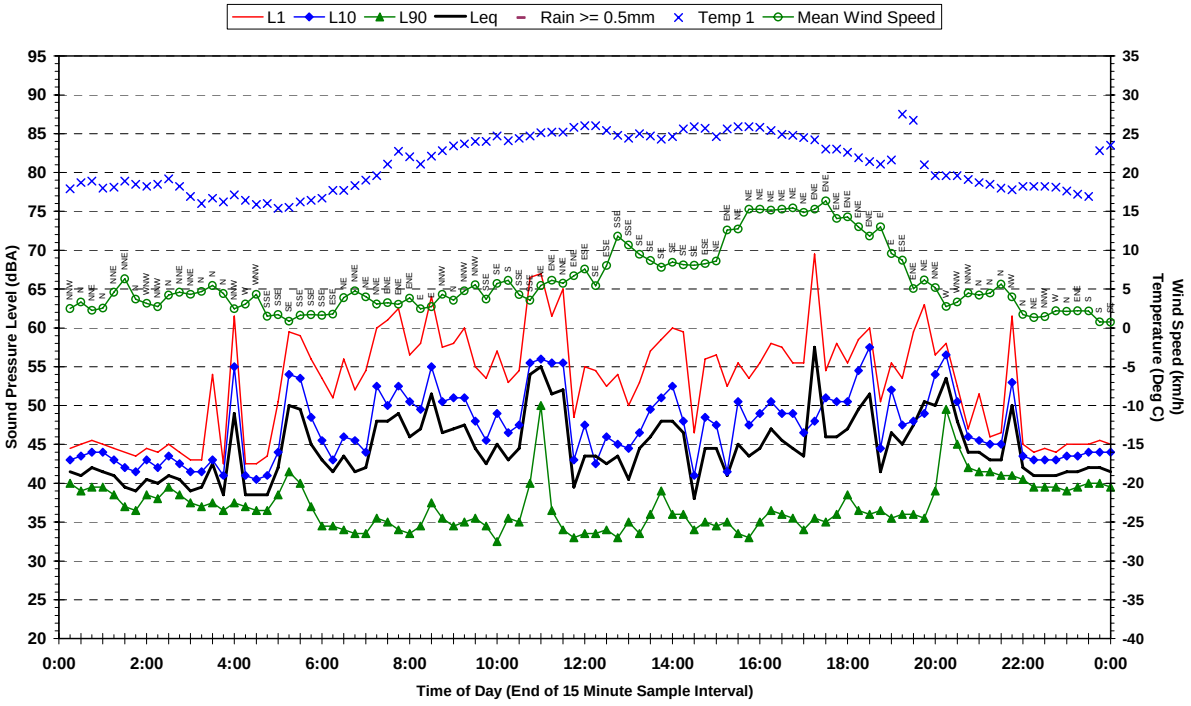


UNATTENDED NOISE LOGGER RESULTS NOVEMBER 2007 - 172 LYALL

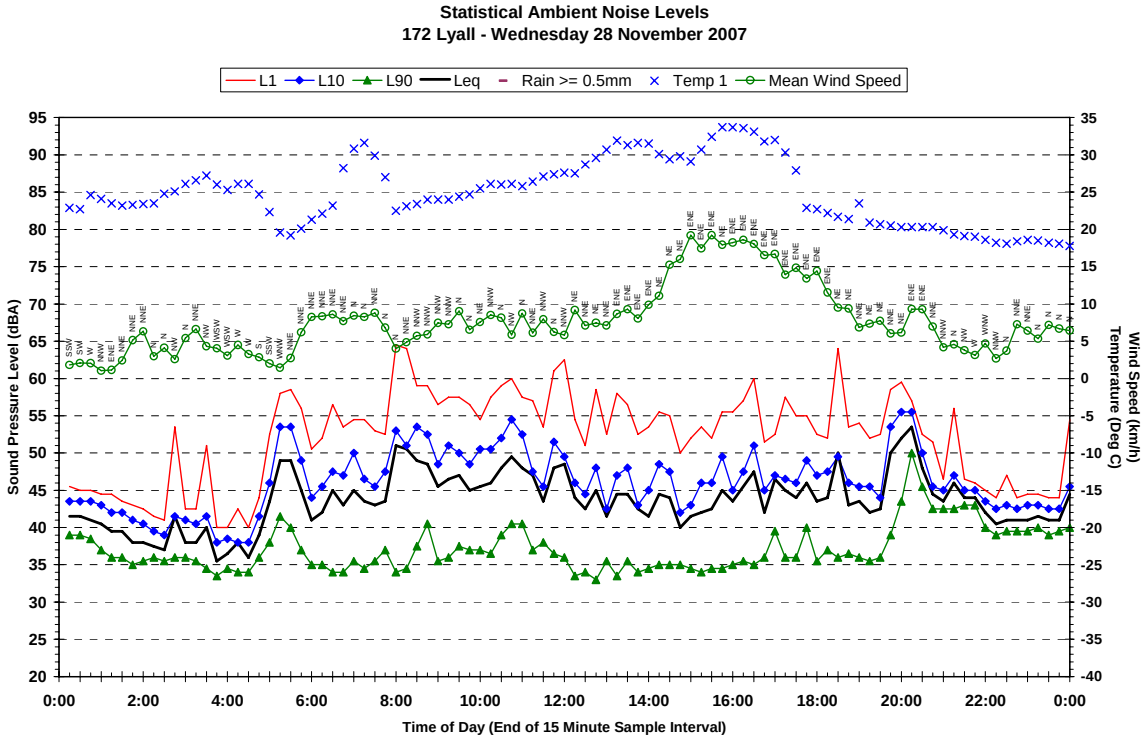
Statistical Ambient Noise Levels
172 Lyall - Monday 26 November 2007

