APPENDIX B3

Construction Noise and Vibration Management Plan

Halfway Creek to Glenugie

MAY 2015

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CMC PM	CMC EM	RMS representative

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5		

Contents

Tables

Appendices

Glossary / Abbreviations

Blasting (Airblast) Overpressure	Transient air pressure, generated by the shock wave from an explosion, which is greater than the surrounding atmospheric pressure.
CMC	Civil Mining & Construction Pty Ltd, a specialised civil engineering contractor engaged to complete the Halfway Creek to Glenugie section of the Pacific Highway upgrade.
CEMP	Construction Environmental Management Plan
CoA	Condition of Approval
dBA	Decibels using the A-weighted scale measured according to the frequency of the human ear.
DECCW	Department of Environment, Climate Change and Water
DECC	Department of Environment and Climate Change (now EPA)
DPE	Department of Planning & Environment
EIS	Environmental Impact Statement: Woolgoolga to Ballina Pacific Highway Upgrade Environmental Impact Statement (December, 2012)
EMS	Environmental management system
Environmental aspect	Defined by AS/NZS ISO 14001:2004 as an element of an organisation's activities, products or services that can interact with the environment.
Environmental impact	Defined by AS/NZS ISO 14001:2004 as any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation's environmental aspects.
Environmental objective	Defined by AS/NZS ISO 14001:2004 as an overall environmental goal, consistent with the environmental policy, that an organisation sets itself to achieve.
Environmental target	Defined by AS/NZS ISO 14001:2004 as a detailed performance requirement, applicable to the organisation or parts thereof, that arises from the environmental objectives and that needs to be set and met in order to achieve those objectives.
EPA	Environment Protection Authority
EP&A Act	*Environmental Planning and Assessment Act 1979*
ER	Environmental Representative
ERG	Environmental Review Group
EWMS	Environmental Work Method Statements
Feasible and reasonable	Consideration of best practice taking into account the benefit of proposed measures and their technological and associated operational application in the NSW and Australian context. Feasible relates to engineering considerations and what is practical to build. Reasonable relates to the application of judgement in arriving at a decision, taking into account mitigation benefits and cost of mitigation versus benefits provided, community views and nature and extent of potential improvements.
HC2G	Halfway Creek to Glenugie Pacific Highway Upgrade: also

	known as Section 2 of Woolgoolga to Ballina Pacific Highway Upgrade
NML	Noise Management Levels
$L_{Aeq\ (15min)}$	The A-weighted equivalent continuous (energy average) A-weighted sound pressure level of the construction works under consideration over a 15-minute period and excludes other noise sources such as from industry, road, rail and the community.
$L_{A\ (max)}$	the A-weighted maximum noise level only from the construction works under consideration, measured using the fast time weighting on a sound level meter.
LGA	Local government area
OEH	Office of Environment and Heritage
OOHW	Out of hours work
SPIR	Submission / Preferred Infrastructure Report: Woolgoolga to Ballina Pacific Highway Upgrade Submissions Preferred Infrastructure Report (November, 2013)
RBL	The Rating Background Level for each period is the medium value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period (day, evening and night)
Roads and Maritime	Roads and Maritime Services
Secretary	Secretary of the Department of Planning and Environment
SWP	Sound Power Level
SPL	Sound Pressure Level
NCA	Noise Catchment Areas
WP	Working Paper: Noise and vibration; full title *UPGRADING THE PACIFIC HIGHWAY, Woolgoolga to Ballina Upgrade, Working Paper: Noise and vibration, November 2012, Final*

1 Introduction

1.1 Context

This Construction Noise and Vibration Management Plan (CNVMP or Plan) forms part of the Construction Environmental Management Plan (CEMP) for the upgrade of the Pacific Highway from Halfway Creek to Glenugie (the Project). The Project is Section 2 of the Woolgoolga to Ballina (W2B) Pacific Highway upgrade project, approved by the Minister for Planning in June 2014.

This CNVMP has been prepared to address the requirements of the Minister's Conditions of Approval (CoA) and the mitigation measures listed in the Pacific Highway Upgrade Woolgoolga to Ballina Environmental Impact Statement (EIS) and all applicable legislation.

The existing Glenugie Upgrade Project is to tie into the northern extent of the Project. The Glenugie Project was approved separately by the Minister for Planning in December 2009 and relevant conditions of this approval have been referenced in the CEMP and this plan as appropriate.

1.2 Background

The Pacific Highway Upgrade Woolgoolga to Ballina EIS (Roads and Maritime Services (RMS) 2012) assessed noise and vibration impacts on sensitive receivers and structures from construction of the Project.

As part of EIS development, a construction and operational noise and vibration assessment was prepared to satisfy the Director General Requirements (DGRs) issued by Planning and Infrastructure. The noise and vibration assessment was included in the EIS as Working Paper: Noise and Vibration.

The EIS concluded that there will be some noise and vibration impacts during construction and the extent will vary depending on the type of activity in progress and the proximity to sensitive receivers.

Additional management measures were provided within the *Woolgoolga to Ballina Submissions/Preferred Infrastructure Report Nov 2013*, with applicable management measures from that report included as part of this CNVMP.

1.3 Environmental management systems overview

The overall Environmental Management System for the Project is described in the Construction Environmental Management Plan (CEMP).

The CNVMP is part of the Civil, Mining and Construction (CMC) environmental management framework for the Project, as described in Section 4.1 of the CEMP. This Plan has been developed in accordance with the requirements of CoA D26 (a).

Management measures identified in this Plan will be incorporated into site or activity specific Environmental Work Method Statements (EWMS). EWMS will be developed and signed off by environment and management representatives prior to associated works. Construction personnel will be required to undertake works in accordance with the identified requirements and associated mitigation measures.

Used together, the CEMP, strategies, procedures and EWMS form management guides that clearly identify required environmental management actions for reference by CMC personnel and contractors.

The review and document control processes for this Plan are described in Section 1.6 and Chapter 10 of the CEMP.

2 Purpose and objectives

2.1 Purpose

The purpose of this Plan is to describe how CMC proposes to manage potential noise and vibration impacts during construction of the Project.

The management of noise and vibration impacts in this Plan is based on the assessment undertaken as part of the EIS. The assessment in the EIS considered the following guidelines and standards:

- NSW Industrial Noise Policy (EPA 2000).
- RTA Environmental Noise Management Manual (ENMM) (RTA 2001).
- Interim Construction Noise Guideline (ICNG) (DECC 2009).
- Assessing Vibration: A Technical Guideline (DEC 2006).
- British Standard 7385: Part 2 “Evaluation and measurement of vibration in buildings”.
- Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration (1990) Australian and New Zealand Environment and Conservation Council (ANZECC).
- Australian Standard AS2187.2-2006: “Explosives – Storage, Transport and Use”.
- German DIN 4150: Part 3 – 1999 Effects of Vibration on Structure (DIN 1999).

2.2 Objectives

The key objective of the CNVMP is to ensure that impacts to the local community and the built environment from noise and vibration are minimised. Specific objectives include:

- Identifying sensitive receivers and ensuring appropriate environmental controls and procedures are implemented during construction activities.
- Minimising potential adverse noise and vibration impacts to the environment and community.
- Managing impacts if they occur through a systematic analysis of mitigation strategies.
- Ensuring appropriate measures are implemented to address the relevant CoA outlined in Table 3.1 and the mitigation measures detailed in the EIS.
- Ensuring appropriate measures are implemented to comply with all relevant legislation and other requirements as described in Section 3.1 and Section 3.4 of this Plan.

2.3 Targets

Targets have been established for the management of noise and vibration impacts during the Project to ensure:

- Full compliance with the relevant legislative requirements, relevant guidelines and CoA.
- Implementation of feasible and reasonable noise mitigation measures with the aim of achieving the construction noise management levels detailed in the Interim Construction Noise Guideline (DECC, 2009).
- Blasting activities are only undertaken at designated times and remain within established/agreed criteria.
- Complaints from the community and stakeholders are minimised.

3 Environmental requirements

3.1 Relevant legislation and guidelines

3.1.1 Legislation

Legislation relevant to noise and vibration management includes:

- *Protection of the Environment Operations Act 1997* (POEO Act).
- *Protection of the Environment Operations (Noise Control) Regulation 2008*.

Relevant provisions of the above legislation are explained in the register of legal and other requirements included in Appendix A1 of the CEMP.

3.1.2 Guidelines

The main guidelines, specifications and policy documents relevant to this Plan include:

- RMS QA Specification G36 – Environmental Protection (Management System).
- Environmental Criteria for Road Traffic Noise (ECRTN) (EPA 1999).
- NSW Industrial Noise Policy (EPA 2000).
- RTA Environmental Noise Management Manual (ENMM) (RTA 2001a).
- Interim Construction Noise Guideline (ICNG) (DECC 2009).
- Assessing Vibration: A Technical Guideline (DEC 2006).
- British Standard 7385: Part 2 “Evaluation and measurement of vibration in buildings”.
- German DIN 4150: Part 3 – 1999 Effects of Vibration on Structure (DIN 1999).
- Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration (1990) Australian and New Zealand Environment and Conservation Council (ANZECC).
- Australian Standard AS2187.2-2006: “Explosives – Storage, Transport and Use”.

3.2 Minister’s Conditions of Approval

The CoA relevant to this Plan are listed Table 3.1. A cross reference is also included to indicate where the condition is addressed in this Plan or other project management documents.

Table 3.1 Conditions of Approval relevant to noise and vibration

CoA No.	Condition Requirements	Document Reference
	Construction Noise	
B14	The State Significant Infrastructure (SSI) shall be constructed with the aim of achieving the construction noise management levels detailed in the *Interim Construction Noise Guideline* (DECCW, 2009). All feasible and reasonable noise mitigation measures shall be implemented and any activities that could exceed the construction noise management levels shall be identified and managed in accordance with the Construction Noise and Vibration Management Plan. *Note:* *The Interim Construction Noise Guideline identifies ‘particularly annoying’ activities that require the addition of 5dB(A) to the predicted level before*	Ch 5-2

comparing to the construction NML.

B15	Construction activities associated with the SSI shall be undertaken during the following standard construction hours: (a) 7:00am to 6:00pm Monday to Friday, inclusive; and (b) 8:00am to 5:00pm Saturday; and (c) at no time on Sunday or public holidays.	Appendix D
B16	Construction works outside of the standard construction hours identified in condition B15 may be undertaken in the following circumstances: (a) construction works that generate noise that is: (i) no more than 5 dB(A) above rating background level at any residence in accordance with the *Interim Construction Noise Guideline* (Department of Environment and Climate Change, 2009); and (ii) no more than the noise management levels specified in Table 3 of the *Interim Construction Noise Guideline* (Department of Environment and Climate Change, 2009) at other sensitive receivers*;* or (b) for the delivery of materials required outside these hours by the NSW Police Force or other authorities for safety reasons; or (c) where it is required in an emergency to avoid the loss of lives, property and/or to prevent environmental harm; or (d) between 6.00am and 7.00am and 6.00pm and 7.00pm Monday to Friday (except public holidays) in sparsely populated areas (these construction hours may be reviewed and/or revoked by the Director General in consultation with the EPA in the case of unresolved noise complaints); or (e) low noise impact activities and work as follows: (i) between 6.00am and 7.00am Monday to Friday; and/or (ii) between 6.00pm and 7.00pm Monday to Friday; or (f) works approved through an EPL; or (g) works approved by a Construction Environment Management Plan or Construction Noise and Vibration Management Plan for the SSI	Appendix D
B17	Construction activities which cannot be undertaken during the standard construction hours for technical or other justifiable reasons (Out of Hours work) may be permitted outside the construction hours specified in condition B15 with the approval of the Environmental Representative. Out of Hours work shall be undertaken in accordance with an approved Construction Environment Management Plan or Construction Noise and Vibration Management Plan for the SSI, where that plan provides a process for the consideration of Out of Hours work. This consideration includes: (a) process for obtaining the Environmental Representative's approval for Out of Hours work; (b) details of the nature and need for activities to be conducted during the varied construction hours; (c) justifies the varied construction hours in accordance with the *Interim Construction Noise Guideline* (DECCW, 2009); (d) provides evidence that consultation with potentially affected receivers and notification of the relevant council has been undertaken, that the issues raised have been addressed and all feasible and reasonable mitigation measures have been put in place; and (e) provides evidence of consultation with the EPA on the proposed variation in standard construction hours.	Appendix D
B18	Construction activities resulting in impulsive or tonal noise emission (such as rock breaking, rock hammering, pile driving) shall only be undertaken: (a) between the hours of 8:00am to 5:00pm Monday to Friday; (b) between the hours of 8:00am to 1:00pm Saturday; and (c) in continuous blocks not exceeding three hours each with a minimum respite from those activities and works of not less than one hour	Ch 7-2

	between each block. For the purposes of this condition 'continuous' includes any period during which there is less than a one hour respite between ceasing and recommencing any of the work the subject of this condition. The works subject to this condition may be undertaken in sparsely populated areas within the construction hours specified in condition B15.	
B19	The Applicant shall, where feasible and reasonable, limit high noise impact activities and work to the mid-morning and mid-afternoon periods, except in sparsely populated areas.	Ch 7-2
	Construction Vibration	
B20	The SSI shall be constructed with the aim of achieving the following construction vibration goals: (a) for structural damage to heritage structures, the vibration limits set out in the German Standard *DIN 4150-3: Structural Vibration – Part 3 Effects of vibration on structures*; (b) for damage to other buildings and/or structures, the vibration limits set out in the British Standard *BS 7385-1:1990 – Evaluation and measurement of vibration in buildings* (and referenced in Australian Standard 2187.2 – 2006 *Explosives – Storage and use – Use of explosives*). Guide for measurement of vibration and evaluation of their effects on buildings; and (c) for human exposure, the acceptable vibration values set out in *Assessing Vibration: A Technical Guideline* (Department of Environment and Conservation, 2006).	Ch 5-3 Ch 5-4 Ch 7-3-1
B21	Blasting associated with the SSI shall only be undertaken during the following hours: (a) 9:00am to 5:00pm, Monday to Friday, inclusive; (b) 9:00am to 1:00pm on Saturday; and (c) at no time on Sunday or public holidays. Blasting outside the above hours and in accordance with the standard construction hours where: (i) no sensitive receivers in sparsely populated areas would be impacted by blasting; or (ii) an agreement has been made with receivers within 200 metres of the blast zone to permit blasting in accordance with the standard construction hours. This condition does not apply in the event of a direction from the NSW Police Force or other relevant authority for safety or emergency reasons to avoid loss of life, property loss and/or to prevent environmental harm.	Ch 8-1
B22	The Applicant shall ensure that Airblast overpressure generated by blasting associated with the SSI shall not exceed the criteria specified in Table 1 when measured at the most affected residence or other sensitive receiver.	Ch 7-3-2

Table 1 - Airblast overpressure limits for human comfort

Sensitive site	Blasting operations lasting more than 12 months or more than 20 blasts	115 dBL for 95% of blasts per year
		120 dBL maximum limit
Sensitive site	Blasting operations lasting less than 12 months or less than 20 blasts in total	120 dBL for 95% of blasts per year
		125 dBL maximum limit

Occupied non-sensitive sites, such as factories and commercial premises	All blasting	125 dBL maximum limit. For sites containing equipment sensitive to vibration, the vibration level should be kept below manufacturer's specifications or levels that can be shown to adversely affect the equipment operation	

Note – a sensitive site includes houses and low rise residential buildings, theatres, schools and other similar buildings occupied by people.
Source – Table J5.4(A) – AS 2187.2 – 2006

B23 The Applicant shall ensure that Ground vibration generated by blasting associated with the SSI shall not exceed the criteria specified in Table 2 and Table 3 when measured at the most affected residence or other sensitive receiver. Ch 7-3-2

Table 2 – Ground vibration limits for human comfort

Receiver	Type of blasting operations	Peak component particle velocity (mm/s)
Sensitive site	Blasting operations lasting more than 12 months or more than 20 blasts	5 mm/s for 95% of blasts per year
		10 mm/s maximum limit
Sensitive site	Blasting operations lasting less than 12 months or less than 20 blasts in total	10 mm/s maximum limit
Occupied non-sensitive sites, such as factories and commercial premises	All blasting	25 mm/s maximum limit. For sites containing equipment sensitive to vibration, the vibration level should be kept below manufacturer's specifications or levels that can be shown to adversely affect the equipment operation

Note – a sensitive site includes houses and low rise residential buildings, theatres, schools and other similar buildings occupied by people.
Source – Table J4.5(A) – AS 2187.2 – 2006.

Table 3 – Ground vibration limits for control of damage to structures

Receiver	Type of blasting operations	Peak component particle velocity (mm/s)	
Other structures or architectural elements that include masonry, plaster and plasterboard in their construction [1]		15 mm/s 4 Hz to 15 Hz, except for heritage structures where a frequency dependent vibration criteria would be determined in accordance with AS 2187.2 – 2006.	20 mm/s 15 Hz and above

	Reinforced or framed structures. Industrial and heavy commercial buildings [2]	All blasting	50 mm/s at 4 Hz and above	
	Unreinforced or light framed structure. Residential or light commercial type building [2]	All blasting	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above
	Unoccupied structures of reinforced concrete or steel construction	All blasting	100 mm/s maximum, where agreed with the structure owner.	
	Infrastructure service structures, such as pipelines, powerlines, cables and reservoirs.	All blasting	Limits to be determined by structural design methodology in consultation with the infrastructure service provider.	

Source:
1 - Table J4.5(B) – AS 2187.2 – 2006.
2 - Table J4.4.2.1 – AS 2187.2 – 2006 (BS 7385-2).

B24	The blasting criteria specified in conditions B22 and/or B23 may be increased where the Applicant has obtained the written agreement of the relevant landowner to increase the criteria. In obtaining the agreement the Applicant shall make available to the landowner: (a) details of the proposed blasting program and justification for the proposed increase to blasting criteria including alternatives considered (where relevant); (b) the environmental impacts of the increased blast limits on the surrounding environment and most affected residences or other sensitive receivers including, but not limited to noise, vibration and air quality and any risk to surrounding utilities, services or other structures; and (c) the blast management and mitigation measures, and monitoring procedures to be implemented to monitor blasting impacts. The Applicant shall provide a copy of the written agreement to the Director General and the EPA, including details of the consultation undertaken (with clear identification of proposed blast limits and potential property impacts) prior to commencing blasting at the increased limits. Unless otherwise agreed by the Secretary, the following exclusions apply to the application of this condition: (a) Any agreements reached may be terminated by the landowner at any time should concerns about the increased blasting limits be unresolved. Should an agreement be terminated by a landowner, the Applicant shall not exceed the criteria specified in conditions B22 and/or B23 for future blasting at that receiver. (b) The blasting limit agreed to under any agreement for an occupied residential building can at no time exceed a maximum Peak Particle Velocity vibration level of 25 mm/s or maximum Airblast Overpressure level of 125 dBL.	Ch 8-1
B25	Wherever feasible and reasonable, piling activities shall be undertaken using quieter construction methods, such as bored piles or vibrated piles	Ch 7-3-1

	rather than impact or percussion piling methods.	
B26	Prior to the use of the dynamic compaction construction method, the Applicant shall undertake an assessment of vibration generated by dynamic compaction on nearby sensitive receivers. Feasible and reasonable mitigation measures shall be implemented to minimise vibration impacts.	Ch 7-3-1
B27	During construction, affected educational institutions shall be consulted and reasonable steps taken to ensure that noise generating construction works in the vicinity of affected buildings are not timetabled during examination periods where practicable, unless other reasonable arrangements to the affected institutions are made at no cost to the affected institution.	Ch 4-1
D10	Prior to the commencement of construction, the Applicant shall undertake a land use survey to identify areas that are sensitive to construction vibration and construction ground-borne noise impacts. The results of the survey shall be incorporated into the Construction Noise and Vibration Management Plan	Ch 4-1
D26 (a)	As part of the Construction Environmental Management Plan for the SSI, the Applicant shall prepare and implement: a) a **Construction Noise and Vibration Management Plan** to detail how construction noise and vibration impacts will be minimised and managed. The Plan shall be developed in consultation with the EPA and shall be consistent with the guidelines contained in the *Interim Construction Noise Guidelines* (DECC, 2009) and shall include, but not necessarily be limited to:	
	(i) identification of sensitive receivers and relevant construction noise and vibration goals applicable to the SSI stipulated in this approval;	Ch 7
	(ii) details of construction activities and an indicative schedule for construction works; including the identification of key noise and/or vibration generating construction activities (based on representative construction scenarios, including at ancillary facilities) that have the potential to generate noise and/or vibration impacts on surrounding sensitive receivers, particularly residential areas;	Ch 7
	(iii) identification of feasible and reasonable measures proposed to be implemented to minimise and manage construction noise and vibration impacts (including construction traffic noise impacts);	Table 9.1
	(iv) procedures and mitigation measures to ensure relevant vibration and blasting criteria are achieved, including a suitable blast program, applicable buffer distances for vibration intensive works, use of low-vibration generating equipment/vibration dampeners or alternative construction methodology, and pre- and post-construction dilapidation surveys of sensitive structures where blasting and/or vibration is likely to result in damage to buildings and structures (including surveys being undertaken immediately following a monitored exceedance of the criteria); and	Ch 7.3, Table 9.1
	(v) a description of how the effectiveness of these actions and measures would be monitored during the proposed works, clearly indicating how often this monitoring would be conducted, the locations where monitoring would take place, how the results of this monitoring would be recorded and reported, and, if any exceedance is detected, how any non-compliance would be rectified;	Table 9.1 NV63, Ch 9.3
	(vi) an out-of-hours work (OOHW) protocol for the assessment, management and approval of works outside of standard construction hours as defined in condition B15 including a risk assessment process under which the Environmental	Appendix D

	Representative may approve out-of-hour construction activities. The OOHW protocol shall detail standard assessment, mitigation and notification requirements for high and low risk out-of-hour works, consultation procedures with the EPA, the relevant council and affected landowners;		
	(i)	procedures for notifying sensitive receivers of construction activities that are likely to affect their noise and vibration amenity, as well as procedures for dealing with and responding to noise complaints;	Table 9.1 NV57 – NV61
	(vii)	a program for construction noise and vibration monitoring clearly indicating monitoring frequency, location, how the results of this monitoring would be recorded and, procedures to be followed where exceedances of relevant noise and vibration goals are detected; and	Table 9.1 NV63, Ch 9.3
	(viii)	mechanisms for the monitoring, review and amendment of this plan.	Ch 10
2.9 Glenugie Upgrade approval 2009)	Construction activities associated with the project shall only be undertaken during the following hours: a) 7:00 am to 6:00 pm, Mondays to Fridays, inclusive; b) 8:00 am to 1:00 pm on Saturdays; and c) at no time on Sundays or public holidays. This condition does not apply to: i) any works that do not cause construction noise to be audible at any sensitive receiver; or ii) for delivery of materials required outside these hours by the police or other authorities for safety reasons; or iii) where it is required in an emergency to avoid the loss of lives, property and/or to prevent environmental harm.	
2.10 Glenugie Upgrade approval 2009)	Notwithstanding condition 2.9, certain construction activities may be allowed to occur outside the hours specified under that condition with the prior written approval of the Director General. Requests for out of hours approval will be considered for construction activities that cannot be undertaken during standard construction hours for technical or other justifiable reasons and will be considered on a case-by-case or activity-specific basis. Any request for out of hours works shall be accompanied by: a) details of the nature and need for activities to be conducted outside standard construction hours; b) written evidence to the DECCW and the Director General that activities undertaken outside standard construction hours are justified, appropriate consultation with potentially affected receivers and notification of the relevant Council has been undertaken, issues raised have been addressed, and all feasible and reasonable mitigation measures have been put in place; and c) evidence of consultation with the DECCW on the proposed work outside standard construction hours. For the purpose of this condition, the Director General may grant approval for out-of-hours construction works on a case-by-case or activity-specific basis that is consistent with and has been identified in the Construction Noise and Vibration Management Plan required under condition 6.2(d)(iv) of this approval.	
2.11 Glenugie Upgrade approval 2009)	Blasting associated with the project shall only be undertaken during the following hours: a) 9:00 am to 5:00 pm, Mondays to Fridays, inclusive; b) 9:00 am to 1:00 pm on Saturdays; and	

	c) at no time on Sundays or public holidays. This condition does not apply in the event of a direction from police or other relevant authority for safety or emergency reasons to avoid loss of life, property loss and/or to prevent environmental harm.
2.12 Glenugie Upgrade approval 2009)	The Proponent shall implement all reasonable and feasible noise mitigation measures with the aim of achieving the construction noise management levels detailed in the *Interim Construction Noise Guideline* (DECC, 2009). Any activities that could exceed the construction noise management levels shall be identified and managed in accordance with the Construction Noise and Vibration Management Plan required under condition 6.2(d)(iv) of this approval.
2.15 Glenugie Upgrade approval 2009)	Unless otherwise agreed to by the Director General, the Proponent shall submit for the approval of the Director General a review of proposed operational noise mitigation measures identified in the documents listed under condition 1.1 within six months of commencing construction. The review shall take into account the detailed design of the project and, where feasible and reasonable, and where necessary, refine the proposed measures with the objective of meeting the criteria outlined in the *Environmental Criteria for Road Traffic Noise* (NSW EPA, 1999). The review shall be undertaken in consultation with the DECCW.

4 Existing environment

4.1 Sensitive receivers

4.1.1 Woolgoolga to Ballina

The W2B Project extends from the Coffs Harbour local government area (LGA) in the south to Ballina LGA in the north and comprises regional urban communities such as South Grafton and Maclean as well as smaller rural communities including Corindi, Tucabia, Ulmarra, Harwood, New Italy, Woodburn, Broadwater and Wardell. There are large portions of the study area that are comprised of national park, state forest and nature reserves, along with rural and agricultural land uses.

The noise and vibration assessment identified and considered potential noise impacts for each individual dwelling along the 155 kilometre alignment and within 600 metres either side of the new or existing road centre line (the study area). A total of 1,222 residences are located within the study area.

4.1.2 Halfway Creek to Glenugie

Relative to the other 10 sections of the overall W2B Project, the Halfway Creek to Glenugie upgrade (HC2G) has a small number of noise and vibration sensitive receivers. Along almost 12 kilometres of HC2G there are 29 receivers identified within the 600 metres zone from the upgraded highway. This includes four commercial/non-residential receivers.

Most of the sensitive receivers are scattered throughout the southern part of the section, between the villages of Halfway Creek and Wells Crossing.

Appendix A shows the location of the assessed sensitive receivers, the noise catchment areas and the proposed blasting locations.

In the northern part of the corridor, the upgraded highway alignment runs through Glenugie State Forest with no sensitive receivers.

Major road realignment that requires blasting will be undertaken along the section of the Pacific Highway upgrade that runs through Glenugie State forest. The potential blasting locations are identified as follows:

Cut 8: - CH24600 - CH25400;

Cut 9: - CH26300 - CH27300; and

Cut 10: - CH27400 - CH28100.

Whilst the drilling and blasting will be relatively brief activities with high but short duration noise emissions, the extraction and processing of the blasted rock will be an activity of a longer duration and similar to the earthworks activities.

The distances to the nearest sensitive receives from Cuts 8, 9 & 10 are as follows-

Cut 8: 630m

Cut 9: 2300m

Cut 10: 3300m

4.2 Ambient noise

The dominant noise source is the existing single carriage way two lane highway. Additionally there are two service stations and a mechanical workshop which would have some localised 'ambient' noise. The background noise levels also reflect other temporary noise emissions consistent with a rural setting. Noise monitoring was conducted as part of the EIS in 2011 and 2012. The monitoring was undertaken to provide background noise levels and, among other purposes, to establish appropriate construction noise assessment criteria. Locations were selected to be representative of receivers that would experience a noise impact from the existing highway or from the Project. The relevant noise monitoring results from the EIS have been reproduced in this report and are presented in Appendix B. A summary of the rating background levels (RBL) are provided in Table **4.1**.

Table 4.1 Ambient noise monitoring results (dBA)

Location	Setback from existing highway (m)	Standard hours	Extended hours – morning	Extended hours – evening	Out of hours / Night-time
		(7am-6pm)	(6am-7am)	(6pm-7pm)	(7pm-6am)
		RBL dB(A)	RBL dB(A)	RBL dB(A)	RBL dB(A)
Section 2 (RBL from Table 6-24 and Table 6-25 of WP)					
R597	241	48	43	44	37
R651	120	46	46	46	37

5 Noise and vibration criteria for NSW

The EPA recommends management levels and goals when assessing construction noise and vibration. These are outlined in:

- Interim Construction Noise Guideline (ICNG).
- Assessing Vibration: a technical guideline.
- The ANZECC Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration.

Relevant elements of these documents are summaries and discussed in this Chapter.

5.1 Construction noise and assessment objectives

The DECC Interim Construction Noise Guideline (ICNG, July 2009) provides guidelines for the assessment and management of construction noise. The ICNG focuses on applying a range of work practices to minimise construction noise impacts rather than focusing on achieving numeric noise levels.

The main objectives of the ICNG are to:

- Identify and minimise noise from construction works.
- Focus on applying all 'feasible' and 'reasonable' work practices to minimise construction noise impacts.
- Encourage construction during the recommended standard hours only, unless approval is given for works that cannot be undertaken during these hours.
- Reduce time spent dealing with complaints at the project implementation stage.
- Provide flexibility in selecting site-specific feasible and reasonable work practices to minimise noise impacts.

5.1.1 Quantitative noise assessment criteria

Construction noise assessment goals presented in the ICNG are referenced to noise management levels for residential, sensitive land uses and commercial/ industrial premises.

Residential premises

Table 5.1 sets out management levels for noise at residences and how they are to be applied.

In Table 5.1 the rating background level (RBL) is used when determining the management level. The RBL is the overall single-figure background noise level measured in each relevant assessment period (during or outside the recommended standard hours). The term RBL is described in detail in the NSW Industrial Noise Policy (EPA, 2000).

As a guide, the difference between the internal noise level and the external noise level is typically 10dB with windows open for adequate ventilation.

Table 5.1 Noise at residents using quantitative assessment

Time of day	Management Level $L_{Aeq\ (15\ min)}$ *	How to apply
Recommended standard hours (as per CoA B15 this plan): Monday to Friday 7 am to 6 pm Saturday 8 am to 5 pm No work on Sundays or public holidays	Noise affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured $L_{Aeq\ (15\ min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices 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.
	Highly noise affected 75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. • Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that 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.
Outside recommended standard hours	Noise affected RBL + 5 dB	• A strong justification would typically be required for works outside the recommended standard hours. • The proponent should apply all feasible and reasonable work practices to meet the noise affected level. • Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community.

* Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5m above ground level. If the property boundary is more than 30m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence. Noise levels may be higher at upper floors of the noise affected residence.

Other land uses

Other sensitive land uses, such as schools, typically find noise from construction to be disruptive when the properties are being used (such as during school times). Table 5.2 presents management levels for noise at other sensitive land uses based on the principle that the characteristic activities for each of these land uses should not be unduly disturbed. Consultation should be undertaken with noise sensitive land use occupants likely to be affected by noise from the works to schedule the project's work hours to achieve a reasonable noise outcome.

Internal noise levels are assessed at the centre of the occupied room. External noise levels are assessed at the most affected point within 50 metres of the area boundary. Where internal noise levels cannot be measured, external noise levels may be used. A conservative estimate of the difference between internal and external noise levels is 10dB for buildings other than residences. Some buildings may achieve greater performance, such as where windows are fixed (that is, cannot be opened). The management levels in Table 5.2 are 5dB above the corresponding road traffic noise levels in the Environmental Criteria for Road Traffic Noise (EPA 1999) (and the 'maximum' levels in the NSW Industrial Noise Policy (EPA 2000) for commercial and industrial uses) to account for the variable and short-term nature of construction noise.

