

Appendix B3

Noise and vibration management sub plan

Nambucca Heads to Urunga

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- Appendix B Sensitive receivers and monitoring locations**
- Appendix C Blast management plan**
- Appendix D Out of hours works procedure**

Glossary / Abbreviations

Abbreviation	Meaning
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.
DECC	Department of Environment and Climate Change (now EPA)
EA	Environmental Assessment
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	<i>Environmental Planning and Assessment Act 1979</i>
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..
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.
RBL	The Rating Background Level for each period is the medium

Abbreviation	Meaning
	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)
SoC	Revised Statement of Commitments included in the Submissions Report
SWP	Sound Power Level
SPL	Sound Pressure Level

1 Introduction

1.1 Context

This Construction Noise and Vibration Management Sub Plan (CNVMP or Plan) forms part of the Construction Environmental Management Plan (CEMP) for the upgrade of the Pacific Highway from Nambucca Heads to Urunga (NH2U). The NH2U Project is Stage 1 of the Warrell Creek to Urunga (WC2U) Project, approved by the Minister for Planning and Infrastructure in 2011.

The NH2U section of the WC2U Project involves the construction of approximately 21.6km of new highway from south of Nambucca Heads Interchange to the existing Waterfall Way Interchange at Raleigh, north of Urunga. The NH2U Project is being constructed by Lend Lease.

This CNVMP has been prepared to address the requirements of the Minister's Conditions of Approval (CoA), the Roads and Maritime Statement of Commitments (SoC), the mitigation measures listed in the Warrell Creek to Urunga Environmental Assessment (EA) and all applicable legislation.

1.2 Background

The *Warrell Creek to Urunga – Upgrading the Pacific Highway - Environmental Assessment* (RTA 2010) assessed noise and vibration impacts on sensitive receivers and structures from construction of the Project.

As part of EA development, a detailed construction and operational noise and vibration assessment was prepared to address the Environmental Assessment Requirements issued by the then Department of Planning. The noise and vibration assessment was included in the EA as Working Paper 3 – Noise and Vibration.

The EA 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.

1.3 Environmental management systems overview

The overall Environmental Management System for the NH2U Project is described in the Construction Environmental Management Plan (CEMP).

The CNVMP is part of Lend Leases environmental management framework for the Project, as described in Section 4.1 of the CEMP. In accordance with CoA B.31(c), this Plan has been developed in consultation with the NSW Environment Protection Authority (EPA).

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 and 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 Lend Lease's 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 Lend Lease 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 EA. The assessment in the EA considered the following guidelines and standards:

- 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) (DECCW 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”.

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.
- Ensure appropriate measures are implemented to address the relevant CoA and SoC outlined in Table 3.1 and Table 3.2, and the mitigation measures detailed in the EA.
- Ensure appropriate measures are implemented to comply with all relevant legislation and other requirements as described in Section 3.1 and Section 3.3 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, CoA and SoC.
- Implement 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).
- That 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:

- Roads and Maritime 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) (DECCW 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 below. 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
CoA B31 c)	As part of the Construction Environment Management Plan for the project required under condition B30 of this approval, the Proponent shall prepare and implement the following...: 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 include, but not necessarily be limited to:	This plan
	i. identification of nearest sensitive receptors and relevant construction noise and vibration goals applicable;	Chapter 4, Chapter 5

CoA No.	Condition Requirements	Document Reference
	<ul style="list-style-type: none"> ii. identification of key noise and/or vibration generating construction activities (based on representative construction scenarios) that have the potential to impact on surrounding sensitive receivers including expected noise/ vibration levels; iii. identification of all feasible and reasonable measures proposed to be implemented to minimise construction noise and vibration impacts (including construction traffic noise impacts); iv. procedure for dealing with out-of-hour works in accordance with condition C4, including procedures for notifying the Director General concerning complaints received in relation to the extended hours approved under condition C4(d); v. procedures and mitigation measures to ensure relevant vibration and blasting criteria are achieved, including a suitable blast program supported by test blast results, 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 building damage; vi. 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; and 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 significant exceedances of relevant noise and vibration goals are detected. 	<p>Chapter 7, Appendix A</p> <p>Chapter 8</p> <p>Appendix D</p> <p>Chapter 8, Section 9.3, Appendix C</p> <p>Chapter 8, Community Involvement Plan</p> <p>Section 9.3, Section of 8.3 of the CEMP</p>
C3	<p>The Proponent shall only undertake construction activities associated with the project during the following standard construction hours:</p> <ul style="list-style-type: none"> a. 7:00am to 6:00pm Mondays to Fridays, inclusive; and b. 8:00am to 1:00pm Saturdays; and c. at no time on Sundays or public holidays. 	Chapter 8
C4	<p>Works outside of the construction hours identified in conditions C3 may be undertaken in the following circumstances:</p> <ul style="list-style-type: none"> a. works that generate noise that is not audible at any sensitive receptor; b. for delivery of materials required outside these 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. construction works undertaken through sparsely populated areas in which sensitive receptors are located greater than 300 metres away from the project boundary. In this case construction is permissible during the following hours: 6.00am to 6.00pm Monday to Friday and 7.00am to 4.00pm Saturdays and at no time on Sundays or public holidays. These works hours may be reviewed and/ or revoked by the Director General in consultation with the EPA in the case of excessive or unresolved noise complaints; or e. where an EPL applies to the construction of the project, construction hours which are approved in accordance with the conditions of an EPL for the project; or f. where an EPL does not apply to the construction of the project, Out of Hours Works as agreed to by the Director general in accordance with condition C5. 	Chapter 8 and Appendix D

CoA No.	Condition Requirements	Document Reference
C5	<p>For the purposes of condition C4 (f), certain construction activities (Out of Hours Works) may be allowed to occur outside the construction hours specified in conditions C3 with the prior written approval of the Director General. Requests for out of hours approval will be considered for construction activities which cannot be undertaken during the construction hours specified in conditions C3 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 must be accompanied by:</p> <ol style="list-style-type: none"> details of the nature and need for activities to be conducted during the varied construction hours; written evidence to the EPA and the Director General that activities undertaken during the varied construction hours are justified, appropriate consultation with potentially affected receivers and notification of Council has been undertaken, issues raised have been addressed, and all feasible and reasonable mitigation measures have been put in place; and evidence of consultation with the EPA on the proposed variation in standard construction hours. Despite the above, Out of Hours Works may also occur in accordance with an approved Construction Environment Management Plan or Construction Noise and Vibration Management Plan for this project, where that plan provides a process for considering the above on a case by case or activity specific basis by the Proponent, including factors a) to c) above. 	Chapter 8 and Appendix C
C6	<p>Blasting associated with the project shall only be undertaken during the following hours</p> <ol style="list-style-type: none"> 9:00 am to 5:00 pm, Mondays to Fridays, inclusive; 9:00 am to 1:00 pm on Saturdays; and at no time on Sundays or public holidays. <p>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.</p>	Chapter 8 and Appendix C
C7	<p>The Proponent shall implement all 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) during construction activities. 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 B31(c) of this approval.</p>	Chapter 8, Section 9.3, Section 9.4
C8	<p>The Proponent shall implement all feasible and reasonable mitigation measures with the aim of achieving the following construction vibration goals and ground-borne noise levels:</p> <ol style="list-style-type: none"> for structural damage vibration, the vibration limits set out in the German Standard D/N 4150 Part 3-1999 Structural Vibration in Buildings - Effects on Structures; for works in the vicinity of the heritage structures, the vibration limits set out in the German Standard DIN 4150-3: 1999 Structural Vibration - part 3: Effects of vibration on structures; and for human exposure, the acceptable vibration values set out in the Environmental Noise Management Assessing Vibration: A Technical Guideline (DEC 2006); and the ground-borne noise levels set out in the Interim Construction Noise Guidelines (DECC, 2009). 	Chapter 8, Appendix C

CoA No.	Condition Requirements	Document Reference						
C9	<p>The Proponent shall ensure that airblast overpressure generated by blasting associated with the project does not exceed the criteria specified in Table 1 when measured at the most affected residence or other sensitive receiver. To ensure that criteria are satisfied at the most affected residence or other sensitive receiver, blasting trials shall be undertaken prior to the commencement of the project blasting program, with results from the trials used to determine site specific blast design to satisfy the criteria specified in Table 1.</p> <p>Table 1 Airblast overpressure criteria</p> <table border="1"> <thead> <tr> <th>Airblast overpressure (dB(Lin Peak))</th> <th>Allowable exceedance</th> </tr> </thead> <tbody> <tr> <td>115</td> <td>5% of total number of blasts over a 12 month period</td> </tr> <tr> <td>120</td> <td>0%</td> </tr> </tbody> </table>	Airblast overpressure (dB(Lin Peak))	Allowable exceedance	115	5% of total number of blasts over a 12 month period	120	0%	Chapter 8, Appendix C
Airblast overpressure (dB(Lin Peak))	Allowable exceedance							
115	5% of total number of blasts over a 12 month period							
120	0%							
C10	<p>The Proponent shall ensure that ground vibration generated by blasting associated with the project does not exceed the criteria specified in Table 2 when measured at the most affected residence or other sensitive receiver. To ensure that criteria are satisfied at the most affected residence or other sensitive receiver, blasting trials shall be undertaken prior to the commencement of the project blasting program, with results from the trials used to determine site specific blast design to satisfy the criteria specified in Table 2.</p> <p>Table 2 Peak particle velocity criteria</p> <table border="1"> <thead> <tr> <th>Peak particle velocity (mms-1)</th> <th>Allowable exceedance</th> </tr> </thead> <tbody> <tr> <td>5</td> <td>5% of total number of blasts over a 12 month period</td> </tr> <tr> <td>10</td> <td>0%</td> </tr> </tbody> </table>	Peak particle velocity (mms-1)	Allowable exceedance	5	5% of total number of blasts over a 12 month period	10	0%	Chapter 8, Appendix C
Peak particle velocity (mms-1)	Allowable exceedance							
5	5% of total number of blasts over a 12 month period							
10	0%							

CoA No.	Condition Requirements	Document Reference
C11	<p>The blasting criteria identified in condition C9 and/ or C10 do not apply where the Proponent has a written agreement with the relevant landowner to exceed the criteria identified in condition C9 and/ or C10 and the Director General has approved the terms of the written agreement. In obtaining the Director General approval for any such agreement, the Proponent shall submit to the Director General:</p> <ol style="list-style-type: none"> details of the proposed blasting program and justification for the proposed increase to blasting criteria including alternatives considered (where relevant); an assessment of 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; details of the blast management, mitigation and monitoring procedures to be implemented; and details of consultation undertaken and agreement reached with the relevant landowners (including a copy of the agreement in relation to increased blasting limits). <p>The following exclusions apply to the application of this condition:</p> <ol style="list-style-type: none"> any agreements reached may be terminated by the landowner at any time should concerns about the increased blasting limits be unresolved; the blasting limit agreed to under any agreement can at no time exceed a maximum Peak Particle Velocity vibration level of 25 mm/s or maximum Airblast Overpressure level of 125 dBL; and the provisions under condition C'11 (to increase applicable blast criteria in agreement with the relevant landowners) do not apply where the property is a heritage property. 	Chapter 8, Appendix C

3.3 Statement of commitments

Relevant SoC are listed Table 3-2 below. This includes reference to required outcomes, the timing of when the commitment applies and relevant documents or sections of the NVMP influencing the outcome and implementation.

Table 3-2 Statements of commitment relevant to this NVMP

Outcome	Ref #	Commitment	Timing	NVMP Reference
Minimise construction noise and vibration impacts.	N1	<p>Further investigation of all feasible and reasonable mitigation and management measures to minimise construction noise at sensitive receivers will occur as part of detailed design (including consideration of early implementation of operational noise mitigation measures).</p> <p>Noise and vibration monitoring will measure against predicted levels and assess effectiveness. Implementation of further feasible and reasonable mitigation measures will occur where necessary.</p>	Pre-construction and construction	Chapter 8, Section 9.3
	N2	<p>Consultation with affected education institutions during construction works in their vicinity will attempt to limit audible construction works during important events, such as examination periods.</p>	Pre-construction / Construction	Chapter 8, Community Involvement Plan

Outcome	Ref #	Commitment	Timing	NVMP Reference
	N3	Best practice mitigation and management measures will be used to minimise construction noise and vibration at sensitive receivers.	Construction	Chapter 8
	N4	<p>Construction would normally be limited to the following hours:</p> <ul style="list-style-type: none"> • Between 6am and 6pm Monday to Friday. • Between 7am and 4pm Saturday. <p>There would be no works outside these hours or on Sundays or public holidays except:</p> <ol style="list-style-type: none"> a) Works that do not cause construction noise to be audible at any sensitive receivers. b) For the delivery of materials required outside these hours by the Police or other authorities for safety reasons. c) Where it is required in an emergency to avoid the loss of lives, property and/or to prevent environmental harm. d) Any other work as agreed through negotiations between the RTA and potentially affected sensitive receivers. Any such agreement must be recorded in writing and a copy kept on site for the duration of the works. e) Where the work is identified in the CNVMP and approved as part of the Construction Environmental Management Plan. f) As agreed by Department of Planning and or Department of Environment, Climate Change and Water in an EPL for the construction of the Proposal. <p>Local residents and the Department of Environment, Climate Change and Water must be informed of the timing and duration of work approved under items (d) and (e) at least 48 hours before that work commences.</p>	Construction	<p>*Note that Project's construction hours are contained in CoA C3-C4 which prevail over those nominated in SoC N4.</p> <p>Hours of construction are addressed in Chapter 8 and Appendix D</p>
	N5	All reasonable attempts will be made to contact sensitive receivers located within 500 metres of a blast location. The contact will be at least 48 hours before a blast and will include a schedule of blast time(s), and a telephone contact name and number.	Construction	Chapter 8 and Appendix B
	N6	<p>Where complaints relating to noise or vibration impacts as a result of extended workings cannot be satisfactorily resolved with the affected residents then works hours will revert back to standard working hours at that particular location for that particular activity. Resident(s) will be consulted before recommencing any works outside standard working hours.</p> <p>Any complaints received in relation to working hours will be made available to DoP and DECCW.</p>	Construction	Chapter 8

4 Existing environment

4.1 Sensitive receivers

The Project is located within the Nambucca and Bellingen local government areas. Land use is characterised by a mix of agricultural land uses, bushland, forests, small settlements and the townships of Nambucca Heads, Bellwood and Urunga. These townships are situated on the Nambucca and Kalang Rivers.

As part of the EA, a noise assessment identified and considered potential noise impacts for each individual dwelling along the 22 kilometre alignment and within one kilometre either side (the study area). A total of 280 residences are located within the study area. Residences are shown in Appendix B.

4.2 Ambient noise

In addition to the noise assessment undertaken as part of the EA, more recent noise monitoring was conducted in May 2012 at 14 locations and in June 2013 at another 12 locations at a range of distances from the existing highway. 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. Measurements affected by extraneous noise including wind greater than 5 m/s and rain, were excluded from the recorded data in accordance with the NSW EPA and Roads and Maritime policies.

A map showing all identified sensitive receivers and monitoring locations is provided in Appendix B, with a summary of the noise monitoring results in Table 4-1.

Table 4-1 below incorporates NSW EPA requirements that the level of background and ambient noise be assessed separately for the daytime, evening and night-time periods. These periods are defined as follows:

- **Day** is defined as 7:00am to 6:00pm, Monday to Saturday and 8:00am to 6:00pm Sundays & Public Holidays.
- **Evening** is defined as 6:00pm to 10:00pm, Monday to Sunday & Public Holidays.
- **Night** is defined as 10:00pm to 7:00am, Monday to Saturday and 10:00pm to 8:00am Sundays & Public Holidays.

Table 4-1 Ambient noise monitoring results (dBA)

Ref	Address	Day			Evening			Night		
		L _{A10}	L _{Aeq}	L _{A90}	L _{A10}	L _{Aeq}	L _{A90}	L _{A10}	L _{Aeq}	L _{A90}
May 2012 Noise Data										
1	6858 Pacific Hwy	68	65	49	70	65	42	68	63	34
2	21 Auld Cl	57	54	47	53	52	44	52	51	39
3	19 Valla Rd	60	57	47	61	57	44	59	55	39
4	7000 Pacific Hwy	68	65	50	69	65	43	67	63	33
5	7119 Pacific Hwy	53	52	45	54	51	44	53	50	39
6	7216 Pacific Hwy	58	56	47	58	55	43	57	54	38
7	6 East West St	60	57	47	62	57	42	60	56	38
8	7337 Pacific Hwy	62	59	48	64	60	43	62	58	39
9	7370 Pacific Hwy	65	62	49	67	62	43	65	61	38
10	7525B Pacific Hwy	62	60	49	64	60	42	62	58	40
11	7643 Pacific Hwy	60	57	49	61	57	44	60	56	41
12	20 Short Cut Rd	60	58	51	61	57	45	59	55	40
13	60 Old Pacific Hwy	53	52	42	51	48	39	50	46	34
14	127 Reevers Rd	62	60	52	63	61	48	62	58	40
June 2013 Noise Data										
1A	70 Foxes Rd	-	46	35	-	47	38	-	46	37
2A	47 Boggy Creek Rd	-	48	38	-	47	39	-	45	36
6A	7 Valla Beach Rd	-	63	42	-	58	42	-	56	39
8A	7440 Pacific Hwy	-	51	40	-	51	42	-	53	43
9A	7443 Pacific Hwy	-	53	45	-	54	45	-	51	40
11A	1316 Martells Rd	-	51	42	-	52	44	-	49	40
12A	358 South Arm Rd	-	41	30*	-	49	33	-	51	34
13A	354 South Arm Rd	-	45	30	-	44	35	-	47	39
14A	17 Ridgewood Dr	-	47	35	-	46	37	-	41	34
15A	79 Short Cut Rd	-	49	36	-	46	38	-	42	33
16A	63 Waterfall Way	-	52	44	-	52	41	-	49	35
17A	100 Old Pacific Hwy	-	54	47	-	57	45	-	53	38

5 Noise and vibration criteria for NSW

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

- The 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 summarised and discussed in this Chapter.

5.1 Construction noise and assessment objectives

5.1.1 ICNG

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.

Table 5-1 sets out Noise Management Level (NMLs) at residences and how they are to be applied. The rating background level (RBL) is used when determining the NML level and 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.

NMLs apply at the property boundary that is most exposed to construction noise, 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.

Table 5-1 Noise at residents using quantitative assessment

Time of day	Management Level $L_{Aeq} (15 \text{ min})$	How to apply
Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 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. <ul style="list-style-type: none"> Where the predicted or measured $L_{Aeq} (15 \text{ min})$ 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. <ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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.

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, with some buildings achieving 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 (e.g. reading, meditation).

5.2 Adopted project noise management levels

Based on measured noise levels described in Section 4.2, the project-specific construction noise objectives for each representative monitoring location have been determined and are presented in Table 5-3. Considering the possibility of works outside standard construction hours additional management levels for these times are also included in the construction noise objectives.

RBLs and NMLs for each receiver have been selected based on the most representative noise monitoring location, taking into consideration comparable distances from the Pacific Highway and local land uses. Note, the location of the background noise monitoring locations in Table 5-3 are detailed in Appendix B.

Table 5-3 Project-specific construction noise objectives

Mon. Loc.	Setback from the existing highway, m	Standard hours 7am – 6pm Mon-Fri 8am – 1pm Sat		Day Extended hours 1pm – 6pm Sat 8am – 6pm Sun & Public Holidays		Evening hours 6pm – 10pm Mon-Sun & Public Holidays		Night hours 10pm – 7am Mon-Sat and 10pm – 8am Sundays & Public Holidays	
		RBL	Objective	RBL	Objective	RBL	Objective	RBL	Objective
1	65	49	59	49	54	42	47	34	39
2	55	47	57	47	52	44	45	39	44
3	90	47	57	47	52	44	49	39	44
4	55	50	60	50	55	43	48	33	38
5	175	45	55	45	50	44	49	39	44
6	90	47	57	47	52	43	48	38	43
7	75	47	57	47	52	42	47	38	43
8	120	48	58	48	53	43	48	39	44
9	75	49	59	49	54	43	48	38	43
10	70	49	59	49	54	42	47	40	45
11	100	49	59	49	54	44	49	41	46
12	110	51	61	51	56	45	50	40	45
13	240	42	52	42	47	39	44	34	39
14	130	52	62	52	57	48	53	40	45
1A	250	35	45	35	40	38	43	37	42
2A	450	38	48	38	43	39	44	36	41
6A	175	42	52	42	47	42	47	39	44
8A	290	40	50	40	45	42	47	43	48
9A	220	45	55	45	50	45	50	40	45
11A	250	42	52	42	47	44	49	40	45
12A	> 2000	30	40	30	35	33	38	34	39
13A	> 2000	30	40	30	35	35	40	39	44
14A	1280	35	45	35	40	37	42	34	39
15A	700	36	46	36	41	38	43	33	38
16A	250	44	54	44	49	41	46	35	40
17A	110	47	57	47	52	45	50	38	43

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 5-4).
- Impulsive vibration – up to three instances of sudden impact e.g. dropping heavy items, per monitoring period (see Table 5-5).
- Intermittent vibration – such as from drilling, compacting or activities that would result in continuous vibration if operated continuously (see Table 5-6).

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 5-7. The criteria are frequency dependent and specific to particular categories of structure.

Table 5-4 Continuous vibration acceleration criteria (m/s²) 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 5-5 Impulsive vibration acceleration criteria (m/s²) 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 5-6 Intermittent vibration impacts criteria (m/s²) 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 5-7 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" have been used to establish goals for assessing blast air-blast overpressure and ground vibration.

The following blast assessment parameters, as detailed in CoA C9 and C10 have been adopted for assessing and managing blast impacts.

As per MCoA C11, C9 and C10 do not apply where the Proponent has a written agreement with the relevant landowners to exceed and the Director General has approved the terms of the written agreement. In obtaining the Director General approval for any such agreement, the Proponent must submit to the Director General:

- a) details of the proposed blasting program and justification for the proposed increase to blasting criteria including alternatives considered (where relevant);
- b) an assessment of 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;
- c) details of the blast management, mitigation and monitoring procedures to be implemented; and
- d) details of consultation undertaken and agreement reached with the relevant landowners (including a copy of the agreement in relation to increased blasting limits).

It also should be noted that 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;
- (b) the blasting limit agreed to under any agreement can at no time exceed a maximum Peak Particle Velocity vibration level of 25 mm/s or maximum Airblast Overpressure level of 125 dBL; and
- (c) the provisions under condition C11 (to increase applicable blast criteria in agreement with the relevant landowners) do not apply where the property is a heritage property.

Table 5-8 Airblast overpressure criteria

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

Table 5-9 Peak particle velocity criteria

Peak particle velocity (mms-1)	Allowable exceedance
5	5% of total number of blasts over a 12 month period
10	0%

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.

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 categories of construction activity likely to interact with these receivers are identified in Table 6-1.

Table 6-1 Summary of construction activity aspects

■ Clearing and grubbing (discrete locations and broad area)	■ Soft soil treatment
■ Geotechnical investigation	■ Quarrying – crushing and screening and rock hammering
■ Earthworks	■ Bridgeworks (piling and construction)
■ Drilling and blasting	■ Demolition of dwellings and other structures
■ Drainage infrastructure	■ Road furnishing
■ Pavement removal	■ Retaining walls
■ Paving and concrete saw cutting	■ Stockpiling
■ Service relocation	■ Ancillary site operations (e.g. batch plants and compounds)

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 types and numbers of equipment in use
- Proximity to sensitive receivers
- Topography and other physical barriers
- Hours/duration of construction works
- Ground condition
- The condition of sensitive receivers
- Existing noise levels, e.g. from 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/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.

7.1 Construction activities

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 A provides a list of equipment and a correlating sound pressure level.

Table 7-1 Construction scenarios and associated plant and equipment

Scenario reference	Construction activity	Typical plant and equipment	Indicative Timing
A	Clearing and grubbing – discrete basin locations	Chainsaw, 25t Dump truck, excavator with mulcher attachment	December 2013 – August 2014
B	Clearing and grubbing – broad area	D8/D11 Bulldozer, 7t – 40t tracked excavators, tub grinder & mulcher, Front End Loader, Sweeper trucks, Water trucks	December 2013 – September 2014
C	Geotech Investigation	Truck mounted drills, backhoe, excavators, pumps, generators Concrete agitators, truck and dogs, trucks, piling rigs	August 2013 – April 2014
D	Earthworks	D8/D11 Bulldozers, 651E Open bowl Scrapers, 637E/G Twin powered scrapers, Rock Breakers, 7t – 100t tracked excavators, Graders, Loader / backhoe, Vibratory Roller, Compactors, Vibratory Rammer, Vibroplates, Dump trucks, Articulated Trucks, Bogie, Truck and Dogs, Jack Hammers, Water cart, Sweeper truck	December 2013 – May 2015
E	Drilling and blasting – Preparation	Air track drill, explosives truck	May 2014 – January 2015
F	Drilling and blasting – clean up	Rock hammer, 30 t excavator, dump truck, bulldozer	May 2014 – January 2015
G	Crushing and screening	30t – 50t tracked excavators, crusher and screening machine, loader, Truck and Dogs, water cart	May 2014 – May 2015
H	Drainage infrastructure	45t tracked excavator, Loader / backhoe, Dump truck, Crane truck, Mobile crane, Sheet piling equipment, Water cart, micro-tunnel machine & pipe jacking, vibratory roller, hand held compaction equipment	January 2014 – August 2015

Scenario reference	Construction activity	Typical plant and equipment	Indicative Timing
I	Bridge work - Piling (bored or impact)	Hammer piling rig, sheet piling rig (vibratory), drill rig, compressor, concrete agitator trucks, concrete pumps, mobile cranes, concrete vibrators.	January 2014 – July 2015
J	Bridge works - construction	220 t Crane, Concrete pump, Concrete vibrator, Welding equipment, 7t – 40t tracked excavator, Pneumatic jackhammer, Delivery truck, Concrete truck, motor boat, generator, water pump, barge, lighting tower, small mobile cranes	January 2014 – July 2015
K	Pavement removal	Profiler, dump trucks, road saw, road trucks, excavator 7 – 40t, road sweeper	January 2014 – December 2015
L	Demolition of dwellings and other structures	Excavator with rock hammer attachment, Pulverisers, 7t – 40t Tracked excavators, Dump trucks, Backhoe, Cranes, Loader, Jack Hammers	August 2013 – December 2013
M	Paving	Concrete pavers, Hot asphalt pavers, Hot bitumen equipment, Concrete Agitator Trucks, Compressor, Hand operated jack hammers, Bobcat mounted scrabbler, Multi Rubber tyred roller, Drum Rollers, Skid steer or tractor mounted sweep, Water truck, , Semi trailers & bogie tippers, Mobile crane, Backhoe, Profiler, Concrete vibrator, Generator	April 2014 – December 2015
N	Pavement saw cutting	Concrete saw, Light vehicles, road sweeper	April 2014 – December 2015
O	Road furniture installation	Mobile crane, Crane truck, Trucks, Light vehicles, Backhoe, Line marking truck & equipment, Light compaction equipment, Small Tools, Rattle gun, Compressor, Genset, Concrete truck, Auger, Slip-form machine, Formwork system, Light vehicles, Steel post driver, Sweeper truck.	August 2014 – December 2015
P	Service Adjustments	7t – 40t Excavators, Piling rig, Rock hammer attachment, Road saw, EWP, Delivery truck, Drill rigs (directional drilling), small compaction equipment	August 2013 – December 2014
Q	Retaining Walls	7t – 40t Excavator, Piling rig, Concrete truck, Concrete Pump, Crane truck, Mobile cranes, Semi-trailers, Tip trucks, Small tools	December 2013 – December 2014
R	Soft Soil Ground Improvement (wick drains and stone columns)	20T excavators, vibro-displacement rig, loader, dump trucks, drill rigs, excavators, bull dozers, concrete trucks, concrete pumps, concrete vibrators, impact pile driver	September 2013 – December 2014

7.2 Construction noise impacts

7.2.1 General construction

Table 7-2, “Noise impact on sensitive receivers” provides a summary of predicted noise impacts from each related construction scenario. Noise management level thresholds for each sensitive receiver location have also been provided. For ease of review and action, predicted noise levels are divided into convenient work areas as given by the construction team. The four work areas and corresponding chainages are:




- Rail to Deep Creek (61800 to 64900)
- Deep Creek to Bourkes Lane (64900 to 68400)
- Bourkes Lane to Kalang Bridge (68400 to 77700)
- North of Kalang (77700 to 82900)

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 A. Noise sources (construction equipment) are assumed to be operating in the centre of the construction corridor on existing topography, with average source heights of approximately 2 m. This does not take into account future cuttings and fills or works at the corridor boundary (discussed below).

Predicted impacts are the maximum predicted noise level of each construction scenario, i.e. where works are at their shortest distance from receivers. Hence, noise levels will increase as activity moves toward this nearest point and will then decrease as it moves away again. The distances listed in the table are the shortest distance between the centre of the corridor and receiver; however, where works are at the corridor boundary, higher noise levels are expected, as discussed below.

For activities considered to be annoying such as rock drilling, vibratory rolling, road profiling, impact piling and rock hammering, a 5 dB(A) penalty has been applied to predicted levels in line with the ICNG.

Predictions are summarised with the following highlights for quick analysis:

	expected to exceed the night NML
	expected to exceed the evening NML
	expected to exceed the day NML
N/a	In excess of 1km from the works – not applicable

7.2.2 Results discussion

Table 7-2, “Noise impact on sensitive receivers” shows that exceedances of the project NMLs are likely for a number of scenarios and sensitive receivers, and results are discussed for each work area below.

South of Deep Creek (Ch: 61800 – 64900)

In this work area, a number of receivers are in close proximity to the corridor (the nearest being receivers 10 – 12. Clearing and earthworks are likely to exceed the day time NMLs at nearly all receivers by 1-7 dB(A), and up to 17 dB(A) at one receiver. In some instances paving and service relocation may exceed the day time NMLs for nearby receivers.

Clearly, those activities that exceed the day criteria will also exceed the evening and night criteria during out of hours works and must be managed accordingly. Many activities are expected to exceed the evening and night criteria at many receivers, as shown by the yellow and green highlights.

Deep Creek to Bourkes Lane (Ch: 64900 – 68400)

Receivers in this area are generally further from the works and are managed under a higher NML than the other areas and few are expected to exceed the daytime NMLs during the majority of construction work. The exceptions being broad clearing and earthworks activities, during which around 10 per cent of receivers are likely to experience an exceedance of day criteria. Exceedances of the evening NMLs are also predicted at approximately one third of properties during clearing and earthworks.

There are 11 receivers in close proximity to the works (the nearest of which, receiver 141, is approximately 60 m from the centre of the corridor). During other work stages, these receivers may experience noise levels that exceed the day NML. For receiver 141, daytime exceedances are also predicted during drainage works, pavement works, demolition works, bridge works and service relocations.

Of the remaining receivers, only a handful is expected to exceed the evening and/or the night NMLs during these other work stages.

Bourkes Lane to Kalang Bridge (68400 to 77700)

In this section, the majority of receivers are located more than 200 m from the works and around a third are expected to exceed the day NML during clearing and earthworks. Only a handful of receivers are likely to exceed evening and night NMLs for other activities.

North of Kalang (77700 to 82900)

Daytime NML exceedances are predicted at most receivers during clearing, earthworks, demolition, service relocation and paving activities. Exceedances of the day NMLs are predicted to occur during most work stages at receivers 189 to 197.

The majority of receivers is also predicted to exceed evening and night NMLs for activities required to be undertaken outside standard hours. This is due in part to the generally lower background noise levels, and works will need to be managed in close consultation with receivers to advise of predicted noise impacts.

Existing ground level vs. future

It is expected that the change in topography within the construction corridor as construction progresses will have some effect on predicted noise levels. Fills will reduce topographical shielding, whilst cuttings will add to it. As an indication, increase topographical shielding is expected to reduce predicted noise levels by 5 dB(A) on average across the project. In some case, larger cuttings will provide higher levels of shielding (approximately 10 dB(A)). On the contrary, fills will reduce shielding and are expected, on average to increase noise levels by up to 3 dB(A).

Centre of corridor noise sources vs. boundary sources

Where works reduce the distance between source and receiver, i.e. by moving toward the project boundary, the noise level at a sensitive receiver is likely to increase by a magnitude dependent on how close the receiver is to the boundary and how far the source closes the distance. An indicative noise level increase, assuming an average distance between the corridor centre and the boundary of 40m, is provided below, based on simple distance attenuation and ignoring other affects.

The average distance of receivers from the centre of the corridor is around 400 m and, around 70 per cent (1 standard deviation) are outside 200 m. This implies an average increase in noise level of between 1 and 2 dB(A), which is barely discernible.

