



Transport
Roads & Maritime
Services

THE NORTHERN ROAD UPGRADE STAGE 1

Addendum review of environmental
factors

OCTOBER 2015

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1 Introduction

1.1 Background

A Review of Environmental Factors (REF) was prepared by the NSW Roads and Maritime Services (Roads and Maritime) in October 2012 for the upgrade of about 15 km of The Northern Road between The Old Northern Road, Narellan and Mersey Road, Bringelly. The REF for The Northern Road Upgrade was subsequently determined in February 2013 under Part 5A of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The approved activity described in The Northern Road Upgrade REF includes upgrading a 15 km section of The Northern Road from a two lane, two way road to a four lane, divided road. Stage 1 of the approved activity was progressed through detailed design and relates to the upgrade of 3.3 km of The Northern Road, between Old Northern Road, Narellan and Peter Brock Drive, Oran Park.

The location of the construction site compound for The Northern Road Upgrade was confirmed during detailed design and is assessed within this addendum REF.

Stage 1 of The Northern Road Upgrade and the proposed modified activity are located within south west Sydney, as shown in Figure 1-1. The location of the construction site compound is also shown on Figure 1-1.

1.2 Purpose of the report

The purpose of this Addendum REF is to describe the modified activity, assess the potential impacts of the modified activity on the environment, identify any additional mitigation measures that should be implemented and determine whether the modified activity can proceed.

The Addendum REF has been prepared by GHD Pty Ltd (GHD) on behalf of Roads and Maritime Infrastructure Development, Sydney Region. The Addendum REF only assesses the changes to The Northern Road Upgrade associated with the proposed site compound location. This Addendum REF should be read in conjunction with The Northern Road Upgrade REF. For the purposes of the works described in this Addendum REF, Roads and Maritime is the proponent and the determining authority under Part 5 of the EP&A Act.

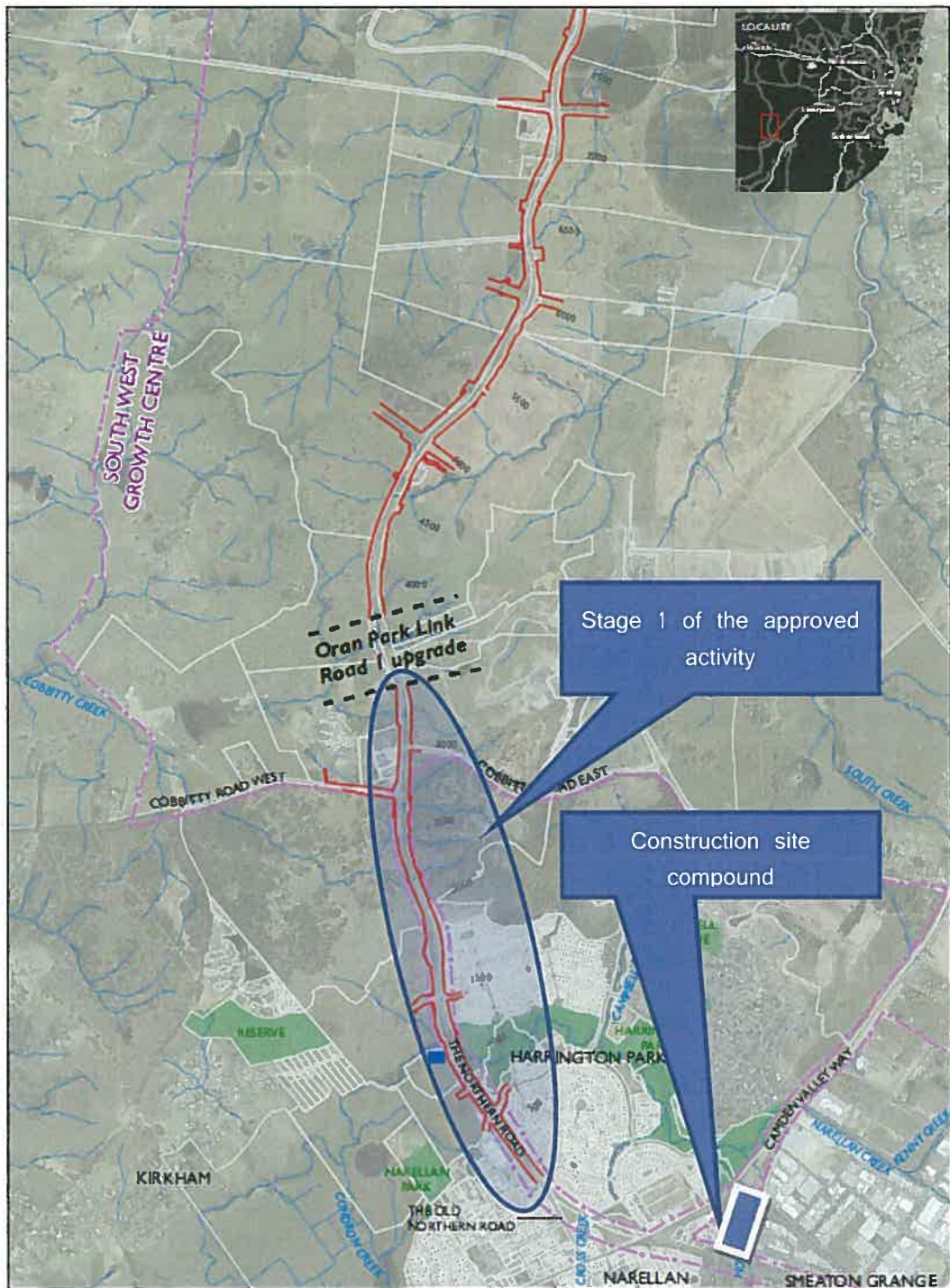


Figure 1-1 Location of the approved activity (Stage 1) and proposed modified activity

The description of the modified activity and associated environmental impacts have been undertaken in the context of clause 228 of the *Environmental Planning and Assessment Regulation 2000*, the *Threatened Species Conservation Act 1995* (TSC Act), the *Fisheries Management Act 1994* (FM Act), and the Australian Government's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). In doing so, the Addendum REF helps to fulfil the requirements of section 111 of the EP&A Act by allowing Roads and Maritime to examine and take into account to the fullest extent possible, all matters affecting or likely to affect the environment by reason of

the modified activity.

The findings of the Addendum REF would be considered when assessing:

- Whether the modified activity is likely to have a significant impact on the environment and therefore the necessity for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning under Part 5.1 of the EP&A Act.
- The significance of any impact on threatened species as defined by the TSC Act and/or FM Act, in section 5A of the EP&A Act and therefore the requirement for a Species Impact Statement.
- The potential for the modified activity to significantly impact a matter of national environmental significance or Commonwealth land and the need to make a referral to the Australian Government Department of the Environment for a decision by the Commonwealth Minister for the Environment on whether assessment and approval is required under the EPBC Act.

1.3 Stakeholder and community consultation

No additional stakeholder or community consultation has been undertaken during development of the modified activity. Information relating to stakeholder and community consultation that was undertaken during development of the approved activity is provided in The Northern Road Upgrade REF (SKM 2012).

Roads and Maritime would continue to consult with the community and relevant Government agencies during delivery of the approved and modified activity. In particular, the following consultation with the community and stakeholders would be undertaken:

- Ongoing updates to the wider community prior to commencement of construction
- Follow up meetings with directly affected property owners prior to commencement of construction
- Ongoing consultation with Council.

2 The Project

2.1 Description of the approved activity

The approved activity as described in The Northern Road Upgrade REF (SKM 2012) comprises upgrading a 15 km section of The Northern Road between Old Northern Road, Narellan and Mersey Road, Bringelly from a two lane, two way road to a four lane divided road.

Stage 1 of the approved activity is the upgrade of 3.3 km of The Northern Road, between Old Northern Road, Narellan and Peter Brock Drive, Oran Park. This Addendum to the REF relates to Stage 1 works. As described in the REF, Stage 1 works of the approved activity comprises the following key features:

- An upgrade of the existing two-lane road to a four-lane road (two lanes each way) divided by a wide central median
- Posted speed limit of 80 km/h
- Provision of a three metre wide off-road shared pedestrian/cyclist path on the eastern side of the proposal, with space provided on the western side of the proposal for the future construction of a path if required
- A typical lane width of 3.5 m (3.3 m lanes for turning lanes) with two metre outside shoulders and 0.5 m inside shoulders
- Bicycle and pedestrian crossing provisions at traffic lights
- A bus priority lane on the approach and indented bus bay on the departure side of the signalised intersections on The Northern Road
- Upgrade and/or tie in with six local roads
- Upgrade of three existing intersections to include two four-way signalised intersections and a signalised T- intersection
- Upgrade of one unsignalised T-intersection
- Designated turning lanes at all signalised intersections
- Tie in with The Northern Road at the start of the proposal and Peter Brock Drive
- Retention of the existing bridge over Narellan Creek for the southbound carriageway and provision of a new three span bridge over Narellan Creek for the northbound carriageway
- Scour protection works at Narellan Creek
- Upgrade of cross drainage to meet flood immunity for a 1 in 100 year average recurrence interval (ARI) flood event
- Provision of street lighting
- Two permanent spill basins
- Batters required for cut and fill areas
- One major cut location.

During development of detailed design for Stage 1 of The Northern Road Upgrade a number of minor changes were made to the design assessed in The Northern Road Upgrade REF. These changes were reviewed and assessed in a Consistency Assessment Report (GHD 2014) which concluded that the changes were minor and did not require preparation of a supplementary REF. The changes that were made to the approved activity assessed in the Consistency Assessment Report are summarised in Table 2-1.

Table 2-1 Changes to the approved activity during detailed design

Item	Location of change	Approved activity assessed in The Northern Road Upgrade REF	Change during detailed design
1	Old Northern Road to Peter Brock Drive	The Northern Road Upgrade REF assessed 15 km of The Northern Road Upgrade from Old Northern Road to Mersey Road	Detailed design was developed for Stage 1, from Old Northern Road to Peter Brock Drive (3.3 km)
2	All signalised intersections	Standard pedestrian crossings provided	Staged pedestrian crossings provided
3	Shared path alignment at Narellan Creek	A new pedestrian bridge constructed over Narellan Creek adjacent to the southbound carriageway	The shared path was diverted near the sporting fields and connected to the existing shared path around Harrington Lake. No pedestrian bridge required over Narellan Creek.
4	Shared path at southern end of limit of works.	No shared path linking the approved activity to Camden Valley Way	The shared path was extended 300 m to the south of Old Northern Road to link with the existing shared path at Camden Valley Way.

2.2 Description of the modified activity

Following preparation of detailed design and tender documentation for Stage 1 of The Northern Road Upgrade, Roads and Maritime has finalised the location of the construction site compound.

The construction site compound would be located on Lot 4 DP 248585, adjacent to the Camden Bypass ramp between Camden Valley Way, Narellan Road and Smeaton Grange Road. It would be accessed directly from Smeaton Grange Road and would cover about 1.1 hectares. The land is owned by Roads and Maritime and would be used for the duration of construction works. Further information regarding the construction site compound is provided in Section 2.2.1.

The site compound location is shown in Figure 2-1.

2.2.1 Construction site compound

The construction site compound would include:

- Portable buildings with amenities (such as lunch rooms and toilets)
- Secure and bunded storage areas for site materials, including stockpiles, fuel and chemicals
- Office space for on-site personnel and associated parking.

Liquid and solid waste would be removed by tanker or truck and disposed of off-site at a suitably licensed facility able to accept those wastes for storage, reuse or disposal. Fuel and chemical storage areas would be bunded and protected in accordance with the specifications set out by the NSW Office of Environment and Heritage.

The site would be securely fenced with temporary fencing. All necessary signage advising the general public of access restrictions would be provided. Upon completion of construction works, the compound would be demobilised, all rubbish and materials would be removed from site and the area would be rehabilitated to a state consistent with its current landuse.



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Job Number | 21-22831
 Revision | A
 Date | 22 Oct 2015

Roads and Maritime Services
 The Northern Road upgrade



- LEGEND**
- Hollow bearing tree
 - Mature Tree
 - Study Area
 - River Flat Eucalypt Forest
 - Water area
 - Growth Centre Existing Certified
 - Planted
 - Cleared
 - 2m contour
 - Waterways



Paper Size A4
 0 10 20 40 60 80 100
 Metres
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 56

Compound Location
Figure 2-1

Level 15, 133 Castlereagh Street Sydney NSW 2000 Australia T 61 2 9239 7100 F 61 2 9239 7199 E sydney@ghd.com W www.ghd.com
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 Data Source: NSW Department of Lands, Cadastre - Jan 2014, Geoscience Australia 250K Data - Jan 2014, NSW Department of Primary Industry - Jan 2014, SIX maps image Jan 2015. Created by: gching

3 Statutory and planning framework

3.1 State Environmental Planning Policies

3.1.1 State Environmental Planning Policy (Infrastructure) 2007

State Environmental Planning Policy (Infrastructure) 2007 (ISEPP) aims to facilitate the effective delivery of infrastructure across the State.

Clause 94 of ISEPP permits development on any land for the purpose of a road or road infrastructure facilities to be carried out by or on behalf of a public authority without consent.

As the modified activity is for a road and is to be carried out by Roads and Maritime, it can be assessed under Part 5 of the *Environmental Planning and Assessment Act 1979*. Development consent from council is not required.

The modified activity is not located on land reserved under the *National Parks and Wildlife Act 1974* and does not affect land or development regulated by *State Environmental Planning Policy No. 14 - Coastal Wetlands*, *State Environmental Planning Policy No. 26 - Littoral Rainforests*, *State Environmental Planning Policy (State and Regional Development) 2011* or *State Environmental Planning Policy (Major Development) 2005*.

Part 2 of the ISEPP contains provisions for public authorities to consult with local councils and other public authorities prior to the commencement of certain types of development. Consultation, including consultation as required by ISEPP (where applicable), is discussed in Section 1.3 of this Addendum REF.

3.1.2 State Environmental Planning Policy (Sydney Region Growth Centres) 2006

The *State Environmental Planning Policy (Sydney Region Growth Centres) 2006* (Growth Centres SEPP) aims to co-ordinate the release of land for residential, employment and other urban development in the North West and South West growth centres of Sydney. The policy also aims to provide for comprehensive planning for those growth centres and to provide for the orderly and economic provision of infrastructure in and to those growth centres.

A small portion of the modified activity from Cobbitty Road to the Oran Park Road Link and the land immediately adjoining (chainage 3000 to 3300) is located within the South West Growth Centre, and is land to which this policy applies.

Clause 18A of the Growth Centres SEPP allows development for public utility undertakings (which includes road transport undertakings) to be carried out provided written notice of the intention to carry out the development to the Department of Planning and Environment is provided and consideration of any response received from the Department of Planning and Environment is undertaken. Section 5 provides details of the consultation undertaken for the modified activities.

The modified activity is considered consistent with the aims of the Growth Centres SEPP and would provide for the anticipated increase in local population in the South West Growth Centre.

3.1.3 State Regional Environmental Plan No 20 – Hawkesbury-Nepean River (No 2 – 1997) (now deemed a SEPP)

The *Sydney Regional Environmental Plan No 20 – Hawkesbury-Nepean River (No 2 – 1997)* (SREP 20) (now deemed a SEPP) integrates planning with catchment management and aims to protect the environment of the Hawkesbury-Nepean River system by ensuring that the impacts of future land uses are considered in a regional context. SREP 20 covers water quality and quantity, environmentally sensitive areas, riverine scenic quality, agriculture, and urban and rural residential development. It controls development that has the potential to impact on the river environment.

Camden and Liverpool LGAs are identified as two of the LGAs to which SREP 20 applies.

Clause 5 of SREP 20 outlines general planning considerations and Clause 6 outlines specific planning policies and recommended strategies that must be considered when determining activities under Part 5 of the EP&A Act. The Northern Road Upgrade REF demonstrated the approved activities consistency with SREP 20. The modified activity is consistent with this assessment.

3.2 Local Environmental Plans

The modified activity is located within the Camden and Liverpool LGAs. Consequently, any development on this land would be subject to the provisions of the *Camden Local Environmental Plan 2010* (Camden LEP) and the *Liverpool Local Environmental Plan 2008* (Liverpool LEP). However, the ISEPP operates to remove otherwise applicable consent requirements, as discussed in Section 3.1.1.

3.3 Other relevant legislation

3.3.1 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NPW Act) is the primary legislation dealing with Aboriginal cultural heritage in New South Wales. Items of Aboriginal cultural heritage (Aboriginal objects) or Aboriginal places (declared under section 84) are protected and regulated under the NPW Act. Aboriginal objects are protected under section 86 of the Act. Under section 90 (1) of the Act the Director-General may issue an Aboriginal heritage impact permit for an activity which will harm an Aboriginal object. As the approved activity would impact on Aboriginal heritage items, an Aboriginal heritage impact permit is required prior to construction commencing.

No additional impacts on Aboriginal cultural heritage are anticipated to those identified and assessed The Northern Road Upgrade REF.