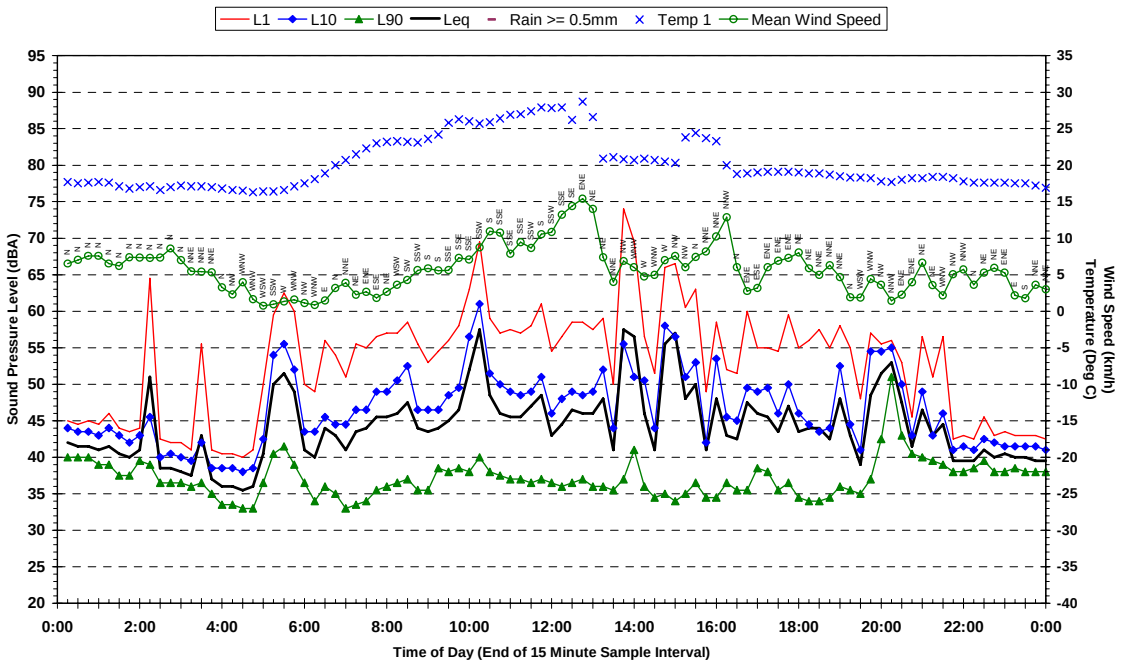


Statistical Ambient Noise Levels
172 Lyall - Tuesday 27 November 2007

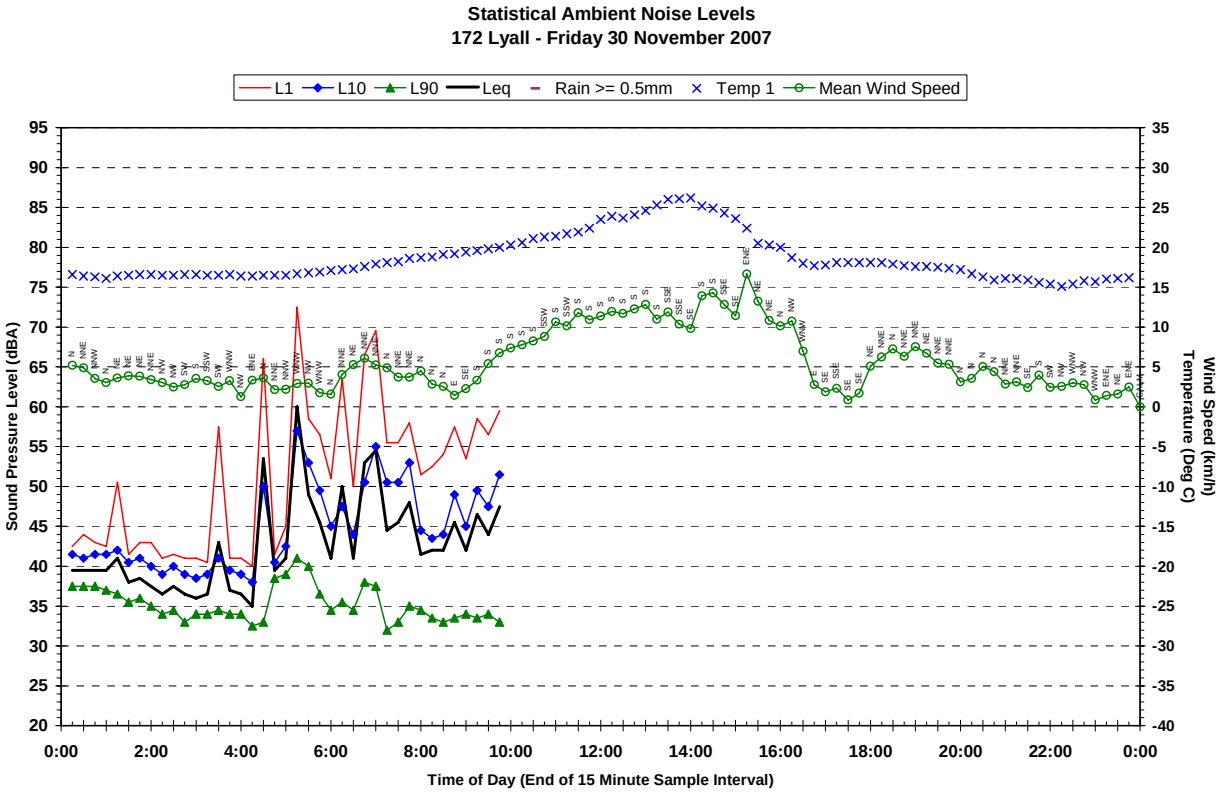


UNATTENDED NOISE LOGGER RESULTS NOVEMBER 2007 - 172 LYALL

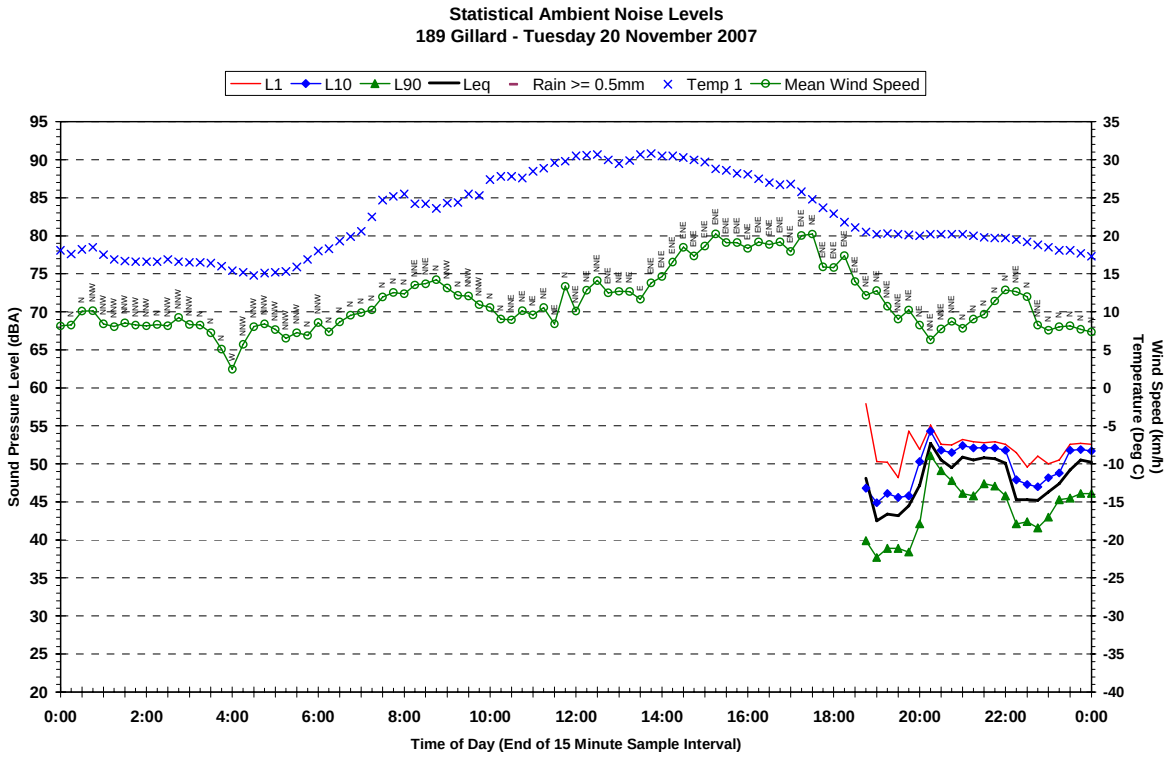


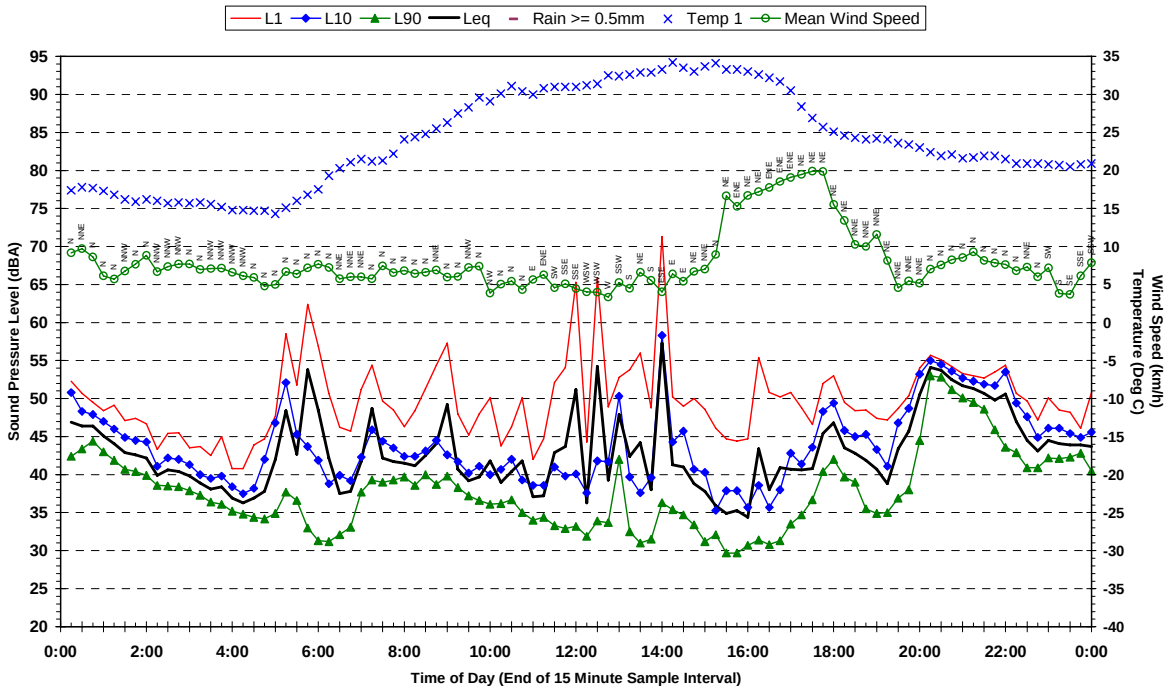


UNATTENDED NOISE LOGGER RESULTS NOVEMBER 2007 - 172 LYALL



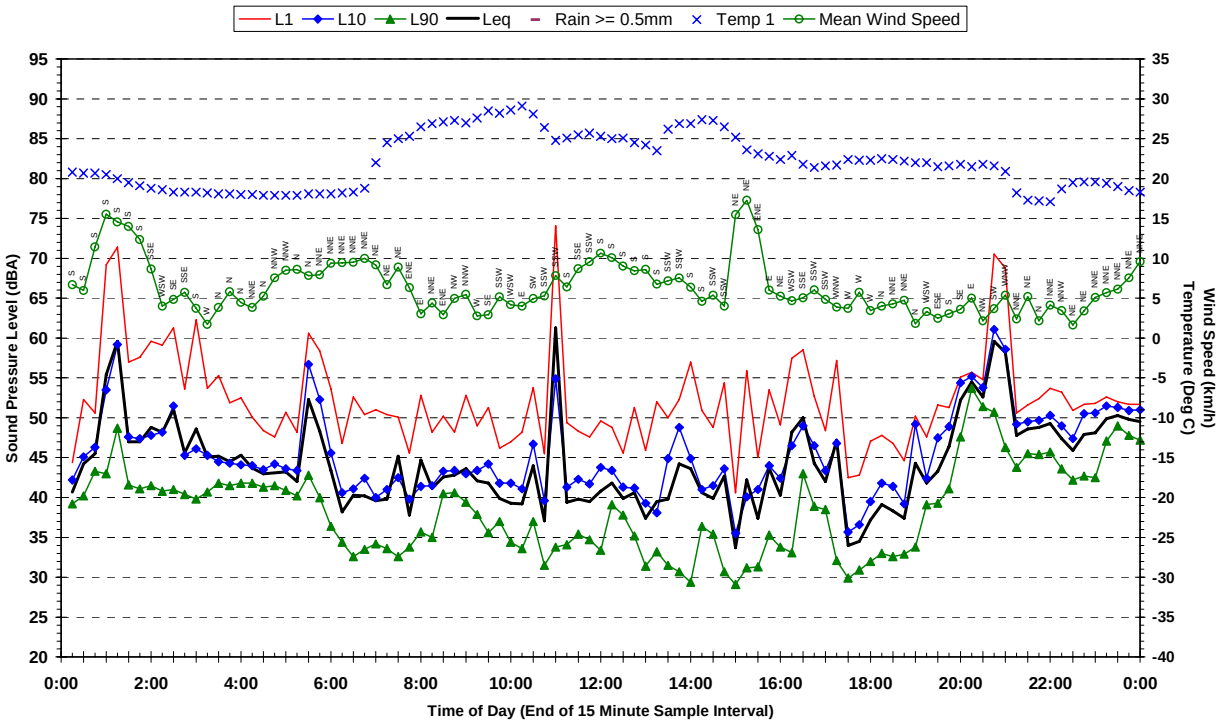
UNATTENDED NOISE LOGGER RESULTS NOVEMBER 2007 - 189 GILLARD



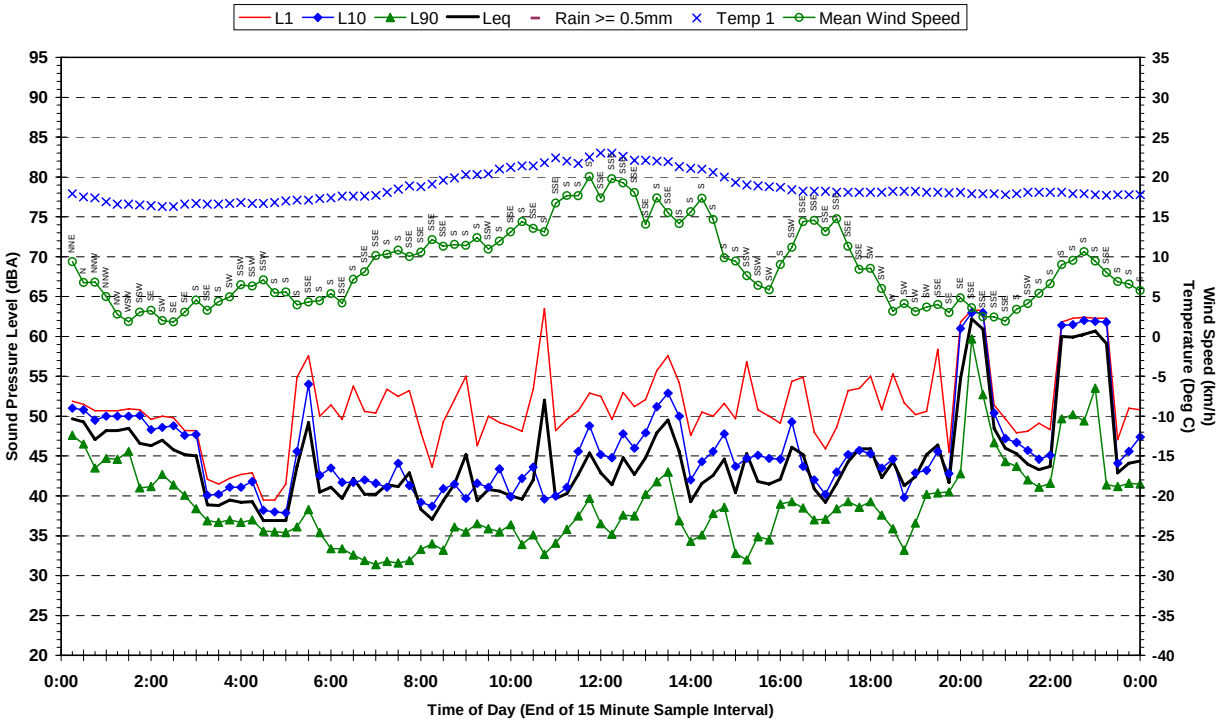


UNATTENDED NOISE LOGGER RESULTS NOVEMBER 2007 - 189 GILLARD

Statistical Ambient Noise Levels