Table 5.2 Noise at sensitive land uses (non-residents) using quantitative assessment

Land use	Noise assessment location	Noise management level ($L_{Aeq,15min}$)
Classrooms at schools and other educational institutions	Internal	45
Hospitals and operating theatres		
Places of worship		
Active recreation areas[1]	External	65
Passive recreation areas[2]	External	60
Community centres	Dependent on intended use	Maximum internal levels recommended in AS2107 for specific use
Industrial premises	External	75
Office, retail outlets	External	70
Other noise sensitive businesses	Investigation to determine suitable noise levels on project-by-project basis	

Notes:

1. *Active recreation areas are characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion.*
2. *Passive recreation areas are characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion (eg. reading, meditation).*

5.2 Adopted project noise management levels

Based on measured noise levels presented in Appendix B, the project-specific construction noise objectives for each noise catchment area (NCA) have been determined and are presented in Table 5.3. Considering the possibility of works outside standard construction hours additional management levels for these other periods are also included.

The project has been have been split into noise catchment areas (NCAs). Each NCA represents a typical background noise environment. This is based on noise levels measured across the project.

For NCAs located between the two monitoring locations, the lower RBL for each period has been adopted to be conservative.

The residential noise management levels are presented in Table 5.3.

Table 5.3 Residential project-specific construction noise objectives

Location	Receivers within NCA	Standard hours (7am-6pm Mon-Fri) (8am-5pm Sat)	Extended hours* – morning (6am-7am Mon-Fri) (7am-8am Sat)	Extended hours* – evening (6pm-7pm Mon-Fri) (5pm-6pm Sat)	Out of hours / Night-time (7pm-6am Mon-Fri) (6pm-7am Sat)
		NML dB(A)	NML dB(A)	NML dB(A)	NML dB(A)
NCA 2-a	581, 582, 584, 588, 597	58	48	49	42
NCA 2-b	601, 607, 608, 613, 617, 624, 630, 636	56	48	49	42
NCA 2-c	604, 615, 627, 633, 639	56	48	49	42
NCA 2-d	645, 649, 651	56	48	49	42
NCA 2-e	658, 662, 664, 668	56	51	51	42

**Only applicable in sparsely populated areas.*

The four (4) commercial receivers considered within the Project area are treated as retail outlets in determining their noise management levels. The receivers are comprised of two service stations, a café and a machinery hire business. The noise management levels for the commercial receivers are presented in Table 5.4.

Table 5.4 Commercial project specific construction noise objectives

Location	Receivers within NCA	Standard hours (7am-6pm Mon-Fri) (8am-5pm Sat)	Extended hours* – morning (6am-7am Mon-Fri) (7am-8am Sat)	Extended hours* – evening (6pm-7pm Mon-Fri) (5pm-6pm Sat)	Out of hours / Night-time (7pm-6am Mon-Fri) (6pm-7am Sat)
		NML dB(A)	NML dB(A)	NML dB(A)	NML dB(A)
Section 2 (NML from Table 5.2 of this plan)					
NCA 2-a	578, 579	70	70	70	70
NCA 2-c	616	70	70	70	70
NCA 2-e	665	70	70	70	70

**Only applicable in sparsely populated areas.*

According to ICNG the occupants of these commercial operations should be regularly updated with information on the expected noise levels and hours of operation of the works.

5.3 Vibration criteria

Effects of ground vibration on buildings resulting from construction may be segregated into the following three categories:

- Human exposure – disturbance to building occupants: vibration in which the occupants or users of the building are inconvenienced or possibly disturbed.
- Effects on building contents – vibration where the building contents may be affected.
- Effects on building structures – vibration in which the integrity of the building or structure itself may be prejudiced.

Vibration criteria relating to human comfort that are applicable to this project are taken from the DEC (2006) document Assessing Vibration – A Technical Guideline and include the following.

- Continuous vibration – from uninterrupted sources (see Table 5.5).
- Impulsive vibration – up to three instances of sudden impact e.g. dropping heavy items, per monitoring period (see Table 5.6).
- Intermittent vibration – such as from drilling, compacting or activities that would result in continuous vibration if operated continuously (see Table 5.7).

Two standards by which building damage from construction-induced vibration are commonly assessed include:

- British Standard 7385: Part 2-1993 Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration (BSI 1993)
- German DIN 4150: Part 3 – 1999 Effects of Vibration on Structure (DIN 1999).

The German standard provides the most stringent criteria and will be used in this CNVMP. The DIN guideline values for peak particle velocity (mm/s) measured at the foundation of the building are summarised in Table 5.8. The criteria are frequency dependent and specific to particular categories of structure.

Table 5.5 Continuous vibration acceleration criteria (m/s^2) 1-80Hz

Location	Assessment period	Preferred Values		Maximum Values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
Residences	Daytime	0.010	0.0071	0.020	0.014
	Night-time	0.007	0.005	0.014	0.010
Offices, schools, educational institutions and places of worship	Day or night-time	0.020	0.014	0.040	0.028
		0.04	0.029	0.080	0.058
Workshops	Day or night-time	0.04	0.029	0.080	0.058

Table 5.6 Impulsive vibration acceleration criteria (m/s^2) 1-80Hz

Location	Assessment period	Preferred Values		Maximum Values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
Residences	Daytime	0.30	0.21	0.60	0.42
	Night-time	0.10	0.071	0.20	0.14
Offices, schools, educational institutions and places of worship	Day or night-time	0.64	0.46	1.28	0.92
Workshops	Day or night-time	0.64	0.46	1.28	0.92

Table 5.7 Intermittent vibration impacts criteria (m/s^2) 1-80Hz

Location	Daytime		Night-time	
	Preferred Values	Maximum Values	Preferred Values	Maximum Values
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

Table 5.8 Structural damage criteria

Type of Structure	Peak Component Particle Velocity, mm/s			
	Vibration at the foundation at a frequency of			Vibration of horizontal plane of highest floor at all frequencies
	1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz*	
Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
Structures that, because of their sensitivity to vibration, do not correspond to those listed in lines 1 and 2 and are of great intrinsic value (e.g. buildings that are under a preservation order)	3	3 to 8	8 to 10	8

** For frequencies above 100Hz, at least the values specified in this column shall be applied.*

5.4 Blast criteria

Guidelines documented in the ANZECC "Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration" has been used to establish goals for assessing air-blast overpressure and ground vibration.

(CoA B22) Airblast overpressure generated by blasting associated with the SSI shall not exceed the criteria specified in Table 5.9 when measured at the most affected residence or other sensitive receiver.

Table 5.9 Airblast overpressure limits for human comfort

Receiver	Type of blasting operations	Airblast Overpressure Limit
Sensitive site	Blasting operations lasting more than 12 months or more than 20 blasts	115 dBL for 95% of blasts per year
		120 dBL maximum limit
Sensitive site	Blasting operations lasting less than 12 months or less than 20 blasts in total	120 dBL for 95% of blasts per year
		125 dBL maximum limit
Occupied non-sensitive sites, such as factories and commercial premises	All blasting	125 dBL maximum limit. For sites containing equipment sensitive to vibration, the vibration level should be kept below manufacturer's specifications or levels that can be shown to adversely affect the equipment operation

Note – a sensitive site includes houses and low rise residential buildings, theatres, schools and other similar buildings occupied by people. Source – Table J5.4(A) – AS 2187.2 – 2006

(CoA B23) Ground vibration generated by blasting associated with the SSI shall not exceed the criteria specified in Table 5.10 and Table 5.11 when measured at the most affected residence or other sensitive receiver.

Table 5.10 Ground vibration limits for human comfort

Receiver	Type of blasting operations	Peak component particle velocity (mm/s)
Sensitive site	Blasting operations lasting more than 12 months or more than 20 blasts	5 mm/s for 95% of blasts per year
		10 mm/s maximum limit
Sensitive site	Blasting operations lasting less than 12 months or less than 20 blasts in total	10 mm/s maximum limit
Occupied non-sensitive sites, such as factories and commercial premises	All blasting	25 mm/s maximum limit. For sites containing equipment sensitive to vibration, the vibration level should be kept below manufacturer's specifications or levels that can be shown to adversely affect the equipment operation

Note – a sensitive site includes houses and low rise residential buildings, theatres, schools and other similar buildings occupied by people. Source – Table J4.5(A) – AS 2187.2 – 2006.

Table 5.11 Ground vibration limits for control of damage to structures

Receiver	Type of blasting operations	Peak component particle velocity (mm/s)	
Other structures or architectural elements that include masonry, plaster and plasterboard in their construction [1]		15 mm/s 4 Hz to 15 Hz, except for heritage structures where a frequency dependent vibration criteria would be determined in accordance with AS 2187.2 – 2006.	20 mm/s 15 Hz and above
Reinforced or framed structures. Industrial and heavy commercial buildings [2]	All blasting	50 mm/s at 4 Hz and above	
Unreinforced or light framed structure. Residential or light commercial type building [2]	All blasting	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above
Unoccupied structures of reinforced concrete or steel construction	All blasting	100 mm/s maximum, where agreed with the structure owner.	
Infrastructure service structures, such as pipelines, powerlines, cables and reservoirs.	All blasting	Limits to be determined by structural design methodology in consultation with the infrastructure service provider.	

Source: 1 - Table J4.5(B) – AS 2187.2 – 2006; 2 - Table J4.4.2.1 – AS 2187.2 – 2006 (BS 7385-2).

For assessment of air-blast overpressure the DECC/ANZECC guidelines recommend measurement at any sensitive receiver at least 3.5 metres from building or structure, and ground vibration measured at any point on the noise sensitive site at least the longest dimension of the foundations of a building or structure away from the building or structure.

The blasting criteria specified in CoA B22 and/or CoA B23 may be increased where the Applicant has obtained the written agreement of the relevant landowner to increase the criteria, in accordance with CoA B24.

6 Environmental aspects and impacts

6.1 Environmental aspects

The Project will involve a range of activities incorporating various heavy machinery, plant and equipment that will operate in a number of locations across the Project. In order to assess the level of potential impact on noise and vibration sensitive receivers, the broad categories of construction activity likely to interact with these receivers are identified below:

- Site establishment.
- Establishment and operation of ancillary facilities.
- Clearing and grubbing.
- Demolition (Housing, Culverts and Bridges).
- Earthworks and drainage.
- Drilling and blasting.
- Quarrying – crushing and screening and rock hammering.
- Batch Plant (concrete and asphalt).
- Bridgeworks (piling).
- Paving and concrete saw cutting.
- Road furnishing.

6.2 Impacts

The potential for noise and vibration impacts on sensitive receivers or structures will depend on a number of factors. Typically these might include:

- The type of equipment in use.
- The number of equipment simultaneously in use.
- Site specific construction (bridgeworks).
- Linear construction.
- Ground condition.
- Topography and other physical barriers.
- Proximity to sensitive receivers.
- The condition of sensitive receivers.
- Hours/duration of construction works.
- Proximity of heavy traffic areas such as the highway.

Relevant aspects and the potential for related impacts have been considered in a risk assessment at Section 3.4 and Appendix A2 of the CEMP.

Noise and vibration impacts attributable to the Project are anticipated. Chapter 8 provides a suite of mitigation measures that will be implemented to avoid or minimise impacts on the receiving community and/or built environment.

7 Construction noise and vibration assessment

A range of plant and equipment will be required to undertake activities associated with the Project. A summary of anticipated construction scenarios and predicted noise levels are provided below. This information will be used to determine potential impacts on the receiving community. An adaptive management approach will be applied to the implementation of mitigation measures to minimise impacts on the community.

Calculations of construction noise propagation with distance in this section of the plan was based on the following equation:

$$L_p = L_w - 20Log_{10}(r) - 8$$

Where:

L_p = sound pressure level at the receiver in dB(A);
L_w = combined sound power level of all noise sources in dB re 10^{-12}W;
r = distance from the nearest construction site to the nearest receiver in m.

The noise propagation calculations were carried out without consideration of terrain characteristics and meteorological conditions. As terrain characteristics will have significant noise reduction effect, the approach is conservative and it is used as an indication of the potential noise impacts and for establishment of appropriate operational noise control strategy.

In general a combination of equipment and plant is characterised by a broad band signal with minimal tonality, however tonality may be introduced by intermittent noise generated by the primary noise of some non-continuously operated plant (e.g. drilling, grinding, piling, etc) or by the secondary noise of some continuously operated plant (e.g. reversing alarms for heavy machinery). This intermittent noise is considered 'particularly annoying' under the ICNG and an adjustment of +5dB(A) is applied to combined sound power levels of plant and equipment combinations that have the potential to exhibit tonality.

7.1 Construction schedule and activities

Construction activities will commence in the Southern portion of the project from the Shell Service station at Lemon Tree Road in the south to Wells Crossing Bridge in June 2015. The works will start with the clearing and grubbing of the future north bound carriageway. The new north bound alignment runs parallel to the existing HW10 highway for approximately 6km. This work will be undertaken with specific harvesting equipment. The bulk earthworks operation will follow on directly on from this operation. Plant to be utilised for this work will include but not be limited to tractor scrapers, dozers, rollers, water tankers, off road and on road trucks and motor graders. Once earthworks have been completed the paving operation will follow on directly afterwards in late 2015/early 2016. The paving will be done by a large multilane paver that CMC owns and it is expected that the north bound, weather pending, will be complete and ready to receive traffic after 14 months.
A traffic switch will take place to enable the future south bound alignment to be built which is designed over the top of the existing HW10 highway. The traffic will run in a contra flow fashion on the new north bound carriageway until the balance of the south bound carriageway construction has been completed and the road would then be opened as a dual carriageway after approximately 6 months.
The Northern extent of the project from Wells Crossing Bridge in the south to Franklins Road in the north is constructed through state forest and has no interaction with the existing HW10 other than at the two extremities.

This portion of the works will involve clearing and grubbing operations with specialist harvesting equipment, bulk earthworks equipment will include but not be limited to tractor scrapers, dozers, rollers, water tankers, off road and on road trucks and motor graders. This area of the works will also entail some drill and blast operations however this work will be away from the public and it is not anticipated to cause any disruption. The carriageway will also be paved with the multilane paver and the road will only be opened in time with the second stage of works in the southern portion which puts the duration of the works in the northern zone at approximately 2 years in duration.

Table 7.1 provides a summary of construction scenarios, and associated plant and equipment required for the works. Plant and equipment may be used in isolation or simultaneously. Appendix C provides a list of equipment and a correlating sound power level.

Table 7.1 Construction scenarios and associated plant and equipment

Scenario reference	Construction scenario	Typical plant and equipment required	Combined Sound Power Level L_{Aeq} dB(A)
A	Site enabling works (soft soil treatments)	30t Excavator, 20t Dozer, 25t Product truck, 12t Vibratory compactor, Padfoot compactor, 25t Grader, 18t Smooth barrel roller, Water cart	123 (+5)
B	Formation, clearing and mulching	30t Excavator, 20t Dozer, 25t Product truck, 12t Vibratory compactor, Padfoot compactor, 25t Grader, 18t Smooth barrel roller, Water cart, Mulcher/Chipper, Crusher, Screener, Rock hammer	123 (+5)
C	Earthworks	30t Excavator, 20t Dozer, 25t Product truck, 12t Vibratory compactor, Padfoot compactor, 25t Grader, 18t Smooth barrel roller, Water cart, Backhoe, Front end loader, Scraper, Mulcher/Chipper, Crusher, Screener, Rock hammer	125 (+5)
D	Ancillary sites, compounds and concrete batch plants	30t Excavator, 20t Dozer, 25t Product truck, Water cart, Backhoe, Front end loaders Batch plant, Office vehicles, Forklift trucks, Powered hand tools	122 (+5)
E	Haulage routes	25t Haul trucks	108
F	Blasting	Explosive charges	N/A
G	Bridge building	Impact piling rig, Bored piling rig, Pneumatic hammer, Excavator, Haul truck, Generator, Mobile crane, Concrete truck, Concrete pump, Air compressor, Air ratchet gun	125 (+5)
H	Paving and concrete saw cutting	Generator, Backhoe, Asphalt paver, Concrete paver, Concrete truck, Concrete vibrator, Concrete saw, Bob cat	120 (+5)
I	Drilling, Crushing and Screening	Blast hole drill rig, Mobile crusher and screener, Pneumatic hammer, Mulcher/Chipper, Excavator	114 (+5)

7.2 Construction noise impacts

7.2.1 General construction

Table 7.2 provides a summary of predicted noise impacts on the residential receivers from each related construction scenario. Noise management level thresholds for each key sensitive receiver location have also been provided. Predicted noise levels for each construction scenario have been derived by calculating the combined noise output from the sound power levels of each piece of equipment listed in Appendix C.

The construction noise levels presented in Table 7.2 are highly conservative and should be considered indicative values. Their primary purpose is to inform the decision process of where the focus of the noise mitigation measures should be.

Table 7.2 Residential receivers - Predicted construction noise levels

NCA	Receiver	Scenario reference	Daytime NML*	Extended hours am NML*	Extended hours pm NML*	Out of hours / Night-time NML*	Predicted noise level range** L_{Aeq} dB(A)
NCA 2-a	*581, 582, 583, 588, 597*	*A*	*58*	*48*	*49*	*42*	*72-86*
		B					*72-86*
		C					*74-88*
		D					*71-84*
		F					*52-66*
		G					*74-88*
		H					*69-83*
NCA 2-b	*601, 607, 608, 613, 617, 624, 630, 636*	*A*	*56*	*48*	*49*	*42*	*66-78*
		B					*66-78*
		C					*68-80*
		D					*65-77*
		F					*46-58*
		G					*68-80*
		H					*63-75*
NCA 2-c	*604, 615, 627, 633, 639*	*A*	*56*	*48*	*49*	*42*	*67-94*
		B					*67-94*
		C					*68-95*
		D					*66-93*
		F					*47-74*

NCA	Receiver	Scenario reference	Daytime NML*	Extended hours am NML*	Extended hours pm NML*	Out of hours / Night-time NML*	Predicted noise level range** L_{Aeq} dB(A)
		G					*68-96*
		H					*64-91*
NCA 2-d	*645 649 651*	*A*	*56*	*48*	*49*	*42*	*70-74*
		B					*70-74*
		C					*72-76*
		D					*69-73*
		F					*50-54*
		G					*72-76*
		H					*67-71*
NCA 2-e	*658 662 664 668*	*A*	*56*	*51*	*51*	*42*	*68-96*
		B					*69-96*
		C					*70-98*
		D					*67-95*
		F					*48-76*
		G					*70-98*
		H					*65-93*

* Refer to Table 5.3 for a definition for extended hours

** Estimated using the noise propagation formula described in Section 7-2.

Table 7.3 provides a summary of the predicted noise impacts on the commercial receivers from each related construction scenario. The construction noise levels presented in Table 7.3 are highly conservative and should be considered indicative values. Should scenarios arise outside the scope of these predictions the Environmental Manager will undertake the noise assessment in association with the CMC noise specialist.

Table 7.3 Commercial receivers - Predicted construction noise levels

NCA	Receiver	Scenario reference	Daytime NML*	Extended hours am NML*	Extended hours pm NML*	Out of hours / Night-time NML*	Predicted noise level range** L_{Aeq} dB(A)
NCA 2-a	*578 579*	*A*	*70*	*70*	*70*	*70*	*72-86*
		B					*72-86*
		C					*74-88*
		D					*71-84*

NCA	Receiver	Scenario reference	Daytime NML*	Extended hours am NML*	Extended hours pm NML*	Out of hours / Night-time NML*	Predicted noise level range** L_{Aeq} dB(A)
		F					*52-66*
		G					*74-88*
		H					*69-83*
NCA 2-c	*616*	*A*	*70*	*70*	*70*	*70*	*67-94*
		B					*67-94*
		C					*68-95*
		D					*66-93*
		F					*47-74*
		G					*68-96*
		H					*64-91*
NCA 2-e	*665*	*A*	*70*	*70*	*70*	*70*	*68-96*
		B					*69-96*
		C					*70-98*
		D					*67-95*
		F					*48-76*
		G					*70-98*
		H					*65-93*

* Refer to Table 5.3 for a definition for extended hours

** Estimated using the noise propagation formula described in Section 7-2.

The construction activities to be carried out by CMC along Section 2 (Halfway Creek to Glenugie) upgrade of the Pacific Highway has been the subject of extensive investigation under the overall project EIS. Site specific investigations along the Pacific Highway alignment from Halfway Creek to Glenugie has identified 29 receivers within the 600m project area. The noise sensitive receivers are dispersed widely along the project area alignment with the receivers located in relative proximity arranged in a Noise Catchment Area (NCA) with a common characteristic being existing noise amenity and relative proximity to the planned construction corridor (including identified ancillary facilities and bridges).

Depending on the distance from the construction corridor and the terrain characteristics, the typical construction activities have a potential to impact on the noise amenity at all 29 of the identified sensitive receivers. The majority of the noise impact is associated with the earthworks under an assumption of high concentration of plant and equipment. The highest construction noise impact is predicted at the four (4) commercial receivers (R578, R579, R616, R665) and two (2) residential receivers (R627, R644) , as presented in Appendix A. These critical receivers should be screened during all operations as their proximity to the road offers very little natural acoustic attenuation. The situation is similar for bridge building

operations, however, as these operations take place at specific locations, not all receivers are equally effected. Receivers of concern during bridge building operations are R582, R616 and R627. Note that R616 is a commercial receiver and therefore is of less concern than R582 and R627. During earthworks and bridge building operations, temporary acoustic barriers should be deployed to prevent a direct line of view of the construction works from nearby receivers. Where practicable, operations shall be carried out in a manner that limits high concentrations of plant and equipment operating simultaneously.

It is important to note that the predicted construction noise levels represent the highest noise levels expected over any 15 minute period with highly concentrated concurrent operation of multiple noise sources. Considering that the highway upgrade corridor is linear, with wide spread of plant and equipment, it is likely that the actual construction noise levels will be lower.

Considering the significantly lower NML for extended and night-time hours of operation, community consultation will be required before any extended hours or night works (6pm-7am Mon-Fri) operations are considered.

7.2.2 Drilling and Blasting

One of the issues that was subject of particular investigation along Section 2 is the potential noise impact from drilling and blasting. The potential blasting locations are identified as follows:

Cut 8: - CH24600 - CH25400;

Cut 9: - CH26300 - CH27300; and

Cut 10: - CH27400-CH28100.

The impact of noise and vibration generated by blasting is considered in Section 7.3.2 of this report. The extraction and processing of the blasted rock will be an activity of a longer duration similar to, though less intensive than, earthworks activities. To determine the potential noise impact from drilling and the subsequent resource extraction activities, the combined sound power level of all of the noise sources identified in Table 7.4 was considered.

Table 7.4 Ancillary operations during blasting

Scenario reference	Construction scenario	Typical plant and equipment required	Combined Sound Power Level L_{Aeq} dB(A)
I	Drilling, Crushing and Screening	Blast hole drill rig, Mobile crusher and screener, Pneumatic hammer, Mulcher/Chipper, Excavator	119

The combined sound power level of all noise sources considered during the road basing operation carried out coincident with the planned blasting period was 119dB(re 10^{-12} W). The setback distance from the nearest section where blasting may be required (CH24600) to the nearest noise sensitive receiver (R668), located in NCA 2-a, is approximately 630m (see Appendix A). Applying the noise propagation formula, the noise at the most exposed façade of this receiver is 55dB(A) which falls within the relevant day-time NML. For blasting only the day-time NML is relevant as no blasting will be undertaken during extended hours or out of hours periods.

7.2.3 Compound and stockpile operation (including access)

The Project will require a main site compound, and a number of ancillary facilities and stockpile sites. These compound and ancillary facilities will accommodate a range of activities, plant and equipment including, but not limited to:

- Office accommodation.
- Staff amenities.
- Light vehicle parking and access.
- A plant and equipment maintenance workshop.
- Material and chemical storage.
- Concrete batching plant.
- Equipment storage.
- Material storage.
- Concrete casting areas.

Not all sites will serve the same purpose and may include only one, or many combinations of the activities listed above. Table 7.5 summaries the likely combination of activities, plant and equipment anticipated at facilities for the project. Appendix A4 of the CEMP provides a list and assessment of all ancillary facilities and stockpile sites on the Project.

Table 7.5 Likely ancillary facilities and associated attributes

Facility	Activities	Site Noise Source	Combined Sound Power Level L_{Aeq} dB(A)
Lemon Tree Road Rest Area Main Compound	Storage of culverts and location of the project batch plant.	Batch plant, 10t tip trucks, forklift, 25t Franna, crane trucks, 20t excavator, vacuum trucks, light vehicles, power tools	120 (+5)
Lemon Tree Service Road Spoil/Stockpile Area	Stockpile site for topsoil and mulch and spoil area.	10t tip trucks, truck and dogs, 20t excavator, vibratory compactor, light vehicles	116 (+5)
Heavy Vehicle Inspection Bay Stockpile Area	Stockpile site for topsoil, select gravel fill and mulch.	10t tip trucks, truck and dogs, 20t excavator, vibratory compactor, light vehicles	116 (+5)
Kungala Road Stockpile/Office Area	Stockpile site for topsoil, select gravel fill and mulch with a small site office.	10t tip trucks, truck and dogs, 20t excavator, vibratory compactor, light vehicles, generator	117 (+5)
Halfway Creek Bridge Compound	Pre-fabrication work area and storage of culverts.	Forklift, 25t Franna, crane trucks, light vehicles, power tools	117 (+5)
Bernies' Stockpile Area	Stockpile site for topsoil, select fill, mulch and a spoil	10t tip trucks, truck and dogs, 20t excavator, vibratory compactor, light vehicles	116 (+5)

Facility	Activities	Site Noise Source	Combined Sound Power Level L_{Aeq} dB(A)
	area.		
Luthers Road Extension Spoil/Stockpile Area	Stockpile site for topsoil, select gravel fill and mulch and spoil area	10t tip trucks, truck and dogs, 20t excavator, vibratory compactor, light vehicles	116 (+5)
Wells Crossing Bridge Compound	Pre-fabrication work area and storage of culverts.	Forklift, 25t Franna, crane trucks, 10t tip trucks, truck and dogs, 20t excavator, vibratory compactor, light vehicles, power tools	118 (+5)
Northbound Parker Road Compound	Storage of culverts and location of the project batch plant.	Batch plant, 10t tip trucks, forklift 25t Franna, 20t excavator, front-end loader, concrete truck, light vehicles, power tools	121 (+5)
Parker Road West Stockpile/Laydown Area	Stockpile site for topsoil and laydown for other materials.	10t tip trucks, truck and dogs, 20t excavator, vibratory compactor, flatbed trucks, 25t Franna, light vehicles	117 (+5)
Bald Knob Road Stockpile Area	Stockpile site for topsoil and mulch and a spoil area.	10t tip trucks, truck and dogs, 20t excavator, vibratory compactor, light vehicles	116 (+5)
Old Heavy Vehicle Inspection Station (HVIS) Spoil/Stockpile Area	Stockpile site for topsoil and mulch and a spoil area.	10t tip trucks, truck and dogs, 20t excavator, vibratory compactor, light vehicles	116 (+5)
Franklins Road Spoil/Stockpile Area	Stockpile site for topsoil and mulch and a spoil area.	10t tip trucks, truck and dogs, 20t excavator, vibratory compactor, light vehicles	116 (+5)

Table 7.6 provides a summary of predicted combined noise impacts from the ancillary sites, compounds and concrete batching plants on the residential receivers.

Table 7.6 Residential receivers - Predicted ancillary facility noise levels

Sensitive receiver location	Sensitive receiver	Daytime NML*	Extended hours am NML*	Extended hours pm NML*	Out of hours / Nigh-time NML	Maximum noise level**
1	*581*	*58*	*48*	*49*	*42*	*78*
(NCA 2-	*582*					*81*

Sensitive receiver location	Sensitive receiver	Daytime NML*	Extended hours am NML*	Extended hours pm NML*	Out of hours / Nigh-time NML	Maximum noise level**
a)	*584*					*67*
	588					*68*
	597					*67*
2 (NCA 2-b)	*601*	*56*	*48*	*49*	*42*	*63*
	607					*65*
	608					*66*
	613					*64*
	617					*67*
	624					*66*
	630					*69*
	636					*66*
3 (NCA 2-c)	*604*	*56*	*48*	*49*	*42*	*65*
	615					*65*
	616					*77*
	633					*68*
	639					*75*
4 (NCA 2-d)	*645*	*56*	*48*	*49*	*42*	*66*
	649					*65*
	651					*69*
5 (NCA 2-e)	*658*	*56*	*51*	*51*	*42*	*74*
	662					*77*
	664					*79*
	668					*64*

* Refer to Table 5.3 for a definition for extended hours

** Estimated using the noise propagation formula described in Section 7-2.

Table 7.7 provides a summary of predicted combined noise impacts from the ancillary sites, compounds and concrete batching plants on the commercial receivers.

Table 7.7 Commercial receivers - Predicted ancillary facility noise levels

NCA	Receiver	Daytime NML*	Extended hours am NML*	Extended hours pm NML*	Out of hours / Night-time NML*	Predicted noise level ** L_{Aeq} dB(A)
NCA 2-a	*578*	*70*	*70*	*70*	*70*	*76*
	579					*85*
NCA 2-c	*616*	*70*	*70*	*70*	*70*	*76*
NCA 2-e	*665*	*70*	*70*	*70*	*70*	*76*

* Refer to Table 5.3 for a definition for extended hours

** Estimated using the noise propagation formula described in Section 7-2.

The establishment of the ancillary facilities (including concrete batching plant) along Section 2 of the Pacific Highway upgrade may have high noise impact on the noise amenity at all 29 sensitive receivers. The majority of the noise impact is associated with the operation of the concrete batching plants at the Lemon Tree Road rest area main compound and the Northbound Parker Road compound. The highest noise impact is predicted at the Shell Service Station identified as R579 with a maximum noise level of 85dB(A) and a relevant day-time NML of 70dB(A).

The residential and commercial receivers in close proximity to both the Parker Road West Stockpile/Laydown Area and the batching operations at the Northbound Parker Road Compound are also expected to be among the most affected receivers.

The operating noise levels presented in Table 7.6 and Table 7.7 are highly conservative and should be considered as indicative values only. Their primary purpose is to inform the decision process of where the focus of the noise mitigation measures should be.

Although the predicted noise levels are highly conservative and the actual noise may be less, the potential noise impact is present and should be carefully considered during the establishment of the concrete batching plants. Engineering noise control measures may be required to ensure the highest noise emission sources at the concrete batching plant are screened to prevent direct line of view to the nearest noise sensitive receivers.

Operation of the batching plants outside of standard operating hours (7am-6pm) will be avoided unless approval has been sought through community consultation. Where practicable, operations shall be carried out in a manner that limits high concentrations of plant and equipment operating simultaneously.

7.3 Construction Vibration and Blasting Assessment

7.3.1 Vibration assessment

The relationship between the amount of energy transmitted to the soil, the horizontal separation distance and the resulting vibration velocity has been subject of empirical and theoretical research over the past 40 years. One of the early empirical models, developed by Attewell and Farmer in 1973, has become one of the mostly widely used and quoted procedures for practical estimation of vibration due to pile driving (F. Deckner, K. Viking and S. Hintze, 2012). This empirical model suggests that vertical peak particle velocity ('Z' axis) from pile driving attenuates with distance and can be determined using the following equation:

$$v = k\left(\frac{\sqrt{W_0}}{r}\right)^x$$

Where: k = empirically determined constant

W_0 = input energy (hammer energy) (J or N m)

r = horizontal distance between pile and calculation point (m)

x = empirically determined index

The setting for k and x is 1, as recommended by Attewell and Farmer, when empirical data is lacking.