3.3.2 Heritage Act 1977

The *Heritage Act 1977* provides for the protection and conservation of NSW's environmental heritage. Under clause 57, the Act establishes the need for approval for the excavation or disturbance of items listed on the State Heritage Register (SHR). The approved activity impacted on Orielton, an item listed on the SHR. However, given the impacts were assessed as minor, a site specific exemption under clause 57(2) of the Heritage Act would be sought from The Heritage Office prior to commencement of works. An exception under section 139 of the Heritage Act 1977 would also be obtained for works associated with Narellan Army Camp. Two permits under section 60 and section 140 of the Heritage Act would be required to undertake

archaeological monitoring at Hillside Drive.

The impacts of the modified activity on non-Aboriginal heritage are considered consistent with the impacts identified and assessed in The Northern Road Upgrade REF.

3.3.3 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) provides the legal framework for the management of air, noise, water and waste pollution. Under Part 3.2 of the Act, the carrying out of scheduled development work as defined in Schedule 1 - road construction, (meaning the construction, widening or re-routing of roads) is relevant to the proposal. The clause specifies that an activity is considered a scheduled activity if it results in the existence of four or more traffic lanes (not including bicycle lanes or lanes used for entry or exit) on a road classified or proposed to be classified as a main road (but not a freeway or tollway) under the *Roads Act 1993* for at least five kilometres in any area other than the metropolitan area requires an environmental protection license.

As the approved activity involves widening The Northern Road to four lanes and would be about 15 km in length it is considered a scheduled activity under the POEO Act. Therefore, an Environmental Protection Licence is required.

The modified activity is considered part of this approved activity and would be covered within the Environmental Protection Licence.

3.3.4 Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act 1995* (TSC Act) provides for the protection of endangered, threatened and vulnerable species, populations, endangered ecological communities, critical habitats and key threatening processes in NSW.

Activities carried out under Part 5 of the EP&A Act within biodiversity certified land do not require assessments of significance and removes the need to progress to the preparation of a Species Impact Statement to seek concurrence or offset impacts in certified areas.

As part of The Northern Road Upgrade REF, significance assessments were carried out for threatened species with the potential to occur in non-certified areas or outside the SEPP boundary. The assessments found the approved activity would not have a significant impact on threatened species, populations or communities. The impacts of the modified activity on threatened species, populations or communities are considered consistent with the impacts identified and assessed in The Northern Road Upgrade REF.

3.3.5 Fisheries Management Act 1994

The objects of the *Fisheries Management Act 1994* (FM Act) are to conserve, develop and share the fishery resources of the State for the benefit of present and future generations, including conserving fish stocks and fish habitat and promoting ecological sustainable development.

The approved activities would involve dredging and reclamation work and therefore under section 199 of the FM Act notification would be given to the Minister for

Primary Industries and any matters raised by the Ministers would be considered within 28 days after the giving of the notice.

The impacts of the modified activity on fish habitat are considered consistent with the impacts identified and assessed in The Northern Road Upgrade REF.

3.4 Commonwealth legislation

3.4.1 *Environment Protection and Biodiversity Conservation Act 1999*

Under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) a referral is required to the Australian Government for proposed 'actions that have the potential to significantly impact on matters of national environmental significance or the environment of Commonwealth land. An assessment of the modified activities potential impacts on matters of national environmental significance or Commonwealth land found that a significant impact is unlikely (refer Appendix A). Accordingly, the proposal has not been referred to the Department of the Environment.

3.5 Confirmation of statutory position

Roads and Maritime is the proponent and determining authority for the modified activity. By adopting the requirements of the ISEPP and the Growth Centres SEPP, the modified activity may be carried out without development consent, and is therefore subject to assessment under Part 5 of the EP&A Act. Consent from council is not required.

4 Environmental assessment

This section of the Addendum REF provides a detailed description of the potential environmental impacts associated with construction and operation of the modified activity. All aspects of the environment potentially impacted are considered. As required, site-specific mitigation and management measures are proposed to ameliorate the identified potential impacts.

4.1 Issue identification

The existing environment described in The Northern Road Upgrade REF is considered consistent with the existing environment potentially impacted by the modified activity. As such, existing environment information has not been duplicated within the Addendum REF.

A large number of the potential environmental impacts identified and assessed in The Northern Road Upgrade REF are also considered unchanged by the modified activity. Table 4-1 provides a summary of the differences in impact between the approved activity and the modified activity. Where additional potential impacts or differences in impacts as a result of the modified activity are identified, further assessment is provided in Section 4.2.

Table 4-1 Identification of environmental issues

Environmental aspect	Further assessment required due to modified activity	Reasoning
Traffic and access	No	Access to the construction site compound would be directly from Smeaton Grange Road. Potential impacts to traffic and access during construction are considered consistent with the approved activity..
Flora and fauna	Yes	The construction site compound is located in a location not assessed in The Northern Road Upgrade REF and therefore additional assessment has been provided in Section 4.2.2.
Aboriginal cultural heritage	No	The construction site compound is located in a location not assessed in The Northern Road Upgrade REF. A stage 1 PACHCI clearance assessment was completed on 22 October 2015 for the site compound. No known Aboriginal objects or places are likely to be impacted by the works. This letter is provided in Appendix B.
Non-Aboriginal cultural heritage	No	The modified activity would not increase the impact of the approved activity on non-Aboriginal heritage.
Noise and vibration	Yes	The construction site compound is located in a location not assessed in The Northern Road

Environmental aspect	Further assessment required due to modified activity	Reasoning
		Upgrade REF. A noise assessment has been undertaken for the site compound as detailed in section 4.2.1 and Appendix D.
Soils and water quality	No	Erosion and sedimentation from the construction compound or accidental spills, if uncontrolled, could potentially impact water quality in Narellan Creek. To minimise the potential impacts to water quality, the soil and water management plan proposed in The Northern Road Upgrade REF would include site specific measures for the construction site compound.
Hydrology	No	The construction site compound would be located above the 1 in 100 year flood level. The modified activity would not increase the impact of the approved activity on hydrology.
Land use	No	The construction site compound would be located within Roads and Maritime owned land. The modified activity would not increase the impact of the approved activity on land use.
Socio-economic	No	The modified activity would not increase the socio-economic impacts of the approved activity.
Landscape character visual amenity	No	The construction site compound would be located between Narellan Road, Camden Valley Way and Smeaton Grange Road within a predominantly infrastructure landscape that generally consist of roadways, industrial and residential receivers. Views of the construction site compound will be from users of Narellan Road, Camden Valley Way and Smeaton Grange Road. Any visual impacts experienced by road users will be temporary and for the duration of construction only. Upon construction completion, the area will be returned to a state suitable for its current land use. Additionally, vegetation clearing would be minimised. As such, some patches of vegetation will block some of the views to the construction site. The modified activity would not increase the impact of the approved activity on landscape character and visual amenity.
Air quality	No	The modified activity would not increase the impact of the approved activity on air quality during construction or operation.
Waste management	No	The modified activity would not increase the impact of the approved activity on resource

Environmental aspect	Further assessment required due to modified activity	Reasoning
and resource use		use.
Greenhouse gas emissions and energy use	No	The modified activity would not result in a noticeable increase in greenhouse gas emissions or energy consumption compared to the approved activity.
Cumulative impacts	No	The modified activity would not increase the cumulative impact of the approved activity.

4.2 Additional assessment

4.2.1 Noise and vibration

A noise assessment of the site compound was undertaken by Renzo Tonin & Associates and is provided in Appendix D. The assessment is based on the nearest affected noise receivers as shown in Figure 1 of Appendix D. Based on the construction noise management levels and construction noise sources, the construction noise management level will be exceeded when works are at closest proximity to three of the eight receivers. This is based on a number of combinations of plant and machinery (as discussed in section 6 of Appendix D), however most items of equipment are typically used for short durations and are not continuous throughout the whole construction period.

The additional traffic on Camden Valley Way as a result of the subject site would not contribute to the existing traffic noise levels from Camden Valley Way to the affected receivers and would be substantially less than the allowable 2 dB(A) increase to existing traffic noise levels.

The mitigation measures provided in section 5.1 would reduce construction noise impacts to residential receivers.

4.2.2 Biodiversity

A site assessment of the proposed compound location was undertaken on 22 October 2015. The biodiversity assessment is provided in Appendix E. The site comprises mostly cleared land (exotic grassland) with scattered trees and shrubs. There are two drainage lines within the site drain through culverts under Camden Valley Way. There are three vegetation types onsite being River Flat Eucalypt Forest endangered ecological community (EEC), cleared land and planted vegetation.

The River Flat Eucalypt Forest EEC is considered to be a degraded form of River Flat Eucalypt Forest EEC listed under the TSC Act due to the presence of mature native trees and severe weed infestation. Most of the vegetation is located within certified land under the South West Growth Centre. The small patch of EEC located in the north-eastern corner of the site is not located within certified land (Refer Figure 1 in the Biodiversity Assessment (Appendix E).

The planted vegetation is located in the south and east of the site and is dominated by Forest Red Gum. The rest of the site is cleared and highly disturbed and

dominated by exotic grasses, shrubs and herbs. Five noxious weeds were identified onsite and are categorised as Class 4 locally controlled weeds under the *Noxious Weeds Act 1993*.

The site is heavily disturbed and contains opportunistic species common to urban areas and disturbed woodland. One hollow-bearing tree, located in the north eastern corner of the site, may provide nesting habitat for common or introduced birds or roosting habitat for microchiropteran bat species such as the threatened Yellow-bellied Sheath-tail Bat (*Saccolaimus flaviventris*). However, given the location of the hollow-bearing tree, it is more likely to be used by introduced or aggressive species such as the Common Myna. No other threatened or migratory fauna species are likely to rely on the habitat present. The culverts may provide temporary roosting habitat for threatened microchiropteran bats listed under the TSC Act. However, the culverts would not be removed as part of the operations and the site is already in close proximity to surrounding roads subject to substantial traffic noise.

There is no habitat for threatened species listed under the *Fisheries Management Act 1994* (FM Act) as the drainage lines are located at a low height above sea level and are not near an estuary. No threatened species listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is likely to occur in the study area.

The compound is proposed to be located in predominantly cleared areas. Some planted or regenerating native shrubs may be removed. There would be no direct impact to the River Flat Eucalypt Forest EEC and the site would be positioned outside the drip line of mature trees in the north eastern corner. An assessment of significance for indirect impacts on the River Flat Eucalypt Forest EEC has identified that the site is considered unlikely to have a significant impact on the River Flat Eucalypt Forest EEC. The site would have minimal impacts on native biodiversity values.

The proposal is unlikely to result in a significant impact on any threatened biota listed under the TSC Act, FM Act and EPBC Act. As such, a species impact statement is not required. Mitigation measures are provided in section 5.1 to minimise the potential for adverse impacts on adjoining and downstream habitats during use of the site as a compound.

5 Environmental management

5.1 Summary of safeguards and management measures

The environmental safeguards and management measures outlined in this Addendum REF would be incorporated into the detailed design phase of The Northern Road Upgrade Stage 1 and implemented during construction and operation. The safeguards and management measures would be implemented in addition to the measures identified in The Northern Road Upgrade REF to minimise any potential adverse impacts arising from the modified activity on the surrounding environment. The additional safeguards and management measures as well as the safeguards and management measures from The Northern Road Upgrade REF are summarised in Table 5-1.

Table 5-1 Summary of site specific environmental safeguards

No.	Impact	Environmental safeguards	Responsibility	Timing
1	General	<ul style="list-style-type: none"> • All environmental safeguards must be incorporated within the following: <ul style="list-style-type: none"> ○ Project Environmental Management Plan ○ Detailed design stage ○ Contract specifications for the proposal ○ Contractor's Environmental Management Plan 	Project manager	Pre-construction
2.	General	A risk assessment must be carried out on the proposal in accordance with the Roads and Maritime Services Audit Pack and OSD risk assessment procedures to identify an audit and inspection program for the works. The recommendations of the risk assessment are to be implemented. A review of the risk assessment must be undertaken after the initial audit or inspection to evaluate if the level of risk chosen for the project is appropriate. Any works resulting from the proposal and as covered by the REF may be subject to environmental audit(s) and/or inspection(s) at any time during their duration.	RMS project manager and regional environmental staff	Pre-construction After first audit
3.	General	The environmental contract specification must be forwarded to the RMS regional environmental officer for review at least 10 working days prior to the tender stage. A contractual hold point must be maintained until the CEMP is reviewed by the RMS regional environmental officer.	RMS project manager	Pre-construction
4.	General	The Roads and Maritime Services Project Manager must notify the RMS regional environmental officer, Sydney Region at least five days prior to work	RMS project manager	Pre-construction

No.	Impact	Environmental safeguards	Responsibility	Timing
		commencing.		
5.	General	All businesses and residences likely to be affected by the proposal must be notified at least five working days prior to the commencement of the proposed activities.	RMS project manager	Pre-construction
6.	General	Environmental awareness training must be provided, by the contractor, to all field personnel and subcontractors.	Contractor	Pre-construction and construction
7.	Traffic and access	<p>A detailed construction traffic management plan (CTMP) would be prepared during the detailed design phase. The CTMP would be prepared in accordance with the RMSs <i>Guide to Traffic Control at Work Sites</i> and would include guidelines, general requirements and procedures to be used when activities or areas of work have a potential impact on existing traffic arrangements. The CTMP would be submitted in stages to reflect the progress of work and would:</p> <ul style="list-style-type: none"> • Identify the traffic management requirements during construction. • Describe the general approach and procedures to be adopted when producing specific traffic control plans. • Provide for the continuous, safe and efficient movement of traffic for both the public and construction workers. • Maintain the capacity of local roads. • Identify temporary speed restrictions to ensure safe driving environmental around work zones. • Minimise impacts on The Northern Road and local traffic. • Provide access to local roads and properties, including the use of temporary turn-around bays. • Provide temporary works and traffic signals. • Identify the number and width of traffic lanes in operation. • Identify traffic barrier requirements and placement. • Include methods for implementing the traffic management plan. • Include methods for minimising 	Construction contractor	Pre-construction

No.	Impact	Environmental safeguards	Responsibility	Timing
		<p>road user delays.</p> <ul style="list-style-type: none"> • Provide appropriate warning and advisory signposting. • Consider other developments such as the South West Growth Centre precincts that may also be under construction, to minimise traffic conflict and congestion that may occur due to the cumulative increase in construction vehicle traffic. • Provide designated pedestrian and cyclist access through and/or around the construction site to maximise connectivity, maintain access and allow safe movements. • Make provision for consultation with relevant local government authority, as appropriate. 		
8.	Traffic and access	Traffic control plans (TCPs) would be prepared and implemented for the appropriate stage of works by suitably qualified personnel. Implementation of TCPs would be inspected as required for the duration of the construction phase in accordance with the RMS <i>Traffic Control at Worksites Manual</i> .	Construction contractor	Pre-construction & construction
9.	Flora and fauna	Minimise the removal of vegetation within areas that are 'non-certified' would be considered in the detailed design.	RMS project manager	Detailed design
10.	Flora and fauna	Safeguards as described in the Biodiversity Guidelines (RTA 2011a) would be applied, including riparian revegetation post-scour protection.	RMS project manager	Detailed design
11.	Flora and fauna	The design of creek and waterway crossings would be in line with guidelines to maintain adequate fish passage according to fish habitat (Fairfull and Witheridge 2003).	RMS project manager	Detailed design
12.	Flora and fauna	A rehabilitation plan including the selection of suitable native plant species would be developed during detailed design.	RMS project manager	Detailed design
13.	Flora and fauna	Should blockage of culverts be required, a permit to temporarily block fish passage would be obtained.	RMS project manager	Pre-construction
14.	Flora and fauna	<p>A flora and fauna management plan would be prepared as part of the CEMP. The plan would include but not be limited to the following:</p> <ul style="list-style-type: none"> • Clearly defined vegetation clearing boundaries including a map representing areas that 	Construction contractor	Pre-construction