189 Gillard - Thursday 22 November 2007

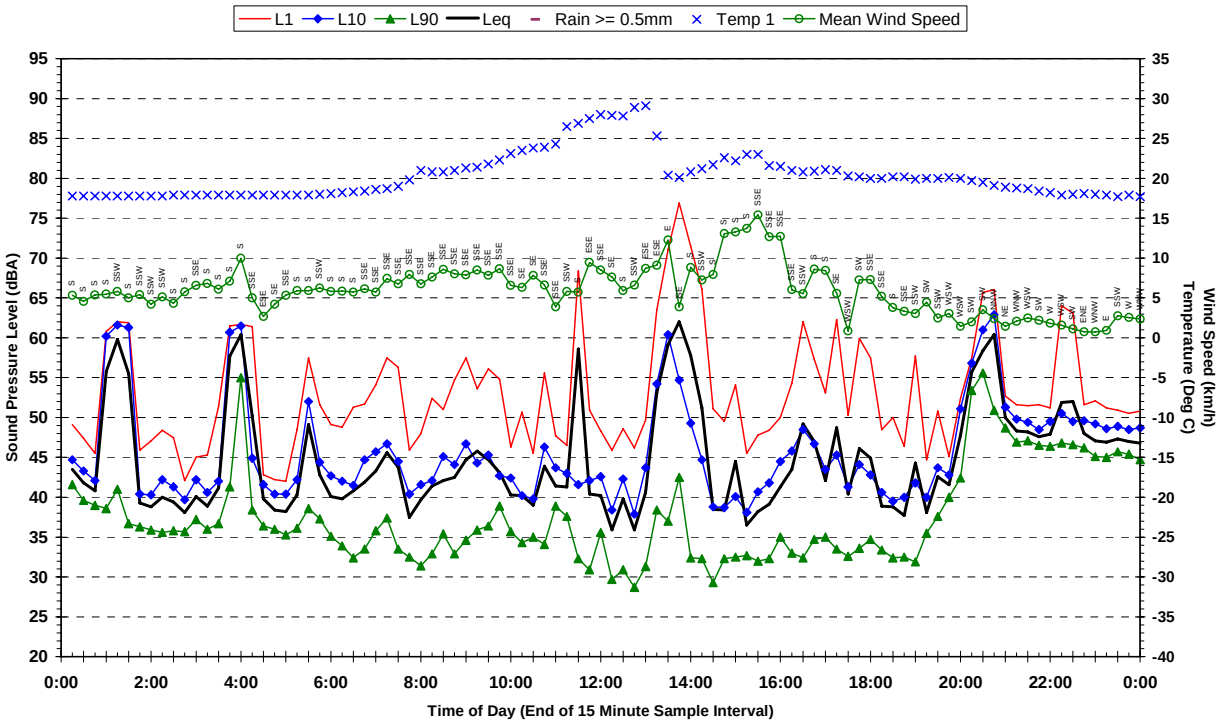


Statistical Ambient Noise Levels
189 Gillard - Friday 23 November 2007

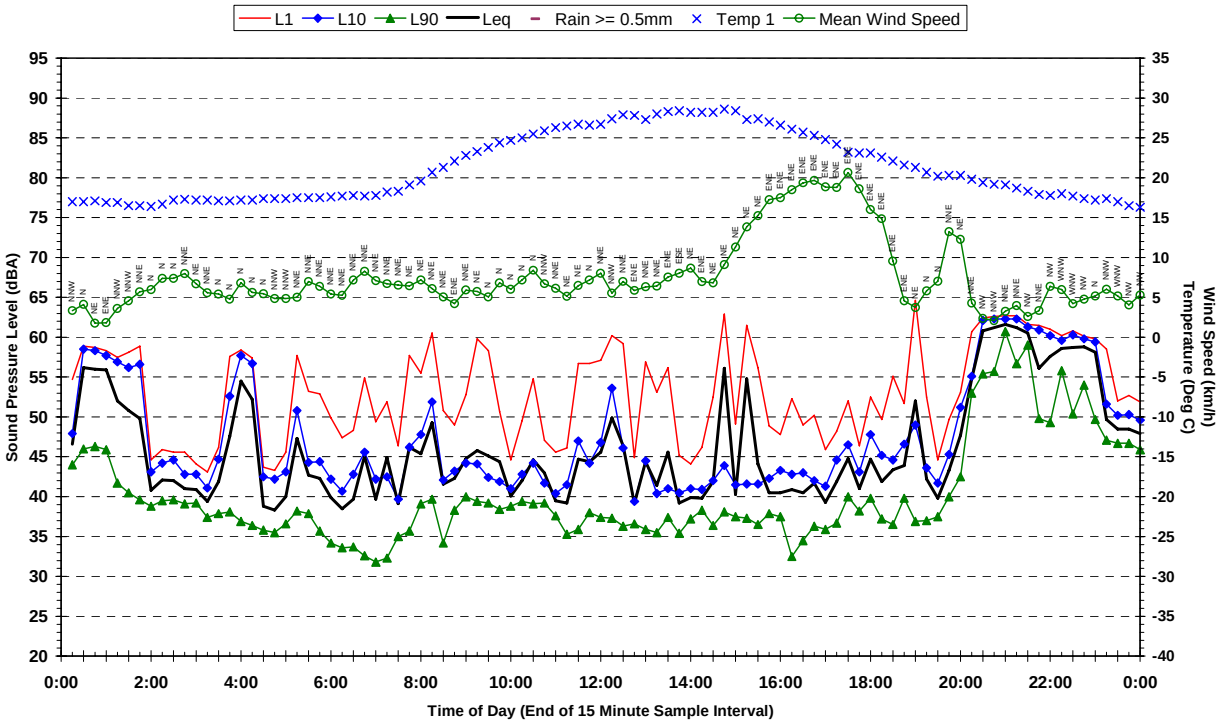


UNATTENDED NOISE LOGGER RESULTS NOVEMBER 2007 - 189 GILLARD

Statistical Ambient Noise Levels
189 Gillard - Saturday 24 November 2007

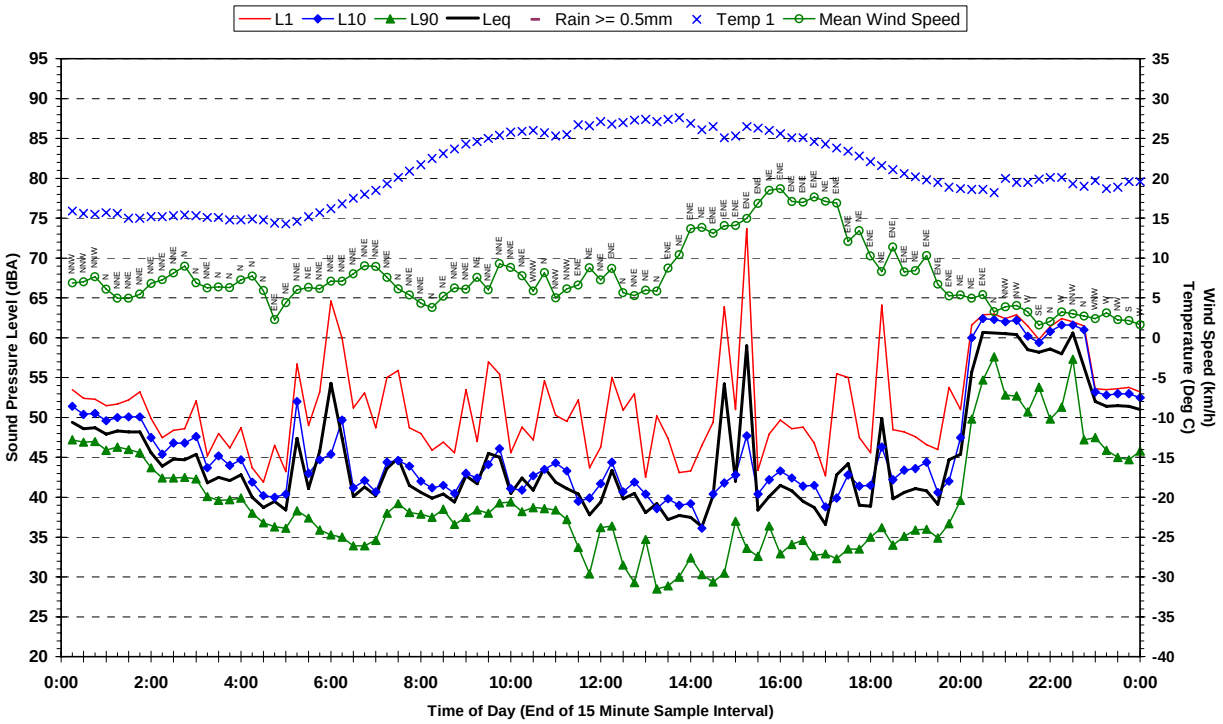


Statistical Ambient Noise Levels
189 Gillard - Sunday 25 November 2007

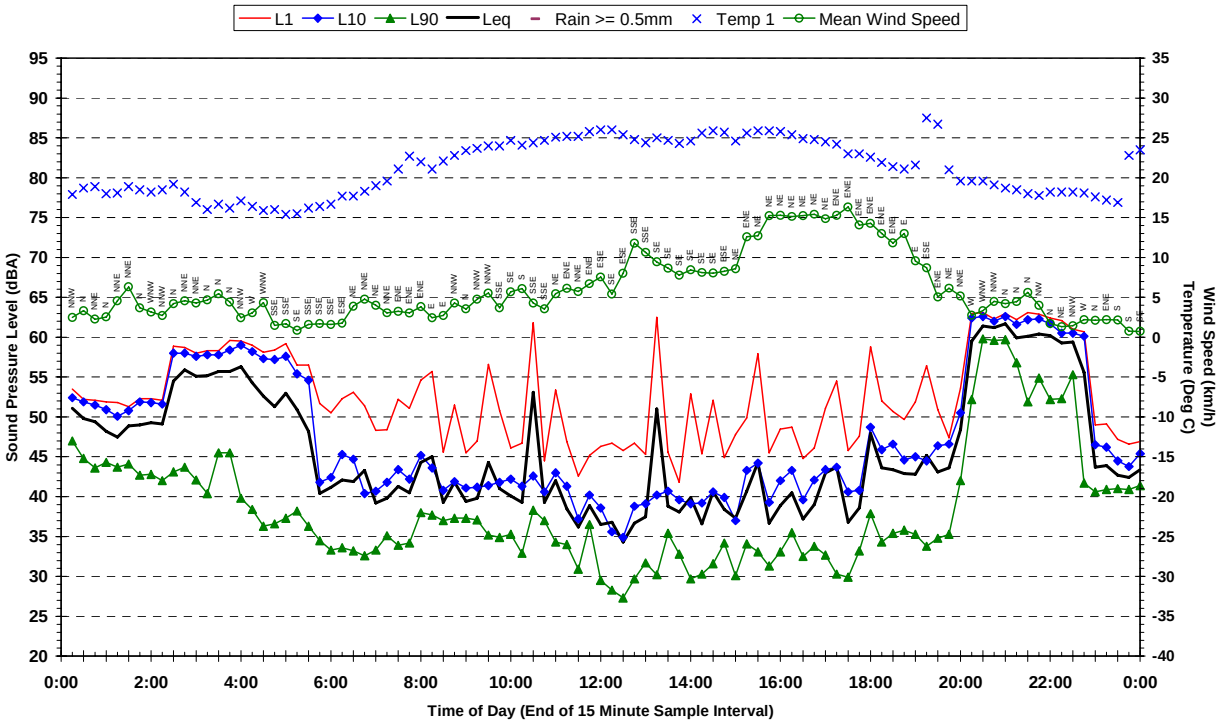


UNATTENDED NOISE LOGGER RESULTS NOVEMBER 2007 - 189 GILLARD

Statistical Ambient Noise Levels
189 Gillard - Monday 26 November 2007