Distance from the corridor centre (m)	100	150	250	500	750	1000
Approximate increase in predicted noise level (dB(A))	4	3	2	1	0.5	0

Table 7-2 Noise impact on sensitive receivers

Work area	Receiver	Distance from center of corridor, m	NML			LAeq, 15 minute maximum predicted noise level																	
			Day	Eve	Night	A discrete clearing	B Broad clearing	C Geotech investigation	D Earthworks	E Blast - drill	F Blast clean up	G Crushing	H Drainage	I Piling	J Bridge construction	K Pavement removal	L structure demolition	M Pave PCP	N Pavement saw cutting	O Road furniture installation	P Service relocation	Q Retaining walls	R Soft soils
Rail to Deep Creek (61800 to 64900)	1	440	45	43	42	26	17	41	44	0	0	0	27	28	30	36	33	33	19	26	31	23	0
	2	370	45	43	42	26	17	41	44	0	0	0	27	29	30	36	34	33	19	26	31	25	0
	3	450	45	43	42	25	16	40	44	0	0	0	26	27	30	36	33	33	18	25	30	23	0
	4	460	45	43	42	25	16	40	43	0	0	0	26	27	29	36	34	33	18	25	30	23	0
	5	470	45	43	42	26	17	41	45	0	0	0	27	27	28	36	34	33	19	26	31	22	0
	6	200	48	44	41	39	35	58	60	0	0	0	44	46	44	52	47	51	39	44	50	34	0
	7	310	48	44	41	35	29	52	59	0	0	0	38	36	39	48	45	45	33	38	44	29	0
	9	190	59	47	39	41	36	59	59	0	0	0	44	46	42	51	52	52	41	45	51	28	0
	10	130	48	44	41	38	42	64	65	0	0	0	51	46	40	50	59	59	45	51	57	38	0
	11	150	59	47	39	37	43	65	66	0	0	0	51	48	44	53	50	58	48	52	59	25	0
	12	120	59	47	39	43	44	66	66	0	0	0	51	55	51	62	49	59	49	53	59	33	0
	13	320	48	44	41	42	32	54	56	0	0	0	39	46	41	45	42	47	35	41	46	40	0
	15	440	48	44	41	38	29	52	51	0	0	0	43	48	44	47	42	45	32	38	43	23	29
	16	400	57	49	44	32	25	48	48	0	0	0	37	42	38	44	43	41	27	33	38	18	29
	17	260	57	49	44	41	33	56	54	0	0	0	45	49	46	50	50	49	37	42	48	25	29
	18	200	57	49	44	42	37	59	60	0	0	0	46	51	47	56	52	52	41	45	52	26	31
	19	290	57	49	44	38	31	53	55	0	0	0	43	47	43	49	51	46	34	40	45	24	32
	20	450	57	49	44	35	24	47	50	0	0	0	37	40	36	43	42	41	26	33	37	16	33
	21	320	57	49	44	36	28	51	53	0	0	0	39	42	38	47	47	44	31	37	42	17	33
	22	220	57	49	44	41	34	56	56	0	0	0	42	43	43	52	54	49	37	43	48	19	33
	23	240	57	49	44	41	34	56	57	0	0	0	42	42	42	52	52	49	37	43	48	18	34
	24	360	57	49	44	37	26	50	52	0	0	0	39	40	35	45	37	43	29	35	40	13	34
	26	140	57	49	44	55	34	67	66	0	0	0	43	41	42	64	56	50	38	43	49	29	28
	27	220	57	49	44	46	31	54	60	0	0	0	39	40	39	56	52	47	31	39	44	29	27
	28	100	57	49	44	48	39	62	62	0	0	0	48	46	48	60	49	56	43	48	54	26	36
	29	210	57	49	44	43	31	55	59	0	0	0	40	39	39	52	48	47	33	40	45	28	33
	30	160	57	49	44	43	34	57	61	0	0	0	48	46	42	47	42	53	36	43	48	14	43
	31	160	60	45	44	45	31	55	55	0	0	0	43	38	34	45	41	48	33	40	45	20	33
32	120	60	45	44	44	36	59	60	0	0	0	45	51	47	44	39	52	39	45	50	0	48	
33	110	60	45	44	45	36	59	60	0	0	0	50	49	45	47	41	52	40	45	51	0	45	
34	330	57	52	49	41	28	51	53	0	0	0	40	37	32	44	39	45	29	36	41	25	34	
36	440	57	52	49	26	16	40	39	0	0	0	27	31	27	36	34	33	17	24	29	0	25	
38	460	55	49	44	33	22	46	48	0	0	0	34	39	34	39	35	38	22	31	36	0	33	
264	1000	40	38	39	0	15	39	45	0	0	0	25	0	0	34	33	31	17	24	28	0	0	
265	1360	40	38	39	0	0	0	0	0	0	0	0	0	0	0	0	28	13	20	0	0	0	
266	1530	40	38	39	0	0	0	0	0	0	0	0	0	0	0	0	26	11	18	0	0	0	
267	1110	40	38	39	0	0	0	0	0	0	0	0	0	0	0	0	30	15	22	0	0	0	
268	750	40	38	39	27	18	42	47	0	0	0	28	35	30	37	35	35	21	27	32	26	0	
282	490	57	45	44	27	12	36	36	0	0	0	23	21	20	29	0	29	18	22	28	14	0	
283	670	48	44	41	27	22	45	44	0	0	0	28	28	33	36	39	35	24	31	36	28	0	

Work area	Receiver	Distance from center of corridor, m	NML			LAeq, 15 minute maximum predicted noise level																		
			Day	Eve	Night	A discrete clearing	B Broad clearing	C Geotech investigation	D Earthworks	E Blast - drill	F Blast clean up	G Crushing	H Drainage	I Piling	J Bridge construction	K Pavement removal	L structure demolition	M Pave PCP	N Pavement saw cutting	O Road furniture installation	P Service relocation	Q Retaining walls	R Soft soils	
Deep Creek to Bourkes Lane (64900 to 68400)	37	310	55	49	44	35	23	47	51	0	0	0	36	42	38	0	0	39	26	32	37	0	36	
	39	570	55	49	44	29	20	44	44	0	0	0	34	34	30	34	0	36	22	29	34	0	29	
	40	240	55	49	44	39	22	45	57	0	0	0	33	40	36	33	0	38	24	31	35	0	36	
	41	540	55	49	44	28	22	45	45	0	0	0	33	0	0	35	0	38	24	31	35	0	28	
	42	250	55	49	44	41	26	50	53	0	0	0	41	40	36	37	0	43	28	34	39	0	35	
	43	140	55	49	44	38	28	51	53	0	0	0	45	35	31	50	39	45	37	40	47	0	28	
	44	830	48	44	41	26	16	40	43	0	0	0	29	33	29	38	0	33	16	23	28	0	29	
	45	790	48	44	41	26	16	40	40	0	0	0	29	0	0	39	0	33	17	23	28	0	28	
	46	950	48	44	41	24	15	39	38	0	0	0	28	0	0	37	0	31	15	23	27	0	0	
	47	100	57	48	43	37	35	57	58	0	0	0	50	0	0	43	52	51	45	46	54	0	0	
	48	320	55	49	44	29	19	42	43	0	0	0	35	0	0	44	43	35	27	30	36	0	0	
	49	160	55	50	49	32	27	49	51	0	0	0	43	0	0	40	49	43	35	38	45	0	0	
	50	140	57	52	48	40	27	50	51	0	0	0	44	31	35	35	48	44	35	38	45	0	0	
	51	500	55	50	49	26	19	41	40	0	0	0	34	0	0	37	44	35	26	30	35	0	0	
	52	740	52	47	44	25	11	34	35	0	0	0	27	28	35	0	35	29	18	22	27	0	0	
	53	710	52	47	44	26	11	34	35	0	0	0	27	29	35	0	35	29	18	22	28	0	0	
	54	700	52	47	44	26	11	34	36	0	0	0	28	29	35	0	36	29	18	22	28	0	0	
	55	140	52	47	44	38	25	48	50	0	0	0	42	30	35	26	40	42	31	34	40	0	0	
	56	680	52	47	44	26	12	35	36	0	0	0	28	29	36	0	36	29	19	23	28	0	0	
	57	730	52	47	44	24	11	34	35	0	0	0	27	28	34	0	35	29	18	22	28	0	0	
	58	530	52	47	44	29	14	37	39	0	0	0	30	31	35	0	38	31	21	25	31	0	0	
	59	640	52	47	44	27	12	35	36	0	0	0	28	30	36	0	36	29	19	23	29	0	0	
	60	720	52	47	44	25	11	34	35	0	0	0	28	29	34	0	35	29	18	22	28	0	0	
	61	610	52	47	44	27	13	37	38	0	0	0	29	30	36	0	37	30	20	24	30	0	0	
	62	590	52	47	44	27	13	37	38	0	0	0	29	31	36	0	37	30	20	24	30	0	0	
	63	710	52	47	44	25	11	36	37	0	0	0	28	29	34	0	35	29	18	22	28	0	0	
	64	570	52	47	44	28	13	37	38	0	0	0	30	31	37	0	37	30	20	25	30	0	0	
	65	550	52	47	44	28	14	37	38	0	0	0	30	31	37	0	38	30	21	25	31	0	0	
	66	140	57	48	43	38	26	49	50	0	0	0	39	25	32	0	39	42	34	37	44	0	0	
	67	700	52	47	44	25	11	36	38	0	0	0	28	29	34	0	36	29	18	23	28	0	0	
	68	600	52	47	44	27	13	37	38	0	0	0	29	31	36	0	37	30	20	24	30	0	0	
	69	530	52	47	44	28	14	37	38	0	0	0	30	32	37	0	38	31	21	25	31	0	0	
	70	520	52	47	44	28	14	38	38	0	0	0	30	32	37	0	38	31	22	26	31	0	0	
	71	690	52	47	44	25	12	36	38	0	0	0	28	29	35	0	35	29	18	23	28	0	0	
	72	590	52	47	44	27	13	37	38	0	0	0	30	31	36	0	37	30	20	24	30	0	0	
	73	500	52	47	44	28	15	38	39	0	0	0	31	32	37	0	39	31	22	26	32	0	0	
	74	580	52	47	44	27	14	37	38	0	0	0	30	31	36	0	37	30	21	25	30	0	0	
	75	560	52	47	44	27	14	37	38	0	0	0	30	31	36	0	38	30	21	25	31	0	0	
	76	540	52	47	44	27	14	37	38	0	0	0	30	32	37	0	38	31	21	25	31	0	0	
	77	480	52	47	44	28	15	38	39	0	0	0	31	33	38	0	39	32	22	26	32	0	0	
	78	530	52	47	44	27	14	37	39	0	0	0	31	32	37	0	38	31	21	26	31	0	0	
	79	510	52	47	44	27	15	38	39	0	0	0	31	33	37	0	38	31	22	26	32	0	0	
	80	680	52	47	44	25	12	36	38	0	0	0	28	30	36	0	36	29	19	23	28	0	0	
	81	490	52	47	44	27	15	38	39	0	0	0	31	33	37	0	39	32	22	26	32	0	0	
	82	220	55	50	49	43	27	49	52	0	0	0	42	28	33	35	46	43	36	38	45	0	0	

Work area	Receiver	Distance from center of corridor, m	NML			LAeq, 15 minute maximum predicted noise level																		
			Day	Eve	Night	A discrete clearing	B Broad clearing	C Geotech investigation	D Earthworks	E Blast - drill	F Blast clean up	G Crushing	H Drainage	I Piling	J Bridge construction	K Pavement removal	L structure demolition	M Pave PCP	N Pavement saw cutting	O Road furniture installation	P Service relocation	Q Retaining walls	R Soft soils	
	83	550	52	47	44	26	14	37	39	0	0	0	30	32	36	0	37	31	21	25	31	0	0	
	84	470	52	47	44	29	16	39	39	0	0	0	32	33	38	0	39	32	23	27	32	0	0	
	85	530	52	47	44	27	14	37	39	0	0	0	31	32	37	0	38	31	21	25	31	0	0	
	86	230	52	47	44	36	22	45	47	0	0	0	34	36	40	0	42	39	31	34	40	0	0	
	87	520	52	47	44	27	15	38	39	0	0	0	31	33	37	0	38	31	21	26	31	0	0	
	88	410	52	47	44	30	17	40	40	0	0	0	33	35	39	0	39	33	23	28	33	0	0	
	89	450	52	47	44	29	16	39	40	0	0	0	32	34	38	0	39	33	23	27	33	0	0	
	90	240	55	49	44	44	26	48	51	0	0	0	42	29	34	35	45	42	33	36	43	0	0	
	91	540	52	47	44	26	14	37	40	0	0	0	31	32	37	0	36	31	21	25	31	0	0	
	92	490	52	47	44	27	15	38	40	0	0	0	32	33	37	0	38	32	22	26	32	0	0	
	93	430	52	47	44	29	16	39	40	0	0	0	33	35	39	0	39	33	23	27	33	0	0	
	94	520	52	47	44	26	15	38	40	0	0	0	31	33	37	0	36	31	21	26	31	0	0	
	95	470	52	47	44	28	16	39	40	0	0	0	32	34	38	0	38	32	22	26	32	0	0	
	96	500	52	47	44	28	15	38	40	0	0	0	32	33	37	0	36	32	22	26	31	0	0	
	97	230	55	49	44	32	18	42	43	0	0	0	33	35	40	0	39	35	25	29	35	0	0	
	98	220	55	49	44	33	20	43	44	0	0	0	34	35	41	0	40	37	26	30	36	0	0	
	99	260	55	49	44	30	17	40	42	0	0	0	32	35	40	0	37	34	23	28	33	0	0	
	100	470	55	49	44	28	15	39	40	0	0	0	32	34	38	0	37	32	22	26	32	0	0	
	101	450	55	49	44	28	16	39	40	0	0	0	32	34	38	0	38	32	22	27	32	0	0	
	102	120	52	47	44	43	32	54	55	0	0	0	39	37	41	0	46	48	41	43	50	0	0	
	103	440	52	47	44	28	16	39	40	0	0	0	33	35	39	0	38	33	23	27	33	0	0	
	104	420	52	47	44	28	16	39	41	0	0	0	33	35	39	0	38	33	23	27	33	0	0	
	105	370	52	47	44	28	17	40	42	0	0	0	34	36	40	0	37	34	23	28	33	0	0	
	106	400	52	47	44	28	17	40	41	0	0	0	33	36	39	0	36	33	23	27	33	0	0	
	107	360	52	47	44	29	17	40	42	0	0	0	34	36	40	0	37	34	24	28	34	0	0	
	108	400	52	47	44	29	17	40	42	0	0	0	34	36	40	0	36	34	23	27	33	0	0	
	109	340	52	47	44	29	17	40	43	0	0	0	33	36	41	0	36	34	24	28	34	0	0	
	110	630	52	47	44	29	13	37	41	0	0	0	30	31	36	0	36	31	20	24	29	0	0	
	111	340	52	47	44	29	17	40	42	0	0	0	33	36	41	0	35	34	24	28	34	0	0	
	112	370	52	47	44	29	17	40	42	0	0	0	34	36	40	0	36	34	24	28	34	0	0	
	113	620	52	47	44	29	13	37	41	0	0	0	30	31	36	0	36	32	20	25	30	0	0	
	114	540	52	47	44	31	14	38	44	0	0	0	31	33	37	0	35	33	20	26	31	0	0	
	115	520	52	47	44	32	15	38	46	0	0	0	31	33	37	0	36	33	21	26	31	0	0	
	116	510	52	47	44	33	15	38	46	0	0	0	31	33	37	0	36	33	21	26	32	0	0	
	117	590	52	47	44	32	13	37	46	0	0	0	30	31	37	0	37	30	20	26	30	0	0	
	118	490	52	47	44	34	15	38	47	0	0	0	32	33	37	0	36	33	22	27	32	0	0	
	119	590	52	47	44	33	13	37	46	0	0	0	30	31	37	0	37	31	20	26	30	0	0	
	120	480	52	47	44	34	18	41	47	0	0	0	32	34	38	37	35	34	23	27	33	0	0	
	121	190	57	47	43	36	29	51	53	0	0	0	41	44	46	0	53	45	38	41	47	0	0	
	122	580	52	47	44	33	14	38	46	0	0	0	30	31	38	34	37	31	20	26	30	0	0	
	123	460	52	47	44	35	18	41	48	0	0	0	32	34	38	37	38	34	23	27	33	0	0	
	124	530	52	47	44	34	15	39	47	0	0	0	30	32	38	34	37	31	21	27	31	0	0	
	125	450	52	47	44	35	18	41	48	0	0	0	32	34	38	37	39	34	23	28	33	0	0	
	126	570	52	47	44	33	15	39	47	0	0	0	30	31	38	34	37	31	20	26	30	0	0	
	127	520	52	47	44	34	15	39	47	0	0	0	31	32	38	34	37	31	21	27	31	0	0	

Work area	Receiver	Distance from center of corridor, m	NML			LAeq, 15 minute maximum predicted noise level																	
			Day	Eve	Night	A discrete clearing	B Broad clearing	C Geotech investigation	D Earthworks	E Blast - drill	F Blast clean up	G Crushing	H Drainage	I Piling	J Bridge construction	K Pavement removal	L structure demolition	M Pave PCP	N Pavement saw cutting	O Road furniture installation	P Service relocation	Q Retaining walls	R Soft soils
Deep Creek to Bourkes Lane (64900 to 68400)	128	290	57	47	43	36	25	46	49	0	0	0	38	41	44	0	49	40	33	36	42	0	0
	129	420	52	47	44	35	19	42	48	0	0	0	33	35	39	37	39	34	24	28	34	0	0
	130	510	52	47	44	34	15	39	48	0	0	0	31	32	38	34	38	31	22	27	31	0	0
	131	350	52	47	44	33	19	42	46	0	0	0	35	37	41	37	40	35	26	30	36	0	0
	132	400	52	47	44	36	19	42	49	0	0	0	33	35	39	38	39	35	24	28	34	0	0
	133	560	52	47	44	31	15	39	44	0	0	0	29	31	38	34	37	31	20	26	30	0	0
	134	220	57	48	43	41	28	50	52	0	0	0	42	46	48	0	54	44	37	39	46	0	0
	135	280	57	48	43	35	25	47	49	0	0	0	39	43	45	0	50	41	33	36	42	0	0
	136	260	52	47	44	38	26	48	50	0	0	0	40	44	46	0	52	42	34	37	44	0	0
	137	500	52	47	44	35	15	39	48	0	0	0	31	32	38	35	38	32	22	27	31	0	0
	138	380	52	47	44	37	19	42	50	0	0	0	33	35	40	38	39	35	25	29	35	0	0
	139	340	52	47	44	37	19	42	47	0	0	0	34	37	41	38	40	35	26	30	36	0	0
	140	550	52	47	44	31	15	39	44	0	0	0	29	31	38	35	37	32	20	25	30	0	0
	141	60	57	47	43	48	39	61	64	0	0	0	55	60	64	33	67	55	50	50	68	0	0
	142	350	52	47	44	37	19	42	50	0	0	0	34	36	40	38	39	35	25	29	35	0	0
	143	550	52	47	44	31	16	40	44	0	0	0	29	30	36	35	36	32	20	25	30	0	0
	144	500	52	47	44	35	16	40	47	0	0	0	30	32	38	35	37	32	21	27	31	0	0
	145	530	52	47	44	32	16	40	44	0	0	0	29	30	36	36	36	33	20	25	30	0	0
	146	260	52	47	44	43	26	48	50	0	0	0	42	46	48	0	52	42	34	37	44	0	0
	147	280	57	52	48	41	25	47	49	0	0	0	41	45	47	0	51	41	33	36	43	0	0
	148	480	52	47	44	34	17	41	47	0	0	0	30	32	38	36	37	33	21	27	31	0	0
	149	520	52	47	44	32	17	40	45	0	0	0	29	31	36	36	36	33	20	25	30	0	0
	150	500	52	47	44	32	17	41	45	0	0	0	29	31	36	36	37	33	20	26	30	0	0
	151	160	57	52	48	52	31	52	55	0	0	0	45	49	51	36	68	46	40	42	49	0	0
	152	460	52	47	44	33	17	41	46	0	0	0	30	32	38	37	37	34	21	28	31	0	0
	153	440	52	47	44	35	19	42	48	0	0	0	31	33	38	38	38	35	22	31	32	0	0
	154	130	58	48	44	48	23	47	58	0	0	0	38	37	41	42	43	40	29	33	38	0	0
	155	120	58	48	44	45	26	46	58	0	0	0	38	41	43	40	62	40	32	35	42	0	0
157	360	50	47	48	33	23	47	46	0	0	0	33	28	33	42	38	39	25	32	37	0	0	
269	700	40	38	39	27	12	34	35	0	0	0	27	28	33	0	36	28	18	22	27	0	0	
270	690	40	38	39	30	15	37	40	0	0	0	29	30	36	0	37	31	22	26	31	0	0	
271	1190	40	38	39	0	0	0	0	0	0	0	0	0	0	0	0	22	12	17	0	0	0	
272	1370	40	38	39	0	0	0	0	0	0	0	0	0	0	0	0	20	10	16	0	0	0	
273	1430	40	38	39	0	0	0	0	0	0	0	0	0	0	0	0	20	9	17	0	0	0	
274	1370	40	38	39	0	0	0	0	0	0	0	0	0	0	0	0	26	12	19	0	0	0	
284	790	59	52	49	27	11	34	34	0	0	0	27	0	0	0	37	27	17	21	27	0	0	
285	470	55	49	44	31	16	39	43	0	0	0	32	34	38	0	42	33	23	27	33	0	0	

Work area	Receiver	Distance from center of corridor, m	NML			LAeq, 15 minute maximum predicted noise level																		
			Day	Eve	Night	A discrete clearing	B Broad clearing	C Geotech investigation	D Earthworks	E Blast - drill	F Blast clean up	G Crushing	H Drainage	I Piling	J Bridge construction	K Pavement removal	L structure demolition	M Pave PCP	N Pavement saw cutting	O Road furniture installation	P Service relocation	Q Retaining walls	R Soft soils	
Bourkes Lane to Kalang Bridge (68400 to 777000)	156	140	59	48	43	48	32	54	55	0	0	0	39	31	35	50	39	47	35	41	46	0	0	
	158	200	59	48	43	37	30	53	53	0	0	0	39	0	0	49	35	46	33	39	44	0	0	
	159	100	55	50	45	51	35	57	58	0	0	0	43	0	0	48	34	51	43	44	53	26	0	
	160	380	50	47	48	36	25	48	48	0	0	0	34	0	0	42	35	41	28	34	39	26	0	
	161	430	50	47	48	35	23	45	46	0	0	0	33	0	0	40	34	39	27	31	36	25	0	
	162	370	50	47	48	39	23	46	47	0	0	0	35	0	0	40	35	39	28	32	38	27	0	
	163	680	50	47	48	28	17	40	41	0	0	0	26	0	0	35	35	33	19	25	30	26	0	
	164	130	55	50	45	42	29	51	53	0	0	0	42	0	0	39	42	45	37	40	47	33	0	
	165	240	50	47	48	36	22	45	47	0	0	0	35	0	0	39	42	39	29	33	39	33	0	
	166	430	50	47	48	32	19	42	44	0	0	0	30	0	0	37	38	36	24	28	34	29	0	
	167	530	50	47	48	29	18	41	41	0	0	0	27	0	0	36	36	34	22	26	31	27	0	
	168	560	50	47	48	33	15	38	40	0	0	0	24	0	0	34	41	31	21	25	31	32	0	
	169	400	50	47	48	33	18	40	42	0	0	0	30	0	0	35	41	34	25	29	35	32	0	
	170	210	50	47	48	47	27	49	52	0	0	0	33	0	0	35	43	43	36	39	45	29	0	
	171	100	59	47	45	49	32	55	58	0	0	0	38	0	0	0	62	49	42	43	50	50	0	
	172	160	59	47	45	41	26	49	55	0	0	0	32	0	0	0	48	43	35	38	44	45	0	
	173	320	50	47	48	32	14	38	39	0	0	0	21	26	20	0	0	31	22	26	31	25	0	
	174	440	50	47	48	30	16	39	40	0	0	0	22	24	18	0	0	32	23	27	32	0	0	
	175	490	50	47	48	36	19	41	43	32	35	31	24	35	29	0	0	34	26	30	35	0	0	
	176	530	59	49	46	32	15	45	40	37	40	35	21	34	29	41	0	31	22	26	32	0	0	
	177	510	59	49	46	35	17	45	42	39	41	36	23	32	30	42	0	34	23	27	33	0	0	
	178	270	59	49	46	42	24	50	49	42	45	40	29	39	33	44	0	40	29	34	41	0	0	
	179	500	59	54	49	36	18	46	43	39	41	36	23	31	30	42	0	34	23	27	33	0	0	
	180	480	59	54	49	36	18	46	43	39	42	37	24	32	31	43	0	35	23	28	34	0	0	
	181	510	52	49	45	32	18	40	43	32	47	44	23	30	29	0	0	34	26	29	35	34	0	
	182	850	52	49	45	16	1	25	23	11	23	27	9	0	0	0	0	21	11	15	18	0	0	
	183	880	52	49	45	21	7	31	27	13	25	28	14	0	0	0	0	25	15	19	24	0	0	
	184	1060	52	49	45	0	0	0	0	0	0	0	0	0	0	0	0	19	8	13	0	0	0	
	185	1190	52	49	45	0	0	0	0	0	0	0	0	0	0	0	0	21	10	15	0	0	0	
186	910	40	40	44	27	10	33	36	0	0	0	16	28	21	0	0	27	18	22	27	0	0		
187	580	40	40	44	31	16	38	40	0	0	0	21	26	20	0	0	32	23	27	33	0	0		
275	1240	40	38	39	0	0	0	0	0	0	0	0	0	0	0	0	28	13	21	0	0	0		
276	1370	40	38	39	0	0	0	0	0	0	0	0	0	0	0	0	27	11	20	0	0	0		
277	1200	40	38	39	0	0	0	0	0	0	0	0	0	0	0	0	28	13	21	0	0	0		
278	950	40	38	39	25	19	41	42	0	0	0	27	0	0	37	0	35	20	27	31	0	0		
279	820	40	38	39	29	20	43	44	0	0	0	29	0	0	39	0	36	22	29	33	0	0		
280	880	40	38	39	27	18	41	42	0	0	0	27	0	0	37	0	35	20	27	31	0	0		
286	1200	40	38	39	0	0	0	0	0	0	0	0	0	0	0	0	27	12	19	0	0	0		
287	1150	40	38	39	0	0	0	0	0	0	0	0	0	0	0	0	23	13	17	0	0	0		
288	890	40	38	39	28	9	33	36	31	33	28	18	31	25	35	0	26	16	20	26	0	0		
289	730	40	38	39	29	11	34	37	32	34	30	20	32	26	36	0	27	18	22	28	0	0		
290	700	40	38	39	27	10	41	36	34	36	31	17	25	25	38	0	27	17	22	27	0	0		

Work area	Receiver	Distance from center of corridor, m	NML			LAeq, 15 minute maximum predicted noise level																		
			Day	Eve	Night	A discrete clearing	B Broad clearing	C Geotech investigation	D Earthworks	E Blast - drill	F Blast clean up	G Crushing	H Drainage	I Piling	J Bridge construction	K Pavement removal	L structure demolition	M Pave PCP	N Pavement saw cutting	O Road furniture installation	P Service relocation	Q Retaining walls	R Soft soils	
			188	530	40	40	44	32	14	37	40	0	0	0	20	38	30	33	33	31	22	26	31	0
189	660	40	40	44	33	13	36	40	25	36	31	19	35	27	30	37	29	20	24	29	0	31		
190	770	40	40	44	30	13	36	38	24	35	31	18	37	28	29	38	29	20	24	30	0	30		
191	380	40	40	44	34	19	41	45	39	45	46	24	42	34	37	39	35	26	30	35	20	38		
192	440	40	40	44	32	20	42	48	38	45	46	24	41	35	35	41	36	27	31	37	16	36		
193	360	40	40	44	34	22	44	47	44	51	51	27	40	37	35	42	38	30	34	39	27	36		
194	280	40	38	39	43	24	46	49	39	49	47	29	40	37	32	46	40	32	35	41	24	34		
195	410	40	40	44	33	21	43	45	41	46	48	26	39	36	33	40	37	29	32	38	26	34		
196	250	40	40	44	41	23	46	51	44	51	52	29	42	41	29	35	41	31	34	40	28	31		
197	110	40	38	39	50	35	56	59	48	60	55	39	52	46	34	45	50	44	46	53	29	36		
198	290	46	43	38	40	24	48	46	0	0	0	35	24	30	43	46	41	32	35	41	0	0		
199	140	45	42	39	41	27	49	51	0	0	0	33	23	32	36	47	43	36	38	45	0	0		
200	260	46	43	38	40	26	50	50	0	0	0	37	26	31	44	46	43	33	36	42	0	0		
201	160	45	42	39	32	17	42	42	0	0	0	29	15	33	37	41	34	24	28	34	0	0		
202	200	45	42	39	29	15	39	41	0	0	0	28	14	32	36	38	32	22	26	32	0	0		
203	220	46	43	38	37	23	47	47	0	0	0	34	26	32	44	45	40	29	32	39	0	0		
204	110	45	42	39	43	28	51	52	0	0	0	37	26	35	41	53	44	37	39	46	0	0		
205	320	45	42	39	32	20	43	44	0	0	0	29	20	31	35	41	36	28	31	37	0	0		
206	300	45	42	39	31	18	42	42	0	0	0	29	16	31	36	39	35	24	28	34	0	0		
207	140	46	43	38	44	35	58	60	0	0	0	45	31	42	50	56	53	38	43	49	0	0		
208	180	45	42	39	38	28	51	51	0	0	0	36	26	35	42	49	45	36	38	45	0	0		
209	260	46	43	38	34	24	48	47	0	0	0	37	26	38	50	46	40	28	33	38	0	0		
210	150	46	43	38	40	34	57	57	0	0	0	44	34	46	56	56	50	38	43	46	0	0		
211	300	45	42	39	25	11	35	38	0	0	0	25	12	24	36	35	28	17	21	27	0	0		
212	150	46	43	38	42	31	53	55	0	0	0	47	34	47	57	57	47	40	42	49	0	0		
213	440	40	35	42	25	13	38	37	0	0	0	26	24	30	37	36	32	18	25	29	0	0		
214	200	45	42	39	37	28	51	51	0	0	0	37	26	36	43	48	44	36	38	45	0	0		
215	260	46	43	38	29	18	43	43	0	0	0	32	27	34	44	41	35	21	27	32	0	0		
216	350	46	43	38	26	13	37	38	0	0	0	25	25	26	37	35	33	18	25	30	0	0		
217	290	46	43	38	32	21	45	45	0	0	0	34	28	35	47	43	38	25	30	35	0	0		
218	220	46	43	38	40	25	48	54	0	0	0	39	33	45	57	47	41	30	34	40	0	0		
219	160	46	43	38	41	27	51	56	0	0	0	42	35	44	60	52	43	35	37	44	0	0		
220	220	45	42	39	39	29	52	52	0	0	0	38	26	37	43	46	45	36	39	45	0	0		
221	280	46	43	38	36	18	42	46	0	0	0	31	30	33	43	41	39	26	32	37	0	0		
222	330	61	50	45	36	19	43	49	0	0	0	31	31	37	43	40	39	26	33	37	0	0		
223	210	46	43	38	40	23	48	52	0	0	0	37	34	44	51	46	39	28	32	38	0	0		
224	330	45	42	39	27	13	38	40	0	0	0	28	19	25	37	37	30	18	22	28	0	0		
225	450	46	43	38	30	16	40	45	0	0	0	28	27	34	39	37	37	23	29	34	0	0		
226	470	61	50	45	31	17	39	45	0	0	0	27	31	37	38	36	39	26	33	37	0	0		
227	270	45	42	39	34	26	50	49	0	0	0	36	21	32	42	42	42	29	35	39	0	0		

Work area	Receiver	Distance from center of corridor, m	NML			LAeq, 15 minute maximum predicted noise level																	
			Day	Eve	Night	A discrete clearing	B Broad clearing	C Geotech investigation	D Earthworks	E Blast - drill	F Blast clean up	G Crushing	H Drainage	I Piling	J Bridge construction	K Pavement removal	L structure demolition	M Pave PCP	N Pavement saw cutting	O Road furniture installation	P Service relocation	Q Retaining walls	R Soft soils
North of Kalang (77700 to 82900)	228	320	45	42	39	37	18	42	50	0	0	0	30	32	38	42	39	41	27	34	39	0	0
	229	360	61	50	45	33	17	41	46	0	0	0	30	30	36	41	38	39	27	33	38	0	0
	230	460	45	42	39	38	27	49	50	0	0	0	35	22	35	43	43	42	29	36	40	0	0
	231	330	57	50	43	41	23	45	48	0	0	0	30	30	35	46	0	39	28	32	39	0	0
	232	380	57	50	43	33	18	42	42	0	0	0	29	28	34	43	0	35	23	27	33	0	0
	233	370	57	50	43	36	21	44	44	0	0	0	30	28	34	44	0	37	26	30	35	0	0
	234	370	57	50	43	36	21	45	44	0	0	0	30	27	34	44	0	37	26	30	35	0	0
	235	360	57	50	43	35	21	45	44	0	0	0	31	27	33	43	0	37	25	30	35	0	0
	236	300	57	50	43	41	22	46	46	0	0	0	32	27	34	46	0	39	28	31	38	0	0
	237	360	54	46	40	34	22	46	45	0	0	0	32	30	32	46	0	38	28	32	38	0	0
	238	270	57	50	43	38	27	49	51	0	0	0	35	26	32	49	0	43	29	35	40	0	0
	239	330	54	46	40	35	27	49	50	0	0	0	35	30	32	50	0	42	29	36	40	0	0
	240	290	54	46	40	36	28	50	51	0	0	0	36	26	33	51	0	43	30	37	42	0	0
	241	320	54	46	40	35	27	50	50	0	0	0	35	26	32	51	0	42	30	36	41	0	0
	242	450	54	46	40	26	21	45	44	0	0	0	31	24	26	41	0	38	24	30	35	0	0
	243	260	57	50	43	38	26	49	49	0	0	0	35	25	31	49	0	42	29	35	40	0	0
	244	240	57	50	43	41	30	53	53	0	0	0	38	25	31	49	0	46	34	39	44	0	0
	245	710	57	50	43	26	18	42	41	0	0	0	28	0	0	33	0	34	20	27	32	0	0
	246	490	57	50	43	27	21	45	44	0	0	0	31	0	0	39	0	38	23	30	35	0	0
	247	450	57	50	43	28	23	46	46	0	0	0	32	0	0	40	0	39	25	32	37	0	0
	248	810	57	50	43	25	17	41	40	0	0	0	26	0	0	34	0	33	19	26	30	0	0
	249	640	57	50	43	22	19	43	42	0	0	0	29	0	0	33	0	35	22	28	33	0	0
	250	200	57	50	43	39	32	55	55	0	0	0	40	25	31	51	0	48	36	41	47	0	0
	251	250	57	50	43	39	31	54	54	0	0	0	39	24	30	49	0	47	34	40	45	0	0
	252	320	57	50	43	28	23	47	46	0	0	0	33	20	20	39	0	40	25	32	37	0	0
	253	690	57	50	43	23	19	42	41	0	0	0	28	0	0	34	0	35	21	28	32	0	0
	254	330	54	46	40	33	28	51	52	0	0	0	37	17	22	51	0	44	29	36	41	0	0
	255	240	57	50	43	36	32	55	55	0	0	0	40	24	29	49	0	47	36	41	46	0	0
	256	410	57	50	43	28	24	48	47	0	0	0	33	0	0	40	0	40	27	33	38	0	0
	257	240	57	50	43	35	32	55	55	0	0	0	40	24	20	49	0	48	36	42	47	0	0
258	630	57	50	43	17	20	43	43	0	0	0	29	0	0	30	0	36	22	29	33	0	0	
259	470	57	50	43	22	23	46	46	0	0	0	32	0	0	38	0	39	26	32	37	0	0	
260	570	57	50	43	19	21	45	44	0	0	0	30	0	0	36	0	37	23	30	35	0	0	
261	210	57	50	43	31	35	57	58	0	0	0	43	0	0	49	0	51	38	43	49	0	0	
262	280	57	50	43	25	31	54	55	0	0	0	39	0	0	44	0	47	34	39	45	0	0	
263	80	57	50	43	31	43	65	65	0	0	0	50	0	0	47	0	58	48	52	58	0	0	
281	350	40	40	44	38	19	42	47	0	0	0	25	44	35	34	36	36	27	31	37	0	37	
291	290	46	43	38	31	20	45	44	0	0	0	31	23	30	43	43	37	23	29	34	0	0	
292	360	46	43	38	31	19	43	43	0	0	0	30	22	28	40	40	36	23	28	33	0	0	
293	350	46	43	38	30	20	44	44	0	0	0	31	23	29	41	42	37	22	29	34	0	0	
294	340	46	43	38	29	14	38	39	0	0	0	25	23	28	38	38	33	20	25	30	0	0	
295	320	46	43	38	29	15	39	39	0	0	0	26	24	28	39	38	33	20	26	30	0	0	
296	483	46	43	38	30	16	40	39	0	0	0	28	35	36	39	0	36	23	29	34	0	0	
297	551	46	43	38	30	16	40	39	0	0	0	27	33	35	39	0	35	21	28	32	0	0	

7.2.3 Ancillary 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/asphalt 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 7-3 summarises the likely combination of activities, plant and equipment anticipated at facilities for the project. Appendix A4 of the CEMP and Appendix I of the SWMP provide a list and assessment of all ancillary facilities and stockpile sites on the Project, respectively.

