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Tomingley Gold Project

Noise and Blasting Assessment

September 2011

Prepared by

SLR Consulting Australia Pty Ltd

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Tomingley Gold Project

Noise and Blasting Assessment

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September 2011

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EXECUTIVE SUMMARY

SLR Consulting Australia Pty Ltd has been commissioned by R.W. Corkery & Co. Pty. Limited on behalf of Alkane Resources Ltd (the Proponent) to undertake a Noise and Blasting Assessment for the operation of the Tomingley Gold Project. The Tomingley Gold Project ("the Project"), comprises four open cut mines, and underground mine, a processing plant, three waste rock emplacements and a residue storage facility, as well as ancillary activities and associated infrastructure, including construction of a water supply pipeline.

Broadly, the objective of the Noise and Blasting Assessment is to determine whether noise and blasting emissions from the Project would comply with the relevant noise and blasting criteria at the nearest residential receptors.

The site of the proposed mining and associated activities ("the Mine Site") is located in the central west of NSW, immediately south of Tomingley, approximately 15km to the north of Peak Hill and approximately 53km to the southwest of Dubbo.

The Mine Site comprises an area of approximately 750ha that would incorporate all areas of proposed Project-related disturbance associated with the mining operations and related activities.

Surrounding Residences

A number of rural residential dwellings, and dwellings within the village of Tomingley, are situated in the area surrounding the Mine Site. The closest dwellings to the Project Site were identified as sensitive receptor locations to be taken into account during the assessment.

Each dwelling with a similar noise environment, based on their proximity to, or exposure to traffic, livestock and native fauna, vegetation and topography, has been grouped for noise assessment purposes into one of four Noise Assessment Groups, labelled A to D. Each noise monitoring location was chosen to be representative of the ambient noise levels in the vicinity of each Noise Assessment Group.

Operational Noise Emissions

The Project computer noise model was developed to incorporate the significant noise sources associated with the Project. Additional surrounding terrain and nearby residences and properties were also included in the model.

Five operational scenarios were selected for the assessment of potential noise emissions from the Project representing early construction (1 to 3 months), late construction and operation (10 to 12 months) and operations during Years 2, 3 and 4. Project Site Noise Limits (PSNLs) were established at each of the non-mine owned residences surrounding the Project Site based on the measured background noise level and application of the intrusiveness criteria (background + 5dB(A)) of the Industrial Noise Policy.

Table E1 presents a summary of all known non-mine owned residences where $L_{Aeq(15minute)}$ intrusive noise emissions are predicted to exceed the PSNL's during life of the Project. The level of exceedance places the effected residences into either a noise management zone and/or noise affectation zone.

Table E1 Summary of Potentially Impacted Non-Mine Owned Residences

Noise Assessment Group	Period	Noise Management Zone		Noise Affected Zone
		1dB(A) to 2dB(A) above Intrusive PSNL	3dB(A) to 5dB(A) above Intrusive PSNL	>5dB(A) above Intrusive PSNL
A	Day	-	-	-
	Evening	-	-	-
	Night		-	-
	Night (3ºC/100m)	1, 5, 6	-	-
B	Day	-	-	-
	Evening	-	-	-
	Night	-	-	-
	Night (3ºC/100m)	2		-
C	Day	28, 29	3	-
	Evening	3, 29	-	-
	Night	3, 28, 29, 33	-	-
	Night (3ºC/100m)	13, 18, 20, 24, 25, 26, 35	3, 27, 28, 29, 33	-
D	Day	-	-	-
	Evening	-	-	-
	Night	-	-	-
	Night (3ºC/100m)	32, 37	-	-

In order to reduce the level of potential impacts to those presented above, the following feasible and reasonable noise controls are proposed and have been included in the computer noise model.

- Achieving the nominal overall L_{Aeq} sound power levels (SWLs) presented in **Table 25**.
- Restricting plant operations as indicatively presented in **Table 26**.

Road Traffic Noise Assessment

The noise impact assessment of the Project-related road traffic on the respective access roads was conducted by calculating the noise generated by existing and future traffic levels on the subject roads and comparing this against the relevant criteria of "*Environmental Criteria for Road Traffic Noise*" (EPA, 1999).

Based on the proposed maximum hourly traffic flows (with the mine operational), the future traffic noise levels comply with the respective daytime and night-time criteria on Tomingley West Road, as well as the northern and southern sections of Tomingley – Narromine Road.

As the recommended NSW OEH's daytime and night-time traffic noise criteria on the Newell Highway are already exceeded with the existing traffic, EPA (1999) requires that "*traffic arising from the development should not lead to an increase in existing noise levels of more than 2dB(A)*". The increase in the daytime and night-time traffic noise levels resulting from the operation of the mine are 0.2dB(A) and 0.5dB(A) respectively and therefore comply with the recommended criteria.

Blast Emissions Impact Assessment

In areas of the open cuts where the ore and waste rock is too hard for ripping and excavation, the ore and waste rock material would be fragmented using drill and blast methods. Blast holes would be drilled using one or more hydraulic drill rigs.

The following information is derived from the predicted levels of blast emissions:

- The predicted levels of ground vibration at the closest residence, Residence R3, comply with the ANZECC general human comfort criterion (of 5mm/s) and consequently with the maximum human comfort criterion of 10mm/s as well as the AS2187-2006 (BS7385) structural damage criterion of 15mm/s (at 4Hz).
- The predicted levels of peak airblast at all residences comply with the ANZECC maximum human comfort criterion of 120dBLinear.
- The predicted levels of peak airblast at all residences comply with the ANZECC human comfort criterion of 115dBLinear, except at Residence 3 when blasting at the near point of the Wyoming Three and Caloma One open cuts.
- If required, when blasting in the Wyoming Three open cut approaches the near point to Residence 3, the bench height (or the explosive column length) would be reduced to 7.8m (or by 3.2m for the explosives column) for compliance with the ANZECC 115dBLinear general airblast criterion.
- Similarly, should blasting in the Caloma One Open Cut approaches the near point to Residence 3, the bench height (or the explosive column length) would be reduced to 5.2m (or by 5.8m for the explosives column) for compliance with the ANZECC 115dBLinear general airblast criterion.
- The predicted levels of peak airblast are clearly well below the US Bureau of Mines damage limit of 132dBLinear.

Notwithstanding the above, it is recommended that all blasts are monitored at the closest/potentially most affected residence in order to establish, and to progressively update, blast emissions site laws (for ground vibration and airblast) in order to optimise future blast designs, based on actual site conditions. In this way, the site laws can be used to assist with the blast designs in order to ensure compliance with the ANZECC criteria is met.

By adopting this approach, in conjunction with the inevitable future introduction of improved blasting products, it is anticipated that the blast emissions criteria can be met without imposing any significant constraints on the blast designs throughout the life of the mine.

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1 INTRODUCTION

SLR Consulting Australia Pty Ltd (hereafter, "SLR") has been commissioned by R.W. Corkery & Co. Pty. Limited (hereafter, "RWC") on behalf of Alkane Resources Ltd (hereafter, the "Proponent") to undertake a Noise and Blasting Assessment for the operation of the Tomingley Gold Project (hereafter, "the Project").

Broadly, the objective of the Noise and Blasting Assessment is to determine whether noise and blasting emissions from the Project would comply with the relevant noise and blasting criteria at the nearest residential receptors.

2 LOCAL SETTING AND PROJECT OVERVIEW

2.1 Project Site Location and Project Site

The Project Site is located in the central west of NSW, immediately south of Tomingley, approximately 15km to the north of Peak Hill and approximately 53km to the southwest of Dubbo. The Project Site comprises two components (**Figure 1** and **2**), namely the:

- Mine Site; and
- Tomingley Narromine Water Pipeline Route.

This assessment addresses the noise and blasting impacts associated with the Mine Site only.

The Mine Site comprises an area of approximately 776ha that would incorporate all areas of proposed Project-related disturbance associated with the open cut mining operations and related activities.

2.2 Project Overview

The Project would include the following components (see **Figure 2** for the Mine Site layout).

- Establishment of infrastructure required for the Project, including a water supply pipeline, an underpass beneath the Newell Highway, and vegetated amenity bunds.
- Extraction of waste rock and ore material from four open cut areas, namely:
  - Caloma Open Cut (approximately 19ha);
  - Caloma Two Open Cut (indicative design approximately 9ha);
  - Wyoming Three Open Cut (approximately 10ha); and
  - Wyoming One Open Cut (approximately 19ha).
- Extraction of waste rock and ore material from the Wyoming One Underground. All waste rock removed during underground mining operations would be re-used underground to backfill the mining stopes.
- Construction of three waste rock emplacements covering a combined area of approximately 129ha.
- Construction and use of various haul roads and a run-of-mine (ROM) pad.
- Construction and use of a processing plant and office area, incorporating a crushing and grinding circuit, a standard carbon-in-leach (CIL) processing plant, site offices, workshops, ablutions facilities, stores, car parking, and associated infrastructure.

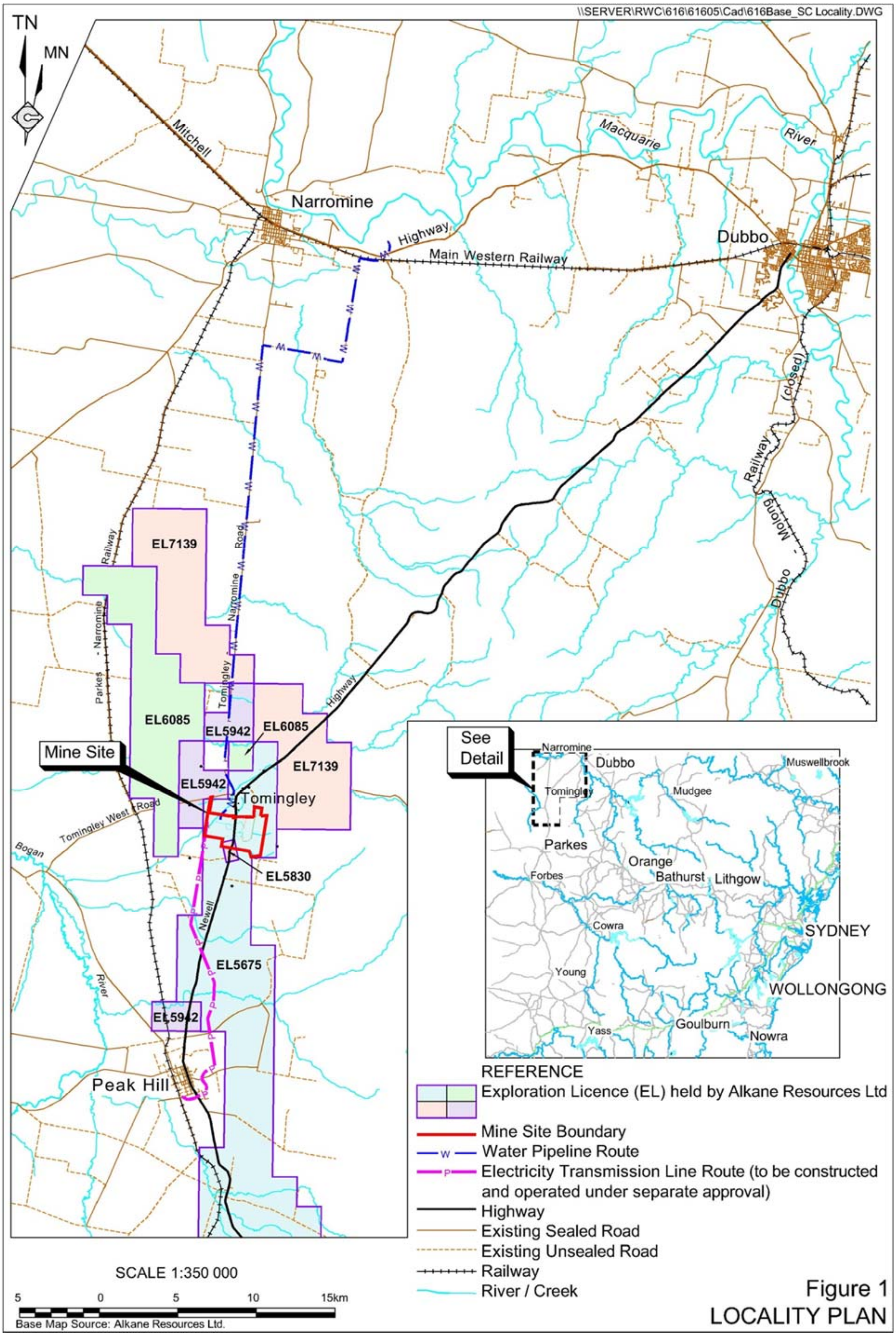


Figure 1
LOCALITY PLAN

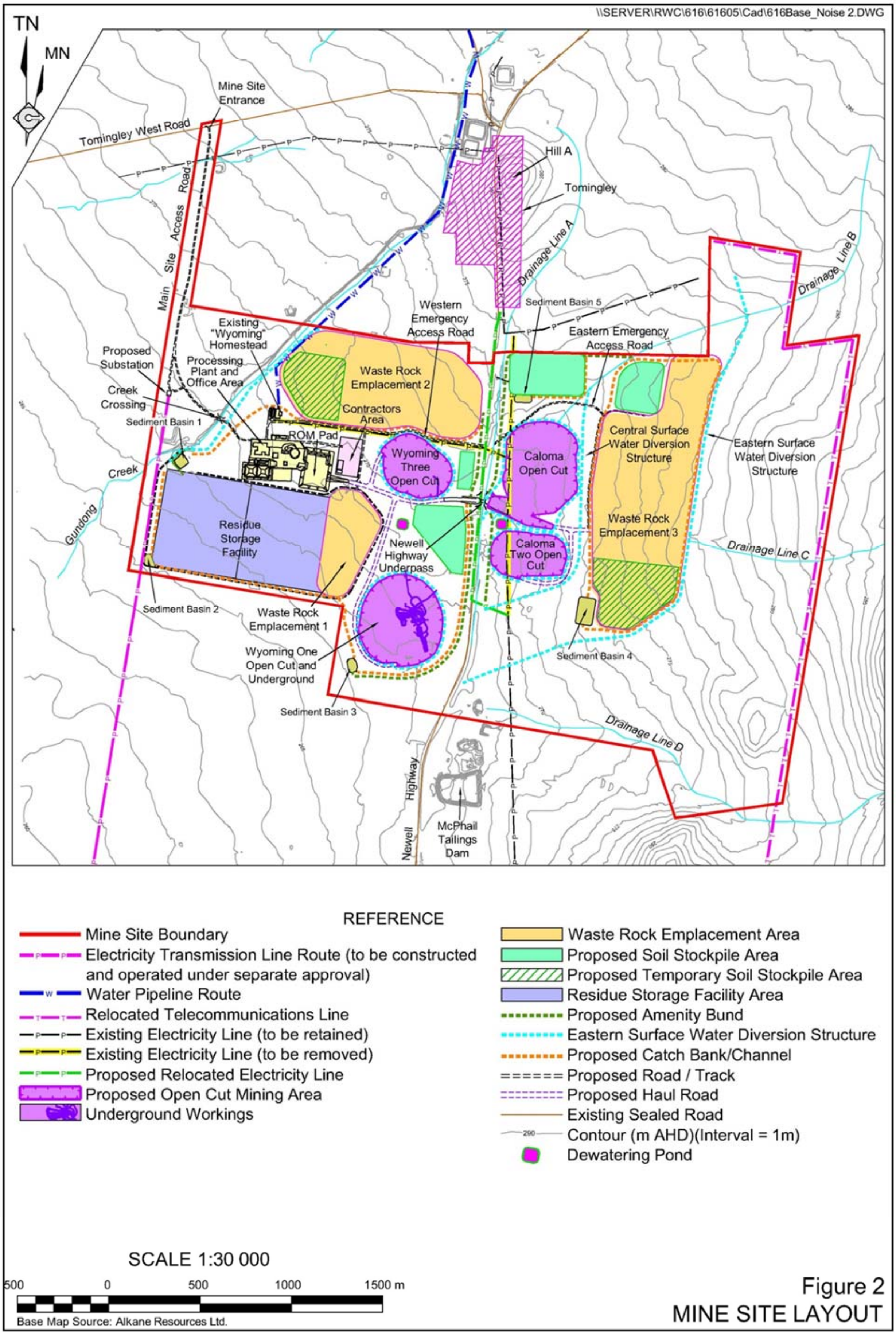


Figure 2
MINE SITE LAYOUT

- Construction and use of a residue storage facility (approximately 49ha).
- Construction and use of a transformer and electrical distribution network within the Mine Site (from the 20km of 66kV electricity transmission line from Peak Hill to the Mine Site to be constructed under separate approval).
- Construction and use of an approximately 46km water pipeline, from a licensed bore located approximately 7km to the east of Narromine, to the Mine Site.
- Relocation of existing items of infrastructure, including a 22kV power line which currently passes over the area of the Caloma and Caloma Two Open Cuts.
- Re-routing (node to node) of a 4.2km section of a Nextgen Network fibre optic cable (telecommunications line).
- Construction and use of ancillary infrastructure, including the Main Site Access Road and intersection with Tomingley West Road.
- Construction of soil stockpiles (for use in rehabilitation works).
- Construction of the Eastern Surface Water Diversion Structure to divert surface water flows to the east of mining and waste rock emplacement activities. Additional surface water management structures would be constructed within the Project Site to control surface water flows within the Mine Site.
- Construction and use of dewatering ponds to store water accumulating in and pumped from the open cuts.

Table 1 provides the proposed hours of operation of the various component activities to be undertaken on the Mine Site.

Table 1
Proposed Hours of Operation

Activity	Proposed Days of Operation	Proposed Hours of Operation
Vegetation clearing and topsoil stripping	7 days per week, during each campaign	Daylight hours
Construction operations	7 days per week for a period of approximately 6 to 12 months	24 hours per day
Open cut mining operations	7 days per week	24 hours per day
Underground mining operations	7 days per week	24 hours per day
Blasting operations	Monday to Saturday	9:00am to 5:00pm[1]
Maintenance operations	7 days per week	24 hours per day
Processing operations	7 days per week	24 hours per day
Rehabilitation operations	7 days per week	7:00am to 10.00pm
Note 1: Unless required for misfire re-blast, emergency or safety reasons.		
Source: Alkane Resources Ltd		

The anticipated Project-related traffic levels on the local road network are provided in **Table 2**.

Table 2
Anticipated Daily Traffic Movements[1]

Route	Light Vehicles	Heavy Vehicles[2]
Project Construction		
Newell Highway	120	14
Tomingley – Narromine Road	60	6
Tomingley West Road	180	20
Project Operation		
Newell Highway	102	6
Tomingley – Narromine Road	34	2
Tomingley West Road	136	8
Note 1: Two vehicle movements = one return trip. Note 2: Includes over size and over weight vehicles.		
Source: Alkane Resources Ltd		

Disturbance associated with the mining and associated activities would be progressively rehabilitated to create a geotechnically stable final landform, suitable for a final land use of nature conservation, agriculture, tourism and/or light industry.

It is noted that the design of the proposed Caloma Two Open Cut is an indicative design only, with additional drilling required to further define the mineralisation. As a result, the indicative design for the Caloma Two Open Cut presented in this document represents the maximum area that would be developed. The development of this maximum impact footprint has been taken into account in all other aspects of the Project, including the required capacity, layout and design of the waste rock emplacements and residue storage facility, and the life of the Project. Approval is sought for the proposed design, acknowledging that the final design of the open cut would be the same size or smaller than that displayed on **Figure 2**.

In addition, throughout the life of the Project, the Proponent proposes to undertake additional exploration drilling to further identify mineralisation. Should further mineable mineralisation be identified, and once sufficient information is available to adequately identify the proposed activities, a subsequent application for approval to extract these resources may be prepared.

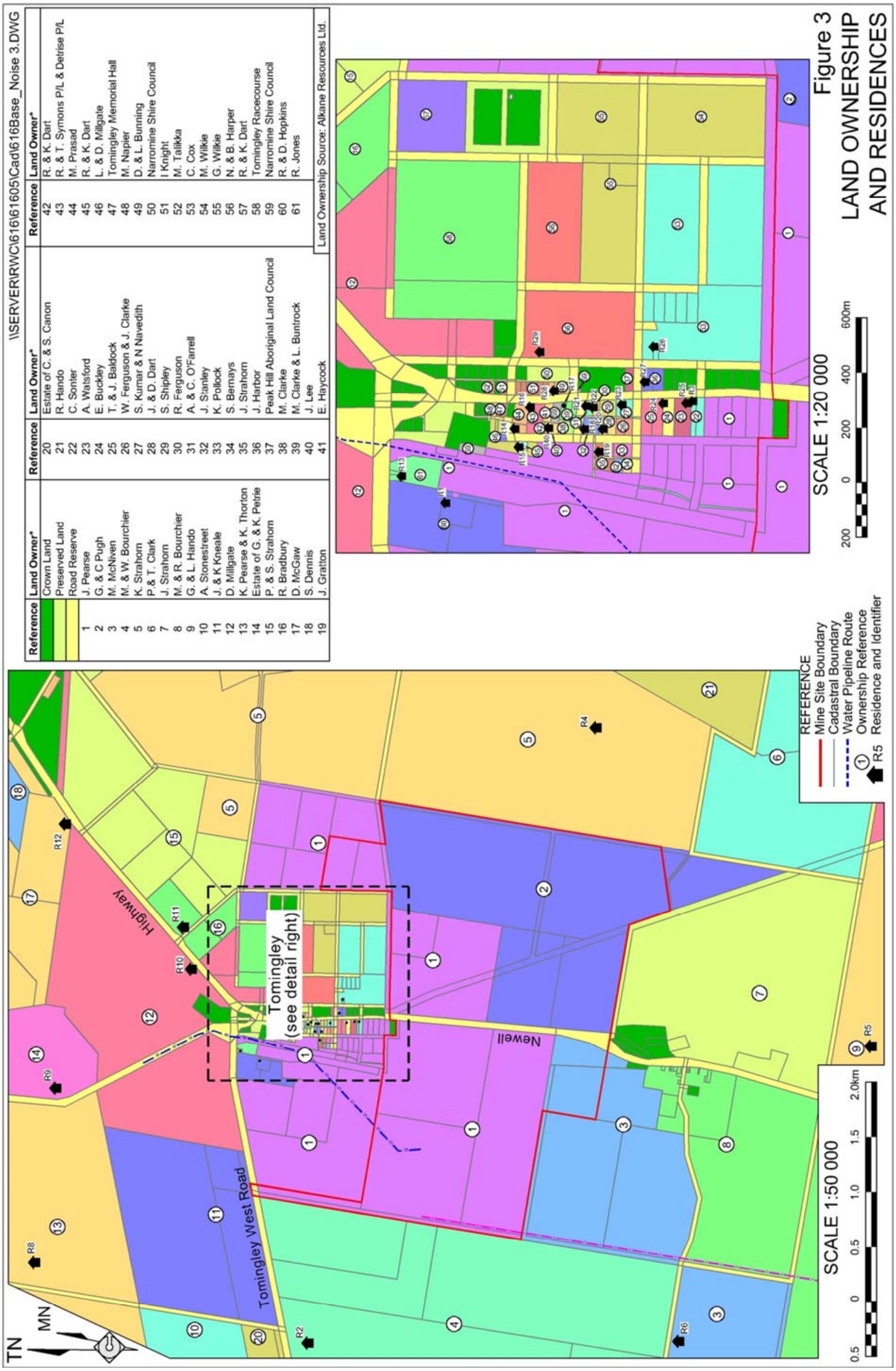
2.3 Surrounding Residences

A number of residential dwellings are situated in the area surrounding the Mine Site. The closest dwellings were identified as sensitive receptor locations to be taken into account during the assessment. These dwellings, identified as Residences R1 to R40, are presented in **Table 3** and on **Figure 3**.

It is noted that a number of locations that were originally identified as residential receptors were subsequently identified as non-residential. To ensure consistency with the air quality assessment and limit the potential for transcription errors, while the non-residential receptors have been excluded from this assessment, the original receptor numbering has been retained. As a result, the numbering of residential receptors is not in all cases sequential.

It is also noted that a number of residences not presented in **Table 3** or **Figure 3** are located adjacent to the alignment of the water pipeline route. However, all of these residences are located further from the route than those presented in **Table 3** or **Figure 3**

The Noise and Blasting Assessment Study Area extends to include all residences identified in **Table 3** and **Figure 3**.



Reference	Land Owner*	Reference	Land Owner*	Reference	Land Owner*
	Crown Land	20	Estate of C. & S. Canon	42	R. & K. Dart
	Preserved Land	21	R. Hando	43	R. & T. Symons P/L & Detrise P/L
	Road Reserve	22	C. Sonter	44	M. Prasad
1	J. Pearse	23	A. Watsford	45	R. & K. Dart
2	G. & C Pugh	24	E. Buckley	46	L. & D. Millgate
3	M. McNiven	25	T. & J. Baldock	47	Tomingley Memorial Hall
4	M. & W. Bourchier	26	W. Ferguson & J. Clarke	48	M. Napier
5	K. Strahorn	27	S. Kumar & N Navedith	49	D. & L. Bunning
6	P.& T. Clark	28	J. & D. Dart	50	Narromine Shire Council
7	J. Strahorn	29	S. Shipley	51	I Knight
8	M. & R. Bourchier	30	R. Ferguson	52	M. Talikka
9	G. & L. Hando	31	A. & C. O'Farrell	53	C. Cox
10	A. Stonestreet	32	J. Stanley	54	M. Wilkie
11	J. & K Kneale	33	K. Pollock	55	G. Wilkie
12	D. Millgate	34	S. Bernays	56	N. & B. Harper
13	K. Pearse & K. Thorton	35	J. Strahorn	57	R. & K. Dart
14	Estate of G. & K. Petrie	36	J. Harbor	58	Tomingley Racecourse
15	P. & S. Strahorn	37	Peak Hill Aboriginal Land Council	59	Narromine Shire Council
16	R. Bradbury	38	M. Clarke	60	R. & D. Hopkins
17	D. McGaw	39	M. Clarke & L. Buntrock	61	R. Jones
18	S. Dennis	40	J. Lee		
19	J. Gratton	41	E. Haycock		

Figure 3
LAND OWNERSHIP AND RESIDENCES

Table 3
Sensitive Residential Receptors Surrounding the Project Site

Residence	Location		Elevation (m, AHD)
	Easting (AMG)	Northing (AMG)	
R1	614212	6395978	277
R2	611644	6395536	268
R3	614572	6395070	277
R4	617245	6392913	289
R5	614350	6390410	271
R6	611660	6392161	261
R8	613968	6397830	280
R9	615050	6396596	283
R10	615431	6396669	284
R11	616372	6397743	292
R12	614306	6396153	279
R13	614337	6395971	279
R16	614423	6395714	278
R17	614560	6395661	281
R18	614560	6395592	281
R19	614560	6395592	280
R21	614550	6395518	279
R22	614404	6395427	277
R23	614483	6395413	278
R24	614555	6395462	280
R25	614553	6395439	280
R26	614560	6395332	278
R27	614563	6395185	277
R28	614573	6395112	277
R29	614650	6395108	277
R32	614650	6395251	278
R33	614634	6395517	282
R35	614640	6395601	283
R37	614812	6395759	283
R40	614456	6395325	279

2.4 Noise Assessment Groups

Each residence with a similar noise environment, based on their proximity to, or exposure to the Newell Highway, noise associated with fauna (e.g. birds, insects or livestock), vegetation and topography, has been grouped for noise assessment purposes into one of four Noise Assessment Groups (NAG), labelled A to D. Each noise monitoring location was chosen to be representative of the ambient noise levels in the vicinity of each Noise Assessment Group.

The selection methodology included an initial desktop investigation, referencing topographic maps to confirm residences and noise environments. The four NAGs are presented in **Table 4** and on **Figure 4**.

Table 4
Noise Assessment Groups

Noise Assessment Group (NAG)	Description Ambient Noise Environment	Residence (R)
A	Ambient noise influenced by both local roads and Newell Highway	1, 4, 5, 6, 8, 9*, 10, 11, 12
B	Rural setting with minimal traffic noise influence	2
C	Ambient noise highly elevated due to Newell Highway	3, 13*, 18, 19, 21, 24, 25, 26, 27, 28, 29, 33, 35, 40
D	Ambient noise elevated due to Newell Highway	16, 22, 17*, 23, 32, 37
Note *: Represents the closest residence within the NAG to the water pipeline route.		

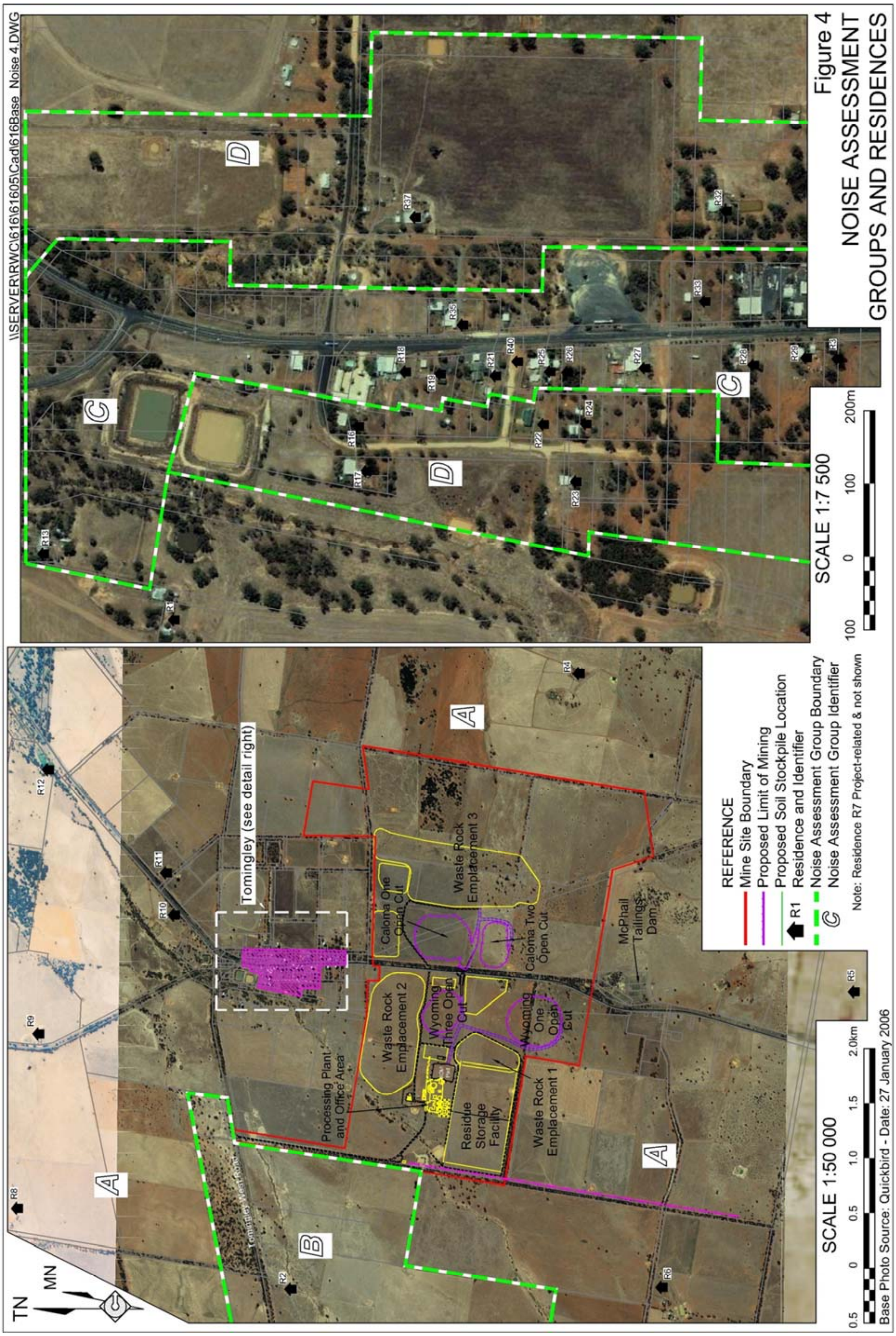


Figure 4
NOISE ASSESSMENT GROUPS AND RESIDENCES
\\SERVER\RWC\616\61605\Cad\616Base Noise 4.DWG
SCALE 1:7 500
SCALE 1:50 000
REFERENCE
Mine Site Boundary
Proposed Limit of Mining
Proposed Soil Stockpile Location
Residence and Identifier
Noise Assessment Group Boundary
Noise Assessment Group Identifier
Note: Residence R7 Project-related & not shown
Base Photo Source: Quickbird - Date: 27 January 2006
Tomingley (see detail right)
Caloma One Open Cut
Caloma Two Open Cut
Wyoming Three Open Cut
Wyoming One Open Cut
Waste Rock Emplacement 1
Waste Rock Emplacement 2
Waste Rock Emplacement 3
Residue Storage Facility
Processing Plant and Office Area
McPhail Tailings Dam
TN
MN

3 ASSESSMENT GUIDELINES AND DOCUMENTS

3.1 Operational Noise Emissions

3.1.1 Introduction

The New South Wales (NSW) Office of Environment and Heritage (OEH), formerly the Department of Environment, Climate Change and Water, has regulatory responsibility for the control of noise from "scheduled premises" under the *Protection of the Environment Operations Act 1997* (POEO Act). In implementing the NSW "*Industrial Noise Policy",* 2000 (INP), the OEH has two broad objectives:

- controlling intrusive noise impacts in the short-term; and
- maintaining noise level amenity for particular land uses over the medium to long-term.

The specific policy objectives are as follows.

- Establish noise criteria that would protect the community from excessive intrusive noise and preserve the amenity for specific land uses.
- Use the criteria as the basis for deriving "Project Specific Noise Levels" (PSNLs).
- Promote uniform methods to estimate and measure noise impacts, including a procedure for evaluating meteorological effects.
- Outline a range of mitigation measures that could be used to minimise noise impacts.
- Provide a formal process to guide the determination of feasible and reasonable noise limits for consents or licences that reconcile noise impacts with the economic, social and environmental considerations of the industrial development.
- Carry out functions relating to the prevention, minimisation and control of noise from the premises scheduled under the Act.

3.1.2 Assessing Intrusiveness

For assessing intrusiveness, the background noise generally needs to be measured. The intrusiveness criterion essentially means that the equivalent continuous noise level (L_{Aeq}) of the source should not be more than 5dB(A) above the measured (or default) Rating Background Level (RBL).

3.1.3 Assessing Amenity

The cumulative effect or amenity impacts of noise from industrial sources also needs to be considered. The amenity assessment is based on noise criteria specific to the land use and associated activities. The criteria relate only to industrial-type noise and do not include road, rail or community noise. If present, the existing noise level from industry is generally measured. If it approaches the criterion value, then noise levels from new industries need to be designed so that the cumulative effect does not produce noise levels that would significantly exceed the criterion. For high-traffic areas there is a separate amenity criterion

Extracts from the INP that relate to the amenity criteria are presented in **Table 5**.

Table 5
Amenity Criteria - Recommended L_{Aeq} Noise Levels from Industrial Noise Sources

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended L_{Aeq} Noise Level	
			Acceptable	Recommended Maximum
Residence (NAG A, B and D)	Rural	Day	50dB(A)	55dB(A)
		Evening	45dB(A)	50dB(A)
		Night	40dB(A)	45dB(A)
Residence (NAG C)	Suburban	Day	55dB(A)	60dB(A)
		Evening	45dB(A)	50dB(A)
		Night	40dB(A)	45dB(A)
Notes: For Monday to Saturday, Daytime 7.00am - 6.00pm; Evening 6.00pm - 10.00pm; Night-time 10.00pm - 7.00am. On Sundays and Public Holidays, Daytime 8.00am - 6.00pm; Evening 6.00pm - 10.00pm Night-time 10.00pm - 8.00am.				

The L_{Aeq} index corresponds to the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

3.2 Construction Noise Emissions

3.2.1 Interim Construction Noise Guideline

The assessment and management of on-site construction works will be guided by the requirements of the INP. Off-site construction works, namely the construction of the water supply pipeline and the management of the associated impacts will be guided by the OEH's "*Interim Construction Noise Guideline*" (ICNG) (DECCW, 2009).

The ICNG recognises that higher levels of noise are likely to be tolerated by people in view of the relatively short duration of the works and recommends the following approaches to mitigating adverse noise impacts from construction sites.

3.2.2 Hours of Construction

The ICNG recommend confining permissible work times as outlined in **Table 6**.

Table 6
Preferred Hours of Construction

Day	Preferred Construction Hours
Monday to Friday	7.00 am to 6.00 pm
Saturdays	8.00 am to 1.00 pm
Sundays or Public Holidays	No construction

3.2.3 Construction Noise Assessment Method

The ICNG recognises that people are usually annoyed more by noise from longer-term works than by the same type of works occurring for only a few days. For this reason the ICNG identifies two methods of assessing noise from construction:

- The quantitative assessment method which applies to long-term duration work, and
- The qualitative assessment method which applies to short-term duration work.

Quantitative Assessment Method

The ICNG recommends that the $L_{Aeq(15minute)}$ noise levels arising from a construction project, measured within the curtilage of an occupied noise-sensitive premises (ie at boundary or within 30m of the residence, whichever is the lesser), should not exceed the levels indicated in **Table 7**. These noise management levels are generally consistent with community reaction to construction noise.

Table 7
Recommended DECCW General Noise Management Levels for Construction Works

Period of Noise Exposure	$L_{Aeq(15minute)}$ Construction Noise Management Level
Recommended Standard Hours	Noise affected[1] RBL + 10 dBA
	Highly Noise affected[2] 75 dBA
Outside Recommended Standard Hours	Noise affected[1] RBL + 5 dBA

Note 1: The noise affected level represents the point above which there may be some community reaction to noise.
Note 2: The highly noise affected level represents the point above which there may be strong community reaction to noise.

The ICNG also recognises other kinds of noise sensitive receivers and provides recommended construction noise levels for them. Those specific receivers and their recommended noise levels are presented in **Table 8** and **Table 9**.

Table 8
Noise at sensitive land uses (other than residences)

Land use	$L_{Aeq(15minute)}$ Construction Noise Management Level
Classrooms at schools and other educational institutions	Internal noise level: 45 dBA
Hospital wards and operating theatres	Internal noise level: 45 dBA
Places of worship	Internal noise level: 45 dBA
Active recreation areas (characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion)	External noise level: 65 dBA
Passive recreation areas (characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation)	External noise level: 60 dBA
Community centres	Depends on the intended use of the centre

Table 9
Management Levels at Commercial and Industrial Premises

Land Use	Management level, L_{Aeq} (15 minute) (applies when properties are being used)
Offices, retail outlets	External noise level: 70 dB(A)
Industrial premises	External noise level: 75 dB(A)
Other noise sensitive businesses such as theatres and childcare centres	Assess on a case by case basis. Refer to the recommended 'maximum' internal levels in AS2107 for specific uses.

The ICNG recommends using the following quantitative assessment when the noise affected level is not met.

Mitigation

Recommended Standard Hours - Noise affected RBL + 10 dBA

- Where the predicted or measured $L_{Aeq(15minutes)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices in order to meet the noise affected level.
- The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.

Recommended Standard Hours - Highly Noise affected RBL 75 dBA

- Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours during which the very noisy activities can occur, taking into account:
- times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences
- if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times

Qualitative Assessment Method

The qualitative method for assessing construction noise is a simplified way to identify the cause of potential noise impacts. It avoids the need to perform complex predictions by using a checklist approach to assessing and managing noise. Short-term means that the works are not likely to affect an individual or sensitive land use for more than three weeks in total.

The following checklist for work practice can be used:

- Community notification
- Operate plant in a quiet and efficient manner
- Involve workers in minimising noise
- Handle complaints

For the purpose of this report, construction noise impacts associated with the construction of the water supply pipeline will be assessed using the Quantitative method. Given the progressive nature of the trenching and pipe laying works involved, however, no one residence will be affected by the works for a period of more than three weeks, and as such the Qualitative method could be implemented to manage the associated construction noise impacts.

3.3 Sleep Disturbance

The OEH's most recent policy considers sleep disturbance as the emergence of the maximum or $L_{A1(1minute)}$ noise level above the $L_{A90(15minute)}$ level at the time. An appropriate screening criteria for sleep disturbance is therefore an $L_{A1(1minute)}$ level 15dB(A) above the Rating Background Level (RBL) for the night-time period (10.00pm to 7.00am).

When the criterion is not met, a more detailed analysis may be required which should cover the maximum noise level or $L_{A1(1minute)}$, the extent that the maximum noise level exceeds the background level and the number of times this occurs during the night-time period. Some guidance on possible impacts is contained in the review of research results in the appendices to the "*NSW Environmental Criteria for Road Traffic Noise*" (ECRTN) (EPA, 1999).

Other factors that may be important in assessing the extent of impacts on sleep include:

- how often high noise events will occur;
- time of day (normally between 10.00pm and 7.00am); and
- whether there are times of the day when there is a clear change in the noise environment (such as during early morning shoulder periods).

It is noteworthy that there are no specific criteria for sleep disturbance nominated in the INP, in the INP Application Notes, the ECRTN or in the ICNG. This is consistent with the statement in the ECRTN that "*at the current level of understanding, it is not possible to establish absolute noise level criteria that would correlate to an acceptable level of sleep disturbance".*

A substantial portion of the ECRTN is a review of international sleep disturbance research, indicating that:

- *A maximum internal noise levels below 50-55dB(A) are unlikely to cause awakening reactions, and*
- *One or two noise events per night with maximum internal noise levels 65-70dB(A) are not likely to significantly affect health and wellbeing.*

Off-Site Road Traffic Noise Emissions

The ECRTN provides non-mandatory procedures for setting acceptable L_{Aeq} noise levels on arterial, collector and local roads, as well as guidelines for assessing noise impacts from off-site road traffic.

On-Site Blast Emissions

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

The assessment of blast emission impacts outside the hours advocated by ANZECC remains according to the OEH's Chapter 154 Noise Control Guideline - Blasting.

4 EXISTING ACOUSTICAL ENVIRONMENT

4.1 Unattended Background Noise Surveys

Unattended background noise monitoring was conducted at the residences identified in **Table 10**and shown in **Figure 4**. **Table 10** also presents the survey period at each residence. Environmental noise loggers were used to continuously record noise levels at the respective monitoring locations during the survey period.

Within the periods selected as being representative of the background noise level, noise data during periods of any rainfall and/or wind speeds in excess of 5m/s (approximately 9 knots) were discarded.

The unattended ambient noise logger data from each monitoring location, together with the on-site weather conditions, are presented graphically on a daily basis in **Appendices A1** to **A6**.

The ambient noise data have been processed in accordance with the requirements of the INP in order to derive the Monday to Sunday ambient noise levels and are presented in **Table 10**.

Review of the graphs presented in **Appendix A** indicates that only a small percentage of the noise data was discarded during processing, i.e. data corresponding to wind speeds above 5m/s and/or rainfall above 0.5mm per 15 minute period.

Table 10
Unattended Ambient Noise Environment (dB(A) re 20μPa)

NAG	Residence	Survey Period	Ambient ($L_{A90(15minute)}$) Level All Noise Sources		
			Day	Evening	Night
A	R1	30 April, 1 May, 13 May to 15 May 2009	29	26	24
B	R2	29 April to 6 May 2009	31	33	35
C	R3	1 October to 8 October 2009	40	30	28
A	R4	29 April to 1 May, 12 May to 15 May 2009	29	24	23
A	R5	29 April to 6 May 2009	30	25	25
A	R6	29 April to 6 May 2009	28	24	23
D	R23	1 October to 8 October 2009	38	33	31

4.2 Operator-attended Noise Surveys

In order to supplement the unattended noise logger measurements and to assist in identifying the character and duration of the ambient noise sources, operator-attended night-time noise surveys were conducted. **Table 11** lists the results of the operator-attended noise measurements, undertaken in accordance with the INP.

4.3 Rating Background Noise Level

Based on the observations made during the operator-attended noise monitoring, it is concluded that the ambient ($L_{A90(15minute)}$) Rating Background Levels (RBLs) presented in **Table 12** are representative of the background noise environment in the absence of noise emissions from the Project at Residences 1 to 6 and Residence 23.

5 INP ASSESSMENT OF PREVAILING WEATHER CONDITIONS

5.1 Wind

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

Table 11
Operator-attended Ambient Noise Survey Results – 29 May to 30 May 2009

Residence Date / Time Meteorological Conditions						Primary Noise Descriptor (dB(A) re 20µPa)					Description of Noise Emissions and Typical Maximum Levels – dB(A) (LAmax)
Res.	**Time**	**Cloud Cover (Octa)**	**Wind**	**Temp**	**Relative Humidity**	L_{Aeq}	L_{A1}	L_{A10}	L_{A50}	L_{A90}	
R1	11.44pm	0	<1m/s	5°C	70%	42	50	47	37	32	Distant Traffic 30-34 Local Heavy Traffic 48-51
R2[1]	12.45am	0	<1m/s	3°C	81%	37	49	38	25	25	Distant Traffic 20-25 Drilling Rig to East <24
R3	1.05am	0	<1m/s	3°C	75%	65	79	56	35	30	Local Heavy Traffic 70-86 Distant Traffic 30-33 Trucks at Rest Stop (idle) 25-30 Dog Barks (distant) 40
R4	2.36am	0	<1m/s	3°C	81%	25	48	35	25	25	Distant Traffic 30-34 Sheep (distant) <25
R5	3.06am	0	<1m/s	1°C	87%	44	56	47	32	26	Distant Traffic 28-57

Note 1: As access to the private road leading to the residence was not available at this monitoring location, the operator attended noise survey was conducted on Tomingley West Road at the front gate of the private road approximately 330m north-northeast of the unattended noise logger.

Table 12
Summary of Existing LA90 Rating Background Levels (RBLs) (dB(A) re 20µPa)

Residence	Rating Background Level[1] (LA90(15minute) Level All Noise Sources		
	Day	**Evening**	**Night**
R1	30	30	30
R2	31	30[2]	30[2]
R3	40	30	30
R4	30	30	30
R5	30	30	30
R6	30	30	30
R23	38	33	31

Note 1: Rating Background Level (RBL) determined in accordance with the procedures specified in the Industrial Noise Policy, 2000 (INP).

Note 2: It has been determined from the attended noise monitoring results that the LA90 noise levels measured by the unattended noise logger were controlled by local domestic activity at Residence 2. The evening and night-time RBLs at this receptor have been adjusted accordingly.

Wind effects need to be considered when wind is a feature of the area under consideration. Where the source to receiver wind component at speeds of up to 3m/s occur for 30% or more of the time in any seasonal period (during the day, evening or night), then wind is considered to be a feature of the area and noise level predictions must be made under these conditions,

The NSW INP Section 5.3, Wind Effects, states:

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

An assessment of existing wind conditions for the Project Site has been prepared from the on-site meteorological data recorded at the Peak Hill Gold Mine located approximately 15km to the south of the Project Site for the period January 2003 to December 2003. The data, corrected for the height of the anemometer mast, was analysed in order to determine the frequency of occurrence of wind speeds up to 3m/s in each season.

The dominant seasonal wind speeds and directions are presented in **Table 13**, **Table 14** and **Table 15** for the daytime (7.00am to 6.00pm), evening (6.00pm to 10.00pm) and night-time (10.00pm to 7.00am) periods respectively.

Table 13
Seasonal Frequency of occurrence Wind Speed Intervals - Daytime

Period	Calm (<0.5m/s)	Wind Direction ±45°	Wind Speed		
			0.5 to 2m/s	2 to 3m/s	0.5 to 3m/s
Summer	7.5%	ENE	5.3%	4.4%	9.7%
Autumn	28.5%	S	13.6%	3.3%	16.8%
Winter	33.9%	SSW	11.6%	3.8%	15.4%
Spring	11.6%	S	5.4%	3.0%	8.4%

Table 14
Seasonal Frequency of occurrence Wind Speed Intervals - Evening

Period	Calm (<0.5m/s)	Wind Direction ±45°	Wind Speed		
			0.5 to 2m/s	2 to 3m/s	0.5 to 3m/s
Summer	1.0%	ESE	4.4%	3.4%	7.8%
Autumn	0.4%	E	11.7%	5.8%	17.5%
Winter	1.1%	NW	8.0%	12.2%	20.2%
Spring	1.5%	NW	1.7%	3.9%	5.7%

Table 15
Seasonal Frequency of occurrence Wind Speed Intervals - Night-Time

Period	Calm (<0.5m/s)	Wind Direction ±45°	Wind Speed		
			0.5 to 2m/s	2 to 3m/s	0.5 to 3m/s
Summer	7.5%	ENE	6.5%	5.2%	11.7%
Autumn	18.7%	E	11.9%	6.1%	18.0%
Winter	23.8%	SSW	10.2%	5.1%	15.4%
Spring	14.9%	SSE	7.1%	3.8%	10.8%

There are no prevailing winds of velocity less than (or equal to) 3m/s, with a frequency of occurrence greater than (or equal to) 30% of the time. Assessment of specific wind direction is not considered to be relevant to the site in accordance with the NSW INP.

5.2 Temperature Inversion

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

However, the INP states that temperature inversions need only be considered for the night-time noise assessment period ie 10.00pm to 7.00am. The OEH accepts three methods for estimating the strength of temperature inversions:

1. Direct measurement of the temperature lapse rate over a 50m height interval range.
2. Cloud cover, wind speed and solar radiation which are used to determine the rate of atmospheric heat loss (i.e. rate of cooling).
3. Sigma-theta (standard deviation of wind direction) and wind speed which are used to determine atmospheric stability and the corresponding atmospheric stability category.

Using Sigma-theta (Method 3) is the most commonly employed method for estimating the temperature inversion strength.

The INP contains a detailed procedure for determining the night-time Pasquill-Gifford stability category for a given sigma-theta and wind speed (ranging from A-Class to G-Class). The INP then sets default temperature inversion strengths for each stability category.

An assessment of existing atmospheric stability conditions has been prepared from the Peak Hill Gold Mine meteorological data recorded on site for the period January 2003 to December 2003. The frequency of occurrence of each stability class is presented in **Appendix B** for evening/night-times (6.00pm to 7.00am) during each season, where stability classes F and G indicate the occurrence of noise enhancing temperature inversions. **Table 16** presents a summary of this data during the winter season only.

Table 16
Frequency of Occurrence of Each Stability Class Winter Evening/Night-time Period Peak Hill – January 2003 to December 2004

Stability Class	Winter Evening/Night-time
A	0.0%
B	0.0%
C	0.0%
D	23.8%
E	19.2%
F	43.9%
G	13.0%
F+G	56.9%

The assessment shows that the cumulative frequency of occurrence of F and G stability class is greater than (or equal to) 30% during the winter evening/night-time period. Therefore, temperature inversions are considered to be relevant to the site in accordance with the INP. Further, it is appropriate to cater for the presence moderate (F class, 3˚C/100m - refer to the INP Section 5.2 and INP Appendix F) temperature inversions in the assessment of winter night-time noise emissions from the Project.

5.3 Drainage Flow Winds

The INP identifies that a default wind drainage value be applied where sources are situated at a higher altitude than receivers with no intervening topography.

The drainage-flow wind does not apply to this Project as the topography of the area is relatively flat.