An adaptation of this formula was fitted, by Wheeler[1], to a study made of vibratory rollers over 10 sites with 15 combinations of roller type, operating frequency and ground conditions. From this work a conservative value of k is given as 3.16 when x is 1 (D. Hiller and V. Hope, 1998). The input energy has been determined from the specifications of commercially available vibratory rollers and pile drivers at the upper end of the specified or available weight range.

Table 7.8 lists vibration intensive plant likely to be used during construction and provides predicted ground vibration levels at various distances from the plant. The vibration levels are indicative only and will vary depending on the particular item of plant and geotechnical conditions.

Table 7.8 Typical plant vibration levels

Plant description	Structural Damage Criteria (mm/s)	Vibration level (mm/s)			
		5 metres	10 metres	25 metres	50 metres
Vibratory roller (1-2 tonne)	*5-15 mm/s*	*2.59*	*1.29*	*0.52*	*0.26*
Vibratory roller (2-4 tonne)	*5-15 mm/s*	*4.64*	*2.32*	*0.93*	*0.46*
Vibratory roller (4-6 tonne)	*5-15 mm/s*	*9.45*	*4.73*	*1.89*	*0.95*

[1] Wheeler A. B. S. The Attenuation of Ground Vibrations Caused By Vibratory Rollers. MSc Dissertation, University of Durham, 1990.

Plant description	Structural Damage	Vibration level (mm/s)			
Vibratory roller (7-13 tonne)	*5-15 mm/s*	*7.53*	*3.77*	*1.51*	*0.75*
Vibratory roller (13-18 tonne)	*5-15 mm/s*	*15.45*	*7.72*	*3.09*	*1.54*
Vibratory roller (>18 tonne)	*5-15 mm/s*	*16.69*	*8.34*	*3.34*	*1.67*
Large hydraulic hammer	*5 mm/s*	*4.50*	*1.30*	*0.40*	*0.10*
Vibratory pile driver	*5 mm/s*	*9.02*	*4.51*	*1.80*	*0.90*
Drilling of blasting holes	*5 mm/s*	*1.67*	*0.59*	*0.15*	*0.05*
Pile boring	*5 mm/s*	*4.26*	*1.50*	*0.38*	*0.14*
Jackhammer (hand held)	*5 mm/s*	*1.67*	*0.59*	*0.15*	*0.05*

Conventional vibratory rollers have an operating frequency in the 10-100Hz frequency range, typically between 20-80Hz. The other plant and equipment listed have varying operating frequencies and the most conservative structural damage criteria have been applied. Table 7.9 contains safe working distances from sensitive receivers as per the relevant British standards. Table 7.8 applies the German standard and is therefore not comparable with the second column of Table 7.9. Where there are differences in the two tables the most conservative value will be applied.

Table 7.9 Typical plant safe working distances

Plant description	Safe Working Distance[2] (m)	
	Cosmetic Damage (BS 7385)	Human Comfort (BS 6472:2008)
Vibratory roller (1-2 tonne)	*5*	*20 to 25*
Vibratory roller (2-4 tonne)	*6*	*25*
Vibratory roller (4-6 tonne)	*12*	*50*
Vibratory roller (7-13 tonne)	*15*	*130-150*
Vibratory roller (13-18 tonne)	*20*	*130-150*
Vibratory roller (>18 tonne)	*25*	*130-150*
Small hydraulic hammer	*2*	*10*
Medium hydraulic hammer	*7*	*30*
Large hydraulic hammer	*22*	*90*
Vibratory pile driver	*2 to 20*	*30*
Drilling of blasting holes	*1*	*N/A*

[2] Derived from an Environmental Noise and Vibration Impact Assessment carried out by SLR (2013).

Pile boring	*2*	*N/A*
Jackhammer (hand held)	*1*	*N/A*

The safe working distances presented in Table 7-5 are meant to serve as an indication only. Exact distances depend on the individual plant specifications and local geotechnical conditions. The distances are valid for typical buildings under typical geotechnical conditions.

7.3.2 Blasting assessment

Blasting may be required to remove rock outcrops. Blast holes will be drilled and filled with an explosive charge and detonated with the aid of primers and detonators. Impacts associated with blasting normally relate to air blast overpressure and ground vibration.

Potential vibration and air blast overpressure impacts generated through blasting will be managed primarily through a site and blast-specific assessment in conjunction with preliminary small scale testing conducted at each proposed blast site prior to the commencement of full scale blasting.

A complete Blast Management Program is contained in Table 9.1 of this report.

Quantitative assessment was carried out in accordance with AS2187.2-2006 '*Explosives – Storage and Use'* to give an indication of safe explosive charge masses.

According to AS2187.2-2006, airblast overpressure can be estimated by a cube root scaling formula:

$$P = K_a \left[\frac{R}{Q^{\frac{1}{3}}} \right]^a$$

where

P = pressure, in kilopascals
Q = explosives charge mass, in kilograms
R = distance from charge, in metres
K_a = site constant
a = site exponent

For confined blasthole charge blasting, the expected form of blasting, the values of -1.45 for the site exponent (a) and up to 100 for the site constant (K_a) are given. Table 7.10 presents the maximum explosive charge mass allowed by the airblast overpressure criteria as outlined in Table 5.9.

Table 7.10 Allowable explosive charge mass for airblast overpressure

Blasting Location	Setback distance from nearest receiver	Allowable noise[3] dBL	Allowable explosive charge mass (kg)
Cut 8: CH24600-CH25400	630m	115	1.7

[3] For blasting lasting more than 12 months or 20 blasts.

Cut 9: CH26300-CH27300	2300m	115	85
Cut 10: CH27400-CH28100	3300m	115	245

According to AS2187.2-2006, ground vibration resulting from blasting operations can be estimated by the following equation:

$$V = K_g \left[\frac{R}{Q^{\frac{1}{2}}} \right]^{-B}$$

where

V = ground vibration as vector peak particle velocity, in millimetres per second
Q = explosives charge mass, in kilograms
R = distance from charge, in metres
K_g = site constant
B = site exponent

The values of 1.6 for the site exponent (B) and 1140 for the site constant (K_a) are given for average conditions. In practice vibrations can exceed the calculated values by up to four (4) times. Table 7.11 presents the maximum explosive charge mass allowed by the vibration criteria outlined in Table 5.10 calculated with the equation presented above, adjusted by a factor of four (4). Note that the human comfort vibration criteria are more severe than the structural integrity criteria presented in Table 5.11 and are therefore used to determine the maximum allowable vibration.

Table 7.11 Allowable explosive charge mass for vibration

Blasting Location	Setback distance from nearest receiver	Allowable peak particle component velocity3 (mm/s)	Allowable explosive charge mass (kg)
Cut 8: CH24600-CH25400	630m	5	80
Cut 9: CH26300-CH27300	2300m	5	1050
Cut 10: CH27400-CH28100	3300m	5	2200

A comparison of the results in Table 7.10 and Table 7.11 from the two blast criteria shows that the limitation on charge mass is the airblast overpressure criteria. Measures to limit the overpressure resulting from blasting have been considered in the blast management plan included in Table 9.1.

8 Construction traffic noise assessment

The activities associated with the Project are expected to result in a substantial increase in traffic on the segment of the Pacific Highway from Halfway Creek to Glenugie for the duration of the project. Under the NSW Road Noise Policy 2011 (RNP) the construction site is considered a traffic generating land use development impacting on residential receivers. The relevant criteria are presented in Table 8.1.

Table 8.1 Road traffic noise assessment criteria for residential land uses.

Road Category	Type of project/land use	Assessment criteria – dB(A)	
		Day (7am-10pm)	Night (10pm-7am)
Freeway/ arterial/ sub-arterial roads	3. Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{Aeq,(15\ hour)}$ 60 (external)	$L_{Aeq,(15\ hour)}$ 55 (external)

Where the above criteria are exceeded, the total increase in traffic noise should not be more than 2dB (where an increase of up to 2dB represents a minor impact that is considered barely perceptible to the average person).

Traffic counts and a noise monitoring survey has been carried out for the Halfway Creek to Glenugie section in March 2012. The traffic data is recorded in Table 5-14 of the WP and is reproduced in Table 8.2.

Table 8.2 Sample daily traffic flows in March 2012

Description	Daytime (15 hour)				Night-time (9 hour)			
	Light	Heavy	Total	%Heavy	Light	Heavy	Total	%Heavy
Northbound	4,239	566	4,805	12%	522	362	884	41%
Southbound	4,289	808	5,097	16%	424	227	651	35%

A traffic noise propagation model was developed using SoundPLAN software to predict the increase in noise resulting from additional traffic due to the construction activities. SoundPLAN calculates traffic noise as per the procedure specified in the UK Department of Transport Welsh Office *Method of Calculation of Road Traffic Noise* (CoRTN'88). This is an accepted traffic noise calculation procedure applied widely in Australia.

A validation of the noise propagation model used to predict additional construction traffic noise was carried out considering the day-time and night-time traffic flow data from Table 8.2.

The following factors were considered in the validation of the model:

- The speed of the vehicles passing the subject site is 100km/h;

- The road surface is considered to be spray seal with a +3dB(A) adjustment for road surface in the model; and
- The noise loggers were modelled in a free field location with a height of 1.5m above ground level and adjusted by +2.5dB(A) for façade correction (the loggers were set up at the facades of the receivers R597 and R651).

The model was validated by reproduction of the traffic noise monitoring survey results as recorded in Table 5-10 of the WP and reproduced with the validation results in Table 8.3.

Table 8.3 Traffic noise propagation model validation results

Receiver	Daytime $L_{Aeq,(15\ hour)}$ dB(A)			Night-time $L_{Aeq,(9\ hour)}$ dB(A)		
	Measured	Predicted	Difference	Measured	Predicted	Difference
R597	56.1	55.1	-1.0	56.0	53.0	-3.0
R651	56.6	57.3	+0.7	54.2	55.2	+1.0

The predicted noise levels are within ±2dB(A) of the measured levels, except for the night-time noise levels at R597. As the measured night-time noise levels at R597 were virtually the same as the day-time levels, despite lesser traffic flows, it can reasonably be expected that some noise source other than the Pacific Highway contributed to the measured levels during the night-time period at R597. The accuracy of the noise model is considered suitable for predicting noise impact from traffic on the Pacific Highway on the sensitive receivers within the project area.

The extent to which traffic flow volumes will be increased over the project duration is unknown, however a highly conservative scenario assuming a 25% increase in traffic volumes, with 90% increase comprising of heavy vehicles, has been modelled. The breakdown of traffic volumes in the modelled scenario is shown in Table 8.4.

Table 8.4 Modelled construction traffic scenario

Description	Daytime (15 hour)				Night-time (9 hour)			
	Light	Heavy	Total	%Heavy	Light	Heavy	Total	%Heavy
Northbound	4,359	1,647	6,006	27%	543	552	1,095	50%
Southbound	4,416	1,955	6,371	31%	440	373	813	46%

The following factors were considered in the construction traffic noise propagation model:

- The speed of the vehicles passing the subject site will be 80km/h due to road works speed limitations;
- The road surface is considered to be spray seal with a +3dB(A) adjustment for road surface in the model; and
- The receivers were modelled in a free field location with a height of 1.5m above ground level and adjusted by +2.5dB(A) for façade correction.

The resulting increase in traffic noise levels at the sensitive receivers along the Halfway Creek to Glenugie section of the Pacific Highway, due to increase in construction traffic, is presented in Table 8.5.

Table 8.5 Daytime and night-time construction traffic noise impact

Sensitive receiver location	Sensitive receiver	Daytime		Night-time		Compliance with assessment criteria	Total increase less than 2dB
		Current $L_{Aeq,(15\ hour)}$ dB(A)	Predicted $L_{Aeq,(15\ hour)}$ dB(A)	Current $L_{Aeq,(9hour)}$ dB(A)	Predicted $L_{Aeq,(9hour)}$ dB(A)		
1 (NCA 2-a)	*581*	*61.*	*62*	*59*	*59*	*No*	*Yes*
	582	*72*	*73*	*70*	*70*	*No*	*Yes*
	584	*55*	*55*	*53*	*53*	*Yes*	*Yes*
	588	*57*	*58*	*55*	*55*	*Yes*	*Yes*
	597	*55*	*56*	*53*	*53*	*Yes*	*Yes*
2 (NCA 2-b)	*601*	*49*	*50*	*49*	*47*	*Yes*	*Yes*
	607	*50*	*51*	*48*	*48*	*Yes*	*Yes*
	608	*50*	*50*	*48*	*48*	*Yes*	*Yes*
	61	*48.*	*49*	*46*	*46*	*Yes*	*Yes*
	617	*53*	*54*	*51*	*51*	*Yes*	*Yes*
	624	*53*	*54*	*51*	*51*	*Yes*	*Yes*
	630	*51*	*52*	*49*	*49*	*Yes*	*Yes*
	636	*47*	*48*	*45*	*45*	*Yes*	*Yes*
3 (NCA 2-c)	*604*	*47*	*48*	*45*	*45*	*Yes*	*Yes*
	615	*48*	*49*	*46*	*46*	*Yes*	*Yes*
	616	*60*	*60*	*58*	*58*	*No*	*Yes*
	633	*50*	*50*	*48*	*48*	*Yes*	*Yes*
	639	*56*	*56*	*54*	*54*	*Yes*	*Yes*
4 (NCA 2-d)	*645*	*54*	*55*	*52*	*52*	*Yes*	*Yes*
	649	*58*	*58*	*55*	*56*	*No*	*Yes*
	651	*57*	*58*	*55*	*55*	*Yes*	*Yes*
5 (NCA 2-	*658*	*53*	*53*	*51*	*51*	*Yes*	*Yes*
	662	*54*	*55*	*52*	*53*	*Yes*	*Yes*

Sensitive receiver location	Sensitive receiver	Daytime		Night-time		Compliance with assessment criteria	Total increase less than 2dB
		Current $L_{Aeq,(15\ hour)}$ dB(A)	Predicted $L_{Aeq,(15\ hour)}$ dB(A)	Current $L_{Aeq,(9hour)}$ dB(A)	Predicted $L_{Aeq,(9hour)}$ dB(A)		
e)	*664*	*66*	*67*	*64*	*65*	*No*	*Yes*
	668	*49*	*49*	*47*	*47*	*Yes*	*Yes*

There are five (5) receivers that exceed the traffic noise criteria for day-time or night-time conditions. However, under highly conservative construction traffic noise modelling scenario, the noise levels have not increased by more than 2dB at any of the sensitive receivers along the Halfway Creek to Glenugie section of the Pacific Highway.

The additional construction traffic along the Halfway Creek to Glenugie section of the Pacific Highway upgrade does not result in increase in the total traffic noise level above 2dB. Considering that an increase of up to 2dB represents a minor impact, barely perceptible to the average person, the residences along the Halfway Creek to Glenugie section of the Pacific Highway are unlikely to be impacted by construction traffic noise.

9 Environmental control measures

A range of environmental requirements and control measures are identified in the various environmental documents, including the EIS, Submissions/Preferred Infrastructure Report, Conditions of Approval and Roads and Maritime documents. Specific measures and requirements to address impacts from noise and vibration are outlined in Table 9.1.

Table 9.1 Noise and vibration management and mitigation measures

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
GENERAL					
NV1	Training will be provided to all project personnel, including relevant sub-contractors on noise and vibration requirements from this plan through inductions, toolboxes and targeted awareness training. Noise and vibration training requirements will be as per Section 9.2 of this plan.	Induction Personnel	Pre-construction, construction	Environment Manager	G36, Section 9.2
NV2	Work compounds, parking areas, equipment and material stockpile sites will be positioned away from noise-sensitive locations in accordance with the criteria in Section 3.7.2 and Appendix A2 of the CEMP, and Appendix I of the CSWQMP.	N/A	Construction	Environment Manager	G36
NV3	Site entry and exit points will be located as far as possible from sensitive receivers, taking into account the importance of safe access.	N/A	Construction	Supervisor	Submissions / PIR(CNV3)
NV4	Truck routes to and from the worksite will be via major roads where possible, in accordance with the Construction Traffic Management Plan.	N/A	Construction	Superintendent	Submissions / PIR (CNV9)
NV5	Operational noise mitigation measures eg at property treatments, noise mounds, will be installed as early as possible during construction.	Monitoring Personnel	Construction	Construction Manager	G36
NV6	Where piling, hydraulic hammering or dynamic compaction is proposed within 200 metres of any structure or service, a building condition survey would be conducted and preliminary vibration monitoring undertaken by a qualified contractor.	Condition Survey Personnel	Construction	Construction Manager	Submissions / PIR (CNV15), G36
NV7	Where piling, hydraulic hammering or dynamic compaction is proposed within 200 metres of any heritage structure or potentially structurally unsound service, a building condition survey would be conducted and preliminary vibration monitoring undertaken by a qualified contractor. A follow-up survey would be conducted in response to any vibration	Condition Survey Personnel	Construction	Construction Manager	Submissions / PIR (CNV16), G36

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
	complaints.				
NV8	Prior to the use of the dynamic compaction construction method, the Applicant shall undertake an assessment of vibration generated by dynamic compaction on nearby sensitive receivers. Feasible and reasonable mitigation measures shall be implemented to minimise vibration impacts.	N/A	Construction	Construction Manager	CoA B26
PLANT AND EQUIPMENT					
NV9	Where feasible and reasonable noisy equipment and/or construction processes will be substituted by alternative low noise emitting equipment and/or construction process. For example; (CoA B25) where feasible and reasonable, piling activities shall be undertaken using quieter construction methods, such as bored piles or vibrated piles rather than impact or percussion piling methods.	Field Staff	Construction	Supervisor	G36, Submissions / PIR (CNV5, CNV 9 and CNV 14) CoA B25
NV10	Static noise sources, such as generators, pumps and lighting towers, will be located as far as possible from sensitive receivers. Place screening or enclosures around fixed plant under regular operation that may impact upon noise sensitive receivers. The use of temporary noise shielding will be determined following community consultation.	Field Staff	Construction	Supervisor	G36, Submissions / PIR (CNV11 and CNV12)
NV11	Undertake saw-cutting operations wherever possible to minimise noise impacts and use mitigation methods such as screening or respite where appropriate.	Field Staff	Construction	Supervisor	G36
NV12	Plant or machinery will not be permitted to 'warm-up' before the nominated working hours.	Field Staff	Construction	Operators	Submissions / PIR (CNV8)
NV13	Switching off engines when equipment is not in use for extended periods (i.e 30 minutes).	Field Staff	Construction	Operators	G36
NV14	Unless required for technical reasons, undertake high noise generating work (such as use of a concrete saw or hydraulic hammer) during the day, or early in the	Field Staff	Construction	Supervisor	G36

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
	evening if required to be undertaken at night; avoiding short sharp sounds from impacts during night work to minimise sleep disturbance to neighbouring residents.				
NV15	Manually adjustable or ambient noise sensitive or 'quacker' type reversing alarms on plant and/or flashing lights will be used at night.	Field and Management Staff	Construction	Superintendent	G36, Submissions / PIR (CNV6)
NV16	Where possible, maintenance work on construction plant will be undertaken away from noise sensitive receivers.	Field and Management Staff	Construction	Supervisor	G36
NV17	All construction plant and equipment used on the site will be, in addition to other relevant requirements: • Fitted with properly maintained noise suppression devices in accordance with the manufacturer's specifications. • Maintained in an efficient condition. • Operated in a proper and efficient manner	Field and Management Staff	Construction	Superintendent	CoA B80, G36, Submissions / PIR Submissions / PIR (CNV4)
NV18	Loading and unloading will be carried out as far as practical away from sensitive receivers.	Field and Management Staff	Construction	Supervisor	Good practice
NV19	Truck movements will be kept to a minimum, ie that trucks are sufficiently utilised for each trip.	Field and Management Staff	Construction	Supervisor	Good practice
NV20	Trucks will not queue up outside residential properties. No trucks will arrive on site or be permitted to queue near sensitive receivers prior to the 7.00 am start time unless required by road safety considerations.	Field and Management Staff	Construction	Supervisor	Good practice
NV21	Noisy plant working simultaneously close together will be avoided to the greatest extent practical adjacent to noise affected sensitive receivers.	Field and Management Staff	Construction	Supervisor	Good practice
NV22	Whenever practical, at the end of shifts, excavation and/or ripping plant will be taken from their work areas and left overnight away from the immediate vicinity of sensitive receivers. Warming up of the plant will then be conducted away from such receivers.	Field and Management Staff	Construction	Supervisor	Good practice
NV23	Truck drivers will limit compression braking as far as	Field and	Construction	Operators	Good practice

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
	practicable.	Management Staff			
NV24	Where possible, noise generating equipment will be strategically positioned to take advantage of natural screening from geographical features or other structures to reduce the transmission of noise between work sites and receiver locations.	Field and Management Staff	Construction	Supervisor	Good practice
NV25	Appropriately sized equipment would be selected in order to minimise vibration emissions, where required.	Field and Management Staff	Construction	Supervisor	Submissions / PIR (CNV17)
CONSTRUCTION HOURS					
NV26	Construction works associated with the Project, other than blasting, will only be undertaken during the following hours: • 7:00am to 6:00pm Mondays to Fridays, inclusive; and • 8:00am to 5:00pm Saturdays; and • at no time on Sundays or public holidays. Unless otherwise assessed and justified in the CEMP or this Plan.	Field and Management Staff	Construction	Construction Manager	CoA B15
NV27	Works outside of the construction hours identified in CoA B15 will only be undertaken in the following circumstances: a) works that generate noise that is (i) no more than 5 dB(A) above rating background level at any residence in accordance with the Interim Construction Noise Guideline (Department of Environment and Climate Change, 2009); and (ii) no more than the noise management levels specified in Table 3 of the Interim Construction Noise Guideline (Department of Environment and Climate Change, 2009) at other sensitive receivers; or b) for delivery of materials required outside these	Field and Management Staff	Construction	Construction Manager	CoA B16

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
	hours by the Police or other authorities for safety reasons; or c) where it is required in an emergency to avoid the loss of lives, property and/or to prevent environmental harm; or d) between 6.00am and 7.00am and 6.00pm and 7.00pm Monday to Friday (except public holidays) in sparsely populated areas (these construction hours may be reviewed and/or revoked by the Director General in consultation with the EPA in the case of unresolved noise complaints); or e) low noise impact activities and work as follows: (i) between 6.00am and 7.00am Monday to Friday; and/or (ii) between 6.00pm and 7.00pm Monday to Friday; f) works approved through an EPL or g) works approved by a Construction Environment Management Plan or Construction Noise and Vibration Management Plan for the SSI in accordance with CoA B19.				
NV28	The Applicant shall, where feasible and reasonable, limit high noise impact activities and work to the mid - morning and mid-afternoon periods, except in sparsely populated areas. Rock breaking, rock hammering, sheet piling, pile driving and any similar activity will be scheduled only between the hours of 9am to 12pm and 2pm to 5pm, Monday to Friday; and 9am to 12pm, Saturday except where works are to be undertaken outside proposed construction hours as outlined above. These activities, if undertaken in continuous blocks and where there is an impact on a sensitive receiver, must not exceed 3-hours in duration, particularly if work extends outside the standard construction hours. A minimum respite period of 1 hour shall be scheduled	Field and Management Staff	Construction	Construction Manager	CoA B19, Submissions / PIR (CNV2)

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
	before activities recommence.				
NV29	Construction activities resulting in impulsive or tonal noise emission (such as rock breaking, rock hammering, pile driving) shall only be undertaken: (a) between the hours of 8:00am to 5:00pm Monday to Friday; (b) between the hours of 8:00am to 1:00pm Saturday; and (c) in continuous blocks not exceeding three hours each with a minimum respite from those activities and works of not less than one hour between each block. *For the purposes of this condition 'continuous' includes any period during which there is less than a one hour respite between ceasing and recommencing any of the work the subject of this condition.* *The works subject to this condition may be undertaken in sparsely populated areas within the construction hours specified in condition CoA B15.*		Construction	Supervisor	Submissions / PIR (CNV2) CoA B18
NV30	Any proposal to undertake works outside of the standard working hours identified in CoA B15 will be subject to CoA B17 and the processes and assessment requirement contained in the out of hours works procedure (see Appendix D).	Field and Management Staff	Construction	Construction Manager	CoA B17
NV31	Affected receivers would be consulted prior to the commencement of out of hours work and initially at project commencement for extended hours..	Field and Management Staff	Construction	Communications Manager	Submissions / PIR (CNV1)
NV32	Affected educational institutions shall be consulted and reasonable steps taken to ensure that noise generating construction works in the vicinity of affected buildings are not timetabled during examination periods where practicable, unless other reasonable arrangements to the affected institutions are made at no cost to the affected institution.	N/A	Construction	Construction Manager	CoA B27

ID	Measure / Requirement	Resources	When to	Responsibility	Reference
BLAST MANAGEMENT					
NV33	Where sensitive receivers are located close to the blast site, a series of trials will be undertaken at a reduced scale to determine site-specific blast response characteristics, in order to define allowable blast sizes to occur within the criteria.	Field and Management Staff	Construction	Supervisor	Submissions / PIR (CNV19)
NV34	Controlled blasting activities will only be undertaken between the hours of: a) 9am to 5pm, Monday to Friday b) 9am to 1pm, Saturday; and c) at no time on Sunday or public holidays Blasting may occur in accordance with the construction hours specified in CoA B15 where no sensitive receivers would be impacted by blasting in sparsely populated areas or that an agreement has been made with receivers within 200 metres of the blast zone to permit blasting in accordance with the construction hours specified in CoA B15. Where the blast management plan has identified potential impacts on sensitive receivers, these hours will be subject to change. *This condition does not apply in the event of a direction from the NSW Police Force or other relevant authority for safety or emergency reasons to avoid loss of life, property loss and/or to prevent environmental harm.*	Field and Management Staff	Construction	Construction Manager	Submissions / PIR (CNV20) CoA B21
NV35	Airblast overpressure generated by blasting associated with the SSI shall not exceed the criteria specified in the CNVMP when measured at the most affected receiver or other sensitive receiver.	Field and Management Staff	Construction	Construction Manager	CoA B22 Ch 5-4 Ch 7-3-2
NV36	Ground vibration generated by blasting associated with the SSI shall not exceed the criteria specified in the CNVMP when measured at the most affected receiver or other sensitive receiver.	Monitoring Equipment	Construction	Construction Manager	CoA B23 Ch 5-4 Ch 7-3-2
NV37	Should an increase in the blasting criteria be required, written agreement of the relevant landowner will be	Field and Management Staff	Construction	Construction Manager	CoA B24

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
	sought. In obtaining the agreement the following will be made available to the landowner: a) details of the proposed blasting program and justification for the proposed increase to blasting criteria including alternatives considered (where relevant); b) the environmental impacts of the increased blast limits on the surrounding environment and most affected residences or other sensitive receivers including, but not limited to noise, vibration and air quality and any risk to surrounding utilities, services or other structures; and c) the blast management and mitigation measures, and monitoring procedures to be implemented to monitor blasting impacts. A copy of the written agreement will be provided to the Director General and the EPA, including details of the consultation undertaken (with clear identification of proposed blast limits and potential property impacts) prior to commencing blasting at the increased limits. *The blasting limit agreed to under any agreement for an occupied residential building can at no time exceed a maximum Peak Particle Velocity vibration level of 25 mm/s or maximum Airblast Overpressure level of 125 dBL.*				
NV38	A minimum of 24 hours' notice will be provided to all residences located within 500 metres of any blast, including an indication of blasting times and a contact name and telephone number.	Field and Management Staff	Construction	Communications Manager	EIS (CNV21)
NV39	Monitoring of overpressure and vibration levels will be undertaken for each blast at the potentially most affected receivers.	Monitoring Personnel	Construction	Supervisor	EIS (CNV22)
NV40	A building condition survey will be undertaken for all buildings located within 500 metres of the proposed blasting area prior to the start of blasting and any damage occurring from the blasting rectified at no cost	Condition Survey Personnel	Construction	Construction Manager	EIS (CNV23)

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
	to the property owner.				
NV41	The maximum instantaneous charge (MIC) will be reduced to the lowest possible level by the use of delays, reduced diameter holes, and/or deck loading.	Field and Management Staff	Construction	Supervisor	Submissions / PIR (CNV25)
NV42	Adequate stemming will be provided and exposed detonating cord will be eliminated (by covering with at least 300 millimetres of quarry dust or road base).	Field and Management Staff	Construction	Supervisor	Submissions / PIR (CNV26)
NV43	Secondary blasting will be eliminated. (A rock breaker or drop hammer will be used instead of popping). Effort will be made to eliminate the need for toe shots (eg by better control of drill patterns).	Field and Management Staff	Construction	Supervisor	Submissions / PIR (CNV27)
NV44	Weather conditions at the time of the blast will be assessed. Blasting will be avoided where possible during heavy cloud cover and/or if a strong wind is blowing towards residences. Days of severe temperature inversion will be avoided where possible or, (if not possible) blasting would occur between 11am and 1pm.	Field and Management Staff	Construction	Supervisor	Submissions / PIR (CNV28)
NV45	Strict control will be exercised over the spacing and orientation of all blast drill holes. Holes will be spaced in such a manner that the explosive force is just sufficient to break the stone to the required size.	Field and Management Staff	Construction	Supervisor	Submissions / PIR (CNV29)
NV46	Controlled blasting times will be determined in consideration of site-specific conditions and in consultation with affected residents and take place, where possible, when impacts are likely to be the least intrusive (eg all blasts would be fired at a set time acceptable to residents and preferably when the background noise is highest).	Field and Management Staff	Construction	Supervisor	Submissions / PIR (CNV30)
NV47	Use delays of less than 25-40ms to avoid resonant response	Field and Management Staff	Construction	Supervisor	Good practice
NV48	Design the blast events with maximum confinement	Field and Management Staff	Construction	Supervisor	Good practice

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	
NV49	In the case of multiple row blasts the delay between rows will be long enough to allow the rock from an earlier row to move out and thus reduce the pressure for the next blast row.	Field and Management Staff	Construction	Supervisor	Good practice
NV50	All complaints received will be managed in accordance with the Communications and Stakeholder Engagement Strategy. As a minimum the details to be recorded are: a) Details of the complainant; b) The reason for the complaint; c) The time of the complaint and the duration of the offending blasting event; d) Record of the activities undertaken at the site at the time the complaint was received; and e) The measures undertaken to address the issues in the complaint.	Field and Management Staff	Construction	Site Manager or authorised staff member	Good practice
NV51	On the receipt of dust complaints, resulting from blasting, dust monitoring will be undertaken at an appropriate location near the origin of the complaint in accordance with the requirements specified under the CEMP.	Field and Management Staff	Construction	Site Manager or authorised staff member	Good practice
NV52	The following records will be maintained: a) Records of the blasting activities carried out (e.g. Location of the blast, maximum instantaneous charge, number of blasting holes, etc.) for reference with any complaint investigation and vibration/overpressure monitoring. b) Complaint log and complaint investigation records. c) Vibration/overpressure monitoring records (if monitoring is required). *These records must be readily available for audit by the relevant Administrative Authority*	Field and Management Staff	Construction	Site Manager or authorised staff member	Good practice
NV53	Should there be any need for vibration and blasting overpressure monitoring to be carried out by a specialist consultant (i.e. due to vibration/blasting overpressure complaint to an Administrative Authority)	Consulted Monitoring	Construction	Site Manager or authorised staff member	Good practice