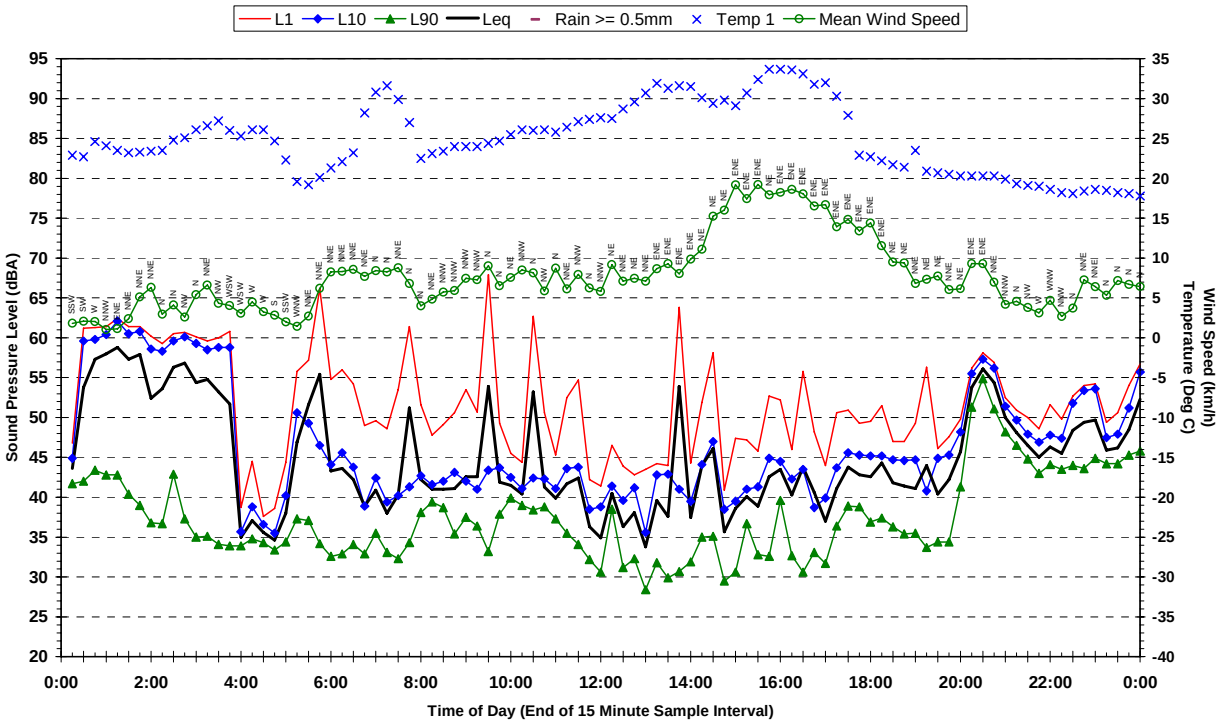


Statistical Ambient Noise Levels
189 Gillard - Tuesday 27 November 2007

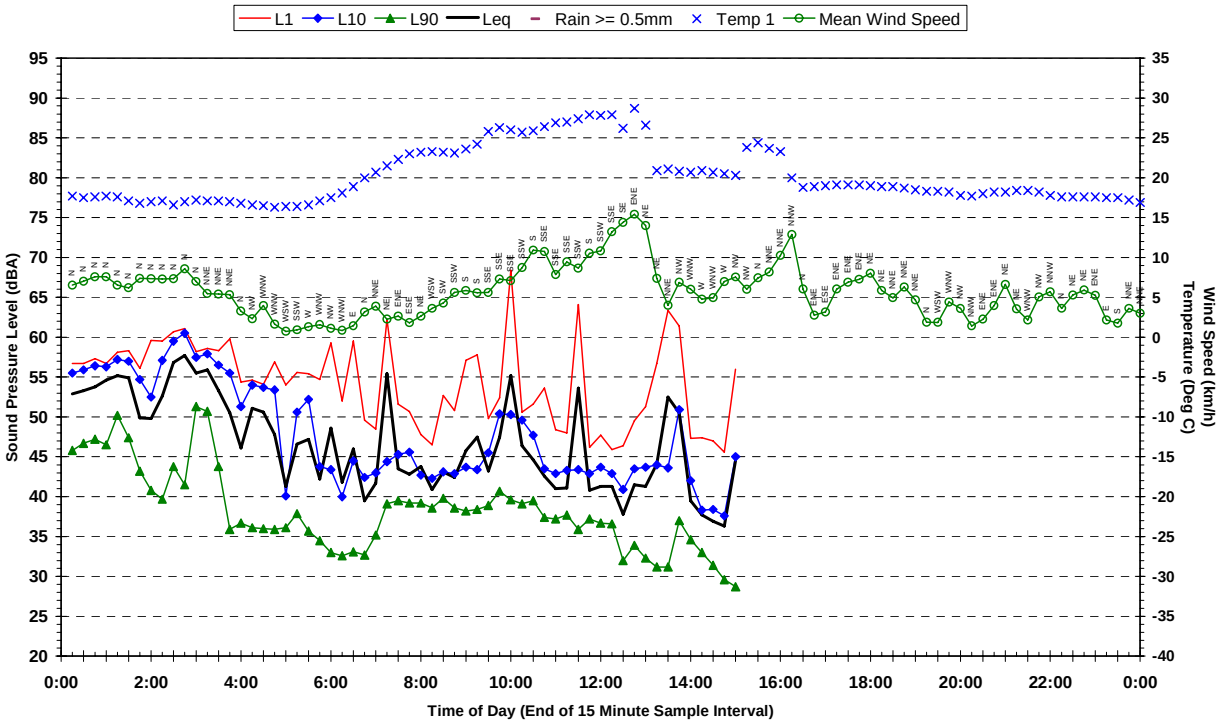


UNATTENDED NOISE LOGGER RESULTS NOVEMBER 2007 - 189 GILLARD

Statistical Ambient Noise Levels
189 Gillard - Wednesday 28 November 2007

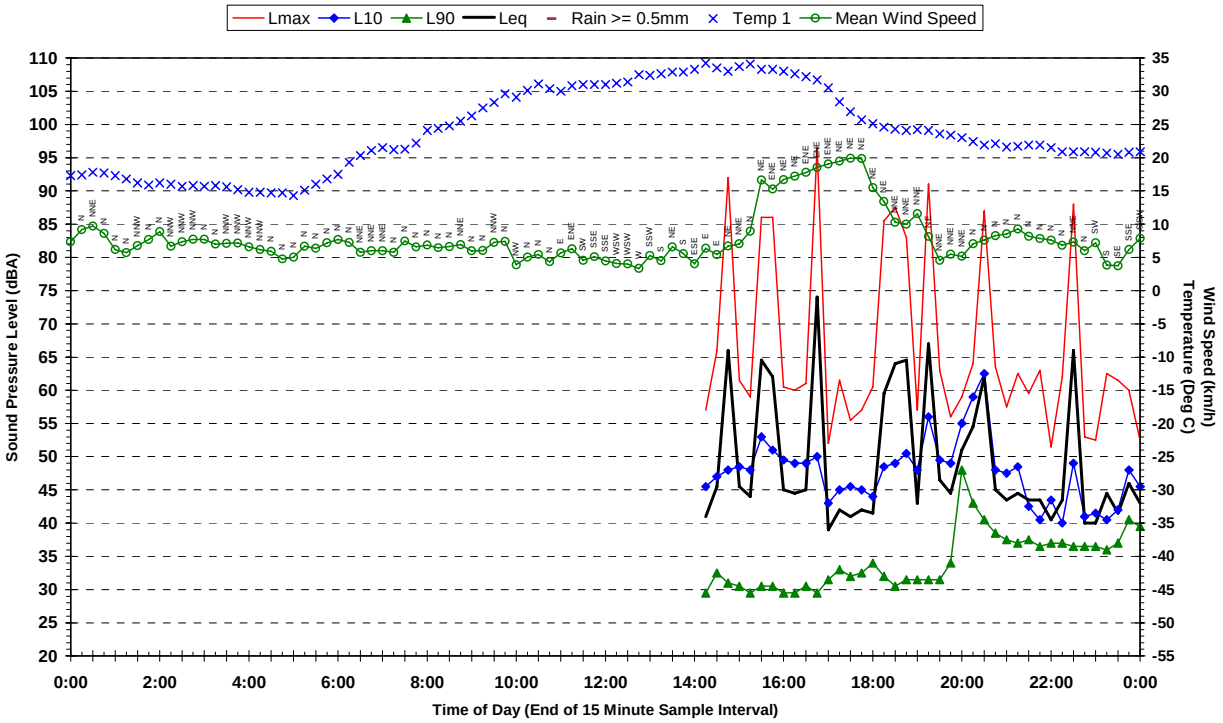


Statistical Ambient Noise Levels
189 Gillard - Thursday 29 November 2007

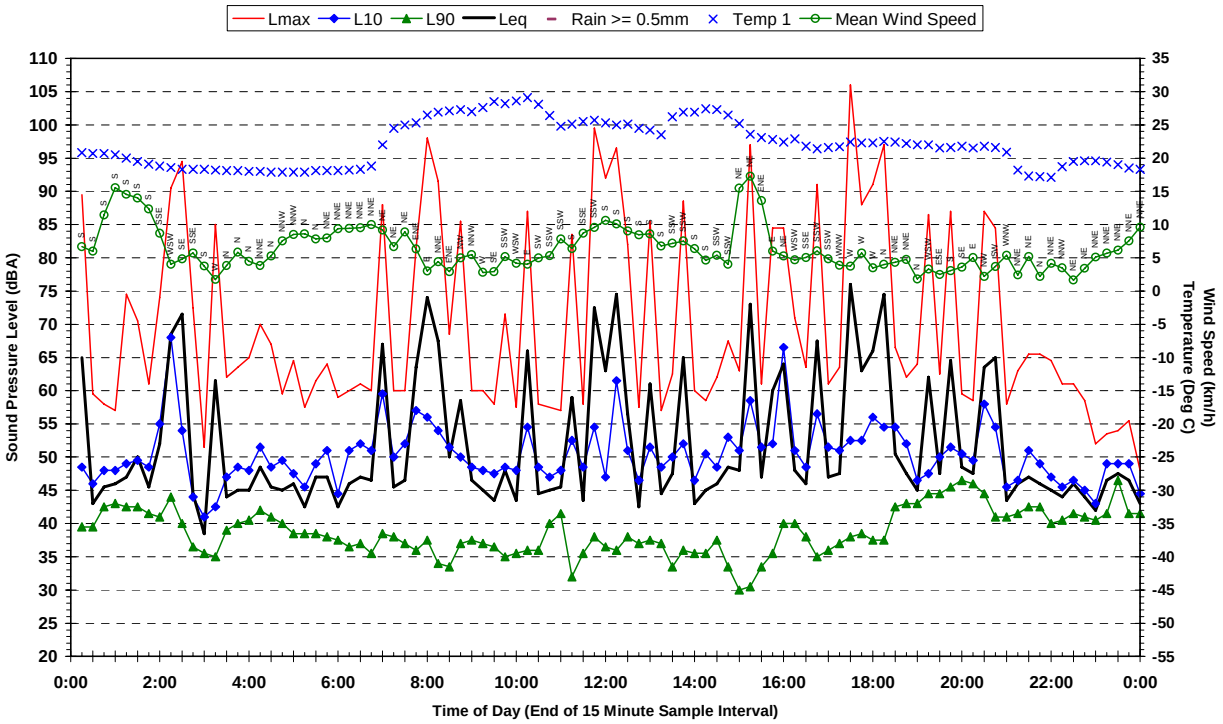


UNATTENDED NOISE LOGGER RESULTS NOVEMBER 2007 - TRAIN

Statistical Ambient Noise Levels - Location 19 GCL
12m from North Coast Railway (South of Wards River) - Wednesday 21 November 2007