5.4 Summary of Prevailing Weather Conditions

Temperature inversions are considered to be a feature of the area during the night-time in all seasons. However, in accordance with the INP, temperature inversions are only required to be assessed during the winter period.

6 ASSESSMENT CRITERIA

6.1 Operational Noise Criteria and Management Measures

6.1.1 Introduction

The NSW Industrial Noise Policy prescribes detailed calculation routines for establishing "project specific" $L_{Aeq(15minute)}$ intrusive and $L_{Aeq(period)}$ amenity noise criteria for a development at potentially affected receivers.

6.1.2 Background Noise Levels for Project Assessment Purposes

Based on the background noise monitoring data presented in **Table 10**, **Table 17** presents the Rating Background Levels (RBLs) determined in accordance with the INP. The RBLs adopted for assessment purposes are representative of the background noise environment at the respective noise assessment groups.

Existing industrial amenity noise levels from other industrial operations in the locality are not significant (i.e. greater than 6dB(A) lower than the acceptable amenity noise level nominated in INP) at the surrounding residences.

6.1.3 Assessment Criteria

The INP-based intrusiveness and amenity noise assessment criteria for each assessment group is presented in **Table 18**. The criteria are nominated for the purposes of assessing the potential operational noise impacts from the Project and are based on a review of the unattended and attended noise monitoring results. It is noteworthy that the $L_{Aeq(15minute)}$ intrusive criteria are the controlling noise criteria at all residential receivers.

Table 17
Noise Environment for Project Assessment Purposes (dB(A) re 20µPa)

NAG	Rating Background Level ($L_{A90(15minute)}$) Level All Noise Sources			Estimated Existing $L_{Aeq(period)}$ Industrial Amenity Noise		
	Day	Evening	Night	Day	Evening	Night
A[1]	30	30	30	<44	<39	<34
B	31	30	30	<44	<39	<34
C	40	30	30	<44	<39	<34
D	38	33	31	<44	<39	<34

Note 1: Determined over a total of 27 days of noise logging at 4 monitoring locations.

Table 18
Project Specific Noise Assessment Criteria (dB(A) re 20µPa)

NAG	NSW INP Noise Amenity Area	Project Specific Assessment Criteria					
		Intrusive L_{Aeq}(15minute)			Amenity L_{Aeq}(period)		
		Day	Evening	Night	Day	Evening	Night
A	Rural	35	35	35	50	45	40
B	Rural	36	35	35	50	45	40
C	Suburban	45	35	35	55	45	40
D	Rural	43	38	36	50	45	40

Note 1: Amenity noise criteria have been determined from the predictions estimated existing LAeq(Period) industrial amenity noise in **Table 17**

6.1.4 Operational Noise Management Measures

The INP states that the method of determining these project specific noise assessment criteria has been selected in order to protect at least 90% of the population living in the vicinity of industrial noise sources from the adverse effects of noise for at least 90% of the time. Provided that the criteria in the INP are achieved, it is unlikely that most people would consider the resultant noise levels excessive.

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

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

In view of the foregoing, **Table 19** presents the methodology for assessing noise levels which may exceed the INP project specific noise assessment criteria.

Table 19
Project Noise Impact Assessment Methodology

Assessment Criteria	Project Specific Criteria	Noise Management Zone		Noise Affectation Zone
		Marginal	Moderate	
Intrusive $L_{Aeq(15minute)}$	Rating background level plus 5dB(A)	1dB(A) to 2dB(A) above project specific criteria	3dB(A) to 5dB(A) above project specific criteria	> 5dB(A) above project specific criteria
Amenity $L_{Aeq(period)}$	INP based on existing industrial level			

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

Noise Management Zone

Depending on the degree of exceedance of the project specific criteria (1dB(A) to 5dB(A)) noise impacts could range from negligible to moderate. In the event that exceedances of 5dB(A) or less are experienced, it is recommended that the following noise management procedures be implemented.

- Noise monitoring on-site and within the community.
- Prompt response to any community issues of concern.
- Refinement of on-site noise mitigation measures and mine operating procedures, where practicable.
- Discussions with relevant land owners to assess concerns.
- Consideration of acoustical mitigation at receivers where substantiated by monitoring results.
- Consideration of negotiated agreements with land owners.

Noise Affectation Zone

Exposure to noise levels corresponding to this zone may be considered unacceptable by some landowners, particularly at night. It is recommended that, should predicted noise levels fall into this category, the Proponent should explore the following.

- Discussions with relevant land owners to assess concerns and define responses.
- Implementation of acoustical mitigation at receivers.
- Negotiated agreements with land owners, where required.
- Acquisition if negotiated agreement cannot be reached.

6.1.5 Sleep Disturbance Criteria

Peak noise level events such as reversing alarms, noise from the dropping of heavy items or other high noise level events may have the potential to cause sleep disturbance.

It should be noted, the INP does not specifically address sleep disturbance from high noise level events, furthermore, the OEH recognises that the current sleep disturbance criterion of $L_{A1(1minute)}$ less than $L_{A90(15minute)}$ plus 15dB(A) is not ideal as it is considered to be an overly simplistic assessment approach. However, OEH has found that the $L_{A1(1minute)}$ provides adequate control of sleep disturbance events.

A review of noise events from comparable mining operations shows that the $L_{A1(1minute)}$ levels from mobile equipment (i.e. bulldozers, haul trucks, etc.) are typically no greater than 10dB(A) above the $L_{Aeq(15minute)}$ intrusive level.

Accordingly, if the $L_{Aeq(15minute)}$ intrusive criteria (i.e. RBL plus 5dB(A)) are achieved then the OEH's sleep disturbance guideline criteria (i.e. RBL plus 15dB(A)) will also generally be met. This relationship enables the noise assessment process to focus on the setting of the appropriate $L_{Aeq(15minute)}$ intrusive criteria.

6.2 Construction Noise Assessment Criteria

The airborne noise objective for residential/commercial receivers indicates that noise from off-site construction activities should be managed such that the L_{Aeq} noise level, measured over a period of not less than 15 minutes, should not exceed the background (L_{A90}) noise level by more than 10 dBA during the OEH's preferred construction hours.

Based on the measured $L_{A90(15minute)}$ RBL's, the airborne $L_{Aeq(15minute)}$ construction noise goals during the preferred hours of construction are presented in **Table 20**.

Table 20
Construction Noise Management Levels (dB(A) re 20µPa)

NAG (closest receiver and distance)	Rating Background Level ($L_{A90(15minute)}$) Level All Noise Sources	Project Specific Construction Noise Management Level	
	OEH Preferred Hours of Construction	Noise Affected	Highly Noise Affected
A* (R9 – 125m)	30	40	75
B (R2 – 1920m)	31	41	75
C (R13 – 115m)	40	50	75
D (R17 – 85m)	38	48	75

Note *: Representative of additional residences located along the water pipeline route between Tomingley and the groundwater source

Achievement of the construction noise criteria at the residences noted in **Table 20** would be indicative of satisfaction of the criteria at other residences within these NAG's.

6.3 Road Transportation Noise Assessment Criteria

Whilst operating on the Mine Site, the assessment criteria for vehicle noise is as outlined in **Section 6.1**. That is, road vehicle noise contributions are included in the overall predicted $L_{Aeq(15minute)}$ operational noise emissions. On public roads, different noise assessment criteria apply to the vehicles which would be regarded as "traffic" rather than as part of the Project operational noise sources.

In June 1999, the OEH (then the EPA) issued a document entitled "*Environmental Criteria for Road Traffic Noise*". In terms of the functional categories of roads, the OEH's document states that:

> *"It is noted that some industries (such as mines and extractive industries) are, by necessity, in locations that are often not served by arterial roads. Heavy vehicles must be able to get to their bases of operation, and this may mean travelling on local roads. Good planning practice recognises that we must acknowledge this type of road use and develop ways of managing any associated adverse impacts. To this end, the concept of 'principal haulage routes' has been endorsed by the Department of Urban Affairs and Planning's North Coast Extractive Industries Standing Committee. Ways of identifying 'principal haulage routes' and managing associated adverse impacts have not yet been fully defined. Where local authorities identify a 'principal haulage route', the noise criteria for the route should match those for collector roads, recognising the intent that they carry a different level and mix of traffic to local roads."*

Based on the above, the relevant assessment criteria for the Project-related road traffic noise impact assessment are presented in **Table 21** and **Table 22**.

Table 21
Road Traffic Noise Criteria - Collector Roads - Tomingley West Road and Tomingley - Narromine Road

Type of Development	Criteria LAeq(1hour) Daytime	Criteria LAeq(1hour) Night-time	Where Criteria Are Already Exceeded
8. Land use developments with potential to create additional traffic on collector roads	60dB(A)	55dB(A)	Where feasible and reasonable, existing noise levels should be mitigated to meet the noise criteria. In all cases, traffic arising from the development should not lead to an increase in existing noise levels of more than 2dB(A)
Note: Total traffic noise contribution including existing and project related vehicle movements. LAeq(1hour) represents the highest LAeq noise level for any hour during daytime (0700am to 10.00pm) and night-time (10.00pm to 7.00am).			

Table 22
Road Traffic Noise Criteria - Arterial Roads - Newell Highway

Type of Development	Criteria LAeq(15hour) Daytime	Criteria LAeq(9hour) Night-time	Where Criteria Are Already Exceeded
8. Land use developments with potential to create additional traffic on existing freeway/arterials	60dB(A)	55dB(A)	Where feasible, existing noise levels should be mitigated to meet the noise criteria. In all cases, traffic arising from the development should not lead to an increase in existing noise levels of more than 2dB(A)
Note: Total traffic noise contribution including existing and project related vehicle movements. LAeq(1hour) represents the highest LAeq noise level for any hour during daytime (0700am to 10.00pm) and night-time (10.00pm to 7.00am).			

It is recognised that the ECRTN was replaced by the "*NSW Road Noise Policy*" (RNP) on July 1 2011. The RNP modifies the application of several noise criteria, however, as the road noise traffic assessment was undertaken prior to July 1 2011, the ECRTN remains the applicable guideline document and has been used for this Project.

6.4 Blast Emissions Assessment Criteria

6.4.1 Ground Vibration - Structural Damage

In terms of the most recent relevant blast vibration damage criteria, British Standard 7385:Part 2-1993 "*Evaluation and Measurement for Vibration in Buildings Part 2*" is a definitive standard against which the likelihood of building damage from ground vibration can be assessed. This is the Standard recommended in Australian Standard AS 2187: Part 2-2006 "*Explosives - Storage and Use - Part 2: Use of Explosives*" as the guideline values and assessment methods "*are applicable to Australian conditions*".

Although there is a lack of reliable data on the threshold of vibration-induced damage in buildings, both in countries where national standards already exist and in the UK, BS 7385:Part 2 has been developed from an extensive review of UK data, relevant national and international documents and other published data. The standard sets guide values for building vibration based on the lowest vibration levels above which damage has been credibly demonstrated. These levels are judged to give a minimum risk of vibration-induced damage, where minimal risk for a named effect is usually taken as a 95% probability of no effect.

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

As the strain imposed on a building at the foundation level is proportional to the peak particle velocity, but is inversely proportional to the propagation velocity of the shear or compressional waves in the ground, this quantity (i.e. peak particle velocity) has been found to be the best single descriptor for correlating with case history data on the recurrence of vibration-induced damage.

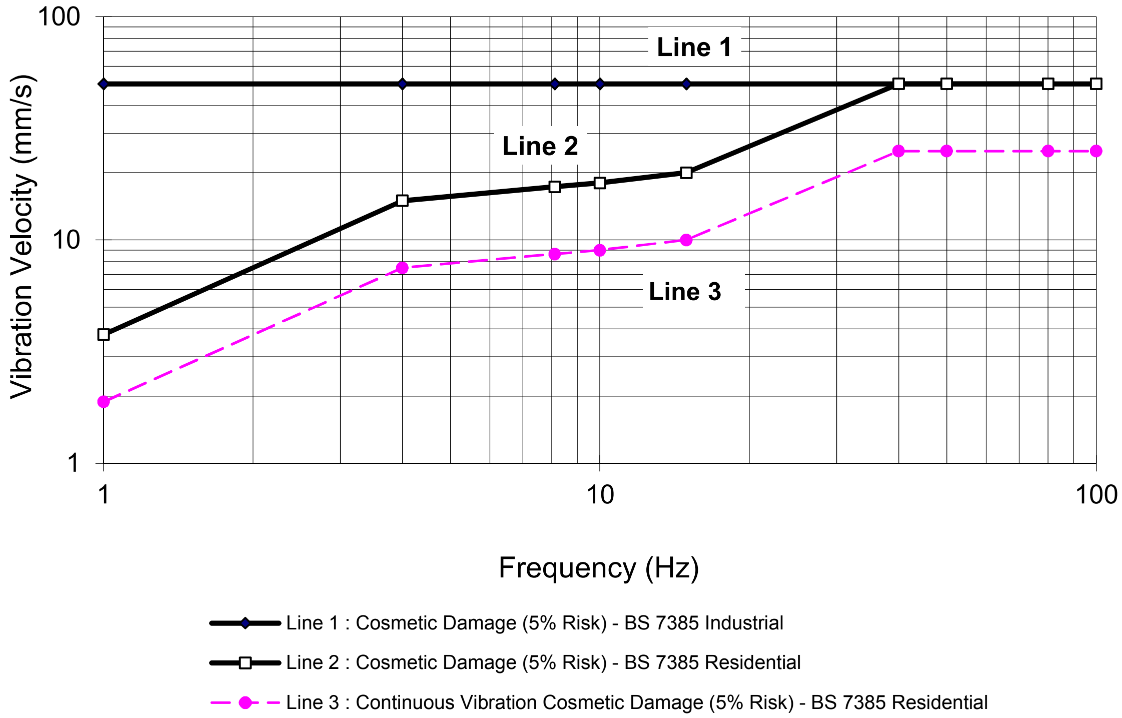
The guide values from this standard for transient vibration judged to result in a minimal risk of cosmetic damage to residential buildings and industrial buildings are presented numerically in **Table 23** and graphically in **Figure 5**.

Table 23
Transient Vibration Guide Values for Cosmetic Damage

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

In the lower frequency region where strains associated with a given vibration velocity magnitude are higher, the guide values for the building types corresponding to Line 2 are reduced. Below a frequency of 4Hz where a high displacement is associated with the relatively low peak component particle velocity value, a maximum displacement of 0.6mm (zero to peak) is recommended. This displacement is equivalent to a vibration velocity of 3.7mm/s at 1Hz.

Figure 5
Transient Vibration Guide Values for Cosmetic Damage



The standard goes on to state that minor damage is possible at vibration magnitudes which are greater than twice those given in **Table 23** and major damage to a building structure may occur at values greater than four times the tabulated values.

Fatigue considerations are also addressed in the standard and it is concluded that unless calculation indicates that the magnitude and number of load reversals is significant (in respect of the fatigue life of building materials) then the guide values in **Table 23** should not be reduced for fatigue considerations.

It is noteworthy that extra to the guide values nominated in **Table 23**, the standard states that:

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

Also that:

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

6.4.2 Airblast - Structural Damage

Based largely on work carried out by the US Bureau of Mines, the US Office of Surface Mining has presented the following regulatory limits for airblast from blasting (depending on the low frequency limit of the measuring system):

Low Frequency Limit	Peak Airblast Level Limit
2Hz or lower	132dBLinear
6Hz or lower	130dBLinear

These levels are generally consistent with the level of 133dBLinear nominated in AS 2187.2-2006 "*Explosives Storage and Use*".

The US criteria are structural damage limits based on relationship between the level of airblast and the probability of window breakage, and include a significant safety margin. It has been well documented that windows are the elements of residential buildings most at risk to damage from airblast from blasting.

While cracked plaster is the type of damage most frequently monitored in airblast complaints, research has shown that window panes fail before any other structural damage occurs (USBM, RI 8485-1980). The probabilities of damage to windows exposed to a single airblast event are as shown in **Table 24**.

Table 24
Probability of Window Damage from Airblast

Airblast (dBLinear)	Level (kPa)	Probability of Damage	Effects and Comments
140	0.2	0.01%	"No damage" - windows rattle
150	0.6	0.5%	Very occasional failure
160	2.0	20%	Substantial failures
180	20.0	95%	Almost all fail

6.4.3 Human Comfort and Disturbance Considerations

The ground vibration and airblast levels which cause concern or discomfort to residents are significantly lower than levels which may result in structural damage to buildings.

The criteria normally recommended for blasting in NSW, based on human discomfort, are contained in the *Environmental Noise Control Manual* (Chapter 154). However, for recent projects, the OEH has advocated the use of the Australian and New Zealand Environment and Conservation Council (ANZECC) guidelines.

The ANZECC criteria for the control of blasting impact at residences are as follows:

- The recommended maximum level for airblast is 115dBLinear.
- The level of 115dBLinear may be exceeded on up to 5% of the total number of blasts over a period of 12 months. The level should not exceed 120dBLinear at any time.
- The recommended maximum level for ground vibration is 5mm/s (peak particle velocity (ppv)).
- The ppv level of 5mm/s may be exceeded on up to 5% of the total number of blasts over a period of 12 months. The level should not exceed 10mm/s at any time.
- Blasting should generally only be permitted during the hours of 9.00am to 5.00pm Monday to Saturday. Blasting should not take place on Sundays and Public Holidays.

7 OPERATIONAL NOISE MODELLING PROCEDURES

7.1 Prediction of Noise Emissions

The Project computer noise model was developed to incorporate the significant noise sources associated with the Project. Additional surrounding terrain and nearby residences and properties were also included in the model.

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

The following scenarios were assessed (based on proposed Project progression) (**Figures 6**, **7**, **8**, **9** and **10**).

Scenario 1A: Representative of months 1 to 3 of the initial site construction operations (see **Figure 6**). The primary activities undertaken include soil stripping operations, overburden removal and the construction of an acoustic bund (to 15m in height) around the northern perimeter of Waste Rock Emplacement (WRE) 2. Other activities include the placement of soil within soil stockpiles, construction of roads, and placement of overburden within WRE 2.

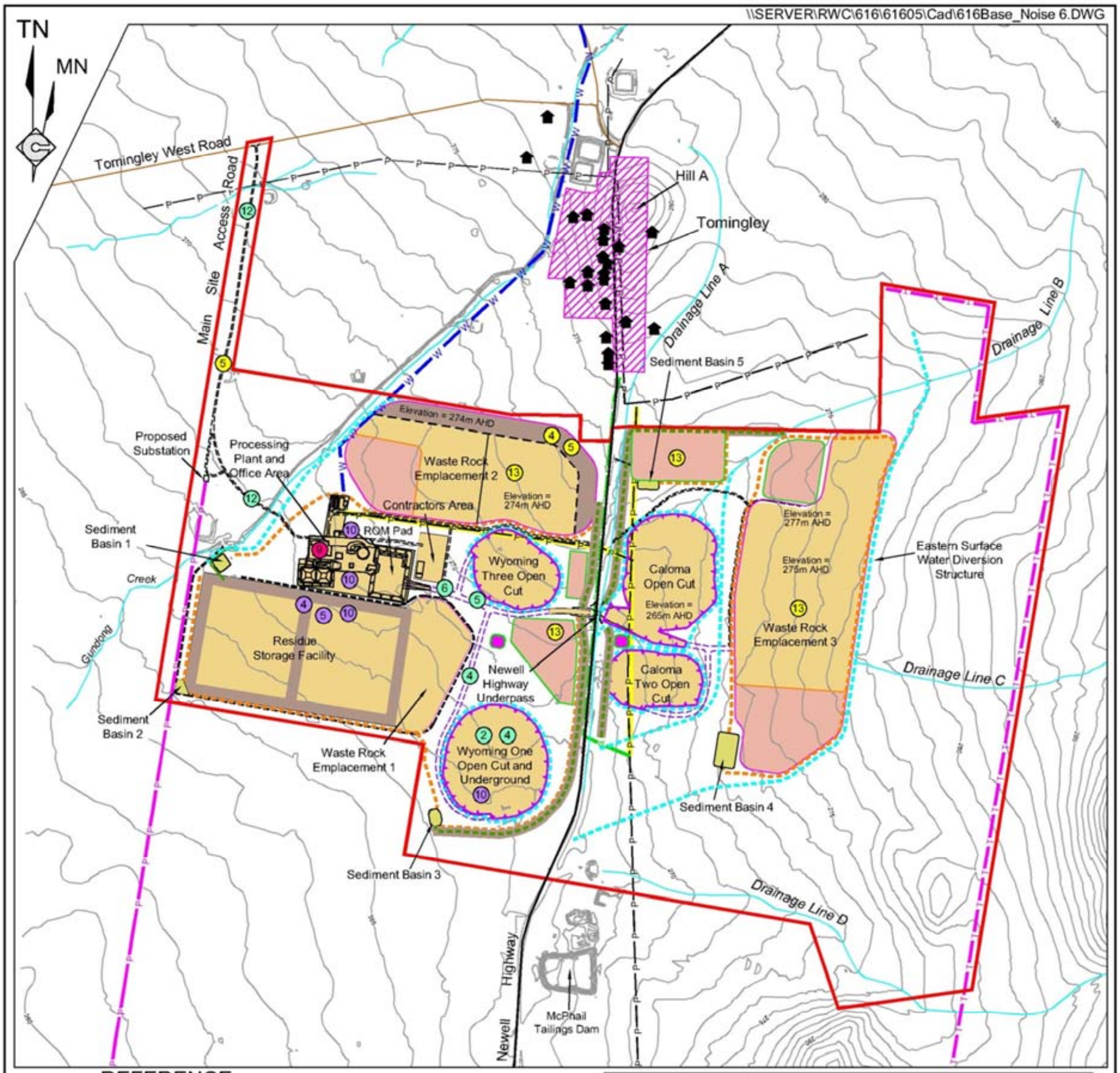
Scenario 1B: Representative of months 10 to 12 of the site construction and initial mining operations (see **Figure 7**). The primary noise generating activities include the overburden removal and initial mining operations at Caloma Open Cut and Wyoming One Open Cut and construction of the acoustic bund (to 5m in height) around the northern perimeter of WRE 3. Other activities include the construction of roads, soil stockpiles and placement of overburden within WRE 2 and WRE 3.

Scenario 2: Representative of mining operations at around month 15 within the Caloma Open Cut and Wyoming Three Open Cut (see **Figure 8**). Activities include haulage of ore material to the ROM Pad and operation of crushing, screening and processing plant. All acoustic bunds constructed to 15m in height.

Scenario 3: Representative of mining operations at the end of Year 2 within the Caloma Open Cut, Wyoming Three Open Cut, and Wyoming One Open Cut (see **Figure 9**). Activities include haulage of ore material to the ROM Pad, operation of crushing, screening and processing plant and rehabilitation of WRE 3. All acoustic bunds constructed to 15m in height.

Scenario 4: Representative of mining operations at the end of Year 4 within the Wyoming One Open Cut and Caloma Two Open Cut (see **Figure 10**). Activities include haulage of ore material to the ROM Pad, operation of crushing, screening and processing plant, and rehabilitation of WRE 3.

It is noteworthy that, even though Scenario 1A comprises of mostly construction works primarily for the purpose of noise control, the scenario has been assessed as against the intrusiveness criteria established in accordance with the INP (not the ICNG). Consequently, there is no separate Construction Phase noise assessment.



REFERENCE

- Mine Site Boundary
- Water Pipeline Route
- Proposed Limit of Mining
- Proposed Amenity Bund
- Proposed Surface Water Control Structure
- Proposed Road / Track
- Proposed Haul Road
- Existing Sealed Road
- Contour (m AHD)(Interval = 1m)
- Dewatering Pond
- Residence

Activities

- Road Construction
- Soil Stripping Operations
- Soil Stockpile Construction
- Overburden Removal/Mining Operations
- Waste Rock Emplacement / Bund Construction
- Residue Placement
- Rehabilitation in Progress

SCALE 1:30 000

500 0 500 1000 1500 m

Source: Alkane Resources Ltd

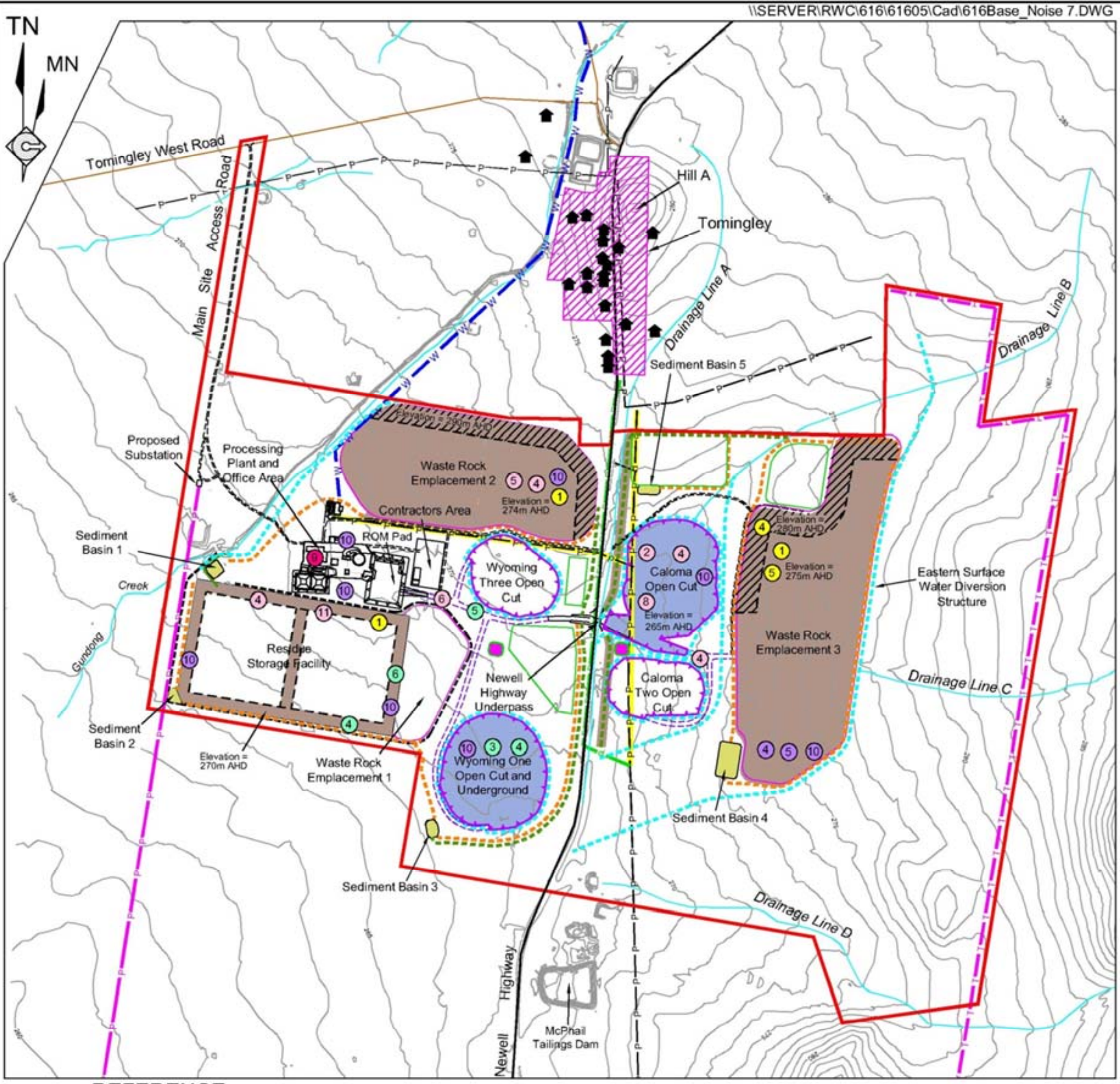
	Day Shift	Evening Shift	Night Shift	Equipment
1	0	0	0	Bulldozer (Cat D10)
2	1	1	1	Excavator (Hitachi EX1200 - 120t)
3	0	0	0	Excavator (Hitachi 2N870 - 85t))
4	3	3	3	Haul Trucks (Caterpillar 777F)
5	2	0	0	Graders (Caterpillar 16H)
6	1	1	1 (0)	Water Truck (Caterpillar 796)
7	0	0	0	Front-end Loader (Caterpillar 988G)
8	0	0	0	Blast Hole Rig
9	0	0	0	Processing Plant (Ball Mill & Screen)
10	0	4	4	Lighting Plants (Evening & Night-time Only)
11	0	0	0	Vibrating Roller
12	2	2	2	Road Trucks
13	4	0	0	Scrapers

Note: Number in parentheses represents a further reduction in equipment operation required to reduce noise levels received at most affected residences to Project Specific Noise Level or less under noise enhancing (inversion) conditions (night time only).

Indicative Equipment Locations

- (1) Day Shift Only (7:00am to 6:00pm)
- (10) Evening/Night Shift Only (6:00pm to 7:00am)
- (4) 24 hour Operation
- (9) Not Operating

Figure 6
OPERATIONAL
SCENARIO 1A - MONTHS 1 to 3



REFERENCE
- Mine Site Boundary
- Water Pipeline Route
- Proposed Limit of Mining
- Proposed Amenity Bund
- Proposed Surface Water Control Structure
- Proposed Road / Track
- Proposed Haul Road
- Existing Sealed Road
- Contour (m AHD)(Interval = 1m)
- Dewatering Pond
- Residence

Activities
- Road Construction
- Soil Stripping Operations
- Soil Stockpile Construction
- Waste Rock Emplacement Amenity Bund
- Overburden Removal/Mining Operations
- Waste Rock Emplacement / Bund Construction
- Residue Placement
- Rehabilitation in Progress

SCALE 1:30 000

500 0 500 1000 1500 m

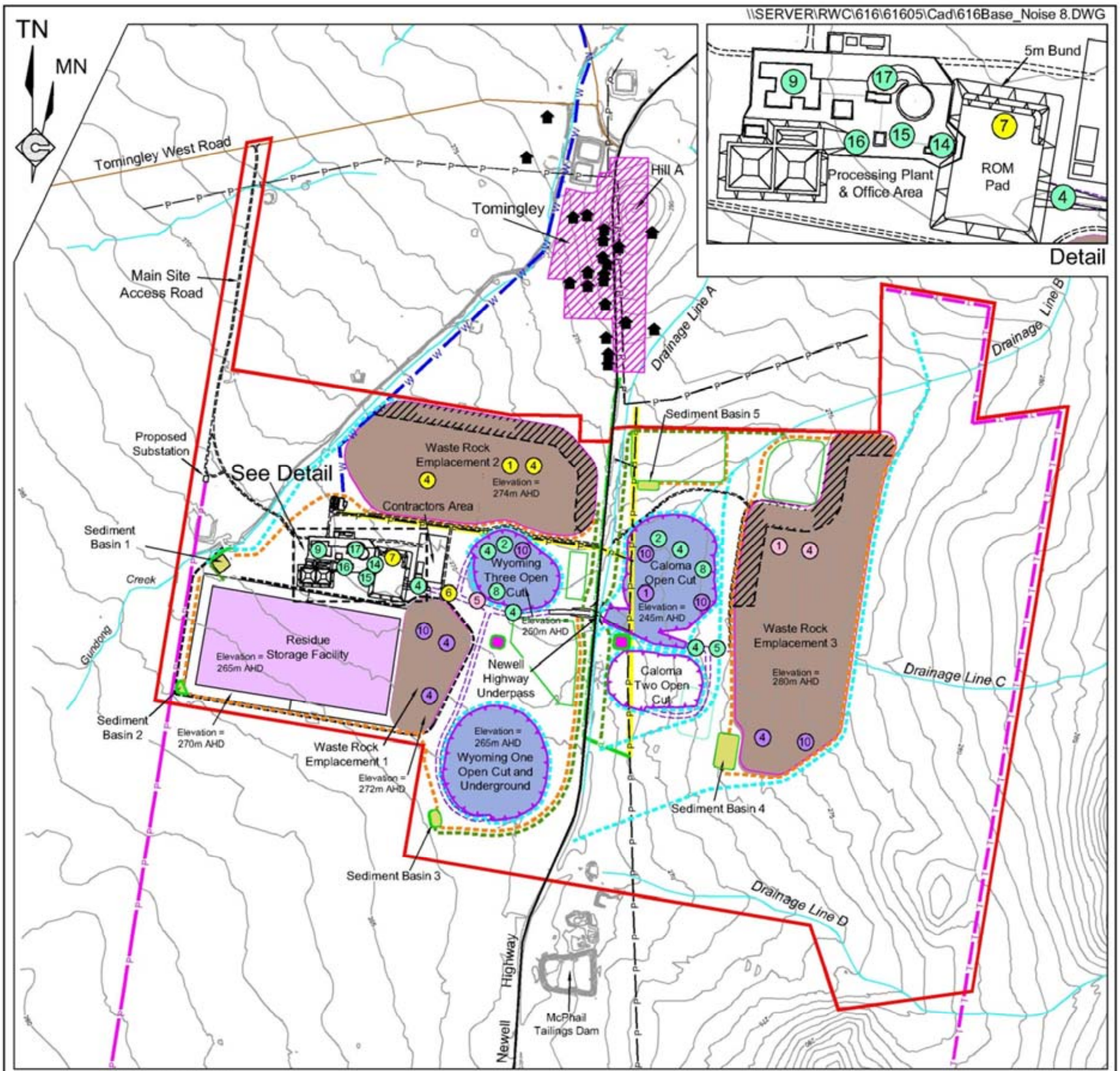
	Day Shift	Evening Shift	Night Shift	Equipment
1	3	0	0	Bulldozer (Cat D10)
2	1	1	1 (0)	Excavator (Hitachi EX1200 - 120t)
3	1	1	1	Excavator (Hitachi 2N870 - 85t))
4	7	2	2	Haul Trucks (Caterpillar 777F)
5	3	3	0	Graders (Caterpillar 16H)
6	2	2	1 (0)	Water Truck (Caterpillar 796)
7	0	0	0	Front-end Loader (Caterpillar 988G)
8	1	1	0	Blast Hole Rig
9	0	0	0	Processing Plant (Ball Mill & Screen)
10	0	8	8	Lighting Plants (Evening & Night-time Only)
11	1	1	0	Vibrating Roller
12	0	0	0	Road Trucks
13	0	0	0	Scrapers

Note: Number in parentheses represents a further reduction in equipment operation required to reduce noise levels received at most affected residences to Project Specific Noise Level or less under noise enhancing (inversion) conditions (night time only).

Indicative Equipment Locations
- Day Shift Only (7:00am to 6:00pm)
- Day/Evening Shift Only (7:00am to 10:00pm)
- Evening/Night Shift Only (6:00pm to 7:00am)
- 24 hour Operation
- Not Operating

Figure 7
OPERATIONAL
SCENARIO 1B - MONTHS 10 to 12

Source: Alkane Resources Ltd



REFERENCE

- Mine Site Boundary
- Water Pipeline Route
- Proposed Limit of Mining
- Proposed Amenity Bund
- Proposed Surface Water Control Structure
- Proposed Road / Track
- Proposed Haul Road
- Existing Sealed Road
- Contour (m AHD)(Interval = 1m)
- Dewatering Pond
- Residence

Activities

- Road Construction
- Soil Stripping Operations
- Soil Stockpile Construction
- Waste Rock Emplacement Amenity Bund
- Overburden Removal/Mining Operations
- Waste Rock Emplacement / Bund Construction
- Residue Placement
- Rehabilitation in Progress

SCALE 1:30 000

500 0 500 1000 1500 m

	Day Shift	Evening Shift	Night Shift	Equipment
1	2	1	1 (0)	Bulldozer (Cat D10)
2	2	2	2 (0)	Excavator (Hitachi EX1200 - 120t)
3	0	0	0	Excavator (Hitachi 2N870 - 85t))
4	8	6	6 (1)	Haul Trucks (Caterpillar 777F)
5	2	1	1 (0)	Graders (Caterpillar 16H)
6	1	0	0	Water Truck (Caterpillar 796)
7	1	0	0	Front-end Loader (Caterpillar 988G)
8	2	2	2 (1)	Blast Hole Rig
9	1	1	1	Processing Plant (Ball Mill & Screen)
10	0	5	5	Lighting Plants (Evening & Night-time Only)
11	0	0	0	Vibrating Roller
12	0	0	0	Road Trucks
13	0	1	0	Scrapers
14	1	1	1	Primary Jaw Crusher
15	1	1	1	Secondary Cone Crusher
16	1	1	1	Screen Tower
17	1	1	1	Surge Plant Screen

Note: Number in parentheses represents a further reduction in equipment operation required to reduce noise levels received at most affected residences to Project Specific Noise Level or less under noise enhancing (inversion) conditions (night time only).

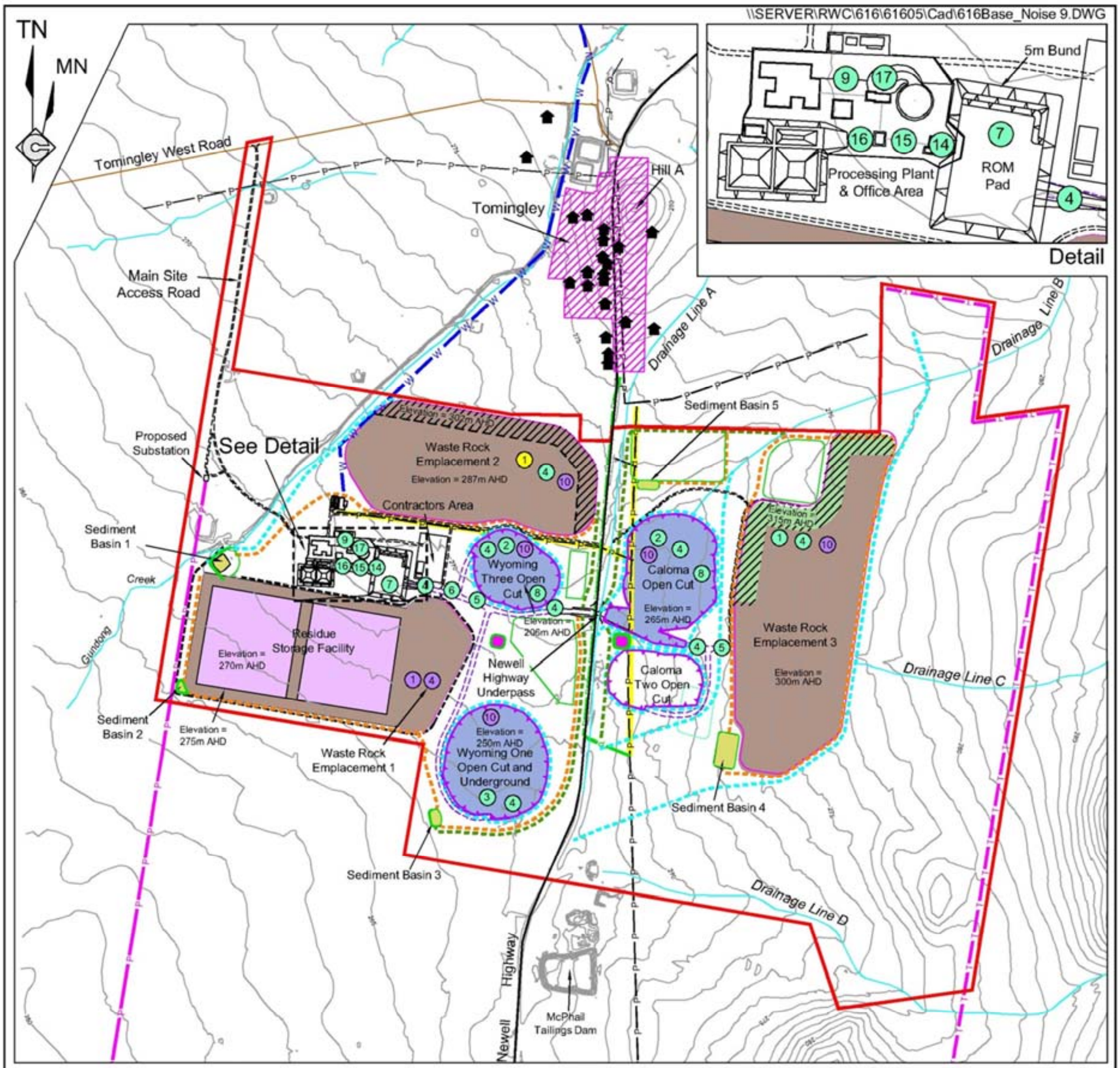
Indicative Equipment Locations

- (1) Day Shift Only (7:00am to 6:00pm)
- (1) Day/Evening Shift Only (7:00am to 10:00pm)
- (10) Evening/Night Shift Only (6:00pm to 7:00am)
- (4) 24 hour Operation

Source: Alkane Resources Ltd

Figure 8
OPERATIONAL
SCENARIO 2 - MONTH 15

\\SERVER\RWC\616\61605\Cad\616Base_Noise 9.DWG



REFERENCE

- Mine Site Boundary
- Water Pipeline Route
- Proposed Limit of Mining
- Proposed Amenity Bund
- Proposed Surface Water Control Structure
- Proposed Road / Track
- Proposed Haul Road
- Existing Sealed Road
- Contour (m AHD)(Interval = 1m)
- Dewatering Pond
- Residence

Activities

- Road Construction
- Soil Stripping Operations
- Soil Stockpile Construction
- Waste Rock Emplacement Amenity Bund
- Overburden Removal/Mining Operations
- Waste Rock Emplacement / Bund Construction
- Residue Placement
- Rehabilitation in Progress

SCALE 1:30 000

500 0 500 1000 1500 m

	Day Shift	Evening Shift	Night Shift	Equipment
1	2	1	1 (0)	Bulldozer (Cat D10)
2	2	2	2 (1)	Excavator (Hitachi EX1200 - 120t)
3	1	1	1	Excavator (Hitachi 2N870 - 85t))
4	8	8	8 (4)	Haul Trucks (Caterpillar 777F)
5	2	2	2 (1)	Graders (Caterpillar 16H)
6	1	1	1(0)	Water Truck (Caterpillar 796)
7	1	1	1	Front-end Loader (Caterpillar 988G)
8	2	2	2	Blast Hole Rig
9	1	1	1	Processing Plant (Ball Mill & Screen)
10	0	5	5	Lighting Plants (Evening & Night-time Only)
11	0	0	0	Vibrating Roller
12	0	0	0	Road Trucks
13	0	1	0	Scrapers
14	1	1	1	Primary Jaw Crusher
15	1	1	1	Secondary Cone Crusher
16	1	1	1	Screen Tower
17	1	1	1	Surge Plant Screen

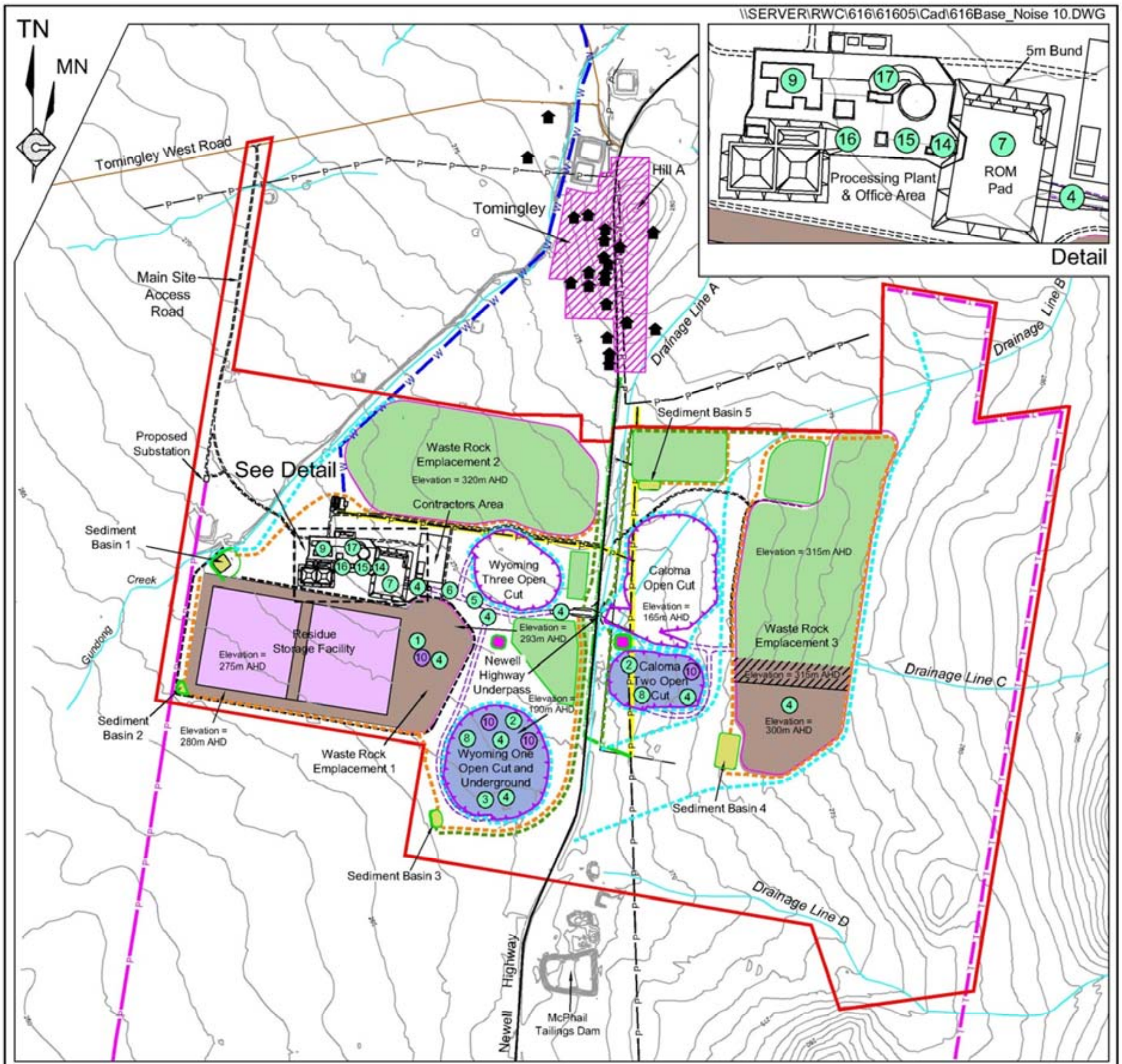
Note: Number in parentheses represents a further reduction in equipment operation required to reduce noise levels received at most affected residences to Project Specific Noise Level or less under noise enhancing (inversion) conditions (night time only).

Indicative Equipment Locations

- Day Shift Only (7:00am to 6:00pm)
- Day/Evening Shift Only (7:00am to 10:00pm)
- Evening/Night Shift Only (6:00pm to 7:00am)
- 24 hour Operation

Figure 9
OPERATIONAL SCENARIO 3
- END YEAR 2

Source: Alkane Resources Ltd



REFERENCE

- Mine Site Boundary
- Water Pipeline Route
- Proposed Limit of Mining
- Proposed Amenity Bund
- Proposed Surface Water Control Structure
- Proposed Road / Track
- Proposed Haul Road
- Existing Sealed Road
- Contour (m AHD)(Interval = 1m)
- Dewatering Pond
- Residence

Activities

- Road Construction
- Soil Stripping Operations
- Soil Stockpile Construction
- Waste Rock Emplacement Amenity Bund
- Overburden Removal/Mining Operations
- Waste Rock Emplacement / Bund Construction
- Residue Placement
- Rehabilitation in Progress

SCALE 1:30 000

500 0 500 1000 1500 m

	Day Shift	Evening Shift	Night Shift	Equipment
1	1	1	1 (0)	Bulldozer (Cat D10)
2	2	2	2 (1)	Excavator (Hitachi EX1200 - 120t)
3	1	1	1	Excavator (Hitachi 2N870 - 85t))
4	8	8	8 (4)	Haul Trucks (Caterpillar 777F)
5	2	2	1	Graders (Caterpillar 16H)
6	1	1	1	Water Truck (Caterpillar 796)
7	1	1	1	Front-end Loader (Caterpillar 988G)
8	2	2	2	Blast Hole Rig
9	1	1	1	Processing Plant (Ball Mill & Screen)
10	0	4	4	Lighting Plants (Evening & Night-time Only)
11	0	0	0	Vibrating Roller
12	0	0	0	Road Trucks
13	0	1	0	Scrapers
14	1	1	1	Primary Jaw Crusher
15	1	1	1	Secondary Cone Crusher
16	1	1	1	Screen Tower
17	1	1	1	Surge Plant Screen

Note: Number in parentheses represents a further reduction in equipment operation required to reduce noise levels received at most affected residences to Project Specific Noise Level or less under noise enhancing (inversion) conditions (night time only).

Indicative Equipment Locations

- (1) Day Shift Only (7:00am to 6:00pm)
- (10) Evening/Night Shift Only (6:00pm to 7:00am)
- (4) 24 hour Operation

Figure 10
OPERATIONAL SCENARIO 4
- END YEAR 4

Source: Alkane Resources Ltd

7.2 Modelling Assumptions

7.2.1 Mobile Equipment and Fixed Plant Noise Emissions

Table 25 presents a list of the Sound Power Levels for each of the items of plant and equipment available for use over the life of the mine. The numbers of each item of plant and equipment presented in **Table 25** represents the maximum availability of each based on the mine production schedule.

Table 25
Available Plant and Equipment

Item	Sound Power Level (dB(A) re. 1 pW)	Maximum Number of Items Available									
		Scenario 1A		Scenario 1B		Scenario 2		Scenario 3		Scenario 4	
		D[1]	E/N[2]	D[1]	E/N[2]	D[1]	E/N[2]	D[1]	E/N[2]	D[1]	E/N[2]
Dozer (CAT D10)	118dB(A)	3	3	3	3	2	2	2	2	1	1
Excavator (Hitachi EX1200)	115dB(A)	2	2	2	2	2	2	2	2	2	2
Excavator (Hitachi 2N870)	118dB(A)	0	0	1	1	0	0	1	1	1	1
Haul Truck (CAT 777F)	118dB(A)	8	8	8	8	8	8	8	8	8	8
Grader (CAT 16H)	115dB(A)	3	3	3	3	2	2	2	2	1	1
Water Truck (CAT 796)	118dB(A)	1	1	2	2	1	1	1	1	1	1
Front End Loader (CAT 988G)	115dB(A)	0	0	0	0	1	1	1	1	1	1
Blast Hole Rig	112dB(A)	0	0	1	1	2	2	2	2	2	2
Processing Plant	108dB(A)	0	0	0	0	1	1	1	1	1	1
Lighting Plant	90dB(A)	0	4	0	8	0	5	0	5	0	4
Vibrating Roller	114dB(A)	0	0	1	1	0	0	0	0	0	0
Road Truck	104dB(A)	2	2	0	0	0	0	0	0	0	0
Scraper (CAT 657)	113dB(A)	4	4	0	0	0	0	0	0	0	0
Primary Jaw Crusher	81dB(A)	0	0	0	0	1	1	1	1	1	1
Secondary Crusher	113dB(A)	0	0	0	0	1	1	1	1	1	1
Primary Screen	117dB(A)	0	0	0	0	1	1	1	1	1	1
Surge Bin for Ball Mill	102dB(A)	0	0	0	0	1	1	1	1	1	1
Stockpile Discharge	101dB(A)	0	0	0	0	1	1	1	1	1	1

Note 1: Daytime operation only.
Note 2: Evening and night-time operation only.