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
	the Vibration and Blasting Overpressure Monitoring Report will be made available to the relevant Administrative Authority that is managing the complaint issue.				
NV54	The Vibration and Blasting Overpressure Monitoring Report will contain, as a minimum, the following information: a) Monitoring methodology and instrumentation. b) Vibration and blasting overpressure levels recorded at the most exposed part of the residence of the complainant. c) Analysis of the data and discussion of the results relative to the relevant vibration and blasting overpressure criteria. Recommendations for modified blasting activities to reduce vibration/overpressure levels.	Consultant	Construction	Site Manager or authorised staff member	Good practice
NV55	Regular reviews of the implementation of the vibration and blasting overpressure management practices will be carried out. The audit will especially consider the level of compliance with the following: a) Implementation of the requirement for vibration/overpressure levels to be kept as low as practicably possible (within the relevant criteria); and b) Auditing compliance by assessing the number of vibration/overpressure complaints by the residents.	EMP Audit Personnel	Construction	Construction Manager	Good practice
NV56	In the event that a non-conformance occurs as a result of poor practices, personnel on site and contractors will be made aware of the problem and informed of acceptable practices.	Field and Management Staff	Construction	Construction Manager	Good practice
CONSULTATION AND COMPLAINTS MANAGEMENT					
NV57	Residents / sensitive receivers will be notified of construction activities that are likely to affect their noise and vibration amenity in accordance with the Communications and Stakeholder Engagement	Community Personnel	Pre-construction / Construction	Communications Manager	Submissions / PIR (CNV31)

ID	Measure / Requirement	Resources	When to	Responsibility	Reference
	Strategy. Information provided will include: (i) The types of activities to be undertaken. (ii) The timing of activities including expected start and finish. (iii) The location of activities. (iv) Details of the community information line and how to make an enquiry and/or complaint				
NV58	Affected receivers will be consulted prior to the commencement of out of hours work.	Community Personnel	Construction	Superintendent / Communications Manager	Submissions / PIR (CNV1)
NV59	Circumstances may arise during construction where works outside of standard construction hours are essential and sensitive receivers are assessed to be highly noise affected (ie experience noise levels greater than 75 dBA). Where this is the case, opportunities to minimise impacts on highly noise effected receivers, including the provision of alternative accommodation, would be considered in consultation with those affected receiver(s).	Field and Management Staff	Construction	Communications Manager	Good practice
NV60	All complaints received will be managed in accordance with the Communications and Stakeholder Engagement Strategy.	Community Personnel	Construction	Communications Manager	Submissions / PIR (CNV7)
NV61	Where it has been identified as necessary (eg in response to community complaints), noise monitoring will be undertaken to check that noise mitigation measures are effective.	Field and Management Staff	Construction	Construction Manager / Communications Manager	Submissions / PIR (CNV10)
SURVEY, MONITORING AND REPORTING					
NV62	Initial noise monitoring of plant and equipment will be undertaken to ensure the noise performance levels predicted in this CNVMP are being met.	Field and Management Staff	Pre-construction / Construction	Environmental Officer / Noise Specialist	Good practice
NV63	Noise and vibration monitoring will be undertaken in accordance with Section 10.3. The program for construction noise and vibration monitoring indicates monitoring frequency, location, how the results of this monitoring are recorded and, procedures that are	Field and Management Staff	Construction	Environmental Officer / Noise Specialist	Submissions / PIR (CNV13)

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
	followed where significant exceedances of relevant noise and vibration goals are detected.				
NV64	Building Condition Inspections for each public utility, structure and building will be carried out where: (i) Blasting operations are within 500 metres or the distance at which the calculated 95th percentile Peak Velocity of ground vibration from the proposed blast is 2 mm/s, whichever is the greater. (ii) Other vibration causing activities where the distance at which the calculated 95th percentile Peak Velocity of ground vibration is 2 mm/s. (iii) Within 200 metres of piling, hydraulic hammering, demolition or dynamic compaction.	Condition Survey Personnel	Pre-construction / Construction	Project Engineer	G36
NV65	The Building Condition Inspection report will include as a minimum: (i) Floor plan of the subject building. (ii) Record site details - age, construction, site slope and provision for drainage, presence of trees. (iii) Type of defects and their positions and extents on the floor plan. (iv) Photograph of external view and photograph of all defects of significance (especially if of concern to the owner), or typical examples of say, hairline plaster cornice cracks. (v) How doors sit in the jambs - out of line may indicate foundation settlement. (vi) External signs of reactive clay foundation soil, e.g. lifting of slabs, uneven kerbing.	Condition Survey Personnel	Pre-construction / Construction	Project Engineer	G36
NV66	All complaints, including those related to property damage, will be managed in accordance with theRoads and MaritimeComplaints and Enquiries Procedure – see section 6.3.2 of the CEMP.	Community Personnel	Construction	Communications Manager	Good practice

10 Compliance management

10.1 Roles and responsibilities

CMC's Project Team's organisational structure and overall roles and responsibilities are outlined in Section 4.2 of the CEMP. Specific responsibilities for the implementation of environmental controls are detailed in Chapter 8 of this Plan.

10.2 Training

All employees, contractors and utility staff working on site will undergo site induction training that includes construction noise and vibration management issues. The induction training will address elements related to noise and vibration management including:

- Existence and requirements of this sub-plan.
- Relevant legislation.
- Normal construction hours.
- The process for seeking approval for out of hours works, including consultation.
- Location of noise sensitive areas.
- Complaints reporting.
- General noise and vibration management measures.
- Specific responsibilities to minimise impacts on the community and built environment from noise and vibration associated with the works.

Prior to commencement of Out of Hours Work staff will receive Toolbox training detailing noise mitigation methods, location of sensitive receivers and community concerns.

Further details regarding staff induction and training are outlined in Section 5 of the CEMP.

10.3 Inspections and monitoring

Weekly and other routine inspections by Environmental Officers, RMS, ERG representatives and ER will occur throughout construction. Detail on the nature and frequency of these inspections are documented in Section 8.2 of the CEMP.

Noise and vibration monitoring will also occur routinely for the duration of the Project. Monitoring will be undertaken by an Acoustic Consultant or the Environmental Officer during the construction phase of the Project.

10.3.1 Noise monitoring

The following noise monitoring will be undertaken:

- Periodic noise monitoring at nominated sensitive receiver locations (refer to section 4.1 of this plan) to determine the effectiveness of mitigation measures against predicted impacts.
- Where complaints are received, additional noise monitoring may be undertaken at sensitive receivers to determine if the actual construction noise generated exceeds the predicted 'worst case' construction noise levels identified in Section 7.2 of this Plan.
- Noise monitoring may be carried out for the purpose of refining construction methods or techniques to minimise noise.

- Ongoing spot checks of noise intensive plant and equipment will be undertaken throughout construction to ensure compliance with manufactures specifications.

Where actual noise levels are found to exceed the predicted worst case levels, the source of excessive noise generations will be identified, and any additional feasible and reasonable measures available will be implemented to either reduce noise emissions or reduce the impacts on receivers.

Details of site activity and equipment usage will be noted during construction noise monitoring.

Acoustic instrumentation employed in the noise monitoring surveys will comply with the requirements of AS1259.2-1990 Acoustics – Sound Level Meters, Part 2: Integrating – Averaging and carry appropriate NATA (or manufacturer) calibration certificates.

Within six months of commencing construction, the contractor shall, in consultation with the EPA, prepare to the satisfaction of the Secretary, a review of the operational noise mitigation measures proposed to be implemented for the SSI. The review may be submitted in stages to suit the staged construction of the SSI. This Operational Noise Review is to be completed in accordance with CoA D11.

10.3.2 Vibration monitoring

The following vibration monitoring will be undertaken:

- For the protection of buildings, monitoring will be carried out at the commencement of vibratory compaction work within 50 metres of buildings to ensure that safe vibration levels are not exceeded and to confirm safe working distances.
- When vibration intensive activities are required, vibration monitoring will be carried out within the established buffer zones, or where there is considered to be a risk that levels may exceed the relevant structural damage goals.
- Vibration monitoring may be carried out in response to complaints, exceedances, or for the purpose of refining construction methods or techniques to minimise vibrations.
- Vibration monitoring will continue throughout construction, where appropriate, at nominated sensitive receiver locations to determine the effectiveness of mitigation strategies.

Where vibration is found to exceed safe levels, impacts will be avoided by changing work methods and/or equipment, or through the provision of building protection measures where possible. In the event a complaint relating to property damage is received, an inspection of the property would be undertaken and an interim building condition survey prepared.

Vibration monitoring will be carried out with the aim of achieving the following construction vibration goals (CoA B20):

a) for structural damage to heritage structures, the vibration limits set out in the German Standard DIN 4150-3: Structural Vibration – Part 3 Effects of vibration on structures;

b) for damage to other buildings and/or structures, the vibration limits set out in the British Standard BS 7385-1:1990 – Evaluation and measurement of vibration in buildings (and referenced in Australian Standard 2187.2 – 2006 Explosives – Storage and use – Use of explosives). Guide for measurement of vibration and evaluation of their effects on buildings; and

c) for human exposure, the acceptable vibration values set out in Assessing Vibration: A Technical Guideline (Department of Environment and Conservation, 2006).

10.4 Non-conformances

Non-conformances in general will be dealt with and documented in accordance with Section 8.6 of the CEMP.

10.5 Complaints

Complaints will be recorded in accordance with the *Woolgoolga to Ballina Communications and Stakeholder Engagement Strategy* and HC2G Community Action Plan. Information to be recorded will include location of complainant, time/s of occurrence of alleged noise or vibration impacts (including nature of impact particularly with respect to vibration), perceived source, prevailing weather conditions and similar details that could be utilised to assist in the investigation of the complaint. All resident complaints will be responded to in a timely manner and action taken recorded in accordance with the *Woolgoolga to Ballina Communications and Stakeholder Engagement Strategy* and HC2G Community Action Plan.

10.6 Auditing

Audits (both internal and external) will be undertaken to assess the effectiveness of environmental controls, compliance with this plan, CoA and other relevant approvals, licenses and guidelines.

Audit requirements are detailed in Section 8.3 of the CEMP.

10.7 Reporting

Reporting requirements and responsibilities are documented in Section 8.3 of the CEMP.

Specific reports prepared in response to noise and vibration monitoring will capture detail including, but not limited, to:

- The locations and description of monitoring undertaken.
- A tabulation of results (e.g. for noise including L_{MAX}, L_{10}, L_{90} and L_{Aeq} noise levels) together with notes identifying the principle sources and operations.
- Summary of any measurements exceeding the nominated criteria, and descriptions of the plant or operations causing these exceedances.
- Detail of any corrective actions and confirmation of their successful implementation.

11 Review and improvement

11.1 Continuous improvement

Continuous improvement of this Plan will be achieved by the ongoing evaluation of environmental management performance against environmental policies, objectives and targets for the purpose of identifying opportunities for improvement.

The continuous improvement process will be designed to:

- Identify areas of opportunity for improvement of environmental management and performance.
- Determine the cause or causes of non-conformances and deficiencies.
- Develop and implement a plan of corrective and preventative action to address any non-conformances and deficiencies.
- Verify the effectiveness of the corrective and preventative actions.
- Document any changes in procedures resulting from process improvement.
- Make comparisons with objectives and targets.

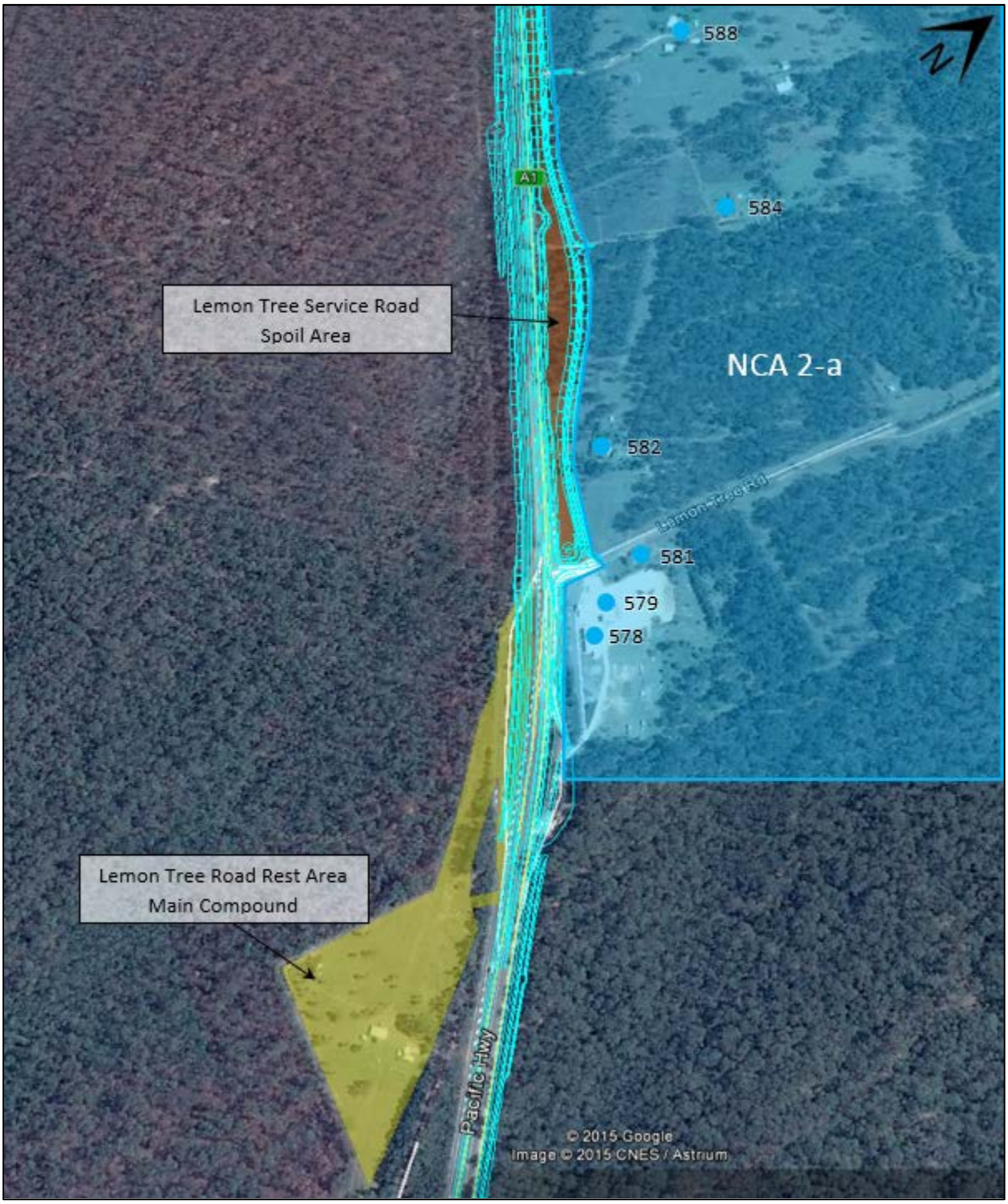
11.2 Update and amendment

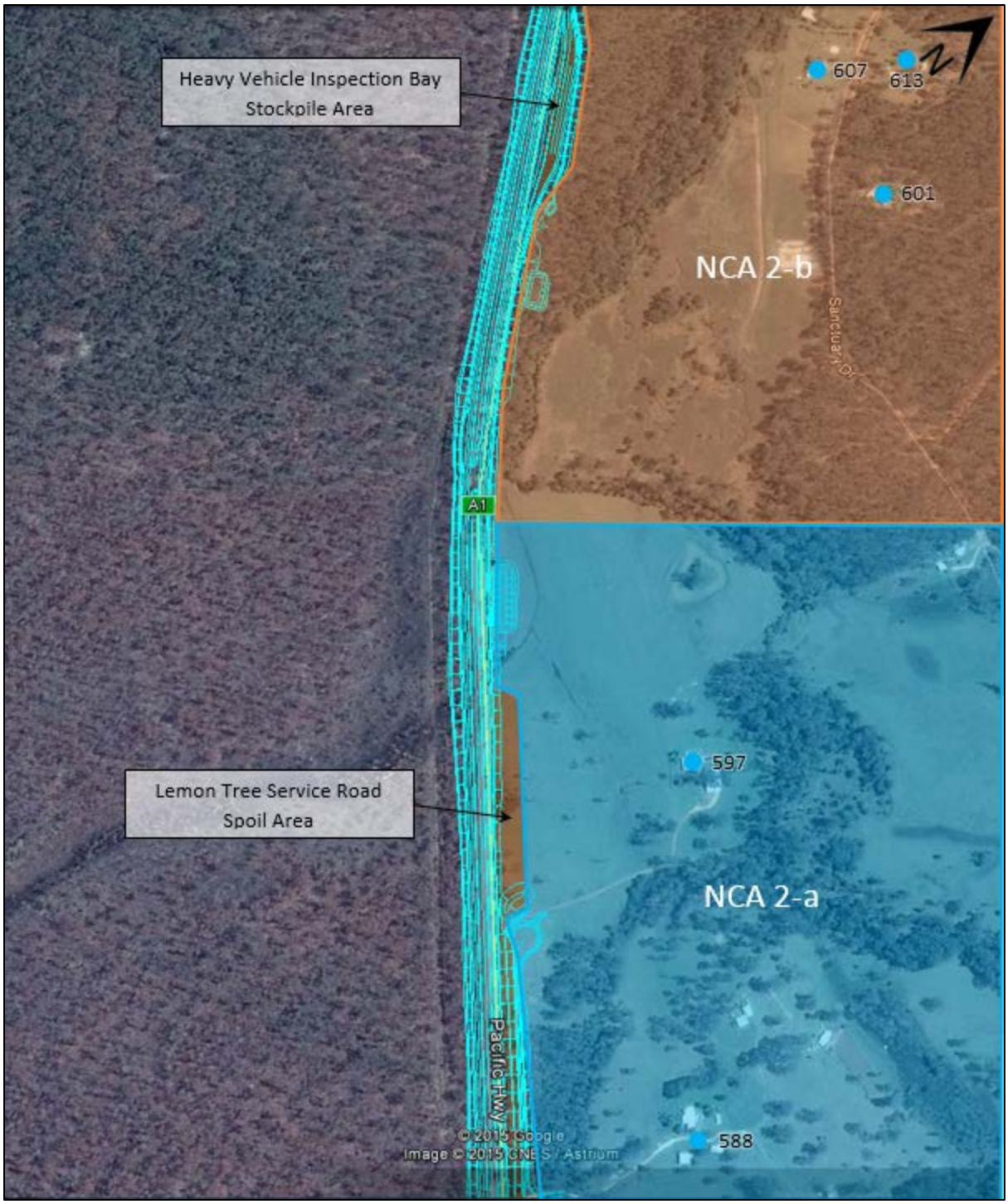
The processes described in Section 8 and Section 9 of the CEMP may result in the need to update or revise this Plan. This will occur as needed.

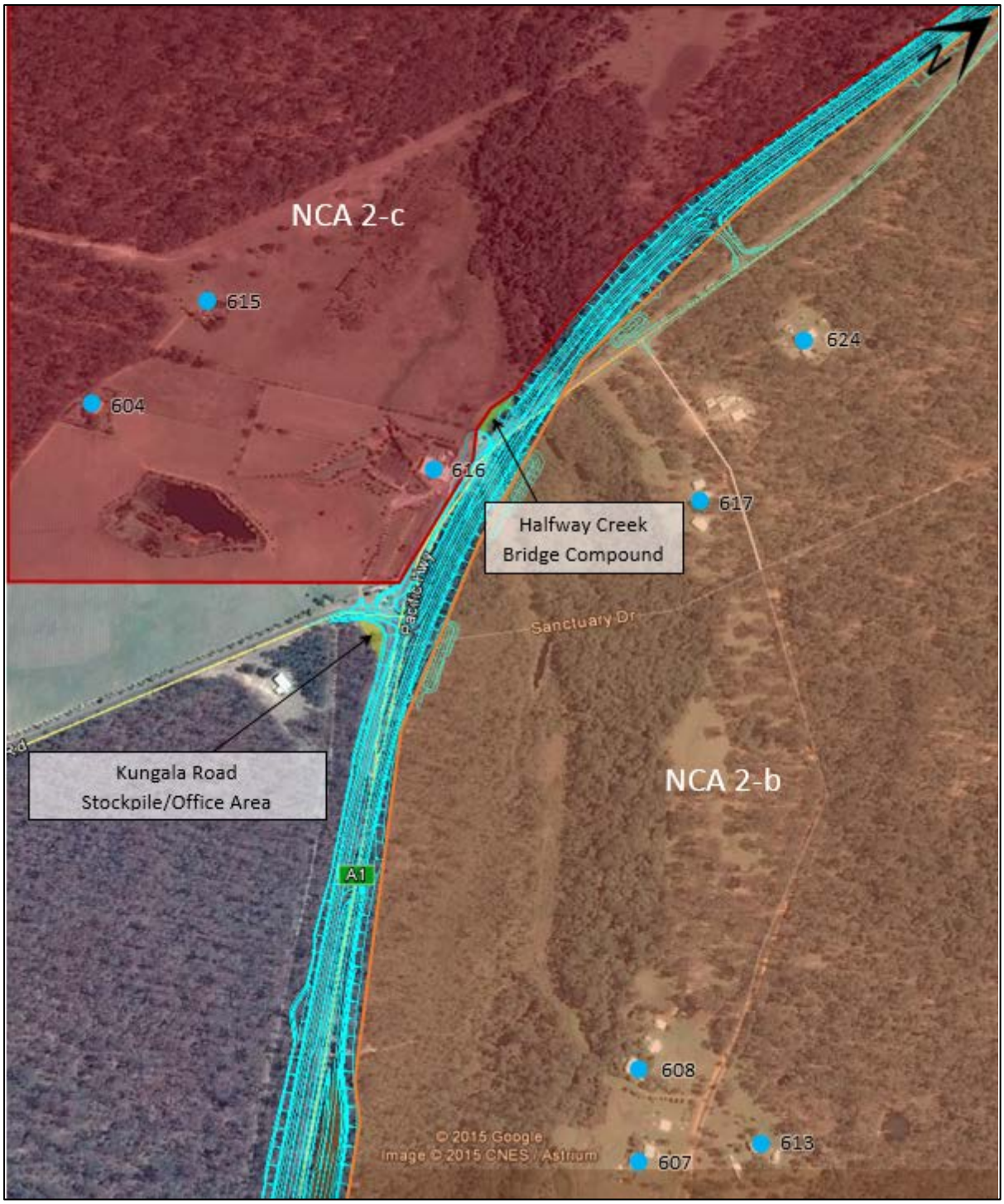
Only the ER can approve minor amendments to the CEMP (including sub-plans). All other amendments must be approved by the Secretary.

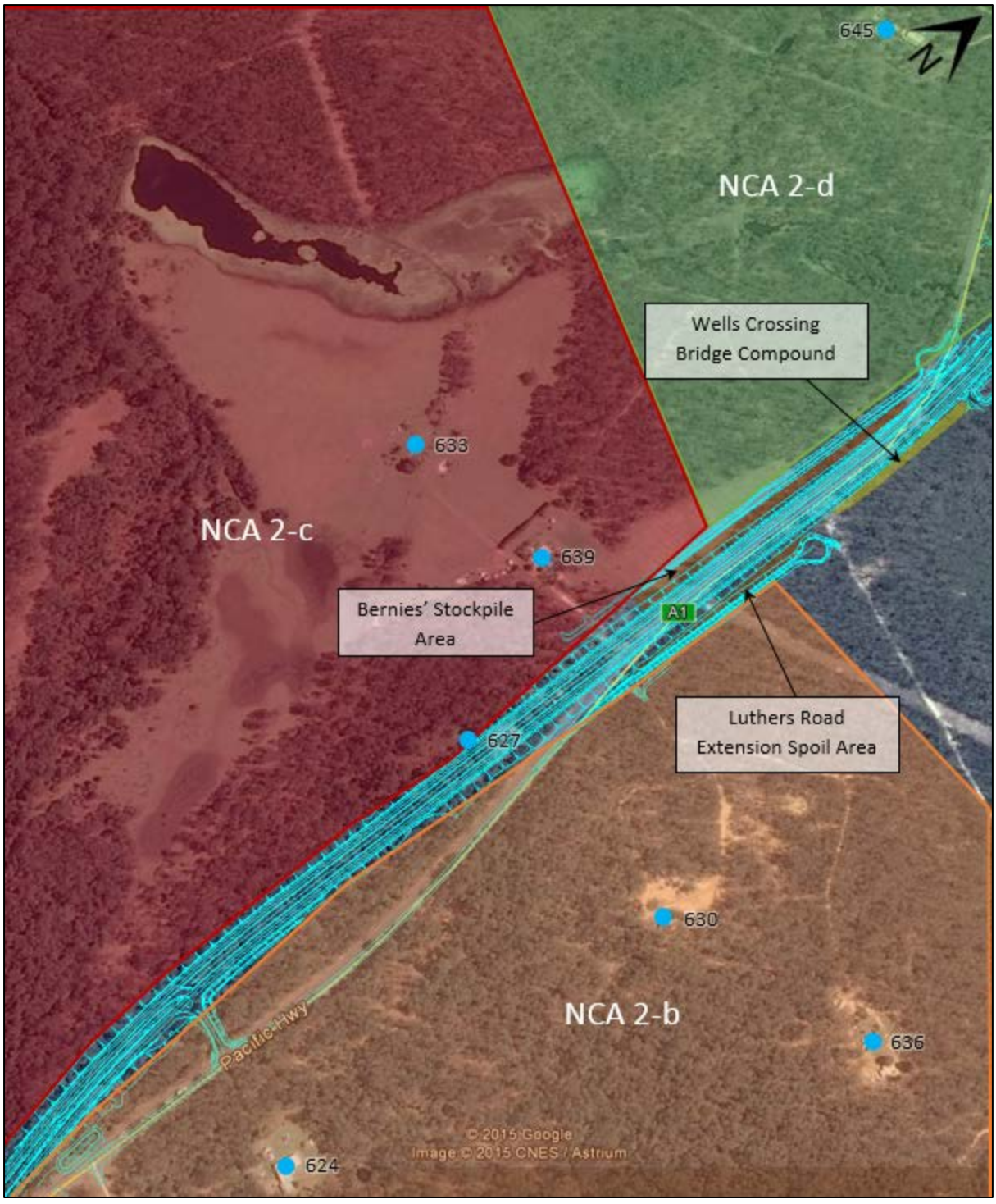
A copy of the updated plan and changes will be distributed to all relevant stakeholders in accordance with the approved document control procedure – refer to Section 10.2 of the CEMP.

Appendix A Locations of sensitive receivers

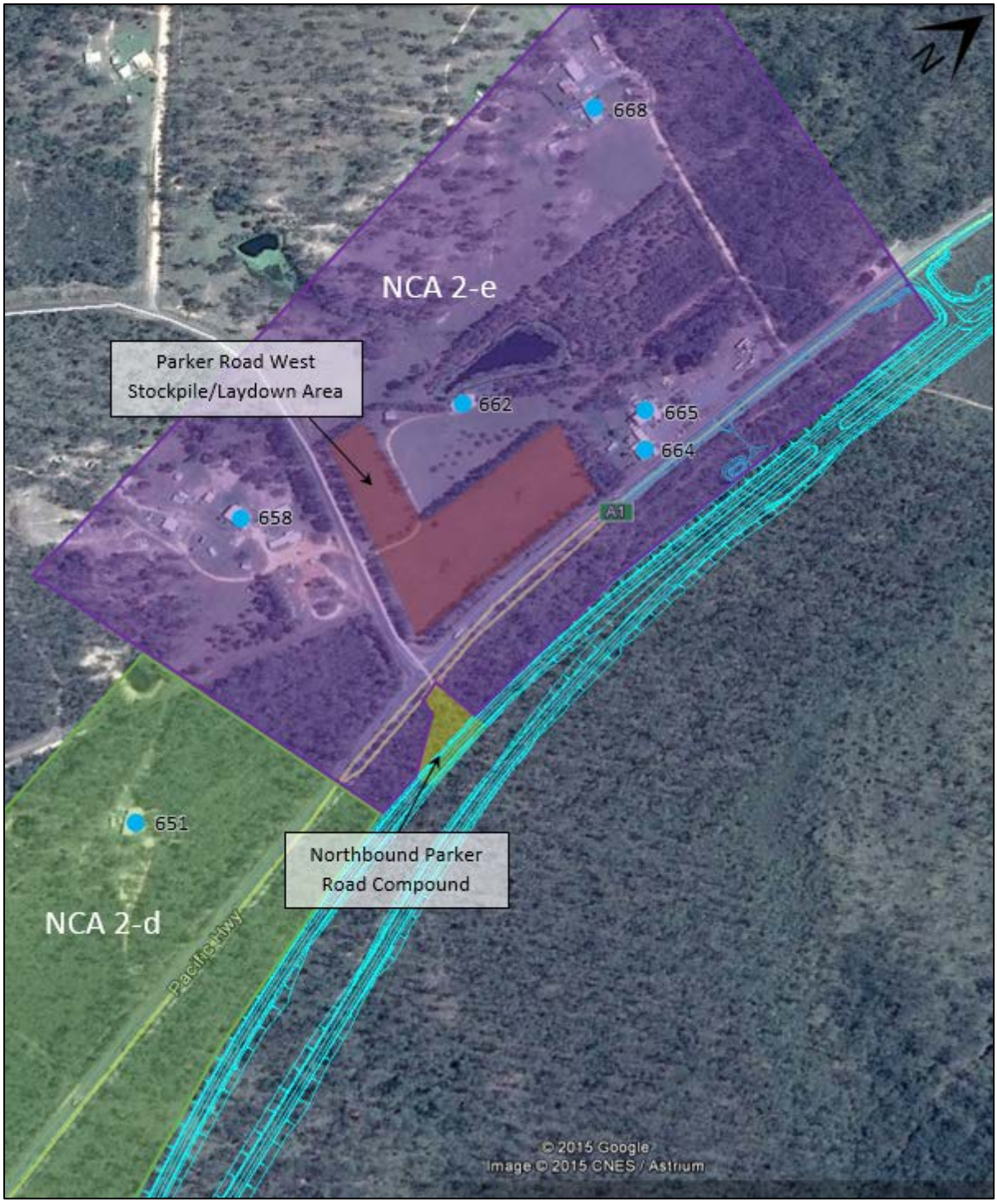

588
584
582
581
579
578
A1
Lemon Tree Service Road
Spoil Area
NCA 2-a
Lemon Tree Rd
Lemon Tree Road Rest Area
Main Compound
Pacific Hwy
© 2015 Google
Image © 2015 CNES / Astrium


Heavy Vehicle Inspection Bay
Stockpile Area
607
613
601
NCA 2-b
Sanctuary Dr
A1
Lemon Tree Service Road
Spoil Area
597
NCA 2-a
Pacific Hwy
588
© 2015 Google
Image © 2015 CNES / Astrium


NCA 2-c
615
604
616
624
617
Halfway Creek
Bridge Compound
Pacific Hwy
Sanctuary Dr
Kungala Road
Stockpile/Office Area
NCA 2-b
A1
608
607
613
© 2015 Google
Image © 2015 CNES / Astrium


645
NCA 2-d
Wells Crossing
Bridge Compound
633
NCA 2-c
639
Bernies' Stockpile
Area
A1
Luthers Road
Extension Spoil Area
627
630
NCA 2-b
Pacific Hwy
636
© 2015 Google
Image © 2015 CNES / Astrium
624