(It should be noted these sites may still be subject to further assessment and approvals, and the reference to these sites in this NVMP does not necessarily permit their use, but only assesses the potential noise impacts from their use).

Table 7-3 Likely construction facilities and associated attributes

Site No.	Approximate chainage	Facility type	Activities	Typical plant and equipment required
1	62500	Small ancillary, stockpiling, batch plant	<ul style="list-style-type: none"> • Dirt stockpiling • Material laydown 	<ul style="list-style-type: none"> • Loader, excavator, truck and dogs, grader • Mobile crane, light vehicles, delivery trucks • Concrete batch plant
2	64000	Small ancillary	<ul style="list-style-type: none"> • Satellite office • material storage 	<ul style="list-style-type: none"> • Mobile crane, light vehicles, delivery trucks
3A/B	63400 - 63600	Main compound, stockpiling, batching plant	<ul style="list-style-type: none"> • Staff and worker parking. • Office accommodation. • Equipment maintenance and storage. • Concrete batching • Pre-cast yard • Soil stockpiling 	<ul style="list-style-type: none"> • Light vehicles, delivery trucks, mobile crane, workshop, heavy vehicles, compressors/generator • Concrete and asphalt batch plants • Loader, excavator, truck and dogs, grader
5	65600	Small ancillary, stockpiling	<ul style="list-style-type: none"> • Dirt stockpiling • Material laydown • Satellite office 	<ul style="list-style-type: none"> • Loader, excavator, truck and dogs, grader • Mobile crane, light vehicles, delivery trucks

Site No.	Approximate chainage	Facility type	Activities	Typical plant and equipment required
8	68000	Small ancillary, stockpiling	<ul style="list-style-type: none"> Dirt stockpiling Material laydown Satellite office 	<ul style="list-style-type: none"> Loader, excavator, truck and dogs, grader Mobile crane, light vehicles, delivery trucks
9	69000	Small ancillary, stockpiling	<ul style="list-style-type: none"> Dirt stockpiling Material laydown Satellite office 	<ul style="list-style-type: none"> Loader, excavator, truck and dogs, grader Mobile crane, light vehicles, delivery trucks
10	69100	Small ancillary, stockpiling	<ul style="list-style-type: none"> Dirt stockpiling Material laydown Satellite office 	<ul style="list-style-type: none"> Loader, excavator, truck and dogs, grader Mobile crane, light vehicles, delivery trucks
11	69700	Small ancillary, stockpiling	<ul style="list-style-type: none"> Dirt stockpiling Material laydown 	<ul style="list-style-type: none"> Loader, excavator, truck and dogs, grader Mobile crane, light vehicles, delivery trucks
12A/B/C/D	71800 – 72100	Main compound, stockpiling, batching plant	<ul style="list-style-type: none"> Staff and worker parking. Office accommodation. Equipment maintenance and storage. Laboratory Concrete batching Soil stockpiling 	<ul style="list-style-type: none"> Light vehicles, delivery trucks, mobile crane, workshop, heavy vehicles, compressors/generator Concrete and asphalt batch plants Loader, excavator, truck and dogs, grader
14A/B/C	77000 – 77400	Small ancillary, stockpiling, batching plant	<ul style="list-style-type: none"> Dirt stockpiling Material laydown Concrete batching plant Satellite office 	<ul style="list-style-type: none"> Loader, excavator, truck and dogs, grader Mobile crane, light vehicles, delivery trucks Concrete batching plant
15	7800	Small ancillary, stockpiling	<ul style="list-style-type: none"> Dirt stockpiling Material laydown Satellite office 	<ul style="list-style-type: none"> Loader, excavator, truck and dogs, grader Mobile crane, light vehicles, delivery trucks
16	78200	Small ancillary	<ul style="list-style-type: none"> Dirt stockpiling Satellite office Material laydown 	<ul style="list-style-type: none"> Mobile crane, light vehicles, delivery trucks
19	81300	Small ancillary, stockpiling, Batch plant	<ul style="list-style-type: none"> Dirt stockpiling Material laydown Satellite office Batching plant 	<ul style="list-style-type: none"> Loader, excavator, truck and dogs, grader Mobile crane, light vehicles, delivery trucks Batching plant
21	83300	Small ancillary, stockpiling	<ul style="list-style-type: none"> Dirt stockpiling Material laydown Satellite office 	<ul style="list-style-type: none"> Loader, excavator, truck and dogs, grader Mobile crane, light vehicles, delivery trucks
22	83100	Small ancillary, stockpiling	<ul style="list-style-type: none"> Dirt stockpiling Material laydown Satellite office 	<ul style="list-style-type: none"> Loader, excavator, truck and dogs, grader Mobile crane, light vehicles, delivery trucks

Site No.	Approximate chainage	Facility type	Activities	Typical plant and equipment required
23	77900	Small ancillary, stockpiling	<ul style="list-style-type: none"> • Dirt stockpiling • Material laydown • Satellite office 	<ul style="list-style-type: none"> • Loader, excavator, truck and dogs, grader • Mobile crane, light vehicles, delivery trucks
24	78200	Small ancillary, batching plant	<ul style="list-style-type: none"> • Dirt stockpiling • Concrete batching plant 	<ul style="list-style-type: none"> • Loader, excavator, truck and dogs, grader • Concrete batching plant

Table 7-4 provides the predicted noise levels at potentially affected sensitive receivers for the ancillary facilities listed in Table 7-3. Where more than one facility affects a receiver, the prediction is cumulative.

Where predicted noise levels exceed the night criteria, the result is highlighted in green. Similarly, where the evening or day NML is likely to be exceeded, these results are highlighted in orange and red respectively.

Noise levels may exceed the NMLs for the day period where background noise levels are low, as indicated by results highlighted in red. Where compounds are likely to operate into the evening and night period, the level of expected impact will be greater considering the lower NMLs in these periods.

The results of stockpiling locations are considered to be conservative, as once the stockpiles are constructed, they will act as noise barriers for the majority of their time and only be a noise source when they are removed or modified from time to time.

Due to ongoing operations, particularly of batching plants, there is potential for cumulative impacts with other construction activities. Where general construction noise is not the dominant source (i.e. less than 10 dB(A) greater than compound noise) predicted cumulative impacts are presented in the table. Where construction noise is likely to be dominant, no cumulative values are shown.

It is evident that there is potential for cumulative impacts, particularly where construction activities are at their loudest and batching plants are operating. Predictions are for earthworks (worst-case) and therefore actual levels should be lower than predicted values during general construction.

Vibration impacts from the operation of compound and ancillary facilities are not anticipated.

Table 7-4 Predicted noise levels from facility type (L_{Aeq} (15min))

Work area	Receiver	Distance from center of corridor, m	NML			L _{Aeq} , 15 minute predicted noise level			U Cumulative (compound and earthworks)
			Day	Eve	Night	S Stockpiling	T Ancillaries	Compound as dominant noise source	
Rail to Deep Creek (61800 to 64900)	1	440	45	43	42	30	36	1	45
	2	370	45	43	42	31	35	1	45
	3	450	45	43	42	30	36	1	44
	4	460	45	43	42	31	36	1	44
	5	470	45	43	42	30	36	1	45
	6	200	48	44	41	51	50	1	60
	7	310	48	44	41	43	48	1	
	9	190	59	47	39	50	45	1	
	10	130	48	44	41	49	47	3A/1	
	11	150	59	47	39	49	46	3A/1	
	12	120	59	47	39	48	46	3A	
	13	320	48	44	41	44	52	3A	59
	15	440	48	44	41	40	28	2	
	16	400	57	49	44	39	27	2	
	17	260	57	49	44	48	42	3A/2	
	18	200	57	49	44	52	44	3A/2	
	19	290	57	49	44	47	42	3A/2	
	20	450	57	49	44	37	24	2	
	21	320	57	49	44	43	28	2	
	22	220	57	49	44	54	41	3A/2	
	23	240	57	49	44	50	40	3A/2	
	24	360	57	49	44	33	19	2	
	26	140	57	49	44	42	42	3A	
	27	220	57	49	44	40	44	3A	
	28	100	57	49	44	43	41	3A	
	29	210	57	49	44	39	42	3A	
	30	160	57	49	44	37	23	2	
	31	160	60	45	44	35	37	3A	
	32	120	60	45	44	35	20	2/5	
	33	110	60	45	44	40	25	2/5	
34	330	57	52	49	35	25	2		
36	440	57	52	49	30	26	2		
38	460	55	49	44	37	25	5/2		
264	1000	40	38	39	28	42	3B	47	
265	1360	40	38	39	0	43	3B	43	
266	1530	40	38	39	0	42	3B	42	
267	1110	40	38	39	0	51	3B	51	
268	750	40	38	39	28	50	3B	52	
282	490	57	45	44	0	0	-		
283	670	48	44	41	33	44	1	47	

Work area	Receiver	Distance from center of corridor, m	NML			LAeq, 15 minute predicted noise level			U Cumulative (compound and earthworks)
			Day	Eve	Night	S Stockpiling	T Ancillaries	Compound as dominant noise source	
	37	310	55	49	44	36	22	5	
	39	570	55	49	44	33	19	5	
	40	240	55	49	44	49	25	5	
	41	540	55	49	44	35	18	5	
	42	250	55	49	44	45	30	5	
	43	140	55	49	44	51	23	5	
	44	830	48	44	41	34	17	5	
	45	790	48	44	41	32	17	5	
	46	950	48	44	41	32	15	5	
	47	100	57	48	43	34	16	5	
	48	320	55	49	44	34	14	5	
	49	160	55	50	49	32	9	5	
	50	140	57	52	48	0	0	-	
	51	500	55	50	49	30	0	-	
	52	740	52	47	44	0	0	-	
	53	710	52	47	44	0	0	-	
	54	700	52	47	44	0	0	-	
	55	140	52	47	44	0	0	-	
	56	680	52	47	44	0	0	-	
	57	730	52	47	44	0	0	-	
	58	530	52	47	44	0	0	-	
	59	640	52	47	44	0	0	-	
	60	720	52	47	44	0	0	-	
	61	610	52	47	44	0	0	-	
	62	590	52	47	44	0	0	-	
	63	710	52	47	44	0	0	-	
	64	570	52	47	44	0	0	-	
	65	550	52	47	44	0	0	-	
	66	140	57	48	43	0	0	-	
	67	700	52	47	44	0	0	-	
	68	600	52	47	44	0	0	-	
	69	530	52	47	44	0	0	-	
	70	520	52	47	44	0	0	-	
	71	690	52	47	44	0	0	-	
	72	590	52	47	44	0	0	-	
	73	500	52	47	44	0	0	-	
	74	580	52	47	44	0	0	-	
	75	560	52	47	44	0	0	-	
	76	540	52	47	44	0	0	-	
	77	480	52	47	44	0	0	-	
	78	530	52	47	44	0	0	-	
	79	510	52	47	44	0	0	-	
	80	680	52	47	44	0	0	-	
	81	490	52	47	44	0	0	-	
	82	220	55	50	49	0	0	-	
	83	550	52	47	44	0	0	-	
								-	
	84	470	52	47	44	0	0	-	
	85	530	52	47	44	0	0	-	
	86	230	52	47	44	0	0	-	
	87	520	52	47	44	0	0	-	
	88	410	52	47	44	0	0	-	
	89	450	52	47	44	0	0	-	
	90	240	55	49	44	0	0	-	
	91	540	52	47	44	0	0	-	
	92	490	52	47	44	0	0	-	
	93	430	52	47	44	0	0	-	
	94	520	52	47	44	0	0	-	
	95	470	52	47	44	0	0	-	
	96	500	52	47	44	0	0	-	
	97	230	55	49	44	0	0	-	
	98	220	55	49	44	0	0	-	
	99	260	55	49	44	0	0	-	
	100	470	55	49	44	0	0	-	
	101	450	55	49	44	0	0	-	
	102	120	52	47	44	0	0	-	

Work area	Receiver	Distance from center of corridor, m	NML			LAeq, 15 minute predicted noise level			U Cumulative (compound and earthworks)
			Day	Eve	Night	S Stockpiling	T Ancillaries	Compound as dominant noise source	
	103	440	52	47	44	0	0	-	
	104	420	52	47	44	0	0	-	
	105	370	52	47	44	0	0	-	
	106	400	52	47	44	0	0	-	
	107	360	52	47	44	0	0	-	
	108	400	52	47	44	0	0	-	
	109	340	52	47	44	0	0	-	
	110	630	52	47	44	0	0	-	
	111	340	52	47	44	0	0	-	
	112	370	52	47	44	0	0	-	
	113	620	52	47	44	0	0	-	
	114	540	52	47	44	0	0	-	
	115	520	52	47	44	0	0	-	
	116	510	52	47	44	0	0	-	
	117	590	52	47	44	0	0	-	
	118	490	52	47	44	0	0	-	
	119	590	52	47	44	0	0	-	
	120	480	52	47	44	0	0	-	
	121	190	57	47	43	0	29	8	
	122	580	52	47	44	0	0	-	
	123	460	52	47	44	0	0	-	
	124	530	52	47	44	0	0	-	
	125	450	52	47	44	0	0	-	
	126	570	52	47	44	0	0	-	
	127	520	52	47	44	0	0	-	
	128	290	57	47	43	0	30	8	
								-	
	129	420	52	47	44	0	0	-	
	130	510	52	47	44	0	0	-	
	131	350	52	47	44	0	0	-	
	132	400	52	47	44	0	0	-	
	133	560	52	47	44	0	0	-	
	134	220	57	48	43	0	30	8	
	135	280	57	48	43	0	32	8	
	136	260	52	47	44	0	31	8	
	137	500	52	47	44	0	0	-	
	138	380	52	47	44	0	0	-	
	139	340	52	47	44	0	0	-	
	140	550	52	47	44	0	0	-	
	141	60	57	47	43	0	26	8	
	142	350	52	47	44	0	0	-	
	143	550	52	47	44	0	0	-	
	144	500	52	47	44	0	0	-	
	145	530	52	47	44	0	0	-	
	146	280	52	47	44	0	31	8	
	147	280	57	52	48	0	34	8	
	148	480	52	47	44	0	0	-	
	149	520	52	47	44	0	0	-	
	150	500	52	47	44	0	0	-	
	151	160	57	52	48	0	30	8	
	152	460	52	47	44	0	0	-	
	153	440	52	47	44	0	0	-	
	154	130	58	48	44	0	14	9	
	155	120	58	48	44	0	30	8	
	157	360	50	47	48	28	31	8/10	
	269	700	40	38	39	0	37	8	39
	270	690	40	38	39	0	41	8	43
	271	1190	40	38	39	0	35	8	
	272	1370	40	38	39	0	35	8	
	273	1430	40	38	39	0	40	8	40
	274	1370	40	38	39	0	40	8	40
	284	790	59	52	49	0	32	8	
	285	470	55	49	44	0	36	8	

Work area	Receiver	Distance from center of corridor, m	NML			LAeq, 15 minute predicted noise level			U Cumulative (compound and earthworks)
			Day	Eve	Night	S Stockpiling	T Ancillaries	Compound as dominant noise source	
	156	140	59	48	43	29	31	10	
	158	200	59	48	43	33	37	10	
	159	100	55	50	45	42	47	9/10	
	160	380	50	47	48	38	39	10/11	49
	161	430	50	47	48	37	39	10	47
	162	370	50	47	48	39	43	10	49
	163	680	50	47	48	28	37	11	
	164	130	55	50	45	50	44	10/11	54
	165	240	50	47	48	40	44	11	49
	166	430	50	47	48	34	42	11	
	167	530	50	47	48	31	39	11	
	168	560	50	47	48	34	44	11	
	169	400	50	47	48	36	48	11	49
	170	210	50	47	48	37	39	11	
	171	100	59	47	45	83	47	11	
	172	160	59	47	45	43	37	11	
	173	320	50	47	48	35	27	12D	
	174	440	50	47	48	33	25	12D	
Bourkes Lane to Kalang Bridge (68400 to 777000)	175	490	50	47	48	38	47	12B/12D	49
	176	530	59	49	46	36	47	12B/12C	47
	177	510	59	49	46	39	48	12B/12C	49
	178	270	59	49	46	43	55	12C/12B	56
	179	500	59	54	49	40	48	12B/12C	
	180	480	59	54	49	41	48	12B/12C	
	181	510	52	49	45	0	0	-	
	182	850	52	49	45	0	0	-	
	183	880	52	49	45	0	0	-	
	184	1060	52	49	45	0	0	-	
	185	1190	52	49	45	0	0	-	
	186	910	40	40	44	31	45	14C	44
	187	580	40	40	44	31	33	14A/B/C	41
	275	1240	40	38	39	0	37	8	
	276	1370	40	38	39	0	35	8/11	
	277	1200	40	38	39	0	35	8/11	
	278	950	40	38	39	27	34	8/11	43
	279	820	40	38	39	27	35	11/8	45
	280	880	40	38	39	28	35	11/8	43
	286	1200	40	38	39	0	0	-	
	287	1150	40	38	39	0	31	12B	
	288	890	40	38	39	0	45	12B	46
	289	730	40	38	39	28	47	12B	48
	290	700	40	38	39	32	42	12C	43

Work area	Receiver	Distance from center of corridor, m	NML			LAeq, 15 minute predicted noise level			U Cumulative (compound and earthworks)
			Day	Eve	Night	S Stockpiling	T Ancillaries	Compound as dominant noise source	
	281	350	40	40	44	37	54	14C	55
	188	530	40	40	44	35	45	14C/14A	48
	189	660	40	40	44	35	45	14C/15/16	48
	190	770	40	40	44	33	44	14C/15/16	45
	191	380	40	40	44	38	48	16/23	49
	192	440	40	40	44	35	47	16/23	49
	193	360	40	40	44	35	50	16	52
	194	280	40	38	39	41	52	16	54
	195	410	40	40	44	34	49	16	50
	196	250	40	40	44	30	44	16	51
	197	110	40	38	39	39	57	16	61
	198	290	46	43	38	38	46	19	50
	199	140	45	42	39	38	49	19	53
	200	260	46	43	38	39	47	19	52
	201	160	45	42	39	35	46	19	47
	202	200	45	42	39	35	43	19	45
	203	220	46	43	38	37	45	19	49
	204	110	45	42	39	48	53	19	56
	205	320	45	42	39	33	45	19	48
	206	300	45	42	39	35	46	19	47
	207	140	46	43	38	46	52	19	61
	208	180	45	42	39	52	59	19	56
	291	290	46	43	38	34	43	19	46
	292	360	46	43	38	33	42	19	45
	293	350	46	43	38	34	43	19	46
	294	340	46	43	38	29	37	19	41
	295	320	46	43	38	30	38	19	42
	209	260	46	43	38	37	46	19	50
	210	150	46	43	38	43	51	19	58
	211	300	45	42	39	31	39	19	42
	212	150	46	43	38	43	50	19	57
	213	440	40	35	42	29	38	19	41
	214	200	45	42	39	51	56	19	57
	215	260	46	43	38	33	43	19	46
	216	350	46	43	38	29	37	19	41
	217	290	46	43	38	34	44	19	48
	218	220	46	43	38	40	47	19	55
	219	160	46	43	38	42	49	19	57
	220	220	45	42	39	49	57	19	58
	221	280	46	43	38	33	42	19	49
	222	330	61	50	45	35	41	19	49
North of Kalang (77700 to 82900)	223	210	46	43	38	40	45	19	53
	224	330	45	42	39	32	40	19	43
	225	450	46	43	38	32	40	19	46
	226	470	61	50	45	34	39	19	46
	227	270	45	42	39	40	52	19	54
	228	320	45	42	39	36	41	19	50
	229	360	61	50	45	35	41	19	47
	230	460	45	42	39	42	56	19	53
	296	483	46	43	38	33	25	22	40
	297	551	46	43	38	33	26	22	39
	231	330	57	50	43	37	33	22	
	232	380	57	50	43	34	28	22	
	233	370	57	50	43	34	30	22	
	234	370	57	50	43	35	30	22	
	235	360	57	50	43	34	29	22	
	236	300	57	50	43	37	31	22	
	237	360	54	46	40	39	33	22/21	
	238	270	57	50	43	38	35	22/21	
	239	330	54	46	40	38	34	22/21	
	240	290	54	46	40	36	36	22/21	
	241	320	54	46	40	36	35	22/21	
	242	450	54	46	40	32	27	22/21	
	243	260	57	50	43	38	36	22/21	
	244	240	57	50	43	38	37	22/21	
	245	710	57	50	43	27	22	22/21	
	246	490	57	50	43	30	25	22/21	
	247	450	57	50	43	31	27	22/21	
	248	810	57	50	43	25	22	22/21	
	249	640	57	50	43	28	22	22/21	
	250	200	57	50	43	37	39	22/21	
	251	250	57	50	43	37	37	22/21	
	252	320	57	50	43	31	28	22/21	
	253	690	57	50	43	26	22	22/21	
	254	330	54	46	40	31	33	22/21	
	255	240	57	50	43	35	37	22/21	
	256	410	57	50	43	30	27	22/21	
257	240	57	50	43	35	38	22/21		
258	630	57	50	43	24	19	22/21		
259	470	57	50	43	26	24	22/21		
260	570	57	50	43	26	23	22/21		
261	210	57	50	43	34	37	22/21		
262	280	57	50	43	29	32	22/21		
263	80	57	50	43	33	34	21		

7.3 Construction vibration and blasting assessment

7.3.1 Vibration assessment

Table 7-5 list 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. The vibration levels summarised in Table 7-5 indicate that structural damage is unlikely during the project, unless a delicate structure (e.g. heritage listed building or object) is within 40 m of vibratory rolling plant or within 20 m of piling. Where this is the case, monitoring of the specific plant and soil conditions should be undertaken to more accurately assess the likelihood of damage.

Table 7-5 Typical plant vibration levels

Plant description	Typical vibration level (mm/s)					Source
	5 metres	10 metres	20 metres	30 metres	40 metres	
Compactor 825G	ND	2.3	2.4	2.4	ND	
Vibratory roller (padfoot 13 tonne, high setting)	ND	8.3	5.1	2.8	1.8	
Vibratory roller (padfoot 17 tonne, high setting)	ND	12.1	5.7	5.0	3.2	
Vibratory roller (padfoot 17 tonne, low setting)	ND	7.3	3.8	4.0	3.0	
Hydraulic hammer	4.5	1.3	0.4	ND	0.1	
Impact pile driver	ND	ND	3.0	ND	ND	
Vibratory sheet pile driver	20	6.5	1.5	ND	ND	
Drilling of blasting holes	5.0	1.5		0.5	0.1	
Vibro-compaction	4 - 9	2.4 - 5	1.5 – 2.5	ND	ND	

ND = No data

An estimate of the risk to human comfort is provided in Table 7-6, which highlights the likelihood of exceeding human comfort criteria at various distances from selected vibration sources. A vibration criterion for intermittent activity has been used in accordance with the EPA Vibration guideline (see Table 5-6).

Table 7-6 Vibration risk matrix – Human Comfort (Daytime)

Activity	Lowest adopted criteria*	Separation distance from receiver (m)					
		>50	40	30	20	10	5
Rock Hammering	0.2 mms ^{-1.75}	0.1	0.2	0.3	1.0	1.9	2.9
Concrete Impact Piling	0.2 mms ^{-1.75}	0.2	0.3	0.4	1.4	2.5	4.8
Vibratory Sheet Piling	0.2 mms ^{-1.75}	0.2	0.2	0.3	1.1	2.1	3.1
Vibratory pad foot roller (17 t)	0.2 mms ^{-1.75}	0.1	0.1	0.2	0.2	0.5	2.0

Notes: Red indicates high risk of human disturbance, amber indicates moderate risk, green indicates low risk.

According to the table, human comfort is likely to be impacted within 30 m of the assessed activities and residents within this distance should be consulted and monitoring undertaken.

There are only five receivers identified as being within 100 m of the centre of the project corridor. Of these, just one, receiver 171 is less than 50 m from the boundary and should be considered when vibratory works are close to the boundary.

7.3.2 Blasting assessment

Blasting will 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. Further assessment of potential blasting impacts is discussed in the Blast Management Plan contained in Appendix C.

7.4 Out of Hours Works

While the project team will make all efforts to complete work within the approved construction hours, it is anticipated that there will be a need to undertake a range of works outside of the standard hours – Out of Hours Works (OOHW) - that are not necessarily approved by the Project CoA. These may include the following;

- Concrete works (including delivery) and saw cutting during paving works;
- Rail Possession works;
- Service relocation works;
- Works impacting highway and local road traffic;
- Use of ancillary facility sites during OOHW;
- Refuelling during OOHW; and
- Security patrolling throughout the construction phase.

In order to manage these OOHW, an OOHW Procedure has been developed and is included as Appendix D to this NVMP. The aim of the OOHW procedure is to ensure that all OOHW 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; and
- Environmental impacts from the OOHW are managed / mitigated in line with the approved CEMP documents to minimise impact on the surrounding environment & community.

It is essential that effective community consultation occurs for out of hours works. The OOHW Procedure 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 and impacts to stakeholders, including predicted exceedances of the NMLs as indicated in Table 7-2.

It is important to note that a complaints management system will also be implemented as detailed in the Community Involvement Plan.

8 Environmental control measures

A range of environmental requirements and control measures are identified in the various environmental documents, including the EA, Statement of Commitments, Conditions of Approval, Roads and Maritime documents, Lend Lease EMS Procedures (700 Environmental Series) and from recent experience on similar road projects. Specific measures and requirements to address impacts from noise and vibration are outlined in Table 8-1.