No.	Impact	Environmental safeguards	Responsibility	Timing
		<p>would need to be protected (including exclusion zone fencing requirements). This would include the site compound.</p> <ul style="list-style-type: none"> • Pre-clearance surveys and management measures. • Provision for the education of all construction personnel with regards to the importance of clearing limits and remnants/individual trees of significant value. • A procedure for clearing hollow bearing trees in line with the then RMS Biodiversity Guidelines. • A weed management plan. • Safeguards to minimise unavoidable impacts to biodiversity according to the Biodiversity Guidelines (RTA 2011a). 		
15.	Flora and fauna	<p>Pre-clearance surveys would be undertaken by a suitably qualified ecologist prior to any clearing works to clearly demarcate and map vegetation protection areas. These surveys would include a survey of the existing bridge structures to confirm that the bridges do not continue provide habitat for microchiropteran bats.</p> <p>The management measures identified as a result of the pre-clearing survey would be incorporated into the Flora and Fauna Management Plan of the CEMP.</p>	Construction contractor	Pre-construction
16.	Flora and fauna	<p>An offset plan would be developed for the 0.1 hectares of ENV to be removed from non-certified areas. This plan would be developed in consultation with OEH. Offsets would be in accordance with relevant biodiversity measure 11 of the Biodiversity Certification. Offsets would be developed in consultation with both DP&I and OEH.</p>	RMS project manager	Pre-construction
17.	Flora and fauna	<p>Temporary infrastructure would be sited and the sites managed to avoid potential impacts to areas of significant biodiversity, such as areas of native vegetation and the locations of records of the Cumberland Plain Land Snail.</p>	Construction contractor	Construction
18.	Flora and fauna	<p>Regular inspections would be undertaken to ensure all retained vegetation and fauna habitat are clearly marked and exclusion zones</p>	Construction contractor	Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
		and fencing are maintained.		
19.	Flora and fauna	An ecologist would be present during the clearing of habitat trees to handle and relocate any injured fauna. WIRES would be consulted if any injured fauna are encountered.	Construction contractor	Construction
20.	Flora and fauna	Vegetation representative of River-flat Eucalypt Forest would be replanted in cleared areas adjacent to Thompsons Creek.	Construction contractor	Post Construction
21.	Aboriginal cultural heritage	An Aboriginal cultural heritage management plan would be prepared and incorporated into the CEMP. The plan would include, but not be limited to the following: <ul style="list-style-type: none"> • Identification of Aboriginal cultural heritage areas using diagrams. • Identification of Aboriginal items that are not impacted by the proposal. • Measures to protect Aboriginal item such as fencing. • Induction requirements. • Mitigation measures to avoid risk of harm. • Process to communicate risk and responsibilities through environmental awareness training. • Include any requirements for AHIPs or approvals. 	Construction contractor	Pre-construction
22.	Aboriginal cultural heritage	An area based Section 90 Aboriginal heritage impact permit (AHIP) would be sought for impacts on all Aboriginal sites within the proposal that cannot be conserved, and for any required salvage excavations or surface collections. This includes the following items IFI (Harrington Park), O-IF-2/TNRU2, NR4, NR5, BRP-IF-16/TNRU14, TNRU1, TNR2, TNRU3, TNRU4, TNRU5, TNRU6, TNRU7, TNRU9 and TNRU10.	RMS project manager	Pre-construction
23.	Aboriginal cultural heritage	A number of Aboriginal sites are currently listed on existing AHIPs (O-IF-3, BRP-S-01, BRP-S-04 and BRP-S-08). Before an AHIP application is submitted by RMS, the permit holder and OEH would be consulted as to the current status of the Aboriginal sites.	RMS project manager	Pre-construction
24.	Aboriginal cultural heritage	Salvage excavation of a representative area of the sites with moderate archaeological significance would be undertaken to identify appropriate	RMS project manager	Pre-construction

No.	Impact	Environmental safeguards	Responsibility	Timing
		mitigation measures for these sites. This would include the following sites O-IF-2/TNRU2, BRP-IF- 16/TNRU14, TNRU4 and TNRU6, TRNU10. A section 90 AHIP would be obtained to conduct this testing.		
25.	Aboriginal cultural heritage	Hand collection of site TNRU7 would be undertaken by the Aboriginal stakeholder group.	RMS project manager	Pre-construction
26.	Aboriginal cultural heritage	The scarred tree NRST1 would continue to be conserved by the design. Prior to and during construction an exclusion zone would be in place around the tree so that impacts would be avoided during construction.	Construction contractor	Pre-construction and construction
27.	Aboriginal cultural heritage	Site cards for the newly recorded sites would be submitted to AHIMS and site update cards for those sites found to have errors in their co-ordinates would also be submitted.	RMS project manager	Pre-construction
28.	Aboriginal cultural heritage	An exclusion zone would be created for O-IF-3, Northern Road PAD2, NR6, BRP-S-01, BRP-S-02, BRP-S-08, TRNU8 and TRNU13 during construction.	RMS project manager	Construction
29.	Aboriginal cultural heritage	Should Aboriginal cultural heritage items be uncovered during construction, RMS's unexpected finds procedure would be followed. All work in the vicinity of the find would cease and the RMS Aboriginal Cultural Heritage Advisor and the regional environmental officer would be contacted immediately. Works in the vicinity of the find would not recommence until clearance is been received from those RMS officers and the OEH.	Construction contractor	Construction
30.	Non-Aboriginal cultural heritage	Where possible, heritage items and archaeological deposits would be avoided by the proposal.	RMS project manager	Detailed design
31.	Non-Aboriginal cultural heritage	Consultation with the Heritage Council regarding the State heritage register listed item and items of archaeological potential would be undertaken. Consultation would also be undertaken with Camden and Liverpool City councils regarding potential impacts to locally listed heritage items.	RMS project manager	Detailed design
32.	Non-Aboriginal cultural heritage	Consideration would be given to veering the Derwent link road near Farmstead complex (Lots 141 & 142, DP 625519) to the west to avoid impacts to the farm buildings. If the route of the road is not altered then	RMS project manager	Detailed design

No.	Impact	Environmental safeguards	Responsibility	Timing
		archival recording would be conducted prior to any works being carried out.		
33.	Non-Aboriginal cultural heritage	Consideration would be given to moving the proposed link road at Mersey Road to avoid demolition of the house (Lot 1, DP 234403) and any associated archaeological deposits.	RMS project manager	Detailed design
34.	Non-Aboriginal cultural heritage	<p>A non-Aboriginal cultural heritage management plan would be prepared and incorporated into the CEMP. The plan would include, but not be limited to the following:</p> <ul style="list-style-type: none"> • Identification of non-Aboriginal cultural heritage items using diagrams. • Identification of non-Aboriginal items that are not impacted by the proposal. • Measures to protect non-Aboriginal item such as fencing. • Induction requirements. • Mitigation measures to avoid risk of harm. • Process to communicate risk and responsibilities through environmental awareness training. • Requirements for applications and approvals. 	Construction contractor	Pre-construction
35.	Non-Aboriginal cultural heritage	An exemption would be sought from the NSW Heritage Branch for Orielson before any impacts occur to the site, including impacts on archaeological deposits associated with the millers cottage. A research design would be completed as part of this application and a suitably qualified excavation director would be nominated to ensure consistency of archaeological monitoring during the construction of the Hillside Drive link road.	RMS project manager	Pre-construction
36.	Non-Aboriginal cultural heritage	<p>Archival and photographic recording of the Orielson homestead, driveway and its surroundings would be undertaken in order to document the character of the estate before construction.</p> <p>RMS project manager Pre-construction Non-Aboriginal cultural heritage Archival recording would be undertaken for Lots 141 & 142, DP 625519 prior to any works being carried out.</p>	Construction contractor	Pre-construction
37.	Non-Aboriginal cultural	If the route remains unchanged for House at Lot 1, DP 234403 archival and photographic recording, the	Construction contractor	Pre-construction

No.	Impact	Environmental safeguards	Responsibility	Timing
	heritage	creation of site plans and archaeological monitoring would be required. A section 140 permit would be required to undertake monitoring and archaeological excavations if required at the site. As part of the application for the permit a research design would be developed and a suitably qualified excavation director nominated.		
38.	Non-Aboriginal cultural heritage	An exception would be obtained under section 139 of the Heritage Act before works begin within the Narellan Army Camp area.	Construction contractor	Pre-construction
39.	Non-Aboriginal cultural heritage	A heritage induction would be provided before construction begins to inform workers of the location general of known heritage items. This induction would include the process to follow if unanticipated heritage items or deposits are located during works, in accordance with the RMS Unexpected Archaeological Finds Procedure (November 2011).	Construction contractor	Construction
40.	Non-Aboriginal cultural heritage	The Orielton fence that would be removed as part of the road widening would be replaced with a suitable rural-style fence.	Construction contractor	Construction
41.	Non-Aboriginal cultural heritage	A suitable entrance gate to Orielton would be constructed on the new link road stub. The link road stub would be constructed with suitable road treatments in order to reduce noise impacts at to Orielton.	Construction contractor	Construction
42.	Non-Aboriginal cultural heritage	Archaeological monitoring would be conducted during the construction of the Hillside Drive link road where deposits associated with the miller's cottage may be located. A section 60 Permit would be required for archaeological monitoring.	Construction contractor	Construction
43.	Non-Aboriginal cultural heritage	An exclusion zone would be created for the northern and southern gateposts, gatehouse at the entrance to Maryland, Prince of Wales Inn, Bringelly Church, Structures at Lot 3 DP 590913.	Construction contractor	Construction
44.	Non-Aboriginal cultural heritage	Screening vegetation would be planted along the road boundary of The Northern Road in order to alleviate any impacts on views from Maryland homestead and Cottage at 1186 The Northern Road.	Construction contractor	Construction
45.	Noise and vibration	Further investigation of all feasible and reasonable noise control options would be considered for the affected receivers (as identified in tables 6-44 and 6-45, and listed in Appendix K as	RMS project manager	Detailed design

No.	Impact	Environmental safeguards	Responsibility	Timing
		part of the proposal to reduce traffic noise levels to within the applicable noise limits. As a part of this investigation affected		
46.	Noise and vibration	<p>A Construction Noise and Vibration Management Plan (CNVMP) would be developed during finalisation of the construction methodology and the detailed design phase. This plan would include but not be limited to:</p> <ul style="list-style-type: none"> • A noise assessment in accordance with the Interim Construction Noise guideline (DECC2009). • Identification of potentially affected properties and residences. • A risk assessment to identify potential risk for discrete work elements/activities likely to affect residents. This would guide the development of the construction timetable and the identification of feasible and reasonable mitigation measures. • A map indicating the locations of likely potential impacts potentially impacted receivers. • Mitigation measures to control and minimise the impacts of construction noise and vibration with consideration of the requirements of section 5 of ENMM. • Noise monitoring program during construction. • A process for assessing the performance of the implemented mitigation measures. • Landowners would be consulted regarding their individual needs. 	Construction contractor	Pre-construction
47.	Noise and vibration	<ul style="list-style-type: none"> • Construction timetabling would be organised to minimise noise impacts. Timetabling considerations may include time and duration restrictions and respite periods. • The nearest noise receptors would be notified of the construction work schedule and expected noise levels prior to construction. • Where rock breaking/ hammering is required within 10 metres of 	Communications manager	Pre-construction

No.	Impact	Environmental safeguards	Responsibility	Timing
		any occupied dwelling, occupants would be notified of the works and the duration of activity. Activity would be restricted to no more than two hours in any working day.		
48.	Noise and vibration	Where feasible and reasonable, measures identified to manage and mitigation operational noise and vibration impacts would be implemented as early and possible during construction to provide additional construction phase mitigation as well.	Construction contractor	Construction
49.	Noise and vibration	Where residents are highly noise affected (above 75 dB(A)) additional safeguards including respite periods would be considered in consultation with the affected community.	Construction contractor	Construction
50.	Noise and vibration	Works would be carried out during standard working hours (that is 7am-6pm Monday to Friday, 8am-1pm Saturdays). Any work that is performed outside normal work hours or on a Sunday or public holiday is to minimise noise impacts in accordance with the Environmental Noise Management Manual, "Practice Note vii – Roadworks Outside of Normal Working Hours and the Interim Construction Noise Guidelines (OEH 2010). This would include notifying the local community of any works planned to be undertaken outside standard construction hours.	Construction contractor	Construction
51.	Noise and vibration	A community liaison phone number and site contact would be provided so that noise and vibration related complaints can be received and addressed in a timely manner.	Construction contractor	Construction
52	Noise and vibration	Periodic noise monitoring at affected receivers near the site compound should be undertaken to confirm predicted noise impacts within two weeks of commencement of construction.	Construction contractor	Construction
53	Noise and vibration	All employees, contractors and subcontractors are to receive an environmental induction. The induction must at least include: <ul style="list-style-type: none"> • all relevant project specific and standard noise and vibration mitigation measures • relevant licence and approval conditions • permissible hours of work 	Construction contractor	Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
		<ul style="list-style-type: none"> any limitations on high noise generating activities location of nearest sensitive receivers construction employee parking areas designated loading/ unloading areas and procedures construction traffic routes site opening/closing times (including deliveries) environmental incident procedures 		
54	Noise and vibration	<ul style="list-style-type: none"> No swearing or unnecessary shouting or loud stereos/radios on site. No dropping of materials from height, throwing of metal items and slamming of doors. 	Construction contractor	Construction
55	Soils, landscape and water quality	<p>Detailed design would consider the following:</p> <ul style="list-style-type: none"> Separation of offsite and on site water. Sedimentation basin locations and sizes. Management of runoff during construction, including the application of appropriate erosion and sediment control measures. 	Design contractor	Detailed design
56	Soils, landscape and water quality	During detailed design the design of the grass swales would include review of their location, length, size and design for operational water quality treatment.	Design contractor	Detailed design
57	Soils, landscape and water quality	<p>A soil and water management plan (SWMP) would be prepared as part of the construction environmental management plan (CEMP) for the proposal before construction. The SWMP would address the RMS Code of Practice for Water Management, the RMS Erosion and Sediment Procedure and incorporate specifications outlined in the NSW Soils and Construction – Managing Urban Stormwater Volume 1 “the Blue Book” (Landcom, 2004) and Volume 2 (DECC, 2008). The SWMP would include but not be limited to:</p> <ul style="list-style-type: none"> Minimisation of the area of disturbance, including designated exclusion zones for construction plant and equipment storage and 	Construction contractor	Pre-construction

No.	Impact	Environmental safeguards	Responsibility	Timing
		<p>use.</p> <ul style="list-style-type: none"> • Delineation of traffic areas and restriction of entry and exit points to construction sites. • Appropriate storage of chemicals and fuels. • Description of works and activities and a list of equipment and machinery. • Identify areas of risk (eg steep areas or high erosivity soils) and areas requiring management controls. • A maintenance schedule for the ongoing maintenance of temporary erosion and sediment controls. • Emergency procedures for chemical spills and other potential emergency incidents. <p>This plan would be reviewed by the RMS regional environmental officer, Sydney Region before construction.</p>		
58	Soils, landscape and water quality	An Environmental Work Method Statement (EWMS) would be prepared for the proposal. With regards to soils, landscape and water quality, it would include the identification of areas requiring management controls (such as high risk areas including Narellan Creek, Thompsons Creek and Lowes Creek).	Construction contractor	Pre-construction
59	Soils, landscape and water quality	Progressive erosion and sediment control plans would be implemented.	Construction contractor	Construction
60	Soils, landscape and water quality	Water quality monitoring and construction works would be undertaken in line with the RMS Guideline for Construction Water Quality Monitoring (RTA undated) and EPL conditions.	Construction contractor	Construction
61	Soils, landscape and water quality	An incident emergency spill plan would be developed and incorporated into the CEMP. The plan would include measures to avoid spillages of fuels, chemicals, and fluids onto any surfaces or into any adjacent/nearby waterways and emergency response plan.	Construction contractor	Construction
62	Soils, landscape and water quality	An emergency spill kit would be kept on site at all times. All staff would be inducted into the incident emergency procedures and made aware of the location of emergency spill kits.	Construction contractor	Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
63	Soils, landscape and water quality	Should a spill occur during construction, the incident emergency spill plan would be implemented, and the RMS regional environmental officer, Sydney Region would be contacted.	Construction contractor	Construction
64	Soils, landscape and water quality	Stockpiles would be managed in accordance with the <i>Stockpile Site Management Guideline</i> (RTA 2011).	RMS project manager	Construction
65	Soils, landscape and water quality	A site stabilisation plan would be prepared as part of the CEMP. The plan would include but not be limited to the following: <ul style="list-style-type: none"> • Identification and mapping of areas along the length of the proposal requiring stabilisation. • A risk assessment for disturbed areas and stockpiles. • Detailed methods for stabilisation. • A monitoring program for the stabilised areas. • A process for determining the success of stabilised areas or methods. • A process for identifying additional stabilisation methods in: <ul style="list-style-type: none"> • All high risk areas would be stabilised within two weeks. • All medium risk areas would be stabilised within one month. • In anticipation of rain events. 	RMS project manager	Construction
66	Soils, landscape and water quality	Topsoil would be stockpiled separately for possible reuse in landscaping and rehabilitation works.	RMS project manager	Construction
67	Soils, landscape and water quality	Controls would be implemented at entry and exit points to minimise the tracking of soils and particulates onto pavement surfaces.	Construction contractor	Construction
68	Soils, landscape and water quality	Any material transported onto pavement surfaces would be swept and removed at the end of each working day.	Construction contractor	Construction
69	Soils, landscape and water quality	Soil sampling would be undertaken prior to works commencing where high risk of salinity occurs, to identify the level of salinity in the soils.	Construction contractor	Construction
70	Soils, landscape and water quality	Where high saline soils are identified, salinity management options would be considered and incorporated into the detailed design for structure protection (eg concrete cover requirements).	Construction contractor	Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
71	Soils, landscape and water quality	In the event that indication of contamination is encountered (such as odorous or visually contaminated materials), work in the area would cease until an environmental consultant can advise on the need for remediation or other action, as deemed appropriate.	Construction contractor	Construction
72	Soils, landscape and water quality	A fuel truck would be used during construction to refuel vehicles. This truck would be appropriately bunded and carry spill kit material. Should fuels, chemicals and liquids be stored within the proposal they would be: <ul style="list-style-type: none"> • Stored at least 50 metres away from any waterways or drainage lines. • Stored in an impervious surface or undertaken off-site. 	Construction contractor	Construction
73	Soils, landscape and water quality	Vehicle wash downs and/or concrete truck washouts would be undertaken within a designated bunded area of an impervious surface or undertaken off-site.	Construction contractor	Construction
74	Soils, landscape and water quality	The proposal would be undertaken in line with the Code of Practice for Water Management (RTA 1999) and RMS's Water Policy.	Construction contractor	Construction
75	Soils, landscape and water quality	Machinery would be checked daily to ensure that no oil, fuel or other liquids are leaking from the machinery.	Construction contractor	Construction
76	Soils, landscape and water quality	Should the groundwater table be encountered a management plan would be prepared.	Construction contractor	Construction
77	Hydrology	The proposal would be undertaken in line with the Code of Practice for Water Management (RTA 1999) and RMS's Water Policy.	RMS	Detailed design
78	Hydrology	Works to maintain bridge waterway area at Thompsons Creek bridge so that the potential increase in the 100 year ARI upstream flood levels and increase in flood risk to existing properties is alleviated.	RMS	Detailed design
79	Hydrology	Detailed flood modelling would be undertaken during detailed design. RMS would consult with any affected landowners identified regarding the potential drainage and flooding impacts on private properties, in order to formulate appropriate mitigation measures.	RMS	Detailed design
80	Hydrology	RMS would consult with Council during detailed design to confirm that future development upstream of proposal	RMS	Detailed design

