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Red Hill Mining Lease
Environmental Impact Statement
Construction and Operational
Noise and Vibration Assessment

Report Number 20-2291-R3

18 November 2013

URS Australia Pty Ltd
Level 17, 240 Queen Street
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Environmental Impact Statement

Construction and Operational

Noise and Vibration Assessment

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1 INTRODUCTION

The Red Hill Mining Lease is located adjacent to the existing Goonyella Riverside and Broadmeadow (GRB) mine complex in the Bowen Basin, approximately 20 kilometres north of Moranbah and 135 kilometres south-west from Mackay, Queensland.

BHP Billiton Mitsubishi Alliance (BMA), through its joint venture manager, BM Alliance Coal Operations Pty Ltd, proposes to convert the existing Red Hill Mining Lease Application (MLA 70421) to enable the continuation of existing mining operations associated with the GRB mine complex. Specifically, the mining lease conversion will allow for:

- An extension of three longwall panels (14, 15 and 16) of the existing Broadmeadow underground mine (BRM).
- A future incremental expansion of the existing Goonyella Riverside Mine (GRM).
- A future Red Hill Mine (RHM) underground expansion option located to the east of the GRM complex which includes development of key infrastructure as detailed in **Section 1.1**.

SLR Consulting Australia Pty Ltd ('SLR') has been commissioned by URS Australia Pty Ltd (URS) to undertake a Construction and Operational Noise and Vibration Impact Assessment ('assessment') of the project for inclusion in an environmental impact statement (EIS).

This report identifies the potential construction and operational noise (including transport noise) impacts on the greater community surrounding the GRB mine complex.

1.1 The Project

The key elements of the project include:

1. The extension of BRM longwall panels 14, 15, and 16 into MLA70421. Key elements include;
 - No new mining infrastructure is proposed other than infrastructure required for drainage of incidental mine gas (IMG) to enable safe and efficient mining.
 - Management of waste and water produced from drainage of IMG will be integrated with the existing BRM waste and water management systems.
 - The mining of the BRM panel extensions is to sustain existing production rates of the BRM mine and will extend the life of mine (LOM) by approximately one year.
 - The existing BRM workforce will complete all work associated with the extensions.
2. The incremental expansion of the Goonyella Riverside Mine including:
 - Underground mining associated with the RHM underground expansion option to target the Goonyella Middle Seam (GMS).
 - A new mine industrial area (MIA).
 - A CHPP adjacent to the Riverside MIA on MLA1764 and ML1900 – the Red Hill CHPP will consist of up to three 1,200 tonne per hour (tph) modules.
 - Construction of a drift for mine access.
 - A conveyor system linking RHM to the Red Hill CHPP.
 - Associated coal handling infrastructure and stockpiles.
 - A new conveyor linking product coal stockpiles to a new rail load-out facility located on ML1900.

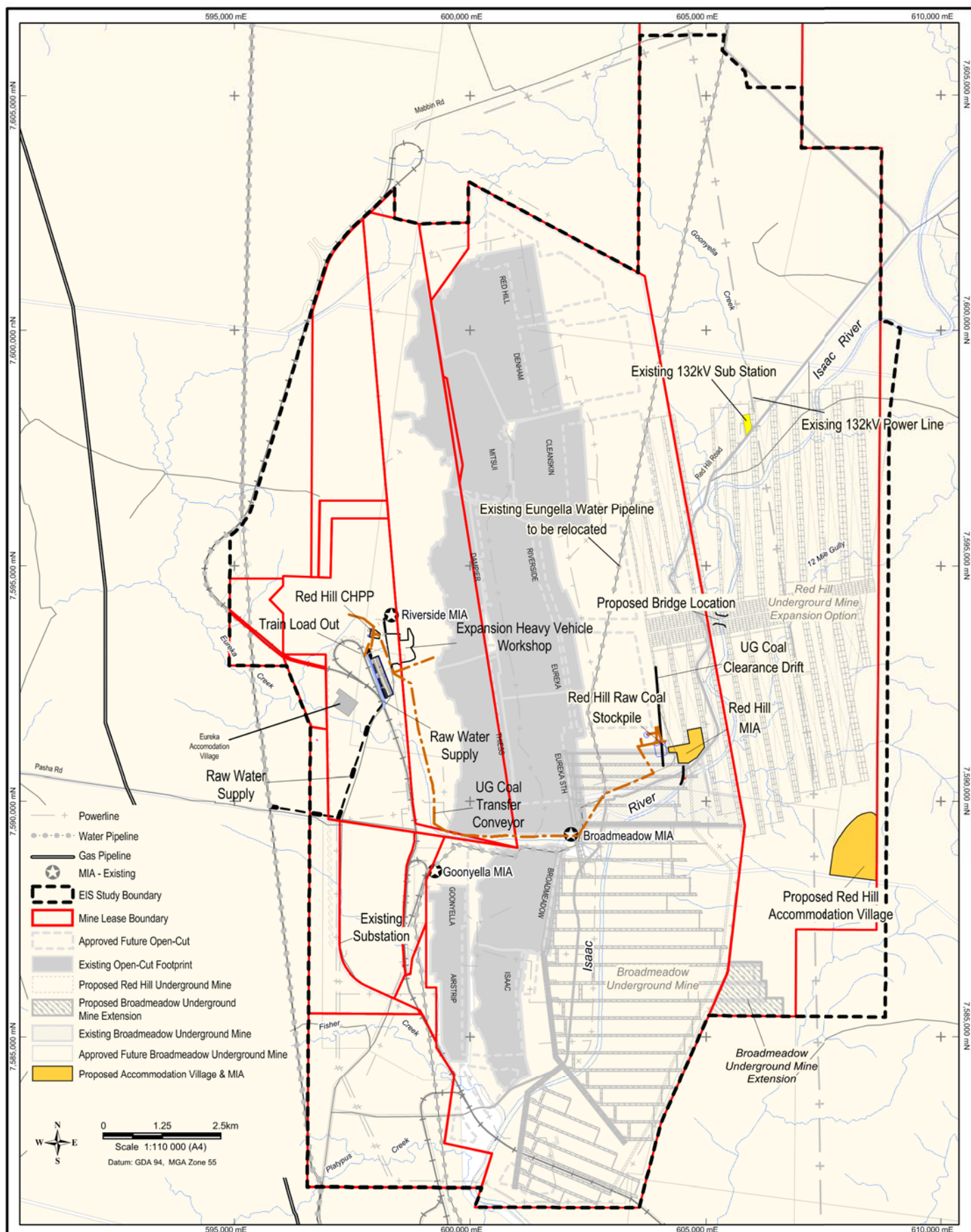
- Means for providing flood protection to the mine access and MIA, potentially requiring a levee along the west bank of the Isaac River.
3. A potential new Red Hill underground mine expansion option to the east of the GRB mine complex, to target the GMS on MLA70421. The proposed mine layout consists of a main drive extending approximately west to east with longwall panels ranging to the north and south:
- A network of bores and associated surface infrastructure over the underground mine footprint for mine gas pre-drainage (IMG) and management of goaf methane drainage to enable the safe extraction of coal.
 - A ventilation system for the underground workings.
 - A bridge across the Isaac River for all-weather access. This will be located above the main headings, and will also provide a crossing point for other mine related infrastructure including water pipelines and power supply.
 - A new accommodation village (Red Hill accommodation village) for the up to 100 per cent remote construction and operational workforces with capacity for up to 3,000 workers.

Potential production capacity of 14mtpa of high quality hard coking coal over a life of 20 to 25 years

The project includes extension of the BRM footprint eastward. However, as this extension only includes underground mining, there are no expected noise impacts on the surface. Therefore, this extension to the BRM has not been included in the noise and vibration impact assessment. If incidental mine gas management is required for the Broadmeadow extension, surface infrastructure will be minimal and is unlikely to contribute to noise disturbance.

The assessment has been undertaken for the RHM underground expansion option and GRM incremental expansion which have the potential to produce up to 14 million tonnes per annum (mtpa) of product coking coal using thick seam longwall mining techniques. This production, together with the approved production rate of 18.5 mtpa at GRB has the potential to result in a total production capacity for the combined mining operations of approximately 32.5 mtpa.

The EIS study area is shown in **Figure 1** below.



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Client 	Project RED HILL MINING LEASE NOISE AND VIBRATION REPORT	Title EIS STUDY AREA	
	Drawn: VH Approved: GC Date: 17-06-2013 Job No: File No: URS 42627136-g-2092.wor	Figure: 1 Rev:A A4	

1.2 Red Hill Accommodation Village Assessment

BMA is proposing to establish an additional accommodation village to house construction and operational workforces. **Figure 1** shows the location of the proposed Red Hill accommodation village.

SLR has been commissioned by URS to undertake a Noise and Vibration Impact Assessment of the proposed Red Hill accommodation village for inclusion in the assessment. It is intended that the findings of this noise and vibration assessment and other environmental and engineering assessments would feed into the detailed design for the accommodation village.

Potential noise impacts associated with the proposed Red Hill accommodation village include:

- Noise impacts from construction of the accommodation camps on existing residences.
- Noise impacts from operational plant and vehicle movements at the Red Hill accommodation village on existing residences and the accommodation village itself.
- Noise impacts from the mine construction and operation on the accommodation village (including existing GRB mine complex noise and noise and vibration from blasting).

For the purposes of the assessment, the proposed Red Hill accommodation village has been considered to be 'permanent'.

2 LOCATION SETTING AND PROJECT OVERVIEW

2.1 Site Location

The Red Hill Mining Lease is located adjacent to the existing GRB mine complex in the Bowen Basin, approximately 20 kilometres (km) north of Moranbah and 135 km south-west of Mackay, Queensland. The existing mine covers an area of approximately 17 to 18 km (north/south) and up to 5 to 6 km (east/west) at its widest point.

General site access is via Goonyella Road (sealed) which connects the town of Moranbah. There are also two rail loops connecting to the Goonyella Rail Network (Aurizon operated).

2.2 Existing Receptor Locations

The closest receptors to the EIS study area include 14 residences and the existing GRB mine complex accommodation village (Eureka Village), which are located within a distance of approximately 15 km from the EIS study area. These comprise:

- Eureka Village located within the EIS study area.
- Seven residences located within a distance of approximately 5 km of the EIS study area.
- Two residences located within a distance of approximately 5 to 10 km of the EIS study area.
- Five residences located within a distance of approximately 10 to 15 km of the EIS study area. This includes the town of Moranbah, which for modelling purposes, has been represented by a single receiver located at the northern extents of the town.

Distances from each noise receptor to the EIS study area boundary and the Red Hill CHPP are given in **Table 1**.

Table 1 Proximity of Noise Receptors to the EIS Study Area

Location Number	Noise Receptor – Property Reference	Distance to EIS Study Area (km)	Distance to Mining Lease Boundary (km)	Distance to Nearest CHPP (km)	Notes
1	Broadlea	12.5	13.3	25.5	
2	Broadmeadow Cottage 1	0 ¹	0 ¹	10.1	Privately owned – compensation agreement being negotiated
3	Broadmeadow Cottage 2	0 ¹	0 ¹	9.7	Privately owned – compensation agreement being negotiated
4	Broadmeadow Homestead	0 ¹	0 ¹	9.7	Privately owned – compensation agreement being negotiated
5	Burton Downs Homestead	4.2	4.2	19.1	Owned by BMA
6	Dabin	9.3	6.4	22.1	
7	Denham Park Homestead	5.8	6.3	15.1	Owned by BMC
8	Lapunyah Homestead	1.8	2.1	8.1	Owned by BMC
9	Moranbah Township	14.1	14.1	27.3	
10	Nibbereena	15.9	17.0	19.4	
11	Pretoria Homestead	16.9	17.8	19.9	
12	Red Hill	0.9	0.9	13.4	Owned by BMA
13	Riverside Homestead	0 ¹	0 ¹	10.5	Privately owned – compensation agreement being negotiated
14	Rugby	14.3	16.5	25.0	
15	Eureka Village	0 ¹	0 ¹	1.6	Owned by BMA

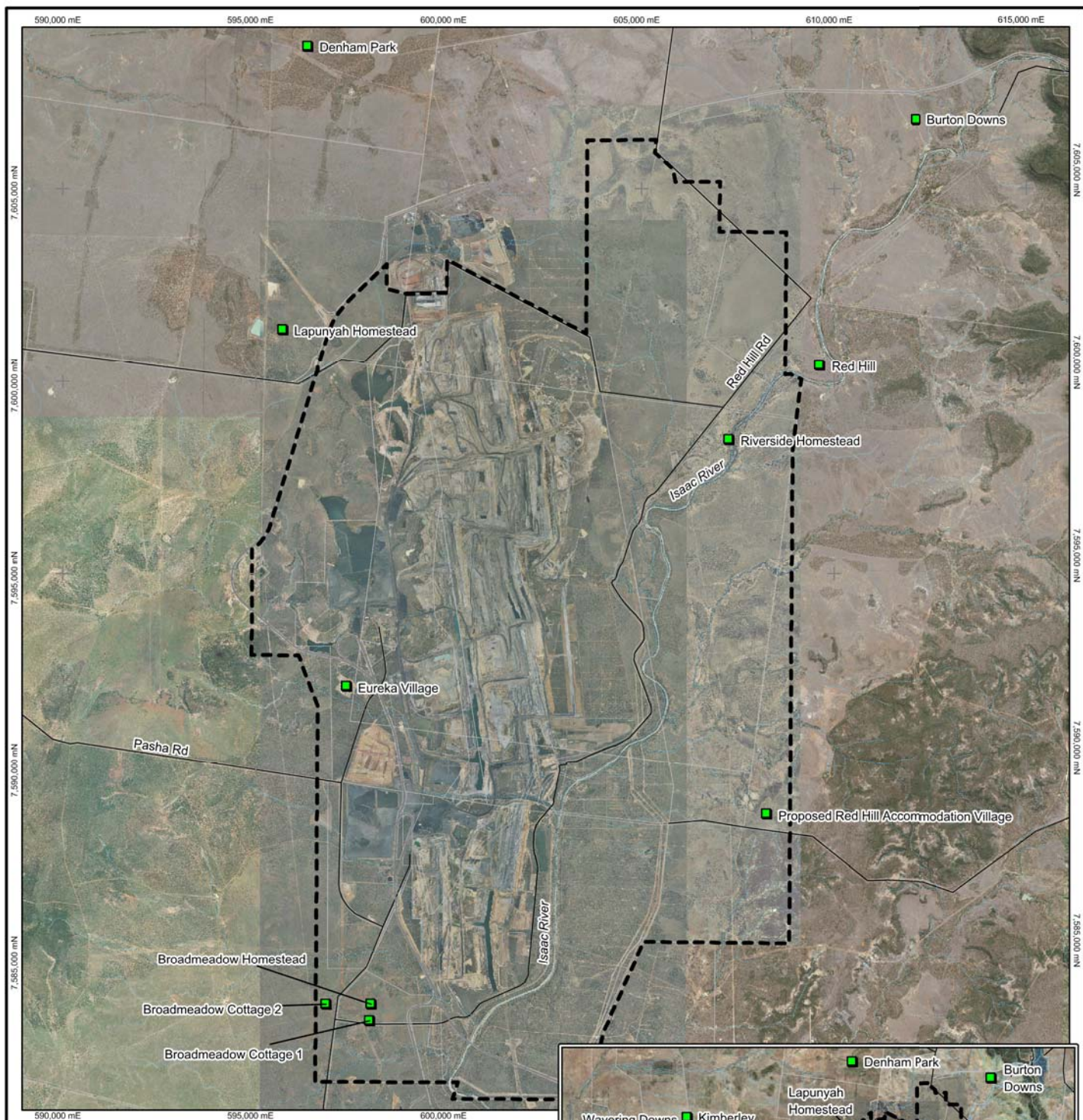
Note 1: Property currently lies within the boundary of the EIS study area and is therefore given a 0 km distance.

It can be seen from **Table 1** that a number of the nearest noise receptors are owned by BMA or compensation is currently being negotiated with the landowners. This is an important consideration as BMA can, if required, control who lives in these properties and can readily apply noise control measures directly to the properties (for example acoustically upgraded glazing).

The residential properties at Denham Park and Lapunyah are owned by BHP Mitsui Coal (BMC). It is understood that BMC has an agreement with BMA whereby BMA has full access to these properties. If required, BMA and BMC can control who lives in these properties and can apply noise control measures directly to the properties.

The Riverside Homestead is currently occupied by the current landowners, BMA will seek to put in place a compensation agreement whereby this receptor is vacated when existing or proposed project activities are proposed to impact on their continued occupancy.

Locations of receptors in relation to the project study area are shown in **Figure 2**.

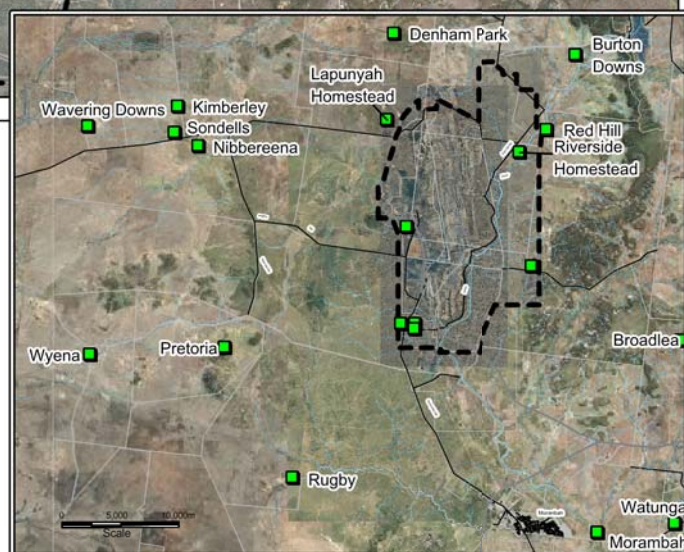


0 1.25 2.5km
Scale 1:150 000 (A4)
Projection: MGA94 Zone 55, (GDA94)

EIS Study Boundary
 Noise Receptors

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		Rev: A A4	

2.3 Proposed Development

2.3.1 Mining

The future Red Hill Mine will be developed as a conventional underground operation with drifts for access and services, and main drives for coal longwall access and coal transport, utilising TSM methodology for resource extraction.

The EIS provides a scenario for development and mining of the GRM incremental expansion and RHM underground expansion option for the purposes of undertaking impact assessments. The scenario assumes the commencement of construction in 2020 for a period of approximately 30 months, with operations commencing for Longwall 1 in 2022 and Longwall 2 in 2024. This scenario is provided in order to fulfil the Terms of Reference (ToR) requirements and does not reflect a commitment by the project owners to proceed. The owners will undertake further assessment once the approvals and tenure conversion are finalised.

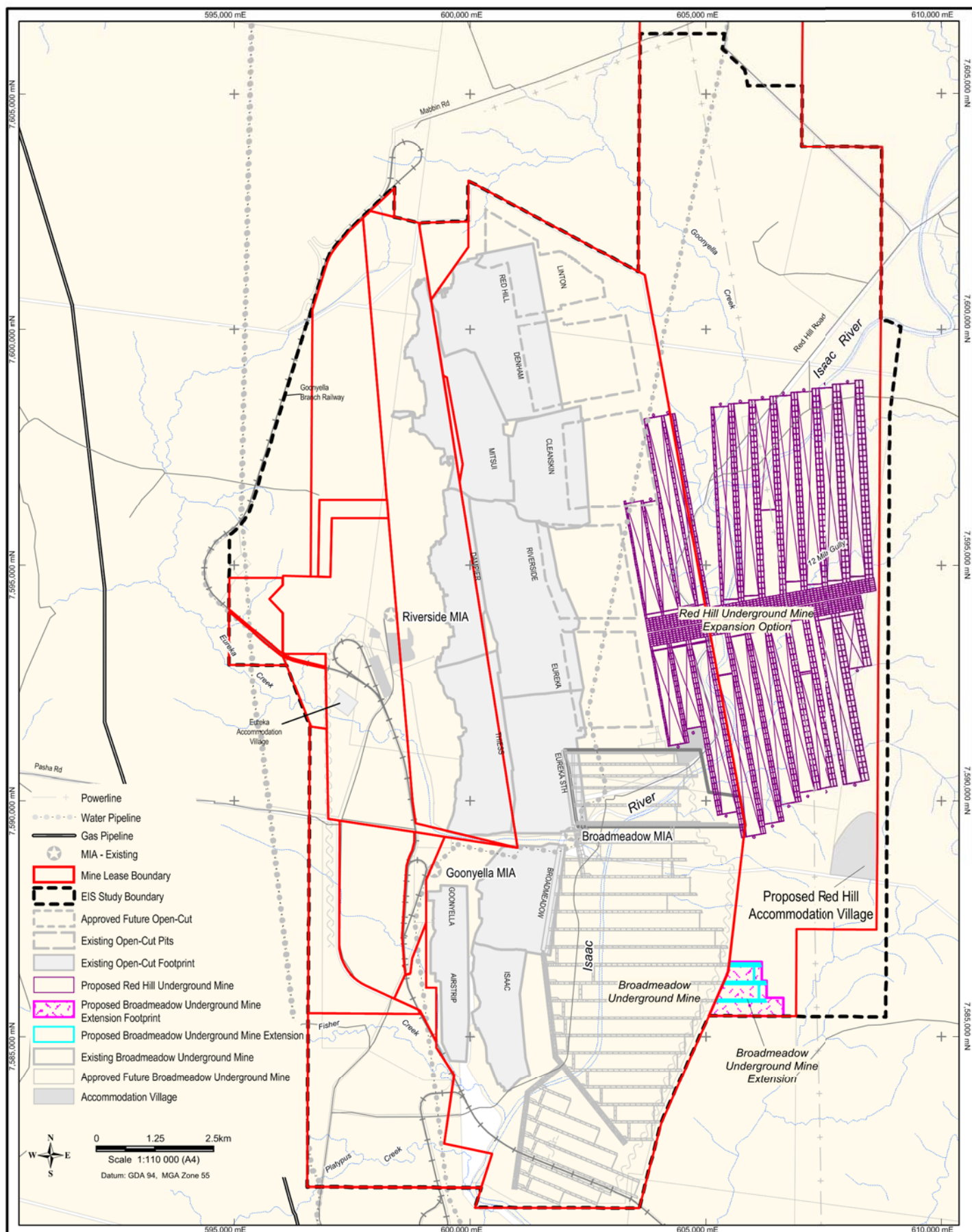
Construction will take approximately 30 months and will require the construction of a 2.5 km long drift. The drift will intersect the coal seam at an approximate depth of 250 metres (m). This will be followed by a further 1.5 years of underground roadway development using continuous miners, followed by the commencement of longwall mining.

An incidental mine gas (IMG) management program will be implemented progressively approximately 5 to 15 years prior to commencement of mining of each longwall. The program will involve drilling a network of holes in the proposed RHM footprint to extract underground gas and associated water. This will enable mining to proceed safely. BMA will investigate options for the beneficial use of IMG in accordance with the requirements of the Mineral Resources Act.

Noise impacts from underground mining operations are expected to be insignificant, as noise will be contained underground. However, the following above ground noise sources have the potential to impact on surrounding receptors:

- Conveyor systems (including conveyor alarms);
- Fixed plant, such as motors, pumps, compressors and upcast ventilators;
- Mobile plant; and
- Fixed and mobile plant associated with the IMG and goaf gas drainage system.

There are no significant vibration sources associated with the project elements as it is not proposed to undertake blasting. Due to the buffer distances between receptors and the vibration sources, no other discernible vibration levels are expected to reach nearby receptors. Further detailed assessment of vibration emissions are therefore not required; however, the potential impact of existing blast vibration emissions from the GRM at the proposed position of the Red Hill accommodation village has been assessed. **Figure 3** provides details of the project.



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2.3.2 House of Operations

The future mine will operate on a 24 hour schedule, seven days a week during construction and operational phases.

2.3.3 Red Hill Accommodation Village

As indicated in **Section 1.2**, the design of the proposed Red Hill accommodation village will be finalised following the completion of environmental and engineering assessments during the detailed design phase. Consequently, a conceptual village layout based on BMA's Buffel Park accommodation village near Moranbah has been adopted.

The Red Hill accommodation village has the potential to cater for up to 3,000 workers, and contain a number of common-use facilities.

A conceptual layout of the proposed Red Hill accommodation village is shown in **Figure 4**.

The nearest existing receptors to the proposed Red Hill accommodation village, and the respective distances of these from the accommodation village are shown in **Table 2**.

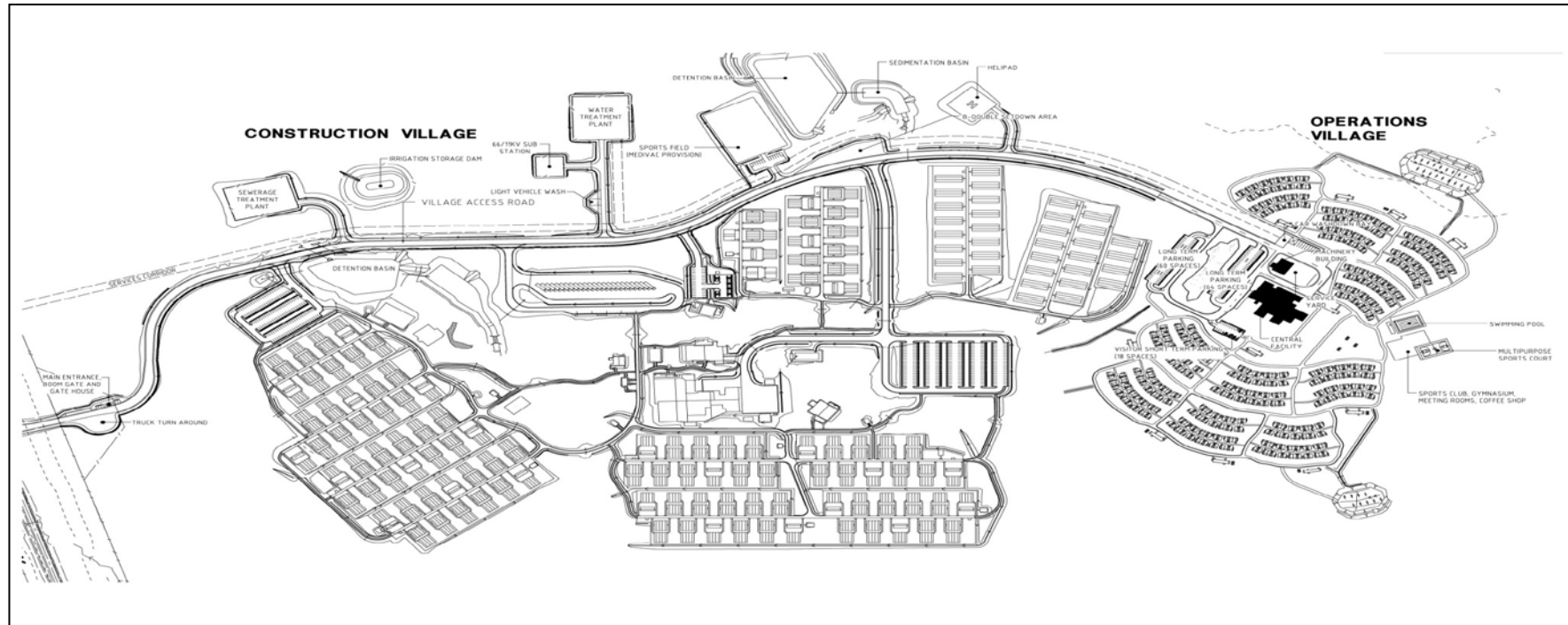
Table 2 Proximity of Noise Receptors to the Proposed Red Hill Accommodation Village

Existing Receptor	Distance to Proposed Red Hill Accommodation Village (km)
1 - Broadlea	14.0
2 - Broadmeadow Cottage 1	N/A ¹
3 - Broadmeadow Cottage 2	N/A ¹
4 - Broadmeadow Homestead	N/A ¹
5 - Burton Downs Homestead	16.7
6 - Dabin	26.7
7 - Denham Park Homestead	22.3
8 - Lapunyah Homestead	17.1
9 - Moranbah Township	19.0
10 - Nibbereena	29.6
11 - Pretoria Homestead	27.4
12 - Red Hill	11.0
13 - Riverside Homestead	N/A ¹
14 - Rugby	25.9
15 - Eureka Village	10.5

Note 1: It is intended that BMA will negotiate compensation with the landowner and manage the occupancy of the Riverside Homestead, Broadmeadow Homestead and Cottages 1 and 2.

Figure 4 Conceptual Accommodation Village Layout

Source: Caval Ridge Mine Project (Drawing Ref: PHCVR02-0000-CC-SK-0001-A).



3 EXISTING ACOUSTIC ENVIRONMENT

Existing ambient noise levels at nearby receptors have been assessed in order to determine noise limits in accordance with the Queensland Department of Environment and Heritage Protection (EHP) (formerly Department of Environment and Resource Management (DERM) and Queensland Environmental Protection Agency (EPA)) noise guideline: *Planning for Noise Control* and the Queensland Coordinator-General's ToR.

SLR undertook ambient noise monitoring during May 2009 for another study. It is considered that this ambient noise monitoring is still relevant as there have not been any significant changes in the types and locations of noise sources since this monitoring was undertaken.

In addition to the ambient noise monitoring undertaken in 2009, SLR undertook ambient noise monitoring at Eureka Village and the proposed Red Hill accommodation village in March through June 2011).

Ambient vibration monitoring was undertaken at the proposed Red Hill accommodation village in April through June 2011 to monitoring airblast overpressure and ground vibrations from existing blasting operations at the GRB mine complex.

This section of the report outlines the methodology and results of this baseline noise and vibration monitoring.

3.1 Unattended Background Noise Surveys

The monitoring was undertaken using Acoustic Research Laboratories Type EL-316 and EL-215 Environmental Noise Loggers programmed to record various statistical noise levels over consecutive 15 minute intervals. Each logger was checked for calibration before and after the survey with a Rion NC-73 Sound Level Calibrator and no significant drift (greater than 1 dBA) in calibration was detected.

All items of acoustic instrumentation employed during the noise monitoring were set to A-weighted and 'Fast' response in accordance with the relevant Australian Standards and EHP's *Noise Measurement Manual* (EPA 2000). All items of acoustic instrumentation employed during the noise measurement surveys were designed to comply with AS IEC 61672.1-2004 *Electroacoustics-Sound level meters-Specifications* and carry current manufacturer calibration certificates.

The instrumentation that was used for the unattended noise monitoring is listed in **Table 3**.

Ambient noise logging was undertaken to establish baseline noise levels at Locations 4, 5 and 8 (listed in **Table 3**) between 13 May to 26 May 2009, and at Locations 7 and 13 from 26 May to 11 June, 2009. The monitoring locations are shown in **Figure 5**.

Ambient noise logging was also undertaken to establish baseline noise levels at Eureka Village between 31 March and 13 April 2011, and the proposed Red Hill accommodation village between 20 May and 2 June 2011.

Photographs showing the noise logger location and set-up at each property are shown in **Appendix A**.

Table 3 Noise Monitoring Instrumentation

Measurement Location	Instrumentation
4. Broadmeadow Homestead	ARL Environmental Noise Logger EL215, SN 194627
5. Burton Downs Homestead	ARL Environmental Noise Logger EL316, SN 16-203-505
7. Denham Park Homestead	ARL Environmental Noise Logger EL316, SN 16-203-505
8. Lapunyah Homestead	ARL Environmental Noise Logger EL316, SN 16-203-529
13. Riverside Homestead	ARL Environmental Noise Logger EL316, SN 16-203-529
15. Eureka Village	ARL Environmental Noise Logger EL316, SN 16-203-525
Proposed Red Hill Accommodation Village	ARL Environmental Noise Logger EL316, SN 16-203-508
All Locations	Calibrator, Rion Type NC-73 SN 10697066

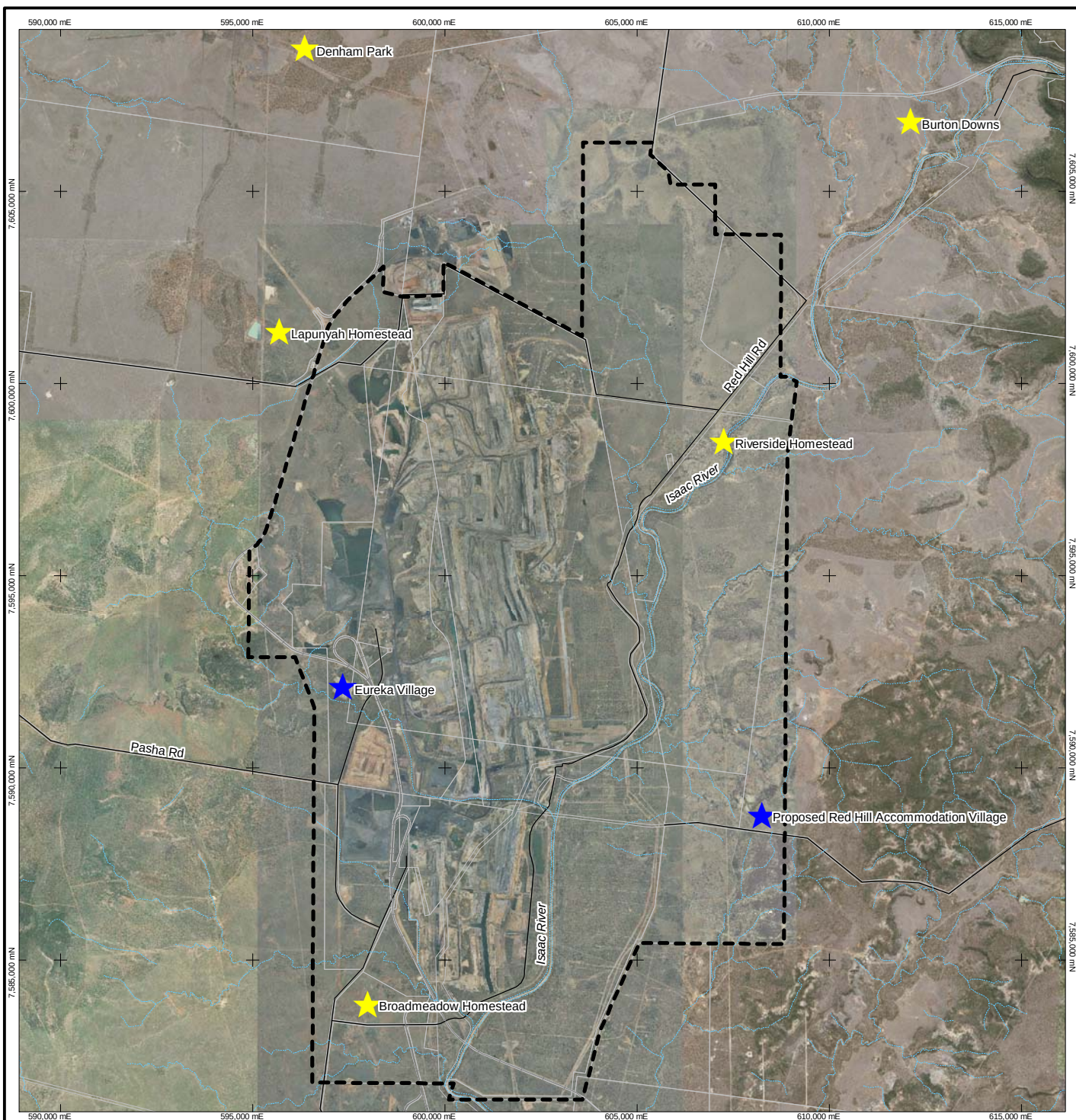
Note 1: ARL - Acoustic Research Laboratories

Fifteen minute weather data over the noise monitoring period was sourced via weather stations at GRM. The weather conditions during the monitoring periods were generally fine, with temperatures ranging from 10°C to 25°C, with calm to moderate breezes (below 3 metres per second (m/s)) blowing generally from the south-west to south-east. Minimal rainfall was recorded during the monitoring periods and there were some gusty wind periods above 3 m/s. These periods (rain > 0.3 mm and/or wind > 3 m/s) have been excluded from the measurement results. The weather conditions during the remainder of the monitoring period are considered to be suitable for background noise measurements.

An error occurred in the weather data collected between 27 May and 6 June 2009 (period during which monitoring equipment was set-up at Locations 7 and 13). Weather data from the Moranbah meteorological station was sourced for this period and analysed for adverse weather. Analysis of the weather data noted that all except two days during this period were suitable for noise monitoring (4 and 5 June 2009 excluded due to rain).

The unattended ambient noise measurements at each monitoring location were used to determine the 'Rating Background Level' (RBL) for daytime (7.00am to 6.00pm), evening (6.00pm to 10.00pm) and night-time (10.00pm to 7.00am) periods at each location. The RBL is the median of the 90th percentile of the daily background (LA90) noise levels in each assessment period (day, evening and night) over the duration of the monitoring. The complete measurement results of the background noise surveys are presented graphically in **Appendix B. Table 4** contains the determined RBL for each measurement location. These values are used to determine the operational noise criteria in accordance with the *Planning for Noise Control* guideline and the *Environmental Protection (Noise) Policy 2008* (EPP (Noise)) (see **Section 4.2**).

The maximum LAeq(1hour) noise level representative of the daily ambient noise environment was noted for the daytime, evening and night-time periods. The representative daily maximum LAeq(1hour) noise levels at each location are shown in **Table 4**. The representative daily maximum LAeq(1hour) noise levels measured at each location has been used for this assessment as required by the *Planning for Noise Control* guideline.



0 1.25 2.5km
Scale 1:150 000 (A4)

Projection: MGA94 Zone 55, (GDA94)



EIS Study Boundary



Monitoring Location - 2009



Monitoring Location - 2011

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Project

**RED HILL MINING LEASE
NOISE AND VIBRATION REPORT**

Title

**NOISE AND VIBRATION
MONITORING LOCATIONS**

Drawn: VH

Approved: GC

Date: 08-08-2013

Job No:

File No: URS 42627136-g-2094.wor

Figure: **5**

Rev: A

A4

Table 4 Summary of (Unattended) Noise Logging Results

Locations	Description	Background Noise Levels minLA90 (dBA) ¹			Maximum Hourly Sound Pressure Level (SPL) LAeq(1hour) (dBA)		
		Day 7am- 6pm	Evening 6pm- 10pm	Night 10pm- 7am	Day 7am- 6pm	Evening 6pm- 10pm	Night 10pm- 7am
4. Broadmeadow Homestead	Noise logger located in centre of yard between homestead and cottage/dongers approximately 15m from homestead	30	28 ²	30	51	40 ²	39 ²
5. Burton Downs Homestead	Noise logger located in centre of front yard approximately 100m from homestead (between homestead and working shed, next to fruit garden)	25	24	24	50	33 ²	32 ²
7. Denham Park Homestead	Noise logger located in south-eastern corner of front yard approximately 15m from homestead	28	25	25	49 ²	35 ²	36 ²
8. Lapunyah Homestead	Noise logger located in south-eastern corner of front yard approximately 20m from homestead	26	30 ²	28	44 ²	37 ²	37 ²
13. Riverside Homestead	Noise logger located in north-eastern corner of tennis court approximately 40m from homestead	30	23	23	51	44 ²	44 ²
15. Eureka Village	Noise logger located ~200m from Eureka Creek & ~500m from Mabbins Road.	36	39	36	46	48 ²	47
Proposed Red Hill Accommodation Village	Noise logger located in southern end of proposed location.	25	25	25	43	28 ²	28 ²

Note 1: The LA90 represents the level exceeded for 90 per cent of the interval period and is referred to as the background noise level.

The LAeq is the equivalent continuous noise level defined as the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

Note 2: Values have been adjusted downward to remove the (seasonal) influence of insect and bird noise.

A review of the data presented in **Table 4** at the five residential monitoring locations indicates that the RBLs ranged between 25 dBA to 30 dBA during the day-time, and 23 dBA to 30 dBA during both the evening and night-time.

Further, **Table 4** indicates that the RBLs at Eureka Village ranged between 36 dBA to 39 dBA during the day-time, evening and night-time. The RBLs at proposed Red Hill accommodation village ranged between 24 dBA to 26 dBA during the day-time, evening and night-time.

The measured background noise levels are typical of those of a rural environment with natural noise sources, such as birds, light wind in trees, insects, and some industrial noise contributions associated with the GRB mine complex, Peabody's Eaglefield Mine (north of GRM) and Anglo's Moranbah North Mine (south of GRM).

3.2 Operator-Attended Noise Surveys

Operator attended noise surveys of 15 minutes duration were conducted at the noise logging locations during on-site visits between 13 May and 27 May 2009 (for the residential locations), 31 March and 1 June 2011 (for the Eureka Village, and the proposed Red Hill accommodation village).

The operator-attended noise measurements were conducted using a Rion NA-27 Precision Sound Level Meter (SLM) (SN 960103). The Rion NA-27 SLM is a Type 1 SLM. The Rion-NA27 SLM was checked for calibration before and after each set of noise measurements using a Rion NC-73 Sound Level Calibrator and no significant drift (greater than 1 dBA) in calibration signal level was observed.

The operator-attended noise measurements were conducted 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 ambient noise sources. Wherever possible, the operator quantified local traffic flows and made a qualitative assessment of the prevailing weather conditions.

The operator-attended noise survey results are presented in **Table 5**.

Table 5 Summary of Operator-Attended (Short-term) Noise Measurements

Locations	Time Period	Date/Time	LA90 (dBA)	LAeq (dBA)	LA10 (dBA)	Discernible Sources
4. Broad-meadow Homestead	Day 1	14 May 13:00	32	40	43	Bird and insect noise (low level); light tree movement in breeze; occasional domestic noise; distant traffic on Red Hill Road audible (~30 dBA for cars, ~35-40 dBA for trucks); GRM audible in the distance (~28-30 dBA).
	Day 2	26 May 12:15	33	44	44	Bird noise audible; light tree movement in breeze; occasional dragline noise (slapping of rigging); infrequent traffic noise audible on Red Hill Road (up to ~42 dBA).
	Evening 1	14 May 19:15	39	43	46	Insects dominant noise source; distant traffic on Red Hill Road audible (up to ~40 dBA); dragline working southern pit of GRM faintly audible; train passby for ~3.5 mins, levels constant at ~38-42 dBA.
	Evening 2	25 May 18:30	40	49	46	Insect noise dominant (3.15-5 kHz); GRM dragline movement audible (peaks ~45-50dBA); GRM processing plant audible however low levels (~25 dBA); distant traffic on Red Hill Road audible (up to ~40 dBA); brief reverse beep at homestead, raised LAeq level up.
	Night 1	15 May 23:15	29	31	33	GRM audible and dominant, processing plant and dragline both clearly audible (dragline noise includes rigging movement and bucket scraping ground).
	Night 2	26 May 01:00	37	41	41	GRM audible and dominant, processing plant and dragline both clearly audible (dragline noise includes rigging movement and bucket scraping ground), dragline levels peak ~45-50 dBA; constant background noise levels ~37-40 dBA.

Locations	Time Period	Date/Time	LA90 (dBA)	LAeq (dBA)	LA10 (dBA)	Discernible Sources
5. Burton Downs Homestead	Day 1	13 May 16:45	26	41	36	Bird noise dominant, insects audible; brief dog bark; distant traffic noise (~25-28 dBA).
	Day 2	26 May 14:15	27	41	44	Birds dominant noise source; light tree movement.
	Evening 1 ¹	14 May 20:30	26	29	31	Insects dominant; light tree movement in breeze; distant farm animal noise.
	Evening 2 ¹	25 May 20:45	30	36	37	Light tree movement in breeze, low level insect noise, infrequent traffic noise audible.
	Night 1 ¹	14 May 22:15	22	33	30	Insects audible, low levels though; distant farm animal noise.
	Night 2 ¹	26 May 03:15	18	20	22	Very quiet measurement; low level distant low frequency noise to east of property (80 Hz).
7. Denham Park Homestead	Day 1	14 May 11:30	36	43	45	Insect and bird noise audible; light tree movement in breeze.
	Day 2	26 May 15:15	31	34	36	Insects and birds dominant noise source; light tree movement in breeze.
	Evening 1	15 May 21:15	23	26	28	Insect noise audible; occasional light tree movement in breeze.
	Evening 2	26 May 18:30	34	35	37	Insects dominant noise source; very low level distant mine noise audible (<25 dBA @ <250 Hz).
	Night 1	14 May 23:00	29	31	33	Distant mine noise audible and constant ~29-33 dBA; low level insect noise (<25 dBA).
	Night 2	27 May 00:00	23	25	26	Very low level distant mine noise audible (~23-25 dBA @ <500 Hz); very light tree movement.
8. Lapunyah Homestead	Day 1	14 May 10:30	34	40	43	Insect and bird noise audible; light tree movement in breeze; faint mine noise audible (engine drones and horn blasts).
	Day 2	26 May 16:00	30	35	36	Insect and bird noise audible; light tree movement in breeze; mine noise audible (engine drones and horn blasts), mine SPLs ~29-34 dBA.
	Evening 1	14 May 21:15	39	40	42	Insects dominant noise source (3.15 – 4 kHz); mine noise clearly audible, dominant noise source below <1kHz; engine drone, horn blasts, reverse beepers and track noise all audible.
	Evening 2	25 May 20:00	37	45	48	Insects dominant noise source (2.5 – 3.15kHz); mine noise clearly audible and constant, dominant noise source below <1kHz; engine drone, horn blasts, reverse beepers and track noise all audible.
	Night 1	14 May 23:45	38	40	42	Mine noise audible and dominant noise source (engine drone, horn blasts and reverse beepers), constant at 37 – 39 dBA; low level insect noise (~22-25 dBA).
	Night 2	26 May 02:30	33	36	38	Mine noise audible and dominant noise source (engine drone, horn blasts, track noise and reverse beepers), constant at 33 – 36 dBA.

13. Riverside Homestead	Day 1	14 May 09:15	34	43	47	Birds dominant noise source; frequent farm activity noise; occasional farm animal and dog noise.
	Day 2	27 May 09:30	29	46	46	Birds and insects dominant noise source; occasional farm animal and dog noise; passing 4WD on local access path.
	Evening 1 ¹	14 May 20:00	25	35	34	Insects dominant noise source; occasional farm animal noise; 1 car passby on Red Hill Road, clearly audible and elevated LAeq for measurement.
	Evening 2 ¹	25 May 19:15	24	35	30	Insects dominant noise source (~24-27 dBA); infrequent traffic passby on Red Hill Road, clearly audible and elevated LAeq for measurement.
	Night 1 ¹	15 May 22:30	18	21	22	Very quiet measurement; very low level insect noise.
	Night 2 ¹	26 May 01:45	20	24	26	Low level insect noise, horses grazing nearby.
15. Eureka Village	Day	1/04/11 12:45	45	48	51	Tree movement/ wind noise dominant at times; Traffic on access road (Mabbin Rd) audible, levels ~ 45-49 dBA; intermittent insects and birds audible; GRM clearly audible in light wind, rumble of fixed plant and mobile plant levels <40 dBA; Train passing for ~3 mins, levels 43-46 dBA.
	Day	12/04/11 13:15	33	36	39	Traffic on access road (Mabbin Rd) audible, levels ~34-40 dBA; intermittent insects and birds audible, levels ~32-36 dBA; GRM barely audible, rumble of fixed plant levels <25 dBA; Light intermittent tree movement; Intermittent mobile plant at Eureka Village audible, levels ~30-35 dBA.
	Day	13/04/11 11:00	37	42	45	Traffic on access road (Mabbin Rd) audible, levels ~40-48 dBA; intermittent insects and birds audible, levels ~20-25 dBA; GRM audible, rumble of fixed plant levels and mobile plant levels ~30-35 dBA; Intermittent mobile plant at Eureka Village audible, levels ~35 dBA; Light intermittent tree movement.
	Evening	31/03/11	-	-	-	Inclement weather, no measurement.
	Evening	12/04/11 19:30	41	43	45	GRM audible and dominant, rumble of fixed plant and mobile plant levels ~40-47 dBA; Intermittent traffic on access road (Mabbin Rd) audible, levels <40 dBA; intermittent insects audible, levels ~30-33 dBA (3.15 to 5 kHz), and ~41-42 (12.5 kHz).
	Night	1/04/11 03:00	36	41	45	Intermittent insects and frogs audible; GRM audible in calm/light breeze, rumble of fixed plant and mobile plant levels =<25 dBA; Intermittent tree movement/ wind noise; Distant generator at Eureka Village audible, levels <25 dBA.
	Night	13/04/11 02:15	36	38	40	GRM audible and dominant, rumble of fixed plant levels ~34-36 dBA, mobile plant levels ~37-40 dBA; Haul truck horns intermittently audible, levels ~40-45 dBA; Intermittent insects audible, levels ~25 dBA;

Proposed Red Hill Accommodation Village	Day	21/05/11 09:45	31	37	40	Tree movement/ wind noise dominant; intermittent bird noise; GRM not audible; distant engine noise intermittently audible (only during light breeze) to the E-SE, peak levels ~22-26 dBA with a dominant frequency of 100 Hz (possible drill rig).
	Day	02/06/11 10:00	24	31	32	Insects audible, levels ~30 dBA; intermittent tree movement/ wind noise; GRM inaudible.
	Evening	20/05/11 19:15	41	43	45	Insects dominant noise source, levels 38-40 dBA, dominant frequency of 2.5 kHz; Spike at 12.5 kHz with levels of ~38-39 audible throughout measurement; GRM not audible.
	Evening	01/06/11 21:15	21	23	24	Insects audible, low levels; GRM mostly inaudible, brief periods were very low level rumble is just audible, levels <15 dBA with a dominant frequency of 40-50 Hz.
	Night	21/05/11 03:30	34	38	41	Insects dominant noise source, levels 36-40 dBA, dominant frequency of 2.5 kHz; GRM barely audible (rumble of haul trucks), peak levels ~20 dBA with a dominant frequency of 80-100 Hz; Intermittent tree movement/ wind noise, levels <25 dBA.
	Night	01/06/11 22:45	19	21	21	Minor Insects noise, low levels; GRM mostly inaudible, brief periods were very low level rumble is just audible, levels <15 dBA with a dominant frequency of 50 Hz.

Note 1: At the request of land owners, measurement taken at representative location for Burton Downs and Riverside Homestead (approximately 500 m away from homesteads) due to dogs barking if property entered at night.

The operator-attended noise measurement results validated the results obtained from the unattended noise loggers and supported the use of the unattended long-term measured noise levels as being representative of the background noise environment at all residences.

3.3 Vibration Survey

The GRM incremental expansion and the RHM underground expansion option are not predicted to cause any discernible vibration at nearby noise receptors. This is due to the buffer distances between receptors and sources, and because no blasting is proposed.

Between 20 May and 18 June 2011, vibration measurements were carried out at the proposed Red Hill accommodation village. This was done to determine baseline vibration levels resulting from blasting at the existing GRB mine complex.

Baseline vibration measurements were taken directly on the ground in the vicinity of the chosen receiver location.

The baseline vibration measurements at the proposed Red Hill accommodation village did not include an airblast overpressure microphone between 20 May and 2 June 2011. The measurements during this period were for ground vibration only. There was no trigger set on the monitoring equipment during the period, however the monitoring equipment was programmed to record continual ground vibration levels during the period of 6.00am to 7.00pm. A summary of this monitoring data has been included in **Appendix C**.

The instrumentation that was used for the vibration monitoring is listed in **Table 6**.

Table 6 Vibration Monitoring Instrumentation

Measurement Location	Instrumentation
Proposed Red Hill Accommodation Village	Instantel Minimate Plus 4CH SN BE 16016

The vibration logger was programmed to record 10 seconds of over-pressure and ground vibration data when triggered by a ground vibration velocity of 0.2 mm/s.

The summarised results of the vibration measurements are documented in **Table 7**, which represents the highest recorded peak component particle velocity and corresponding over pressure level measured. A full list of recorded vibration measurements is contained in **Appendix C**.

A review of the vibration measurements at the proposed Red Hill accommodation village noted that measurements captured on 13 and 14 June were most likely caused by an animal interfering with the monitoring equipment, causing multiple triggers.

Table 7 Summarised Vibration Measurements

Location	Date-Time	Highest Peak Vector Component Ground Vibration (mm/s)	Peak Airblast (dBL)
Proposed Red Hill Accommodation Village	12/06/11 17:45	0.52	<88.0

A review of both the GRB mine complex blast schedule data (as provided by BMA) and the recorded vibration events during the blast monitoring at the proposed Red Hill accommodation village was completed. This identified ground vibration events that potentially resulted from scheduled blasts. These are summarised in **Table 8**. All remaining recorded vibration events during the blast monitoring at the proposed Red Hill accommodation village are listed in **Appendix C**.

Table 8 Potential Captured Blast Event Results

Location	Date-Time	Peak Vector Component Ground Vibration (mm/s)	Peak Airblast (dBL)	Blast Details
Proposed Red Hill Accommodation Village	22/05/11 12:50	0.18	- ¹	22/05/11 13:00 Ramp 8 North (unknown holes fired)
Proposed Red Hill Accommodation Village	29/05/11 16:46	0.16	- ¹	29/05/11 16:45 Ramp 10 North (1038 holes fired)
Proposed Red Hill Accommodation Village	10/06/11 16:00	0.21	< 88.0	10/06/11 16:05 Ramp 10 North (100 holes fired)

Note 1: Only ground vibrations were measured during this period.

On review of the data presented in **Table 8** it is noted that the measured ground vibration levels and airblast overpressure (where measured) were very low. Further, the measured ground vibration levels are marginally above the threshold of perception for a 'normal' person and well below the threshold at which structural damage might occur.

4 NOISE AND VIBRATION CRITERIA

Table 9 below outlines relevant legislation and guidelines, which includes those referred to in the EIS ToR.

Table 9 Relevant Legislation and Guidelines

Project Activity	Applicable Legislation	Relevant Guidelines / Best Practise Documents
Construction activities	<i>Environmental Protection Act 1994</i> (EP Act)	World Health Organisation's Guidelines for Community Noise
Operational activities	Environmental authority (ML) Non-Code Compliant licence conditions (Permit Number MIN100921609). EP Act EPP (Noise)	EHP guideline <i>Planning for Noise Control</i> EHP guideline <i>Assessment of Low Frequency Noise</i> enHealth Council's 'the Health effects of environmental noise – other than hearing loss' Australian Standard 2107:2000 Acoustics – <i>Recommended design sound levels and reverberation times for building interiors</i> World Health Organisation's Guidelines for Community Noise
Transportation	N/A	Rail - Queensland Rail Code of Practise – <i>Rail way Noise Management</i> . Road traffic – N/A

It should be noted that there is only one activity – blasting – that is capable of producing measurable or discernible vibration levels at surrounding receptors. This is due to the offset distances between the mine operations and the surrounding receptors. No blasting is proposed and therefore a detailed assessment of vibration is not required. The following sections detail the development of specific noise criteria in accordance with the legislation and guidance outlined in **Table 9**.

4.1 Construction Noise

4.1.1 Independently Owned Residential Properties

The EPP (Noise) does not include construction noise limits. Noise impacts are usually minimised by limiting the hours of operation and, in particular circumstances, scheduling the noisiest activities to occur at times when they would generate least disruption. For construction work occurring during normal daytime hours, provided all mechanical powered plant is fitted with mufflers as per manufacturers specifications, specific noise limits are generally not warranted.

In accordance with the *Environmental Protection Act 1994* (EP Act), where construction noise may affect adjacent residential premises or other residential accommodation (including hotels, motels, serviced units or backpacker accommodation), it is recommended to limit the hours of construction activities to Monday to Saturday - 6.30am to 6.30pm.

For construction works outside these hours, particular noise limits should be applied to prevent disturbances at independently owned residential properties.

The most important amenity issue for surrounding residents outside of 6.30am to 6.30pm Monday to Saturday is sleep preservation. The World Health Organisation (WHO) *Guidelines for Community Noise* (WHO 1999) recommends for quality sleep, maximum noise levels should not exceed 45 dBA.

Based on a conservative building façade noise reduction of 5 dBA through an open window, the following external criterion is proposed for sleep disturbance: L_{Amax} (external) 50 dBA.

This level is assessable at four metres from the building façade of any independently owned residential properties between 6.30pm and 6.30am Monday to Saturday and all day on Sunday.

4.1.2 BMA and BMC Owned Homesteads and Accommodation Villages

For BMA owned residential properties, including Eureka Village and the proposed Red Hill accommodation village, it is important that conditions conducive to sleep are provided for all periods during the day, evening and night-time. This is because shift workers utilising this accommodation may be required to sleep at any time.

Therefore, based on the WHO (1999) guidance, the following internal noise criterion is recommended for sleep disturbance measured inside sleeping area of BMA owned residences and accommodation villages during the day, evening or night-time periods:

- L_{Amax} (internal) - 45 dBA

The existing accommodation units at Eureka Village are air conditioned and the accommodation units at the proposed Red Hill accommodation village will also be air conditioned. Therefore, windows to all accommodation units can remain closed at all times. Assuming a conservative noise reduction from outside to inside of 20 dBA through the closed façade of the accommodation units, the external construction noise criterion for all accommodation villages/sites is therefore:

- L_{Amax} (external) – 65 dB

For BMA/BMC owned residential properties at Burton Downs, Denham Park, Lapunyah and Red Hill, air conditioning may not be provided. For these properties the following external construction noise criterion is proposed based on a 5 dBA façade reduction (i.e. assuming open windows) applicable at any time during the day, evening or night, given that the residents may be shift workers:

- L_{Amax} (external) – 50 dB

4.2 Operational Noise and Vibration

4.2.1 Introduction

Acceptable noise criteria for mining operations are derived from:

- The EP Act, which recognises that noise can impact on amenity.
- The EPP (Noise) which provides the framework for determining noise levels required to protect amenity.
- Guidelines issued by EHP (formerly DERM and EPA) in relation to methodologies and techniques for determining appropriate noise levels in particular circumstances. These guidelines are:
 - o *Planning for Noise Control* (EPA 2004);
 - o *Assessment of Low Frequency Noise* (EPA 2005); and
 - o *Noise and Vibration from Blasting* (EPA 2006).

Criteria for the assessment of rail noise are also given in Queensland Rail's (QR) *Code of Practice – Railway Noise Management*.

In addition to this regulatory framework, the Australian Environmental Health Committee has published guidelines on *the health effects of environmental noise – other than hearing loss* (enHealth 2004). These guidelines consider the more holistic impacts of noise on individuals. Additional noise criteria are also provided in Australian Standard 2107:2000 *Acoustics – Recommended design sound levels and reverberation times for building interiors*.

Noise criteria are considered in two categories:

- Those residences and other receptors that are occupied by members of the community and not directly under the control of BMA; and
- Those residences and other receptors which are under the control of BMA, and thus occupation is determined by BMA.

Note that occupational health and safety noise is not considered in this assessment as there is a separate regulatory framework for determining occupational noise exposure and control.

Part of the underground mine footprint, accommodation village and gas drainage activities are proposed on a new mining lease for which a new environmental authority (EA) will be issued. The existing mining operations at GRM and BRM are subject to an existing EA (mining lease) EPML00853413 (formerly MIN100921609). Part of the underground mine footprint, infrastructure associated with the project including the MIA, CHPP and overland conveyor will be located on the existing EA for GRM. Once implemented, these elements of the project will be subject to the monitoring and compliance requirements contained within the existing GRM EA conditions.

4.2.2 Independently Owned Residential Properties

The appropriate assessment tools for the evaluation of environmental noise affecting the amenity of independently owned residences are the EPP (Noise) and EHP's *Planning for Noise Control* guideline.

The criteria derived from EPP (Noise) and the *Planning for Noise Control* guidelines are not directly applicable to residential properties owned by BMA/BMC because BMA/BMC can control who live in the properties, can apply acoustic treatments directly to the properties where required, and can consent to the properties' amenity being impacted.

However, for the purposes of the assessment, the BMA/BMC owned (or proposed to be managed under a compensation agreement) residential receivers at Lapunyah, Denham Park, Burton Downs and Riverside have been assessed in accordance with the *Planning for Noise Control* guideline and the EPP (Noise) to establish appropriate noise criteria for residential receivers further from the project.

The relevant operational noise criteria for residential properties owned by BMA/BMC (or under agreement with BMC) including Eureka Village, and the proposed Red Hill accommodation village are discussed in **Section 4.2.3**.

EPP (Noise)

The EPP (Noise) assessment process has two main considerations:

- Minimising background creep; and
- Acoustic Quality Objectives (refer to Schedule 1 in EPP (Noise)).

Background Creep

The background creep criterion is intended to minimise the progressive increase in background noise levels in an area over time. The EPP (Noise) defines background creep criteria as follows:

- For noise that is continuous noise measured by LA90,T – more than nil dBA greater than the existing acoustic environment measured by LA90,T; or

- For noise that varies over time measured by LAeq,T – more than 5 dBA greater than the existing acoustic environment measured by LA90,T.

Based on the most stringent RBL listed in **Table 4**, the following criteria are applicable:

- 25 LA90; and
- 30 LAeq.

Acoustic Quality Objectives

The EPP (Noise) includes long term acoustic quality objectives. It is intended that the acoustic quality objectives be progressively achieved as part of achieving the purpose of the EPP (Noise) policy over the long term. **Table 10** summarises the relevant Acoustic Quality Objectives.

Table 10 Acoustic Quality Objectives

Receptor	Time of Day	Acoustic Quality Objectives (measured at the receptor) dBA			Environmental Values
		LAeq, adj, 1hr	LA10, adj, 1hr	LA1, adj, 1hr	
Dwelling (for outdoors)	Daytime and evening	50	55	65	Health and wellbeing
Dwelling (for indoors)	Daytime and evening	35	40	45	Health and wellbeing
	Night-time	30	35	40	Health and wellbeing, in relation to the ability to sleep

On comparison of the two assessment processes contained within the EPP (Noise), it can be seen that in all cases the background creep criterion are equal to or more stringent than the Acoustic Quality Objectives. Therefore, the EPP (Noise) background creep criterion criteria will be applicable to the GRM incremental expansion and the RHM underground expansion option.

Planning for Noise Control Guideline

This *Planning for Noise Control* assessment process has four main considerations:

1. control and prevention of background creep;
2. determination of planning noise levels;
3. containment of variable and short term noise emissions by setting specific (intrusive) noise levels; and
4. sleep disturbance.

The guideline recommends that the lower of the two levels derived from bullet points (2) and (3) be used for assessment purposes as these levels are both based on the LAeq parameter.

Background Creep

The guideline provides recommended RBLs in order to prevent background noise levels from progressively increasing over time with the establishment of new developments.

The background creep criteria is calculated by comparing existing RBLs (as measured at noise receptors) with recommended RBLs given in the guideline.

The recommended RBLs are applicable to the daytime (7.00am to 6.00pm), evening (6.00pm to 10.00pm) and night-time (10.00pm to 7.00am) periods and are summarised in **Table 11** below for the following areas.

Table 11 Recommended Outdoor Background Noise Planning Levels

Receiver Area Dominant Land Use (description of neighbourhood)	Applicable Location/s	Background noise level, minLA90, 1hour (dBA)		
		Day	Evening	Night
Very Rural	All	35	30	25

Where existing noise levels in an area approach the recommended RBL, the criteria must be adjusted to prevent background creep. The recommended adjustments are shown in **Table 12**.

Table 12 Adjustment to Recommended RBL to Prevent Background Creep

Existing Background Level at Residential Receiver	Recommended LA90(1hour)
> Recommended RBL	Background – 10 dBA
= Recommended RBL	Recommended RBL – 10 dBA
Recommended RBL – 1	Recommended RBL – 9 dBA
Recommended RBL – 2	Recommended RBL – 5 dBA
Recommended RBL – 3	Recommended RBL – 3 dBA
Recommended RBL – 4	Recommended RBL – 2 dBA
Recommended RBL – 5	Recommended RBL – 2 dBA
< Recommended RBL – 5	Background + 5 dBA

Using the measured RBLs given in **Table 4**, and recommended RBLs and adjustments in **Table 11** and **Table 12**, the background creep criteria in **Table 13** were calculated in accordance with the *Planning and Noise Control* guideline

Table 13 Background Creep Criteria

Location	Criteria minLA90, 1hour (dBA)		
	Day	Evening	Night
4. Broadmeadow Homestead	33	25	25
5. Burton Downs Homestead	30	29	25
7. Denham Park Homestead	33	25	25
8. Lapunyah	31	25	25
13. Riverside Homestead	33	28	25

Note: The guideline sets a 'floor' on background creep criteria of 25 dBA.

From the information contained in **Table 13**, it can be seen that the most stringent criteria is the night-time noise level of 25 dBA which is required at all properties. For the purposes of assessment, 25 dBA LA90 will be used as the background creep criteria for all locations.

Determination of Planning Noise Levels

Maximum Planning Noise Levels (PNL) for different noise area categories are recommended within this guideline. The PNL criteria is used to prevent, where possible, average ambient noise levels (defined as LAeq) from exceeding recommended ambient noise levels given in the *Planning for Noise Control* guideline. These planning levels are applicable to the daytime (7.00am to 6.00pm), evening (6.00pm to 10.00pm) and night-time (10.00pm to 7.00am) periods. The PNL for Area Noise Categories applicable to the GRM incremental expansion and the RHM underground expansion option appear in **Table 14** below.

Table 14 Recommended Maximum Values of PNL

Noise Area Category (description of neighbourhood)	Applicable Location/s	Maximum hourly SPL, LAeq, (1hour) (PNL)		
		Day	Evening	Night
Z1: Very Rural, purely residential. Less than 40 vehicles an hour	All	40	35	30

Where existing noise levels in an area approach the maximum PNL, the noise level from any new source must be controlled to preserve the amenity of the area. To achieve this, the guideline recommends modifications be made to the recommended maximum PNL depending on the existing noise levels. These modifications are summarised in **Table 15**.

Table 15 Modifications to Recommended Maximum PNL to Preserve Amenity

Existing Noise Level (dBA)	PNL for New Sources (dBA)
≥ PNL + 2	Existing Noise Levels Likely to decrease: PNL – 10 Existing Noise Levels Unlikely to Decrease: Existing Level - 10
PNL + 1	PNL – 9
PNL	PNL – 8
PNL – 1	PNL – 6
PNL – 2	PNL – 4
PNL – 3	PNL – 3
PNL – 4	PNL – 2
PNL – 5	PNL – 2
PNL – 6	PNL – 1
< PNL – 6	PNL

The resultant PNL criterion (utilising **Table 4**, **Table 14** and **Table 15**) at each monitoring location appears below in **Table 16**.

Table 16 Planning Noise Level Criteria

Location	Criteria LAeq, (1hour) (PNL)		
	Day	Evening	Night
4. Broadmeadow Homestead	41	30	29
5. Burton Downs Homestead	40	31	28 ¹
7. Denham Park Homestead	39	27	26
8. Lapunyah Homestead	34	27	27
13. Riverside Homestead	41	34	34

Note 1: Calculated PNL is less than 25 LAeq dB. As such, PNL has been recommended at 28 LAeq dB based on the below SNL (25 dBA + 3 dB).

Containment of Short-Term Emissions – Specific (Intrusive) Noise Level

The Specific (intrusive) Noise Level (SNL) criteria are also used to control ambient noise levels (defined as LAeq). The SNL (LAeq(1hour)) is determined as follows:

SNL LAeq(1hour) = RBL + 3dBA (adjusted for tonality and impulsiveness).

The SNL is determined from the existing RBL (shown in **Table 4**) and is shown in **Table 17**.

Table 17 Specific (Intrusive) Noise Level Criteria

Location	Criteria LAeq, (1hour) (SNL)		
	Day	Evening	Night
4. Broadmeadow Homestead	33	31	33
5. Burton Downs Homestead	28	28	28
7. Denham Park Homestead	31	28	28
8. Lapunyah Homestead	29	33	31
13. Riverside Homestead	33	28	28

Note: The guideline sets a 'floor' on SNL of 28 dBA (e.g. background creep 'floor' of 25 dBA plus 3 dBA).

Comparing the PNL criteria shown in **Table 16** and the SNL criteria shown in **Table 17**, it can be seen that the criteria levels expressed in **Table 16** for the night-time period would be the most stringent at all locations except for Location 13. Therefore, the PNL criteria would form the basis of the limiting LAeq criteria at all locations except Location 13 where the limiting LAeq criteria will be the SNL criteria.

To manage the LAeq criteria effectively for every noise receptor and not just the five noise monitoring locations, an overall LAeq criterion of 28 dBA has been set for all noise receptors within the EIS study area. This is based on the minimum SNL criteria of 28 dBA recommended in the *Planning for Noise Control* guideline.

On comparison of the criteria derived from the EPP (Noise) and the *Planning for Noise Control* guideline, it can be seen that in all cases the *Planning for Noise Control* guideline criteria are equal to or more stringent than the EPP (Noise) criteria. Therefore, the *Planning for Noise Control* guideline criteria will be the defining criteria.

Sleep Disturbance

The guideline recommends that in order to achieve a good night's sleep, internal noise levels should not exceed LAmax 45 dBA more than 10 to 15 times per night. Based on a conservative attenuation of 5 dBA through a facade with open windows, the following external criterion is recommended, assessable four metres from the facade and during the night-time period only:

- LAmax (external) - 50 dBA

enHealth's Health Effects of Environmental Noise

The Australia Environmental Health Committee (enHealth) (2004) undertook a review of health effects of environmental noise. While limited qualitative information is available, possible health effects from environmental noise may include:

- noise-induced hearing impairment;
- interference with speech communication;
- disturbance of rest and sleep;
- psychophysiological, mental health and performance effects;
- effects on residential behaviour and annoyance; and
- interference with intended activities.

The enHealth report '*The health effects of environmental noise – other than hearing loss*' document contains four recommendations:

1. Recognise environmental noise as a potential health concern.
2. Promote measures to reduce environmental noise and its health impacts.
3. Address environmental noise in planning and development activities.

4. Foster research on the non-auditory health impacts of noise.

Following are responses to these four recommendations.

Recognise environmental noise as a potential health concern

The guidelines suggest two actions in relation to recommendation 1:

- recognition and awareness of the need to address environmental health effects of noise in legislation and planning; and
- adoption of the WHO *Guidelines for Community Noise* (WHO 1999).

The WHO guidelines specify that the following noise levels should be achieved in residential premises:

- bedrooms (internal) - 30 dBA LAeq (steady noise);
- bedrooms (internal) - 45 dBA LMax (intermittent noise);
- living Areas (internal) – 35 dBA LAeq (steady noise); and
- living Areas (outdoor) – 50 dBA LAeq (steady noise).

The noise criteria determined using the *Planning for Noise Control* methodology are below the most stringent of the WHO noise levels, and are hence considered adequate to protect residents from adverse health effects.

The above 30 dB LAeq guideline for bedrooms (internal) conservatively equates to 35 dB LAeq external assuming a conservative 5 dBA façade noise reduction. Given that the proposed *Planning for Noise Control* criterion is 28 dB LAeq and including 5 dBA as a conservative façade noise reduction (AS3671 recommends the use of 10 dBA and indeed the WHO guideline recommends the use of 15 dBA as a façade noise reduction), it is considered that *Planning for Noise Control* criterion will also ensure compliance with the WHO guidelines.

Promote measures to reduce environmental noise and its health impacts

The enHealth document contains many 'high level' actions in this recommendation in relation to education programs, mitigation and licensing controls, relevant standards and product labelling. This recommendation does not contain any relevant recommendations in relation to this study.

Address environmental noise in planning and development activities

The enHealth document contains many 'high level' actions in this recommendation in relation to integrating noise into planning processes and national consistency for limits that are not relevant to this study. The one relevant recommendation is that baseline environmental noise levels should be undertaken (where appropriate) to inform planning actions. This is a standard approach in Queensland and has been done for this study as outlined in **Section 3** of this technical report.

Foster research on the non-auditory health impacts of noise

The enHealth document recommends that research be undertaken in many areas of noise to further understand the non-auditory health effects of noise.

There is much ongoing work still to be done in this area but the following information has been provided to assist in understanding the primary concerns in this area of acoustics.

4.2.3 BMA and BMC Owned Residential Properties

With respect to BMA/BMC owned residences, BMA/BMC can control who lives in these properties and can readily apply noise control measures directly to the properties. Also, BMA/BMC, as owners, can consent to the properties' amenity being impacted. Therefore, the EPP (Noise) background creep criteria and *Planning for Noise Control* background creep, PNL and SNL criteria, all of which are intended to minimise impacts on amenity, are not strictly applicable. The considerations for BMA/BMC owned residential properties, including Eureka Village and the proposed Red Hill accommodation village, are based on sleep preservation and minimising the risk of adverse health effects.

As previously mentioned, the WHO recommends for quality sleep, maximum noise levels should not exceed 45 dB LA_{max}. In addition, Australian Standard 2107:2000 *Acoustics – Recommended design sound levels and reverberation times for building interiors* recommends a satisfactory continuous noise level inside bedrooms of 30 dB LA_{eq}. This is also in accordance with enHealth/WHO recommendations.

The existing accommodation units at Eureka Village are air conditioned and the accommodation units at the proposed Red Hill accommodation village will also be air conditioned. Therefore, windows to all accommodation units can remain closed at all times. Assuming a conservative noise reduction from outside to inside of 20 dBA through the closed façade of the accommodation village units, the external noise criteria for Eureka Village, the accommodation units at the proposed Red Hill accommodation village to achieve the WHO and AS2107 recommended levels are therefore:

- 65 dB LA_{max}; and
- 50 dB LA_{eq}.

For BMA/BMC owned residential properties at Burton Downs, Denham Park, Lapunyah and Red Hill, air conditioning may not be provided. For these properties the following external noise criteria are recommended based on a 5 dBA façade reduction (i.e. assuming open windows):

- 50 dB LA_{max}; and
- 35 dB LA_{eq}.

It should be noted that if the above external criteria are achieved, the recommended satisfactory internal noise levels in AS2107 and the WHO guidelines for other habitable living areas would also be achieved.

4.2.4 Low Frequency Noise

Sound in the frequency range below 20 hertz (Hz) is defined as infrasound while the frequency range of audible noise is normally taken from 20 Hz to 20,000 Hz. Contrary to this interpretation, noise at frequencies below 20 Hz can be audible, however tonality is lost below 16 – 18 Hz thus losing a key element of perception. Low frequency noise spans the infrasonic and audible ranges and may be considered as the range from about 10 Hz to 200 Hz.

Low frequency noise should be assessed where it has the potential to cause disturbance. Guidance on the assessment of low frequency noise impacts can be sought from the Queensland DEHP's *Assessment of Low Frequency Noise* guideline (EPA 2005). The intent of this guideline is to accurately assess annoyance and discomfort to persons at noise receptors from low frequency noise. The guideline assesses both infrasound – below 20 Hz (Part A), and low frequency noise – above 20 Hz (Part B).

The potential for low frequency noise to cause disturbance at nearby noise receptors has been assessed in accordance with the *Assessment of Low Frequency Noise* guideline.

Part A – Infrasound (<20 Hz)

Recommended infrasound limit values are:

- 85 dB(G) inside dwellings during the day, evening and night and inside classrooms and offices.
- 90 dB(G) for occupied rooms in commercial enterprises.

Part B – Low Frequency Noise (≥20 Hz)

Low frequency noise spans the frequency range from about 20 Hz to 200 Hz. The intent of these criteria is to accurately assess annoyance and discomfort to persons at noise receptors.

The assessment procedure for low frequency noise, as set out in the *Assessment of Low Frequency Noise* guideline, involves the following:

Initial Screening:

- sound pressure levels inside residences should not exceed 50 dB(Linear);
- if the difference between the LL_{ineq} value and the LA_{eq} value is greater than 15 dB, a 1/3rd octave band analysis should be performed.

Audibility Assessment:

- determine if $LL_{ineq} - LA_{eq} > 15$ dB;
- if it does, 1/3rd octave band data should be compared to the median hearing threshold.

Annoyance due to Tonal Noise:

- if the sound pressure in a particular 1/3rd octave band is 5 dB or more above the levels in the two neighbouring bands, the noise is said to be tonal;
- for acceptable tonal noise, values should be limited to the following exceedences of the threshold table values:

Frequency Band Period	8 Hz to 63 Hz	80 Hz	100 Hz	>100 Hz and <200 Hz
Day	5	10	15	17
Night	0	5	10	12

Annoyance due to Non-Tonal Noise:

- the A-weighted 1/3rd octave band data for indoors is summed to yield the A-weighted noise level in the frequency range 10 Hz to 160 Hz. The resulting level is called $L_{pA,LF}$;
- the acceptable criteria for non-tonal noise ($L_{pA,LF}$) are as follows:

Type of Space	$L_{pA,LF}$ (dBA)
Dwelling – Evening and night	20
Dwelling – Day	25
Classroom, office etc	30
Rooms within commercial enterprises	35

The criteria above are for indoor noise levels, assuming a conservative attenuation of 5 dB in the low frequency range through a façade with open windows, the outdoor noise limits should be raised by 5 dB compared to the above criteria.

For the purposes of this assessment, the low frequency criteria have been analysed to determine how they relate to the L_{Aeq} (specific/intrusive) criterion developed using *Planning for Noise Control*.

This was undertaken as follows:

- The noise sources documented in **Table 28** (see **Section 5.4**) were used to predict A-weighted and linear noise levels at the 15 noise receptors as well as the proposed Red Hill accommodation village.
- The linear levels were compared to the 50 dBL (internal) initial screening tests outlined in the *Assessment of Low Frequency Noise* guideline. The only predicted exceedence was at Eureka Village. All other sensitive receptors are predicted to comply with the 50 dBL (internal) criteria.
- For Eureka Village, the A-weighted and linear noise levels were then compared against one another and for all instances, the difference was less than the 15 dBA trigger for further assessment given in the *Assessment of Low Frequency Noise* guideline.

Therefore, given that both screening tests were not exceeded for any receptor (residential or accommodation village or site), further assessment of low frequency noise was not considered necessary.

4.2.5 Summary of Operational Criteria

The following operational noise criteria have been nominated:

Independently owned residences (in accordance with the *Planning for Noise Control* guideline):

- Background Creep Criteria (for steady-state noise sources) – 25 dBA (L_{A90});
- PNL Criteria (for variable noise sources) – 28 dBA (L_{Aeq}); and
- Sleep Disturbance Criteria – 50 dB L_{Amax} .

BMA/BMC owned residences at Burton Downs, Denham Park, Lapunyah and Red Hill:

- 50 dB L_{Amax} ; and
- 35 dB L_{Aeq} .

Eureka Village and the proposed Red Hill accommodation village:

- 65 dB L_{Amax} ; and
- 50 dB L_{Aeq} .

As stated in **Section 4.2.1**, part of the underground mine footprint, associated infrastructure including the MIA, CHPP and overland conveyor will be located on the existing EA for GRM and therefore subject to the monitoring and compliance requirements contained within the existing GRM EA conditions. Notwithstanding this requirement, it is necessary to assess noise emissions from the new infrastructure (ie MIA, CHPP and overland conveyor) together with the project activities carried out on the new mining lease. To do this, it is considered appropriate at this stage to assess noise emissions against the noise criteria summarised above.

4.3 Transportation Noise Assessment Criteria

4.3.1 Rail

Rail noise from track and rail loadout loops have been assessed in combination with other operational mining noise sources (see **Section 5.4.2**) rather than as a stand along railway facility, and as such the criteria are derived from the *Planning for Noise Control* guideline. This has resulted in more stringent criteria than those typically applied to rail noise in Queensland as stipulated in QR's *Code of Practice – Railway Noise Management*:

- 87 dBA L_{Amax} ;

- 65 dBA LAeq(24hour)

It should be noted that the noise assessment covers noise from train load out only, not from train movements between the mine and port.

4.3.2 Road

The effect of construction and operational road traffic on the noise emission from roadways affected by the GRM incremental expansion and the RHM underground expansion option has been assessed. In the absence of relevant legislation or guidance, this assessment has been performed by using the common method of assessing how traffic changes would alter the LA10(18hour) level of noise emission from roadways using the Calculation of Road Traffic Noise (CoRTN) prediction algorithms. The LA10(18hour) parameter is the average of the hourly LA10 traffic noise level between the hours of 6am and midnight.

Assuming that the proportion of heavy vehicles, traffic speed and road surface remain constant, the relationship between increases in traffic volume on a roadway and the resulting increase in LA10(18hour) traffic noise emission is summarised in **Table 18**.

Table 18 Relationship Between Traffic Volumes Changes and LA10(18hour) Noise Emission

Increase/Decrease in AADT Traffic	Resultant Change in LA10(18hour) Noise Emission
10%	0.4 dBA
25%	1.0 dBA
50%	1.8 dBA
75%	2.4 dBA
100%	3.0 dBA

It can be seen from **Table 14** that a doubling of traffic on a given roadway will result in a 3 dBA increase in the LA10(18hour) emission from this roadway. A change of up to 3 dBA in the level of a dynamic noise, such as passing vehicles is difficult for most people to detect, whilst a 3 dBA to 5 dBA change corresponds to a small but noticeable change in loudness. A 10 dBA change corresponds to an approximate doubling or halving in loudness.