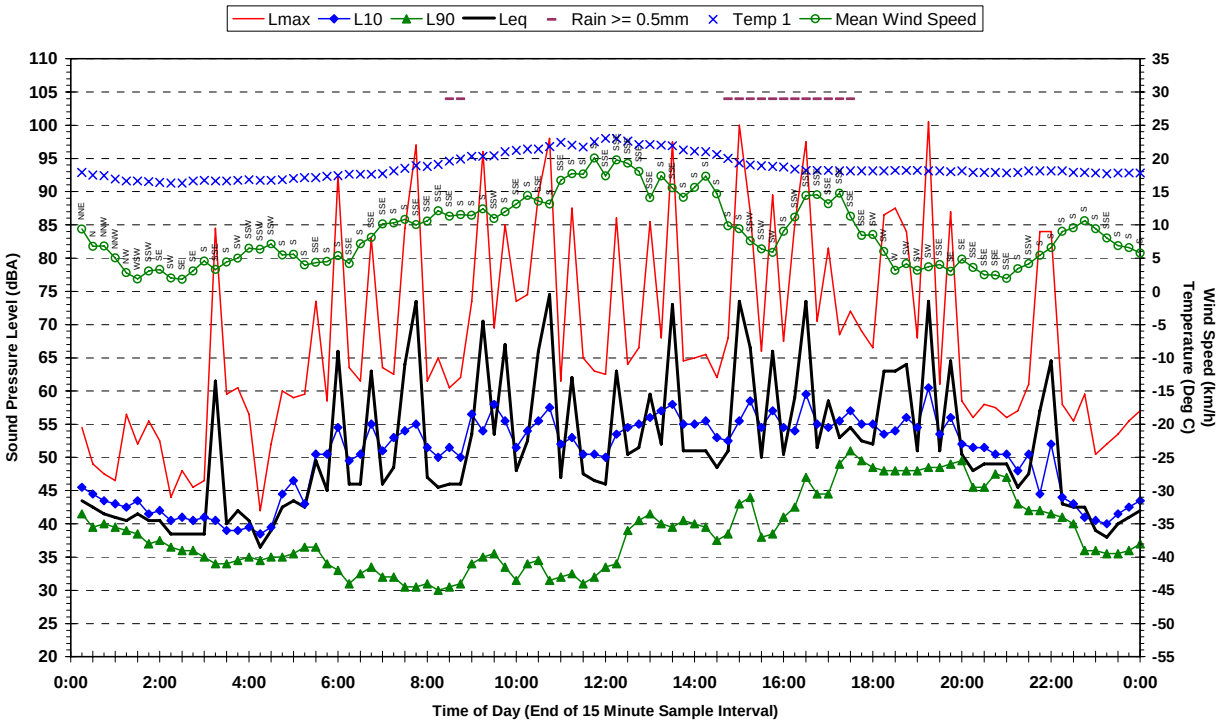


Statistical Ambient Noise Levels - Location 19 GCL
12m from North Coast Railway (South of Wards River) - Thursday 22 November 2007

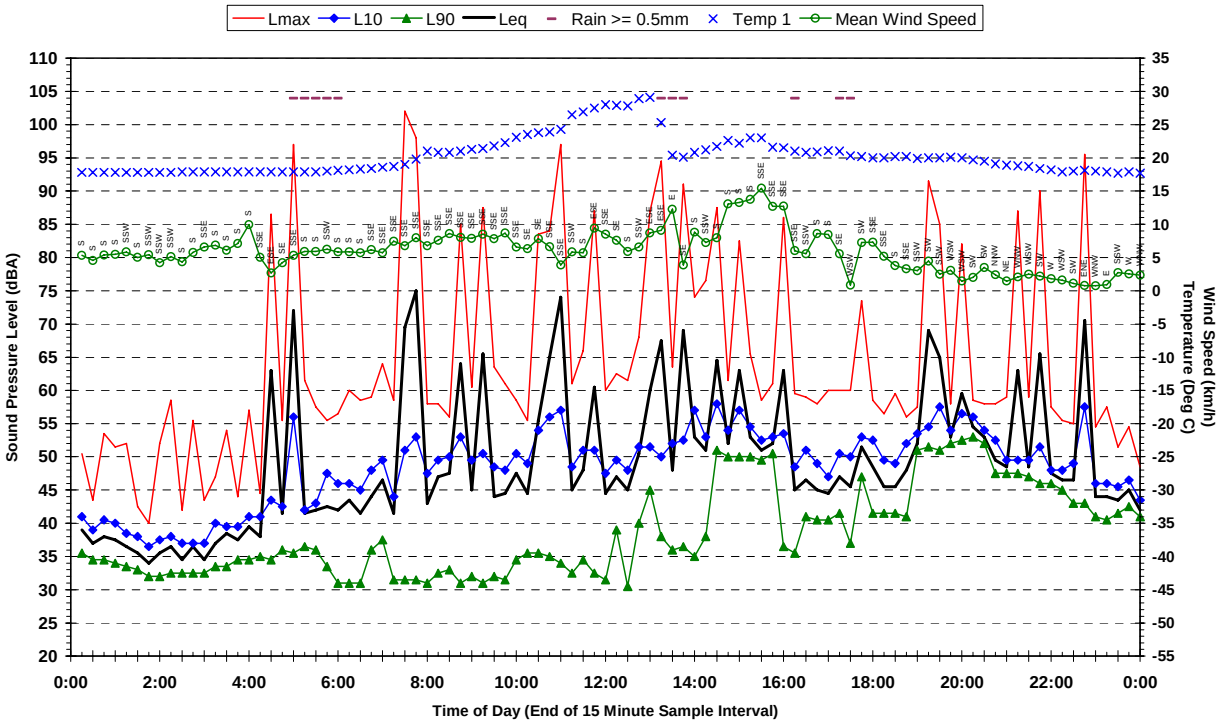


UNATTENDED NOISE LOGGER RESULTS NOVEMBER 2007 - TRAIN

Statistical Ambient Noise Levels - Location 19 GCL
12m from North Coast Railway (South of Wards River) - Friday 23 November 2007

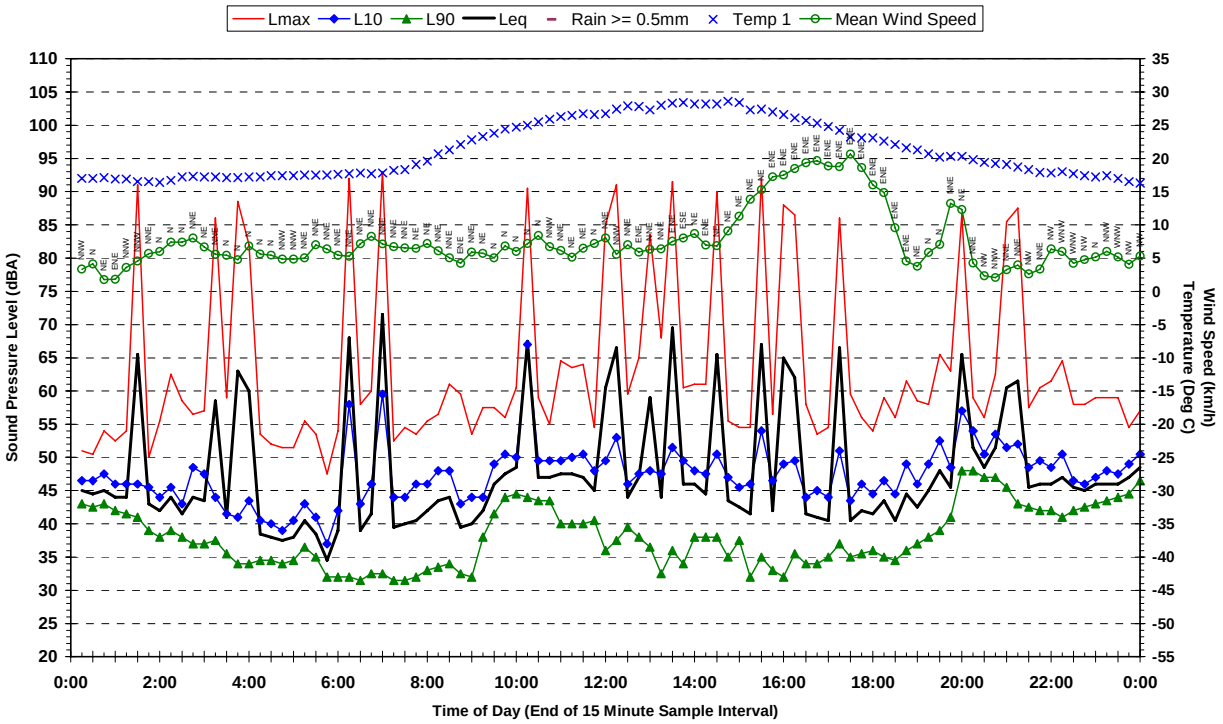


Statistical Ambient Noise Levels - Location 19 GCL
12m from North Coast Railway (South of Wards River) - Saturday 24 November 2007

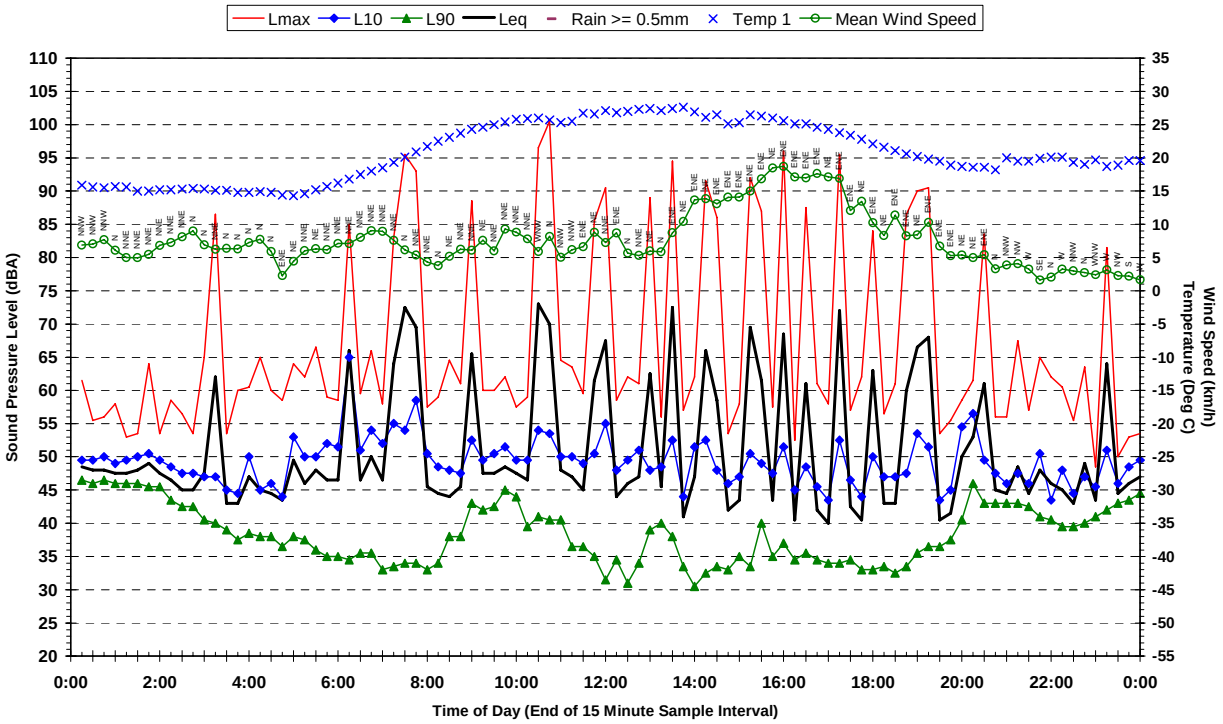


UNATTENDED NOISE LOGGER RESULTS NOVEMBER 2007 - TRAIN

Statistical Ambient Noise Levels - Location 19 GCL
12m from North Coast Railway (South of Wards River) - Sunday 25 November 2007