Following the completion of initial modelling incorporating the equipment numbers and locations nominated in **Table 25**, exceedances of the PSNL's were predicted at a number of residences surrounding the Mine Site. Reasonable and feasible noise management and mitigation measures, including use of low noise equipment, i.e. individual equipment attenuation, and operational controls, i.e. restrictions on the number and location of equipment, were then considered to reduce the predicted noise levels at these locations. The following provides a summary of the process followed to identify reasonable, feasible and effective noise mitigation measures.

7.2.2 Feasible and Reasonable Mitigation Investigations

During the initial assessment phase, the following process was followed to ascertain potential unmitigated noise emissions and to assess the feasibility and practicability of implementing noise mitigation and management measures to reduce the Project noise emissions at residences.

- Preliminary noise modelling of critical years was completed in order to identify potential areas of affectation, as well as investigate various noise mitigation and management measures to assess their relative effectiveness.
- Consideration was then given to various combinations of noise mitigation and management measures to minimise the potential noise affectation zone, and adoption of mitigation measures (including a fully mitigated mobile fleet) that significantly reduce the Project's operational noise emissions.

The Proponent has advised that the cost associated with attenuating individual mobile equipment economically is unreasonable. However, the Proponent has committed to maintaining the mobile equipment fleet to achieve the predicted noise emission levels present in **Section 8**. This acknowledges that the overall LAeq sound power levels (SWLs) presented in **Table 25** are indicative only, and it is the total mine SWL that would be used by the Proponent to manage the on-site noise emissions.

This notwithstanding, the overall SWLs for the mobile equipment are based on current demonstrated "achievable" noise emission standards. Further reductions may be possible in the future. Initial cost estimates to install, maintain and service the "achievable" noise controls have been undertaken and are included in the Project's operating budgets.

Subsequent detailed design studies may be required to refine individual SWLs and to prepare procurement specifications in order to ensure that the approved off-site environmental noise limits are achieved.

On the basis that attenuation of noise levels of individual equipment was identified as unreasonable, reductions in the number of operating equipment was investigated. Advice was sought from the Proponent and **Table 26** presents a list of the minimum plant and equipment that could be operated for each noise modelling scenario (without impacting on the viability of the Project). It has been assumed for modelling purposes that all items of plant and equipment are reasonably new and in well maintained condition, and that no additional noise mitigation (i.e. beyond the manufactures' standard) has been applied to individual items. **Figures 6** to **10** illustrate the approximate locations of all equipment modelled for Scenarios 1A to 4 for different periods of the day (day, evening and night) and under the prevailing meteorological conditions (see Section 7.3).

Table 26
Modelled Plant and Equipment

Item	Maximum Number of Items Modelled														
	Scenario 1A			Scenario 1B			Scenario 2			Scenario 3			Scenario 4		
	D[1]	E/NC[2]	NI[3]	D[1]	E/NC[2]	NI[3]	D[1]	E/NC[2]	NI[3]	D[1]	E/NC[2]	NI[3]	D[1]	E/NC[2]	NI[3]
Dozer (CAT D10)	0	0	0	3	0	0	2	1	0	2	1	0	1	1	0
Excavator (Hitachi EX1200)	1	1	1	1	1	0	2	2	1	2	2	1	2	2	1
Excavator (Hitachi 2N870)	0	0	0	1	1	1	0	0	0	1	1	1	1	1	1
Haul Truck (CAT 777F)	3	3	3	7	2	2	8	6	1	8	8	4	8	8	4
Grader (CAT 16H)	2	0	0	3	0	0	2	1	0	2	2	1	1	1	1
Water Truck (CAT 796)	1	1	0	2	1	0	1	0	0	1	1	0	1	1	1
Front End Loader (CAT 988G)	0	0	0	0	0	0	1	0	0	1	1	1	1	1	1
Blast Hole Rig	0	0	0	1	0	0	2	2	1	2	2	2	2	2	2
Processing Plant	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1
Lighting Plant	0	4	4	0	8	8	0	5	5	0	5	5	0	4	4
Vibrating Roller	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Road Truck	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0
Scraper (CAT 657)	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Primary Jaw Crusher	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1
Secondary Crusher	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1
Primary Screen	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1
Surge Bin for Ball Mill	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1
Stockpile Discharge	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1

Note 1: Daytime operation only.
Note 2: Evening and night-time calm operation only.
Note 3: Night-time inversion operation only.

A further iteration of noise modelling, applying the restriction in mobile equipment operation identified by **Table 26**, was then completed. The results still indicated exceedances of the PSNL's at many residences surrounding the Mine Site. Additional noise attenuation through a reduction in the noise emitted from fixed plant operations (crushing, screening and milling operations) was then considered. In order to determine the most effective approach to fixed plant noise attenuation, a review of the relative contribution of the individual items of crushing, screening and processing fixed plant was completed. This review identified that the secondary crusher, screen tower and ball mill represented the three critical noise sources requiring mitigation. For practical reasons associated with requirements for crane and other equipment access to the processing plant, enclosure or cladding of the ball mill and associated plant was not considered feasible. As a result, the level of noise mitigation (sound power level reduction) applied at the secondary crusher and screen tower was increased, namely, enclosure of the secondary crusher and primary screens to achieve a sound power level reduction of 13dBA. In order to achieve this level of sound power level reduction, the following (or equivalent) enclosure would be constructed around the secondary crusher and screen tower.

- Double cladding comprising two layers of Colorbond with an absorptive Rockwool (or similar) layer in between.
- Absorptive lining (Rockwool or similar) on the inside of the secondary crushing building.
- Isolation of the screen from the rest of the screening building/enclosure in order to reduce vibration and structure borne noise.

The following feasible and reasonable noise controls have subsequently been included in the predictive modelling and assessment of noise-related impacts.

- Achieving the nominal overall LAeq sound power levels (SWLs) presented in **Table 25**.
- Restricting plant operations as indicatively presented in **Table 26**.
- Attenuation to the secondary crusher and primary screens to achieve a 13dB reduction in the sound power level emitted, i.e. reduce the secondary crusher from 113dB to 100dB and the primary screens from 117dB to 104dB.

Modelling of mining operations include all proposed noise sources identified on **Figures 6** to **10** operating concurrently in order to simulate the overall maximum energy equivalent (i.e. $L_{Aeq(15minute)}$) intrusive noise level for each scenario. A large proportion of the mobile equipment is operated in repeatable routines and representative waste rock and ore truck transportation cycles have been included in the modelling.

7.3 Meteorological Parameters

The Environmental Noise Model (ENM) noise modelling meteorological parameters presented in **Table 27** are based on the prevailing wind speeds as determined in **Section 5.1** of this report and *Section 5* of the *INP*.

Table 27
Modelled Meteorological Scenarios

Period	Meteorological Condition	Air Temperature	Relative Humidity	Wind Velocity	Temperature Gradient
Daytime	Calm	18˚C	60%	0m/s	0˚C/100m
Evening	Calm	12˚C	75%	0m/s	0˚C/100m
Night-time	Calm	6˚C	90%	0m/s	0˚C/100m
Night-time	Inversion	6˚C	90%	0m/s	3˚C/100m

8 INTRUSIVENESS NOISE IMPACT ASSESSMENT

8.1 Introduction

The noise levels presented in this section are based on the assumption that the Proponent will implement both real-time noise monitoring and real-time weather monitoring, such that mine operations can be adjusted where necessary (including plant relocation and/or shut-downs as indicatively presented in **Table 26**) in order to achieve compliance with the PSNL's. The model results are therefore provided for each scenario incorporating the number of operating equipment nominated in **Table 26**. It is noted that the same or greater level of noise mitigation may be achievable through the implementation of alternative noise attenuation measures, e.g. individual equipment noise attenuation, alternative locations of operating equipment or modified operating technique. The results presented in Sections 8.2 to 8.6 simply illustrate that effective noise mitigation can be achieved.

8.2 Noise Impact Assessment – Scenario 1A

The predicted (point to point) $L_{Aeq(15minute)}$ intrusive noise emissions during Scenario 1A operations at the surrounding residences are presented in **Table 28**, together with the project specific assessment criteria.

Table 28
Scenario 1A $L_{Aeq(15minute)}$ Intrusive Emissions (dB(A) re 20μPa)

NAG	Residence Reference	Daytime		Evening		Night-time		
		Calm	Project Specific Criteria	Calm	Project Specific Criteria	Calm	Inversion	Project Specific Criteria
A	R1	32	35	24	35	25	30	35
	R4	21	35	19	35	19	33	35
	R5	24	35	25	35	25	27	35
	R6	22	35	22	35	22	24	35
	R8	17	35	10	35	10	15	35
	R9	20	35	14	35	15	20	35
	R10	25	35	19	35	19	25	35
	R11	23	35	17	35	18	23	35
	R12	16	35	11	35	12	17	35
B	R2	25	36	22	35	22	25	35
C	R3	<u>**49**</u>[2]	45	31	35	31	34	35
	R13	30	45	23	35	23	28	35
	R18	39	45	27	35	27	31	35
	R20	40	45	28	35	28	31	35
	R24	43	45	28	35	29	32	35
	R25	41	45	28	35	29	31	35
	R26	42	45	28	35	29	31	35
	R27	43	45	29	35	29	32	35
	R28	**46**[1]	45	30	35	30	33	35
	R29	<u>**48**</u>[2]	45	30	35	31	34	35
	R33	44	45	29	35	29	32	35
	R35	40	45	28	35	29	30	35
D	R16	38	43	26	38	26	30	36
	R17	38	43	25	38	26	31	36
	R22	41	43	27	38	28	32	36
	R23	42	43	28	38	28	33	36
	R32	43	43	28	38	29	32	36
	R37	36	43	26	38	27	31	36

Note 1: Marginal Noise Management Zone 1 to 2dB(A) above project specific criteria (**bold** text).
Note 2: Moderate Noise Management Zone 3 to 5dB(A) above project specific criteria (<u>**bold**</u> text).

The $L_{Aeq(15minute)}$ intrusive noise contour diagrams for Scenario 1A daytime and night-time (calm) are presented in **Appendix C** (**Figures AC-1** to **AC-4**). (The calculation of the noise contours involves numerical interpolation of a noise level array with a graphical accuracy of up to approximately ±2.5dB(A)).

8.3 Noise Impact Assessment – Scenario 1B

The predicted (point to point) $L_{Aeq(15minute)}$ intrusive noise emissions during Scenario 1B operations at the surrounding residences are presented in **Table 29** together with the project specific assessment criteria.

The $L_{Aeq(15minute)}$ intrusive noise contour diagrams for Scenario 1B daytime and night-time (calm) are presented in **Appendix C** (**Figures AC-5** to **AC-8**). (The calculation of the noise contours involves numerical interpolation of a noise level array with a graphical accuracy of up to approximately ±2.5dB(A)).

Table 29
Scenario 1B $L_{Aeq(15minute)}$ Intrusive Emissions (dB(A) re 20μPa)

NAG	Residence Reference	Daytime		Evening		Night-time		
		Calm	Project Specific Criteria	Calm	Project Specific Criteria	Calm	Inversion	Project Specific Criteria
A	R1	33	35	26	35	26	30	35
	R4	26	35	19	35	20	26	35
	R5	28	35	24	35	25	23	35
	R6	25	35	20	35	20	24	35
	R8	21	35	16	35	17	18	35
	R9	22	35	18	35	18	22	35
	R10	29	35	22	35	22	27	35
	R11	26	35	20	35	20	25	35
	R12	21	35	15	35	16	20	35
B	R2	28	36	19	35	20	21	35
C	R3	41	45	32	35	32	30	35
	R13	32	45	25	35	25	30	35
	R18	36	45	28	35	28	32	35
	R20	37	45	28	35	29	32	35
	R24	38	45	29	35	30	33	35
	R25	38	45	29	35	29	33	35
	R26	38	45	29	35	29	33	35
	R27	39	45	30	35	30	33	35
	R28	40	45	31	35	31	31	35
	R29	41	45	31	35	32	30	35
	R33	40	45	30	35	30	32	35
	R35	38	45	29	35	29	32	35
D	R16	34	43	27	38	27	32	36
	R17	34	43	27	38	27	32	36
	R22	37	43	29	38	29	33	36
	R23	37	43	29	38	30	33	36
	R32	41	43	30	38	30	31	36
	R37	37	43	28	38	28	32	36

8.4 Noise Impact Assessment – Scenario 2

The predicted (point to point) $L_{Aeq(15minute)}$ intrusive noise emissions during Scenario 2 operations at the surrounding residences are presented in **Table 30** together with the project specific assessment criteria.

The $L_{Aeq(15minute)}$ intrusive noise contour diagrams for Scenario 2 daytime and night-time (calm) are presented in **Appendix C** (**Figures AC-9** to **AC-12**). (The calculation of the noise contours involves numerical interpolation of a noise level array with a graphical accuracy of up to approximately ±2.5dB(A)).

Table 30
Scenario 2 $L_{Aeq(15minute)}$ Intrusive Emissions (dB(A) re 20μPa)

NAG	Residence Reference	Daytime		Evening		Night-time		
		Calm	Project Specific Criteria	Calm	Project Specific Criteria	Calm	Inversion	Project Specific Criteria
A	R1	32	35	30	35	32	35	35
	R4	24	35	21	35	24	24	35
	R5	22	35	21	35	24	26	35
	R6	27	35	27	35	29	30	35
	R8	21	35	20	35	23	21	35
	R9	24	35	22	35	25	26	35
	R10	28	35	26	35	29	30	35
	R11	27	35	25	35	28	29	35
	R12	23	35	21	35	23	24	35
B	R2	30	36	29	35	31	30	35
C	R3	38	45	35	35	**37**[1]	35	35
	R13	31	45	29	35	31	33	35
	R18	34	45	32	35	34	**36**[1]	35
	R20	35	45	33	35	35	**36**[1]	35
	R24	35	45	33	35	35	**36**[1]	35
	R25	35	45	33	35	35	**36**[1]	35
	R26	36	45	33	35	35	**36**[1]	35
	R27	36	45	34	35	**36**[1]	**36**[1]	35
	R28	37	45	35	35	**37**[1]	34	35
	R29	37	45	35	35	**37**[1]	34	35
	R33	36	45	34	35	**36**[1]	**36**[1]	35
	R35	35	45	33	35	35	**36**[1]	35
D	R16	33	43	31	38	33	35	36
	R17	33	43	31	38	33	36	36
	R22	35	43	33	38	35	36	36
	R23	35	43	33	38	35	35	36
	R32	36	43	34	38	36	36	36
	R37	34	43	32	38	34	35	36

Note 1: Marginal Noise Management Zone 1 to 2dB(A) above project specific criteria (**bold** text).

8.5 Noise Impact Assessment – Scenario 3

The predicted (point to point) $L_{Aeq(15minute)}$ intrusive noise emissions during Scenario 3 operations at the surrounding residences are presented in **Table 31** together with the project specific assessment criteria.

The $L_{Aeq(15minute)}$ intrusive noise contour diagrams for Scenario 3 daytime and night-time (calm) are presented in **Appendix C** (**Figures AC-13** to **AC-16**). (The calculation of the noise contours involves numerical interpolation of a noise level array with a graphical accuracy of up to approximately ±2.5dB(A)).

Table 31
Scenario 3 $L_{Aeq(15minute)}$ Intrusive Emissions (dB(A) re 20μPa)

NAG	Residence Reference	Daytime		Evening		Night-time		
		Calm	Project Specific Criteria	Calm	Project Specific Criteria	Calm	Inversion	Project Specific Criteria
A	R1	30	35	30	35	29	**36**[1]	35
	R4	28	35	27	35	27	35	35
	R5	32	35	32	35	32	**37**[1]	35
	R6	29	35	29	35	28	**36**[1]	35
	R8	22	35	22	35	22	33	35
	R9	23	35	23	35	23	33	35
	R10	27	35	27	35	26	35	35
	R11	27	35	27	35	26	35	35
	R12	23	35	23	35	22	32	35
B	R2	32	36	31	35	29	**36**[1]	35
C	R3	35	45	35	35	34	**38**[2]	35
	R13	29	45	29	35	28	**36**[1]	35
	R18	32	45	32	35	31	**36**[1]	35
	R20	33	45	32	35	32	**37**[1]	35
	R24	33	45	33	35	32	**36**[1]	35
	R25	33	45	33	35	32	**37**[1]	35
	R26	33	45	33	35	32	**37**[1]	35
	R27	34	45	34	35	33	**37**[1]	35
	R28	34	45	34	35	33	**37**[1]	35
	R29	35	45	35	35	33	**37**[1]	35
	R33	34	45	34	35	33	**37**[1]	35
	R35	33	45	33	35	32	**37**[1]	35
D	R16	31	43	31	38	30	36	36
	R17	31	43	31	38	30	36	36
	R22	33	43	32	38	32	36	36
	R23	33	43	32	38	32	36	36
	R32	34	43	34	38	33	**38**[1]	36
	R37	32	43	32	38	31	**37**[1]	36

Note 1: Marginal Noise Management Zone 1 to 2dB(A) above project specific criteria (**bold** text).
Note 2: Moderate Noise Management Zone 3 to 5dB(A) above project specific criteria (**bold** underlined text).

8.6 Noise Impact Assessment – Scenario 4

The predicted (point to point) $L_{Aeq(15minute)}$ intrusive noise emissions during Scenario 4 operations at the surrounding residences are presented in **Table 32** together with the project specific assessment criteria.

The $L_{Aeq(15minute)}$ intrusive noise contour diagrams for Scenario 4 daytime and night-time (calm) are presented in **Appendix C** (**Figures AC-17** to **AC-20**). (The calculation of the noise contours involves numerical interpolation of a noise level array with a graphical accuracy of up to approximately ±2.5dB(A)).

Table 32
Scenario 4 $L_{Aeq(15minute)}$ Intrusive Emissions (dB(A) re 20μPa)

NAG	Residence Reference	Daytime		Evening		Night-time		
		Calm	Project Specific Criteria	Calm	Project Specific Criteria	Calm	Inversion	Project Specific Criteria
A	R1	26	35	27	35	25	30	35
	R4	24	35	24	35	22	33	35
	R5	33	35	34	35	30	35	35
	R6	34	35	35	35	26	34	35
	R8	18	35	20	35	14	27	35
	R9	17	35	18	35	14	24	35
	R10	22	35	22	35	20	28	35
	R11	22	35	23	35	21	28	35
	R12	17	35	18	35	15	25	35
B	R2	31	36	32	35	26	34	35
C	R3	32	45	33	35	31	**36**[1]	35
	R13	23	45	24	35	21	27	35
	R18	27	45	28	35	26	31	35
	R20	29	45	29	35	27	32	35
	R24	28	45	29	35	26	31	35
	R25	29	45	30	35	27	33	35
	R26	29	45	30	35	27	33	35
	R27	30	45	31	35	28	33	35
	R28	31	45	32	35	30	35	35
	R29	32	45	33	35	30	35	35
	R33	31	45	32	35	29	35	35
	R35	29	45	30	35	28	32	35
D	R16	26	43	27	38	24	30	36
	R17	26	43	27	38	24	29	36
	R22	28	43	28	38	26	31	36
	R23	28	43	28	38	26	31	36
	R32	31	43	32	38	29	35	36
	R37	28	43	29	38	27	32	36

Note 1: Marginal Noise Management Zone 1 to 2dB(A) above project specific criteria (**bold** text).

8.7 Summary of Intrusive Noise Assessment

Table 33 presents a summary of all known non-mine owned residences where the intrusive Project-specific noise criteria are predicted to be exceeded during life of the Project. Based on the predicted $LA_{eq(15minute)}$ intrusive noise emissions for Scenarios 1A, 1B , 2, 3 and 4, the exceedances are placed into either the noise management zone and/or noise affectation zone. Note, the predicted exceedances are anticipated after implementing all feasible and reasonable noise controls including the relocation and/or shut-down of plant items as indicatively presented in **Table 26** and **Figures 6 to 10**.

Table 33
Summary of Potentially Impacted Non-Mine Owned Residences

NAG	Period	Noise Management Zone		Noise Affected Zone
		1dB(A) to 2dB(A) above Intrusive PSNL	3dB(A) to 5dB(A) above Intrusive PSNL	>5dB(A) above Intrusive PSNL
A	Day	-	-	-
	Evening	-	-	-
	Night (calm)		-	-
	Night (3ºC/100m)	1, 5, 6	-	-
B	Day	-	-	-
	Evening	-	-	-
	Night (calm)	-	-	-
	Night (3ºC/100m)	2		-
C	Day	28, 29	3	-
	Evening	3, 29	-	-
	Night (calm)	3, 28, 29, 33	-	-
	Night (3ºC/100m)	13, 18, 20, 24, 25, 26, 35	3, 27, 28, 29, 33	-
D	Day	-	-	-
	Evening	-	-	-
	Night (calm)	-	-	-
	Night (3ºC/100m)	32, 37	-	-

9 CUMULATIVE NOISE ASSESSMENT

In order to assess any cumulative noise emissions, it is important to appreciate and distinguish between the INP's first and second environmental noise control objectives as follows.

Intrusive Noise Criteria $L_{Aeq(15minute)}$

The INP's first objective, that the intrusive noise emission from any single development does not exceed the background level by more than 5dB(A), relates to individual industrial sites where the intrusive noise limit is generally specified in the Development Consent and/or Pollution Control Licence.

There is no established procedure (or regulatory requirement) to derive intrusive $L_{Aeq(15minute)}$ noise criteria for the cumulative operation of existing and/or approved industrial developments in a locality.

Noise Amenity Criteria $L_{Aeq(period)}$

The INP's second objective, that the $L_{Aeq(period)}$ amenity level (i.e. non-transport related) does not exceed the specified "acceptable" or "maximum" noise level appropriate for the particular locality and land use, is aimed at restricting the potential cumulative increase in amenity noise levels, otherwise known as "background creep".

The INP based acceptable and maximum noise amenity criteria (cumulatively for all industrial operations) for all the receivers are summarised in **Table 34**.

Table 34
INP Noise Amenity Assessment Criteria (dB(A) re 20µPa)

Receiver	Land Use	Amenity Assessment Criteria					
		Amenity $L_{Aeq(period)}$[1] Acceptable			Amenity $L_{Aeq(period)}$[1] Maximum		
		Daytime	Evening	Night-time	Daytime	Evening	Night-time
All Residences	Rural	50	45	40	55	50	45
Note 1: Daytime 7:00am to 6:00pm, Evening 6:00pm to 10:00pm and Night-time 10:00pm to 7:00am.							

There are no other significant industrial noise sources in the vicinity of the Project Site, and accordingly a cumulative noise assessment is not required.

10 OFF-SITE CONSTRUCTION NOISE IMPACT ASSESSMENT

10.1 Off-Site Construction Noise Assessment Methodology

Off-site construction activity associated with the Project would consist of the establishment of the supply water pipeline, which would comprise an area no greater than 5m wide and approximately 45.7km long within road reserves associated with:

- Webbs Siding Road;
- Sunnyside Lane;
- Bootles Road;
- Pinedene Road;
- Narromine-Tomingley Road; and
- Tomingley West Road.

The assessment of noise impacts associated with the construction of the supply water pipeline has been divided into four distinct stages:

- Clearing and site establishment;
- Trenching;
- Laying of pipeline; and
- Back-filling.

Table 35 presents a list of the Sound Power Levels for each of the items of equipment which will be utilised during the construction of the pipeline.

Table 35
Available Construction Equipment

Equipment	LAeq Sound Power Level (dB(A) re. 1 pW)	Duration of Use in a Typical 15 minute Period (minutes)			
		Clearing and Site Establishment	Trenching	Laying of Pipeline	Back-filling
Trencher	112 dB(A)	-	13	-	-
Grader	115 dB(A)	-	-	2	7.5
Excavator (10t)	94 dB(A)	7.5	2	7.5	7.5
Dozer (D6)	113 dB(A)	5	-	-	-
Ute mounted HDPE welder	97 dB(A)	-	-	10	-
Road Truck	104 dB(A)	-	-	5	3

10.2 Off-Site Construction Noise Assessment Results

The minimum distance required from the site of the construction associated with the water pipeline in order to comply with the construction noise criteria are presented in **Table 36** to **Table 39** for each NAG.

Table 36
Minimum Working Distances Required to Achieve the Construction Noise Management Levels within NAG A (R9)

Stage Of Construction	Minimum Working Distance (m)	
	Noise Affected (40 dB(A))	Highly Noise Affected (75 dB(A))
Clearing and Site Establishment	1039 m	18 m
Trenching	1480 m	26 m
Laying of Pipeline	937 m	17 m
Back-filling	1618 m	29 m

Table 37
Minimum Working Distances Required to Achieve the Construction Noise Management Levels within NAG B (R2)

Stage Of Construction	Minimum Working Distance (m)	
	Noise Affected (41 dB(A))	Highly Noise Affected (75 dB(A))
Clearing and Site Establishment	926 m	18 m
Trenching	1319 m	26 m
Laying of Pipeline	835 m	17 m
Back-filling	1442 m	29 m

Table 38
Minimum Working Distances Required to Achieve the Construction Noise Management Levels within NAG C (R13)

Stage Of Construction	Minimum Working Distance (m)	
	Noise Affected (50 dB(A))	Highly Noise Affected (75 dB(A))
Clearing and Site Establishment	328 m	18 m
Trenching	468 m	26 m
Laying of Pipeline	296 m	17 m
Back-filling	512 m	29 m

Table 39
Minimum Working Distances Required to Achieve the Construction Noise Management Levels within NAG D (R17)

Stage Of Construction	Minimum Working Distance (m)	
	Noise Affected (48 dB(A))	Highly Noise Affected (75 dB(A))
Clearing and Site Establishment	413 m	18 m
Trenching	589 m	26 m
Laying of Pipeline	373 m	17 m
Back-filling	644 m	29 m

Table 40 provides a prediction for the maximum LAeq(15min) noise level predicted at the closest residence in each NAG during construction activities associated with the water pipeline.

Table 40
Maximum Predicted $L_{Aeq(15min)}$ Construction Noise Level

Stage of Construction	Noise Assessment Group (Closest Residential Receiver)			
	A (R9)	B (R2)	C (R13)	D (R17)
Clearing and Site Establishment	58 dBA	35 dBA	59 dBA	62 dBA
Trenching	61 dBA	38 dBA	62 dBA	65 dBA
Laying of Pipeline	57 dBA	34 dBA	58 dBA	61 dBA
Back-filling	62 dBA	39 dBA	63 dBA	66 dBA

Tables 36 to **40** indicate that with the exception of NAG B, the construction works associated with the water pipeline would encroach within the minimum distance required to comply with the 'Noise Affected' construction noise criteria, resulting in short term noise levels of up to 66dB(A). However, given the duration of each stage of construction would be minimal (no more than a couple of hours over a period of less than 3 weeks) at any one residence, and assuming appropriate notification and site management are implemented, the impact is assess to be acceptable. Furthermore, the distance between the construction activities and the closest residence within each NAG is well in excess of the distance (29m) at which the 'Highly Noise Affected' criteria (75dB(A)) is predicted.

11 ROAD TRAFFIC NOISE IMPACT ASSESSMENT

11.1 Current and Proposed Road Transportation

11.1.1 Proposed Project-related Traffic Movements

The Proponent anticipates that there would be three principal transportation routes to access the Mine Site as follows:

- To/from Narromine - via the Tomingley - Narromine Road and Tomingley West Road.
- To/from Dubbo - via the Newell Highway, Tomingley - Narromine Road and Tomingley West Road.
- To/from Peak Hill and Parkes - via the Newell Highway, Tomingley - Narromine Road and Tomingley West Road.

Both the Newell Highway (State Highway 17) and the Tomingley - Narromine Road (Main Road 89) are State roads. Tomingley West Road is a local road administered by Narromine Shire Council.

During the normal operation stage, it is anticipated that the maximum number of employees on the Mine Site at any one time would be 65. For the purposes of the noise assessment, it has been conservatively assumed that each employee would commute to and from the Mine Site during a morning and afternoon peak in their own vehicle. Deliveries of plant and materials would also occur during the morning and afternoon peak but would more likely be spread over the day. Refer to **Table 41** for normal operation traffic volumes.

Table 41
Normal Operation Traffic Volumes

Activity		**Estimated Monthly Traffic Volumes**		**Estimated Daily Traffic Volumes**	
1.	Workers commuting	3,900	movements	128	movements
2.	Diesel deliveries	20	movements	1.3	movements
3.	Cyanide deliveries	29	movements	1.9	movements
4.	Lime deliveries	25	movements	1.7	movements
5.	Acid deliveries	9	movements	0.6	movements
6.	Carbon deliveries	7	movements	0.9	movements
7.	Oxygen deliveries	7	movements	0.5	movements
8.	Grinding media deliveries	21	movements	1.4	movements
9.	Stores deliveries	60	movements	4	movements
Traffic Volume Totals		4,078	movements	140.3	movements

Note 1: Traffic volumes are two-way.
Source: Alkane Resources Ltd.

The traffic distributions along the respective mine access routes are understood to be as follows:

- Tomingley West Road: 100%
- Tomingley – Narromine Road: 25% North / 75% South
- Newell Highway: 25% North / 75% South

Further, based on the traffic volumes presented in **Table 41** and information presented in the Traffic Impact Assessment (presented as Part 7 of the Specialist Consultant Studies Compendium and referred to hereafter as FJF (2010)). **Table 42** presents the anticipated peak hour traffic movements for the Project.

11.1.2 Road Traffic Noise Assessment Methodology

The noise impact assessment of the Project-related road traffic on the respective access roads was conducted through calculation of the existing and future traffic noise levels on the subject roads.

The US Environment Protection Agency's method was used for the prediction of the L_{Aeq} traffic noise levels for the offset distances of the closest residences adjacent to the access roads.

Table 42
Anticipated Peak Hour Traffic Movements for the Project

Daytime Peak Hour Vehicle Movements (7.00am to 8.00am, 6.00pm to 7.00pm and 7.00pm to 8.00pm)		
	Light	**Heavy**
Tomingley West Road	32	4
Tomingley – Narromine Road (North)[1]	8	1
Tomingley – Narromine Road (South)[2]	24	3
Newell Highway (North)[3]	8	1
Newell Highway (South)[4]	16	2
Night-time Peak Hour Vehicle Movements (6.00am to 7.00am)		
	Light	**Heavy**
Tomingley West Road	32	4
Tomingley – Narromine Road (North)[1]	8	1
Tomingley – Narromine Road (South)[2]	24	3
Newell Highway (North)[3]	8	1
Newell Highway (South)[4]	16	2

Note 1: Tomingley – Narromine Road north of the Tomingley West Road intersection.
Note 2: Tomingley – Narromine Road south of the Tomingley West Road intersection.
Note 3: Newell Highway north of the Tomingley – Narromine Road intersection.
Note 4: Newell Highway south of the Tomingley – Narromine Road intersection.

The US EPA's method of prediction of the L_{Aeq} noise levels from traffic is an internationally accepted theoretical traffic noise prediction model which takes into account the L_{Amax} vehicle noise levels (light and heavy), receiver offset distance, pass-by duration, vehicle speed, ground absorption (based on the ratio of soft ground and average height of propagation), number of hourly vehicle movements, receiver height, truck exhaust height and the height and location of any intervening barriers.

In relation to the existing traffic noise levels, the ECRTN, on page 11, Technical notes and tables, states that "*$L_{Aeq(1hr)}$ represents the highest tenth percentile hourly A-weighted L_{eq} during the period 7 am to 10 pm or the period 10 pm to 7 am*".

The allowable number of additional Project-related heavy vehicles on the respective access roads has therefore been based upon establishing the existing highest 10th percentile traffic noise level (based on the results from the Traffic Count Surveys conducted in April/May 2009 and presented in FJF (2010)) for the period of the day under investigation and determining the existing and future (with the Project) traffic noise levels.

11.1.3 Road Traffic Noise Assessment Results

Based on the measured existing traffic flows and traffic mix (light and heavy vehicles) on the respective access roads, **Table 43** presents the existing traffic noise levels as well as the future traffic noise levels and noise level increase, (with the Project) at the closest residences to the respective access roads.

Review of the road traffic noise level predictions presented in **Table 43** and the traffic noise criteria presented in **Table 16** and **Table 17** indicate the following:

- The existing daytime and night-time $L_{Aeq(1hour)}$ road traffic noise levels are lower than the NSW OEH's recommended assessment criteria of 60dB(A) and 55dB(A) at the closest residences on Tomingley West Road, Tomingley – Narromine Road (north) and Tomingley – Narromine Road (south).

Table 43
Existing and Future L_{Aeq} Traffic Noise Levels - dB(A)

Load	Minimum Offset Distance	Road Speed	Criterion		Existing Traffic Noise Levels		Future Traffic Noise Levels with TGP		Future Increase Above Existing	
			Day	Night	Day	Night	Day	Night	Day	Night
Tomingley West Road	88m	100km/hr	60 (1hr)	55 (1hr)	39.6	34.1	45.2	44.3	5.6	10.2
Tomingley – Narromine Road (North)	140m	100km/hr	60 (1hr)	55 (1hr)	42.8	38.7	43.4	40.2	0.6	1.5
Tomingley – Narromine Road (South)	222m	60km/hr	60 (1hr)	55 (1hr)	40.4	36.5	42.0	39.7	1.6	3.2
Newell Highway (South)	18m	50km/hr	60 (15hr)	55 (9hr)	60.8	55.7	61.0	56.2	0.2	0.5

- The existing daytime ($L_{Aeq(15hour)}$) and night-time ($L_{Aeq(9hour)}$) noise levels are higher than the NSW OEH's recommended assessment criteria of 60dB(A) and 55dB(A) at the closest residence on the Newell Highway (in Tomingley Village) by 0.8dB(A) and 0.7dB(A) respectively.
- Based on the proposed maximum hourly traffic flows (with the mine operational), refer to **Section 10.1.1**, the future traffic noise levels comply with the respective daytime and night-time criteria on Tomingley West Road, as well as the northern and southern sections of Tomingley – Narromine Road.
- As the recommended NSW OEH's daytime and night-time traffic noise criteria on the Newell Highway are already exceeded with the existing traffic, "*traffic arising from the development should not lead to an increase in existing noise levels of more than 2dB(A)*" (see **Table 22**). Reference to indicates that the increases in the daytime and night-time traffic noise levels resulting from the operation of the mine are only 0.2dB(A) and 0.5dB(A) respectively and therefore comply with the recommended criteria.

12 BLAST EMISSIONS IMPACT ASSESSMENT

12.1 Proposed Blasting Practices

In areas of the open pits, where materials may not be excavated, ore and waste rock material would be fragmented using drill and blast methods. Blast holes would be drilled using one or more hydraulic drill rigs.

Table 44 presents the indicative blast design parameters to be employed during blasting operations. In summary, typically one or more blast hole rigs would be used to drill holes with diameters of up to 89mm. Blast holes would typically be vertical and have a maximum depth of up to approximately 11m. These holes would be loaded with detonators, boosters and bulk explosive.

Table 44
Indicative Blast Design Parameters

Parameter	Oxide Material	Unweathered Material
Blast hole Diameter	89mm	
Blast hole Depth	5.5m to 11.0m	
Blast hole/Burden	4m x 4m	3m x 3m
Depth of Stemming	1.9m	
Area of Blast	1 600m^2	900m^2
Size of Blast	8 000m^3	4 500m^3
Bulk Explosive Type	ANFO (Emulsion if wet blastholes)	
Power Factor	0.25kg/BCM	0.60kg/BCM
Maximum Instantaneous Charge (MIC)	68kg	
Initiation System	Nonel	
Note: bcm - bank cubic metre		
Source: Alkane Resources Ltd		

12.2 Blast Emission Impact Assessment

12.2.1 Residential Receivers

Based on the nominated indicative blast design presented in **Table 44**, the level of blast emissions (ground vibration and airblast) can be predicted using the formula given in the Orica (ex ICI) Explosives Blasting Guide and AS 2187.2-1993, applicable to blasting to a free face in average rock. Also given in the Guide, and in the Standard, is a formula in relation to the prediction of airblast emissions. Both methods of blast emissions estimation are considered conservative.

The ground vibration and airblast criteria advocated by the OEH and the ANZECC cater for the inherent variation in emission levels from a given blast design by allowing a five percent exceedance of a general criterion up to a (never to be exceeded) maximum. Correspondingly, the “5% exceedance” prediction formulae were generated for the blast emission site laws.

The resulting formulae are as follows:

PVS (50%) = 1,140 (R/Q ^0.5) ^-1.6

PVS (5%) = 2,917 (R/Q ^0.5) ^-1.6

SPL (50%) = $164.2 - 24(\log_{10} R - 0.33 \log_{10} Q)$

SPL (5%) = $172.4 - 24(\log_{10} R - 0.33 \log_{10} Q)$

Where,

PVS = Peak Vector Sum ground vibration level (mm/s)

SPL = Peak airblast level (dBLinear)

R = Distance between charge and receiver (m)

Q = Charge mass per delay (kg)

and where PVS (50%) and (5%) and SPL (50%) and (5%) are the levels of ground vibration (Peak Vector Sum - mm/s) and airblast (dBLinear), above which 50% and 5% of the total population (of data points) will lie respectively, assuming that the population has the same statistical distribution as the underlying measured sample.

The relationship between distance and the Peak Vector Sum (PVS) ground vibration and peak airblast from the proposed mine blasting are presented in **Figure 11** and **Figure 12** respectively for an MIC of 68kg (corresponding to the highest MIC nominated in **Table 44**).

Figure 11 Peak Vector Sum Ground Vibration for an MIC of 68kg

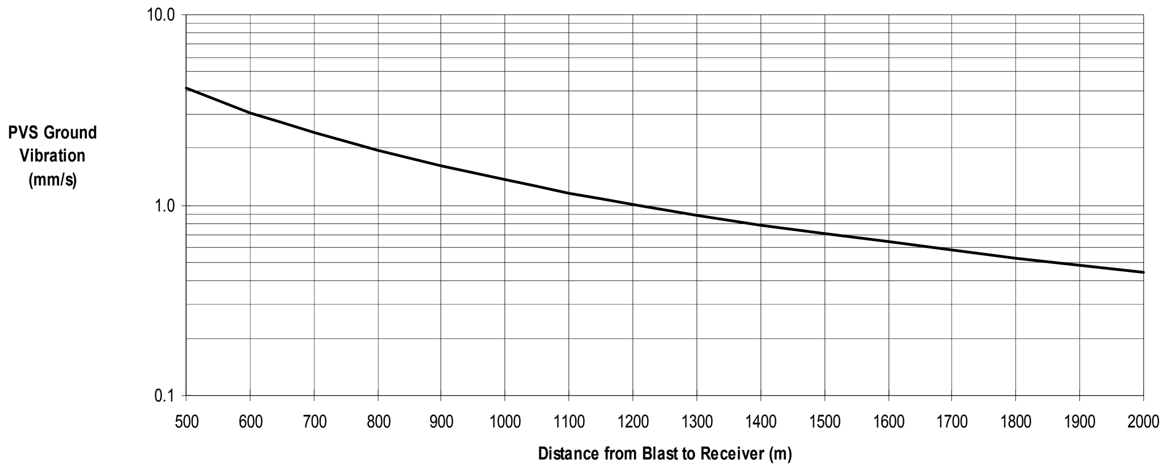
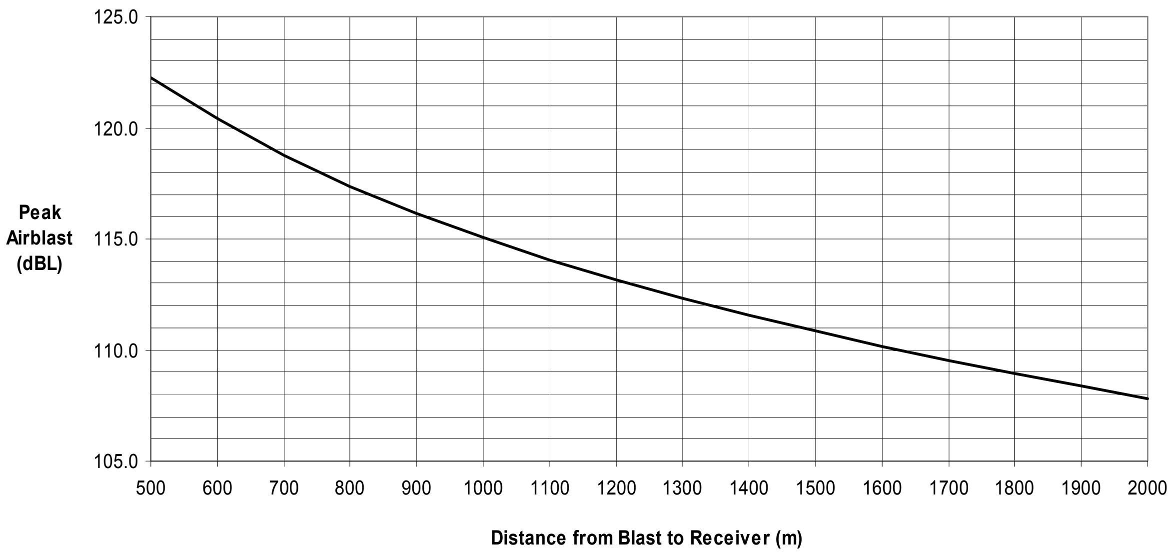


Figure 12 Peak Airblast for an MIC of 68kg



The predicted levels of blast emissions (5% likelihood of exceedance) were then determined using the closest distances from surrounding residences to the near extraction boundary of the Wyoming Three, Caloma, Caloma Two and Wyoming One Cuts. The predicted levels of PVS ground vibration velocity and peak airblast at the nearest potentially affected residence namely, Residence R3, are presented in **Table 45**.

Table 45
Predicted Levels of Blast Emissions at Residence R3 for 68kg MIC

Open-cut Blast Location	Offset Distance (m)	Ground Vibration (mm/s)	Airblast (dBLinear)
Wyoming Three	871	1.7	116.5
Caloma	715	2.3	118.6
Caloma Two	1,250	0.9	112.7
Wyoming One	1,579	0.7	110.3

The following information is derived from the predicted levels of blast emissions:

- The predicted levels of ground vibration at the closest residence, Residence R3, comply with the ANZECC's general human comfort criterion (of 5mm/s) and consequently with the maximum human comfort criterion of 10mm/s, as well as the AS2187-2006 (BS7385) structural damage criterion of 15mm/s (at 4Hz).
- The maximum predicted ground vibration level of 2.3mm/s occurs at Residence R3 using an MIC of 68kg at the near-point of the Caloma Open Cut.
- The predicted levels of peak airblast at all residences comply with the ANZECC's maximum human comfort criterion of 120dBLinear.
- The predicted level of airblast at the closest residence, Residence R3, for blasting at the near point of the Wyoming One and Caloma Two Open Cuts comply with the ANZECC's general human comfort criterion of 115dBLinear, however, exceedances of 1.5dBLinear and 3.6dBLinear are predicted for blasting at the near point of the Wyoming Three and Caloma Open Cuts respectively to Residence 3 for an MIC of 68kg (corresponding to the maximum bench height of 11m).
- The maximum predicted peak airblast level of 118.6dBLinear occurs at Residence 3 using an MIC of 68kg.
- If required, when blasting in the Caloma Open Cut approaches the near point to Residence 3, the MIC may need to be reduced through a reduction in bench height in order to achieve compliance with the ANZECC's 115dBLinear general airblast criterion.
- Similarly, if required, when blasting in the Wyoming Three Open Cut approaches the near point to Residence 3, the MIC may need to be reduced through a reduction in bench height in order to achieve compliance with the ANZECC's 115dBLinear general airblast criterion.
- The predicted levels of peak airblast are clearly well below the US Bureau of Mines damage limit of 132dBLinear.

Notwithstanding the above, it is recommended that all blasts are monitored at the closest/potentially most affected residence in order to establish, and to progressively update, blast emissions site laws (for ground vibration and airblast) in order to optimise future blast designs, based on actual site conditions. In this way, the site laws can be used to assist with the blast designs in order to ensure compliance with the ANZECC criteria is met.

By adopting this approach, in conjunction with the future introduction of improved blasting products, it is anticipated that the blast emissions criteria can be met without imposing any significant constraints on the blast designs throughout the life of the mine.

12.2.2 Newell Highway Underpass

In addition to the blast emissions impact assessment at the closest residences, a blasting impact assessment for the Newell Highway underpass, located approximately 370m from the near-point of blasting in the Wyoming Three Open Cut, has also been conducted.

The predicted maximum levels of vibration and airblast at the underpass are 6.6mm/s and 125.4dBLinear respectively. These blast emission (vibration and airblast) levels are clearly well below the structural damage criteria of 50mm/s vibration (for reinforced concrete structures) and 133dBLinear airblast, as discussed in **Section 6.4**.

For blasting in the Caloma Open Cut, for the indicative MIC of 68kg, the 50mm/s structural damage criterion corresponds to an offset distance of 105m. It is therefore strongly recommended that the underpass is monitored for blast vibration when blasting is conducted within, 70m of the underpass. The MIC applied to blasts approaching and exceeding this proximity may need to be reduced (based on specific blast design using site laws) to ensure compliance with the 50mm/s structural damage criterion.

12.2.3 Flyrock Assessment

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

There are generally two main areas within the blast from which flyrock has the potential to be produced. These are:

- At the blast hole collar (where the stemming length has not been optimised and the explosive column is too close to the upper surface of the rock mass creating crater effects - rifling).
- At the face of the blast, where less than optimum burden on one or more blast holes could result in a face blowout.

In order to minimise the potential for flyrock generation, the burden on the front-row blast holes would be checked by the blasting contractor and the loading of explosives in the blast hole modified accordingly.

In terms of collar ejection, the proposed stemming length presented in **Table 44** is considered optimum for the proposed blast hole length and has been selected in order to totally contain the explosives and separate them from the collar of the blast hole. Further, aggregate will be used as the stemming material (not drill dust), in order to fully contain the explosives within the blast hole. Where sub-optimal burden is identified, the blast holes would either not be charged or the adjacent face would be buttressed.

In relation to flyrock, Drilling Services Pty Ltd advised SLR that, based on their blasting experience and subject to the implementation of the mitigation measures detailed above, they are able to confidently state that blasted rock would fall within a blast envelope with dimensions:

- 50m in front of the face;
- 20m on either side of the face; and
- 10m behind the face.

Furthermore, such dimensions are consistent with industry best practice and are readily achievable.

Accordingly, flyrock may be managed through appropriate blast design to ensure there is no flyrock risk to the public using the Newell Highway, or to any of the surrounding residences.

13 NOISE MANAGEMENT AND CONTROL

13.1 Proposed Noise Management Practices

The following feasible and reasonable noise controls are proposed.

- Informing all potentially impacted residents during the construction of the supply water pipeline where works will come within the Minimum Working Distances presented in **Section 10.1**. Residents would be notified of the nature of the works to be carried out, the expected noise levels, the duration of the works as well as contact details.
- Achieving the nominal overall LAeq sound power levels (SWLs) presented in **Table 25**.
- Restricting plant operations as indicatively presented in **Table 26**.
- Noise attenuation to secondary crusher and primary screens to achieve a 13dB reduction in sound power level at each source.

Alternatively, or in addition to the controls identified above, the following noise mitigation and management controls may also be considered in order to achieve the predicted noise emission levels present in this assessment.

- Additional plant mitigation, i.e. reduction of individual SWL's of mining equipment.
- Use of alternative mining methods and/or plant and equipment.
- Review, calibration and updating of Project noise model.
- Negotiated agreements with surrounding residents.

13.2 Noise Management Plan

The Proponent would produce a Noise Management Plan (NMP) within three months of commencing site activities. The NMP would address all relevant consent conditions, and would also include details on the implementation and operation of both a real-time noise monitoring device and an on-site weather station. Specific items which may be addressed in the NMP include.

- Minimum noise mitigation requirements and site best practices to be implemented by all mine personnel.
- Noise monitoring procedures and real-time noise monitoring trigger levels.
- Weather station monitoring procedures and adverse weather trigger levels.
- Measures which would be implemented in the event of exceedences in either noise or adverse weather trigger levels.
- Noise monitoring reporting procedures.
- Mobile plant and equipment maximum sound power levels and compliance monitoring procedures.
- Community liaison and complaints handling procedures.

The ICNG sets out procedures to deal with the impacts of construction noise on residences and other sensitive land uses. While the INCG explicitly excludes construction associated with mining activities from the presented assessment methods, it would still provide important guidance to be incorporated into the NMP, particularly for the management for construction works during Scenario 1A.