NCA 2-e
651
Northbound Parker Road Compound
649
NCA 2-d
645
A1
Pacific Hwy


668
NCA 2-e
Parker Road West
Stockpile/Laydown Area
662
665
664
658
A1
651
Northbound Parker
Road Compound
NCA 2-d
Pacific Hwy
© 2015 Google
Image © 2015 CNES / Astrium


Cut 10
Franklins Road
Spoil Area
Cut 9
Old Heavy Vehicle Inspection
Station (HVIS) Spoil Area
A1
Cut 8
Bald Knob Road
Stockpile Area
668
© 2015 Google
Image © 2015 CNES / Astrium

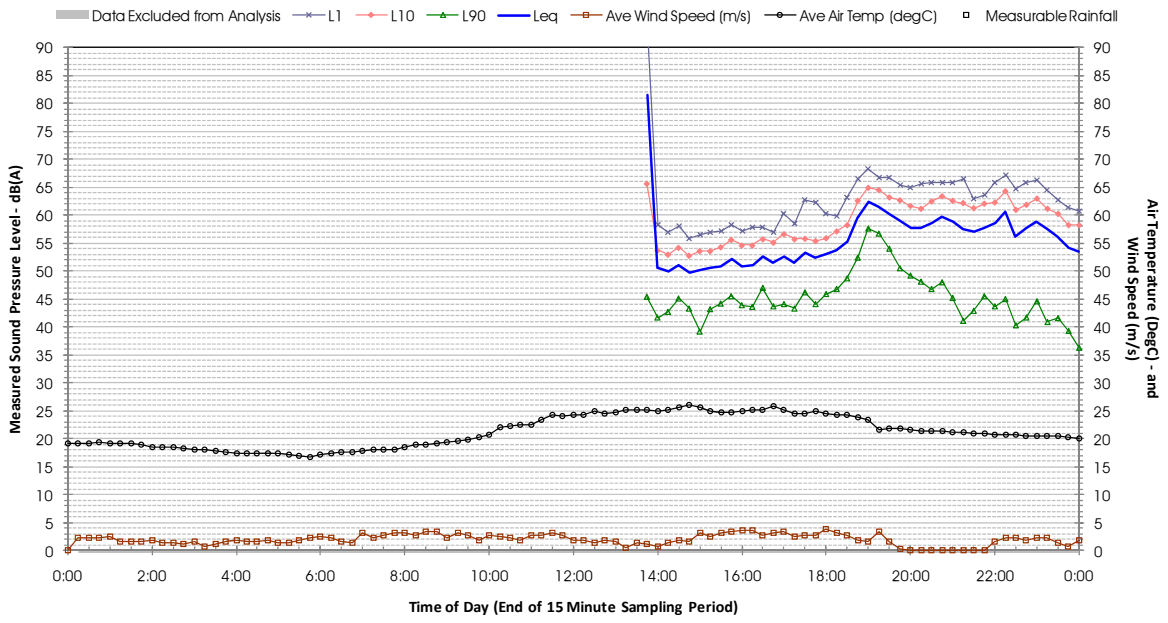
Sensitive Receiver Location

Rev 1

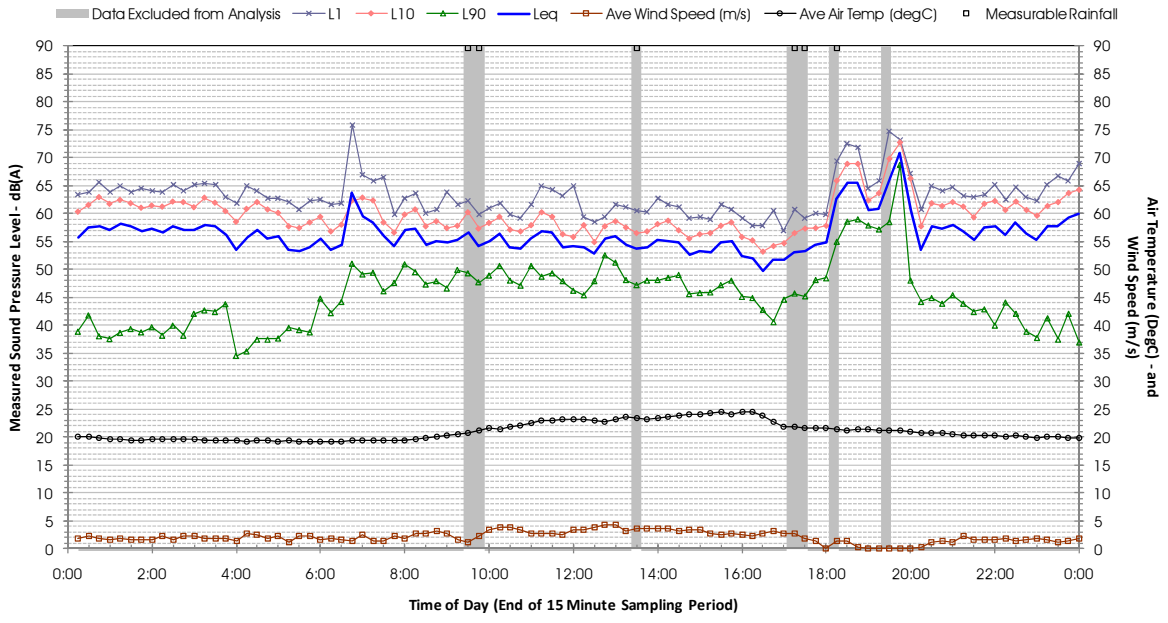
Legend	
	Sensitive Receiver
	Blasting area
	NCA 2a (Noise catchment area)
	NCA 2b (Noise catchment area)
	NCA 2c (Noise catchment area)
	NCA2d (Noise catchment area)
	NCA2e (Noise catchment area)

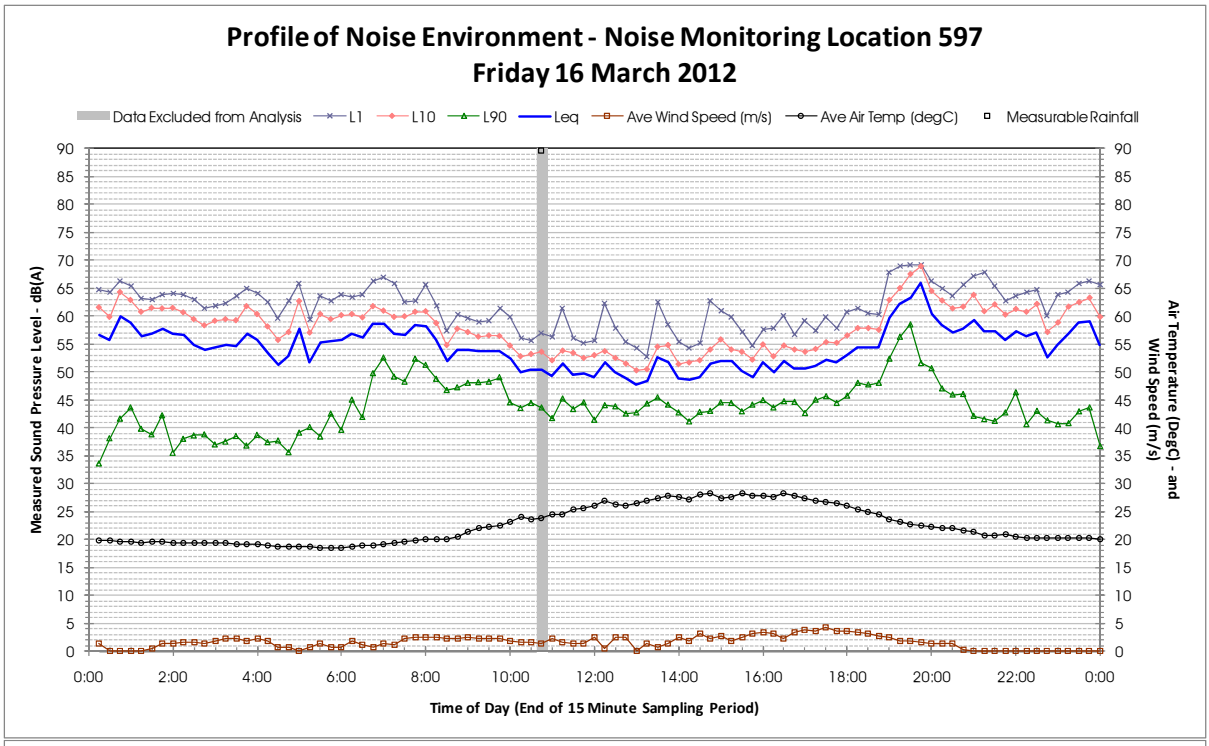
Appendix B Noise monitoring data

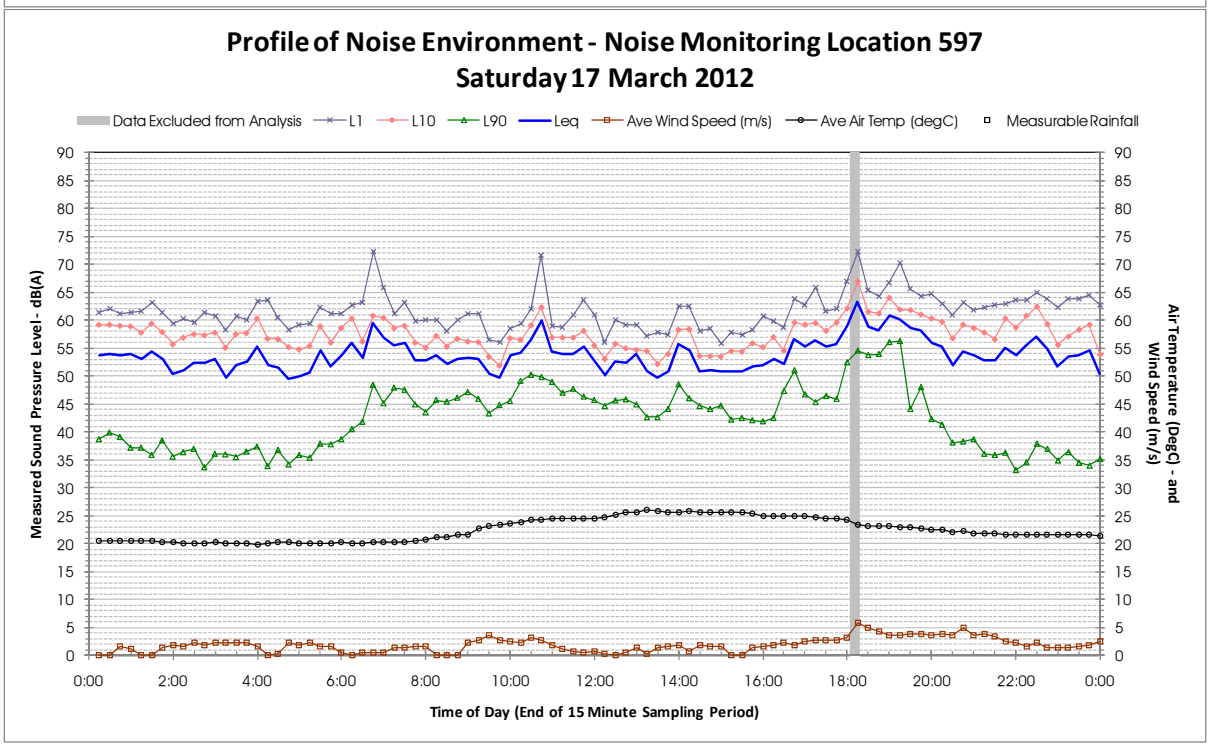
Profile of Noise Environment - Noise Monitoring Location 597
Wednesday 14 March 2012

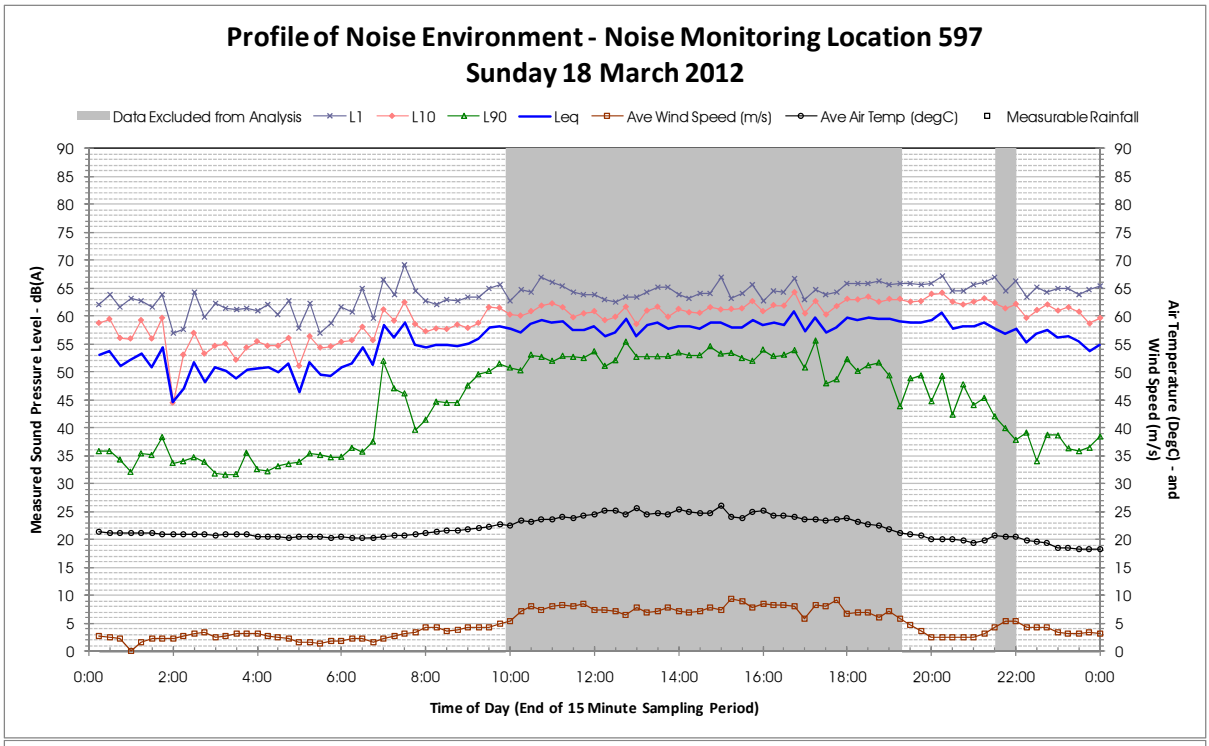


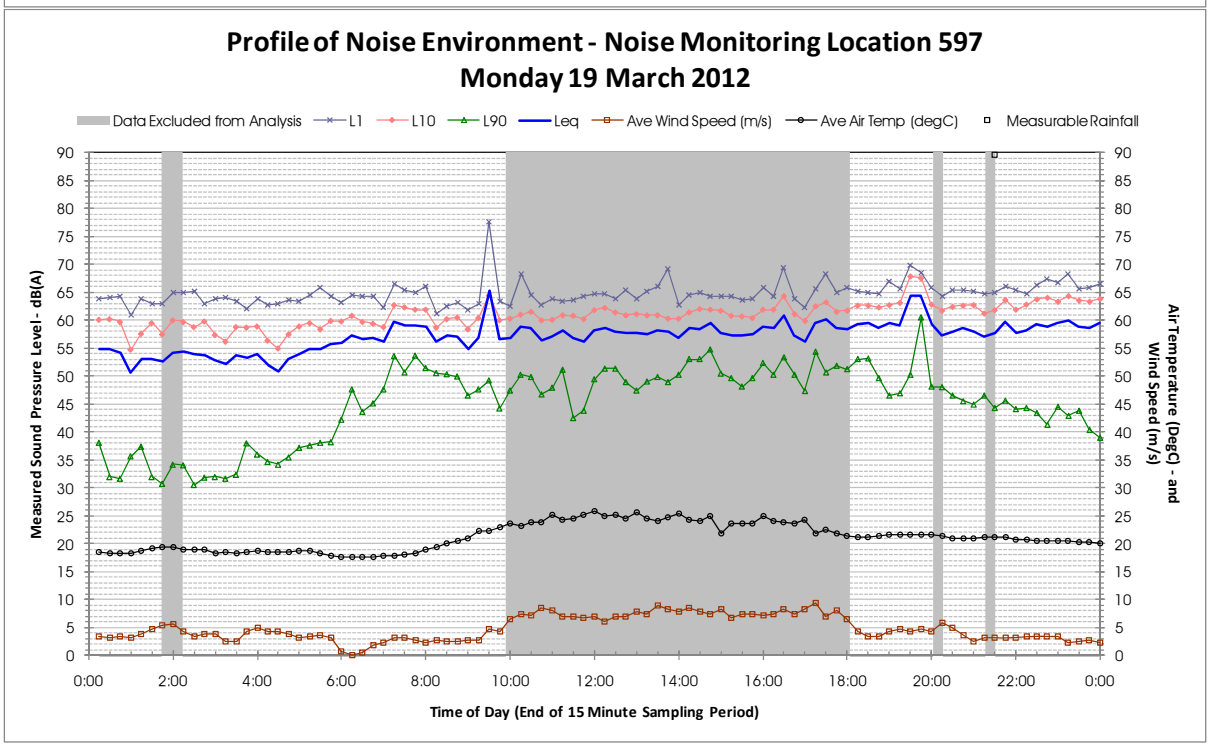
Profile of Noise Environment - Noise Monitoring Location 597
Thursday 15 March 2012



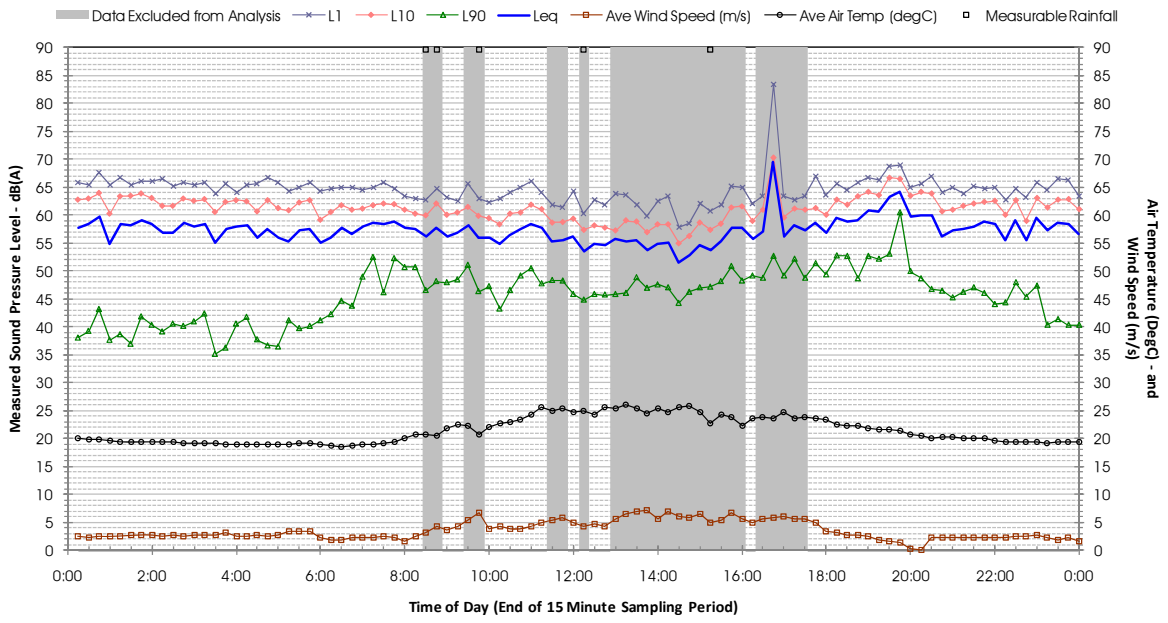

Profile of Noise Environment - Noise Monitoring Location 597
Friday 16 March 2012
Data Excluded from Analysis
L1
L10
L90
Leq
Ave Wind Speed (m/s)
Ave Air Temp (degC)
Measurable Rainfall
Measured Sound Pressure Level - dB(A)
Air Temperature (DegC) - and Wind Speed (m/s)
Time of Day (End of 15 Minute Sampling Period)


Profile of Noise Environment - Noise Monitoring Location 597
Saturday 17 March 2012
Data Excluded from Analysis
L1
L10
L90
Leq
Ave Wind Speed (m/s)
Ave Air Temp (degC)
Measurable Rainfall
Measured Sound Pressure Level - dB(A)
Air Temperature (DegC) - and Wind Speed (m/s)
Time of Day (End of 15 Minute Sampling Period)

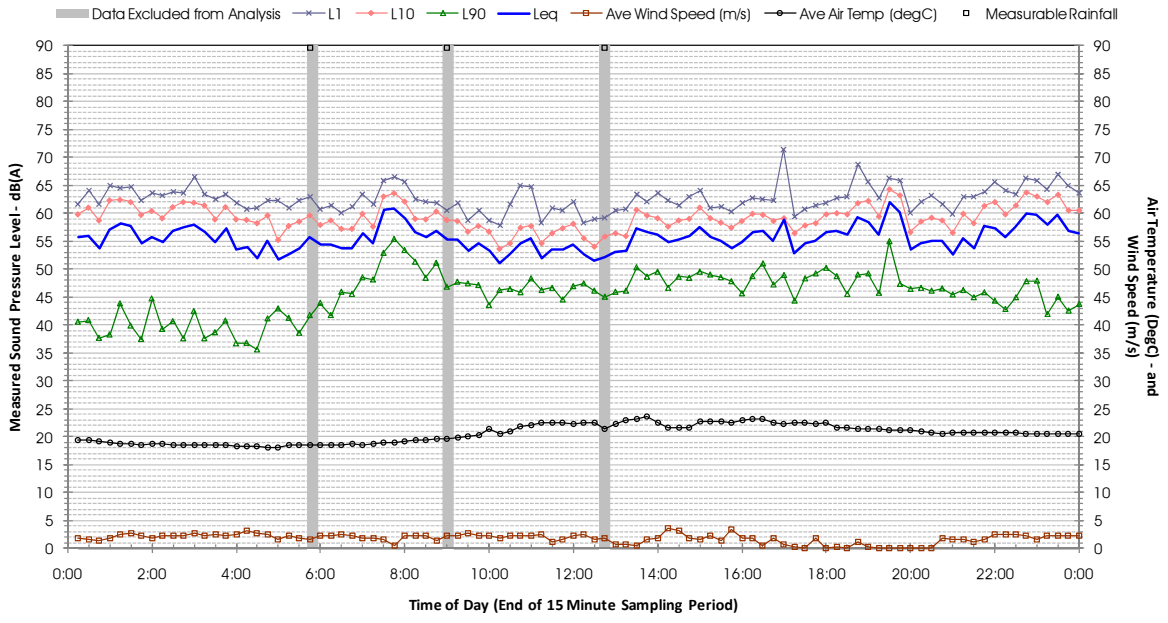

Profile of Noise Environment - Noise Monitoring Location 597
Sunday 18 March 2012
Data Excluded from Analysis
L1
L10
L90
Leq
Ave Wind Speed (m/s)
Ave Air Temp (degC)
Measurable Rainfall
Measured Sound Pressure Level - dB(A)
Air Temperature (DegC) - and Wind Speed (m/s)
Time of Day (End of 15 Minute Sampling Period)


Profile of Noise Environment - Noise Monitoring Location 597
Monday 19 March 2012
Data Excluded from Analysis
L1
L10
L90
Leq
Ave Wind Speed (m/s)
Ave Air Temp (degC)
Measurable Rainfall
Measured Sound Pressure Level - dB(A)
Air Temperature (DegC) - and Wind Speed (m/s)
Time of Day (End of 15 Minute Sampling Period)

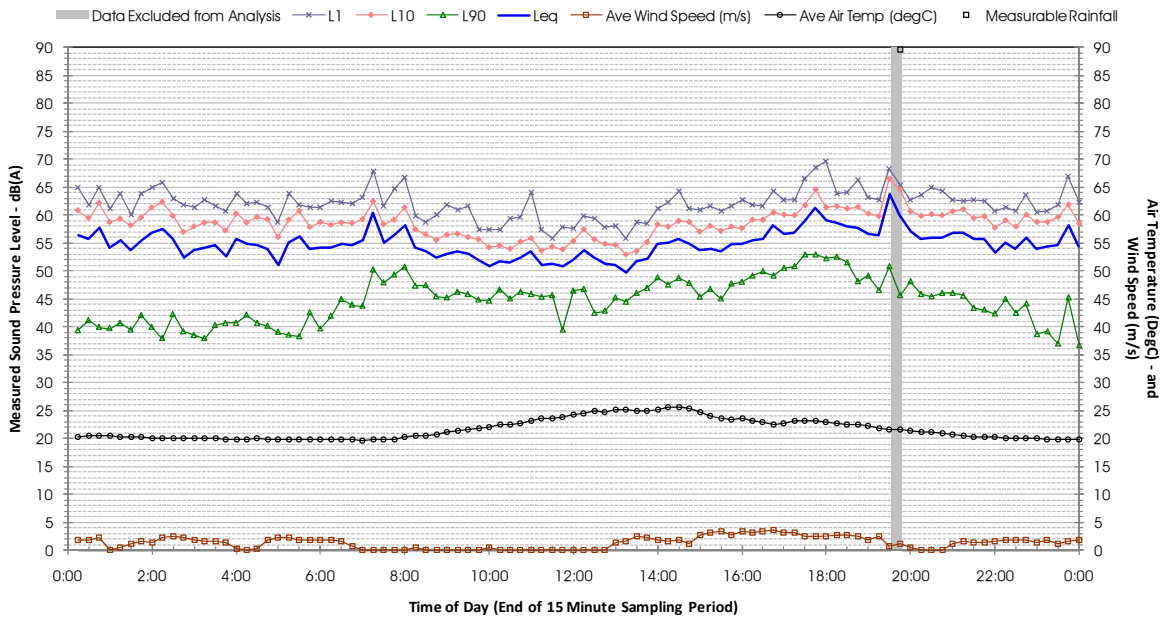
Profile of Noise Environment - Noise Monitoring Location 597
Tuesday 20 March 2012



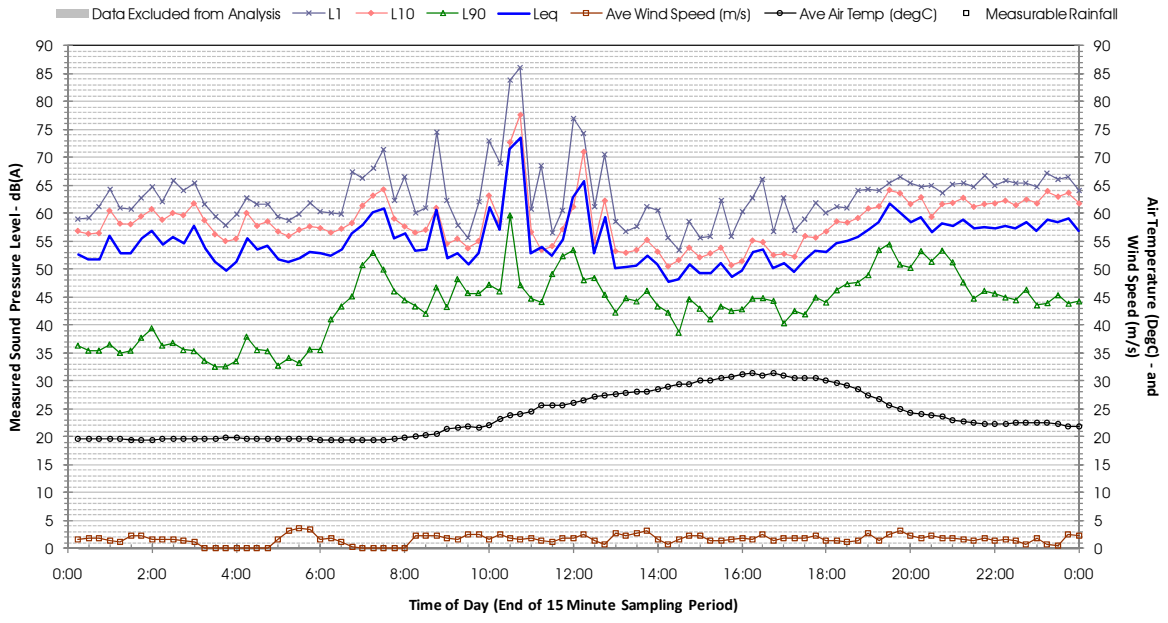
Profile of Noise Environment - Noise Monitoring Location 597
Wednesday 21 March 2012

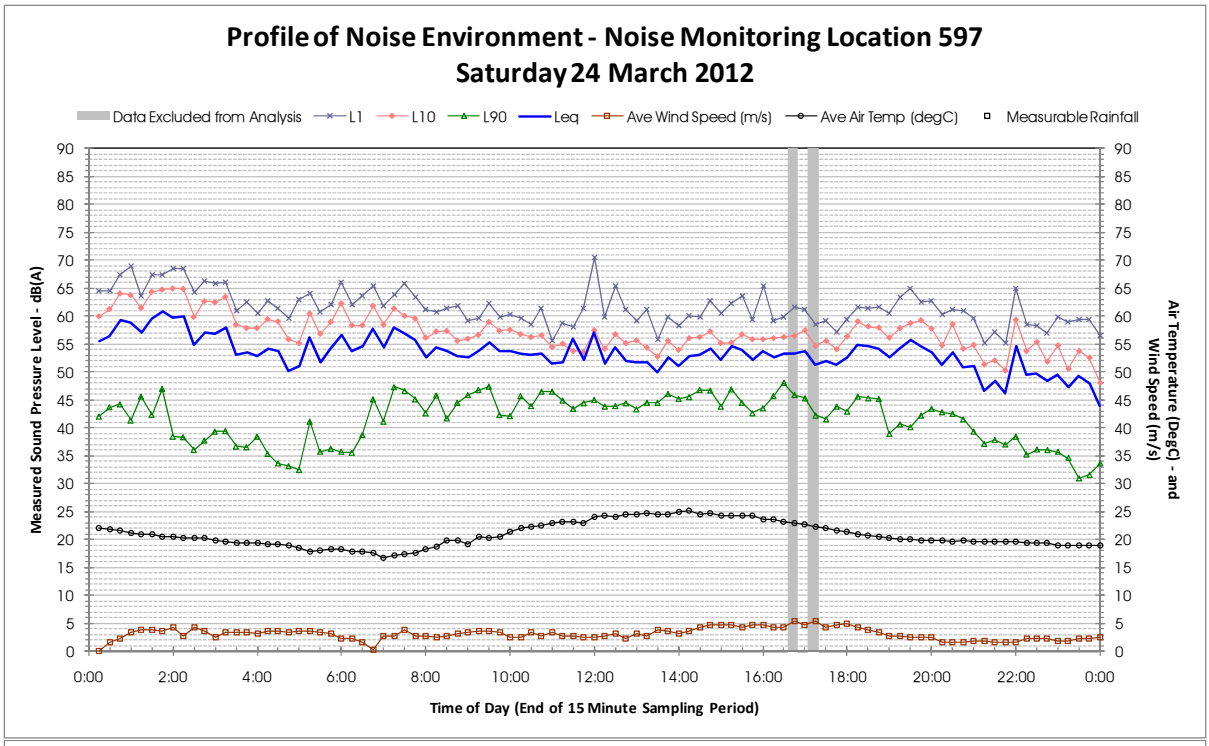


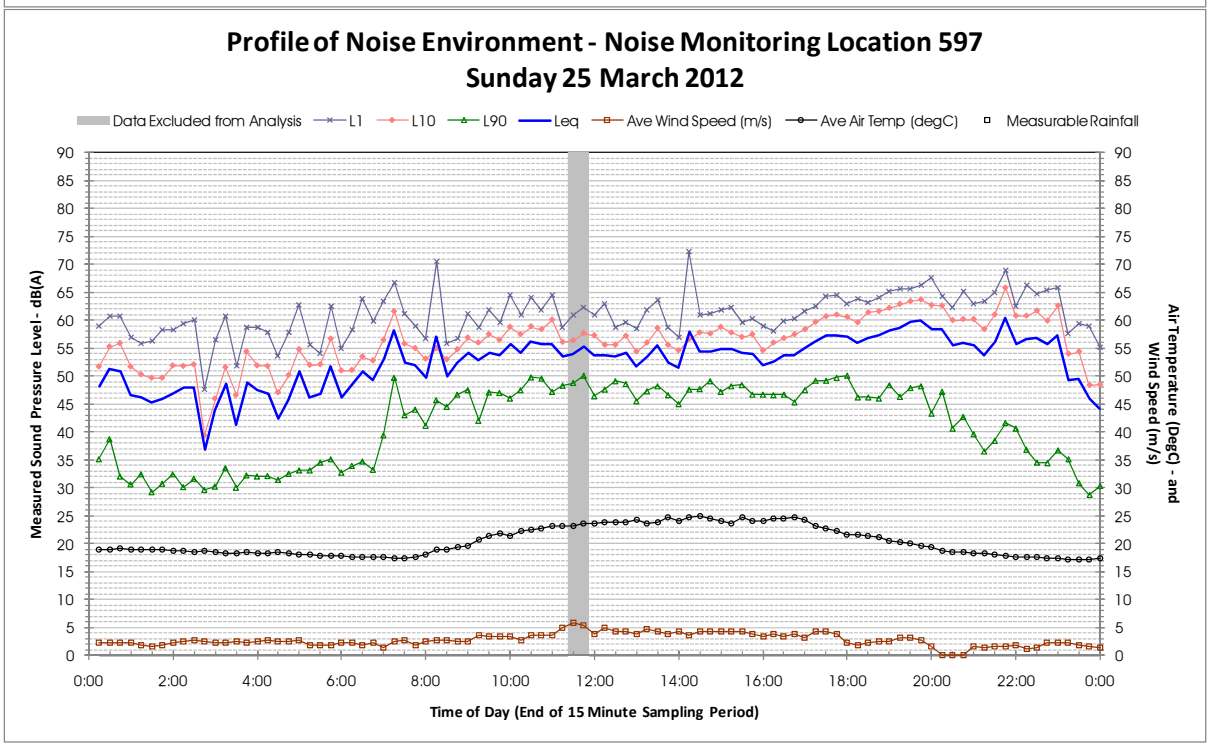
Profile of Noise Environment - Noise Monitoring Location 597
Thursday 22 March 2012