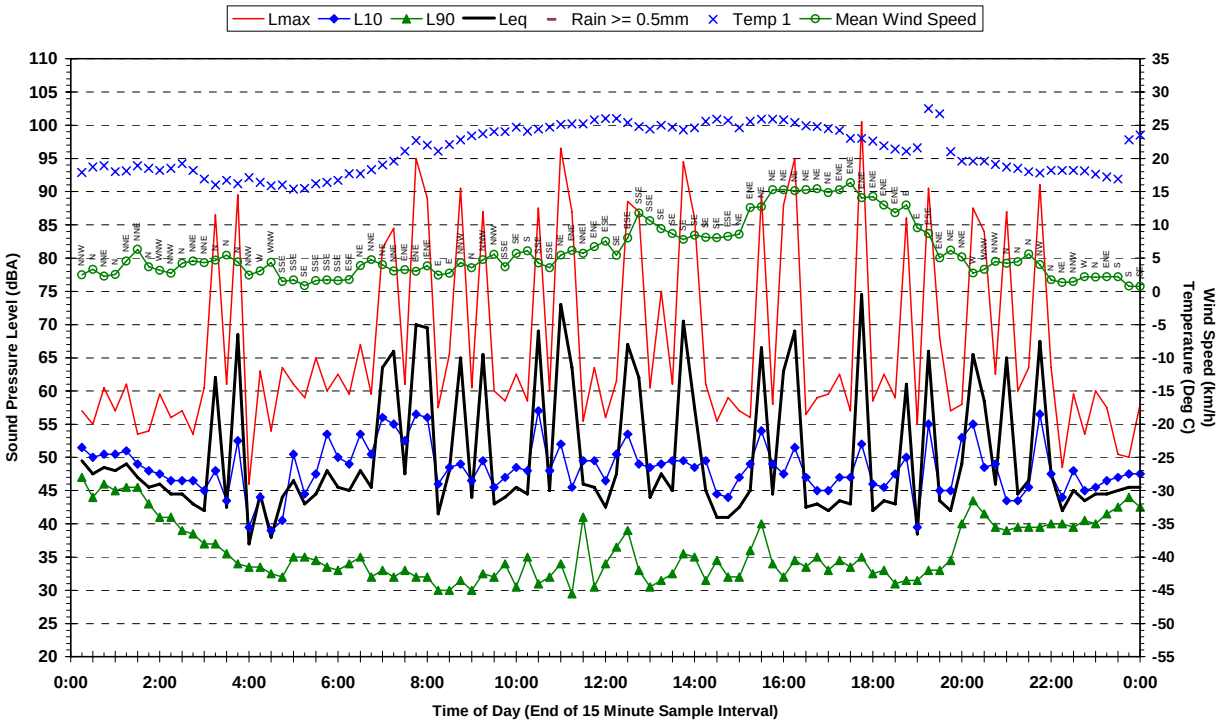


Statistical Ambient Noise Levels - Location 19 GCL
12m from North Coast Railway (South of Wards River) - Monday 26 November 2007

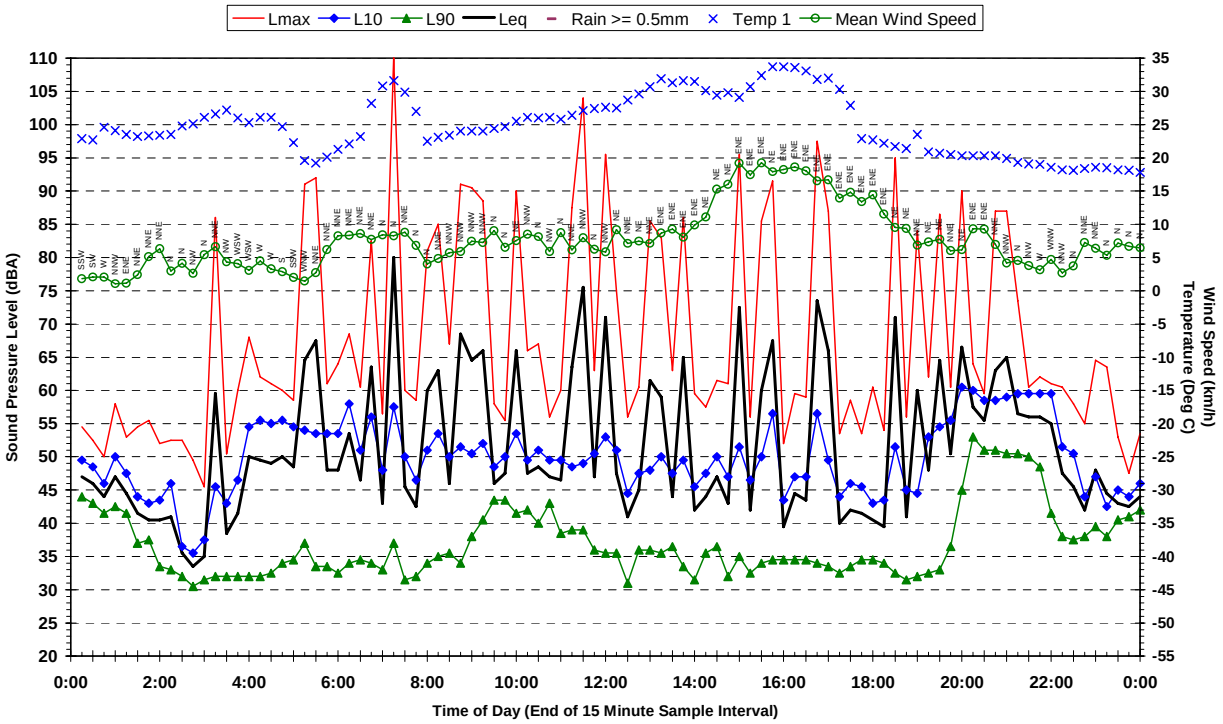


UNATTENDED NOISE LOGGER RESULTS NOVEMBER 2007 - TRAIN

Statistical Ambient Noise Levels - Location 19 GCL
12m from North Coast Railway (South of Wards River) - Tuesday 27 November 2007

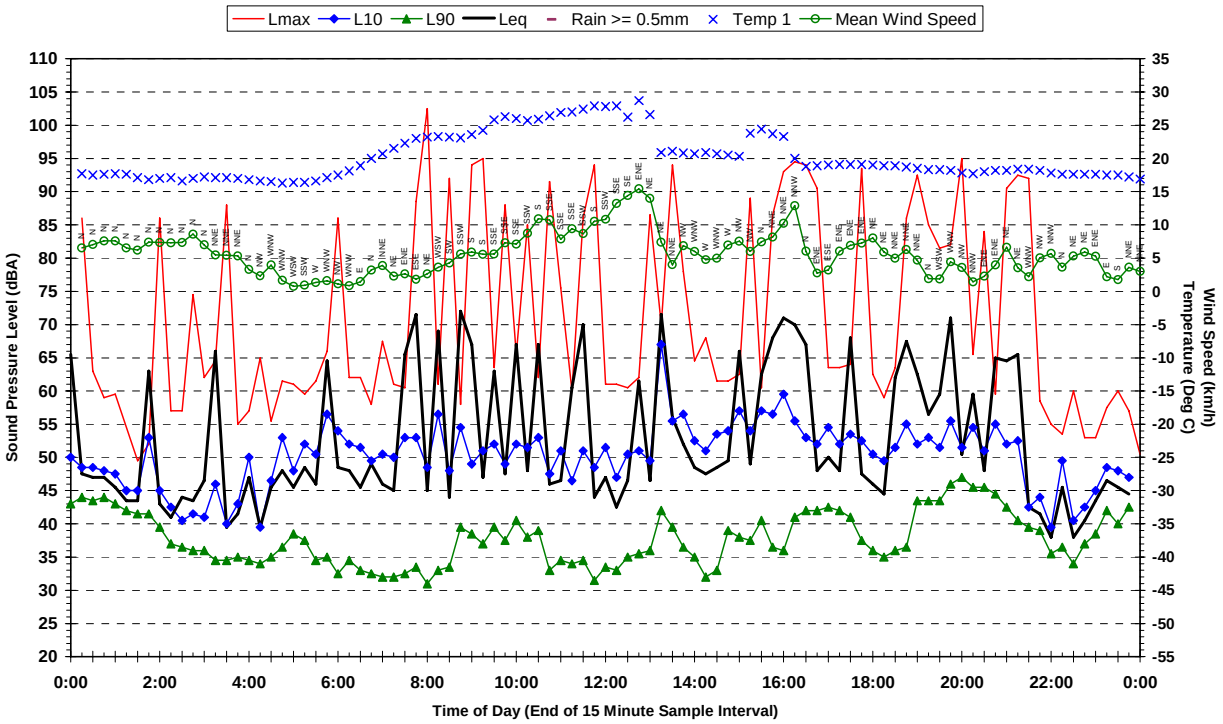


Statistical Ambient Noise Levels - Location 19 GCL
12m from North Coast Railway (South of Wards River) - Wednesday 28 November 2007