APPENDICES

(No. of pages excluding this page = 62)

Appendix A	**Statistical Ambient Noise Levels**
Appendix B	**Frequency of Occurrence of Each Stability Class**
Appendix C	**Intrusive Noise Contours**
Appendix D	**Director-General's Requirements**

Note: Appendices A, B and C are provided in full on the Project CD

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Appendix A
STATISTICAL AMBIENT NOISE LEVELS

(No. of pages excluding this page = 28)

(A copy of this Appendix is available on the Project CD)

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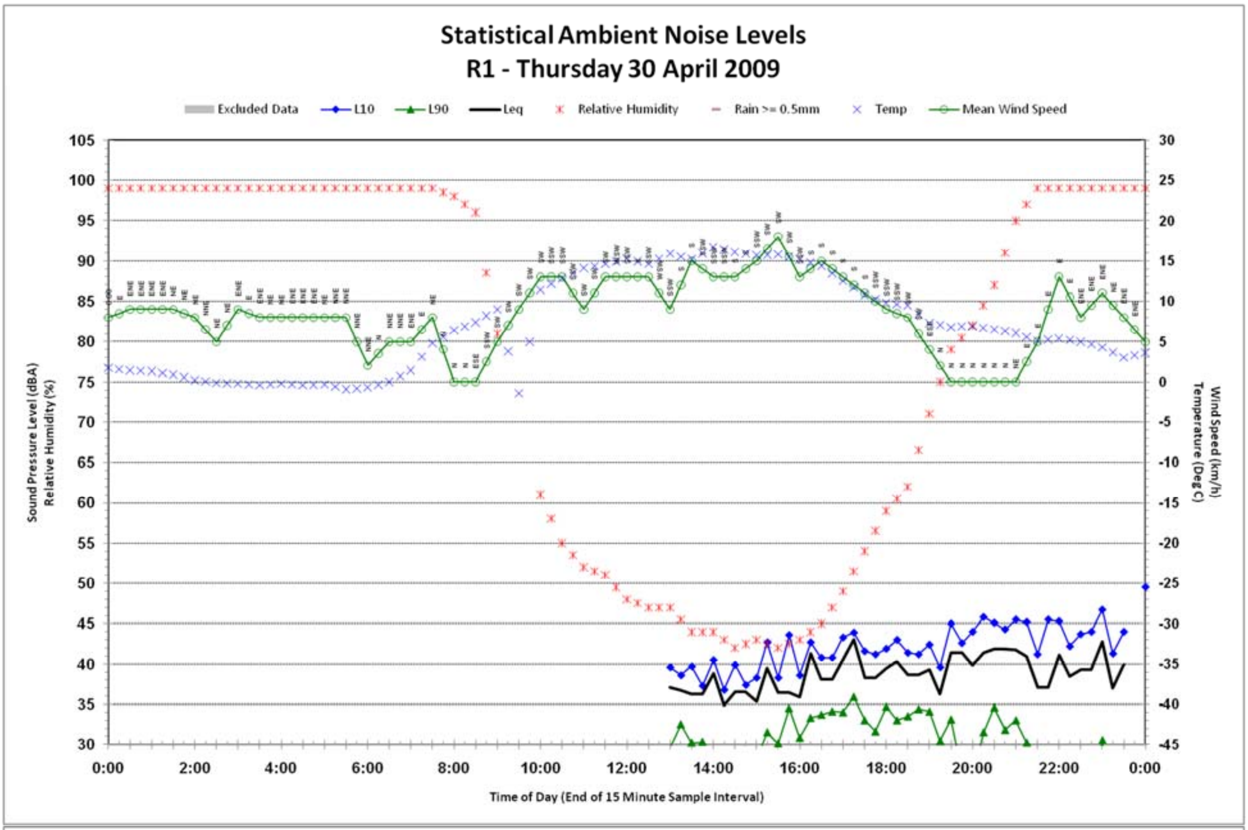
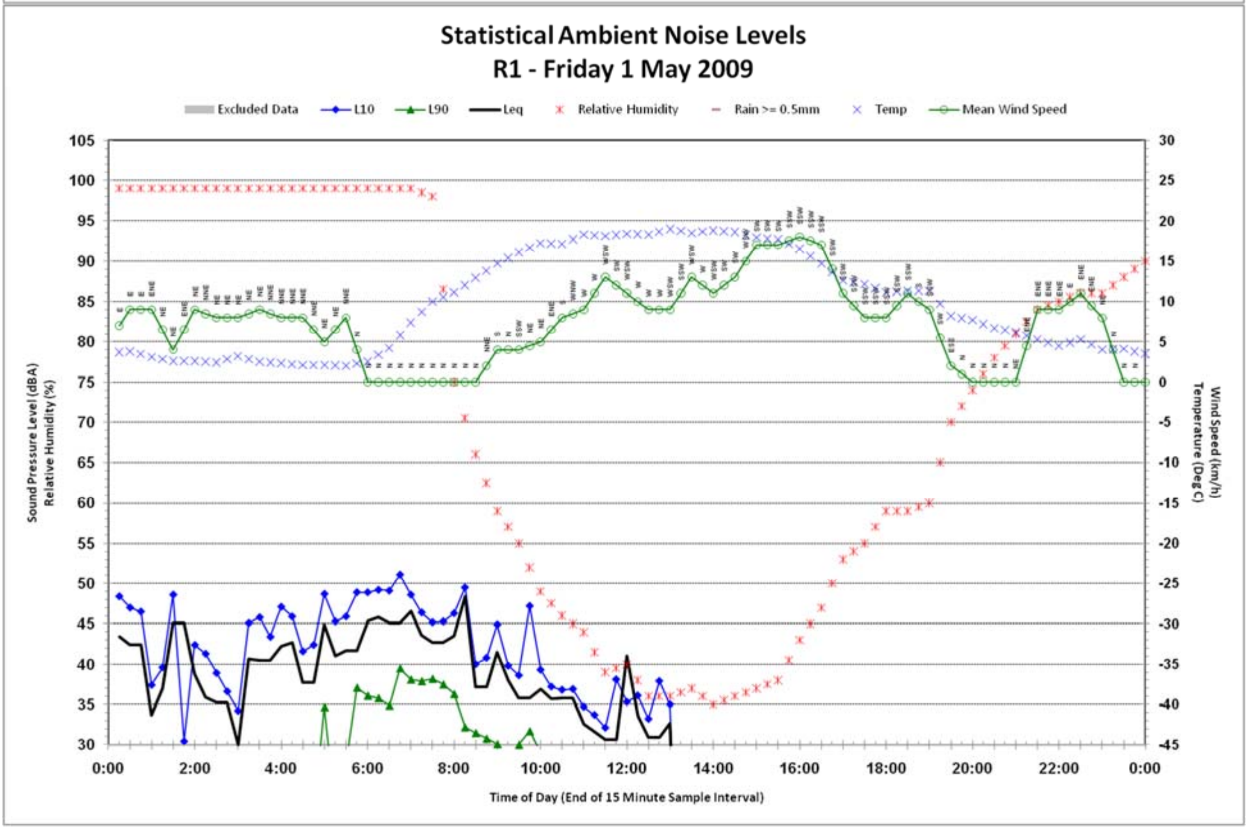

Statistical Ambient Noise Levels
R1 - Thursday 30 April 2009
Excluded Data
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)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R1 - Friday 1 May 2009
Excluded Data
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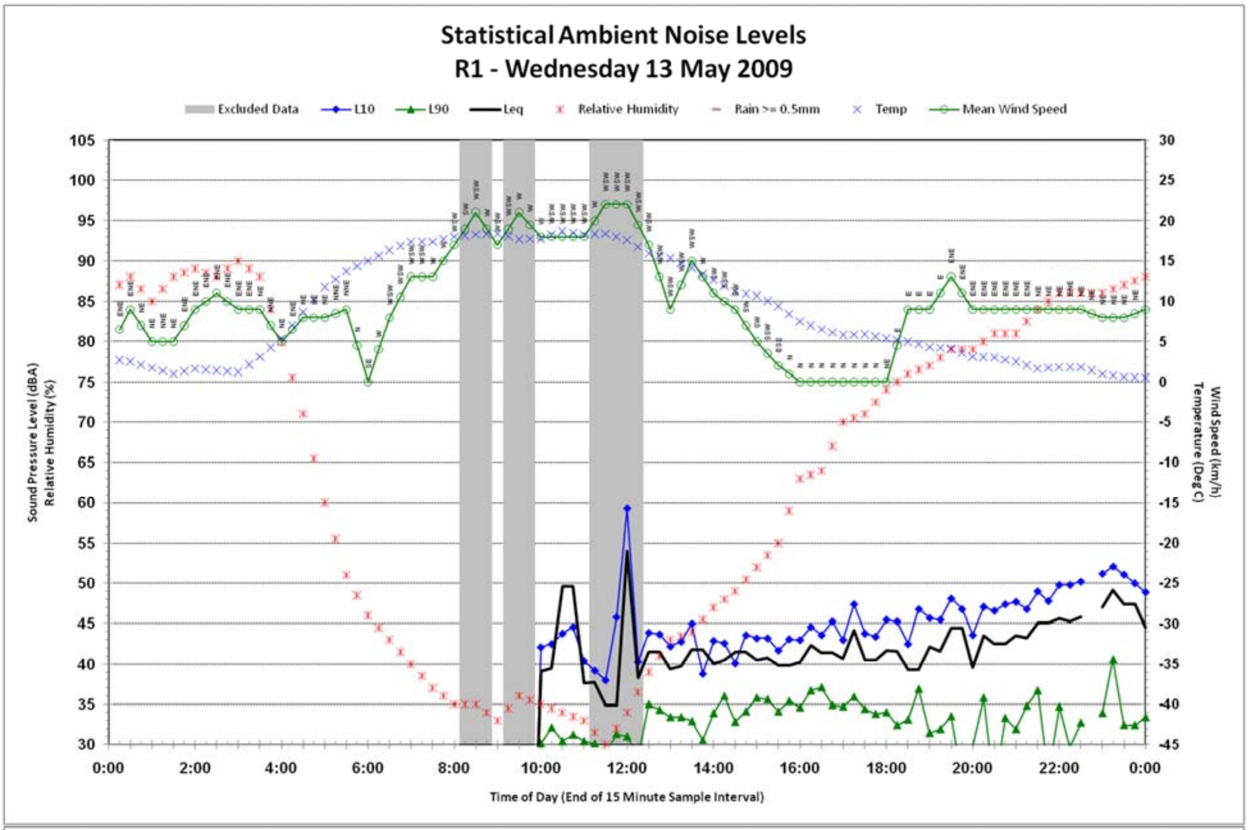
L90
Leq
Relative Humidity
Rain >= 0.5mm
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)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Excluded Data
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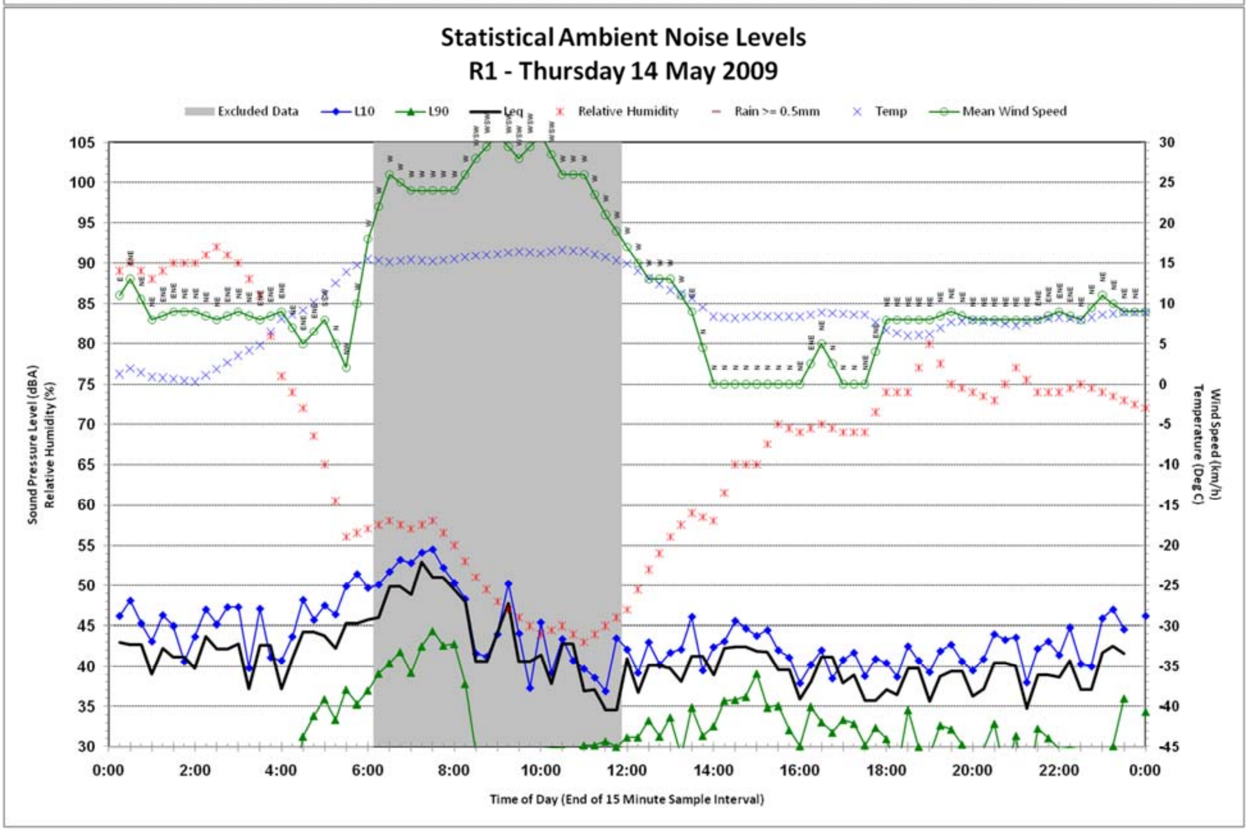
L90
Leq
Relative Humidity
Rain >= 0.5mm
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)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Leq
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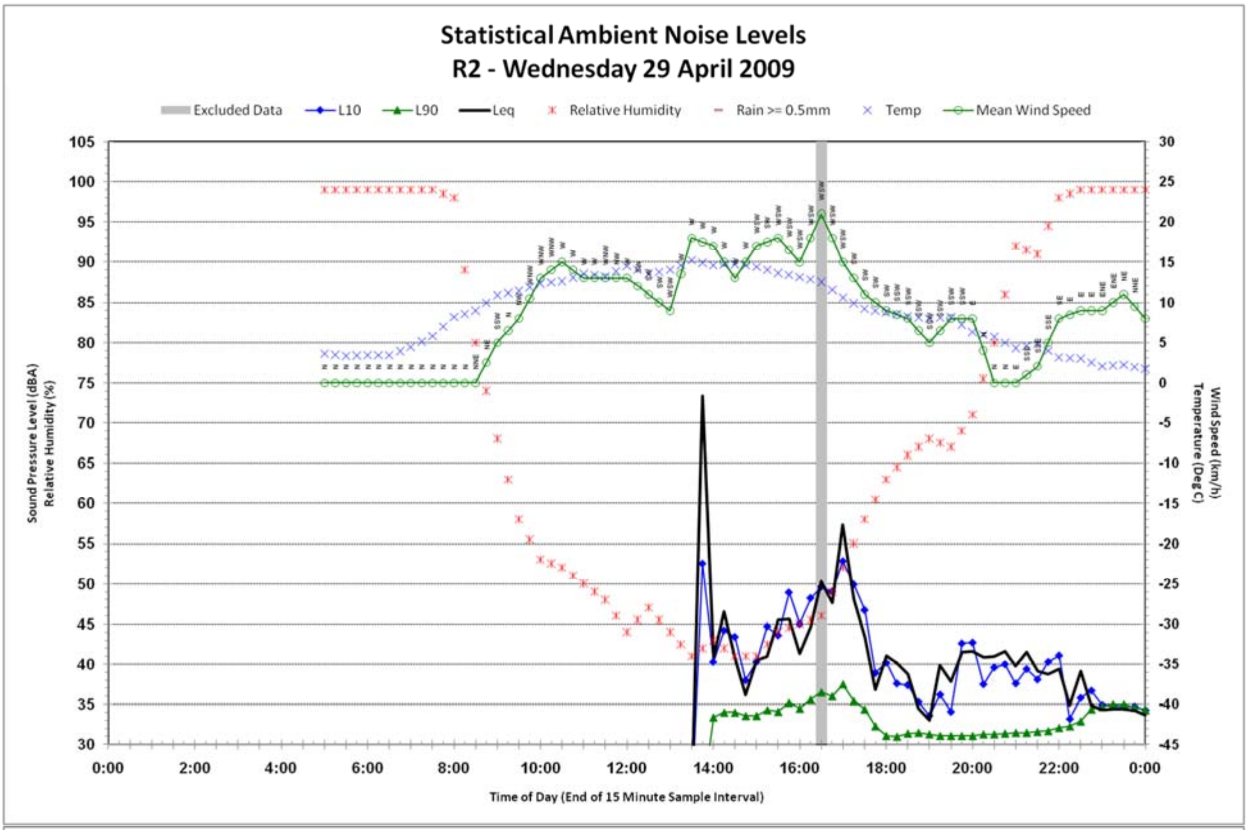
Rain >= 0.5mm
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)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R2 - Wednesday 29 April 2009
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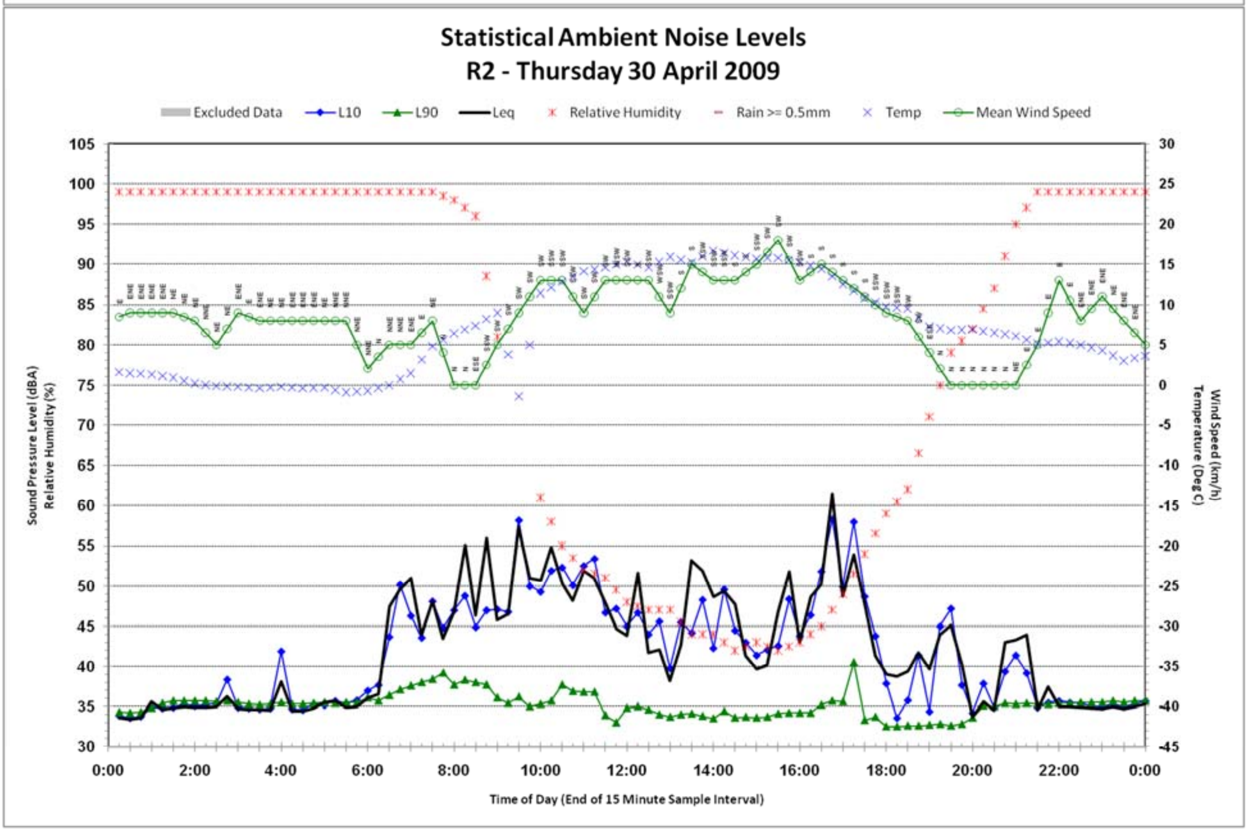
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)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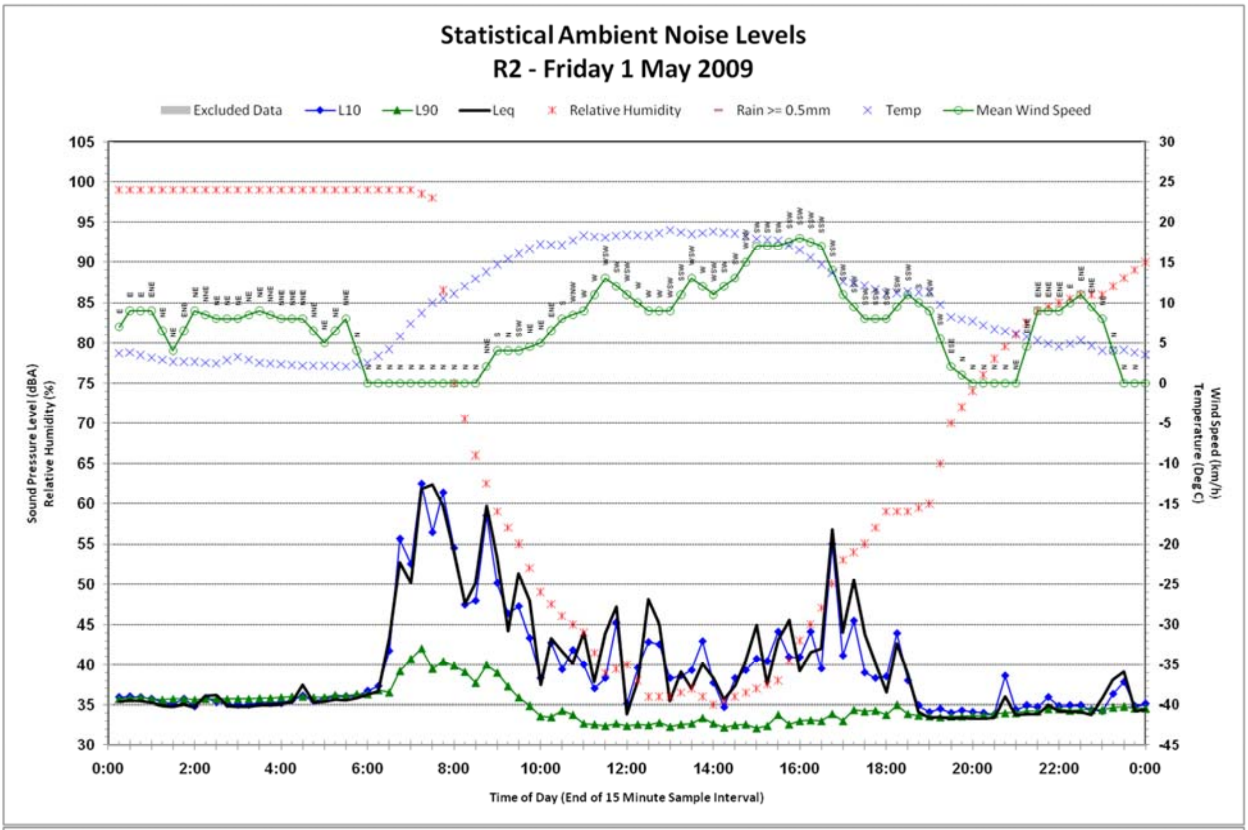
L90
Leq
Relative Humidity
Rain >= 0.5mm
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)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Excluded Data
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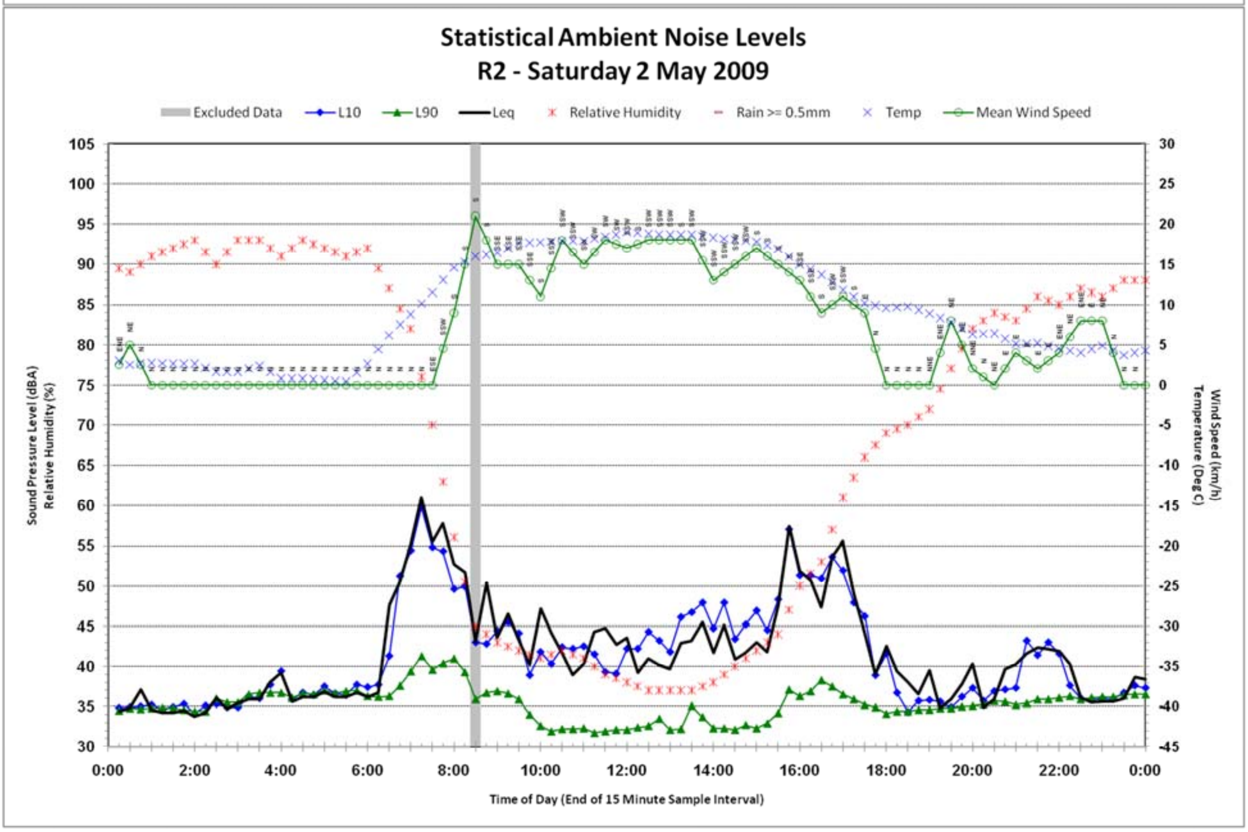
L90
Leq
Relative Humidity
Rain >= 0.5mm
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)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R2 - Saturday 2 May 2009
Excluded Data
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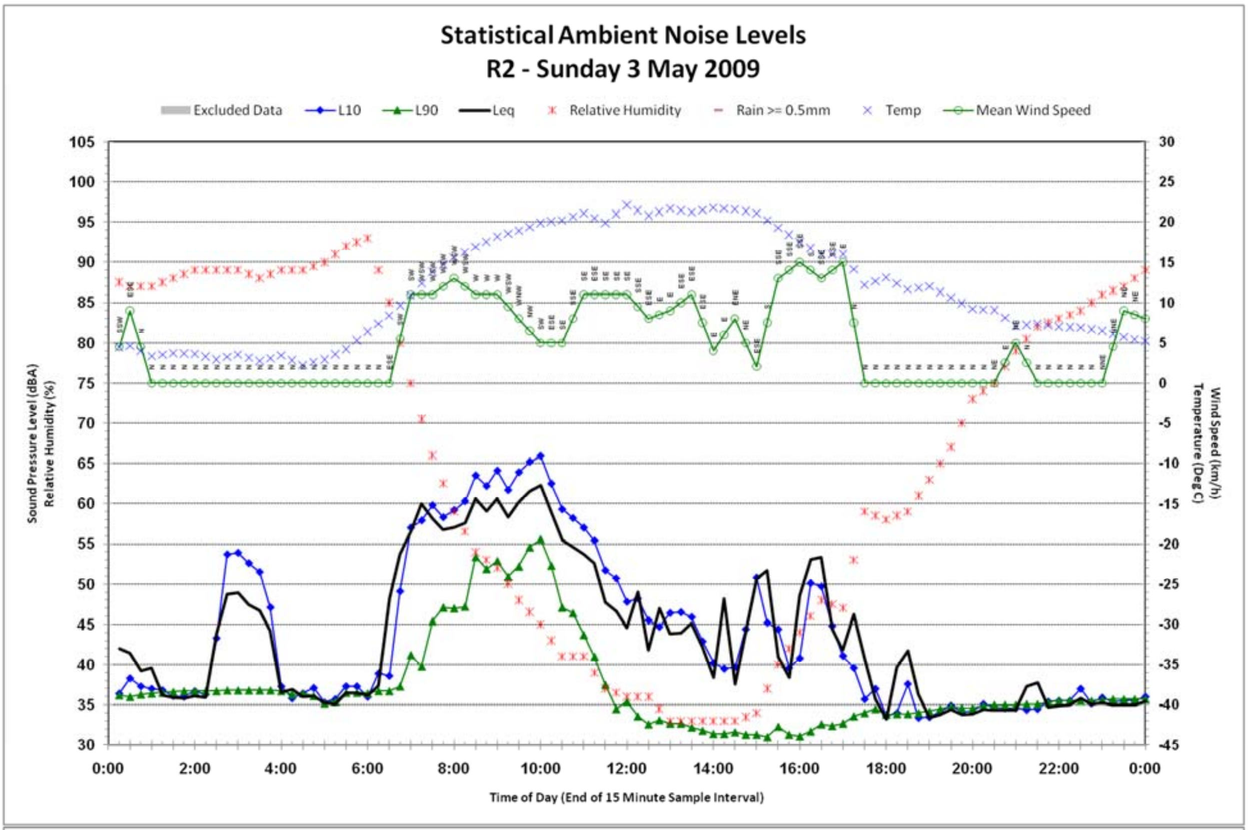
L90
Leq
Relative Humidity
Rain >= 0.5mm
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)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Excluded Data
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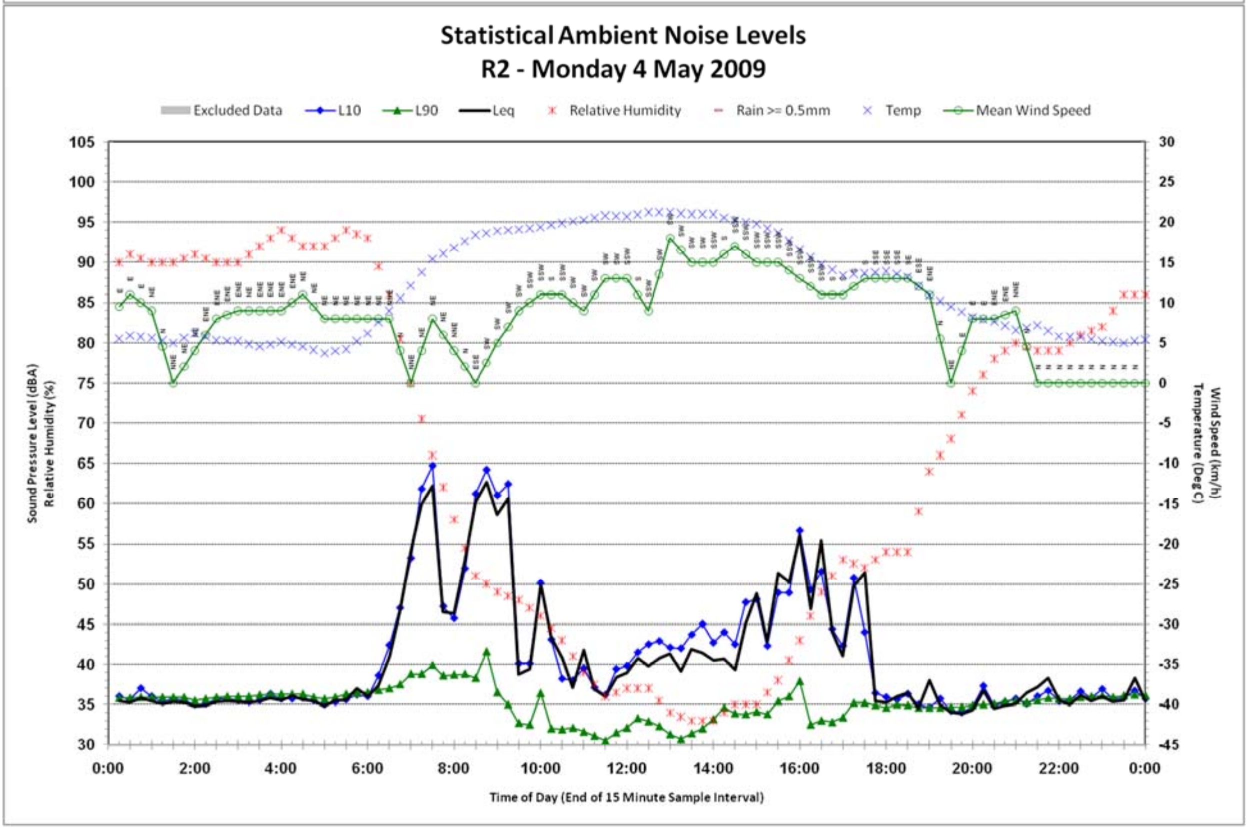
L90
Leq
Relative Humidity
Rain >= 0.5mm
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)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Excluded Data
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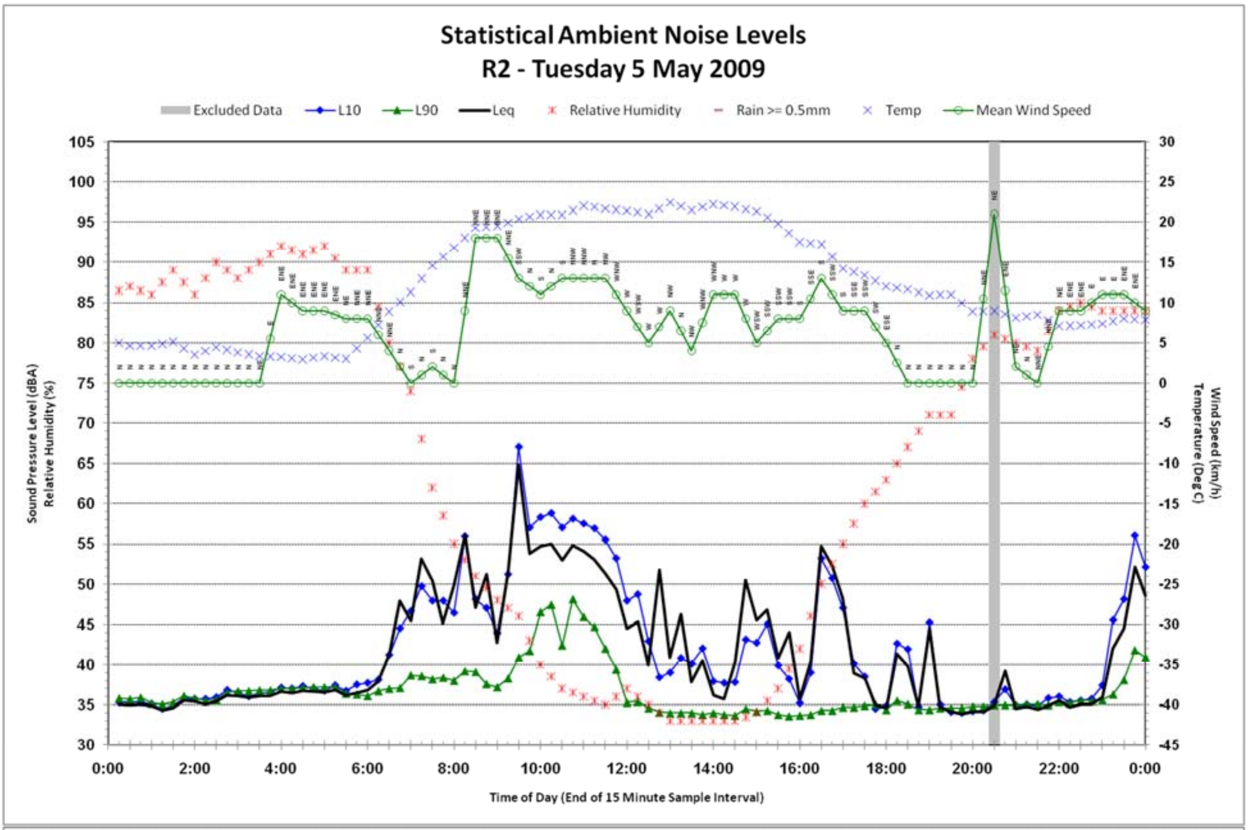
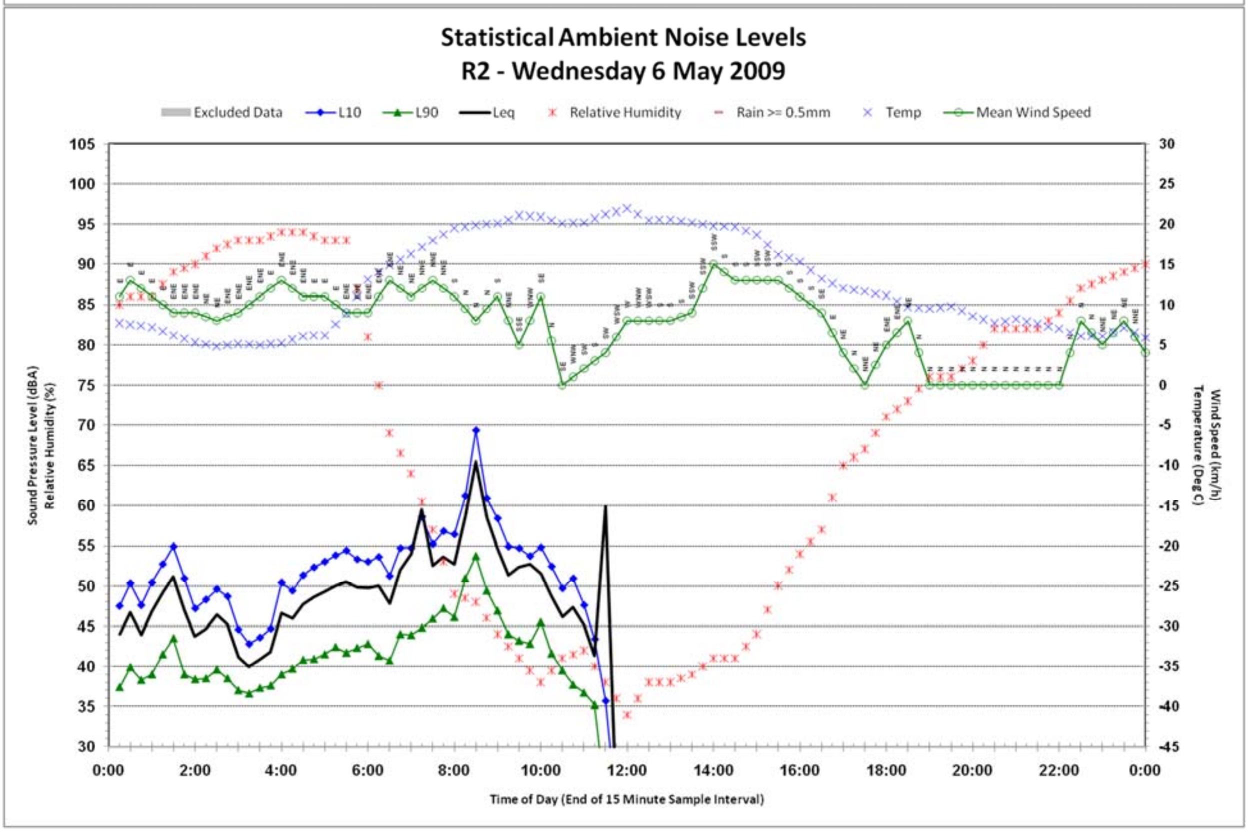
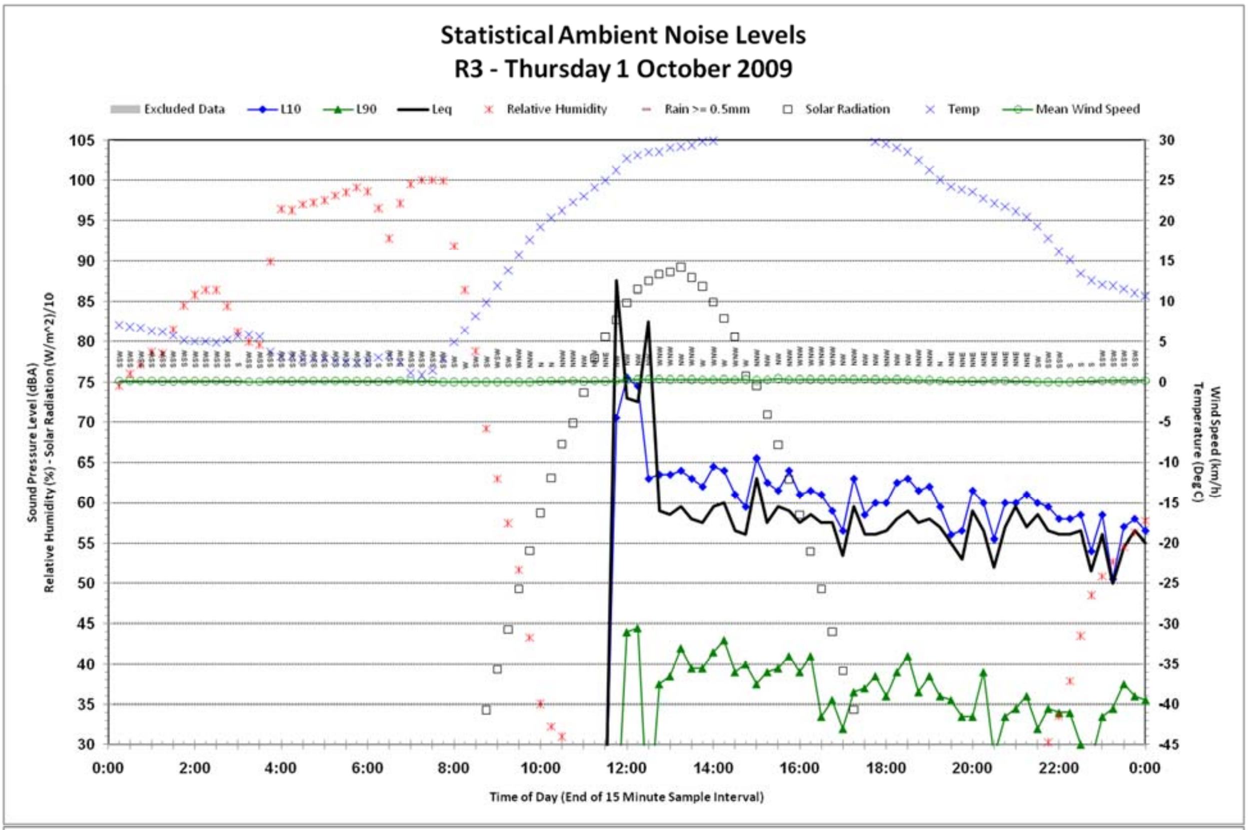
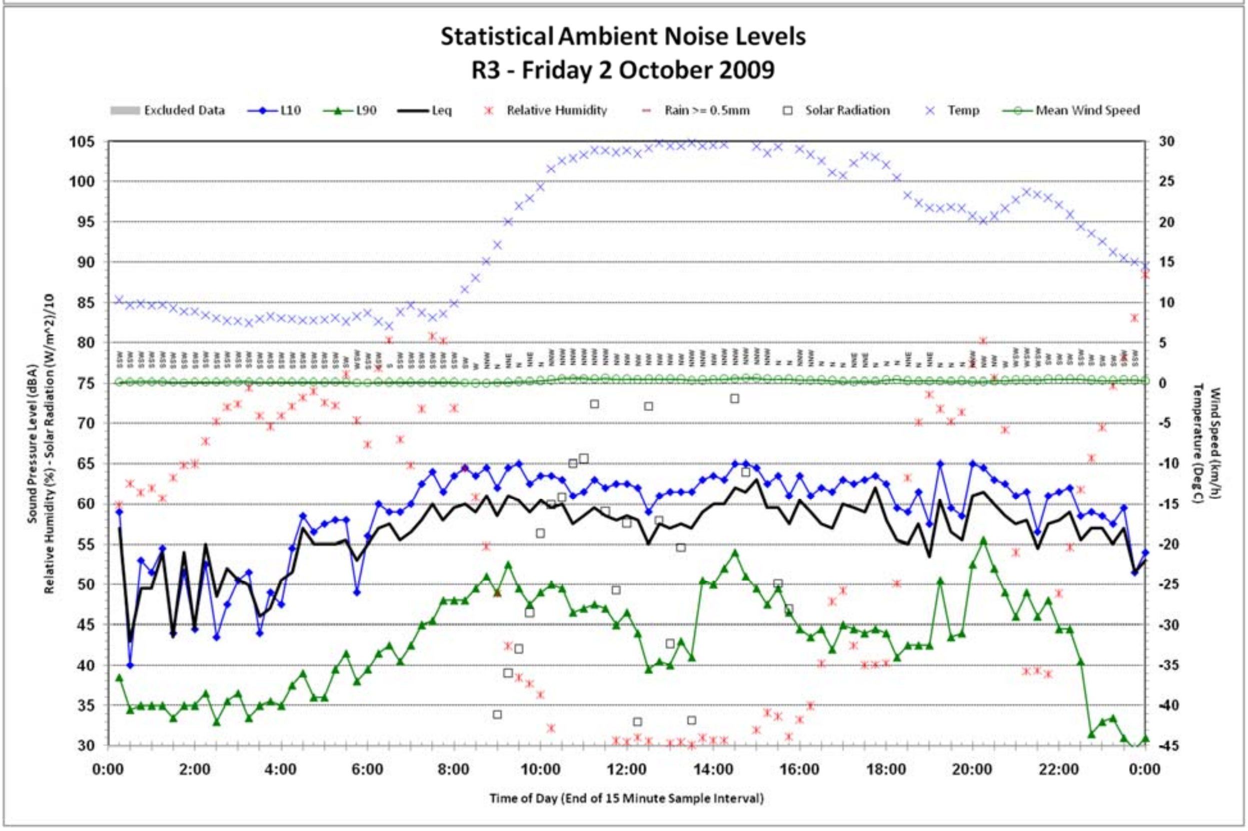
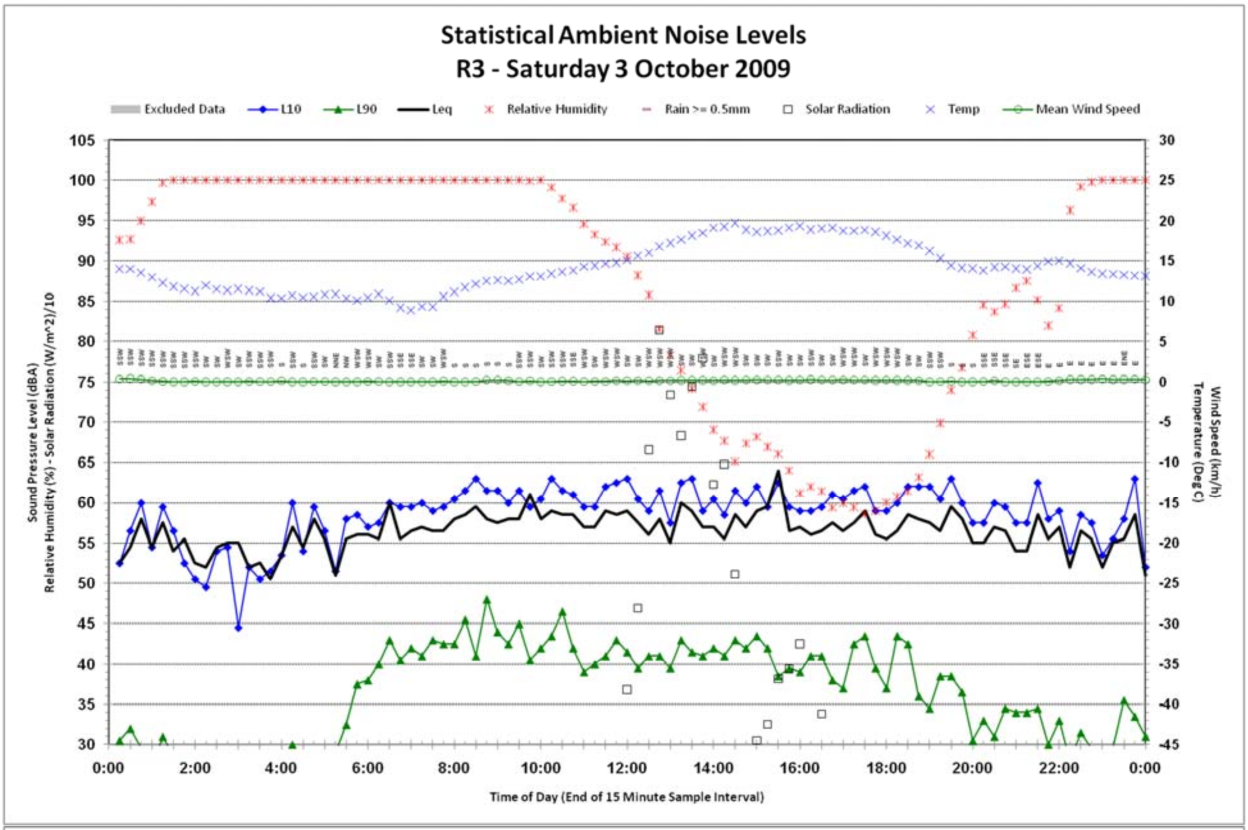
L90
Leq
Relative Humidity
Rain >= 0.5mm
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)

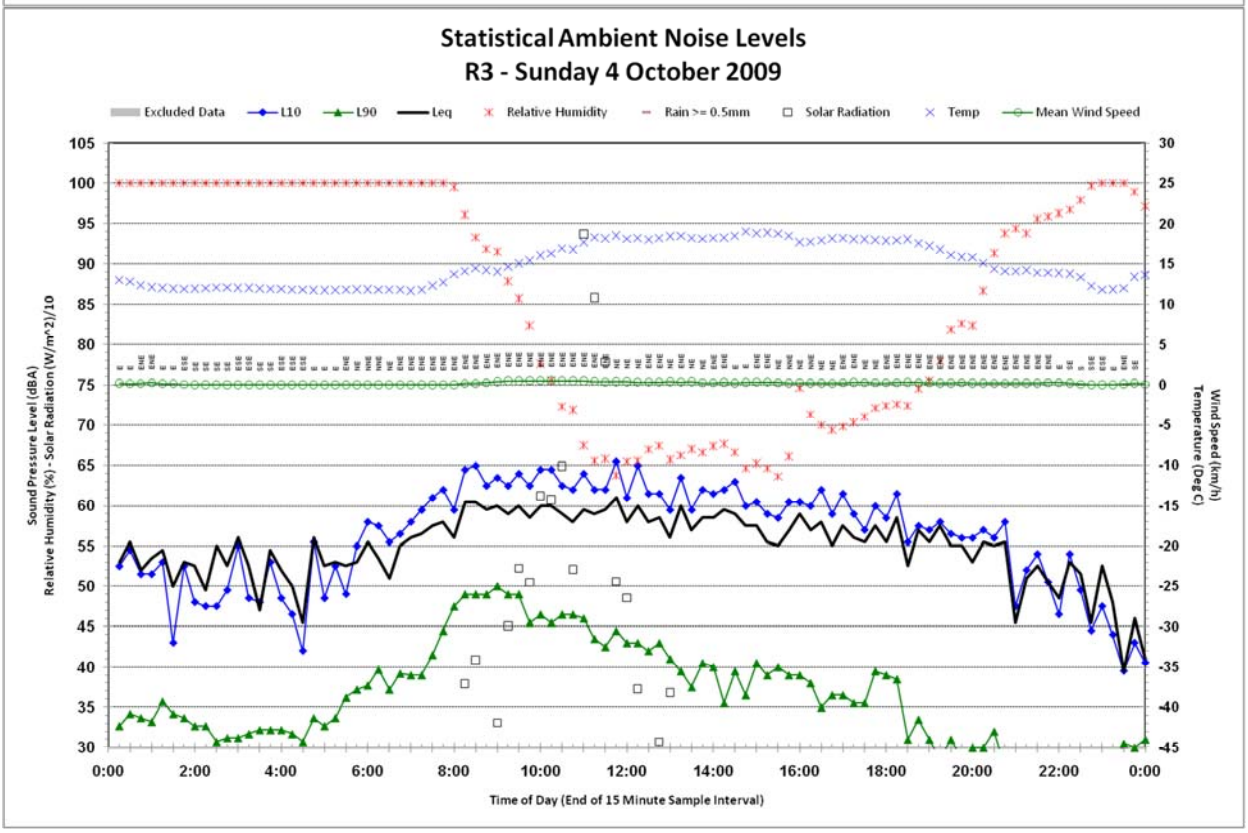

Statistical Ambient Noise Levels
R2 - Tuesday 5 May 2009
Excluded Data
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)