Table 8-1 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.		Pre-construction, construction	Environmental Manager	G36, Section 9.2
NV2	Public address systems used at any construction site will not be used outside normal construction hours, except where prior consultation has been undertaken with affected residents. Public address systems would be designed to limit noise spillage off-site.		Construction	Superintendent	EA
NV3	Work compounds, parking areas, equipment and material stockpile sites will be positioned away from noise-sensitive locations in accordance with the criteria in Section 3.8.2, Section 3.8.3 and Appendix A4 of the CEMP, and Appendix I of the SWMP.		Construction	Environment Manager	G36
NV4	Site entry and exit points will be located as far as possible from sensitive receivers, taking into account the importance of safe access.		Construction	Foreman	
NV5	Where space permits, compounds, refuelling areas and sensitive works areas will be designed to promote one-way traffic so that vehicle reversing movements are minimised.		Construction	Foreman	
NV6	Truck routes to and from the worksite will be via major roads where possible, in accordance with the Construction Traffic Management Plan.		Construction	Superintendent	
NV7	Operational noise mitigation measures e.g. at property treatments, noise walls/mounds, will be installed as early as possible during construction.		Construction	Roads and Maritime / Construction Manager	SoC N1, G36
PLANT AND EQUIPMENT					
NV8	Where feasible and reasonable noisy equipment and/or construction processes will be substituted by alternative low noise emitting equipment and/or construction process.		Construction	Foreman	G36

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
NV9	Place screening or enclosures around fixed plant under regular operation that may impact upon noise sensitive receivers.		Construction	Foreman	G36
NV10	Undertake saw-cutting operations wherever possible to minimise noise impacts		Construction	Foreman	G36
NV11	Plant or machinery will not be permitted to 'warm-up' before the nominated working hours.		Construction	Operators	
NV12	Switching off engines when equipment is not in use for extended periods (i.e. 30 minutes).		Construction	Operators	G36
NV13	Where possible, the occurrence of consecutive works within the same locality, and coincidence of noisy plant/equipment working close together and adjacent to sensitive receivers will be minimised.		Construction	Superintendent	
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 evening if required to be undertaken at night; avoiding short sharp sounds from impacts during night work to minimise sleep disturbance to neighbouring residents.		Construction	Foreman	G36
NV15	Manually adjustable or ambient noise sensitive or 'quacker' type reversing alarms on plant and/or flashing lights will be used at night.		Construction	Superintendent	G36
NV16	Where possible, maintenance work on construction plant will be undertaken away from noise sensitive receivers.		Construction	Foreman	G36
NV17	All construction plant and equipment used on the site will be, in addition to other relevant requirements: <ul style="list-style-type: none"> 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 		Construction	Superintendent	G36, EA
NV18	Where noise impacts have been predicted, plant will be fitted with noise control devices (in addition to the requirements in		Construction	Superintendent	

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
	NV17), where practicable, including: <ul style="list-style-type: none"> • Acoustic lining of engine bays. • Air intake / discharge silencers. 				
NV19	Loading and unloading will be carried out as far as practical away from sensitive receivers.		Construction	Foreman	
NV20	Truck movements will be kept to a minimum, i.e. that trucks are sufficiently utilised for each trip.		Construction	Foreman	
NV21	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.		Construction	Foreman	
NV22	Noisy plant working simultaneously close together will be avoided to the greatest extent practical adjacent to noise affected sensitive receivers.		Construction	Foreman	
NV23	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 where practical.		Construction	Foreman	
NV24	Truck drivers will limit compression braking as far as practicable.		Construction	Operators	
NV25	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.		Construction	Foreman	
CONSTRUCTION HOURS					
NV26	Construction works associated with the Project, other than blasting, will only be undertaken during the following hours: <ul style="list-style-type: none"> • 7:00am to 6:00pm Mondays to Fridays, inclusive; and • 8:00am to 1:00pm Saturdays; and • at no time on Sundays or public holidays. 		Construction	Construction Manager	CoA C3, CoA C5

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
	Unless otherwise assessed and justified in the CEMP or this Plan.				
NV27	<p>Works outside of the construction hours identified in NV26 will only be undertaken in the following circumstances:</p> <ul style="list-style-type: none"> works that generate noise that is not audible at any sensitive receptor; for delivery of materials required outside these hours by the Police or other authorities for safety reasons; or where it is required in an emergency to avoid the loss of lives, property and/or to prevent environmental harm; or construction works undertaken through sparsely populated areas in which sensitive receptors are located greater than 300 meters away from the project boundary. In this case construction is permissible during the following hours: 6.00am to 6.00pm Monday to Friday and 7.00am to 4.00pm Saturdays and at no time on Sundays or public holidays. These works hours may be reviewed and/or revoked by the Director General in consultation with the EPA in the case of excessive or unresolved noise complaints; or in accordance with the Project EPL; or where an EPL does not apply to the construction of the project, Out of Hours Works as agreed to by the Director General in accordance with CoA C5. 		Construction	Construction Manager	CoA C4, SoC N4
NV28	<p>Where high level noise impacts (>75dBA) are predicted at sensitive receivers, 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.</p> <p>The above activities are also considered to be potentially annoying due to their tonality and impulsiveness. Tonality penalties should be considered when assessing compliance with the 75 dB(A) criterion.</p> <p>These activities, if undertaken in continuous blocks and</p>		Construction	Construction Manager	CoA C8, EA

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
	<p>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 before activities recommence.</p> <p>An exception to the above is where negotiated agreements have been reached with all of the affected receivers. Any complaints will be managed in accordance with the CIP.</p>				
NV29	<p>Where activities resulting in tonal or impulsive noise generation are undertaken, whether within or outside of standard working hours, for a continuous 3 hour period and impact on noise sensitive receivers, or activities result in high noise impacts at receivers greater than 75 dB(A), a minimum respite period of 1 hour shall be scheduled before activities recommence.</p> <p>An exception to the above is where negotiated agreements have been reached with all of the affected receivers. Any complaints will be managed in accordance with the CIP.</p>		Construction	Foreman	
NV30	<p>Any proposal to undertake works outside of the standard working hours identified in NV26 will be subject to the processes and assessment requirement contained in the out of hours works procedure (see Appendix D).</p>		Construction	Environment Manager / Foreman	
BLAST MANAGEMENT					
NV31	<p>Blasting shall only be undertaken during the following hours</p> <ul style="list-style-type: none"> • 9:00 am to 5:00 pm, Mondays to Fridays, inclusive; • 9:00 am to 1:00 pm on Saturdays; and • at no time on Sundays or public holidays. <p>Unless 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 is received.</p>		Construction	Construction Manager	CoA C6
NV32	<p>All blasting associated with the Project will be conducted within the air blast overpressure and Peak Particle Velocity Criteria outlined within Table 5-8 and Table 5-9. This requirement does not apply where written agreement from the affected landowners and/or Director-General is obtained,</p>		Construction	Foreman / Specialist Sub-contractor	C9, C10, C11

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
	and subject to the additional requirements in Table 3-1 and condition C.11.				
NV33	Blasting shall be undertaken in accordance with the Blast Management Plan contained in Appendix C of this document.		Construction	Foreman / Specialist Sub-contractor	
NV34	Blasting trials would be undertaken with results from the trials used to determine site law and site-specific blast designs to satisfy relevant performance criteria.		Construction	Foreman / Specialist Sub-contractor	EA
CONSULTATION AND COMPLAINTS MANAGEMENT					
NV35	Residents / sensitive receivers will be notified of construction activities that are likely to affect their noise and vibration amenity in accordance with the Community Involvement Plan. Information provided will include: <ul style="list-style-type: none"> • The types of activities to be undertaken. • The timing of activities including expected start and finish. • The location of activities. • Details of the community information line and how to make an enquiry and/or complaint 		Pre- construction, Construction	Community Relations Manager	
NV36	Consultation with affected education institutions during construction works in their vicinity will attempt to limit audible construction works during important events, such as examination periods.		Pre- construction, Construction	Community Relations Manager	SoC N2
NV37	The EPA must be notified 48 hours prior to any works outside of standard working hours commencing, including details of timing and duration, where the works are conducted in accordance with NV27 and/or written agreement has been obtained from potentially affected noise sensitive receivers, unless an alternative agreement from the EPA is obtained.		Pre- construction, Construction	Environment Manager	SoC N4
NV38	All reasonable attempts will be made to contact sensitive receivers located within 500 metres of a blast location. The contact will be at least 48 hours before a blast and will include a schedule of blast time(s), and a telephone contact name and number.		Pre-construction, Construction	Community Relations Manager	SoC N5, EA

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
NV39	Where complaints relating to noise or vibration impacts as a result of extended workings cannot be satisfactorily resolved with the affected residents then works hours will revert back to standard working hours at that particular location for that particular activity. Resident(s) will be consulted before recommencing any works outside standard working hours. Any complaints received in relation to working hours will be made available to DoPI and EPA.		Construction	Superintendent, Community Relations Manager	SoC N6
NV40	Prior consultation and notification would be undertaken with nearby residents that may be affected by noise or vibration generating activities that exceed the relevant criteria.		Pre-construction, Construction	Community Relations Manager	EA
NV41	Circumstances may arise during construction where works outside of standard construction hours are essential and sensitive receivers are assessed to be highly noise affected (i.e. experience noise levels greater than 75 dBA). Where this is the case, opportunities to minimise impacts on highly noise affected receivers, including the provision of alternative accommodation, would be considered in consultation with those affected receiver(s).		Construction	Community Relations Manager	Good practice
NV42	All complaints received will be managed in accordance with the Community Involvement Plan.		Construction	Community Relations Manager	B27
SURVEY, MONITORING AND REPORTING					
NV43	Initial noise monitoring of plant and equipment will be undertaken to ensure the noise performance levels predicted in this CNVMP are being met.		Pre-construction, Construction	Environmental Officer, Noise Specialist	Good practice
NV44	Noise and vibration monitoring will be undertaken in accordance with Section 9.3. The program for construction noise and vibration monitoring indicates monitoring frequency, location, how the results of this monitoring are recorded and, procedures that are followed where significant exceedances of relevant noise and vibration goals are detected.		Construction	Environmental Officer, Noise Specialist	CoA B31 c) vii
NV45	Building Condition Inspections for each public utility, structure and building will be carried out where:		Pre-construction, Construction	Engineer	G36/E

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
	<ul style="list-style-type: none"> • 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. • Pile driving activities are within 250 metres or the distance at which the calculated 95th percentile Peak Velocity of ground vibration from the proposed pile driving is 2 mm/s, whichever is the greater • Other vibration causing activities where the distance at which the calculated 95th percentile Peak Velocity of ground vibration is 2 mm/s. 				
NV46	<p>The Building Condition Inspection report will include as a minimum:</p> <ul style="list-style-type: none"> • Floor plan of the subject building. • Record site details - age, construction, site slope and provision for drainage, presence of trees. • Type of defects and their positions and extents on the floor plan. • 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. • How doors sit in the jambs - out of line may indicate foundation settlement. • External signs of reactive clay foundation soil, e.g. lifting of slabs, uneven kerbing. 		Pre-construction, Construction	Engineer	G36
NV47	<p>All complaints, including those related to property damage, will be managed in accordance with the Roads and Maritime Complaints and Enquiries Procedure – see section 6.3.2 of the CEMP.</p>		Construction	Community Relations Manager	

9 Compliance management

9.1 Roles and responsibilities

The Lend Lease 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.

9.2 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.

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

9.3 Inspections and monitoring

Weekly and other routine inspections by Environmental Officers, Roads and Maritime, 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.

9.3.1 Noise monitoring

The following noise monitoring will be undertaken:

- From June 2015, the monitoring of noise on a monthly basis will be discontinued and noise will only be monitored if a noise complaint is received or for the commencement of new activities to confirm predictions at nominated sensitive receiver locations (refer to Appendix B of this plan).
- Monitoring results will be added to a noise monitoring register to be kept for the duration of the project and a summary report will be prepared and submitted to Roads and Maritime on a monthly basis.
- Noise monitoring may be carried out for the purpose of refining construction methods or techniques to minimise noise.

Where actual noise levels are found to exceed the predicted worst case levels, the source of excessive noise generation 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.

9.3.2 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 specified in Section 7.3.1 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, reduction in impacts will be achieved 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 in accordance with:

- For structural damage vibration – German Standard DIN 4150 and BS 7385: Part 2 – 1993.
- For human exposure to vibration – the evaluation criteria presented in the Environmental Noise Management Assessing Vibration: A Technical Guideline (DECC 2006).

9.4 Non-conformances

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

9.5 Complaints

Complaints will be recorded in accordance with the Community Involvement Plan (CIP). 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 CIP.

9.6 Auditing

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

Audit requirements are detailed in Section 8.4 of the CEMP.

9.7 Reporting

Reporting requirements and responsibilities are documented in Section 8.4 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} 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.

10 Review and improvement

10.1 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.

10.2 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 Environment Manager, or delegate, has the authority to change any of the environmental management documentation.

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

Plant and equipment sound power levels

Scenario reference	Construction activity	Description	Plant	No.	Usage	Total A-weighted sound power									
						63	125	250	500	1000	2000	4000	8000	Sum	
A	Clearing and grubbing (discrete)	small pockets of vegetation where dozer and chain method is too broad, e.g. Sed basins	Chainsaw	2	20%	72	81	88	94	95	98	98	96	104	
			excavator w mulcher attachment	1	20%	80	83	89	95	94	93	90	83	100	
			25 t dump truck moving	1	20%	72	80	88	92	95	93	89	79	99	
						81	86	93	99	99	100	99	96	106	
B	Geotech investigation	drilling	Cable percussion drill rig	1	20%	72	82	79	84	91	90	84	76	95	
C	Clearing and grubbing (broad)	large scale clearing with dozer	D11 dozer	1	40%	96	101	106	111	112	111	103	93	117	
			40 t excavator	2	40%	86	89	95	101	100	99	96	89	106	
			tub grinder	1	20%	91	96	101	106	107	106	97	88	112	
			25 t dump truck moving	1	20%	85	92	89	97	96	95	89	83	102	
						97	102	108	113	113	112	105	95	118	
D	Earthworks	bulk earth moving and compacting	D8	1	20%	75	89	99	103	106	102	96	87	109	
			651E scrapers	2	40%	89	98	101	103	111	106	102	91	114	
			637E/G scrapers	2	40%	87	96	99	101	109	104	100	89	112	
			40t tracked excavator	1	20%	86	97	95	102	101	100	99	90	107	
			Graders	1	40%	86	95	98	100	108	103	99	88	111	
			vibratory rollers 18 t	1	40%	70	83	96	99	98	95	88	78	104	
			compactors	1	20%	71	83	86	95	98	99	95	90	104	
			dump trucks	1	10%	68	77	85	89	92	90	86	76	96	
			truck and dogs	1	10%	82	89	86	94	93	92	86	80	99	
						73	83	88	91	94	90	85	79	98	
						93	103	107	110	115	111	107	97	118	
E	Drill and blast	Rock hammering	prepare cutting for blast	Airtrak drill	3	20%	85	103	95	102	106	106	103	99	111
			Rock hammer	2	20%	82	91	98	106	108	110	108	102	115	
			30t excavator	2	40%	73	82	92	97	96	94	91	84	102	
			D8 Dozer	1	40%	78	92	102	106	109	105	99	90	112	
			Dump truck	2	20%	88	95	92	100	99	98	92	86	105	
						89	98	104	110	112	112	108	102	117	
F	Crushing and screening	crush and screen larger rock from blast	Crusher, excavator and loader	2	40%	97	105	104	110	113	111	106	98	117	
			truck and dog	2	20%	88	95	92	100	99	98	92	86	105	
						98	106	104	110	113	111	106	98	117	
G	Drainage surface	open trenching, culverts etc	22t excavator	1	40%	73	84	87	89	89	88	82	72	95	
			8t back hoe	1	40%	70	71	82	88	87	87	81	73	93	
			dump truck	1	20%	85	92	89	97	96	95	89	83	102	
			crane (franna or hiab)	1	20%	71	73	78	83	88	85	78	69	91	
						85	93	92	98	98	97	91	84	104	

Scenario reference	Construction activity	Description	Plant	No.	Usage	Total A-weighted sound power										
H	Drainage underbore	under existing hwy	14 t excavator	1	40%	75	73	82	88	87	86	82	70	93		
			direction drill generator	1	40%	65	88	89	93	96	97	93	84	102		
			compressor	1	40%	65	88	89	93	96	97	93	84	102		
			pipe jack	1	20%	74	91	99	101	103	99	95	84	107		
						78	94	100	102	105	103	99	89	109		
I	Bridge works piling	Tubular steel	4t hammer piling rig	3	20%	80	97	105	107	109	105	101	90	113		
			compressor	2	40%	68	91	92	96	99	100	96	87	105		
								80	98	105	107	109	106	102	92	114
		Precast concrete	hydraulic hammer	3	20%	82	92	99	112	109	105	102	95	114		
		Sheet piling	Sheet piling rig (vibratory)	3	20%	83	92	96	105	110	109	104	92	114		
						75	89	93	96	100	106	101	94	108		
J	Bridgeworks construction	welding, lifting, pouring	Concrete pump	2	20%	81	89	93	100	101	99	96	89	106		
			40 t excavator	1	40%	83	86	92	98	97	96	93	86	103		
			220t crane	1	20%	67	71	82	88	88	86	80	71	93		
			concrete truck	4	40%	84	83	87	97	101	100	95	87	105		
						87	91	97	103	105	104	100	92	110		
K	Pavement removal	existing pavement removal	profiler	1	40%	79	95	94	98	101	99	95	90	106		
			dump truck	1	100%	75	76	74	80	88	85	79	70	91		
			Rock hammer	1	20%	79	88	95	103	105	107	105	99	112		
			Excavator loading truck	1	40%	80	86	97	102	105	103	97	87	109		
						84	96	101	106	109	109	106	99	114		
L	Demolition	removal of houses and other structures	15t breaker	1	20%	83	93	98	107	104	105	102	96	111		
			40t excavator loading truck	1	40%	80	86	97	102	105	103	97	87	109		
			30 t Pulveriser	1	20%	70	77	83	91	91	91	88	79	97		
						85	94	101	108	108	107	103	97	113		
M	Paving	PCP paver	Paver	1	50%	88	95	99	104	106	104	102	91	111		
			concrete truck	2	40%	74	75	73	79	87	84	78	69	90		
								88	95	99	104	106	104	102	91	111
		Paving asphalt	Asphalt paver and tipper (18 t)	1	50%	86	93	97	102	104	102	100	89	109		
			Rubber tyred roller	1	40%	85	93	90	94	99	98	94	86	104		
						88	96	98	102	105	104	101	91	110		
paving - concrete cutting			Concrete saw	3	20%	58	85	84	89	92	95	99	96	102		

Scenario reference	Construction activity	Description	Plant	No.	Usage	Total A-weighted sound power										
N	road furniture installation	barriers, signs	franna crane	1	20%	71	73	78	83	88	85	78	69	91		
			rattle gun	1	20%	54	66	79	86	86	91	94	93	98		
			compressor	1	40%	65	88	89	93	96	97	93	84	102		
			concrete truck	1	40%	78	77	81	91	95	94	89	81	99		
						79	88	91	96	99	100	97	94	105		
O	service relocation	move power poles and change underground service locations	Drill rig	1	20%	82	91	89	91	96	94	89	79	100		
			mobile crane	1	20%	71	73	78	83	88	85	78	69	91		
			15 t excavator	1	40%	75	82	86	91	92	91	85	77	97		
			road saw	1	20%	67	94	93	98	101	104	108	105	112		
						83	96	96	99	103	105	108	105	112		
P	retaining walls	bored piling	40t excavator	1	40%	83	86	92	98	97	96	93	86	103		
			piling rig	1	20%	70	84	88	91	95	101	96	89	104		
								83	88	94	99	99	102	98	91	106
		lift and pour	concrete truck	1	40%	75	79	80	86	90	91	85	74	95		
			concrete pump	1	20%	78	86	90	97	98	96	93	86	103		
			mobile crane	1	20%	80	78	79	89	93	91	85	76	97		
delivery truck	1		20%	91	87	86	91	98	94	93	84	102				
						91	90	92	99	102	100	97	88	106		
Q	soft soil treatment	stone columns and vibro compaction	20 t excavator	1	40%	80	92	90	90	93	92	87	80	99		
			vibro-displacement rig	2	20%	89	92	94	98	98	94	95	82	104		
			loader	1	40%	81	85	85	91	94	93	89	81	99		
			dump truck	1	20%	85	92	89	97	96	95	89	83	102		
						91	97	97	101	102	100	97	88	107		
R	Stockpiling	Materials handling and storage	20 t excavator	1	40%	81	85	85	91	94	93	89	81	99		
			Loader	1	40%	80	92	90	90	93	92	87	80	99		
			Truck and dog	1	20%	88	95	92	100	99	98	92	86	105		
						89	97	95	101	101	100	95	88	107		
S	Ancillary facilities	Small ancillary	Material lay down, small office, stockpile	1	100%	77	83	81	88	89	87	82	74	94		
		Medium ancillary	Material store, office and workshop, stockpile	1	100%	85	88	87	93	93	92	88	78	99		
		Wet-mix batch plant	Batching plant, loaders, concrete trucks, deliveries	1	100%	77	91	93	102	103	103	102	87	108		
		Dry mix batch plant	Agitator trucks, loader	1	100%	82	86	87	92	95	95	90	82	100		

Appendix B

Sensitive receivers,

Background noise monitoring locations and

Construction noise monitoring locations



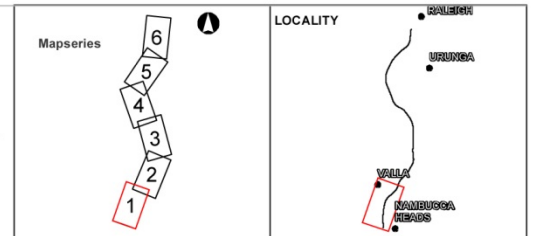
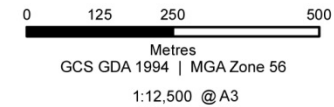
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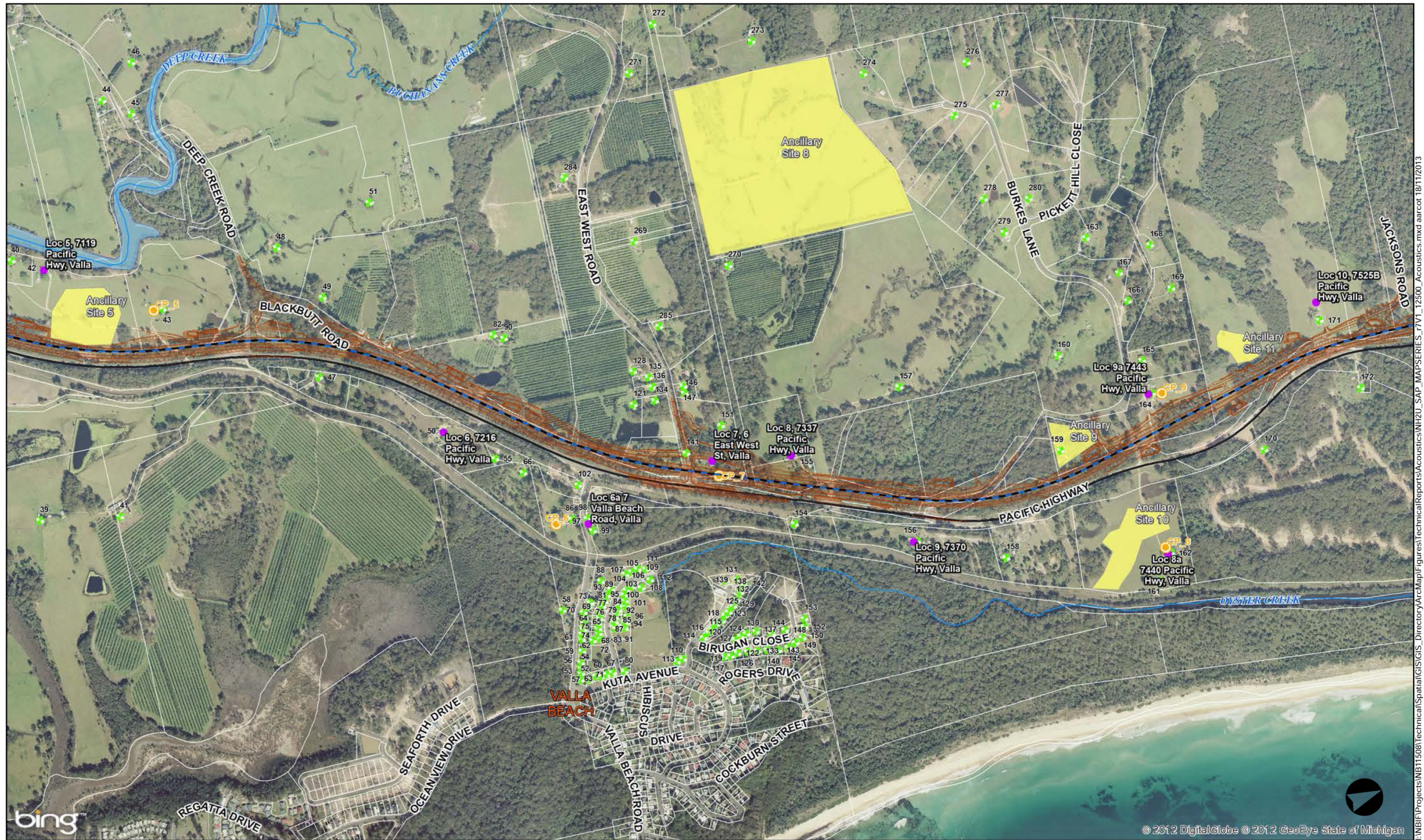







PLAN TITLE Construction noise and vibration sensitive receivers
 Sheet 1 of 6
 PROJECT TITLE Nambucca Heads to Urunga Pacific Highway Upgrade
REVISION DATE: 18/11/2013

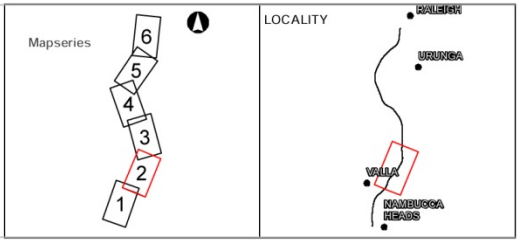
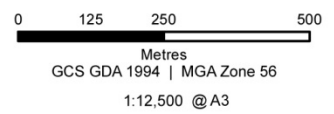
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 - + Noise construction receivers
 - Construction phase noise monitoring locations (CP_#)
 - Ancillary sites

NH2U Design

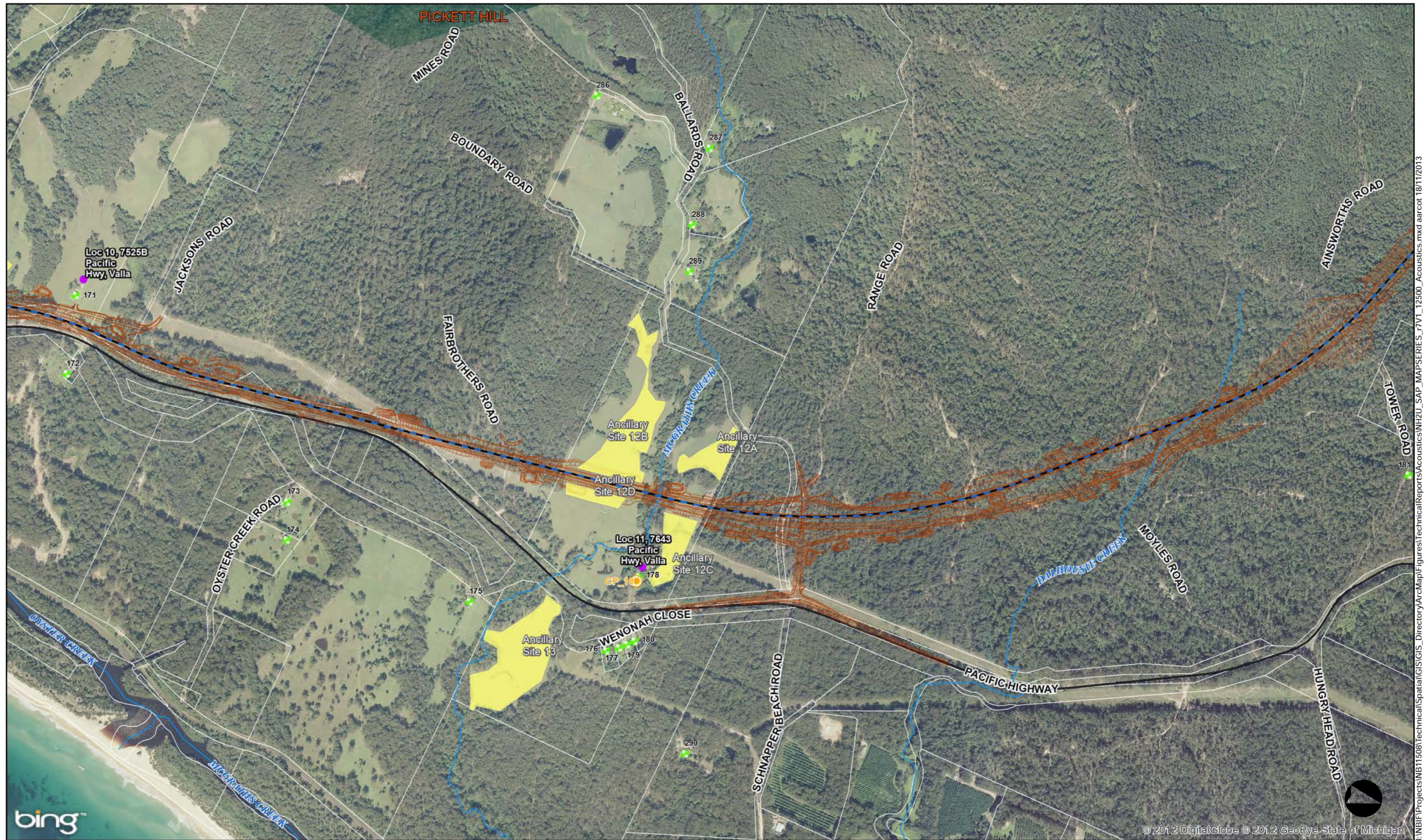




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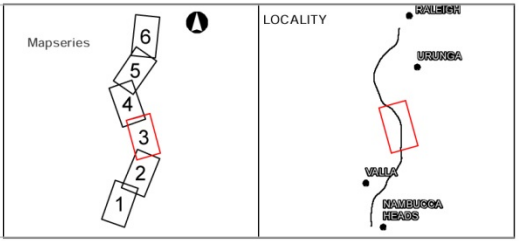
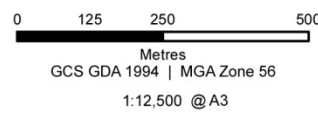


PLAN TITLE
Construction noise and vibration sensitive receivers
 Sheet 3 of 6






PROJECT TITLE
Nambucca Heads to Urunga Pacific Highway Upgrade

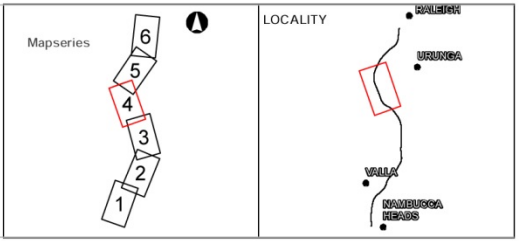
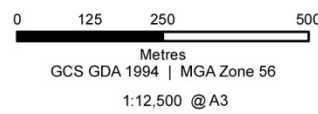
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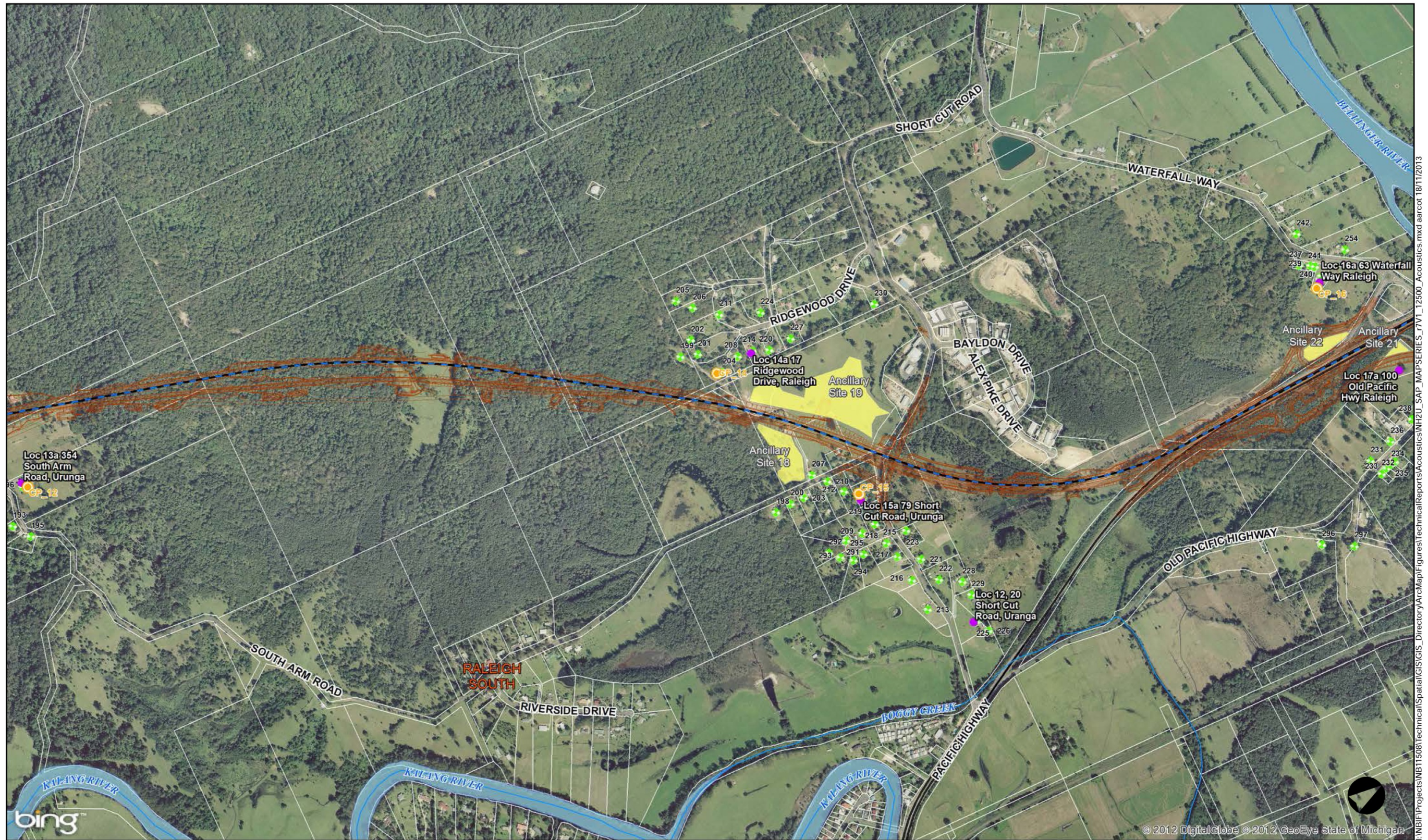




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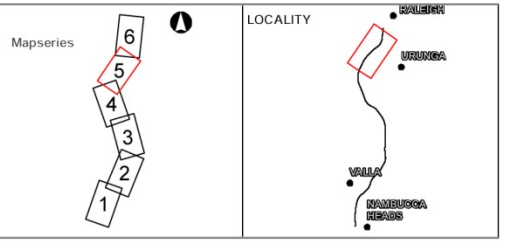
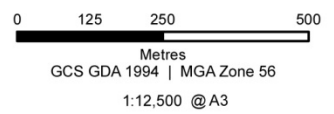