For assessment purposes it is common to set the threshold of significance in relation to changes to the noise emission level from roads at 2 dBA. This threshold is adopted in this study.

5 MINE SITE NOISE MODELLING METHODOLOGY

Noise modelling was used to assess construction noise, operational noise (excluding blasting) and noise from the proposed Red Hill accommodation village.

5.1 SoundPLAN

In order to calculate the noise emission levels at the various noise receptor locations, a SoundPLAN (Version 7.0) environmental computer model was developed. SoundPLAN is a software package which enables compilation of a sophisticated computer model comprising a digitised ground map (containing ground contours and buildings), the location and acoustic sound power levels (SWLs) of potentially critical noise sources on site and the location of receivers for assessment purposes.

The computer model can calculate noise levels taking into account such factors as the source SWLs and locations, distance attenuation, ground absorption, air absorption and shielding attenuation, as well as meteorological conditions, including wind effects.

BMA supplied 3D ground topography corresponding to the operational modelling scenarios in **Section 5.4.2** for input to the noise model. The Red Hill CHPP, stockpiles, conveyors alignments and associated industrial infrastructure were supplied in 2D electronic format. Specific heights for the Red Hill CHPP, conveyors and industrial infrastructure were detailed in SLR's Assumption Memo (Ref: 20-2291 URS GCE Memo 20111115) dated 15 November 2011, which was submitted to BMA for confirmation and approval (see **Appendix D**). Railway track and major on-site haul route layouts were supplied in 2D electronic format and hard copy drawings. BMA also supplied colour aerial photographs.

Please note that this memo makes reference to the conveyor CV-813 (Superloop Product conveyor). As this conveyor is no longer part of the project scope, this conveyor has been subsequently removed from the noise model.

All ground areas have been modelled as absorptive.

For construction activities, the distances at which the nominated noise criteria of L_{Amax} 65 dB (for Eureka Village and the proposed Red Hill accommodation village and L_{Amax} 50 dB (for all other residences) would be achieved for calm and worst case (enhanced propagation) have been calculated for the various construction scenarios. The distances can be considered to be minimum 'buffer' distances between the construction activities and the noise receptors.

For operational activities, noise levels have been predicted at surrounding noise receptors (15 in total) as well as the proposed Red Hill accommodation village. All receivers have been positioned 1.5 m above ground and 4 m from the building under consideration. Noise contour plots have been produced for the greater surrounding area and are located in **Appendix E** (for neutral weather conditions) and **Appendix F** (for worst case weather conditions).

5.2 CONCAWE

The CONCAWE prediction methodology was utilised within SoundPLAN. The CONCAWE prediction method is specially designed for large facilities and incorporates the influence of wind effects and the stability of the atmosphere.

The statistical accuracy of environmental noise predictions using CONCAWE was investigated by Marsh (Applied Acoustics 15 - 1982). Marsh concluded that CONCAWE was accurate to ± 2 dBA in any one octave band between 63 Hz and 4 kHz and ± 1 dBA overall.

5.3 Meteorological Conditions

In accordance with the *Planning for Noise Control* guideline, consideration has been given to the effects of prevailing and worst case meteorological conditions (wind, temperature, humidity and temperature inversions) on noise propagation.

Wind Effects

In accordance with the *Planning for Noise Control* guideline, annual meteorological data was analysed for the following wind parameters:

- 30 per cent occurrence in any assessment period (day, evening or night) in any season;
- 3 m/s or less source to receiver component; and
- 10 m height for wind speed.

This analysis noted that there were no calculated periods of wind occurring at least 30 per cent of the time in any one season and assessment period, and speeds of up to 3 m/s. Peak wind occurred during autumn nights, where wind from the east-southeast occurred 27 per cent of the time. Therefore wind is not considered a feature of the area and has not been included for worst case weather conditions in this assessment.

Temperature Inversion

In accordance with the *Planning for Noise Control* guideline, annual meteorological data was analysed for the following temperature inversion parameters (non-arid):

- 30 per cent occurrence for night time (6.00pm-7.00am) period during winter (June, July, August); and
- moderate inversions (F-class stability category).

Analysis of temperature inversions data for the site noted that F-class stability category had an occurrence of 89 per cent. Therefore temperature inversions are considered to be a characteristic of the surrounding area..

Modelled Meteorological Parameters

Based on the above analysis of available meteorological data, the weather conditions used to assess the effect of neutral and worst case meteorological conditions are shown in **Table 19** below. The assessment for worst case weather is applied to all receptors due to the effects of the temperature inversion.

Table 19 Meteorological Conditions – Neutral and Worst Case

Parameter	Neutral Weather	Worst Case Weather
Temperature	10°C	10°C
Humidity	70%	90%
Pasqual Stability Class	D	F
Wind Speed	0 m/s	0 m/s

5.4 Modelling Scenarios

5.4.1 Construction Noise Modelling Scenarios

Seventeen general construction scenarios have been modelled for this assessment comprising concurrent activities. These seventeen general construction scenarios were grouped in the following main construction activities:

- Construction of the Red Hill CHPP, MIA and stockpiles (**Table 20**);
- Construction of the IMG drainage wells (**Table 21**);
- Construction of the IMG gathering pipeline system (**Table 22**); and
- Construction of the IMG facility (**Table 23**).

Further detailed assumptions have been provided in **Appendix D**.

Note that while changes to construction equipment and scenarios may occur, these changes are likely to be minor and not affect overall construction noise levels. Should significant changes occur, such as changes in location of noisy activities, or significantly increased intensity of construction activities, further noise modelling may be required.

Table 20 Construction Scenarios, Plant and Numbers – Red Hill CHPP / MIAs / Stockpiles

Construction Scenario	Activity	Equipment	Number of Plant Items	
			Red Hill CHPP and Riverside MIA	Red Hill UG MIA and Raw Coal Stockpile
Install Pavement (direct supply)	Deliver material from quarry	Road Truck - B-double / triple	2	2
	Add water	CAT 777 Water truck	2	1
	Grade material	CAT 16 Grader	2	1
	Roll	825 Roller Compactor	2	1
Install Pavement (via Stockpile) ¹	Deliver material from quarry	Road Truck - B-double / triple	2	2
	Unload to Stockpile	CAT 966 Loader	1	1
	Add water	CAT 777 Water truck	2	1
	Load onto truck	CAT 966 Loader	1	1
	Deliver to site	10T Body Truck	2	1
		40T Articulated Dump Truck	2	1
	Add water	CAT 777 Water truck	2	1
	Grade	CAT 16 Grader	2	1
	Roll	825 Roller Compactor	2	1
Bulk Earthworks – Cut	Ground removal	CAT 631 Scraper	2	2
		30 T Excavator	2	1
	Ripping	D7 Bulldozer with ripper	2	1
Bulk Earthworks – Fill	Placement	CAT 631 Scraper	2	2
		CAT 773 Dump truck	4	2
	Add water	CAT 777 Water truck	2	1
	Grade	CAT 16 Grader	2	1
	Roll	825 Roller Compactor	2	1
Plant Assembly	Lifting	100T Outrigger	1	1
		Roughie - 4WD 50T	1	1
		Franna - up to 20T	2	2
	Access	Elevated Work platform	2	2
		Scissor Lift	2	2
	Concrete delivery	Concrete truck	4	2
		Concrete pump	2	1
	Construction equipment	Air compressor	2	1
		Generators	2	2
		Welders	2	2
		Winches	2	1

Table 21 Construction Scenarios, Plant and Numbers – Gas Drainage – Gas Wells

Construction Scenario	Activity	Equipment	Assumed Plant Number
Gas Well – Creating Lease Pad	Ground Removal	D7 Bulldozer	1
		30 T Excavator	1
	Add water	CAT 777 Water truck	1
	Grade	CAT 16 Grader	1
	Roll	825 Roller Compactor	1
Gas Well – Drilling well	Drilling	Drill Rig (including generators and mud pump)	1
Gas Well – Assembly	Lifting	Franna - up to 20T	1
	Construction equipment	Air compressor	1
		Generators	1
		Welders	1

Table 22 Construction Scenarios, Plant and Numbers – Gas Drainage – Gas Gathering Pipeline System

Construction Scenario	Activity	Equipment	Assumed Plant Number
Clearing, grubbing and stripping of topsoil	Slashing	Slasher	1
		Tub Grinder	1
	Ground Removal	CAT 631 Scraper	2
		CAT 16 Grader	2
		Backhoe	1
		D7 Bulldozer	1
	Add Water	CAT 777 Water truck	1
Trenching, and lowering and welding	Trenching	Verner Trenchsaw	1
		30 T Excavator	1
	Lowering	D7 Bulldozer with sideboom	2
	Welding	Generators	2
		Welders	2
Backfill of pipe and testing	Compacting	Ozzie Padder	1
	Placement	12T Excavator	2
		Wheel Dozer	1
	Deliver material from quarry	Road Truck - B-double / triple	2
	Trench compacting	Trench Roller	1
	Add Water	CAT 777 Water truck	2
	Pipe testing	Hydrostatic Test Pump	1
		Air compressor	1
Horizontal Directional Drilling (Crossing Issac River)	HDD Unit	Mud Pump	1
		Hydraulic Power Uni	1
		Recycling Unit	1
	Placement	30 T Excavator	1
	Power Generation	Generators	1
	Lighting	Lighting Tower	3
Access Track Construction	Deliver material from quarry	Road Truck - B-double / triple	2
	Roll	825 Roller Compactor	3

Construction Scenario	Activity	Equipment	Assumed Plant Number
	Grade	CAT 16 Grader	3
	Add Water	CAT 777 Water truck	2

Table 23 Construction Scenario, Plant and Numbers – Gas Drainage – Gas Facility

Construction Scenario	Activity	Equipment	Assumed Plant Number
Install Pavement (direct supply)	Deliver material from quarry	Road Truck - B-double / triple	2
	Add water	CAT 777 Water truck	1
	Grade material	CAT 16 Grader	1
	Roll	825 Roller Compactor	1
Bulk Earthworks – Cut	Ground removal	CAT 631 Scraper	2
		30 T Excavator	1
	Ripping	D7 Bulldozer with ripper	1
Bulk Earthworks – Fill	Placement	CAT 631 Scraper	2
		CAT 773 Dump truck	2
	Add water	CAT 777 Water truck	1
	Grade	CAT 16 Grader	1
	Roll	825 Roller Compactor	1
	Plant Assembly	Lifting	100T Outrigger
Roughie - 4WD 50T			1
Franna - up to 20T			2
Access		Elevated Work platform	2
		Scissor Lift	2
Concrete delivery		Concrete truck	2
		Concrete pump	1
Construction equipment		Air compressor	1
		Generators	2
		Welders	2
	Winches	1	

Table 24 lists the modelled SWLs for the items of mobile plant contained in the construction scenarios. SWLs were obtained through SLR's databases.

LAeq SWLs stated in **Table 24** are 8 dBA lower than LAmax SWL for all sources where noise levels vary over time (eg mobile plant). This is based on the relationship of a 3 dBA difference between measured LAeq and LA10 levels and a 5 dBA difference between measured LA10 and LAmax levels from intermittent noise sources. Fixed noise sources that run continuously such as pumps and motors would generally have a negligible difference between their LAeq, LA10 and LAmax noise emission levels.

Table 24 SWL of Construction Plant for Noise Modelling

Modelling Scenario	Plant Items	LAeq SWL (dBA)	LAmax SWL (dBA)
Construction	Air Compressor	105	105
Construction	Articulated Truck – 40 T	110	118
Construction	Body Truck – 10 T	105	113
Construction	Concrete Pump	107	115
Construction	Concrete Truck	104	112
Construction	Compactor – CAT 825	106	114

Modelling Scenario	Plant Items	LAeq SWL (dBA)	LAmx SWL (dBA)
Construction	Crane – Franna – 20T	105	113
Construction	Crane – 100T Outrigger	107	115
Construction	Crane – Roughie – 4WD 50T	105	113
Construction	Dozer – D7	107	115
Construction	Drill Rig (including generators and mud pumps)	115	123
Construction	Dump Truck	110	118
Construction	Elevated Work Platform	96	104
Construction	Excavator – 12T	110	118
Construction	Excavator – 30T	106	114
Construction	Hydraulic Power Unit	107	107
Construction	Hydrostatic Test Pump	98	98
Construction	Generator	102	102
Construction	Grader – CAT 16 Class	110	118
Construction	Lighting Tower	98	98
Construction	Loader – CAT 966	107	115
Construction	Road Truck – B-double or B-triple	110	118
Construction	Mud Pump	107	107
Construction	Ozzie Padder	110	118
Construction	Recycling Unit	94	94
Construction	Scissor Lift	96	96
Construction	Scraper – CAT 631	108	116
Construction	Slasher	107	115
Construction	Trench Roller	100	108
Construction	Tub Grinder	110	118
Construction	Trench Saw	110	118
Construction	Vibratory Roller	106	114
Construction	Welders	100	108
Construction	Wheel Dozer	110	118
Construction	Winches	102	110
Construction	Water Trucks – CAT 777	113	121

Predicted construction noise levels will inevitably depend upon the number of plant items and equipment operating at any one time and on their precise location relative to the receiver(s). Therefore a receiver will experience a range of values representing 'minimum' and 'maximum' construction noise emissions depending upon:

- the location of the particular construction activity (i.e. if the plant item of interest were as close as possible to or further away from the receiver of interest); and
- the likelihood of the various items of equipment operating simultaneously.

The noise modelling predictions assume that all equipment in each construction scenario are operating simultaneously. This can be considered 'worst case'.

5.4.2 Operational Noise Modelling

Noise sources associated with the operational phases have been separated into the following categories:

- conveyor systems;

- conveyor alarms;
- other fixed plant associated with general mining operations including the CHPP and upcast ventilators;
- mobile plant associated with general above ground mining operations;
- fixed and mobile plant associated with the IMG and goaf gas drainage system (including plant associated with gas wells and three options for gas management measured in **Section 2.3.1**).

Based on the above, twelve operational mining scenarios were developed (excluding conveyor alarms which have been modelled separately). Operational scenarios were made up of the following components:

- Continuous or steady state noise sources (i.e. fixed plant items including IMG and goaf gas management). This represents noise sources that are effectively continuous and the noise emissions from these sources have been compared with the nominated background creep criteria.
- Variable noise sources (i.e. mobile plant and rail). These sources are not operating on a continuous basis, and/or are operating at a range of locations. The noise emissions from these sources have been compared with the nominated average (ie LAeq) criteria.

All twelve operational mining scenarios developed were predicted under both neutral and worst case weather conditions, as detailed in **Table 19**.

Within the noise model, operations consisted of all plant items operating concurrently in order to simulate the overall maximum potential noise emissions.

Noise emissions from these sources have been predicted for three future scenarios:

- FY2020 – ‘start of mine’;
- FY2030 – ‘mid-life of mine’; and
- FY2040 – ‘end of mine’.

Details of the above mentioned categories have been described in the following section.

Appendix G contains a plan showing the location of noise sources utilised for the operational scenarios detailed above. Further details on assumptions and modelling scenarios are included in **Appendix D**.

It should be noted that as engineering and technical studies progress, some changes to the types, capacities and locations of equipment may occur. In most cases, these will probably have minimal impact on noise levels at receptors, however where significant changes in types, capacities or locations of equipment occur, it may be necessary to revisit the noise modelling and review mitigation measures.

Conveyor Systems

Existing conveyors at the site are not included in the assessment as these form part of the ‘Existing Operations’ (which are already covered under the approved environmental authority conditions for GRM).

Proposed conveyors are shown in **Table 25** including the heights of conveyors above ground level. The locations of the new conveyors are shown in **Figure 1**.

Table 25 Red Hill Mine Future Conveyors

Conveyor Number	Conveyor Name	Belt Speed (m/s)	Belt Width (mm)	Height Above Ground (m)	SWL per Metre (dBA)	Comments
CV-132	Raw Coal Stacking	4.5	2000	1.5 – 45	91.1	1.5 m at base of Primary Sizing Station, 45 m at coal stockpile.
CV-102	Raw Coal Stacking	4.5	2000			
CV-111	Emergency ROM Stacking	4.5	2000	10 – 25	91.1	10 m at Primary Sizing Station, 25 m at coal stockpile.
CV-121	Tunnel Reclaim	3.0	1800	1.5 – 10	87.1	1.5 m at base of Tunnel, 10 m at Breaker Station.
CV-711	Rotary Breaker Rejects	2.0	1200	1.5 – 20	81.9	1.5 m at base Breaker Station, 20 m at coal stockpile.
CV-221	Breaker Station Raw Coal	4.0	1400	1.5 – 5	88.5	5 m at rise to Transfer Station.
CV-222	Raw Coal Transfer	4.0	1400	1.5 – 5	82.5	5 m at rise to Transfer Station. Low noise idlers will be installed.
CV-223	Raw Coal Transfer	4.0	1400		82.5	
CV-224	Raw Coal Transfer	4.0	1400			
CV-225	Raw Coal Transfer	4.0	1400			
CV-226	Raw Coal Transfer	4.0	1400	1.5 – 30	88.5	1.5 m at base transfer station, 30 m at Surge Bin.
CV-227	U/G Raw Coal Transfer	3.6	1800	1.5 – 5	88.7	5 m at rise to Transfer Station.
CV-261	O/C Raw Coal Transfer	3.5	1200	1.5 – 10	86.7	1.5 m at base of Primary Sizing Station, 10 m at Secondary Sizing Station.
CV-262	O/C Raw Coal Transfer	3.5	1200	1.5 – 30	86.7	1.5 m at base Secondary Sizing Station, 30 m at Surge Bin.
CV-281	Tertiary Station Feed	3.6	1800	1.5 – 10	82.7	1.5 m at base Surge Bin, 10 m at Tertiary Station Feed.
CV-315	Plant Surge Bin Feed	3.6	1800	1.5 – 30	88.7	1.5 m at base Tertiary Sizing Station, 30 m at Surge Bin.
CV-316	Plant Feed	3.5	1200	1.5 – 25	86.7	1.5 m at base Surge Bin, 25 m at Red Hill CHPP.
CV-317	Plant Feed	4.0	1400			
CV-801	Product	3.6	1800	1.5 – 30	88.7	1.5 m at base Red Hill CHPP, 30m at Surge Bin.
CV-804	Transfer	0.65	2200	5	74.7	-
CV-803	Transfer	0.65	2200			
CV-802	Product Stacker	3.6	1800	1.5 - 20	88.7	1.5 m at start, 20 m at Product Stacker.
CV-811	Product Reclaim	5.5	2200	20 – 5	93.3	20 m at Product Reclaim, 5 m at Loadout Transfer Station
CV-812	Product TLO	5.5	2200	1.5 – 15	93.3	1.5 m at Transfer Station, 15 m at TLO.
CV-814	Silo Transfer	4.0	1400	16	88.5	1 m above 15 m Superloop TLO Silos

Conveyor Number	Conveyor Name	Belt Speed (m/s)	Belt Width (mm)	Height Above Ground (m)	SWL per Metre (dBA)	Comments
CV-701	Coarse Rejects	3.0	1200	1.5 – 5	85.4	5 m at rise to Transfer Station.
CV-702	Combined Rejects	3.0	1200			
CV-703	Rejects Bin Feed	3.0	1200	1.5 - 15	85.4	1.5 m at Transfer Station, 15m at Reject Bin.

The SWL per metre of the conveyors has been calculated based on noise emissions from a standard conveyor system (noise levels obtained from SLR's noise database) corrected for conveyor speed and belt width.

Besides the conveyor speed and belt width, noise emissions from conveyor systems also depend on the type of idlers being used. The difference between noise emissions from conveyor systems with standard steel idlers and low noise steel idlers is generally 6 dBA, with super low noise aluminium idlers being a further 8 dBA quieter than low noise steel idlers (14 dBA quieter than standard steel idlers).

Each conveyor system also includes alarms spaced at regular intervals along the conveyor which sounds prior to the conveyor stopping or starting. Noise from the conveyors alarms (which is tonal and intermittent) has the potential to result in sleep disturbance where conveyors are situated close to residences and accommodation villages.

A SWL of 134 dBA at 1 KHz has been used to assess the risk of conveyor alarms causing sleep disturbance at residences and accommodation villages. This SWL is based on previous measurements taken of conveyor alarms and includes a +5 dBA correction to account for the tonal and intermittent character of alarm noise.

Other Fixed Plant Associated with General Mining Operations

The new fixed plant items associated with the general mining operations (for example Red Hill CHPP, transfer stations, crushers, ROM and trainload) are detailed in **Table 26**.

Table 26 Fixed Plant Sound Power Levels

Plant Items	LAeq SWL (dBA)	Height Above Ground (m)
Breaker Station	113	10
Red Hill CHPP	116	23
Crusher / Sizing / Screen – Primary	124	19
Crusher / Sizing / Screen – Secondary	117	9
Crusher / Sizing / Screen – Tertiary	111	9
Product Stacker Reclaimer	104	20
Rail Load-out	111	15
Rejects Hopper	100	30
ROM Hopper	105	29
Surge Bin	101	30
Transfer Station	111	5
Vent Shafts	111	10

The modelling also includes the following based on discussions with BMA:

- The Red Hill CHPP and stockpile pad is to be constructed at the following reduced levels (RL):

- o directly under the Red Hill CHPP – RL 273 m;
 - o Transfer Stations at northern end of the stockpiles – RL 272 m;
 - o southern end of stockpiles – RL 265 m.
- The Red Hill underground raw and emergency coal stockpiles pads will be level and at natural ground height.
- Upcast shaft' ventilators:
 - o There will be an initial downcast shaft near the start of the mains for fresh air intake.
 - o The first mains upcast shaft will be aligned near the three longwall panel.
 - o A second upcast ventilator will be situated approximately two-thirds the way down the mains (i.e. 7th longwall panel).
 - o The fans installed on the first upcast will be transitioned to the new inbye/second upcast shaft once it is in place.
 - o The first upcast will then become an additional downcast shaft for fresh air intake to alleviate pressure.
 - o This set up will be replicated for both the southern mains and panels and the northern mains and panels i.e. total of six shafts to be sunk.
 - o Only one upcast on each side (north/south) will be operating as a mains upcast at any one time (i.e. two in total).
 - o There will a bleeder shaft required at the back of the panels; assume capacity will be 1/6 of the main fan (approximately 80-100 m³/hr).
 - o The height of the ventilators will be around 10m.
 - o The proposed staging for the shafts will be as follows:
 - Start of mine (i.e. FY2020) – Sink initial downcast shaft at start of mains, and sink/install first mains upcast shaft at the 3rd longwall panel (north and south).
 - Mid-life of mine (i.e. FY2030) – Sink/install second mains upcast shaft at the 7th longwall panel (north and south), convert first mains upcast shaft at the 3rd longwall panel (north and south) into downcast shaft.
 - End of mine (i.e. FY2040) – Second mains upcast shaft at the 7th longwall panel, downcast shafts at start of mains and at the 3rd longwall panel (north and south).

Mobile Plant Associated with General Mining Operations

The following operational mobile plant fleet is to be located at the Red Hill CHPP / MIAs / Stockpiles (see **Table 27**) and will operate at the surface of the RHM. There is considerably more mobile plant to be used at the mine but it all operates underground and is therefore a non-issue in terms of environmental noise considerations.

Three scenarios have been considered to assess noise emissions from the required mobile plant over the 25 year life of the future Red Hill Mine. These are 'start of mine' (i.e. FY2020), 'mid-life' (i.e. FY 2030) and 'end of mine' (i.e. FY2040).

Table 27 Operational (at Surface) Mobile Plant Fleet

Location	Plant Type	Plant Numbers			Typical Operating Position
		FY2020	FY230	FY2040	
Red Hill CHPP	CAT 994 Wheel Loader	1	1	1	Around the Red Hill CHPP at the northern end of stockpiles
	CAT 789 Haul Truck (Rejects)	1	1	2	
	CAT 854 Wheel Dozer	4	4	4	
	CAT 16H Grader	1	1	1	
	CAT 777 Water Truck	1	1	1	
Red Hill UG Mine	10t LHD	1	1	1	Near primary sizing station (St-101 and ST-131)
	12 Person Transporter	1	1	1	
	Maintenance Vehicle ¹	1	1	1	N/A
	Mine Ambulance ¹	1	1	1	N/A
	CAT 994 Wheel Loader (Emergency Coal Stockpile)	1	1	1	On emergency coal stockpiles

Note 1 Are not considered to be a significant noise source given infrequent use and has therefore been excluded from further assessment.

Table 28 lists the modelled sound power levels for the items of mobile plant contained in the operational scenarios. SWLs were obtained through SLR's databases.

Table 28 SWL of Operational Plant for Noise Modelling

Modelling Scenario	Plant Items	LAeq SWL (dBA)	LAmx SWL (dBA)
Operational	Loader – CAT 994	123	131
Operational	Haul Truck - CAT 789	120	128
Operational	Dozer – CAT 854	116	124
Operational	Grader – CAT 16 Class	110	118
Operational	Water Trucks – CAT 777	113	121
Operational	10t LHD	116	124
Operational	12 Person Transporter	101	109
Operational	Maintenance Vehicle	n/a ¹	n/a ¹

Note 1 Not considered to be a significant source due to infrequency of use

As with construction noise, predicted operational noise levels will inevitably depend upon the number of plant items and equipment operating at any one time and on their precise location relative to the receiver(s). Therefore a receiver will experience a range of values representing "minimum" and "maximum" operational noise emissions.

Within the noise model, operations consisted of all plant items operating concurrently in order to simulate the overall maximum potential noise emissions. Model results can therefore be considered conservatively high.

Fixed Plant Associated with the IMG and Goaf Gas Drainage System

Gas Wells

The following will be required during the operational phase to develop the gas wells required for gas drainage:

- Gas pre-drainage:
 - o Drilling of between 50 in-seam wells and 25 vertical wells per longwall panel or up to 1,200 wells in total.
 - o Acoustically significant surface facilities for vertical wells will consist of a drive pump and gas/water separator. The SWL of the drive pump is estimated to be 95 dBA. The SWL of the separator is estimated to be 98 dBA.
- Goaf gas:
 - o Drilling of between 20 to 35 goaf drainage holes per longwall panel or up to 770 goaf drainage holes in total.
 - o There will be one central hub gas plant so no need for pumps at each well head. Therefore, there will be no acoustically significant sources associated with the goaf wells and noise from goaf gas collection is not considered further.

For the purposes of the noise modelling it has been conservatively assumed that up to 25 per cent of the total number of gas wells could be running at any one time.

Gas Drainage Management

There are two options for gas drainage management: electricity generation and on-selling for power supply. If neither of these options is feasible, the gas will be flared. These options are outlined below:

Gas Fired Power Station

If gas fired power generation is determined to be feasible and no other alternatives are agreed with the overlapping petroleum tenure owner, a potential power plant would be initially sized for an available pre-drain gas supply of 0.5 PJ/annum which is sufficient to generate approximately 5 MW using two GE Jenbacher 620 GS-SI regenerator modules – 'gensets'. The power plant would be expandable to 40 MW (i.e. 12 GE Jenbacher 620 GS-SI gensets).

Based on the above, the gas fired power station was modelled with a nominal capacity of 40 MW utilising 12 GE Jenbacher 620 GS-SI gensets. The power plant will operate on both pre-drain and goaf gas. The SWL for one GE Jenbacher 620 GS-SI genset is detailed in **Table 29** (based on measurements of similar gensets).

Table 29 SWL for one GE Jenbacher 620 GS-SI Genset

Component	SWL (dBA)
Vent Air Outlet	84
Vent Air Inlet	84
Left Side Wall	82
Right Side Wall	82
Roof	84
Radiator Fans	85
Exhaust	93

Note 1: Noise emission data for each genset unit was a SPL of 85 dBA at 1m from all components and directions. As noted above, the power station would comprise 12 genset units.

One compressor (CAT G3608 or similar) will be required to add compression and pressure control. This compressor will be comprised of the following:

- Engine / Compressor – SWL 123 dBA;
- Exhaust – SWL 140 dBA; and
- Air Inlet – SWL 128 dBA.

The SWL data taken for the compressors is based on noise emissions from an unmitigated unit (i.e. no housing or silencers).

There will be a transformer associated with the power station. The SWL of the transformer (40 MVA) has been taken to be 60 dBA.

One flare (either enclosed ground flare or partially enclosed horizontal flare) would also be required for this option to burn excess gas. A conservative SWL for the flare has been taken to be 120 dBA based on noise measurements of flares carried out previously.

The plant associated with the gas fired power station including the flare would be located between the 3rd and 4th longwall panels.

Compression and On-Sell (Offsite)

It is understood from discussions with BMA that there could potentially be three reciprocating style compressors (CAT G3608 or similar). Each compressor would comprise the following:

- Engine / Compressor – SWL 123 dBA;
- Exhaust – SWL 140 dBA;
- Air Inlet – SWL 128 dBA; and
- Cooling fans – SWL 91 dBA

The SWL data for the compressors is for an unmitigated unit (i.e. no housing or silencers).

One flare (either enclosed ground flare or partially enclosed horizontal flare) would also be required for this option to burn excess gas. A conservative SWL for the flare has been taken to be 120 dBA based on noise measurements of flares carried out previously.

The plant associated with this option, including the flare, would be located between the 3rd and 4th longwall panels.

Flares Used to Burn Gas

A total number of three flares (either enclosed ground flares or partially enclosed horizontal flares) would be required for this option. A conservatively high SWL for one flare has been taken to be 120 dBA based on noise measurements of flares carried out previously. The flares would be located between the 3rd and 4th longwall panels.

5.4.3 Red Hill Accommodation Village Noise Modelling

Noise modelling was carried out to assess construction and operational noise emission from the proposed Red Hill accommodation village. Noise modelling was also carried out to predict general mine noise levels at the proposed accommodation village location.

Construction Noise

Construction equipment and numbers that will be used during the construction phase of the proposed Red Hill accommodation village are shown in **Table 30**.

Table 30 Construction Scenario, Plant and Numbers – Proposed Red Hill Accommodation Village

Construction Scenario	Activity	Equipment	Number
Bulk Earthworks – Cut	Ground removal	CAT 631 Scraper	2
		30 T Excavator	2
	Ripping	D10 Bulldozer with ripper	2
Bulk Earthworks – Fill	Placement	CAT 631 Scraper	2
		CAT 773 Dump truck	4
	Add water	CAT 777 Water truck	2
	Grade	CAT 16 Grader	2
	Roll	825 Roller Compactor	2
Install Pavement (direct supply)	Deliver material from quarry	Road Truck - B-double / triple	2
	Add water	CAT 777 Water truck	2
	Grade material	CAT 16 Grader	2
	Roll	825 Roller Compactor	2
Village Assembly	Delivery	Road Truck - B-double / triple	4
	Lifting	100T outrigger	1
		Roughie - 4WD 50T	2
		Franna - up to 20T	2
	Access	Elevated Work platform	2
		Scissor Lift	2
	Concrete delivery	Concrete truck	4
		Concrete pump	2
	Construction equipment	Air compressor	2
		Generators	2
		Welders	2
		Winches	2

The SWLs of the equipment shown in **Table 30** are given in **Table 24**.

Operational Noise

The main facilities located within the proposed Red Hill accommodation village will include the following:

- rooms;
- kitchen and dining (crib room);
- laundry;
- indoor recreational areas;
- BBQ and outdoor entertainment area;
- Sports Club (gym, meeting rooms, coffee shop, lap pool, basketball court);
- water treatment plant;
- wastewater treatment plant; and,
- washdown.

SPLs of the noise sources within the operational proposed Red Hill accommodation village include:

- Accommodation rooms:
 - o air conditioning plant - 65 dBA @ 3 m (1 unit per 4 rooms);
 - o backup generator/s - 85 dBA @ 1 m; and
 - o kitchen refrigeration - 93 dBA (SWL – adjusted for tonality).
- Recreational facilities - air conditioning plant - 70 dBA @ 3 m (assume 4 units).
- Lap pool pump - 70 dBA @ 1 m (adjusted for tonality).
- Sports field (shouting) - 96 dBA (SWL).
- Refuse Collection - 105 dBA (SWL).
- Water treatment plant:
 - o air compressors x 2 - in acoustic enclosure to achieve 85 dBA @1 m;
 - o blowers x 2 - in acoustic enclosure to achieve 85 dBA @1 m; and
 - o dosing pumps x 2 - 63 dBA (SWL).
- Wastewater treatment plant:
 - o air compressors x 2 - in acoustic enclosure to achieve 85 dBA @1 m;
 - o blowers x 2 - in acoustic enclosure to achieve 85 dBA @1 m;
 - o dosing pumps x 2 - 63 dBA (SWL); and
- Washdown - 93 dBA (SWL).

The above noise sources are a combination of both supplied data and SLR's internal noise source data base.

Accommodation rooms have been assumed to be constructed from a material which provides 20 dBA façade reduction (or higher). All rooms are assumed to be air conditioned and provided with filtered fresh air.

For the purposes of the noise modelling, the plant items have been located near the centre of the proposed Red Hill accommodation village area as shown in **Figure 2**.

For the purposes of assessing general mine noise at the positions of the accommodation units in the Red Hill accommodation village, receivers have been evenly distributed across the footprint of the proposed Red Hill accommodation village in the SoundPLAN noise model. The highest predicted level has then been reported.

6 TRANSPORTATION NOISE MODELLING PROCEDURES

6.1 CoRTN Road Traffic Noise Prediction Method

CoRTN was developed by the UK Department of Transport in 1984 and was used to calculate the effect of road traffic increases due to the construction and operational phases. It allows calculation of the statistical descriptors LA10(1hour) and an average LA10(18hour). These values are used to represent the highest traffic noise levels during a one hour period during the day and the overall traffic noise levels during the day respectively.

Existing and estimated future traffic patterns for Moranbah Access Road, Goonyella Road, Red Hill Road and Riverside Access Road are summarised in **Table 31** and have been assumed for the purpose of assessing the road traffic noise impact due to construction and operational activities.

Table 31 Baseline Road Traffic Parameters

Road	Year 2009/10 Traffic Census		Year 2020 Projection		Year 2020 Projection with the Project (Construction Phase)		Year 2020 Projection		Year 2022 Projection with the Project (Operational Phase)		Year 2032 Projection		Year 2032 Projection with the Project (Operational Phase)	
	AADT ¹	% Heavy Vehicles	AADT ¹	% Heavy Vehicles	AADT ¹	% Heavy Vehicles	AADT ¹	% Heavy Vehicles	AADT ¹	% Heavy Vehicles	AADT ¹	% Heavy Vehicles	AADT ¹	% Heavy Vehicles
Moranbah Access Road – Peak Downs Hwy to Mills Ave	4,691	10.5	6,177	10.5	6,337	11.2	6,393	10.5	6,481	11.0	9,018	10.5	9,106	10.9
Moranbah Access Road – Mills Ave to Curtin St	4,297	9.5	5,658	9.5	6,118	9.7	5,856	9.5	6,244	9.5	8,261	9.5	8,649	9.5
Goonyella Road – Curtin St to Red Hill Road	3,263	18.4	4,152	18.4	4,612	17.8	4,296	18.3	4,684	17.6	6,061	18.4	6,449	17.8
Goonyella Road – Red Hill Road to Riverside Access Road	2,391	18.9	3,042	18.9	3,082	18.6	3,148	18.9	3,188	18.6	4,441	18.9	4,481	18.7
Red Hill Road	919	27.8	1,169	27.8	1,589	23.9	1,210	27.8	1,558	23.7	1,707	27.8	2,055	24.7
Riverside Access Road	1,629	11.7	2,072	11.6	2,112	11.4	2,145	11.7	2,185	11.4	3,026	11.7	3,066	11.5

Note 1: AADT – Annual Average Daily Traffic

6.2 Nordic Rail Traffic Noise Prediction Method

The Nordic Rail Traffic Noise Prediction Method (Kilde 130) dates from 1984. As this method reliably delivers accurate predictions (typically within 2 dBA), it has been commonly utilised in rail noise assessments across Queensland for over a decade. It calculates emission noise levels based on the number of trains, speed, and length, and predicts $L_{Aeq}(24\text{hour})$ and pass-by maximum levels as required by QR *Code of Practice*.

Rail noise levels from the section of rail associated with the GRM incremental expansion and the RHM underground expansion option have been predicted at all receptor locations. The parameters used to calculate the future rail noise levels, summarised in **Table 32**, were supplied by BMA and QR and have been confirmed by BMA as suitable.

Table 32 Train Movements for the GRM incremental expansion and the RHM underground expansion option

Parameter	Future (Riverside Loop)
Number of train movements per day (average)	6.2
Notch setting of train	Notch 1 / 2
Speed of train	1 km/h
Length of train	2,040 m
Number and type of locomotives	3 x E40AC-V2 (Siemens)

Note 1: Although train speeds have been stated as travelling at 4-6 km/h (i.e. walking pace) through the rail loops, the algorithm for rail calculations predicts accurately at speeds greater than 30 km/h. The rail noise model has therefore been configured with train speeds of 30 km/h (which will calculate conservatively high).

Rail noise emissions were represented by two noise sources:

- electric locomotives; and
- freight consist (coal wagons).

Rail noise levels were predicted by reference to the general rolling stock emissions used by QR for all Queensland rail noise assessments.

The rail noise emission levels calculated using the Nordic Rail Traffic Noise Prediction Method were incorporated into the SoundPLAN noise modelling predictions discussed in **Section 5**.

7 NOISE IMPACT ASSESSMENT

7.1 Construction Noise

The distances at which the nominated criteria of L_{Amax} 65 dB (for Eureka Village and the proposed Red Hill accommodation village) and L_{Amax} 50 dB (for all other residences) would be achieved for calm and worst case (enhanced propagation) weather conditions has been calculated using SoundPLAN. These off-set distances can be considered to be minimum 'buffer' distances between the construction activities and nearby noise receptors for compliance with the nominated construction criteria.

Table 33 Predicted Off-Set Distances for Construction Activities – Red Hill CHPP / MIAs / Stockpiles

Construction Scenario	Predicted Minimum Off-Set Distance to achieve LA _{max} 65 dB		Potential Exceedences	Predicted Minimum Off-Set Distance to achieve LA _{max} 50 dB		Potential Exceedences
	Calm Weather Conditions	Enhanced Propagation		Calm Weather Conditions	Enhanced Propagation	
Install Pavement (direct supply)	340 m	410 m	None	970 m	1,410 m	None
Install Pavement (via Stockpile)	410 m	490 m	None	1,210 m	1,710 m	None
Bulk Earthworks – Cut	240 m	270 m	None	740 m	960 m	None
Bulk Earthworks – Fill	370 m	450 m	None	1,070 m	1,550 m	None
Plant Assembly	270 m	320 m	None	820 m	1,090 m	None

Table 34 Predicted Off-Set Distances for Construction Activities – Gas Drainage – Gas Wells

Construction Scenario	Predicted Minimum Off-Set Distance to achieve LA _{max} 65 dB		Potential Exceedences	Predicted Minimum Off-Set Distance to achieve LA _{max} 50 dB		Potential Exceedences
	Calm Weather Conditions	Enhanced Propagation		Calm Weather Conditions	Enhanced Propagation	
Gas Well – Creating Lease Pad	230 m	250 m	None	690 m	900 m	None
Gas Well – Drilling well	210 m	230 m	None	610 m	820 m	None
Gas Well – Assembly	110 m	110 m	None	350 m	420 m	None

Table 35 Predicted Off-Set Distances for Construction Activities – Gas Drainage – Gas Gathering Pipeline System

Construction Scenario	Predicted Minimum Off-Set Distance to achieve LA _{max} 65 dB		Potential Exceedences	Predicted Minimum Off-Set Distance to achieve LA _{max} 50 dB		Potential Exceedences
	Calm Weather Conditions	Enhanced Propagation		Calm Weather Conditions	Enhanced Propagation	
Clearing, grubbing and stripping of topsoil	260 m	320 m	None	820 m	1,110 m	None
Trenching, and lowering and welding	190 m	210 m	None	540 m	760 m	None
Backfill of pipe and testing	300 m	360 m	None	890 m	1,210 m	None
Horizontal Directional Drilling (Crossing Issac River)	120m	130 m	None	380 m	460 m	None
Access Track Construction	300 m	370 m	None	900 m	1,250 m	None

Table 36 Predicted Off-Set Distances for Construction Activities – Gas Drainage – Gas Facility

Construction Scenario	Predicted Minimum Off-Set Distance to achieve LA _{max} 65 dB		Potential Exceedences	Predicted Minimum Off-Set Distance to achieve LA _{max} 50 dB		Potential Exceedences
	Calm Weather Conditions	Enhanced Propagation		Calm Weather Conditions	Enhanced Propagation	
Install Pavement (direct supply)	240 m	290 m	None	750 m	970 m	None
Bulk Earthworks – Cut	190 m	200 m	None	540 m	730 m	None
Bulk Earthworks – Fill	250 m	310 m	None	800 m	1,050 m	None
Plant Assembly	210 m	230 m	None	630 m	830 m	None

Table 37 Predicted Off-Set Distances for Construction Activities – Red Hill Accommodation Village

Construction Scenario	Predicted Minimum Off-Set Distance to achieve LA _{max} 65 dB		Potential Exceedences	Predicted Minimum Off-Set Distance to achieve LA _{max} 50 dB		Potential Exceedences
	Calm Weather Conditions	Enhanced Propagation		Calm Weather Conditions	Enhanced Propagation	
Bulk Earthworks – Cut	210 m	220 m	None ¹	608 m	820 m	None ¹
Bulk Earthworks – Fill	320 m	390 m	None ¹	936 m	1,330 m	None ¹
Install Pavement (direct supply)	290 m	350 m	None ¹	859 m	1,170 m	None ¹
Village Assembly	280 m	350 m	None ¹	862 m	1,180 m	None ¹

Note 1 This assumes that the village would be fully constructed before it was used

It can be seen from **Table 33**, **Table 34**, **Table 35**, **Table 36** and **Table 37**, for all construction activities, the closest sensitive receiver is further away than the minimum off-set distance required to achieve the nominated construction noise criteria. No further noise mitigation options for construction noise are considered necessary.

7.2 Operational Noise

As previously mentioned in **Section 5.4.2**, noise impacts from operation are made up of the following components:

- Continuous or steady state noise from fixed plant items. This represents noise levels that are effectively continuous and this noise is assessed against the background creep criteria (LA₉₀).
- Variable noise from conveyor alarms, which has been assessed against sleep disturbance criteria. Conveyor alarms warn operators of conveyor start-ups and therefore represent an intermittent noise source.
- Other variable noise sources such as mobile plant and train loading. These sources are not operating on a continuous basis, and/or are operating at a range of locations. Noise from these sources has been assessed against the nominated average (LA_{eq}) noise criteria.

7.2.1 Steady State Plant - Fixed Plant and Conveyors Including Gas Drainage Options

Table 38 presents the results of the noise modelling predictions for steady-state (LA₉₀) noise levels from the fixed plant, conveyors, upcast vents, gas wells and the gas drainage options for neutral and worst case weather conditions. **Table 38** also shows the nominated background creep criteria from **Section 4.2**.

Noise from fixed plant is not expected to change over the lifetime of the project and therefore the predicted levels in **Table 38** would be the same for FY2020 'start of mine', FY2030 'mid-life of mine' and FY2040 'end of mine'.

Colour noise contour plots of the noise emissions are shown in **Appendix E** (Neutral Weather Conditions) and **Appendix F** (Worst Case Weather Conditions). All noise contours have been calculated at 1.5 m above ground level.

From the information contained in **Table 38**, the nominated background creep criteria for steady-state noise sources are predicted to be achieved at all locations under neutral weather conditions.

Under worst case weather conditions, the relevant steady-state operational noise criteria are predicted to be achieved at all locations with the exception of Eureka Village.

The predicted exceedences at Eureka Village are largely due to noise from conveyor CV-802 and CV-811, which are associated with product coal stacking and reclaiming at the new CHPP. It is noteworthy that an exceedence of 2 dBA is generally considered marginal in environmental acoustics and is only predicted under worst case weather conditions. Never-the-less, noise mitigation options for Eureka Village is discussed further in **Section 9.2**.

Table 38 Predicted Operational Noise Levels for Fixed Plant, Conveyors, Gas Wells and Gas Drainage Options

Location	Property Reference	LA90/LAeq (dBA)	Criteria	Predicted Noise Level (dBA) for Fixed Plant, Conveyors, Gas Wells					
				Flaring		Power Generation		On-Selling	
				Neutral Weather Conditions	Worst Case Weather Conditions	Neutral Weather Conditions	Worst Case Weather Conditions	Neutral Weather Conditions	Worst Case Weather Conditions
1	Broadlea	25	<10	12		<10	12	<10	14
2	Broadmeadow Cottage 1	N/A ¹	-	-		-	-	-	-
3	Broadmeadow Cottage 2	N/A ¹	-	-		-	-	-	-
4	Broadmeadow Homestead	N/A ¹	-	-		-	-	-	-
5	Burton Downs Homestead	35	<10	17		<10	17	11	18
6	Dabin	25	<10	<10		<10	<10	<10	<10
7	Denham Park Homestead	35	10	18		11	18	11	19
8	Lapunyah Homestead	35	17	25		17	25	18	25
9	Moranbah	25	<10	<10		<10	<10	<10	<10
10	Nibbereena	25	<10	14		<10	14	<10	14
11	Pretoria Homestead	25	<10	13		<10	13	<10	13
12	Red Hill	35	19	26		20	26	21	27
13	Riverside Homestead	N/A ¹	-	-		-	-	-	-
14	Rugby	25	<10	<10		<10	<10	<10	<10
15	Eureka Village	50	47	52		47	52	47	52
-	Proposed Red Hill Accommodation Village	50	32	37		32	38	33	38

Note: Levels in bold and highlighted indicates an exceedence of the relevant noise criteria.

Note 1: BMA will seek to negotiate a compensation agreement with the landowners of Riverside Homestead, Broadmeadow Homestead and Broadmeadow Cottages 1 and 2 and, if required, will manage the occupancy of the dwellings.

7.2.2 Conveyor Alarms

Conveyor alarm noise has been assessed by predicting the minimum offset distance to achieve the external sleep disturbance criteria of L_{Amax} 65 dB at the proposed Red Hill accommodation village and Eureka Village, and L_{Amax} 50 dB for all other residences. A SWL of 134 dBA for a conveyor alarm has been used based on previous measurements of conveyor alarms including a +5dBA correction to account for the tonal and intermittent nature of alarm noise.

The predicted minimum offset distances are shown in **Table 39**.

Table 39 Predicted Minimum Offset Distances for Conveyor Alarm Noise

Noise Source	Predicted Minimum Off-Set Distance to achieve L_{Amax} 65 dB		Potential Exceedences	Predicted Minimum Off-Set Distance to achieve L_{Amax} 50 dB		Potential Exceedences
	Neutral Weather	Worst Case Weather		Neutral Weather	Worst Case Weather	
Conveyor Alarm	490 m	710 m	None	1,610 m	2,120 m	None

As shown in **Table 39**, the assessment of conveyor alarms has indicated that the nominated external sleep disturbance criteria will be achieved at all receptors within the Project study area. No Further noise mitigation options for conveyor alarm noise are considered necessary.

7.2.3 Variable Noise Sources - Mobile Plant and Rail Operations

Table 40 presents the combined results of the noise modelling predictions for average (L_{Aeq}) noise levels from the mobile plant and rail movements associated with the three operational phases (FY2020, FY2030, FY2040) and the predicted steady-state noise levels from **Table 38** for fixed plant, conveyors, upcast vents and gas wells. For the steady-state noise levels, the predicted levels include noise emissions from the on-sell gas management option, as this has been used to represent the 'worst case' gas management option. The results are presented for neutral and worst case weather conditions.

Table 40 also shows the nominated noise criteria (L_{Aeq}) for overall noise sources (steady-state plus variable) as detailed in **Section 4.2**.

Colour noise contour plots of the noise emissions are shown in **Appendix E** (Neutral Weather Conditions) and **Appendix F** (Worst Case Weather Conditions). All noise contours have been calculated at 1.5 m above ground level.

As a project wide initiative modelling assumed that 'self-adjusting volume' or 'broad-band buzzer' type reversing alarms will be utilised to avoid additional annoyance to neighbours. Should only traditional 'constant volume beeping' type reversing alarms be used, then the L_{Aeq} noise predictions presented in **Table 40** for mobile mechanical plant could be up to 5 dBA higher to allow for the annoyance of reversing alarms.

Table 40 Predicted Operational Noise Levels for Steady-State Noise Sources, Mobile Plant and Rail Movements

Location	Property Reference	LAeq Criteria (dBA) ¹	LAeq Predicted Noise Level (dBA)					
			FY2017		FY2030		FY2040	
			Neutral Weather Conditions	Worst Case Weather Conditions	Neutral Weather Conditions	Worst Case Weather Conditions	Neutral Weather Conditions	Worst Case Weather Conditions
1	Broadlea	28	<10	17	<10	17	<10	17
2	Broadmeadow Cottage 1	N/A ²	-	-	-	-	-	-
3	Broadmeadow Cottage 2	N/A ²	-	-	-	-	-	-
4	Broadmeadow Homestead	N/A ²	-	-	-	-	-	-
5	Burton Downs Homestead	35	13	21	13	20	13	20
6	Dabin	28	<10	<10	<10	<10	<10	<10
7	Denham Park Homestead	35	14	21	13	21	13	21
8	Lapunyah Homestead	35	20	27	19	26	19	26
9	Moranbah	28	<10	<10	<10	<10	<10	<10
10	Nibbereena	28	<10	16	<10	16	<10	16
11	Pretoria Homestead	28	<10	16	<10	16	<10	16
12	Red Hill	35	21	28	21	28	21	28
13	Riverside Homestead	N/A ²	-	-	-	-	-	-
14	Rugby	28	<10	<10	<10	<10	<10	<10
15	Eureka Village	50	48	52	49	54	49	54
-	Proposed Red Hill Accommodation Village	50	33	38	33	38	33	38

Note: Levels in bold and highlighted indicates an exceedence of the relevant noise criteria.

Note 1: The LAeq 28 dBA criterion has been applied to independently owned receivers, in accordance with the Operational Criteria section.

Note 2: BMA will seek to negotiate a compensation agreement with the landowners of Riverside Homestead, Broadmeadow Homestead and Broadmeadow Cottages 1 and 2 and, if required, will manage the occupancy of the dwellings

It can be seen from **Table 40** that the combined steady state and variable operational noise levels are predicted to achieve the nominated noise criteria at all sensitive receptors other than:

- Eureka Village - predicted 2 to 4 dBA exceedences during worst case weather conditions.

The predicted exceedences at Eureka Village are largely caused by noise from conveyor CV-802 and CV-811, which are associated with product coal stacking and reclaiming at the new CHPP, and mobile plant located at the new CHPP.

It can be seen from a comparison of **Table 38** and **Table 40** that noise from fixed plant and conveyors generally dictates predicted noise levels at all nearby receptors. Noise contributions from mobile plant and rail movements are predicted to marginally increase overall noise levels at some receptor locations.

Noise mitigation options for Eureka Village are discussed in **Section 9.2.1**.

Given the distances between operational sources and receptor locations and that steady-state noise from fixed plant and conveyors generally dictates the noise levels at nearby receptors, L_{Amax} noise emissions would expected to be no greater than 5 dBA higher than the predicted L_{Aeq} levels. Therefore, the nominated sleep disturbance criteria of L_{Amax} 65 dBA and 50 dBA for accommodation villages and other residences respectively would be predicted to be achieved at all locations during neutral and worst case weather conditions.

7.3 Red Hill Accommodation Village

7.3.1 Noise Sources within the Red Hill Accommodation Village

Noise impact levels from sources within the conceptual proposed Red Hill accommodation village were calculated at the nearest accommodation unit(s) to the noise source. The calculated noise levels within the proposed Red Hill accommodation village are shown in **Table 41**.

Table 41 Noise Levels Based on Conceptual Accommodation Village Layout

Noise Source	Distance to Nearest Receiver ¹ (m)	Predicted Noise Level (dBA)	Relevant Noise Criteria
Air conditioners (accommodation units)	5	58 LAeq	50 dB LAeq
750 kVA kitchen backup generator	60	56 LAeq	50 dB LAeq
Kitchen refrigeration	60	49 LAeq	50 dB LAeq
Refuse collection	70	60 LAmax	65 dB LAmax
Maintenance operations / wash booster pump	290	36 LAeq	50 dB LAeq
Water treatment plant	170	43 LAeq	50 dB LAeq
Sewage treatment plant	120	46 LAeq	50 dB LAeq
Sports fields (shouting)	70	51 LAeq	50 dB LAeq
Recreational facilities	120	38 LAeq	50 dB LAeq
Pool pump	15	46 LAeq	50 dB LAeq

Note1: Receiver within accommodation village (i.e. unit).

Levels in bolded and highlighted indicates an exceedence of the relevant noise criteria.

Table 41 shows that L_{Amax} noise levels within the proposed Red Hill accommodation village will achieve the external criterion of 65 dB L_{Amax}. It can be seen that a number of plant items have the potential to exceed the external L_{Aeq} criterion of 50 dBA. Options for mitigating the predicted exceedences, where practicable, include:

- selection of quieter mechanical plant;
- increasing the building façade noise reduction above the nominal 20 dB used in this assessment, for example by double glazing or choice of wall materials;

- locating the plant such that it is shielded (for example behind buildings or on roof tops) from sensitive areas;
- increasing the distance between the plant and the nearest accommodation unit; and,
- placing of noise barriers or plant enclosures around noise items.

Since the assessment of noise impacts in **Table 41** is based on a conceptual village layout, it is proposed that a further acoustic assessment be undertaken during detailed design of the proposed Red Hill accommodation village. Based on the mitigation measures listed above, it is expected that an acceptable noise environment can be achieved.

7.3.2 Red Hill Accommodation Village Noise at Receptor Locations

The total noise level from the village noise sources was also predicted at the nearest existing residences (i.e. off-site) to the proposed Red Hill accommodation village. The predictions for neutral and worst case weather conditions are shown in **Table 42**.

Table 42 Noise Levels at Existing Residences from proposed Red Hill Accommodation Village

Existing Sensitive Receiver	Accommodation Noise Level LA90 (dBA)	
	Neutral	Worst Case
1 – Broadlea	< 10	< 10
2 – Broadmeadow Cottage 1 ¹	-	-
3 – Broadmeadow Cottage 2 ¹	-	-
4 – Broadmeadow Homestead ¹	-	-
5 – Burton Downs Homestead	< 10	< 10
6 – Dabin	< 10	< 10
7 – Denham Park Homestead	< 10	< 10
8 – Lapunyah Homestead	< 10	< 10
9 – Moranbah Township	< 10	< 10
10 – Nibbereena	< 10	< 10
11 – Pretoria Homestead	< 10	< 10
12 – Red Hill	< 10	< 10
13 – Riverside Homestead ¹	-	-
14 – Rugby	< 10	< 10
15 – Eureka Village	< 10	< 10

Note 1: BMA will seek to negotiate a compensation agreement with the landowners of Riverside Homestead, Broadmeadow Homestead and Broadmeadow Cottages 1 and 2 and, if required, will manage the occupancy of the dwellings

The results in **Table 42** indicate that noise emissions from proposed Red Hill accommodation village will be negligible at surrounding receiver locations.

7.3.3 Blasting Assessment

Based on a review of the measured vibration levels detailed in **Section 3.3** the distances between the proposed Red Hill accommodation village, and the locations of blasting at GRB mine complex, blasting noise and vibration levels at the proposed Red Hill accommodation village is unlikely to cause unacceptable impacts and further assessment is not required.

7.4 Transportation

7.4.1 Rail

It can be seen from **Table 40** (Section 7.2.3) that overall noise levels including rail noise are below the *Planning for Noise Control* guideline as well as the 65 dBA $L_{Aeq}(24\text{hour})$ criterion contained in QR's *Code of Practice* (which would be used to assess rail noise emissions elsewhere on the QR network). Therefore predicted average (i.e. L_{Aeq}) noise levels from the railway are considered to be acceptable.

In addition, based on the predicted overall average noise level (L_{Aeq}) and the offset distance between the railway and the receptors, maximum noise levels from rail movements would also readily achieve the 87 dBA L_{Amax} criterion contained in QR's *Code of Practice* at all surrounding receptor locations.

7.4.2 Road Traffic Noise

Based on the traffic volumes and compositions described in **Section 6.1** of this report, **Table 43** shows the expected increase in road traffic noise levels associated with construction and operation related vehicle movements.

Table 43 Increase in Road Traffic Noise Levels due to Construction and Operational Vehicles

Road Segment	Predicted Increase in $L_{A10}(18\text{hour})$ Noise Levels (dBA)		
	Construction Phase	Operational Phase	
		2018	2028
Moranbah Access Rd – Peak Downs Hwy to Mills Ave	0.2	0.1	0.1
Moranbah Access Rd – Mills Ave to Curtin St	0.4	0.3	0.2
Goonyella Rd – Curtin St to Red Hill Rd	0.4	0.3	0.2
Goonyella Rd – Red Hill Rd to Riverside Access Rd	0.0	0.0	0.0
Red Hill Rd	1.0	0.7	0.5
Riverside Access Rd	0.0	0.0	0.0

As changes in environmental noise levels of less than 2 dBA are generally unnoticeable to the human ear, no adverse impact is anticipated due to road traffic associated with the GRM incremental expansion or RHM underground expansion option.

7.5 Cumulative Mining Noise Impacts

Cumulative noise impacts are inherently assessed through the background creep (L_{A90}) and specific/intrusive (L_{Aeq}) criteria (see **Section 4.2**) contained in the *Planning for Noise Control* guideline. Both criteria take into account the existing ambient noise level in an area from all existing industry and other noise sources such as road and railway traffic.

The *Planning for Noise Control* assessment methodology is based on the existing ambient noise monitoring (undertaken at eight locations surrounding the GRB mine complex) and comparison to recommended ambient noise levels. Hence, it takes account of cumulative impacts from existing operations and activities.

The cumulative effect of the existing industry and other noise sources, together with the proposed RHM, is assessed to not exceed the recommended ambient noise levels. If the existing ambient noise level is already above the recommended noise levels, the associated criteria for the proposed mine are set up to 10 dBA below the existing ambient noise level to prevent the cumulative effects of existing and proposed industry from increasing above existing ambient noise levels.

SLR notes there is an EIS currently underway for the proposed Grosvenor Coal Mine. SLR's review of the relevant sections note that this proposed mine is an underground coal mine south of the existing North Moranbah Mine (Anglo American owned). The proposed mine will utilise existing surface facilities at North Moranbah Mine including their existing CHPP.

As the proposed mine will utilise existing surface facilities, and the main proposed surface facilities are to be located to the south of North Moranbah Mine, it is considered that noise emissions from the proposed mine will be no greater than the noise emissions from North Moranbah Mine. Further, the existing ambient noise monitoring undertaken has inherently captured noise contributions from North Moranbah Mine (where applicable).

8 NOISE IMPACT ASSESSMENT ON FAUNA

8.1 Introduction

The effect of noise from human activities on fauna is increasingly a subject of concern in the community when proposing developments such as new infrastructure, mines or industrial developments. The potential effects of noise on wildlife include physical damage to hearing, increased energy expenditure or physical injury while responding to noise, interference with normal animal activities and impaired communication. Ongoing impacts of these effects might include habitat loss through avoidance, reduced reproductive success and increased mortality.

While noise impacts on people are commonly regulated, there are no government policies or other widely accepted guidelines as to noise levels or thresholds that may have an adverse effect on wildlife. One reason for the lack of guidelines is that noise effects on most wildlife species are poorly understood (Larkin et al. 1996, Brown 2001; OSB 2003, summarised in AMEC 2005). The lack of understanding of noise effects on wildlife is understandable when the following points are considered:

- Response to noise disturbance cannot be generalised across species or among genuses. Studies of one species cannot be extrapolated to other species.
- Hearing characteristics are species-specific. For example, noise impacts on humans are determined using a frequency weighting filter (A-weighting) which corresponds to human hearing characteristics, determined through laboratory testing. The frequency-dependent hearing characteristics of animals cannot be determined in this way.
- When studying of noise effects on animals it can be difficult to separate noise effects from other sensory disturbing effects (e.g. visual or olfactory cues).
- Experimental research in a laboratory is not always applicable in a natural setting.

As with humans, an animal's response to noise can depend on a variety of factors, including noise level, frequency distribution, duration, number of events, variation over time, rate of onset, noise type, existence and level of ambient noise, time of year, and time of day. The animal's location, age, sex, and past experience may also affect their response to noise.

- The US FHA review summarises the sensitivities of various groups of wildlife to noise as follows:
 - o mammals < 10 Hz to 150 kHz; sensitivity to -20 dB;
 - o birds (more uniform than mammals) 100 Hz to 8-10 kHz; sensitivity at 0-10 dB;
 - o reptiles (poorer than birds) 50 Hz to 2 kHz; sensitivity at 40-50 dB; and
 - o amphibians 100 Hz to 2 kHz; sensitivity from 10-60 dB.

Despite the difficulties associated with assessing noise impacts on animals, studies have been done that can assist in drawing some general conclusions. The literature in the field has been collated in a number of reviews including AMEC 2005 (noise from mining operations), Dawe and Goosem 2008 (road traffic noise impacts, an Australian study), Mancini et al. 1988 (effect of aircraft noise and sonic booms), and US FHA 2004 (road traffic noise impacts). Some key findings of these reviews are summarised here. For original references, the reader is directed to these review studies. A tabular summary of studies and effects is given in Mancini et al..

8.2 Mammals

Manci et al. (1998) state that:

'Sound levels above about 90 dB are likely to be adverse to mammals and are associated with a number of behaviours such as retreat from the sound source, freezing, or a strong startle response. Sound levels below about 90 dB usually cause much less adverse behavior. Laboratory studies of domestic mammals have indicated that behavioural responses vary with noise types and levels, and that domestic animals appear to acclimate to some sound disturbances.'

The US FHA review notes that some mammals avoid roads, and that in some cases this avoidance behaviour has been attributed to noise.

Very few of the mammal studies in the literature state absolute levels above which physiological damage may occur. One case described in Manci et al. (1998) is a study of guinea pigs showing anatomical damage and hearing loss when exposed to sonic booms at 130 dB.

8.3 Birds

Measures of absolute auditory sensitivity in a wide variety of bird species show a region of maximum sensitivity between 1 and 5 kHz, with a rapid decrease in sensitivity at higher frequencies. The data suggests that in this frequency range birds show a level of hearing sensitivity that is similar in most respects to that found for the most sensitive mammals, with avian performance clearly inferior above and below this range of frequencies (Manci et al. 1998).

The general conclusion of the US FHA review is that some (although not all) bird species are sensitive to road traffic noise at least during breeding and that the distances over which this effect is seen can vary considerably, from a few meters to more than 3 km away. Reduced bird diversity and density of bird life near to roads, in some cases associated with average noise levels above 50 dBA.

Dawe and Goosem (2008) state that:

'Anthropogenic noise can also trigger flight and alert responses in birds and altered behaviour after the noise disturbance, which can lead to reduced breeding success, at noise levels ranging from 65-85 dB(A). Complete habituation to such disturbance does not always occur, even in less noise-sensitive species.'

With respect to peak noise levels such as sonic booms, studies of various species have shown startle responses for a range of noise levels from 70 dBA up to 145 dBA. For example, birds may flush from the nest in response to a sudden loud noise, but in most cases will return within ten minutes.

8.4 Reptiles

Sound perception appears to be subordinate in importance to vision or chemoreception in the activities of most reptiles, but studies have shown that certain desert reptiles are sensitive to low-intensity sound (Manci et al. 1998). Noise may be of more adaptive significance for nocturnal species because full use cannot be made of vision. Critical environmental sounds are often of relatively low intensity (eg the movement of insect prey and predators such as snakes and owls).

Some studies reviewed by Manci et al. (1998) indicate hearing damage to some lizard species after exposure to steady noise levels above 95 dB.

8.5 Amphibians

Sound influences the activities of most amphibians and plays a significant role in the reproductive behavior of many, but not all, species (Manci et al. 1998). Dawe and Goosem (2008) consider that the degree to which traffic noise affects frog densities remains unclear, although some factor associated with roads and traffic has been shown to reduce frog populations.

Specific noise levels which may result in an adverse impact on amphibians are not available in the literature.

8.6 Invertebrates

Manci et al. describe several studies on the effects of noise on insects. In some cases, noise has been studied with a view to controlling pest insects such as meal-moths and flour beetles, with some success in reducing hatching from the larval stage. Some studies have shown reduced lifespan in insects exposed to noise, and reduced number of eggs produced by females.

Some insects (including bees) stop moving when exposed to high noise levels. Honey bees ceased moving for up to 20 minutes in response to frequencies between 200 and 2,000 Hz with intensities varying from 107-119 dB and did not appear to habituate to the sound (Manci et al. 1998).

8.7 Conclusions

It is clear that noise can have adverse effects on wildlife and domesticated mammals, with different species being more or less sensitive to noise. As with humans, extremely high noise levels can result in hearing damage or other physiological effects. At lower noise levels, it seems likely that animals avoid anthropogenic noise sources and prefer to occupy areas further from noise sources.

On the basis of the literature, and noting the difficulties inherent in assessing noise impacts on fauna described in **Section 8.1**, the following conclusions are drawn:

- Adverse impacts on fauna are highly unlikely at noise levels below 50 dBA LAeq, and unlikely at noise levels below 65 dBA LAeq.
- Long-term adverse impacts on fauna are unlikely to arise from short duration, high noise events. These events may, however, result in a short-term startle response.
- Very high maximum noise levels may result in hearing loss or other long-term physiological effects. The threshold of hearing damage is likely to be species and frequency dependent, and as with humans, damage may be cumulative over time.

It is considered that fauna (including domesticated mammals) exposed to less than **65 dBA LAeq** are unlikely to experience adverse impacts associated with the GRM incremental expansion or RHM underground expansion option.

On review of the noise contours contained within **Appendix E** and **Appendix F**, it is noted that noise levels of 65 dBA LAeq are predicted adjacent to the proposed fixed plant, and centred on the Red Hill CHPP / stockpiles, the Red Hill MIA, and the gas management hub. Due to the extensive areas outside these three fixed plant locations which fauna can occupy, as well as the potential for increased startle cues within these three fixed plant locations, it is expected that fauna are unlikely to experience any adverse impacts.

9 NOISE MITIGATION MEASURES

9.1 Construction Noise

Construction noise levels are predicted to achieve the nominated noise criteria at all receptors.

In the event of complaints (from either independent residents or residents of BMA owned accommodation), an investigation of construction noise should occur and this investigation should include monitoring of noise levels and identification of mitigation measures to address identified construction noise issues.

Prior to commencement of construction, and at regular intervals during construction, existing BMA community liaison networks should be used to inform noise receptors of the proposed construction activities, and contact details in the event that construction noise related issues are experienced.

AS 2436-1981 *Guide to Noise Control on Construction, Maintenance and Demolition Sites* sets out numerous practical recommendations to assist in mitigating construction noise emissions. In the event that noise complaints or issues arise during construction activities, consideration will be given to the following noise control strategies:

- Use of quieter plant and equipment if possible while still being able to undertake the work efficiently.
- Increased maintenance of equipment in order to noise attenuation features in good working order.
- Awareness raising among operators of construction equipment to identify potential noise problems and techniques to minimise noise emission such as turning equipment off when not in use.
- Relocation of noise sources away from receptors if possible.

9.2 Operational Noise

The use of 'self-adjusting volume' or 'broad-band buzzer' type reversing alarms should be adopted where required to avoid additional annoyance to neighbours and those in accommodation villages.

BMA will also continue to maintain contact with local residents through its community consultation framework to inform local residents of potential noise impacts, and make available information on contacting BMA in the event that noise related disturbance occurs. Where noise complaints are received, BMA will investigate the complaint using its established complaint procedures and determine mitigation measures to address noise issues.

9.2.1 Eureka Village

If required, the following measures are available to mitigate operational noise at Eureka Village:

- Use low noise idlers for CV-802 and CV-811 which would be expected to achieve a noise reduction of around 6 dB and likely result in compliance with the noise criteria under worst case weather conditions.

- If necessary, improve the noise attenuation performance of the accommodation units. The nominated operational noise criteria for Eureka Village is based on a conservative outside to inside noise reduction of 20 dBA for the accommodation units. In practice the noise attenuation performance of the accommodation units may be better than the assumed 20 dBA and in fact may be able to achieve the required 24 dBA noise reduction to achieve the internal 30 dBA LAeq criterion. It is recommended that measurement of the acoustic performance of the accommodation units be carried out to confirm, or otherwise, the need for acoustic upgrades. If upgrades are required, it would be possible to achieve significantly higher outside to inside noise reductions using acoustically upgraded constructions for the accommodation units (for example thicker glazing, acoustic door seals and upgraded wall constructions). This would require further assessment at the detailed design stage, however it is expected that an outside to inside noise reduction of 25 to 30 dBA would be readily achievable without the need for extensive modifications to the units (which would be sufficient to achieve the nominated internal noise criteria).
- Construct earth bunds and/or noise barriers around the north and eastern edges of Eureka Village to reduce noise levels from sources located at the Red Hill and Riverside CHPPs and stockpile areas.

It is considered that acceptable operational noise levels could be achieved at Eureka Village using one or more of the above noise control options. This would be subject to a detailed assessment at the detailed design stage for the CHPP and conveyors.

9.2.2 Monitoring

The following noise management measures should also be implemented:

- Utilise existing BMA community consultation framework to provide access to information for the community and maintain positive relations with residents.
- For best practise purposes and to allow BMA to confirm that noise levels are within acceptable levels, a permanent noise monitoring program within the surrounding community will be implemented. This will also provide historical data should a complaint be lodged.

9.2.3 Investigation of Complaints

In the event of a complaint, an investigation of operational noise should occur as follows:

- Noise monitoring should be carried out within a reasonable and practical timeframe to investigate the cause of the complaint;
- The noise monitoring results should be compared with the nominated operational noise limits given in **Section 4.2**; and
- If the monitoring indicates exceedences of the nominated noise limits then further action should be taken as follows:
 - o noise mitigation measures should be implemented so that the nominated noise limits are achieved; or,
 - o the complaint should be addressed through the use of appropriate dispute resolution.

9.3 Noise Impacts from the Proposed Red Hill Accommodation Village

The results in **Section 5.4.3** indicate that noise emissions from proposed Red Hill accommodation village will be negligible at surrounding receiver locations. No mitigation is required.

L_{Amax} noise levels within the proposed Red Hill accommodation village from noise sources associated with the village will generally achieve the external criterion of 65 dB L_{Amax}. A number of plant items have the potential to exceed the external L_{Aeq} criterion of 50 dBA. Options for mitigating the predicted exceedences, where practicable, will include:

- selection of quieter mechanical plant;

- increasing the building façade noise reduction above the nominal 20 dB used in this assessment, for example by double glazing or choice of wall materials;
- locating the plant such that it is shielded (for example behind buildings or on roof tops) from sensitive areas;
- increasing the distance between the plant and the nearest accommodation unit; and,
- placing of noise barriers or plant enclosures around noise items.

Since the assessment of noise impacts in **Table 41** is based on a conceptual accommodation, it is recommended that a further acoustic assessment be undertaken during detailed design of the accommodation village. Based on the mitigation measures listed above, it is fully expected that an acceptable noise environment can be achieved.

9.4 Road Transportation

The predicted increases in the LA10(18hour) road traffic noise levels from Moranbah Access Road, Goonyella Road, Red Hill Road and Riverside Road are below 2 dBA. These levels comply with the nominated 2 dBA threshold of significance in relation to changes to the emission level (see **Section 4.3.2**). Therefore no additional mitigation measures are required.

10 CONCLUSION

A comprehensive study of both construction and operational noise levels has been undertaken.

A detailed assessment of vibration has not been required due to the offset distances between construction and operational activities and receptors, and because blasting is not required. Existing blasting vibration levels associated with the GRB mine complex have been measured at the proposed Red Hill accommodation village, and found to be acceptable.

Construction Noise

The minimum offset distances at which the nominated criteria of LA_{max} 65 dB (for Eureka Village, and the proposed Red Hill accommodation village) and LA_{max} 50 dB (for all other residences) would be achieved for neutral and worst case (enhanced propagation) weather conditions have been calculated.

Based on these calculated minimum offset distances, construction noise levels are predicted to achieve the nominated noise criteria at all sensitive receivers.

Operational Noise

Operational noise levels were predicted to achieve the nominated noise criteria at all receptors other than a 2 to 4 dBA exceedences of the nominated LA_{eq} criterion at Eureka Village during worst case weather conditions.

The use of 'self-adjusting volume' or 'broad-band buzzer' type reversing alarms should be adopted where required to avoid additional annoyance to neighbours.

The following measures are available to mitigate operational noise at Eureka Village:

- Installation of low noise idlers for CV-802 and CV-811 which would be expected to achieve a noise reduction of around 6 dB and likely result in compliance with the noise criteria under worst case weather conditions.
- Achieve (if not already achieved) outside to inside noise reductions of 25 dBA (or better) for the accommodation units using acoustically upgraded constructions for the units (eg thicker glazing, acoustic door seals, upgraded wall constructions). This will require further assessment at the detailed design stage (including onsite measurements of the existing outside to inside noise reduction of the units).

- Construct earth bunds and/or noise barriers around the north and eastern edges of Eureka Village to reduce noise levels from sources located at the Red Hill and Riverside CHPP and stockpile areas.

It is considered that acceptable operational noise levels could be achieved at Eureka Village using one or more of the above noise control options. This would be subject to a detailed assessment at the detailed design stage of the CHPP and conveyors.

The nominated sleep disturbance criteria of L_{Amax} 65 dBA and 50 dBA for accommodation villages/sites and other residences respectively were predicted to be achieved at all locations during neutral and worst case weather conditions for general steady-state and variable operational noise.

The community liaison strategies and complaints investigation program detailed in **Section 9.2** will be implemented for the project.

In summary of the above, operational noise levels are considered to be acceptable subject to a further assessment of operational noise affecting Eureka Village at the detailed design stage.

Noise Impacts from the Proposed Red Hill Accommodation Village

Existing noise and vibration levels at the proposed Red Hill accommodation village are relatively low and suitable for the accommodation villages.

Noise emissions from the proposed Red Hill accommodation village are predicted to be negligible at surrounding receiver locations.

L_{Amax} noise levels within the accommodation village from noise sources associated with the village are predicted to achieve the external criterion of 65 dB L_{Amax} . A number of plant items have the potential to exceed the external L_{Aeq} criterion of 50 dBA and the location of these items, and attenuation of noise can be addressed in the detailed design.

Since the assessment of noise impacts has been based on a conceptual accommodation design, it is recommended that a further acoustic assessment be undertaken during detailed design of the accommodation village. It is fully expected that an acceptable noise environment can be achieved.

Road Transportation

The predicted increases in the $LA_{10(18hour)}$ road traffic noise levels from Moranbah Access Road, Goonyella Road, Red Hill Road and Riverside Road are below 2 dBA. These levels comply with the nominated 2 dBA threshold of significance in relation to changes to the emission level and there no additional mitigation measures are required.

11 CLOSURE

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

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

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

12 GLOSSARY

CONCAWE	'The propagation of noise from petroleum and petrochemical complexes to neighbouring communities' prediction method
dBA	decibels (A weighted)
dB	decibels (unweighted on linear)
dB(G)	decibels (G weighted)
DIALOG	a computer based literature search database
EIS	Environmental Impact Statement
Hz	Hertz (unit of measurement for frequency)
Kilde 130	Norwegian ministry of the environment and communications rail noise prediction method
LA10 (dBA)	noise level (in decibels – A weighted) exceeded for 10 per cent of the measurement period
LA90 (dBA)	noise level (in decibels – A weighted) exceeded for 90 per cent of the measurement period
LAeq(1hour)	equivalent continuous (or 'average') noise level (in decibels – A weighted) over a 1 hour measurement period
LAm _{ax}	maximum noise level
LAeq (dBA)	equivalent continuous (or 'average') noise level (in decibels – A weighted)
LLINeq	equivalent continuous (or 'average') noise level (in decibels – No weighting or linear weighting)
L _{pA,LF}	A-weighted noise level in the range of 10Hz to 160Hz as defined in the EPA's <i>Planning for Noise Control</i> guideline
m/s	metres/second
mm/s	millimetres/second
minLA90	minimum repeatable background noise level as defined in EPA's <i>Planning for Noise Control</i> guideline

13 ACRONYMS

AADT	Annual average daily traffic
ARL	Acoustic Research Laboratories
BMA	BHP Billiton Mitsubishi Alliance
BMC	BHP Mitsui Coal
BRM	Broadmeadow Underground Mine
CoRTN	Calculation of Road Traffic Noise
CHPP	Coal handling and preparation plant
EHP	Department of Environment and Resource Management (formerly Department of Environment and Resource Management (DERM) and Environmental Protection Agency (EPA))
EIS	environmental impact statement
EPP (Noise)	Queensland <i>Environmental Protection (Noise) Policy 2008</i>
gensets	regenerator modules
GMS	Goonyella Middle Seam
GRB	Goonyella Riverside and Broadmeadow
GRM	Goonyella Riverside Mine
IMG	incidental mine gas
km	kilometre
km/hr	kilometres per hour
m	metre
m/s	metres per second
m ³ /h	cubic metres per hour
MIA	mine industrial area
ML	mine lease
MLA	mine lease area
mtpa	million tonnes per annum
MW	megawatts
PJ/annum	petajoules per annum

PNL	Planning Noise Levels
PPV	Peak Particle Velocity
PVS	Peak Vector Sum
QR	Queensland Rail
RBL	Rating Background Level
RHM	Red Hill Mine
RL	reduced levels
SLR Consulting	SLR Consulting Pty Ltd
SNL	Specific (Intrusive) Noise Level
SPL	Sound Pressure Level
SWL	Sound Power Level
URS	URS Australia Pty Ltd
WHO	World Health Organisation

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Legislation

Environmental Protection Act 1994 (EP Act)

Environmental Protection (Noise) Policy 2008 (EPP (Noise))

Environmental Protection Regulation 2008

Appendix A

Report Number 20-2291-R3

MONITORING LOCATION PHOTOGRAPHS

Monitoring Location	Photograph
1. Lapunyah Homestead -21.690367° 147.924000°	 A photograph showing monitoring equipment in a field. In the foreground, there is a black sensor unit on a pole and an orange sensor unit on the ground. A thin wire runs across the field. The background consists of tall grass and several trees under a clear sky.
2. Denham Park Homestead -21.623867° 147.930182°	 A photograph showing monitoring equipment near a building. A black sensor unit is mounted on a pole next to a wooden post. A thin wire runs across the grassy area. In the background, there is a long, single-story building with a dark roof and some trees.

MONITORING LOCATION PHOTOGRAPHS

Monitoring Location	Photograph
3. Burton Downs Homestead -21.639819° 148.081594°	 A photograph showing a grassy field enclosed by a yellow metal fence. In the center of the field, there is a circular concrete structure, possibly a well or a small pond. A black monitoring device is visible on the ground near the fence. The background shows trees and a distant hill.
4. Riverside Homestead -21.713650° 148.036517°	 A photograph showing a tennis court enclosed by a chain-link fence. A black monitoring device is visible on the ground near the fence. In the background, there is a white building and trees.