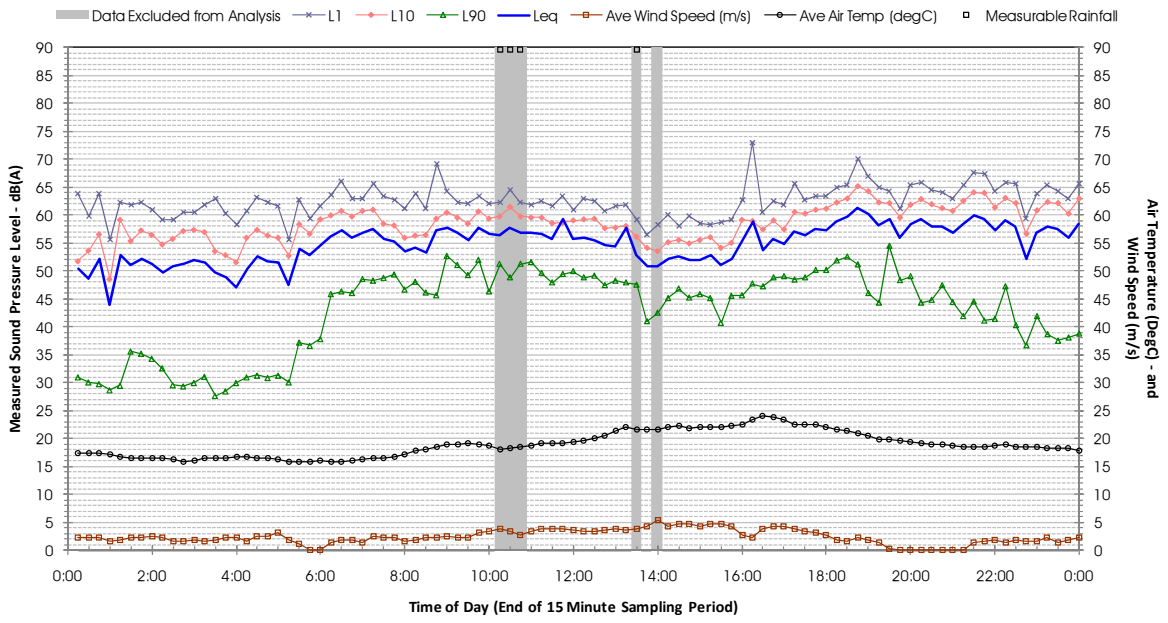
Profile of Noise Environment - Noise Monitoring Location 597
Friday 23 March 2012



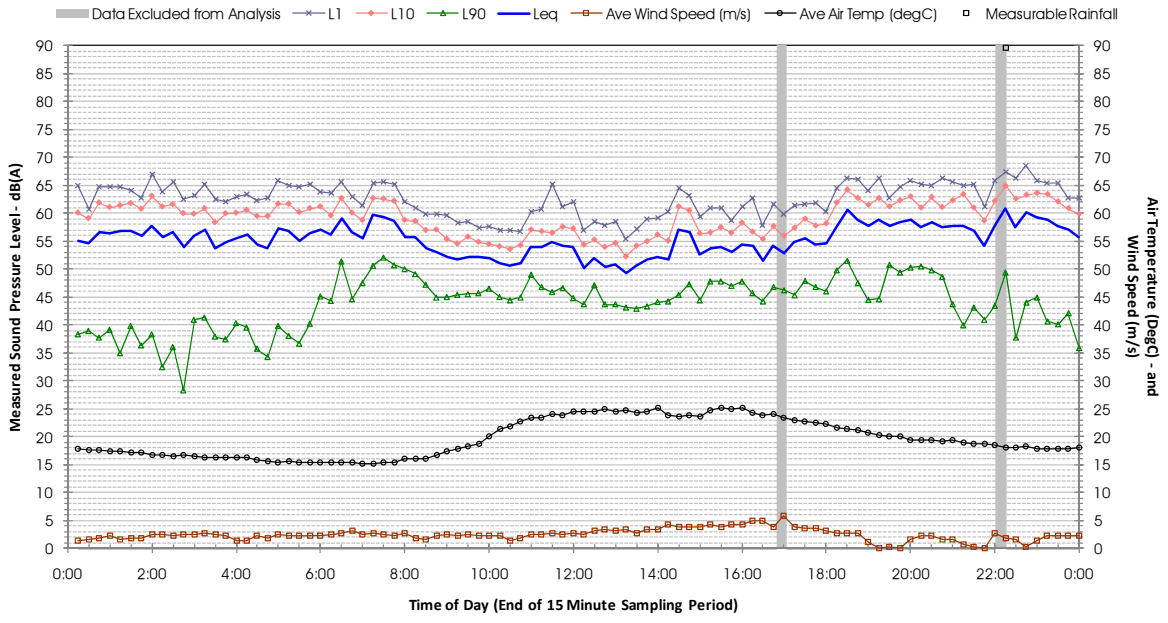

Profile of Noise Environment - Noise Monitoring Location 597
Saturday 24 March 2012
Data Excluded from Analysis
L1
L10
L90
Leq
Ave Wind Speed (m/s)
Ave Air Temp (degC)
Measurable Rainfall
Measured Sound Pressure Level - dB(A)
Air Temperature (DegC) - and Wind Speed (m/s)
Time of Day (End of 15 Minute Sampling Period)

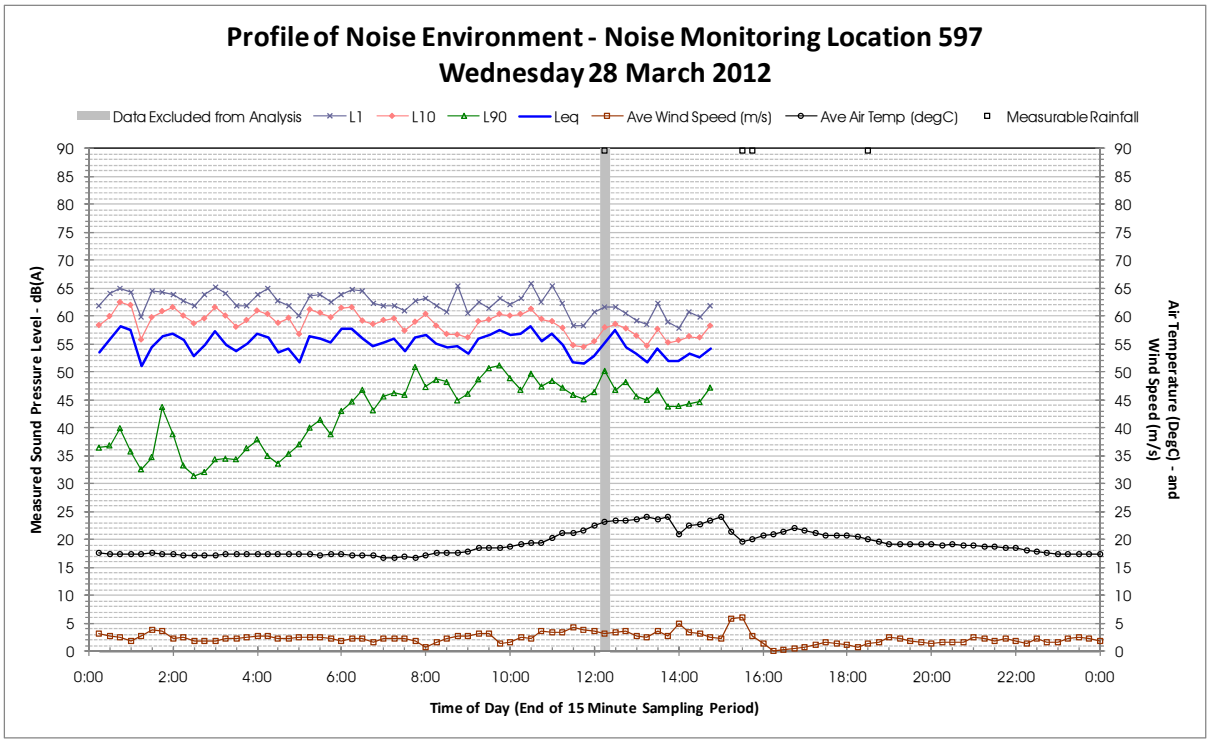

Profile of Noise Environment - Noise Monitoring Location 597
Sunday 25 March 2012
Data Excluded from Analysis
L1
L10
L90
Leq
Ave Wind Speed (m/s)
Ave Air Temp (degC)
Measurable Rainfall
Measured Sound Pressure Level - dB(A)
Air Temperature (DegC) - and Wind Speed (m/s)
Time of Day (End of 15 Minute Sampling Period)

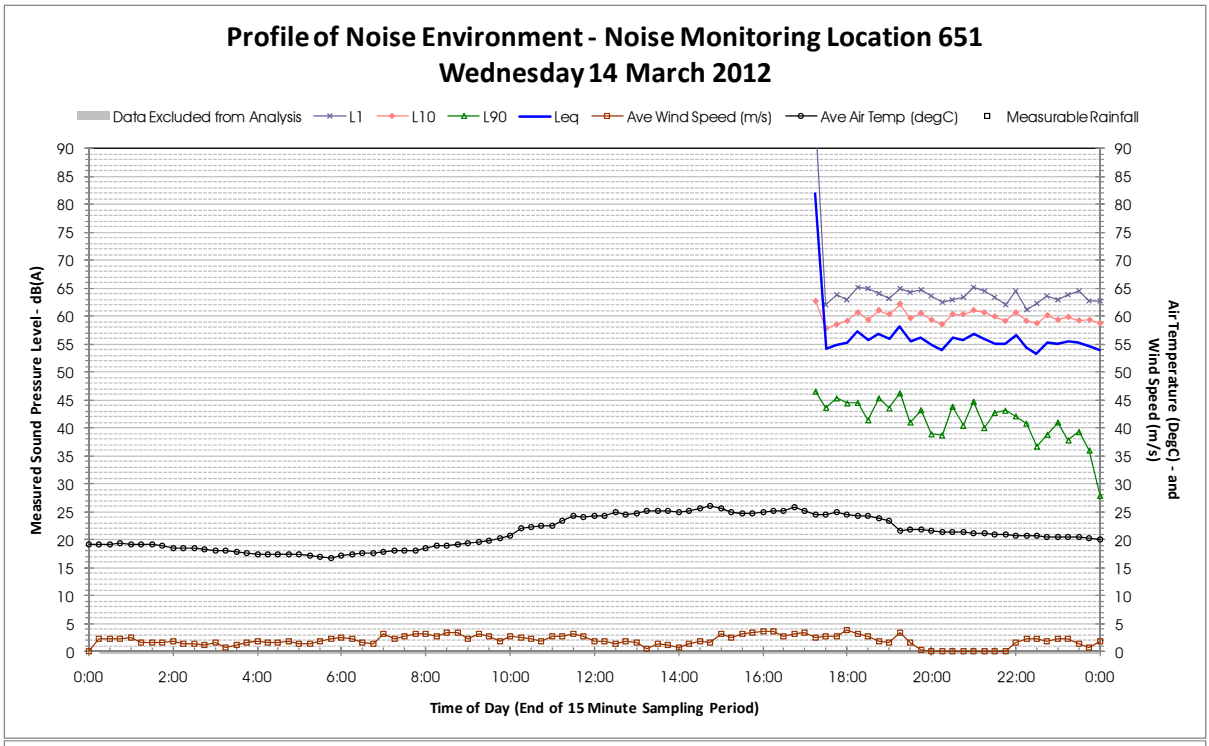
Profile of Noise Environment - Noise Monitoring Location 597
Monday 26 March 2012

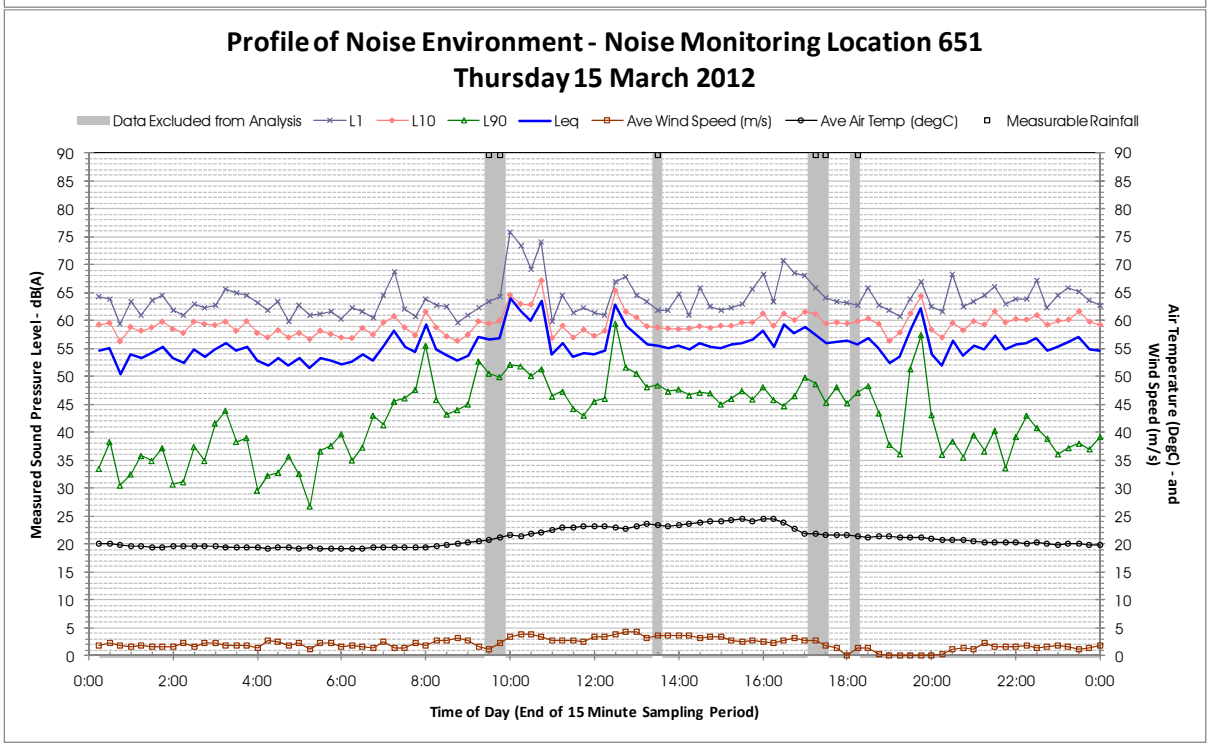


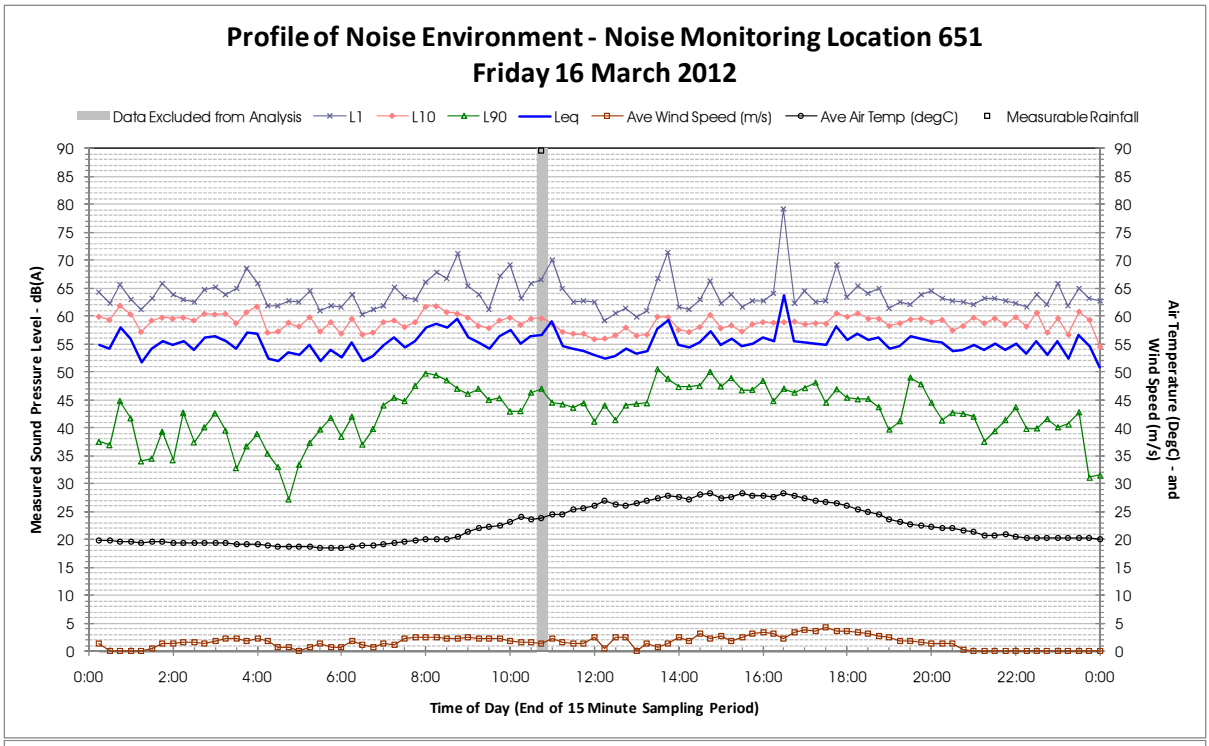
Profile of Noise Environment - Noise Monitoring Location 597
Tuesday 27 March 2012

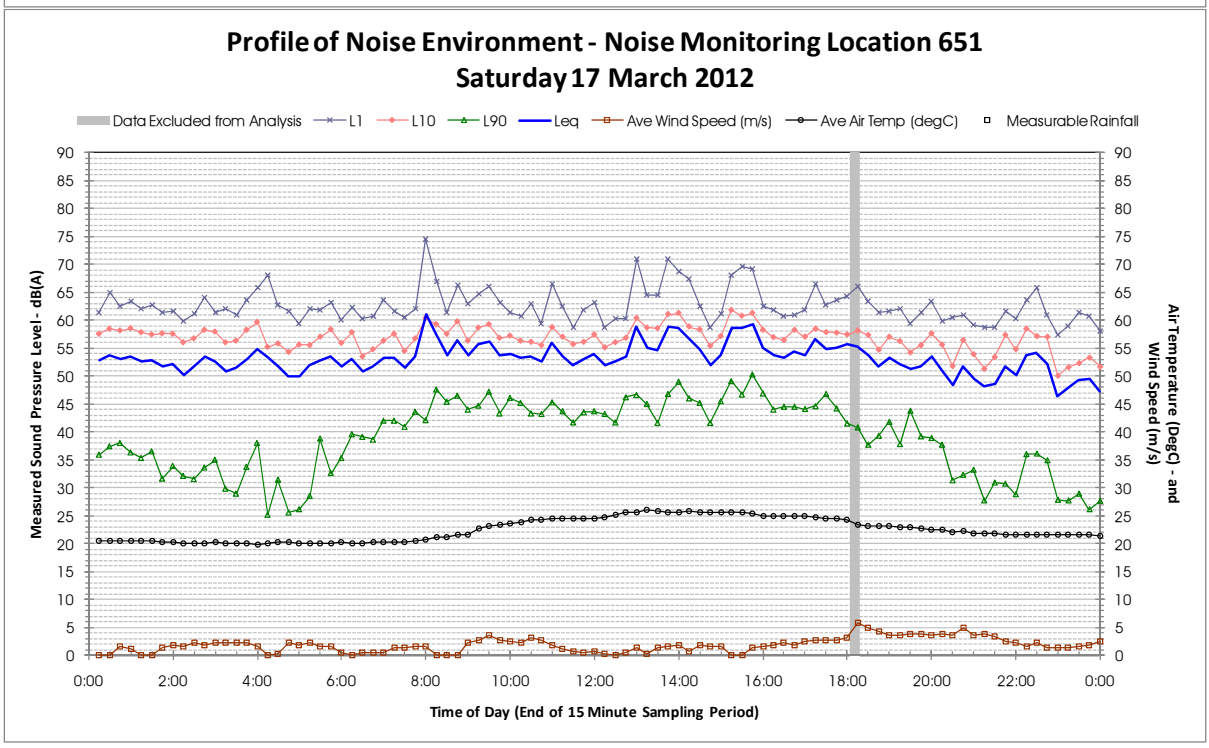



Profile of Noise Environment - Noise Monitoring Location 597
Wednesday 28 March 2012
Data Excluded from Analysis
L1
L10
L90
Leq
Ave Wind Speed (m/s)
Ave Air Temp (degC)
Measurable Rainfall
Measured Sound Pressure Level - dB(A)
Air Temperature (DegC) - and Wind Speed (m/s)
Time of Day (End of 15 Minute Sampling Period)
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

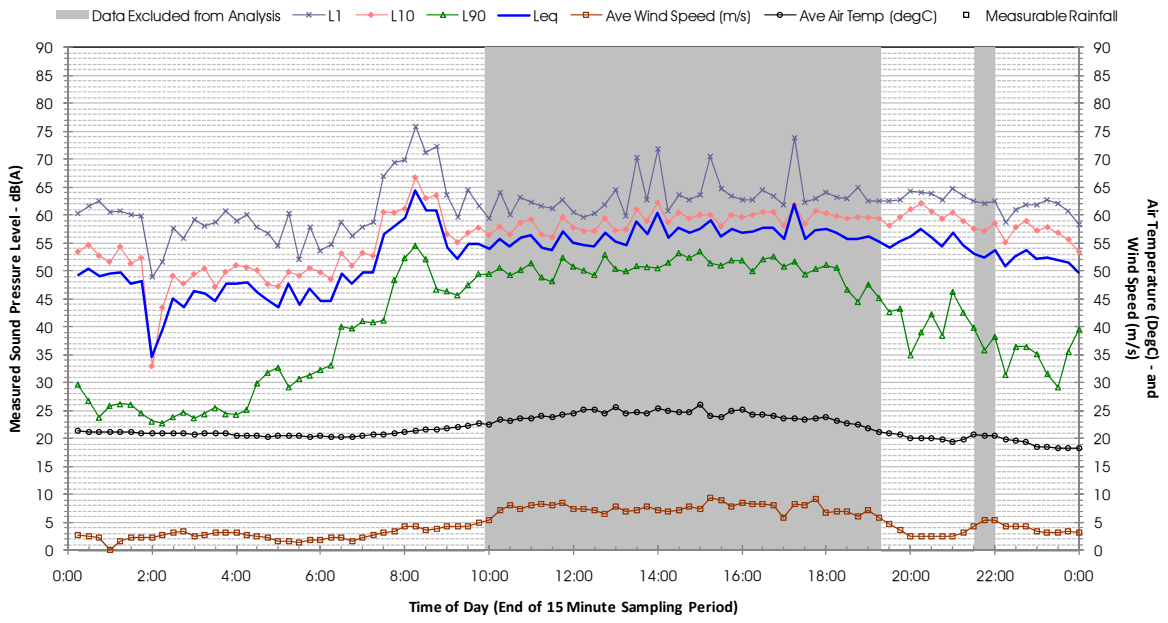

Profile of Noise Environment - Noise Monitoring Location 651
Wednesday 14 March 2012
Data Excluded from Analysis
L1
L10
L90
Leq
Ave Wind Speed (m/s)
Ave Air Temp (degC)
Measurable Rainfall
Measured Sound Pressure Level - dB(A)
Air Temperature (DegC) - and Wind Speed (m/s)
Time of Day (End of 15 Minute Sampling Period)


Profile of Noise Environment - Noise Monitoring Location 651
Thursday 15 March 2012
Data Excluded from Analysis
L1
L10
L90
Leq
Ave Wind Speed (m/s)
Ave Air Temp (degC)
Measurable Rainfall
Measured Sound Pressure Level - dB(A)
Air Temperature (DegC) - and Wind Speed (m/s)
Time of Day (End of 15 Minute Sampling Period)

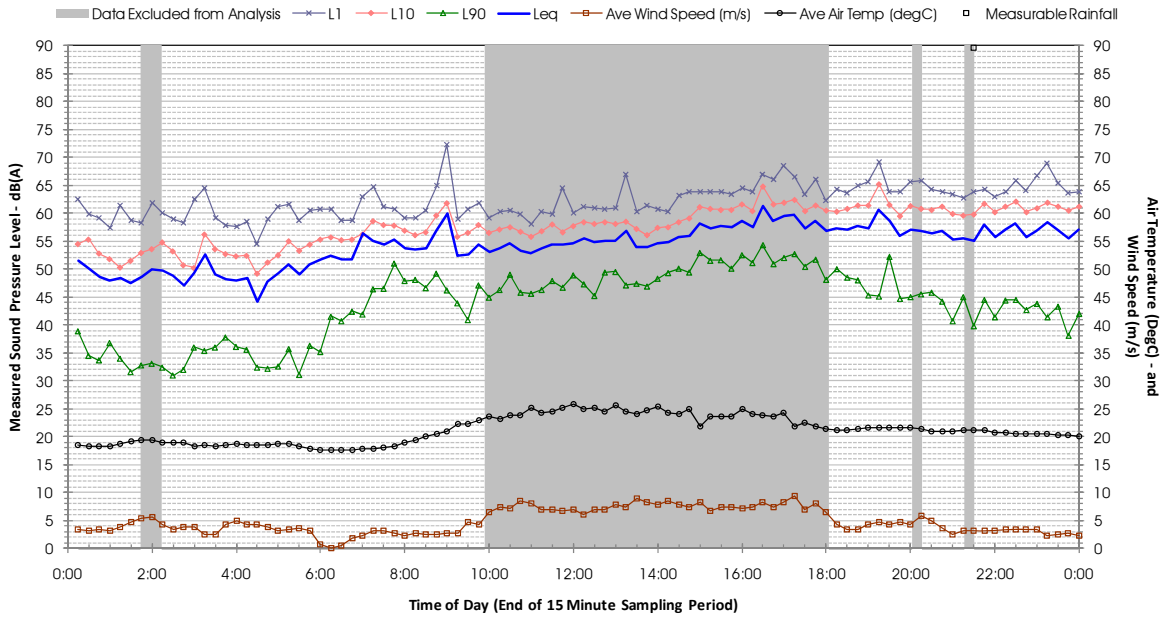

Profile of Noise Environment - Noise Monitoring Location 651
Friday 16 March 2012
Data Excluded from Analysis
L1
L10
L90
Leq
Ave Wind Speed (m/s)
Ave Air Temp (degC)
Measurable Rainfall
Measured Sound Pressure Level - dB(A)
Air Temperature (DegC) - and Wind Speed (m/s)
Time of Day (End of 15 Minute Sampling Period)


Profile of Noise Environment - Noise Monitoring Location 651
Saturday 17 March 2012
Data Excluded from Analysis
L1
L10
L90
Leq
Ave Wind Speed (m/s)
Ave Air Temp (degC)
Measurable Rainfall
Measured Sound Pressure Level - dB(A)
Air Temperature (DegC) - and Wind Speed (m/s)
Time of Day (End of 15 Minute Sampling Period)

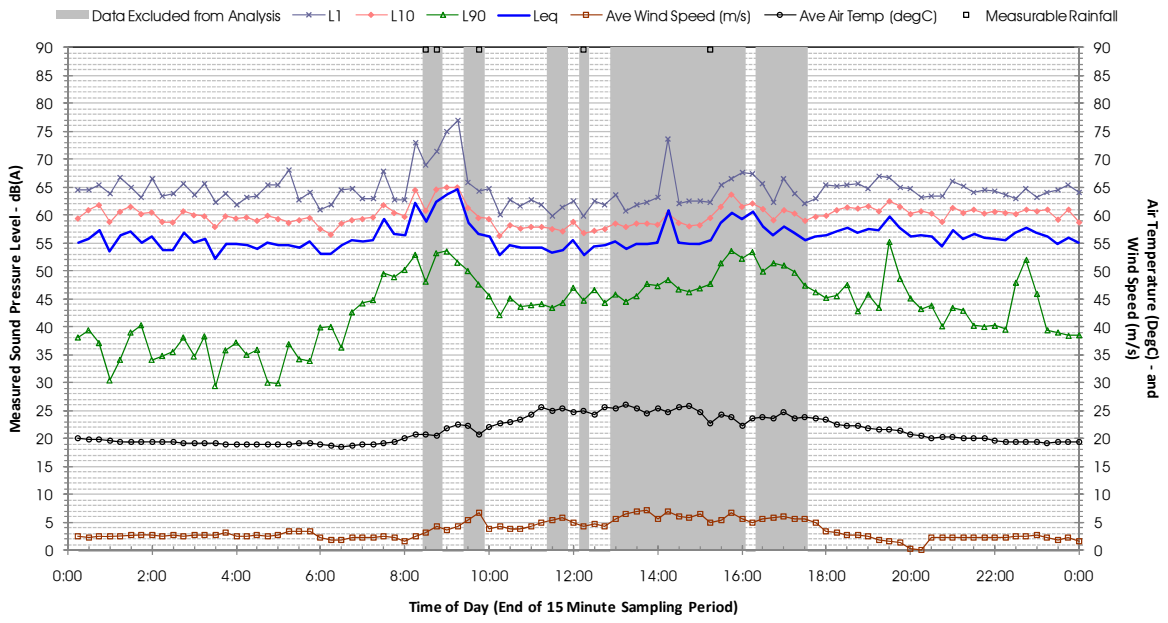
Profile of Noise Environment - Noise Monitoring Location 651
Sunday 18 March 2012