PLAN TITLE
Construction noise and vibration sensitive receivers
 Sheet 5 of 6






PROJECT TITLE
Nambucca Heads to Urunga Pacific Highway Upgrade

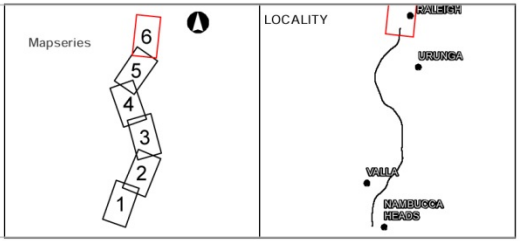
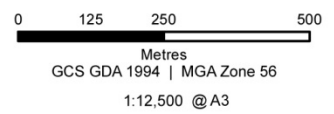
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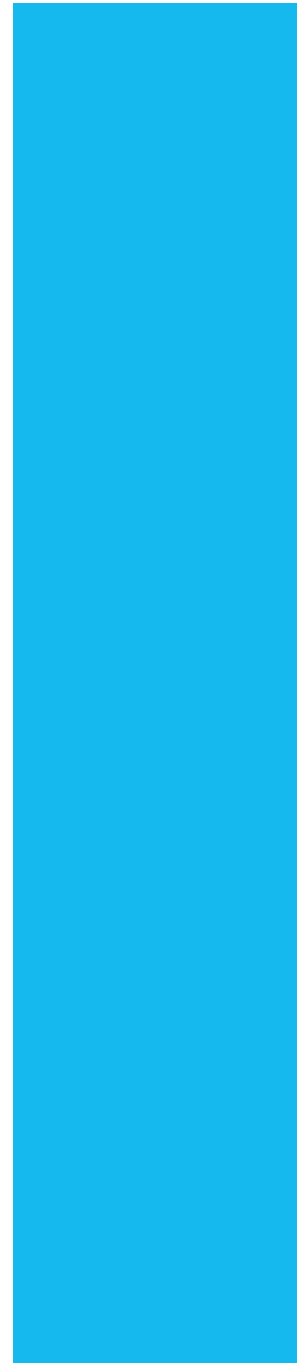
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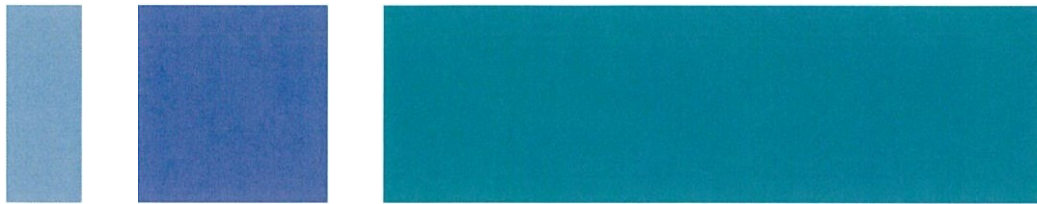
Appendix C

Blast Management Plan



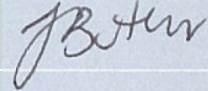
Blast Management Plan



March 2014



Document Control

Title:		Blast Management Plan		Document No/Ref: TBA	
General Description:	Blast Management Plan Revision No. 2.0				
Document Path:	NVMP App C_Blast Management Plan Rev2.0.docx				
Disciplines	Drill and Blast				
	Name	Position	Date	Signed/Approved	
Originator(s)	Matt Amato	Project Engineer	12/03/2014		
Review	John Goding	Area Manager	12/03/2014		
	Jenny Butler	Environmental Manager	12/03/2014		
Approval	David Bone	Environmental Representative			

Document Revisions

Rev No	Date	Issue/Description	Approved
0	Mar 2013	Issued for internal review	
1	Mar 2013	Issued for Roads and Maritime Services I PV I ER review	
1.1	Apr 2013	Updated for issue to ERG	
2.0	Mar 2014	Minor changes for approval by the Environmental Representative	

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Appendices

Appendix A Sensitive Receivers

Glossary / Abbreviations

CEMP	Construction Environmental Management Plan
CoA	Condition of Approval
DPI	Department of Primary Industries (Fisheries, Conservation and Aquaculture)
EA	Environmental Assessment
EEC	Endangered Ecological Community
EPA	Environment Protection Authority
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
EPBC Act	<i>Environmental Protection and Biodiversity Conservation Act 1999</i>
EWMS	Environmental Work Method Statements
FFMP	Flora and Fauna Management Plan
FM Act	<i>Fisheries Management Act 1994</i>
LLE	Lend Lease Engineering
NH2U	Nambucca Heads to Urunga (<i>Stage 1 of WC2U Project</i>)
NPW Act	<i>National Parks and Wildlife Act 1974</i>
NW Act	<i>Noxious Weeds Act 1993</i>
OEH	Office of Environment and Heritage
RMS	Roads and Maritime Services
SEPP	State Environmental Planning Policy
SoC	Revised Statement of Commitments included in the Submissions Report
SWTC	Scope of Works and Technical Criteria (Roads and Maritime Services)
TSC Act	<i>Threatened Species and Conservation Act 1995</i>
WC2U	Warrell Creek to Urunga
WP	Working Paper (part of the Environmental Assessment)

Definitions

Word	Definition
Air-blast/Overpressure	An airborne shock wave resulting from detonation of explosives. An air-blast may be caused by overburden movement or the release of expanding gas into the air.
Bench	A horizontal ledge from which holes can be drilled vertically down into the material to be blasted.
Blast, Blasting	The firing of explosive materials for such purposes as breaking rock or other material, or moving material.
Blast Controller	Coordinates and takes overall control of the blasting and associated activities on the day of the blast. It is anticipated that a LLE Engineer will be the blast controller
Blast Guard	Controls access at designated areas to ensure the blast area is clear of members of the public and the workforce leading up to and at the time of the blast.
Burden	The distance from the drill hole to the nearest free face
Drill Hole	A hole drilled into the material to be blasted for the purpose to contain the explosive charge.
Fly-rock	Rocks propelled from the blast area by the force of an explosion.
Ground Vibration	Movement of the ground by elastic waves emanating from a blast, measured by particle velocity.
Initiation	Detonation in an explosive material.
K-value	A constant value representing the rock properties, used for determining blasting parameters relating to vibration
Misfire	A blast, drill hole or explosive material that failed to detonate as planned.
MIC	Maximum Instantaneous Charge (kg of explosive detonated per millisecond)
Muck Pile	The pile of broken material resulting from a blast.
Overburden	Material of any nature lying on top of a deposit that is to be blasted.
Particle Velocity	A measure of the intensity of ground vibration, specifically the velocity of motion of the ground particles as they are excited by the wave energy.
Primer	Initiates other explosives by either containing a detonator or detonating cord attached to the detonator.
Sensitive Receiver	People, property, environment and infrastructure susceptible to the effects from blasting.
Shot-firer	The qualified person responsible for the loading and firing of a blast.
Spacing	Distance between drill holes.
Stemming	Inert material placed into the drill hole on top of or between separate charges of explosive material. Used to confine the explosives.
Sub-drill	The practice of drilling holes below floor level or working elevations to ensure breakage of rock to work elevation.

Changes from Previous Submission

Change Type	Change	Reference to Management Plan
Change	Changed formatting to Lend Lease standard formatting	All
Change	Changed Abigroup and NH2U to Lend Lease Engineering (LLE)	All
Addition	Addition of K-value and MIC definitions to list	Definitions List
Addition	Addition of table identifying any changes to the previous plan	Changes Table
Update	Updated project details to most current	1.0
Deletion	Cut 23 deleted from consideration for drill and blast	3.0
Update	Updated scope with changed cut numbering, expected quantities of rock and programme durations	3.0
Update	Updated WorkCover NSW requirements	4.1
Addition	Addition of additional safety legislation required for blasting operations	4.2
Addition	Addition of RMS G22	4.6
Update	Updated programme status	5.2
Addition	Addition of steps within construction methodology including programming/communications and also PV hold point submission	5.4
Clarification	Clarification of requirements for blast mats and reduction in overburden requirements from 3m to 2m	5.4
Addition	Addition of table outlining sensitive receivers and roads affected by blasts	5.5
Addition	Addition of safety measures around working around vertical drops	6.1.5
Clarification and Deletion	Clarification that the Pacific highway will not need closing (due to removal of Cut 23 from scope) during blasting activities and the appropriate changes to traffic control	6.2
Addition	Addition of maps identifying 500m and 1000m sensitive receiver locations	Appendix A

1 Introduction

This Blast Management Plan (BMP or Plan) forms part of the Construction Noise and Vibration Management Plan (NVMP) for the upgrade of the Pacific Highway from Nambucca Heads to Urunga (NH2U). The NH2U Project is Stage 1 of the Warrell Creek to Urunga (WC2U) Project, approved by the Minister for Planning and Infrastructure in 2011.

The NH2U section of the WC2U Project involves the construction of approximately 22km of new highway from south of Nambucca Heads Interchange to the existing Waterfall Way Interchange at Raleigh, north of Urunga. The NH2U Project is being constructed by Lend Lease Engineering (LLE).

This BMP has been prepared to address the requirements of the Minister's Conditions of Approval (CoA), the Roads and Maritime Services Statement of Commitments (SoC), the mitigation and management measures listed in the Warrell Creek to Urunga Environmental Assessment (EA) and all applicable legislation. This BMP also details measures to ensure the works are conducted safely and impacts to the local community, environment and traffic are minimised.

2 Purpose & Objectives

2.1 Purpose

The purpose of the BMP is to:

- Supplement the NVMP by specifically detailing the proposed method of blasting and the relevant blasting controls to minimise impacts caused by noise and vibration.
- Ensure the Principal Contractor meets the current legislative requirements and conditions for blasting activities
- Summarise the various specification requirements relating to blasting;
- Present the principles and guidelines for minimising impacts on local residents and other sensitive receivers;
- Describe the practical measures and best management practices to be included in the design and implementation of blasting operations;
- Outline the design, pre and post blast evaluations, monitoring and documentation framework;
- Provide an efficient, simplified and diligent approach to addressing the issues that may arise from the blasting operations.

2.2 Objectives

The objectives of the BMP are to:

- Present the quality, safety, environmental and community procedures relating to blasting activities;
- Minimise the impacts from the blasting operations;
- Ensure vibration, air-blast overpressure and dust is controlled within prescribed limits;
- Protect the amenity of the residents and other building occupiers;
- Protect the amenity of passive recreation areas;
- Ensure the community is consulted and complaints are minimised;
- Prevent damage to adjacent public utilities, structures and buildings.

3 Scope of works

The construction of the Nambucca Heads to Urunga Upgrade Project (NH2U) requires the excavation of areas as shown in the table below. Due to hard rock in these cuttings, the excavation process may require blasting.

Name	From Chainage	To Chainage
Cut 26	73800	74500
Cut 32	78400	78700

Note: additional blast locations may be required during construction as works progress.

LLE will appoint a specialist Drill and Blast Contractor to undertake these works and review and monitor the blasting operations and its effect on the local community.

3.1 Main Cutting – Cut 26

The main cutting is located between CH78400-78700 (refer Figure 3.1) and it is expected that approximately 400,000m³ of material will be blasted from this location. This material will mainly comprise of quartz rich phyllite and volcanic microgranodiorite. The maximum depth of the cutting is 36.0m. The hard rock that requires blasting ranges from the surface down to subgrade level. It is anticipated that blasting at this location will take approximately 10 months.

Figure 3.1. Blast Location Cut 26



3.2 Cut 32

Cut 32 sits between Ch 78400 and Ch 78700 (see Figure 3.2) and it is expected that approximately 50,000m³ of material will be excavated from this location. This material will mainly comprise of quartz rich phyllite with intrusive granodiorite dykes. The maximum depth of this cutting is 22m, with the rock that requires blasting lying from as high as 10m below the existing ground level down to just above subgrade levels in the cut. It is anticipated that blasting at this location will take approximately 2 months.

Figure 3.2. Blast Location Cut 32



4 Requirements, Approvals & Guidelines

The following sections summarise the requirements and guidelines relevant to blasting works as contained in the Ministers Conditions of Approval, the Roads and Maritime Services' Statement of Commitments, the anticipated Environmental Protection Licence, the Environment Assessment, the Scope of Works and Technical Criteria (SWTC) and the NSW Work Cover legislation.

4.1 Approvals & Notifications

In order to commence blasting operations the impacts of the operations and who will be affected need to be considered. The following stakeholders have been considered for notification.

- Department of Planning and Infrastructure (DoPI) – This BMP forms part of the Project's NVMP which requires DoPI approval.
- Environment Protection Authority (EPA) – This BMP will be reviewed by EPA prior to obtaining DoPI approval of the NVMP. An environmental protection licence under the Protection of the Environment Operations Act 1997 for "road construction", "crushing, grinding and separating" and "extractive activities" will be obtained prior to commencing construction of the project.
- Roads and Maritime Services – No formal application or permit required other than review of this Document.
- Bellingen Shire Council (BSC) and Nambucca Shire Council (NSC) – No formal application or permit is required although the Blast Management Plan will be provided to the councils for information.
- WorkCover – Formal notification to be provided to WorkCover NSW in accordance with the legislation requirements as of 1st March 2014 (notification of blasting activities form).
- Police and Emergency Services – no permit required except notification of the works.
- Bus Operators – The bus companies will be informed of the blasting times.
- Utility companies – service providers have been consulted with in regards to any required vibration restrictions. Any such restrictions will be designed into the trial and main blasts. The main restriction in this regard is the telecommunications tower on Tower Rd.
- Sensitive Receivers - Consultation to all sensitive receivers located within 1km of the blast locations will be conducted via letter box drops informing them of the blasting works including day of the week, time of the day, number of blasts etc. Community consultation is further discussed in Section 7 of this BMP.
- General public - Traffic alerts and the VMS will be utilised to advise the broader community including motorists where required. Refer to Section 7 of this BMP for further details.

4.2 Legislation

The key environmental and safety legislation for LLE relating to blasting and the noise and vibration management include:

- Environment Planning and Assessment Act (1979); and
- Protection of the Environment Operations Act 1997, and Amendment Act 2005.
- Work Health and Safety Act 2011
- Work Health and Safety Regulation 2011
- Explosives ACT 2003
- Explosives Regulation 2013
- Australian Standard 2187.2-2006 Explosives – Storage and Use
- Australian Explosives Code AEC

The relevance of these Acts to the Nambucca to Urunga is detailed in the LLE's Construction Environmental Management Plan (CEMP).

4.3 Ministers Conditions of Approval & Statement of Commitments

The Project Conditions of Approval (CoA) issued by the Minister of Planning in July 2011 that relate to blasting include:

CoA #	Minister's Condition of Approval	Reference in BMP
B31 c)	<p>As part of the Construction Environment Management Plan for the project required under condition B30 of this approval, the Proponent shall prepare and implement the following...:</p> <p>A Construction Noise and Vibration Management Plan to detail.....:</p> <p>v. procedures and mitigation measures to ensure relevant vibration and blasting criteria are achieved, including a suitable blast program supported by test blast results, 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 building damage;</p>	This Plan & NVMP
C3	<p>The Proponent shall only undertake construction activities associated with the project during the following standard construction hours:</p> <ol style="list-style-type: none"> 7:00am to 6:00pm Mondays to Fridays, inclusive; and 8:00am to 1:00pm Saturdays; and at no time on Sundays or public holidays. 	Section 5.6.1
C4	<p>Works outside of the construction hours identified in conditions C3 may be undertaken in the following circumstances:</p> <ol style="list-style-type: none"> works that generate noise that is not audible at any sensitive receptor; for delivery of materials required outside these hours by the Police or other authorities for safety reasons; or where it is required in an emergency to avoid the loss of lives, property and/or to prevent environmental harm; or construction works undertaken through sparsely populated areas in which sensitive receptors are located greater than 300 metres away from the project boundary. In this case construction is permissible during the following hours: 6.00am to 6.00pm Monday to Friday and 7.00am to 4.00pm Saturdays and at no time on Sundays or public holidays. These works hours may be reviewed and/ or revoked by the Director General in consultation with the OEH in the case of excessive or unresolved noise complaints; or where an EPL applies to the construction of the project, construction hours which are approved in accordance with the conditions of an EPL for the project; or where an EPL does not apply to the construction of the project, Out of Hours Works as agreed to by the Director general in accordance with condition C5. 	Section 5.6.1
C6	<p>Blasting associated with the project shall only be undertaken during the following hours</p> <ol style="list-style-type: none"> 9:00 am to 5:00 pm, Mondays to Fridays, inclusive; 9:00 am to 1:00 pm on Saturdays; and at no time on Sundays or public holidays. <p>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.</p>	Section 5.6.1
C7	<p>The Proponent shall implement all 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) during construction activities. 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 B31(c) of this approval.</p>	Section 5.6

CoA #	Minister's Condition of Approval	Reference in BMP						
C8	<p>The Proponent shall implement all feasible and reasonable mitigation measures with the aim of achieving the following construction vibration goals and ground-borne noise levels:</p> <ol style="list-style-type: none"> for structural damage vibration, the vibration limits set out in the German Standard D/N 4150 Part 3-1999 Structural Vibration in Buildings - Effects on Structures; for works in the vicinity of the heritage structures, the vibration limits set out in the German Standard DIN 4150-3: 1999 Structural Vibration - part 3: Effects of vibration on structures; and for human exposure, the acceptable vibration values set out in the Environmental Noise Management Assessing Vibration: A Technical Guideline (DEC 2006); and the ground-borne noise levels set out in the Interim Construction Noise Guidelines (DECC, 2009). 	Section 5.6						
C9	<p>The Proponent shall ensure that airblast overpressure generated by blasting associated with the project does not exceed the criteria specified in Table 1 when measured at the most affected residence or other sensitive receiver. To ensure that criteria are satisfied at the most affected residence or other sensitive receiver, blasting trials shall be undertaken prior to the commencement of the project blasting program, with results from the trials used to determine site specific blast design to satisfy the criteria specified in Table 1.</p> <p><i>Table 1 Airblast overpressure criteria</i></p> <table border="1" data-bbox="347 835 1256 987"> <thead> <tr> <th data-bbox="352 835 794 898">Airblast overpressure (dB(Lin Peak))</th> <th data-bbox="794 835 1251 898">Allowable exceedance</th> </tr> </thead> <tbody> <tr> <td data-bbox="352 898 794 958">115</td> <td data-bbox="794 898 1251 958">5% of total number of blasts over a 12 month period</td> </tr> <tr> <td data-bbox="352 958 794 987">120</td> <td data-bbox="794 958 1251 987">0%</td> </tr> </tbody> </table>	Airblast overpressure (dB(Lin Peak))	Allowable exceedance	115	5% of total number of blasts over a 12 month period	120	0%	Section 5.6.1 & Section 5.6.3
Airblast overpressure (dB(Lin Peak))	Allowable exceedance							
115	5% of total number of blasts over a 12 month period							
120	0%							
C10	<p>The Proponent shall ensure that ground vibration generated by blasting associated with the project does not exceed the criteria specified in Table 2 when measured at the most affected residence or other sensitive receiver. To ensure that criteria are satisfied at the most affected residence or other sensitive receiver, blasting trials shall be undertaken prior to the commencement of the project blasting program, with results from the trials used to determine site specific blast design to satisfy the criteria specified in Table 2.</p> <p><i>Table 2 Peak particle velocity criteria</i></p> <table border="1" data-bbox="347 1261 1256 1458"> <thead> <tr> <th data-bbox="352 1261 794 1323">Peak particle velocity (mms-1)</th> <th data-bbox="794 1261 1251 1323">Allowable exceedance</th> </tr> </thead> <tbody> <tr> <td data-bbox="352 1323 794 1413">5</td> <td data-bbox="794 1323 1251 1413">5% of total number of blasts over a 12 month period</td> </tr> <tr> <td data-bbox="352 1413 794 1458">10</td> <td data-bbox="794 1413 1251 1458">0%</td> </tr> </tbody> </table>	Peak particle velocity (mms-1)	Allowable exceedance	5	5% of total number of blasts over a 12 month period	10	0%	Section 5.6.1 & Section 5.6.3
Peak particle velocity (mms-1)	Allowable exceedance							
5	5% of total number of blasts over a 12 month period							
10	0%							
C11	<p>The blasting criteria identified in condition C9 and/ or C10 do not apply where the Proponent has a written agreement with the relevant landowner to exceed the criteria identified in condition C9 and/ or C10 and the Director General has approved the terms of the written agreement. In obtaining the Director General approval for any such agreement, the Proponent shall submit to the Director General:</p> <ol style="list-style-type: none"> details of the proposed blasting program and justification for the proposed increase to blasting criteria including alternatives considered (where relevant); an assessment of 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; details of the blast management, mitigation and monitoring procedures to be implemented; and details of consultation undertaken and agreement reached with the relevant landowners (including a copy of the agreement in relation to increased blasting limits). <p>The following exclusions apply to the application of this condition:</p> <ol style="list-style-type: none"> any agreements reached may be terminated by the landowner at any time should concerns about the increased blasting limits be unresolved; the blasting limit agreed to under any agreement can at no time exceed a maximum 	Subject to further DG approval.						

CoA #	Minister's Condition of Approval	Reference in BMP
	<p>Peak Particle Velocity vibration level of 25 mm/s or maximum Airblast Overpressure level of 125 dBL; and</p> <p>c. the provisions under condition C'11 (to increase applicable blast criteria in agreement with the relevant landowners) do not apply where the property is a heritage property.</p>	

The blasting requirements in Roads and Maritime Services' Statement of Commitments include:

Objective	Ref	Commitment	Timing	Reference in BMP
Minimise construction noise and vibration impacts.	N1	<p>Further investigation of all feasible and reasonable mitigation and management measures to minimise construction noise at sensitive receivers will occur as part of detailed design (including consideration of early implementation of operational noise mitigation measures).</p> <p>Noise and vibration monitoring will measure against predicted levels and assess effectiveness. Implementation of further feasible and reasonable mitigation measures will occur where necessary.</p>	Pre-construction and construction	Section 5.6.1 & Section 5.6.3
	N2	<p>Consultation with affected education institutions during construction works in their vicinity will attempt to limit audible construction works during important events, such as examination periods.</p>	Pre-construction / Construction	Section 7
	N3	<p>Best practice mitigation and management measures will be used to minimise construction noise and vibration at sensitive receivers.</p>	Construction	Section 5.6.1 & Section 5.6.3
	N4	<p>Construction would normally be limited to the following hours:</p> <ul style="list-style-type: none"> • Between 6am and 6pm Monday to Friday. • Between 7am and 4pm Saturday. <p>There would be no works outside these hours or on Sundays or public holidays except:</p> <ol style="list-style-type: none"> a. Works that do not cause construction noise to be audible at any sensitive receivers. b. For the delivery of materials required outside these hours by the Police or other authorities for safety reasons. c. Where it is required in an emergency to avoid the loss of lives, property and/or to prevent environmental harm. d. Any other work as agreed through negotiations between the RTA and potentially affected sensitive receivers. Any such agreement must be recorded in writing and a copy kept on site for the duration of the works. e. Where the work is identified in the CNVMP and approved as part of the Construction Environmental Management Plan. f. As agreed by Department of Planning and or Department of Environment, Climate Change and Water in an EPL for the construction of the Proposal. <p>Local residents and the Department of Environment, Climate Change and Water must be informed of the timing and duration of work approved under items (d) and (e) at least 48 hours before that work commences.</p>	Construction	Section 5.6.1 (note CoA C3-C6 construction hours override these commitments)
	N5	<p>All reasonable attempts will be made to contact sensitive receivers located within 500 metres of a blast location. The contact will be at least 48 hours before a blast and will include a schedule of blast time(s), and a telephone contact name and number.</p>	Construction	Section 7

4.4 Environmental Protection Licence

The EPL (Licence 20321) has been obtained for the scheduled activities “road construction”, “crushing, grinding and separating” and “extractive activities”. The EPL prescribes the following blasting requirements:

	EPL Condition	Reference in BMP
Blasting Limits		
L3.1	The airblast overpressure level from blasting operations at the premises must not exceed 120dB (Lin Peak) at any time at any noise sensitive locations. Error margins associated with any monitoring equipment used to measure this are not to be taken into account in determining whether or not the limit has been exceeded.	Section 5.6.1
L3.2	The airblast overpressure level from blasting operations at the premises must not exceed 115dB (Lin Peak) at any noise sensitive locations for more than five per cent of the total number of blasts over each reporting period. Error margins associated with any monitoring equipment used to measure this are not to be taken into account in determining whether or not the limit has been exceeded.	Section 5.6.1
L3.3	Ground vibration peak particle velocity from the blasting operations at the premises must not exceed 10mm/sec at any time. Error margins associated with any monitoring equipment used to measure this are not to be taken into account in determining whether or not the limit has been exceeded.	Section 5.6.1
L3.4	Ground vibration peak particle velocity from the blasting operations at the premises must not exceed 5mm/sec for more than five per cent of the total number of blasts over each reporting period. Error margins associated with any monitoring equipment used to measure this are not to be taken into account in determining whether or not the limit has been exceeded.	Section 5.6.1
Blasting Hours		
L4.1	Blasting operations at the premises may only take place between 9:00am and 5:00pm Monday to Friday and 9:00am and 1:00pm Saturday. (Where compelling safety reasons exist, the EPA may permit a blast to occur outside the above hours. A prior written request for approval of any such blast must be made to the EPA)	Section 5.6.1
Blasting Monitoring		
L3.5	<p>To determine compliance with condition(s) L7.1, L7.2 and L7.3:</p> <p>a) Airblast overpressure and ground vibration levels experienced at the following noise sensitive locations must be measured and recorded for all blasts carried out in or on the premises;</p> <ul style="list-style-type: none"> and electronically recorded at the most affected residence or noise sensitive location that is not owned by the licensee or subject a private agreement between the owner of the residence or noise sensitive location and the licensee for all blasts carried out in or on the premises; and <p>b) Instrumentation used to measure the airblast overpressure and ground vibration levels must meet the requirements of Australian Standard AS 2187.2-2006.</p> <p>Note: A breach of the licence will still occur where airblast overpressure or ground vibration levels from the blasting operations at the premises exceeds the limit specified in conditions L7.1 to L7.3 at any “noise sensitive locations” other than the locations identified in the above condition.</p>	Section 5.5 and 5.6

4.5 Environmental Assessment

The Environmental Assessment for the Pacific Highway Warrell Creek to Urunga Upgrade prepared by Sinclair Knight Mertz for the Roads and Maritime Services (EA January 2010) details the following in regards to blasting activities:

- Table 14-15 summarises the estimated Maximum Instantaneous Charge (MIC) and the minimum distances required to achieve the applicable criteria. It should be noted that this procedure is only an estimation procedure. In order to obtain an accurate prediction, site specific testing is essential.

Maximum instantaneous charge (MIC)	Minimum distance Limits (metres)	
	Vibration	Over pressure
5	70	290
10	100	350
20	140	430
50	220	560
100	300	670
200	430	750

- The following blasting management measures would be implemented to minimise construction impacts at adjacent sensitive receivers (EA Sections 14.3.4.5 & 14.7.2):
 - The blast charge configuration should be selected to ensure that DECCW goals are not exceeded.
 - Before blasting can commence at a site, critical locations should be identified and appropriate measures taken to limit over pressure and vibration to acceptable levels. Blasts should be monitored initially at these locations to ensure that predicted over pressure and vibration levels are not exceeded.
 - Blasting trials would be undertaken if blasting is to be used, with results from the trials used to determine site-specific blast designs to satisfy relevant performance criteria.
 - The recommended goals for blasting during the Project are based on the ANZECC guidelines, Technical Basis for Guidelines to Minimise Annoyance Due to Blasting Overpressure and Ground Vibration. These state that "Blasting should generally only be permitted during the hours of 9.00am to 5.00pm Mondays to Saturdays" and that "Blasting should not take place on Sundays or Public Holidays".
 - In addition, any exceedance above an over pressure of 115dB (linear) should be limited to not more than 5% of the total number of blasts. On these infrequent occasions a maximum limit of 120dB (linear) should not be exceeded at any time. Ground vibrations above 5 mm/sec should also be limited to not more than 5% of the total number of blasts. On these infrequent occasions a maximum limit of 10mm/sec should not be exceeded at any time.
 - All reasonable attempts would be made to contact sensitive receivers located within 500 metres of a blast location. The contact would be made at least 48 hours before a blast and advice given to the receiver would include a schedule of blast time(s) and a telephone number and contact name.

4.6 Guidelines, Standards & Specifications

The key Guidelines and Standards relevant to blasting management include:

- Standard Roads and Maritime Services Specifications:
 - NH2U R44 Earthworks
 - NH2U G36 Environmental Protection (Management Systems).
 - NH2U G22 Work Health and Safety (Major Works)
- Technical Basis for Guidelines to Minimise Annoyance due to Blasting Over Pressure and Ground Vibration September 1990 – Australian and New Zealand Environment Council (ANZECC).
- British Standard 7385: Part 2 "Evaluation and measurement of vibration in buildings".
- German Standard DIN 4150:1999 – Structural Vibrations in Buildings: Effects on Structures.
- RTA Environmental Noise Management Manual (ENMM) (RTA 2001a).
- Interim Construction Noise Guidelines (ICNG), (DECCW 2009).
- Australian Standard AS2187.2-2006: "Explosives – Storage, Transport and Use".
- Assessing Vibration: a technical guideline (DEC 2006).

6.1.5 Scope of Works and Technical Criteria

Criteria from the Scope of Works and Technical Criteria (SWTC) include:

- Clause 4.3 - Condition Surveys:
 - a) In addition to inspections and surveys required by the deed, including the Environmental Documents, and prior to commencing any activity which could affect existing infrastructure (including roads, structures, railways, Services, buildings, slopes and heritage items), the Contractor must undertake ground and infrastructure condition surveys to establish the pre-construction conditions of all existing ground and infrastructure which could be affected by the Contractor's Work.
 - b) Ground and infrastructure condition surveys must be conducted with the agreement of the property owner and any occupier. The outcomes of the surveys must be recorded in separate reports which include detailed records (including dated photographs) of the pre-construction conditions of the ground and infrastructure which could be affected. Roads and Maritime Services Representative, the Project Verifier and the owner and / or occupier must each be issued with a copy of the reports prior to the Contractor commencing the relevant activity that could affect the existing ground or infrastructure.
 - c) Condition surveys must be carried out by an independent and appropriately qualified assessor acceptable to Roads and Maritime Services Representative.
 - d) Building condition inspections must be undertaken in accordance with requirements of Roads and Maritime Services D&C G36

- Clause 7.7 - Explosives, Blasting and Vibration:
 - a) Blasting for the construction of the Project Works and Temporary Works must comply with EPA requirements, the requirements of other relevant Authorities and the requirements of the deed.
 - b) Further to the requirements of sections 7.7(a) and 7.15.2 of this Scope of Works and Technical Criteria, blasting must be undertaken in a systematic and programmed manner and the Contractor must develop and implement a blasting programme and its community involvement plan to address these requirements and to enable the community and road users to effectively plan their travel to avoid delays.
 - c) At least 48 hours in advance of any proposed blasting operation, the Contractor must provide Roads and Maritime Services Representative with:
 - (i) the proposed location and timing of the operation;
 - (ii) the name of the person who will have control of the operation and evidence of his/her licence;
 - (iii) documentary evidence of all necessary licences and permits from the relevant Authorities;
 - (iv) measures proposed to be implemented for the protection of the public and property during the operation;
 - (v) full details of explosives, blasting patterns and any other relevant information;
 - (vi) methods of monitoring blast vibration; and
 - (vii) additional information required by the deed, including Roads and Maritime Services D&C specifications.
 - d) The Contractor must give the occupants of nearby premises, relevant Authorities and affected Service owner's reasonable notice of intended blasting in accordance with the Environmental Documents.

6.1.6 Roads and Maritime Services D&C R44 - Summary of Blast Requirements

Requirements from Roads and Maritime Services specification R44 Section 4.5 include:

- At the start of each blasting operation, hold point for submission of written details of the proposed blasting procedure including the quantity and type of explosive to be detonated, the blasting pattern to be used and measures proposed to limit noise and to ensure that vibration from blasting does not adversely affect nearby structures.

- All blasts are to be monitored for ground vibration and air-blast, ensuring that the blasting methods, peak particle velocity and air-blast do not cause damage to property.
- Ground vibrations and air-blast levels caused by blasting must not exceed the respective values of peak particle velocity and air-blast overpressure in accordance with the deed.
- Implement and maintain a community liaison program during blasting activities to keep people in the vicinity of the Project Works informed of any activities.
- Advise all residents within a radius of 1km from the site of the proposed blast, before blasting operations commence. Written advice must include the likely times, frequency and duration of blasting and precautions being taken to ensure that damage to property will not result.
- When blasting operations are being carried out, take precautions relating to the safety of persons and animals. Close any roads likely to be affected by the blast to traffic and the appropriate signs are erected in accordance with Roads and Maritime Services D&C G10. A standard warning procedure such as that given in the NAASRA Explosives in Roadworks User Guide 1982 must be established and observed at all times. Clearly outline in the Vibration and Air Blast Management Plan a detailed procedure to be followed in the event of a misfire.
- Presplitting or line-drilling is to be used to ensure protection of batters prior to burden blasts. Prior to commencing blasting, batters with gradients 1.5H:1V or steeper must be pre-split or line drilled to the design batter profile at sufficiently close centres to produce a uniform and neat batter surface after excavation. Centre to centre spacing of drill holes to be as per Clause 4.5.2.
- Accurate records of each blast are to be maintained including details of-
 - Date, identification number and time of blast;
 - Location, number and diameter of blast holes loaded;
 - Depth of each drill hold loaded;
 - Inclination of drill holes;
 - Burden(s) and spacing(s);
 - Types and amounts of explosives used;
 - Maximum instantaneous charge;
 - Initiation plan;
 - Length and type of stemming in each blast hole;
 - Ground vibration and noise levels at measuring locations.

The records must be prepared as holes are loaded and must be signed by the shot-firer. Provide a copy of the records to the Project Verifier and Roads and Maritime Services Representative on the day of the blast.