Monitoring Location	Photograph
5. Broadmeadow Homestead -21.846617° 147.948167°	
Eureka Village -21.777290° 147.941271°	

MONITORING LOCATION PHOTOGRAPHS

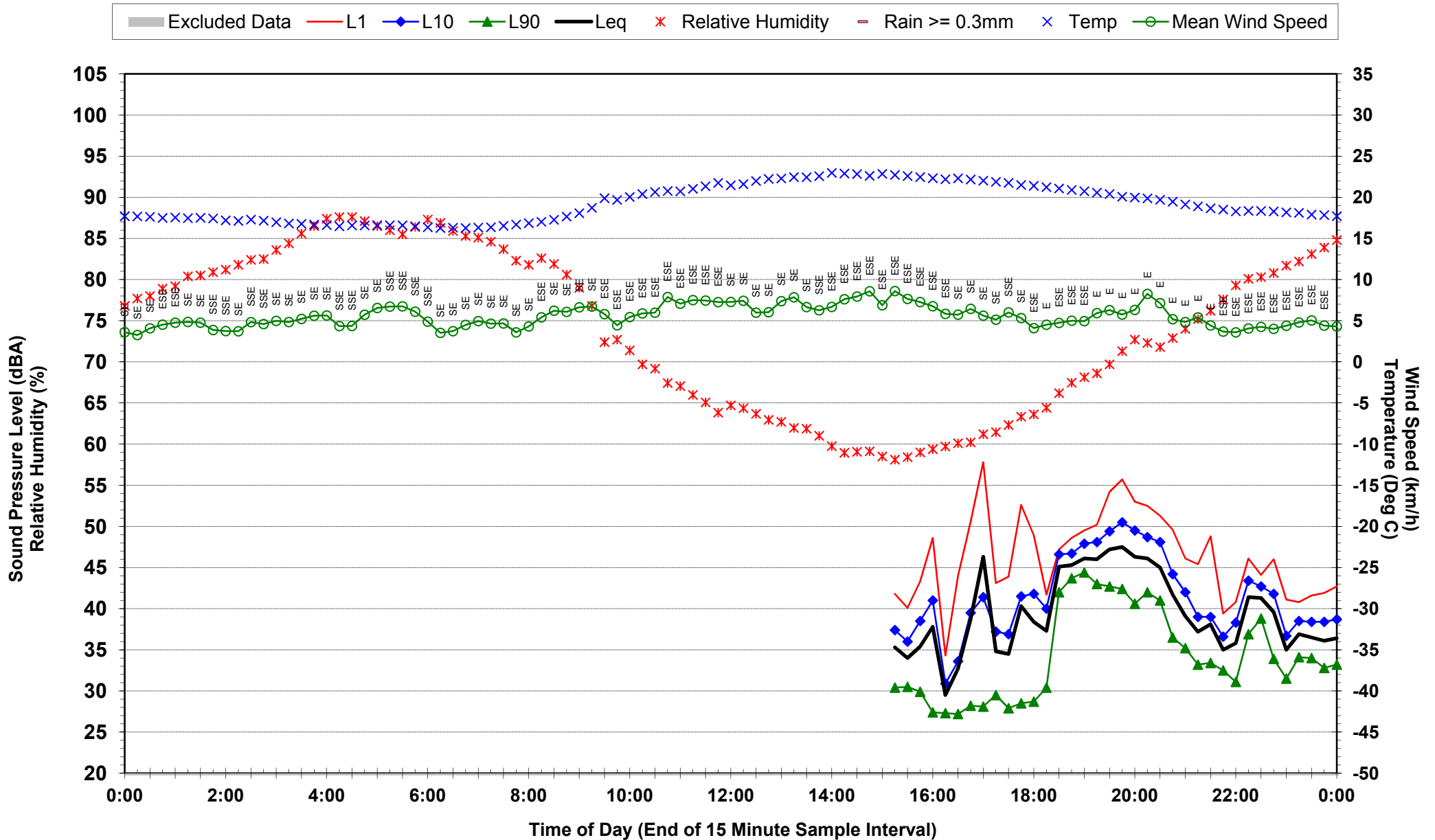
Monitoring Location	Photograph
Proposed Project Accommodation Village -21.804588° 148.045365°	

Appendix B

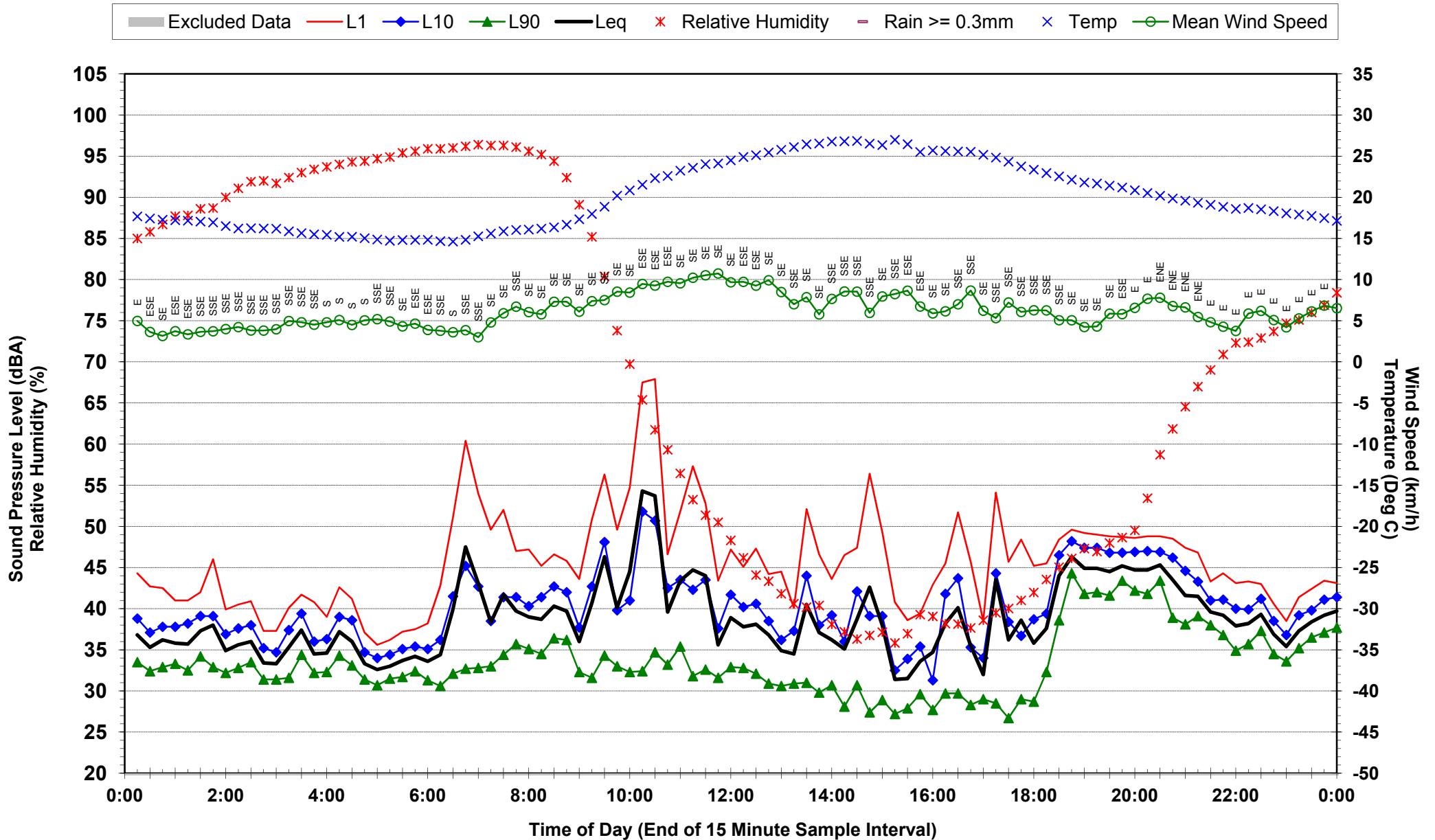
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BASELINE NOISE LOGGING MEASUREMENTS

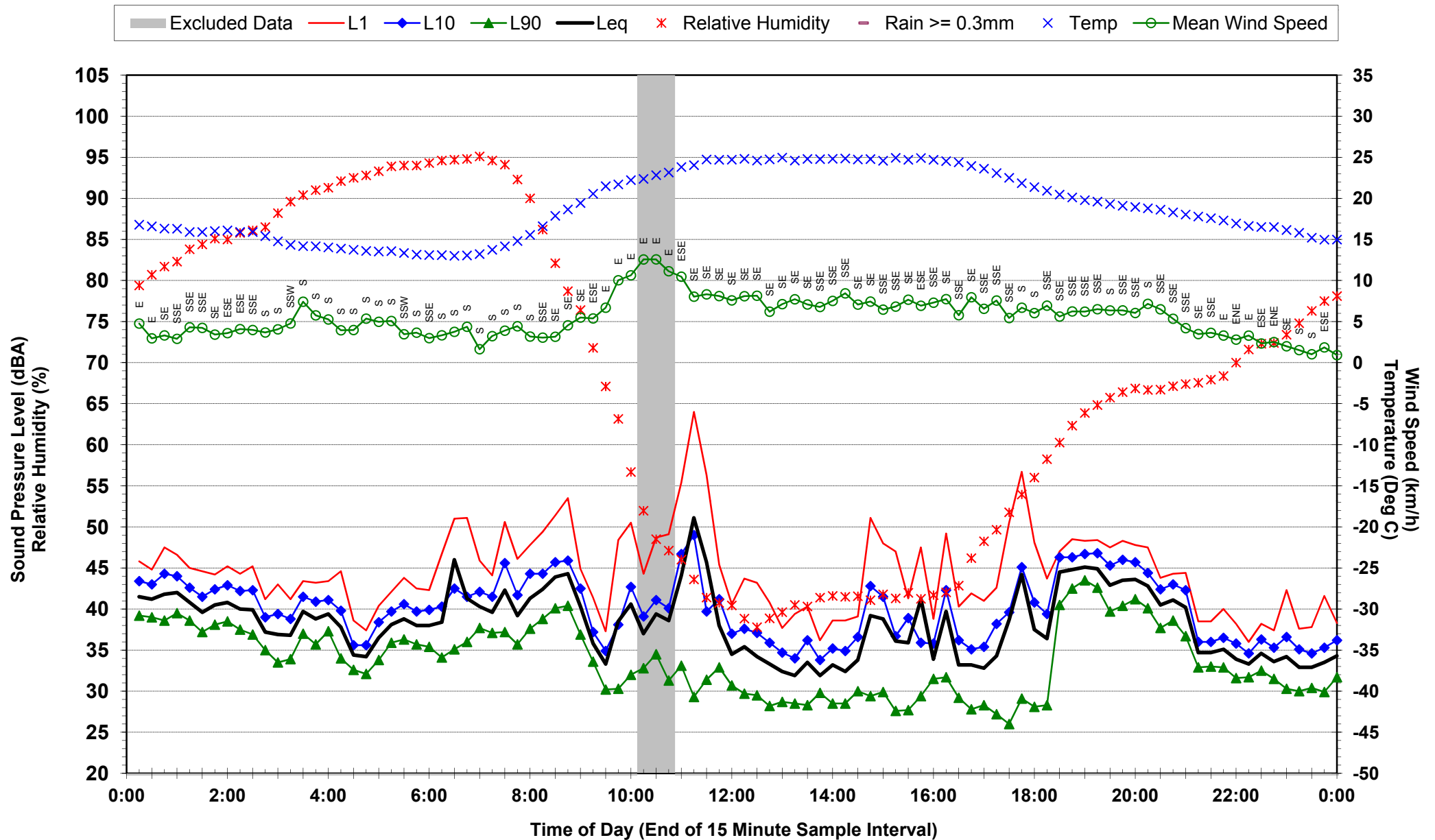
Statistical Ambient Noise Levels **Red Hill Mining Lease Project - Lapunyah Homestead - Wednesday 13 May 2009**



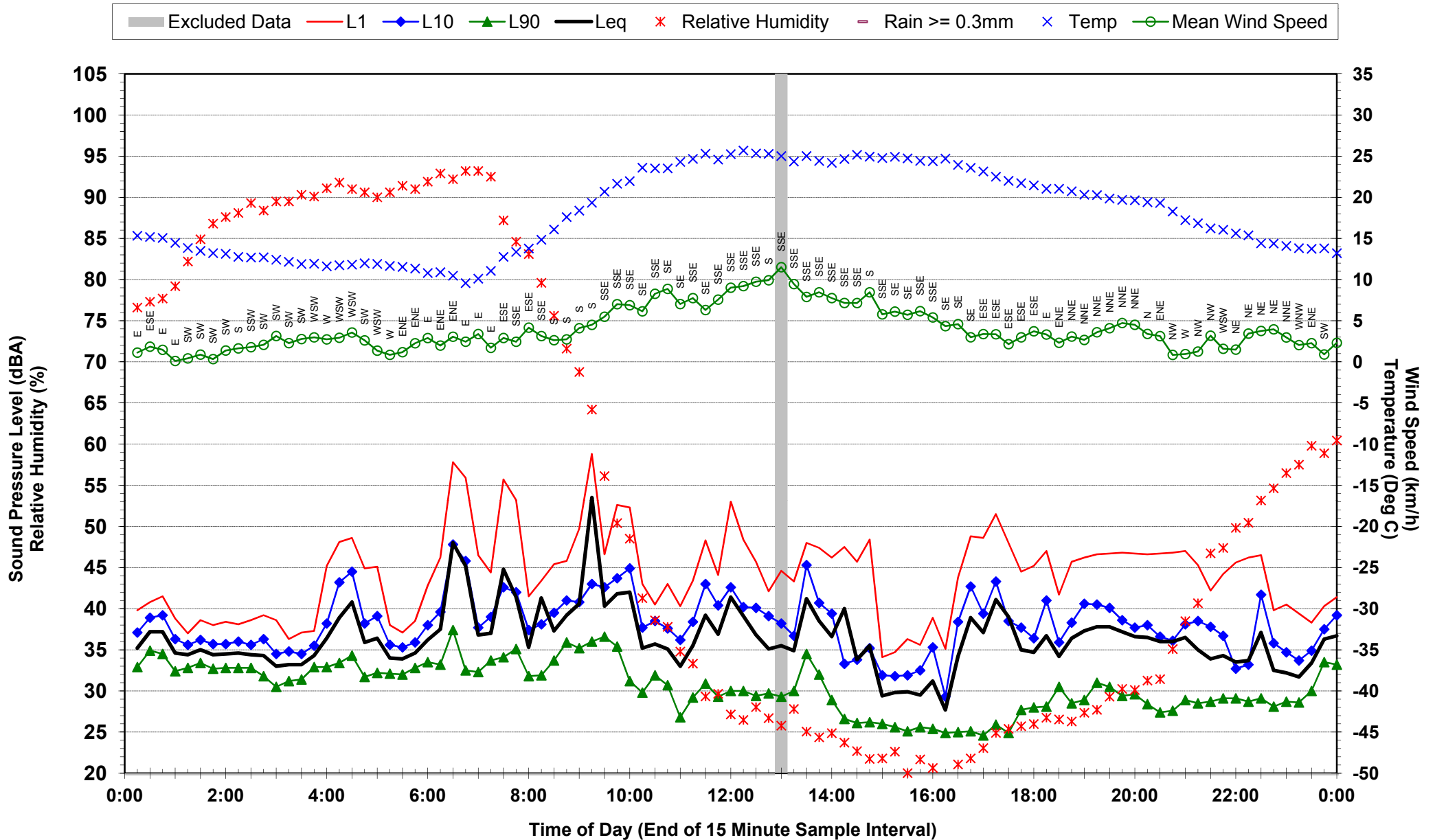
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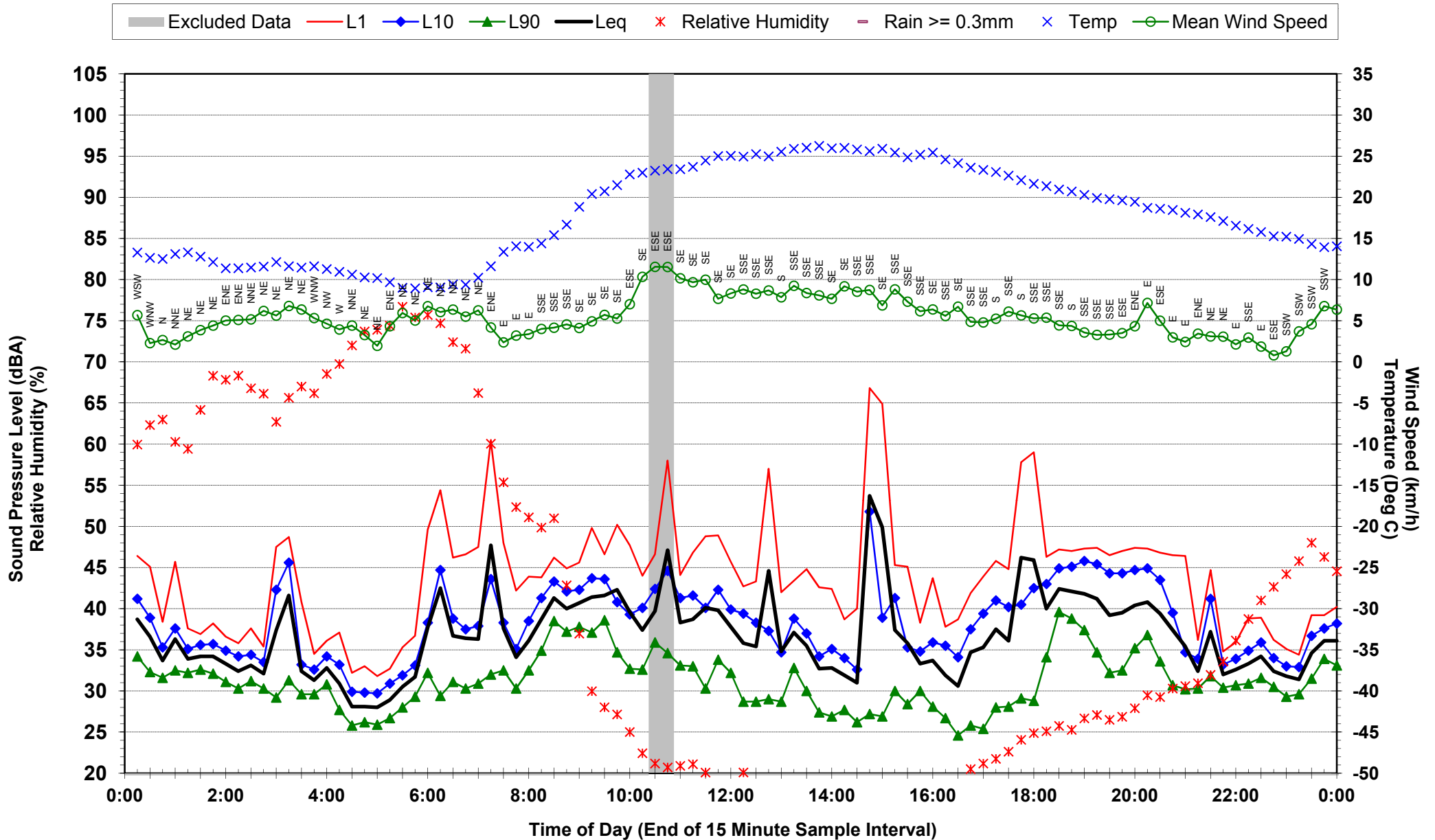
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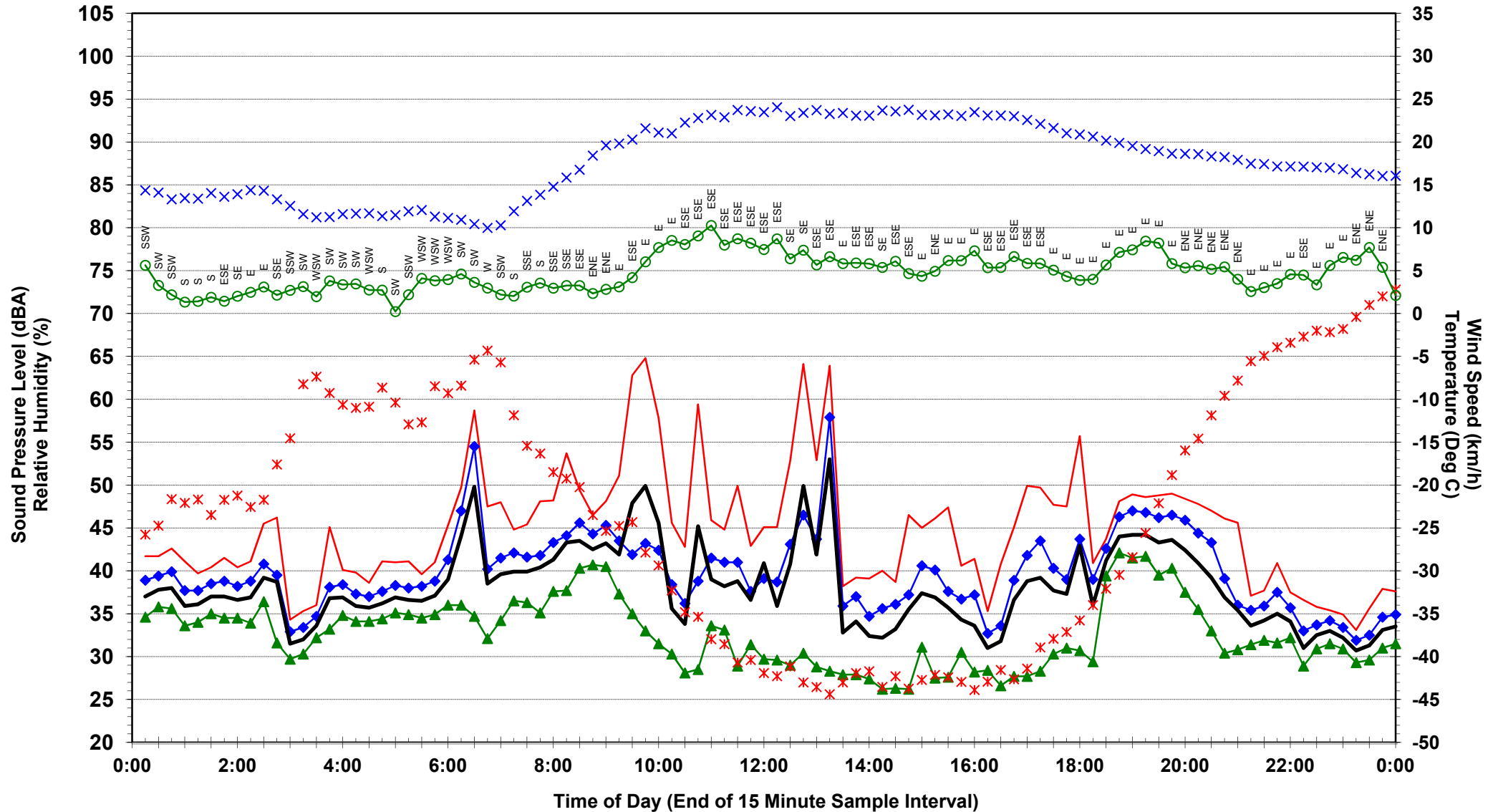
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Statistical Ambient Noise Levels **Red Hill Mining Lease Project - Lapunyah Homestead - Sunday 17 May 2009**

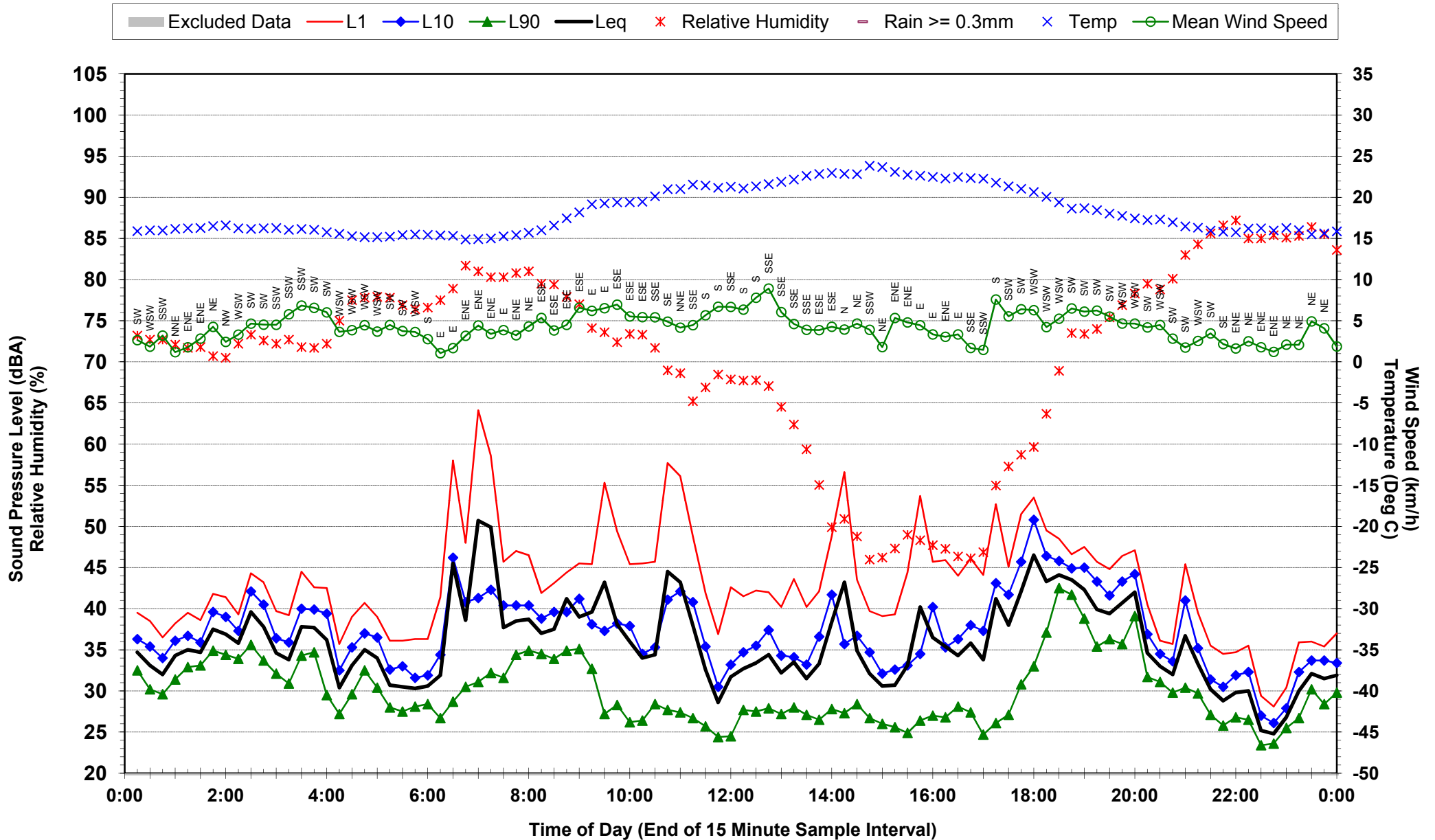


■ Excluded Data
 — L1
 —◆— L10
 —▲— L90
 — Leq
 × Relative Humidity
 — Rain $\geq$ 0.3mm
 × Temp
 —○— Mean Wind Speed

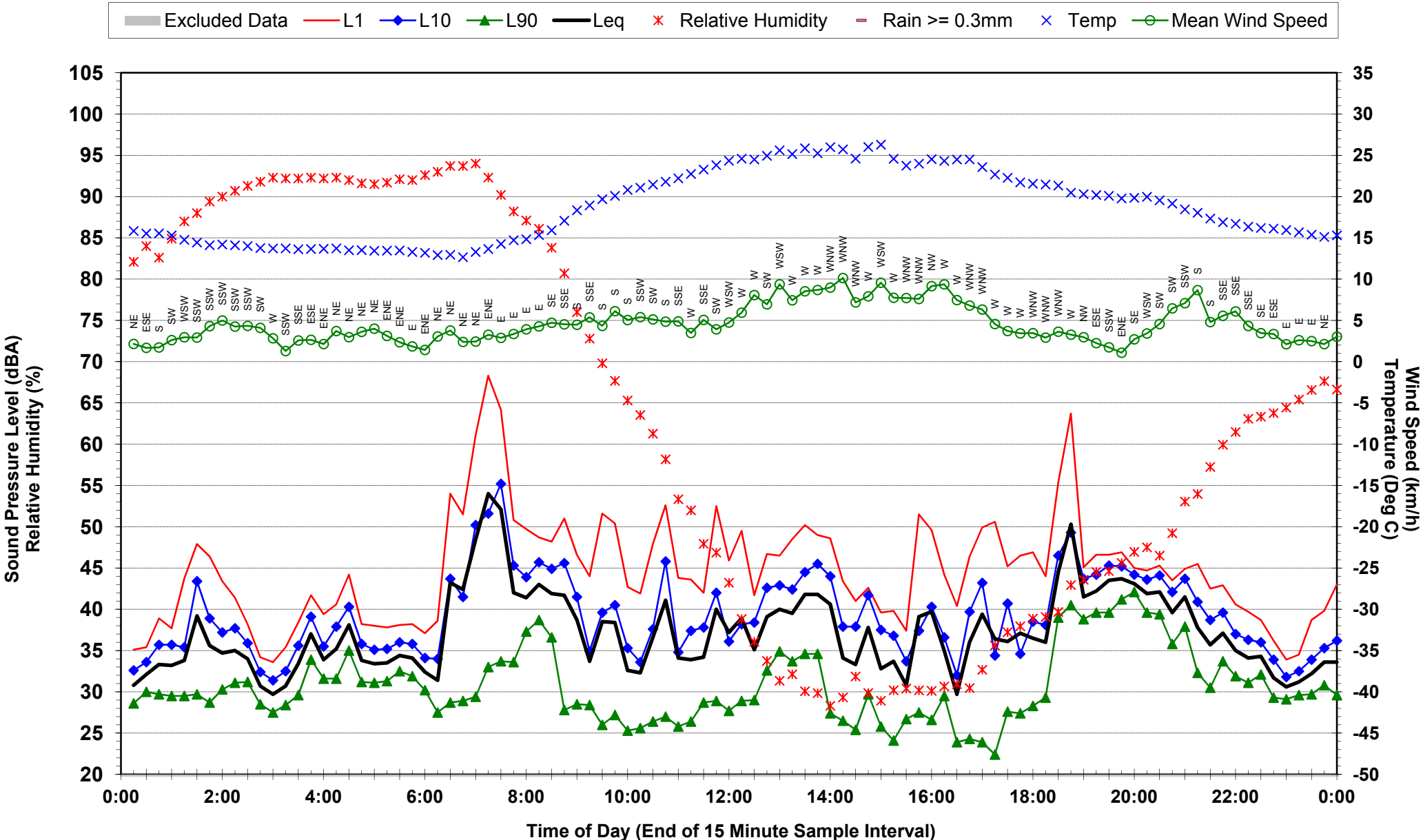


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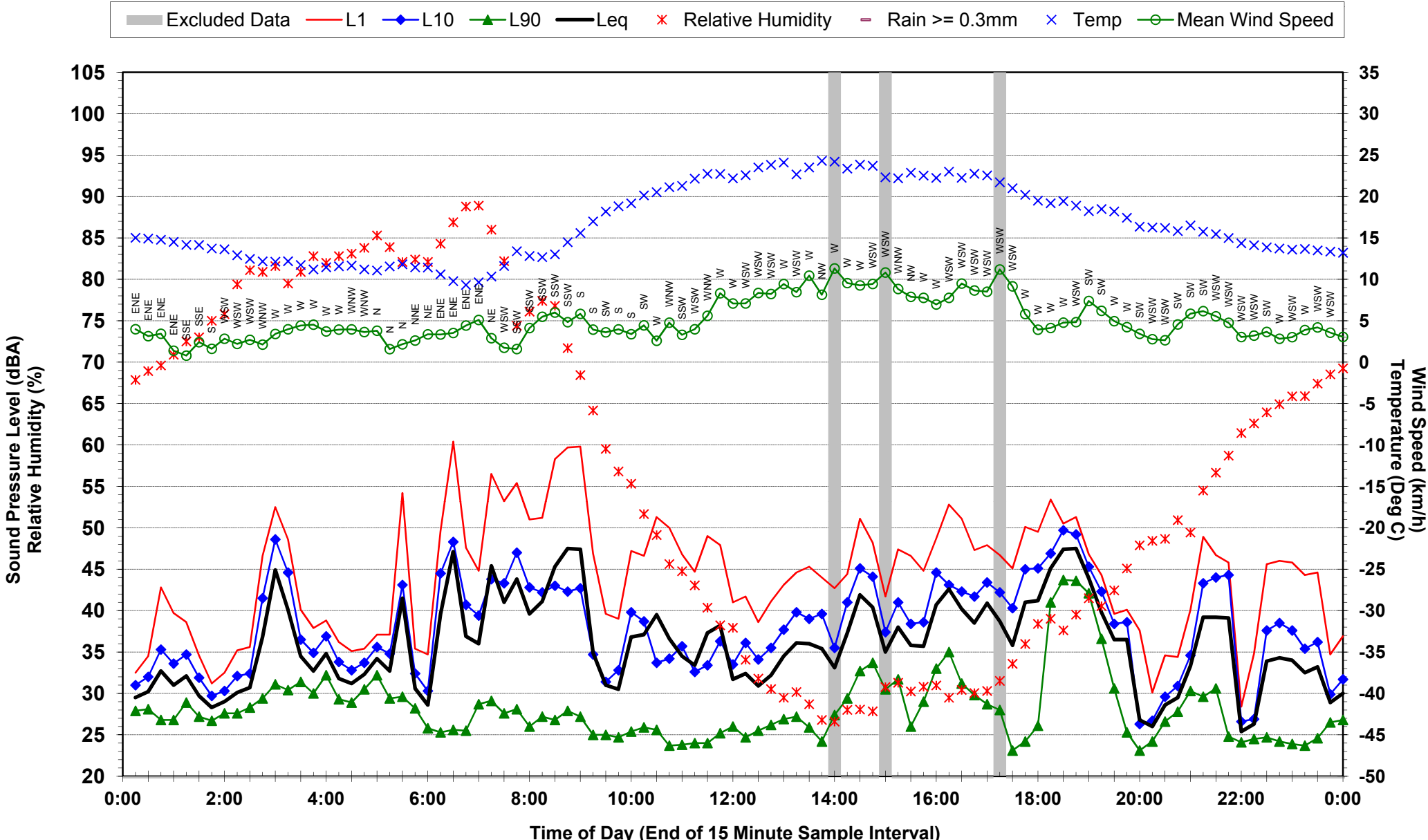
Red Hill Mining Lease Project - Lapunyah Homestead - Tuesday 19 May 2009