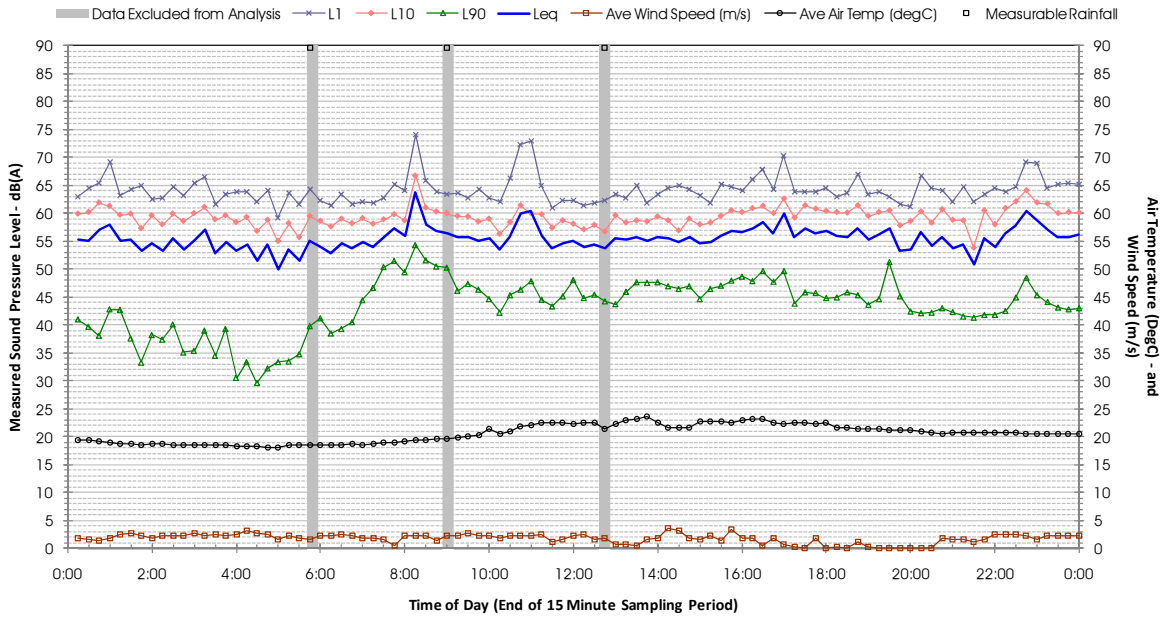
Profile of Noise Environment - Noise Monitoring Location 651
Monday 19 March 2012

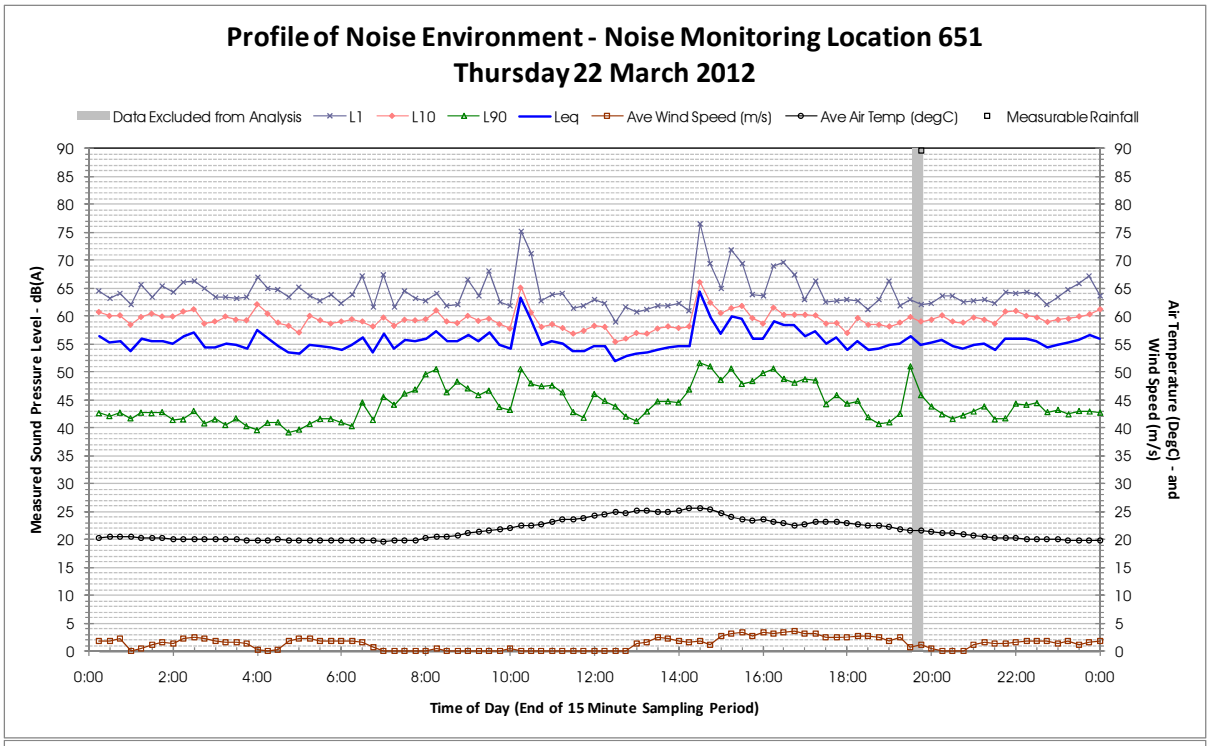


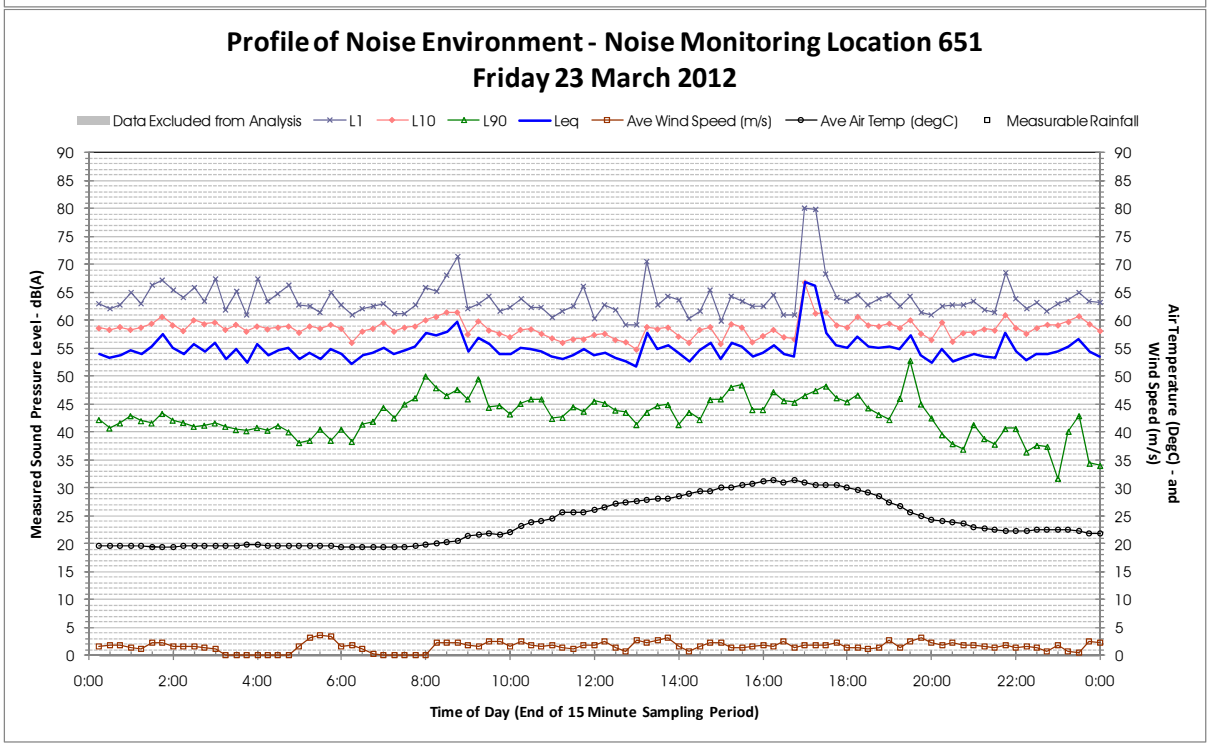
Profile of Noise Environment - Noise Monitoring Location 651
Tuesday 20 March 2012

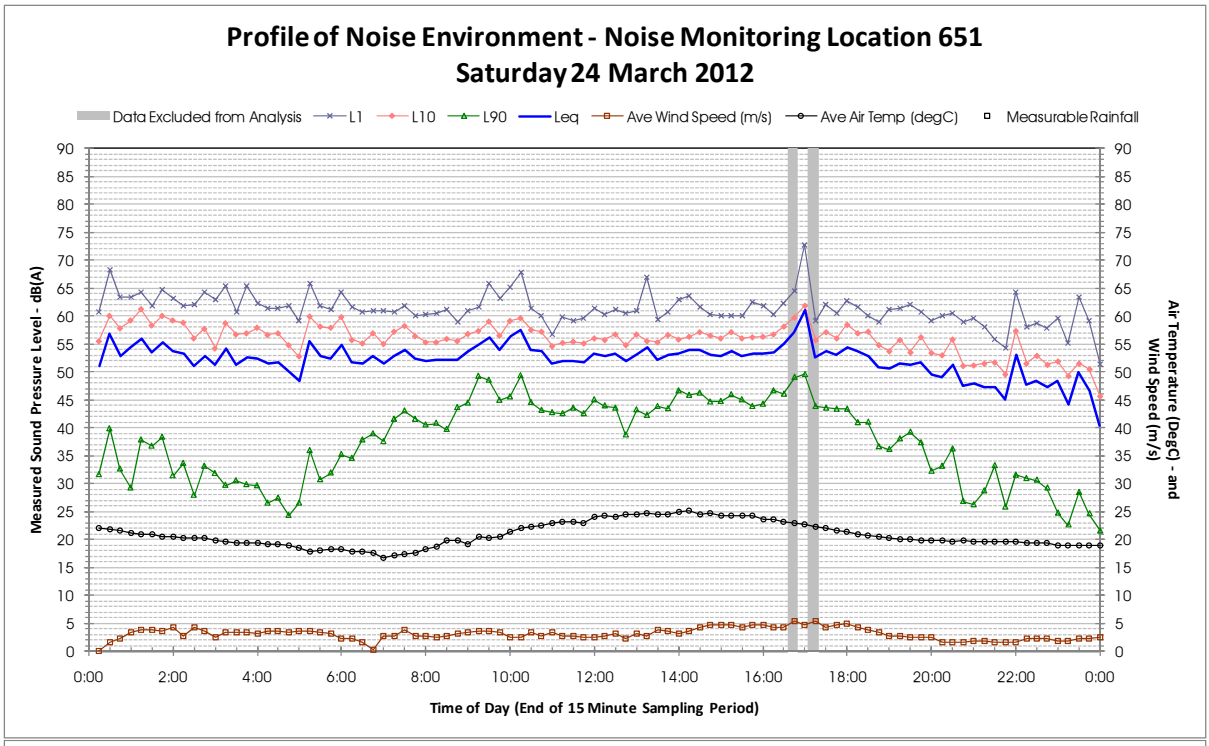


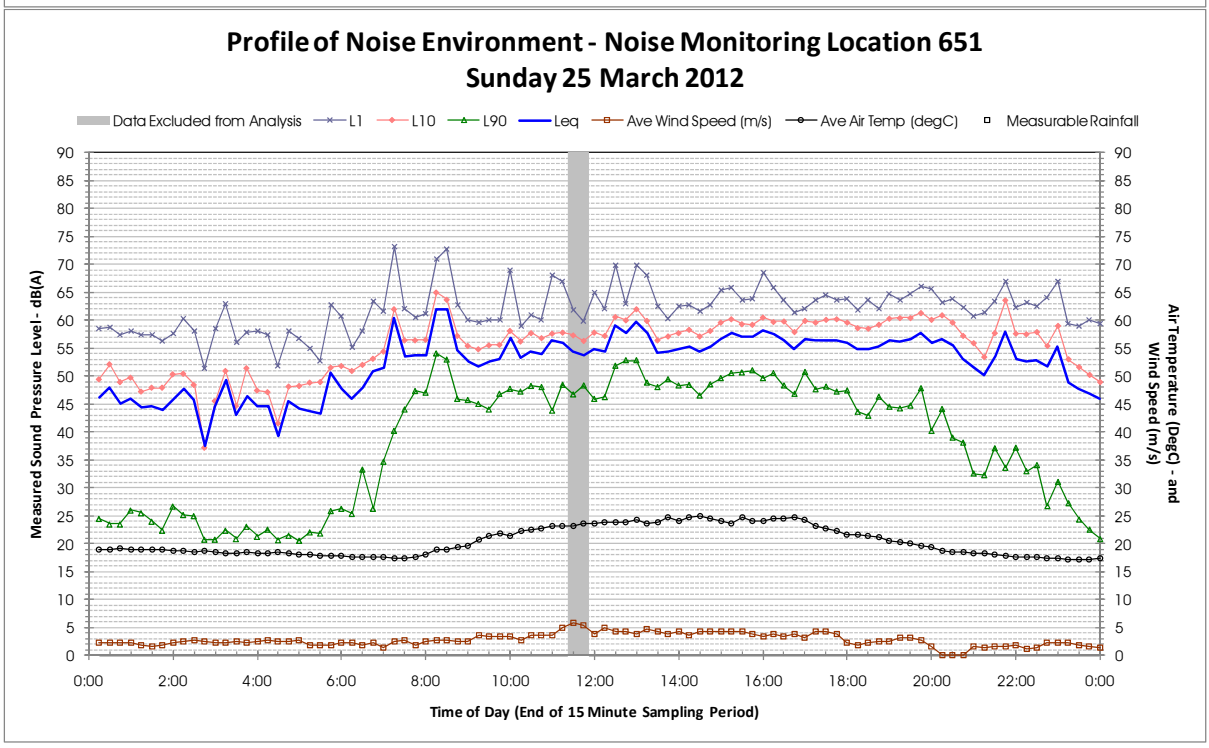
Profile of Noise Environment - Noise Monitoring Location 651
Wednesday 21 March 2012



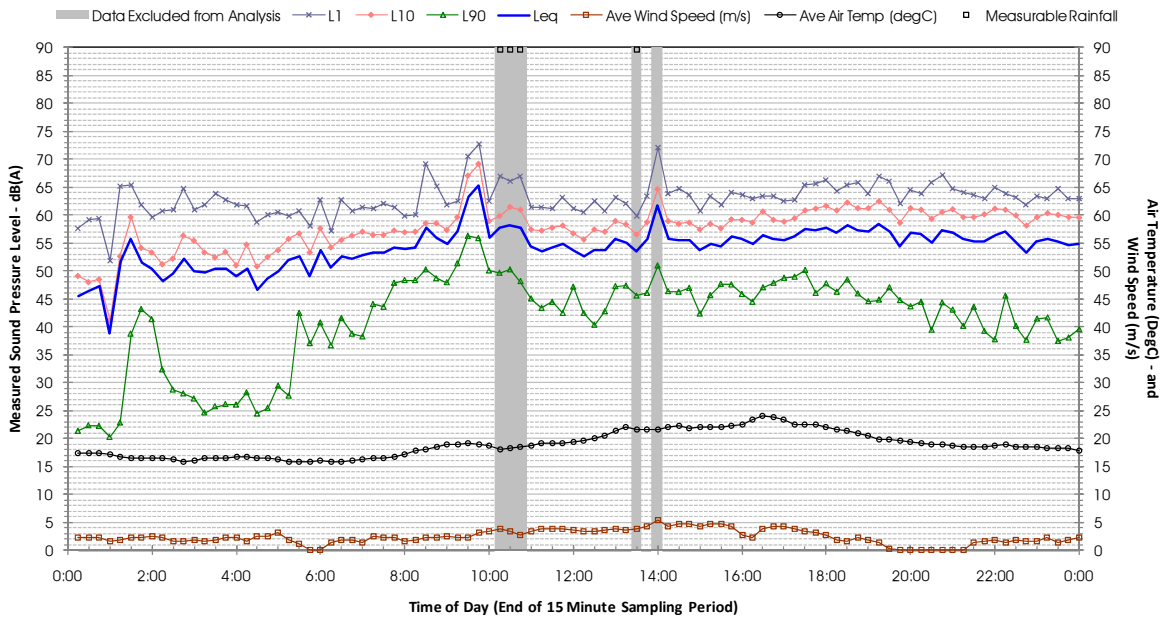

Profile of Noise Environment - Noise Monitoring Location 651
Thursday 22 March 2012
Data Excluded from Analysis
L1
L10
L90
Leq
Ave Wind Speed (m/s)
Ave Air Temp (degC)
Measurable Rainfall
Measured Sound Pressure Level - dB(A)
Air Temperature (DegC) - and Wind Speed (m/s)
Time of Day (End of 15 Minute Sampling Period)


Profile of Noise Environment - Noise Monitoring Location 651
Friday 23 March 2012
Data Excluded from Analysis
L1
L10
L90
Leq
Ave Wind Speed (m/s)
Ave Air Temp (degC)
Measurable Rainfall
Measured Sound Pressure Level - dB(A)
Air Temperature (DegC) - and Wind Speed (m/s)
Time of Day (End of 15 Minute Sampling Period)

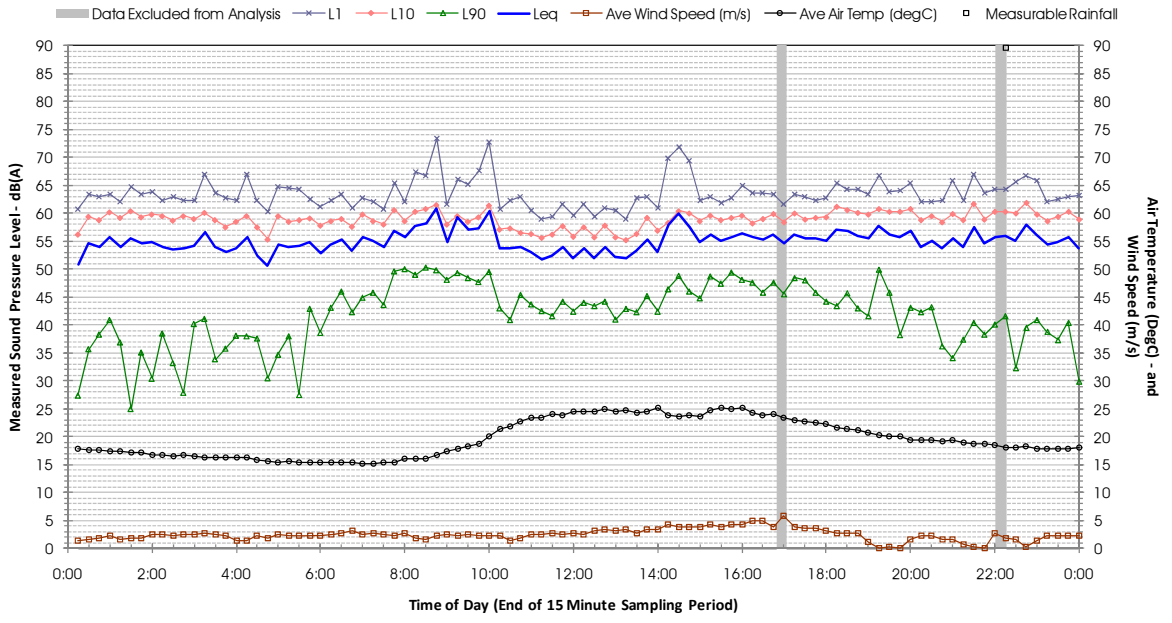

Profile of Noise Environment - Noise Monitoring Location 651
Saturday 24 March 2012
Data Excluded from Analysis
L1
L10
L90
Leq
Ave Wind Speed (m/s)
Ave Air Temp (degC)
Measurable Rainfall
Measured Sound Pressure Level - dB(A)
Air Temperature (DegC) - and Wind Speed (m/s)
Time of Day (End of 15 Minute Sampling Period)

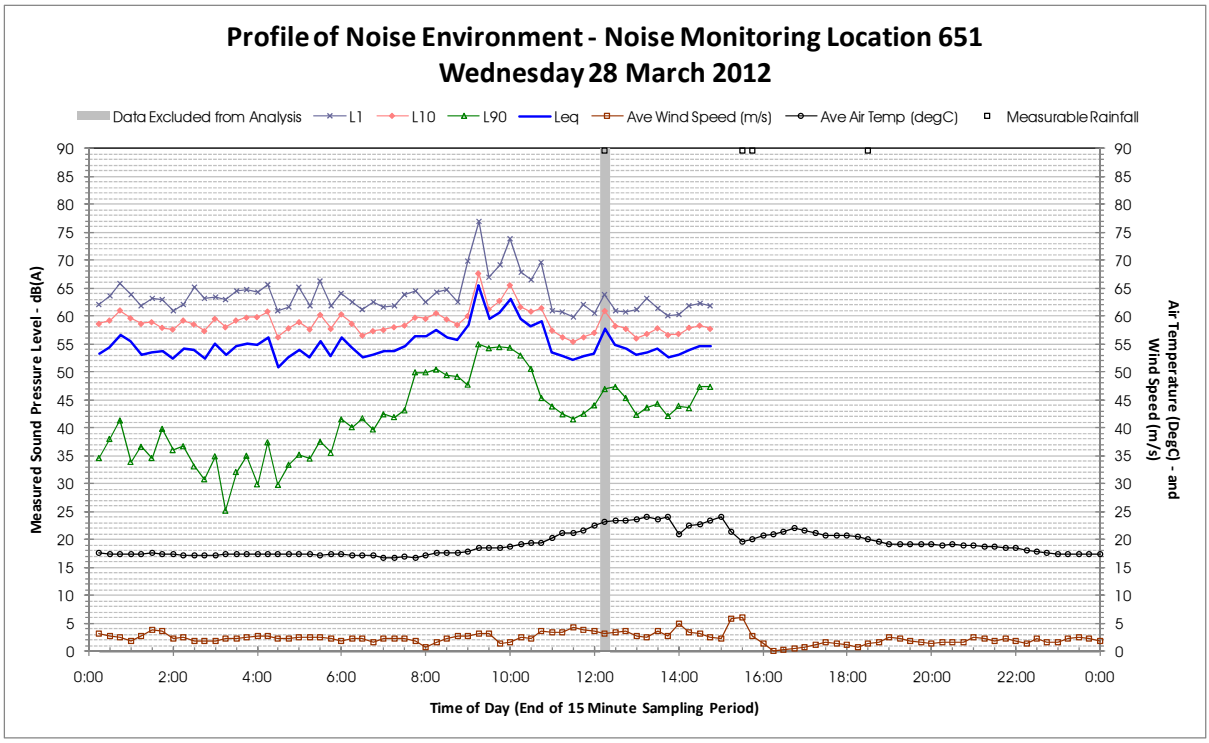

Profile of Noise Environment - Noise Monitoring Location 651
Sunday 25 March 2012
Data Excluded from Analysis
L1
L10
L90
Leq
Ave Wind Speed (m/s)
Ave Air Temp (degC)
Measurable Rainfall
Measured Sound Pressure Level - dB(A)
Air Temperature (DegC) - and Wind Speed (m/s)
Time of Day (End of 15 Minute Sampling Period)

Profile of Noise Environment - Noise Monitoring Location 651
Monday 26 March 2012



Profile of Noise Environment - Noise Monitoring Location 651
Tuesday 27 March 2012




Profile of Noise Environment - Noise Monitoring Location 651
Wednesday 28 March 2012
Data Excluded from Analysis
L1
L10
L90
Leq
Ave Wind Speed (m/s)
Ave Air Temp (degC)
Measurable Rainfall
Measured Sound Pressure Level - dB(A)
Air Temperature (DegC) - and Wind Speed (m/s)
Time of Day (End of 15 Minute Sampling Period)
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

Appendix C Plant and equipment sound power levels

Halfway Creek to Glenugie – Plant and Equipment Sound Power Levels			
Activity	**Plant Noise Source**	**Laq Sound Power Level dB(A)**	**Notes**
Site enablingworks (soft soiltreatments)	2 x Excavator (30 tonne) 1 x Dozer (20t) 18 x Product truck – 4 axle (25t) 2 x Vibratory compactor (12t) 1 x Padfoot compactor 1 x Grader (25t) 1 x Smooth barrel roller (18t) 1 x Water cart – extracting water	103 103 108 112 107 114 107 107	Modelled as single point source at shortest separation to receivers taking account of plant operating duration.
Formation, clearing and mulch	2 x Excavator (30t) 1 x Dozer (20t) 18 x Product truck – 4 axle (25t) 2 x Vibratory compactor (12t) 1 x Padfoot compactor 1 x Grader (25t) 1 x Smooth barrel roller (18t) 1 x Water cart – extracting water 1 x Mulcher/Chipper 1 x Mobile crusher and screener 1 x Pneumatic hammer	103 103 108 112 107 114 107 107 103 104 113	Modelled as single point sourceat 25 metre intervals along the project with highest level at each receiver reported, taking accountof plant operating duration.
Earthworks	2 x Excavator (30t) 1 x Dozer (20t)	103 103	Modelled as single point source at 25 metre intervals along the project with highest level at each receiver reported, taking account of

Halfway Creek to Glenugie – Plant and Equipment Sound Power Levels			
Activity	**Plant Noise Source**	**Laq Sound Power Level dB(A)**	**Notes**
	18 x Product truck – 4 axle (25t) 2 x Vibratory compactor (12t) 1 x Padfoot compactor 1 x Grader (25t) 1 x Smooth barrel roller (18t) 1 x Water cart – extracting water 1 x Backhoe 2 x Front end loaders 2 x Scrapers 1 x Mulcher/Chipper 1 x Crusher and screener 1 x Pneumatic hammer	108 112 107 114 107 107 110 114 108 103 104 113	plant operating duration.
Paving andasphalting	2 x Generators 2 x Backhoes 1 x Asphalt paver 1 x Concrete paver 1 x Concrete truck 1 x Concrete vibrator 2 x Concrete saws	111 110 111 111 111 110 105	Modelled as single point source at 25-metre intervals along the project with highest level at each receiver reported, taking account of plant operating duration.
Bridge works	1x Impact piling rig 1 x Bored piling rig 1 x Pneumatic hammer	121 114 113	Modelled as single point source at 10-metre intervals along the bridgework boundary with highest level at each receiver reported, taking account of plant

Halfway Creek to Glenugie – Plant and Equipment Sound Power Levels			
Activity	**Plant Noise Source**	**Laq Sound Power Level dB(A)**	**Notes**
	1 x Excavator 3 x Haul trucks 2 x Generator 2 x Mobile cranes (45t) 1 x Concrete truck 1 x Concrete pump 2 x Air compressors 1 x Air ratchet gun	112 112 111 105 110 107 105 101	operating duration.
Haul roads	Haul trucks (25t each) (various numbers)	108	Modelled as various point sources along haul road length, taken account of road length, assumed truck speed and truck sound exposure level (SEL)
Drilling, Crushing and Screening	1 x Blast hole drill rig 1 x Mobile crusher and screener 1 x Pneumatic hammer 1 x Mulcher/Chipper 1 x Excavator (30t)	100 104 113 103 103	Modelled as single point source at shortest separation to receivers taking account of plant operating duration.
Ancillary sites – stockpiles	2 x Excavator (30t) 1 x Dozer (20t) 2 x Product truck – 4 axle (25t) 1 x Water cart (water bowser)	103 103 108 107	Modelled as an area source from sum of all sound power of all plant operating, taking account of plant operating duration.

Halfway Creek to Glenugie – Plant and Equipment Sound Power Levels			
Activity	**Plant Noise Source**	**Laq Sound Power Level dB(A)**	**Notes**
	1 x Backhoe 2 x Front-end loaders	110 114	
Ancillary sites – site offices	Office vehicles	-	Construction activity noise not anticipated.
Ancillary sites – plant workshop	1 x Product truck – 4 axle (25t) 1 x Front-end loader 2 x Forklift trucks 3 x Powered hand tools	108 114 101 115	Modelled as an area source from the sum of all sound power of all plant operating, taking account of plant operating duration

Appendix D Out of hours works procedure

1 Purpose

This Procedure provides the CMC approval process to conduct out of hours works (OOHW) at the Halfway Creek to Glenugie project (HC2G) on a case by case or activity specific basis outside of the approved standard hours in accordance with MCoA Conditions below

2 Ministers Conditions of Approval

Construction Noise

B14. The SSI shall be constructed with the aim of achieving the construction noise management levels detailed in the Interim Construction Noise Guideline (DECC, 2009). All feasible and reasonable noise mitigation measures shall be implemented and any activities that could exceed the construction noise management levels shall be identified and managed in accordance with the Construction Noise and Vibration Management Plan.

Note:

· The Interim Construction Noise Guideline identifies 'particularly annoying' activities that require the addition of 5dB(A) to the predicted level before comparing to the construction Noise Management Level.

B15. Construction activities associated with the SSI shall be undertaken during the following standard construction hours:

(a) 7:00am to 6:00pm Monday to Friday, inclusive; and

b) 8:00am to 5:00pm Saturday; and

(c) at no time on Sunday or public holidays.

B16. Construction works outside the standard construction hours may be undertaken in the following circumstances:

(a) construction works that generate noise that is:

(i) no more than 5 dB(A) above rating background level at any residence in accordance with the Interim Construction Noise Guideline (DECC, 2009); and

(ii) no more than the noise management levels specified in Table 3 of the Interim Construction Noise Guideline (DECC 2009) at other sensitive receivers; or

(b) for the delivery of materials required outside the standard construction hours by the NSW Police Force or other authorities for safety reasons; or

(c) where it is required in an emergency to avoid the loss of lives, property and/or to prevent environmental harm; or

(d) between 6.00am and 7.00am and 6.00pm and 7.00pm Monday to Friday (except public holidays) in sparsely populated areas (these construction hours may be reviewed and/or revoked by the Secretary in consultation with the EPA in the case of unresolved noise complaints); or

(e) low noise impact activities and work between:

(i) 6.00am and 7.00am Monday to Friday; and/or

(ii) 6.00pm and 7.00pm Monday to Friday; or

(f) works approved through an EPL; or

(g) works approved by a Construction Environment Management Plan or Construction Noise and Vibration Management Plan for the SSI.

B17. Construction activities which cannot be undertaken during the standard construction hours for technical or other justifiable reasons (Out of Hours work) may be permitted outside the standard construction hours with the approval of the Environmental Representative. Out of Hours work shall be undertaken in accordance with an approved Construction Environment Management Plan or Construction Noise and Vibration Management Plan for the SSI, where that plan provides a process for the consideration of Out of Hours work. This consideration includes:

(a) process for obtaining the Environmental Representative's approval for Out of Hours work;

(b) details of the nature and need for activities to be conducted during the varied construction hours;

(c) justifies the varied construction hours in accordance with the Interim Construction Noise Guideline (DECC, 2009);

(d) provides evidence that consultation with potentially affected receivers and notification of the relevant council has been undertaken, that the issues raised have been addressed and all feasible and reasonable mitigation measures have been put in place; and

(e) provides evidence of consultation with the EPA on the proposed variation in standard construction hours.