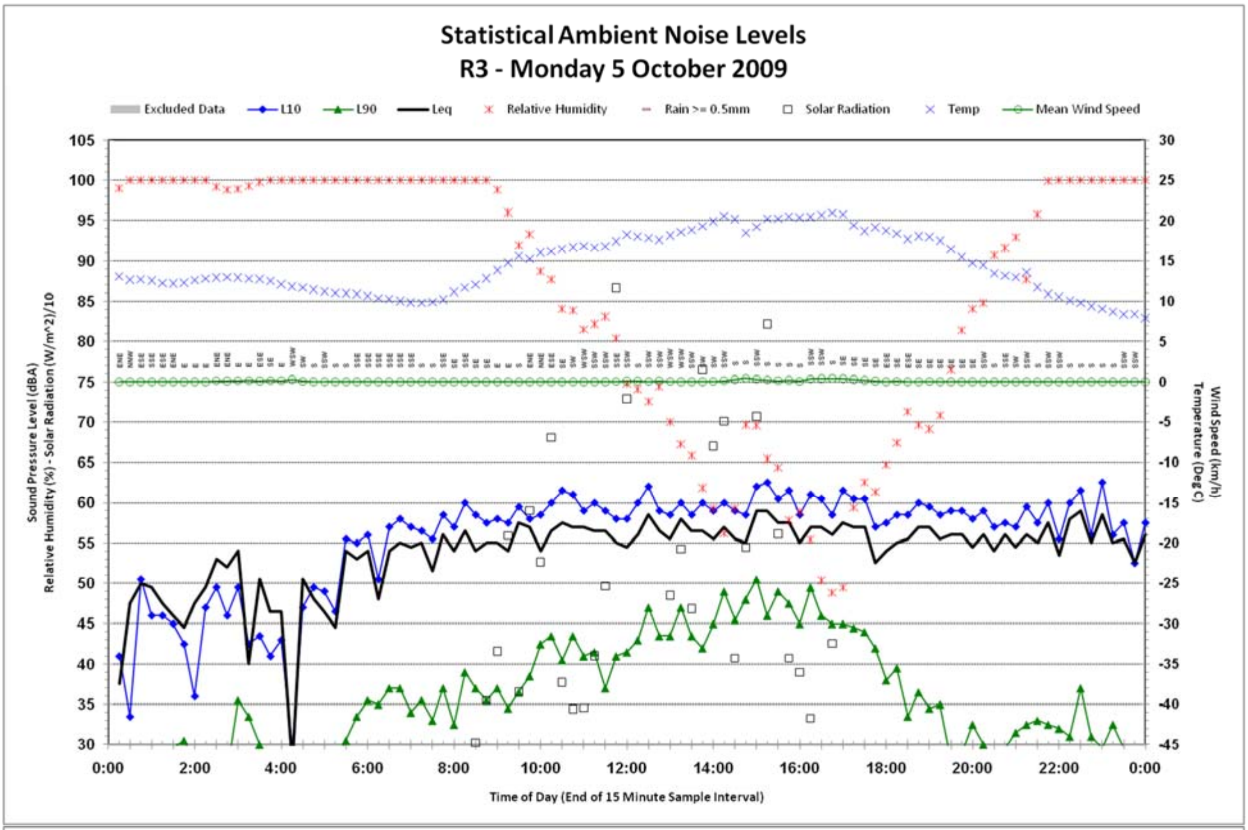

Statistical Ambient Noise Levels
R2 - Wednesday 6 May 2009
Excluded Data
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)

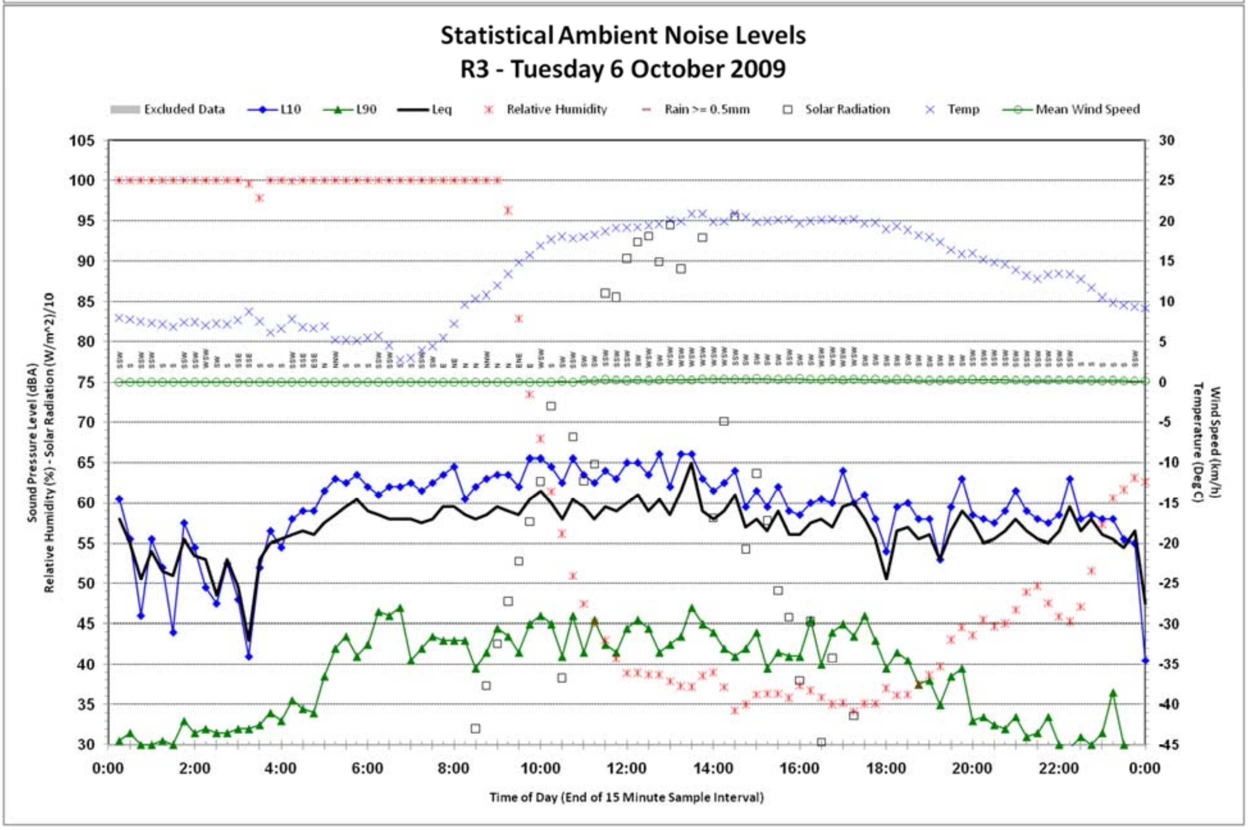

Statistical Ambient Noise Levels
R3 - Thursday 1 October 2009
Excluded Data
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Solar Radiation
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%) - Solar Radiation (W/m^2)/10
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)

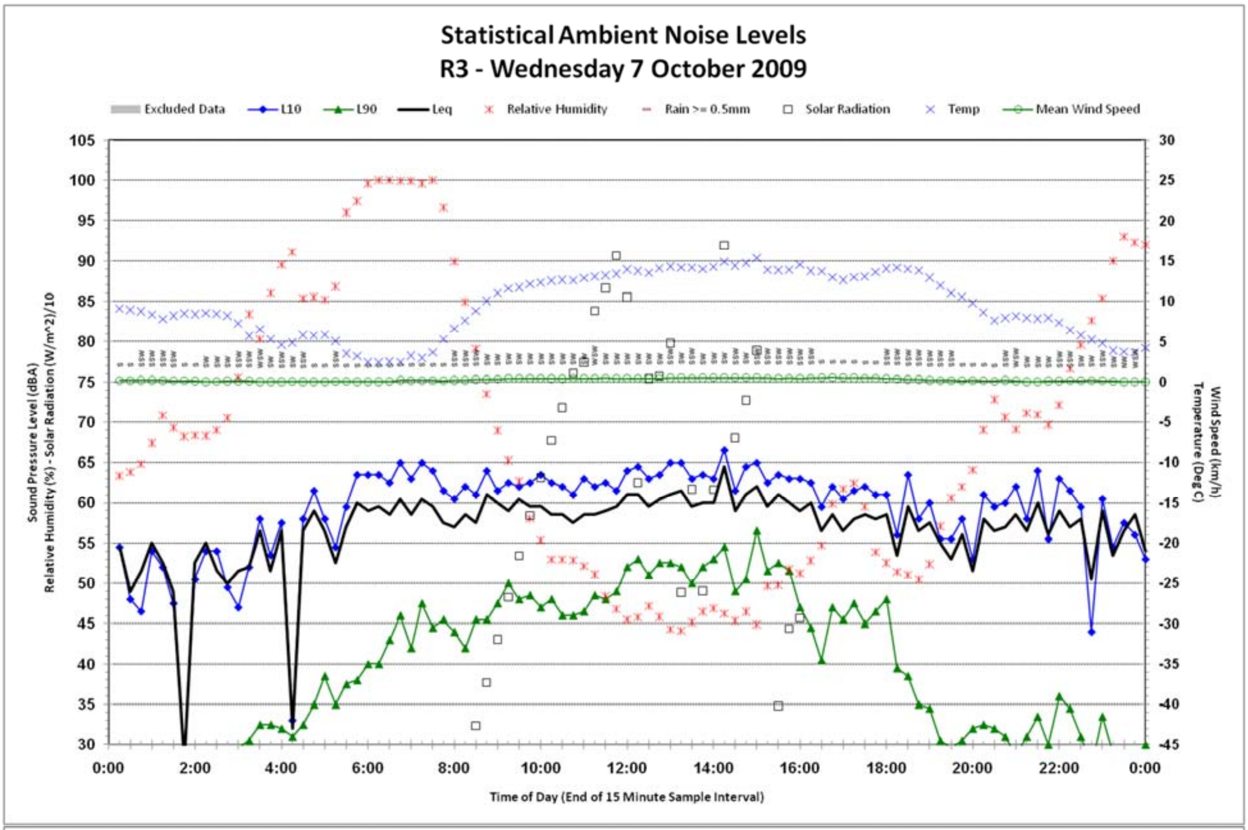

Statistical Ambient Noise Levels
R3 - Friday 2 October 2009
Excluded Data
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Solar Radiation
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%) - Solar Radiation (W/m^2)/10
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)

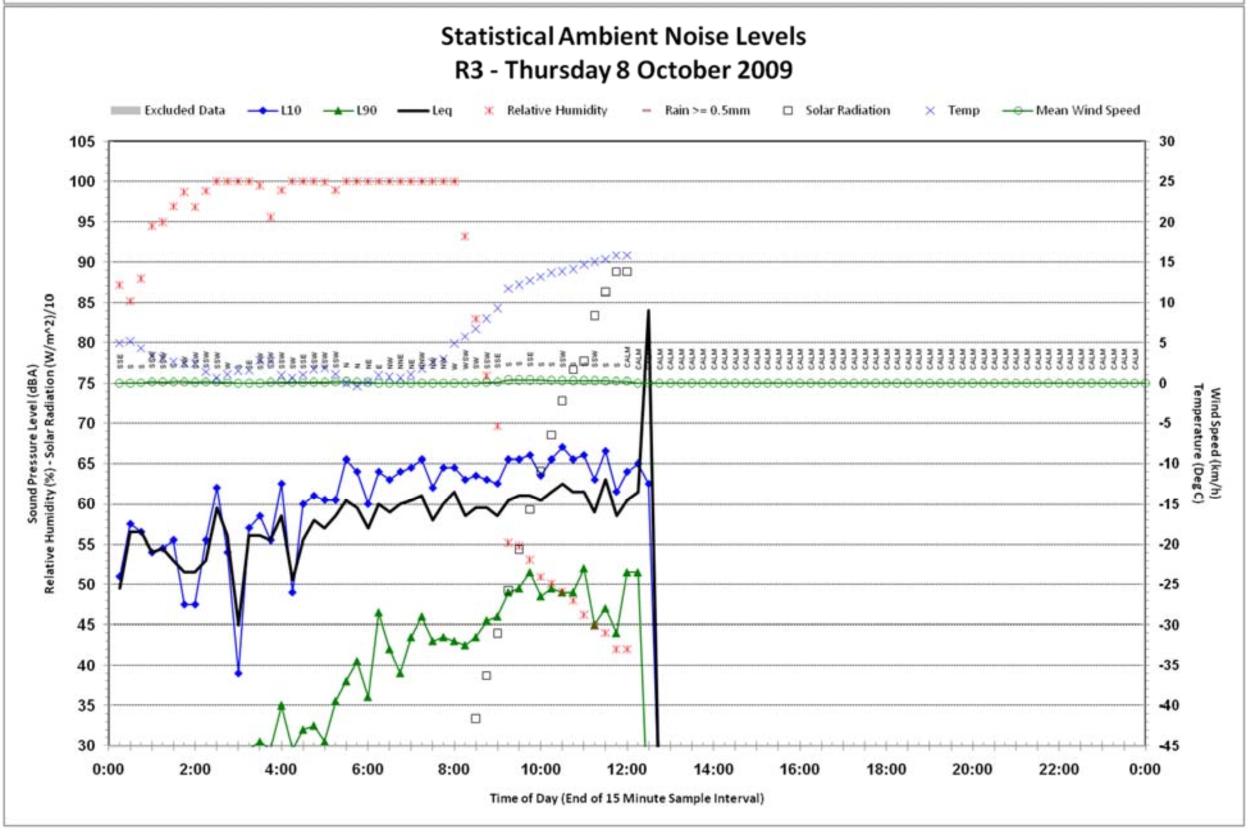

Statistical Ambient Noise Levels
R3 - Saturday 3 October 2009
Excluded Data
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Solar Radiation
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%) - Solar Radiation (W/m^2)/10
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)

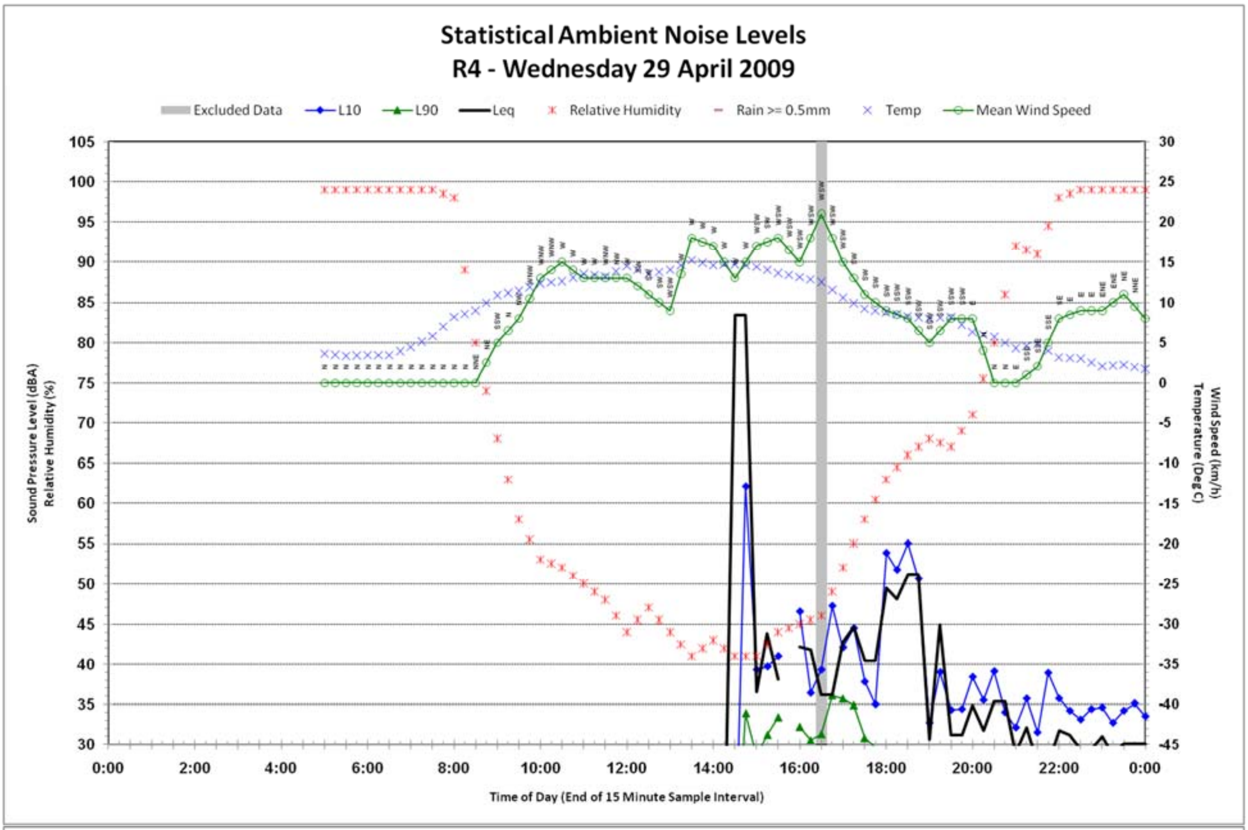

Statistical Ambient Noise Levels
R3 - Sunday 4 October 2009
Excluded Data
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Solar Radiation
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%) - Solar Radiation (W/m^2)/10
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)

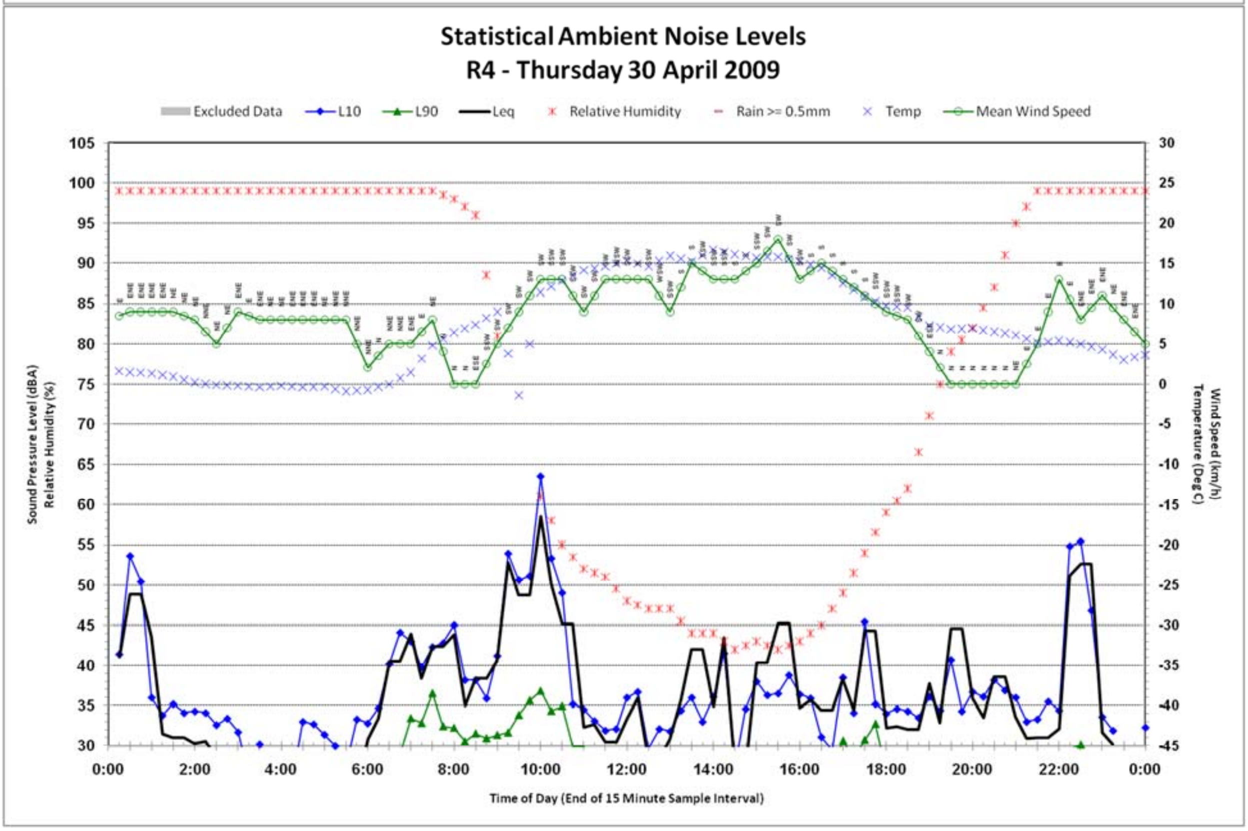

Statistical Ambient Noise Levels
R3 - Monday 5 October 2009
Excluded Data
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Solar Radiation
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%) - Solar Radiation (W/m^2)/10
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)

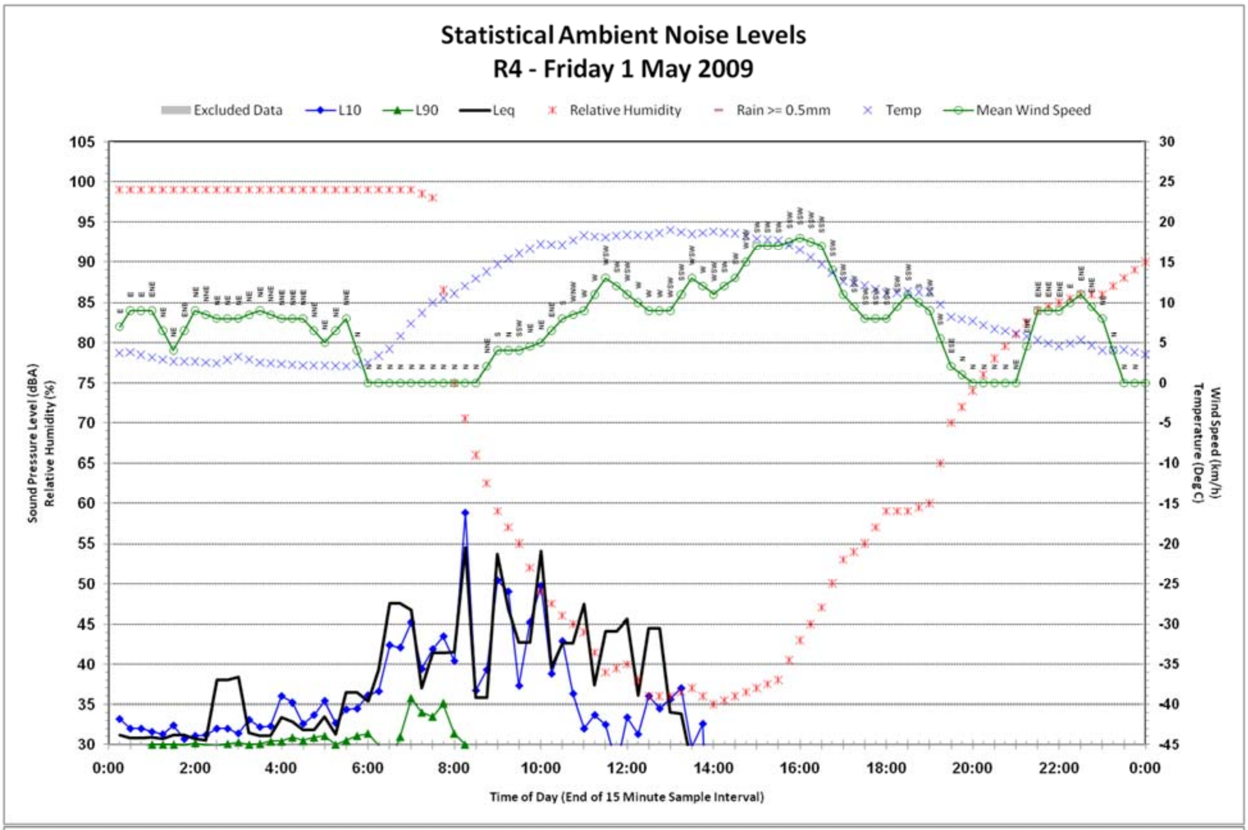

Statistical Ambient Noise Levels
R3 - Tuesday 6 October 2009
Excluded Data
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Solar Radiation
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%) - Solar Radiation (W/m^2)/10
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)

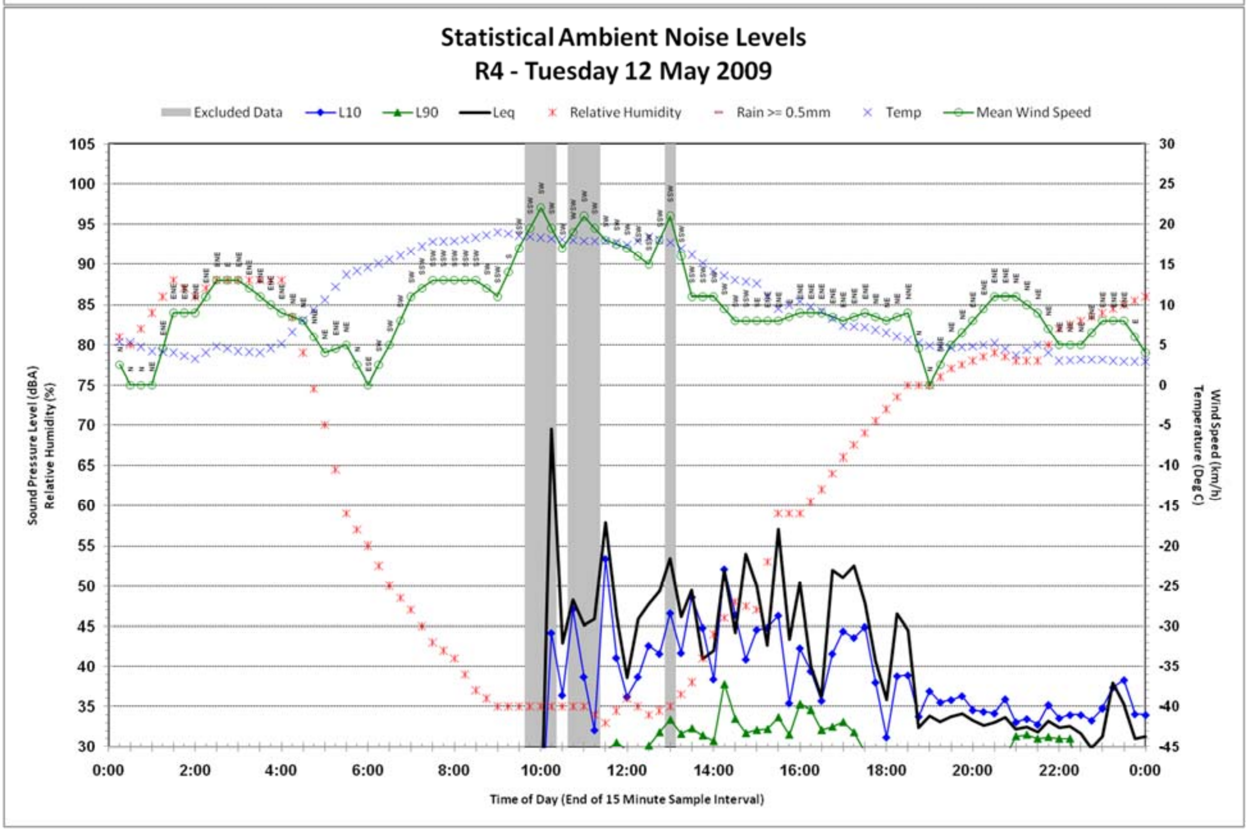

Statistical Ambient Noise Levels
R3 - Wednesday 7 October 2009
Excluded Data
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Solar Radiation
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%) - Solar Radiation (W/m^2)/10
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)

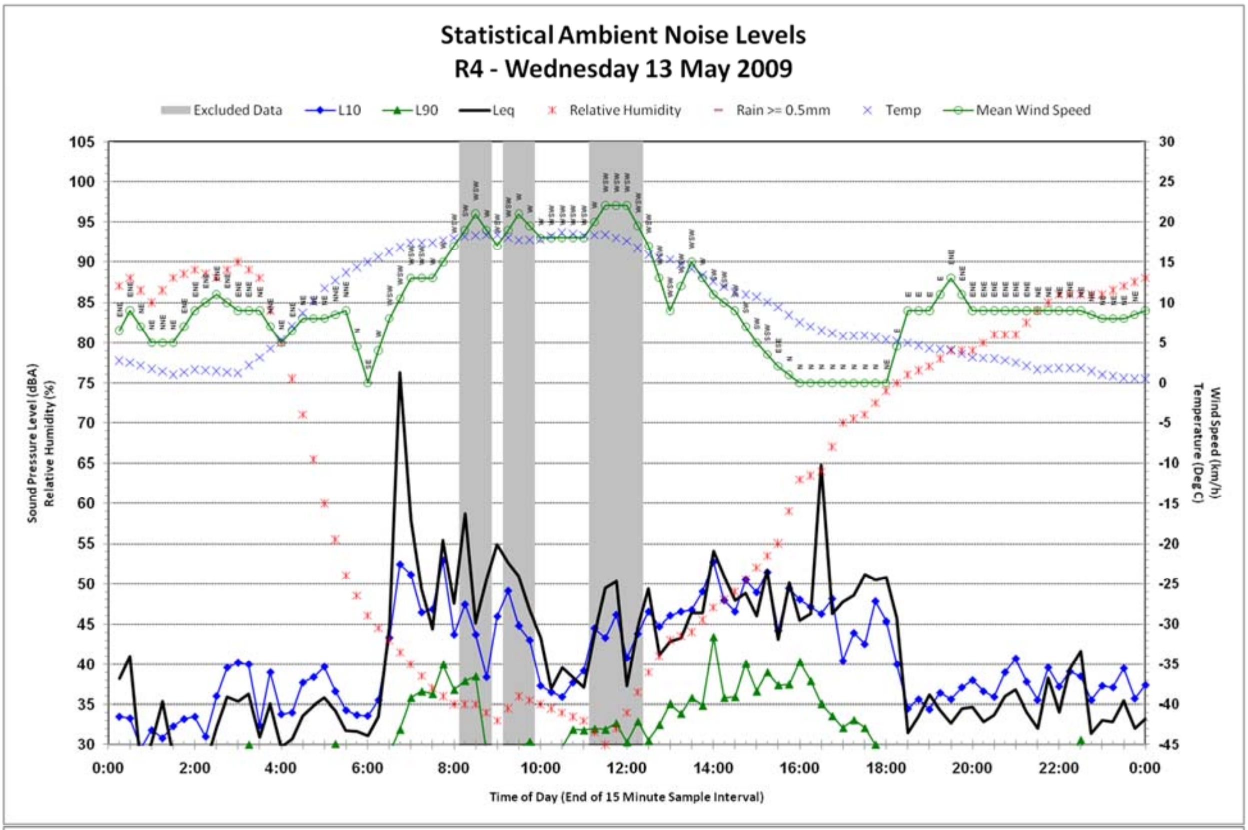

Statistical Ambient Noise Levels
R3 - Thursday 8 October 2009
Excluded Data
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Solar Radiation
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%) - Solar Radiation (W/m^2)/10
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)

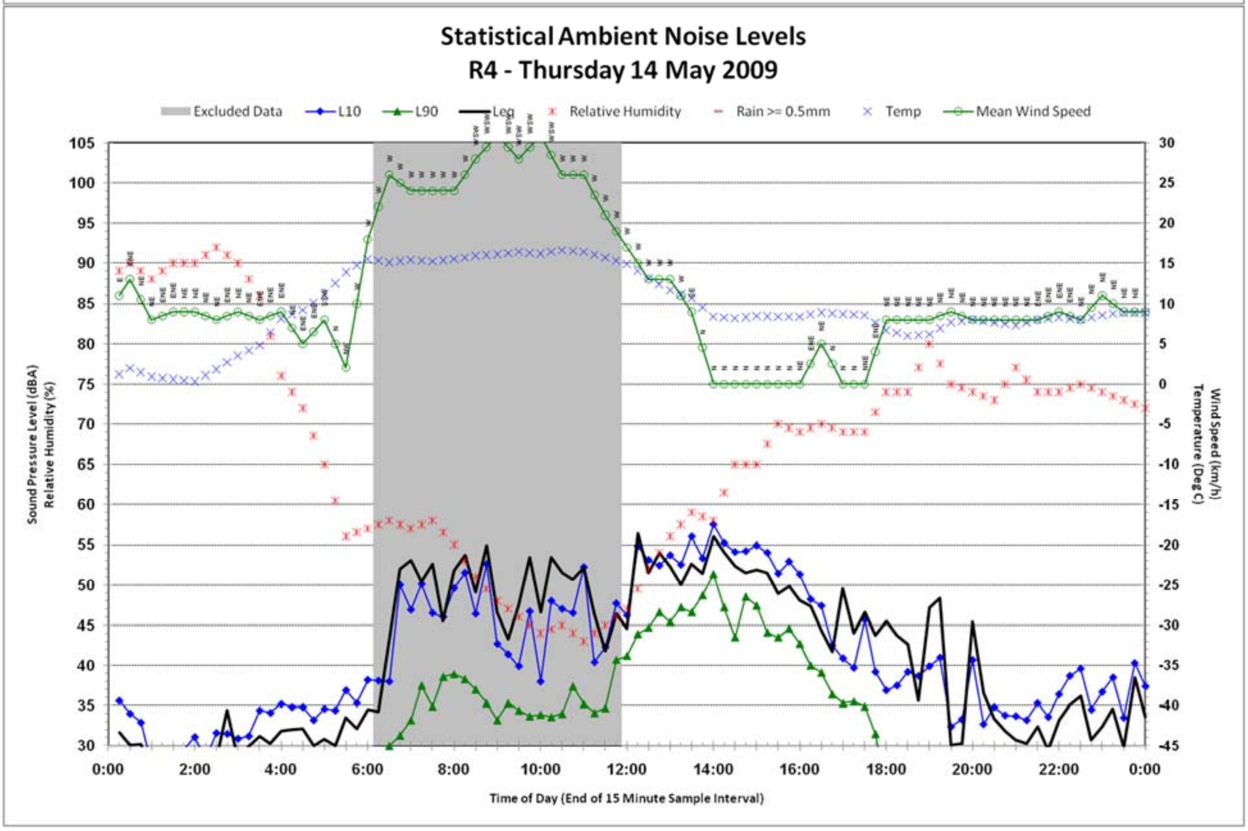

Statistical Ambient Noise Levels
R4 - Wednesday 29 April 2009
Excluded Data
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)

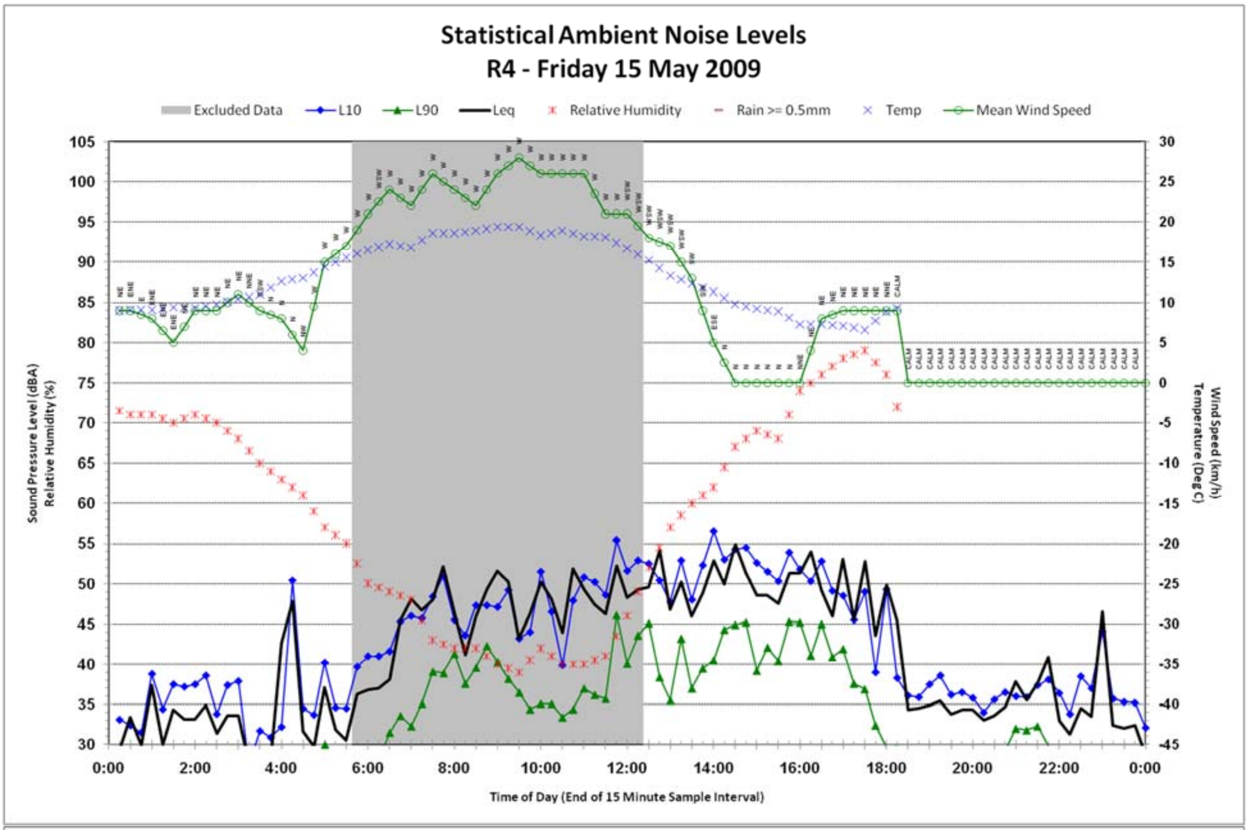

Statistical Ambient Noise Levels
R4 - Thursday 30 April 2009
Excluded Data
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)

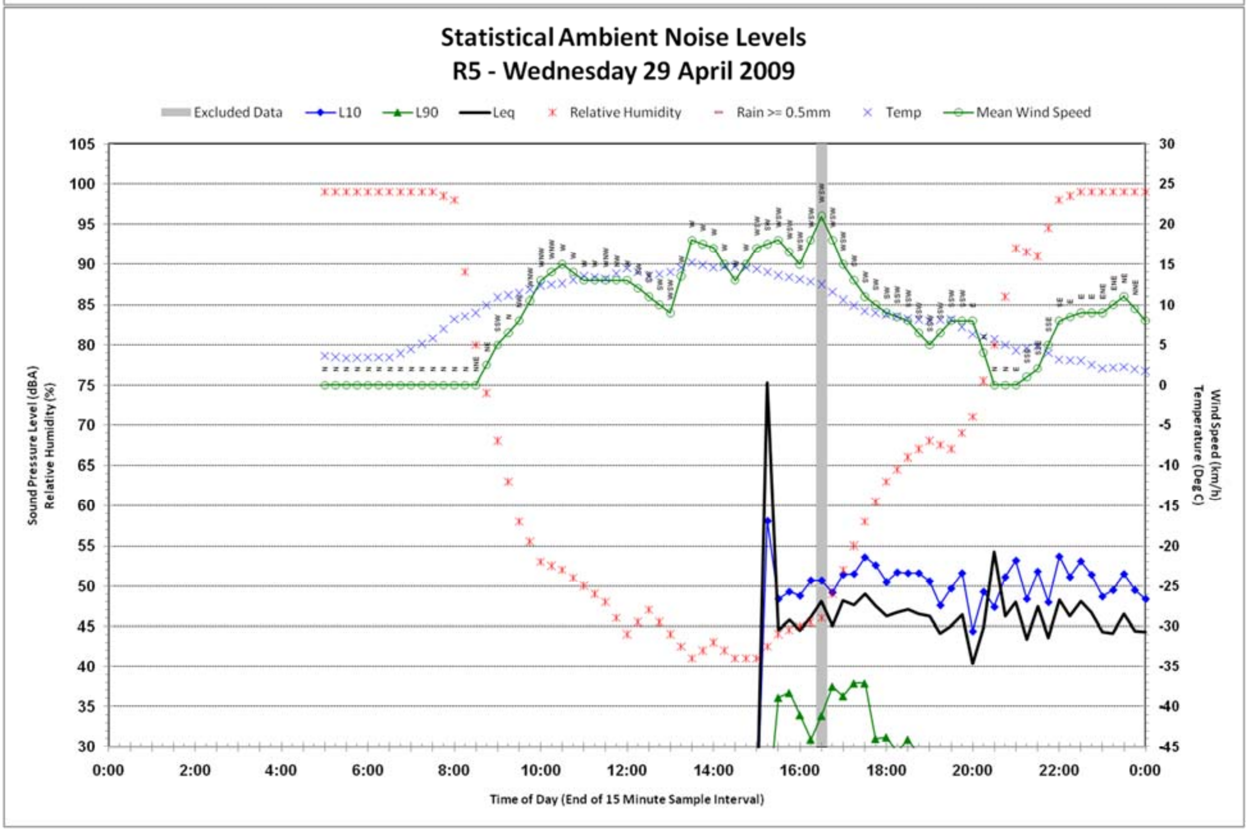

Statistical Ambient Noise Levels
R4 - Friday 1 May 2009
Excluded Data
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)

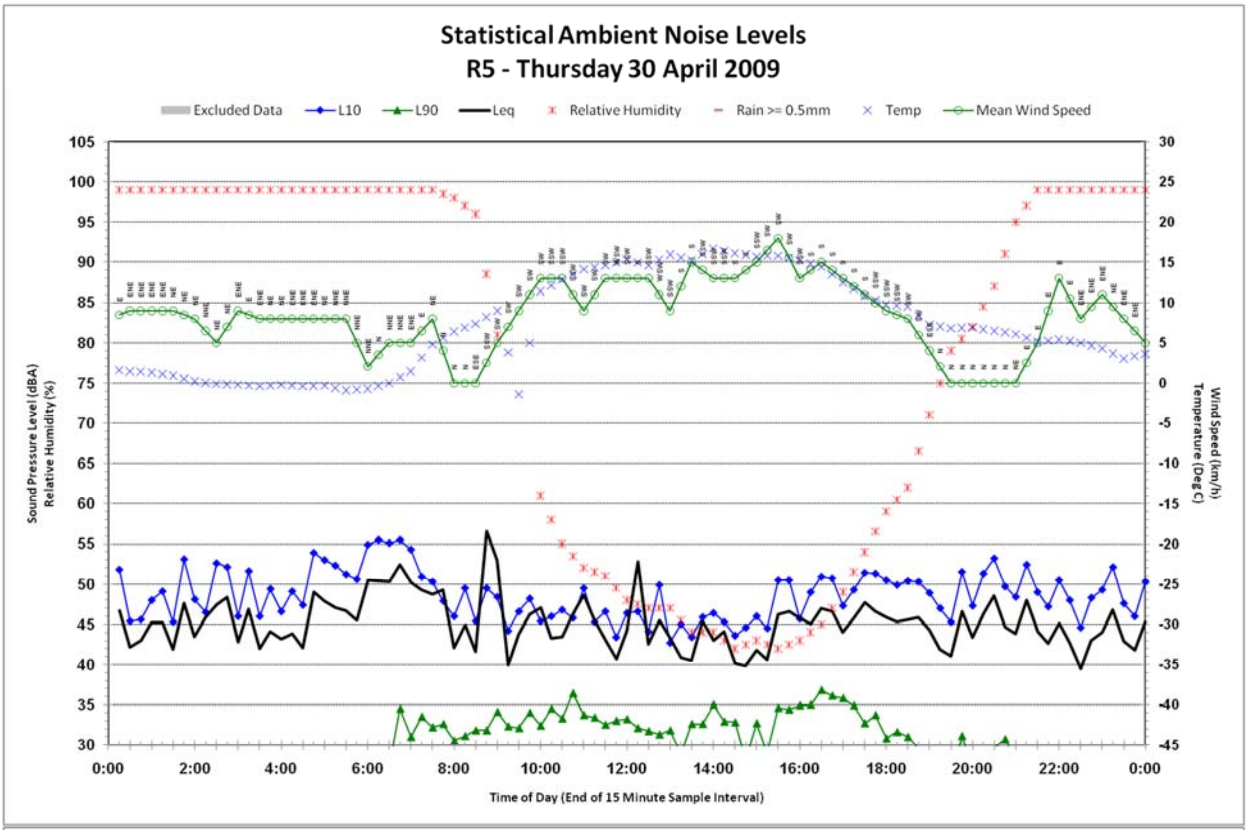

Statistical Ambient Noise Levels
R4 - Tuesday 12 May 2009
Excluded Data
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)

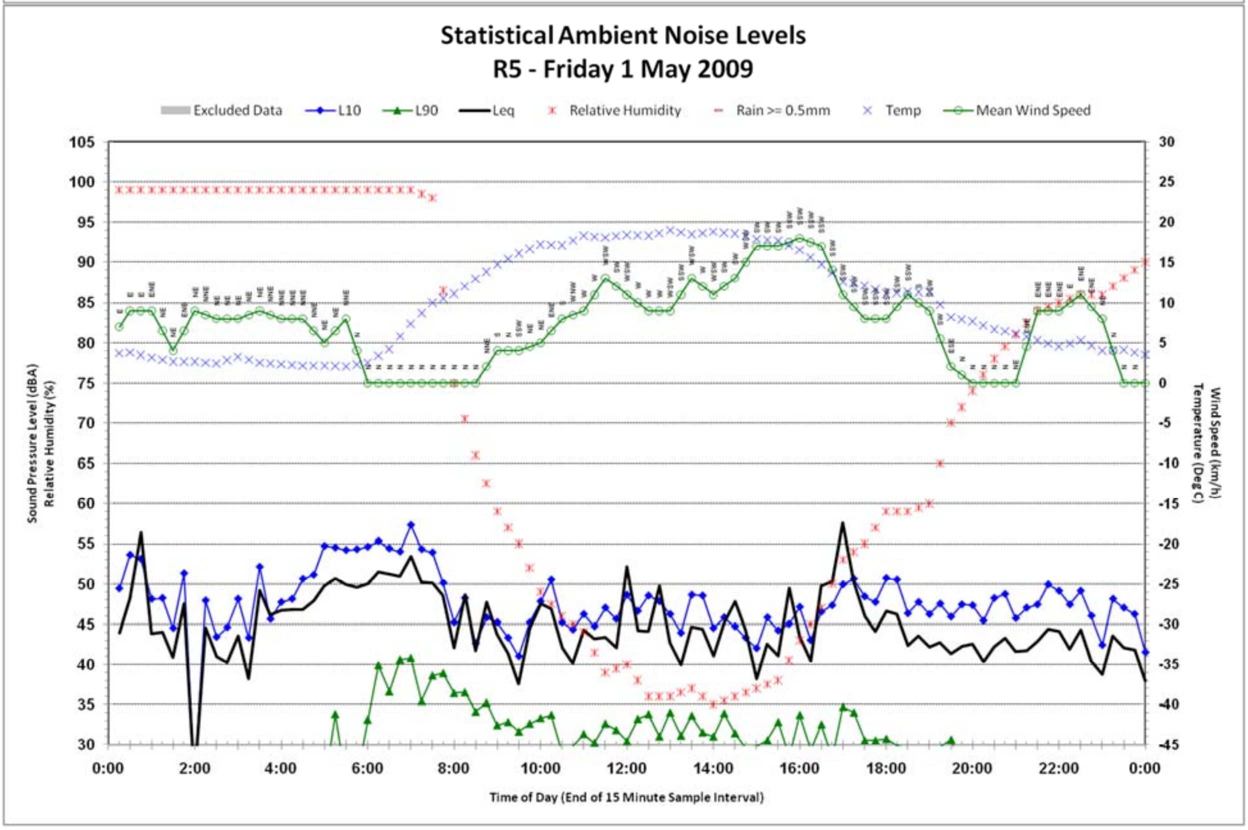

Statistical Ambient Noise Levels
R4 - Wednesday 13 May 2009
Excluded Data
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)

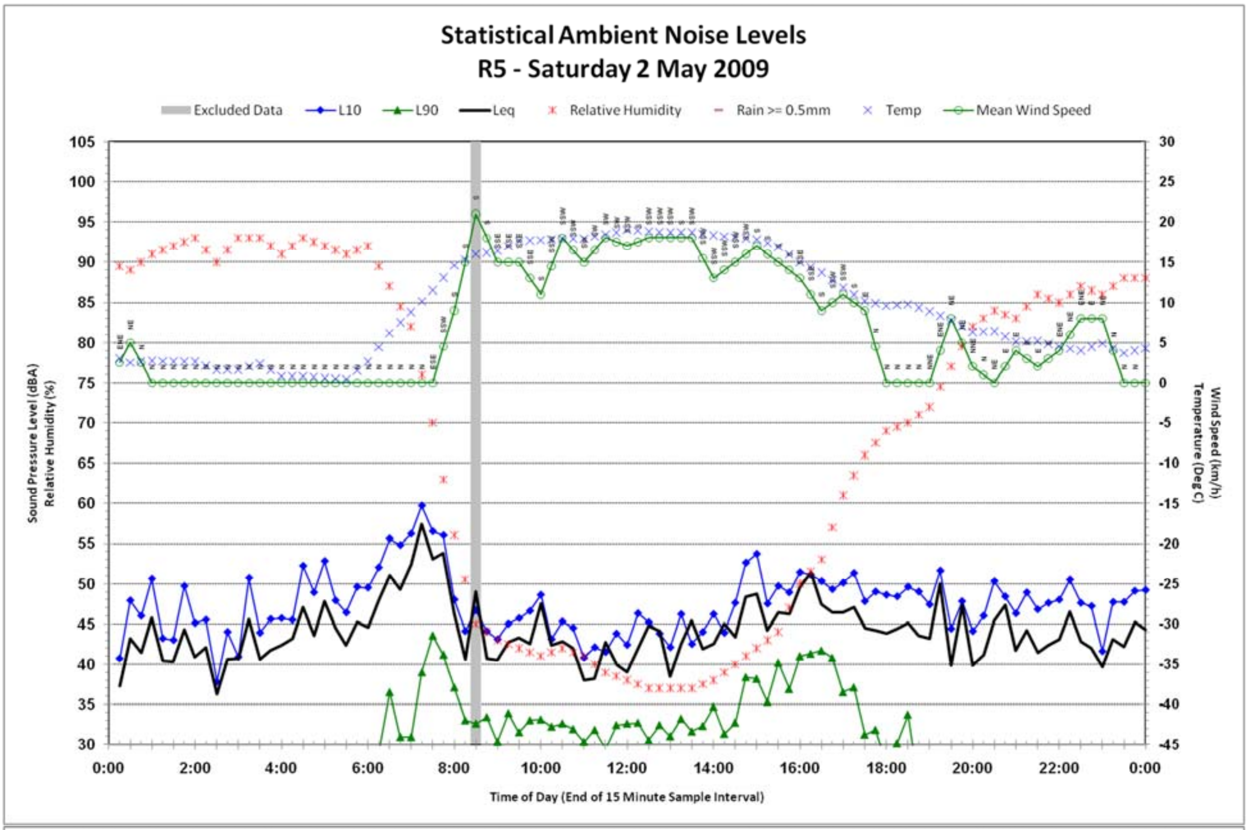

Statistical Ambient Noise Levels
R4 - Thursday 14 May 2009
Excluded Data
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)