No.	Impact	Environmental safeguards	Responsibility	Timing
		would not increase peak flows arriving at the proposed road corridor boundary.		
81	N/A	Not Relevant to Compound Site	N/A	N/A
82	Hydrology	Drainage systems would be checked at regular intervals and maintained to ensure they are operating at full capacity (eg clearance of debris from drainage lines).	RMS	Operation
83	Land use	Consultation would be undertaken with property owners partially or wholly impacted by the proposal.	RMS	Detailed design
84	Land use	Property acquisition would be managed in accordance with the provisions of the Road and Maritime Services' <i>Land Acquisition Policy</i> and the <i>Land Acquisition (Just Terms Compensation) Act 1991</i> .	RMS project manager	Detailed design
85	Socio-economic	Property acquisition would be managed in accordance with the provisions of the Road and Maritime Services' <i>Land Acquisition Policy</i> and the <i>Land Acquisition (Just Terms Compensation) Act 1991</i> .	RMS Property Officer	Detailed design
86	Socio-economic	Detailed design of each construction stage would provide U-turn facilities, including for B-double trucks, to provide a detour length no great than five kilometres to access property.	RMS project manager	Detailed design
87	Socio-economic	Local residents would be notified prior to works commencing and would be kept regularly informed of construction activities during the construction process.	RMS project manager and construction contractor	Pre-construction and construction
88	Socio-economic	A complaints-handling procedure and register would be included in the CEMP.	Construction contractor	Pre-construction
89	Socio-economic	Ongoing consultation with Bringelly Public School to maintain access and safety for students. This may include education and awareness programs for school students about road safety in the vicinity of construction works	Construction contractor	Construction
90	Socio-economic	Road users, pedestrians and cyclists would be informed of changed conditions including likely disruptions to access.	RMS project manager and construction contractor	Construction
91	Socio-economic	Property access would be maintained wherever possible. Prior to any unavoidable disruption to access, consultation would be undertaken with the affected property owner.	Construction contractor	Construction
92	Socio-economic	Early and ongoing consultation and communication with local businesses would be required to identify potential impacts on local businesses and appropriate management strategies to	RMS project manager and construction contractor	Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
		avoid or minimise these impacts. This may include measures such as additional signage, provision of alternative access including for delivery vehicles, and communication with local communities about changes to business access.		
93	Socio-economic	Access would be maintained for emergency vehicles in the vicinity of construction works. Ongoing consultation would be undertaken with emergency services during construction to ensure that potential impacts are identified and appropriately managed	Construction contractor	Construction
94	Socio-economic	Prior to construction, residents in the vicinity of the construction compound sites and work areas would be notified.	Construction contractor	Construction
95	Socio-economic	Prior to construction, RMS would also notify residents that may be in the vicinity of the construction compound sites and work areas.	Construction contractor	Construction
96	Landscape character and visual impact	Detailed design would be undertaken according to the urban design vision, objectives and principles which underpin the concept design and incorporate the urban and landscape design masterplan requirements from section 8 of the landscape character and visual impact assessment.	RMS	Detailed design
97	Landscape character and visual impact	Existing trees would be retained in the road corridor where feasible. This would be undertaken by identifying 'no go areas' to restrict access around trees not affected by the proposal and making minor adjustments to the horizontal and vertical carriageways to move them clear of root zones.	Construction contractor	Construction
98	Landscape character and visual impact	Landscaping would be undertaken in accordance with the masterplan and include: <ul style="list-style-type: none"> • Screening trees and shrubs. • Visually valuable exotic trees in existing residential and commercial areas. • Scattered trees to maintain open views across rural areas. • Planting in verges, medians and traffic islands to soften and break up large areas of pavement. • Maintenance, restoration and enhancement of riparian areas. • Maintenance of landmark regional views to the Blue Mountains and Razorback Mountains. 	Construction contractor	Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
99	Air quality	Stockpiles and general areas with the capacity to cause dust would have site-specific safeguards implemented such as water spraying, wheel washes, compaction or progressive revegetation or stabilisation with cover crops to suppress dust emissions.	Construction contractor	Construction
100	Air quality	Stockpiles would be managed in accordance with the <i>Stockpile Site Management Guidelines</i> (RTA 2011).	Construction contractor	Construction
101	Air quality	Should wind reach a level where dust cannot be controlled, then the dust generating activity would be stopped.	Construction contractor	Construction
102	Air quality	Stabilisation and rehabilitation of disturbed surfaces would be undertaken progressively.	Construction contractor	Construction
103	Air quality	Construction equipment and vehicles would be properly maintained to ensure exhaust emissions comply with the POEO Act.	Construction contractor	Construction
104	Waste management and resource and water use	Water captured in construction sediment basins would be reused for dust suppression, watering of landscaped areas and any other suitable construction activity where feasible.	Construction contractor	Pre-construction
105	Waste management and resource and water use	Procurement would endeavour to use materials and products with a recycled content and low carbon footprint where that material or product is cost and performance effective.	RMS project manager and construction	Pre-construction
106	Waste management and resource and water use	Excavated material would be reused on-site for fill or other RMS projects where feasible.	Construction contractor	Construction
107	Waste management and resource and water use	Roadside materials (guideposts and signs) would be reused or recycled where feasible.	RMS project manager	Construction
108	Waste management and resource and water use	The contractor would classify any excavated spoil in accordance with the <i>Protection of the Environment Operations Act 1997</i> .	Construction contractor	Construction
109	Waste management and resource and water use	Resource management hierarchy principles are to be followed: <ul style="list-style-type: none"> • Avoid unnecessary resource consumption as a priority • Avoidance is followed by resource recovery (including reuse of materials, reprocessing, and recycling and energy recovery). • Disposal is undertaken as a last resort (in accordance with the 	Construction contractor	Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
		<i>Waste Avoidance and Resource Recovery Act 2001).</i>		
110	Waste management and resource and water use	Recyclable wastes would be separated and transported to a suitable recycler.	Construction contractor	Construction
111	Waste management and resource and water use	All construction waste material would be removed from site once the works have been completed.	Construction contractor	Construction
112	Waste management and resource and water use	Working areas would be maintained, kept free of rubbish and cleaned up at the end of each working day.	Construction contractor	Construction
113	Waste management and resource and water use	Any offsite disposal of spoil would be accompanied by a Section 143 permit under the POEO Act.	Construction contractor	Construction
114	Waste and litter impacts during operation	Standard road maintenance works would be undertaken during operation. This would include litter removal and response to accidental spills and collisions. The maintenance requirements would be managed by RMS and/or Council, as per their standard operating procedures.	RMS	Operation
115	Greenhouse gas and energy use	Further investigations into opportunities for reducing greenhouse emissions during construction and operation of the proposal would be undertaken during the detailed design phase.	RMS project manager	Detailed design
116	Greenhouse gas and energy use	Equipment would be selected with the consideration of fuel efficiency.	Construction contractor	Construction
117	Greenhouse gas and energy use	Material would be sourced from the local region, where possible, to reduce transport-related energy consumption.	Construction contractor	Construction
118	Greenhouse gas and energy use	Surplus fill and waste material would be re-used on site, where possible	Construction contractor	Construction
119	Greenhouse gas and energy use	Machinery would be turned off, when not in use.	Construction contractor	Construction
120	Greenhouse gas and energy use	The use of recycled steel in pavement/ concrete reinforcement would be investigated and used, where possible.	Construction contractor	Construction
	Greenhouse gas and energy use	Energy-efficient lighting would be used, where possible.	Construction contractor	Construction
121	Greenhouse gas and energy use	Delivery of materials with full loads would be collected from local suppliers where possible to minimise the number	Construction contractor	Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
		of trips required and maximise fuel consumption.		
122	Greenhouse gas and energy use	Appropriately sized construction equipment, plant and vehicles would be used.	Construction contractor	Construction
123	Greenhouse gas and energy use	Servicing of equipment would be undertaken to ensure optimal performance and minimise downtime (which can reduce time disturbance and access areas).	Construction contractor	Construction
124	Greenhouse gas and energy use	Laydown of the vehicles and buildings would be undertaken in a way to minimise movement and clearing	Construction contractor	Construction
125	Greenhouse gas and energy use	Intelligent vehicle use, such as not leaving the engine idling when not in use, would be undertaken	Construction contractor	Construction
126	Greenhouse gas and energy use	Investigation of alternative fuels and power sources to be used would be undertaken and implemented, where appropriate.	Construction contractor	Construction
127	Greenhouse gas and energy use	Recycling of waste would be undertaken where possible.	Construction contractor	Construction
128	Greenhouse gas and energy use	Material and waste supply and departure scheduling would be undertaken to optimise full loads and minimise required vehicle trips.	Construction contractor	Construction
129	Greenhouse gas and energy use	Energy-efficient lighting would be used where appropriate.	RMS	Operation
130	Greenhouse gas and energy use	Investigation of alternative power sources to be used where appropriate (eg solar power).	RMS	Operation
131	Climate change	Drainage requirements would take into consideration the effect of increased rainfall projections as a result of climate change on the proposal.	RMS project manager	Detailed design
132	Climate change	Conservation of vegetation and planting of street trees providing shade to the road surfaces would be considered during detailed design	RMS project manager	Detailed design
133	Climate change	Hydrology assessment for detailed design to review potential climate change flood levels from both overtopping of local water course and increases sea level.	RMS project manager design	Detailed
134	Climate change	Flora selected for revegetation to take account of long-terms climate projections for the region.	RMS project manager	Detailed design
135	Climate change	Review tolerances for bridge structures to ensure suitability for projected climate extremes	RMS project manager	Detailed design
136	Climate change	Review tolerances for asphalt taking into account projected climate change temperature ranges	RMS project manager	Detailed design
137	Climate change	Consider projections for increased concrete structure deterioration in the	RMS project manager	Detailed

No.	Impact	Environmental safeguards	Responsibility	Timing
		specification and detailed design of concrete structures.		design
138	Climate change	Regular inspections of pavement and structures along the road corridor would be undertaken and maintenance carried out as necessary.	RMS project manager	Operation
139	Flora and Fauna	A suitably qualified ecologist or environmental officer would be engaged prior to any clearing works to clearly demarcate vegetation protection areas, including River Flat Eucalypt Forest and mature and hollow-bearing trees.	Construction Contractor	Construction
140	Flora and Fauna	The compound site must be located outside the drip line of the mature canopy trees marked on Figure 1 of Appendix D	Construction Contractor	Construction
141	Flora and Fauna	Implement hygiene protocols to prevent the introduction and spread of such pathogens as specified in <i>Protecting and managing biodiversity on RMS projects</i> (RMS Environment Branch, 2011). This would include exclusion zones around retained areas of native vegetation. All machinery and plant should be cleaned prior to work on site	Construction Contractor	Construction
142	Flora and Fauna	Erosion and sediment control measures would be established prior to construction in accordance with the principles and guidelines included in <i>Soils and Construction – Managing Urban Stormwater Volume 1</i> (Landcom, 2004) and <i>Volume 2D – Main Roads</i> (DECC, 2008). Controls would be managed and maintained in accordance with the CEMP to ensure their ongoing functionality	Construction Contractor	Construction
143	Flora and Fauna	Chemicals must be stored in clearly marked and bunded areas	Construction Contractor	Construction
144	Flora and Fauna	There would be no refuelling of vehicles, vehicle maintenance or washing of vehicles within 40 m of Waterways	Construction Contractor	Construction
145	Flora and Fauna	An emergency plan for spills must be in place to minimise the risk of impacts on native vegetation and downstream habitats. A spill kit must be kept on site	Construction Contractor	Construction
146	Flora and Fauna	Weed management and control would be undertaken in accordance with the <i>Roads and Maritime Biodiversity Guidelines</i> (RMS 2011).	Construction Contractor	Construction

6 Justification and conclusion

The Northern Road Upgrade REF was determined in February 2013 under Part 5A of the EP&A Act. During detailed design for Stage 1 of The Northern Road Upgrade it was identified that widening the road shoulder of The Northern Road would result in substantial improvements to road user safety (the modified activity).

This Addendum REF has been prepared to assess the potential environmental and social impacts associated with the modified activity and the construction site compound. The existing environment described in The Northern Road Upgrade REF and a large number of the potential environmental impacts identified and assessed are considered unchanged by the modified activity.

No additional stakeholder or community consultation has been undertaken during development of the modified activity however Roads and Maritime would continue to consult with the community and relevant Government agencies during delivery of the works.

Roads and Maritime is the proponent and determining authority for the modified activity. By adopting the requirements of the ISEPP and the Growth Centres SEPP, the modified activity may be carried out without development consent, and is therefore subject to assessment under Part 5 of the EP&A Act. Consent from council is not required.

7 Certification, review and decision

7.1 Certification

This addendum review of environmental factors provides a true and fair review of the modified activities in relation to its potential effects on the environment. It addresses to the fullest extent possible all matters affecting or likely to affect the environment as a result of the proposal.



Anthony Penn
Design Manager
GHD Pty Ltd
Date: 3 November 2015

I have examined this addendum review of environmental factors and the certification by Anthony Penn and accept the review of environmental factors on behalf of Roads and Maritime Services.



Siva Sivasubramaniam
Senior Project Manager
Sydney Region
Date: 3.11.15.

7.2 Environment staff review

The addendum REF has been reviewed and considered against the requirements of sections 111 and 112 of the *Environmental Planning and Assessment Act 1979*.

In considering the proposal this assessment has examined and taken into account to the fullest extent possible, all matters affecting or likely to affect the environment by reason of that activity as addressed in the REF and associated information. This assessment is considered to be in accordance with the factors required to be considered under clause 228 of the *Environmental Planning and Assessment Regulation 2000*.

The proposal described in the REF will have some environmental impacts which can be ameliorated satisfactorily. Having regard to the safeguard and management measures proposed, this assessment has considered that these impacts are unlikely to be significant and therefore an approval for the proposal does not need to be sought under Part 5.1 of the *Environmental Planning and Assessment Act 1979*.

The assessment has considered the potential impacts of the activity on critical habitat and on threatened species, populations or ecological communities or their habitats for both terrestrial and aquatic species as defined by the *Threatened Species Conservation Act 1995* and the *Fisheries Management Act 1994*.

The proposal described in the addendum REF will not affect declared critical habitat. The activity described in the addendum REF will not significantly affect threatened species, populations or ecological communities or their habitats. Therefore a species impact statement is not required.

The assessment has also addressed the potential impacts on the activity on matters of national environmental significance and any impacts on Commonwealth land and concluded that there will be no significant impacts. Therefore there is no need for a referral to be made to the Australian Government Department of Environment for a decision by the Commonwealth Minister for the Environment on whether assessment and approval is required under the *Environment Protection and Biodiversity Conservation Act 1999*.

The REF is considered to meet all relevant requirements.

7.3 Environment staff recommendation

It is recommended that the proposal to modify the approved activity to include the widened road shoulders and enhance the potential road safety outcomes of the project proceed subject to the implementation of all safeguards identified in the approved REF and compliance with all other relevant statutory approvals, licences, permits and authorisations. The approved REF has examined and taken into account to the fullest extent possible all matters likely to affect the environment by reason of the activity and established that the activity is not likely to significantly affect the environment. The REF has concluded that there will be no significant impacts on matters of national environmental significance or any impacts on Commonwealth land.

The REF determination will remain current for five years until August 2020 at which time it shall lapse if works have not been physically commenced. The pre-construction checklist must be completed prior to the commencement of any works.

8 References

SKM, 2012. *The Northern Road Upgrade, Narellan to Bringelly Review of Environmental Factors*, Sinclair Knight Merz, 2012

GHD, 2014. *MR154 The Northern Road, Old Northern Road Narellan to Peter Brock Drive Oran Park, Consistency Assessment Report Final Documentation*, GHD 2014

Appendix A

Consideration of clause 228(2) factors and matters of national environmental significance

Clause 228(2) Checklist

In addition to the requirements of the *Is an EIS required?* guideline as detailed in the REF, the following factors, listed in clause 228(2) of the *Environmental Planning and Assessment Regulation 2000*, have also been considered to assess the likely impacts of the proposal on the natural and built environment.