B18. Construction activities resulting in impulsive or tonal noise emission (such as rock breaking, rock hammering, pile driving) shall only be undertaken:

(a) between the hours of 8:00am to 5:00pm Monday to Friday;

(b) between the hours of 8:00am to 1:00pm Saturday; and

(c) in continuous blocks not exceeding three hours each with a minimum respite from those activities and works of not less than one hour between each block.

For the purposes of this condition 'continuous' includes any period during which there is less than a one hour respite between ceasing and recommencing any of the work the subject of this condition.

The works subject to this condition may be undertaken in sparsely populated areas within the standard construction hours.

B19. The Applicant shall, where feasible and reasonable, limit high noise impact activities and work to the mid-morning and mid-afternoon periods, except in sparsely populated areas.

3 Process

3.1 Justification for Out of Hours Work

The Interim Construction Noise Guideline, (ICGN) (DECC 2009) identifies five categories of work that may be undertaken outside of the recommended standard hours, these are:

- the delivery of oversized plant or structures that police or other authorities determine require special arrangements to transport along public roads;
- emergency work to avoid the loss of life or damage to property, or to prevent environmental harm;
- maintenance and repair of public infrastructure where disruption to essential services and/or considerations of worker safety do not allow work within standard hours;
- public infrastructure works that shorten the length of the project and are supported by the affected community, and
- works where a proponent demonstrates and justifies a need to operate outside the recommended standard hours.

In the last two categories, the proponent should provide the relevant authority with clear justification for reasons other than convenience for undertaking the after hours work.

The need to undertake works outside of the standard construction hours are due to a number of factors, including the following:

1. A Road Occupancy Licence (ROL) is required for any works that occupies road space, delays traffic or reduces speed limits to less than 80km/hour on the Pacific Highway. The ROL's provide very specific details and restrictions on the construction activities in order to ensure that any impacts to the local community and road users (both local and regional road users) are minimised throughout the construction period. Within the ROL there are extensive restrictions on items such as, but not limited to, roadside lane closures, worksite length, queue length of impacted traffic, hours of works on the Pacific Highway, and consultation with the relevant traffic control coordinators across the region and state. It should be noted that the Roads and Maritime considers that road users are an important stakeholder from the community in regards to impacts from road construction projects. Whilst it is acknowledged that road users are not the only stakeholder impacted by our works, the high level of traffic experienced at HC2G mean that they are a very important consideration in the planning of construction works as the traffic impacts if not properly managed will result in impacts that extend far beyond project boundaries with substantial flow-on effects both from a political, safety and local/regional economic perspective. One of the reasons for ensuring that queue lengths are minimised is to reduce the chance of end-to-end accidents within the changed traffic conditions. Apart from the reduced congestion and improved traffic flows through site, there are significant benefits in reducing the chance of injury (both minor and severe) to road users.
2. In sections of the HC2G project there is limited available space required to safely undertake the construction works. Hence HC2G needs to increase the safety of the workforce by undertaking works at periods when traffic numbers are lower. The Australian Standards and the Roads and Maritime's Traffic Control Manual detail that workers cannot be any

closer than 1.2m to the road for 60km/hour traffic. Furthermore, where works are within 3m from the fogline, traffic barriers, 60kph zones, a full Traffic Control Plan and an ROL apply.

3. Certain activities adjacent to the roads (e.g. clearing) are also considered a high risk to the safety of the road users and thus lane closures maybe required to minimise this risk.
4. External restrictions on work times prescribed by service providers or (further discussed below).
5. Quality requirements for concrete works and saw cutting (further discussed below).
6. Due to the scope requirements of the HC2G project, there will be a need to mobilise and at times relocate oversize materials and equipment. Movement of oversize vehicles is regulated and will require relocation outside the nominated period by the controlling authority.

Table 2 below has been prepared to identify the likely activities that will need to be conducted outside of standard construction hours.

CMC will however continually look for opportunities to undertake out of hours works (OOHW) within the standard construction hours. While alternatives to some OOHW may be developed, the majority of OOHW will still be required to construct the project within all the project constraints. The aim of the OOHW procedures below is to ensure that all OOHW activities follow a rigorous process to ensure the following outcomes:

- Potential OOHW are identified as early as possible,
- Justification is provided for each OOHW proposed,
- Appropriate levels of consultation are undertaken for all the OOHW activities,
- Environmental impacts from the OOHW are managed / mitigated in line with the approved CEMP documents to minimise impact on the surrounding environment & community,
- Adequate safety and supervisory provisions are identified and implemented for all OOHW activities, and
- Any complaints arising from the OOHW activities are managed in accordance with the approved *Woolgoolga to Ballina Communications and Stakeholder Engagement Strategy* and HC2G Community Action Plan.

3.2 Out of Hours Works Approval Process

As per CoA B15 standard hours for this SSI project shall be 7:00 am to 6:00pm Monday to Friday and 8:00am to 5:00pm Saturday and at no time on Sunday or public holidays.

CMC has defined potential out of hours activities into five types. Where there is a justified need to conduct OOHW, or impacts can be demonstrated to be negligible, the following process will be followed for each type (refer to Figure 1):

1. Type one:

If works are:

a) For the delivery of materials or oversized plant or structures required outside approved hours by the Police or other relevant authorities for safety reasons; or
b) Required in an emergency to avoid the loss of lives, property and/ or to prevent environmental harm; or
c) Construction works undertaken through sparsely populated areas in which sensitive receptors are located greater than 200 meters away from the project boundary. In this case construction (but not including blasting, pile driving and rock hammering) is permissible during the following hours: 6.00am to 7.00am and 6:00pm to 7:00 pm Monday to Friday except; holidays.

These works hours may be reviewed and/ or revoked by the Secretary in consultation with the EPA in the case of excessive or unresolved noise complaints

Types 1a and 1b works may proceed with no further approval or assessment Notification to the Environmental Manager, the Community Manager and Roads and Maritime is required. The EPA is also to be notified within 24 hours of undertaking any works referred to in Type 1 a) or within 24 hours following undertaking works referred to in 1 b) above.

Locations of the project where Type 1c activities may be undertaken (i.e. located in sparsely populated areas greater than 200m from sensitive receivers) are shown in Appendix C. Prior to initial construction works in the vicinity of these areas, potentially affected receivers will be notified of approved construction hours, including the potential for Type 1c works in the approved extended hours.

Following initial receiver notification, Type 1c works may proceed with no further assessment following approval from the Environmental Manager and Community Manager and notification to Roads and Maritime and the ER.

2. Type two: (Hold Point, must be approved by Environment Manager)

If works are predicted to be less than 5dB (A) above background levels at relevant sensitive receivers, OOHW may take place. This pathway will require an **Out of Hours Request Form (Appendix A)** to be completed and approved by the Environmental Manager. The Community Manager is also to be notified.

Table 7.2 of the CNVP will be used to conduct a noise assessment prior to the OOHW to confirm the works will be less than 5dB (A) above background levels If the scenarios in Table 7.2 do not apply to the works undertaken the Environmental Manager will undertake the noise assessment in association with the CMC noise specialist.

Once approved by the Environment Manager, the works may proceed with no further approval or external consultation other than notification to Roads and Maritime and the ER.

Roads and Maritime will however be provided with the results of any acoustic investigations made in relation to Type 2 activities as part of monthly reporting and the EPA will be provided with a copy of acoustic results in relation to Type 2 activities when requested.

3. Type three: (Hold Point, must be approved by Environment Manager)

Out of hours works may take place if an agreement between CMC and representatives of potentially affected noise sensitive receivers (where works are predicted to be greater than 5dB (A) over background levels) has been reached. Any agreement(s) between CMC and the affected receivers must be recorded in writing and a copy of the agreement(s) kept on the premises by the licensee for the duration of this licence.

This pathway requires Table 7.2 of the CNVP to be used to determine noise predictions and identify receivers exceeding noise objectives and thus which receivers CMC requires agreements from. An **Out of Hours Request Form (Appendix A)** to be completed and approved by the Environment Manager.

The EPA, Roads and Maritime and the ER will be notified 48 hours prior to undertaking Type 3 activities unless otherwise agreed.

4. Type four: (Hold Point, must be approved by Environment Manager)

This OOH category considers works required to be undertaken outside of standard construction hours for technical or other justifiable reasons as provided for in CoA B17 and include:

- Concrete works (including delivery) and saw cutting during paving works;
- Service relocation works;
- Works impacting highway and local road traffic (as listed in Table 2);
- Use of ancillary facility sites during OOHW;
- Refueling during OOHW; and
- Security patrolling throughout the construction phase.

The above works have been assessed in Section 7.2 of the NVMP and the noise predictions detailed in Table 7-2 NVMP. Mitigation measures for these works will be in accordance with Section 8 of the NVMP and this procedure. **An Out of Hours Request Form (Appendix A)** is required to be completed and approved by the Environment Manager**.** The Community Manager is also to be notified.

Further consultation/notification requirements for these works are detailed below. The justification for the need to undertake these works outside of the standard construction hours is provided below.

Concrete Works (including delivery) and Saw Cutting (with agreement of relevant sensitive receivers)

Concrete paving and large concrete pours will be carried out during the construction period. As hot weather affects the quality of concrete pavement, batching, concrete delivery along the alignment and paving/pours will be required in the early mornings, evenings and night as it takes advantage of cooler temperatures. Quality requirements specify concrete works should not occur when surface temperatures are forecast to exceed 35 degrees.

Furthermore to ensure the highest quality of pavement is achieved, the timing of concrete cutting is governed by the hydration rate of the pavement, and may require cutting at any time within four and 24 hours after paving, with a 'cutting window' as short as 30 minutes. This period between paving and cutting can vary due to weather saw cutting will be needed at any time, including outside the daytime construction hours.

Service Relocation Works

Service providers will often require that some works, such as service cut-overs, are carried out in the evening or night to reduce network impact and impacts upon the local community. In these circumstances, CMC will be required to undertake these works as prescribed by the service provider.

Works Impacting Highway and Local Road Traffic

There are strict traffic and safety requirements for works on or near the highway given the high volumes of traffic on the Pacific Highway. OOHW will be required where any of the works listed in Table 2 are predicted to significantly impact road users or the safety of road users.

Use of Ancillary Facility Sites during OOHW

The operation of some ancillary facility sites such as the main compound, a satellite facility and/or a batch plant will be required during OOHW to service the work crews and facilitate the other OOHW. Some loading and unloading of materials associated with the other OOHW may be required at the ancillary facility sites.

Refueling and Security Patrolling

Refueling will be required to ensure any machinery associated with OOHW can continue to operate throughout the out of hours period. Out of hours refueling will however be minimised by having all machinery refueled prior to commencing the OOHW or by refueling within construction hours the following day.

Security patrolling will also be required to ensure plant, equipment and personnel operating out of hours are not threatened or damaged. Security patrolling of the construction corridor will also be required at all other times outside of standard construction hours.

5. Type five:

This category of OOHW applies to any other works not covered above and are deemed as high risk (i.e. predictions above the relevant noise objectives at the nearest sensitive receivers), and where no negotiated agreement has been obtained. These works will require OOHW submissions to the EPA and will fulfill the requirements of CoA B17.

These submissions will be consolidated quarterly (if the activities are ongoing) or as required, and submitted to the EPA at least 2 weeks prior to works commencing. The OOHW submissions to the EPA will include:

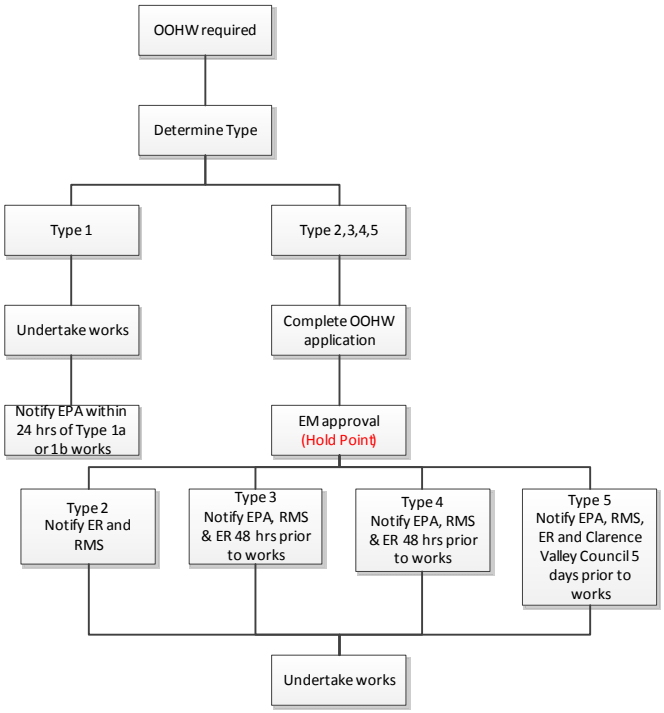
- a description of the works;
- justification of the works;
- information relating to predicted noise levels through the use of Table 7.2;
- details of noise mitigation to be implemented. In determining appropriate mitigation, a reasonable and feasible noise mitigation assessment will be completed as detailed in the Out of Hours Request Form (Appendix A);
- information relating to vibration impacts and management measures;
- Community consultation undertaken, key messages and a summary of feedback, issues and concerns. CMC's responses to any concerns raised during consultation will also be provided to the EPA.

Indicative dates and durations for the proposed OOHW will be provided in the submissions, however as the specific activity dates are finalised, CMC will advise the EPA of the dates not less than 5 days and not more than 14 days prior to the works. CMC will also notify the EPA of any changes to the nominated dates.

The Clarence Valley Council, the ER and Roads and Maritime will also be notified of these proposed OOHW not less than 5 days and not more than 14 days prior to the works.

As stated in CoA B17, provided this OOHW procedure has been approved as part of this NVMP, the Environment Manager will approve the works once the above consultation has been undertaken and any further issues addressed.

Figure 1 Out of Hours Work Process



3.3 Community Engagement and Notification

It is essential that effective community consultation occurs for out of hours works. This section clearly outlines how the stakeholders will be approached prior to OOHW activities on the project. It identifies the stakeholders, the approach and tools that will be used to communicate the key messages to stakeholders.

This section details the consultation approach for each 'type' of out-of-hours activity.

It is important to note that a complaints management system will be implemented as detailed in the *Woolgoolga to Ballina Communications and Stakeholder Engagement Strategy* and HC2G Community Action Plan.

Table 1: 'Type of OOHW activities'

Type 1 and 2		
Stakeholder	Approach	Tools
Roads and Maritime & ER	Notification prior to undertaking any works	Email notification or phone call
EPA	Notification within 24 hours of undertaking any works referred to in Type 1 a) or within 24 hours following undertaking works referred to in 1 b) above. In addition, the EPA will be provided with a copy of the results of any acoustic investigation made in relation to Type 2 when requested.	Email notification
Potentially affected receivers (Type 1c works)	For Type 1c activities, prior to initial construction works in the vicinity of areas this condition applies to potentially affected receivers will be notified of approved construction hours, including the potential for Type 1c works in the approved extended hours.	Written notification
Type 3		
Stakeholder	Approach	Tools
Affected receivers (including private properties, business and education facilities) who are noise affected by greater than 5dba above background levels.	Written agreements will be sought from the affected receivers. A copy of the agreement(s) will be kept on the premises by the licensee for the duration of the project licence. A community information line will be available.	Written agreement Notification 1800 number
EPA, Roads and Maritime & ER	The EPA and Roads and Maritime will be notified 48 hours prior to undertaking Type 3 activities unless otherwise agreed.	Email notification
Type 4		
Stakeholder	Approach	Tools
Private properties/Business and education facilities who are noise affected by greater than 5dba above background levels	Notification will be provided not less than 5 days and not more than 14 days prior to work commencing. An exception is concrete work which is reliant on daily temperatures or circumstances and in some cases this notification may have to be provided daily as required. Information provided to the affected receivers will reflect requirements as outlined in the EPL conditions, including: • Outline the reason for the work; • Include a diagram outlining the location of the works; • Outline time restrictions; • Outline the nature and location scope and duration of the works; • Identify expected noise impacts on receivers; • State how complaints can be made and additional information obtained; and • Include complaints enquiry line and an after hours contact	Door knock/Face to face meeting Written Notification 1800 number Project website

	number and on the project website. A community information line will be available. During the course of the project, if residents request not to be re-contacted regarding OOHW, CMC will make a record of this request in the community database.	
EPA	The EPA will be notified at least 48 hours prior to any Type 4 works occurring outside of standard working hours commencing. An exception is concrete work which is reliant on daily temperatures or circumstances and in some cases this notification may have to be provided daily as required. Details of any complaints received during these OOHW and the actions undertaken will also be forwarded to EPA within 48hrs of receiving the complaint. Information provided to residents as outlined above will also be provided	Email notification EPL compliance report
Clarence Valley Council, the Environmental Representative and Roads and Maritime	Notification will occur 48 hours prior to any Type 4 works occurring outside of standard working hours commencing. An exception is concrete work which is reliant on daily temperatures or circumstances and in some cases this notification may have to be provided daily as required. Information provided to residents as outlined above will also be provided	Email notification 1800 number.
Type 5		
Stakeholder	Approach	Tools
Private properties/Business who are noise affected by greater than 5dba above background levels.	Affected receivers will be doorknocker and consulted on any Type 5 OOHW submissions. The information provided to the affected receivers will reflect requirements as outlined in the EPL conditions, including: • Outline the reason for the work; • Include a diagram outlining the location of the works; • Outline time restrictions; • Outline the nature and location scope and duration of the works; • Identify expected noise impacts on receivers; • State how complaints can be made and additional information obtained; and • Include complaints enquiry line and an after hours contact number and on the project website Residents will be given at least one week to comment on the work and will be provided with a feedback form to detail any concerns. The project team will investigate possible mitigation measures to counter the feedback received from residents and consult with the resident on these possible mitigation measures. A submission detailing the consultation process will be submitted to the EPA for consideration. If the works are agreed as per section 4.2 above, receivers will be notified of the activity to confirm out-of hour's work location, time, agreed mitigations and requirements as per the EPL. This notification will be provided not less than 5 days and not more than 14 days prior to work commencing. A community information line will be available. During the course of the project, if residents request not to be re-contacted regarding out-of-hours works, CMC will make a record of this request in the community database.	Feedback form Door knock/Face to face meeting Notification 1800 number Project website
EPA	Where Type 5 works are required to be undertaken outside of standard	OOH work Submission

	construction hours the proposal will be referred to the EPA for comment. The submission to EPA will include information detailed in Section 4.2 'Type 5'. The submissions will be provided to EPA for comment at least 2 weeks prior to works commencing. In addition, the EPA will be notified in writing not less than 5 days and not more than 14 days prior to the specific OOHW commencing. Details of any complaints received during these OOHW and the actions undertaken will also be forwarded to EPA within 48hrs of receiving the complaint.	EPL compliance report Email notification
Clarence Valley Council, the Environmental Representative and Roads and Maritime	Inform of out of hour's work and locations not less than 5 days and not more than 14 days prior to work commencing.	Email notification 1800 number

3.4 OOH Noise Management & Mitigation

The following management measures will also be implemented for OOH works:

- Relevant noise and vibration management and mitigation measures outlined in Table 8-1 of the NVMP.
- Aim to complete any high noise generating activities (i.e. noise levels greater than 75 dB(A) at any sensitive receiver) before 10pm.
- Aim to programme OOH works on a quarterly basis so that works are maximized in the OOH works period thereby minimizing the number of nights the community is subjected to OOH works. This pre-planning will also ensure the EPA, Roads and Maritime and the community are well informed of the works.
- Consideration of any cumulative impacts from any previous OOHW on the particular sensitive receivers will also be given as part of the OOH impact assessment.
- Where feasible, mobile noise barriers to separate work areas from sensitive receivers shall be trialed and installed.
- Utilisation of any new 'quiet machinery' shall be investigated and utilised for all works.
- Broadband reversing alarms or replacement procedures are to be used for all OOHW.
- If complaints are received, the complainant will be provided the opportunity to discuss the works with the Environmental Representative. Details of complaints will also be forwarded to the EPA within 48hrs of receiving the complaint. DP&I will also be provided with the details of any complaints received and the steps taken to resolve the complaint in the EPL monthly report and six monthly compliance reports.
- If complaints are received from a section of the affected community during a particular activity, then works are to stop and further mitigation measures implemented or other resident agreements negotiated.
- Where noise levels continue to exceed LAeq 75 dB(A) during the evening period after all reasonable and feasible physical mitigation measures have been implemented, CMC will offer one on one briefings with the affected residents. Where this occurs during the night period CMC will offer one on one briefings with the affected residents and offer alternative accommodation. Resident circumstances will also be considered on a case by case basis.

Any additional specific details on the physical noise control measures that will be implemented for the OOHW will be provided in the OOH forms and the OOHW submissions.

3.5 Lighting

During OOH activities, any temporary light that is required to be erected for the works must be directed downwards and away from residences to prevent and/or limit nuisance aspects relating to light pollution. The amount of lighting is to be minimised to the extent of only what is required for the safety of workers and traffic.

3.6 Complaints Management During Out of Hours Activities

Complaints during out of hours activities will be managed in accordance with the Complaints Management Procedure details in the *Woolgoolga to Ballina Communications and Stakeholder Engagement Strategy* and HC2G Community Action Plan.

3.7 OOH Compliance Monitoring, Auditing & Reporting

Inspections of OOH activities will be undertaken by the Environmental Officer(s) or the Environmental Manager. Any non-conformances identified will be highlighted and an environmental inspection report (minor issues) or an environmental improvement notice/environmental incident report completed.

Representative noise monitoring is to be carried out during the work activities (e.g. first night, periodic) for each Activity (excluding Type 1 and Type 3 activities) and Location to confirm the efficacy of the predicted impacts.

Where complaints are received for OOH activities, noise monitoring will be offered to complainants.

All results of noise monitoring undertaken will be provided to Roads and Maritime as part of monthly reporting.

Where a non-conformance is detected or monitoring results are outside of the expected range:

- the possible cause will be for the non-conformance will be identified;
- relevant personnel will be contacted and advised of the problem;
- the Environmental Manager or Environmental Officer will review all reasonable and feasible mitigation measures that are being implemented with the Project Engineer and / or Superintendent;
- an agreed action will be identified; and
- the action will be implemented to rectify the problem.

Non-conformances relating to the Environmental Protection Licence (EPL) will be notified to the EPA and DP&E through the EPL monthly compliance report. The DP&E will be further notified of any non-conformances through the 6 monthly compliance reports.

All audible OOHW will be reported in the monthly EPL compliance report and 6 monthly compliance report submitted to the DP&E and EPA. The report will include the results from monitoring during the OOHW, outline complaints received and the steps taken to resolve complaints. In addition, all works will be reported and discussed at each monthly ERG.

Table 2: 'Activities to be undertaken'

Item No	Activity	Activity Description	Location	Justification for OOHW	Plant Requirements	Indicative Timing
1	Service adjustments	Location and relocation and protection works electrical, water, sewer, Telstra services and street lighting involving road sawing, rock hammering, directional drilling and excavation	Various locations for lenghth of project	• Unavailable off-peak utility shutdown period during normal hours. • restricted Pacific Highway Road (Road Occupancy Licence (ROL) restrictions)	• Excavators • Piling rig • Drill rig • Cranes • Rock hammer attachment • Road sawing attachment • Road saw • EWP • Delivery truck • Potholing and vacuum truck • Small compaction equipment • Lighting equipment	May – Aug 15
2	Clearing & Grubbing	Felling & clearing of trees & removal of tree roots, grass etc. from construction areas adjacent to the Pacific Highway Interface & Local Road Interface	Extent of project	Unsafe work zone adjacent to traffic	• Chainsaw • Mulcher • Trucks • Waste containers • Excavator • Sweeper trucks • Water trucks • Lighting equipment	May – Nov 15
3	Traffic management / Road furniture	Erect temporary barriers, temporary signs, temporary line markings, temporary roads/access, survey works, any required adjustment to existing road furniture	Extent of project	• restricted Pacific Highway & local Road (ROL restrictions) • unsafe work zone to adjacent traffic	• Mobile crane • Crane truck • Trucks • Light vehicles • Backhoe • Line marking truck & equipment	May 15 to Dec 16
4	Demolition	Pavement, barriers, bridge, kerb & gutter, culverts, guard rail involving road sawing, hammering, load & dispose	Halfway Creek, and various locations	• restricted Pacific Highway Road (ROL restrictions) • unsafe work zone to adjacent traffic	• Excavators • Rock Hammers • Pulverisers • Cranes • LoaderRoad saw / hand saw	Jun 15 Dec 16

Item No	Activity	Activity Description	Location	Justification for OOHW	Plant Requirements	Indicative Timing
					• Jack Hammers • Dump trucks • Backhoe • Lighting equipment	
5	Earthworks	Topsoil stripping, road sawing, material excavation, road construction, survey works adjacent to the Pacific Highway Interface & Local Road Interface	Extent of project	• restricted Pacific Highway Road (ROL restrictions) • unsafe work zone to adjacent traffic minimise local road traffic delays	• Excavators • Rock Hammers • Loader / backhoe • Road saw / hand saw • Jack Hammers • Vibratory Roller/ Compactors • Dump trucks/ Bogie • Water cart • Sweeper truck • Lighting equipment	May 15 Feb 16
6	Drainage	Removal and/or installation of pipes, pits, headwalls, kerb & gutter, no fines concrete, open drains & channels, survey works, water diversions/pumping, micro tunneling/pipe jacking adjacent to the Pacific Highway Interface & Local Road Interface	Various locations along the extent fo project	• Highway & local Road (ROL restrictions) • unsafe work zone to adjacent pedestrians, cyclists & traffic	• Excavators • Rock hammers • Loader / backhoe • Road saw / hand saw • Jack Hammers • Crane truck • Mobile crane • Tipper truck • Water cart • Micro-tunnel machine & pipe jacking • Vibratory roller/ hand held compaction equipment • Water pumps • lighting equipment	June 15 Dec 16
7	Major deliveries	Oversize Loads - Loading and unloading of equipment and plant; Material deliveries required for OOH works.	Halfway Creek, Wells Crossing, Main Compound, Batch Plant near	• Restricted Pacific Highway Road (ROL restrictions) • Restricted site access • unsafe work zone to	• Mobile cranes • Semi-trailers • Tip/delivery trucks	May 15 – Dec 16

Item No	Activity	Activity Description	Location	Justification for OOHW	Plant Requirements	Indicative Timing
			Parker Rd	adjacent traffic	• Loader / backhoe • Lighting equipment	
8	Pavement works Including mainline & local roads, emergency uturns & interface works	Batching, delivery and laying of concrete pavements, Saw cutting, Laying of asphalt, spray sealing, profiling, load & dispose of old asphalt, minor excavation, survey works.	Various lovations across alignment as required	• Ambient temperature requirements for placement of concrete, Saw-cutting • requirements for placed concrete restricted Pacific Highway Road (ROL restrictions) • unsafe work zone to adjacent traffic	• Compressor • Hand operated jack • hammers • Bobcat mounted scabbler • Multi Rubber tyred roller • Drum Rollers • Skid steer or tractor mounted sweeper • Water truck • Hot bitumen equipment • Hot asphalt pavers • Semi-trailers & bogie tippers • Line marking equipment • Mobile crane • Excavator • Backhoe • Lighting equipment • Concrete pavers • Concrete Agitator Trucks • Profiler • Concrete vibrator • Concrete saw • Generator	Nov 15 – Dec 16
9	Finishing works / Road furniture	Line marking, traffic signs, reflectors, guard rails, concrete barriers, fencing, landscape works, survey works	Throughout project	• restricted Pacific Highway Road (ROL restrictions) • unsafe work zone to adjacent traffic	• Line marking equipment & trucks • Mobile crane • Crane truck • Rattle gun • Compressor	Dec 15 – Dec 16

Item No	Activity	Activity Description	Location	Justification for OOHW	Plant Requirements	Indicative Timing
					• Genset • Concrete truck • Backhoe • Auger • Slip-form machine • Formwork system • Light compaction equipment • Trucks • Small Tools • Light vehicles • Lighting equipment • Sweeper truck	
10	Traffic switches / Road furniture	Temporary closure Pacific Highway lanes to tie-in traffic switch barriers, line marking, signs, pavement	Chainages: 1700 – 17400, 20200 – 20800, 21500 – 22300, 23400 – 23600, 28000 - 28400	• restricted Pacific Highway Road (ROL restrictions) • unsafe work zone to adjacent traffic	• Line marking equipment &trucks • Mobile crane • Crane truck • Rattle gun • Compressor • Genset • Concrete truck • Backhoe • Auger • Pavement equipment • Light vehicles • Lighting equipment • Sweeper and vacuum truck	As required throughout project
11	Ancillary Facility operation	Operation of main compound or satellite facility for use during OOHW. Some unloading of materials associated with the OOHW may be required. Operation of concrete and asphalt batch plants as required.	Refer to EMP for locations of ancillary facilities/batch plant locations	• Ambient temperature requirements for placement of concrete. • Use of amenities/facilities at main compound or satellite facility during OOHW. • Asphalt required for OOHW at tie-ins / traffic switches.	• Light vehicles • Lighting equipment • Delivery trucks • Mobile crane • Concrete and asphalt batch plants • Loader	As required throughout project

Item No	Activity	Activity Description	Location	Justification for OOHW	Plant Requirements	Indicative Timing
					• Excavator • Truck and dogs • Grader	
12	Bridge and retaining works	Delivery of precast super-tee girders including any final access preparation works	Halfway Creek and Wells Crossing	Track possessions required for erection of temporary works and girders, installation of deck furniture and removal of temporary works	• Cranes • EWP's • Trucks • Small powered equipment • Saw-cutting / grinding • Lighting equipment	Jun 15 – Dec 15
		Mobilisation of cranes including any final access preparation works	Halfway Creek and Wells Crossing	• May need to close lanes of Pacific Hwy to allow access of cranes. • Closures only allowed outside peak hours.	Cranes driving into site (but not working/lifting)	
		Bridge Deck Pour	Halfway Creek and Wells Crossing	During hot weather it may be necessary to start or finish bridge deck pours outside normal work hours to avoid excessive heat	• Crane • Concrete pump • Concrete vibrator • Welding equipment • Excavator	

4 Appendix

Appendix A: **Out of Hours Request Form**

Appendix E Out of hours works application form

Out of Hours Work Application Form

CIV-EN-FRM-0258

Approver: Systems and IT Manager	Reviewer: HSE Manager	Reviewed: 27/05/2014

Out Of Hours Work

Project name		Project number	
Date		Time	

Location of Out of Hours Work (OOHW) (Road name, chainage and description):	
Senesiive Receptors:	
Proposed out of Hours Work Date and Times:	_ _/_ _/_ _

Reason for OOHW:

- ☐ Type 2 OOHW – Works predicted to be less than 5dB(A) above background levels at relevant sensitive receivers
- ☐ Type 3 OOHW – resident agreement works
- ☐ Type 4 OOHW – works as defined in the OOHW procedure
- ☐ Type 5 OOHW - works as defined in the OOHW procedure

Description of proposed Out of Hours Works required and reason. *(include plant and equipment to be used and attach a map of location)*

Proposed Noise Mitigation Measures

Predicted Iimpacts After Mitigation

Residents' Comments			
Name:		Address:	
Date and Time contacted			
Comments			
Name:		Address:	
Date and Time contacted			
Comments			
Name:		Address:	
Date and Time contacted			
Comments			

Permit Completed By:

Name .....

Organisation .....

Signature & Date .....

Permit Approved By CMC Environment Manager:

Name .....

Permit number .....

Signature & Date .....