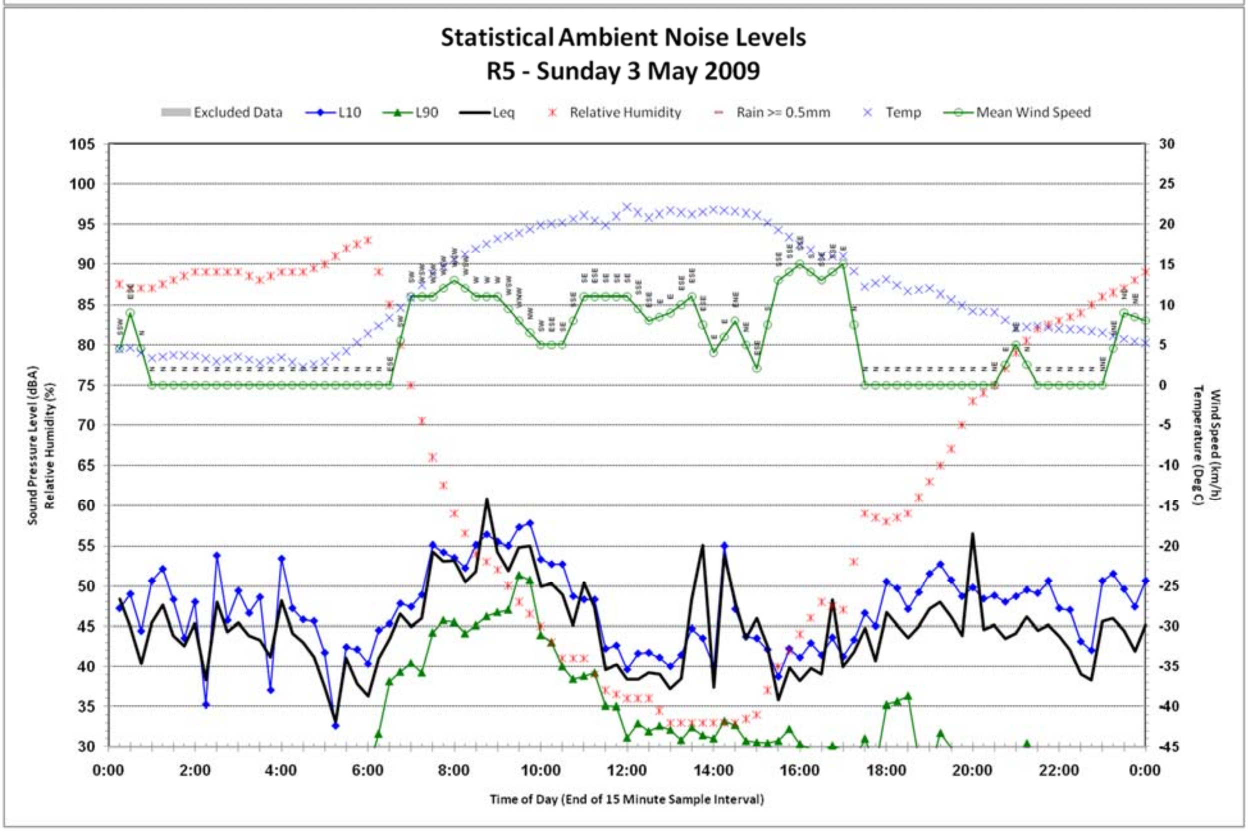

Statistical Ambient Noise Levels
R4 - Friday 15 May 2009
Excluded Data
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)

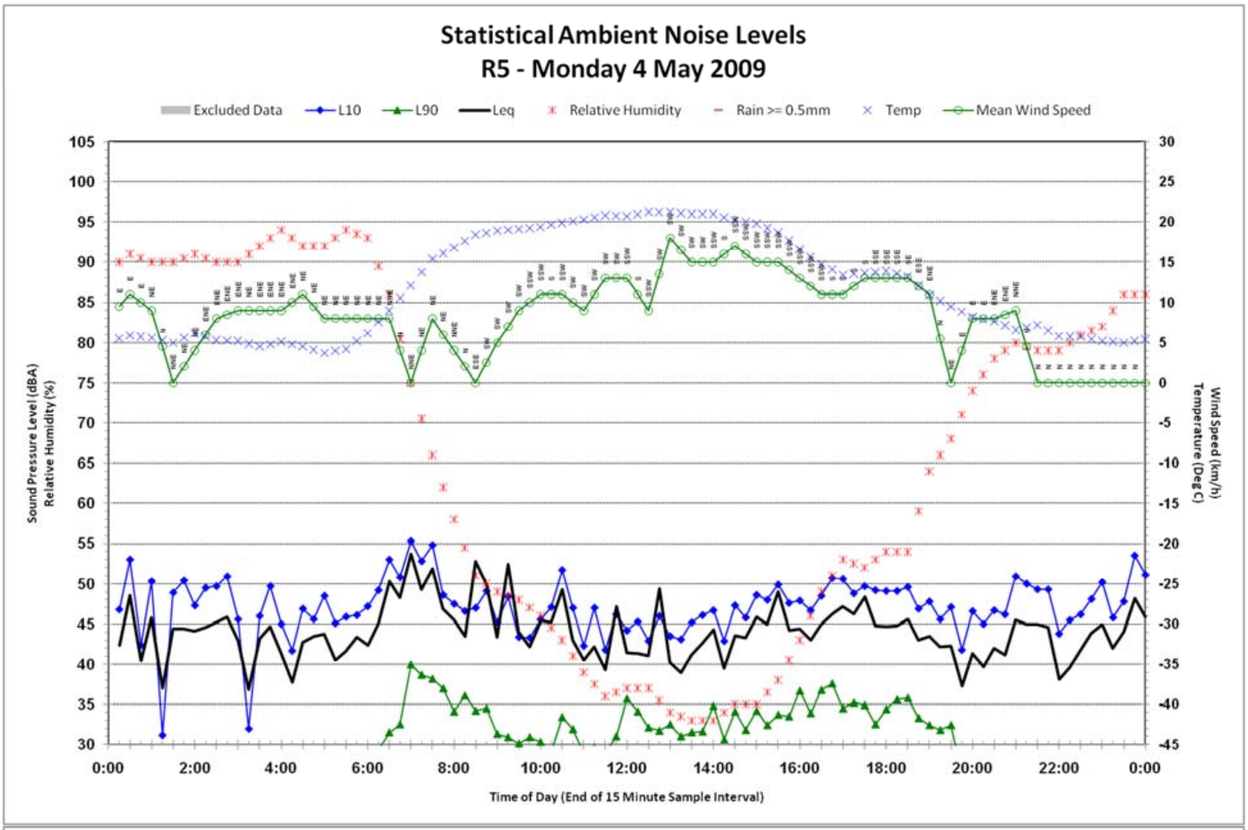

Statistical Ambient Noise Levels
R5 - Wednesday 29 April 2009
Excluded Data
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)

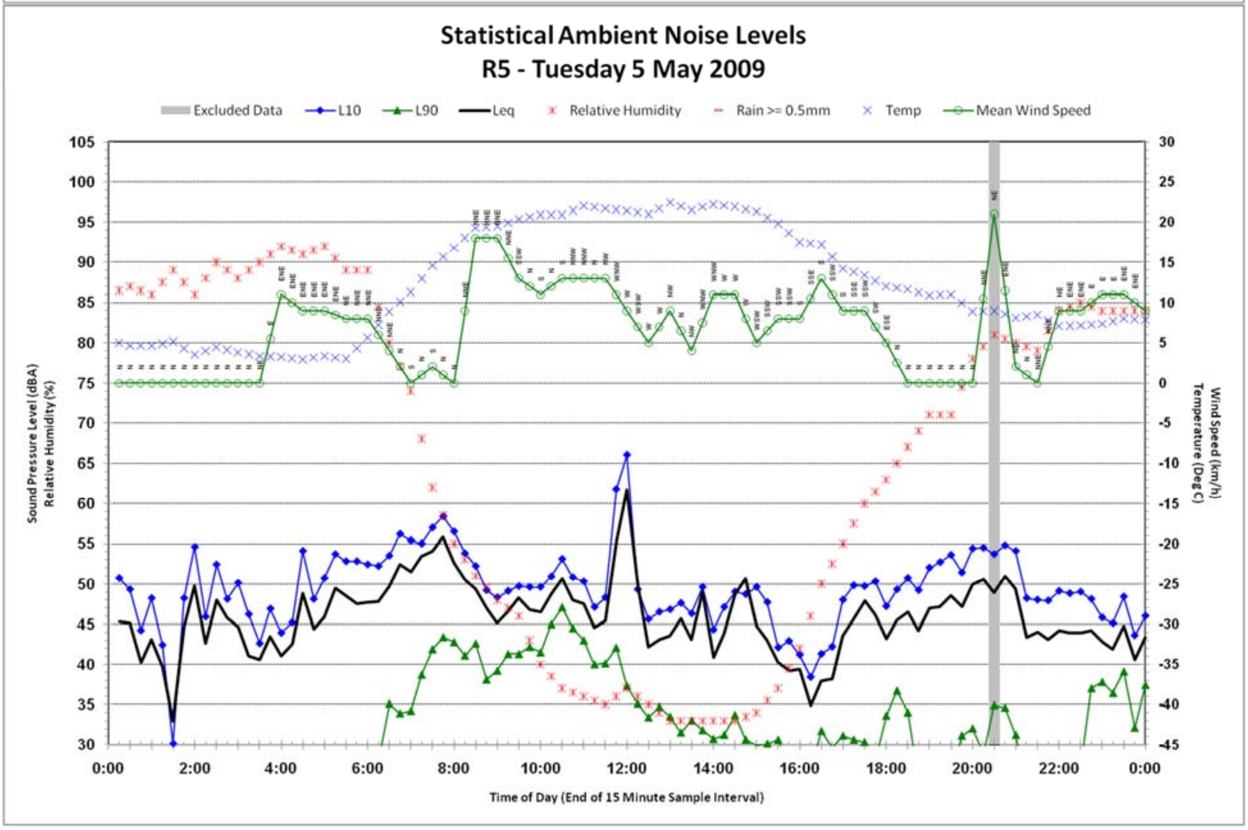

Statistical Ambient Noise Levels
R5 - Thursday 30 April 2009
Excluded Data
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)

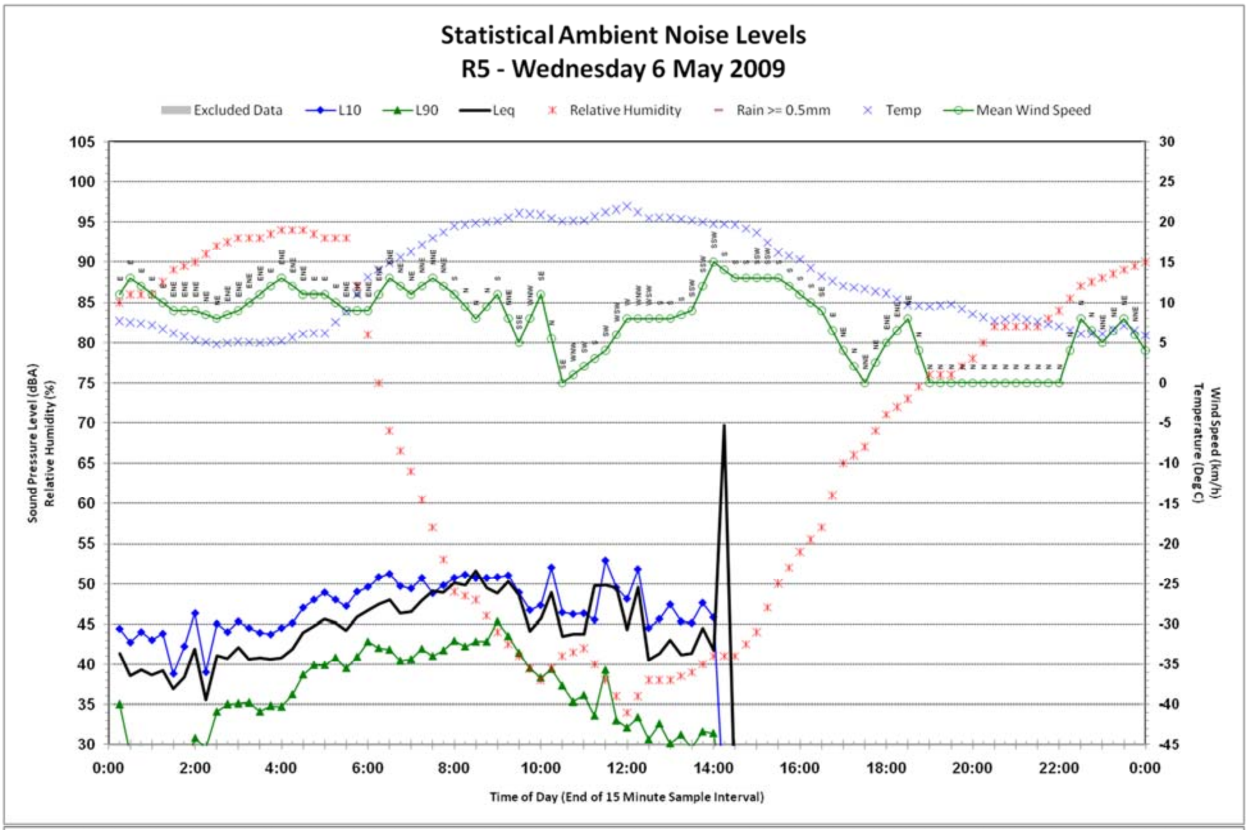

Statistical Ambient Noise Levels
R5 - Friday 1 May 2009
Excluded Data
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)

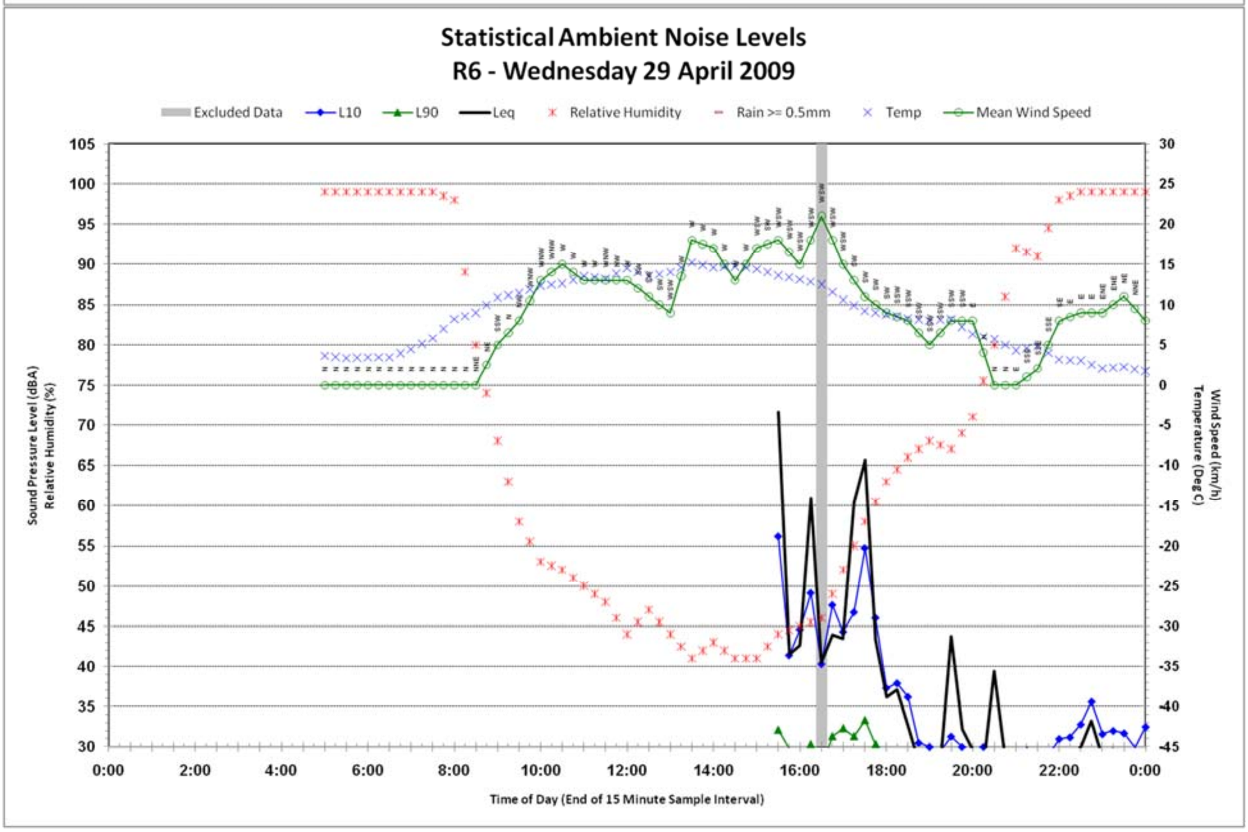

Statistical Ambient Noise Levels
R5 - Saturday 2 May 2009
Excluded Data
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)

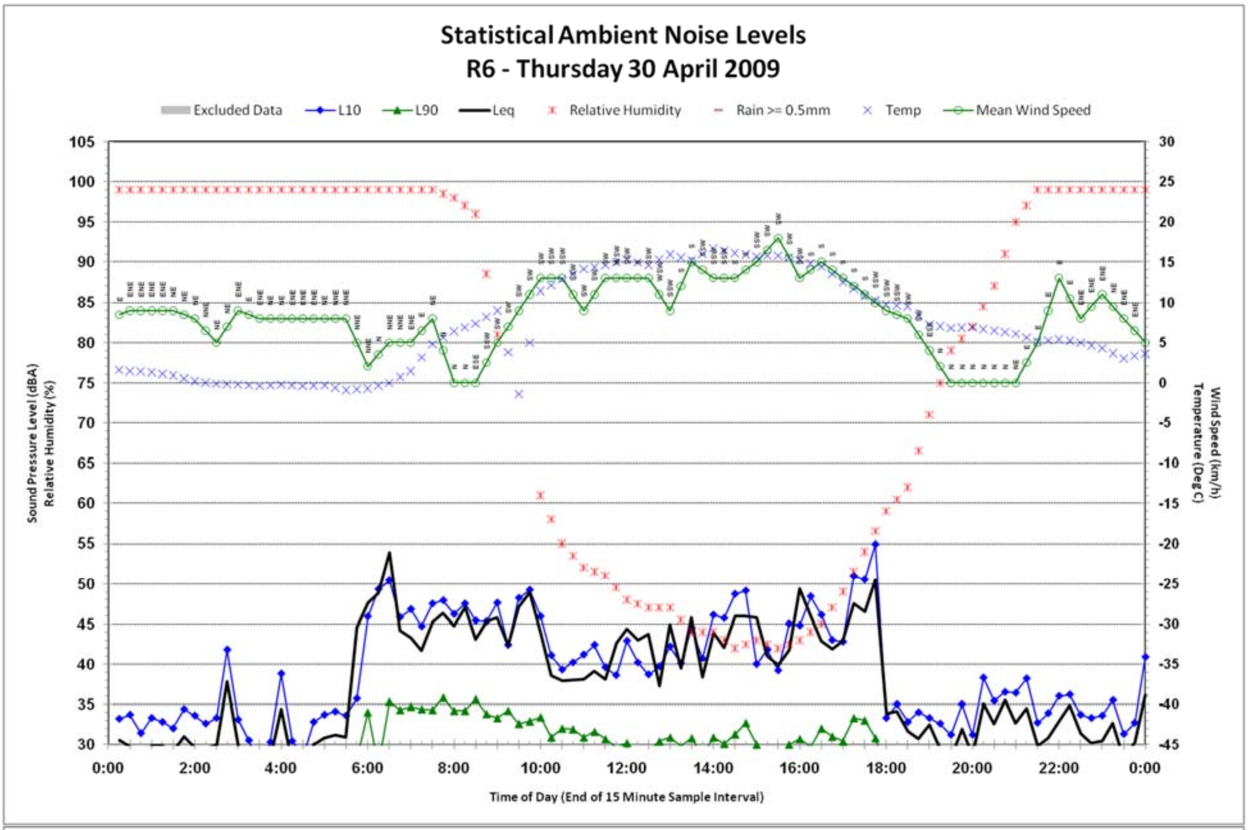

Statistical Ambient Noise Levels
R5 - Sunday 3 May 2009
Excluded Data
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)

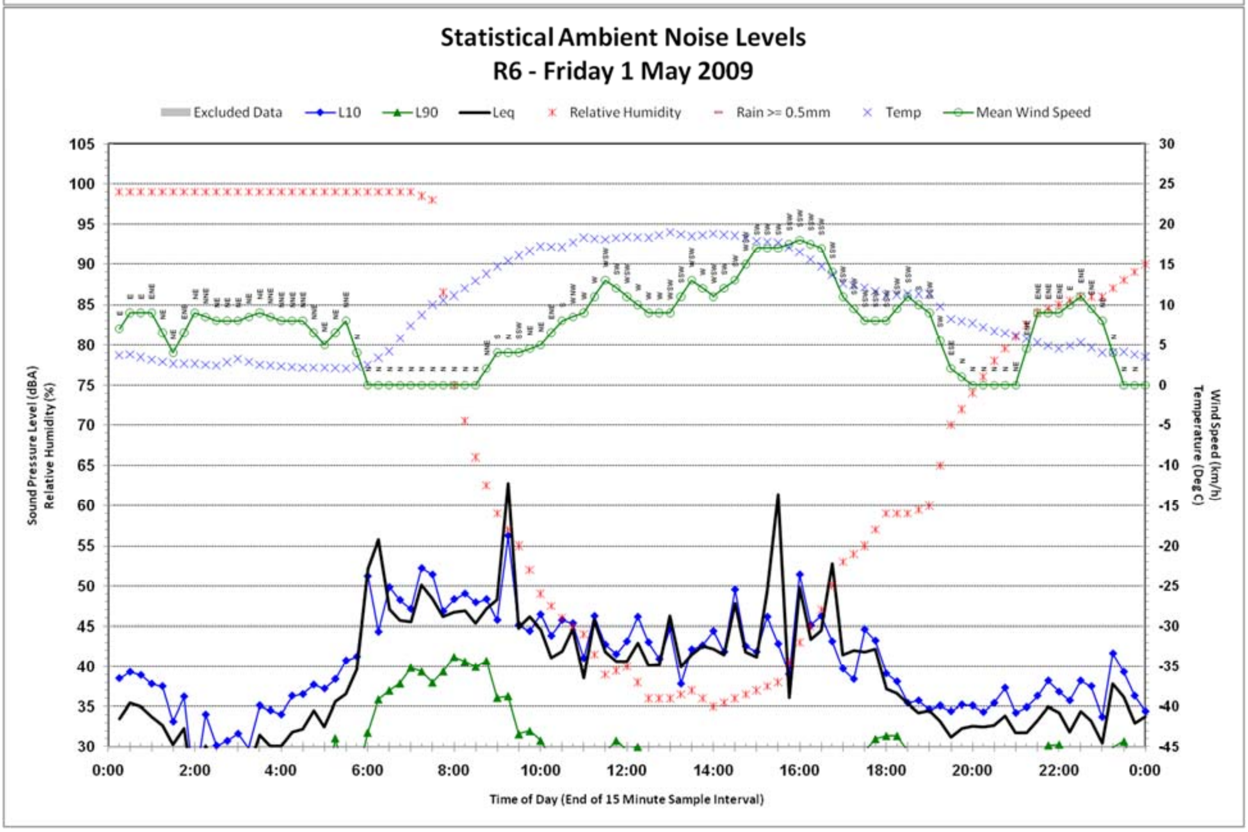

Statistical Ambient Noise Levels
R5 - Monday 4 May 2009
Excluded Data
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)

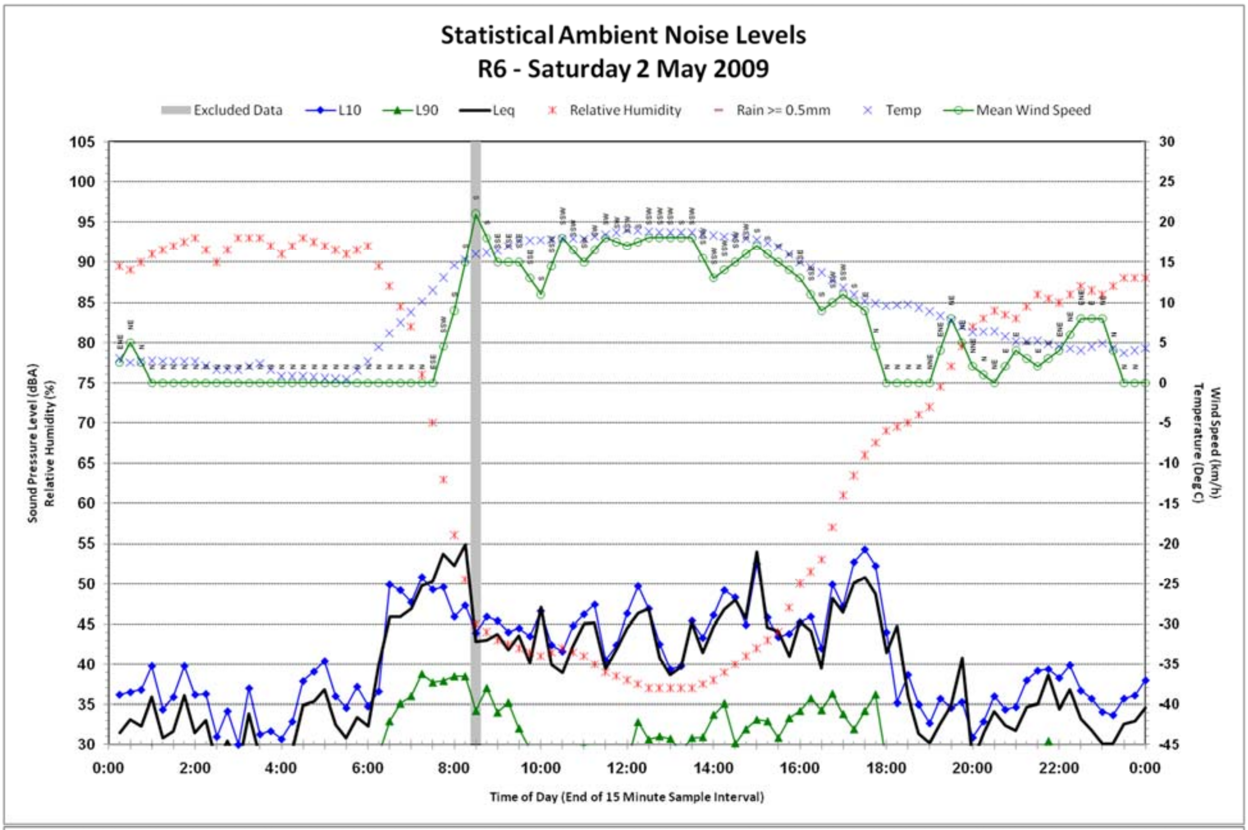

Statistical Ambient Noise Levels
R5 - Tuesday 5 May 2009
Excluded Data
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)

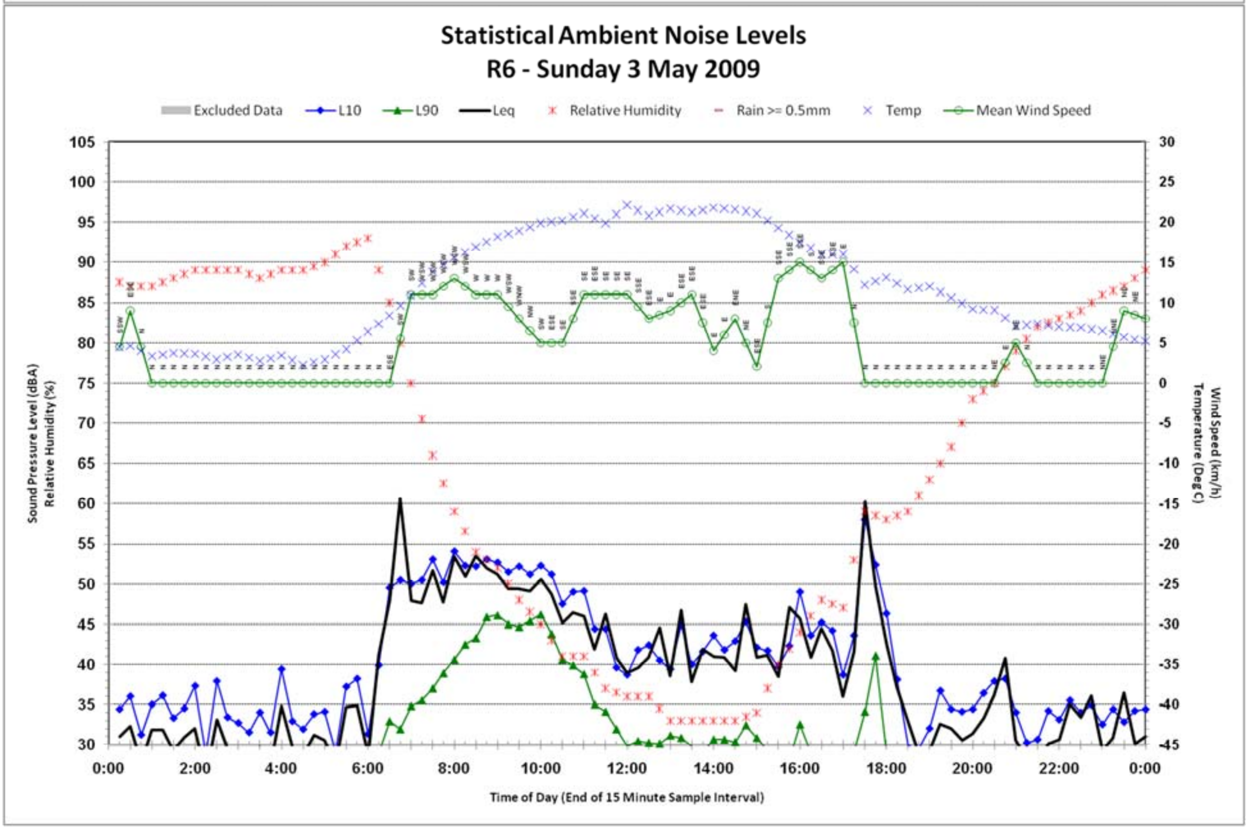

Statistical Ambient Noise Levels
R5 - Wednesday 6 May 2009
Excluded Data
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)

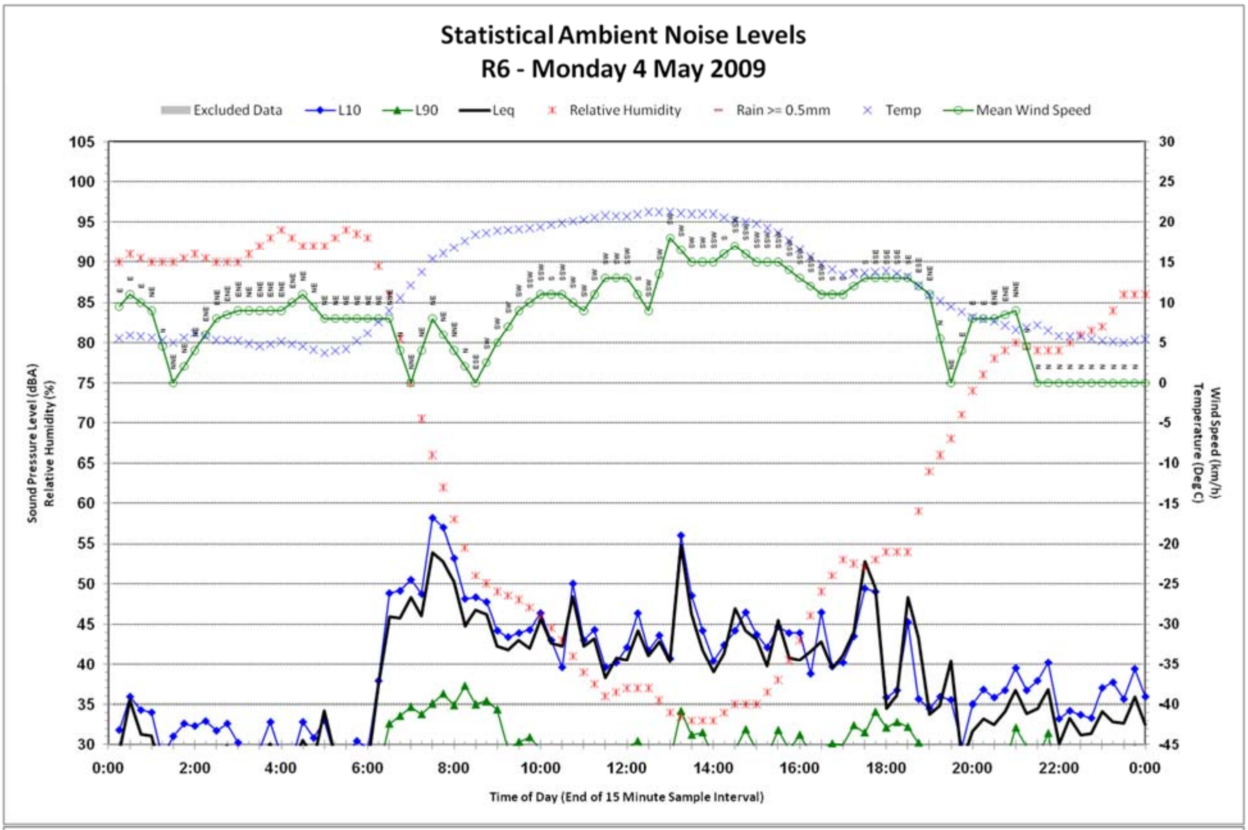

Statistical Ambient Noise Levels
R6 - Wednesday 29 April 2009
Excluded Data
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)

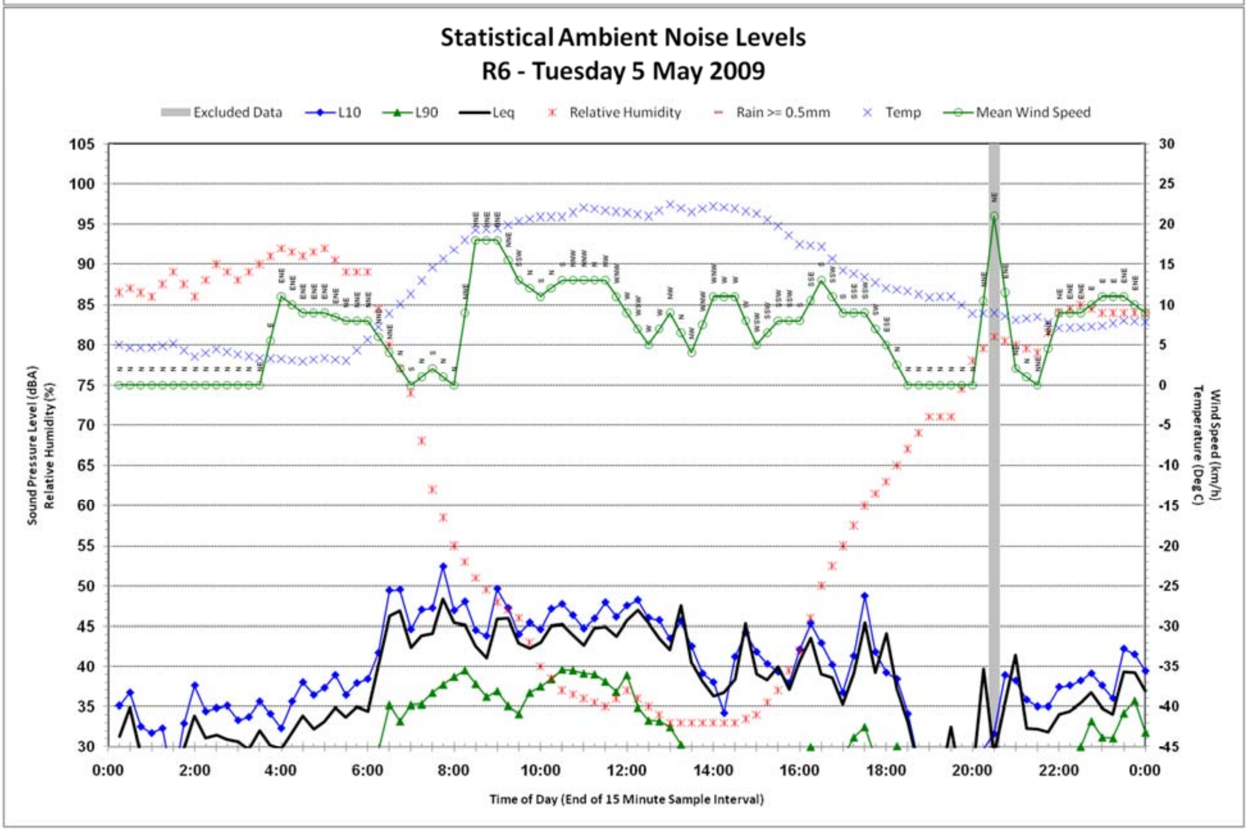

Statistical Ambient Noise Levels
R6 - Thursday 30 April 2009
Excluded Data
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00

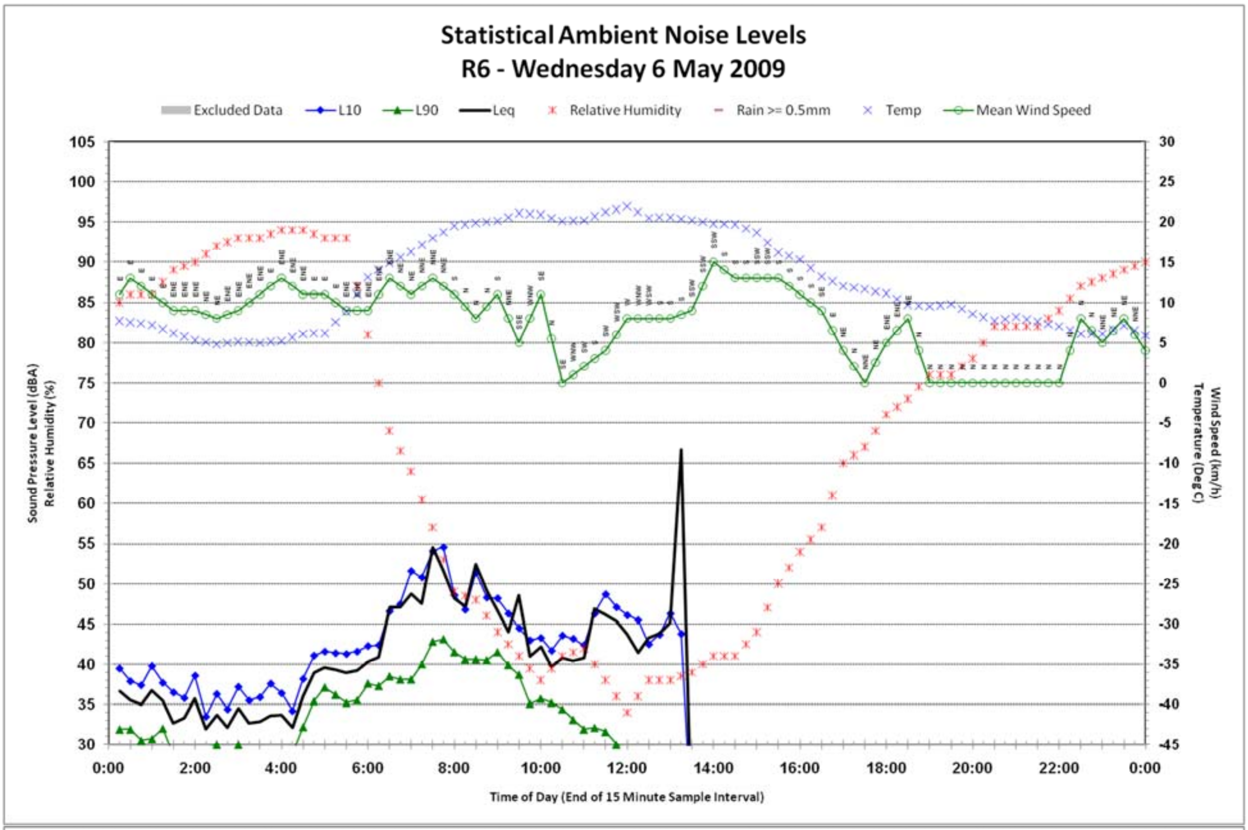

Statistical Ambient Noise Levels
R6 - Friday 1 May 2009
Excluded Data
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00


Statistical Ambient Noise Levels
R6 - Saturday 2 May 2009
Excluded Data
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
R6 - Sunday 3 May 2009
Excluded Data
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
R6 - Monday 4 May 2009
Excluded Data
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
R6 - Tuesday 5 May 2009
Excluded Data
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
R6 - Wednesday 6 May 2009
Excluded Data
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
0:00
2:00
4:00
6:00
8:00
10:00
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16:00
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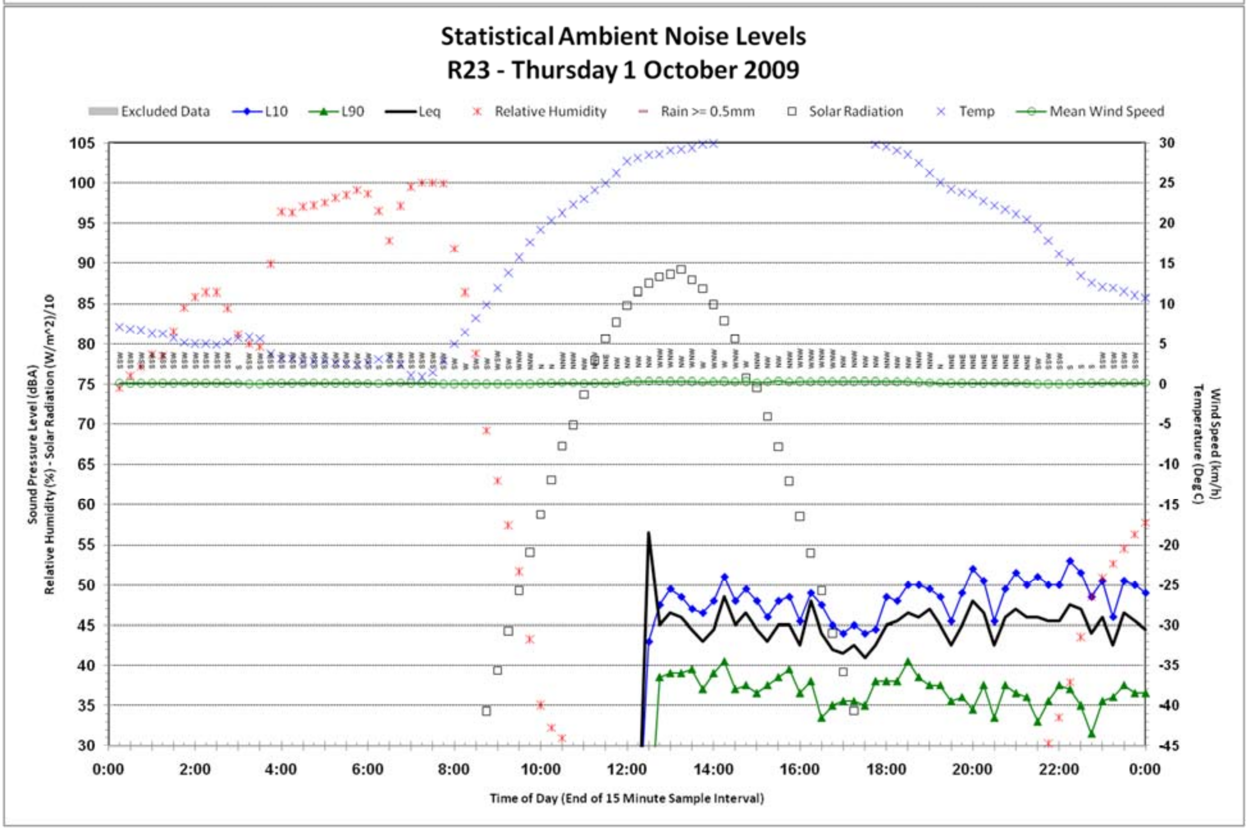
20:00
22:00
0:00