Factor	Impact
<p>a. <i>Any environmental impact on a community?</i></p> <p>The modified activity would result in a safer road design for road users on The Northern Road. The environmental impacts of the modified activity are not considered to differ significantly from those discussed in The Northern Road Upgrade REF.</p>	<p>Short-term: Nil</p> <p>Long-term: Positive</p>
<p>b. <i>Any transformation of a locality?</i></p> <p>The modified activity would not result in a transformation of a locality.</p>	<p>Nil</p>
<p>c. <i>Any environmental impact on the ecosystems of the locality?</i></p> <p>The modified activity would result in minimal additional environmental impacts to those already assessed in The Northern Road Upgrade REF. These additional impacts are not considered to result in any impact on local ecosystems.</p>	<p>Nil</p>
<p>d. <i>Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality?</i></p> <p>The modified activity is not considered to result in any increase in the visual impacts described in The Northern Road Upgrade REF.</p>	<p>Nil</p>
<p>e. <i>Any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations?</i></p> <p>The modified activity would not have any impacts on Aboriginal or non-Aboriginal heritage.</p>	<p>Nil</p>
<p>f. <i>Any impact on the habitat of protected fauna (within the meaning of the National Parks and Wildlife Act 1974)?</i></p> <p>The modified activity would not result in a loss of habitat for threatened or protected fauna.</p>	<p>Nil</p>
<p>g. <i>Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air?</i></p> <p>There would be no endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air as a result of the modified activity.</p>	<p>Nil</p>
<p>h. <i>Any long-term effects on the environment?</i></p> <p>The modified activity would not have any long term effects on the environment.</p>	<p>Nil</p>

Factor	Impact
<p><i>i. Any degradation of the quality of the environment?</i></p> <p>The modified activity is not considered to result in any degradation to the environment other than those discussed in The Northern Road Upgrade REF.</p>	Nil
<p><i>j. Any risk to the safety of the environment?</i></p> <p>The modified activity would result in a road design that is safer for road users.</p>	Long-term: Positive
<p><i>k. Any reduction in the range of beneficial uses of the environment?</i></p> <p>The modified activity is contained within the current and future road reserve of The Northern Road and therefore would not impact upon the beneficial uses of the environment.</p>	Nil
<p><i>l. Any pollution of the environment?</i></p> <p>Pollution impacts resulting from the modified activity are considered to be consistent with the impacts outlined in The Northern Road Upgrade REF.</p>	Nil
<p><i>m. Any environmental problems associated with the disposal of waste?</i></p> <p>All waste would be disposed of at a licensed facility. It is not anticipated there would be any environmental problems associated with the disposal of waste.</p>	Nil
<p><i>n. Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply?</i></p> <p>There would be no increase in demand on resources which are, or are likely to become in short supply.</p>	Nil
<p><i>o. Any cumulative environmental effect with other existing or likely future activities?</i></p> <p>The impacts of the modified activity are not considered to significantly increase the impacts of the overall project. The cumulative impacts of the modified activity are consistent with the impacts described in the Northern Road Upgrade REF.</p>	Nil
<p><i>p. Any impact on coastal processes and coastal hazards, including those under projected climate change conditions?</i></p> <p>The modified activity is not likely to result in any impact on coastal processes and coastal hazards.</p>	Nil

Matters of National Environmental Significance

Under the environmental assessment provisions of the *Environment Protection and Biodiversity Conservation Act 1999*, the following matters of national environmental significance and impacts on Commonwealth land are required to be considered to assist in determining whether the proposal should be referred to the Australian Government Department of the Environment.

Factor	Impact
<p>a. Any impact on a World Heritage property?</p> <p>The modified activity would not have any impact on a World Heritage property. There are no World Heritage properties within 10 km of the modified activity.</p>	Nil
<p>b. Any impact on a National Heritage place?</p> <p>The modified activity would not have any impact on a National Heritage property. There are no National Heritage properties within 10 km of the modified activity.</p>	Nil
<p>c. Any impact on a wetland of international importance?</p> <p>The modified activity would not have any impact on a wetland of international importance. There are no wetlands of international importance within 10 km of the modified activity.</p>	Nil
<p>d. Any impact on a listed threatened species or communities?</p> <p>The modified activity would not have any impact on any threatened species or communities.</p>	Nil
<p>e. Any impacts on listed migratory species?</p> <p>The modified activity would not have any impact on any listed migratory species.</p>	Nil
<p>d. Any impact on a Commonwealth marine area?</p> <p>The modified activity would not have any impact on a Commonwealth Marine Area. There is no Commonwealth Marine Area within 10 km of the modified activity.</p>	Nil
<p>g. Does the proposal involve a nuclear action (including uranium mining)?</p> <p>The modified activity would not involve a nuclear action.</p>	Nil
<p>Additionally, any impact (direct or indirect) on Commonwealth land?</p> <p>The modified activity would not directly or indirectly impact Commonwealth land.</p>	Nil

Appendix B

AHIMS search results and Cultural Heritage Officer
Clearance Letter for the construction site
compound



22/10/2015

Karina Rubenis
Environment Officer
Level 11, 27-31 Argyle Street
Parramatta NSW 2150

Dear Karina

Re: Preliminary assessment results for the survey investigations for the Northern Rd Stage 1 Compound Site, Smeaton Grange Rd, Narellan project, based on Stage 1 of the *Procedure for Aboriginal cultural heritage consultation and investigation* (the procedure).

The project, as described in the Stage 1 assessment checklist, was assessed as being unlikely to have an impact on Aboriginal cultural heritage. The assessment is based on the following due diligence considerations:

- The project is unlikely to harm known Aboriginal objects or places.
- The AHIMS search did not indicate any known Aboriginal objects or places in the immediate study area.
- The study area does not contain landscape features that indicate the presence of Aboriginal objects, based on the Office of Environment and Heritage's *Due diligence Code of Practice for the Protection of Aboriginal objects in NSW* and the Roads and Maritime Services' procedure.
- No mature aged trees with Aboriginal cultural modification are present.
- There is an absence of sandstone rock outcrops likely to contain Aboriginal art.

Your project may proceed in accordance with the environmental impact assessment process, as relevant, and all other relevant approvals.

Please Note: If the scope of your project changes, you must contact me and your regional environmental staff to reassess any potential impacts on Aboriginal cultural heritage.

If any potential Aboriginal objects (including skeletal remains) are discovered during the course of the project, all works in the vicinity of the find must cease. Follow the steps outlined in the Roads and Maritime Services' *Unexpected Archaeological Finds Procedure*.

For further assistance in this matter do not hesitate to contact me.

Yours sincerely

Mark Lester
Aboriginal Cultural Heritage Officer (ACHO) – Sydney Region

Appendix C

Not used

Appendix D

Site compound noise and vibration assessment

THE NORTHERN ROAD UPGRADE STAGE 1 SITE COMPOUND

Construction Noise and Vibration Assessment

28 October 2015

Roads and Maritime Services

TH752-01F01 (r2) Report.docx

Document details

Detail	Reference
Doc reference:	TH752-01F01 (r2) Report.docx
Prepared for:	Roads and Maritime Services
Address:	Level 11, 27 Argyle Street Parramatta NSW 2150
Attention:	Mr Siva Sivasubramaniam

Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Authorised
23.10.2015	Draft Report	0	1	WC	WC	BC
28.10.2015	Final		2	WC		WC

Important Disclaimer:

The work presented in this document was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001.

This document is issued subject to review and authorisation by the Team Leader noted by the initials printed in the last column above. If no initials appear, this document shall be considered as preliminary or draft only and no reliance shall be placed upon it other than for information to be verified later.

This document is prepared for the particular requirements of our Client referred to above in the 'Document details' which are based on a specific brief with limitations as agreed to with the Client. It is not intended for and should not be relied upon by a third party and no responsibility is undertaken to any third party without prior consent provided by Renzo Tonin & Associates. The information herein should not be reproduced, presented or reviewed except in full. Prior to passing on to a third party, the Client is to fully inform the third party of the specific brief and limitations associated with the commission.

In preparing this report, we have relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, we have not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

We have derived data in this report from information sourced from the Client (if any) and/or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination and re-evaluation of the data, findings, observations and conclusions expressed in this report.

We have prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

The information contained herein is for the purpose of acoustics only. No claims are made and no liability is accepted in respect of design and construction issues falling outside of the specialist field of acoustics engineering including and not limited to structural integrity, fire rating, architectural buildability and fit-for-purpose, waterproofing and the like.

Supplementary professional advice should be sought in respect of these issues.

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1 Introduction

Renzo Tonin & Associates was engaged by Roads and Maritime Services (RMS) to conduct a construction noise assessment for the proposed site compound for The Northern Road Upgrades Stage 1 project located at the southern corner of the Camden Valley Way and Smeaton Grange Road intersection, Smeaton Grange.

This report quantifies potential noise impacts from the construction activities associated with the proposed site compound, and assesses the potential construction noise impacts on residential properties and other noise sensitive receivers within the vicinity of the site.

Noise sources related to the construction activities associated with the site compound were identified and noise emissions were calculated at the surrounding receivers and assessed against the 'Interim Construction Noise Guideline' (ICNG) (NSW Environment Protection Authority, 2009).

Potential vibration impacts from construction activities associated with the proposed site compound are also addressed in this report.

The work documented in this report was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001. Appendix A contains a glossary of acoustic terms used in this report.

2 Project Description

2.1 Site Description

RMS proposes to establish their site compound for The Northern Road Upgrade Stage 1 project at the southern corner of the Camden Valley Way and Smeaton Grange Road intersection, Smeaton Grange. The site compound would house the administrative functions for The Northern Upgrade project and would include repair and maintenance facilities, workshops and storage.

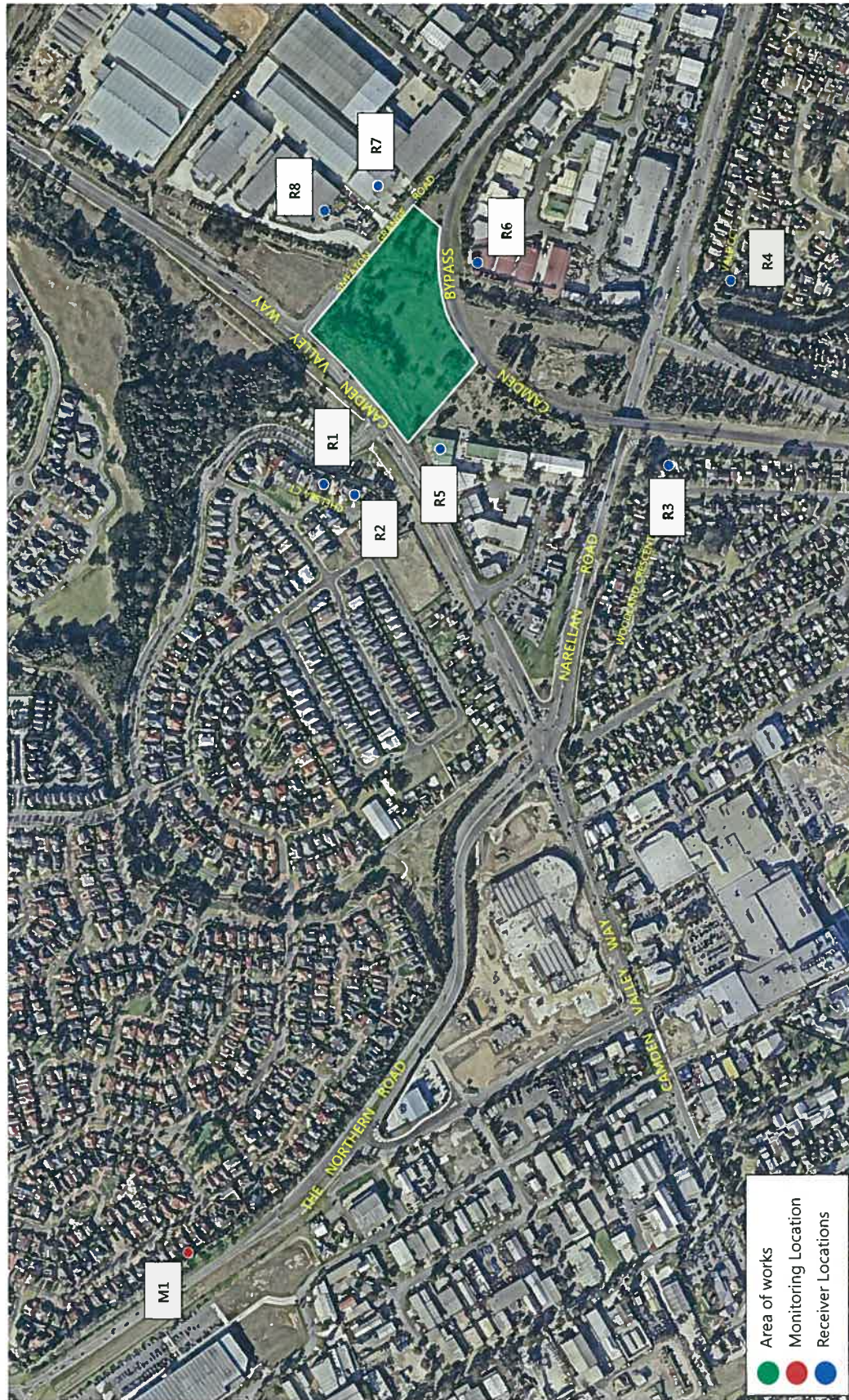
The following noise sensitive receivers were identified using aerial photography of the area to be the nearest affected receivers.

Table 1 – Sensitive Receiver Locations

Receiver	Address	Description
R1	15 Chelsea Court	Double storey residential building located approximately 120m to the north west of the proposed site compound.
R2	21 Chelsea Court	Double storey residential building located approximately 90m to the north west of the proposed site compound.
R3	40 Woodland Crescent	Single storey residential building located approximately 290m to the south of the proposed site compound
R4	15 Vale Circuit	Single storey residential building located approximately 375m to the south of the proposed site compound
R5	8 Maxwell Place	Double storey industrial building located adjacent to the west of the proposed site compound.
R6	20-26 Exchange Parade	Single storey industrial building located approximately 50m to the south of the proposed site compound
R7	9 Smeaton Grange Road	Double storey industrial building located approximately 40m to the east of the proposed site compound.
R8	7 Smeaton Grange Road	Double storey industrial building located approximately 90m to the east of the proposed site compound.

Figure 1 presents the site and surrounds of the study area. The nearest affected noise sensitive receivers are also presented in the figure.

Figure 1 – Locality map showing site, surrounds and monitoring and receiver locations



2.2 Construction Hours

Use of the site compound will be restricted to within the day time period as follows:

- 7:00am to 6:00pm Mondays to Friday

3 Existing Noise Environment

Criteria for the assessment of construction noise are generally derived from the existing noise environment of an area, excluding noise from the subject development.

Appendix B of the NSW EPA 'Industrial Noise Policy' (INP) outlines two methods for determining the background noise level of an area, being 'B1 – Long-term background noise method' and 'B2 – Short-term background noise method'. This assessment has used long-term noise monitoring.

As the noise environment of an area almost always varies over time, background and ambient noise levels need to be determined for the periods when construction works are proposed. For example, in a suburban or urban area the noise environment is typically at its minimum at 3am in the morning and at its maximum during the morning and afternoon traffic peak hours. The NSW 'Industrial Noise Policy' (INP) outlines the following standard time periods over which the background and ambient noise levels are to be determined:

- **Day** – 7am to 6pm, Monday to Saturday and 8am to 6pm Sundays & Public Holidays
- **Evening** – 6pm to 10pm, Monday to Sunday & Public Holidays
- **Night** – 10pm to 7am, Monday to Saturday and 10pm to 8am Sundays & Public Holidays

The INP also outlines methods for assessing 'shoulder periods' being shorter periods on either side of a standard period, where the standard period noise levels are not representative. In this instance the shoulder period has been defined as follows:

- **Shoulder** – 9pm to 10pm, Monday to Saturday and 8am to 6pm Sundays & Public Holidays

3.1 Noise Monitoring Locations

Noise measurements are ideally carried out at the nearest or potentially most affected locations surrounding the construction site. An alternative, representative location should be established in the case of access restrictions or a safe and secure location cannot be established. Furthermore, representative locations may be established in the case of multiple receivers as it is usually impractical to carry out measurements at all locations surrounding a site.

It is noted that long term noise monitoring undertaken by Sinclair Knight Merz (SKM) for the 'The Northern Road Upgrade REF - Noise and Vibration Assessment' (Ref: NB11363-NNA-RP-0159 - Noise Assessment_Final 18102012) and the results of the noise monitoring have been used as part of this assessment.

The long-term noise monitoring location used is outlined in Table 2 and shown in Figure 1.

Table 2 – Noise Monitoring Locations

ID	Address	Description
M1	32 Lachlan Avenue, Harrington Park	Noise monitor located in the front yard of the property and in the 'free field'. Noise data represents the ambient and background noise for residences surrounding the construction site.

3.2 Long-Term Noise Monitoring Results

Long-term noise monitoring was undertaken by SKM from Monday 28th November 2011 to Monday 5th December 2011. The noise monitor was positioned outdoors in the 'free-field' (ie. away from building facades). Construction noise from the site should be assessed away from the facade at the potentially most affected residential boundaries and so the representative noise levels listed in Table 3 are directly applicable.