6.1.7 Roads and Maritime Services D&C G36 - Summary of Blast Requirements

Requirements from Roads and Maritime Services specification G36 Section 6.8 include:

- At each proposed blasting location, trial blasting must be undertaken to establish site law correlations before any production blast.
- Building Condition Inspections for each public utility, structure and building will be carried out where 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. A written report of the Building Condition Inspection supported by photographs, details of the expertise of the inspectors, together with a list of any existing defects in the items, must be submitted to the owner of each item and to Roads and Maritime Services Representative at least four (4) weeks before the construction activity commences. The Building Condition Inspection report must include as a minimum:
 - Floor plan of the subject building;
 - Record site details - age, construction, site slope and provision for drainage, presence of trees;
 - Note type of defects and their positions and extents on the floor plan;
 - Photograph an external view and photograph all defects of significance (especially if of concern to the owner), or typical examples of say, hairline plaster cornice cracks. Photographs must include a description of all defects recorded and must be cross-referenced to building floor plan;
 - Note how doors sit in the jambs - out of line may indicate foundation settlement; and

- Note external signs of reactive clay foundation soil, e.g. lifting of slabs, uneven kerbing.
- As a minimum the Contractor must contact owners / occupiers of all buildings which require Building Condition Inspections within two weeks of commencement of the vibration and air-blast generating activities and at monthly intervals until completion of vibration and air-blast generating activities at each location.
- A final Building Condition Inspection must be conducted within two months of completion of vibration inducing activities, or in response to damage complaints. A written report of the final Building Condition Inspection supported by photographs, details of the expertise of the inspectors, together with a list of any existing defects in the items, must be submitted to the owner and Roads and Maritime Services Representative no later than three weeks following the completion of the final Building Condition Inspection.
- Records must be kept as evidence of compliance with these construction vibration and air-blast restrictions.

5 Planning & Assessment

Detailed planning is the key to ensuring a safe and efficient blast. Monitoring and assessment is required to drive continual improvement in the blasting process and to show compliance with legislation, various standards and conditions. The following sections outline LLE's approach to planning and assessment.

5.1 Principles

The principles and guidelines for minimising the impact on local residents and other sensitive receivers from noise and vibration are detailed in the following sections. All blasts on this project will be restricted blasts. Restricted blasts control every parameter of a blast design to optimise the fragmentation achievable when blasting in close proximity to sensitive receivers while minimising noise, vibration and flyrock.

LLE will be undertaking 2 distinct types of blasting on the project. They are:

1. Trial Blasts: trials will be undertaken prior to the commencement of the project blasting program, with results from the trials used to determine site specific blast design to satisfy the required criteria. The trial blasts will be designed to comfortably achieve the requirements of the vibration and overpressure restrictions. It is a scaled down version of a typical main blast to improve the confidence of the blast design and geological conditions.
2. Main Blasting: the quantum of the blast will be determined based on early investigation of the geology, the blast design, required vibration limits and programme requirements. Assessments will be conducted after the trial blasts have been completed. Main blasts are the blasts utilised to assist excavation of the rock in the cutting

Each blast will be specifically designed and the maximum instantaneous charge weight (MIC) selected such that no one detonation will cause vibration levels to exceed the target goals. This MIC is the critical factor in controlling the impacts to local residents and sensitive receivers and changes depending on distance, geology and velocity of detonation.

Once the MIC has been determined for each blast the other parameters are carefully selected to control distribution of this explosive in the hole to maximise fragmentation, to control the direction of initiation to further reduce vibration effects, to control hole size and stemming material to reduce ejection risks, to control the positioning of the explosives in decked holes and to control the potential for fly rock generation.

Once the above parameters have been determined the blast will be designed to not exceed any vibration limits, to be as safe as possible, and to fragment the rock as much as possible.

5.2 Programme

A detailed blasting program will be developed upon engagement of the Drill and Blast contractor and upon finalisation of detailed design and further geotechnical investigations.

It is currently anticipated that project blasting will need to commence in early April 2014 and be completed in February, 2015.

Blasting will occur between 9:00 am to 5:00 pm, Mondays to Fridays, inclusive or 9:00 am to 1:00 pm on Saturdays unless 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 is received. No blasting will occur on Sundays or public holidays.

All preliminary checks and setup of the blast site will be completed prior to these times so blasting is as close as possible to the advertised blast window.

5.3 Design

The design for each of the blasts will be undertaken by LLE's specialist Drill and Blast Subcontractor. The Drill and Blast Subcontractor will review the blast design, blast methodology and undertake monitoring and analysis of the vibration results to continuously improve the noise and vibration control and ensure compliance with restrictions.

Vibration and air-blast results from the trial blasts and each production blast will be used to accurately model the expected vibration levels and blast design for each subsequent blast. This continual improvement will ensure we decrease the probability of exceeding any limits by continuously improving our model and data set. Predicted air-

blast overpressure levels are to be calculated prior to blast based on the current weather conditions. If predicted levels are likely to be exceeded at neighbouring dwellings cease or restrict the blast.

The blast design will specify the:

- MIC (Maximum Instantaneous Charge)
- Burden
- Spacing
- Depth
- Inclination of holes
- Hole diameter
- Subgrade drilling
- Stemming
- Powder Factor
- Type of explosives
- Initiation Sequence
- Sensitive structures
- Volume of blasted material
- Distance to sensitive receivers
- Expected levels of vibration and air-blast at sensitive receivers

Once the vibration modelling and blasting parameters for each blast have been determined these are run through a blasting program that determines the best initiation sequence to provide further opportunity to modify vibration and also control relief, which can impact in vibration as well.

In accordance with the SWTC, at least 48 hours in advance of any proposed blasting operation, LLE must provide Roads and Maritime Services Representative with:

- i. the proposed location and timing of the operation;
- ii. the name of the person who will have control of the operation and evidence of his/her licence;
- iii. documentary evidence of all necessary licences and permits from the relevant Authorities;
- iv. measures proposed to be implemented for the protection of the public and property during the operation;
- v. full details of explosives, blasting patterns and any other relevant information;
- vi. methods of monitoring blast vibration; and
- vii. additional information required by the deed, including Roads and Maritime Services D&C specifications.

Also in accordance with Roads and Maritime Services Specification NH2U R44, a Hold Point will be submitted to the Project Verifier prior to each of the blasts. This hold point will include the blast design details provided by the Drill and Blast Subcontractor, as above. The records will be prepared as holes are loaded and will be signed by the shot-firer. A copy of the records will be provided to the Project Verifier on the day of the blast in order to release the hold point.

5.4 Construction Methodology for Main Blasts

The trial and main blasting will be carried out following the sequence of activities below:

3. Programming, advertising and signing of upcoming blasts. All upcoming blasts will be programmed and communicated as required and stipulated in Chapter 7 of this BMP.
4. Design of each blast to achieve the intended result including compliance with all environmental and safety requirements. The blast design (as outlined in section 5.3) shall be developed to produce the required cross section at each location and may include line drilling. The depth of each blast will be determined and may include localised deepening for drainage etc. Explosive type should give consideration to factors that may affect the blast such as predicted wet weather.
5. Coordination of blast designs and program to ensure issues associated with materials handling, excavation of other than rock (OTR), site access, haul roads, stockpiles are taken into consideration.
6. Marking out of blast pattern by LLE surveyors and the blast subcontractor
7. Drilling of blast holes. This will likely require a minimum of 2 drill rigs. Areas identified as requiring pre-split will be drilled accordingly on the designed batter slope for the cut.
8. Dipping, priming and loading of blast holes with suitable primers, detonators and explosives to suit the requirements of the blast design. Again the explosive type will give consideration to factors that may affect the blast such as predicted wet weather.
9. Stemming of blast holes. Stockpiles of appropriate stemming material (typically a 10/7mm aggregate) will be provided at each site in close proximity by a backhoe. The estimated required quantity of stemming shall be checked against the quantity used to ensure each blast hole is sufficiently filled with stemming. Filling of blast holes with stemming material will be carried out by competent workers.
10. Connection of all detonators, delays etc. will be carried out as required by the blast design. It is noted that extra sensitivities will be designed into the blast designs for Cut 32 through use of typical pyrotechnic explosives, however electronic detonators may be considered for this blasting due to the environmental and safety constraints of the cutting.
11. Supply and installation of blast protection measures to eliminate 'fly rock' or ejection of material from the shot area for each blast. The control measures will be reviewed and inspected prior to each blast. Existing over burden (approx. 2m) will be the primary control. Blast mats will be considered for use to control flyrock in areas with closely affected homes and structures.
12. Supply of documentation from subcontractor a minimum of 48 hours prior to each blast for review, including all details from section 5.3 above. The documentation shall also include safety considerations and environmental measures such as methods of monitoring vibration and locations of monitoring equipment.
13. Submission of all blast design details to the Project Verifier to release the hold point
14. Coordination in relation to the shot being fired to manage the clearing of each area, stopping of traffic etc.
15. Firing of the shot. The LLE Engineer will be the blast controller and will take overall control and coordination of each blast (in consultation with the shot firer), handing over to the licenced shot firer to control the siren run and initiate the blast.
16. Any rectification measures required as a result of a miss-fire, including overnight security if required. Misfire rectification procedures will be followed in accordance with the misfire operating procedure of the subcontractor's safety management plan.
17. Supply of documentation following each blast including drill sheets, checklists, monitoring results as detailed in Specification R44.

5.5 Monitoring of Main Production Blasts

Vibration and air-blast monitoring will be conducted by an experienced and competent blast subcontractor. For Cut 26 this will be managed by the blasting subcontractor, however an independent monitoring subcontractor may be considered for Cut 32 blasting.

Blast monitoring instrumentation will be installed and maintained in accordance with relevant Australian Standards (e.g. AS2187.2 - 1993). Monitoring units will be calibrated annually to standards that are traceable to Australian Physical Standards held by the National Measurement Laboratory (CSIRO Division of Applied Physics).

The monitoring equipment will be placed at the most affected residence or noise sensitive location, in accordance with the MCoA and EPL requirements. Additional monitoring will be provided at any affected structures in proximity to the blast sites during construction (if required). Concrete pours at these locations will be coordinated with the blasting to ensure no adverse quality impacts.

In accordance with the NVMP, 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.

A summary of all sensitive receivers within 500m of the blast sites is listed below and identified in the maps in Appendix A:

Blast Location	Location ID	Sensitive Receivers / Roads Affected within 500m
Cut 26	A	Telstra Tower / Essential sub station
		Residents - nil
	B	Little Newry Quarry
	C	Bee Keeper S290
		Ainsworth Rd
		Tower Rd
		Moyles Rd
Cut 32	A	360 South Arm Rd
	B	358 South Arm Rd
	C	354 South Arm Rd
	D	337 South Arm Rd
	E	339 South Arm Rd
	F	Roads and Maritime Services Rental
	G	349 South Arm Rd
	H	Roads and Maritime Services Rental

5.6 Noise, vibration & Dust Mitigation

5.6.1 Noise & Vibration Controls

Drilling Activities:

Drilling works are only to occur 7:00am to 6:00pm Monday to Friday; or 8:00am to 1:00pm Saturday, unless undertaken in accordance with CoA C4 allowances.

Noise from the drilling operations need to be minimised as much as possible. As such the following controls need to be implemented as a minimum:

- Drilling rigs will be maintained to manufacturers' standards and will be assessed for noise emission prior to commencement to determine noise mitigations required.
- Drilling rigs are to be switched off when not in use.
- Ensure drill rigs remain within the cut batter whenever possible to contain noise within the cutting.

Blasting Activities:

In accordance with the SWTC and the Roads and Maritime Services specifications, LLE have undertaken ground and infrastructure condition surveys within 500 metres of blast locations 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) to establish the pre-construction conditions of all existing ground and infrastructure at least four (4) weeks prior to blasting. Within 2 months following completion of all potential vibration activities on the Project, LLE will conduct final ground and infrastructure condition surveys in accordance with the Roads and Maritime Services specifications of the properties/structures previously surveyed.

In accordance with CoA C6, blasting works will be limited to approved work hours Monday to Friday 9am-5pm and Saturday 9am to 1pm, unless 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 is received. In consultation with the Blasting Contractor, LLE will establish a blast programme to minimise disruption to sensitive receiver's and will enable a consistent, deliverable communication strategy for completion of the works.

Trial blasts will be conducted in each cut to ascertain the vibration criteria. The vibration results from the trial blasts will be used to calculate the K-value for the main production blasts. The results will allow more accurate modelling of the drill and blast works, which will enable the construction team to optimise all aspects of the blasting operations.

As stated above in Section 5.3, the blasts will be designed to ensure the limits for vibration and air-blast overpressure are not exceeded. The blast design will vary the explosive quantity depending on the proximity of the blast to the sensitive receiver, effectively creating a buffer zone. Vibration and air-blast results from the trial blasts and each additional blast will be modelled and the results used to design the next blast to ensure a minimum number of blasts without exceeding the limits.

Predicted air-blast overpressure levels will be calculated by the blasting subcontractor prior to the blasts based on the current weather conditions. If predicted levels are likely to exceed the allowable limits at neighbouring dwellings, the blast will require redesigning to bring it within the limits. Consideration of overburden depth is also a key method of controlling air-blast overpressure, which the blasting subcontractor will work closely with the LLE construction team to maintain adequate depths.

As detailed in Section 5.5, air-blast overpressure and ground vibration levels will be measured and electronically recorded at the most affected residence or noise/vibration sensitive location that is not owned by the Roads and Maritime Services or subject to a private agreement (including increased allowable limits or dispensation from monitoring) for all blasts carried out. Records will be kept as evidence of compliance with these construction vibration and air-blast restrictions.

All noise and vibration complaints will be recorded and actioned as detailed in Section 7 of this BMP.

5.6.2 Dust

Trucks entering and leaving the premises that are carrying dust generating loads (e.g. Stemming material) must be covered at all times except during loading and unloading.

Water carts will be used as required during the drilling operations. In addition, drill rigs that utilise water and dust collectors will be used on site where there is a potential impact on a sensitive receiver.

Blast protection measures to eliminate 'fly rock' or ejection of material from the shot area will be installed for each blast. The control measures will be reviewed and inspected prior to each blast. Existing over burden (approx. 2m) will be the primary control, however blast mats may be considered for use to control flyrock for the project.

Dust monitoring will occur during blasting activities in accordance with the Project's Air Quality Management Plan.

5.7 Post Blast Evaluation & Documentation

The performance of each blast will be reviewed to consider the safety and environmental outcomes, the impact on traffic and effectiveness of the traffic management, assessment of blast muck pile to verify that there has been no misfire, and inspections of the blast area and surrounding work area for evidence of fly-rock.

The intent of the review is to check that the blast performed as per the design and to seek areas for improvements in future blasts.

Blast report pro-formers will be completed detailing explosives usage, timing plans and environmental monitoring results. Fragmentation and heave performance are also to be evaluated and any comments on the blast will be documented. In accordance with Roads and Maritime Services Specification NH2U R44 all the following details will be recorded:

- Date, Identification number and time of blast;
- Location, number and diameter of blast holes loaded;
- Depth of each drill hole loaded;
- Inclination of drill holes;
- Burden(s) and spacings;
- Types and amounts of explosives used;
- Maximum instantaneous charge (MIC);
- Initiation Plan;
- Length and type of stemming in each blast hole;
- Ground vibration and noise levels at measuring locations.

These records will have been prepared as holes were loaded and are signed by the shot-firer. A copy of the records will be filed in LLE's Quality Management System (QESE) and provided to the Project Verifier and Roads and Maritime Services Representative on the day of the blast.

Should either air-blast overpressure or peak particle velocity be exceeded, the Environmental Manager will investigate the exceedance and consult with the Blast Contractor and Project Engineer to implement strategies to minimise re-occurrences prior to the next blast. In the event of an exceedance the following will be documented:

- the date, time and nature of exceedance;
- review blast procedures and preparation to determine the cause (likely cause) of the exceedance;
- identify actions taken to date to avoid exceedances;
- identify proposed measures to address the exceedance;
- amend blast procedures as a result of any proposed mitigation measures;
- document and file this investigation report onsite.

EPA and DoPI will be notified of any exceedances in the EPL monthly compliance report and the 6 monthly compliance reports. All monitoring results will also be discussed at the monthly Environmental Review Group meetings. In cases where the exceedances have the potential to cause harm to the environment or community, reporting will be as per the CEMP incident reporting procedures.

6 Safety

Blasting is a high risk activity and as such, safety is of extreme importance. This includes the safety of people, property, environment and infrastructure. Safety procedures to be implemented in this Project will be prescribed in the Drill and Blast Subcontractors Safety Management Plan and will generally be as below. Safe Work Method Statements (SWMS), pre-start toolboxes, pre-blast toolboxes and Safety Inspection Checklists (area and activity) will be completed prior and during the works as required.

6.1 Work Site

A summary of the safety measures that will be implemented during the various stages of the blasting operation are given below.

6.1.1 Pre-Planning

Pre-planning includes the details outlined in Sections 5.3 Design and 5.4 Pre-blast Evaluation of this Management Plan. Pre-planning will ensure that all the safety aspects of the blasting are considered in the design and that everyone involved is aware of the risks associated with the blasting works.

LLE surveyors will set-out the perimeter of the blast from which the subcontractor will mark drill holes. This perimeter is key as it sets the exclusion zone limits. Further details on the exclusion area requirements will be provided by the Blasting Contractor and upon completion of trial blasts.

Existing boreholes, test holes and piezometric holes will be identified and assessed by the Blasting Contractor. Appropriate measures will be put in place to control any water ejection from these locations, following advice from the Blasting Contractor.

6.1.2 Drilling

The drilling will be undertaken by suitably qualified operators. The area where drilling and subsequent blasting is required will be marked off, allowing access only to the blasting team. The drilling should be completed prior to any charging commencing, and where drilling must be performed during charging, there must be physical exclusion between the two areas. The drill operator will be briefed on the blast design and pattern requirements by the shot-firer prior to the commencement of drilling. The driller will keep a drillers log and give this to the shot-firer prior to any loading of charges commencing. This includes position, angles and depths of each hole. The driller will notify the shot-firer of any unexpected subsurface voids or changes in rock strata on the blasting works proformas

6.1.3 Charging

Charging and initiation setup will cease upon the approach of electrical storms. The shot-firer and the supervisor will monitor the weather conditions regularly throughout, on a daily basis, to discern the likelihood of storm events. All personnel will be removed from the area and charging will not recommence until electrical storm has passed. The blast area will have a boundary erected around it, allowing entry by authorised personnel only. The blasting area will be kept free of all obstructions and hazards and there will be strictly no smoking permitted.

The set up prior to the blasting initiation involves the loading of the primer, loading the charges, connecting the shot, and clearing the area.

Loading of the primer will be undertaken by the shot-firer or a person under the supervision of the shot-firer. The primers and detonators will be kept separate at all times until loading of the drill holes. The drill holes will be checked to ensure there are no blockages and drilled to the correct depth. The depth of the drill hole will be recorded on the loading sheet. The primer is first to be lowered into the drill hole, in a manner to prevent damage to it or the attached detonator.

Once the primer is in place, the remaining explosive column is loaded. Care is taken to protect the leg wires of the detonators. The loading of bulk explosive materials into the drill hole will be checked to ensure that there is no blockage, or if it has passed through a crevice or cave in the drill hole diverting the explosive. This will prevent excessive loading of the drill hole due to comparisons with the blast design figures. If a cartridge of explosive becomes lodged in the borehole, care must be taken to remove or fix the situation. A retrieval tool can carefully be used; however excessive force, as well as the drill steel or the drill should never be used to force an explosive charge past an obstruction.

When the entire column is loaded, the charge must be confined in the drill hole with an adequate amount and type of stemming. The amount of stemming required will be specified in the blast design. The stemming size will also

be determined by the hole diameter used. Like the loading of the explosive, stemming will be conducted by the shot-firer or a person under the supervision of the shot-firer. It will be placed into the drill hole in a controlled manner to prevent bridging and the quantity monitored to ensure the entire hole is filled with the minimum quantity. The stemming height will be recorded for each hole.

6.1.4 Blasting Initiation

When the shot has been loaded the detonator leads will be connected in the sequence detailed on the approved blast design. This sequence will be checked by the shot-firer check and any issues recorded on the loading initiation sheet. The blast should be detonated as soon as possible. Reducing the time a loaded and connected shot is left in the ground reduces the time of hazardous exposure for employees on site and also reduces the chances of anyone entering the site and becoming in danger from the blast. The main concern at time of detonation is that the area is completely clear and access controlled. The blast controller will coordinate blasting of the shot and take overall control on the day of the blast.

6.1.5 Working Around Vertical Drops (Work at Heights)

All work areas within the blast area will be benched and battered as necessary to fit within the Lend Lease Global Minimum Requirements. In the event that blasting creates vertical or shear faces, similar to quarry-type blasting, physical barriers and signage will be erected to ensure a minimum safe distance from the shear face. Additionally, geotechnical assessments by the Geotechnical Design Site Representative may be carried out to verify the capacity of the rock to take the load of the drill rig.

6.2 Traffic Management

In the event that blasts are required within the determined area of influence of an active road, a full road closure will be required and controlled in accordance with Roads and Maritime Services D&C G10 and worksite manual. A full assessment of access tracks and trails will be completed on a blast-by-blast basis to determine management of traffic on these minor access points, however the table below identifies the predicted roads/access tracks that will be affected.

Blast Location	Roads / Access Tracks Affected
Cut 26	Ainsworth Rd
	Tower Rd
	Moyles Rd
Cut 32	South Arm Rd

It has been assessed that for all blasting activities in Cut 26 and Cut 32, there will be no need for road closures of the Pacific Highway. Should circumstances change and the need for a road closure is required, traffic control plans for each location will be developed and will be submitted for Roads and Maritime Services review and approval. Once approved, a Road Occupancy Licence would be requested and obtained for the closure of the Highway during the blasting operations.

Traffic controllers will implement required road closures at a safe distance (both from the blast site and to ensure safe stopping sight distance) and at a suitable road grade to allow traffic flow to resume quickly. The clear distance for where the traffic is to be stopped is such that the travelling public will not be able to view the blasting operations.

Once the traffic control has stopped, LLE scout vehicles will drive from either ends tailing the last vehicles to ensure and provide confirmation that the area is clear. Queue managers will be positioned at each end of the project to monitor and control this queue if required. There will be multiple advance warning signs and queue managers at each end to facilitate the build-up of traffic if required. VMS boards will be utilised for advance warning also.

7 Community Involvement Plan

This Community Involvement Plan (CIP) for blasting outlines the proposed tasks and activities that will be undertaken by the LLE Community Relations Team to manage the impact of blasting on the local community and other road users.

7.1 Objectives of the CIP

The objectives of the CIP are to:

- Provide all residents and stakeholders with advanced information of the effects, management (including implementing mitigation measures), constraints, and duration of blasting;
- Ensure effected residents and stakeholders are notified and remain outside of the designated safety exclusion zone determined by the Blast Contractor during blasts.

7.2 Affected Stakeholders

The following groups have been identified as stakeholders who may be affected by the blasting works:

- Property owners who live adjacent to, or in the vicinity of, the blast areas;
- Directly affected businesses;
- Civil Aviation Safety Authority (CASA)
- Wider community, including residents and businesses
- Road users including;
- Local traffic
- Through traffic
- Bus companies – local and long distant
- Cyclists
- Pedestrians
- Emergency services (in the unlikely event of an accident);
- Relevant Councils including Nambucca and Bellingen Shire;
- Department of Primary Industries including State Forests
- Service providers including Essential Energy and Telstra
- Relevant School buses including BusWays.

7.3 Timeframe for Disruption

Blasting will occur between 9:00 am to 5:00 pm, Mondays to Fridays, inclusive or 9:00 am to 1:00 pm on Saturdays. No blasting will occur on Sundays or public holidays.

In consultation with the blasting contractor, LLE will establish a blast programme to minimise disruption to sensitive receiver's and will enable a consistent, deliverable communication strategy for completion of the works.

7.4 Community Management Measures

The following measures are required to mitigate safety risks to the public from blasting:

- Ensure affected members of the community are informed and given 48 hours advance notice of blasting activities and remain outside of the designated safety exclusion zone determined by the Blast Contractor during blasts.
- Stop traffic on the Pacific Highway (as required) during blast periods. This may result into delays up to 15 minutes;
- Stop local roads traffic where required during blast periods. This may result into delays up to 15 minutes.

7.5 Identification, Notification, Relocation & Movements of Residents During Blasting

7.5.1 Stakeholder notification Procedure Prior to the Blast

Blasting locations, affected receivers and exclusion zones will be determined by a qualified Blast Contractor. Once this has occurred, the following procedures will be followed:

STEP 1: Notify all affected residents within the 1km radius

All residents within a 1km radius of the blasts will be notified of the blasting activities via a letterbox drop. The letter will inform them of the blasting works including days of the week, time of the day, number of blasts etc. This notification will be disseminated at least five working days prior to the blasting commencing and advice given to the receiver will also include details of the 1800 telephone number and LLE contact details should they have any concerns.

STEP 2: Identify and advise residents of temporary relocation to a safe zone, letter and doorknock prior to blast

LLE will ensure designated residents are given the option of being temporarily relocated to a safe zone or asked to remain indoors during blast periods. It will also be suggested that pets are contained indoors during the blasts.

The details will be provided in a letter to the resident advising that they need to stay indoors or contact the Community Team if they require temporary relocation during the blasting. The letter will also include relevant contact information of the Community Relations Team should stakeholders have any issues/concerns.

STEP 3: VMS signs

In addition, for any blasts that will be considered to potentially affect the Pacific Highway, VMS signs will be erected within the corridor to advise of the day and time of the blast as per the approved traffic control plan.

7.5.2 Consultation Procedure During the Blast

To ensure a consistent and streamlined consultation process during the blast LLE will ensure that following activities are undertaken:

- NH2U staff and blast guards will begin checking each required street/house to ensure all residents are outside of the required exclusion zone. The blast controller will be informed once this is confirmed.
- An alert system will be adopted in accordance with the safety management plan of the Blast Contractor.
- The Community Relations Team will monitor the 1800 number and manage complaints and follow up on any other enquires in relation to the works. All complaints will be reported in NH2U's monthly report to the EPA and DoPI.

7.6 Communication Tools

A range of communication tools will be used throughout the blasting process to adequately inform stakeholders and to ensure all enquiries, complaints and concerns are captured and addressed.

The table below outlines the communication tools to be implemented.

Stakeholder	Communication Tool	Task
Direct contact with closest affected residents	<ul style="list-style-type: none"> • Face-to-face meetings at homes • Phone calls • Letter 	<ul style="list-style-type: none"> • Door knocking of residents in nearest vicinity of the blasts to explain the constraints and requirements for safety during blasts, etc. • Ongoing communication through phone calls and visits.
All stakeholders	<ul style="list-style-type: none"> • 1800 freecall 	<ul style="list-style-type: none"> • The 1800 freecall number is operational 24 hours a day 7 days a week to answer all project related enquiries.

Stakeholder	Communication Tool	Task
All stakeholders	<ul style="list-style-type: none"> Fact sheet 	<ul style="list-style-type: none"> A fact sheet will be developed outlining what controlled blasting is, noise and vibration impacts. This will be available at the Community Information Centre and during community information sessions. It will also be placed on the project website.
All stakeholders	<ul style="list-style-type: none"> Community Information Centre 	<ul style="list-style-type: none"> Stakeholders will be encouraged to visit the centre and speak to a community engagement consultant about the blasting works if they have any queries.
Closest residents	<ul style="list-style-type: none"> Database development and updating 	<ul style="list-style-type: none"> A list of affected residents will be developed to allow all resident information to be captured and documented.
Residents within a 1km radius	<ul style="list-style-type: none"> Letterbox drop 	<p>A letter will be developed to notify community of works. Distribution within a 1km radius includes:</p> <ul style="list-style-type: none"> residents (after direct contact) property owners businesses and the wider community where appropriate
Residents/motorists / businesses	<ul style="list-style-type: none"> Traffic Alert 	<ul style="list-style-type: none"> Advise of traffic stoppages on highway
Additional stakeholders	<ul style="list-style-type: none"> Email 	<ul style="list-style-type: none"> Summary of blast schedule and notification Distribution: Email list which will include bus companies, CASA, education facilities, utility providers, State Forests, other stakeholders.
All motorists (if blast impacts traffic)	<ul style="list-style-type: none"> VMS 	<ul style="list-style-type: none"> Constant notification of the next blast activities (date, time) will be displayed on VMS boards. The 1800 number will also be displayed on VMS boards.(as required)
Emergency Services and Councils	<ul style="list-style-type: none"> Email 	<ul style="list-style-type: none"> Advise Emergency Services and Nambucca and Bellingen Shire Councils of blast activity. There will be allowance for emergency vehicles right up to the time of blast and straight after the blast has been fired – as coordinated with the Blast Controller and Traffic Controllers.

7.7 Points of Contact

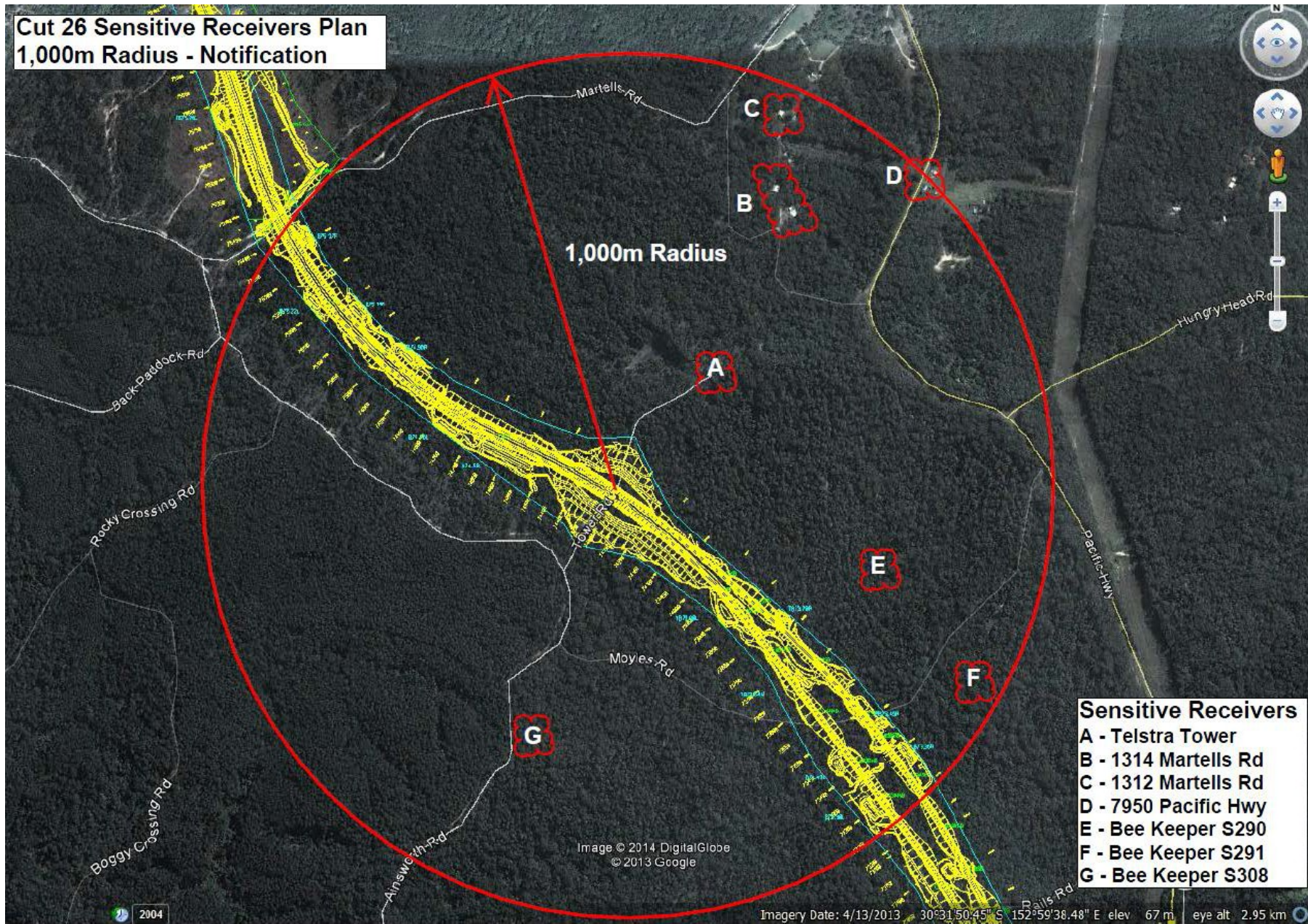
The Project Information number will be displayed on the Project Information signs. The number will also be displayed on VMS signs as required during blasting periods, on the website, on emails and any other correspondence that is sent to the public regarding the blasting works.