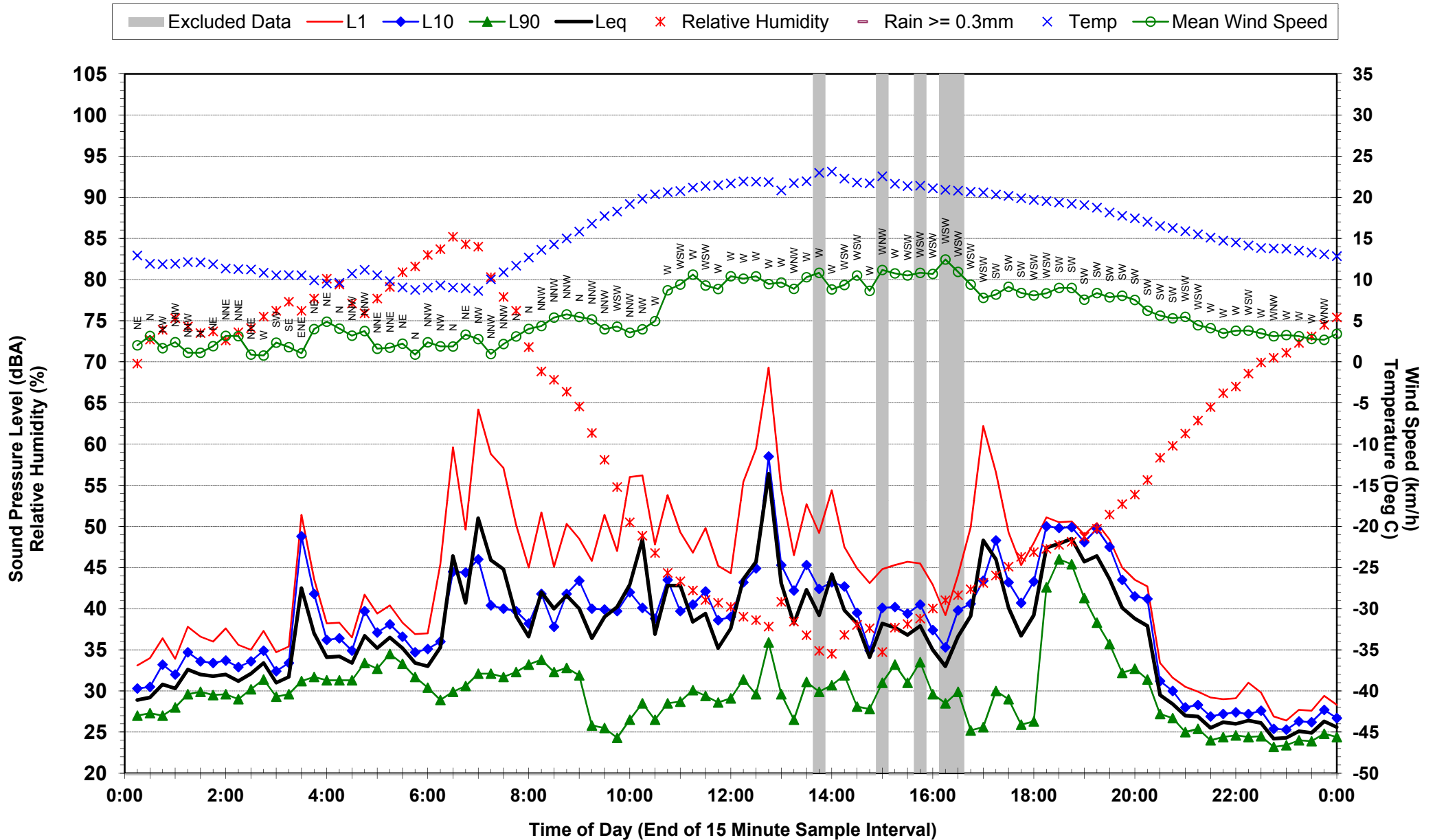
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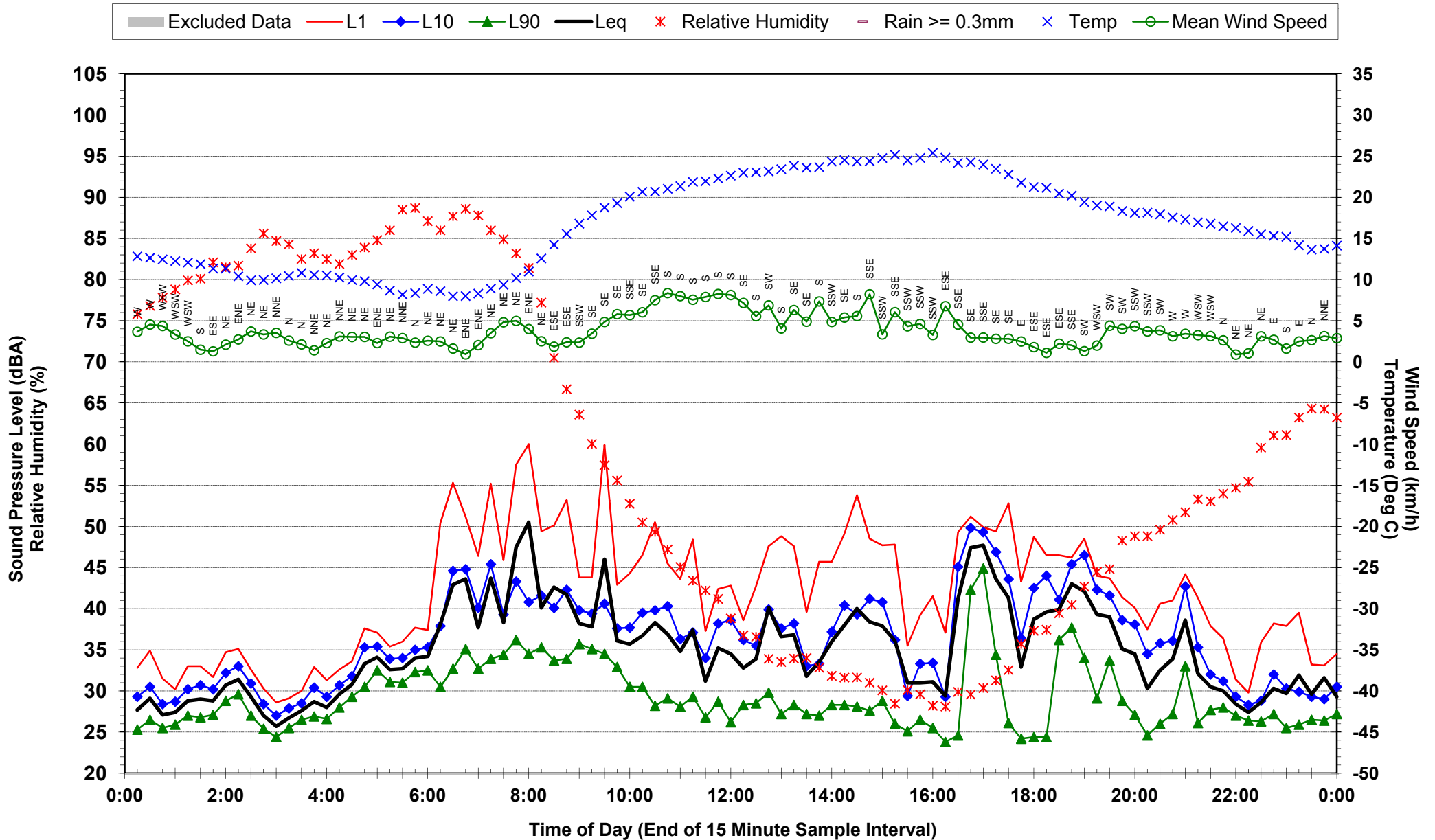
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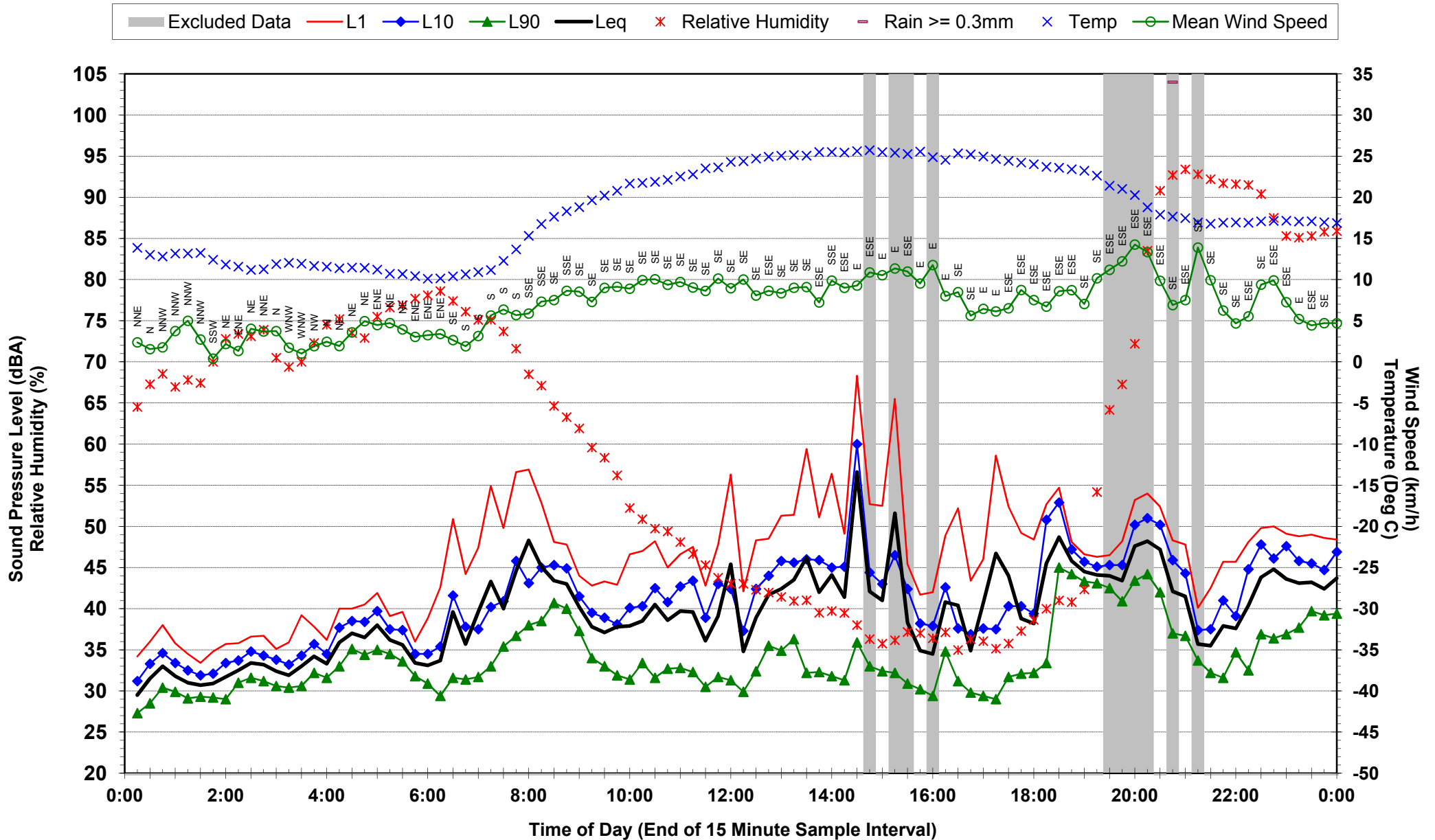
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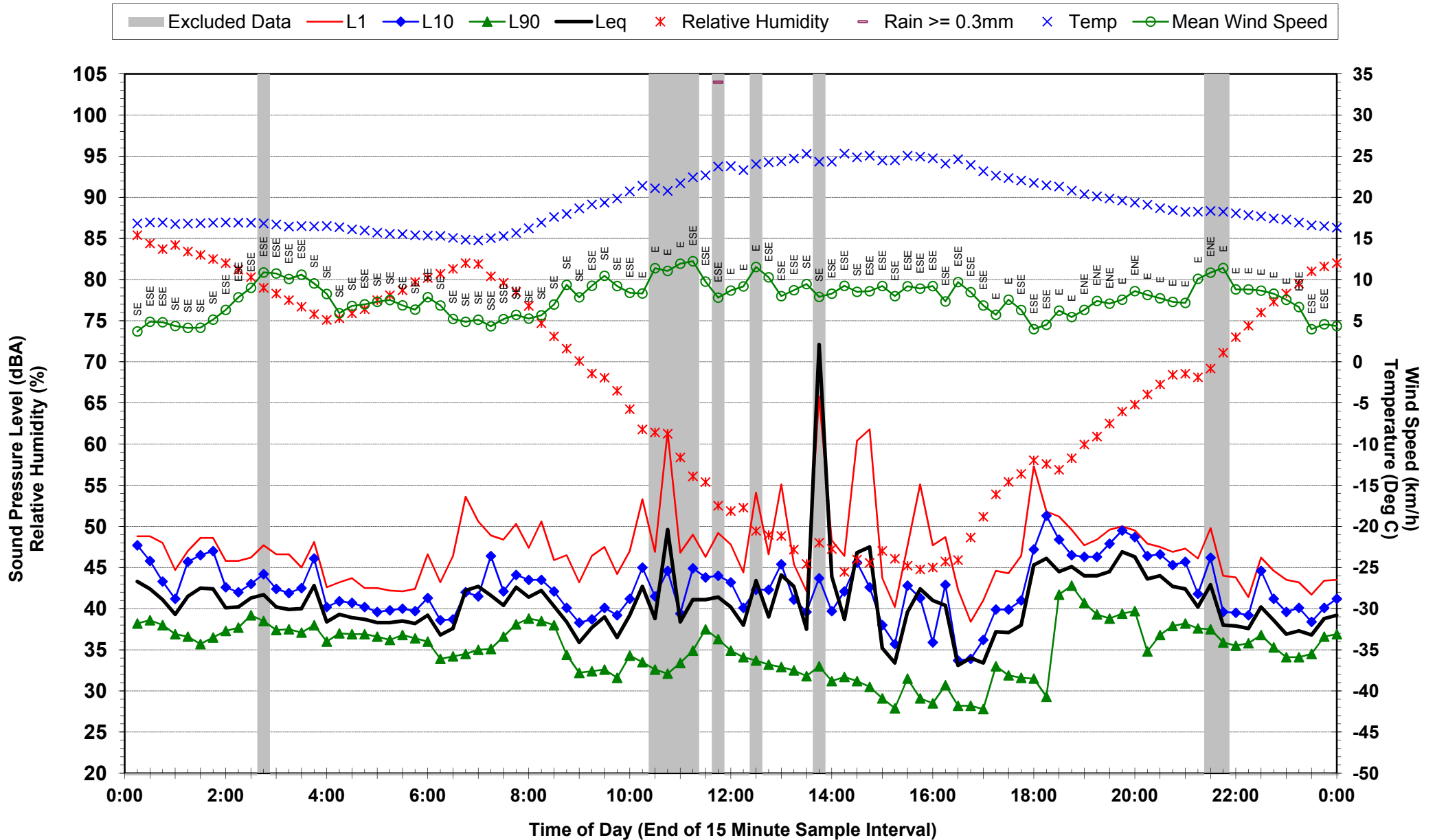
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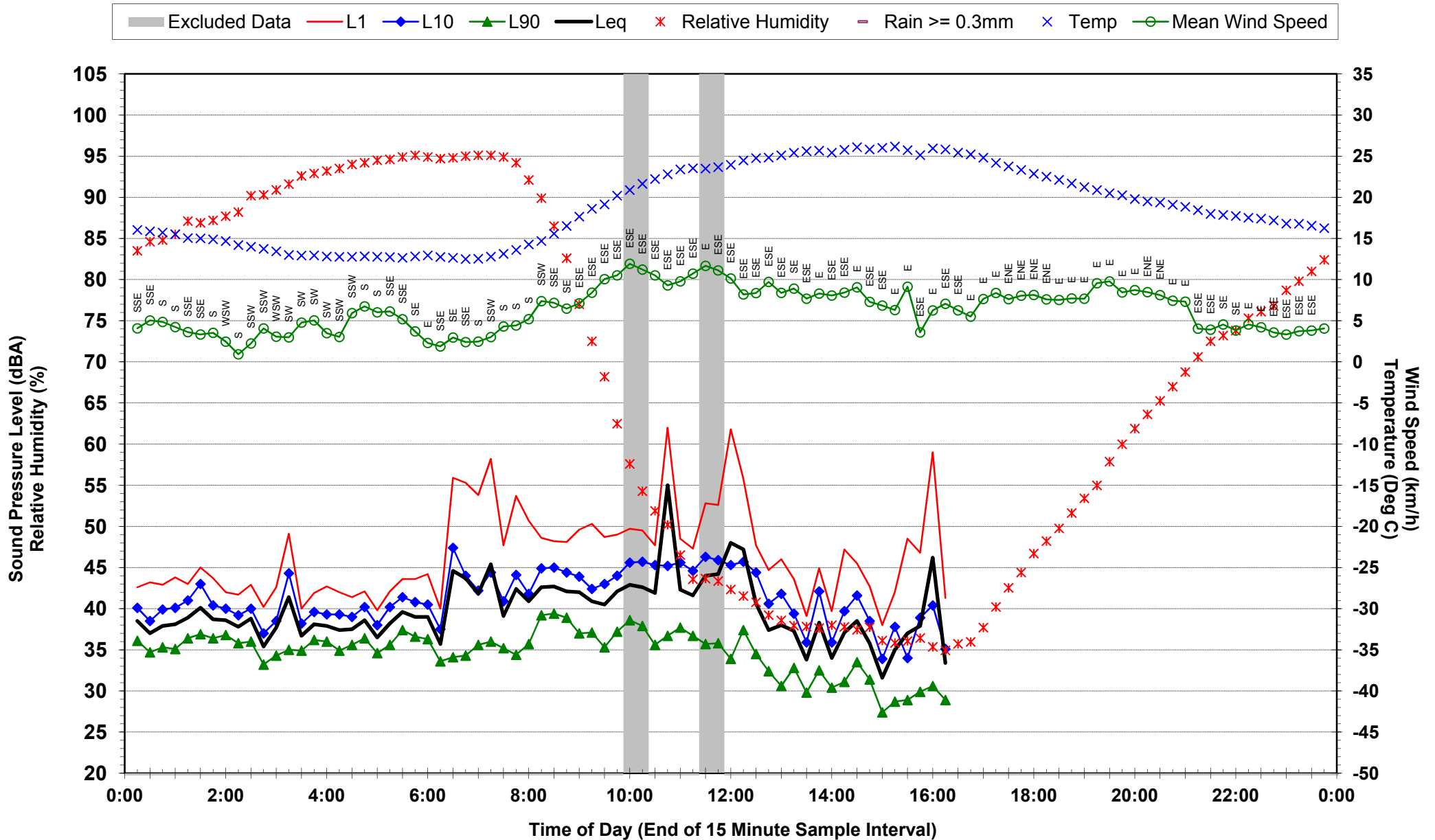
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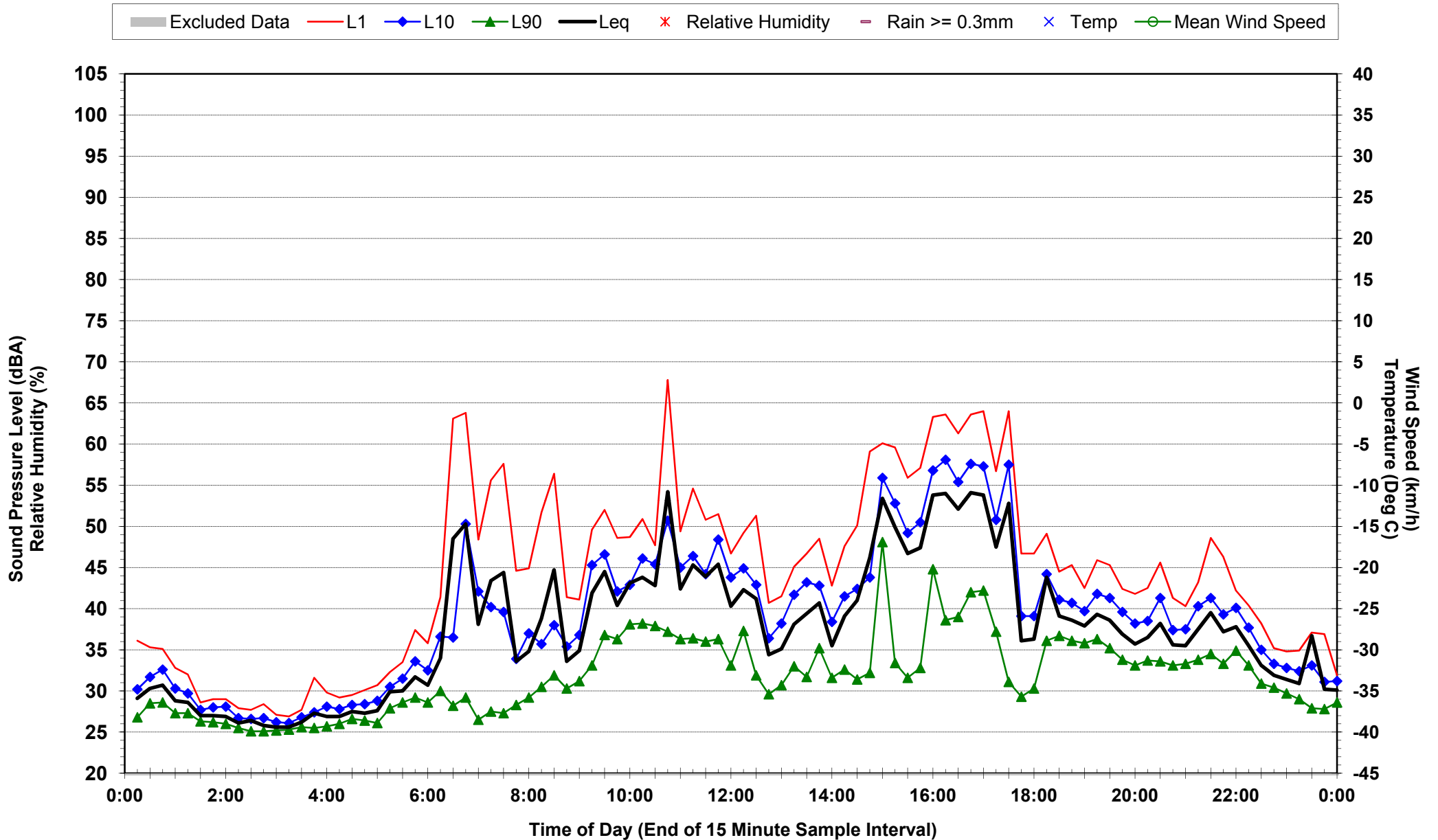
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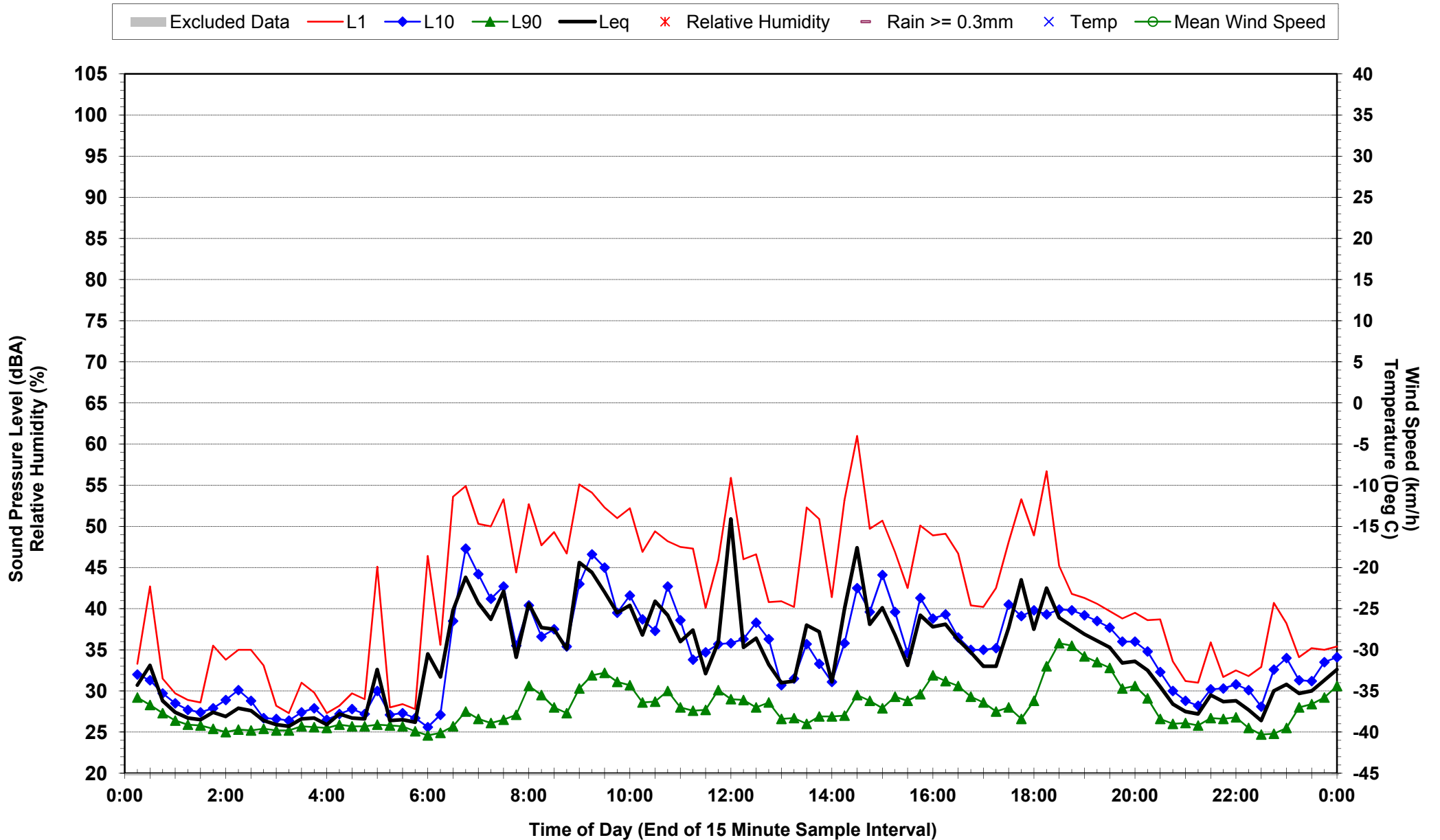
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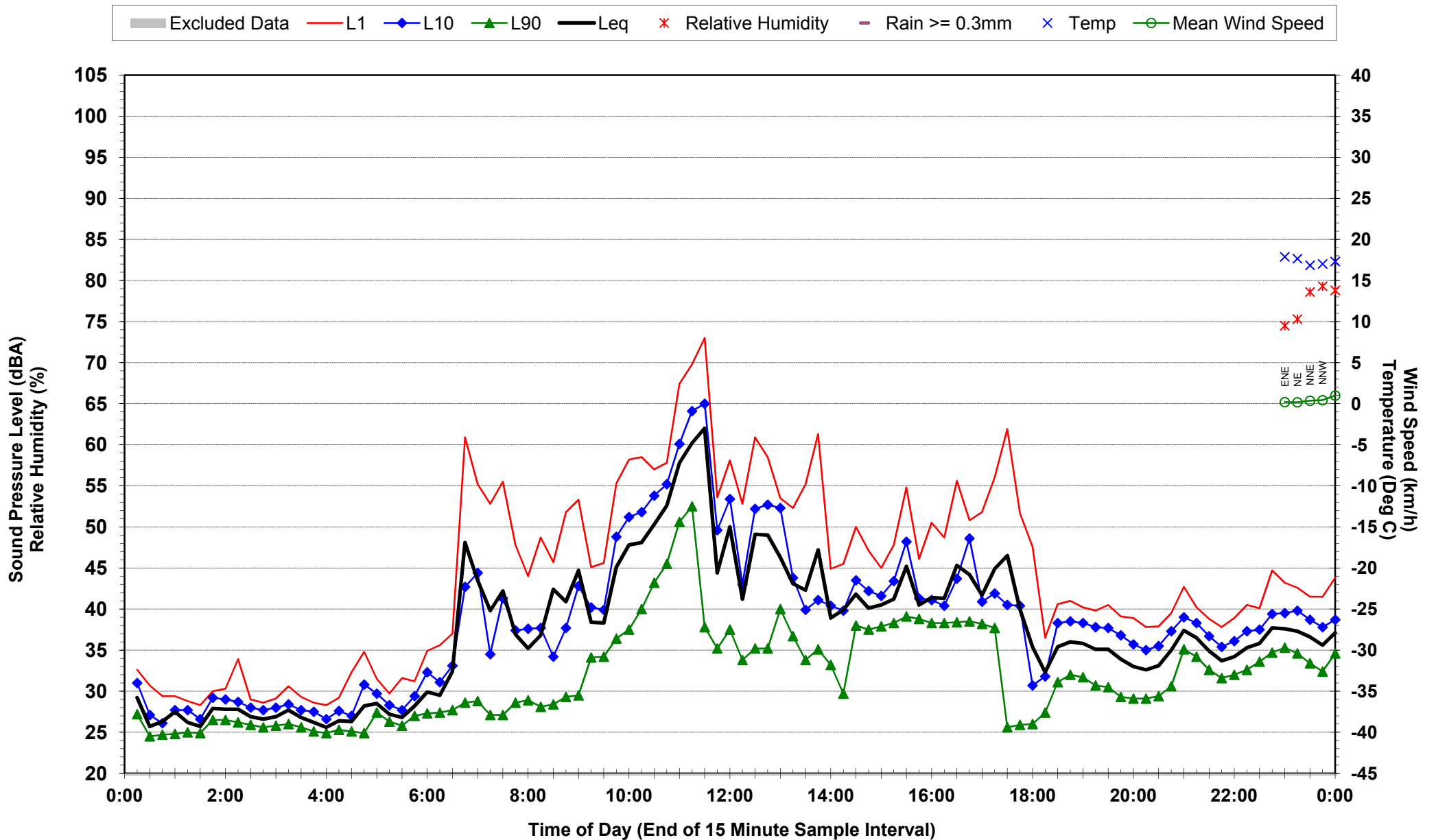
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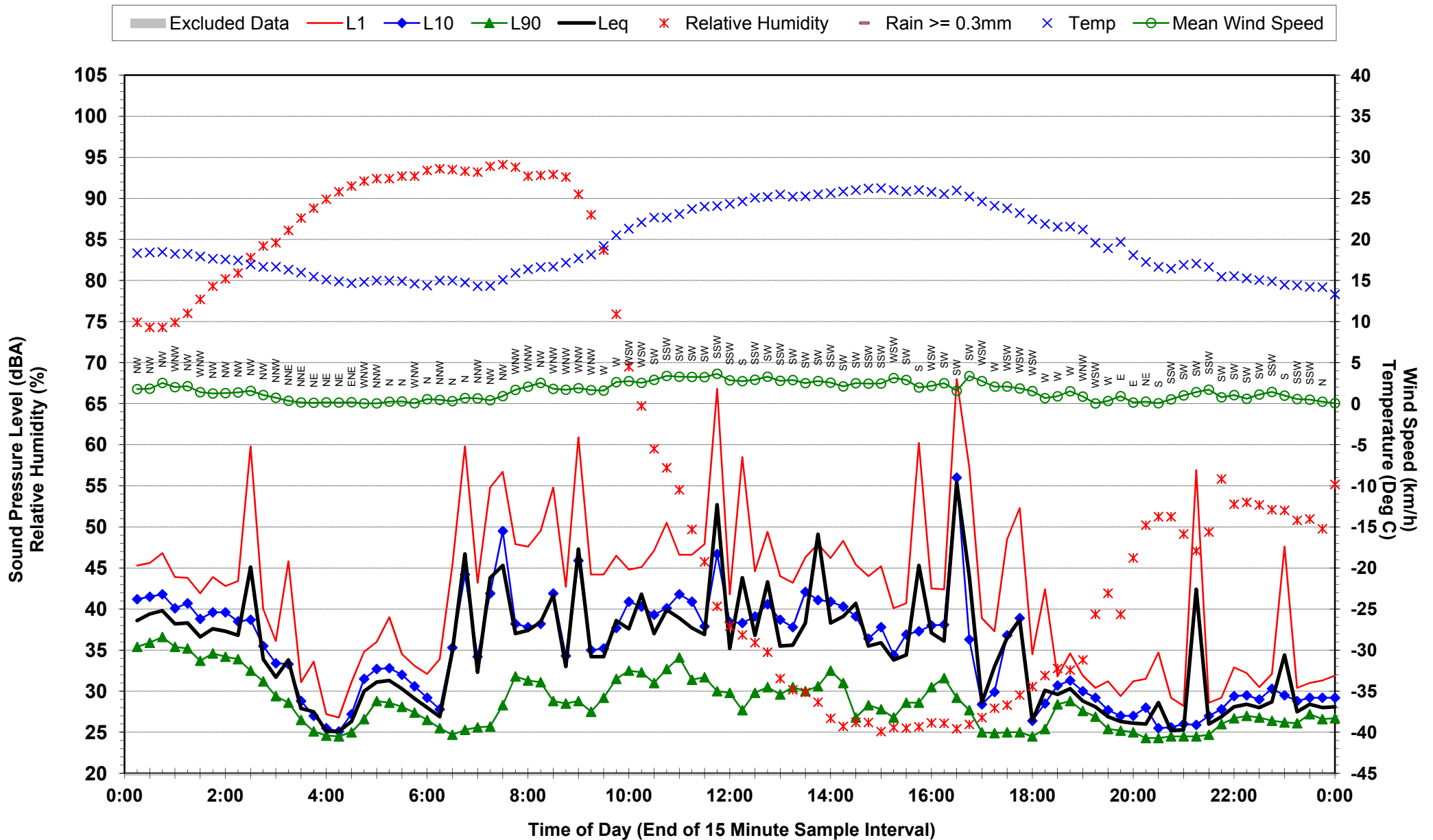
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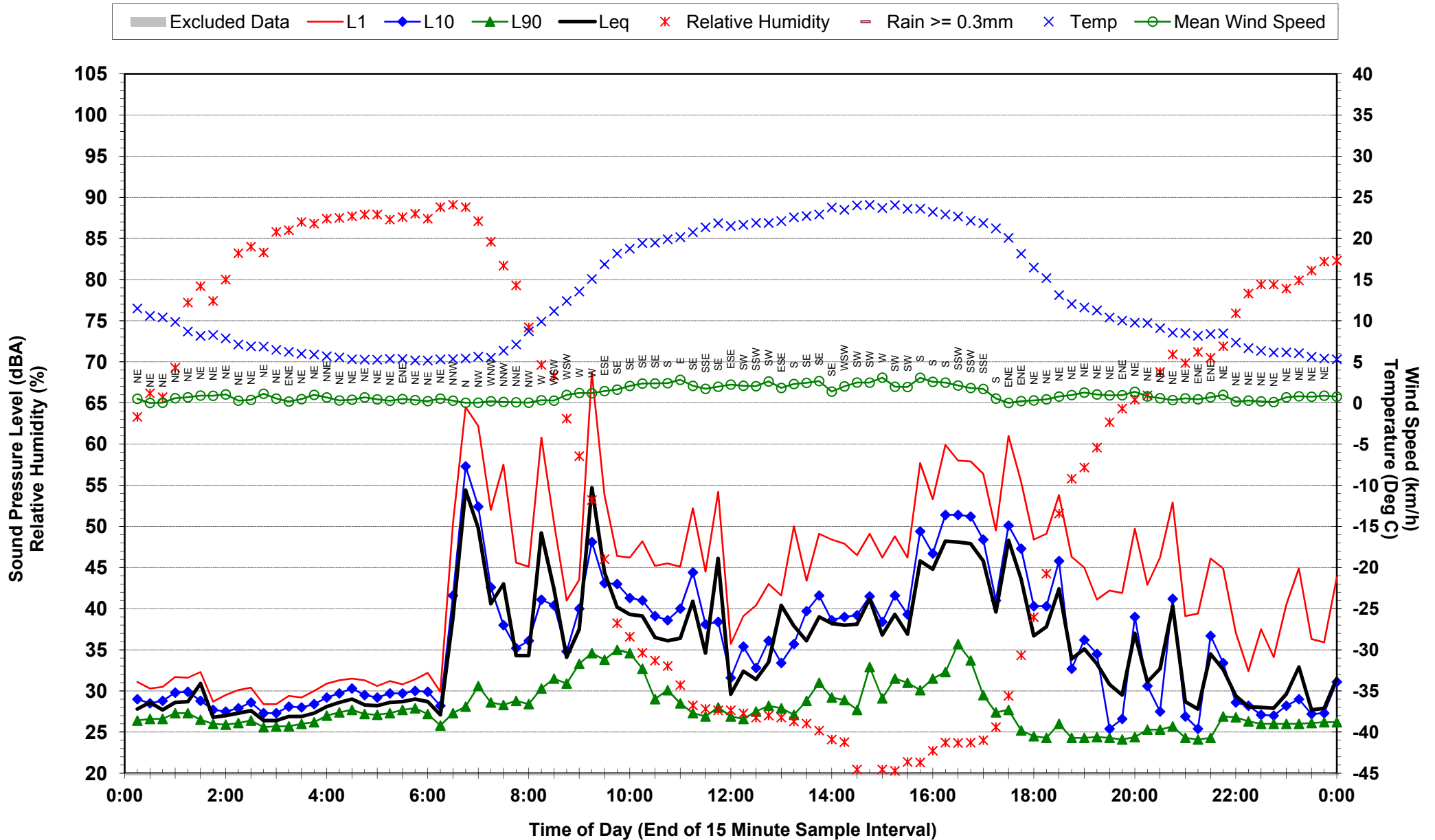
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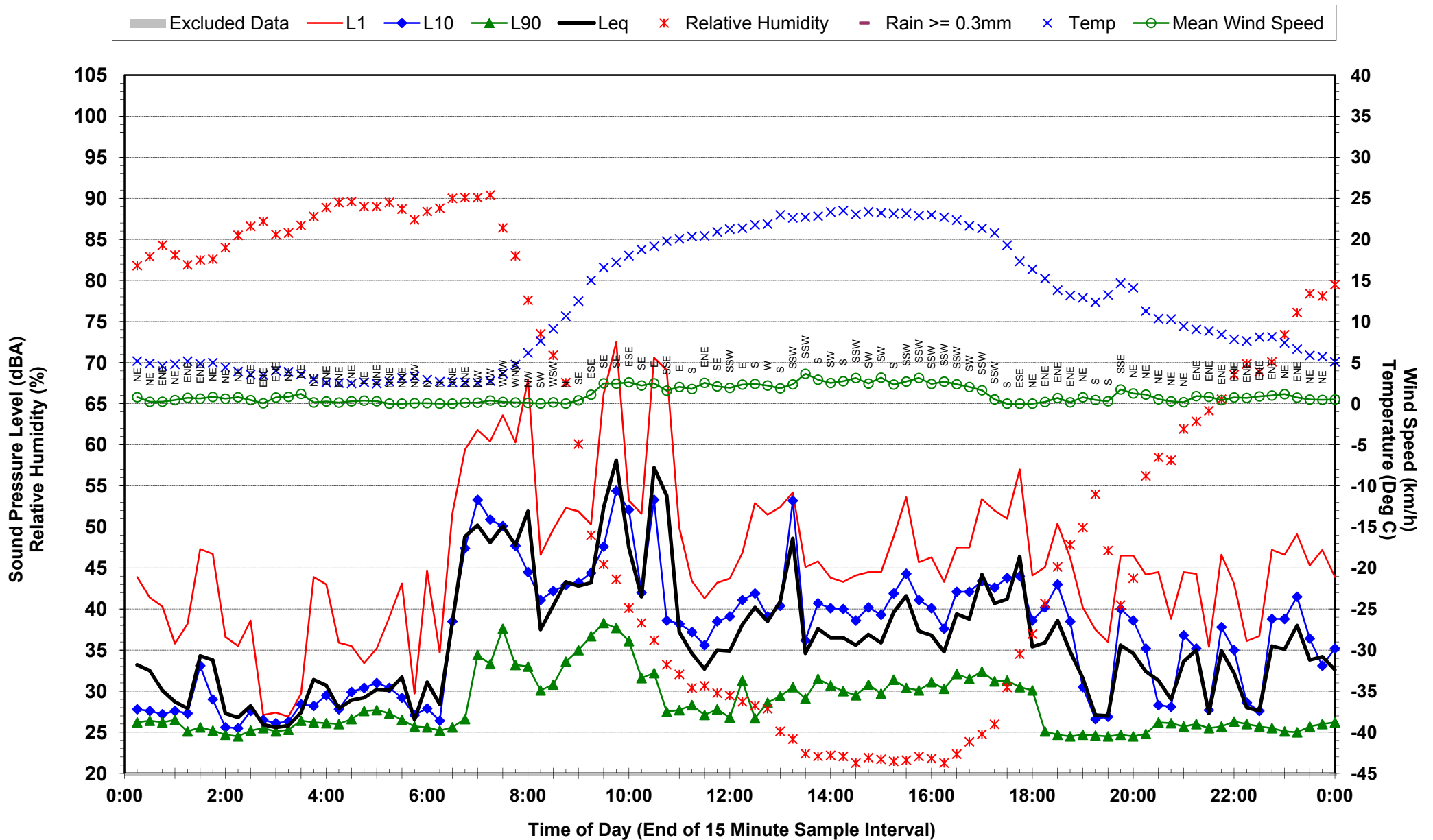
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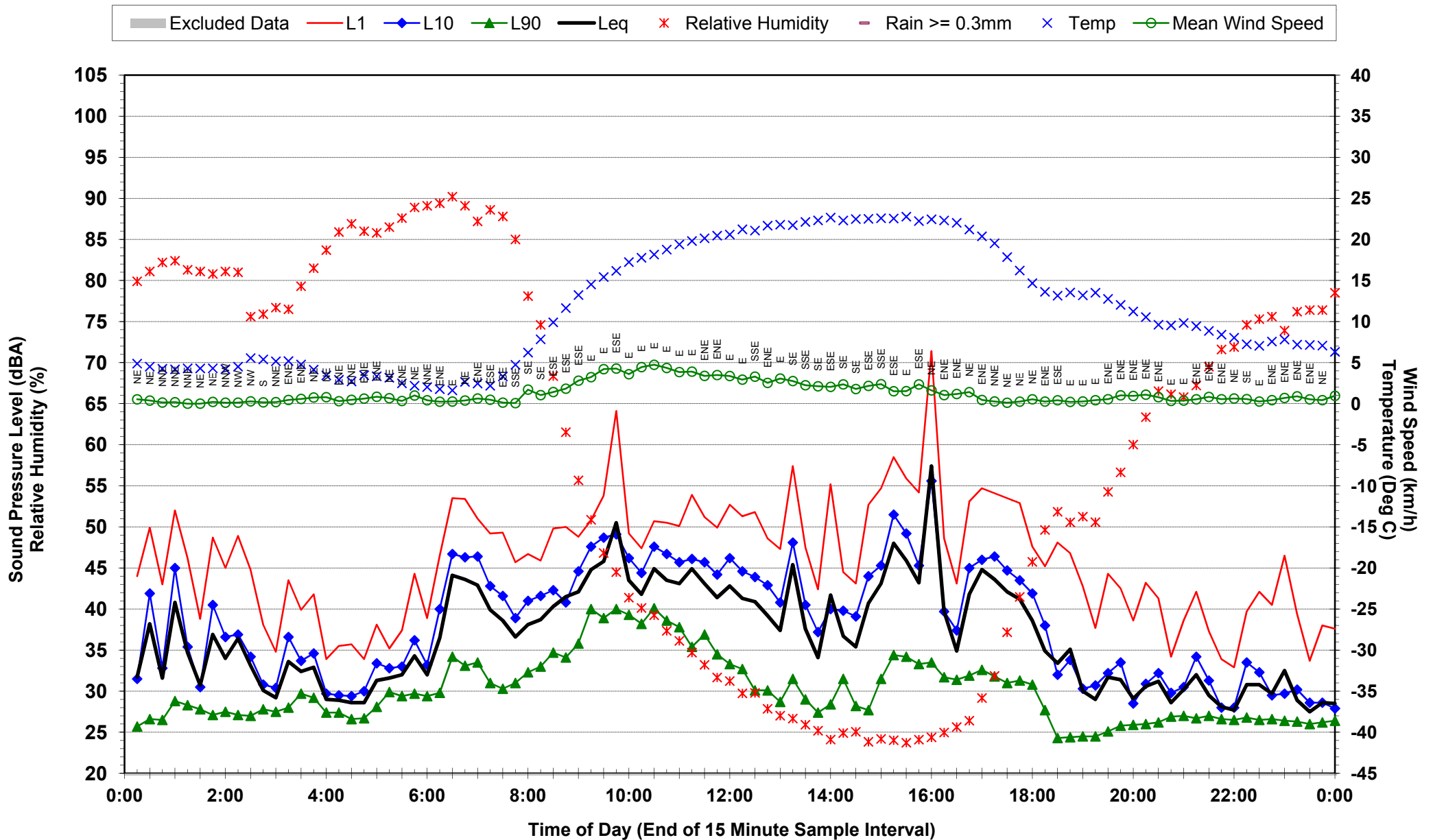
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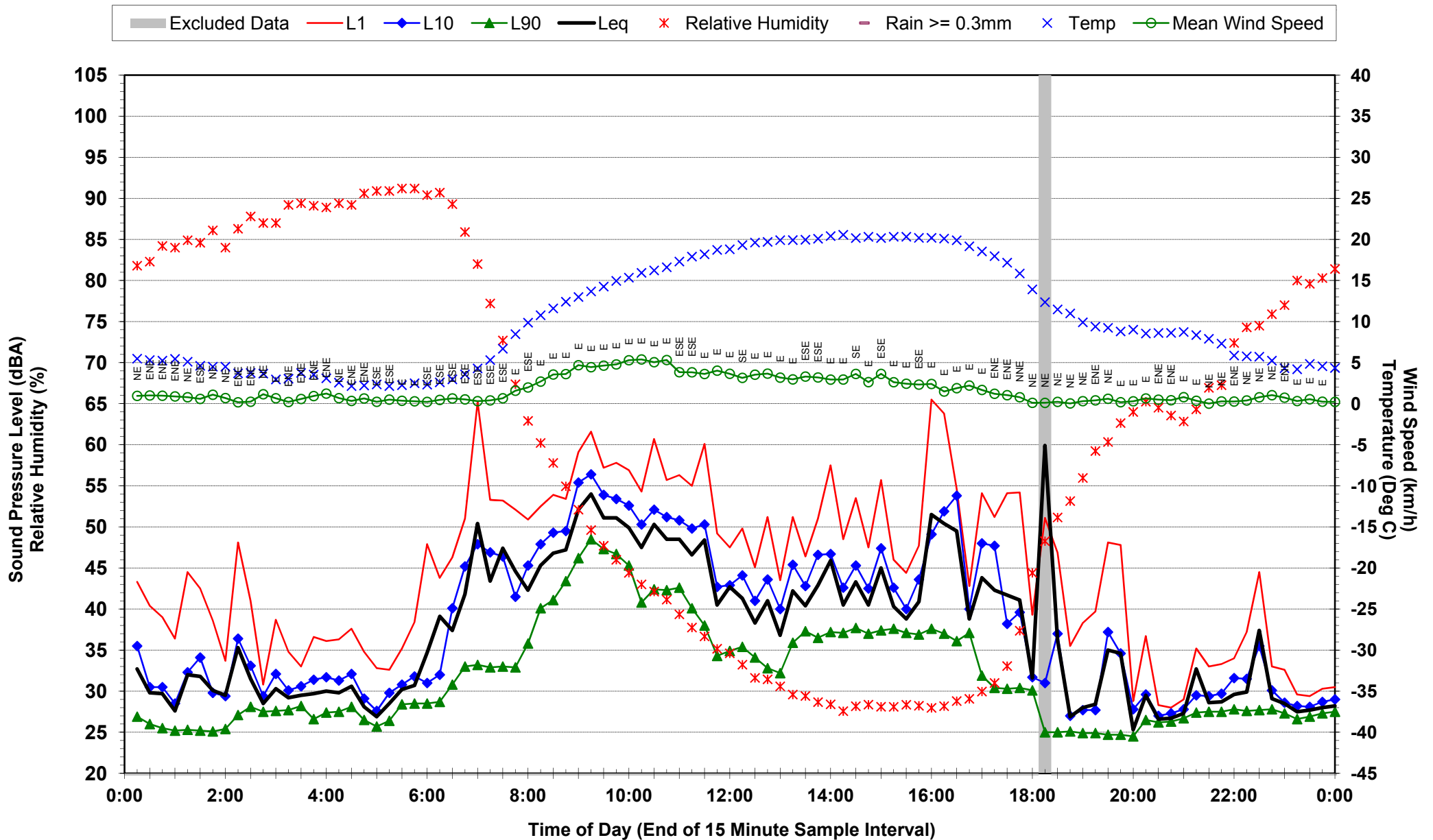
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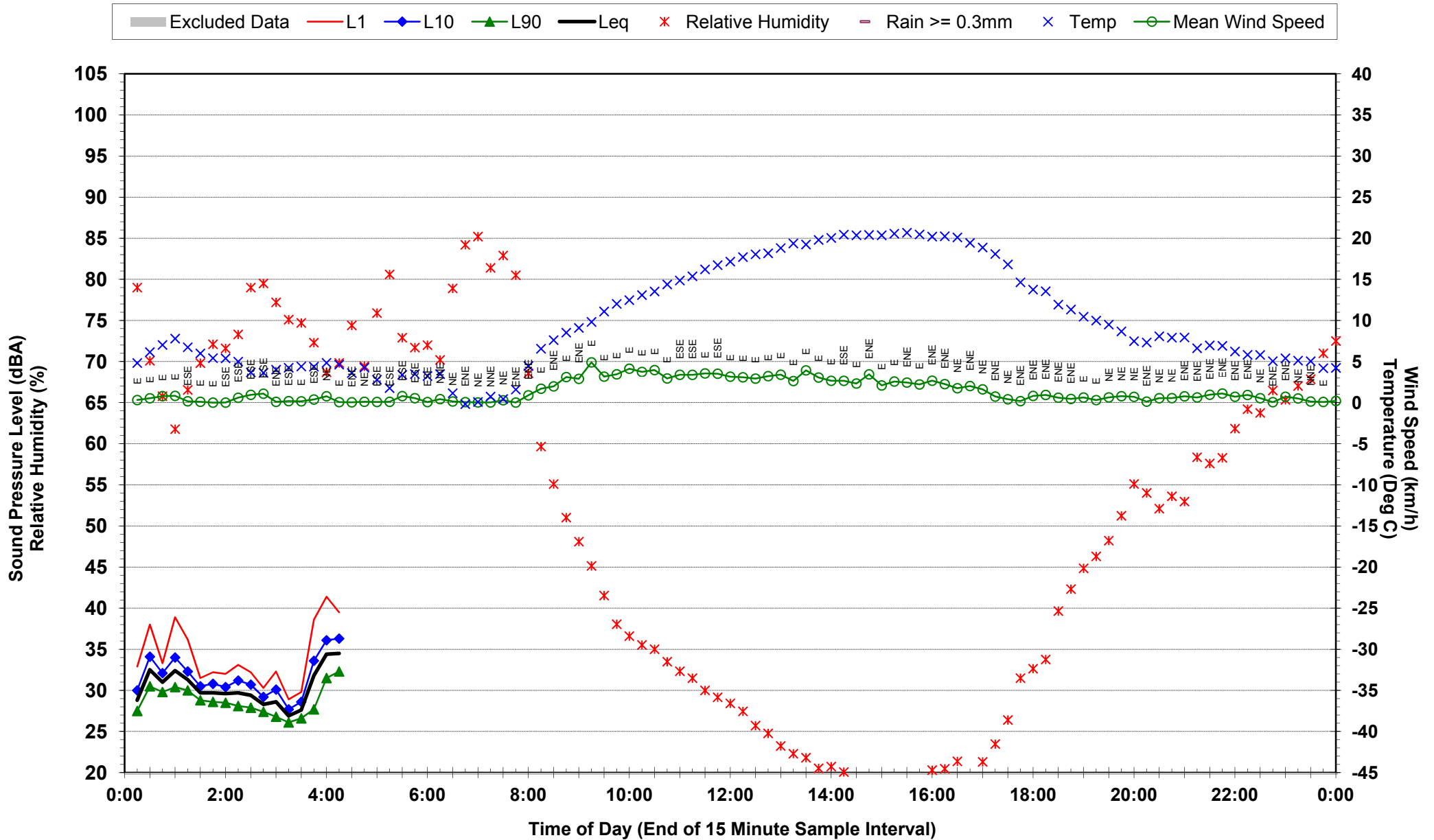
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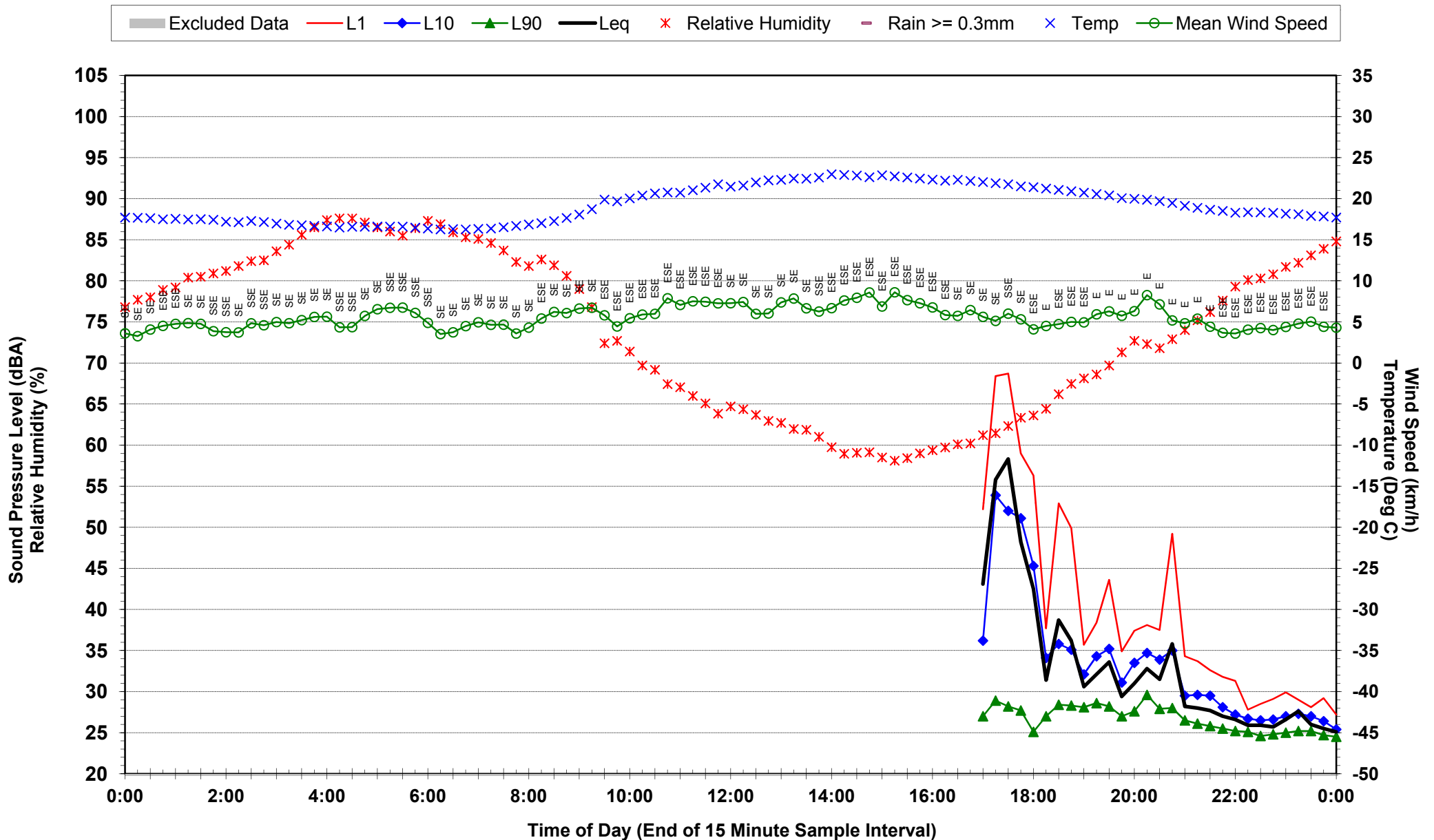
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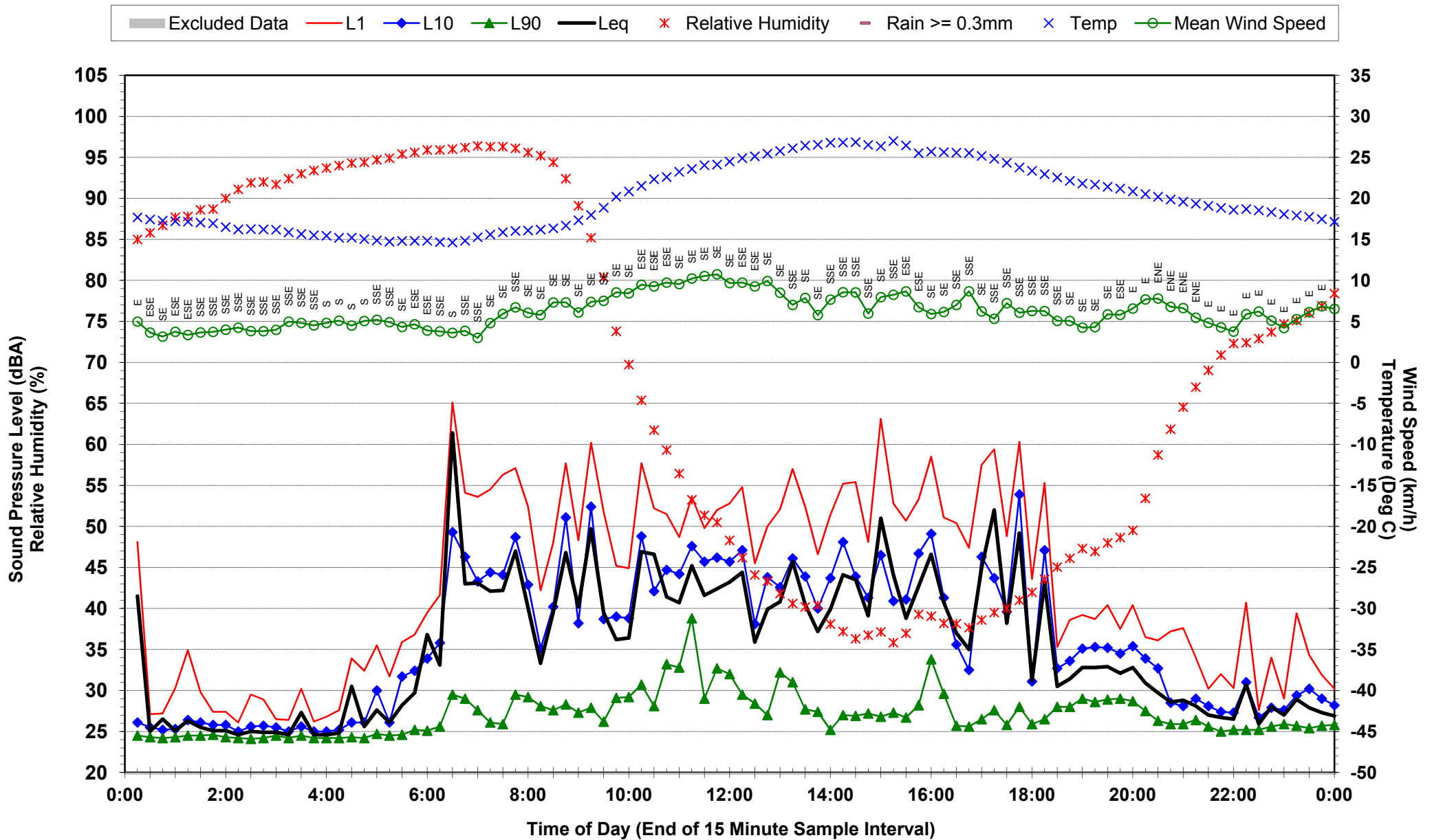
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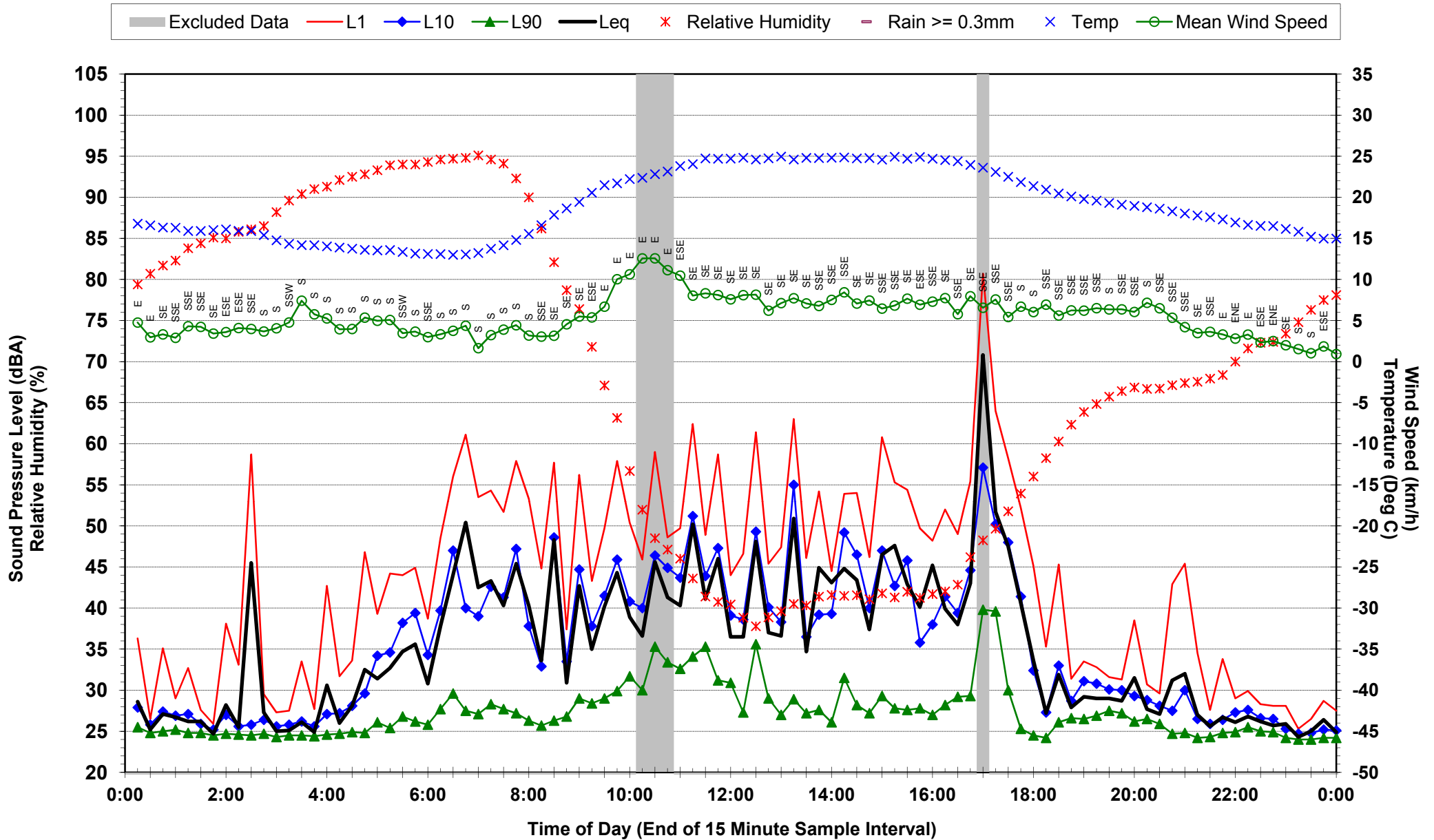
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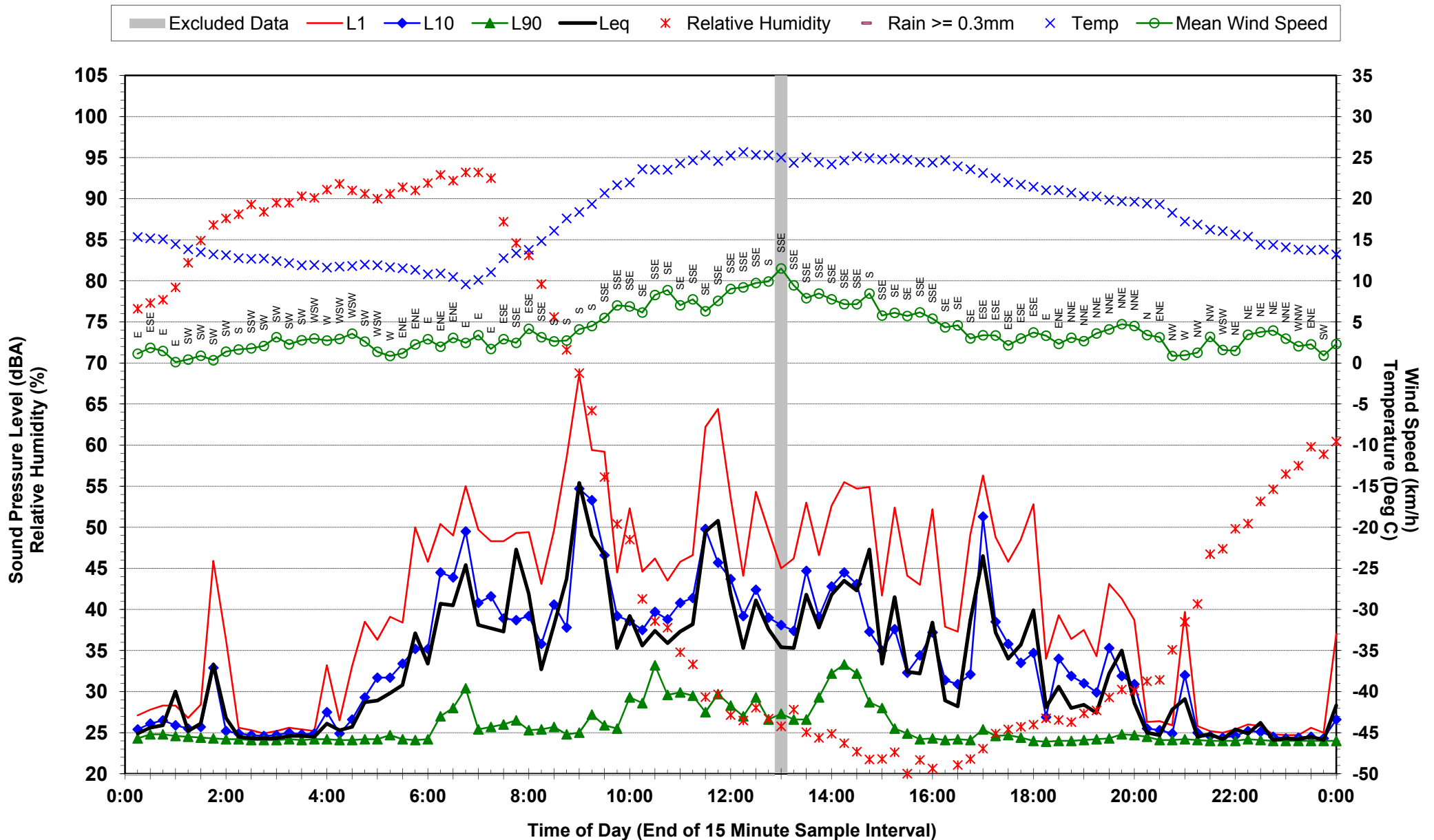
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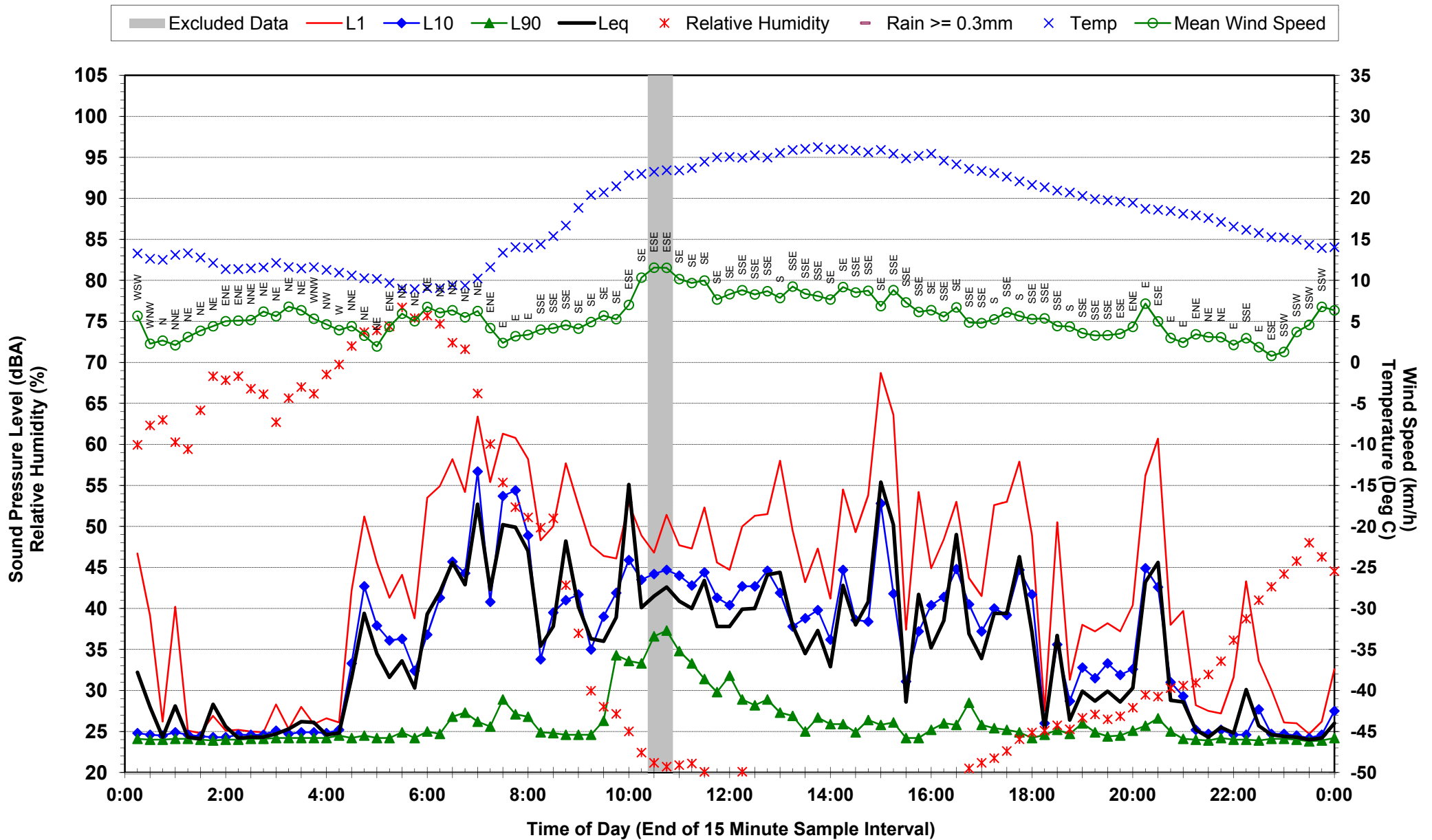
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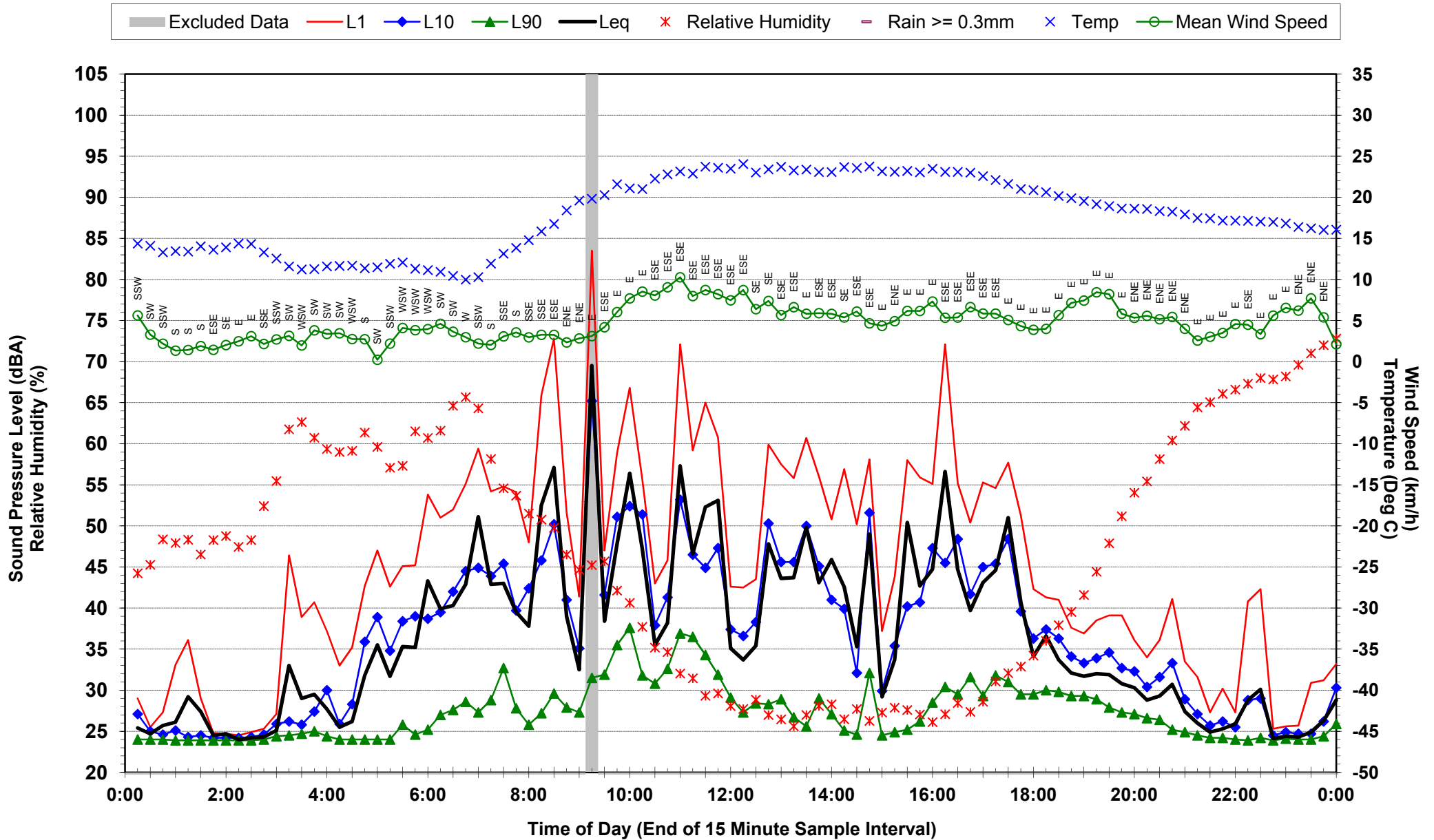
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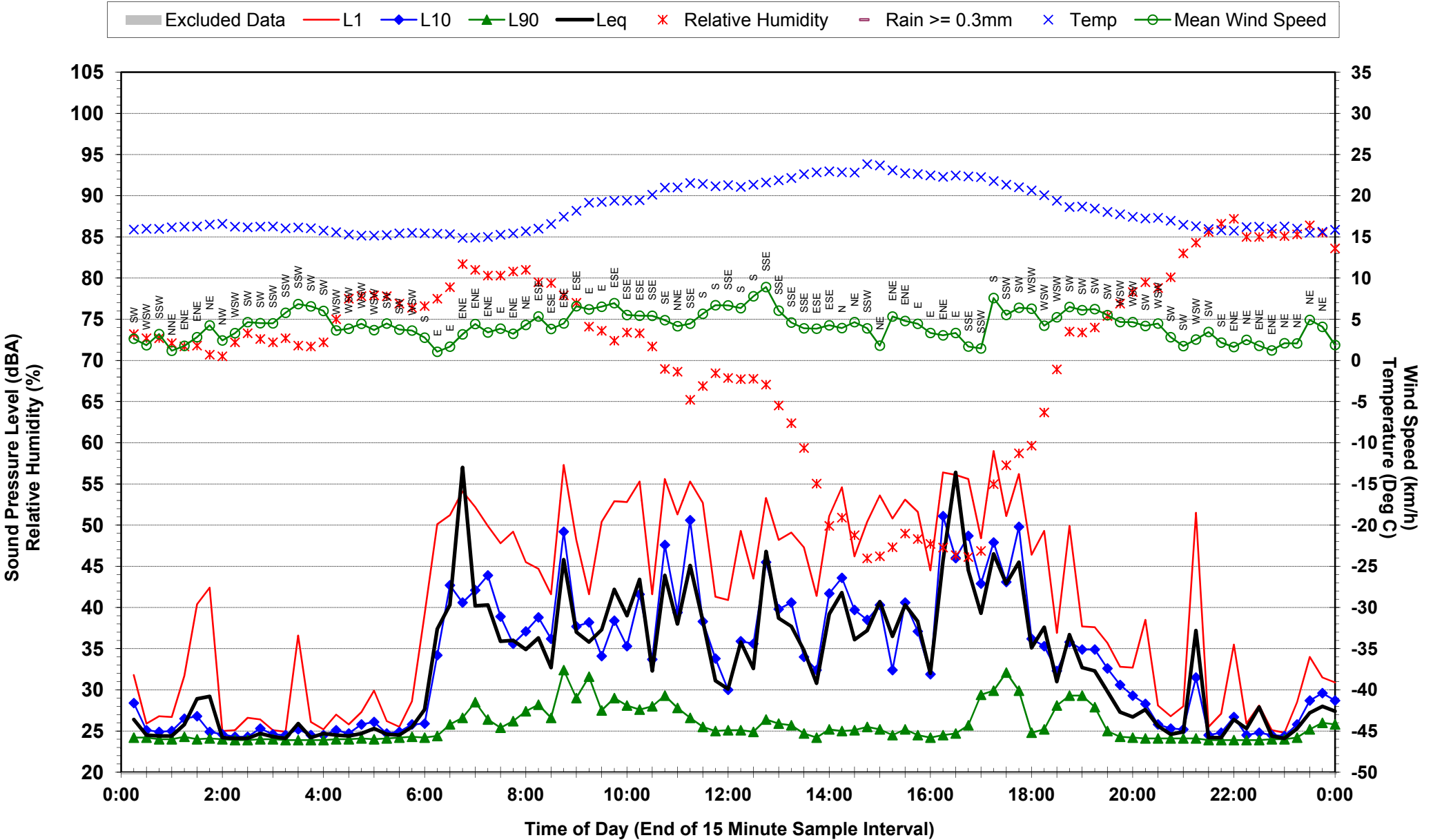
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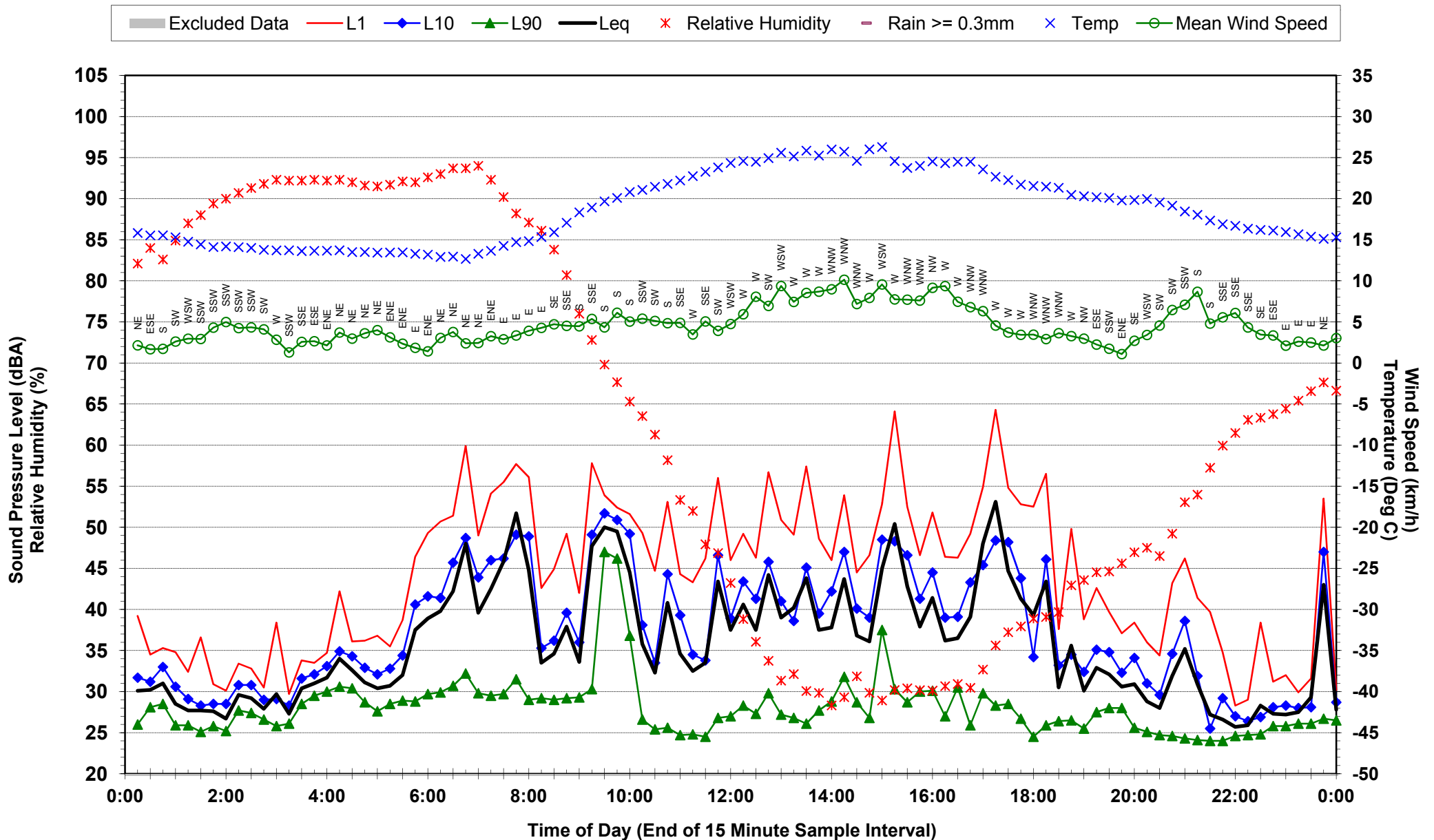
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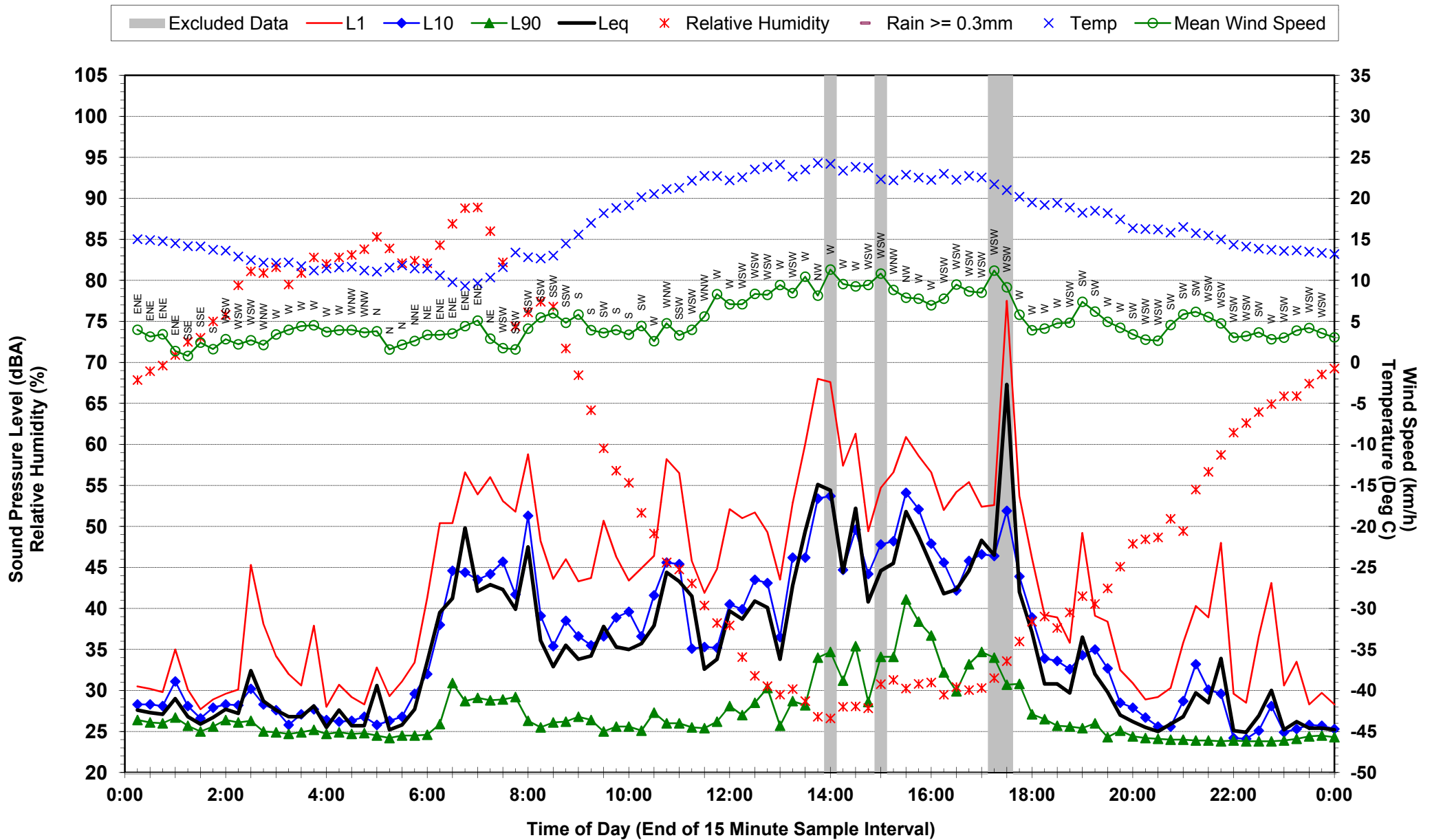
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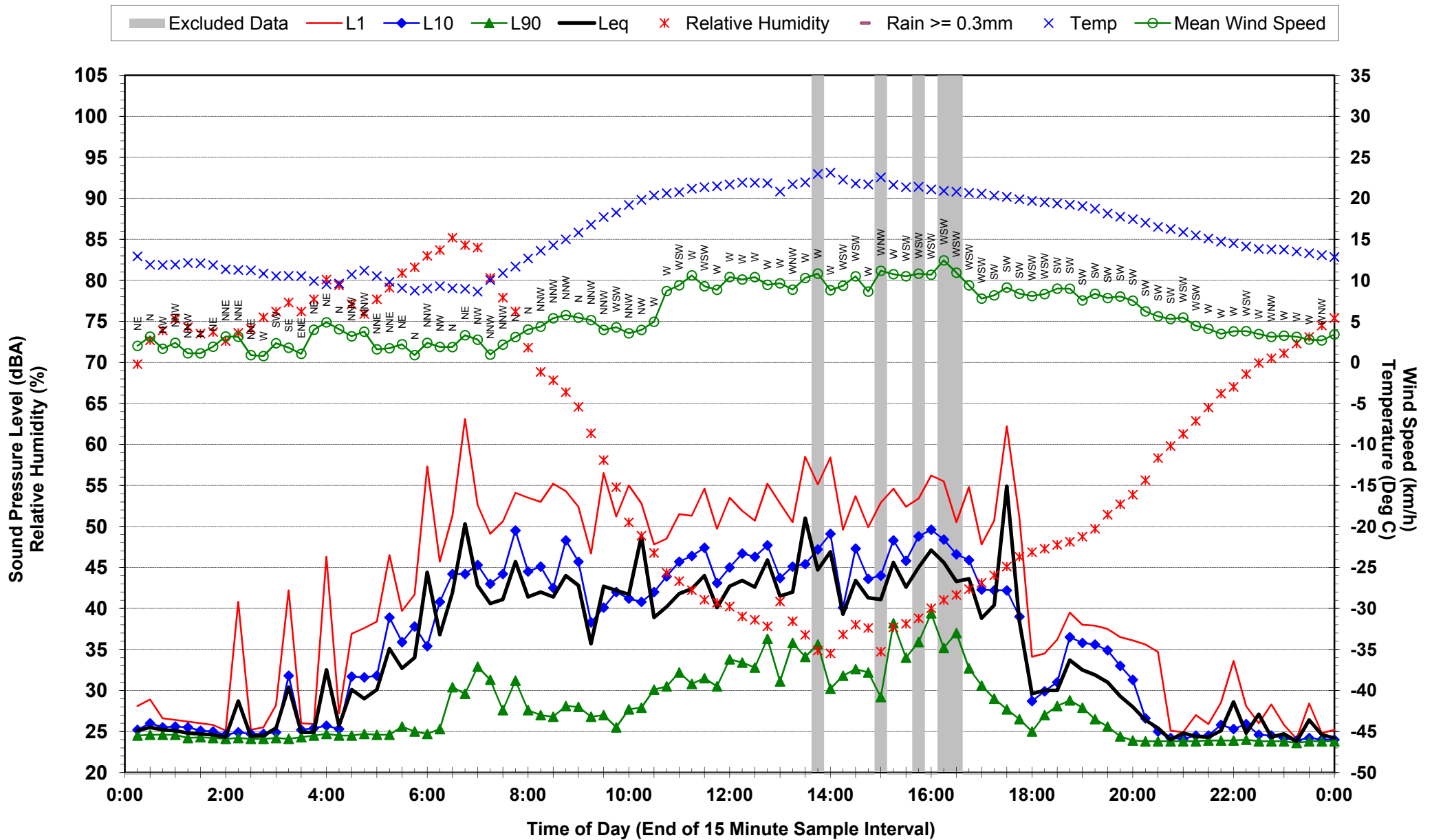
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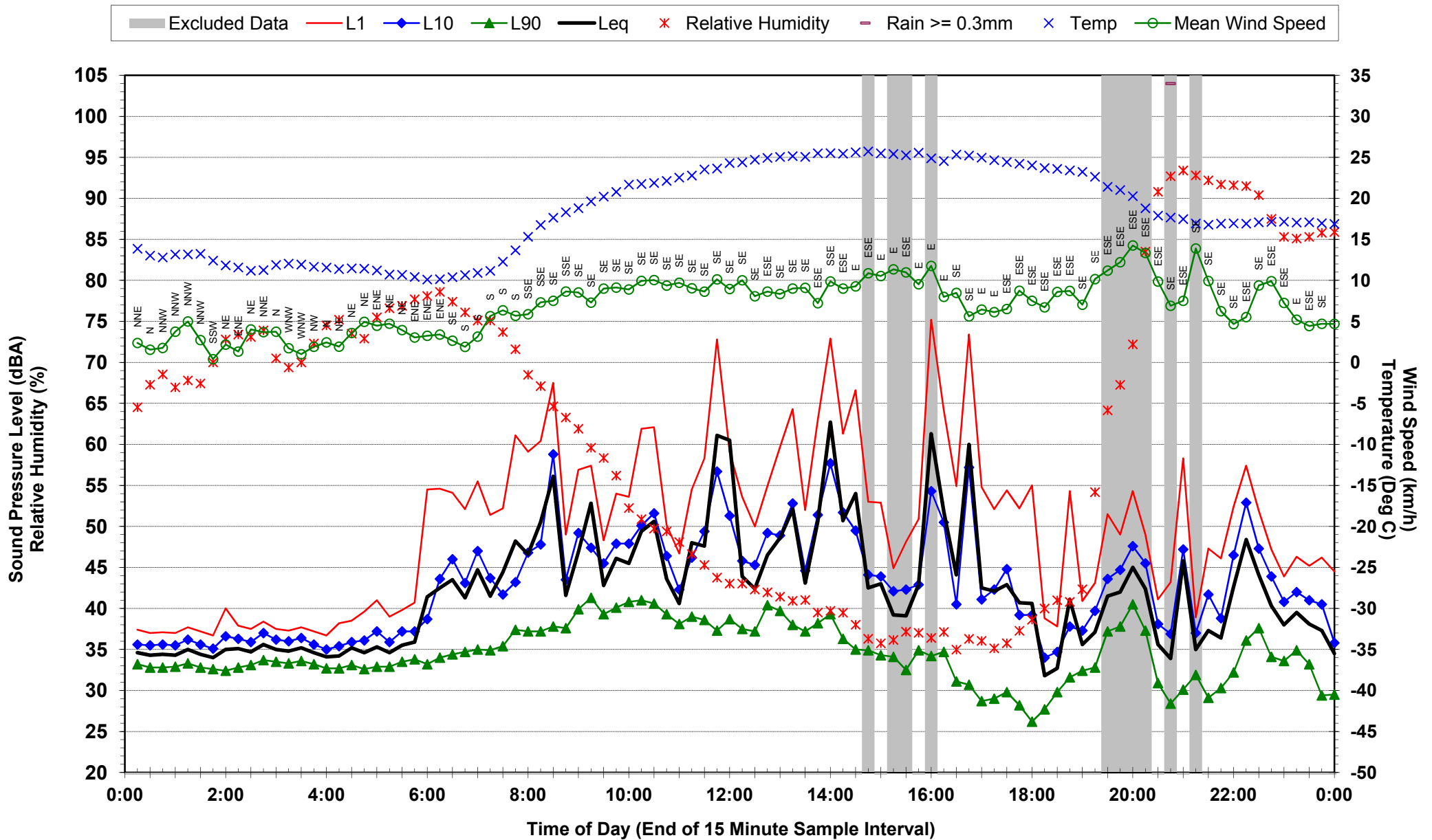
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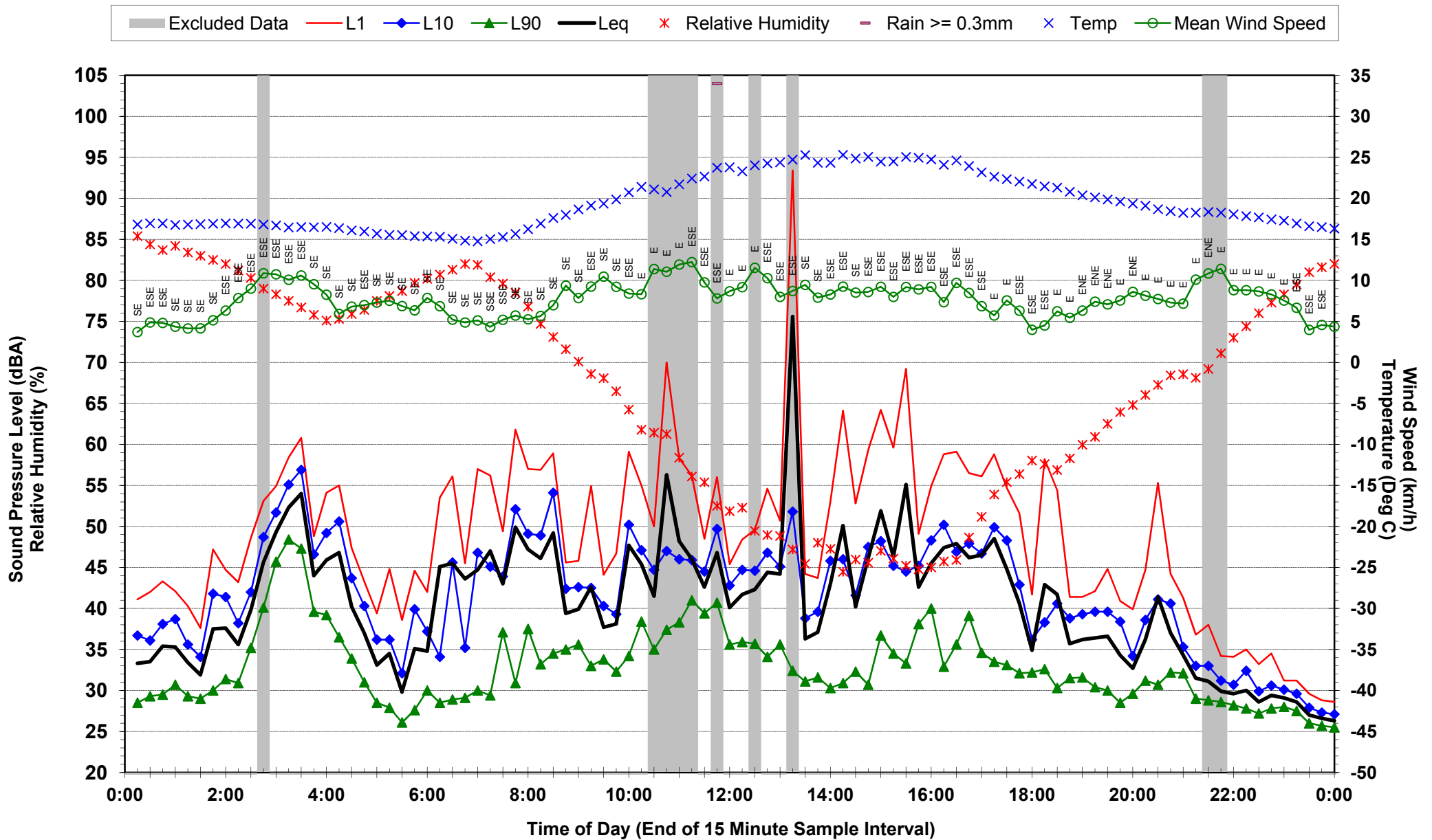
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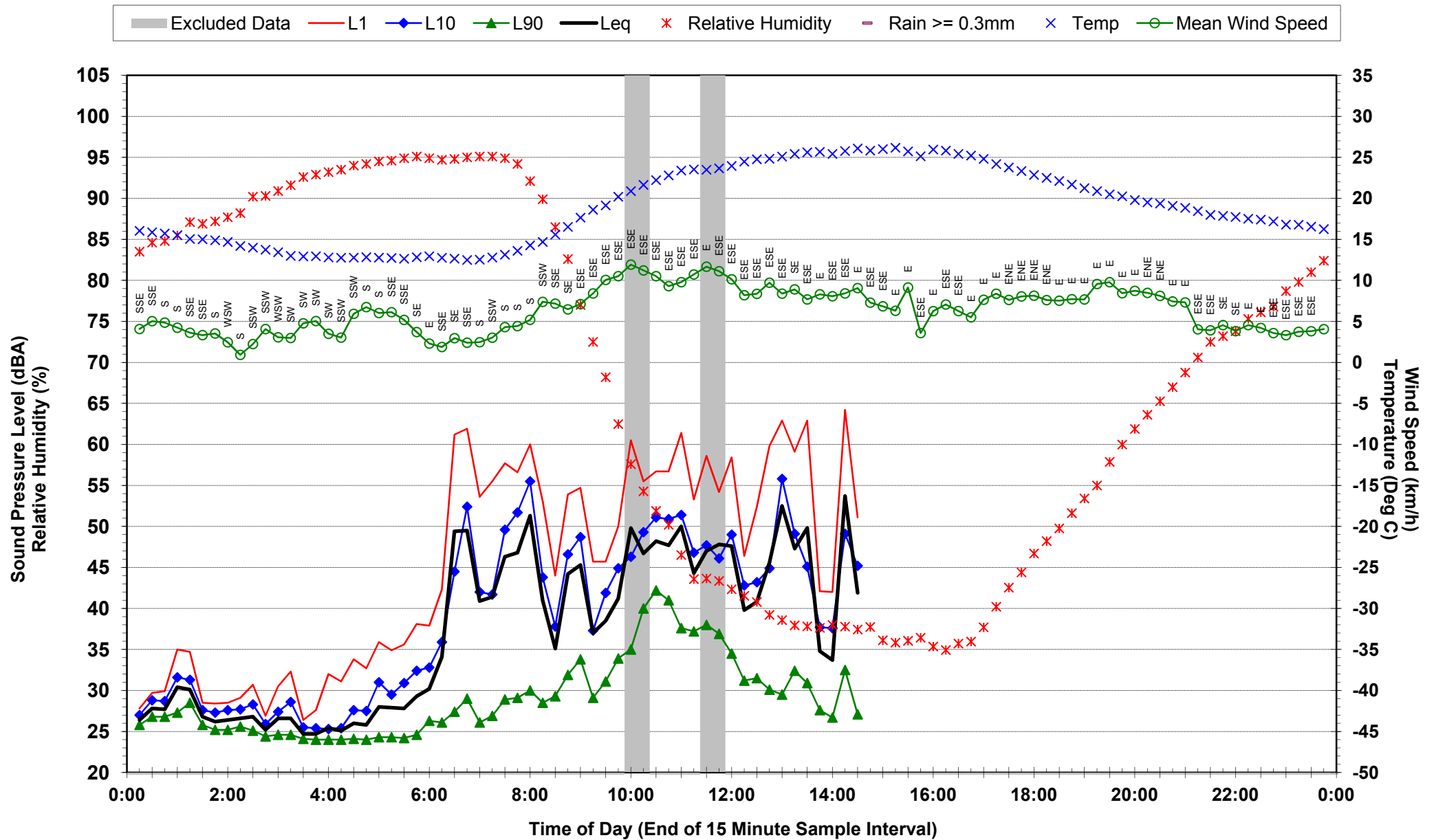
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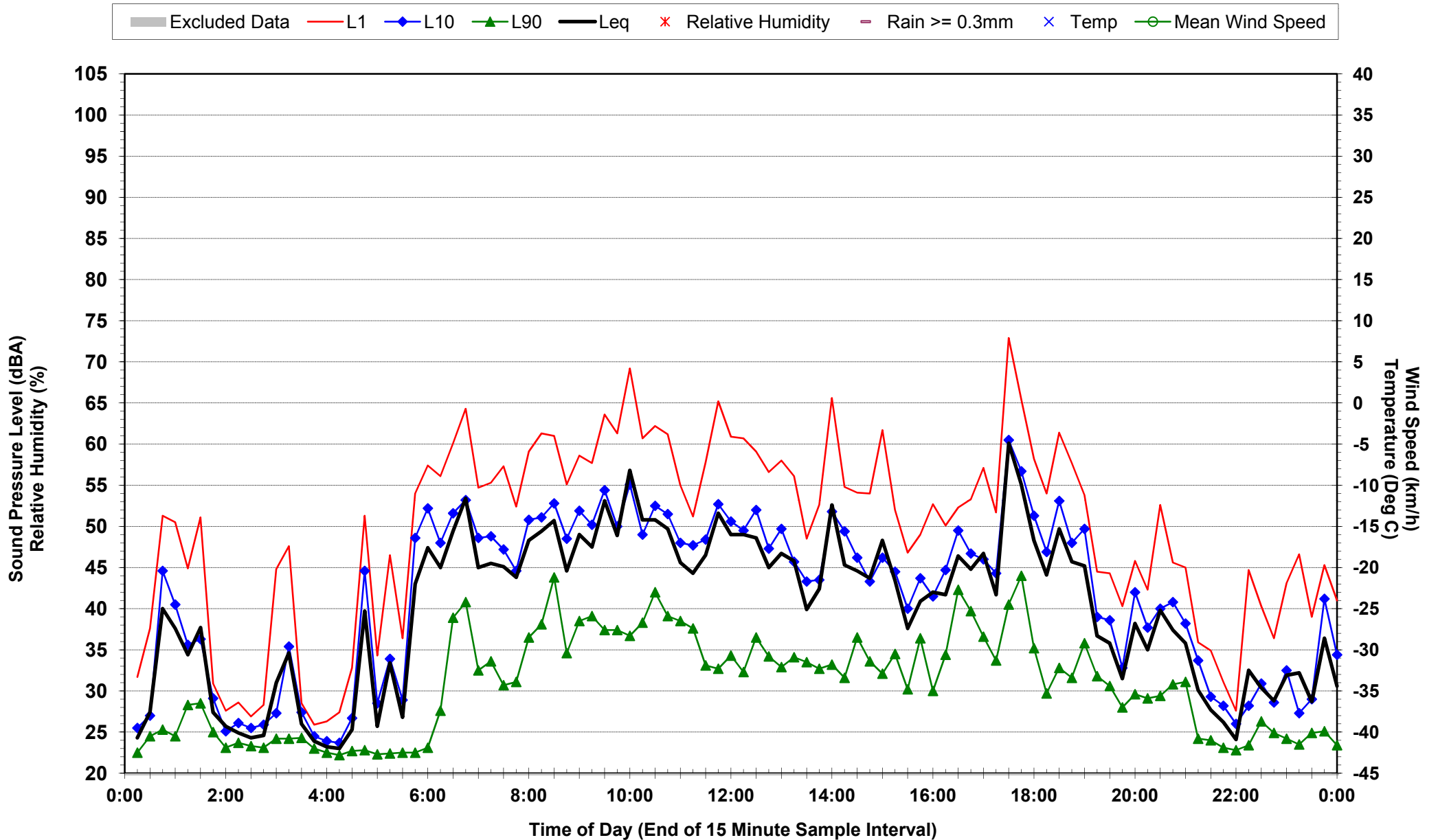
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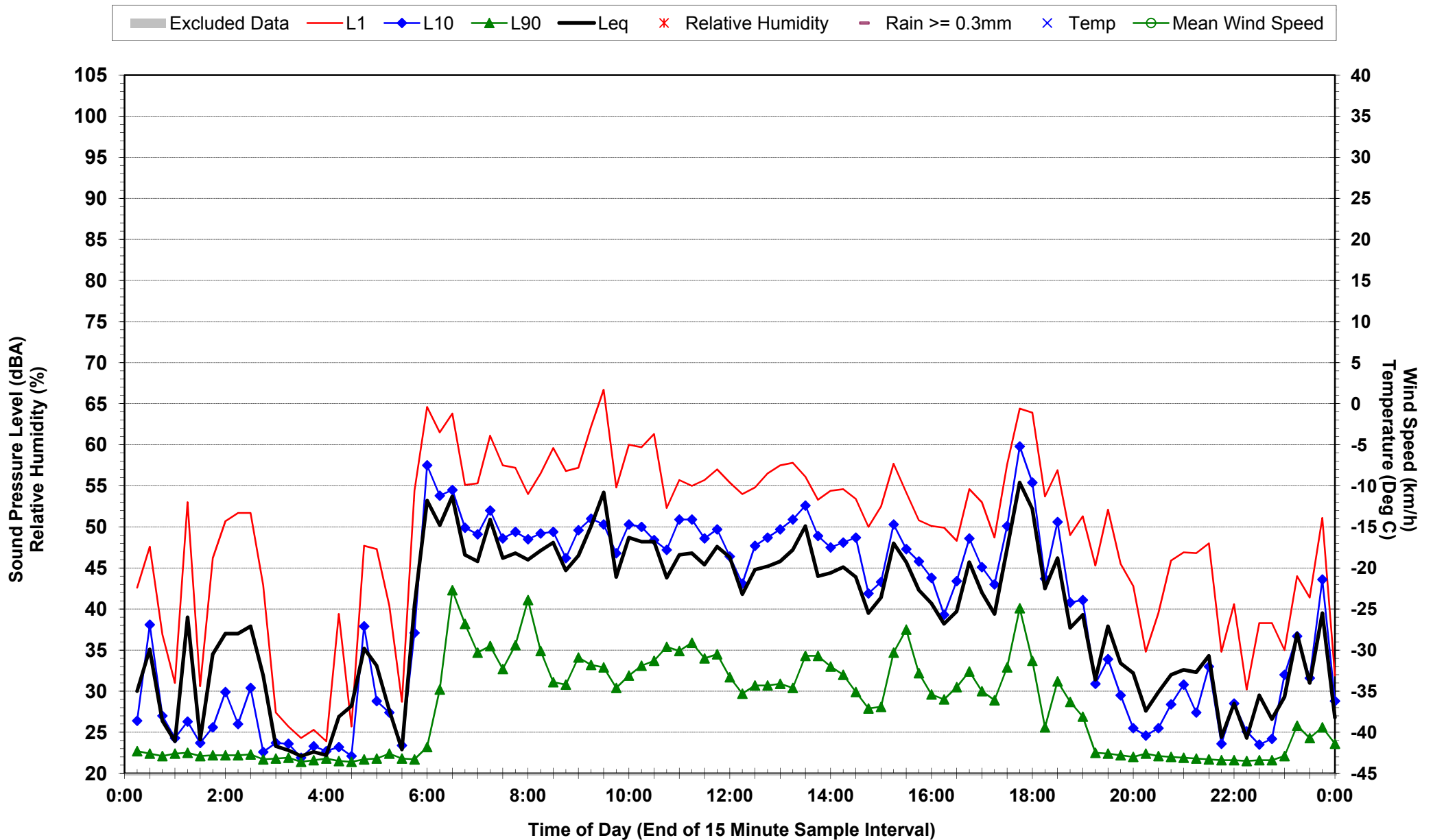
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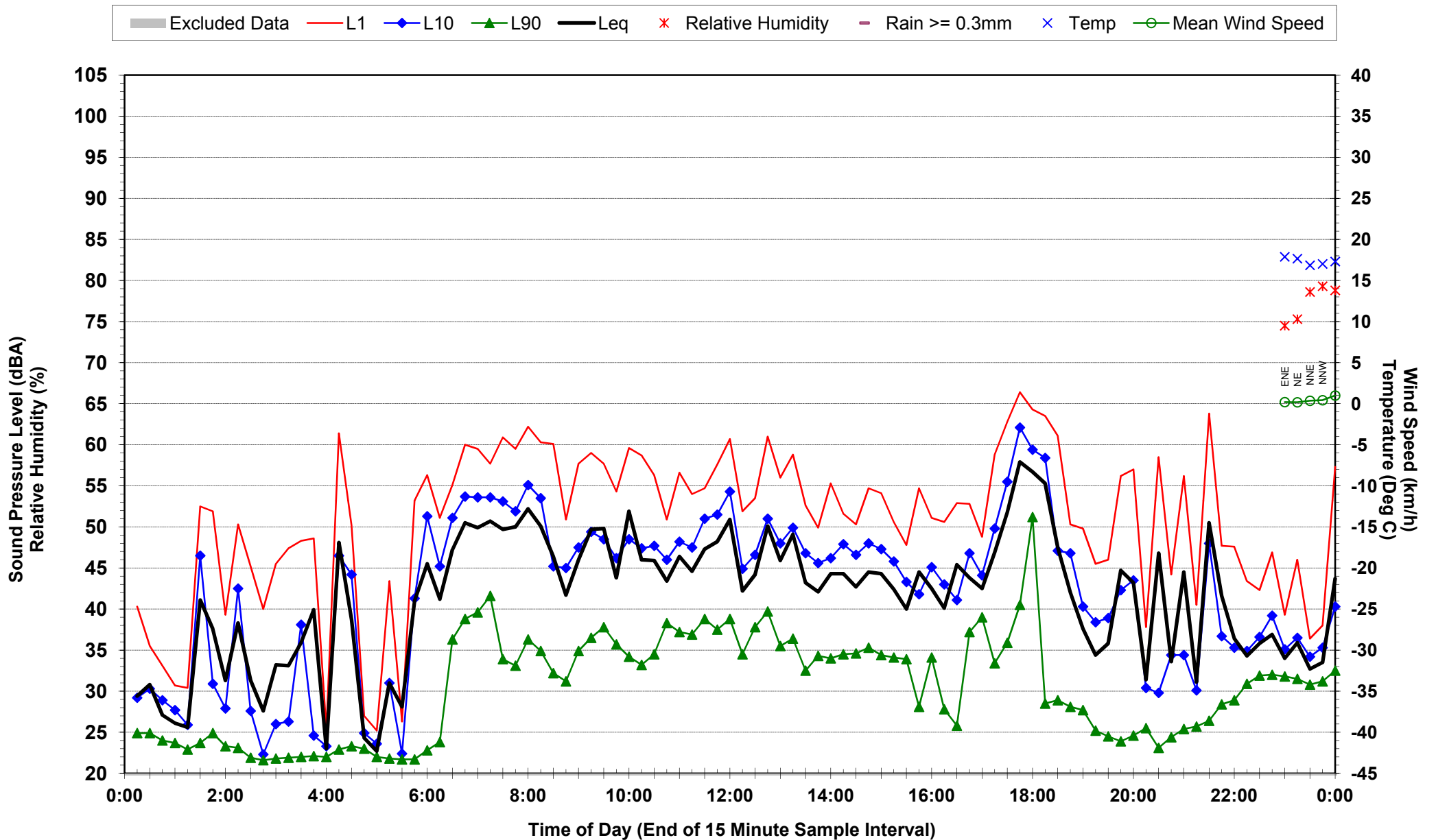
Statistical Ambient Noise Levels Red Hill Mining Lease Project - Riverside Homestead - Tuesday 2 June 2009



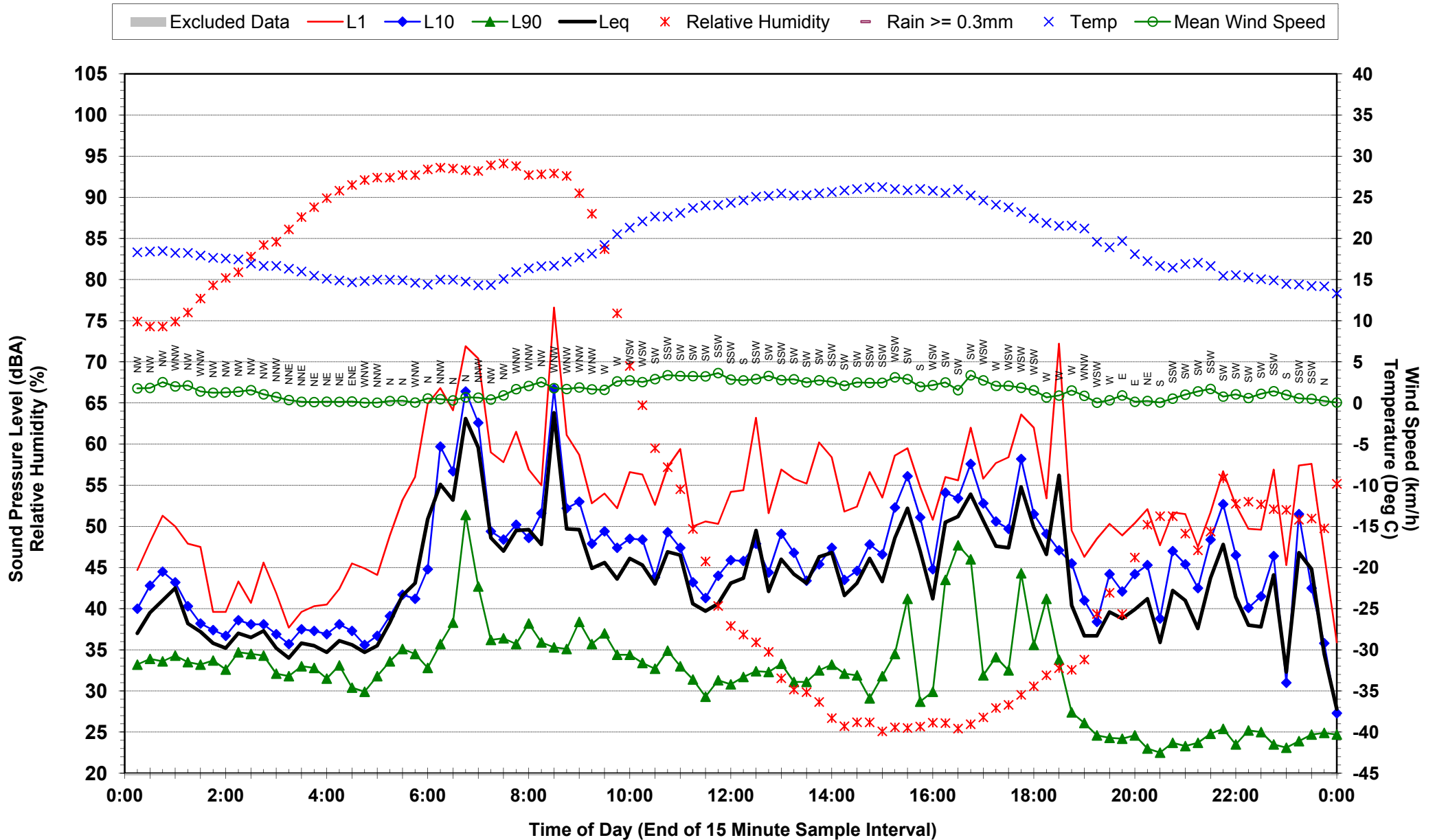
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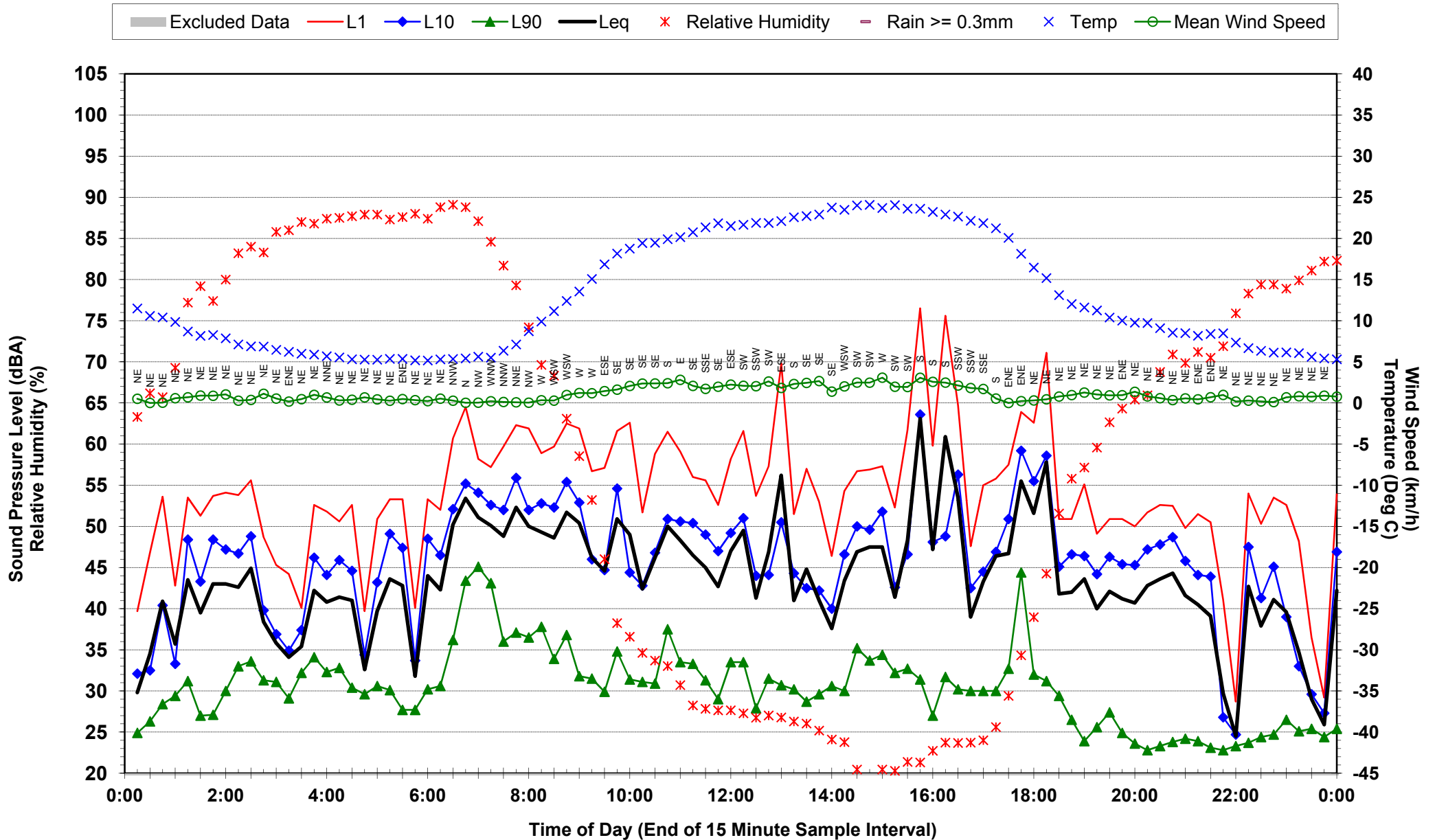
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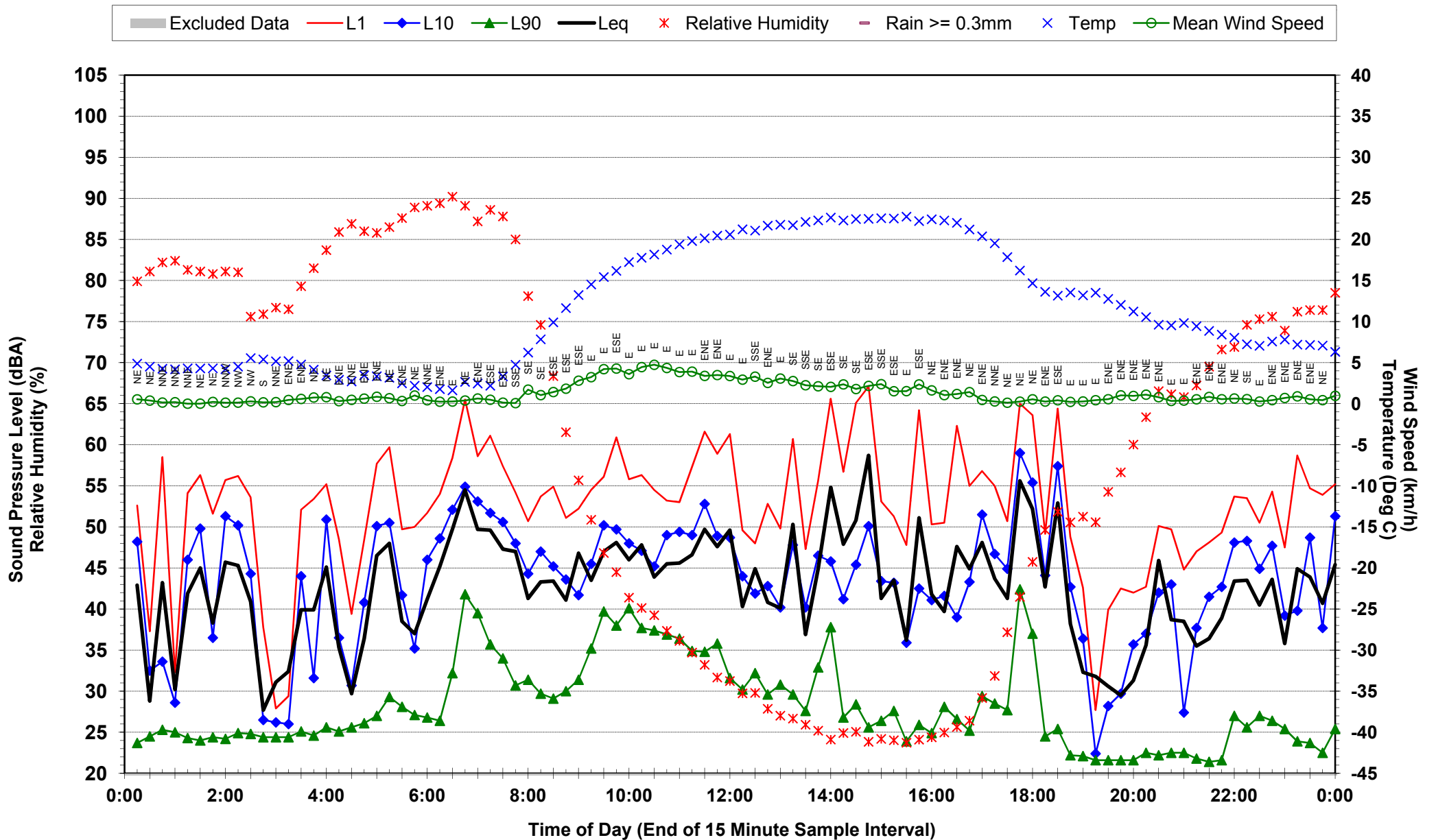


Statistical Ambient Noise Levels **Red Hill Mining Lease Project - Riverside Homestead - Monday 8 June 2009**