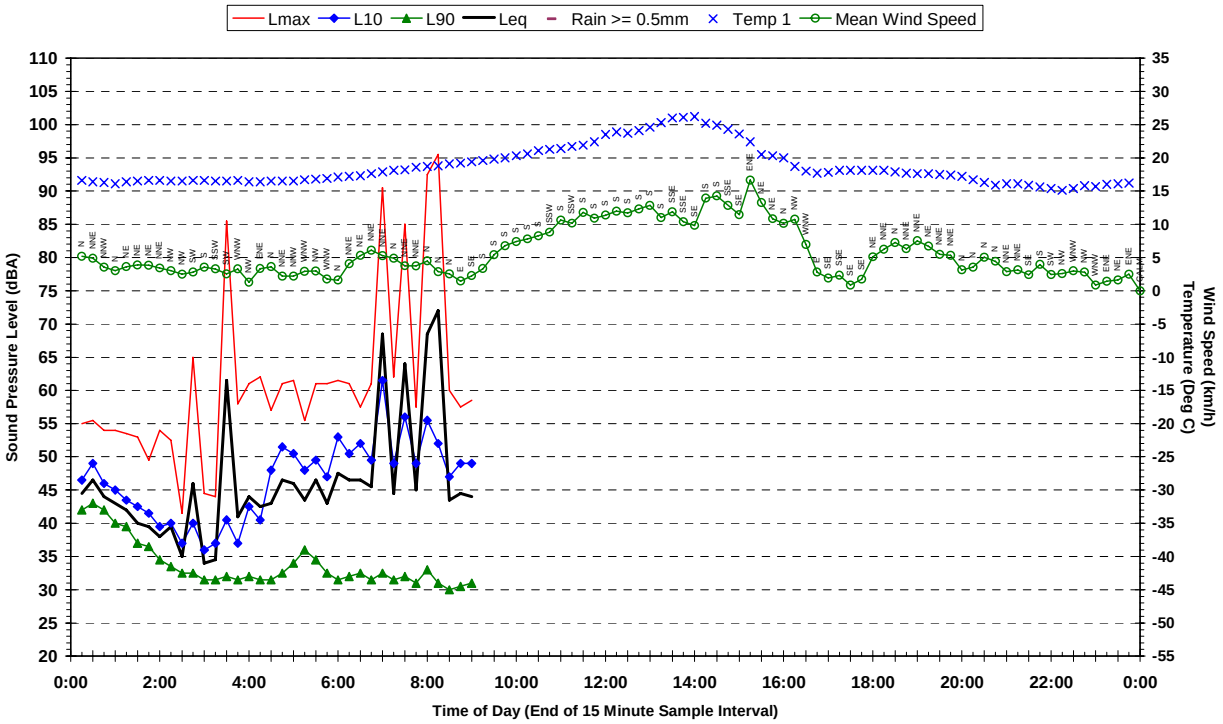


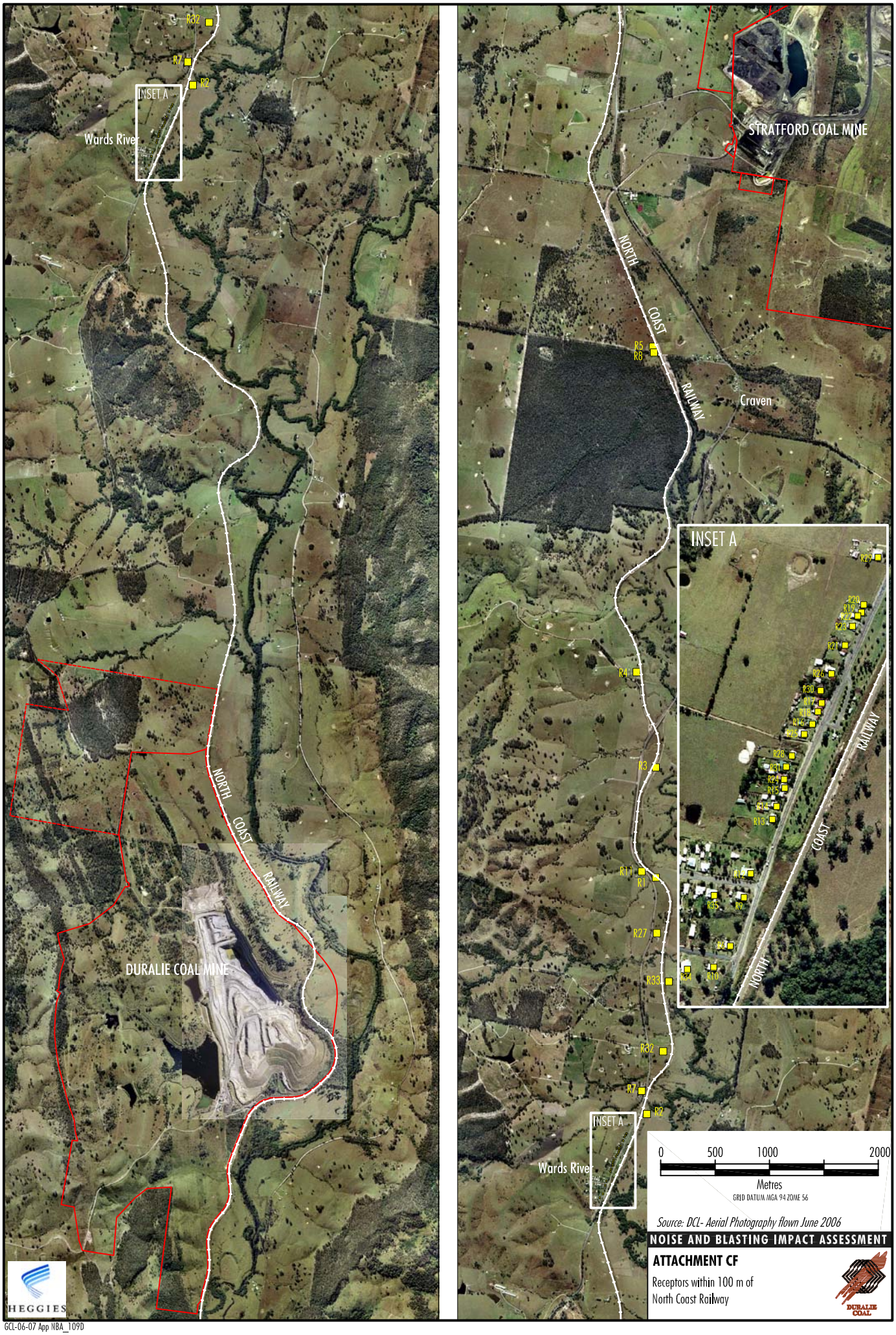
UNATTENDED NOISE LOGGER RESULTS NOVEMBER 2007 - TRAIN

Statistical Ambient Noise Levels - Location 19 GCL
12m from North Coast Railway (South of Wards River) - Thursday 29 November 2007



Statistical Ambient Noise Levels - Location 19 GCL
12m from North Coast Railway (South of Wards River) - Friday 30 November 2007





GCL-06-07 App NBA_109D

DECCW INP APPLICATION NOTES - SLEEP DISTURBANCE

Peak noise level events, such as reversing beepers, noise from heavy items being dropped or other high noise level events, have the potential to cause sleep disturbance. The potential for high noise level events at night and effects on sleep should be addressed in noise assessments for both the construction and operational phases of a development. The NSW Industrial Noise Policy (INP) (New South Wales [NSW] Environmental Protection Agency [EPA], 2000) does not specifically address sleep disturbance from high noise level events.

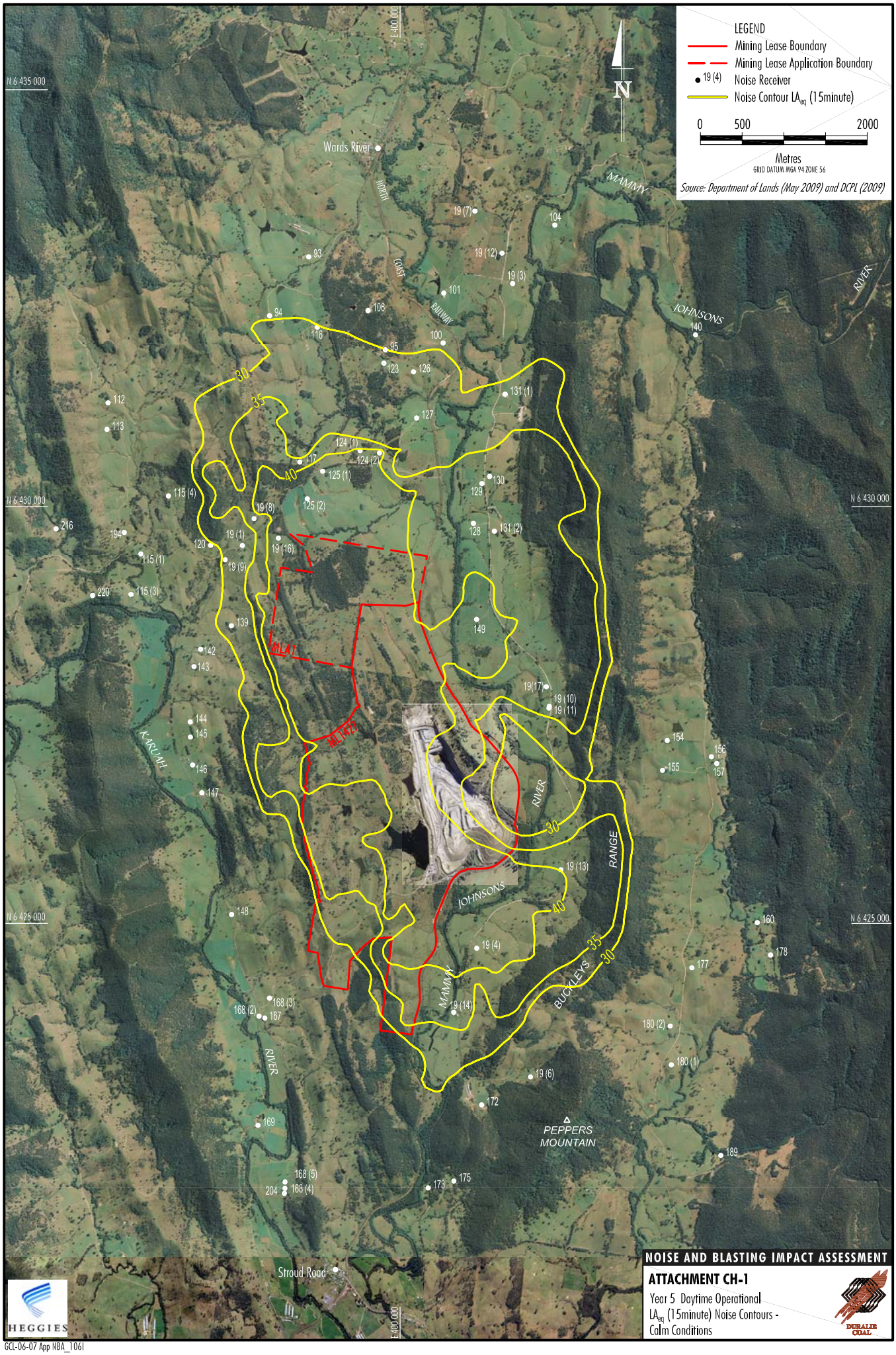
The NSW Department of Environment, Climate Change and Water (DECCW) reviewed research on sleep disturbance in the *NSW Environmental Criteria for Road Traffic Noise* (ECRTN) (EPA, 1999). This review concluded that the range of results is sufficiently diverse that it was not reasonable to issue new noise criteria for sleep disturbance.

From the research, the DECCW recognised that current sleep disturbance criterion of an $L_{A1(1minute)}$ not exceeding the $L_{A90(15minute)}$ by more than 15 A-weighted decibels (dBA) is not ideal. Nevertheless, as there is insufficient evidence to determine what should replace it, the DECCW will continue to use it as a guide to identify the likelihood of sleep disturbance. This means that where the criterion is met, sleep disturbance is not likely, but where it is not met, a more detailed analysis is required.