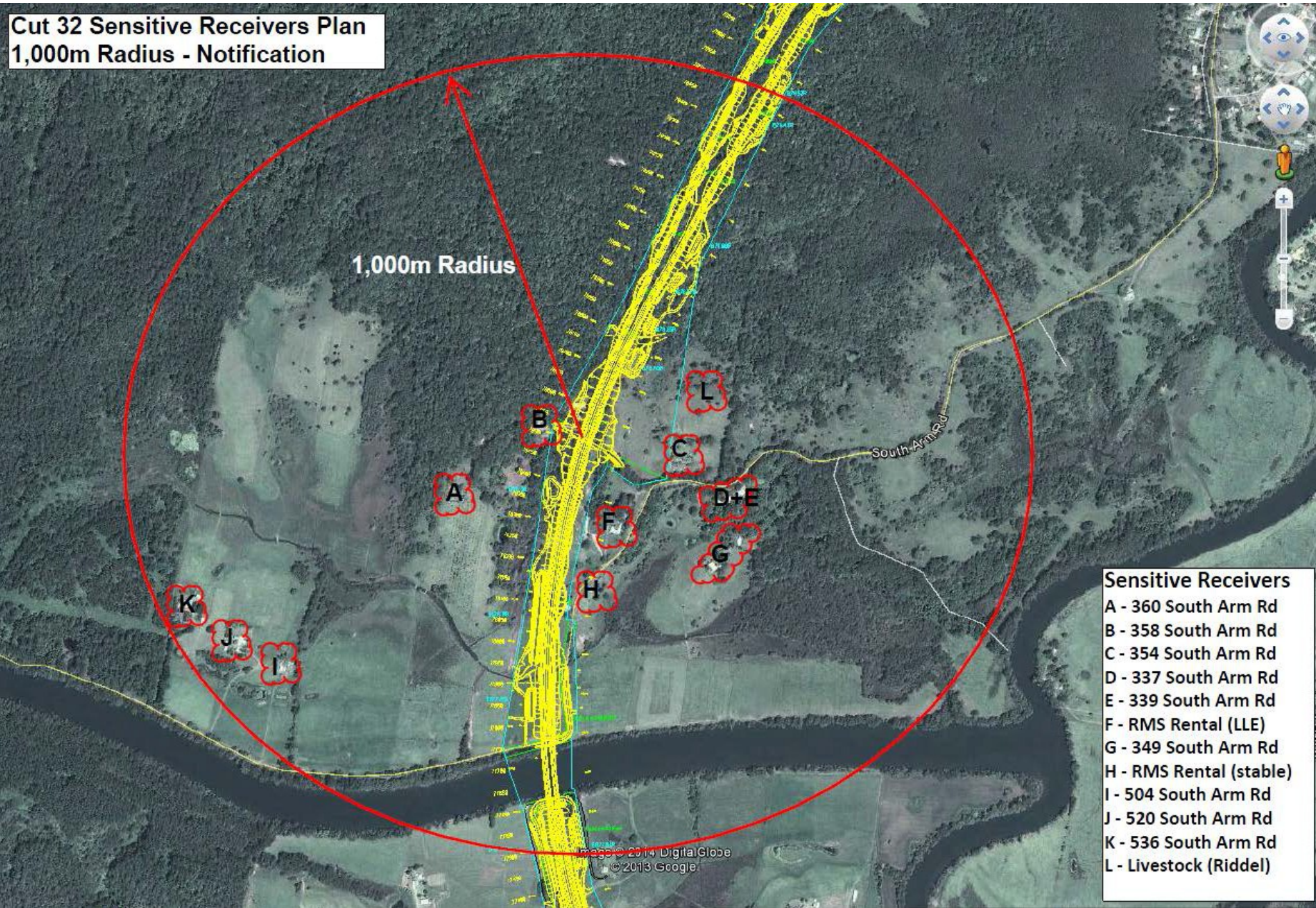
The LLE contact for the blast management will be the Project Engineer who will be available to answer any questions in relation to blasting works. The Community Manager or a member of the Community Relations Team will contact the Senior Project Engineer directly should they require additional information or to advise of community complaints or concerns.

Appendix A

Sensitive Receivers

Appendix A – Sensitive Receivers



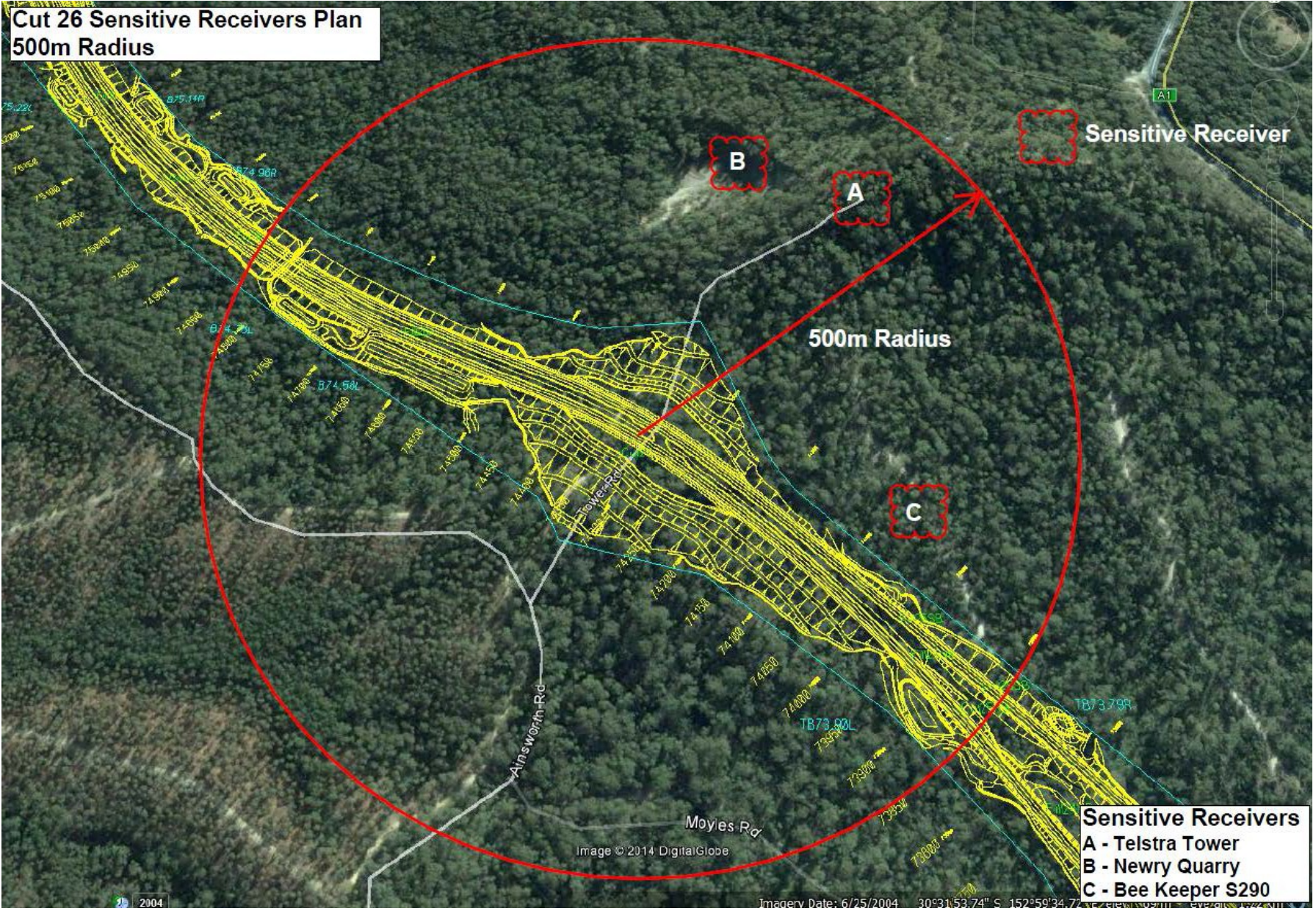


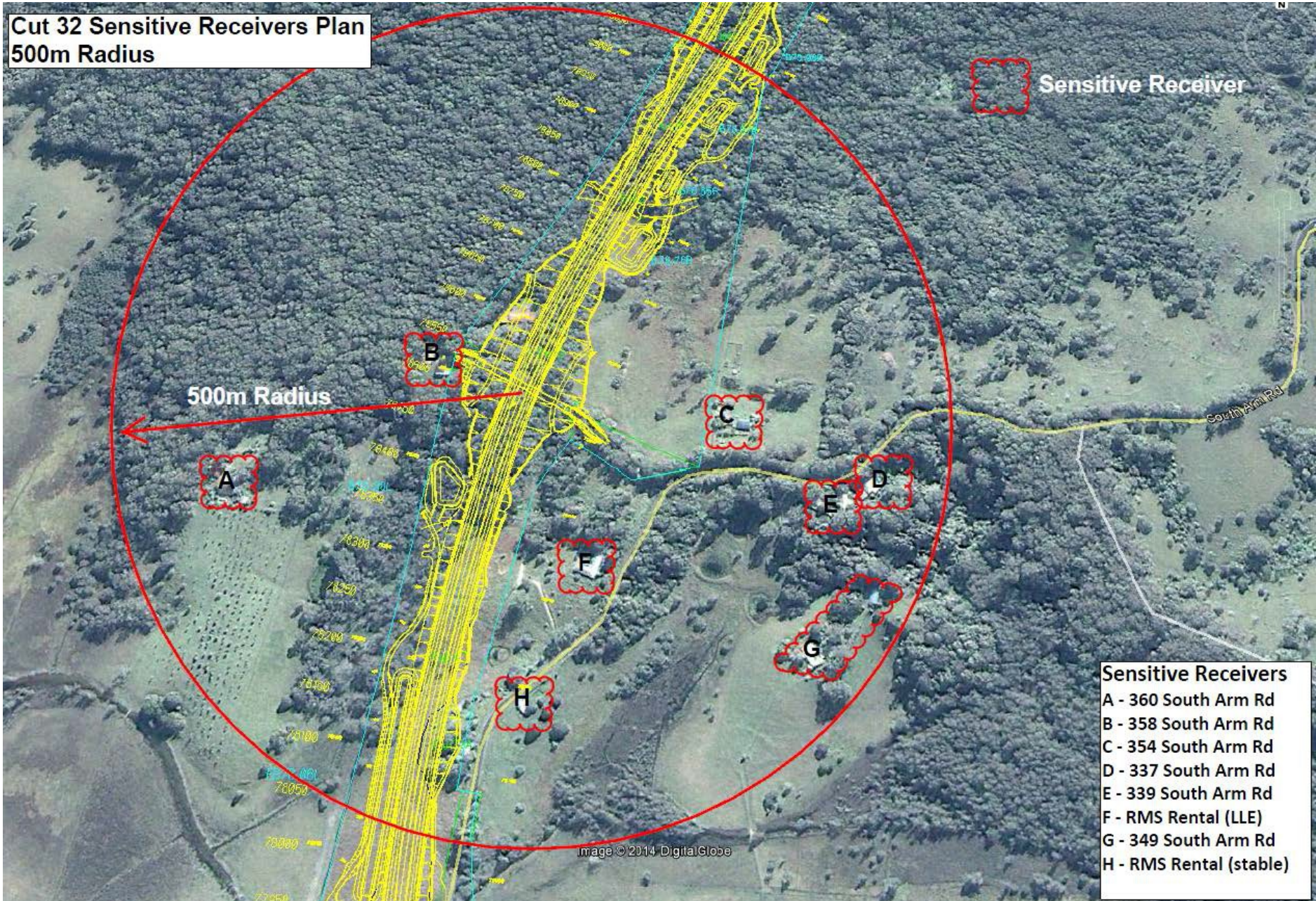
Cut 32 Sensitive Receivers Plan
1,000m Radius - Notification

1,000m Radius

- Sensitive Receivers**
- A - 360 South Arm Rd
 - B - 358 South Arm Rd
 - C - 354 South Arm Rd
 - D - 337 South Arm Rd
 - E - 339 South Arm Rd
 - F - RMS Rental (LLE)
 - G - 349 South Arm Rd
 - H - RMS Rental (stable)
 - I - 504 South Arm Rd
 - J - 520 South Arm Rd
 - K - 536 South Arm Rd
 - L - Livestock (Riddel)

**Cut 26 Sensitive Receivers Plan
500m Radius**





Appendix D

Out of hours works procedure



Out of Hours Work Procedure

Document control

File name	NVMP App D_Out of Hours Work procedure Rev5
Report name	Out of Hours Work Procedure
Revision number	5

Revision history

Revision	Date	Description	Approval
0	Mar 2013	Issued for internal review	
1	Mar 2013	Issued for Roads and Maritime / PV / ER review	
1.1	Apr 2013	Updated for issue to ERG	
1.2	Jun 2013	Updated following agency consultation	
2	Jul 2013	Update to address DP&I comments	
3	Aug 2013	Update to address final DP&I comments	
4	July 2014	Minor update to change RMS to Roads and Maritime, and Abigroup to Lend Lease	
5	Aug 2015	Minor updates as approved by ER	



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Appendix A – Out of Hours Application Form

Appendix B – SKM SoundAdvice Assessment Tool

Appendix C – Locations of potential “Type 1c” works



Glossary / Abbreviations

CEMP	Construction Environmental Management Plan
CoA	Condition of Approval
DPI	Department of Primary Industries (Fisheries, Conservation and Aquaculture)
EA	Environmental Assessment
EEC	Endangered Ecological Community
EPA	Environment Protection Authority
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
EPBC Act	<i>Environmental Protection and Biodiversity Conservation Act 1999</i>
EWMS	Environmental Work Method Statements
FFMP	Flora and Fauna Management Plan
FM Act	<i>Fisheries Management Act 1994</i>
NH2U	Nambucca Heads to Urunga (<i>Stage 1 of WC2U Project</i>)
NPW Act	<i>National Parks and Wildlife Act 1974</i>
NW Act	<i>Noxious Weeds Act 1993</i>
OEH	Office of Environment and Heritage
OOHW	Out of hours work
SEPP	State Environmental Planning Policy
SoC	Revised Statement of Commitments included in the Submissions Report
SWTC	Scope of Works and Technical Criteria (Roads and Maritime)
TSC Act	<i>Threatened Species and Conservation Act 1995</i>
WC2U	Warrell Creek to Urunga
WP	Working Paper (part of the Environmental Assessment)

1. Introduction

1.1 Background

The Nambucca Heads to Urunga project is being constructed in an area that exhibits high volumes of traffic and, in some locations limited available space.

The Project is located within the Nambucca and Bellingen local government areas. Land use is characterised by a mix of agricultural land uses, bushland, forests, small settlements and the townships of Bellwood, Nambucca Heads, Urunga and Raleigh. These townships are situated on the Nambucca and Kalang Rivers.

The project team will make all efforts to complete work within the approved standard construction hours, however it is anticipated that there will be a need to undertake work outside of the standard hours.

1.2 Ministers Conditions of Approval

Ministers Condition of Approval (CoA) C3 requires: The Proponent shall only undertake construction activities associated with the project during the following standard construction hours:

- a) 7:00am to 6:00pm Mondays to Fridays, inclusive; and
- b) 8:00am to 1:00pm Saturdays; and
- c) at no time on Sundays or public holidays.

However, CoA C4 states: Works outside of the construction hours identified in conditions C3 may be undertaken in the following circumstances:

- a) works that generate noise that is not audible at any sensitive receptor;
- b) for delivery of materials required outside these 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) Construction works undertaken through sparsely populated areas in which sensitive receptors are located greater than 300 metres away from the project boundary. In this case construction is permissible during the following hours: 6.00am to 6.00pm Monday to Friday and 7.00am to 4.00pm Saturdays and at no time on Sundays or public holidays.
These works hours may be reviewed and/ or revoked by the Director General in consultation with the EPA in the case of excessive or unresolved noise complaints; or
- e) where an EPL applies to the construction of the project, construction hours which are approved in accordance with the conditions of an EPL for the project; or
- f) where an EPL does not apply to the construction of the project, Out of Hours Works as agreed to by the Director General in accordance with condition C5.

CoA C5 states: For the purposes of condition C4 (f), certain construction activities (Out of Hours Works) may be allowed to occur outside the construction hours specified in conditions C3 with the prior written approval of the Director General. Requests for out of hours approval will be considered for construction activities which cannot be undertaken during the construction hours specified in conditions C3 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 must be accompanied by:

- a) details of the nature and need for activities to be conducted during the varied construction hours;
- b) written evidence to the EPA and the Director General that activities undertaken during the varied construction hours are justified, appropriate consultation with potentially affected receivers and notification of 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 EPA on the proposed variation in standard construction hours.

Despite the above, Out of Hours Works may also occur in accordance with an approved Construction Environment Management Plan or Construction Noise and Vibration Management Plan (NVMP) for this project, where that plan provides a process for considering the above on a case by case or activity specific basis by the Proponent, including factors a) to c) above.

Lend Lease proposes to include the below out of hours approval process into the NVMP.

2. Scope

This Procedure is applicable to all activities relating to undertaking works outside of standard construction hours on the Nambucca Heads to Urunga Project.

This Procedure is also aimed at minimising the impact of necessary works outside of standard construction hours.

3. Induction / Training

Personnel potentially requiring to work outside the standard construction hours will be trained in the requirements of this Procedure. Training will include inductions, toolbox talks and pre-starts as required.

Obligations from this procedure will also be included in relevant environmental work method statements.

4. Procedure

4.1 Justification for Out of Hours Work

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

1. In 2012, the State and Federal Governments committed to fast tracking the Nambucca Heads to Urunga (NH2U) section of the Warrell Creek to Urunga Upgrade following a crash with multiple fatalities at Urunga. This section is to be completed by 2016. This commitment would be difficult to meet unless some work activities can occur outside of standard construction hours, during times of low traffic flow.
2. 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 NH2U 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.

3. In sections of the NH2U project there is limited available space required to safely undertake the construction works. Hence NH2U 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.
4. 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.
5. External restrictions on work times prescribed by service providers or ARTC rail (further discussed below in Section 4.2).
6. Quality requirements for concrete works and saw cutting (further discussed below in Section 4.2).
7. Due to the scope requirements of the NH2U 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 4.1 below has been prepared to identify the likely activities that will need to be conducted outside of standard construction hours.

Lend Lease 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 Community Involvement Plan.

4.2 Out of Hours Works Process

Lend Lease has defined potential out of hours activities into four 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:

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 300 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 6.00pm Monday to Friday; 7.00am to 4.00pm Saturday; and at no time on Sundays or public holidays.

These works hours may be reviewed and/ or revoked by the Director General 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 Team, the Community Team and Roads and Maritime is required. The EPA and ER 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 300m 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 Team and Community Team.

2. Type two:

If works are predicted to be less than 5dB (A) above background levels at relevant sensitive receivers, OOHW may take place.

The SKM Sound Advice assessment tool (see Appendix B) 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.

Once approved by the Environmental Team and Community Team, 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 as part of the EPL monthly report.

3. Type three:

Out of hours works may take place if an agreement between Lend Lease 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 Lend Lease 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 the Sound Advice assessment tool to be used to determine noise predictions and identify receivers exceeding noise objectives and thus which receivers Lend Lease requires agreements from.

The EPA, Roads and Maritime and the ER will be notified prior to undertaking Type 3 activities.

4. Type four:

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 C5 and include:

- Concrete works (including delivery) and saw cutting during paving works;
- Rail Possession works;
- Service relocation works;
- Works impacting highway and local road traffic (as listed in Table 4.1);
- Use of ancillary facility sites during OOHW;
- Refuelling during OOHW; and
- Security patrolling throughout the construction phase.

The above works have been assessed in Section 7 of the NVMP and the noise predictions (day, evening and night) detailed in Table 7-2 and Table 7-4 of the NVMP. Mitigation measures for these works will be in accordance with Section 8 of the NVMP and Sections 4.5 and 4.6 of this procedure. An Out of Hours Request Form (Appendix A) is required to be completed and approved by the Environmental Team. The Community Team is also to be notified.

Further consultation/notification requirements for these works are detailed below in Section 4.3. 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

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 conditions. As the timing of cutting is critical to the quality of the pavement, concrete saw cutting will be needed at any time, including outside the daytime construction hours.

Rail Possession Works

ARTC rail infrastructure that crosses the southern end of the proposed alignment has strict limitations on working adjacent to rail lines. As a result, works will be programmed within gazetted available track possession times. These times are determined by ARTC. Works adjacent to the lines cannot disrupt the normal service of trains. Allowable possession times are invariably completed OOH's through the night or during full shutdown weekends. To enable completion of the project works over and adjacent to ARTC lines works will be programmed according to the available ARTC possession programme.

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, Lend Lease 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 4.1 are predicted to significantly impact road users or the safety of road users or where the following Roads and Maritime restrictions are unable to be met:

- Scope of Works and Technical Criteria (SWTC) Appendix 27- 27.3 Traffic delays, states:
 - (a) The Contractor must not delay the free flow of traffic in any direction:
 - (i) at any single road occupancy for longer than five (5) minutes; and
 - (ii) cumulatively due to all road occupancies between the Old Coast Road bridge over the Existing Highway and Ballards Road for longer than seven (7) minutes.
 - (b) Traffic queues caused by road occupancies, measured along a single lane in any direction, and must not exceed 250 metres in length for any period of traffic delay. If traffic queues reach 250 metres in length, the Contractor must remove the cause of the traffic delay within fifteen (15) minutes until the flow of traffic returns to free flow conditions.
- SWTC Appendix 27 - Annexure 27.1 further states: Regardless of the time of operation stated on the road occupancy licence, the following peak traffic volume periods are excluded for any stoppages:
 - From 6.00am to 9.30am Monday to Friday.
 - From 2.30pm to 6.00pm Monday to Friday.
 - From 6.00am to 2.00pm Saturday.
 - Road closure/stoppage restrictions also apply during all Holiday Periods.

- o Further restrictions and requirements in relation to the ROL's for NH2U are detailed in SWTC Appendix 27.

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.

Refuelling and Security Patrolling

Refuelling will be required to ensure any machinery associated with OOHW can continue to operate throughout the out of hours period. Out of hours refuelling will however be minimised by having all machinery refuelled prior to commencing the OOHW or by refuelling 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.

4.3 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 Community Involvement Plan.

4.3.1 Type one and two

Stakeholder groups and approach

Stakeholder	Approach	Tools
Roads and Maritime & ER	Notification prior to undertaking any works excluding Type 1c) activities	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 as part of the EPL monthly report.	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 (See Appendix C), potentially affected receivers will be notified of approved construction hours, including the potential for Type 1c works in the approved extended hours.	Written notification



4.3.2 Type three

Stakeholder groups and approach

Stakeholder	Approach	Tools
Affected receivers (including private properties, business and education facilities) who are noise affected by greater than 5dba above background levels.	<p>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.</p> <p>A community information line will be available.</p>	<p>Written agreement Notification 1800 number</p>
EPA, Roads and Maritime & ER	The EPA and Roads and Maritime will be notified prior to undertaking Type 3 activities.	Email notification

4.3.3 Type four

Stakeholder groups and approach

Stakeholder	Approach	Tools
Private properties/Business and education facilities who are noise affected by greater than 5dba above background levels.	<p>Affected receivers will be notified on all Type 4 OOHW. Notification will be provided at least 48 hours 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.</p> <p>Information provided to the affected receivers will reflect requirements as outlined in the EPL conditions, including:</p> <ul style="list-style-type: none"> • Outline the reason for the work; • 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. <p>A community information line will be available.</p> <p>During the course of the project, if residents request not to be re-contacted regarding OOHW, Lend Lease will make a record of this request in the community database.</p>	<p>Doorknock/Face to face meeting Written Notification 1800 number Project website</p>

Stakeholder	Approach	Tools
EPA	<p>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.</p> <p>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</p>	<p>Email notification EPL compliance report</p>
Nambucca and Bellingen Shire Council, the Environmental Representative and Roads and Maritime	<p>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.</p> <p>Information provided to residents as outlined above will also be provided</p>	<p>Email notification 1800 number.</p>

Definition of tools

Stakeholder group	Tools
Notification	A notification detailing the out-of-hour's activities, location, timing, predicted noise levels and all requirements as detailed in the EPL.
Written agreement	A form detailing the activity proposed with a section for stakeholder feedback and written agreement for proposed work.
1800 number	A point of contact to request information or provide feedback and lodge complaints. A member of the project team will be contactable via the project 1800 phone number during out-of-hour's work. The team member will liaise with the site supervisor to investigate, stop work and implement measures to reduce noise impacts and address any community complaints as they arise.
door knocking and face to face meeting	One-off and regular meetings to share information and consult with key stakeholders
Email	A point of contact to request information or provide feedback and lodge complaints
Feedback form	A form providing affected receivers with the opportunity to provide detailed feedback on proposed work.
Out-of-hours work submission	Submission to EPA providing information on proposal as detailed in section 4.2.
EPL Compliance Report	Requirement of EPL to demonstrate project compliance.

4.4 General responsibilities of the Community Relations Team

The community relations team:

- Are responsible for communication and consultation on out-of-hour's work and liaison with stakeholder's during the work.
- Provide a specialised, personalised service function to stakeholder's and have the ability to comprehensively investigate complaints and requests to achieve a satisfactory resolution;
- Organise notifications and other communications for planned out-of-hour's works. They liaise with stakeholders who are not satisfied with works done in their area or impacted by construction noise and assist stakeholders who perceive that they are not being responded to;
- Work autonomously across the NH2U to achieve desired outcomes with respect to stakeholders and the community.

4.5 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 trialled 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&E 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, Lend Lease will offer one on one briefings with the affected residents. Where this occurs during the night period Lend Lease will offer one on one briefings with the affected residents and investigate privately negotiated agreements, offers of alternative accommodation or respite periods. 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.

4.6 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.

4.7 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 Community Involvement Plan.

4.8 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 4.1 Indicative out of hours Schedule of Activities for the NH2U Project

Item No.	Activity	Activity Description	Approx. location (Chainages)	Justification for Out of Hours Work	Approximate Plant Requirements	Indicative Timing ¹
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	61800, 62400, 63050, 63300, 63900, 64550, 65700, 66050, 66500, 66600, 66950, 67350, 67700, 68200, 68600, 68950, 70000, 81500	<ul style="list-style-type: none"> unavailable off-peak utility shutdown period during normal hours restricted Pacific Highway Road (Road Occupancy Licence (ROL) restrictions) 	<ul style="list-style-type: none"> 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 	16 weeks Full Project Duration
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	61500-62500, 63400-68500, 69800-70100, 70300-71100, 81400, 82350-83300	<ul style="list-style-type: none"> restricted Pacific Highway Road (ROL restrictions) unsafe work zone to adjacent traffic 	<ul style="list-style-type: none"> Chainsaw Mulcher Trucks Waste containers Excavator Sweeper trucks Water trucks Lighting equipment 	20 weeks (July 2013 to December 2013)
3	Traffic management / Road furniture	Erect temporary barriers, temporary signs, temporary line marking, temporary roads / access, survey works, any required adjustments to existing barriers/wire rope.	62300, 63000, 36500, 36900, 64100, 64200, 65850, 66200, 67700, 68800, 70200, 72450, 75400, 77300, 78000, 78500, 81400, 81600, 82400, 83200 & as required for all OOHW locations	<ul style="list-style-type: none"> restricted Pacific Highway & local Road (ROL restrictions) unsafe work zone to adjacent traffic 	<ul style="list-style-type: none"> Mobile crane Crane truck Trucks Light vehicles Backhoe Line marking truck & equipment Light compaction equipment Small Tools Lighting equipment 	Full Project Duration

Item No.	Activity	Activity Description	Approx. location (Chainages)	Justification for Out of Hours Work	Approximate Plant Requirements	Indicative Timing ¹
4	Demolition	Pavement, barriers, kerb & gutter, culverts, guard rail involving road sawing, hammering, load & dispose	68150, 68500, 70300	<ul style="list-style-type: none"> restricted Pacific Highway Road (ROL restrictions) unsafe work zone to adjacent traffic 	<ul style="list-style-type: none"> Excavators Rock Hammers Pulverisers Cranes Loader Road saw / hand saw Jack Hammers Dump trucks Backhoe Lighting equipment 	30 months (July 2013 to June 2016)
5	Earthworks	Topsoil stripping, road sawing, material excavation, road construction, survey works adjacent to the Pacific Highway Interface & Local Road Interface	62300, 63000, 36500, 36900, 64100, 64200, 65850, 66200, 67700, 68800, 70200, 72450, 75400, 77300, 78000, 78500, 81400, 81600, 82400, 83200	<ul style="list-style-type: none"> restricted Pacific Highway Road (ROL restrictions) unsafe work zone to adjacent traffic minimise local road traffic delays 	<ul style="list-style-type: none"> Excavators Rock Hammers Loader / backhoe Road saw / hand saw Jack Hammers Vibratory Roller/ Compactors Dump trucks/ Bogie Water cart Sweeper truck Lighting equipment 	30 months (July 2013 to June 2016)

Item No.	Activity	Activity Description	Approx. location (Chainages)	Justification for Out of Hours Work	Approximate Plant Requirements	Indicative Timing ¹
6	Drainage	Removal and/or installation of pipes, pits, headwalls, kerb & gutter, no fines concrete, open drains & channels, survey works, water diversions/pumping, micro tunnelling/pipe jacking adjacent to the Pacific Highway Interface & Local Road Interface	61700, 62250, 64500, 68100 or elsewhere as required	<ul style="list-style-type: none"> • Due restricted Pacific Highway & local Road (ROL restrictions) • unsafe work zone to adjacent pedestrians, cyclists & traffic 	<ul style="list-style-type: none"> • 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 	30 months (July 2013 to June 2016)
7	Major deliveries	Oversize Loads - Loading and unloading of equipment and plant; Material deliveries required for OOH works.	CH61400, 64150, 66200, 68500, 72400, 78500 or elsewhere as required	<ul style="list-style-type: none"> • Restricted Pacific Highway Road (ROL restrictions) • Restricted site access • unsafe work zone to adjacent traffic 	<ul style="list-style-type: none"> • Mobile cranes • Semi-trailers • Tip/delivery trucks • Loader / backhoe • Lighting equipment 	30 months (July 2013 to June 2016)

Item No.	Activity	Activity Description	Approx. location (Chainages)	Justification for Out of Hours Work	Approximate Plant Requirements	Indicative Timing ¹
8	Pavement works including mainline & local roads, mainline cross-over, emergency u-turns & 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 locations across alignment as required	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • 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 	24 months (December 2013 to June 2016)

Item No.	Activity	Activity Description	Approx. location (Chainages)	Justification for Out of Hours Work	Approximate Plant Requirements	Indicative Timing ¹
9	Finishing works / Road furniture	Line marking, traffic signs, reflectors, guard rails, concrete barriers, fencing, landscape works, survey works	61500, 62300, 63000, 36500, 36900, 64100, 64200, 65850, 66200, 67700, 68800, 70200, 72450, 75400, 77300, 78000, 78500, 81400, 81600, 82400, 83200	<ul style="list-style-type: none"> restricted Pacific Highway Road (ROL restrictions) unsafe work zone to adjacent traffic 	<ul style="list-style-type: none"> Line marking equipment & trucks Mobile crane Crane truck Rattle gun Compressor Genset Concrete truck Backhoe Auger Slip-form machine Formwork system Light compaction equipment Trucks Small Tools Light vehicles Lighting equipment Sweeper truck 	30 months (July 2013 to June 2016)
10	Traffic switches / Road furniture	Temporary closure Pacific Highway lanes to tie-in traffic switch barriers, line marking, signs, pavement	62300, 63500, 64200, 82400 or elsewhere as required	<ul style="list-style-type: none"> restricted Pacific Highway Road (ROL restrictions) unsafe work zone to adjacent traffic 	<ul style="list-style-type: none"> 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 	30 months (July 2013 to June 2016)

Item No.	Activity	Activity Description	Approx. location (Chainages)	Justification for Out of Hours Work	Approximate Plant Requirements	Indicative Timing ¹
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 CEMP for locations of ancillary facilities/batch plant locations	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> Light vehicles Lighting equipment Delivery trucks Mobile crane Concrete and asphalt batch plants Loader Excavator Truck and dogs Grader 	As required throughout project
12	Bridge and retaining works	Delivery of precast super-tee girders including any final access preparation works	61400, 64150, 66200, 68500, 72400, 78500	<ul style="list-style-type: none"> Police escorted oversized deliveries. May need to close lanes of Pacific Hwy to allow access of tees. Closures only allowed outside peak hours. 	<ul style="list-style-type: none"> Light vehicles (traffic control) Heavy vehicles Cranes Lighting equipment 	14 months (October 2013 to December 2014)
		Construction of bridge and deck furniture on ARTC Rail Bridges	CH 61800	<ul style="list-style-type: none"> Track possessions required for erection of temporary works and girders, installation of deck furniture and removal of temporary works 	<ul style="list-style-type: none"> Cranes EWP's Trucks Small powered equipment Saw-cutting / grinding Lighting equipment 	9 months (October 2013 to June 2014)
		Mobilisation of cranes including any final access preparation works	61400, 64150, 66200, 68500, 72400, 78500	<ul style="list-style-type: none"> May need to close lanes of Pacific Hwy to allow access of cranes. Closures only allowed outside peak hours. 	<ul style="list-style-type: none"> Cranes driving into site (but not working/lifting) 	14 months (October 2013 to December 2014)
		Construction of retaining wall on ARTC Rail Bridge Abutment	CH 61800	<ul style="list-style-type: none"> Track possession required to work in ARTC corridor 	<ul style="list-style-type: none"> Excavator crane EWP Lighting tower Truck Roller/vibe plate Small hand tools 	14 months (June 2013 to September 2014)

Item No.	Activity	Activity Description	Approx. location (Chainages)	Justification for Out of Hours Work	Approximate Plant Requirements	Indicative Timing ¹
		Bridge Deck Pour	CH61800, 62310, 62750, 63650, 64150, 64900, 67710, 71550, 71950, 72440, 73370, 73400, 74810, 75470, 76950, 77650, 78510, 79860, 79910, 81530, 81880, 82410, 82410	<ul style="list-style-type: none"> During hot weather it may be necessary to start or finish bridge deck pours outside normal work hours to avoid excessive heat compromising concrete quality. 	<ul style="list-style-type: none"> Crane Concrete pump Concrete vibrator Welding equipment Excavator Pneumatic jackhammer Delivery truck Concrete truck motor boat generator water pump barge lighting tower 	30 months (August 2013 to December 2015)
		Wet curing of decks / superstructure - top up of water tanks and check curing process once per day over weekend	CH61800, 62310, 62750, 63650, 64150, 64900, 67710, 71550, 71950, 72440, 73370, 73400, 74810, 75470, 76950, 77650, 78510, 79860, 79910, 81530, 81880, 82410, 82410	<ul style="list-style-type: none"> Wet curing process requires continuously topping up the water tanks and check curing process once per day over weekend 	Light vehicle Water pump	14 months (November 2013 to January 2015)
13	Geotech Investigations or survey work	Ground investigations and survey set-out / pick up.	61500-62500, 63400-68500, 69800-70100, 70300-71100, 81400, 82350-83300 or elsewhere as required	<ul style="list-style-type: none"> restricted Pacific Highway Road (ROL restrictions) unsafe work zone to adjacent traffic 	<ul style="list-style-type: none"> Truck mounted drills Piling rigs Backhoe Excavators Trucks Pumps Generators Light vehicle lighting tower 	As required throughout project

¹ **Indicative Timing** - durations stated indicate the early commencement and the finish of final construction activities for the discipline. Works are not continuous over this duration and reference should be made to the construction programme for detailed information.