Table 3 – Long-term Noise Monitoring Results, dB(A)

Monitoring location	L _{A90} Rating Background Level (RBL)			L _{Aeq} Ambient noise levels		
	Day	Evening	Night	Day	Evening	Night
M1 - 32 Lachlan Avenue, Harrington Park	44	37	29	53	51	49

- Notes:
1. Day: 7am to 6pm Monday to Saturday and 8am to 6pm Sundays & Public Holidays
 2. Evening: 6pm to 10pm Monday to Sunday & Public Holidays
 3. Night: 10pm to 7am Monday to Saturday and 10pm to 8am Sundays & Public Holidays

4 Construction Noise Objectives

4.1 Construction Noise Management Levels at Residences

Construction noise management levels are determined by the NSW 'Interim Construction Noise Guideline' (ICNG, DECC 2009). Table 4 below (reproduced from Table 2 of the ICNG) sets out the noise management levels (NMLs) for residences and how they are to be applied.

The guideline intends to provide respite for residents exposed to excessive construction noise outside the recommended standard hours whilst allowing construction during the recommended standard hours without undue constraints.

The rating background level (RBL) is used when determining the management level. The RBL is the overall single-figure background noise level measured in each relevant assessment period (during or outside the recommended standard hours).

Table 4 – Noise Management Levels at Residential Receivers

Time of Day	Management Level $L_{Aeq(15\ min)}^1$	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 + 10dB(A)	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq(15\ min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: <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 + 5dB(A)	A strong justification should 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 5dB(A) above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements see section 7.2.2 of the ICNG.

Notes: 1. Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 metres above ground level. If the property boundary is more than 30 metres from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 metres of the residence. Noise levels may be higher at upper floors of the noise affected residence.

Residential receivers are considered 'noise affected' where construction noise levels are greater than the noise management levels identified in Table 4 above. The noise affected level represents the point above which there may be some community reaction to noise. All feasible and reasonable work practices should be applied to meet the management levels where the predicted and/or measured construction noise levels exceed noise management levels.

During standard construction hours a highly affected noise objective of $L_{Aeq(15min)}$ 75 dB(A) applies at all receivers.

Table 5 identifies the adopted construction noise management levels (NMLs) for the nearest affected receivers identified in Section 2.1. The NMLs for the receiver locations are derived from the RBLs represented by the background noise levels measured at the monitoring location and presented in Section 3.2.

Table 5 – Summary of Construction Noise Management Levels, dB(A)

Time of Day	Management Level $L_{Aeq(15min)}$	Management Level $L_{Aeq(15min)}$ at all Receiver Locations
During recommended standard hours (day)	RBL + 10dB(A)	44 + 10 = 54

4.2 Industrial Premises

Table 6 sets out the ICNG noise management levels for the industrial receiver locations. As identified for residential receivers, a 'highly affected' noise objective of $L_{Aeq(15min)}$ 75dB(A) is also adopted for industrial receivers.

Table 6 – Noise Management Levels at Industrial Receivers

Land use	Where objective applies	Management level $L_{Aeq(15min)}$
Industrial premises	External noise level	75 dB(A)

Notes: 1. Noise management levels only apply when receivers are in use

5 Construction Noise Sources

The following table lists construction plant and equipment likely to be used by the contractor to carry out the necessary construction work within the site compound.

Table 7 – Typical Construction Equipment & Sound Power Levels, dB(A) re. 1pW

Plant Description	Number of plant items	Sound Power Levels, LAeq
Loader	2	110
D6 dozer	2	109
D9 dozer	1	109
Grader 14H	6	107
40 tonne dump truck	8	105
Watercart (15,000L)	2	104
12 tonne tipper	6	101
Light vehicle	20	100
Utility vehicle	10	100

The sound power levels for the majority of plant items presented in the above table are based on maximum levels given in Table A1 of Australian Standard 2436 - 2010 "Guide to Noise Control on Construction, Demolition and Maintenance Sites", the ICNG, information from past projects and information held in our library files.

6 Construction Noise Assessment

Noise levels at any receiver locations resulting from construction works would depend on the location of the receiver with respect to the area of construction, shielding from intervening topography and structures, and the type and duration of construction being undertaken. Furthermore, noise levels at receivers would vary significantly over the total construction program due to the transient nature and large range of plant and equipment that could be used.

Table 8 presents noise worst case levels likely to be experienced at the nearby affected receiver based on the construction activities, and plant and equipment associated with the proposed site compound at the closest proximity to each receiver location. Noise levels were calculated taking into consideration attenuation due to distance between the construction works and the receiver locations and any intervening structures.

Table 8 – Predicted $L_{Aeq(15min)}$ Noise Levels for Typical Construction Plant, dB(A)

Equipment / Plant	Predicted $L_{Aeq(15min)}$ Construction Noise Levels							
	Receiver R1	Receiver R2	Receiver R3	Receiver R4	Receiver R5	Receiver R6	Receiver R7	Receiver R8
<i>Noise Management Level</i>	<i>Day 54 (7am-6pm)</i>				<i>75 when in use</i>			
Loader	53	56	43	41	81	63	67	54
D6 dozer	52	55	42	40	80	62	66	53
D9 dozer	52	55	42	40	80	62	66	53
Grader 14H	50	53	40	38	78	60	64	51
40 tonne dump truck	48	51	38	36	76	58	62	49
Watercart (15,000L)	47	50	37	35	75	57	61	48
12 tonne tipper	44	47	34	32	72	54	58	45
Light vehicle	43	46	33	31	71	53	57	44
Utility vehicle	43	46	33	31	71	53	57	44
Up to 3 (noisiest) plant operating concurrently	58	60	47	45	85	67	71	58

Based on the construction noise levels presented in the table above, the construction noise management level will be exceeded when works are at closest proximity to the receivers R1, R2 and R5. For receiver R1, the construction noise management will be exceeded when works are conducted with the 3 noisiest plant operating concurrently in close proximity. For receiver R2, the construction noise management level will be exceeded when works are conducted with the loader, D6 dozer or D9 dozer individually and conducted with the 3 noisiest plant operating concurrently in close proximity. For receiver R5, the construction noise management level will be exceeded when works are conducted with most individual construction plant and equipment and conducted with the 3 noisiest plant operating concurrently in close proximity.

Furthermore, construction noise levels at receiver R5 are predicted to be greater than the highly noise affected level of 75dB(A) for the operation of most individual construction plant and equipment.

However most items of equipment are typically used for short durations and are not continuous throughout the whole construction period.

In light of the predicted noise levels above, it is recommended that a feasible and reasonable approach towards noise management measures be applied to reduce noise levels as much as possible to manage the impact from construction noise. Further details on construction noise mitigation and management measures are provided in Section 7 below.

7 Construction Noise Mitigation

The following recommendations provide in-principle noise control solutions to reduce construction noise impacts to residential receivers. Where actual construction activities differ from those assessed in this report, more detailed design of noise control measures may be required.

The advice provided here is in respect of noise only. Supplementary professional advice may need to be sought in respect of fire ratings, structural design, buildability, fitness for purpose and the like.

7.1 General Noise Management Measures

Table 9 sets out general noise mitigation measures to be implemented as part of the site compound works, as required.

Table 9 – General Mitigation Measures to Reduce Construction Noise

Action Required	Details
Management Measures	
Implement community consultation measures – inform community of construction activity and potential impacts	Incorporate into Community Liaison Plan
Site inductions	All employees, contractors and subcontractors are to receive a Project induction. The environmental component may be covered in toolboxes and should include: <ul style="list-style-type: none"> • all relevant project specific and standard noise mitigation measures; • relevant licence and approval conditions; • permissible hours of work; • any limitations on high noise generating activities; • location of nearest sensitive receivers; • construction employee parking areas; • designated loading/unloading areas and procedures; • site opening/closing times (including deliveries); and • environmental incident procedures.
Behavioural practices	No swearing or unnecessary shouting or loud stereos/radios on site. No dropping of materials from height where practicable, throwing of metal items and slamming of doors.
Monitoring	Noise monitoring should be considered for the duration of the works as detailed in Section 7.3.
Source Controls	
Construction hours and scheduling	Where feasible and reasonable, construction should be carried out during the standard daytime working hours. Work generating high noise levels should be scheduled during less sensitive time periods if practicable.
Construction respite period	Noise generating activities with impulsive, tonal or low frequency characteristics (such as chainsaw, concrete saws, etc) should only be carried out: <ul style="list-style-type: none"> • in continuous blocks, up to but not exceeding 3 hours each; and • with a minimum respite period of one hour between each block.

Action Required	Details
Equipment selection	Use quieter and less noise emitting construction methods where feasible and reasonable.
Maximum noise levels	All plant and equipment to be appropriately maintained to ensure optimum running conditions, with periodic monitoring.
Rental plant and equipment	The noise levels of plant and equipment items are to be considered in rental decisions and in any case cannot be used on site unless compliant with the criteria in Table 5.
Use and siting of plant	Simultaneous operation of noisy plant within discernible range of a sensitive receiver is to be limited/ avoided where possible. The offset distance between noisy plant and adjacent sensitive receivers is to be maximised where practicable. Plant used intermittently to be throttled down or shut down when not in use where practicable. Noise-emitting plant to be directed away from sensitive receivers where possible.
Plan worksites and activities to minimise noise	Plan traffic flow, parking and loading/unloading areas to minimise reversing movements within the site.
Non-tonal reversing alarms	Non-tonal reversing beepers (or an equivalent mechanism) should be fitted and used on all construction vehicles and mobile plant regularly used on site for periods of over two months where practicable.
Minimise disturbance arising from delivery of goods to construction sites	Where reasonable and feasible, deliveries to occur during standard construction hours.
Path Controls	
Shield sensitive receivers from noisy activities	Where reasonable and feasible, use structures to shield residential receivers from noise such as: <ul style="list-style-type: none"> • temporary or mobile noise screens (where practicable); • enclosures to shield fixed noise sources such as pumps, compressors, fans etc (where practicable); and • consideration of site topography when siting plant.

7.2 Noise Control Measures

Implementation of noise control measures, such as those suggested in Australian Standard 2436-2010 "Guide to Noise Control on Construction, Demolition and Maintenance Sites", are expected to reduce predicted construction noise levels. Reference to Australian Standard 2436-2010, Appendix C, Table C1 suggests possible remedies and alternatives to reduce noise emission levels from typical construction equipment. Table C2 in Appendix C presents typical examples of noise reductions achievable after treatment of various noise sources. Table C3 in Appendix C presents the relative effectiveness of various forms of noise control treatment.

Table 10 below present noise control methods, practical examples and expected noise reductions according to AS2436 and according to Renzo Tonin & Associates' opinion based on experience with past projects.

Table 10 – Relative Effectiveness of Various Forms of Noise Control, dB(A)

Noise Control Method	Practical Examples	Typical noise reduction possible in practice	
		AS 2436	Renzo Tonin & Associates
Distance	Doubling of distance between source and receiver	6	6
Screening	Acoustic barriers such as earth mounds, temporary, mobile or permanent noise barriers	5 to 10	5 to 10
Acoustic Enclosures	Engine casing lagged with acoustic insulation and plywood	5 to 10	5 to 10
Engine Silencing	Residential class mufflers	15 to 25	10 to 20
Substitution by alternative process	Use electric motors in preference to diesel or petrol	-	15 to 25

The Renzo Tonin & Associates' listed noise reductions are conservatively low and should be referred to in preference to those of AS2436, for this project.

Table 11 below identifies possible noise control measures, which are applicable for the construction plant likely to be used on site.

Table 11 – Noise Control Measures for Likely Construction Plant

Plant Description	Screening	Acoustic Enclosures	Silencing	Alternative Process
Loader	✓	✗	✓	✗
D6 dozer	✓	✗	✓	✗
D9 dozer	✓	✗	✓	✗
Grader 14H	✓	✗	✓	✗
40 tonne dump truck	✓	✗	✓	✗
Watercart (15,000L)	✓	✗	✓	✗
12 tonne tipper	✓	✗	✓	✗
Light vehicle	✓	✗	✓	✗
Utility vehicle	✓	✗	✓	✗

It is recommended acoustic engineers work closely with the construction contractors and carry out preliminary testing prior to commencement of works to ensure efficient noise attenuation performance is achieved using any of the methods listed above.

7.3 Regular Periodic Noise Monitoring

The following approach should be adopted with regard to noise monitoring procedures during the construction works.

- Where potential noise impacts are predicted to be within 10 to 15dB(A) of the noise management level, the potential construction noise nuisance is considered to be moderate.

Noise monitoring should be carried out to confirm predicted noise impacts within two weeks of commencement of construction. Reasonable and feasible noise reduction measures should be investigated, where necessary.

- Where potential noise impacts are predicted to be more than 15dB(A) above the noise management levels, the potential construction noise nuisance is considered to be high. All reasonable and feasible noise control measures should be implemented prior to the commencement of construction works. Noise compliance monitoring for all major equipment and activities on the sites should be undertaken prior to their commencement of work on site (refer to APPENDIX B). Finally, noise levels during construction should be monitored and where exceeded, further noise reduction measures (where reasonable and feasible) should be implemented eg. restrict working hours, use silencing equipment, etc.

Specifications for construction noise monitoring procedures are presented in APPENDIX C.

7.4 Complaints Handling Procedure

In addition to the noise mitigation measures outlined above, it is recommended that a management procedure be put in place to deal with noise complaints that may arise from the construction works. Each complaint would need to be investigated and appropriate noise amelioration measures put in place to mitigate future occurrences, where the noise in question is in excess of allowable limits.

An example of a construction noise management procedure is presented in APPENDIX D.

8 Road Traffic Noise Assessment

8.1 Road Traffic Noise Criteria

The EPA's 'Road Noise Policy' (RNP) is used to assess the noise impact from the potential increase in traffic on the surrounding road network due to construction activities. From the RNP, Table 3 – 'Road traffic noise assessment criteria for residential land uses' divides land use developments into different categories and lists the respective criteria for each case.

Based on functionality, Camden Valley Way is categorised as an 'arterial' road. The potentially affected residential premises are located in the vicinity of Camden Valley Way, and all have an acoustic environment which is dominated by traffic noise from Camden Valley Way. Therefore, the appropriate traffic noise criterion for these residences is the 'arterial' road noise criteria presented in Table 12.

Table 12 – EPA Road Traffic Noise Criteria, dB(A)

Road Category	Type of project/land use	Assessment Criteria, dB(A)	
		Day 7am – 10pm	Night 10pm – 7am
Freeway/arterial/sub-arterial roads	3. Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	L _{Aeq(15hr)} 60 (external)	L _{Aeq(9hr)} 55 (external)

According to the guidelines, for existing residences affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level should be limited to 2dB above that of the corresponding 'no build option'. In all cases, traffic arising from the development should not lead to an increase in existing noise levels of more than 2dB(A).

8.2 Road Traffic Noise Predictions & Assessment

Existing annual average daily traffic (AADT) volumes along Camden Valley Way have been obtained from traffic counting undertaken by the Roads and Maritime Services' (RMS) at a permanent traffic counting station (station no. 85.010) located on Camden Valley Way at Catherine Field, south of Cobbitty Road. The AADT volume is reported to be 21,280 vehicles at the traffic counting station in 2005. It is noted that vehicle movements from the subject site would be insignificant (less than 200 vehicles movements per day) in comparison to the AADT along Camden Valley Way and therefore, the increase in road traffic noise due to traffic generated by the subject site would be insignificant for residential properties currently experiencing noise from Camden Valley Way.

Furthermore, the additional traffic on Camden Valley Way as a result of the subject site would not contribute to the existing traffic noise levels from Camden Valley Way to the affected residences and would be significantly less than the allowable 2dB(A) increase to existing traffic noise levels.

9 Construction Vibration

9.1 Vibration Criteria

Construction vibration is associated with three main types of impact:

- disturbance to building occupants;
- potential damage to buildings; and
- potential damage to sensitive equipment in a building.

Generally, if disturbance to building occupants is controlled, there is limited potential for structural damage to buildings.

Vibration amplitude may be measured as displacement, velocity, or acceleration.

- Displacement (x) measurement is the distance or amplitude displaced from a resting position. The SI unit for distance is the meter (m), although common industrial standards include mm.
- Velocity ($v=\Delta x/\Delta t$) is the rate of change of displacement with respect to change in time. The SI unit for velocity is meters per second (m/s), although common industrial standards include mm/s. The Peak Particle Velocity (PPV) is the greatest instantaneous particle velocity during a given time interval. If measurements are made in 3-axis (x, y, and z) then the resultant PPV is the vector sum (i.e. the square root of the summed squares of the maximum velocities) regardless of when in the time history those occur.
- Acceleration ($a=\Delta v/\Delta t$) is the rate of change of velocity with respect to change in time. The SI unit for acceleration is meters per second squared (m/s²). Construction vibration goals are summarised below.

Construction vibration goals are summarised below.

9.1.1 Disturbance to Buildings Occupants

Assessment of potential disturbance from vibration on human occupants of buildings is made in accordance with the DECC '*Assessing Vibration; a technical guideline*' (DECC, 2006). The guideline provides criteria which are based on the British Standard BS 6472-1992 '*Evaluation of human exposure to vibration in buildings (1-80Hz)*'. Sources of vibration are defined as either 'Continuous', 'Impulsive' or 'Intermittent'. Table 13 provides definitions and examples of each type of vibration.