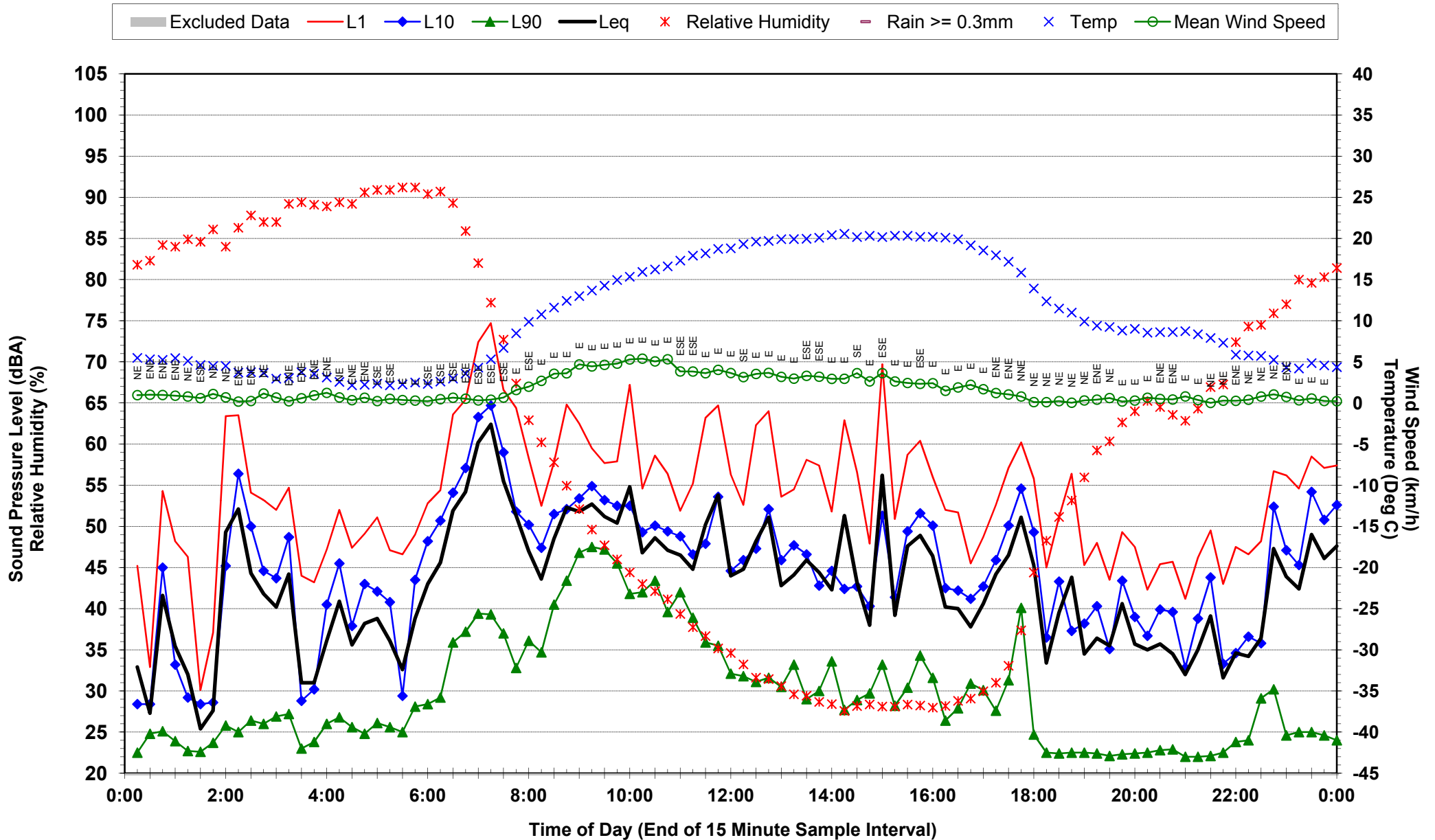




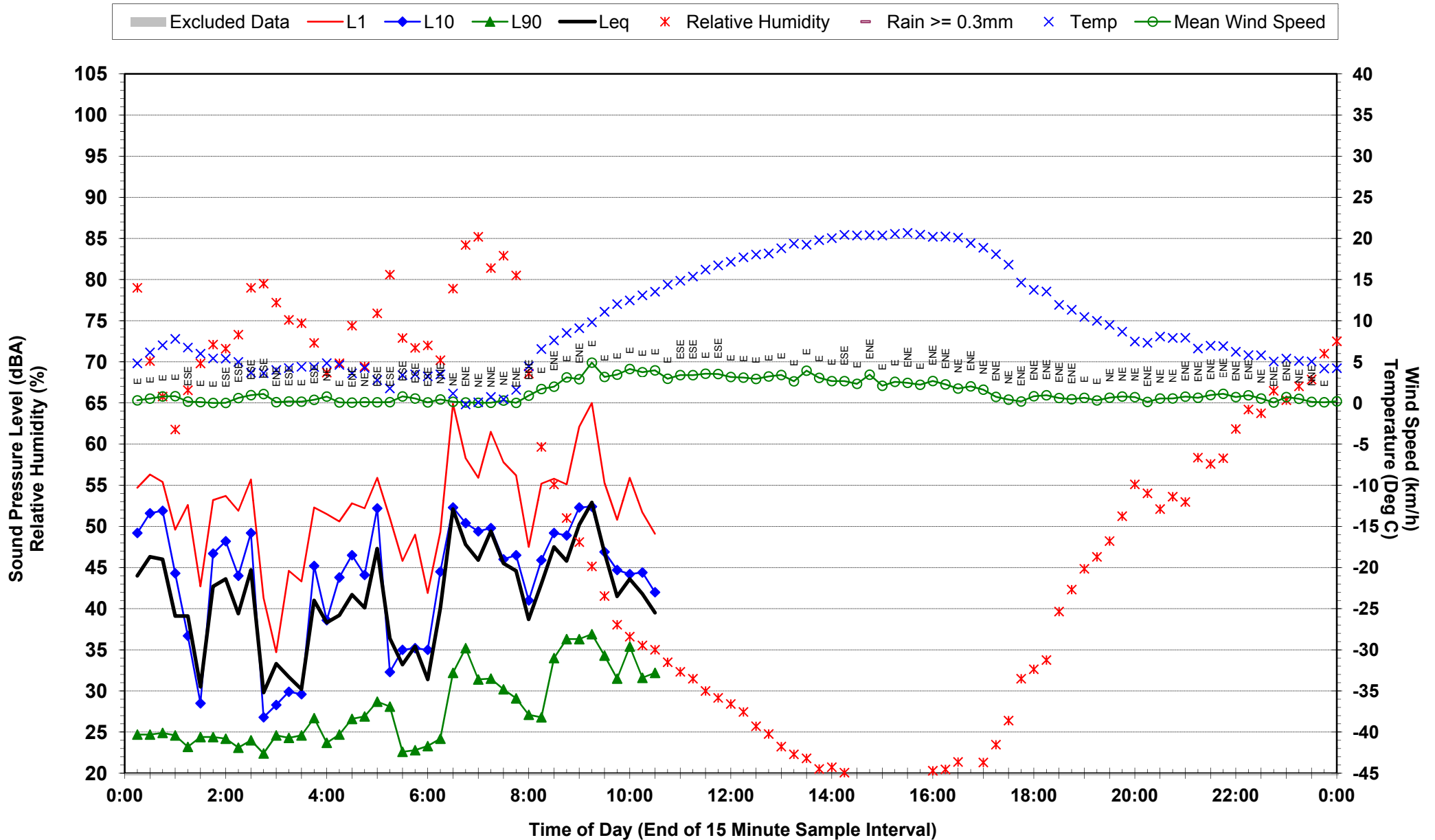
Statistical Ambient Noise Levels **Red Hill Mining Lease Project - Riverside Homestead - Wednesday 10 June 2009**



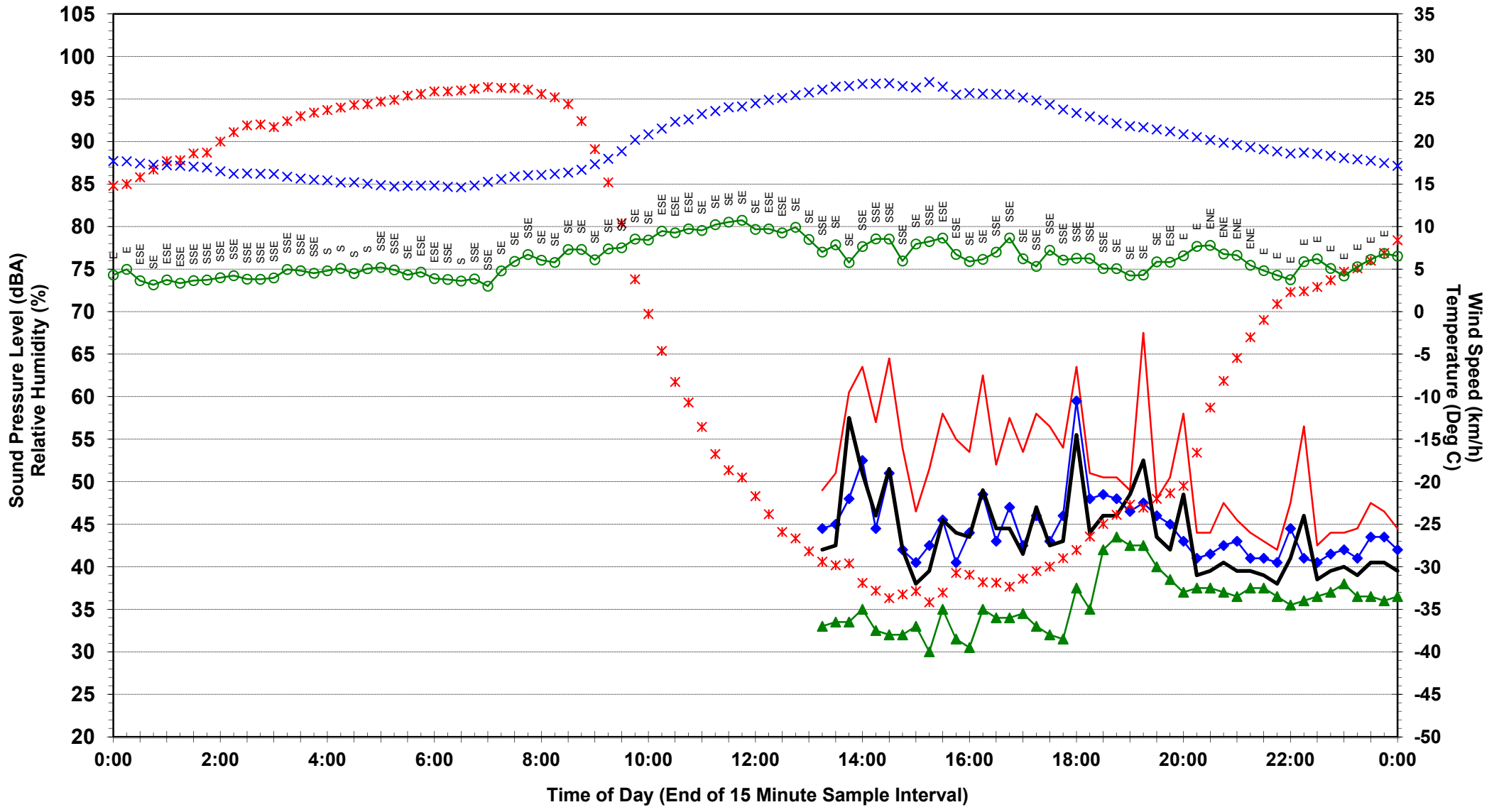
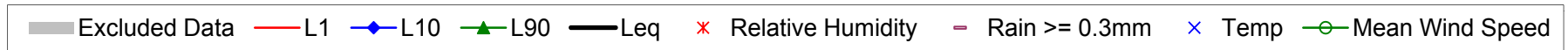
Statistical Ambient Noise Levels **Red Hill Mining Lease Project - Riverside Homestead - Thursday 11 June 2009**



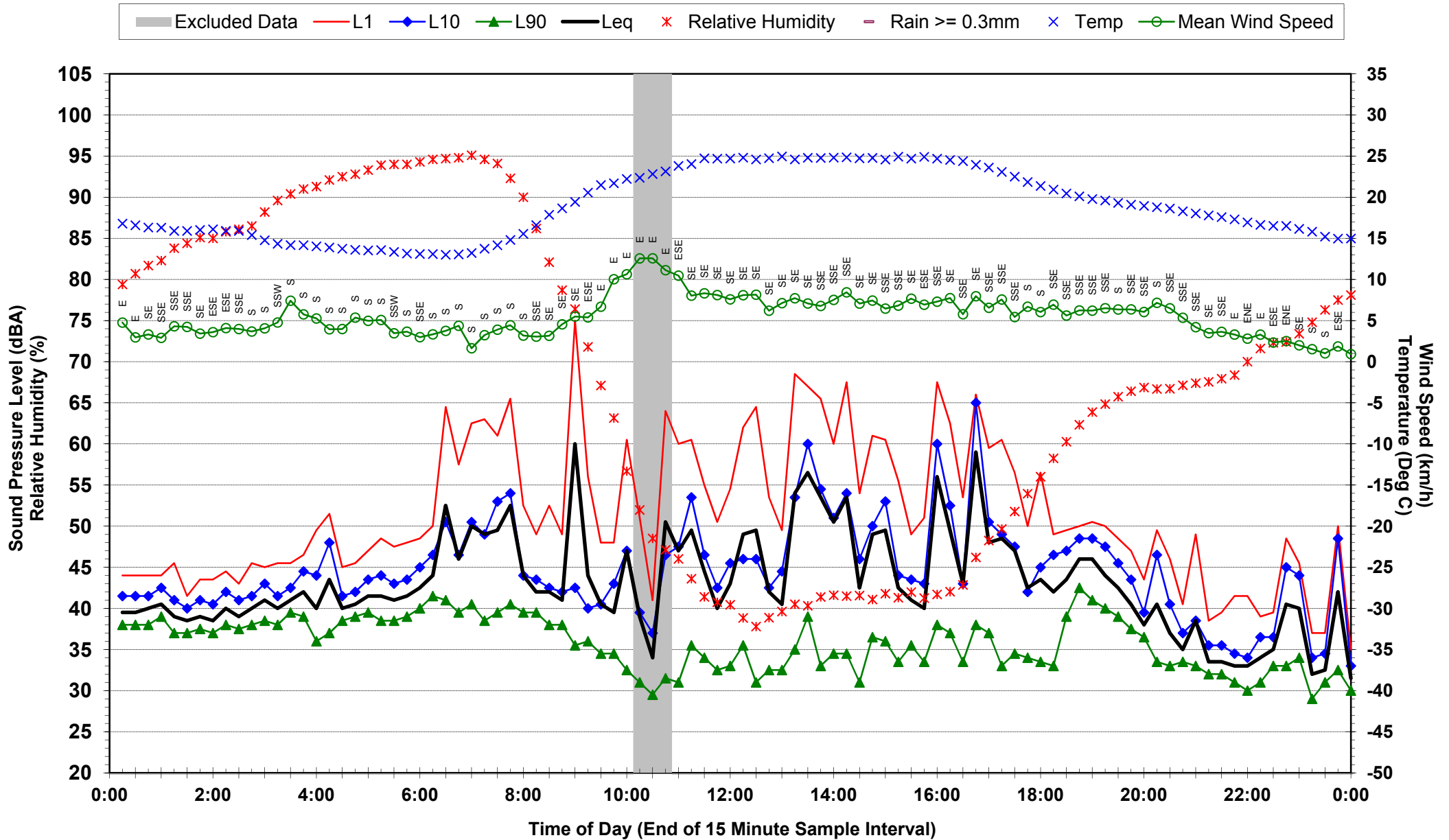
Statistical Ambient Noise Levels **Red Hill Mining Lease Project - Riverside Homestead - Friday 12 June 2009**



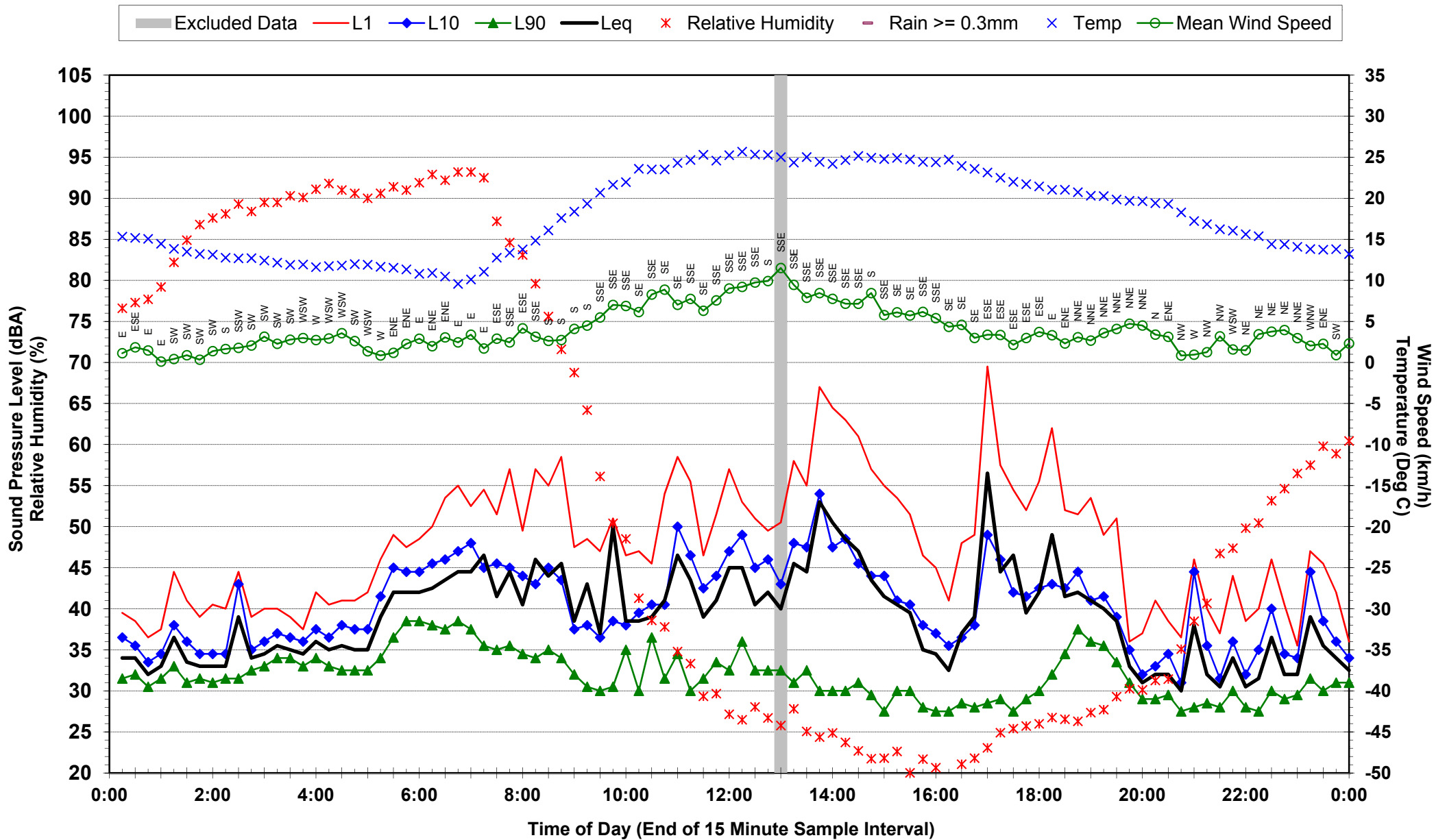
Statistical Ambient Noise Levels **Red Hill Mining Lease Project - Broadmeadows - Thursday 14 May 2009**



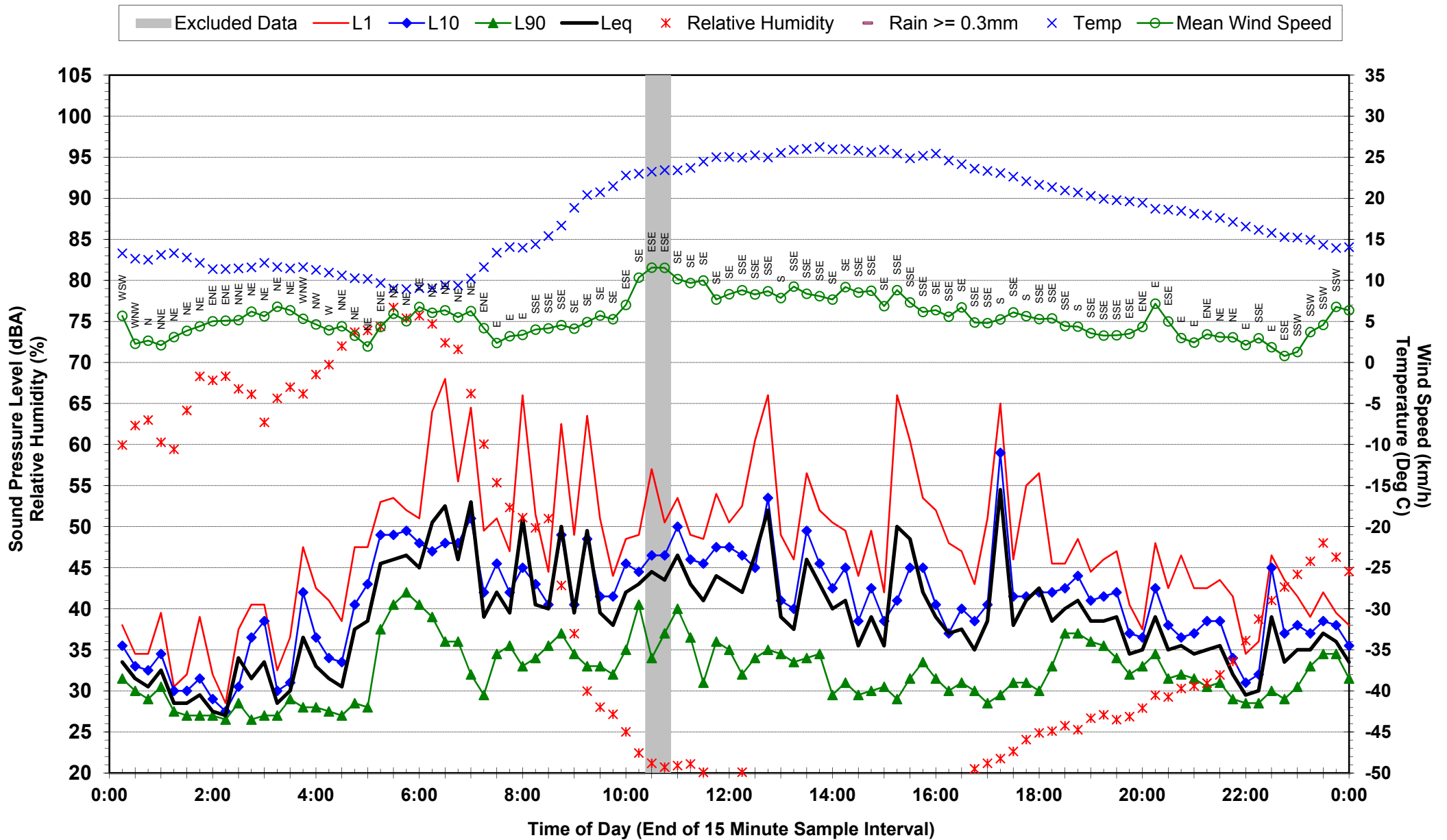
Statistical Ambient Noise Levels **Red Hill Mining Lease Project - Broadmeadows - Friday 15 May 2009**



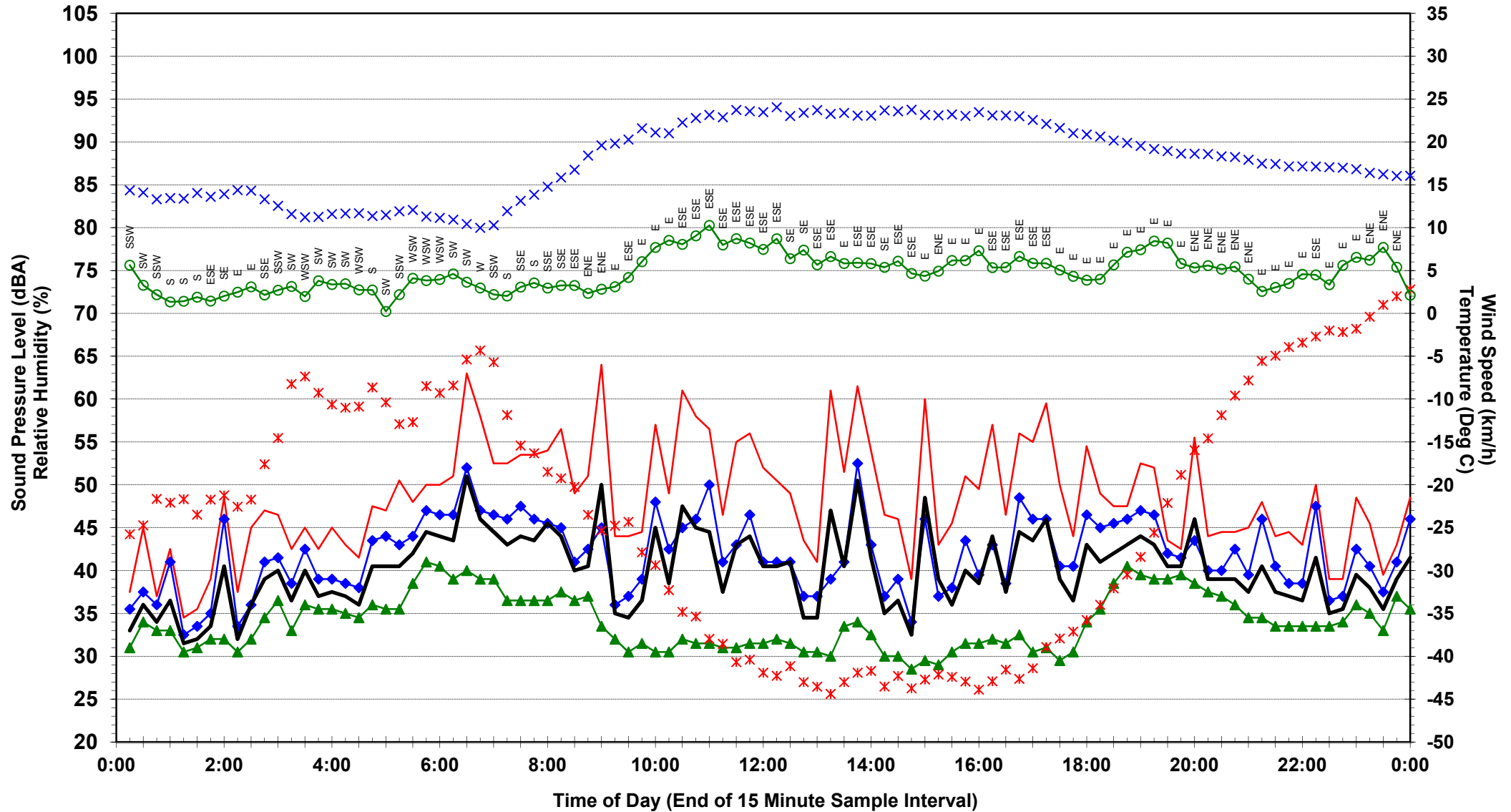
Statistical Ambient Noise Levels **Red Hill Mining Lease Project - Broadmeadows - Saturday 16 May 2009**



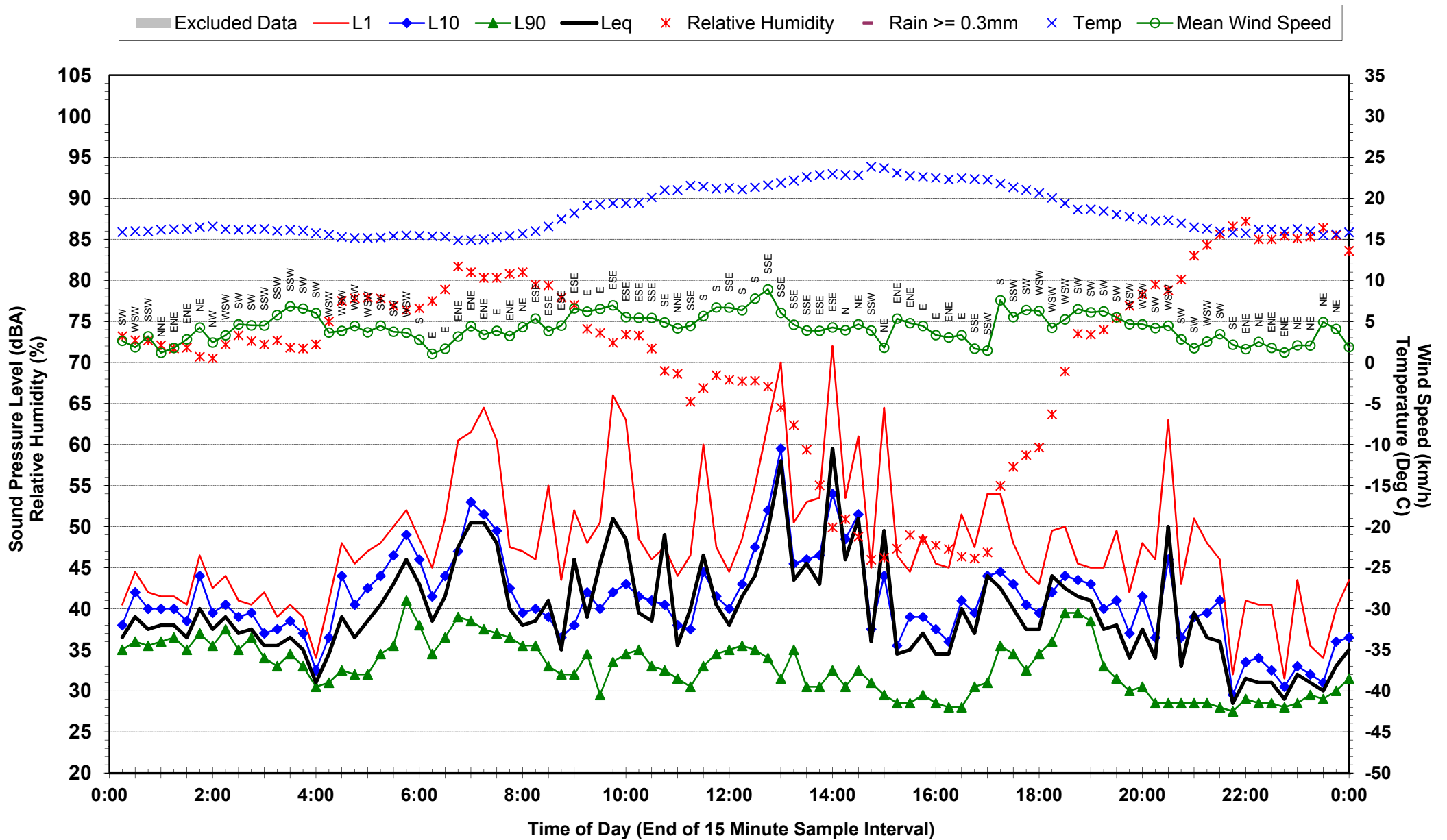
Statistical Ambient Noise Levels **Red Hill Mining Lease Project - Broadmeadows - Sunday 17 May 2009**



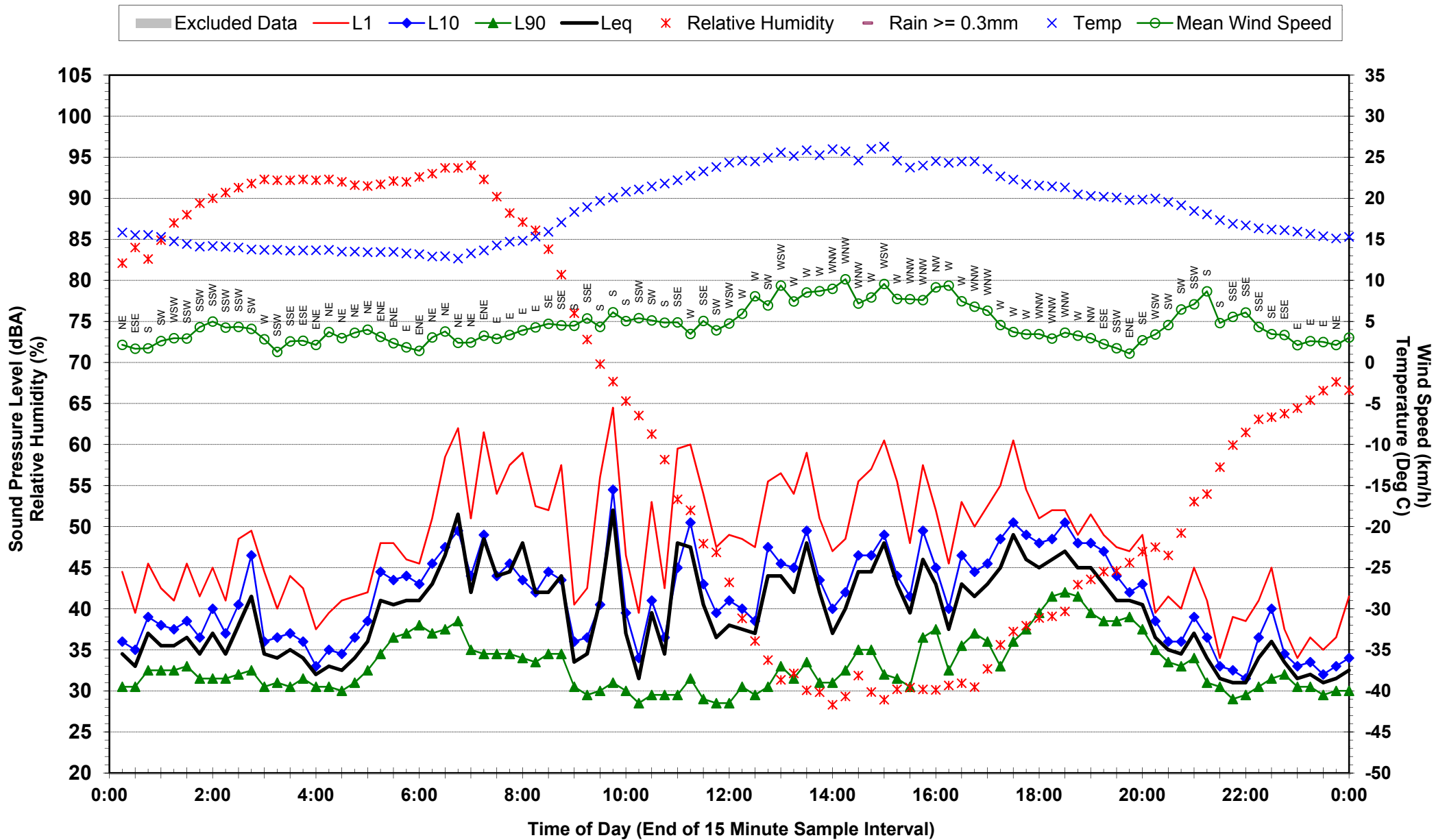
Excluded Data
 L1
 L10
 L90
 Leq
 × Relative Humidity
 Rain $\geq$ 0.3mm
 × Temp
 ○ Mean Wind Speed



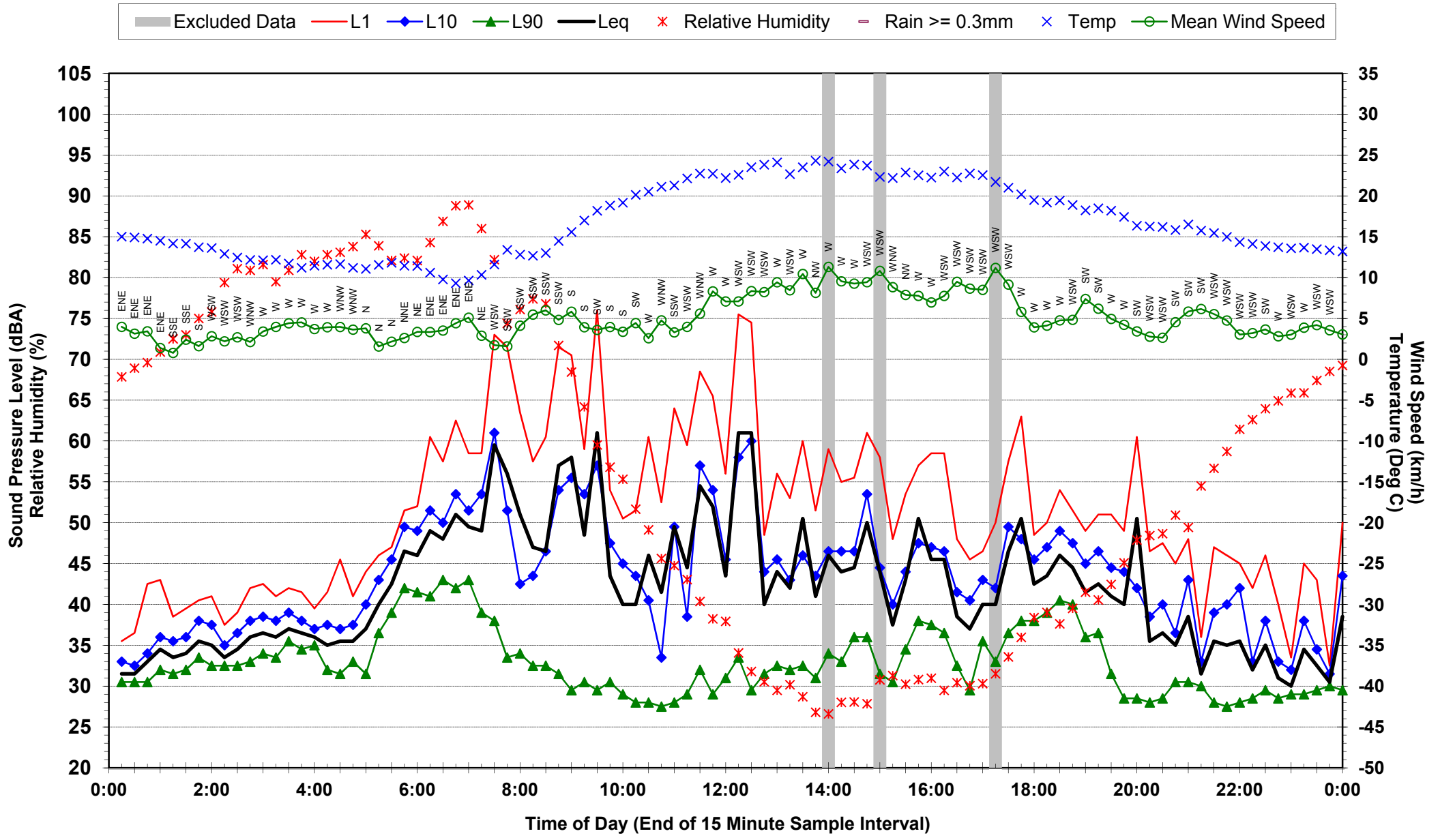
Statistical Ambient Noise Levels **Red Hill Mining Lease Project - Broadmeadows - Tuesday 19 May 2009**



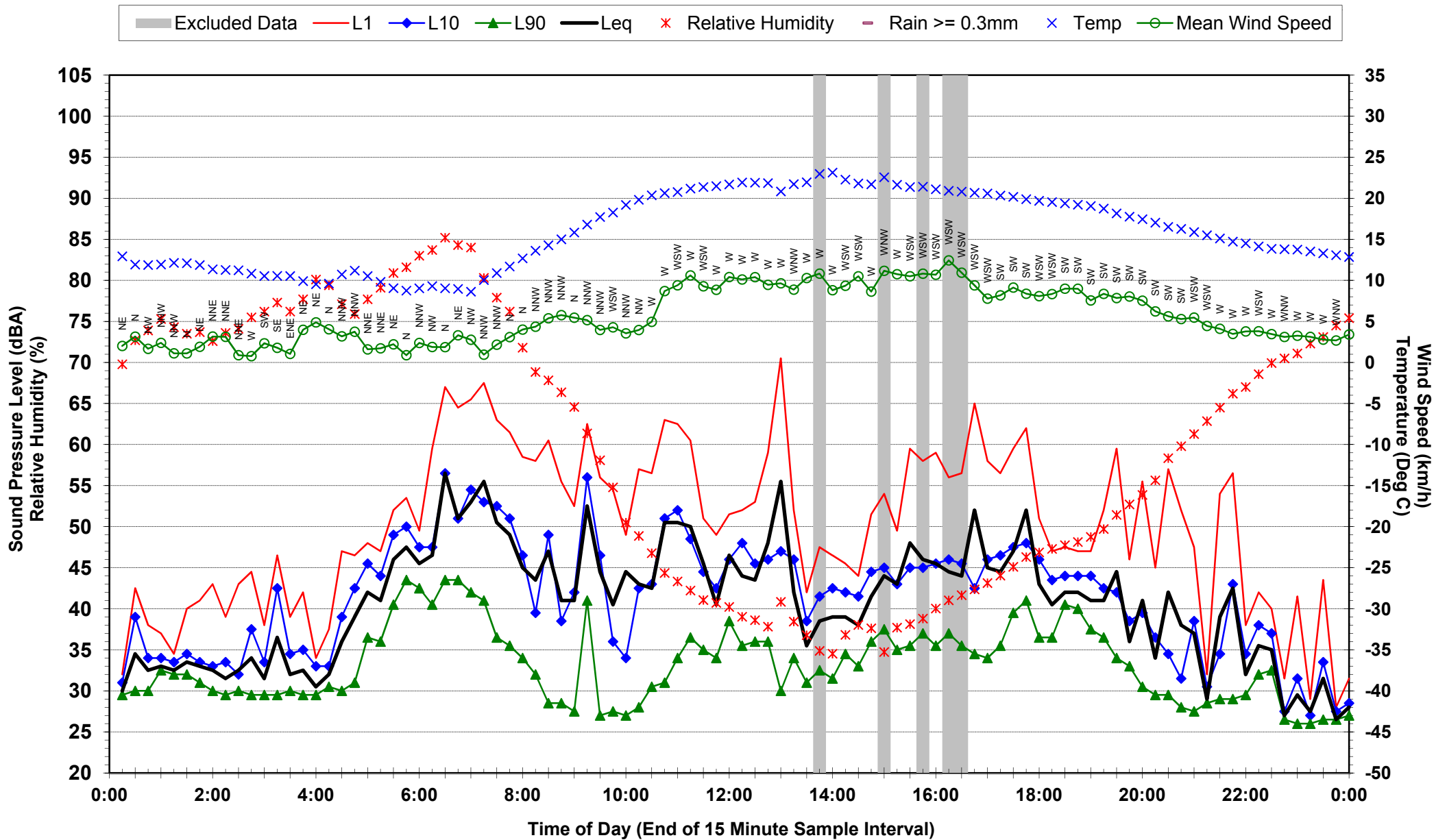
Statistical Ambient Noise Levels **Red Hill Mining Lease Project - Broadmeadows - Wednesday 20 May 2009**



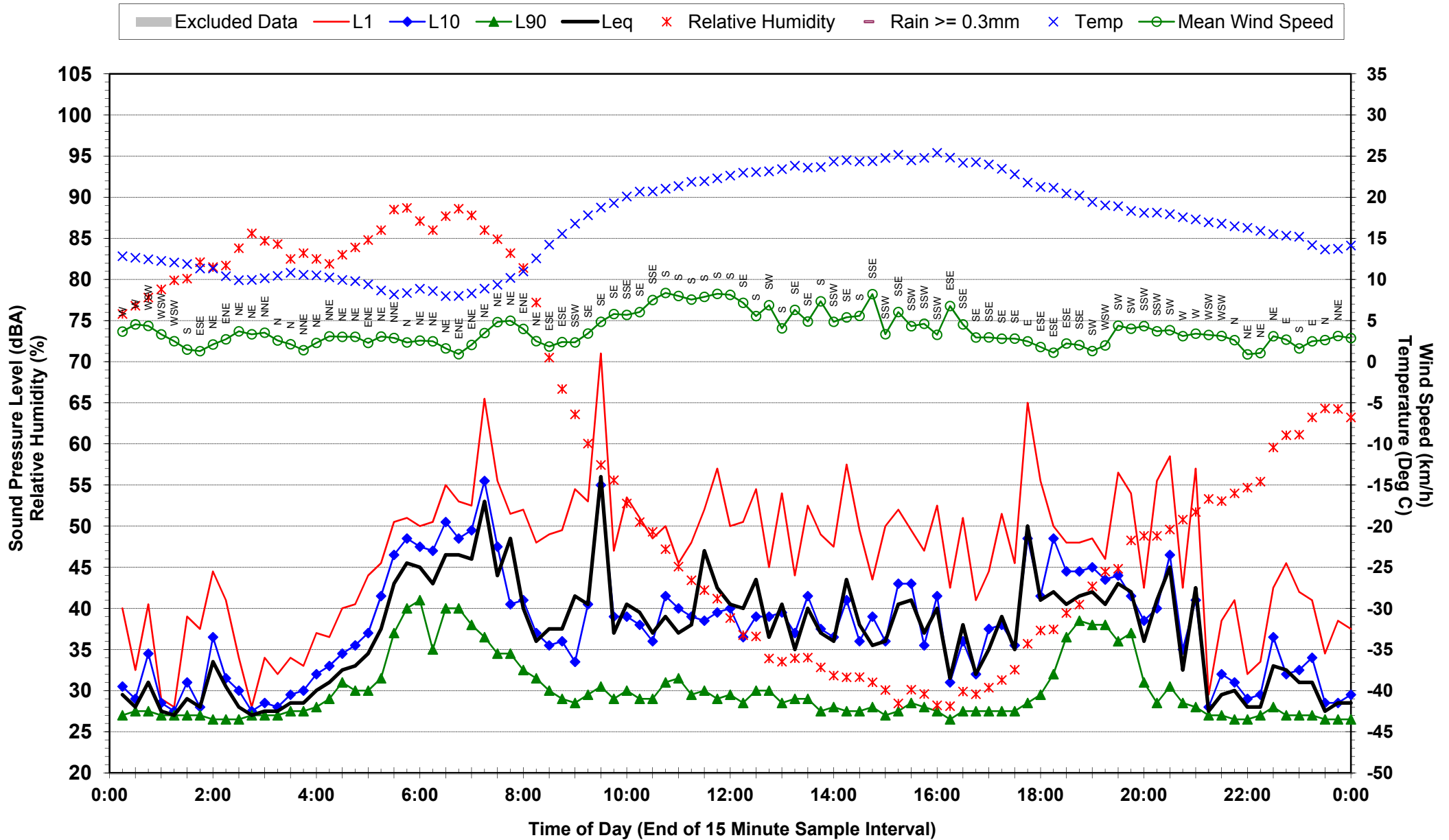
Statistical Ambient Noise Levels **Red Hill Mining Lease Project - Broadmeadows - Thursday 21 May 2009**



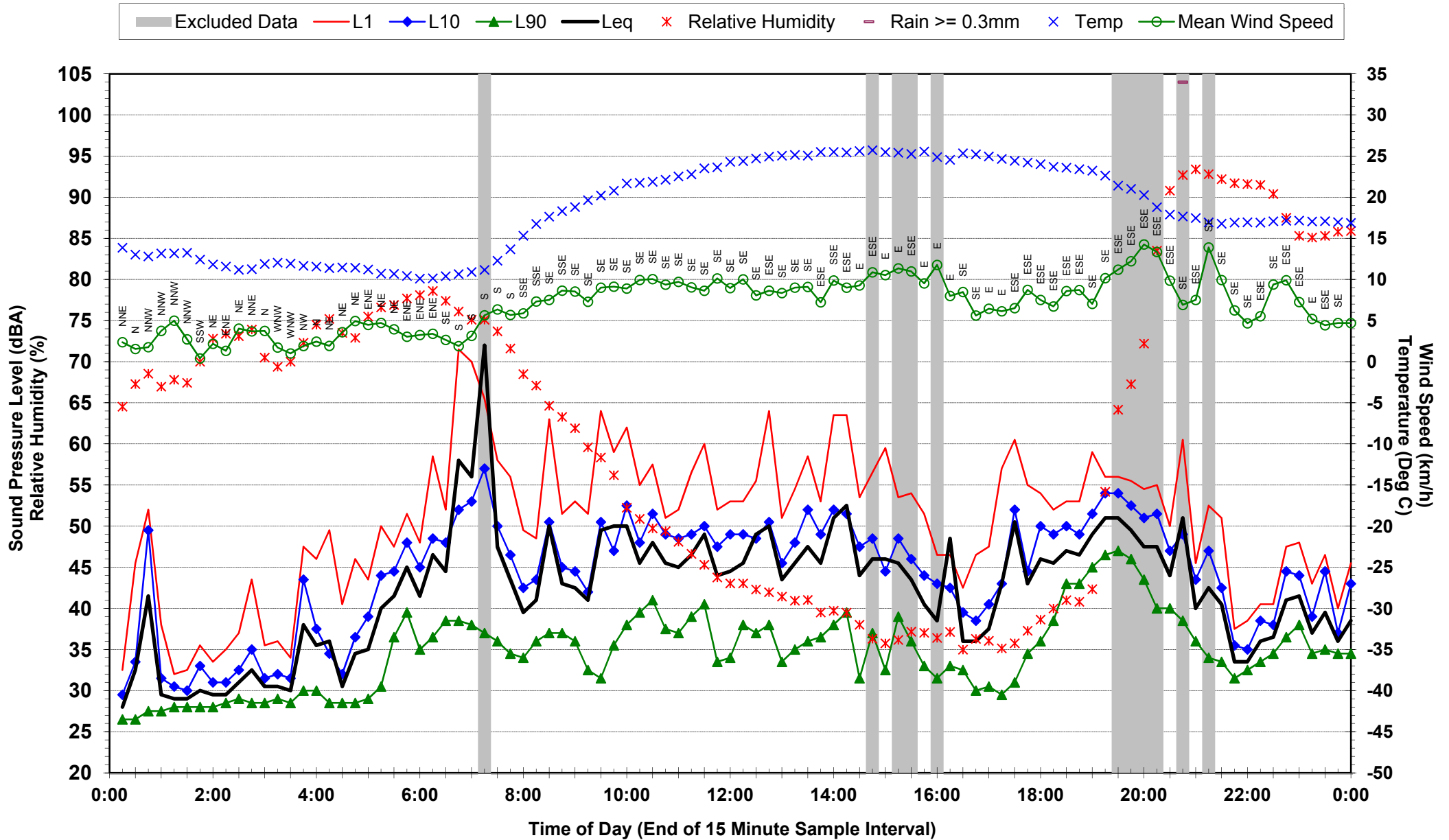
Statistical Ambient Noise Levels **Red Hill Mining Lease Project - Broadmeadows - Friday 22 May 2009**



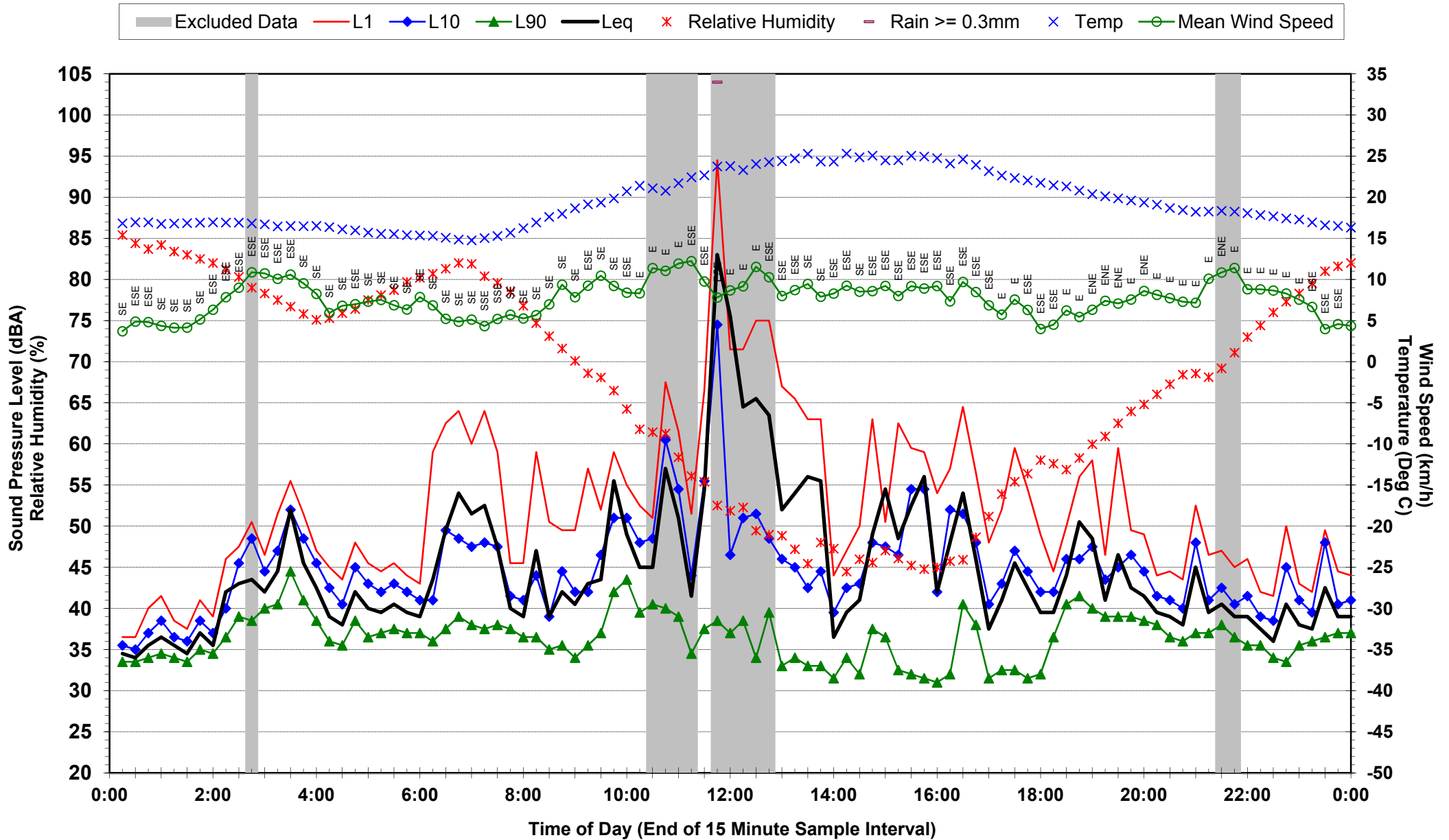
Statistical Ambient Noise Levels **Red Hill Mining Lease Project - Broadmeadows - Saturday 23 May 2009**



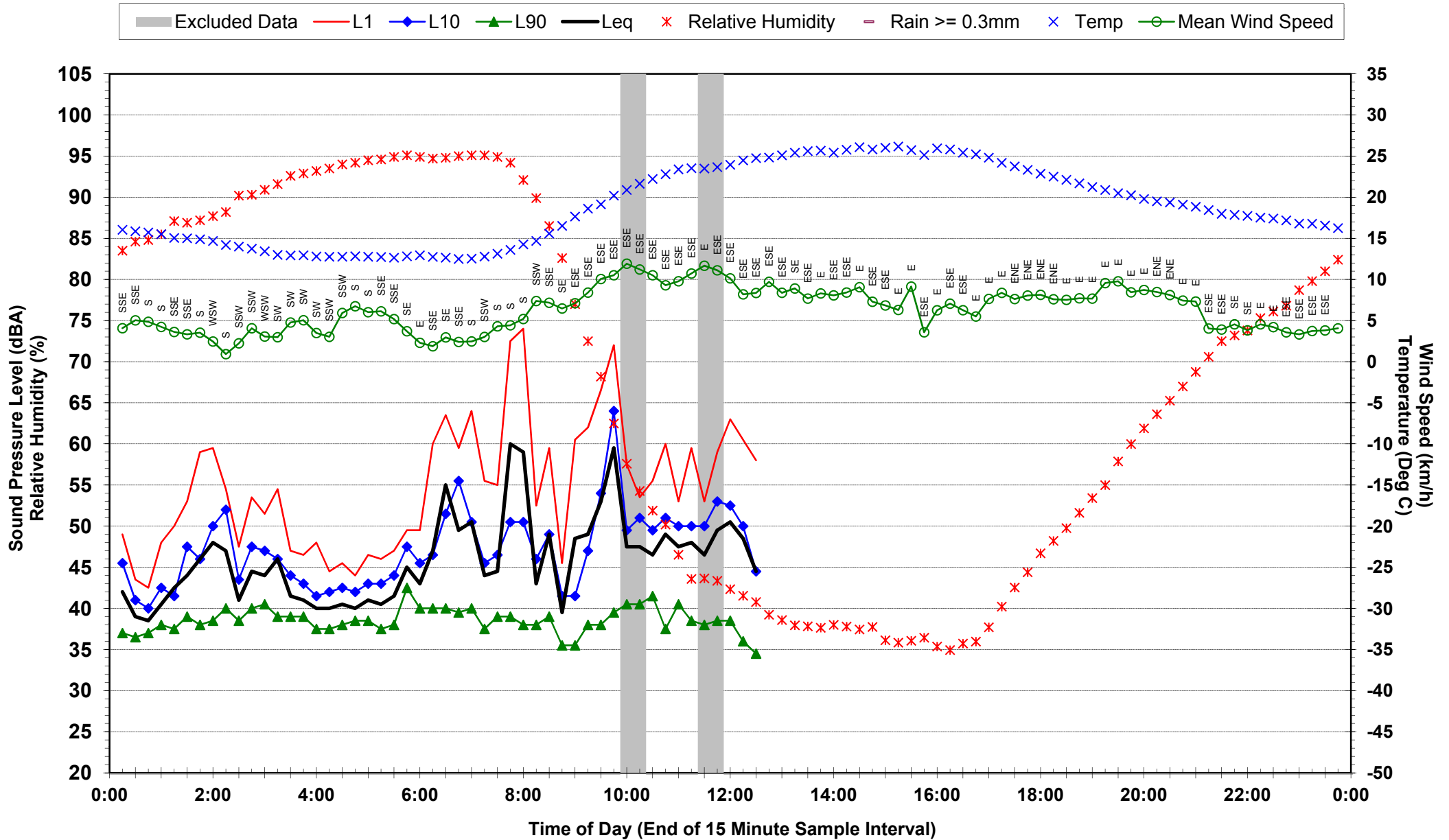
Statistical Ambient Noise Levels **Red Hill Mining Lease Project - Broadmeadows - Sunday 24 May 2009**



Statistical Ambient Noise Levels **Red Hill Mining Lease Project - Broadmeadows - Monday 25 May 2009**

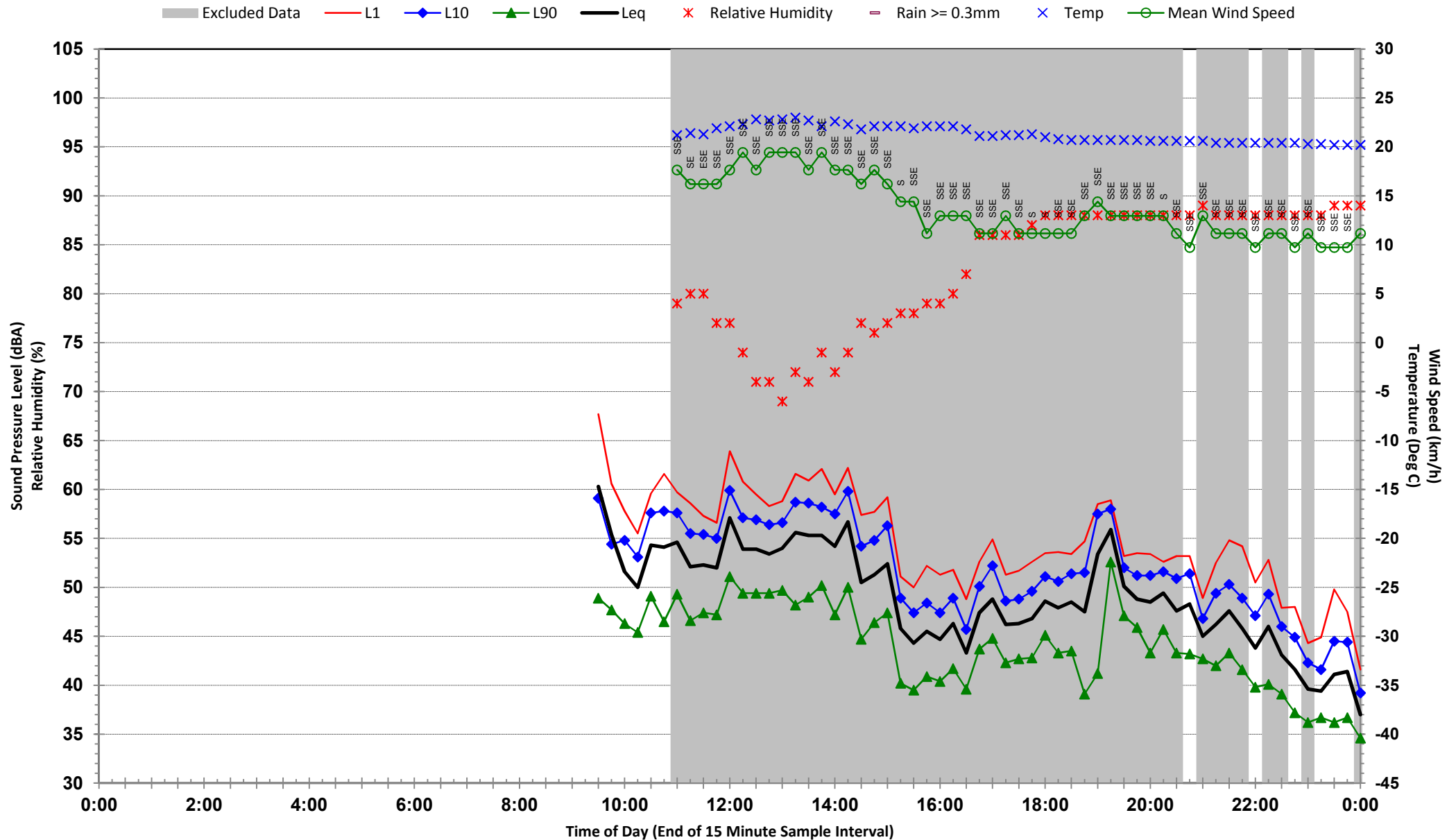


Statistical Ambient Noise Levels Red Hill Mining Lease Project - Broadmeadows - Tuesday 26 May 2009