Statistical Ambient Noise Levels
R23 - Thursday 1 October 2009
Excluded Data
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Solar Radiation
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%) - Solar Radiation (W/m^2)/10
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
0:00
2:00
4:00
6:00
8:00
10:00
12:00
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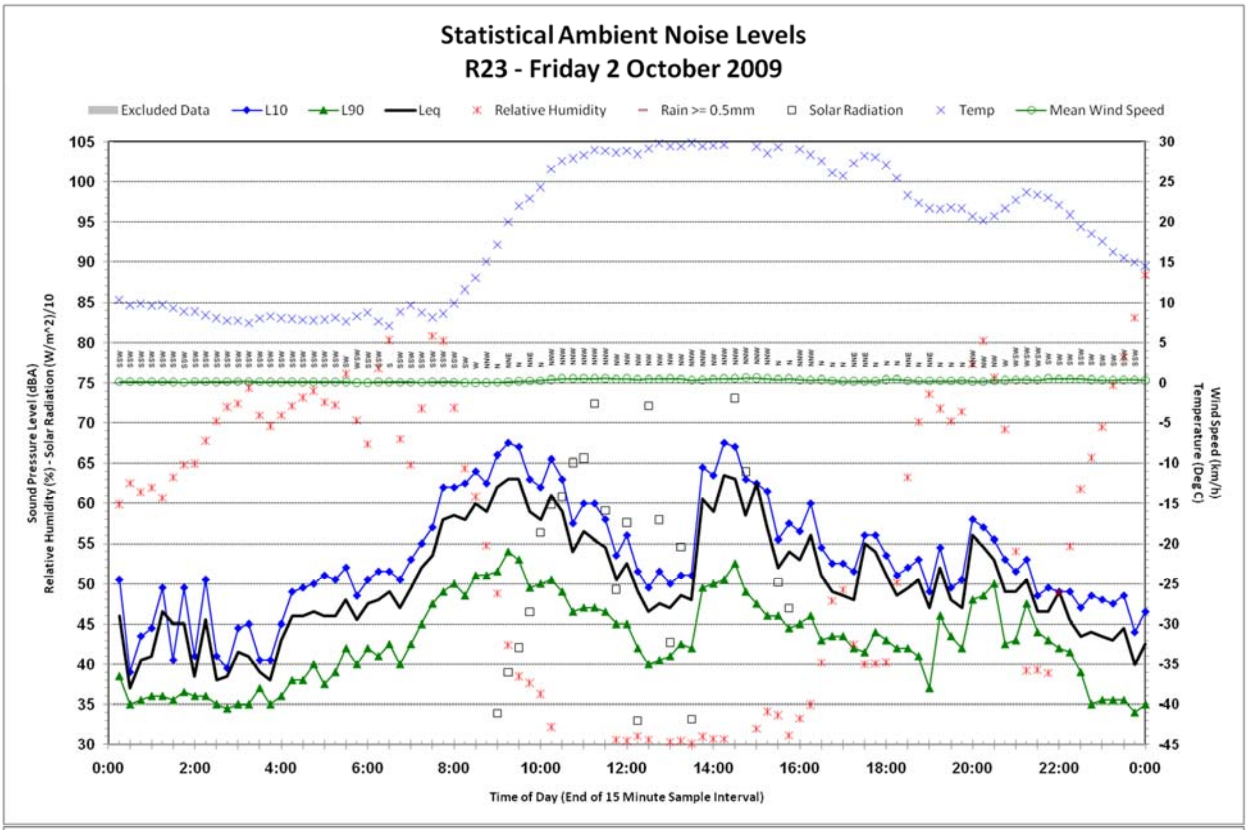
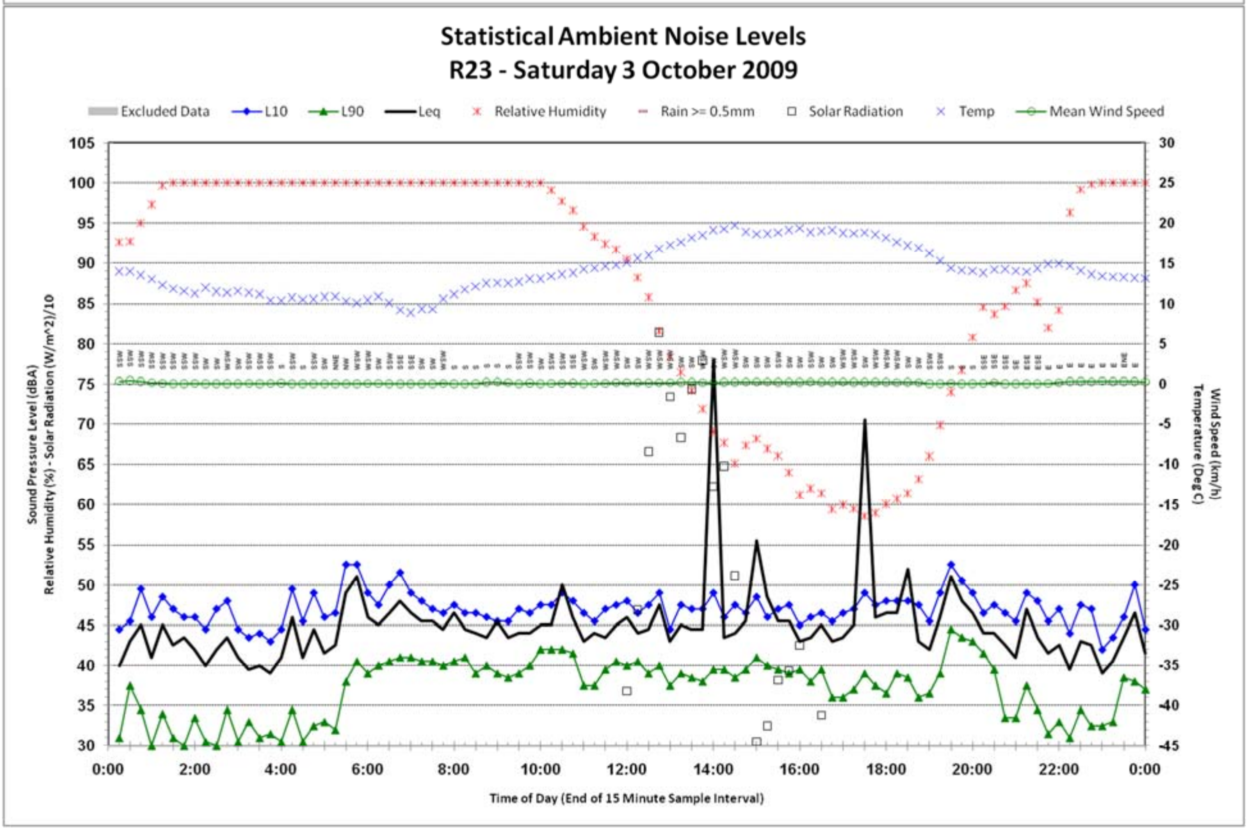
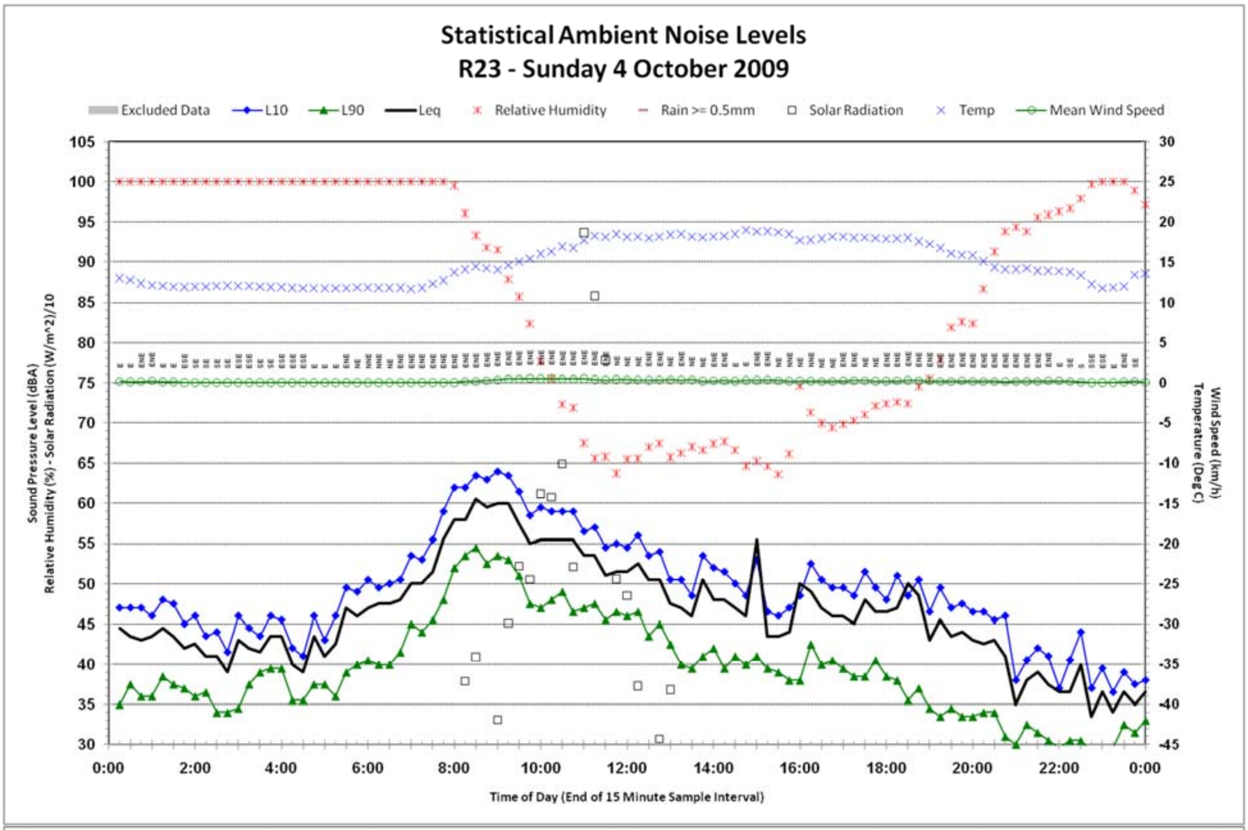
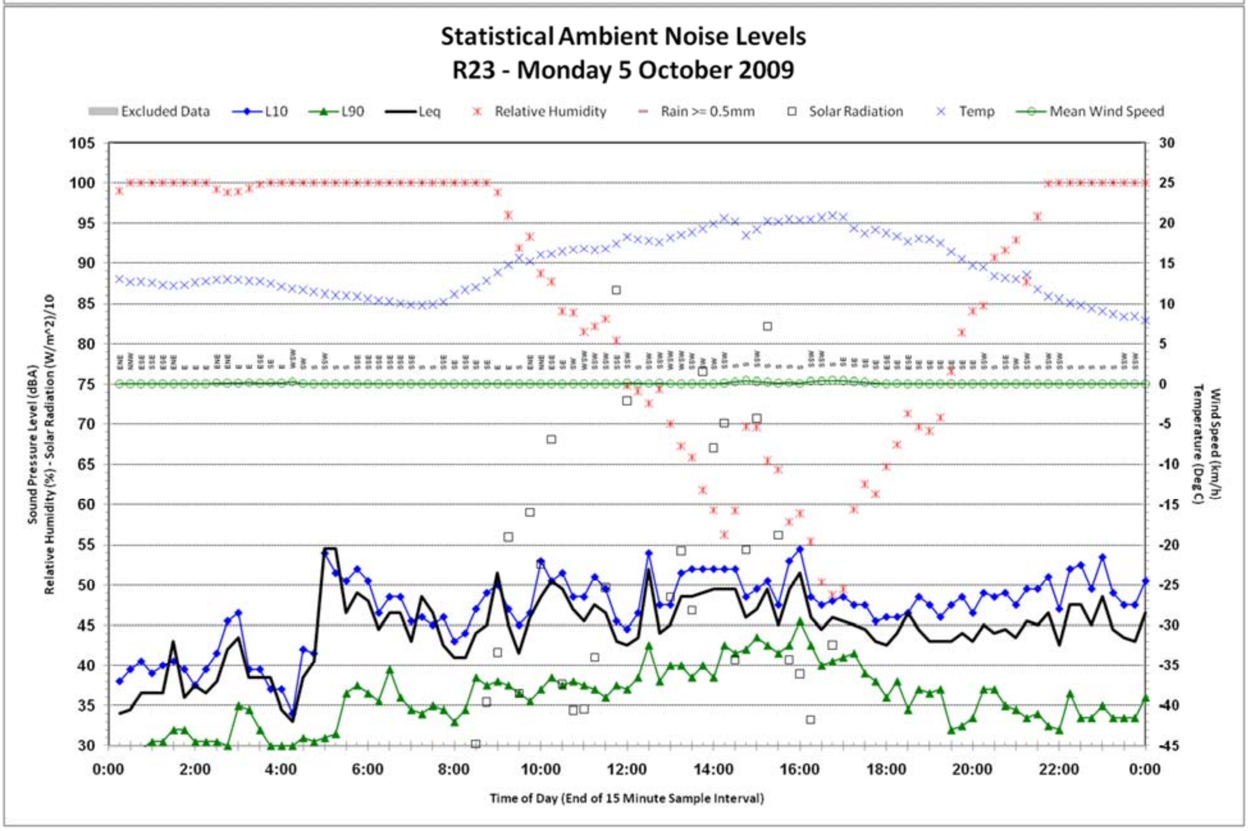
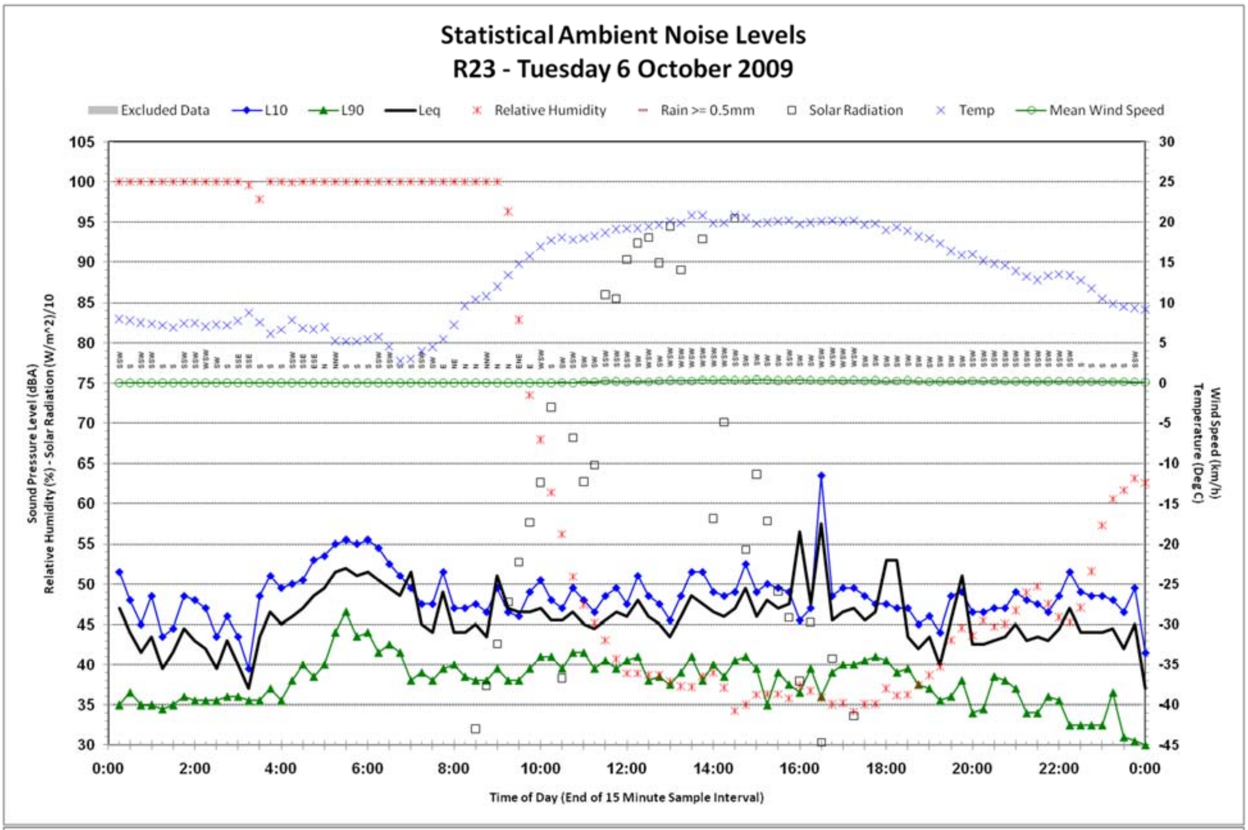
16:00
18:00
20:00
22:00
0:00

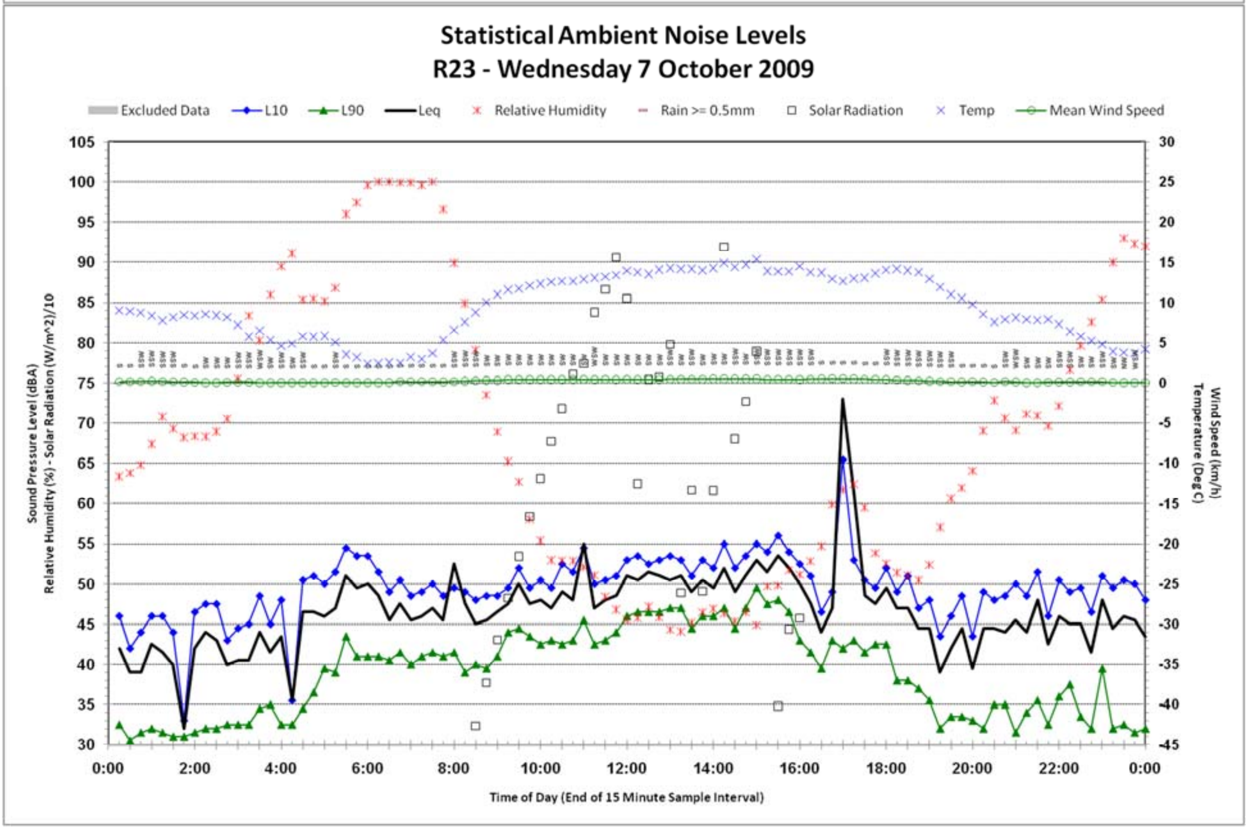

Statistical Ambient Noise Levels
R23 - Friday 2 October 2009
Excluded Data
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Solar Radiation
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%) - Solar Radiation (W/m^2)/10
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)

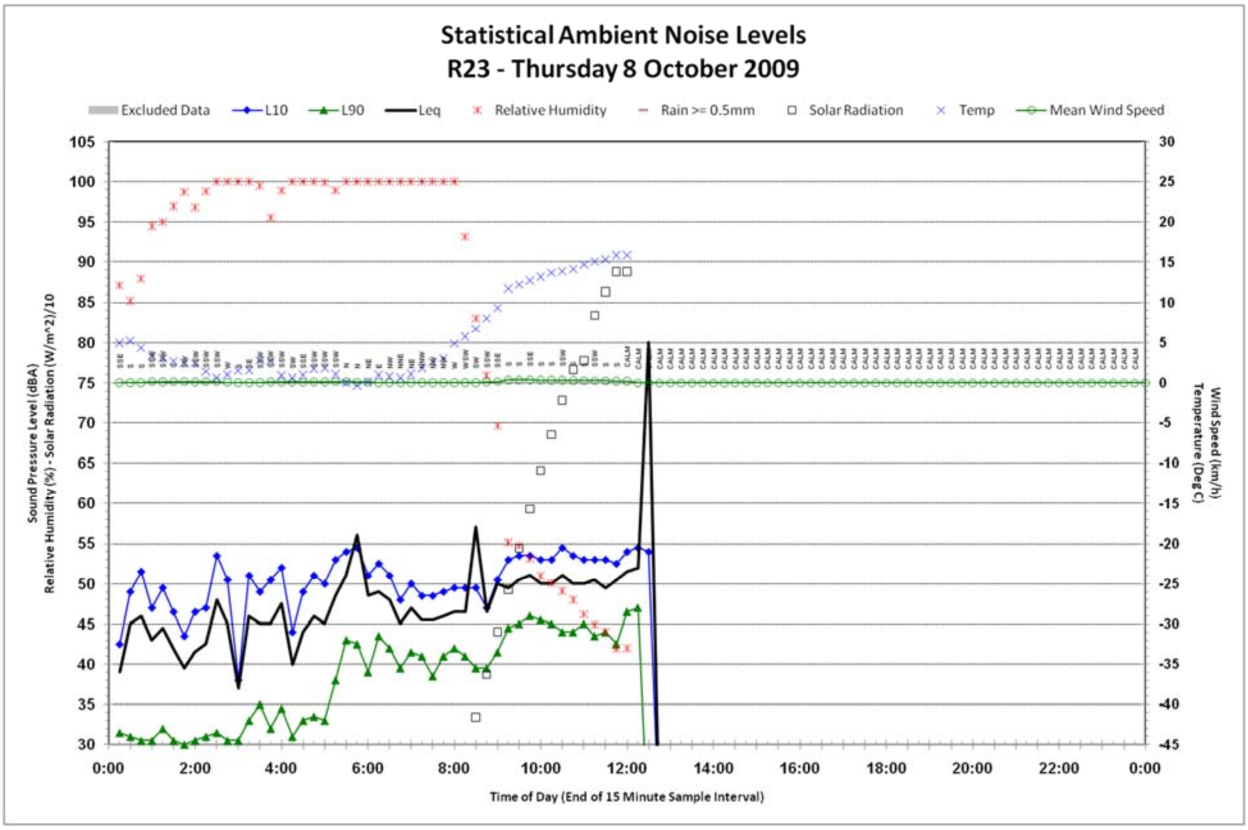

Statistical Ambient Noise Levels
R23 - Saturday 3 October 2009
Excluded Data
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Solar Radiation
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%) - Solar Radiation (W/m^2)/10
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
R23 - Sunday 4 October 2009
Excluded Data
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Solar Radiation
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%) - Solar Radiation (W/m^2)/10
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
R23 - Monday 5 October 2009
Excluded Data
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Solar Radiation
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%) - Solar Radiation (W/m^2)/10
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
R23 - Tuesday 6 October 2009
Excluded Data
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Solar Radiation
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%) - Solar Radiation (W/m^2)/10
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
R23 - Wednesday 7 October 2009
Excluded Data
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Solar Radiation
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%) - Solar Radiation (W/m^2)/10
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
R23 - Thursday 8 October 2009
Excluded Data
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Solar Radiation
Temp
Mean Wind Speed
Sound Pressure Level (dBA)
Relative Humidity (%) - Solar Radiation (W/m^2)/10
Wind Speed (km/h)
Temperature (Deg C)
Time of Day (End of 15 Minute Sample Interval)

Appendix B

Frequency of Occurrence of Each Stability Class

(No. of pages excluding this page = 4)

(A copy of this Appendix is available on the Project CD)

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Frequency of Occurrence of Each Stability Class
Evening/Night-time Period
Peak Hill – January 2003 to December 2004

Stability Class	Summer	Autumn	Winter	Spring
A	0.0%	0.0%	0.0%	0.0%
B	0.0%	0.0%	0.0%	0.0%
C	0.0%	0.0%	0.0%	0.0%
D	39.9%	22.4%	23.8%	45.5%
E	15.9%	17.2%	19.2%	15.6%
F	40.5%	51.9%	43.9%	30.2%
G	3.6%	8.5%	13.0%	8.8%
F+G	44.2%	60.4%	56.9%	39.0%

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Appendix C
Intrusive Noise Contours

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(A copy of this Appendix is available on the Project CD)

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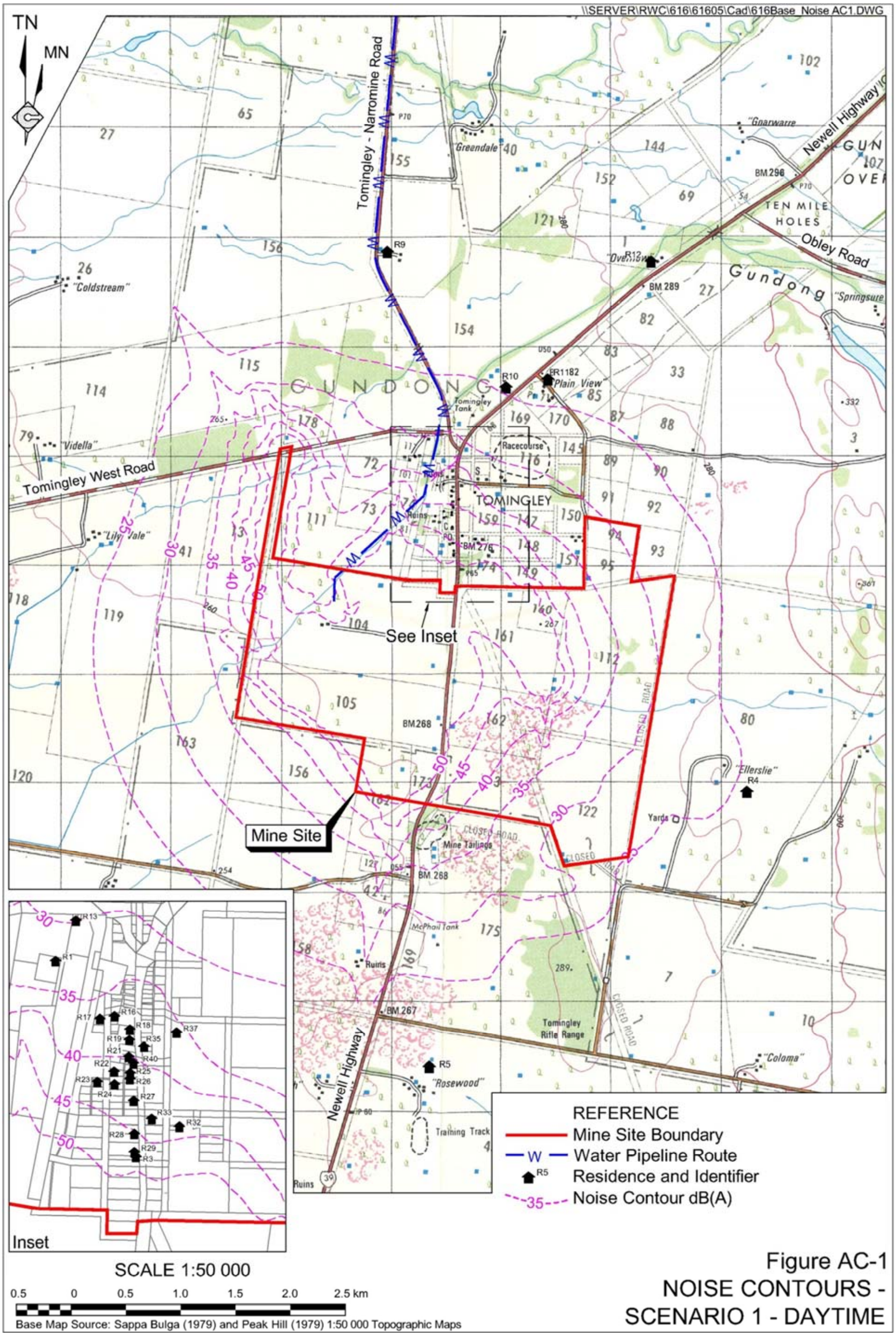