Table 13: Types of vibration

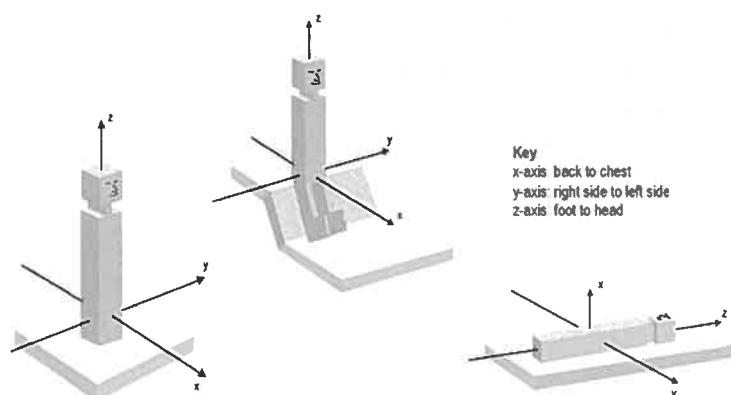
Type of vibration	Definition	Examples
Continuous vibration	Continues uninterrupted for a defined period (usually throughout the day-time and/or night-time)	Machinery, steady road traffic, continuous construction activity (such as tunnel boring machinery).
Impulsive vibration	A rapid build-up to a peak followed by a damped decay that may or may not involve several cycles of vibration (depending on frequency and damping). It can also consist of a sudden application of several cycles at approximately the same amplitude, providing that the duration is short, typically less than 2 seconds	Infrequent: Activities that create up to 3 distinct vibration events in an assessment period, e.g. occasional dropping of heavy equipment, occasional loading and unloading.
Intermittent vibration	Can be defined as interrupted periods of continuous or repeated periods of impulsive vibration that varies significantly in magnitude	Trains, nearby intermittent construction activity, passing heavy vehicles, forging machines, impact pile driving, jack hammers. Where the number of vibration events in an assessment period is three or fewer, this would be assessed against impulsive vibration criteria.

Source: Assessing Vibration; a technical guideline, Department of Environment & Climate Change, 2006

The vibration criteria are defined as a single weighted root mean square (rms) acceleration source level in each orthogonal axis. Section 2.3 of the guideline states:

'Evidence from research suggests that there are summation effects for vibrations at different frequencies. Therefore, for evaluation of vibration in relation to annoyance and comfort, overall weighted rms acceleration values of the vibration in each orthogonal axis are preferred (BS 6472).'

When applying the criteria, it is important to note that the three directional axes are referenced to the human body, i.e. x-axis (back to chest), y-axis (right side to left side) or z-axis (foot to head). Vibration may enter the body along different orthogonal axes and affect it in different ways. Therefore, application of the criteria requires consideration of the position of the people being assessed, as illustrated in Figure 2. For example, vibration measured in the horizontal plane is compared with x- and y-axis criteria if the concern is for people in an upright position, or with the y- and z- axis criteria if the concern is for people in the lateral position.

Figure 2: Orthogonal axes for human exposure to vibration

The preferred and maximum values for continuous and impulsive vibration are defined in Table 2.2 of the guideline and are reproduced in Table 14.

Table 14: Preferred and maximum levels for human comfort

Location	Assessment period ^[1]	Preferred values		Maximum values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
Continuous vibration (weighted RMS acceleration, m/s², 1-80Hz)					
Critical areas ²	Day- or night-time	0.005	0.0036	0.010	0.0072
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
Workshops	Day- or night-time	0.04	0.029	0.080	0.058
Impulsive vibration (weighted RMS acceleration, m/s², 1-80Hz)					
Critical areas ²	Day- or night-time	0.005	0.0036	0.010	0.0072
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

Notes: 1. Daytime is 7:00am to 10:00pm and night-time is 10:00pm to 7:00am
 2. Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. There may be cases where sensitive equipment or delicate tasks require more stringent criteria than the human comfort criteria specify above. Stipulation of such criteria is outside the scope of their policy and other guidance documents (e.g. relevant standards) should be referred to. Source: BS 6472-1992

The acceptable vibration dose values (VDV) for intermittent vibration are defined in Table 2.4 of the guideline and are reproduced in Table 15

Table 15: Acceptable vibration dose values for intermittent vibration (m/s^{1.75})

Location	Daytime ¹		Night-time ¹	
	Preferred value	Maximum value	Preferred value	Maximum value
Critical areas ²	0.10	0.20	0.10	0.20
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

Notes: 1. Daytime is 7:00am to 10:00pm and night-time is 10:00pm to 7:00am
 2. Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. These criteria are only indicative, and there may be a need to assess intermittent values against the continuous or impulsive criteria for critical areas.
 Source: BS 6472-1992

9.1.2 Building Damage

Potential structural damage of buildings as a result of vibration is typically managed by ensuring vibration induced into the structure does not exceed certain limits and standards, such as British Standard 7385 Part 2 and German Standard DIN4150-3. Currently there is no existing Australian Standard for assessment of structural building damage caused by vibration energy.

Within British Standard 7385 Part 1: 1990, different levels of structural damage are defined:

- *Cosmetic - The formation of hairline cracks on drywall surfaces, or the growth of existing cracks in plaster or drywall surfaces; in addition the formation of hairline cracks in mortar joints of brick/concrete block construction.*
- *Minor - The formation of large cracks or loosening of plaster or drywall surfaces, or cracks through bricks/concrete blocks.*
- *Major - Damage to structural elements of the building, cracks in supporting columns, loosening of joints, splaying of masonry cracks, etc.*

The vibration limits in Table 1 of British Standard 7385 Part 2 (1993) are for the protection against cosmetic damage, however guidance on limits for minor and major damage is provided in Section 7.4.2 of the Standard:

7.4.2 Guide values for transient vibration relating to cosmetic damage

Limits for transient vibration, above which cosmetic damage could occur are given numerically in Table 1 and graphically in Figure 1. In the lower frequency region where strains associated with a given vibration velocity magnitude are higher, the guide values for the building types corresponding to line 2 are reduced. Below a frequency of 4 Hz, where a high displacement is associated with a relatively low peak component particle velocity value a maximum displacement of 0.6 mm (zero to peak) should be used.

Minor damage is possible at vibration magnitudes which are greater than twice those given in Table 1, and major damage to a building structure may occur at values greater than four times the tabulated values.

Within DIN4150-3, damage is defined as "any permanent effect of vibration that reduces the serviceability of a structure or one of its components" (p.2). The Standard also outlines:

"that for structures as in lines 2 and 3 of Table 1, the serviceability is considered to have been reduced if

- *cracks form in plastered surfaces of walls;*
- *existing cracks in the building are enlarged;*
- *partitions become detached from loadbearing walls or floors.*

These effects are deemed 'minor damage.' (DIN4150.3, 1990, p.3)

While the DIN Standard defines the above damage as 'minor', based on the definitions provided in BS7385, the DIN standard is considered to deal with cosmetic issues rather than major structural failures.

9.1.2.1 British Standard

British Standard 7385: Part 2 '*Evaluation and measurement of vibration in buildings*', can be used as a guide to assess the likelihood of building damage from ground vibration. BS7385 suggests levels at which 'cosmetic', 'minor' and 'major' categories of damage might occur.

The cosmetic damage levels set by BS 7385 are considered 'safe limits' up to which no damage due to vibration effects has been observed for certain particular building types. Damage comprises minor non-structural effects such as hairline cracks on drywall surfaces, hairline cracks in mortar joints and cement render, enlargement of existing cracks and separation of partitions or intermediate walls from load bearing walls. 'Minor' damage is considered possible at vibration magnitudes which are twice those given and 'major' damage to a building structure may occur at levels greater than four times those values.

BS7385 is based on peak particle velocity and specifies damage criteria for frequencies within the range 4Hz to 250Hz, being the range usually encountered in buildings. At frequencies below 4Hz, a maximum displacement value is recommended. The values set in the Standard relate to transient vibrations and to low-rise buildings. Continuous vibration can give rise to dynamic magnifications due to resonances and may need to be reduced by up to 50%. Table 16 sets out the BS7385 criteria for cosmetic, minor and major damage.

Table 16: BS 7385 structural damage criteria

Group	Type of structure	Damage level	Peak component particle velocity, mm/s		
			4Hz to 15Hz	15Hz to 40Hz	40Hz and above
1	Reinforced or framed structures Industrial and heavy commercial buildings	Cosmetic	50		
		Minor*	100		
		Major*	200		
2	Un-reinforced or light framed structures Residential or light commercial type buildings	Cosmetic	15 to 20	20 to 50	50
		Minor*	30 to 40	40 to 100	100
		Major*	60 to 80	80 to 200	200

Notes: Peak Component Particle Velocity is the maximum Peak particle velocity in any one direction (x, y, z) as measured by a tri-axial vibration transducer.

* Minor and major damage criteria established based on British Standard 7385 Part 2 (1993) Section 7.4.2

9.1.2.2 German Standard

German Standard DIN 4150 - Part 3 '*Structural vibration in buildings - Effects on Structure*' (DIN 4150-3), also provides recommended maximum levels of vibration that reduce the likelihood of building damage caused by vibration and are generally recognised to be conservative.

DIN 4150-3 presents the recommended maximum limits over a range of frequencies (Hz), measured in any direction, and at the foundation or in the plane of the uppermost floor of a building or structure. The vibration limits increase as the frequency content of the vibration increases. The criteria are presented in Table 17.

Table 17: DIN 4150-3 Structural Damage Criteria

Group	Type of structure	Vibration velocity, mm/s			
		At foundation at frequency of			Plane of floor uppermost storey
		1Hz to 10Hz	10Hz to 50Hz	50Hz to 100Hz	All frequencies
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
2	Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
3	Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Group 1 or 2 and have intrinsic value (eg buildings under a preservation order)	3	3 to 8	8 to 10	8

9.2 Potential Vibration Impacts to Residential and Industrial Uses

Based on the proposed plant items presented in Section 5, vibration generated by construction plant was estimated and potential vibration impacts are summarised in Table 18 below. The assessment is relevant to the identified residential and industrial use buildings

Table 18: Potential vibration for residential/commercial properties

Receiver Location	Approx. distance to nearest buildings from works	Type of nearest sensitive buildings	Assessment on potential vibration impacts		
			Structural damage risk	Human disturbance	Vibration monitoring
R1	120m	Residential	Very Low risk of structural damage.	Very Low risk of adverse comment.	Not required.
R2	90m	Residential	Very Low risk of structural damage.	Very Low risk of adverse comment.	Not required.
R3	290m	Residential	Very Low risk of structural damage.	Very Low risk of adverse comment.	Not required.
R4	375m	Residential	Very Low risk of structural damage.	Very Low risk of adverse comment.	Not required.
R5	10m	Industrial	Medium risk of structural damage from construction works.	Medium risk of adverse comment as a result of construction works.	Vibration monitoring shall be conducted where required.
R6	50m	Industrial	Very Low risk of structural damage from construction works.	Low risk of adverse comment as a result of construction works.	Vibration monitoring shall be conducted, where required.

Receiver Location	Approx. distance to nearest buildings from works	Type of nearest sensitive buildings	Assessment on potential vibration impacts		
			Structural damage risk	Human disturbance	Vibration monitoring
R7	40m	Industrial	Very Low risk of structural damage from construction works.	Low risk of adverse comment as a result of construction works.	Vibration monitoring shall be conducted, where required.
R8	90m	Industrial	Very Low risk of structural damage from construction works.	Low risk of adverse comment as a result of construction works.	Vibration monitoring shall be conducted, where required.

Recommendations for reduction potential vibration impacts, including minimum working distances for construction plant are provided in Section 9.3.1 below.

9.3 Vibration mitigation

9.3.1 Recommended Minimum Buffer Distances for Residential/Industrial Properties

The pattern of vibration radiation is very different to the pattern of airborne noise radiation, and is very site specific as final vibration levels are dependent on many factors including the actual plant used, its operation and the intervening geology between the activity and the receiver. Accordingly, based on a database containing vibration measurements from past projects and library information, Table 19 below presents the recommended minimum working distances for high vibration generating plant.

Table 19: Recommended minimum working distances for vibration intensive plant

Plant item	Rating / description	Minimum working distance	
		Cosmetic damage	Human response
Dozer ¹	D6 & D9	2 m (nominal)	10 m
Grader ¹	<= 20 tonne	2 m (nominal)	10 m
Loaders ²	-	-	5 m
Truck Movements ²	Dump trucks, watercarts, tippers	-	10 m

Notes: 1. TCA Construction Noise Strategy (Rail Projects) November 2011
2. Renzo Tonin & Associates project files, databases & library

Site specific buffer distances should be determined once vibration emission levels are measured from each plant item prior to the commencement of their regular use on site. Where construction activity occurs in close proximity to sensitive receivers, minimum buffer distances for building damage should be determined by site measurements and maintained.

9.3.2 Vibration management measures

The following vibration management measures are provided to minimise vibration impact from construction activities to the nearest affected receivers and to meet the relevant human comfort and building damage vibration limits:

1. A management procedure should be implemented to deal with vibration complaints. Each complaint should be investigated and where vibration levels are established as exceeding the set limits, appropriate amelioration measures should be put in place to mitigate future occurrences.
2. Where vibration is found to be excessive, management measures should be implemented to ensure vibration compliance is achieved. Management measures may include modification of construction methods such as using smaller equipment, establishment of safe buffer zones as mentioned above, and if necessary, time restrictions for the most excessive vibration activities. Time restrictions are to be negotiated with affected receivers.
3. Where construction activity occurs in close proximity to sensitive receivers, vibration testing of actual equipment on site would be carried out prior to their commencement of site operation to determine acceptable buffer distances to the nearest affected receiver locations.
4. Dilapidation surveys should be conducted at all residential and other sensitive receivers within 50 metres of the construction site. Notification by letterbox drop would be carried out for all occupied buildings within 100m of the construction site. These measures are to address potential community concerns that perceived vibration may cause damage to property.

10 Conclusion

Renzo Tonin & Associates have completed a construction noise and vibration assessment of the proposed site compound at the southern corner of the Camden Valley Way and Smeaton Grange Road intersection, Smeaton Grange.

Noise emission from construction works associated with the proposed site compound were predicted to potentially exceed the applicable noise management levels at the nearest affected residences and one industrial receiver. Therefore, in-principle feasible and reasonable noise mitigation measures have been provided in order to reduce construction noise.

Potential traffic noise associated with the operation of the site compound and impacting nearby residential receivers is assessed as being insignificant and would comply with the relevant EPA noise policy.

Potential construction vibration impacts have been determined and recommendations for minimum buffer distances for the proposed plant items have been provided.

APPENDIX A Glossary of Terminology

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

Adverse weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment period	The period in a day over which assessments are made.
Assessment point	A point at which noise measurements are taken or estimated. A point at which noise measurements are taken or estimated.
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L90 noise level (see below).
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of every day sounds: 0dB The faintest sound we can hear 30dB A quiet library or in a quiet location in the country 45dB Typical office space. Ambience in the city at night 60dB CBD mall at lunch time 70dB The sound of a car passing on the street 80dB Loud music played at home 90dB The sound of a truck passing on the street 100dB The sound of a rock band 115dB Limit of sound permitted in industry 120dB Deafening
dB(A)	A-weighted decibels. The A-weighting noise filter simulates the response of the human ear at relatively low levels, where the ear is not as effective in hearing low frequency sounds as it is in hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter.
dB(C)	C-weighted decibels. The C-weighting noise filter simulates the response of the human ear at relatively high levels, where the human ear is nearly equally effective at hearing from mid-low frequency (63Hz) to mid-high frequency (4kHz), but is less effective outside these frequencies.
Frequency	Frequency is synonymous to pitch. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
L _{Max}	The maximum sound pressure level measured over a given period.
L _{Min}	The minimum sound pressure level measured over a given period.

L ₁	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L ₁₀	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L ₉₀	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
L _{eq}	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
SEL	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound absorption	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound power level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise	Containing a prominent frequency and characterised by a definite pitch.

APPENDIX B Specification for Determining the Sound Power Levels of Construction Plant

B.1 Scope

This document specifies methods for determination of sound power levels for construction plant including earthmoving equipment and other ancillary plant and equipment used during construction.

B.2 Referenced Standards

- AS IEC 61672.1 2004 '*Electroacoustics - Sound Level Meters*'
- AS 2012.1-1990 '*Acoustics - Measurement of airborne noise emitted by earth-moving machinery and agricultural tractors - Stationary test condition - Determination of compliance with limits for exterior noise*'
- ISO 3744:2010 '*Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Engineering methods for an essentially free field over a reflecting plane*'
- ISO 3746:2010 '*Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Survey method using an enveloping measurement surface over a reflecting plane*'
- ISO 6393:2008 '*Earth-moving machinery - Determination of sound power level - Stationary test conditions*'
- ISO 6395:2008 '*Earth-moving machinery - Determination of sound power level - Dynamic test conditions*'

B.3 Testing Procedures – Earthmoving Machinery

The following procedures are to be followed by personnel suitably qualified and experienced in undertaking acoustic measurements.

Each significant plant item shall be tested in terms of both the 'stationary' and the 'dynamic' testing procedures detailed below.