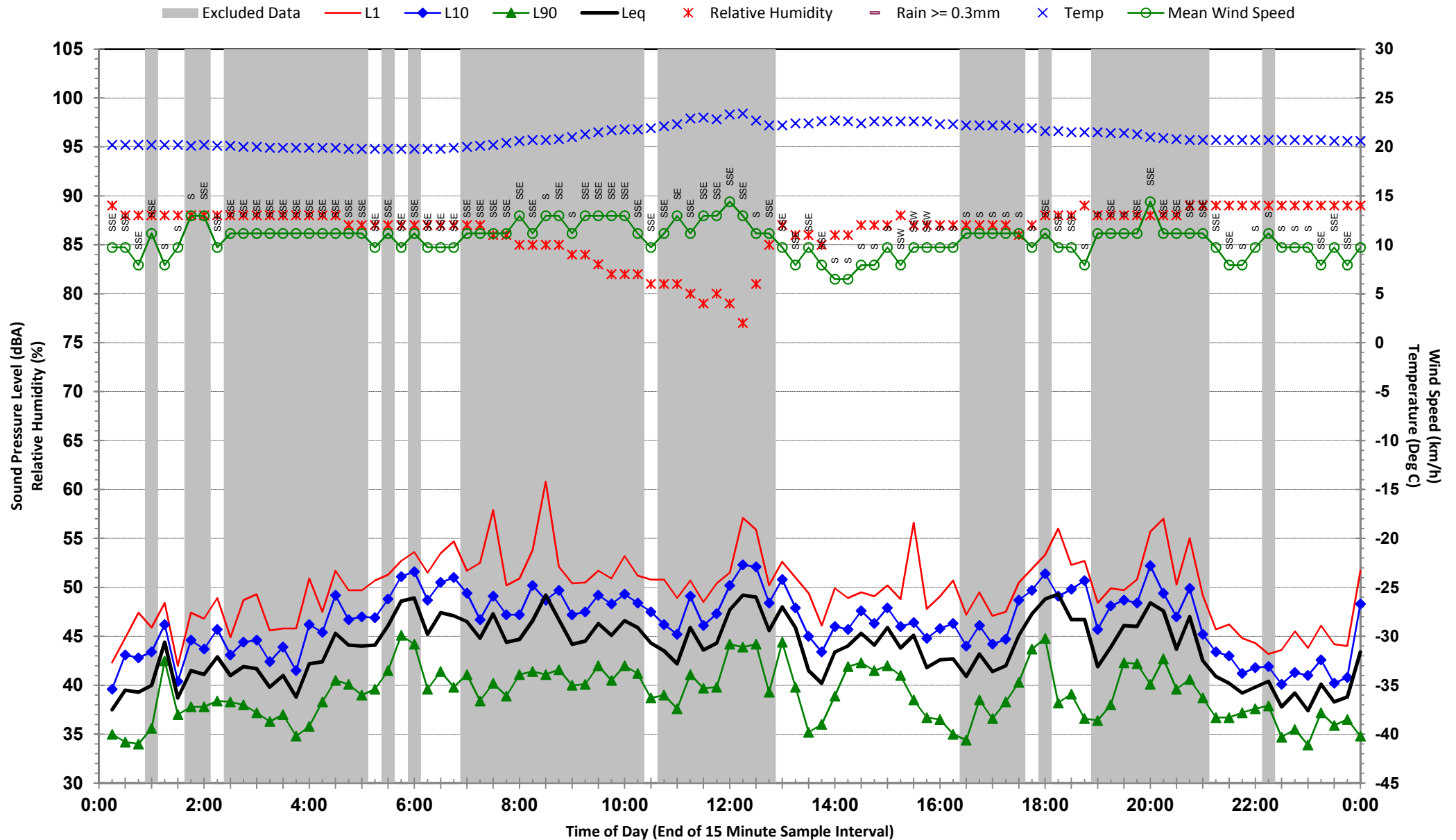
Statistical Ambient Noise Levels

Red Hill Mining Lease Project - Eureka Village - Thursday 31 March 2011



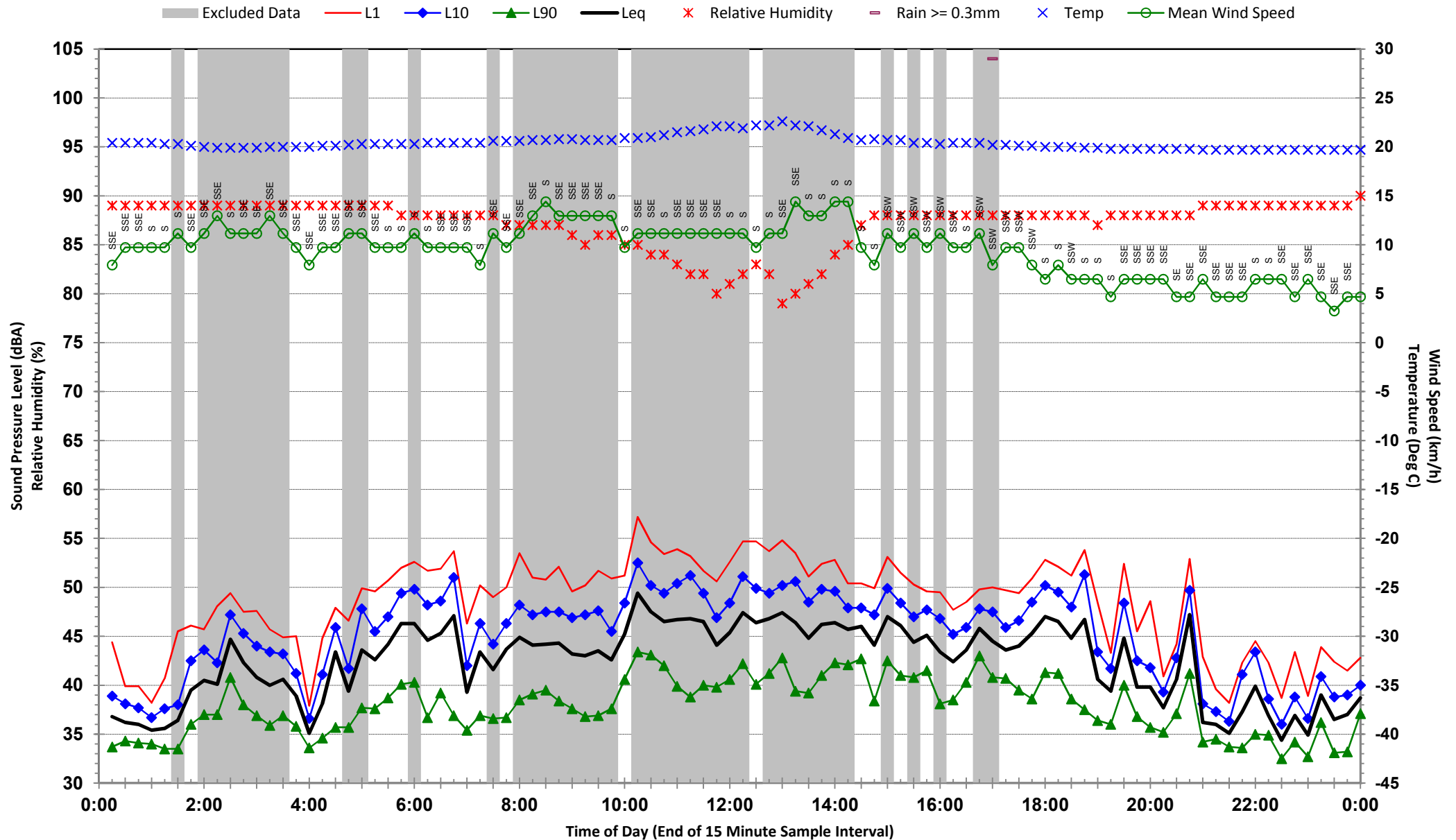
Statistical Ambient Noise Levels

Red Hill Mining Lease Project - Eureka Village - Friday 1 April 2011



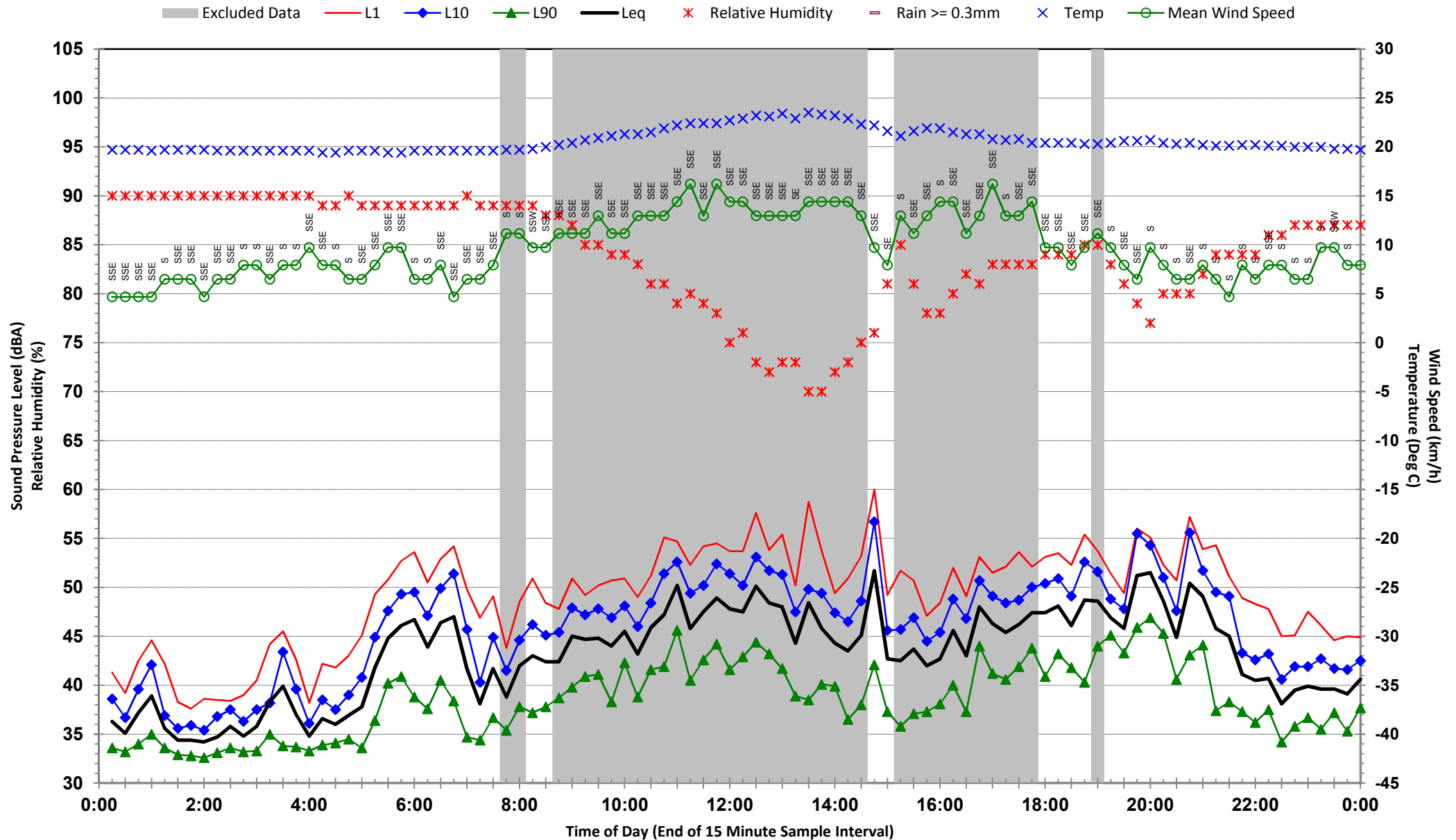
Statistical Ambient Noise Levels

Red Hill Mining Lease Project - Eureka Village - Saturday 2 April 2011



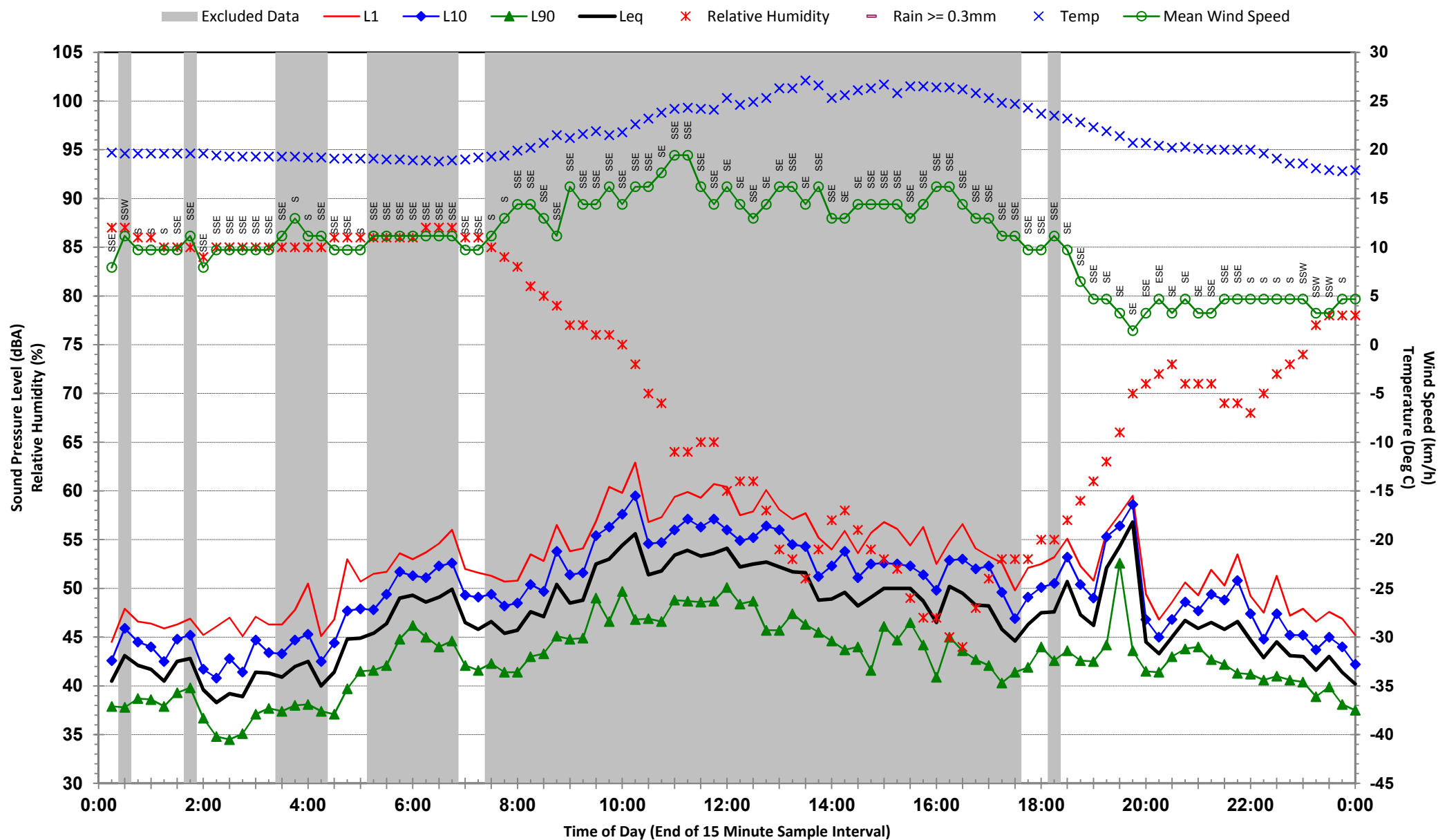
Statistical Ambient Noise Levels

Red Hill Mining Lease Project - Eureka Village - Sunday 3 April 2011



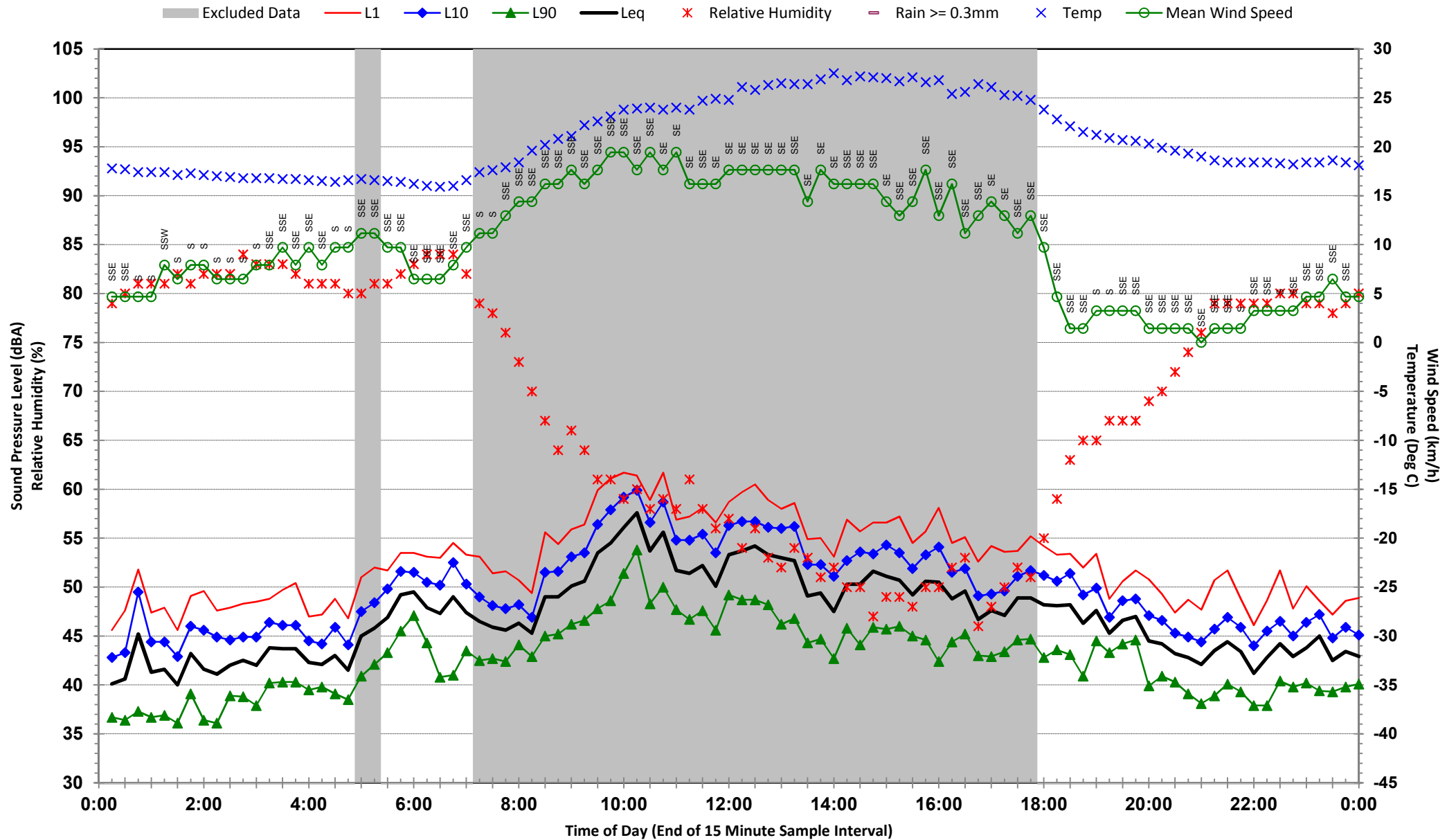
Statistical Ambient Noise Levels

Red Hill Mining Lease Project - Eureka Village - Monday 4 April 2011



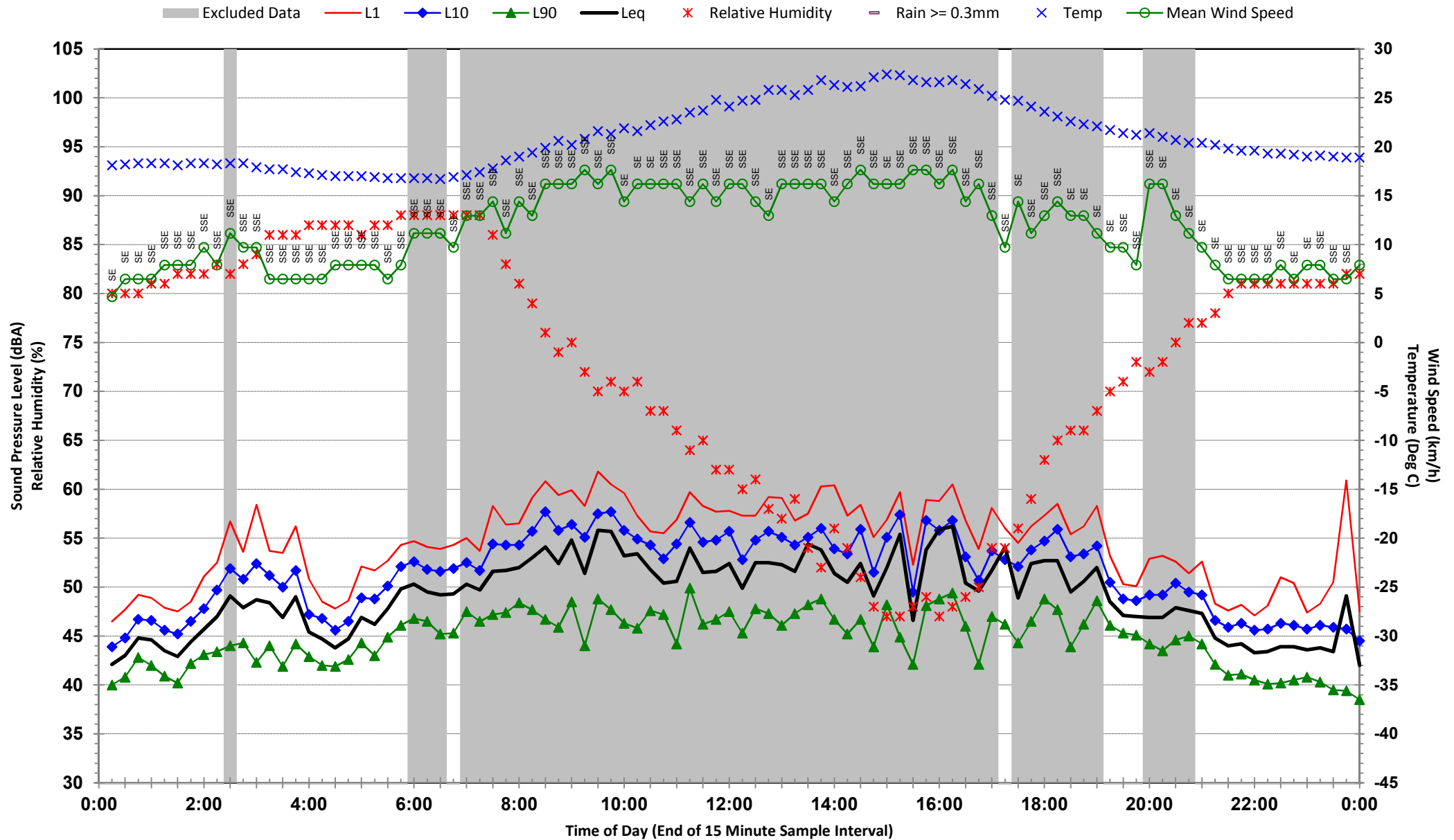
Statistical Ambient Noise Levels

Red Hill Mining Lease Project - Eureka Village - Tuesday 5 April 2011



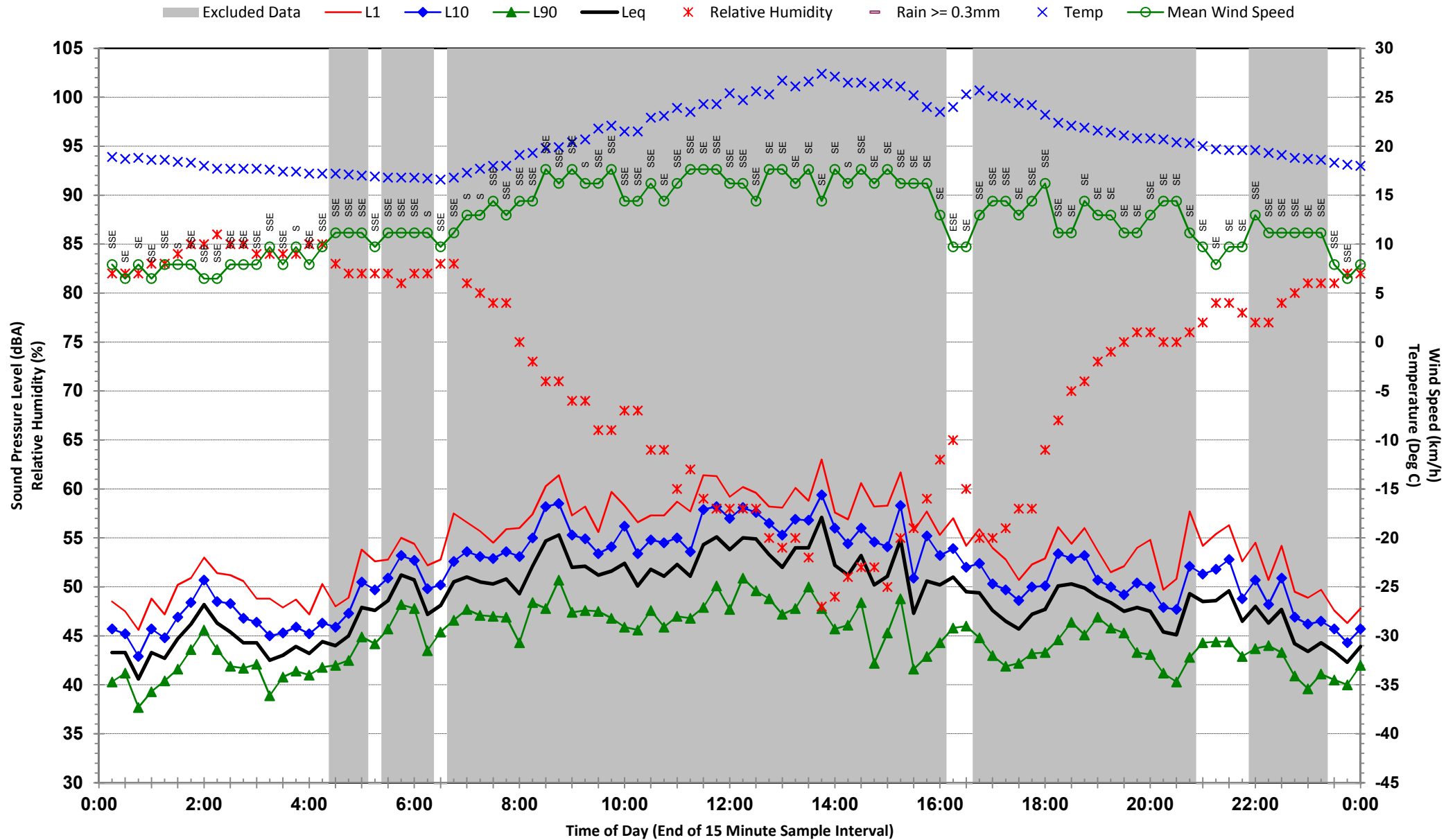
Statistical Ambient Noise Levels

Red Hill Mining Lease Project - Eureka Village - Wednesday 6 April 2011



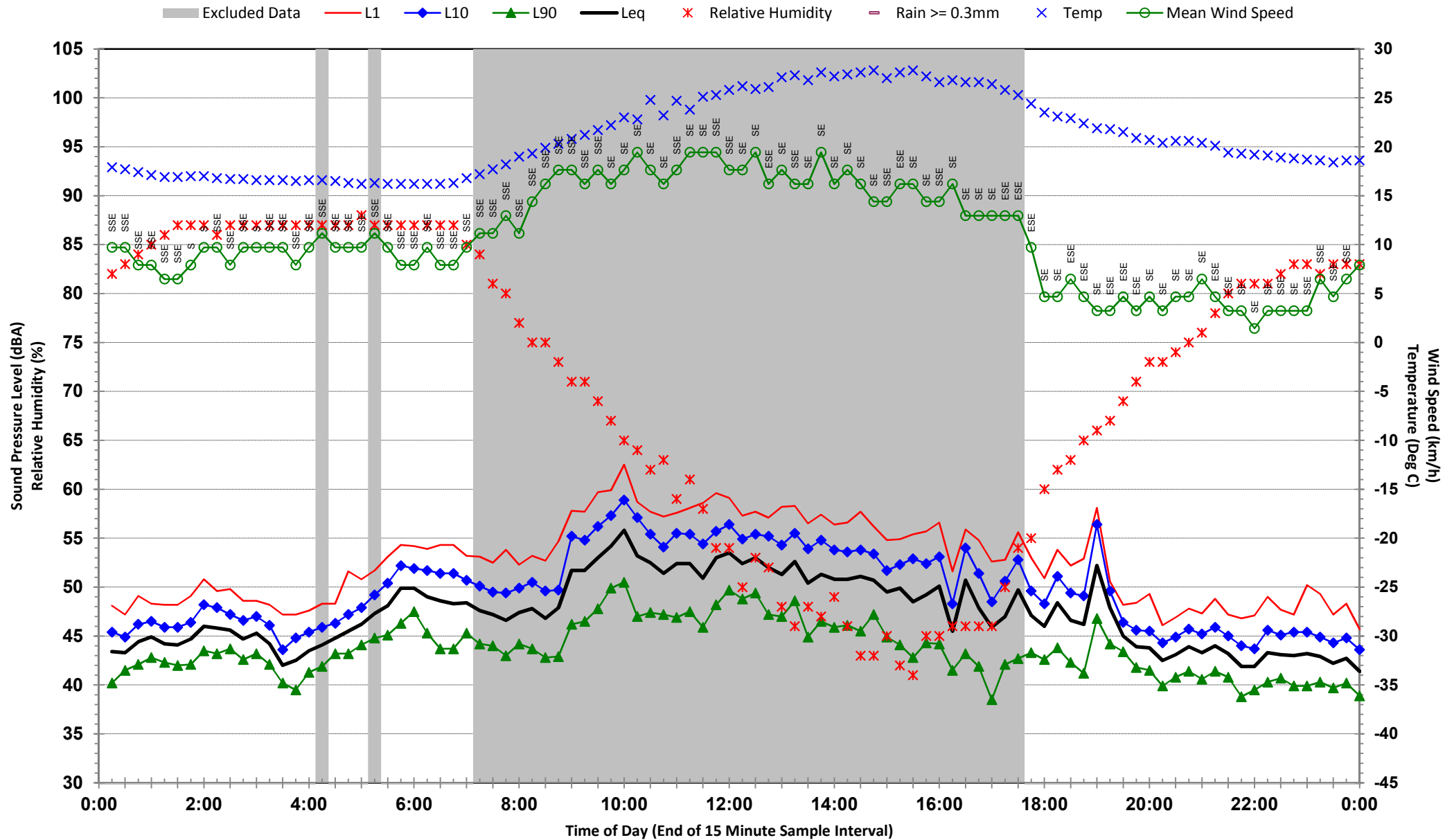
Statistical Ambient Noise Levels

Red Hill Mining Lease Project - Eureka Village - Thursday 7 April 2011



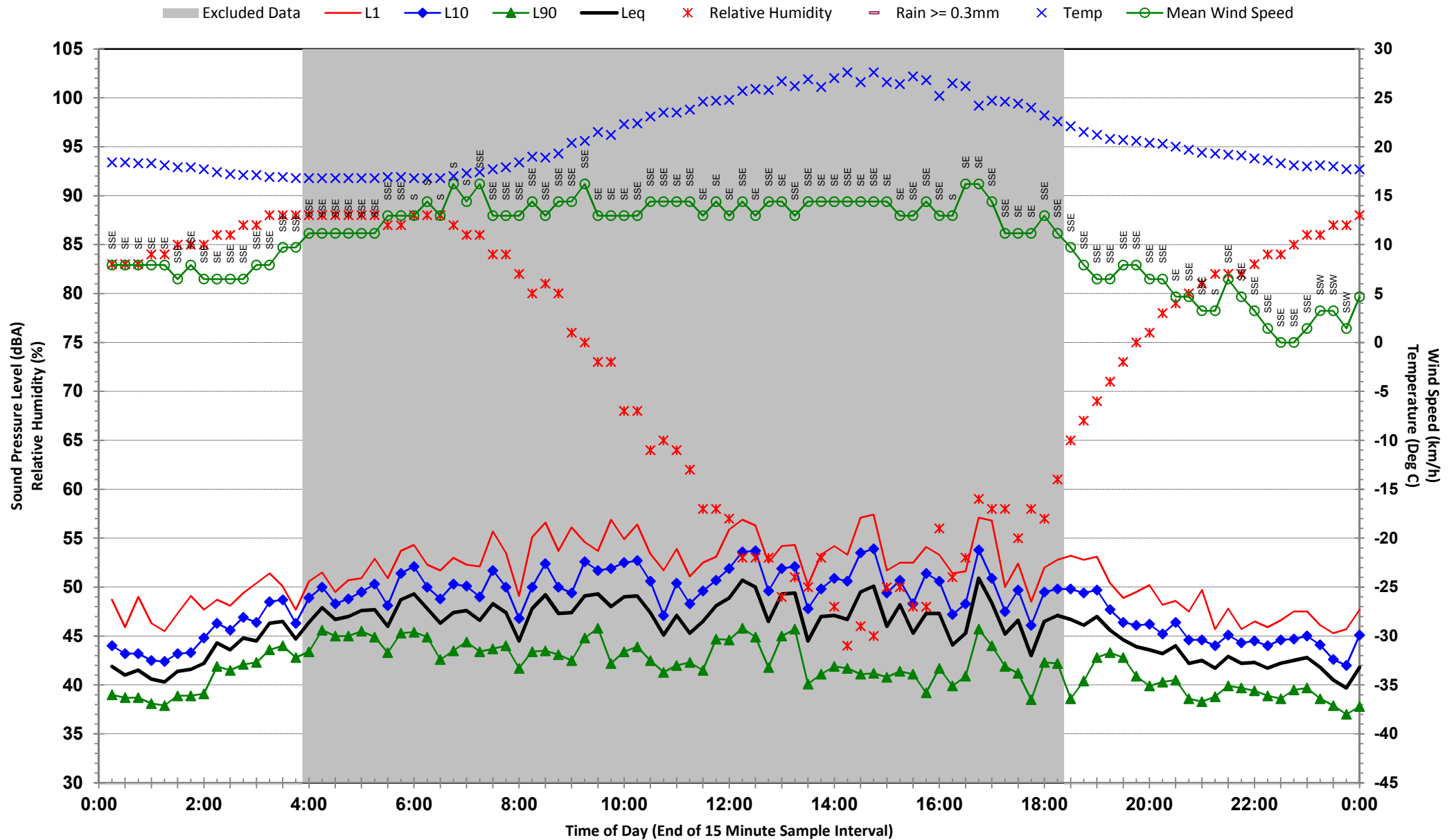
Statistical Ambient Noise Levels

Red Hill Mining Lease Project - Eureka Village - Friday 8 April 2011



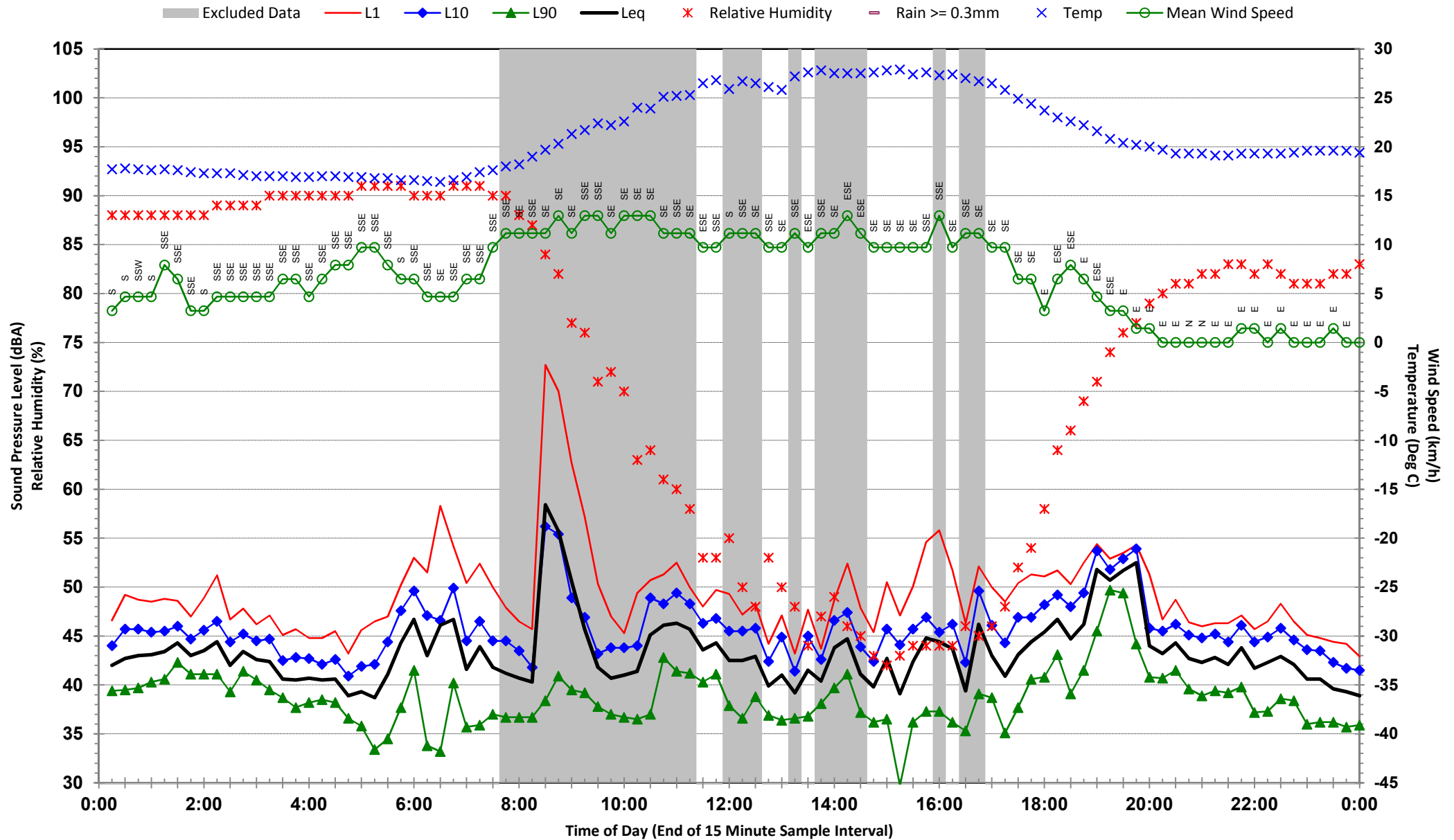
Statistical Ambient Noise Levels

Red Hill Mining Lease Project - Eureka Village - Saturday 9 April 2011



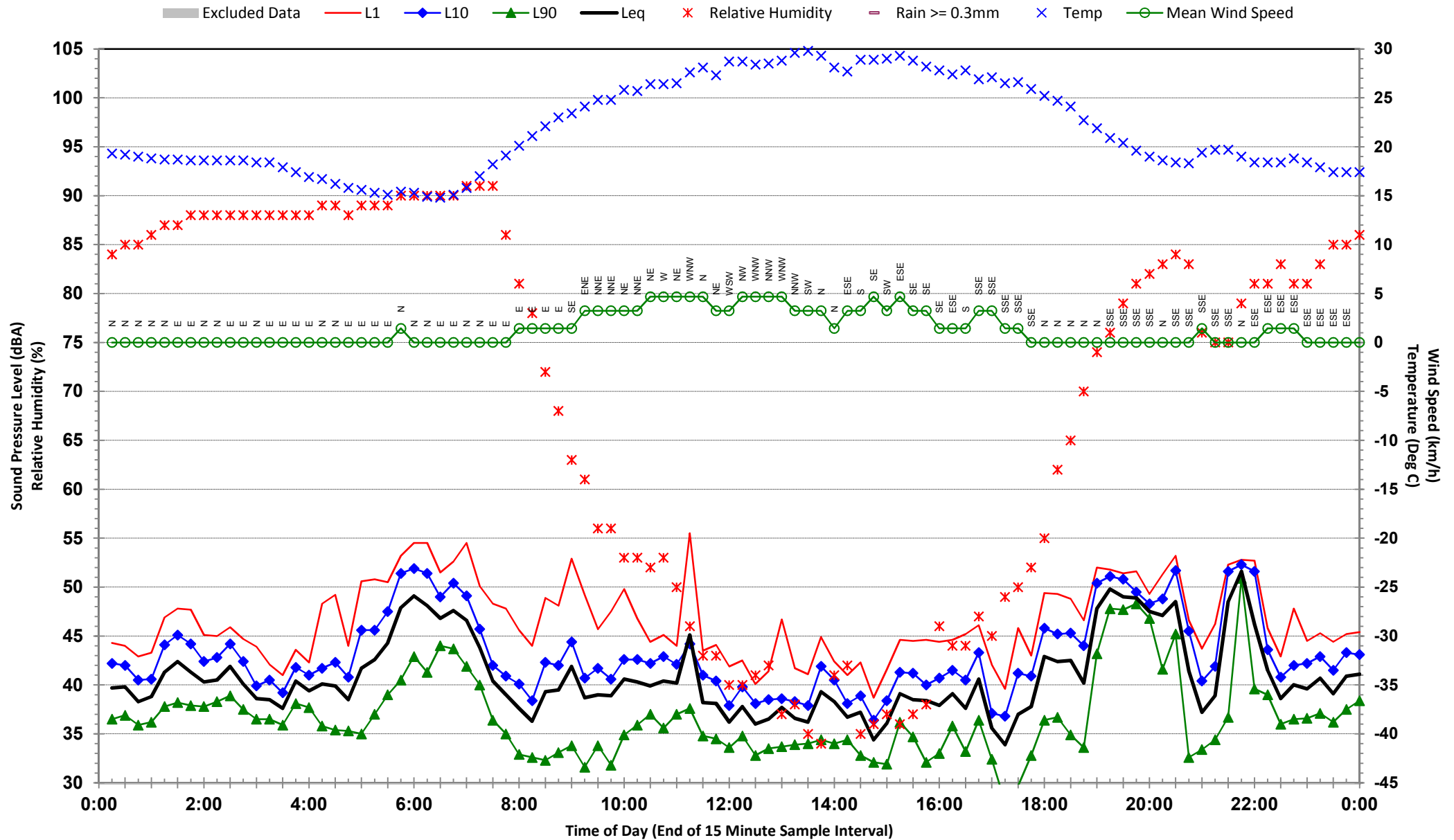
Statistical Ambient Noise Levels

Red Hill Mining Lease Project - Eureka Village - Sunday 10 April 2011

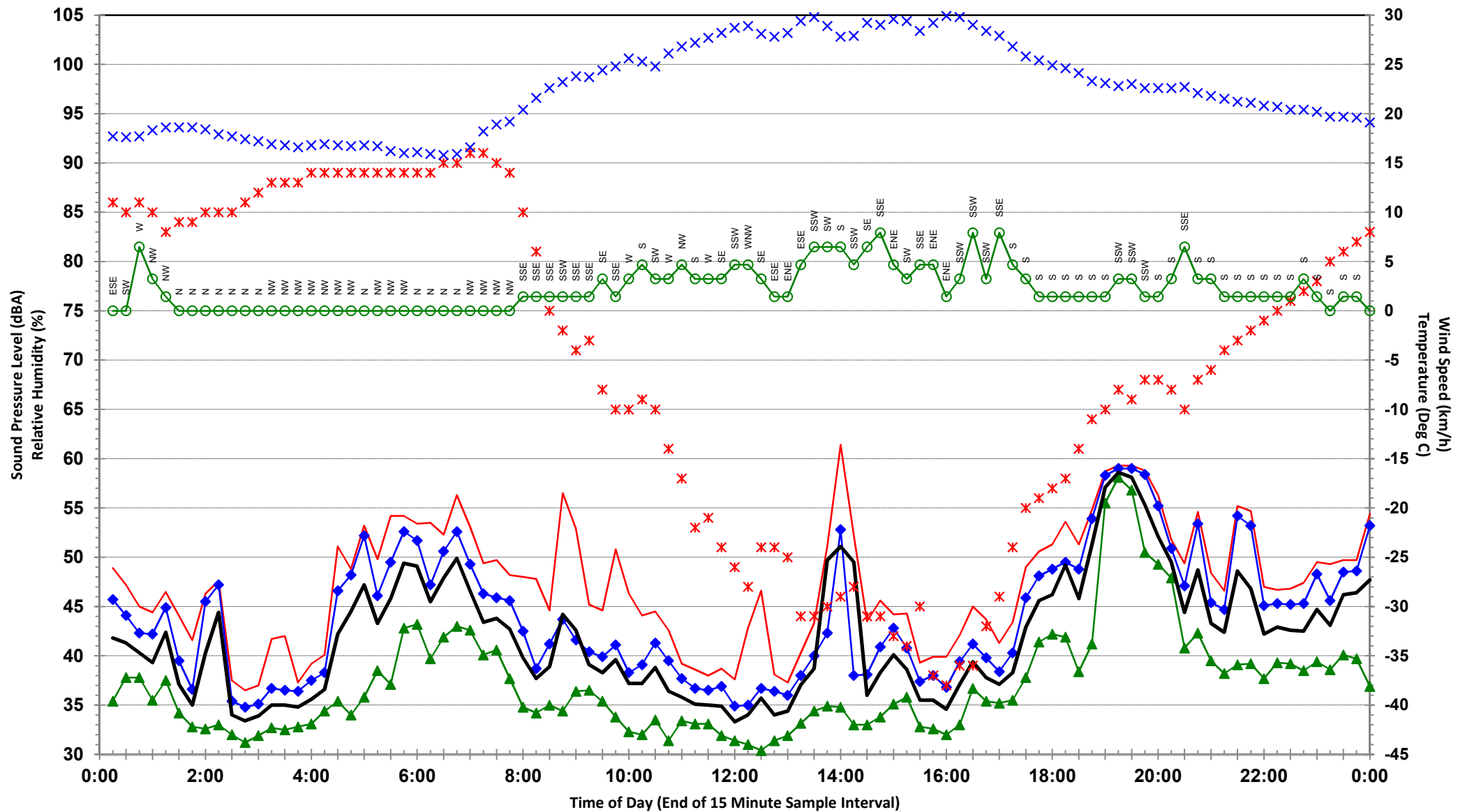


Statistical Ambient Noise Levels

Red Hill Mining Lease Project - Eureka Village - Monday 11 April 2011

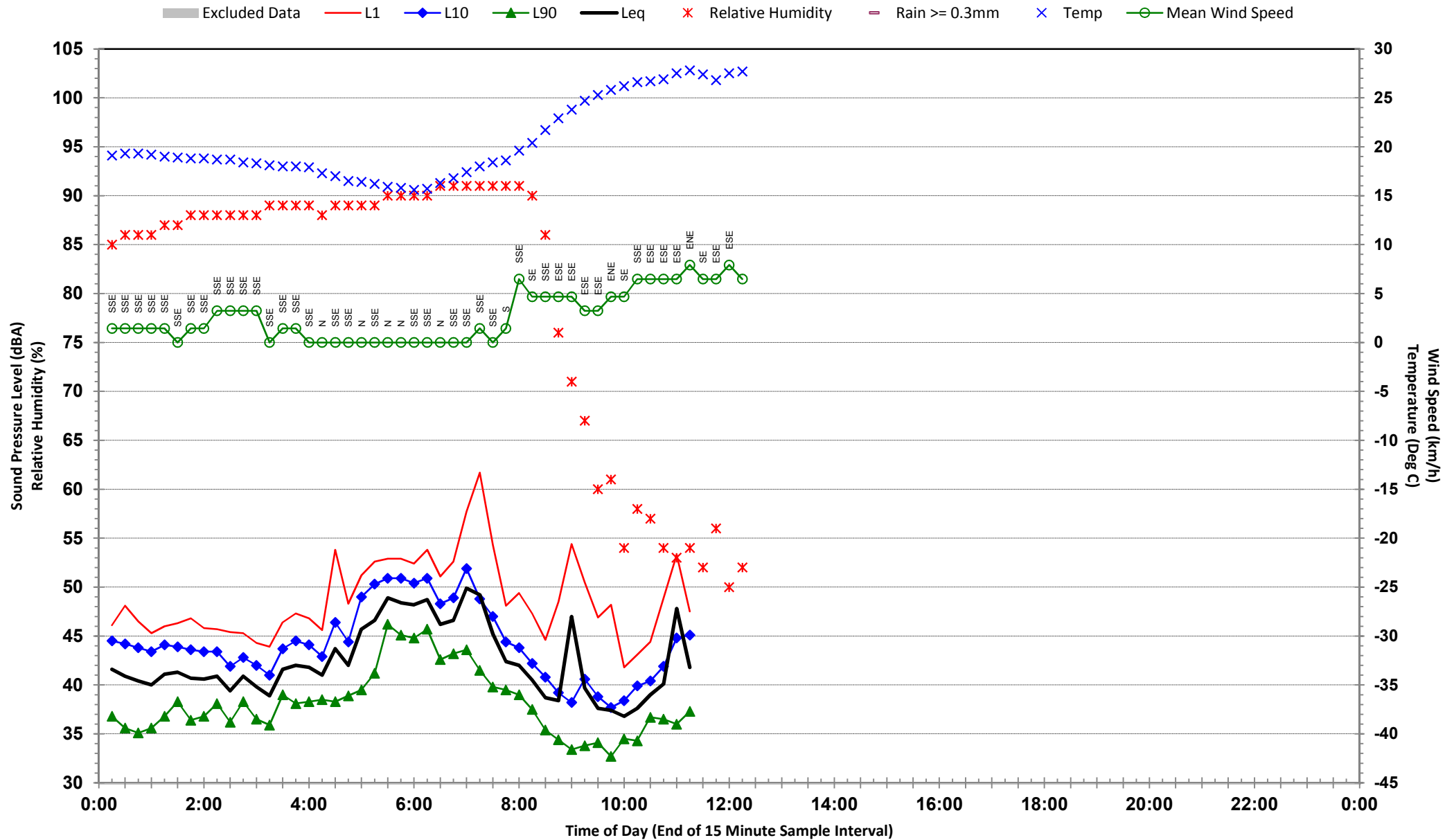


Excluded Data L1 L10 L90 Leq * Relative Humidity = Rain $\geq 0.3\text{mm}$ X Temp $\bigcirc$ Mean Wind Speed



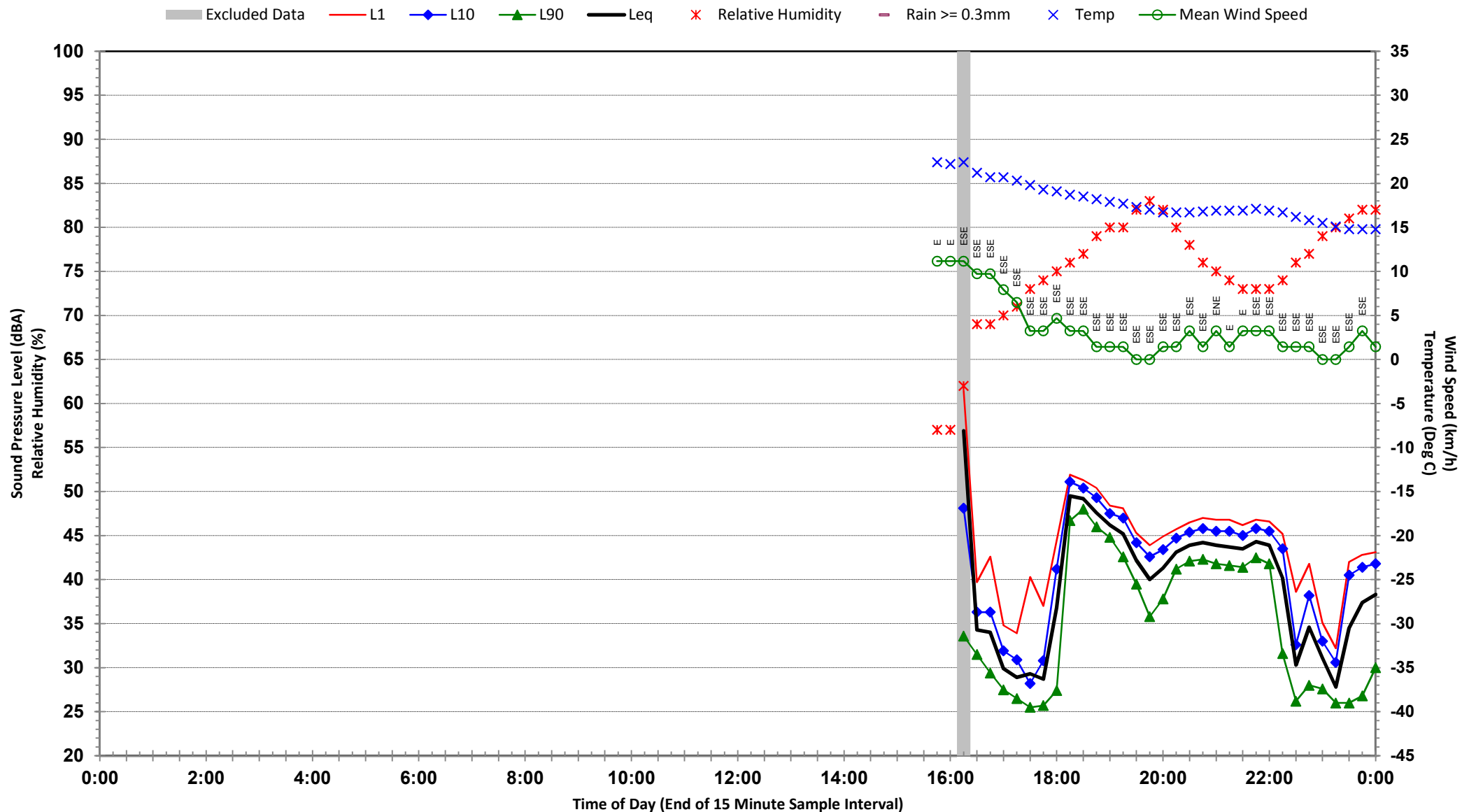
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Red Hill Mining Lease Project - Eureka Village - Wednesday 13 April 2011



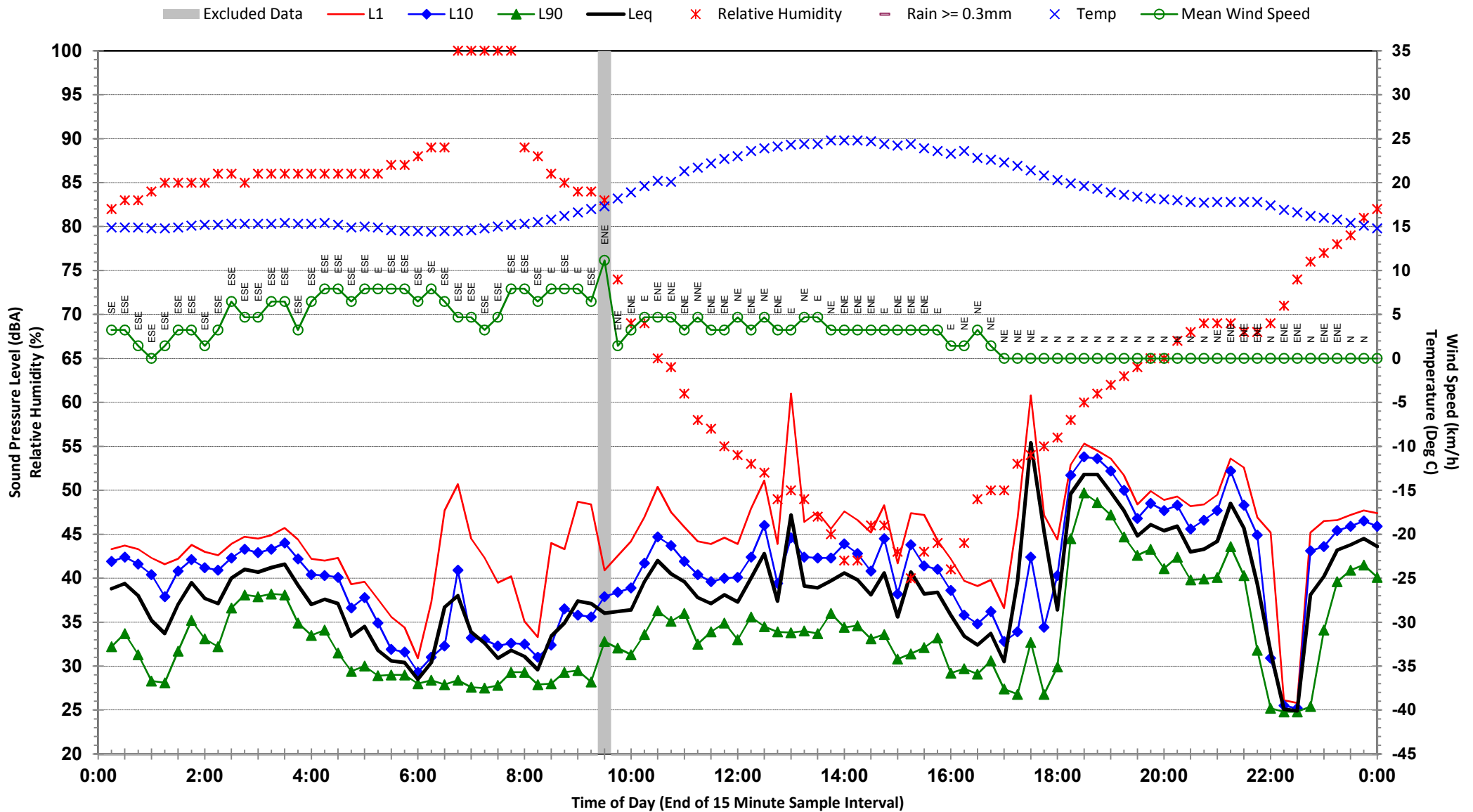
Statistical Ambient Noise Levels

Red Hill Mining Lease Project - Proposed Red Hill Accommodation Village - Friday 20 May 2011



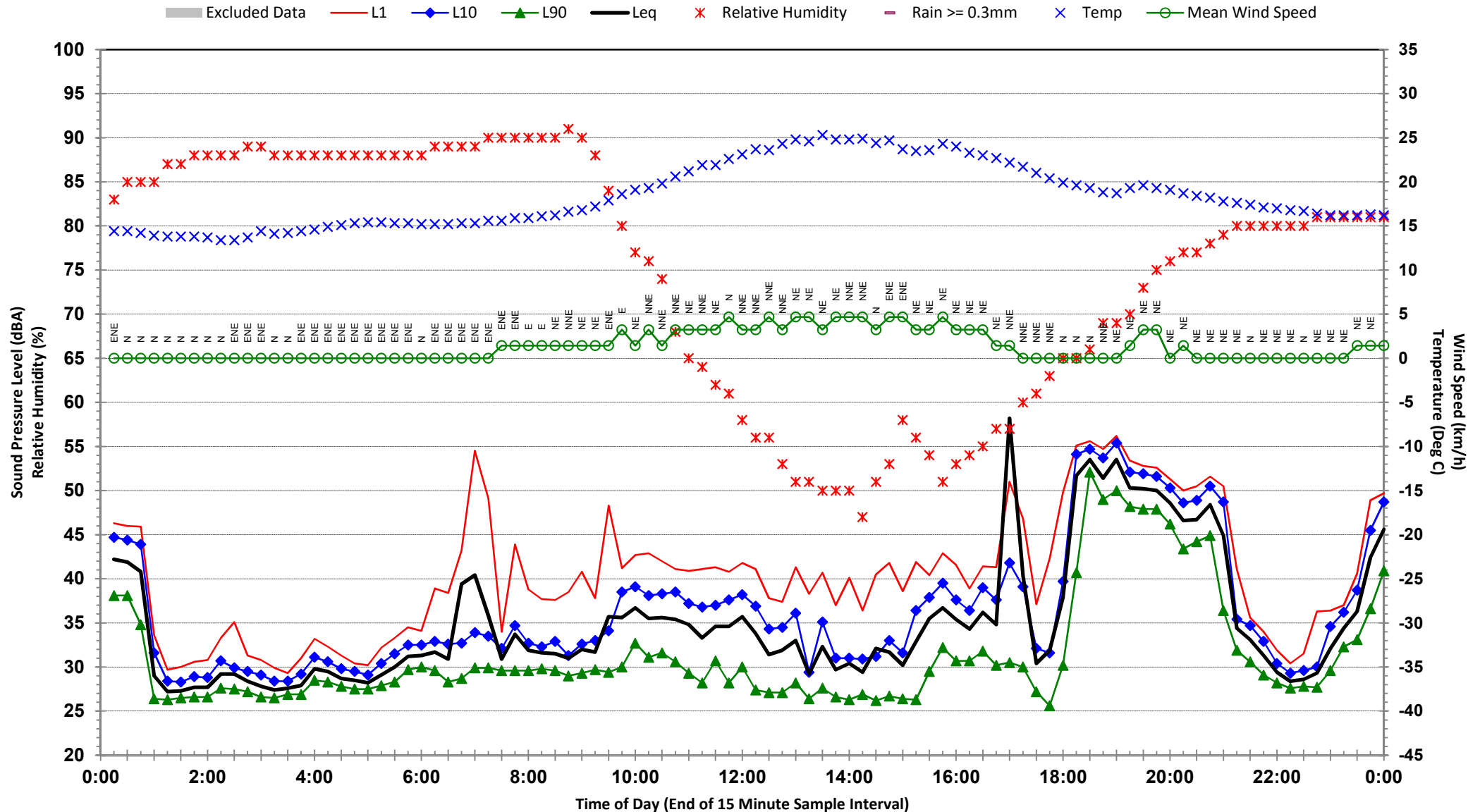
Statistical Ambient Noise Levels

Red Hill Mining Lease Project - Proposed Red Hill Accommodation Village - Saturday 21 May 2011



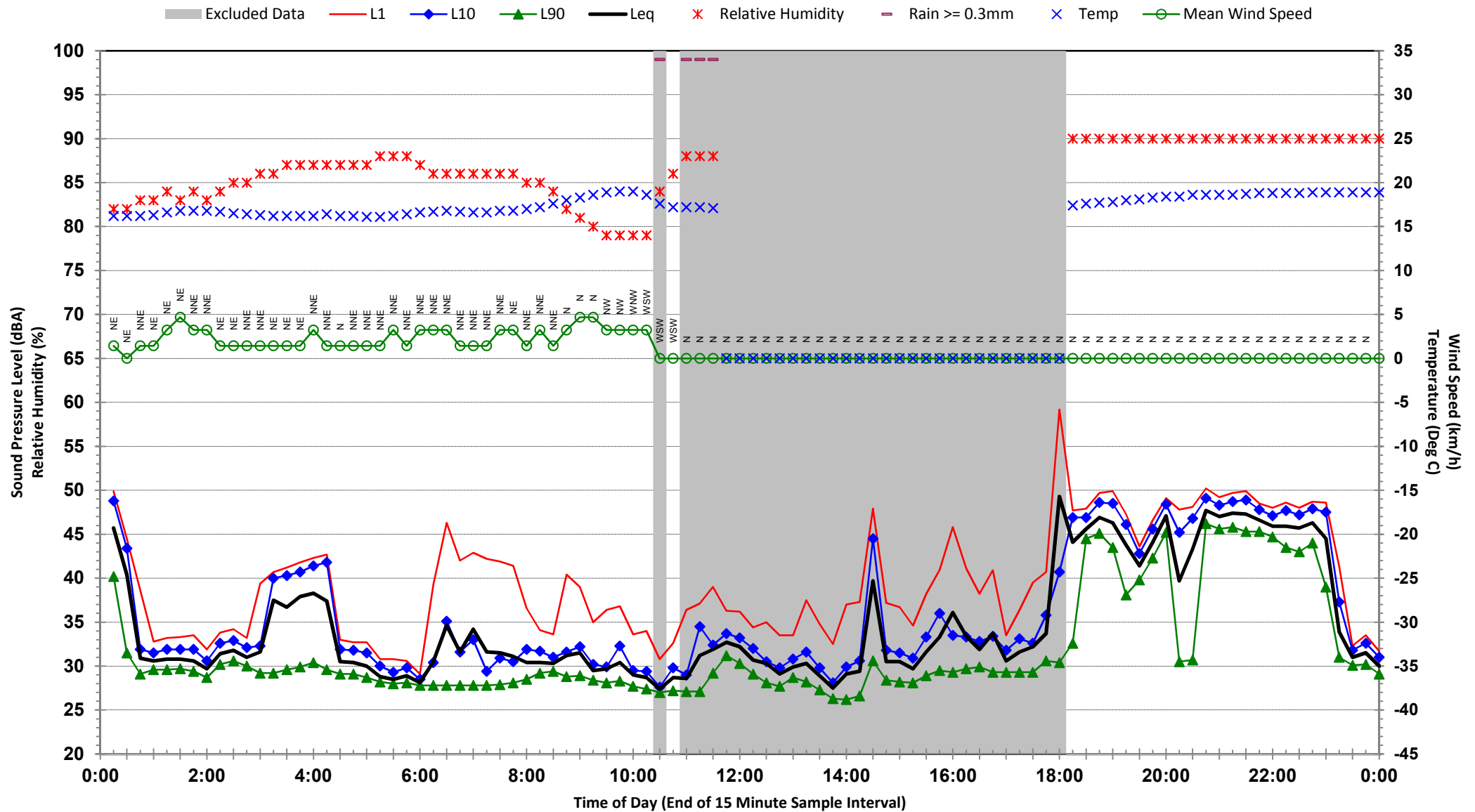
Statistical Ambient Noise Levels

Red Hill Mining Lease Project - Proposed Red Hill Accommodation Village - Sunday 22 May 2011



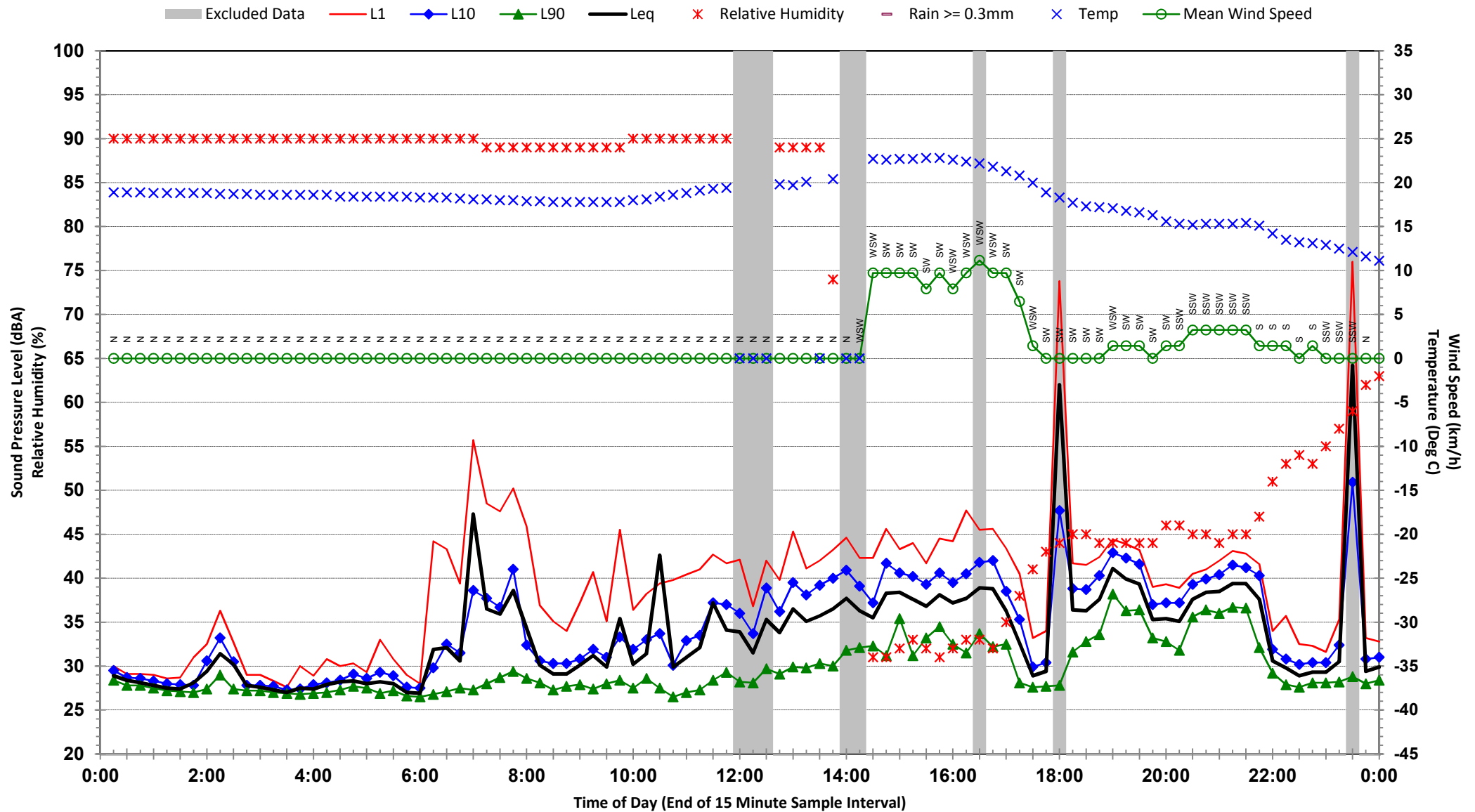
Statistical Ambient Noise Levels

Red Hill Mining Lease Project - Proposed Red Hill Accommodation Village - Monday 23 May 2011



Statistical Ambient Noise Levels

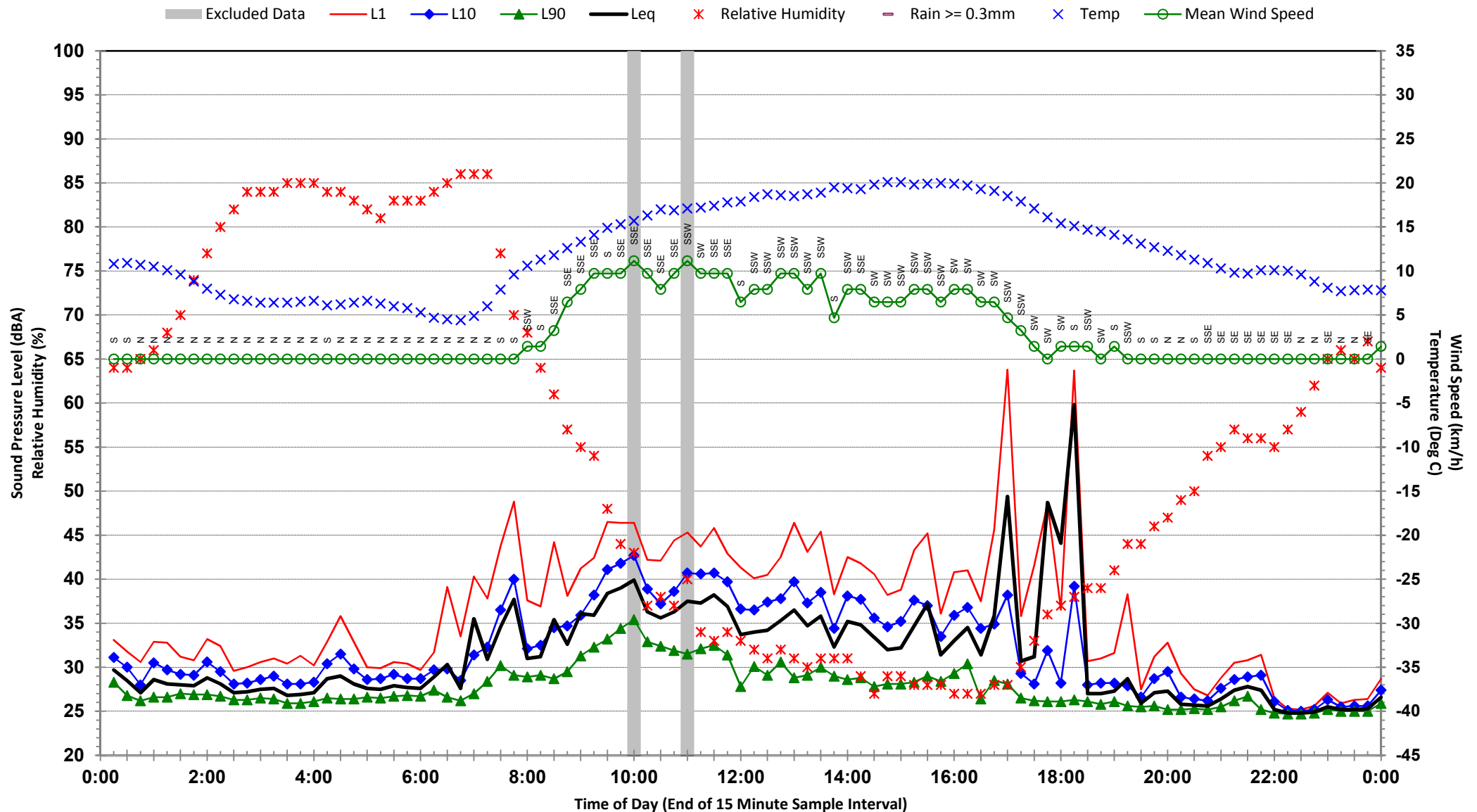
Red Hill Mining Lease Project - Proposed Red Hill Accommodation Village - Tuesday 24 May 2011



Statistical Ambient Noise Levels

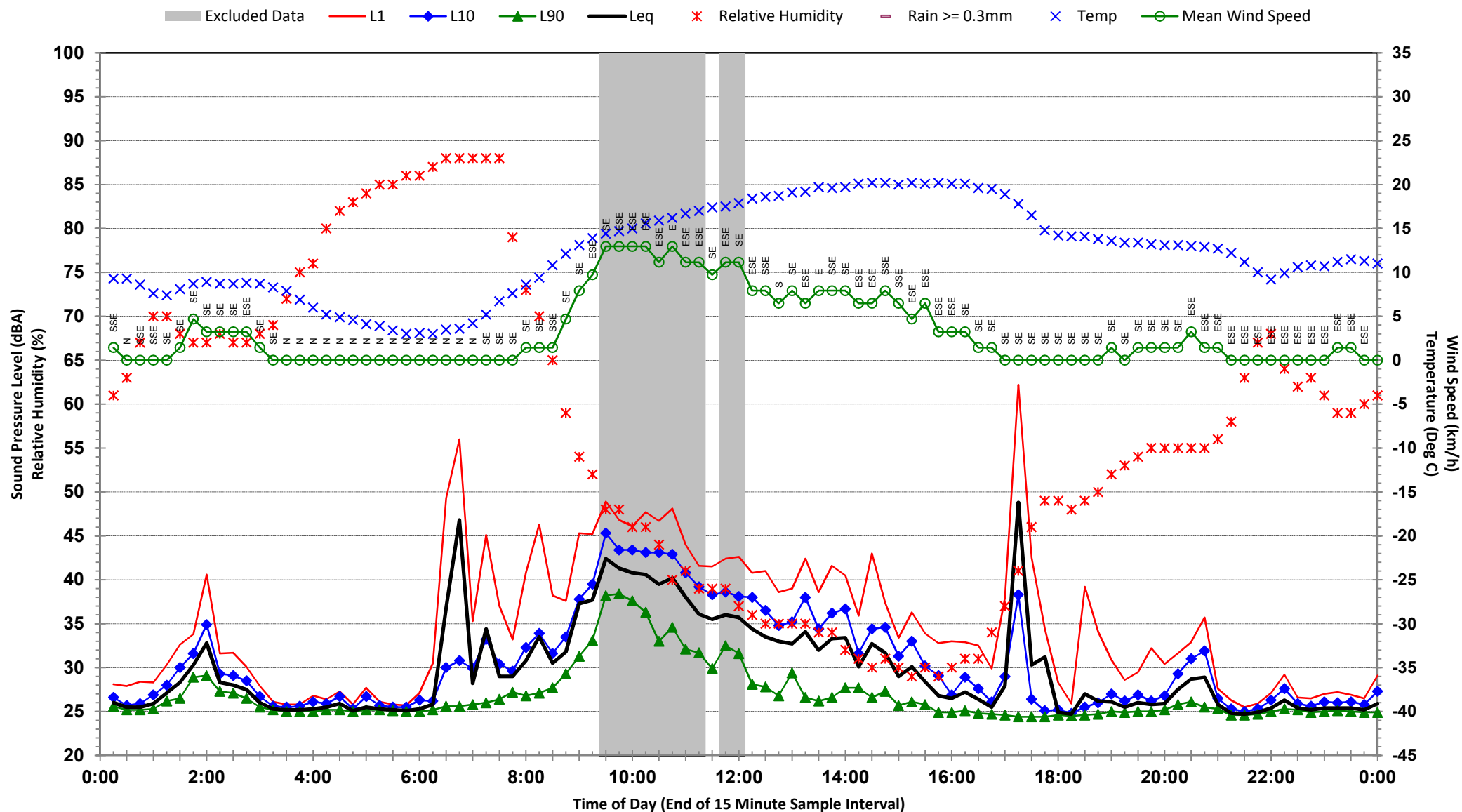
Red Hill Mining Lease Project - Proposed Red Hill Accommodation Village -

Wednesday 25 May 2011



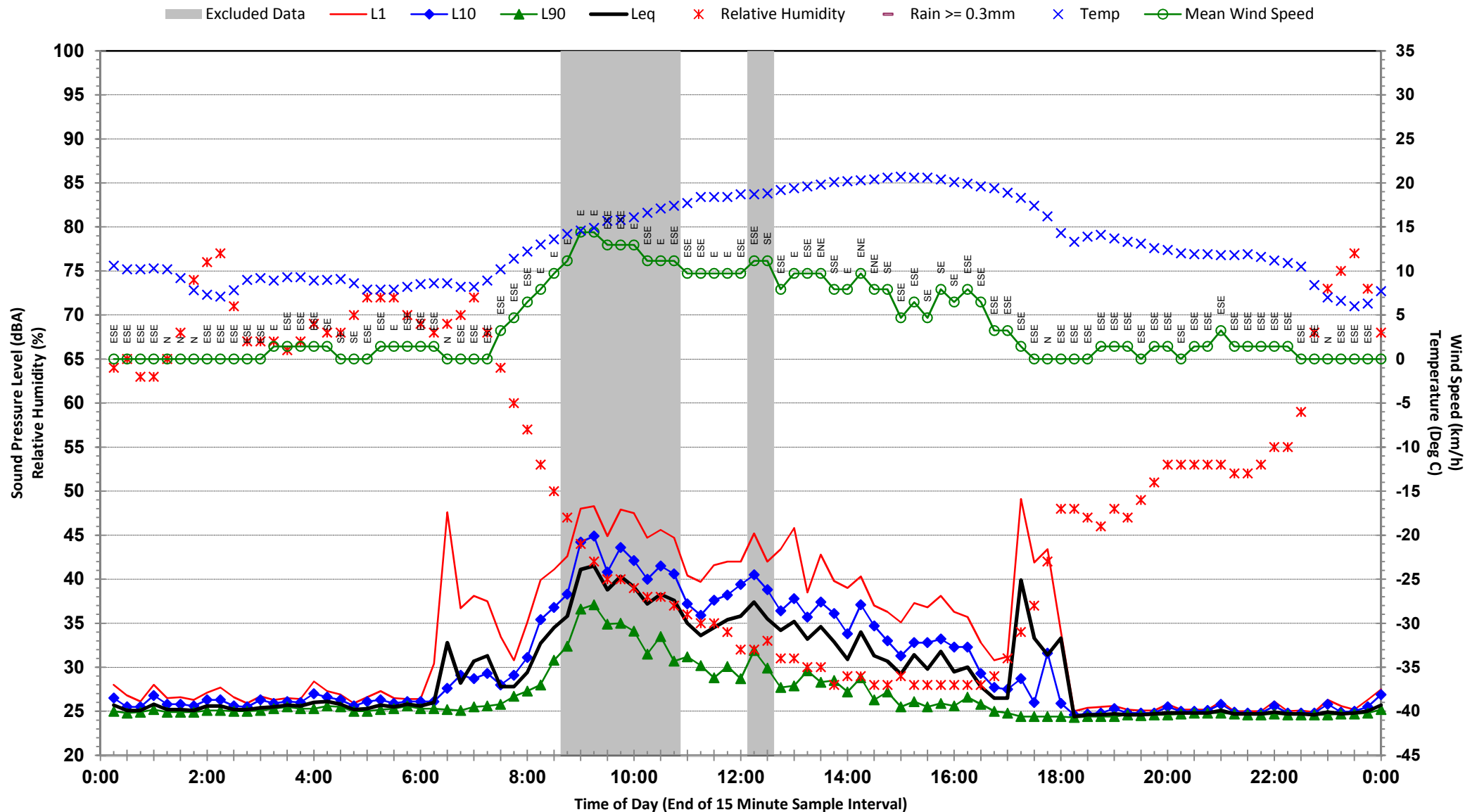
Statistical Ambient Noise Levels

Red Hill Mining Lease Project - Proposed Red Hill Accommodation Village - Thursday 26 May 2011



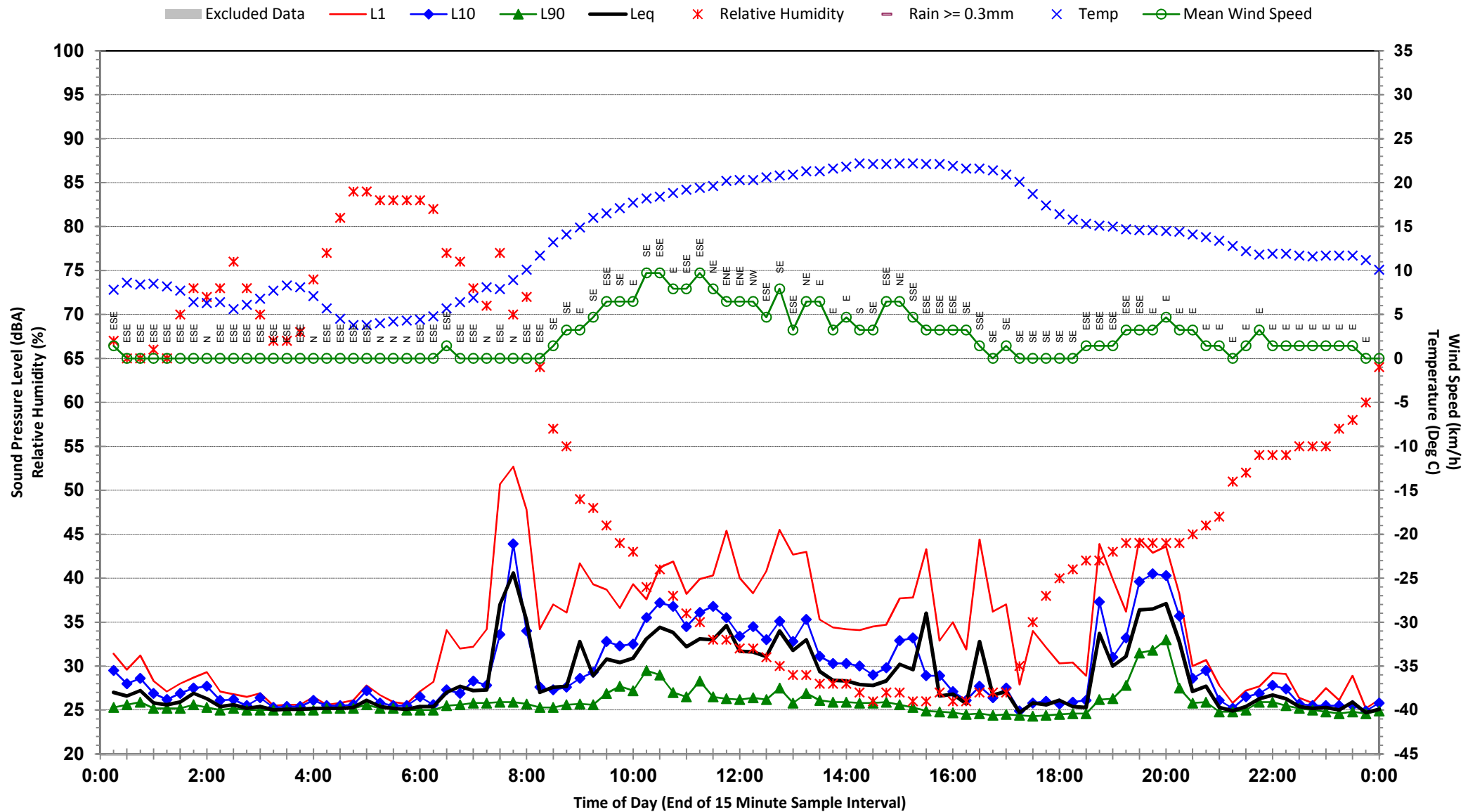
Statistical Ambient Noise Levels

Red Hill Mining Lease Project - Proposed Red Hill Accommodation Village - Friday 27 May 2011



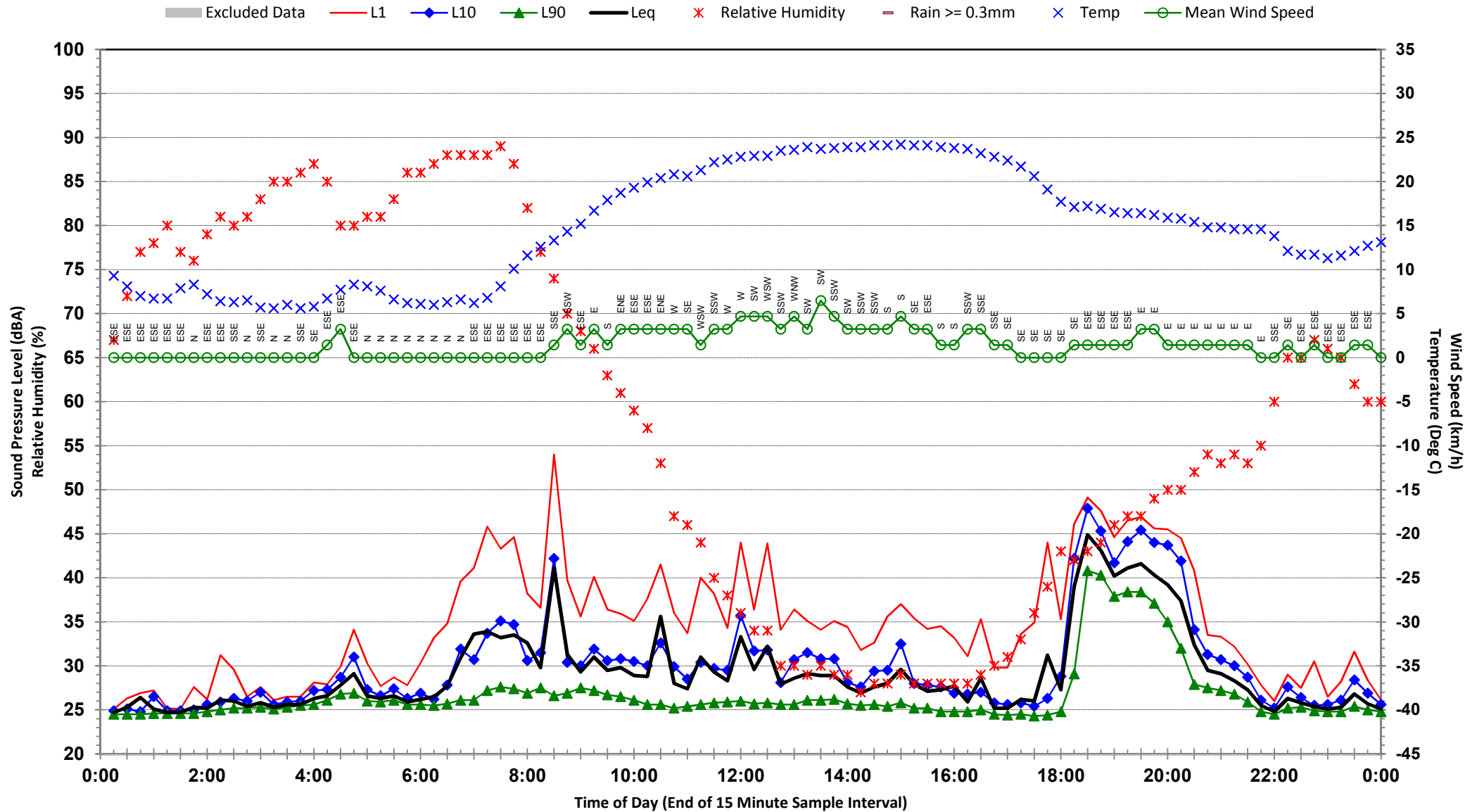
Statistical Ambient Noise Levels

Red Hill Mining Lease Project - Proposed Red Hill Accommodation Village - Saturday 28 May 2011



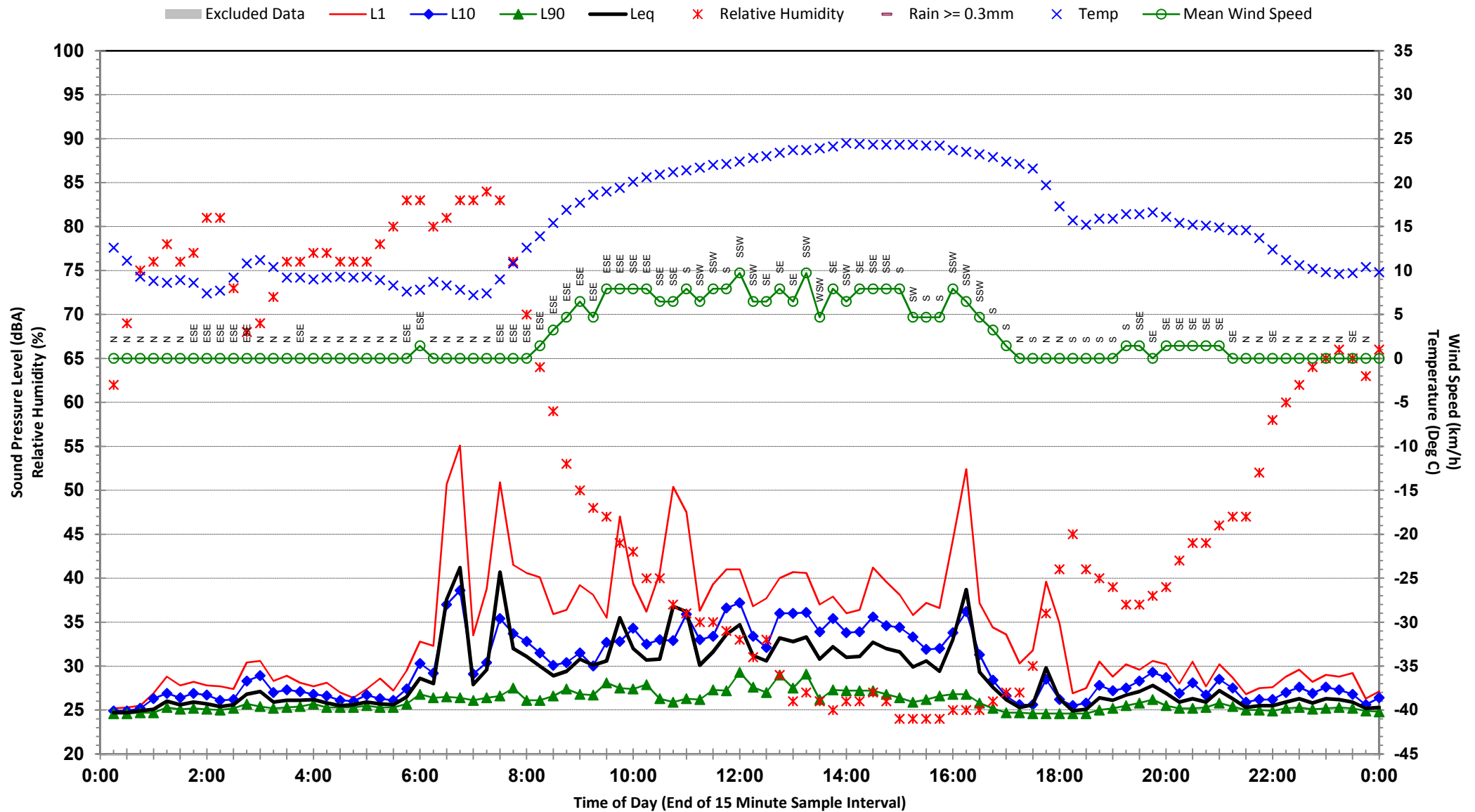
Statistical Ambient Noise Levels

Red Hill Mining Lease Project - Proposed Red Hill Accommodation Village - Sunday 29 May 2011



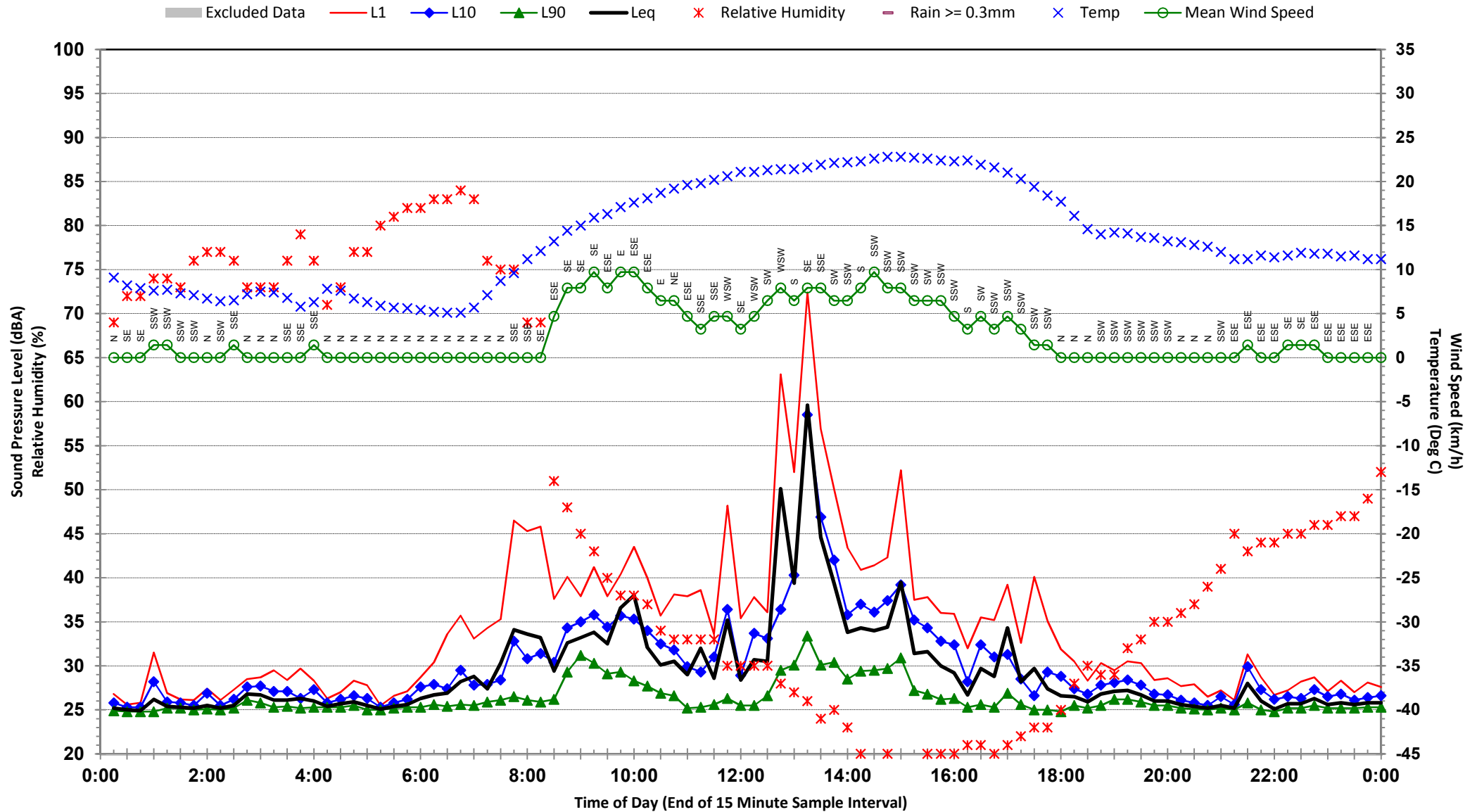
Statistical Ambient Noise Levels

Red Hill Mining Lease Project - Proposed Red Hill Accommodation Village - Monday 30 May 2011



Statistical Ambient Noise Levels

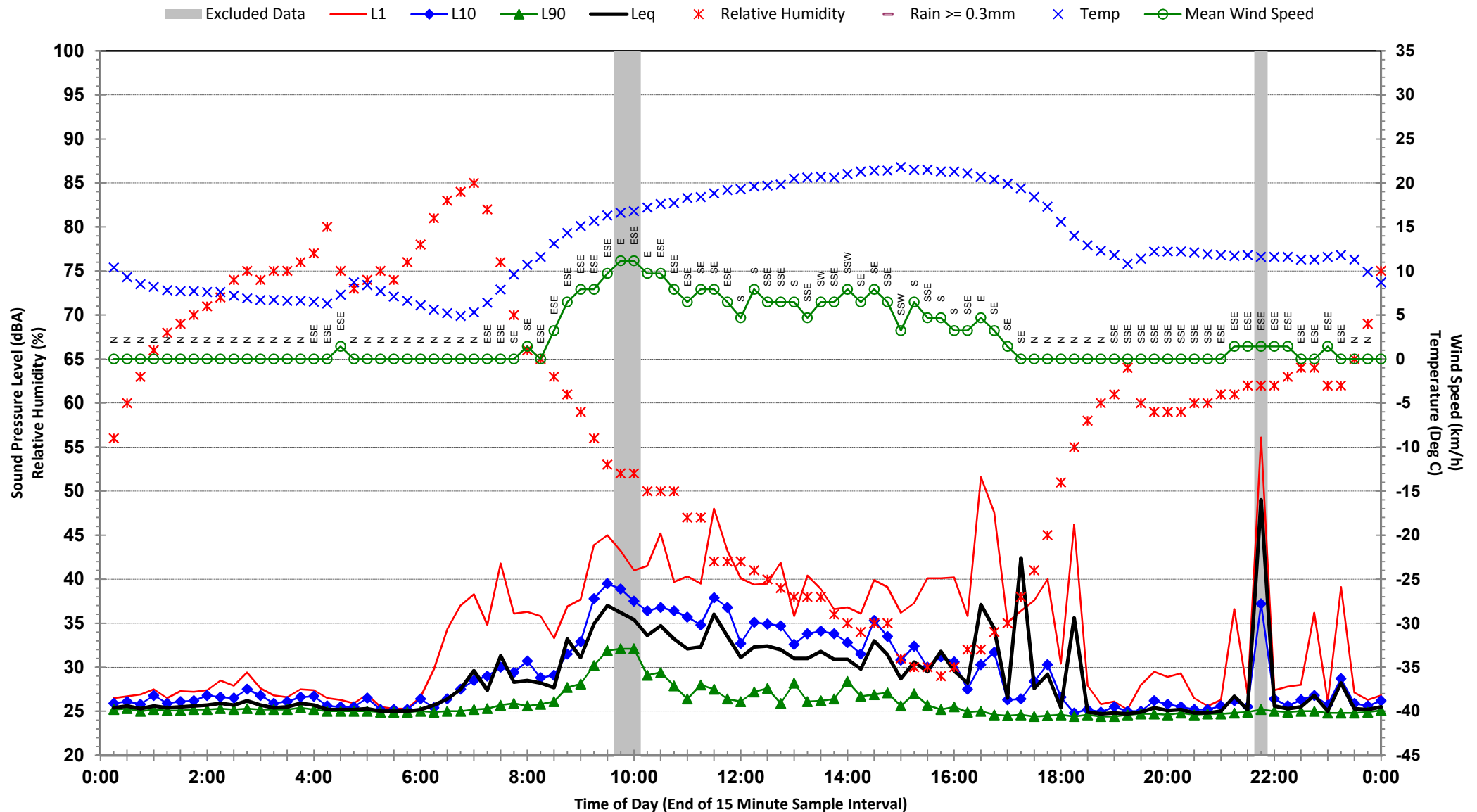
Red Hill Mining Lease Project - Proposed Red Hill Accommodation Village - Tuesday 31 May 2011



Statistical Ambient Noise Levels

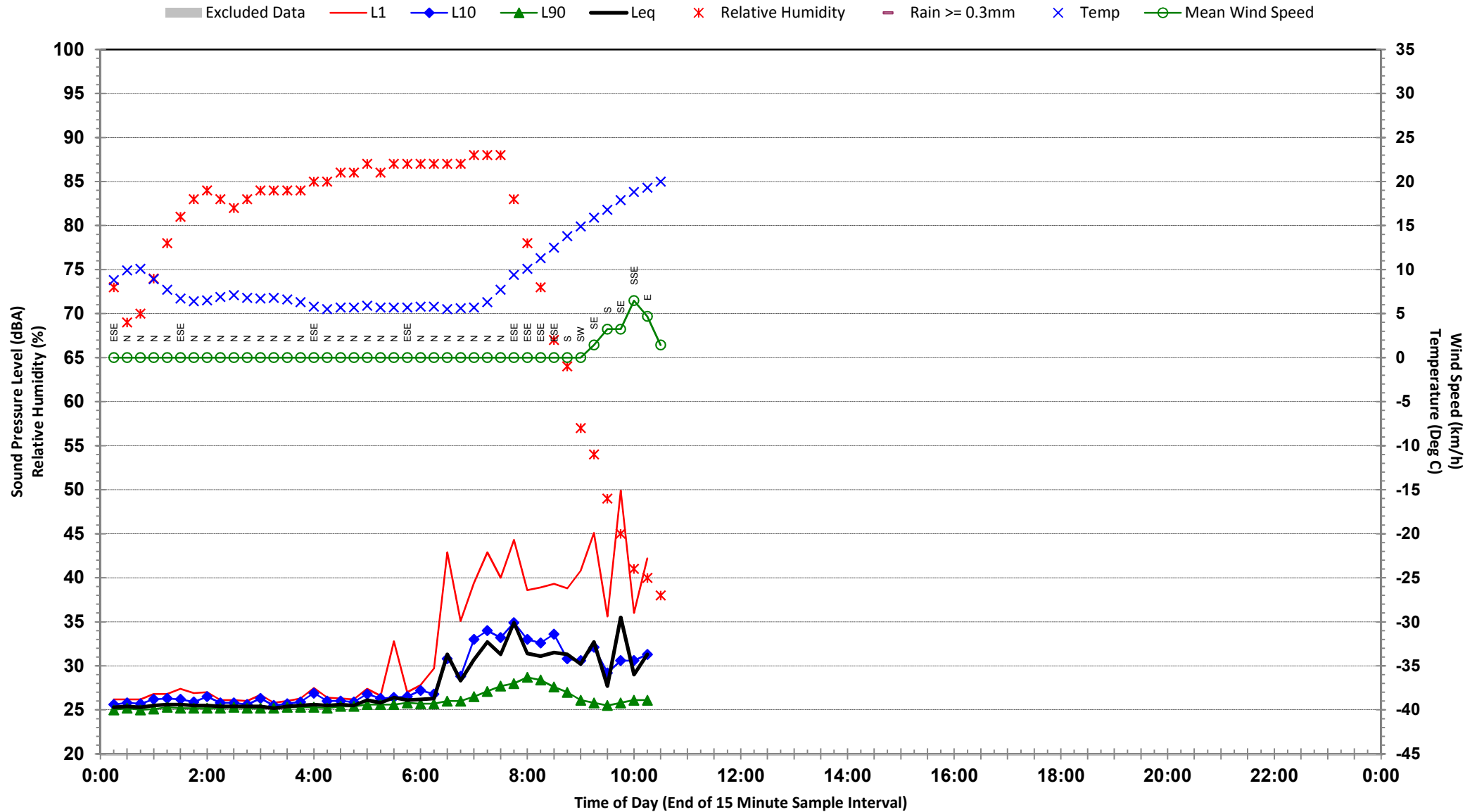
Red Hill Mining Lease Project - Proposed Red Hill Accommodation Village -

Wednesday 1 June 2011



Statistical Ambient Noise Levels

Red Hill Mining Lease Project - Proposed Red Hill Accommodation Village - Thursday 2 June 2011



Appendix C

Report Number 20-2291-R3

BASELINE VIBRATION EVENT LOG

Date	Time	Location	Trigger	PPV (mm/s)	Mic Peak (dBL)
20/05/11	16:09	Proposed Project Accommodation Village	Vert	0.13	- ¹
21/05/11	17:15	Proposed Project Accommodation Village	Tran	0.64	- ¹
22/05/11	12:50	Proposed Project Accommodation Village	Tran	0.18	- ¹
23/05/11	17:51	Proposed Project Accommodation Village	Vert	0.25	- ¹
24/05/11	06:57	Proposed Project Accommodation Village	Tran	***	- ¹
25/05/11	18:05	Proposed Project Accommodation Village	Vert	0.51	- ¹
26/05/11	11:04	Proposed Project Accommodation Village	Vert	0.10	- ¹
27/05/11	11:26	Proposed Project Accommodation Village	Vert	0.10	- ¹
28/05/11	11:08	Proposed Project Accommodation Village	Vert	0.10	- ¹
29/05/11	16:46	Proposed Project Accommodation Village	Tran	0.16	- ¹
30/05/11	14:27	Proposed Project Accommodation Village	Vert	0.25	- ¹
31/05/11	16:48	Proposed Project Accommodation Village	Vert	0.10	- ¹
1/06/11	10:56	Proposed Project Accommodation Village	Vert	0.10	- ¹
2/06/11	06:06	Proposed Project Accommodation Village	Tran	0.08	- ¹
10/06/11	16:00:17	Proposed Project Accommodation Village	Long	0.21	<88.0
12/06/11	08:18:23	Proposed Project Accommodation Village	Vert	0.52	<88.0
13/06/11	17:40:03	Proposed Project Accommodation Village	Tran	0.43	<88.0
13/06/11	17:41:56	Proposed Project Accommodation Village	Long	1.49	97.5
13/06/11	17:42:39	Proposed Project Accommodation Village	Tran	0.57	101.9
13/06/11	17:43:09	Proposed Project Accommodation Village	Vert	0.78	106.0
13/06/11	17:43:30	Proposed Project Accommodation Village	Long	0.33	108.0
13/06/11	17:44:01	Proposed Project Accommodation Village	Vert	0.86	94.0
13/06/11	17:44:30	Proposed Project Accommodation Village	Vert	4.97	109.2
13/06/11	17:44:49	Proposed Project Accommodation Village	Vert	8.46	102.8
13/06/11	17:45:04	Proposed Project Accommodation Village	Vert	12.8	106.5
13/06/11	17:45:19	Proposed Project Accommodation Village	Vert	6.19	106.5
13/06/11	17:45:45	Proposed Project Accommodation Village	Long	24.9	118.7
13/06/11	17:46:04	Proposed Project Accommodation Village	Vert	1.48	91.5
13/06/11	17:46:23	Proposed Project Accommodation Village	Vert	0.95	106.5
13/06/11	17:46:40	Proposed Project Accommodation Village	Vert	0.35	107.5
13/06/11	17:48:00	Proposed Project Accommodation Village	Vert	0.30	113.8
13/06/11	18:25:01	Proposed Project Accommodation Village	Vert	1.87	<88.0
13/06/11	18:25:53	Proposed Project Accommodation Village	Vert	0.21	<88.0
13/06/11	19:29:39	Proposed Project Accommodation Village	Long	0.27	<88.0
14/06/11	18:24:14	Proposed Project Accommodation Village	Tran	0.24	115.6
14/06/11	18:37:20	Proposed Project Accommodation Village	Vert	0.21	104.9
14/06/11	18:39:06	Proposed Project Accommodation Village	Vert	0.53	<88.0
14/06/11	18:39:45	Proposed Project Accommodation Village	Vert	0.22	<88.0
14/06/11	18:40:36	Proposed Project Accommodation Village	Vert	0.22	<88.0
14/06/11	18:40:56	Proposed Project Accommodation Village	Long	0.54	<88.0
14/06/11	18:41:11	Proposed Project Accommodation Village	Long	0.27	<88.0
14/06/11	18:44:29	Proposed Project Accommodation Village	Tran	0.22	<88.0

Note 1: Only ground vibrations were measured during this period (without a trigger).