APPENDIX A – Out of Hours Application Form



Out of Hours Work Approval Application Form

+	Inspection/ Application Date:	
	Proposed Out of Hours works:	
	List of machinery to be used:	
	Persons performing the works:	
	Location of Out of Hours Work (also attach a map of location):	
	Proposed Out of Hours Times	<input type="text"/>
	Date of Proposed After Hours Work:	<input type="text"/>
DEMONSTRATED NEED FOR OUT OF HOURS WORK		
Provide the justification why the works are required to be conducted out of hours.		
DETAIL THE PREDICTED IMPACTS OF THE WORKS WITH MITIGATION		
NOISE/VIBRATION MITIGATION MEASURES		
Complete the following noise/vibration mitigation table to identify all reasonable and feasible mitigation measures that will be implemented during the works.		

Rev 1



Out of Hours Work Approval Application Form

Mitigation Measure	Reasonable (Y/N)	Feasible (Y/N)	Implemented (Y/N)	Comments
Have you considered programming of noisy activities so that works are maximized in the OOHW period thereby minimizing the number of nights the community is subjected to OOHW? If so provide comments.				
Are high noise generating activities (exceedance of RBL by 20dB(A) or more) aimed at being completed before 10pm? Provide details.				
Are there alternative plant or methods that can be used to reduce noise? Eg. using smaller equipment to do the job, or using a different (quieter) method to do the job				
Are plant/equipment requirements at a minimum number?				
Have you confirmed broadband reversing alarms or replacement procedures will be implemented for OOHW?				
Can any temporary noise barriers be installed adjacent to the works?				
If the activity is a high noise/vibration activity can respite periods be applied? If so what are they?				
Are plant/can plant be positioned onsite to reduce emission of noise to the surrounding neighbourhood.				
Are site access points and haul roads located away from sensitive receivers.				
Are access roads regularly graded to reduce noise from trucks rattling?				
Where possible, is construction equipment located in a position that provides the most acoustic shielding from buildings and topography.				
Is equipment equipped with noise control measures ie. mufflers, silenced exhausts acoustic enclosures for any diesel generators and/or air compressors etc.				
Are equipment and diesel combustion engines (including delivery and disposal trucks) turned off when not in use.				
Is machinery used appropriately sized to prevent overloading and associated over-revving?				
Are plant and equipment adequately and regularly maintained?				
Is traffic movement being kept to a minimum, e.g. ensure trucks are fully loaded so that the volume of each delivery is maximised and the number of trips is therefore minimised.				

Rev 1



Out of Hours Work Approval Application Form

Is staff behaviour monitored to control unwanted noise such as loud radios, shouting and revving of engines. Are horn signals between drivers kept to a minimum?				
Are all acoustic screens/fences maintained appropriately? i.e. are all gaps between panels sealed, are gaps between the screen/fence and the ground sealed				
Can any at residence temporary treatments be installed adjacent to the proposed works?				
Should temporary relocation (eg. accommodation) be offered to the affected sensitive receivers (ie. Are predicted noise levels > L _{Aeq} 75 dBA in the night period)?				
Can smaller plant or different methods be used to minimise potential vibration impacts?				
Can static or low vibration functions be used instead of high vibration?				
Can programming been considered to aim at completing potential vibration activities on the weekends or evening periods?				
Is required OOH lighting at a minimum and directed downwards and away from residences as much as possible?				

ANY NEED & SCOPE FOR ADDITIONAL NOISE MITIGATION MEASURES?
HAS AFFECTED RESIDENTS BEEN CONSULTED/ ADVISED OF PROPOSED WORK?

Form Completed by:

Name:

Position:

Date:

Signature:

Form Approved by:

Name:

Position: Environmental Delegate Date:

Signature:

Rev 1

APPENDIX B – SKM SoundAdvice Assessment Tool

Functionality

The tool will be project-specific, with each representative receiver, construction location and potential noise source included. The tool will incorporate meteorological influences and provide predictions on virtually any combination of construction noise scenarios needed.

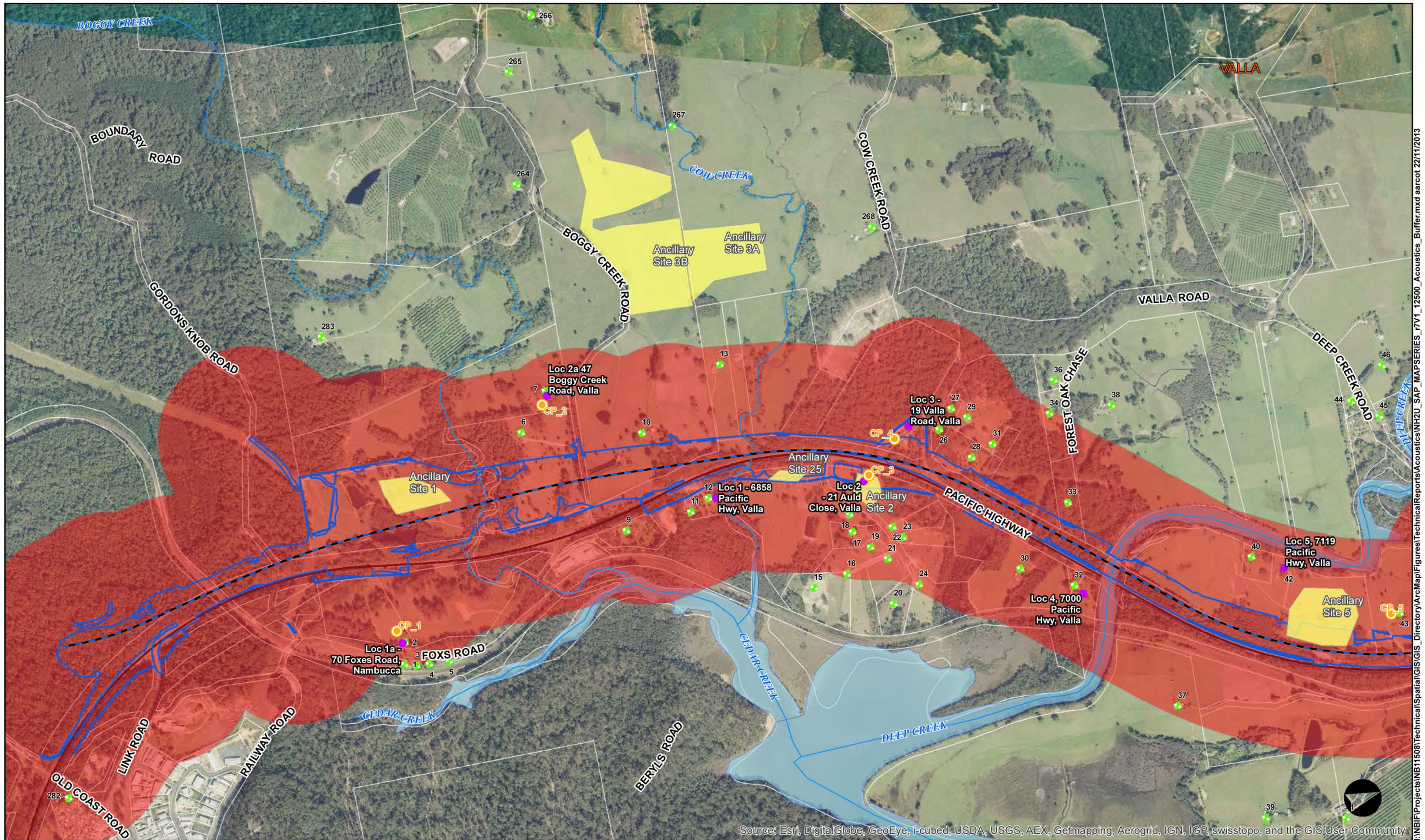
The outputs of the tool will indicate compliance with relevant noise criteria and/or whether inaudibility is achieved for out-of-hours work. A tailored report/auditing form will be generated at the end of each calculation for approval or discussion.

Reliability

The tool will be validated for the NH2U project using SoundPlan, a widely accepted noise prediction package using the CONCAWE prediction methodology. A validation report will be provided for the project.

SoundAdvice has been implemented on previous Lend Lease projects and has been reviewed by the EPA on projects such as the Holbrook Bypass, Hex and M5 upgrades. Hence, the tool is an accepted and valid instrument for construction noise assessment.

APPENDIX C – Locations of potential “Type 1c” works



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



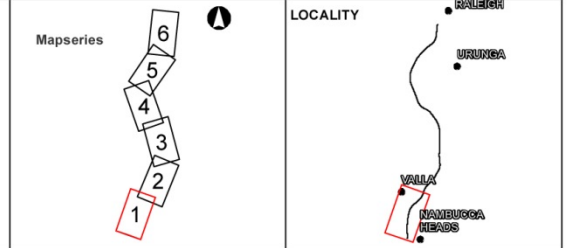
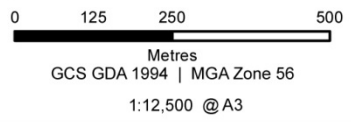
PLAN TITLE
Construction noise and vibration sensitive receivers
 Sheet 1 of 6

PROJECT TITLE
Nambucca Heads to Urunga Pacific Highway Upgrade

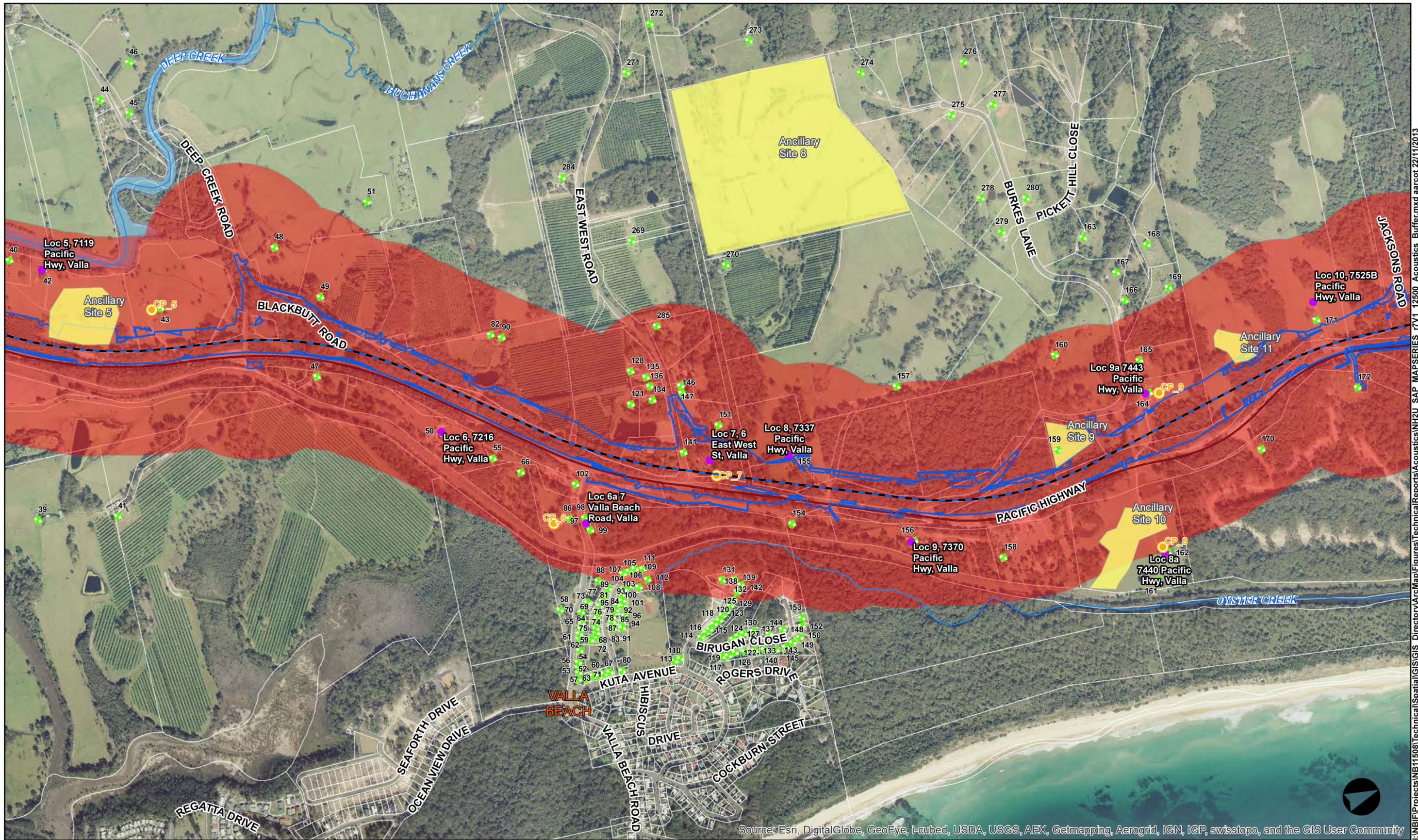
REVISION DATE: 22/11/2013

LEGEND:

- Background noise monitoring locations
- + Noise construction receivers
- Construction phase noise monitoring locations (CP_#)
- Ancillary sites
- NH2U D&C clearing extents (EN1 SDD 100%)
- MCoA C4(d) Extended construction hours work areas
- Standard approved construction hours



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Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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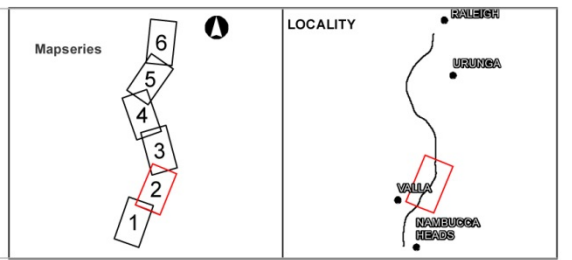
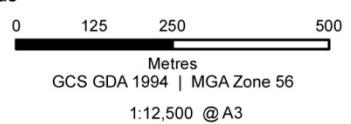


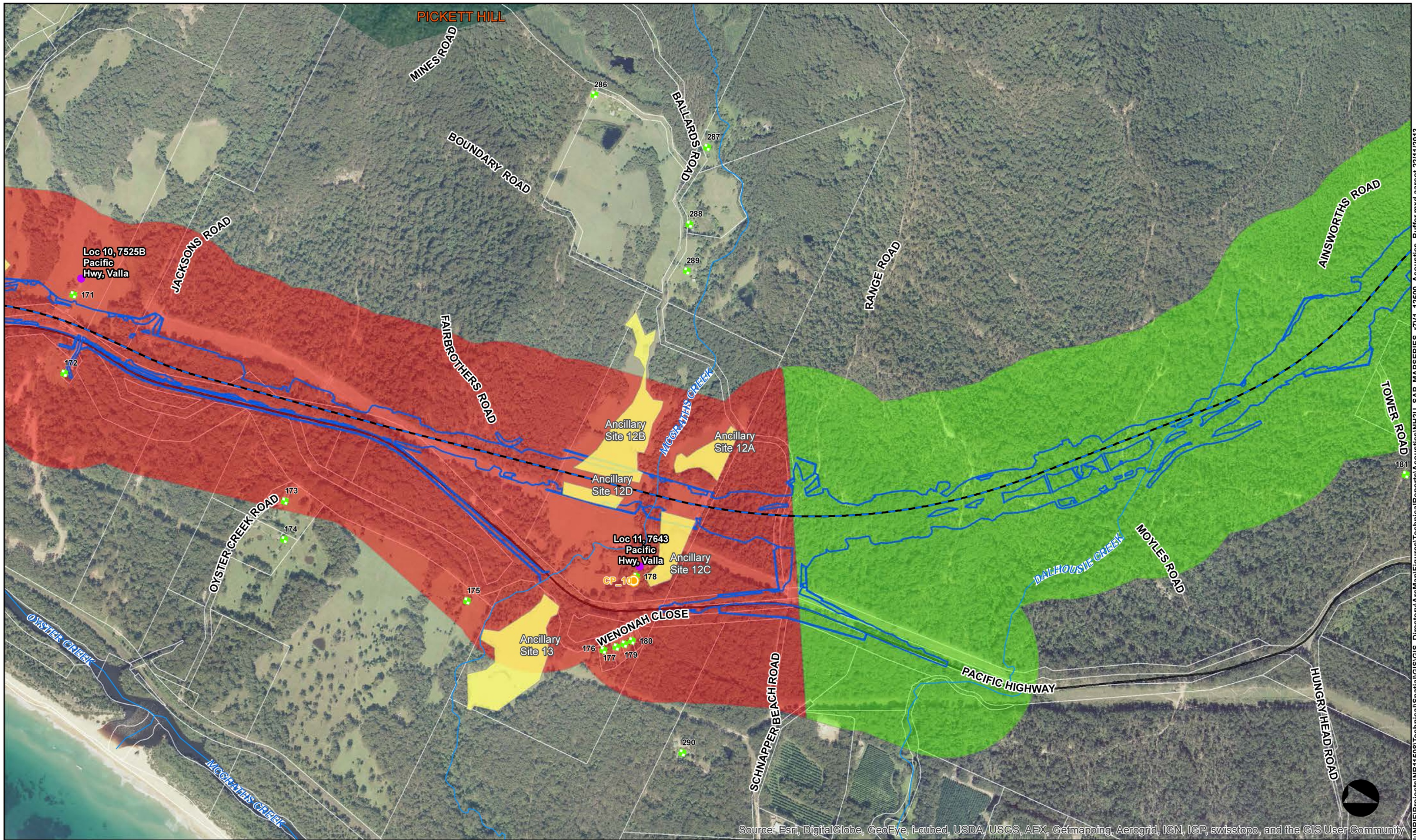
PLAN TITLE
Construction noise and vibration sensitive receivers
Sheet 2 of 6

PROJECT TITLE
Nambucca Heads to Urunga Pacific Highway Upgrade

REVISION DATE: 22/11/2013

- LEGEND:**
- Background noise monitoring locations
 - + Noise construction receivers
 - Construction phase noise monitoring locations (CP_#)
 - + Ancillary sites
 - NH2U D&C clearing extents (EN1 SDD 100%)
 - MCoA C4(d) Extended construction hours work areas
 - Standard approved construction hours





Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



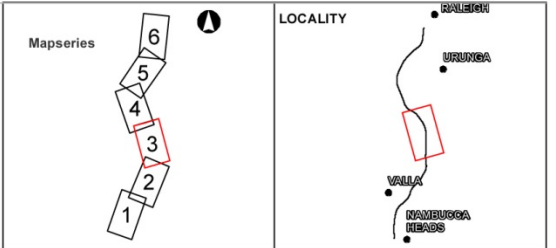
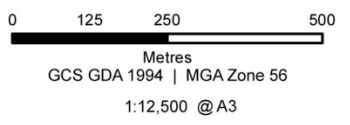
PLAN TITLE
Construction noise and vibration sensitive receivers
Sheet 3 of 6

PROJECT TITLE
Nambucca Heads to Urunga Pacific Highway Upgrade

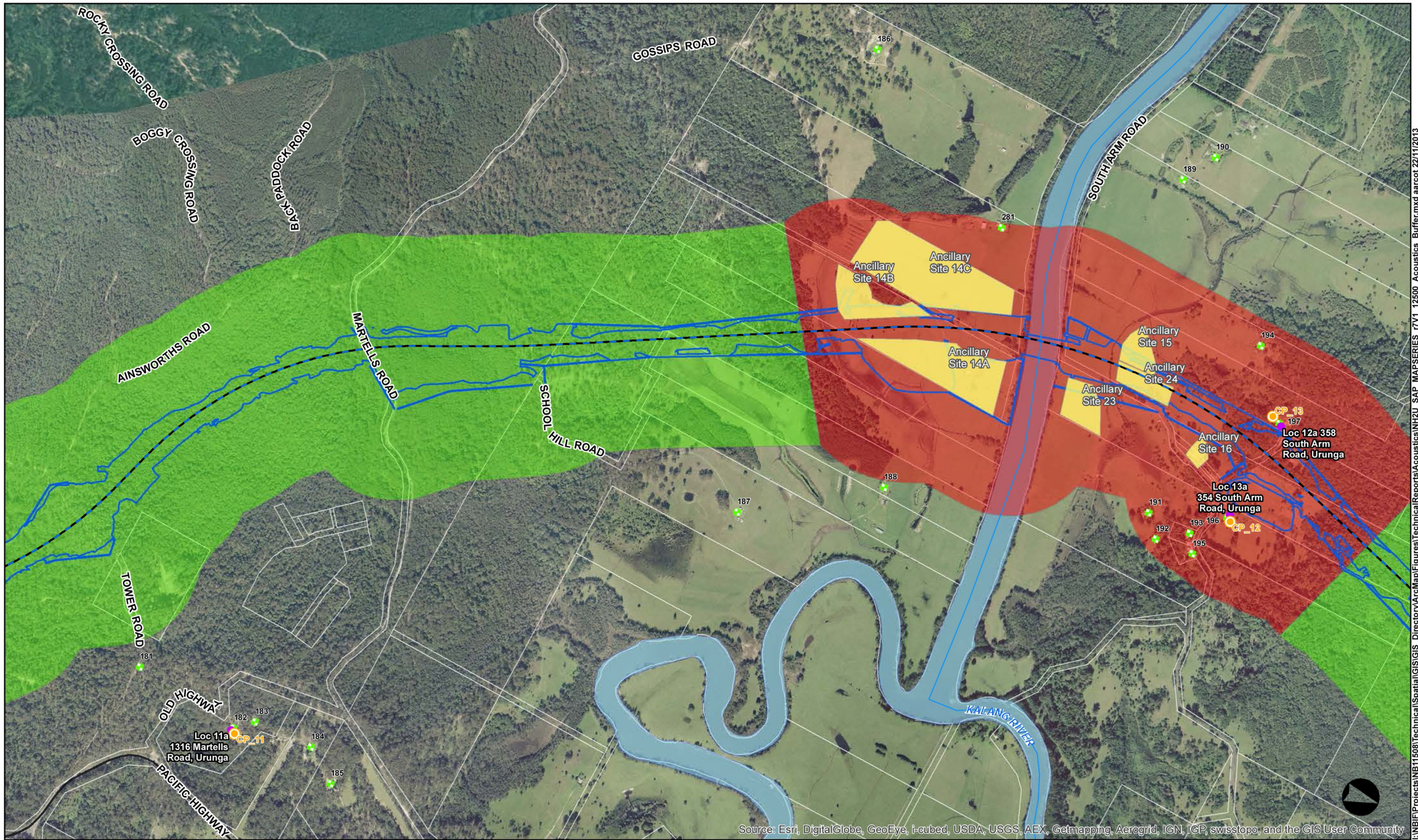
REVISION DATE: 22/11/2013

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Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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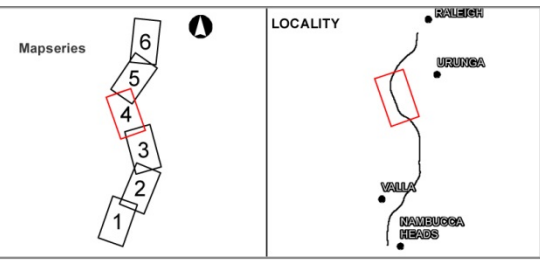
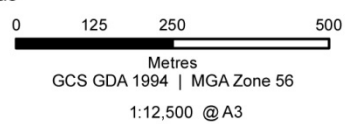
PLAN TITLE
Construction noise and vibration sensitive receivers
Sheet 4 of 6

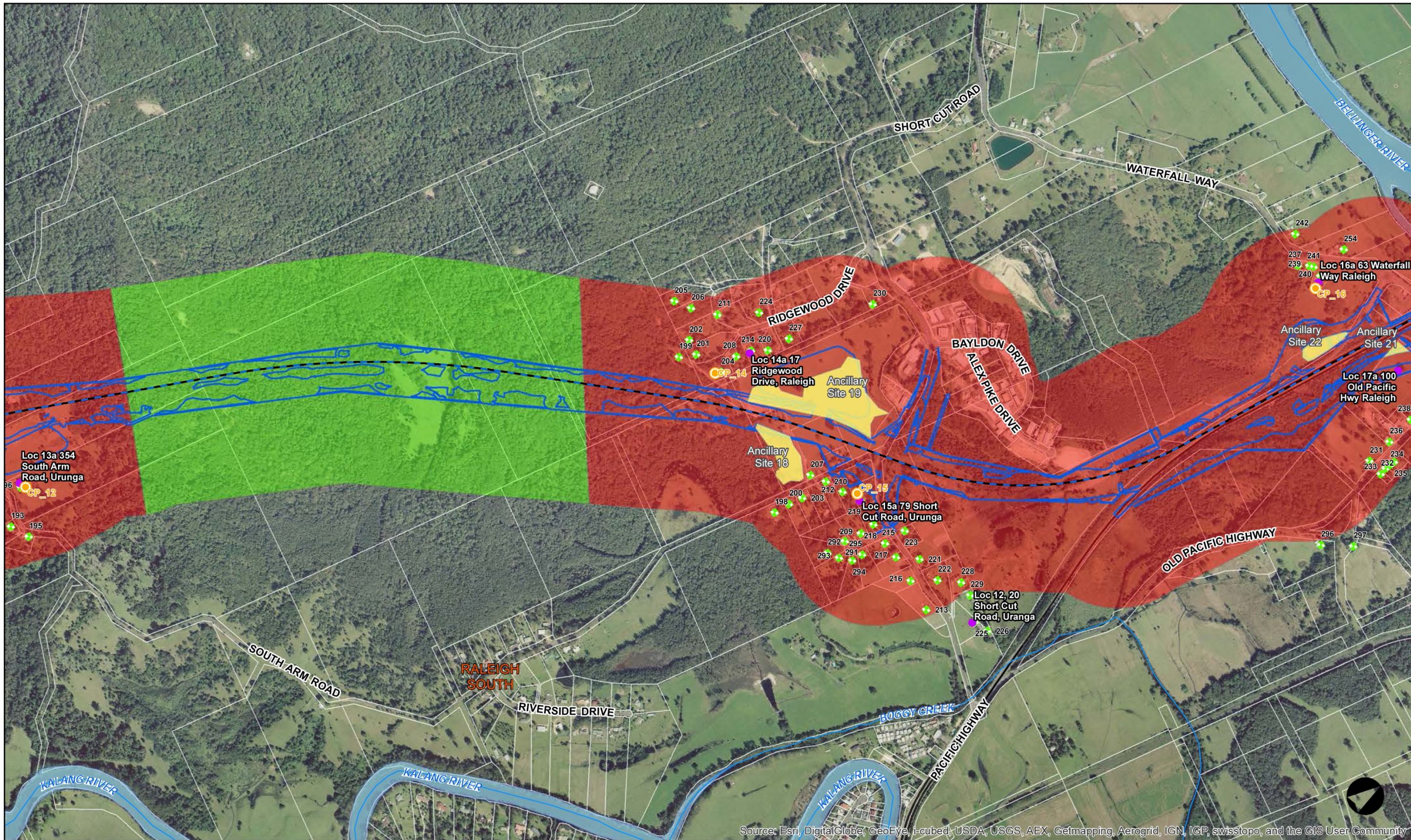
PROJECT TITLE
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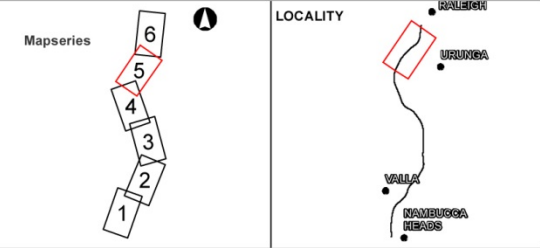
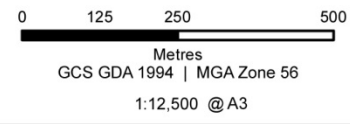
PLAN TITLE
Construction noise and vibration sensitive receivers
Sheet 5 of 6

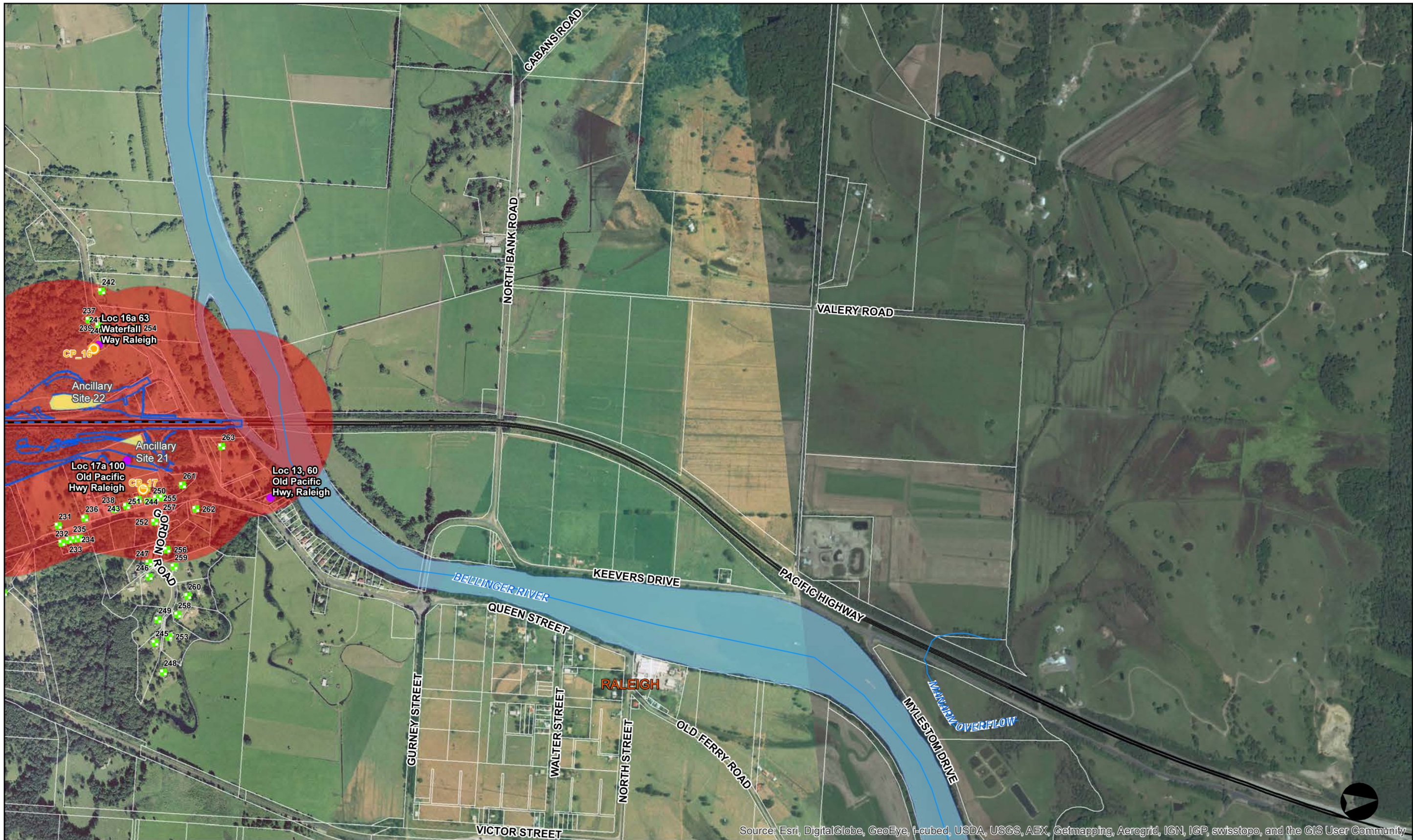
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PLAN TITLE
Construction noise and vibration sensitive receivers
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