Figure AC-1
NOISE CONTOURS - SCENARIO 1 - DAYTIME

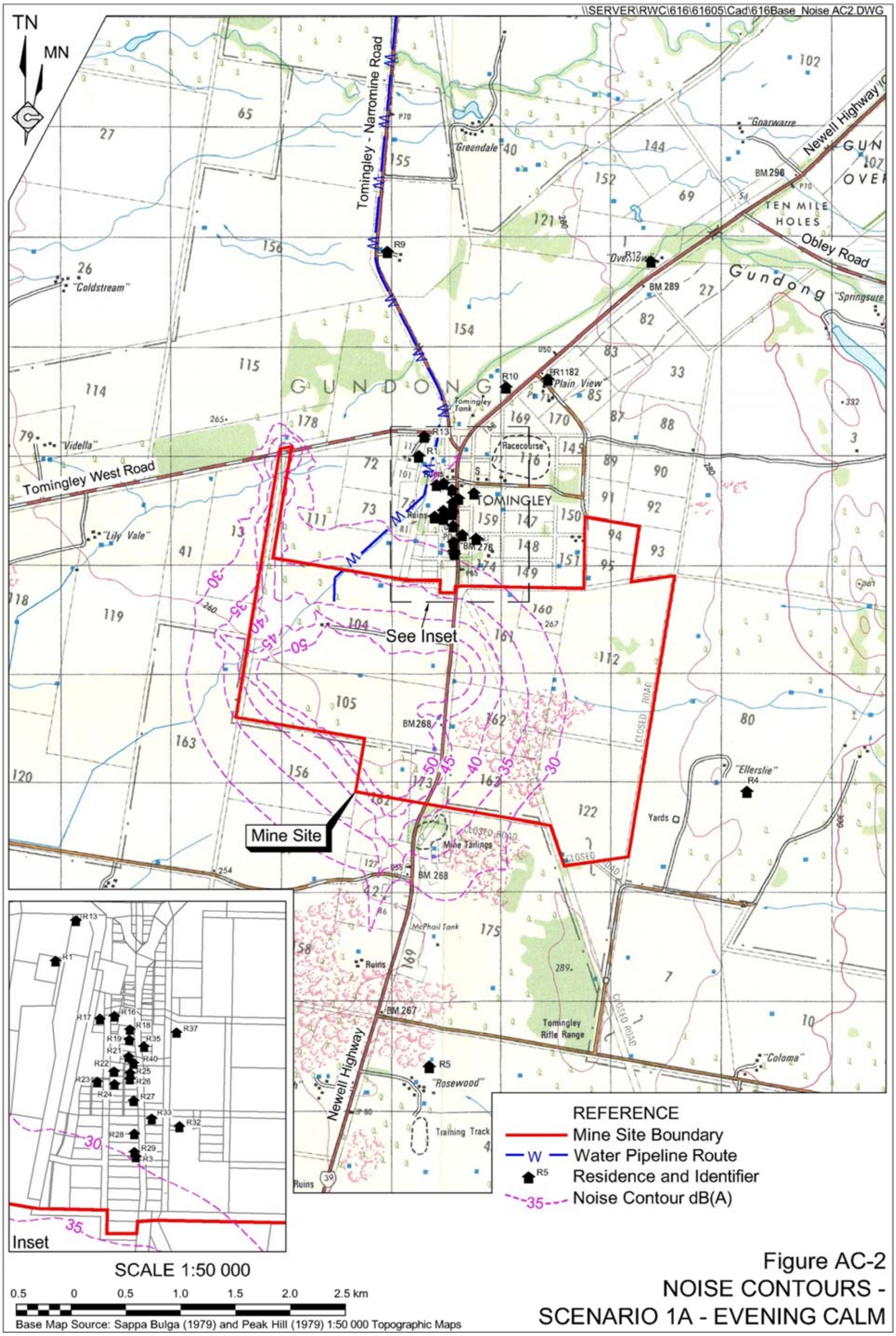

Figure AC-2
NOISE CONTOURS - SCENARIO 1A - EVENING CALM

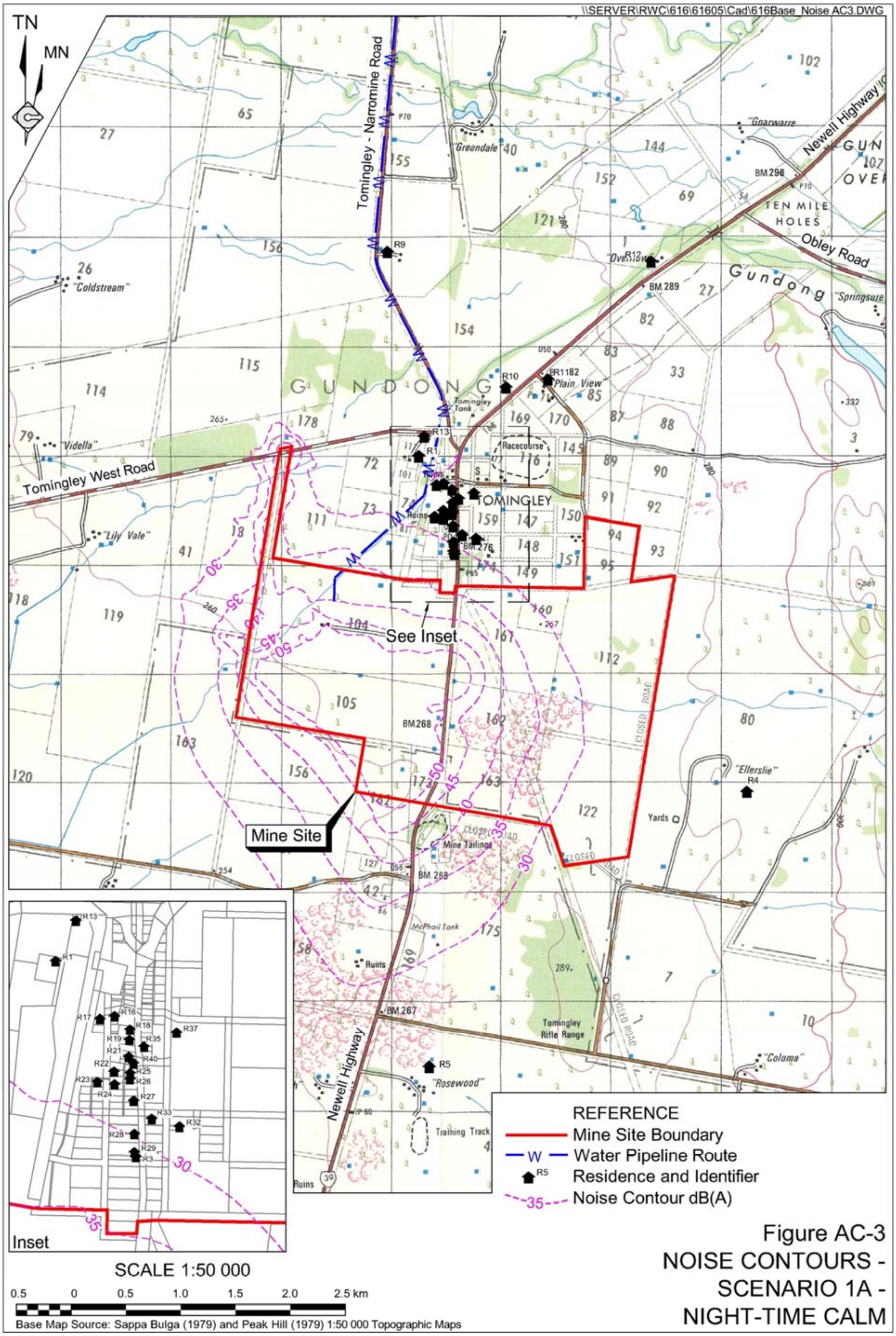

Figure AC-3
NOISE CONTOURS - SCENARIO 1A - NIGHT-TIME CALM

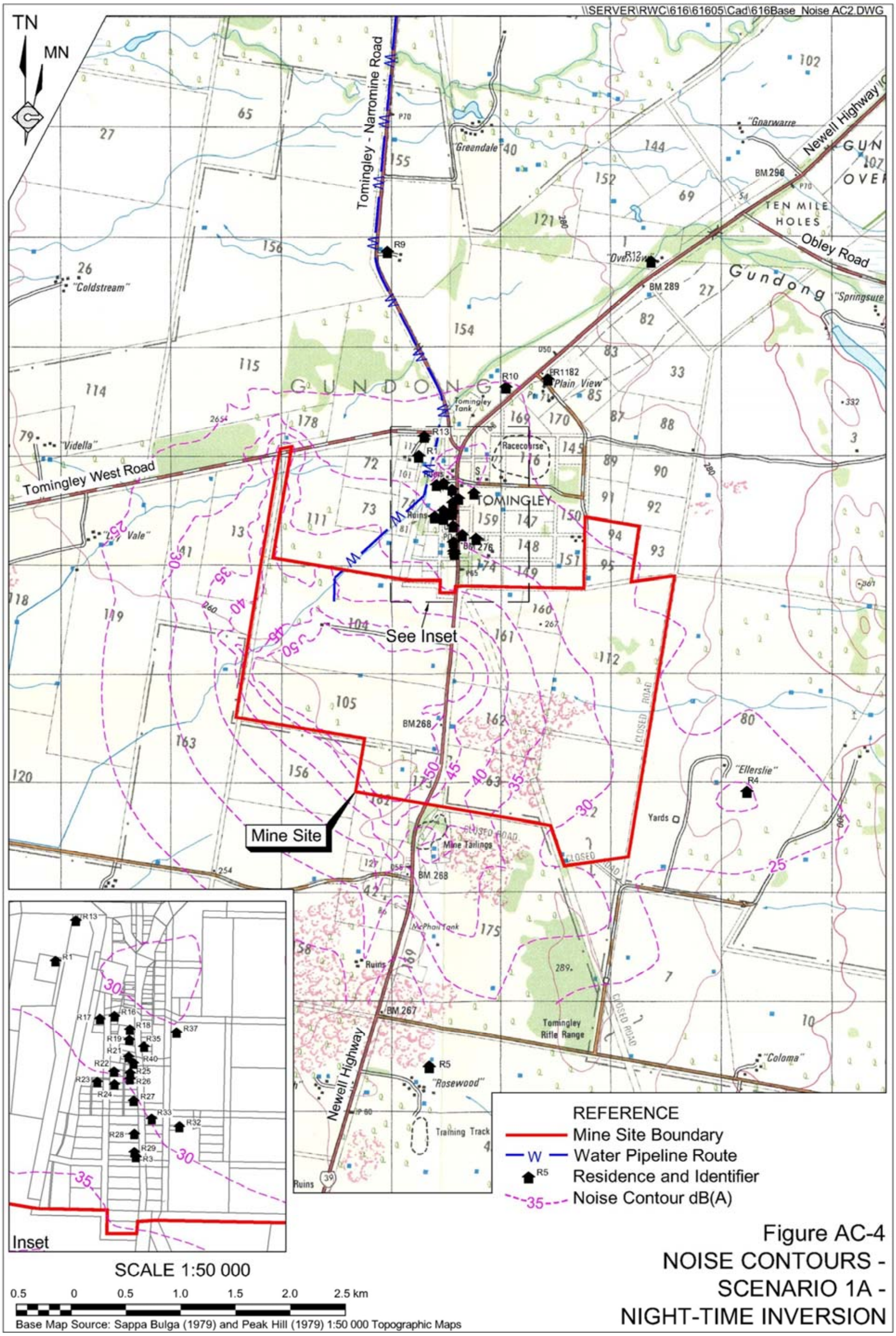

Figure AC-4
NOISE CONTOURS - SCENARIO 1A - NIGHT-TIME INVERSION

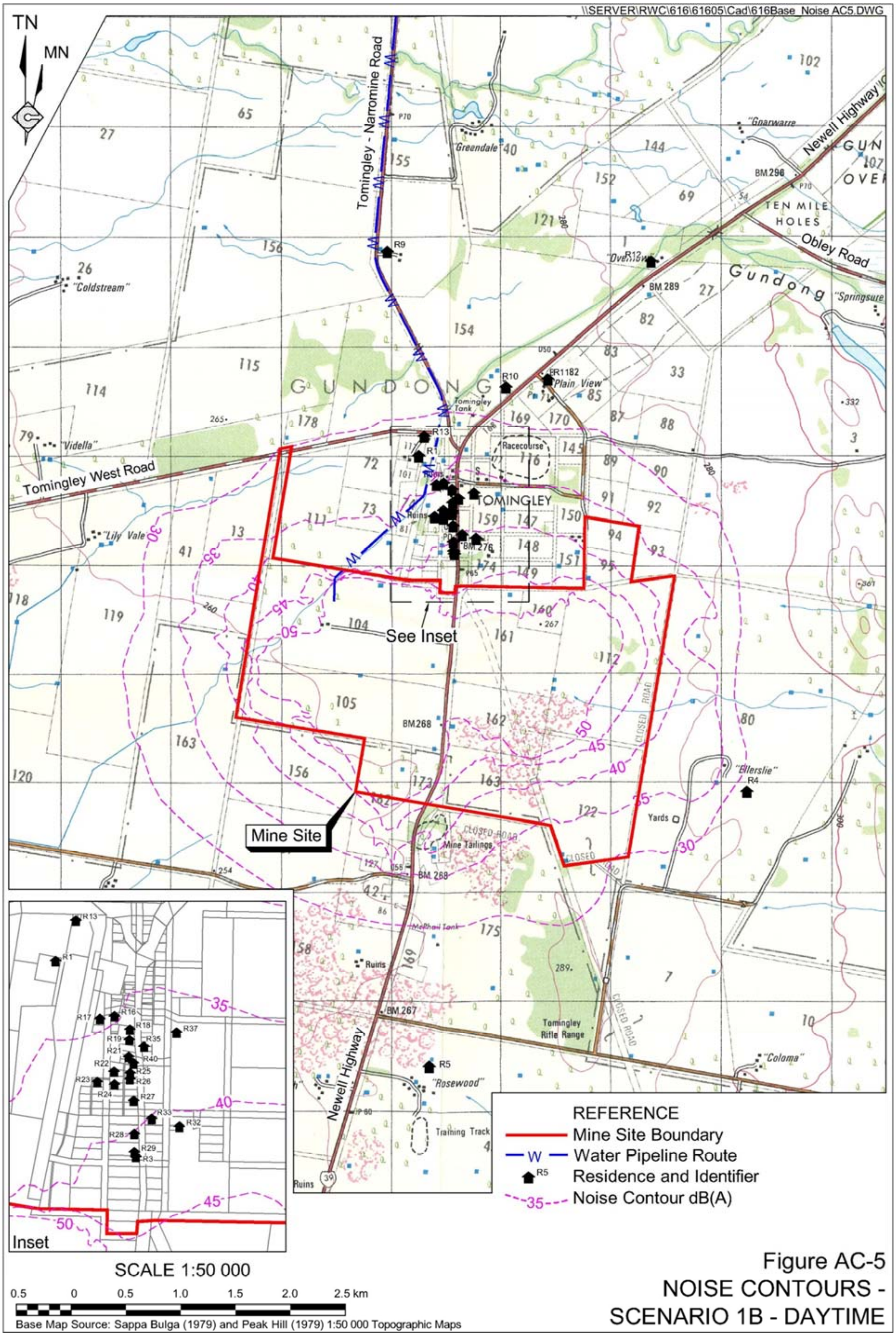

Figure AC-5
NOISE CONTOURS -
SCENARIO 1B - DAYTIME

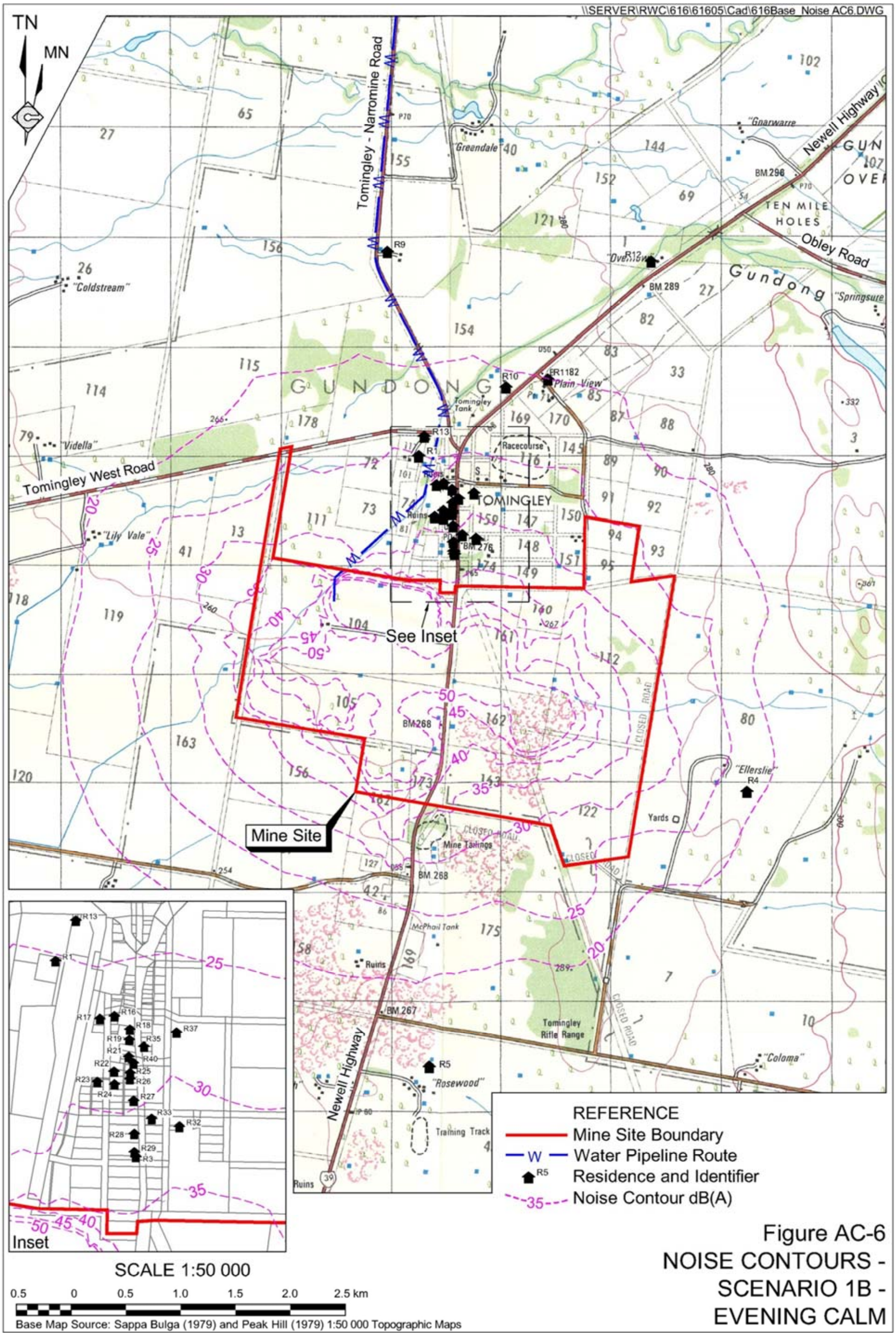

Figure AC-6
NOISE CONTOURS - SCENARIO 1B - EVENING CALM

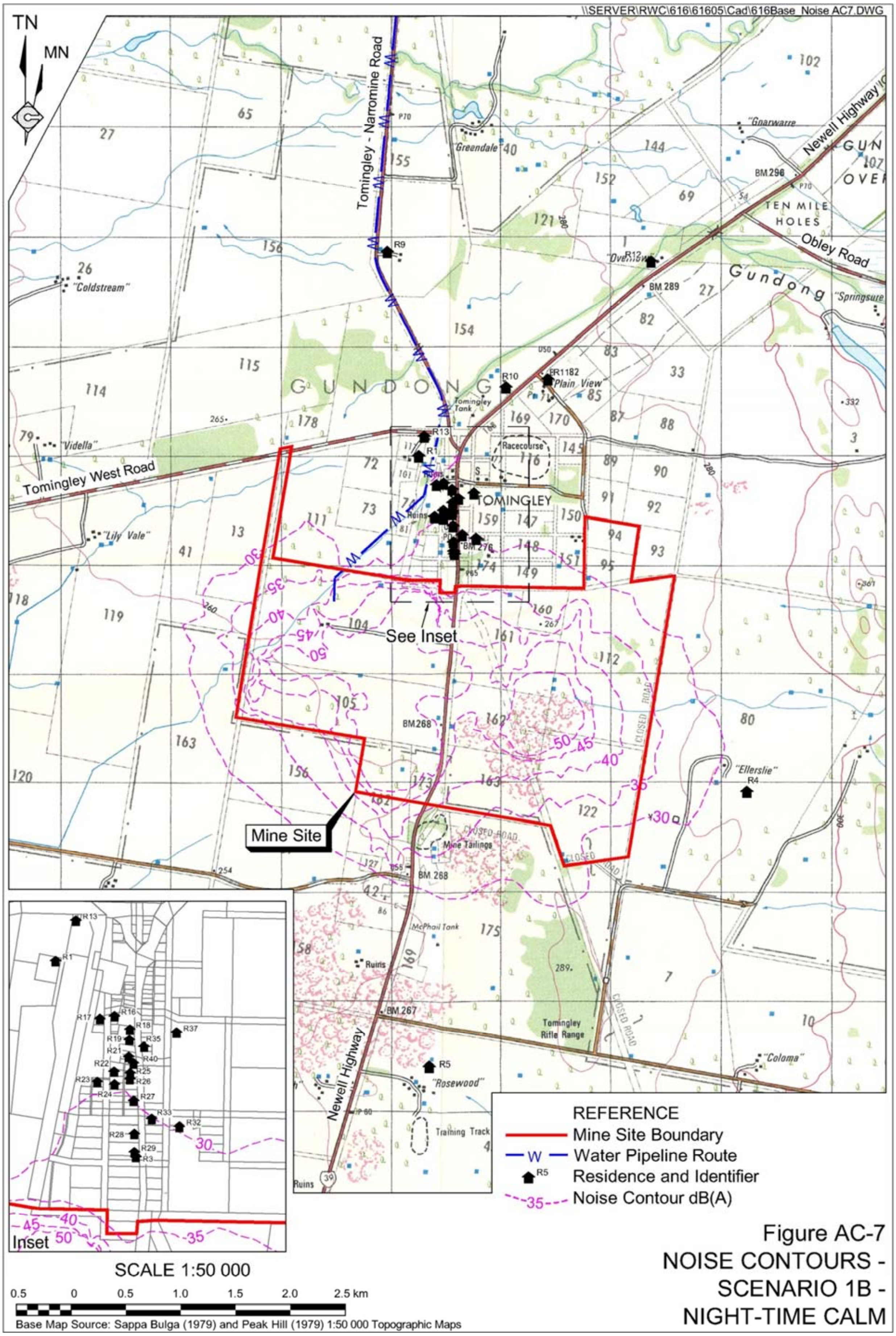

Figure AC-7
NOISE CONTOURS - SCENARIO 1B - NIGHT-TIME CALM

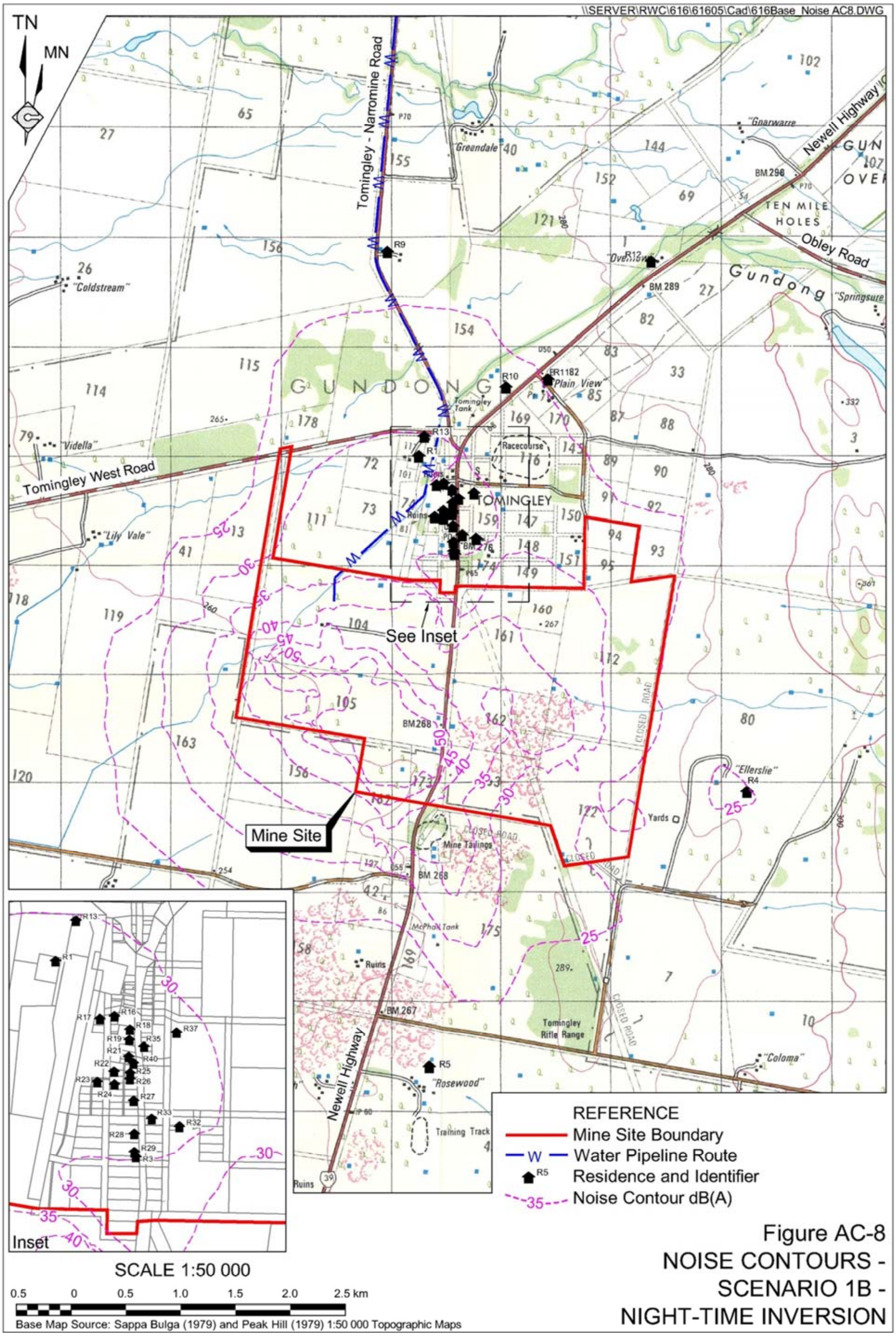

Figure AC-8
NOISE CONTOURS - SCENARIO 1B - NIGHT-TIME INVERSION

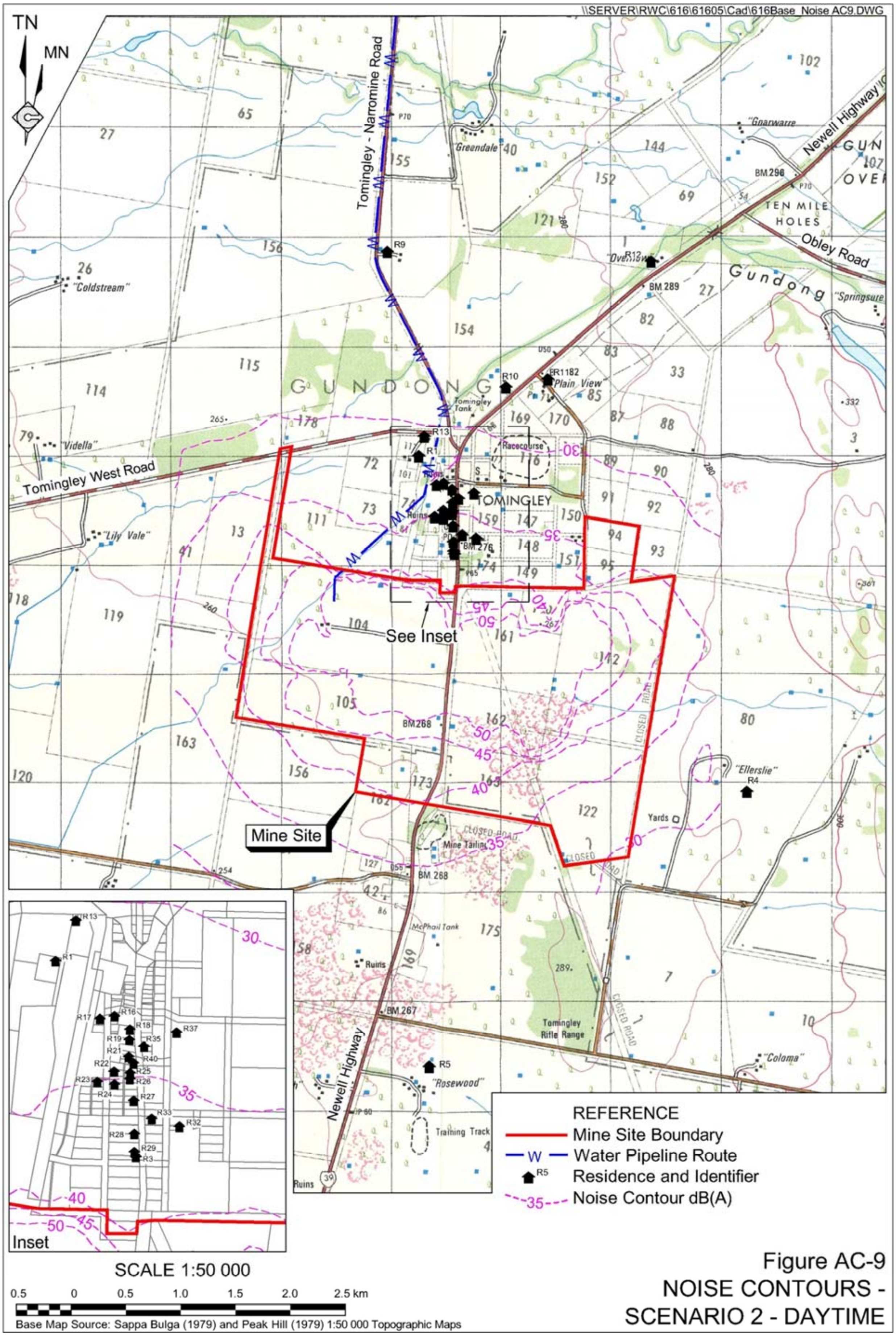

Figure AC-9
NOISE CONTOURS -
SCENARIO 2 - DAYTIME

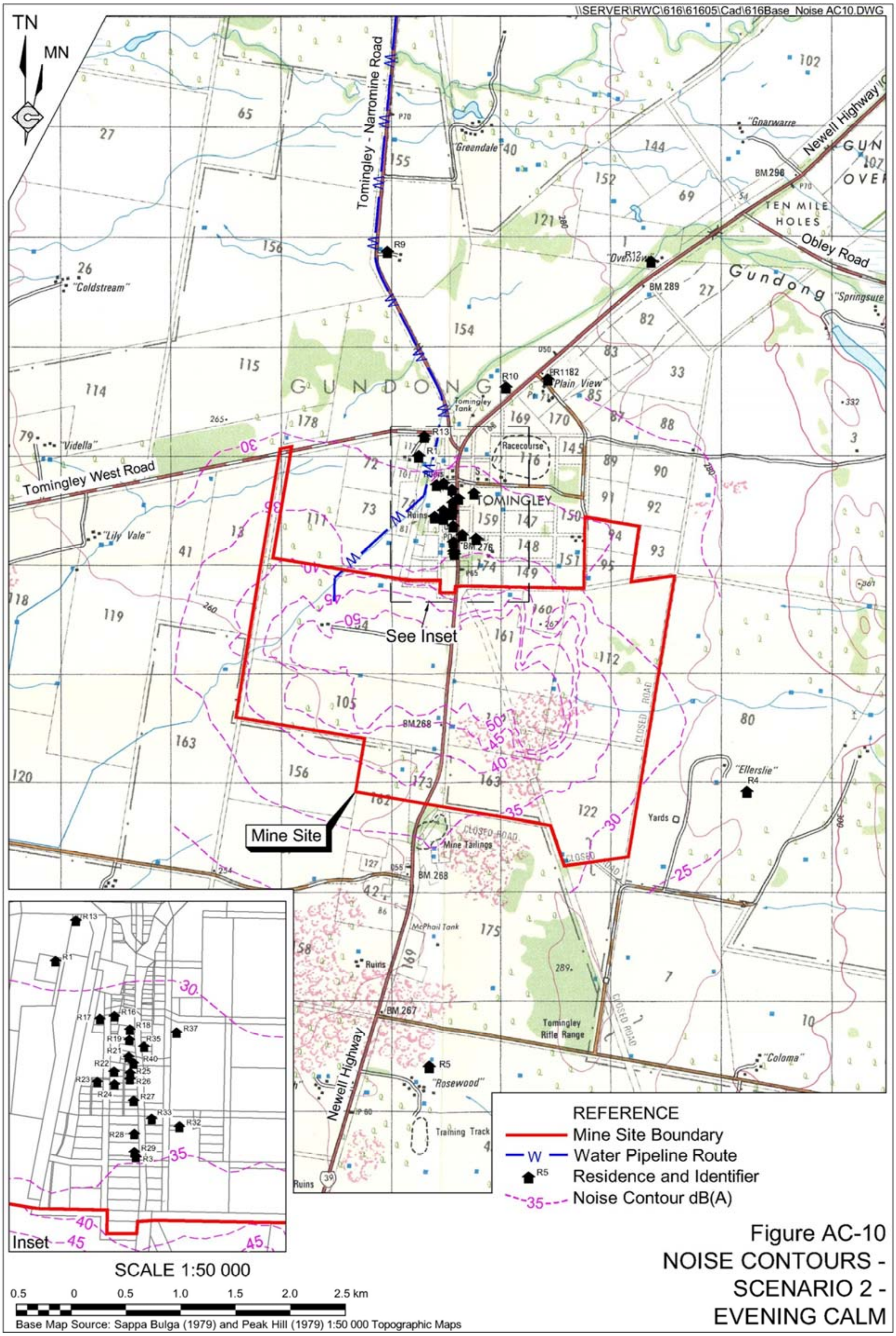

Figure AC-10
NOISE CONTOURS - SCENARIO 2 - EVENING CALM

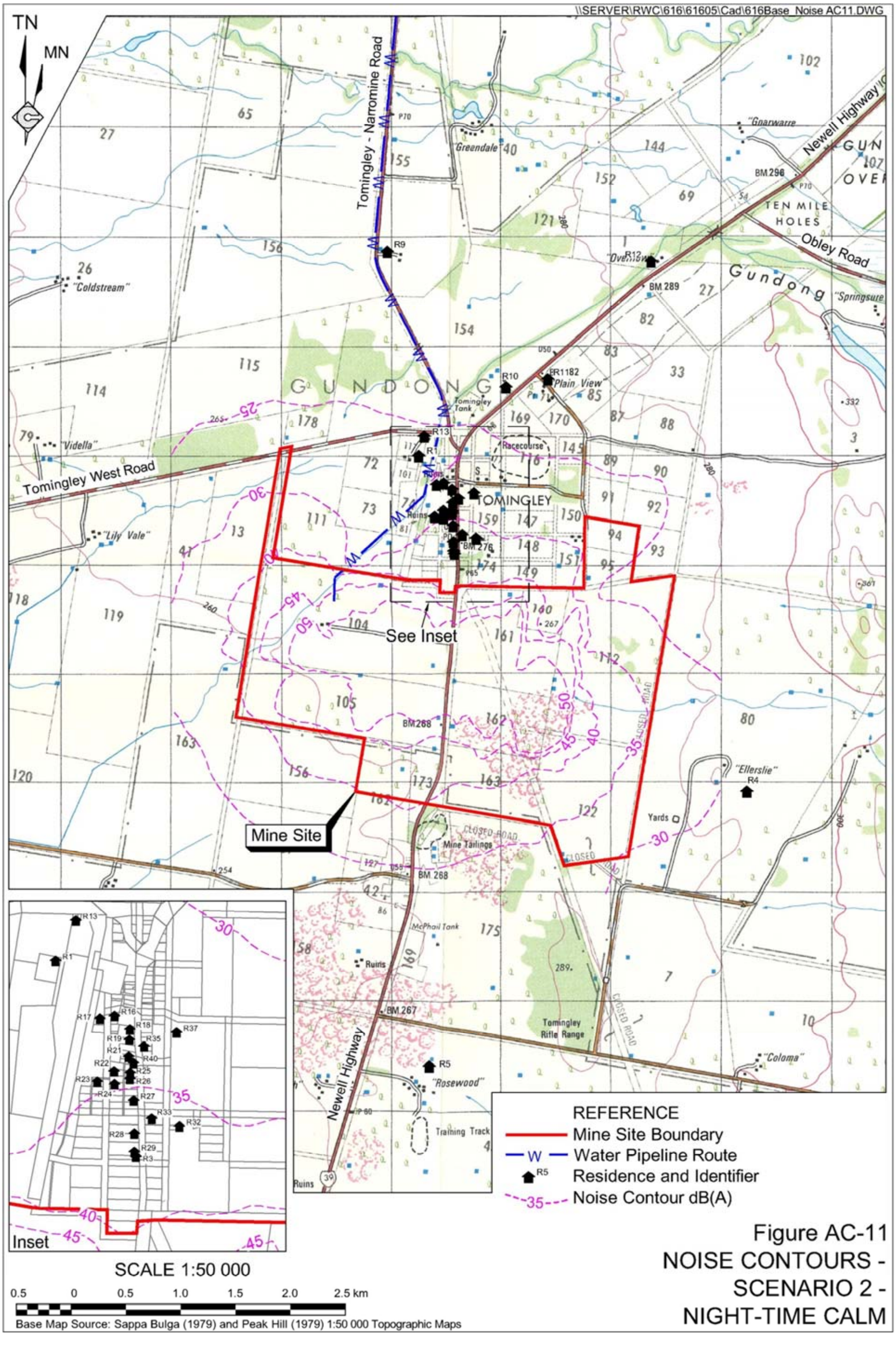

Figure AC-11
NOISE CONTOURS -
SCENARIO 2 -
NIGHT-TIME CALM

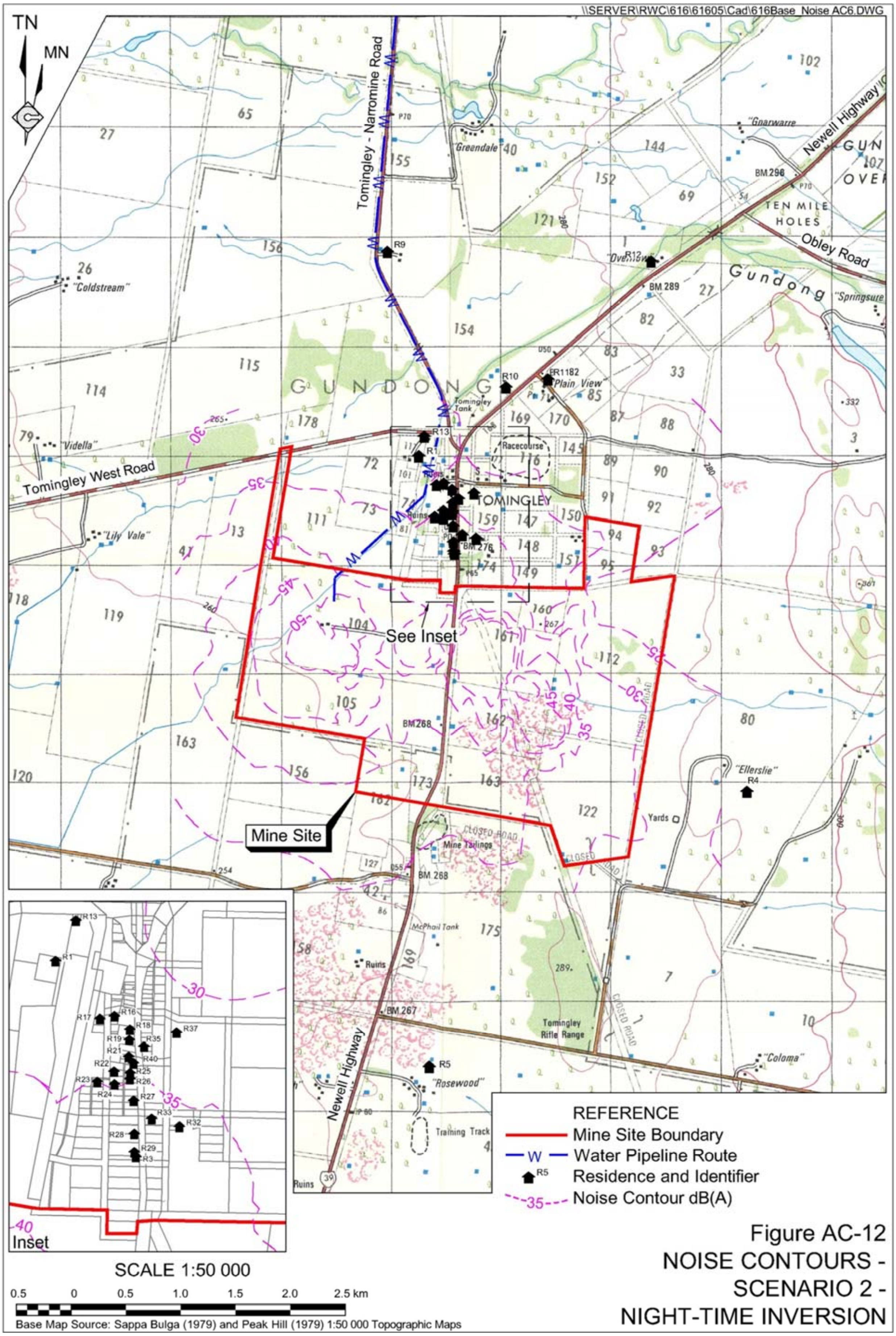

Figure AC-12
NOISE CONTOURS -
SCENARIO 2 -
NIGHT-TIME INVERSION

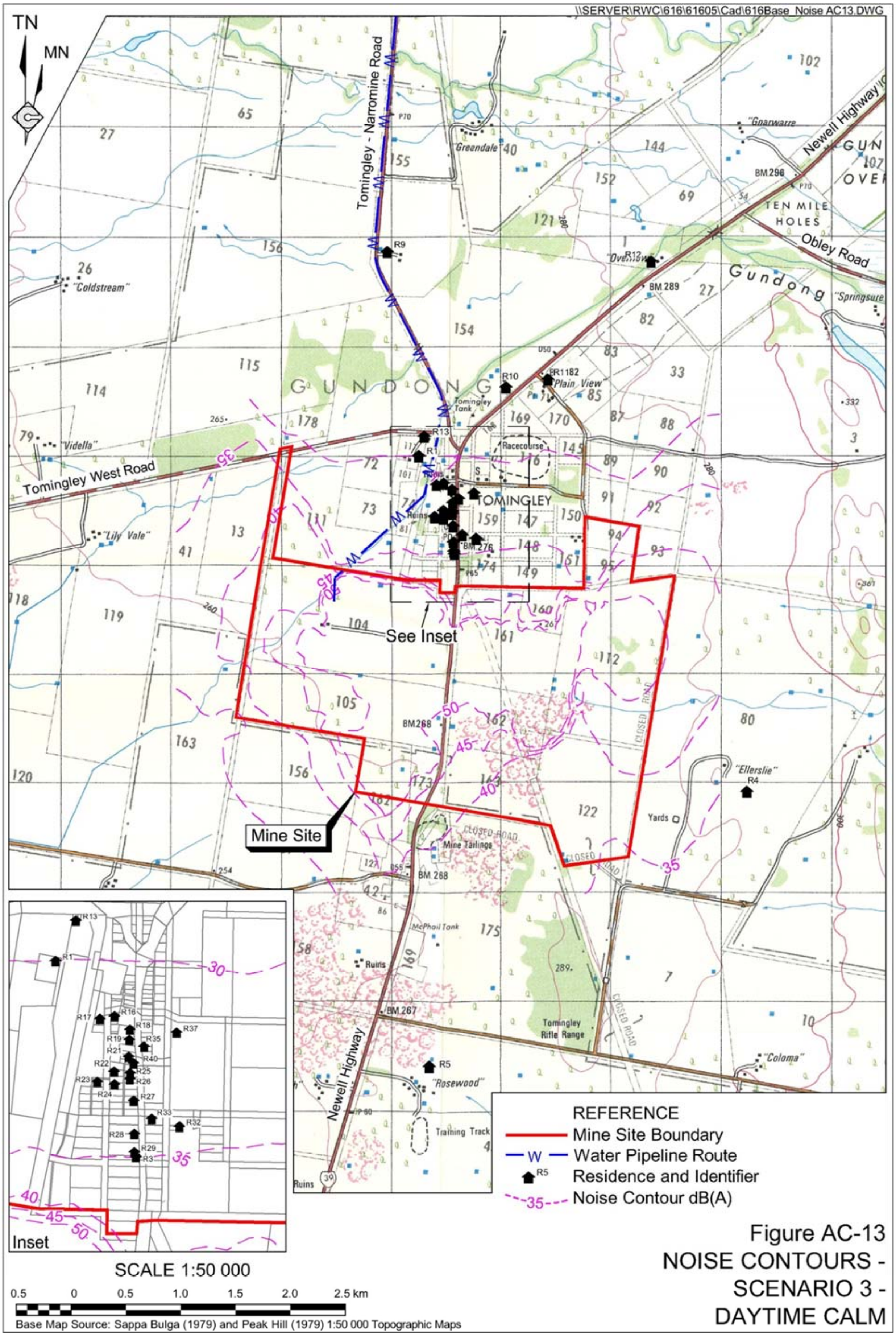

Figure AC-13
NOISE CONTOURS -
SCENARIO 3 -
DAYTIME CALM

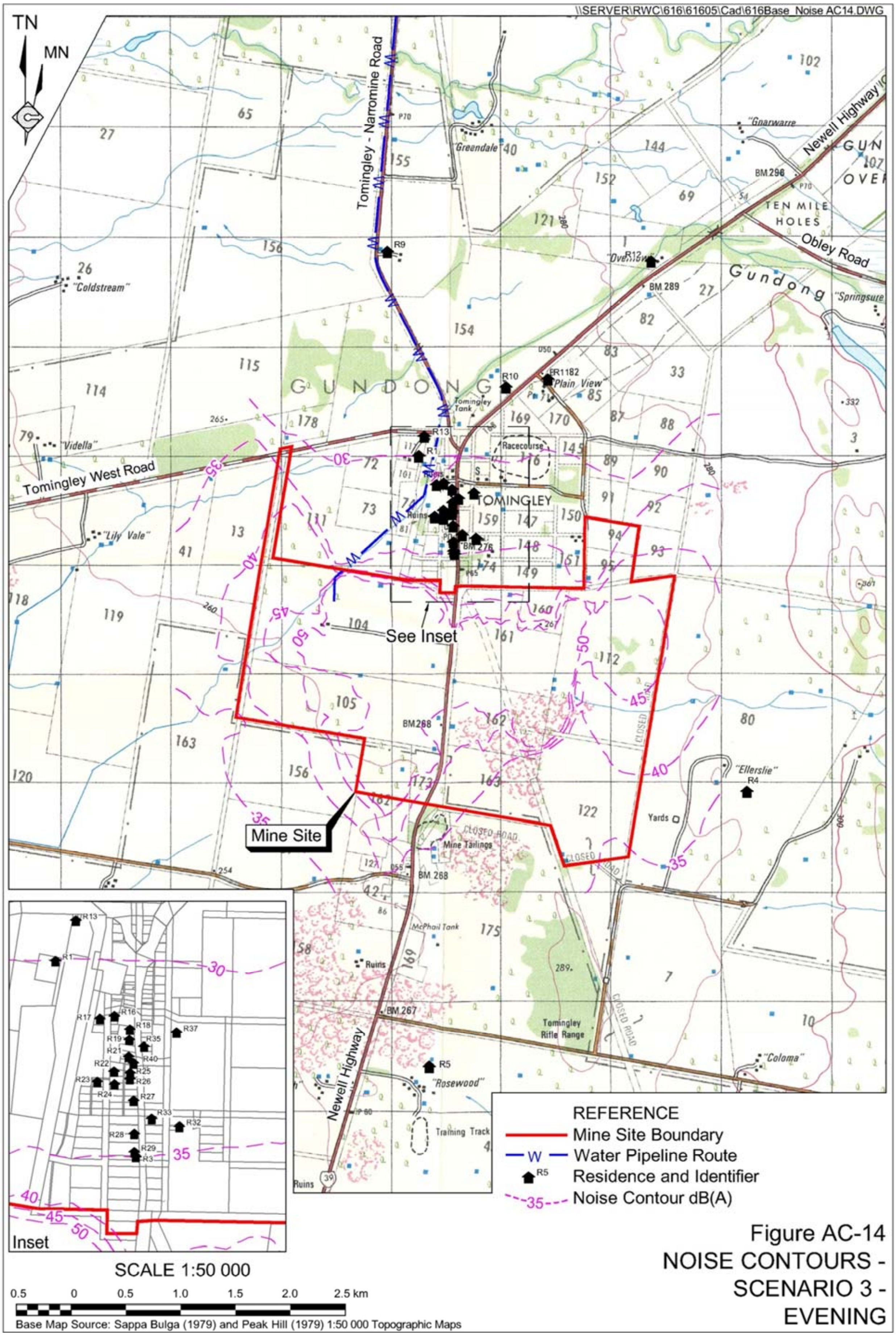

Figure AC-14
NOISE CONTOURS -
SCENARIO 3 -
EVENING

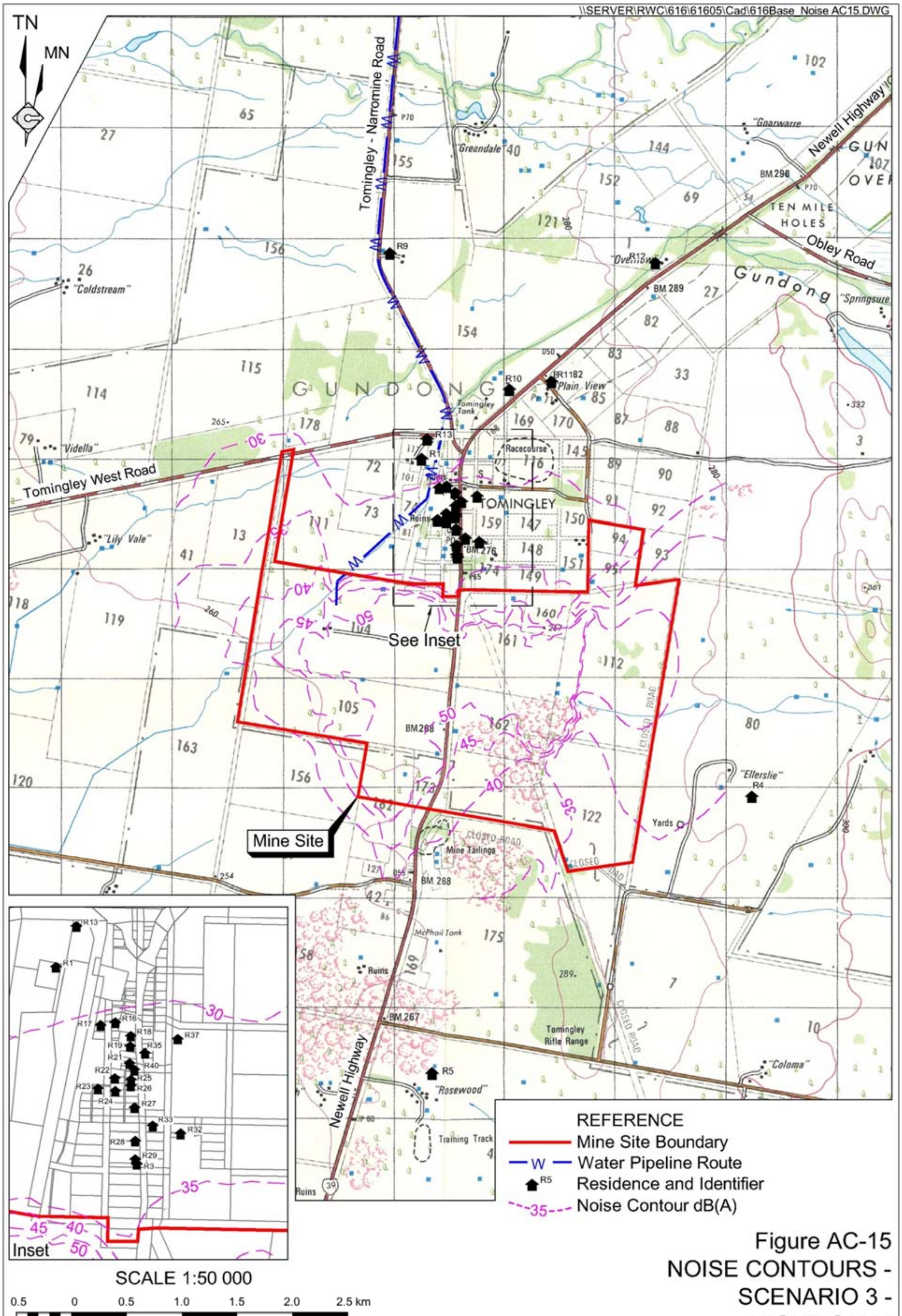

Figure AC-15
NOISE CONTOURS - SCENARIO 3 - NIGHT CALM

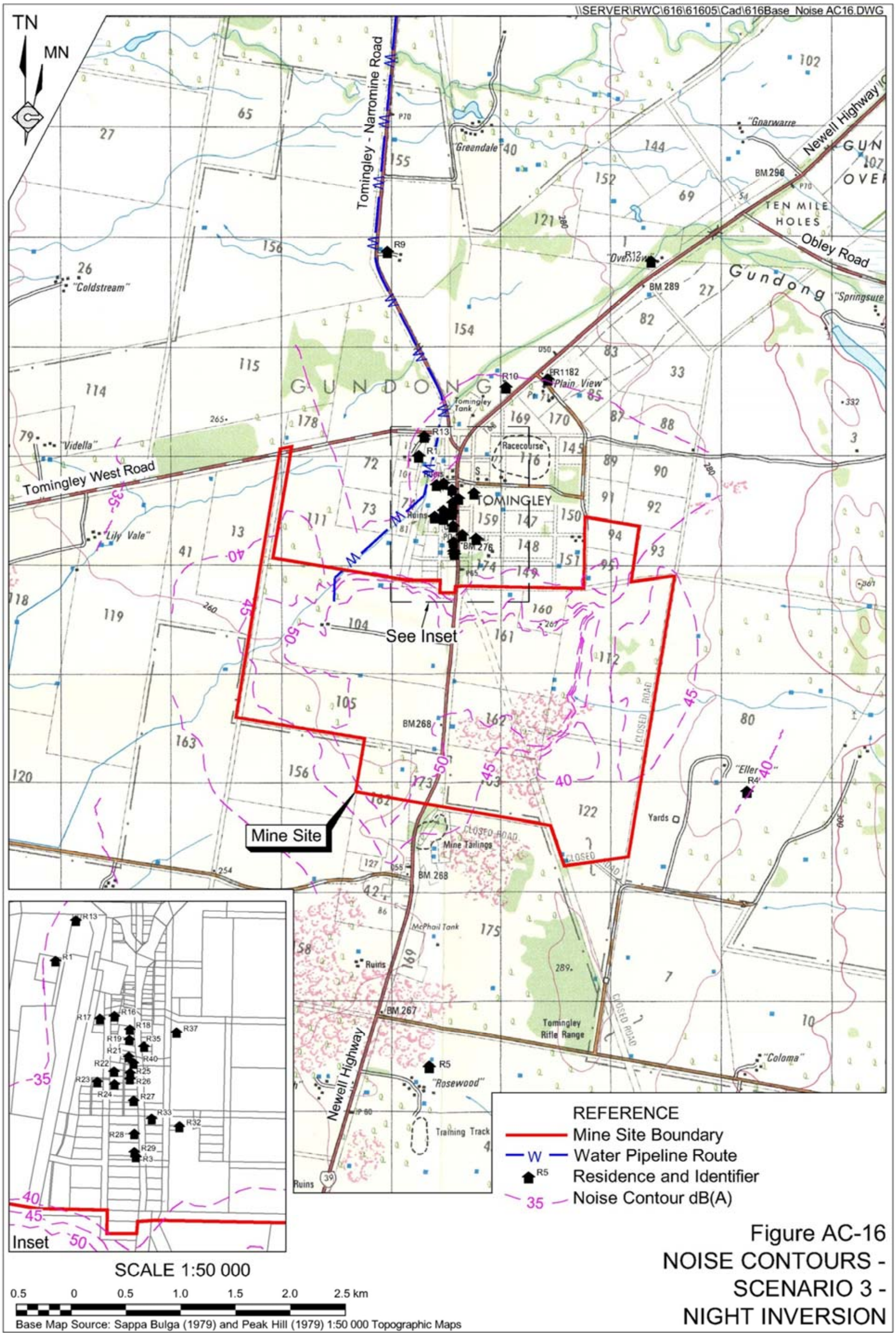

Figure AC-16
NOISE CONTOURS - SCENARIO 3 - NIGHT INVERSION

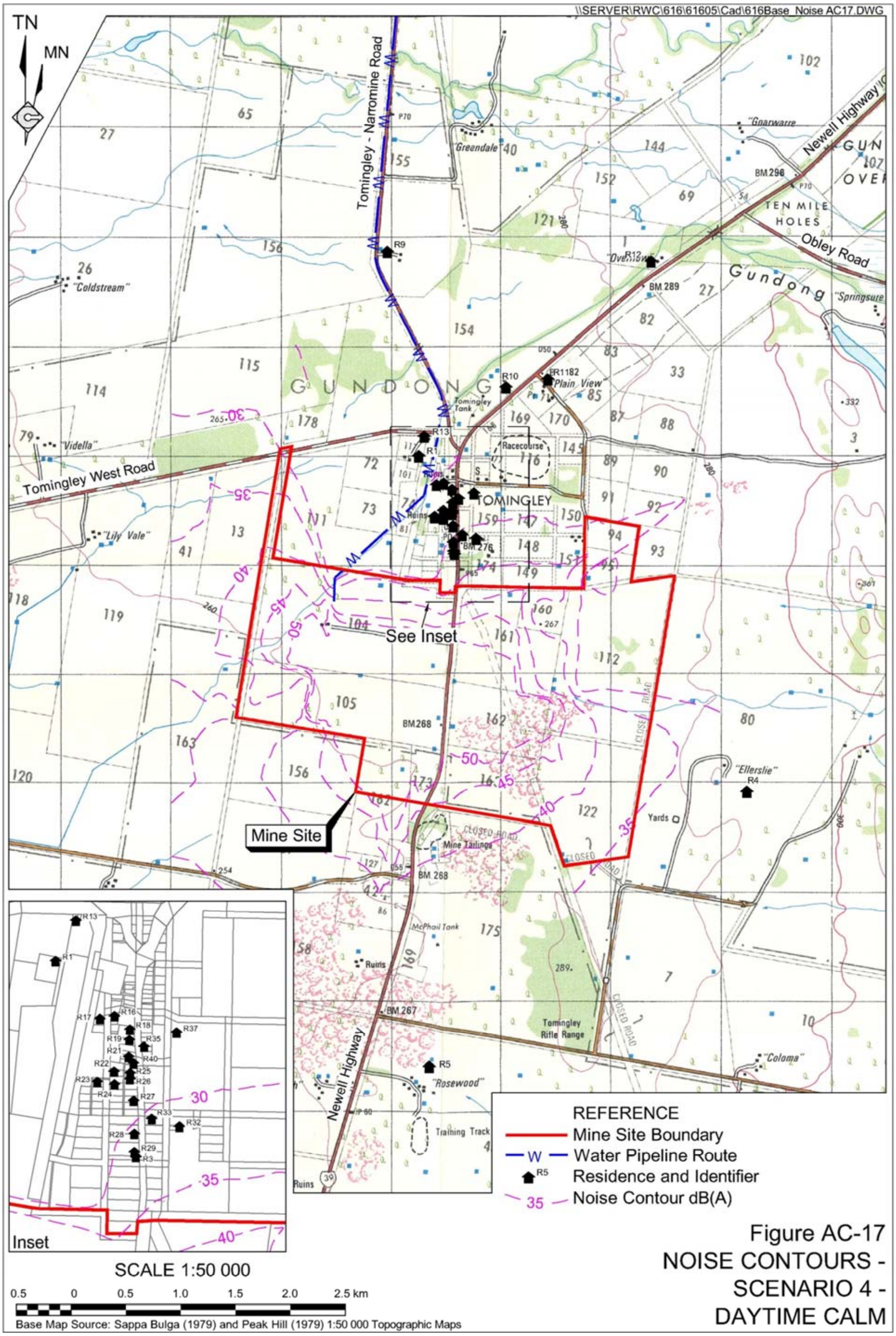

Figure AC-17
NOISE CONTOURS - SCENARIO 4 - DAYTIME CALM

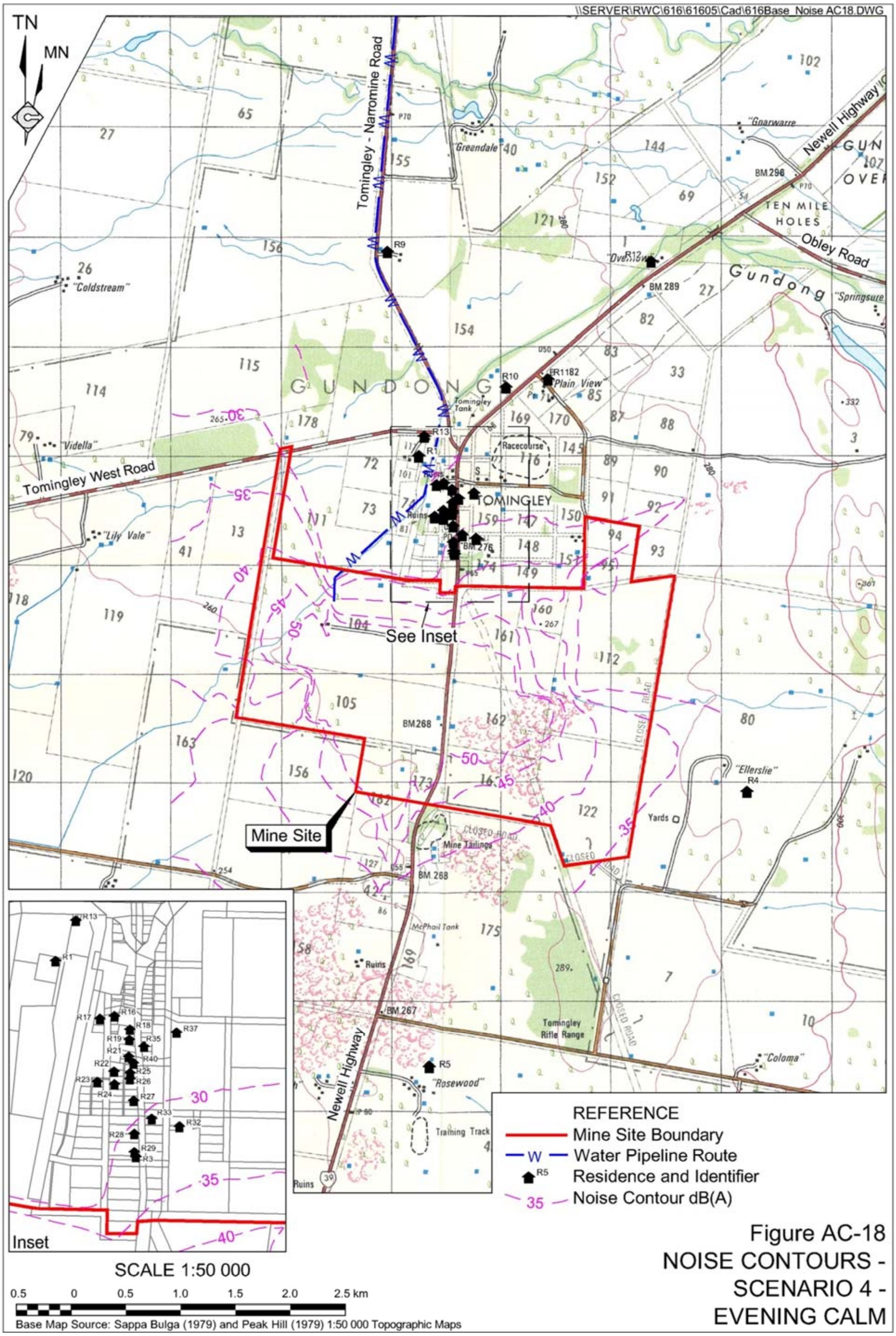

Figure AC-18
NOISE CONTOURS - SCENARIO 4 - EVENING CALM

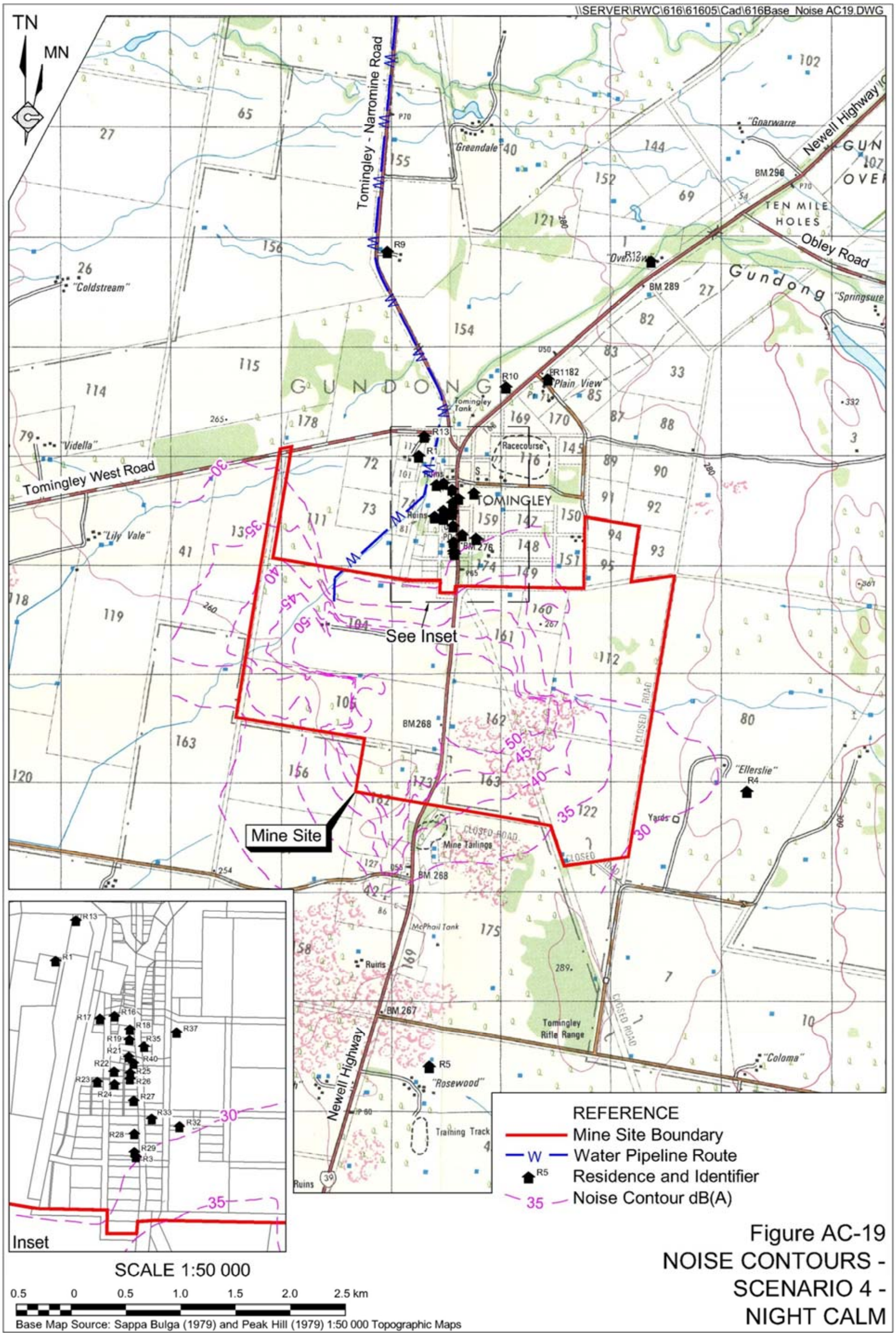

Figure AC-19
NOISE CONTOURS - SCENARIO 4 - NIGHT CALM

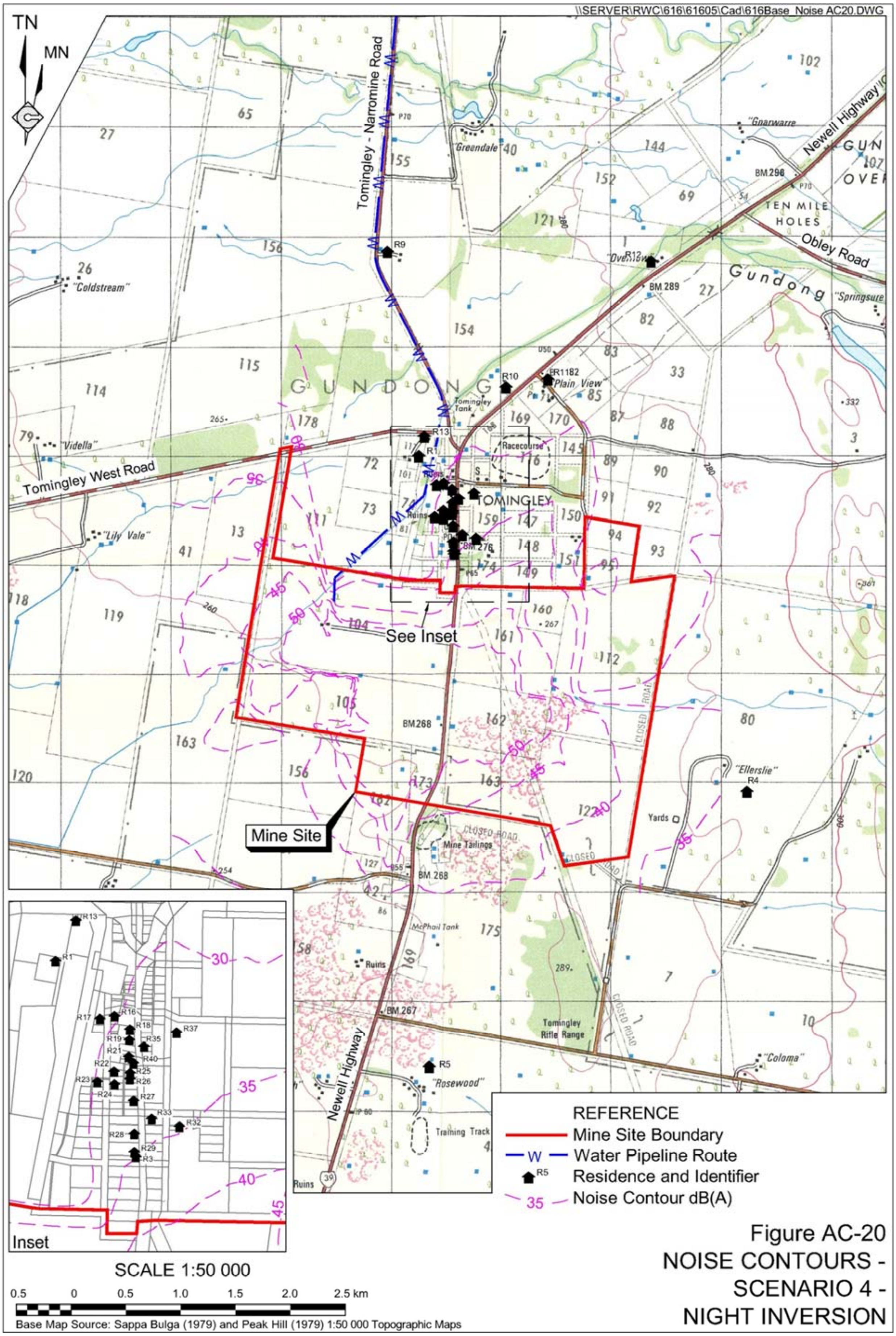

Figure AC-20
NOISE CONTOURS - SCENARIO 4 - NIGHT INVERSION

Appendix D

Director-General's Requirements

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Noise and Blasting
Coverage of Director-General's Requirements in the *Environmental Assessment*

Government Agency	Paraphrased Requirement	Relevant Section(s)
GENERAL		
DoP (09/09/09)	• **Noise and Blasting** – including construction, operational and road traffic noise;	7, 10, 11
NOISE AND BLASTING		
DECCW (28/08/09)	Identify all noise sources from the development (including both construction and operation phases). Detail all potentially noisy activities including ancillary activities such as transport of goods and raw materials.	7.2
	Specify the times of operation for all phases of the development and for all noise producing activities	2.2
	For projects with a significant potential traffic noise impact provide details of road alignment (include gradients, road surface, topography, bridges, culverts etc), and land use along the proposed road and measurement locations — diagrams should be to a scale sufficient to delineate individual residential blocks.	2.2
	Identify any noise sensitive locations likely to be affected by activities at the site, such as residential properties, schools, churches, and hospitals. Typically the location of any noise sensitive locations in relation to the site should be included on a map of the locality.	2.3
	Identify the land use zoning of the site and the immediate vicinity and the potentially affected areas.	2.3
	Determine the existing background (L_{A90}) and ambient (L_{Aeq}) noise levels in accordance with the *NSW Industrial Noise Policy*.	4
	Determine the existing road traffic noise levels in accordance with the *NSW Environmental Criteria for Road Traffic Noise*, where road traffic noise impacts may occur.	10
	The noise impact assessment report should provide details of all monitoring of existing ambient noise levels including:	4, 6
	- details of equipment used for the measurements	4.1
	- a brief description of where the equipment was positioned	4.1
	- a statement justifying the choice of monitoring site, including the procedure used to choose the site, having regards to the definition of 'noise sensitive locations(s)' and 'most affected locations(s)' described in Section 3.1.2 of the *NSW Industrial Noise Policy*	2.3.1
	- details of the exact location of the monitoring site and a description of land uses in surrounding areas	4.1
	- a description of the dominant and background noise sources at the site	4.2
	- day, evening and night assessment background levels for each day of the monitoring period	4.1
	- the final Rating Background Level (RBL) value	4.3
	- graphs of the measured noise levels for each day should be provided	Appendix A

Noise and Blasting
Coverage of Director-General's Requirements in the *Environmental Assessment*

Page 2 of 5

Government Agency	Paraphrased Requirement	Relevant Section(s)
	NOISE AND BLASTING	
DECCW (28/08/09)	- a record of periods of affected data (due to adverse weather and extraneous noise), methods used to exclude invalid data and a statement indicating the need for any re-monitoring under Step 1 in Section B1.3 of the *NSW Industrial Noise Policy* - determination of L_{Aeq} noise levels from existing industry.	4.1 and Appendix A 6.2.2
	Determine the project specific noise levels for the site. For each identified potentially affected receiver, this should include: a) determination of the intrusive criterion for each identified potentially affected receiver - selection and justification of the appropriate amenity category for each identified potentially affected receiver - determination of the amenity criterion for each receiver - determination of the appropriate sleep disturbance limit.	 6.2.3 6.2.3 6.2.3 6.2.3
	Maximum noise levels during night-time period (10pm-7am) should be assessed to analyse possible affects on sleep. Where $L_{A1(1min)}$ noise levels from the site are less than 15 dB above the background L_{A90} noise level, sleep disturbance impacts are unlikely. Where this is not the case, further analysis is required. Additional guidance is provided in Appendix B of the *NSW Environmental Criteria for Road Traffic Noise*.	6.2.5
	Determine expected noise level and noise character (eg tonality, impulsiveness, vibration, etc) likely to be generated from noise sources during: b) site establishment - construction - operational phases - transport including traffic noise generated by the proposal - other services. *Note: The noise impact assessment report should include noise source data for each source in 1/1 or 1/3 octave band frequencies including methods for references used to determine noise source levels. Noise source levels and characteristics can be sourced from direct measurement of similar activities or from literature (if full references are provided).*	 8 8 8 10.3
	Determine the noise levels likely to be received at the most sensitive locations (these may vary for different activities at each phase of the development). Potential impacts should be determined for any identified significant adverse meteorological conditions. Predicted noise levels under calm conditions may also aid in quantifying the extent of impact where this is not the most adverse condition.	8

Noise and Blasting
Coverage of Director-General's Requirements in the *Environmental Assessment*

Page 3 of 5

Government Agency	Paraphrased Requirement	Relevant Section(s)
	NOISE AND BLASTING	
DECCW (28/08/09)	The noise impact assessment report should include: c) a plan showing the assumed location of each noise source for each prediction scenario - a list of the number and type of noise sources used in each prediction scenario to simulate all potential significant operating conditions on the site	7.1 7.2
	- any assumptions made in the predictions in terms of source heights, directivity effects, shielding from topography, buildings or barriers, etc	7.2
	- methods used to predict noise impacts including identification of any noise models used. Where modelling approaches other than the use of the ENM or SoundPlan computer models are adopted, the approach should be appropriately justified and validated	7.1
	- an assessment of appropriate weather conditions for the noise predictions including reference to any weather data used to justify the assumed conditions	5 and 7.3
	- the predicted noise impacts from each noise source as well as the combined noise level for each prediction scenario under any identified significant adverse weather conditions as well as calm conditions where appropriate	8
	- for developments where a significant level of noise impact is likely to occur, noise contours for the key prediction scenarios should be derived	8
	- an assessment of the need to include modification factors as detailed in Section 4 of the *NSW Industrial Noise Policy*.	7.2
	Discuss the findings from the predictive modelling and, where relevant noise criteria have not been met, recommend additional mitigation measures.	8.6 and 12
	The noise impact assessment report should include details of any mitigation proposed including the attenuation that will be achieved and the revised noise impact predictions following mitigation.	7.2
	Where relevant noise/vibration criteria cannot be met after application of all feasible and cost effective mitigation measures the residual level of noise impact needs to be quantified by identifying: d) locations where the noise level exceeds the criteria and extent of exceedance - numbers of people (or areas) affected - times when criteria will be exceeded - likely impact on activities (speech, sleep, relaxation, listening, etc) - change on ambient conditions - the result of any community consultation or negotiated agreement.	8 and 8.6
	For the assessment of existing and future traffic noise, details of data for the road should be included such as assumed traffic volume; percentage heavy vehicles by time of day; and details of the calculation process. These details should be consistent with any traffic study carried out in the EIS.	10

Noise and Blasting
Coverage of Director-General's Requirements in the *Environmental Assessment*

Government Agency	Paraphrased Requirement	Relevant Section(s)
NOISE AND BLASTING		
DECCW (28/08/09)	Where blasting is intended an assessment in accordance with the *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* (ANZECC, 1990) should be undertaken. The following details of the blast design should be included in the noise assessment: e) bench height, burden spacing, spacing burden ratio - blast hole diameter, inclination and spacing - type of explosive, maximum instantaneous charge, initiation, blast block size, blast frequency.	11
	Determine the most appropriate noise mitigation measures and expected noise reduction including both noise controls and management of impacts for both construction and operational noise. This will include selecting quiet equipment and construction methods, noise barriers or acoustic screens, location of stockpiles, temporary offices, compounds and vehicle routes, scheduling of activities, etc.	6.2.4 and 7.2
	For traffic noise impacts, provide a description of the ameliorative measures considered (if required), reasons for inclusion or exclusion, and procedures for calculation of noise levels including ameliorative measures. Also include, where necessary, a discussion of any potential problems associated with the proposed ameliorative measures, such as overshadowing effects from barriers. Appropriate ameliorative measures may include: f) use of alternative transportation modes, alternative routes, or other methods of avoiding the new road usage - control of traffic (eg: limiting times of access or speed limitations) - resurfacing of the road using a quiet surface - use of (additional) noise barriers or bunds - treatment of the facade to reduce internal noise levels buildings where the night-time criteria is a major concern - more stringent limits for noise emission from vehicles (ie. using specially designed 'quite' trucks and/or trucks to use air bag suspension - driver education - appropriate truck routes - limit usage of exhaust breaks - use of premium muffles on trucks - reducing speed limits for trucks - ongoing community liaison and monitoring of complaints m) phasing in the increased road use.	10

Noise and Blasting
Coverage of Director-General's Requirements in the *Environmental Assessment*

Government Agency	Paraphrased Requirement	Relevant Section(s)
CUMULATIVE IMPACTS		
DECCW	Identify the extent that the receiving environment is already stressed by existing development and background levels of emissions to which this proposal will contribute.	6.2.2
	Assess the impact of the proposal against the long term air, noise and water quality objectives for the area or region.	9
	Identify infrastructure requirements flowing from the proposal (eg. water and sewerage services, transport infrastructure upgrades).	-
	Assess likely impacts from such additional infrastructure and measures reasonably available to the proponent to contain such requirements or mitigate their impacts (eg. travel demand management strategies).	-

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