'Tran' – Transverse Channel

'Vert' – Vertical Channel

'Long' – Longitudinal Channel

Appendix D

Report Number 20-2291-R3

SLR CONSULTING NOISE AND VIBRATION ASSUMPTIONS MEMO

MEMORANDUM

20-2291 URS RHP Memo 20111115

Emma_Walker@URSCorp.com Emma Walker

URS Australia Pty Ltd

DATE: 15 November 2011

NO OF PAGES: 12

TO BE MAILED: No

CONFIDENTIALITY

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Dear Emma

Red Hill Project EIS Noise and Vibration Assessment Noise Modelling Assumptions

Further to the Project kick-off meeting dated 12 October 2011, BMA RFI meeting dated 1 November 2011, and various telephone conversations / emails, SLR Consulting Australia Pty Ltd (SLR Consulting) propose the following assumptions used to generate the 3D SoundPLAN noise model associated with the noise and vibration assessment of the Red Hill Project Environmental Impact Statement (EIS). Where permitting, these assumptions are based on previous confirmed detailed for the Goonyella Complex Expansion (GCE) EIS Project.

It is likely that numerous changes to these assumptions will occur as engineering and technical studies progress, however, in most cases, these changes will be minor and are not expected to significantly alter the outcome of the noise modelling.

1 MINE STUDY

1.1 Assumptions:

1.1.1 Construction Schedule, Locations and Fleet Numbers – CHPP3 / MIAs / Stockpiles:

- Construction equipment and numbers used during the construction phase will include the following (Table 1).
- Scenarios, activity and numbers associated with the construction of the new CHPP3 and Riverside MIA are as per the previous GCE Project (approved).
- Scenarios, activity and numbers associated with the construction of the new Red Hill Underground MIA and Red Hill Raw Coal Stockpiles have been assumed.
- Construction equipment will be used sequentially (not all activities will occur at once).

Table 1 Construction Scenario, Plant and Numbers – CHPP3 / MIAs / Stockpiles – Mine Study

Construction Scenario	Activity	Equipment	Assumed Plant Number	
			CHPP3 and Riverside MIA	Red Hill UG MIA and Raw Coal Stockpile
Install Pavement (direct supply)	Deliver material from quarry	Road Truck - B-double / triple	2	2
	Add water	CAT 777 Water truck	2	1
	Grade material	CAT 16 Grader	2	1
	Roll	825 Roller Compactor	2	1
Install Pavement (via Stockpile) ¹	Deliver material from quarry	Road Truck - B-double / triple	2	2
	Unload to Stockpile	CAT 966 Loader	1	1
	Add water	CAT 777 Water truck	2	1
	Load onto truck	CAT 966 Loader	1	1
	Deliver to site	10T Body Truck	2	1
		40T Articulated Dump Truck	2	1
	Add water	CAT 777 Water truck	2	1
	Grade	CAT 16 Grader	2	1
	Roll	825 Roller Compactor	2	1
Bulk Earthworks – Cut	Ground removal	CAT 631 Scraper	2	2
		30 T Excavator	2	1
	Ripping	D7 Bulldozer with ripper	2	1
Bulk Earthworks – Fill	Placement	CAT 631 Scraper	2	2
		CAT 773 Dump truck	4	2
	Add water	CAT 777 Water truck	2	1
	Grade	CAT 16 Grader	2	1
	Roll	825 Roller Compactor	2	1
Plant Assembly	Lifting	100T Outrigger	1	1
		Roughie - 4WD 50T	1	1
		Franna - up to 20T	2	2
	Access	Elevated Work platform	2	2
		Scissor Lift	2	2
	Concrete delivery	Concrete truck	4	2
		Concrete pump	2	1
	Construction equipment	Air compressor	2	1
		Generators	2	2
		Welders	2	2
		Winches	2	1

Note 1: The location of the Stockpile is unknown and needs to be supplied. Please confirm.

1.1.2 Construction Schedule, Locations and Fleet Numbers – Gas Drainage:

- Construction equipment and numbers used during the construction phase will include the following (**Table 2**, **Table 3** and **Table 4**).
- Scenarios, activity and numbers associated with the construction of the Gas Drainage facilities has been assumed based on SLR Consulting's experience on projects of this nature.

Table 2 Construction Scenario, Plant and Numbers – Gas Drainage – Gas Wells

Construction Scenario	Activity	Equipment	Assumed Plant Number
Gas Well – Creating Lease Pad	Ground Removal	D7 Bulldozer	1
		30 T Excavator	1
	Add water	CAT 777 Water truck	1
	Grade	CAT 16 Grader	1
	Roll	825 Roller Compactor	1
Gas Well – Drilling well	Drilling	Drill Rig (including generators and mud pump)	1
Gas Well – Assembly	Lifting	Franna - up to 20T	1
	Construction equipment	Air compressor	1
		Generators	1
		Welders	1

Table 3 Construction Scenario, Plant and Numbers – Gas Drainage – Gas Gathering Pipeline System

Construction Scenario	Activity	Equipment	Assumed Plant Number
Clearing, grubbing and stripping of topsoil	Slashing	Slasher	1
		Tub Grinder	1
	Ground Removal	CAT 631 Scraper	2
		CAT 16 Grader	2
		Backhoe	1
		D7 Bulldozer	1
	Add Water	CAT 777 Water truck	1
Trenching, and lowering and welding	Trenching	Verner Trenchsaw	1
		30 T Excavator	1
	Lowering	D7 Bulldozer with sideboom	2
	Welding	Generators	2
		Welders	2
Backfill of pipe and testing	Compacting	Ozzie Padder	1
	Placement	12T Excavator	2
		Wheel Dozer	1
	Deliver material from quarry	Road Truck - B-double / triple	2
	Trench compacting	Trench Roller	1
	Add Water	CAT 777 Water truck	2
	Pipe testing	Hydrostatic Test Pump	1
		Air compressor	1
Horizontal Directional Drilling (Crossing Issac River)	HDD Unit	Mud Pump	1
		Hydraulic Power Uni	1
		Recycling Unit	1
	Placement	30 T Excavator	1
	Power Generation	Generators	1
	Lighting	Lighting Tower	3

Construction Scenario	Activity	Equipment	Assumed Plant Number
Access Track Construction	Deliver material from quarry	Road Truck - B-double / triple	2
	Roll	825 Roller Compactor	3
	Grade	CAT 16 Grader	3
	Add Water	CAT 777 Water truck	2

Table 4 Construction Scenario, Plant and Numbers – Gas Drainage – Gas Facility

Construction Scenario	Activity	Equipment	Assumed Plant Number
Install Pavement (direct supply)	Deliver material from quarry	Road Truck - B-double / triple	2
	Add water	CAT 777 Water truck	1
	Grade material	CAT 16 Grader	1
	Roll	825 Roller Compactor	1
Bulk Earthworks – Cut	Ground removal	CAT 631 Scraper	2
		30 T Excavator	1
	Ripping	D7 Bulldozer with ripper	1
Bulk Earthworks – Fill	Placement	CAT 631 Scraper	2
		CAT 773 Dump truck	2
	Add water	CAT 777 Water truck	1
	Grade	CAT 16 Grader	1
	Roll	825 Roller Compactor	1
Plant Assembly	Lifting	100T Outrigger	1
		Roughie - 4WD 50T	1
		Franna - up to 20T	2
	Access	Elevated Work platform	2
		Scissor Lift	2
	Concrete delivery	Concrete truck	2
		Concrete pump	1
	Construction equipment	Air compressor	1
		Generators	2
		Welders	2
		Winches	1

1.1.3 Conveyor Systems

- Existing conveyors (as taken from the GCE Project), are not included in the Red Hill Project as these form part of the 'Existing Operations' (which is already covered under the approved EA conditions for Goonyella Riverside Mine).
- Proposed conveyors for the Red Hill Project have been derived from the following drawings / documents, and are noted in **Table 5**.
 - 'U53-P-1-1007 - Option 5.pdf'
 - 'U53-P-2-1133.pdf'
 - 'U53-P-2-1135.pdf'
 - 'U53-P-2-1136.pdf'
 - 'U53-X-R-1007 (infrastructure layout).dwg'

- No 3D conveyor data (AutoCAD DXF) has been provided for the Red Hill Project (only 2D alignments as shown in the above listed drawings / documents). Heights of conveyors (above ground level or CHPP/Coal Stockpile pad) have been assumed as detailed in **Table 5**. Where possible, this information has been derived from the email 'U53-02010-EM-110826 stockpile bin and conveyor details' sent 26 August 2011, and GCE assumptions memo '20-2291 URS GCE Memo 20110504' dated 4 May 2011.

Table 5 Proposed Red Hill Project Future Conveyors

Conveyor Number	Conveyor Name	Belt Speed (m/s)	Belt Width (mm)	Height Above ground (m)	Comments
CV-132	Raw Coal Stacking	4.5	2000	1.5 – 45	1.5 m at base of Primary Sizing Station, 45m at coal stockpile.
CV-102	Raw Coal Stacking	4.5	2000		
CV-111	Emergency ROM Stacking	4.5	2000	10 – 25	10 m at Primary Sizing Station, 25m at coal stockpile.
CV-121	Tunnel Reclaim	3.0	1800	1.5 – 10	1.5 m at base of Tunnel, 10m at Breaker Station.
CV-711	Rotary Breaker Rejects	2.0	1200	1.5 – 20	1.5 m at base Breaker Station, 20m at coal stockpile.
CV-221	Breaker Station Raw Coal	4.0	1400	1.5 – 5	5m at rise to Transfer Station.
CV-222	Raw Coal Transfer	4.0	1400	1.5 – 5	5m at rise to Transfer Station. Low noise idlers will be installed.
CV-223	Raw Coal Transfer	4.0	1400		
CV-224	Raw Coal Transfer	4.0	1400		
CV-225	Raw Coal Transfer	4.0	1400		
CV-226	Raw Coal Transfer	4.0	1400	1.5 – 30	1.5 m at base transfer station, 30m at Surge Bin.
CV-227	U/G Raw Coal Transfer	3.6	1800	1.5 – 5	5m at rise to Transfer Station.
CV-261	O/C Raw Coal Transfer	3.5	1200	1.5 – 10	1.5 m at base of Primary Sizing Station, 10m at Secondary Sizing Station.
CV-262	O/C Raw Coal Transfer	3.5	1200	1.5 – 30	1.5 m at base Secondary Sizing Station, 30m at Surge Bin.
CV-281	Tertiary Station Feed	3.6	1800	1.5 – 10	1.5 m at base Surge Bin, 10m at Tertiary Station Feed.
CV-315	Plant Surge Bin Feed	3.6	1800	1.5 – 30	1.5 m at base Tertiary Sizing Station, 30m at Surge Bin.
CV-316	Plant Feed	3.5	1200	1.5 – 25	1.5 m at base Surge Bin, 25m at CHPP.
CV-317	Plant Feed	4.0	1400		
CV-801	Product	3.6	1800	1.5 – 30	1.5 m at base CHPP, 30m at Surge Bin.
CV-804	Transfer	0.65	2200	5	-
CV-803	Transfer	0.65	2200		
CV-802	Product Stacker	3.6	1800	1.5 - 20	1.5 m at start, 20m at Product Stacker.
CV-811	Product Reclaim	5.5	2200	20 – 5	20 m at Product Reclaim, 5m at Loadout Transfer Station
CV-812	Product TLO	5.5	2200	1.5 – 15	1.5 m at Transfer Station, 15m at TLO.
CV-814	Silo Transfer	4.0	1400	16	1m above 15m Superloop TLO Silos

Conveyor Number	Conveyor Name	Belt Speed (m/s)	Belt Width (mm)	Height Above ground (m)	Comments
CV-813	Superloop Product	4.0	1400	1.5 – 18	1.5 m at Transfer Station, 18m at end of belt (above Silo Transfer).
CV-701	Coarse Rejects	3.0	1200	1.5 – 5	5m at rise to Transfer Station.
CV-702	Combined Rejects	3.0	1200		
CV-703	Rejects Bin Feed	3.0	1200	1.5 - 15	1.5 m at Transfer Station, 15m at Reject Bin.

1.1.4 Fixed Plant Noise Levels - Mine

- The proposed Sound Power Level (SWL) for the new Fixed Plant (CHPP3, transfer stations, crushers, ROM, trainload etc) along with proposed modelling heights are detailed in **Table 6**. Heights and SWLs of fixed plant have been taken from GCE Project assumptions memo '20-2291 URS GCE Memo 20110504' dated 4 May 2011.

Table 6 Fixed Plant Sound Power Levels

Plant Items	LAeq SWL (dBA)	Modelled Height (m)
Breaker Station	113	10
Coal Preparation Plant	116	23
Crusher / Sizing / Screen – Primary	124	19
Crusher / Sizing / Screen – Secondary	117	9
Crusher / Sizing / Screen – Tertiary	111	9
Product Stacker Reclaimer	104	20
Rail Load-out	111	15
Rejects Hopper	100	30
ROM Hopper	105	29
Surge Bin	101	30
Transfer Station	111	5
Vent Shaft	111	10

- The CHPP and Stockpile pad which is to be constructed for the Red Hill Project is assumed as the following RLs (as approved for GCE).
 - Directly under the CHPP – RL 273.
 - Transfer Stations at northern end of the stockpiles – RL 272.
 - Southern end of stockpiles – RL 265.
- The Red Hill Underground Raw and Emergency coal stockpiles pads will be assumed to be level and at nature ground height.
- 'Upcast Shaft' vents:
 - There will be an initial downcast shaft near the start of the mains – fresh air intake.
 - The first mains upcast shaft will be aligned somewhere around the 3 LW panel.
 - Then a second upcast will be needed approximately two-thirds the way down the mains (ie 7 LW panel).
 - The fans installed on the first upcast will be transitioned to the new inbye/second upcast shaft once it is in place.
 - The first upcast will then become an additional downcast shaft – fresh air intake to alleviate pressure.

- This set up will be replicated for both the southern mains and panels and the northern mains and panels i.e. total of 6 shafts to be sunk (at this stage).
- Only one upcast on each side (north/south) will be operating as a mains upcast at any one time (ie two in total).
- There will a bleeder shaft required at the back of the panels; assume capacity will be 1/6 of the main fan (approx 80-100m³/hr).
- The height indication up to 10m.
- The proposed staging for the shafts will be assumed as follows:
 - o Start of mine (ie FY2017-18) – Sink initial downcast shaft at start of mains, and sink/install first mains upcast shaft at the 3rd LW panel (north and south).
 - o Mid-life of mine (ie FY2030) - sink/install second mains upcast shaft at the 7th LW panel (north and south), convert first mains upcast shaft at the 3rd LW panel (north and south) into downcast shaft.
 - o End of mine (ie FY2040) - Second mains upcast shaft at the 7th LW panel, downcast shafts at start of mains and at the 3rd LW panel (north and south).

1.1.5 Fixed Plant Noise Levels – Gas Drainage

SLR has been advised that the assessment of three (3) different 'Gas Hub' options for Gas Drainage is required. The assumptions for these three (3) options are discussed below.

The exact location of the 'Gas Hub' option is unknown at the time of assessment. Through discussions with BMA, SLR Consulting has been advised that the location will be above the UG Mains somewhere between LW panels 1 to 4.

For modelling purposes, SLR Consulting will assume the location of the 'Gas Hub' option will be above the UG Mains at LW panel 4 with the aim to place it in a worst case location for the sensitive receptors on the eastern side of the Project.

Option 1 – Flare

- Total number of flares is unknown at the time of reporting. SLR Consulting will assume a total number of three (3) flares for this option.
- Assumed SWL for one (1) flare is 147 dBA.

Option 2 – Gas Fired Power Station

- Based on SKMs *Goonyella Gas Fired Power Generation Options Study* (document reference: 'QH10259-000-EZ-RP-0001', dated 6 April 2011), the following details of the gas fired power station are noted:
 - Power plant is to be initially sized for an available pre-drain gas supply of 0.5PJ/annum which is sufficient to generate approximately 5MW (two (2) GE Jenbacher 620 GS-SI regenerator modules – 'gensets').
 - The power plant must be expandable to 40 MW (twelve (12) GE Jenbacher 620 GS-SI gensets).
 - Pre-drain gas can become available from late 2013. Goaf gas may become available by 2019.
- Based on the above, the gas fired power station will be modelled with a nominal capacity of 40 MW utilising twelve (12) GE Jenbacher 620 GS-SI gensets. This power plant will operate on both pre-drain and goaf gas. Assumed SWL for one (1) GE Jenbacher 620 GS-SI genset is detailed in **Table 7**.

Table 7 SWL for one (1) GE Jenbacher 620 GS-SI Genset

Component	SWL (dBA)
Vent Air Outlet	84
Vent Air Inlet	84
Left Side Wall	82
Right Side Wall	82
Roof	84
Radiator Fans	85
Exhaust	93

Note 1: Noise emission data for each genset unit was a sound pressure level of 85 dBA at 1m from all components and directions. The above SWLs are based on previous modelling which SLR Consulting has undertaken to verify that each genset is equal to 85 dBA at 1m from all components and directions. As noted above, the power station comprises of 12 genset units.

- It is assumed that there will be one (1) compressor (CAT G3608 or similar) to add in compression and pressure control. This compressor will be comprised of the following:
 - Engine / Compressor – SWL 123 dBA.
 - Exhaust – SWL 140 dBA.
 - Air Inlet – SWL 128 dBA.

It is noted that the assumed SWL data for the compressors is for an unmitigated unit (ie no housing or silencers).

- It is assumed there will be a transformer associated with the power station. The assumed SWL of the transformer (40 MVA) is 60 dBA.
- SLR Consulting will assume that the gas fired power station includes one (1) flare. Assumed SWL for one (1) flare is 147 dBA.

Option 3 – Compression and On-sell (offsite)

- No details are available for this option at this point of the assessment. Therefore, SLR Consulting assume the following:
 - It is assumed that there will be three (3) reciprocating style compressor (CAT G3608 or similar). Each compressor will be comprised of the following:
 - Engine / Compressor – SWL 123 dBA.
 - Exhaust – SWL 140 dBA.
 - Air Inlet – SWL 128 dBA.
 - Cooling fans – SWL 91 dBA

It is noted that the assumed SWL data for the compressors is for an unmitigated unit (ie no housing or silencers).

- SLR Consulting will assume that the gas fired power includes one (1) flare. Assumed SWL for one (1) flare is 147 dBA.

Gas Wells

Based on the provided document *File Note – Gas Management File Note for EIS Scoping Purposes* (document reference: 'CSG Process and Gas and water management for Project description Rev 2', dated 22 March 2011), the following details of the gas wells are noted:

- Gas pre-drainage:
 - Drilling of between 50 in-seam wells and 25 vertical wells per Longwall panel or up to 1200 wells in total.
 - Acoustically significant surface facilities for vertical wells only will consist of a drive pump and gas/water separator. SWL of drive pump will be 95 dBA. SWL of separator will be 98 dBA.
- Goaf Gas:
 - Drilling of between 20 to 35 goaf drainage holes per Longwall panel or up to 770 goaf drainage holes in total.
 - There will be one central hub gas plant so no need for pumps at each well head. Therefore, there will be no acoustically significant sources with the goaf wells.

1.1.6 Mobile Plant

- The following operational mobile plant fleet is proposed to be located at the CHPP3 / MIAs / Stockpiles (see **Table 8**). As the Red Hill Project has a proposed duration of approximately 25 years, SLR Consulting is proposing to model three (3) scenarios, those being 'On-opening' (ie FY2017), 'mid-life' (ie FY 2030) and 'end of life' (ie FY2040).
- Operational mobile plant fleet proposed has been derived from the supplied mobile mining fleet for GCE by MineOp and the supplied UG mobile equipment for the Red Hill UG Mine by MineCraft (Option F).

Table 8 Operational Mobile Plant Fleet

Location	Plant Type	Plant Numbers		
		FY2017	FY230	FY2040
CHPP3	994 Wheel Loader	1	1	1
	CAT 789 Haul Truck (Rejects)	1	1	2
	CAT 854 Wheel Dozer	4	4	4
	CAT 16H Grader	1	1	1
	CAT 777 Water Truck	1	1	1
Red Hill UG Mine	10t LHD	1	1	1
	12 Person Transporter	1	1	1
	Maintenance Vehicle	1	1	1
	Mine Ambulance	1	1	1
	994 Wheel Loader (Emergency Coal Stockpile)	1	1	1

1.1.7 Buildings which house or enclose fixed plant

- The new CHPP3 building will not be cladded or enclosed.

1.1.8 Rail alignments

- There is no change in the rail alignments of the existing Riverside Loop for this project (ie 'future' rail loops will be as per the existing rail loops). Rail traffic on these loops assumed to increase (see **Section 1.1.9**).

1.1.9 Rail traffic:

- The parameters used to calculate the existing and future rail noise levels, as provided by BMA (see email 'Red Hill (GCE) - forecast rail data' dated 17 October 2011), have been assumed as follows (**Table 9**).

Table 9 Train Movements – Riverside Loop

Parameter	Existing (8.8 mpta)	Future (8.8 + 14 mtpa)
Number of train movements per day (average)	2.4	6.2
Notch setting of train	Notch 1 / 2	Notch 1 / 2
Speed of train	1 km/h	1 km/h
Length of train	2040 m	2040 m
Number and type of locomotives	3 x E40AC-V2 (Siemens)	3 x E40AC-V2 (Siemens)

2 ACCOMMODATION OPTIONS 4 AND 5

It is noted that due to the lack of available data at this stage of the project, the following assumptions have been largely based on the noise and vibration assessment of the Buffel Park Accommodation Village which SLR Consulting (then Heggies) undertook as part of the Caval Ridge EIS.

The below information has previously been confirmed by BMA for the GCE Project.

2.1 Assumptions

2.1.1 Layout

- As there is no available generic layout for the accommodation options, SLR Consulting will use the layout available for the Buffel Park Accommodation Village assessment. This layout is shown in **Figure 1** below.

Figure 1 Assumed Accommodation Layout



2.1.2 Construction Schedule, Locations and Fleet Numbers

- Construction equipment and numbers used during the construction phase of the accommodation village (irrespective of which option) will include the following:

Table 10 Construction Scenario, Plant and Numbers – Accommodation Options

Construction Scenario	Activity	Equipment	Number
Bulk Earthworks – Cut	Ground removal	CAT 631 Scraper	2
		30 T Excavator	2
	Ripping	D10 Bulldozer with ripper	2
Bulk Earthworks – Fill	Placement	CAT 631 Scraper	2
		CAT 773 Dump truck	4
	Add water	CAT 777 Water truck	2
	Grade	CAT 16 Grader	2
	Roll	825 Roller Compactor	2
Install Pavement (direct supply)	Deliver material from quarry	Road Truck - B-double / triple	2
	Add water	CAT 777 Water truck	2
	Grade material	CAT 16 Grader	2
	Roll	825 Roller Compactor	2
Village Assembly	Delivery	Road Truck - B-double / triple	4
		100T outrigger	1
	Lifting	Roughie - 4WD 50T	2
		Franna - up to 20T	2
		Elevated Work platform	2
	Access	Scissor Lift	2
		Concrete truck	4
	Concrete delivery	Concrete pump	2
		Air compressor	2
	Construction equipment	Generators	2
		Welders	2
		Winches	2

2.1.3 Accommodation Facilities

- The main facilities located within the accommodation village (irrespective of which option) will include the following:
 - o Rooms (nominally 2,000 rooms).
 - o Kitchen and dining (crib room).
 - o Laundry.
 - o Indoor recreational areas.
 - o BBQ and outdoor entertainment area.
 - o Sports Club (gym, meeting rooms, coffee shop, lap pool, basketball court)
 - o Water treatment plant.
 - o Wastewater treatment plant.
 - o Washdown.

2.1.4 Accommodation Facilities SWL

- Sound pressure levels of the noise sources within the Operational Accommodation Village (irrespective of which option) include:
 - Accommodation rooms
 - o Air conditioning plant - 65 dBA @ 3m (1 unit per 4 rooms).
 - Backup generator/s - 85 dBA @ 1m.
 - Kitchen refrigeration - 93 dBA (sound power level – adjusted for tonality).
 - Recreational facilities
 - o Air conditioning plant - 70 dBA @ 3m (assume 4 units).
 - Lap pool
 - o Pump - 70 dBA @ 1m (adjusted for tonality).
 - Sports field (shouting) - 96 dBA (sound power level).
 - Refuse Collection - 105 dBA (sound power level).
 - Water treatment plant
 - o Air compressors x 2 - in acoustic enclosure to achieve 85 dBA @1m
 - o Blowers x 2 - in acoustic enclosure to achieve 85 dBA @1m
 - o Dosing pumps x 2 - 63 dBA (sound power level)
 - Wastewater treatment plant
 - o Air compressors x 2 - in acoustic enclosure to achieve 85 dBA @1m
 - o Blowers x 2 - in acoustic enclosure to achieve 85 dBA @1m
 - o Dosing pumps x 2 - 63 dBA (sound power level)
 - Washdown - 93 dBA (sound power level)
- The above noise sources are a combination of both supplied data (from the Caval Ridge project team) and SLR Consulting's internal noise source data base.

2.1.5 Buildings which house or enclose fixed plant

- Buildings that house or enclose the major items of mechanical plant have been assumed based on the above mentioned noise source levels.
- Accommodation rooms have been assumed to be constructed from a material which provides 20 dBA façade reduction (or higher). All rooms are assumed to be air conditioned and provided with filtered fresh air.

I trust that the above is sufficient for your present requirements. Please do not hesitate to contact me on (07) 3858 4800 if I can assist you further with this or any other matter regarding the noise and vibration assessment for the Red Hill Project EIS.

Yours sincerely

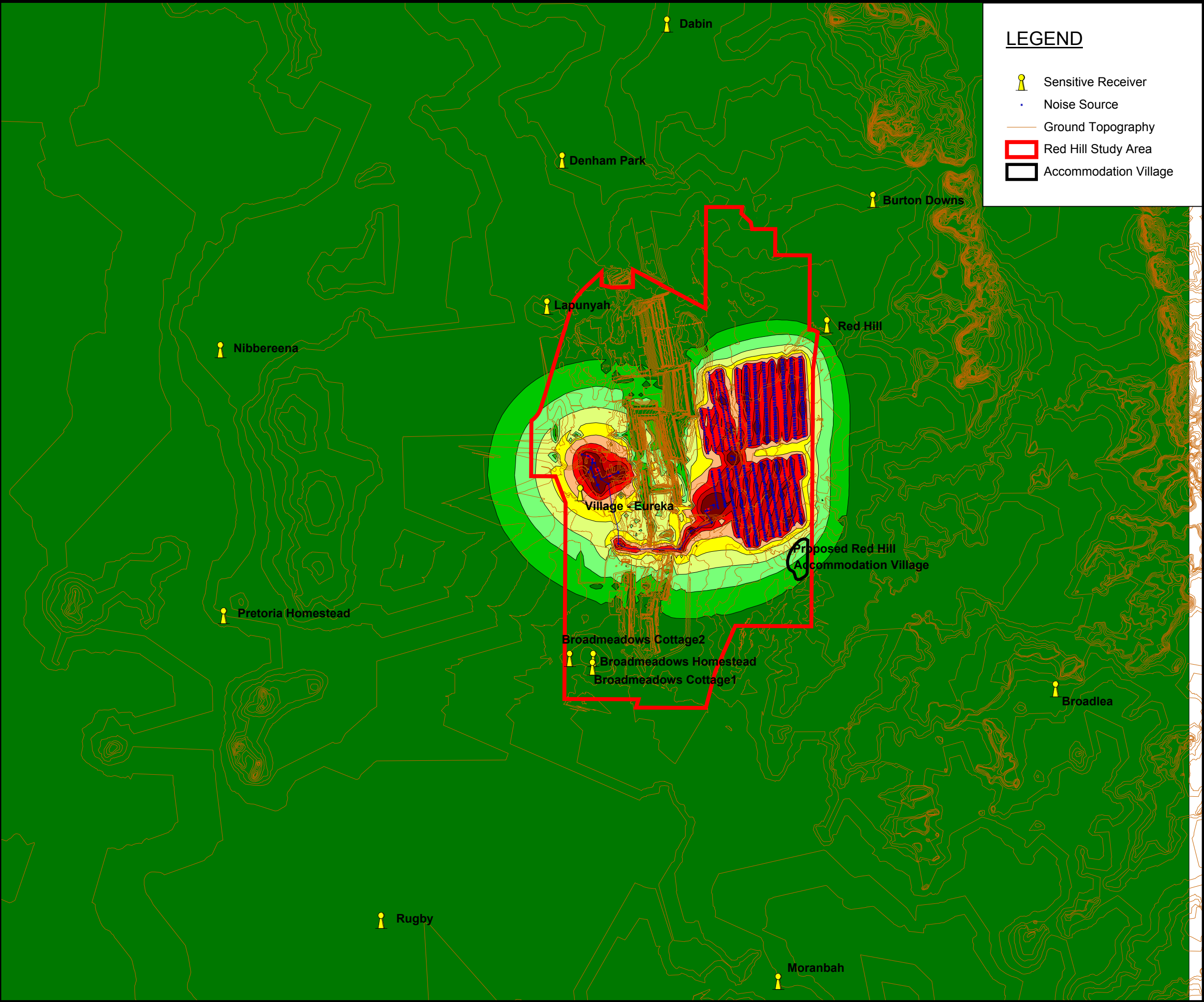


GLYN COWIE
Project Consultant – Acoustics

Appendix E

Report Number 20-2291-R3

NOISE CONTOUR PLOTS – NEUTRAL WEATHER CONDITION



LEGEND

-  Sensitive Receiver
-  Noise Source
-  Ground Topography
-  Red Hill Study Area
-  Accommodation Village

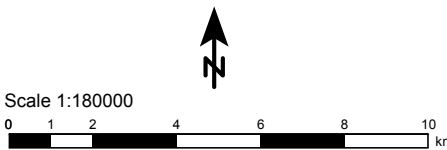
PROJECT:
RED HILL MINING
LEASE PROJECT

TITLE:
FY2020 Fixed Plant and
Gas Option 1

MAP NO: E-01

Noise Levels
LAeq (dBA)

60 <		<= 60
55 <		<= 55
50 <		<= 50
45 <		<= 45
40 <		<= 40
35 <		<= 35
30 <		<= 30
25 <		<= 25



Prediction Algorithm: CONCAWE

CONDITION: Neutral Weather
Meteorological Category: 4
Wind: 0 m/s **Stability Class:** D

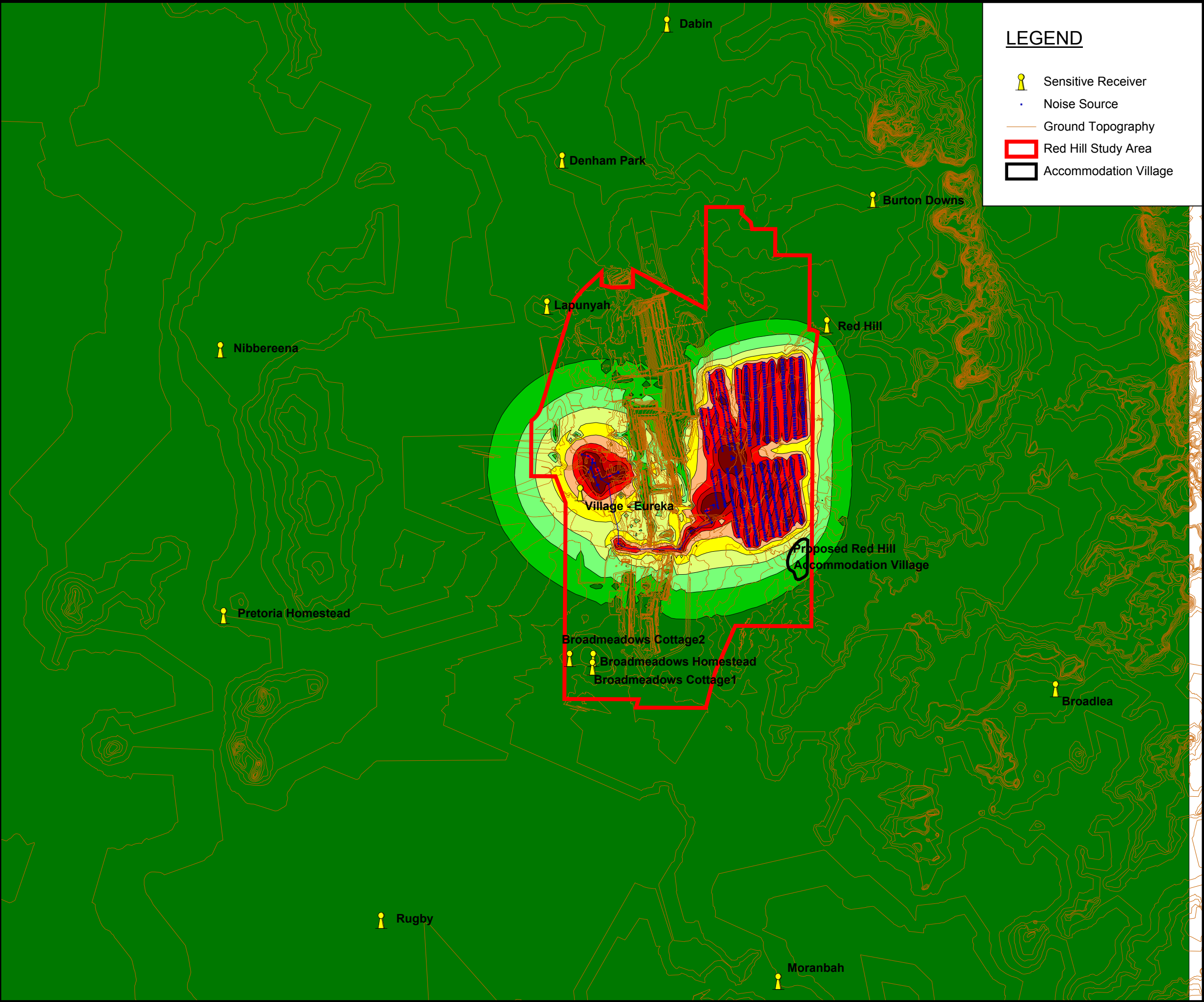
PROJECT NO.: 620.02291.00200

REPORT NO.: 20.2291-R3

APPENDIX: E

DATE: 8-08-2013

PREPARED: GC



LEGEND

- Sensitive Receiver
- Noise Source
- Ground Topography
- Red Hill Study Area
- Accommodation Village



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PROJECT:

RED HILL MINING
LEASE PROJECT

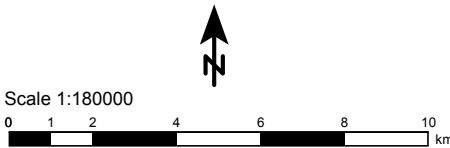
TITLE:

FY2020 Fixed Plant and
Gas Option 2

MAP NO: E-02

Noise Levels
LAeq (dBA)

60 <		
55 <		<= 60
50 <		<= 55
45 <		<= 50
40 <		<= 45
35 <		<= 40
30 <		<= 35
25 <		<= 30
		<= 25



Prediction Algorithm: CONCAWE

CONDITION: Neutral Weather
Meteorological Category: 4
Wind: 0 m/s Stability Class: D

PROJECT NO.: 620.02291.00200

REPORT NO.: 20.2291-R3

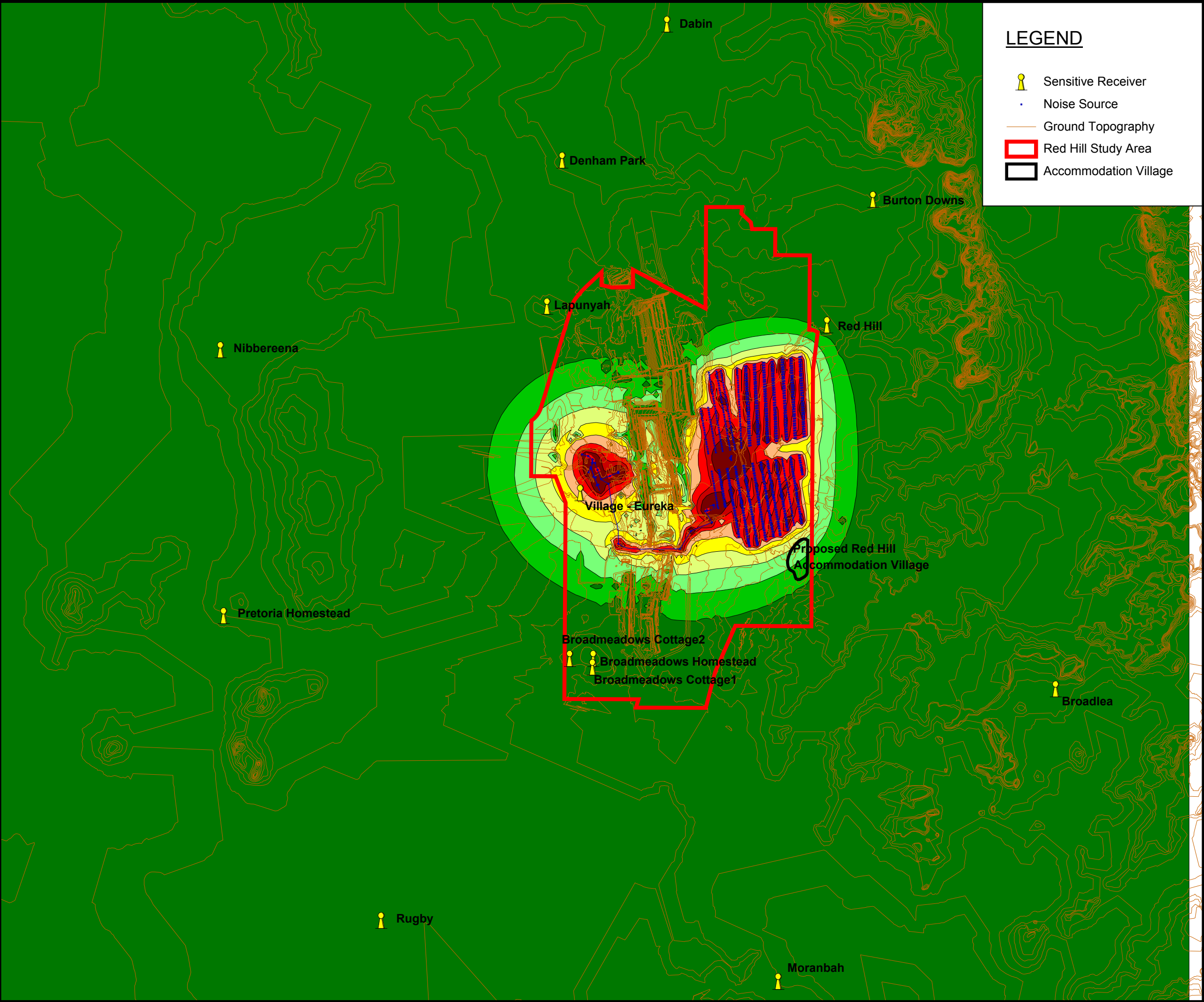
APPENDIX: E

DATE: 08-08-2013

PREPARED: GC



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BHP Billiton Mitsubishi Alliance

PROJECT:

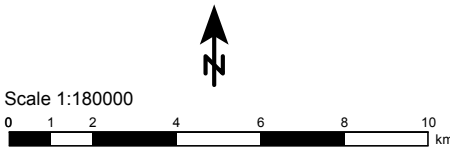
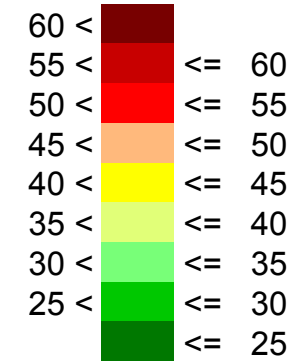
RED HILL MINING
LEASE PROJECT

TITLE:

FY2020 Fixed Plant and
Gas Option 3

MAP NO: E-03

Noise Levels
LAeq (dBA)



Prediction Algorithm: CONCAWE

CONDITION: Neutral Weather
Meteorological Category: 4
Wind: 0 m/s **Stability Class:** D

PROJECT NO.: 620.02291.00200

REPORT NO.: 20.2291-R3

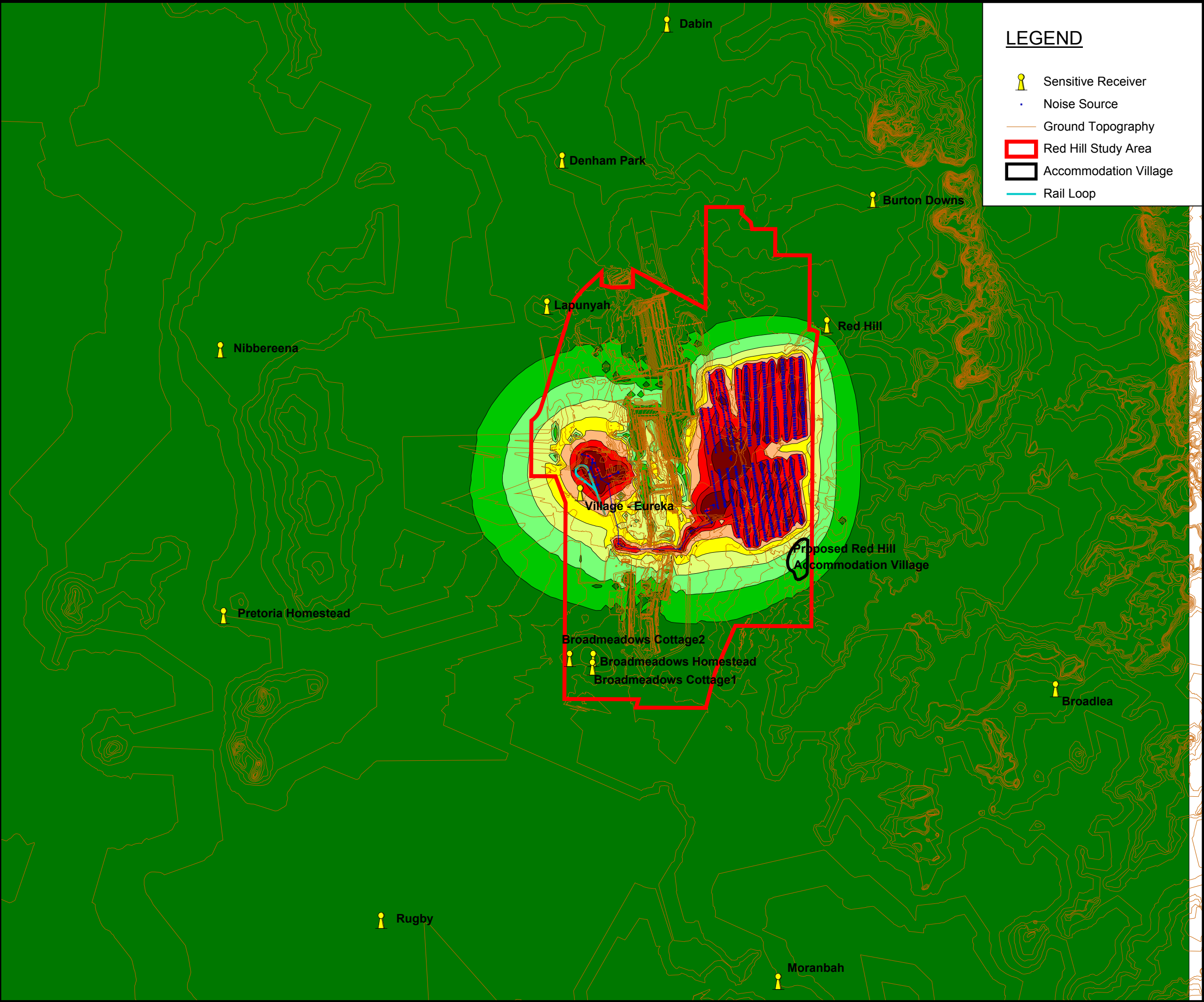
APPENDIX: E

DATE: 08-08-2013

PREPARED: GC



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PROJECT:

RED HILL MINING
LEASE PROJECT

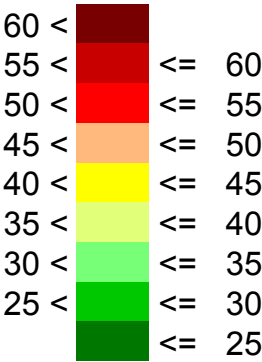
TITLE:

FY2020 Fixed Plant, Gas
Option 3, Mobile Plant & Rail

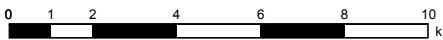
MAP NO:

E-04

Noise Levels
LAeq (dBA)



Scale 1:180000



Prediction Algorithm: CONCAWE

CONDITION: Neutral Weather

Meteorological Category: 4

Wind: 0 m/s Stability Class: D

PROJECT NO.: 620.02291.00200

REPORT NO.: 20.2291-R3

APPENDIX: E

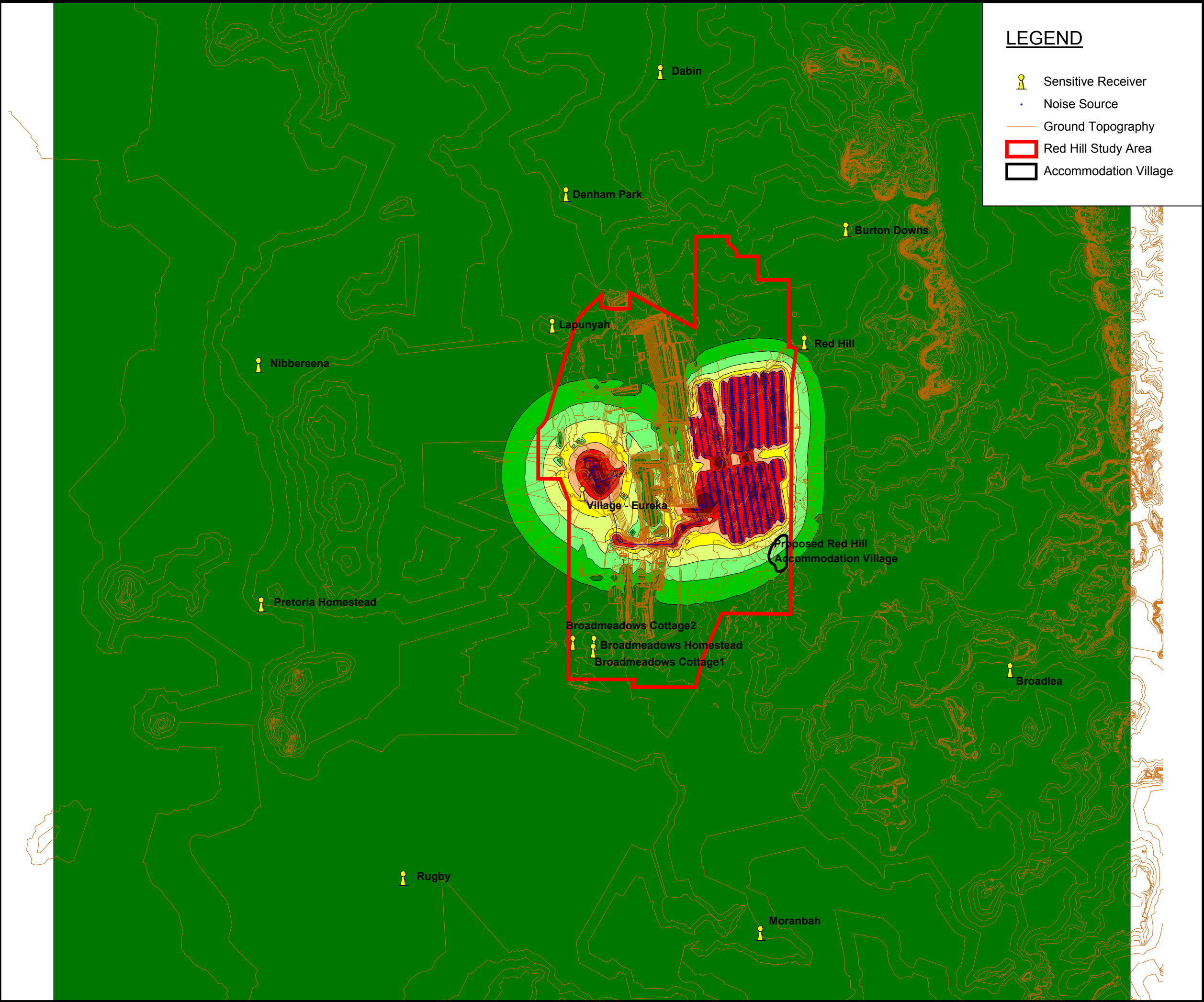
DATE: 08-08-2013

PREPARED: GC



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LEGEND

- Sensitive Receiver
- Noise Source
- Ground Topography
- Red Hill Study Area
- Accommodation Village



BHP Billiton Mitsubishi Alliance

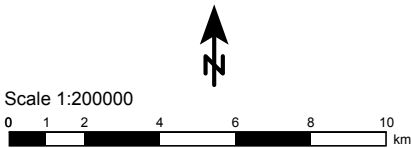
PROJECT:
**RED HILL MINING
LEASE PROJECT**

TITLE:
FY2030 Fixed Plant and
Gas Option 1

MAP NO: E-05

Noise Levels
LAeq (dBA)

60 <		<= 60
55 <		<= 55
50 <		<= 50
45 <		<= 45
40 <		<= 40
35 <		<= 35
30 <		<= 30
25 <		<= 25



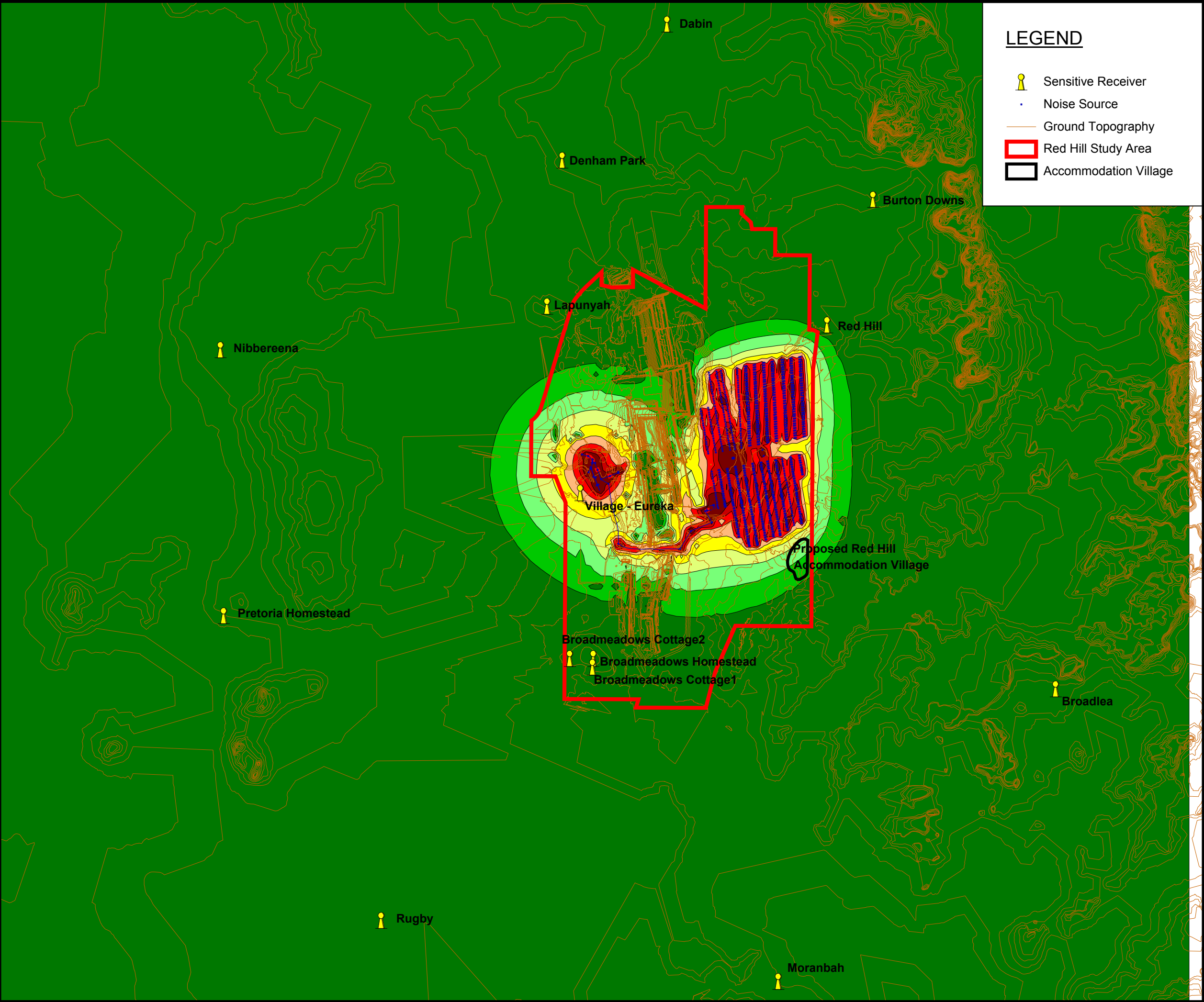
Prediction Algorithm: CONCAWE

CONDITION: Neutral Weather
Meteorological Category: 4
Wind: 0 m/s Stability Class: D

PROJECT NO.: 620.02291.00200
REPORT NO.: 20.2291-R3
APPENDIX: E
DATE: 08-08-2012
PREPARED: GC



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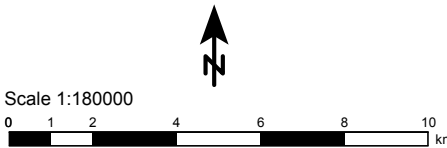
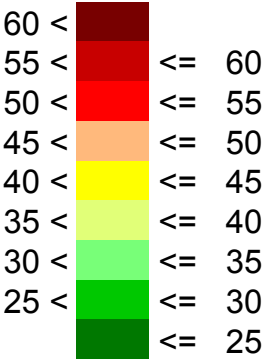
BHP Billiton Mitsubishi Alliance

PROJECT:
RED HILL MINING
LEASE PROJECT

TITLE:
FY2030 Fixed Plant and
Gas Option 2

MAP NO: E-06

Noise Levels
LAeq (dBA)



Prediction Algorithm: CONCAWE

CONDITION: Neutral Weather

Meteorological Category: 4

Wind: 0 m/s **Stability Class:** D

PROJECT NO.: 620.02291.00200

REPORT NO.: 20.2291-R3

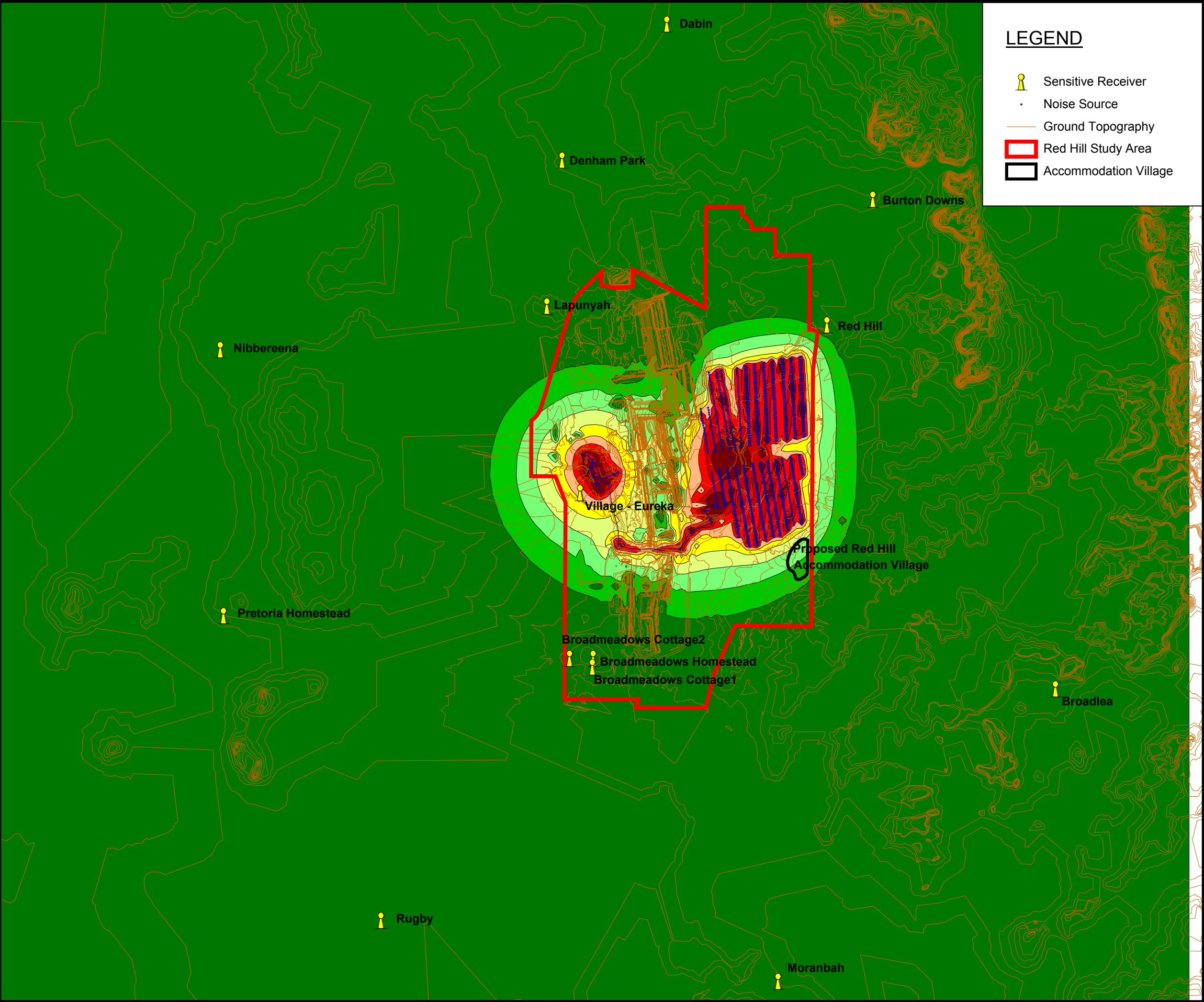
APPENDIX: E

DATE: 08-08-2013

PREPARED: GC



SLR Consulting Australia
ABN 29 001 584 612
Highpoint, 240 Waterworks Road
Ashgrove QLD 4060
Tel: 61 7 3858 8400 Fax: 61 7 3858 4841



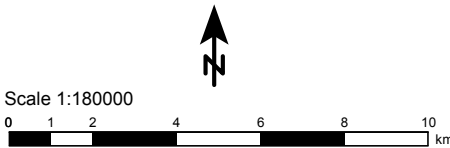
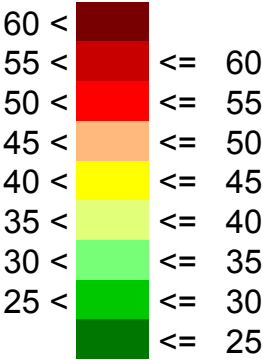
BHP Billiton Mitsubishi Alliance

PROJECT:
RED HILL MINING
LEASE PROJECT

TITLE:
FY2030 Fixed Plant and
Gas Option 3

MAP NO: E-07

Noise Levels
LAeq (dBA)



Prediction Algorithm: CONCAWE

CONDITION: Neutral Weather

Meteorological Category: 4

Wind: 0 m/s **Stability Class:** D

PROJECT NO.: 620.02291.00200

REPORT NO.: 20.2291-R3

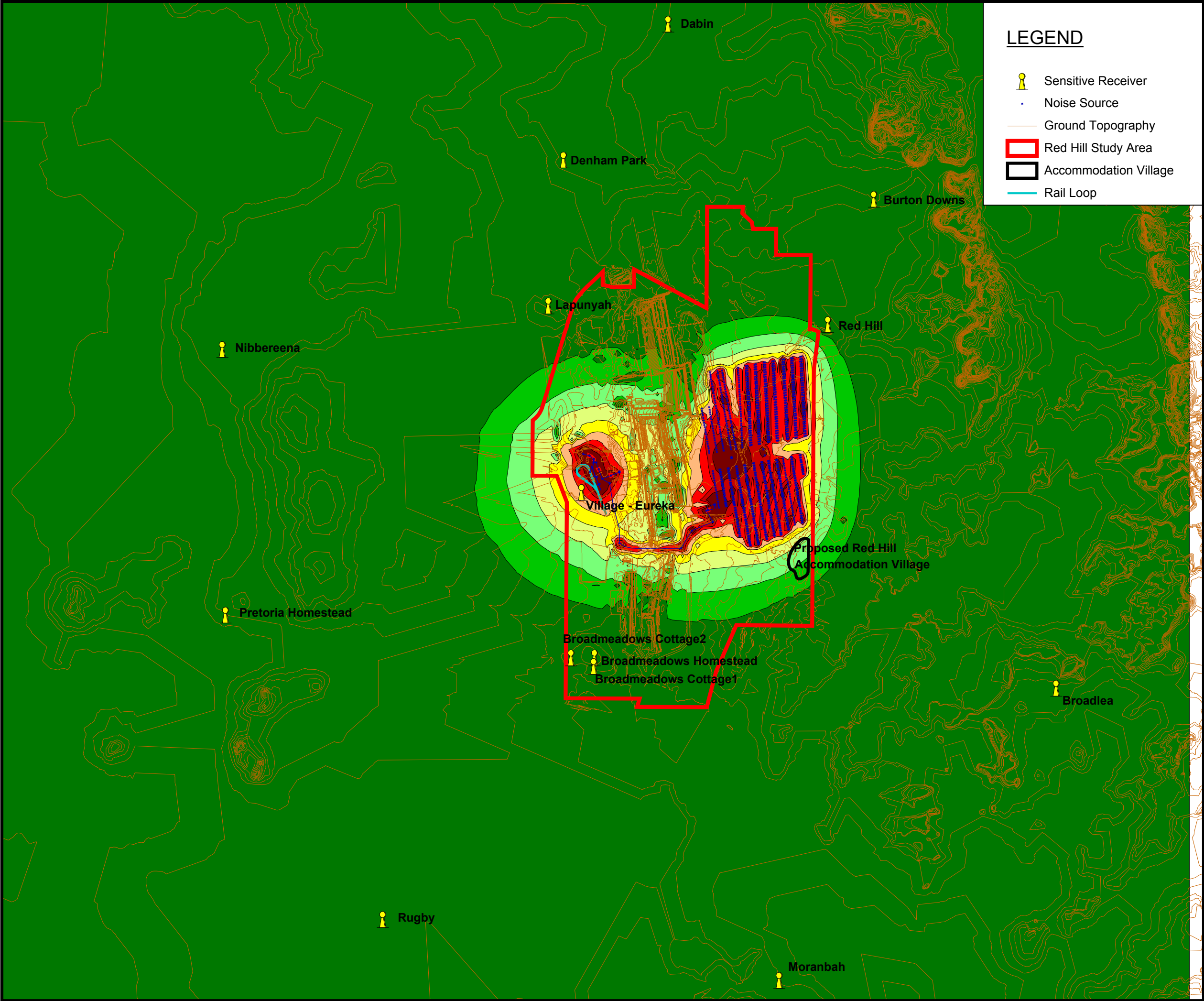
APPENDIX: E

DATE: 08-08-2013

PREPARED: GC



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ABN 29 001 584 612
Highpoint, 240 Waterworks Road
Ashgrove QLD 4060
Tel: 61 7 3858 8400 Fax: 61 7 3858 4841



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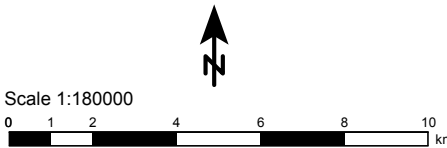
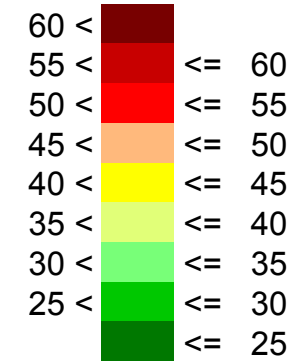
PROJECT:

RED HILL MINING
LEASE PROJECT

TITLE:
FY2030 Fixed Plant, Gas
Option 3, Mobile Plant & Rail

MAP NO: E-08

Noise Levels
LAeq (dBA)



Prediction Algorithm: CONCAWE

CONDITION: Neutral Weather
Meteorological Category: 4
Wind: 0 m/s **Stability Class:** D

PROJECT NO.: 620.02291.00200

REPORT NO.: 20.2291-R3

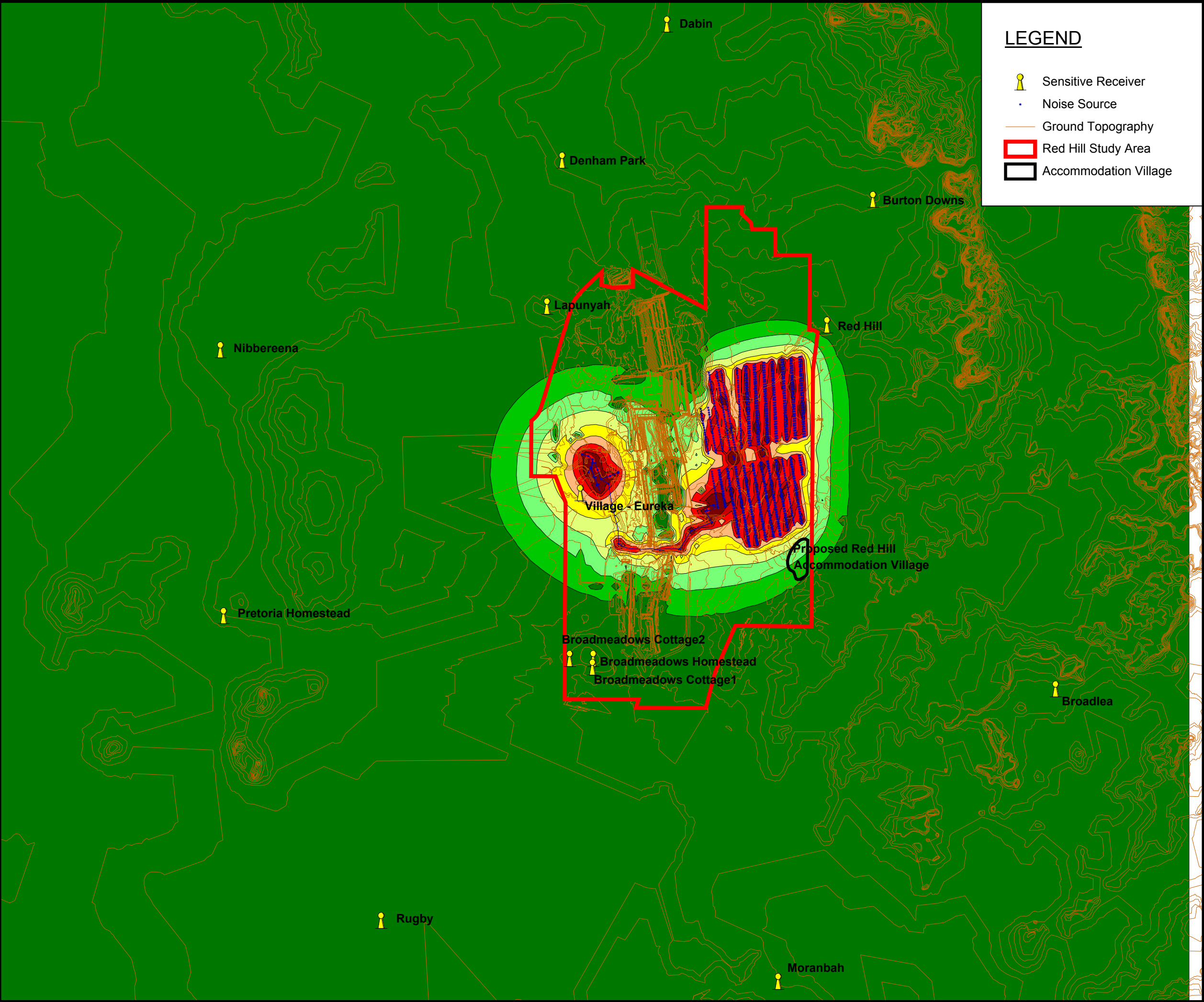
APPENDIX: E

DATE: 08-08-2013

PREPARED: GC



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ABN 29 001 584 612
Highpoint, 240 Waterworks Road
Ashgrove QLD 4060
Tel: 61 7 3858 8400 Fax: 61 7 3858 4841



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PROJECT:

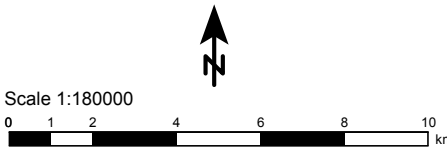
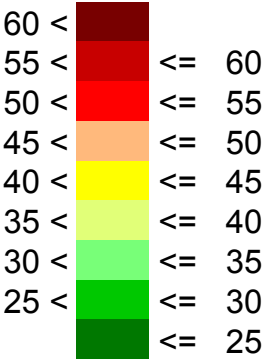
RED HILL MINING
LEASE PROJECT

TITLE:

FY2040 Fixed Plant and
Gas Option 1

MAP NO: E-09

Noise Levels
LAeq (dBA)



Prediction Algorithm: CONCAWE

CONDITION: Neutral Weather

Meteorological Category: 4

Wind: 0 m/s **Stability Class:** D

PROJECT NO.: 620.02291.00200

REPORT NO.: 20.2291-R3

APPENDIX: E

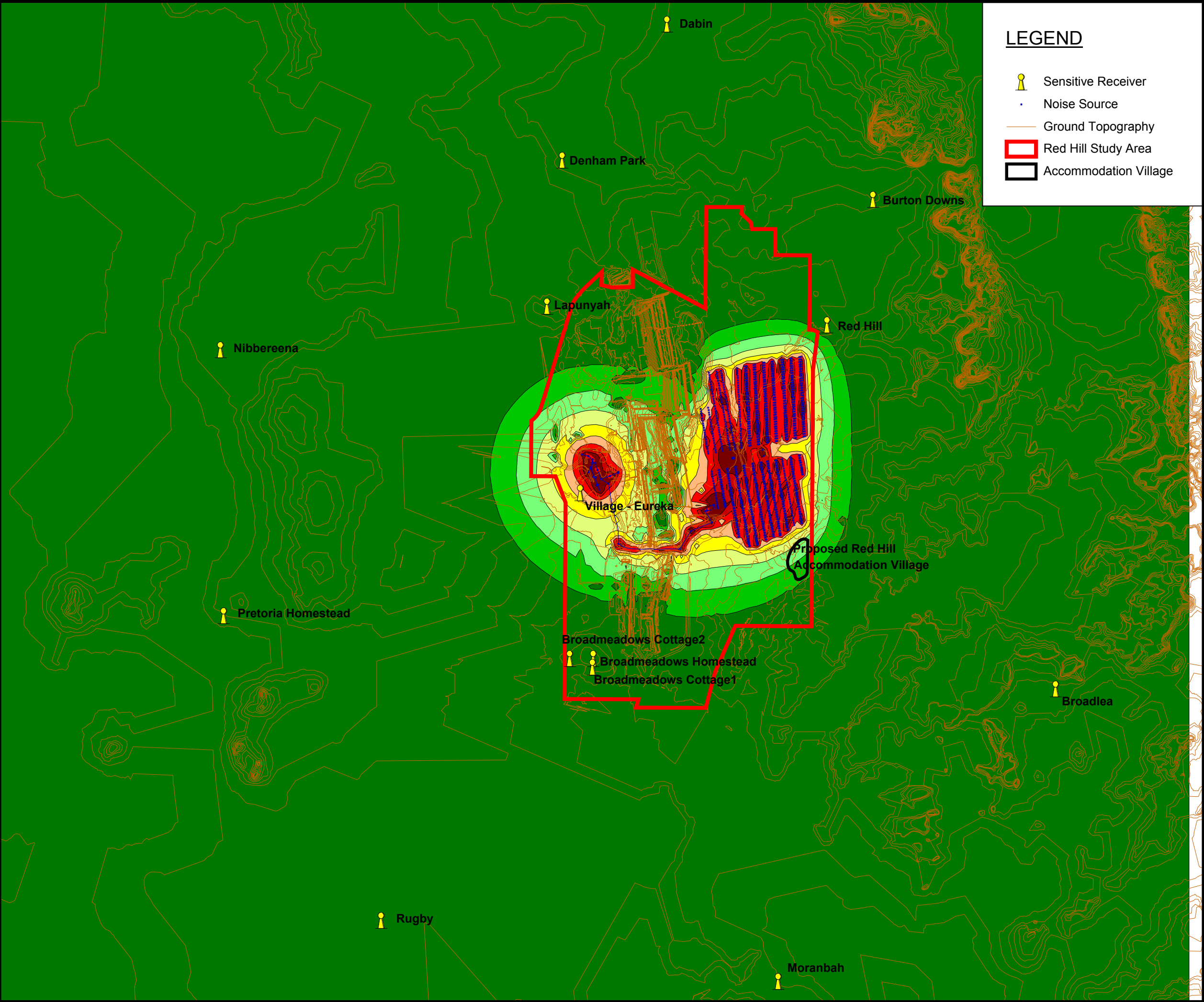
DATE: 08-08-2013

PREPARED: DG



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Tel: 61 7 3858 8400 Fax: 61 7 3858 4841



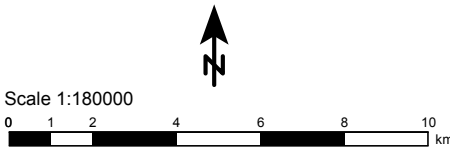
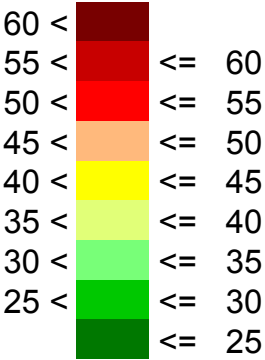
BHP Billiton Mitsubishi Alliance

PROJECT:
**RED HILL MINING
LEASE PROJECT**

TITLE:
FY2040 Fixed Plant and
Gas Option 2

MAP NO: E-10

Noise Levels
LAeq (dBA)



Prediction Algorithm: CONCAWE

CONDITION: Neutral Weather
Meteorological Category: 4
Wind: 0 m/s **Stability Class:** D