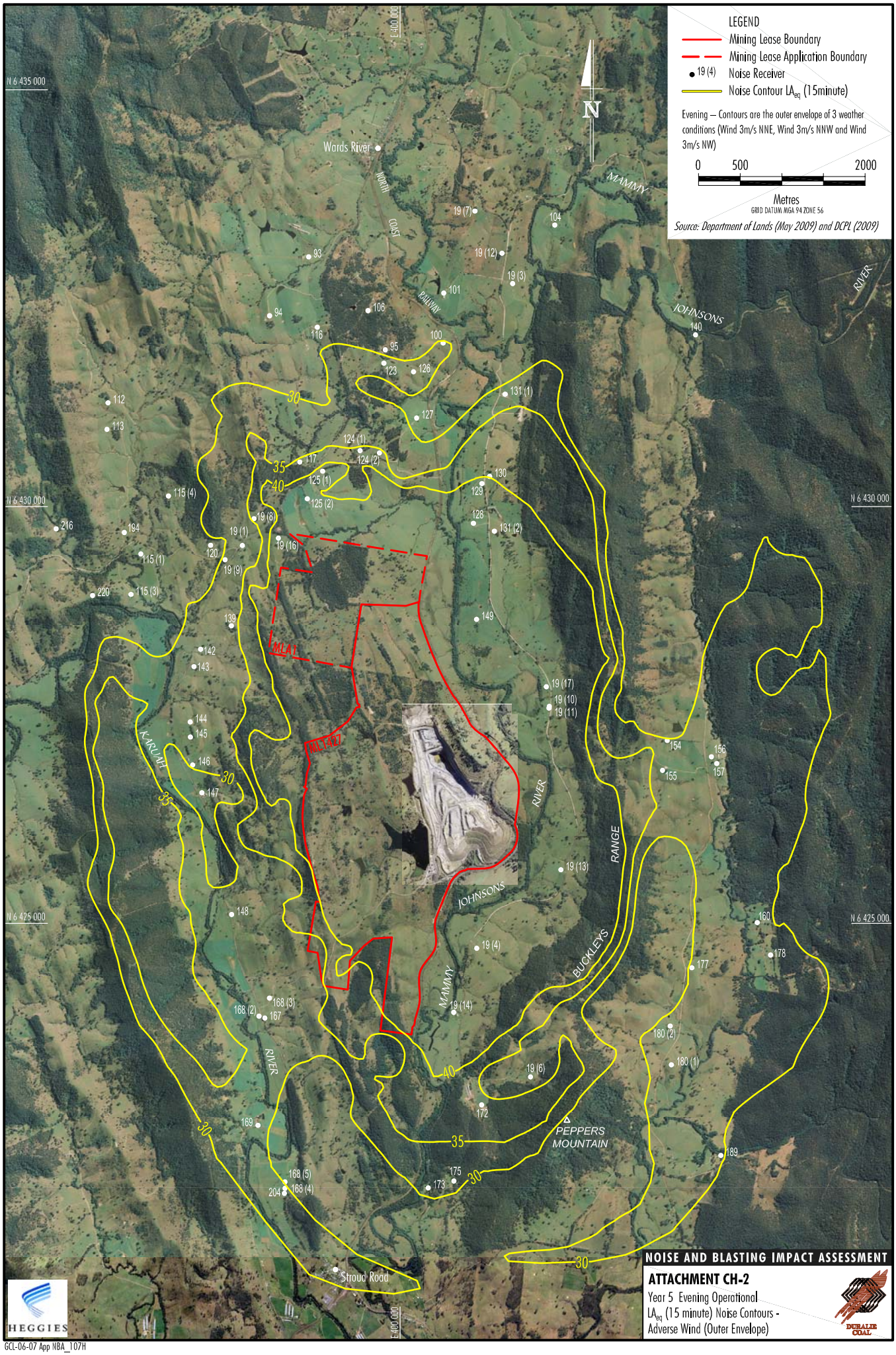
The detailed analysis should cover the maximum noise level or $L_{A1(1minute)}$, that is, the extent to which the maximum noise level exceeds the background level and the number of times this happens during the night-time period. Some guidance on possible impact is contained in the review of research results in the appendices to the ECRTN. Other factors that may be important in assessing the extent of impacts on sleep include:

- How often high noise events will occur.
- Time of day (normally between 2200 hours and 0700 hours).
- Whether there are times of day when there is a clear change in the noise environment (such as during early morning shoulder periods).

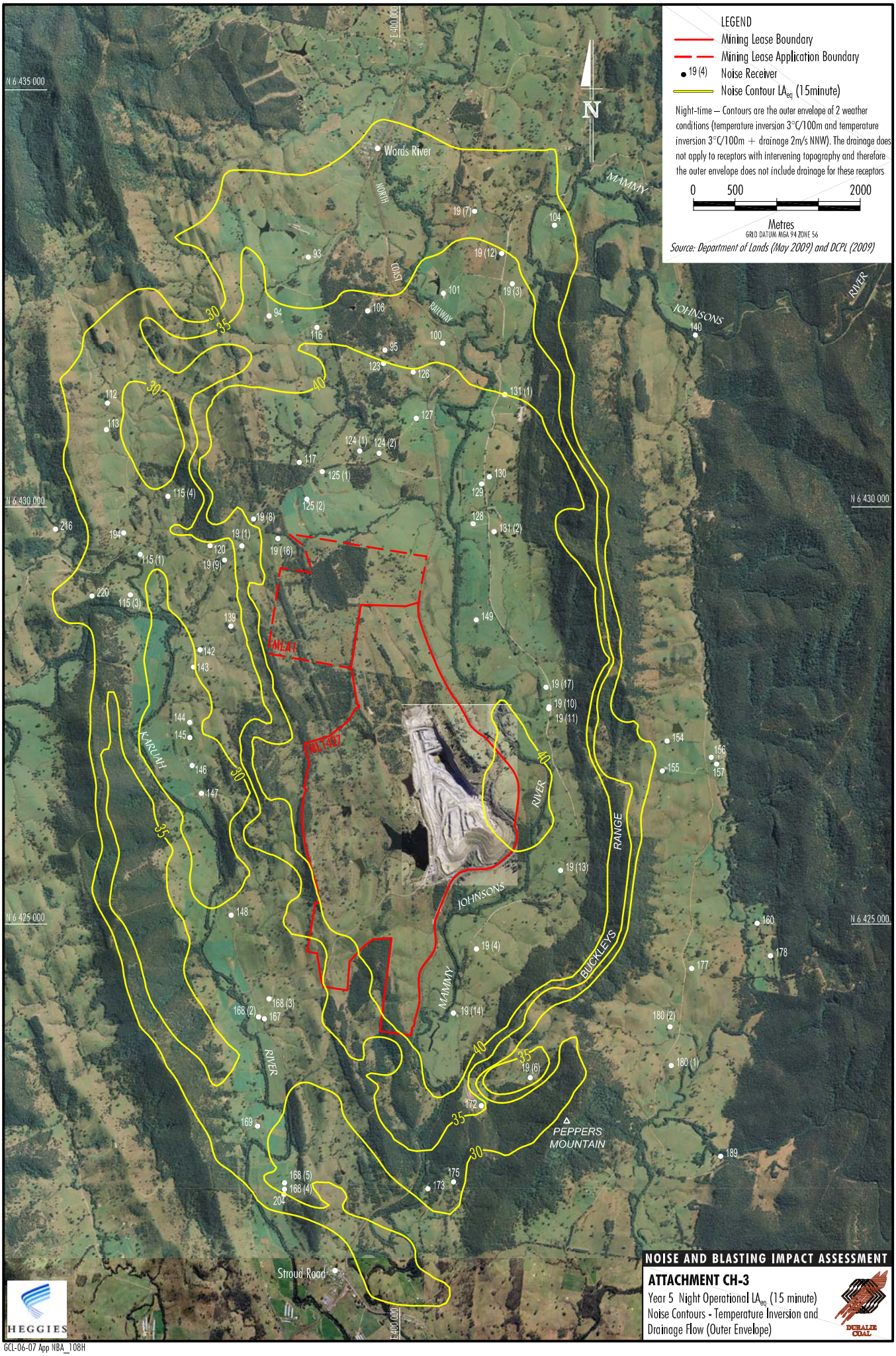
The $L_{A1(1minute)}$ descriptor is meant to represent a maximum noise level measured under “fast” time response. DECC will accept analysis based on either $L_{A1(1minute)}$ or L_{Amax}.



GCL-06-07 App NBA_1061



GCL-06-07 App NBA_107H



GCL-06-07 App NBA_108H

Temperature Inversion Assessment

Background

The following describes a methodology to facilitate the direct measurement of temperature inversion strength during periods of attended (compliance) noise monitoring. This methodology has been developed with input from the DoP and DECCW.

These direct measurements would enable determination of whether relevant noise limits apply during the period of attended noise monitoring and apply to the current noise limits stipulated in the existing DCM Development Consent (DA 168/99) (Consent Condition 2 of Schedule 3) with respect to temperature inversions, which state:

> *The noise emission limits identified in the above table apply under all meteorological conditions except for:*
> - *wind speeds greater than 3 metres/second at 10 metres above ground level; or*
> - *temperature inversions with a strength of greater than 3°C/100 m for all receivers, plus a source-to receiver component drainage flow wind of greater than 2 m/s at 10 metres above ground level for those receivers where applicable.*

Monitoring Locations and Frequency

Noise monitoring is currently undertaken at the DCM on a quarterly basis, at three monitoring locations. Monitoring at three additional locations would be undertaken for the Project.

Where noise is determined to be in excess of noise limits in the DCM Development Consent (DA 168/99), the prevailing meteorological conditions are reviewed to determine whether they were 'exceptional' meteorological conditions (as per Consent Condition 2 of Schedule 3 DA 168/99).

Coincident with the attended monitoring; DCPL would undertake direct temperature measurements at heights above ground level of 10 m and 60 m at two locations (one to the north of the DCM and one south of the DCM) which are representative of the noise monitoring sites (ie. at similar topographic elevation and at locations considered to have similar wind/drainage patterns). The temperature data collected at these elevations would enable the determination of the strength of any temperature inversion present. Direct temperature inversion measurements would be undertaken during night-time operator attended noise monitoring conducted in all seasons.

Methodology

The following methodology would be applied (in general accordance with Appendix E of the INP):

1. Measure the air temperature at approximately 10 m and 60 m above ground surface, using a weather balloon (or similar) and a light-weight remote temperature probe.
2. Calculate the 15 minute average temperature gradient (ie. the temperature at the higher elevation minus the temperature at the lower elevation, divided by the height difference) and normalise to °C/100 m.
3. Compare the temperature gradient (ie °C/100 m) results against the inversion strength stipulated in the Development Consent coincident with the night-time noise measurement results.

Reporting and Verification

The results of the above measurements would be presented in quarterly noise monitoring reports and summarised in the AEMR. In addition and to improve knowledge of the frequency and strength of temperature inversions in the area, stability classes categories would be calculated from sigma-theta data measured at the DCM meteorological station in accordance with Appendix E of the INP (ie. the Pasquill-Gifford stability class categories). The data collected via direct measurement would be compared with stability class categories to see if, over time, a relationship emerges between stability class measured at the meteorological station and the temperature inversion strength measured using the weather balloon as described above.

L6.1 General Noise Limits

L6.1.1 General Noise Limits

It is an objective of this Licence to progressively reduce noise levels to the goals of 65 dB(A)Leq, (day time from 7am – 10pm), 60 dB(A)Leq, (night time from 10pm – 7am) and 85dB(A) (24 hr) max pass-by noise, at one metre from the façade of affected residential properties through the implementation of the Pollution Reduction Programs.

L6.2 EPA Locomotive Noise Limits

L6.2.1 General Noise Limits

Operating Condition	**Speed & Location of Measurement**	**Noise Limit** at a microphone height of 1.5 metres above ground level
Idle with compressor radiator fans and air conditioning operating at maximum load occurring at idle	Stationary 15 metre contour	70 dB(A) $_{Max}$
All other throttle settings under self load with compressor radiator fans and air conditioning operating	Stationary 15 metre contour	87 dB(A) $_{Max}$ 95 dB Linear $_{Max}$
All service conditions	As per Australian Standard AS2377-2002 (Acoustics – Methods for the measurement of railbound vehicle noise) except as otherwise approved by the EPA	87 dB(A) $_{Max}$ 95 dB Linear $_{Max}$

L6.2.2 Limits for Tonality

All external noise must be non-tonal. For the purpose of this condition, external noise is non-tonal if the sound pressure level in each unweighted (linear) one-third octave band does not exceed the level of the adjacent bands on both sides by:

a) 5 dB if the centre frequency of the band containing the tone is above 400 Hz; and

b) 8 dB if the centre frequency of the band containing the tone is between 160 and 400 Hz, inclusively; and

c) 15 dB if the centre frequency of the band containing the tone is below 160 Hz.

L6.2.3 Limits for Low-Frequency Noise