PROJECT NO.: 620.02291.00200

REPORT NO.: 20.2291-R3

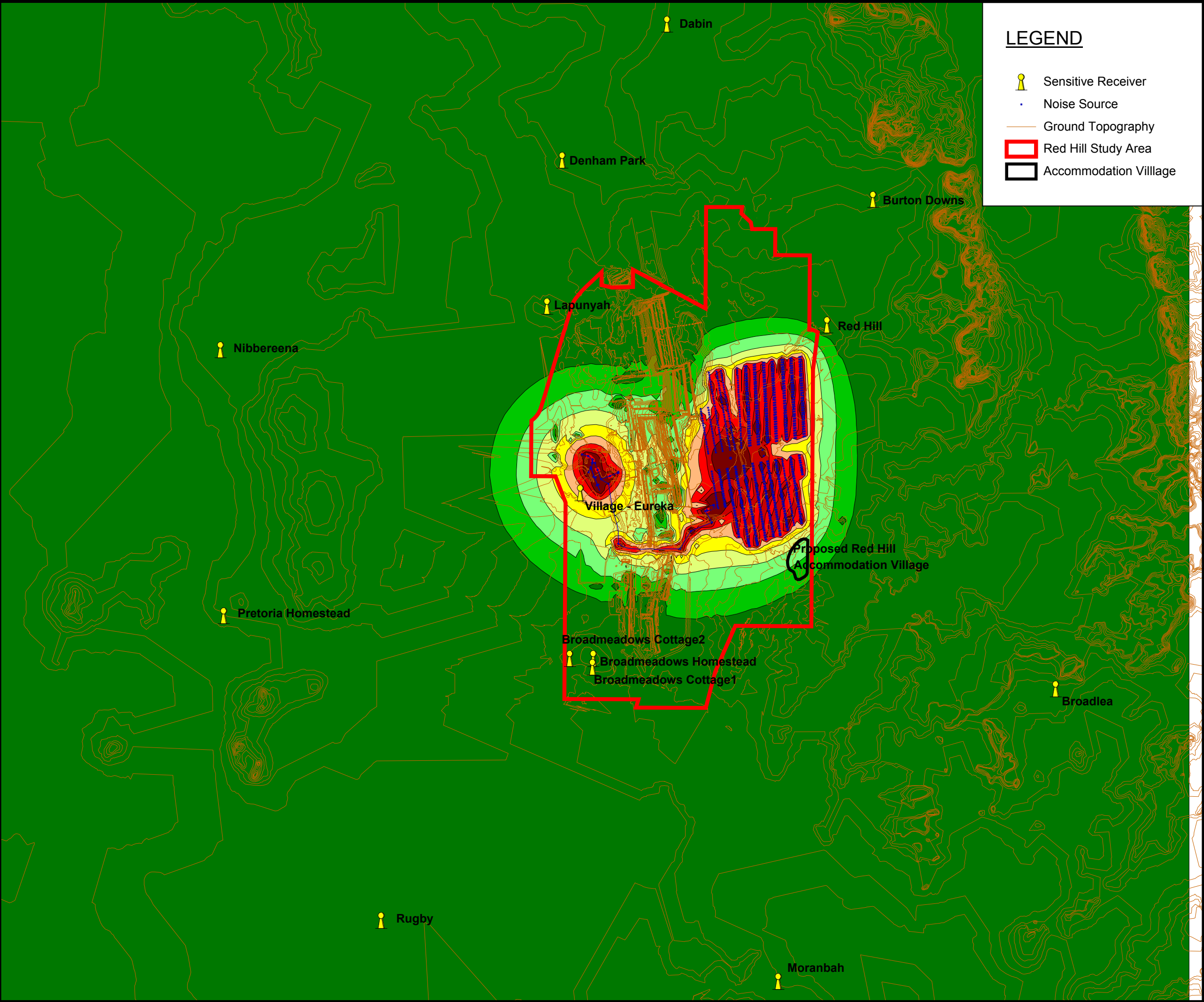
APPENDIX: E

DATE: 08-08-2013

PREPARED: GC



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PROJECT:

RED HILL MINING
LEASE PROJECT

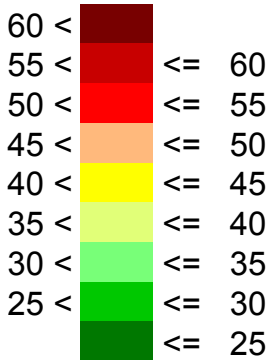
TITLE:

FY2040 Fixed Plant and
Gas Option 3

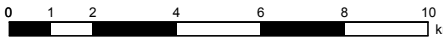
MAP NO:

E-11

Noise Levels
LAeq (dBA)



Scale 1:180000



Prediction Algorithm: CONCAWE

CONDITION: Neutral Weather

Meteorological Category: 4

Wind: 0 m/s Stability Class: D

PROJECT NO.: 620.02291.00200

REPORT NO.: 20.2291-R3

APPENDIX: E

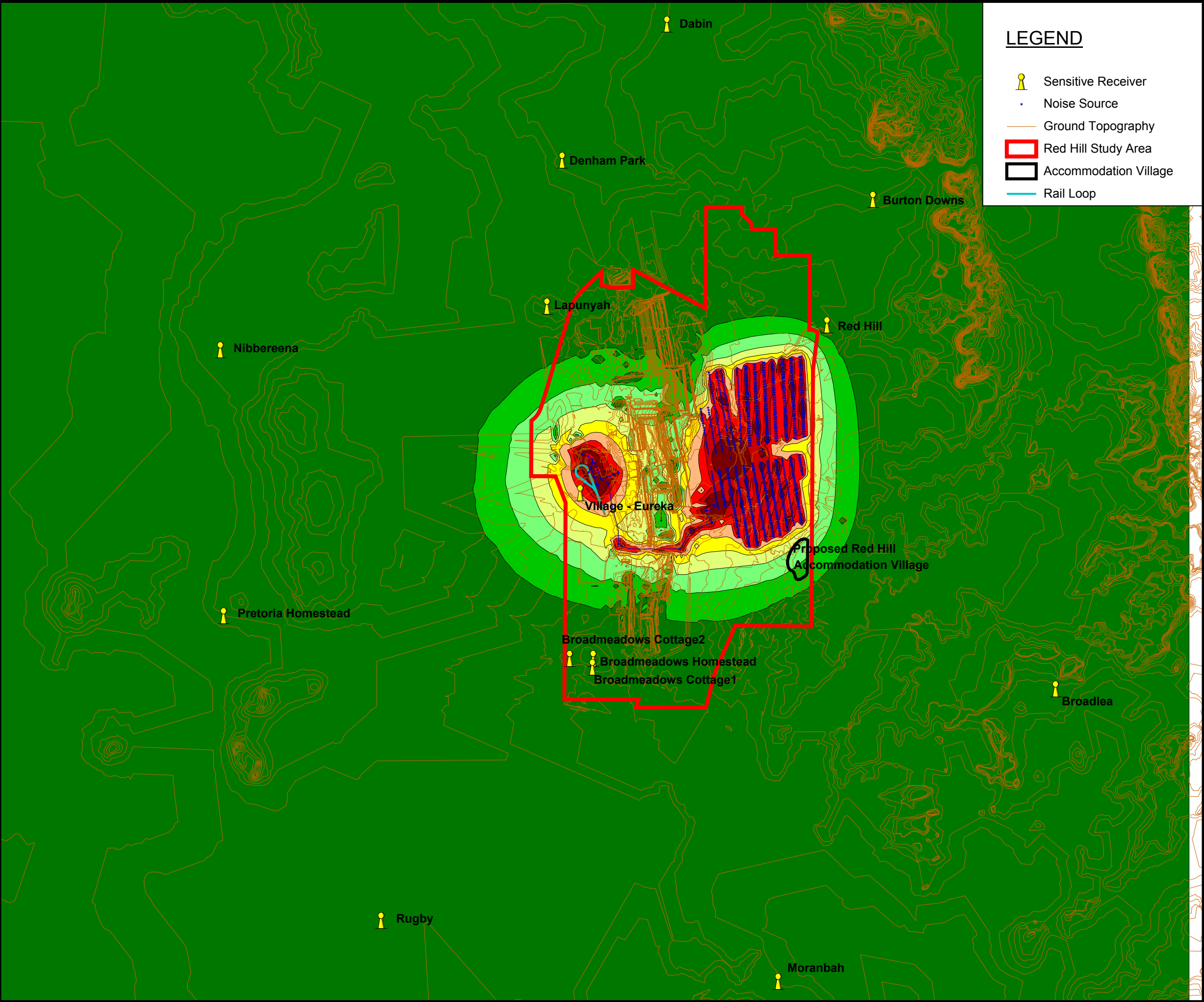
DATE: 08-08-2013

PREPARED: GC



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LEGEND

- Sensitive Receiver
- Noise Source
- Ground Topography
- Red Hill Study Area
- Accommodation Village
- Rail Loop

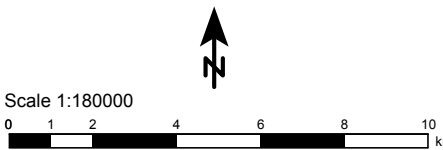
PROJECT:
**RED HILL MINING
LEASE PROJECT**

TITLE:
FY2040 Fixed Plant, Gas
Option 3, Mobile Plant & Rail

MAP NO: E-12

Noise Levels
LAeq (dBA)

60 <		<= 60
55 <		<= 55
50 <		<= 50
45 <		<= 45
40 <		<= 40
35 <		<= 35
30 <		<= 30
25 <		<= 25



Prediction Algorithm: CONCAWE

CONDITION: Neutral Weather
Meteorological Category: 4
Wind: 0 m/s Stability Class: D

PROJECT NO.: 620.02291.00200

REPORT NO.: 20.2291-R3

APPENDIX: E

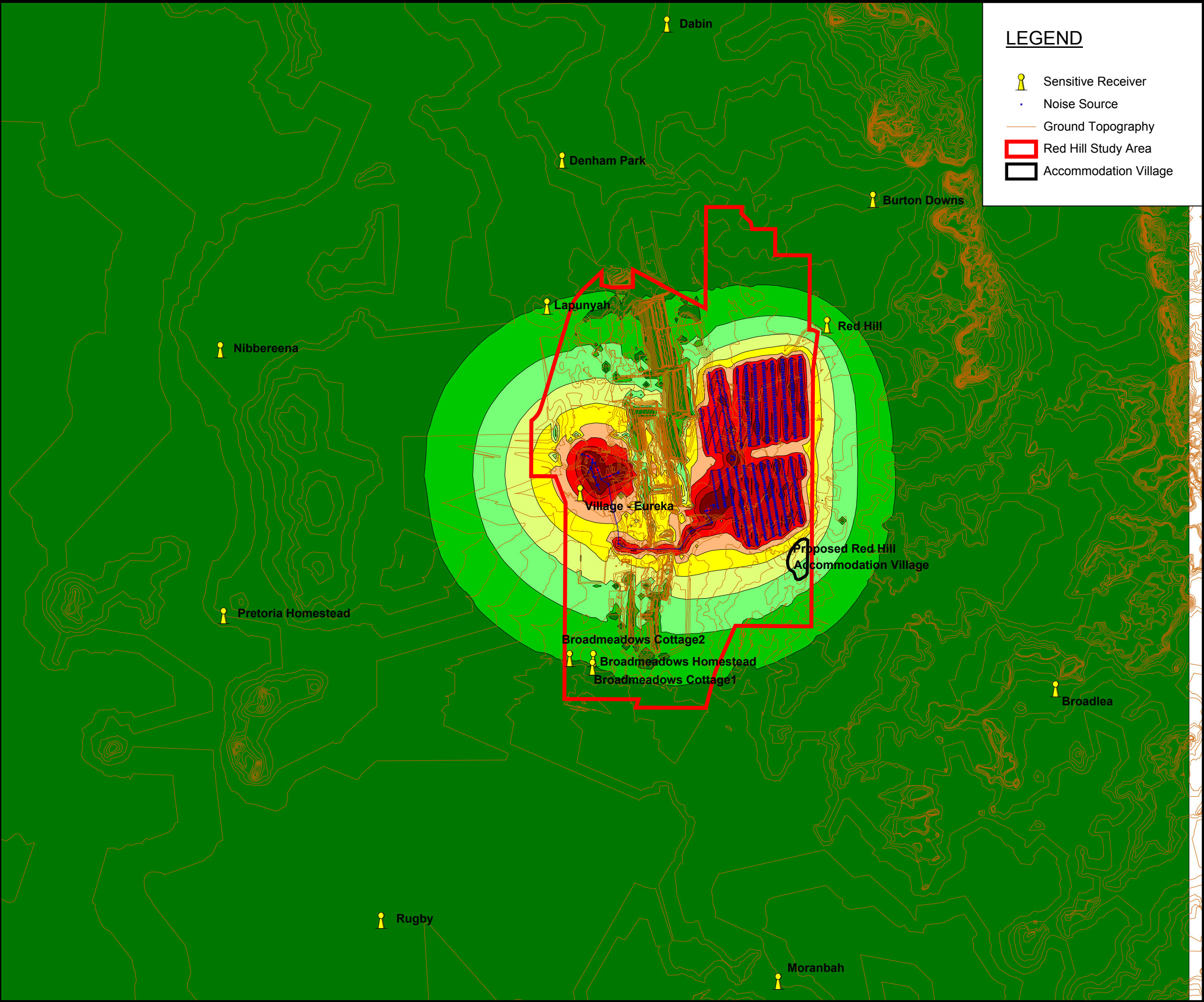
DATE: 08-08-2013

PREPARED: GC

Appendix F

Report Number 20-2291-R3

NOISE CONTOUR PLOTS – WORST CASE WEATHER CONDITION



LEGEND

- Sensitive Receiver
- Noise Source
- Ground Topography
- Red Hill Study Area
- Accommodation Village



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PROJECT:

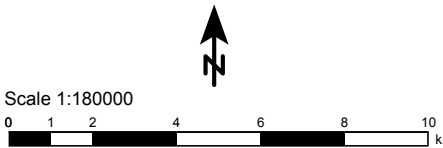
RED HILL MINING
LEASE PROJECT

TITLE:
FY2020 Fixed Plant and
Gas Option 1

MAP NO: F-01

Noise Levels
LAeq (dBA)

60 <		
55 <		<= 60
50 <		<= 55
45 <		<= 50
40 <		<= 45
35 <		<= 40
30 <		<= 35
25 <		<= 30
		<= 25



Prediction Algorithm: CONCAWE

CONDITION: Worst-Case Weather
Meteorological Category: 5
Wind: 0 m/s Stability Class: F

PROJECT NO.: 620.02291.00200

REPORT NO.: 20.2291-R3

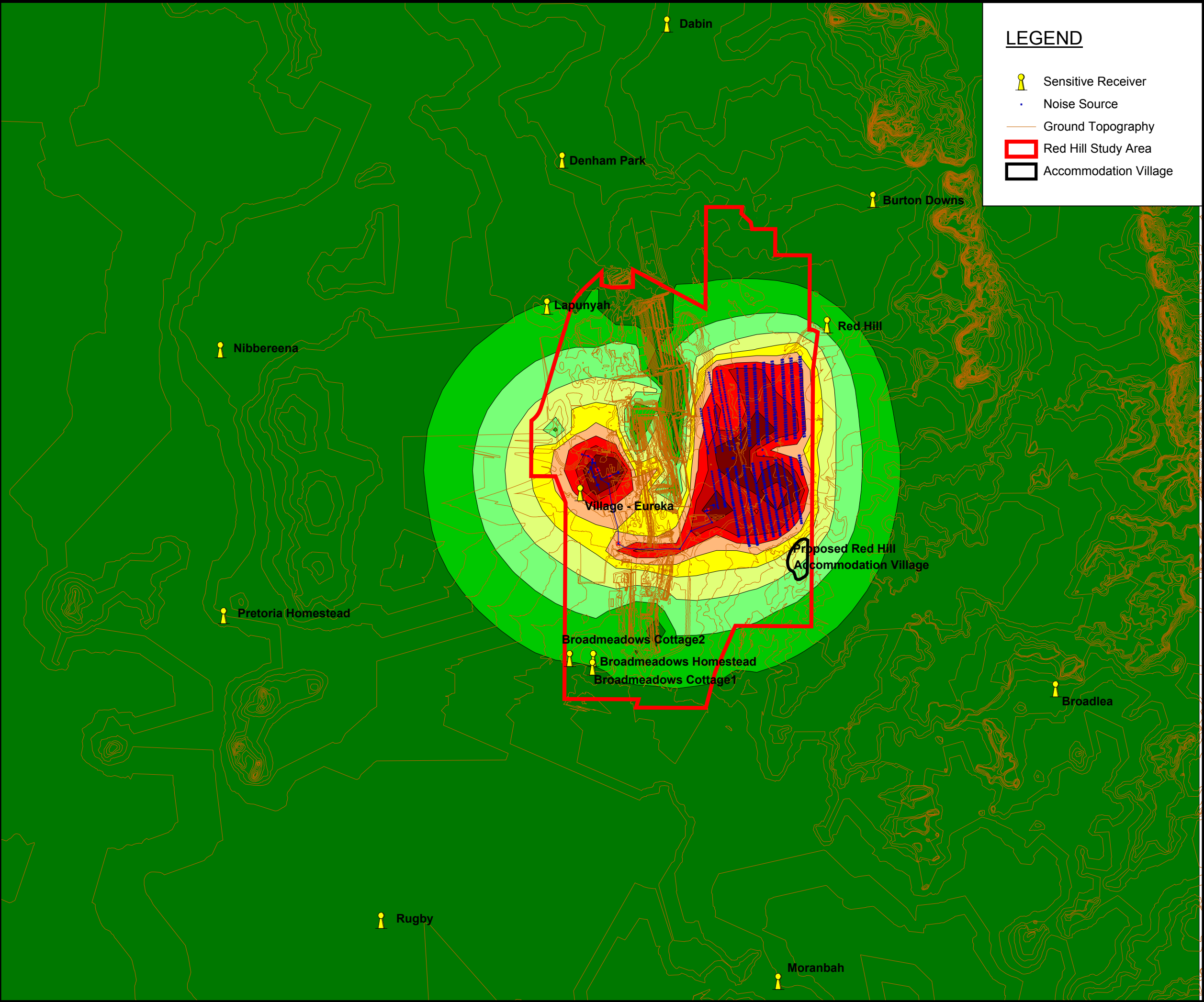
APPENDIX: F

DATE: 08-08-2013

PREPARED: GC



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LEGEND

- Sensitive Receiver
- Noise Source
- Ground Topography
- Red Hill Study Area
- Accommodation Village



PROJECT:

RED HILL MINING
LEASE PROJECT

TITLE:

FY2020 Fixed Plant and
Gas Option 2

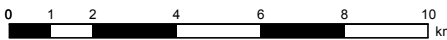
MAP NO:

F-02

Noise Levels
LAeq (dBA)

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55 <		<= 55
50 <		<= 50
45 <		<= 45
40 <		<= 40
35 <		<= 35
30 <		<= 30
25 <		<= 25

Scale 1:180000



Prediction Algorithm: CONCAWE

CONDITION: Worst-Case Weather

Meteorological Category: 5

Wind: 0 m/s Stability Class: F

PROJECT NO.: 620.02291.00200

REPORT NO.: 20.2291-R3

APPENDIX: F

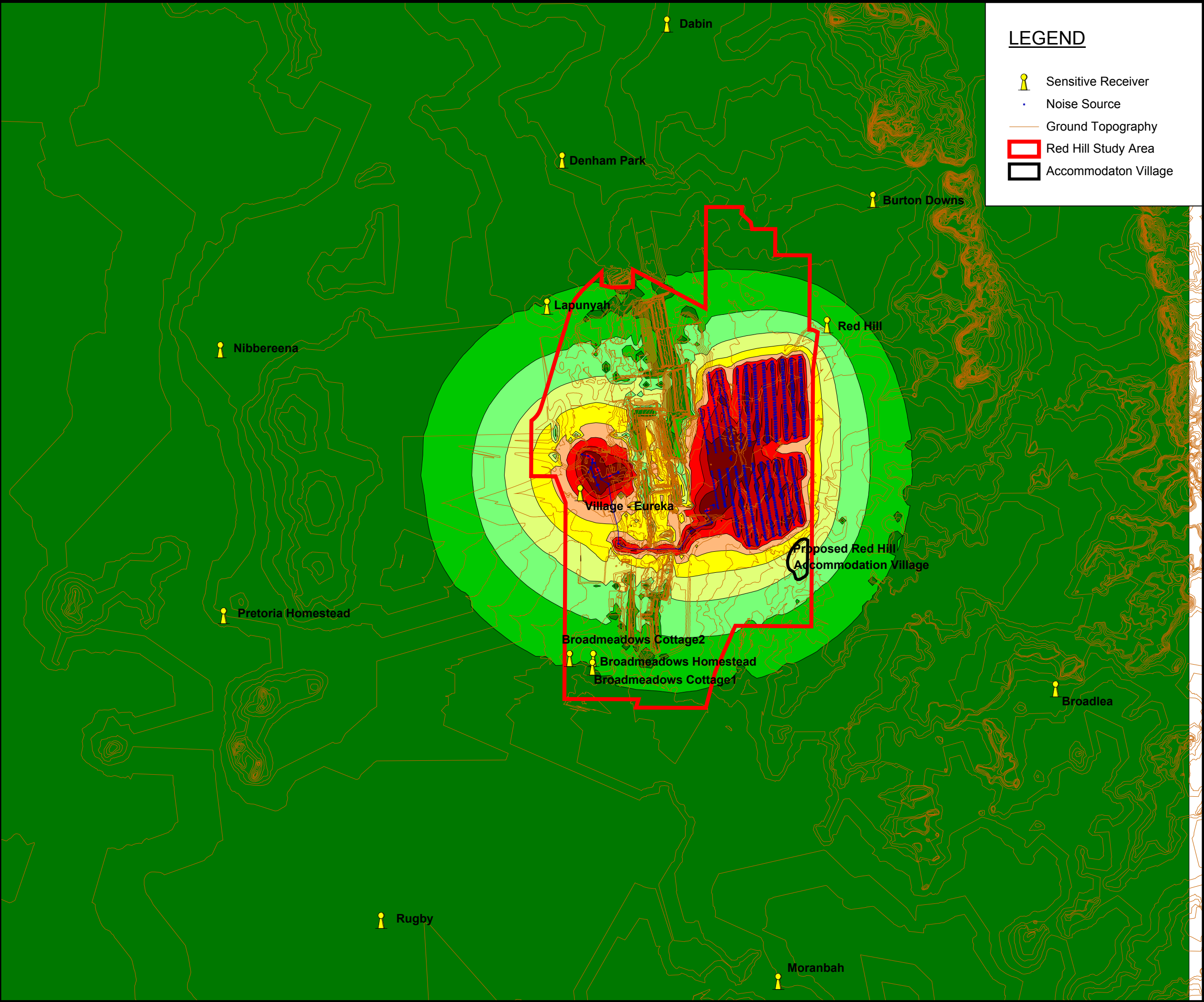
DATE: 08-08-2013

PREPARED: GC



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LEGEND

- Sensitive Receiver
- Noise Source
- Ground Topography
- Red Hill Study Area
- Accomdaton Village



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PROJECT:

RED HILL MINING
LEASE PROJECT

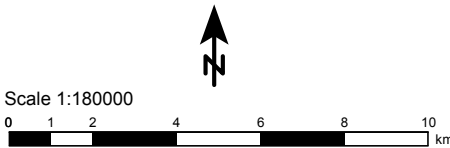
TITLE:

FY2020 Fixed Plant and
Gas Option 3

MAP NO: F-03

Noise Levels
LAeq (dBA)

60 <		<= 60
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50 <		<= 50
45 <		<= 45
40 <		<= 40
35 <		<= 35
30 <		<= 30
25 <		<= 25



Prediction Algorithm: CONCAWE

CONDITION: Worst-Case Weather
Meteorological Category: 5
Wind: 0 m/s Stability Class: F

PROJECT NO.: 620.02291.00200

REPORT NO.: 20.2291-R3

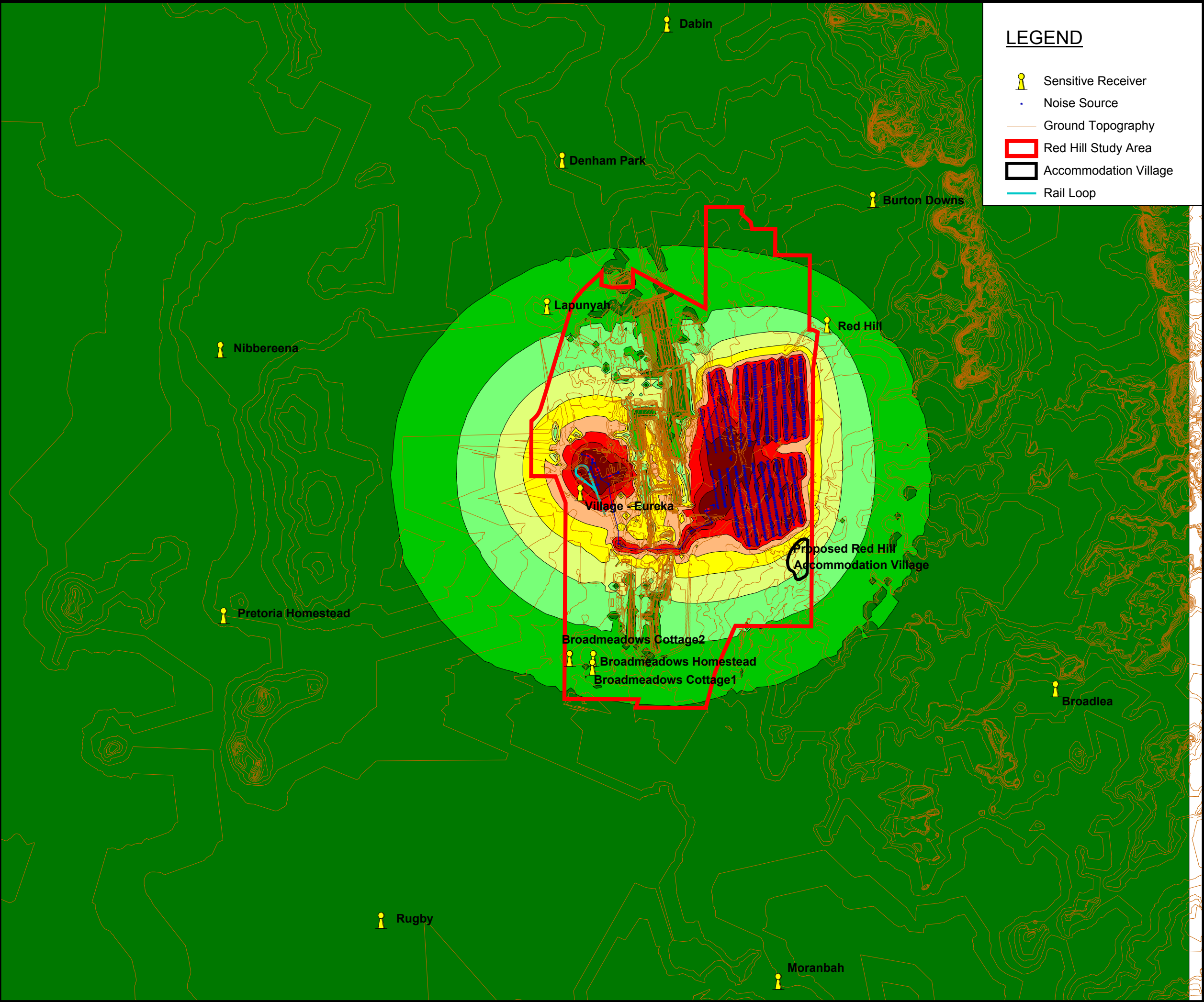
APPENDIX: F

DATE: 08-08-2013

PREPARED: GC



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ABN 29 001 584 612
Highpoint, 240 Waterworks Road
Ashgrove QLD 4060
Tel: 61 7 3858 8400 Fax: 61 7 3858 4841

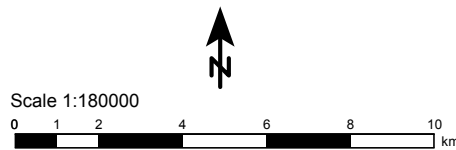


LEGEND

- Sensitive Receiver
- Noise Source
- Ground Topography
- Red Hill Study Area
- Accommodation Village
- Rail Loop

Noise Levels
LAeq (dBA)

60 <		<= 60
55 <		<= 55
50 <		<= 50
45 <		<= 45
40 <		<= 40
35 <		<= 35
30 <		<= 30
25 <		<= 25



Prediction Algorithm: CONCAWE

CONDITION: Worst-Case Weather

Meteorological Category: 5

Wind: 0 m/s Stability Class: F

PROJECT NO.: 620.02291.00200

REPORT NO.: 20.2291-R3

APPENDIX: F

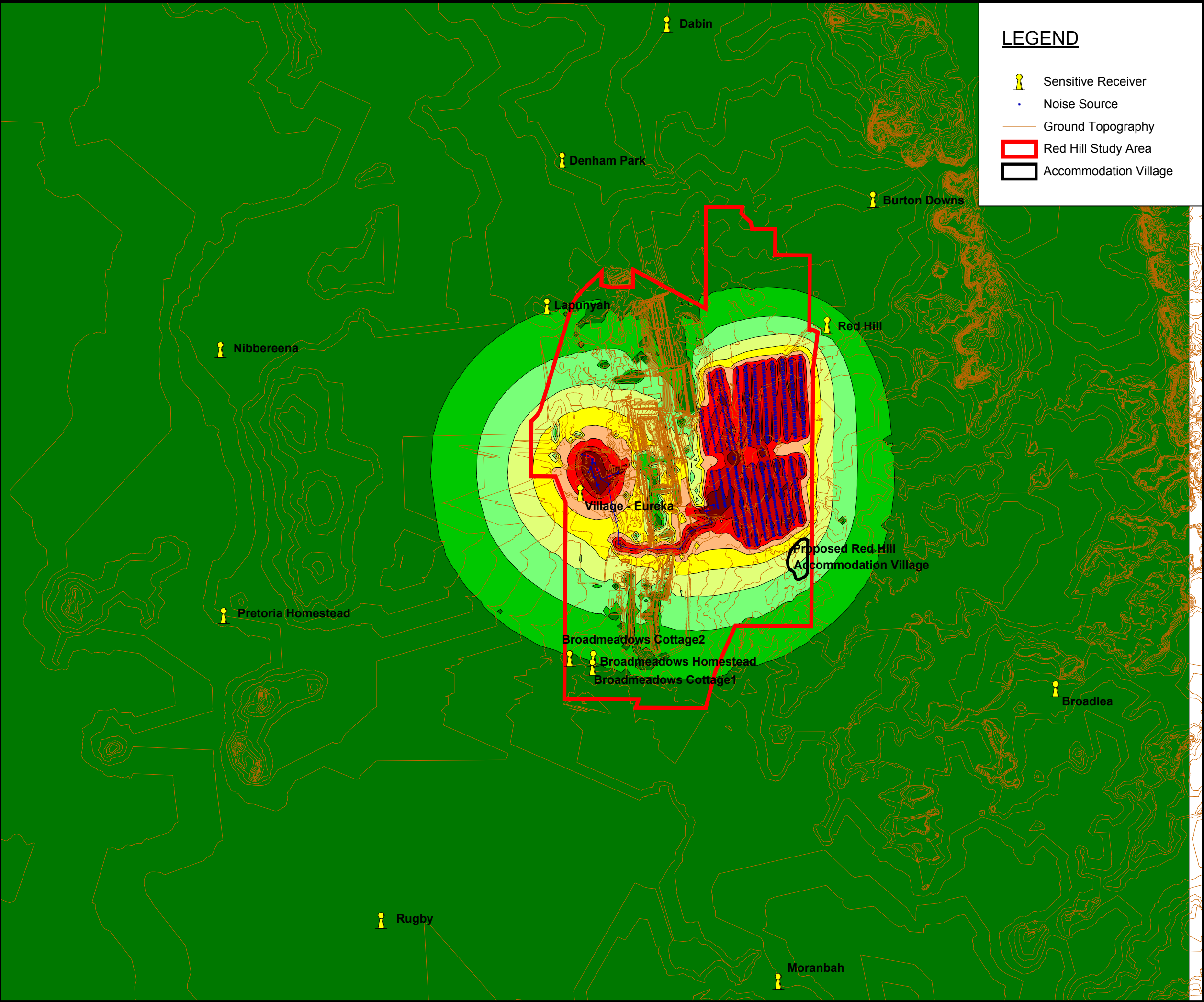
DATE: 08-08-2013

PREPARED: GC



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Ashgrove QLD 4060
Tel: 61 7 3858 8400 Fax: 61 7 3858 4841

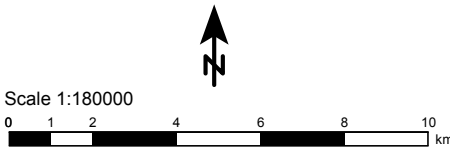


LEGEND

- Sensitive Receiver
- Noise Source
- Ground Topography
- Red Hill Study Area
- Accommodation Village

Noise Levels
LAeq (dBA)

60 <		
55 <		<= 60
50 <		<= 55
45 <		<= 50
40 <		<= 45
35 <		<= 40
30 <		<= 35
25 <		<= 30
		<= 25



Prediction Algorithm: CONCAWE

CONDITION: Worst-Case Weather

Meteorological Category: 5

Wind: 0 m/s Stability Class: F

PROJECT NO.: 620.02291.00200

REPORT NO.: 20.2291-R3

APPENDIX: F

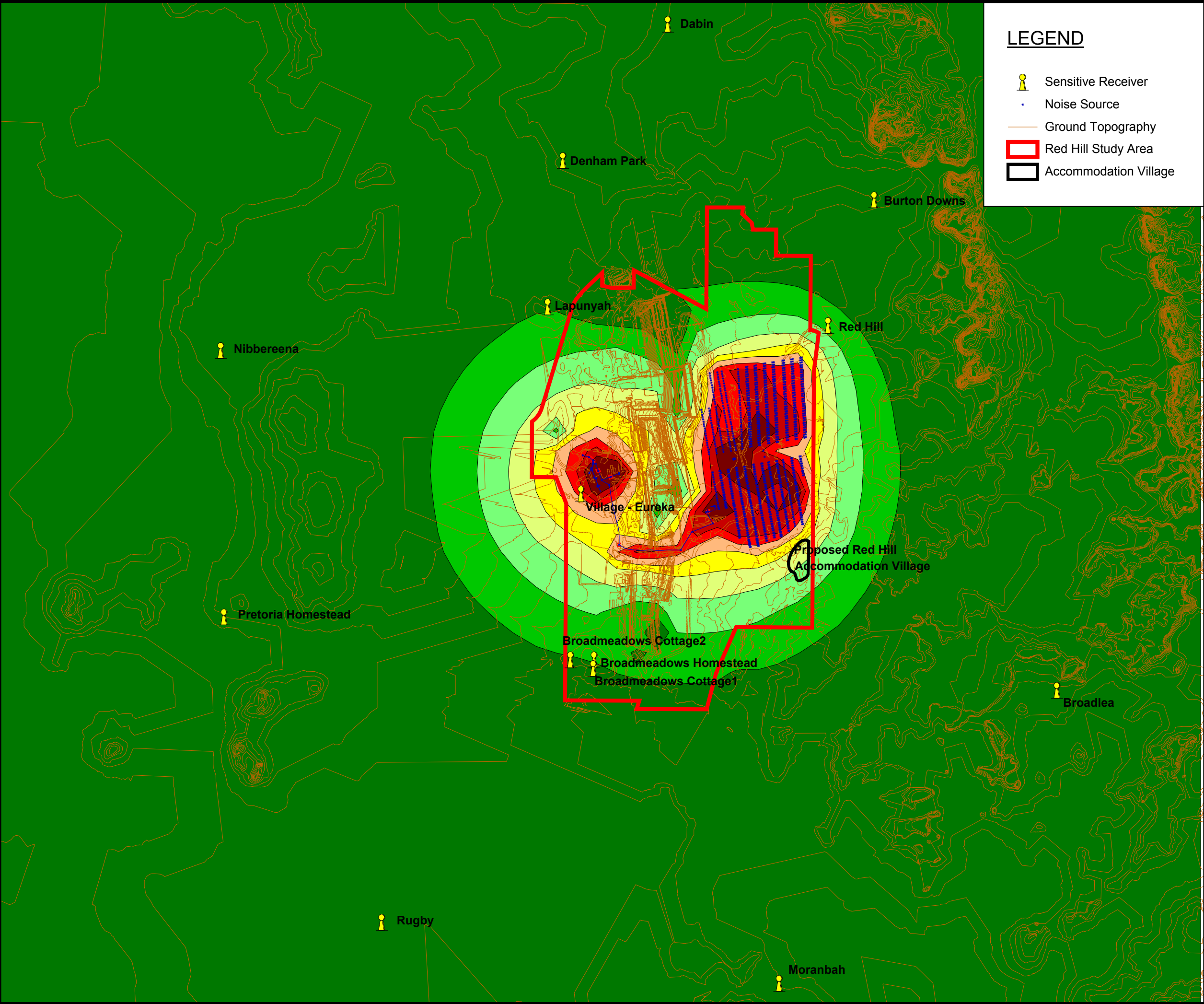
DATE: 08-08-2012

PREPARED: GC



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ABN 29 001 584 612
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Ashgrove QLD 4060
Tel: 61 7 3858 8400 Fax: 61 7 3858 4841

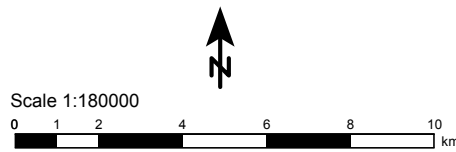


LEGEND

- Sensitive Receiver
- Noise Source
- Ground Topography
- Red Hill Study Area
- Accommodation Village

Noise Levels
LAeq (dBA)

60 <		<= 60
55 <		<= 55
50 <		<= 50
45 <		<= 45
40 <		<= 40
35 <		<= 35
30 <		<= 30
25 <		<= 25



Prediction Algorithm: CONCAWE

CONDITION: Worst-Case Weather

Meteorological Category: 5

Wind: 0 m/s Stability Class: F

PROJECT NO.: 620.02291.00200

REPORT NO.: 20.2291-R3

APPENDIX: F

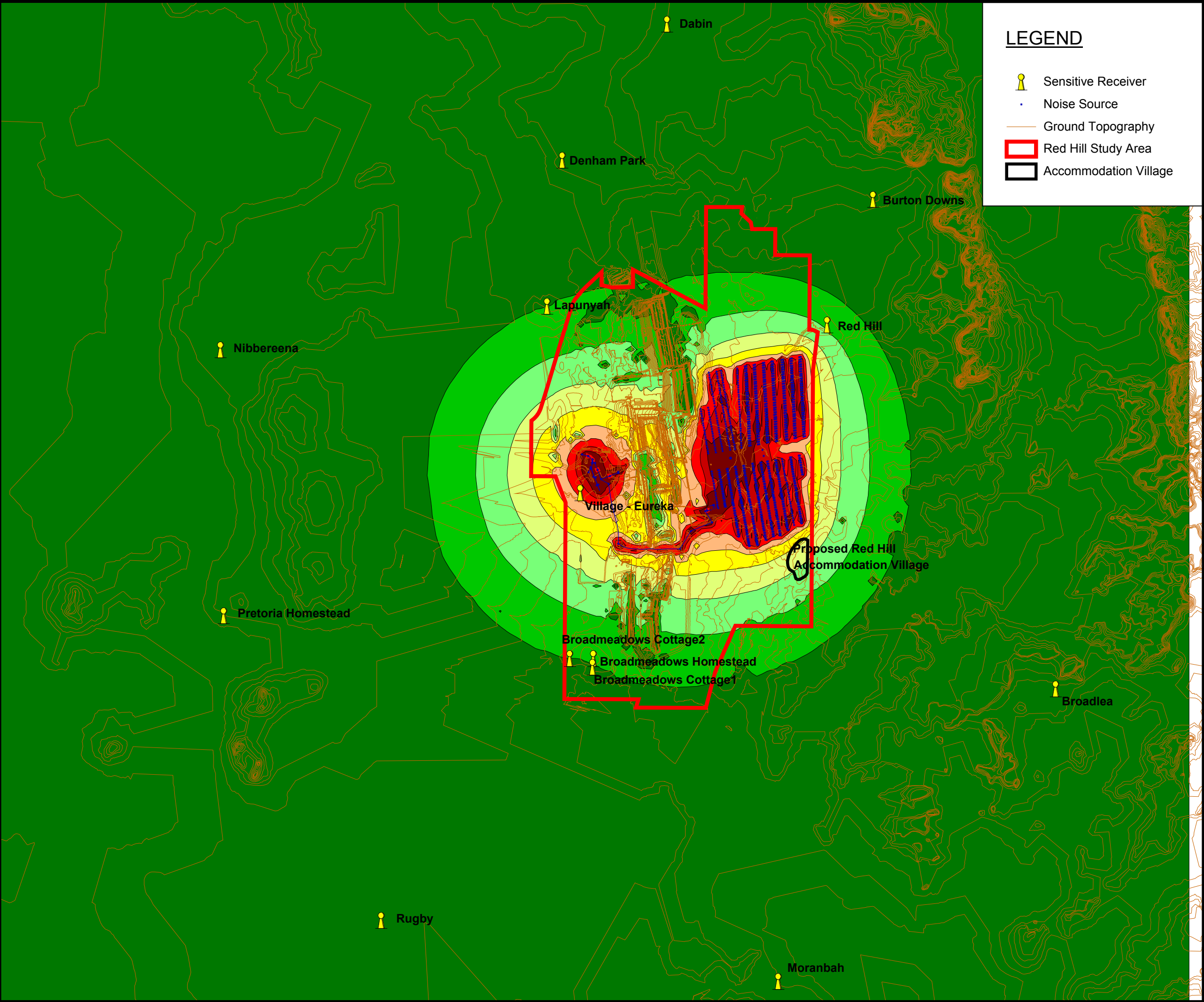
DATE: 08-08-2012

PREPARED: GC



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LEGEND

- Sensitive Receiver
- Noise Source
- Ground Topography
- Red Hill Study Area
- Accommodation Village



BHP Billiton Mitsubishi Alliance

PROJECT:

RED HILL MINING
LEASE PROJECT

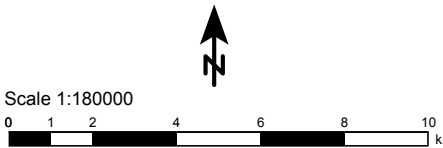
TITLE:

FY2030 Fixed Plant and
Gas Option 3

MAP NO: F-07

Noise Levels
LAeq (dBA)

60 <		<= 60
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50 <		<= 50
45 <		<= 45
40 <		<= 40
35 <		<= 35
30 <		<= 30
25 <		<= 25



Prediction Algorithm: CONCAWE

CONDITION: Worst-Case Weather

Meteorological Category: 5

Wind: 0 m/s Stability Class: F

PROJECT NO.: 620.02291.00200

REPORT NO.: 20.2291-R3

APPENDIX: F

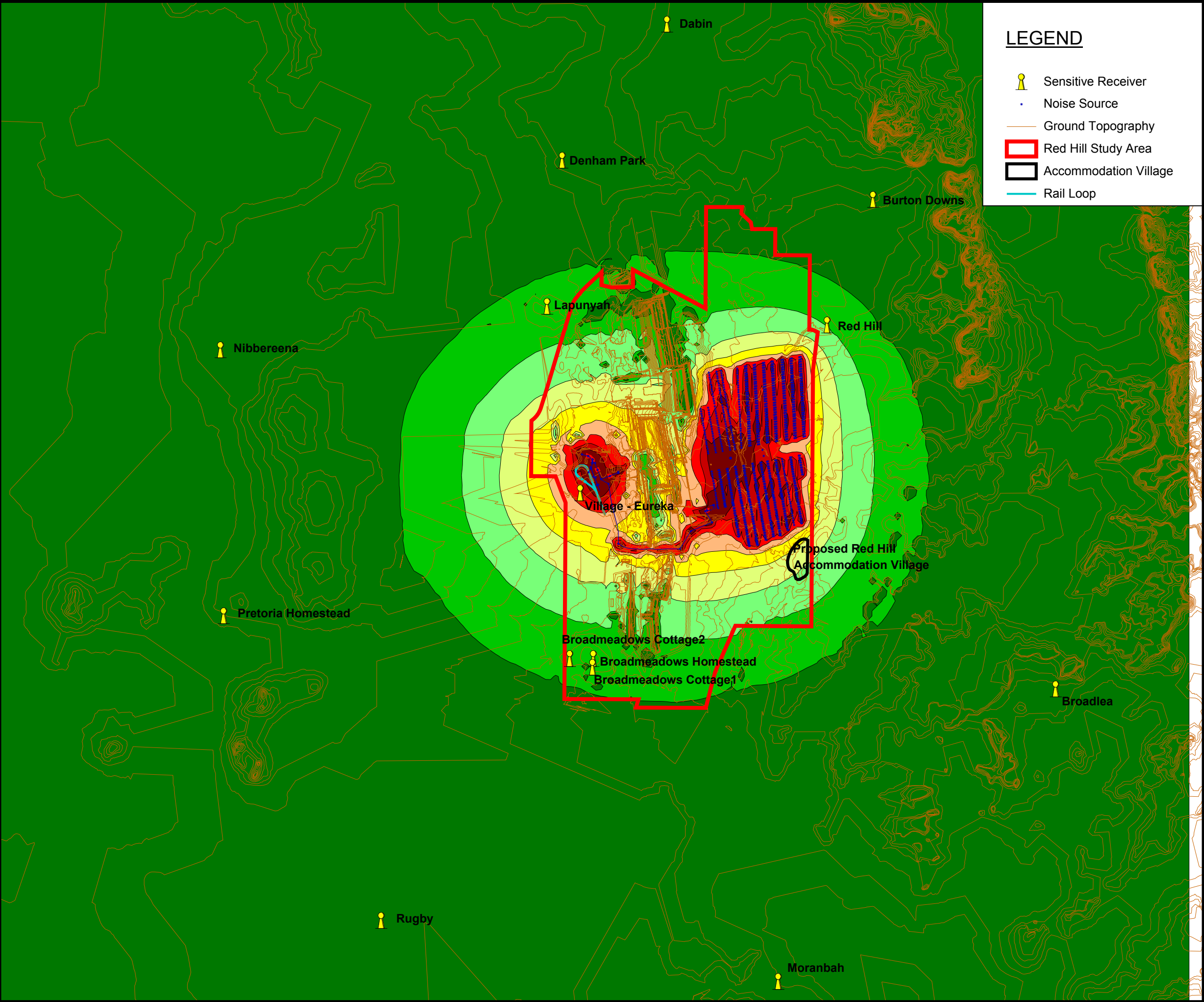
DATE: 08-08-2013

PREPARED: GC



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ABN 29 001 584 612
Highpoint, 240 Waterworks Road
Ashgrove QLD 4060
Tel: 61 7 3858 8400 Fax: 61 7 3858 4841



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PROJECT:

RED HILL MINING
LEASE PROJECT

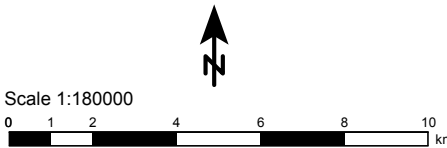
TITLE:

FY2030 Fixed Plant, Gas
Option 3, Mobile Plant & Rail

MAP NO: F-08

Noise Levels
LAeq (dBA)

60 <		
55 <	<=	60
50 <	<=	55
45 <	<=	50
40 <	<=	45
35 <	<=	40
30 <	<=	35
25 <	<=	30
	<=	25



Prediction Algorithm: CONCAWE

CONDITION: Worst-Case Weather
Meteorological Category: 5
Wind: 0 m/s Stability Class: F

PROJECT NO.: 620.02291.00200

REPORT NO.: 20.2291-R3

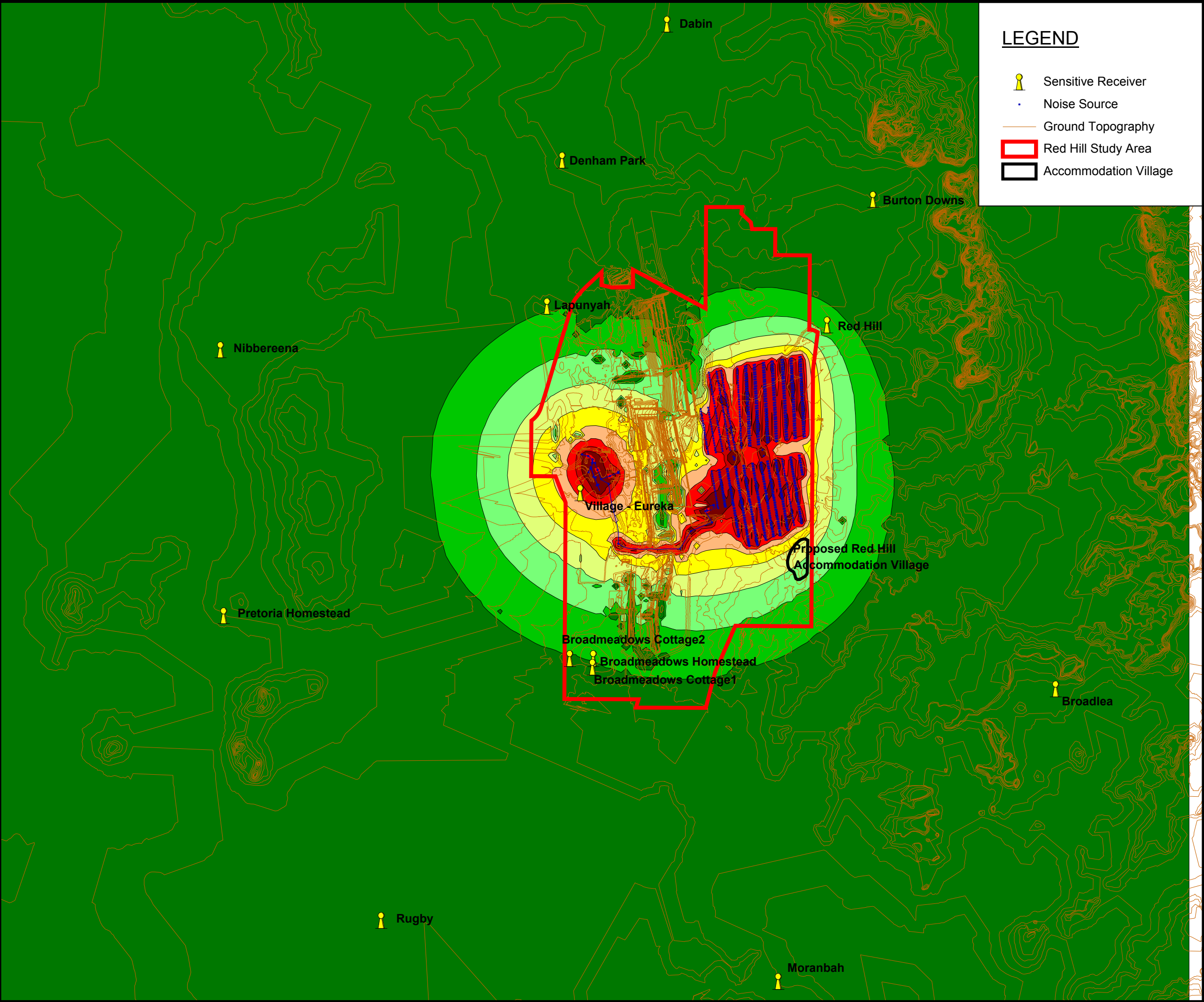
APPENDIX: F

DATE: 08-08-2013

PREPARED: GC



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LEGEND

- Sensitive Receiver
- Noise Source
- Ground Topography
- Red Hill Study Area
- Accommodation Village



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PROJECT:

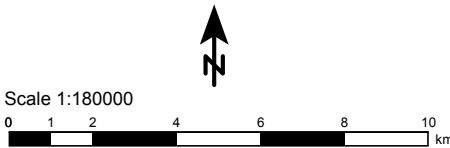
RED HILL MINING
LEASE PROJECT

TITLE:
FY2040 Fixed Plant and
Gas Option 1

MAP NO: F-09

Noise Levels
LAeq (dBA)

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55 <		<= 60
50 <		<= 55
45 <		<= 50
40 <		<= 45
35 <		<= 40
30 <		<= 35
25 <		<= 30
		<= 25



Prediction Algorithm: CONCAWE

CONDITION: Worst-Case Weather
Meteorological Category: 5
Wind: 0 m/s Stability Class: F

PROJECT NO.: 620.02291.00200

REPORT NO.: 20.2291-R3

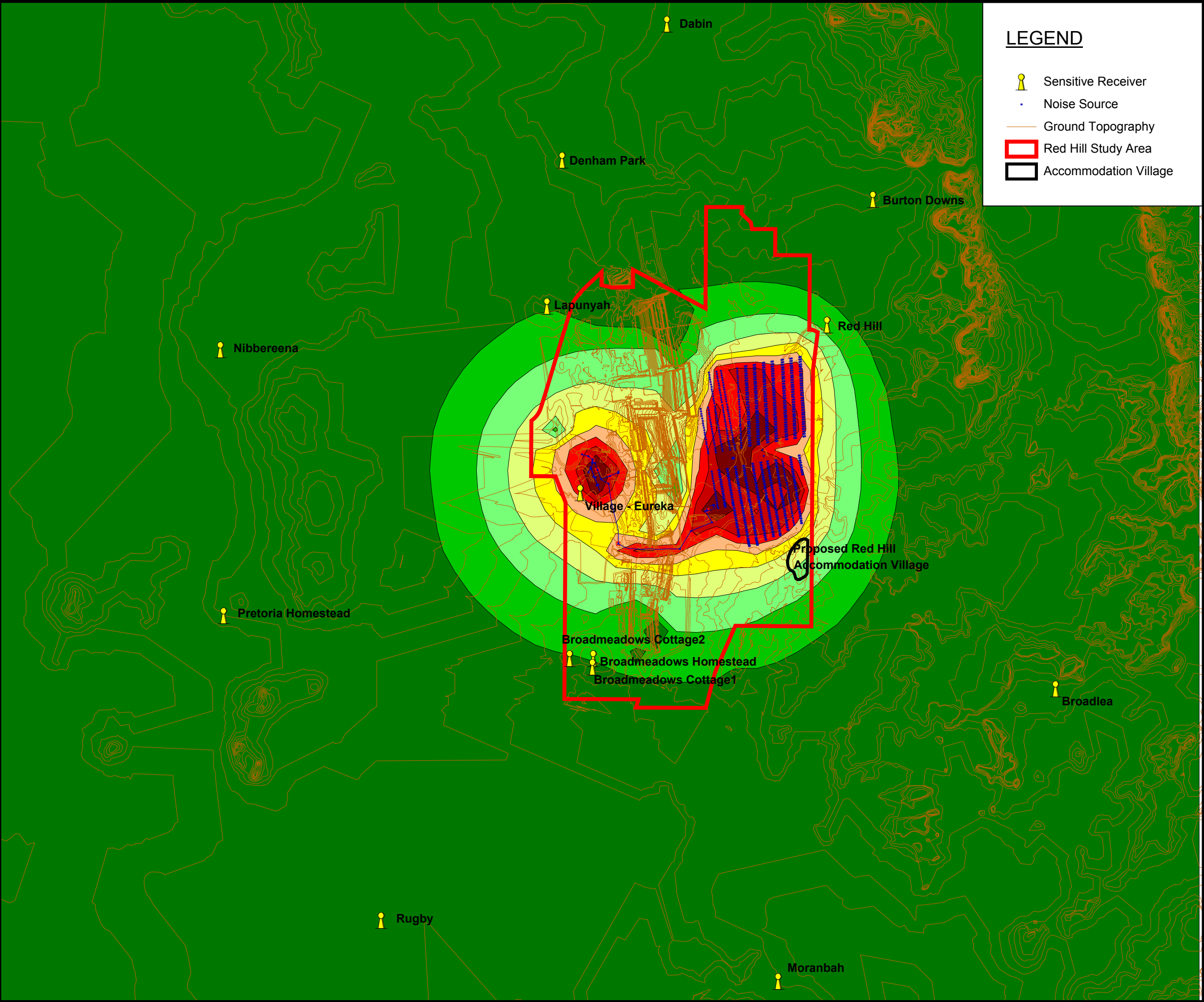
APPENDIX: F

DATE: 08-08-2013

PREPARED: GC



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ABN 29 001 584 612
Highpoint, 240 Waterworks Road
Ashgrove QLD 4060
Tel: 61 7 3858 8400 Fax: 61 7 3858 4841



LEGEND

- Sensitive Receiver
- Noise Source
- Ground Topography
- Red Hill Study Area
- Accommodation Village



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PROJECT:

RED HILL MINING
LEASE PROJECT

TITLE:

FY2040 Fixed Plant and
Gas Option 2

MAP NO:

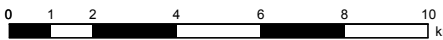
F-10

Noise Levels
LAeq (dBA)

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55 <		<= 55
50 <		<= 50
45 <		<= 45
40 <		<= 40
35 <		<= 35
30 <		<= 30
25 <		<= 25



Scale 1:180000



Prediction Algorithm: CONCAWE

CONDITION: Worst-Case Weather

Meteorological Category: 5

Wind: 0 m/s Stability Class: F

PROJECT NO.: 620.02291.00200

REPORT NO.: 20.2291-R3

APPENDIX: F

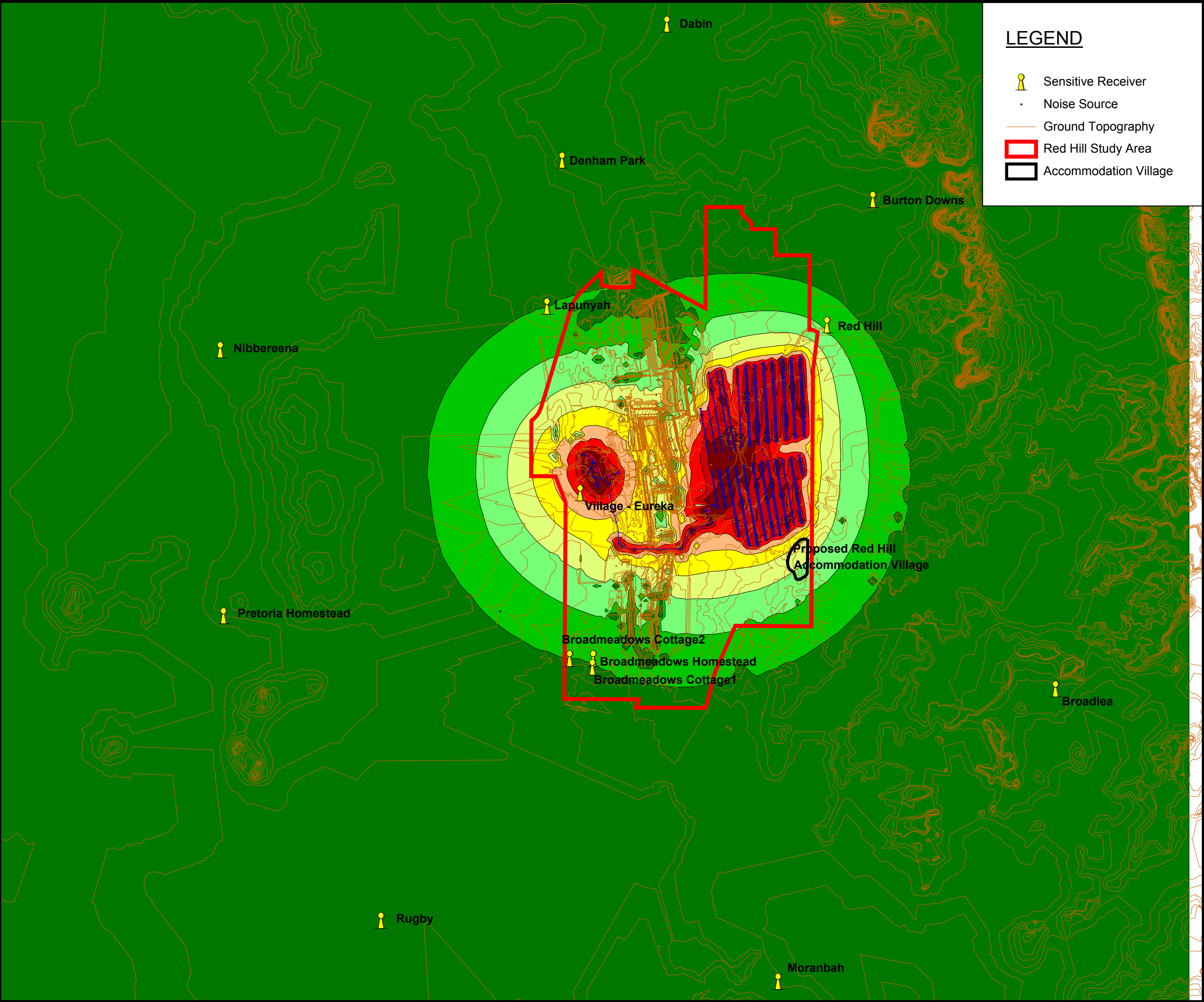
DATE: 08-08-2013

PREPARED: GC



SLR Consulting Australia

ABN 29 001 584 612
Highpoint, 240 Waterworks Road
Ashgrove QLD 4060
Tel: 61 7 3858 8400 Fax: 61 7 3858 4841

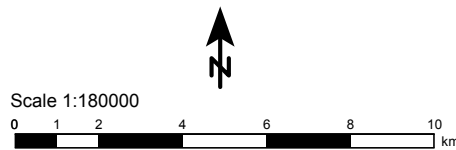


LEGEND

- Sensitive Receiver
- Noise Source
- Ground Topography
- Red Hill Study Area
- Accommodation Village

Noise Levels
LAeq (dBA)

60 <		<= 60
55 <		<= 55
50 <		<= 50
45 <		<= 45
40 <		<= 40
35 <		<= 35
30 <		<= 30
25 <		<= 25



Prediction Algorithm: CONCAWE

CONDITION: Worst-Case Weather

Meteorological Category: 5

Wind: 0 m/s Stability Class: F

PROJECT NO.: 620.02291.00200

REPORT NO.: 20.2291-R3

APPENDIX: F

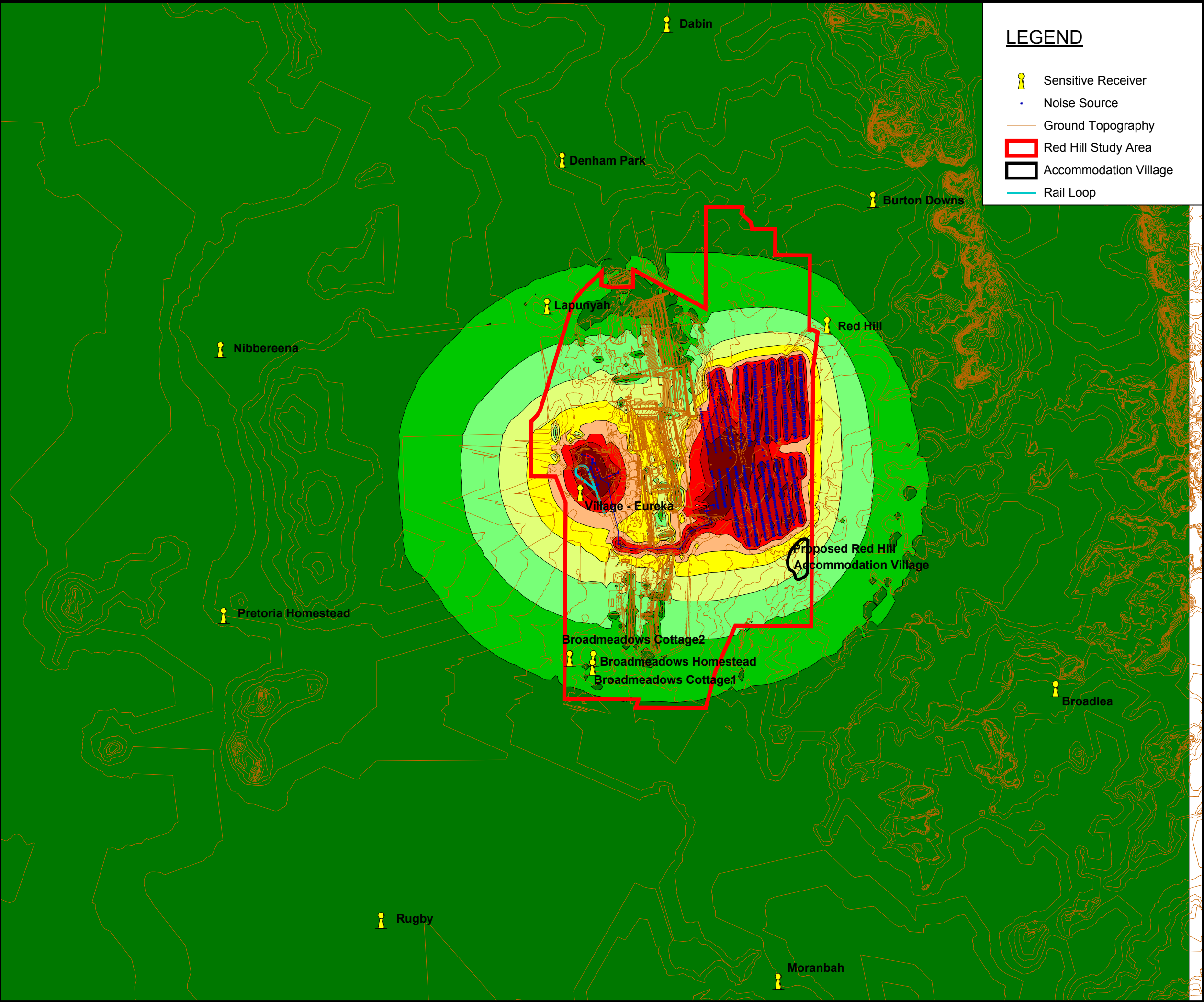
DATE: 08-08-2013

PREPARED: GC



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Ashgrove QLD 4060
Tel: 61 7 3858 8400 Fax: 61 7 3858 4841



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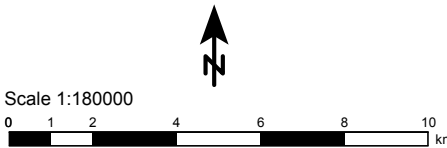
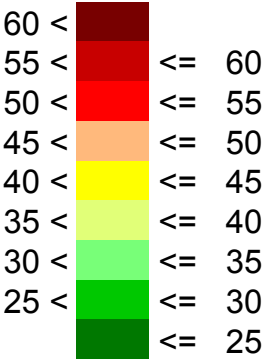
PROJECT:

RED HILL MINING
LEASE PROJECT

TITLE:
FY2040 Fixed Plant, Gas
Option 3, Mobile Plant & Rail

MAP NO: F-12

Noise Levels
LAeq (dBA)



Prediction Algorithm: CONCAWE

CONDITION: Worst-Case Weather

Meteorological Category: 5

Wind: 0 m/s **Stability Class:** F

PROJECT NO.: 620.02291.00200

REPORT NO.: 20.2291-R3

APPENDIX: F

DATE: 08-08-2013

PREPARED: GC



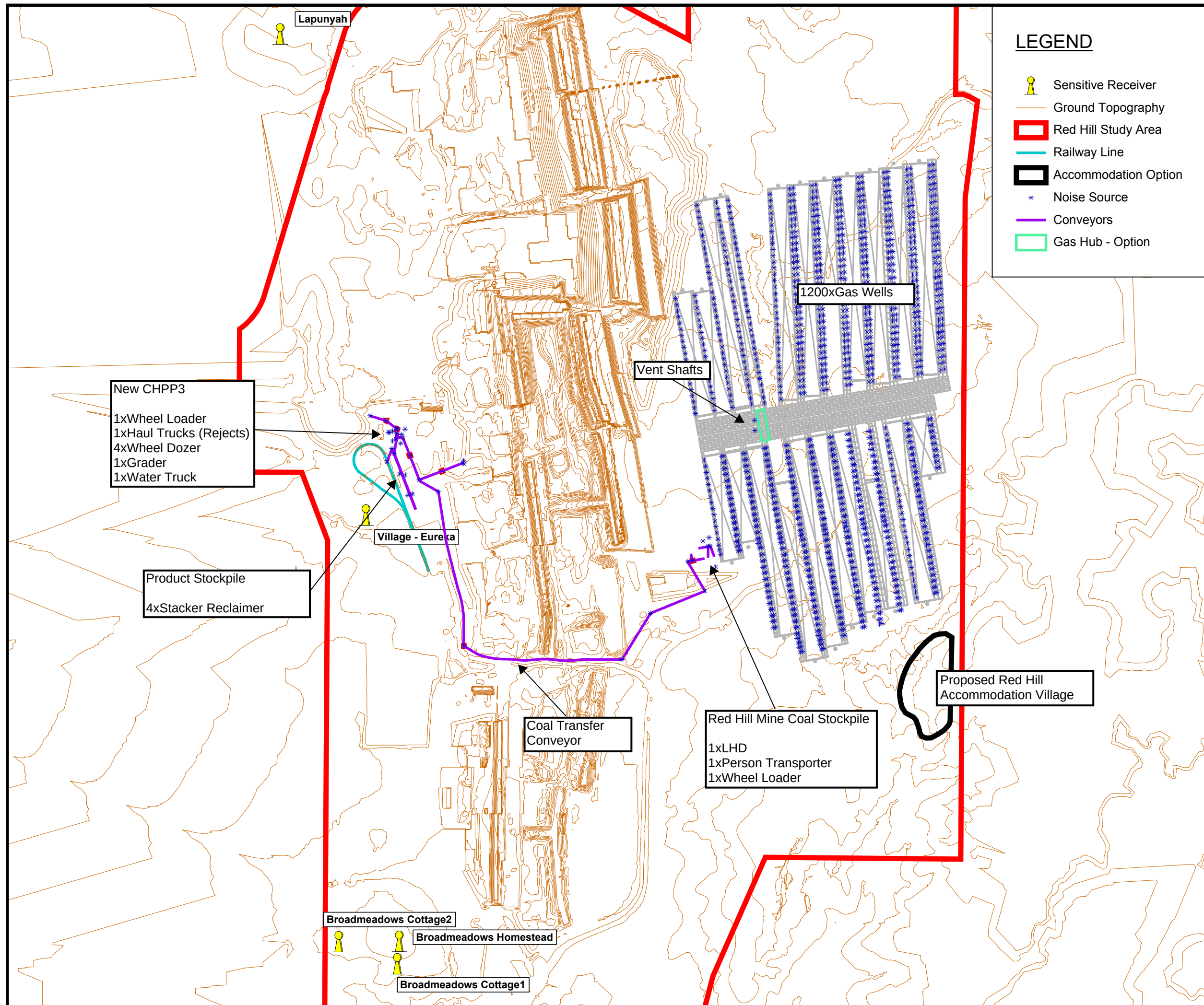
SLR Consulting Australia

ABN 29 001 584 612
Highpoint, 240 Waterworks Road
Ashgrove QLD 4060
Tel: 61 7 3858 8400 Fax: 61 7 3858 4841

Appendix G

Report Number 20-2291-R3

NOISE IMPACT ASSESSMENT SCENARIO DIAGRAMS



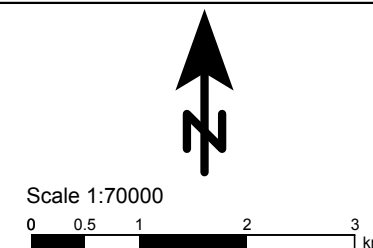
PROJECT:

**RED HILL MINING
LEASE PROJECT**

TITLE:

**FY2020
Fixed Plant, Mobile
Plant, Rail, Gas Wells,
and Vent Shafts**

MAP NO: G-01



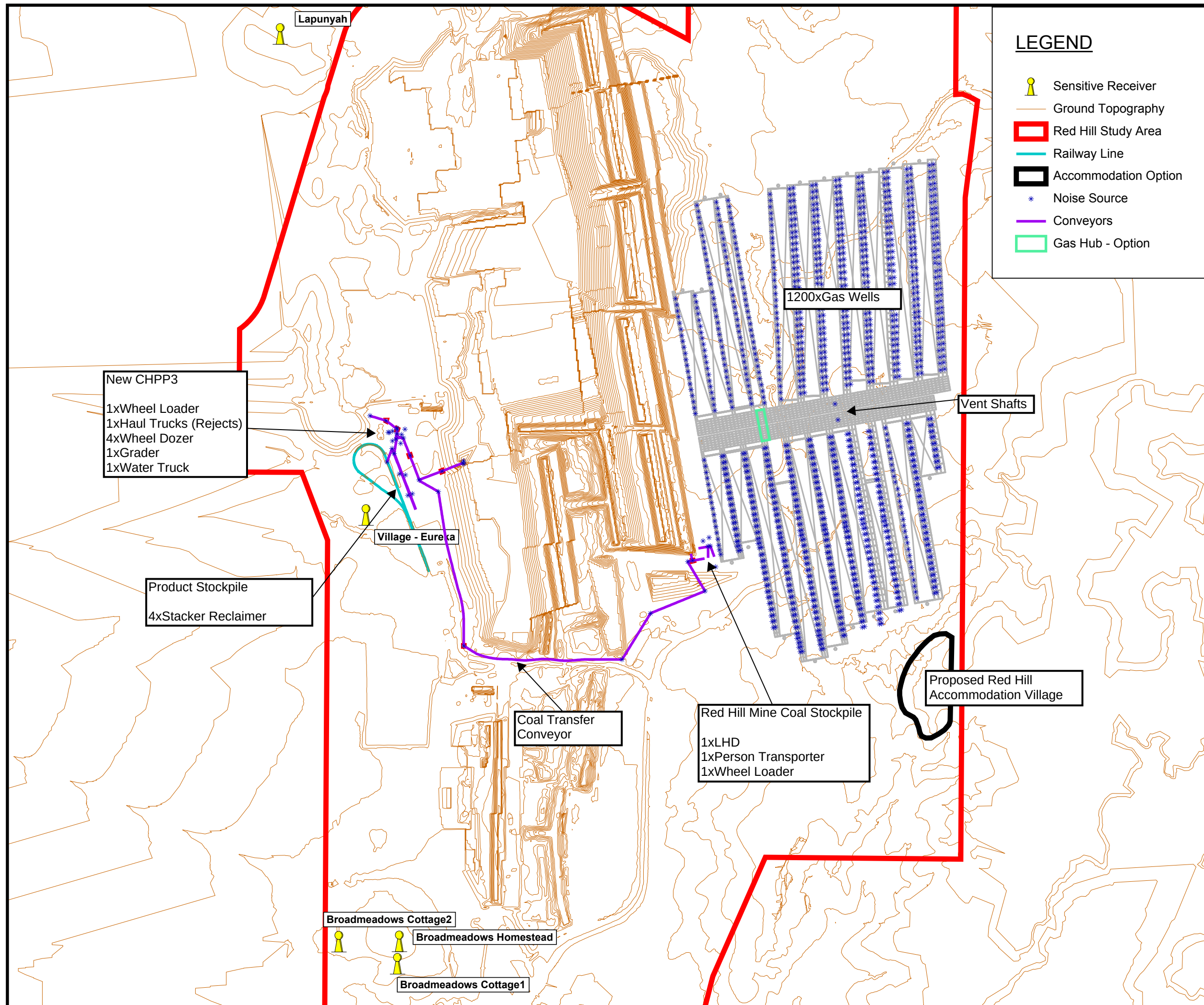
PROJECT NO.: 620.02291.00200

REPORT NO.: 20.2291-R3

APPENDIX: G

DATE: 08-08-2013

PREPARED: GC



LEGEND

- Sensitive Receiver
- Ground Topography
- Red Hill Study Area
- Railway Line
- Accommodation Option
- Noise Source
- Conveyors
- Gas Hub - Option

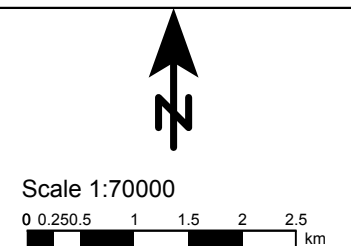
PROJECT:

RED HILL MINING
LEASE PROJECT

TITLE:

FY2030
Fixed Plant, Mobile
Plant, Rail, Gas Wells,
and Vent Shafts

MAP NO: G-02



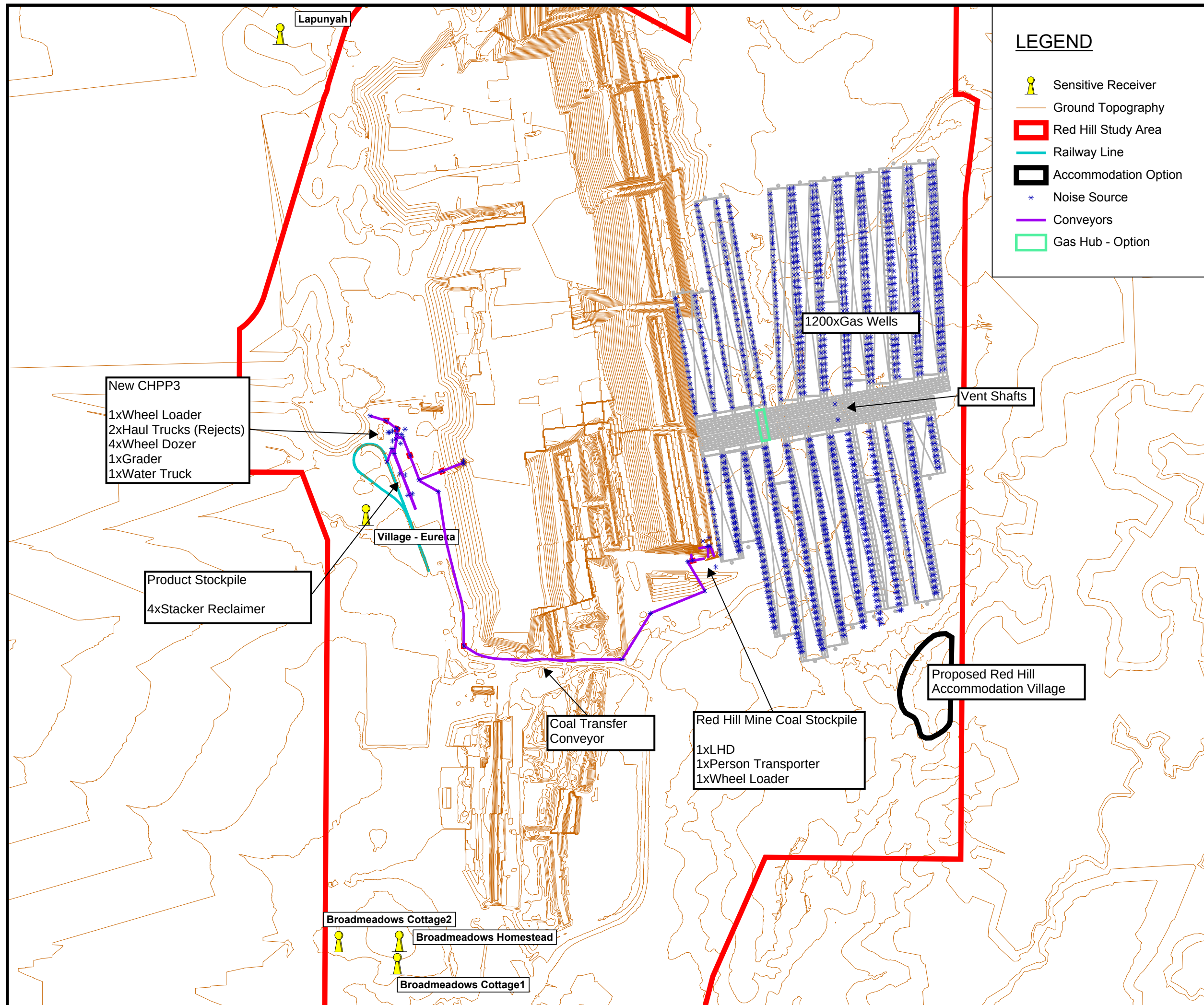
PROJECT NO.: 620.02291.00200

REPORT NO.: 20.2291-R3

APPENDIX: G

DATE: 08-08-2013

PREPARED: GC



LEGEND

- Sensitive Receiver
- Ground Topography
- Red Hill Study Area
- Railway Line
- Accommodation Option
- Noise Source
- Conveyors
- Gas Hub - Option

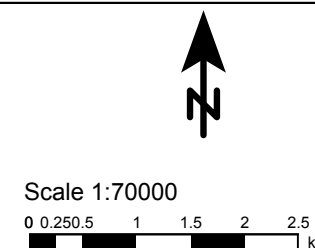
PROJECT:

RED HILL MINING
LEASE PROJECT

TITLE:

FY2040
Fixed Plant, Mobile
Plant, Rail, Gas Wells,
and Vent Shafts

MAP NO: G-03



PROJECT NO.: 620.02291.00200

REPORT NO.: 20.2291-R3

APPENDIX: G

DATE: 08-08-2013

PREPARED: GC