All sound level meters used must be Type 1 instruments as described in AS IEC 61672.1 2004 '*Electroacoustics - Sound Level Meters*' and calibrated to standards that are traceable to Australian Physical Standards held by the National Measurement Laboratory (CSIRO Division of Applied Physics). The calibration of the meters shall be checked in the field before and after the noise measurement period.

B.4 Stationary Testing

Stationary measurements shall be performed on all earthmoving plant according to the method of AS 2012.1-1990 and/or ISO 6393:2008.

In addition to measuring overall A-weighted noise levels, third-octave band frequency $L_{Aeq,T}$ noise levels shall also be measured at each measurement location from 50Hz to 20kHz inclusive. Background noise shall also be recorded in the same third-octave band frequency range, and corrections to measured third-octave band noise levels shall be applied as described in Table 1 of AS2012.1-1990.

Each plant item should be tested in isolation, without any other noisy plant on site operating. Where this cannot be done for practical reasons, then the noise of the plant being tested shall be at least 6dB greater than the background noise from other nearby plant, both in terms of the overall A-weighted level and in all third-octave band frequencies.

Measured third-octave band $L_{Aeq,T}$ noise levels shall also be processed as described in Section 8 of that Standard to establish third-octave band sound power levels.

The overall A-weighted sound power levels shall be determined for $L_{Aeq,T}$, $L_{A10,T}$ and $L_{A1,T}$ noise metrics. The measurement sample time shall be selected so that it is representative of the operating cycle/s of the plant being tested.

Where the plant tested or noise measurements are taken within 3.5 metres of large walls or cliffs, then a reflection correction of up to -2.5dB(A) shall be applied to remove the effect of increased noise due to sound reflections from such structures.

All measured noise level data and determined sound power levels shall be included in the test reports.

B.5 Dynamic Testing

Details of equipment operation during testing will vary depending on the equipment type. Dynamic measurements shall be performed on all earthmoving plant according to the method in International Standard ISO 6395.

In addition to measuring overall A-weighted noise levels, third-octave band frequency $L_{Aeq,T}$ noise levels shall also be measured at each measurement location from 50Hz to 20kHz inclusive. Background noise shall also be recorded in the same third-octave band frequency range, and corrections to measured third-octave band noise levels shall be applied as described in International Standard ISO 6395.

Each plant item should be tested in isolation, without any other noisy plant on site operating. Where this cannot be done for practical reasons, then the noise of the plant being tested shall be at least 6dB greater than the background noise from other nearby plant, both in terms of the overall A-weighted level and in all third-octave band frequencies.

Measured third-octave band $L_{Aeq,T}$ noise levels shall also be processed to establish third-octave band sound power levels.

Where the plant tested or noise measurements are taken within 3.5 metres of large walls or cliffs, then a reflection correction of up to -2.5dB(A) shall be applied to remove the effect of increased noise due to sound reflections from such structures.

The overall A-weighted sound power levels shall be determined for $L_{Aeq,T}$, $L_{A10,T}$ and $L_{A1,T}$ noise metrics. The measurement sample time shall be selected so that it is representative of the operating cycle/s of the plant being tested.

All measured noise level data and determined sound power levels shall be included in the test reports.

B.6 Testing Procedures – Other Construction Plant

The following procedures are to be followed by personnel suitably qualified and experienced in undertaking acoustic measurements.

All sound level meters used must be Type 1 instruments as described in AS IEC 61672.1 2004 'Electroacoustics - Sound Level Meters'. The calibration of the meters shall be checked in the field before and after the noise measurement period.

Noise measurements shall be performed on all non-earthmoving construction plant according to the methods of either ISO 3744:2010 or ISO 3746:2010, whichever is applicable to the items of plant being tested.

Machinery shall be operated at high idle speed. In the case of drilling, boring and rock-breaking machines, the testing location shall allow for these machines to be operated in rock of characteristics that are typical for the project site.

In addition to measuring overall A-weighted noise levels, third-octave band frequency $L_{Aeq,T}$ noise levels shall also be measured at each measurement location from 50Hz to 20kHz inclusive. Background noise shall also be recorded in the same third-octave band frequency range, and corrections to measured third-octave band noise levels shall be applied as described in Table 1 of AS2012.1-1990.

Each plant item should be tested in isolation, without any other noisy plant on site operating. Where this cannot be done for practical reasons, then the noise of the plant being tested shall be at least 6dB greater than the background noise from other nearby plant, both in terms of the overall A-weighted level and in all third-octave band frequencies.

Measured third-octave band $L_{Aeq,T}$ noise levels shall also be processed as described in Section 8 of that Standard to establish third-octave band sound power levels.

The overall A-weighted sound power levels to be determined shall be in terms of both the $L_{Aeq,T}$, $L_{A10,T}$ and $L_{A1,T}$ noise metrics. The measurement sample time shall be selected so that it is representative of the operating cycle/s of the plant being tested.

Where the plant tested or noise measurements are taken within 3.5 metres of large walls or cliffs, then a reflection correction of up to -2.5dB(A) shall be applied to remove the effect of increased noise due to sound reflections from such structures.

All measured noise level data and determined sound power levels shall be included in the test reports.

APPENDIX C Specification for Construction Noise Monitoring

C.1 Scope

This document specifies methods for undertaking noise monitoring during the construction phase of the project.

C.2 Referenced Standards and Guidelines

- Australian Standard AS IEC 61672.1 2004 '*Electroacoustics - Sound Level Meters - Specifications*'
- Australian Standard AS 1259.2-1990 '*Acoustics - Sound Level Meters*'
- Australian Standard AS 1055-1997 '*Acoustics - Description and Measurement of Environmental Noise*'
- NSW '*Interim Construction Noise Guideline*' (Department of Environment and Climate Change 2009)
- NSW '*Industrial Noise Policy*' (Environment Protection Authority 2000)

C.3 Testing Procedures

The following procedures are to be followed by personnel suitably qualified and experienced in undertaking acoustic measurements.

All noise monitoring equipment used must be at least Type 2 instruments as described in AS 1259.2-1990 and calibrated to standards that are traceable to Australian Physical Standards held by the National Measurement Laboratory (CSIRO Division of Applied Physics). The calibration of the monitoring equipment shall also be checked in the field before and after the noise measurement period, and in the case of long-term noise monitoring, calibration levels shall be checked at minimum weekly intervals.

Long-term noise monitoring equipment or Noise Loggers, consist of sound level meters housed in weather resistant enclosures. The operator may retrieve the data at the conclusion of each monitoring period in person or remotely if the logger is fitted with mobile communications.

All environmental noise measurements shall be taken with the following meter settings:

- Time constant: FAST (ie 125 milliseconds)
- Frequency weightings: A-weighting
- Sample period: 15 minutes

All outdoor noise measurements shall be undertaken with a windscreen over the microphone. Windscreens reduce wind noise at the microphones.

Measurements of noise should be disregarded when it is raining and/or the wind speed is greater than 5m/s (18km/h).

C.4 Long-Term (Unattended) Monitoring

Noise monitoring shall be undertaken in accordance with the environmental noise measurement requirements stipulated in the reference standards and documents listed above.

Noise monitoring equipment shall be placed at positions which have unobstructed views of general site activities, while acoustically shielded as much as possible from non-construction site noise (eg. road traffic, rail noise and other surrounding noise).

Noise levels are to be recorded at a minimum rate of 10 samples per second. Every 15 minutes, the data is to be processed statistically and stored in memory. The minimum range of noise metrics to be stored in memory for later retrieval is the following A-weighted noise levels: L_{min} , L_{90} , L_{eq} , L_{10} , L_1 and L_{max} .

Where the noise monitors are placed within 3.5 metres of building facades, walls or cliffs, then a reflection correction of up to -2.5dB(A) shall be applied to remove the effect of increased noise due to sound reflections from such structures.

Meteorological conditions including wind velocity, wind direction and rainfall shall be monitored over the entire noise monitoring period, either on site or recorded from the nearest weather station to the project site.

C.5 Short-Term (Attended) Monitoring

Where noise complaints or requests from relevant authorities are received, attended short-term noise monitoring shall also be conducted at the requested outdoor location (unless the issue is related to regenerated noise from tunnelling and driveage works) and at any other relevant noise receiver location with closest proximity to the construction activities.

Short-term noise monitoring shall be used to supplement long-term noise monitoring undertaken at nearby locations, and to establish whether noise levels measured by the long-term noise monitors are determined by construction activities carried out on site.

All attended short-term noise monitoring shall be recorded over 15 minute sample intervals. Noise levels are to be recorded at a minimum rate of 10 samples per second. Every 15 minutes, the data is to be processed statistically and stored in memory. The minimum range of noise metrics to be stored in memory and reported is the following A-weighted noise levels: L_{min} , L_{90} , L_{eq} , L_{10} , L_1 and L_{max} .

In addition to measuring and reporting overall A-weighted noise levels, statistical L_{90} , L_{eq} , L_{10} noise levels shall be measured and reported in third-octave band frequencies from 31.5Hz to 8kHz.

Where the noise monitors are placed within 3.5 metres of building facades, walls or cliffs, then a reflection correction of up to -2.5dB(A) shall be applied to remove the effect of increased noise due to sound reflections from such structures.

Outdoor noise monitoring is to be undertaken with the microphone at a height of 1.2 – 1.5m from the ground, unless noise measurements are taken from a balcony or veranda, in which case the same microphone height shall apply off the floor.

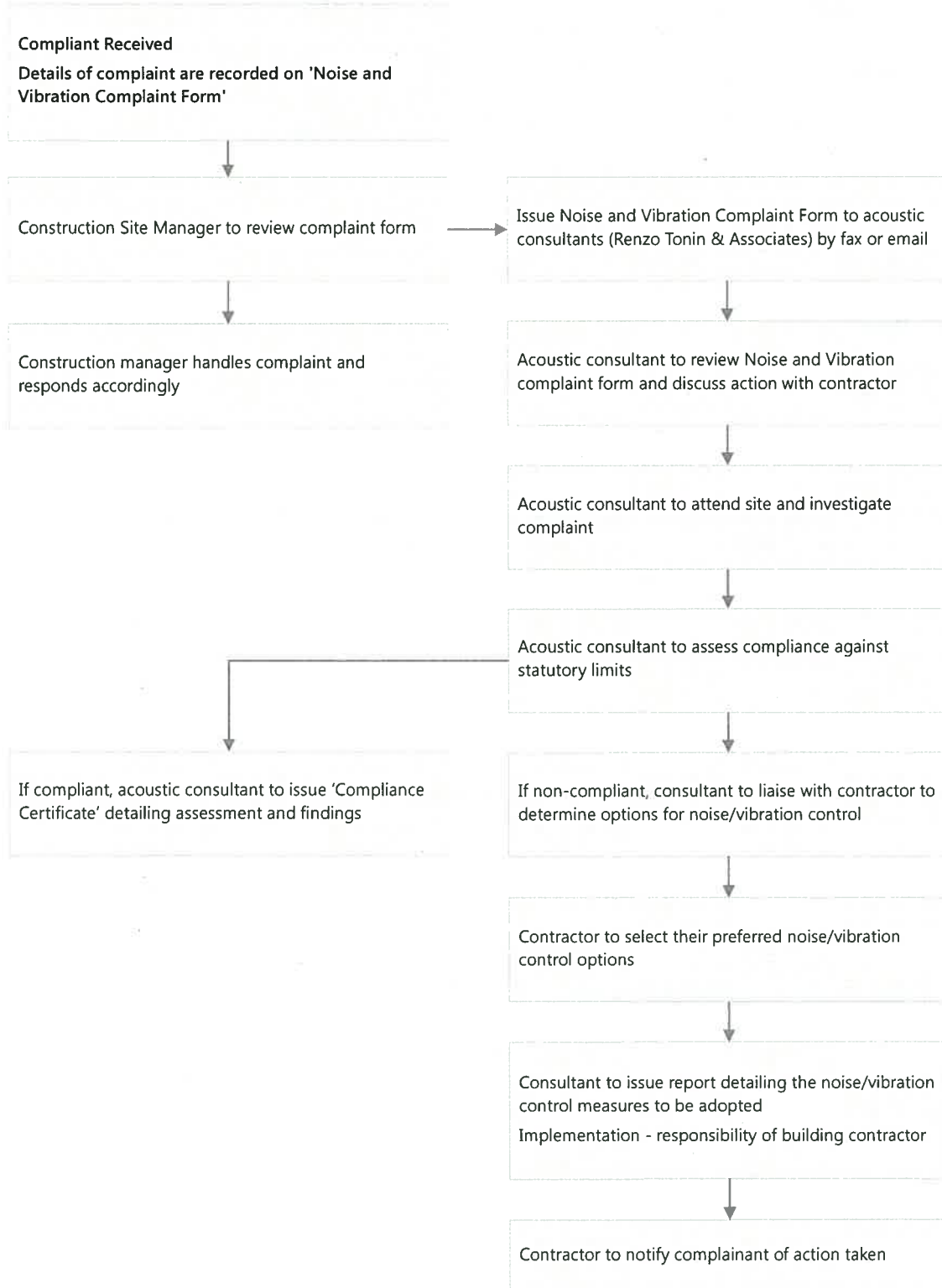
Noise measurements inside buildings should be at least 1m from the walls or other major reflecting surfaces, 1.2m to 1.5m above the floor, and 1.5m from windows.

Noise monitoring shall be undertaken in accordance with the environmental noise measurement requirements stipulated in the reference standards and documents listed above.

The following information shall be recorded:

- Date and time of measurements;
- Type and model number of instrumentation;
- Results of field calibration checks before and after measurements;
- Description of the time aspects of each measurement (ie sample times, measurement time intervals and time of day);
- Sketch map of area;
- Measurement location details and number of measurements at each location;
- Weather conditions during measurements, including wind velocity, wind direction, temperature, relative humidity and cloud cover
- Operation and load conditions of the noise sources under investigation
- Any adjustment made for presence or absence of nearby reflecting surfaces; and
- Noise due to other sources (eg traffic, aircraft, trains, dogs barking, insects etc).

APPENDIX D Noise and Vibration Complaint Management Procedure



NOISE AND VIBRATION COMPLAINT FORM

Project title: _____ **Date:** _____

Site contractor: _____ **Phone:** _____

Site contact: _____ **Email:** _____

Complaint Details

Received by (circle): Phone / Email / In person / Other: _____

Name: _____ **H Ph:** _____

Address: _____ **W Ph:** _____

Email: _____ **M Ph:** _____

Describe when the problem occurred (date and time), what equipment caused the complaint (if known) and where person was standing when he/she experienced the noise:

Investigation

Question foreman responsible on site and obtain information on what equipment or processes would most likely have caused the complaint:

Following approval from the Project Manager, email/fax this form to Renzo Tonin & Associates

Appendix E

Biodiversity assessment



Memorandum

26 October 2015

To Siva Sivasubramaniam

Copy to

From Kirsten Crosby

Tel 02 9239 7225

Subject The Northern Road Upgrade - Biodiversity
Assessment - Addendum to REF

Job no. 21/22831

1 Background

The NSW Roads and Maritime Services (Roads and Maritime) is proposing to upgrade the Northern Road for 15 kilometres between The Old Northern Road and Mersey Road, Bringelly. A Review of Environmental Factors (REF) was completed in 2012 (SKM) and was approved in February 2013. Since approval of the project, the construction contractor has identified the need for a new compound site. The new site is not in an area previously assessed as part of the REF. A desktop assessment completed by Roads and Maritime identified the presence of various threatened ecological communities in the area.

This Biodiversity Assessment assesses the potential for impacts on ecological values at the proposed compound site, with particular emphasis on threatened ecological communities, populations and species listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act) and Matters of National Environmental Significance (MNES) listed under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act). A portion of the site is located within certified land within the South West Growth Centre (SWGCG).

The study area for the proposed compound site is shown on Figure 1. The boundary of the SWGC is also depicted.

2 Legislative context

2.1 Environmental Planning and Assessment Act 1979

The NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) forms the legal and policy platform for proposal assessment and approval in NSW and aims to, amongst other things, 'encourage the proper management, development and conservation of natural and artificial resources'. All development in NSW is assessed in accordance with the provisions of the EP&A Act and the *Environmental Planning and Assessment Regulation 2000*.

Under section 111(1) of the EP&A Act, determining authorities must 'examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of that activity'. This report addresses the ecological components of the environment to assist Roads and Maritime to address the requirements of section 111 of the EP&A Act.

In addition, section 111(4) of the EP&A Act states that the determining authority must consider the effect

21/22831/211829

GHD Level 6, 20 Smith Street Parramatta NSW 2150 PO Box 788 Parramatta NSW 2124 Australia
T 61 2 8898 8800 F 61 2 8898 8810 E ptamail@ghd.com W www.ghd.com

of an activity on:

- 'Critical habitat' (as defined under the TSC Act and FM Act)
- Species, populations or ecological communities, or their habitats (as listed under the TSC Act and FM Act) and whether there is likely to be a 'significant effect' on those species, populations or ecological communities.
- Other protected fauna or protected native plants listed under the *National Parks and Wildlife Act 1974*.

Section 5A of the EP&A Act lists seven factors that must be taken into account when determining the significance of potential impacts of a proposed activity on threatened species, populations or ecological communities (or their habitats) listed under the TSC Act and the FM Act. The 'seven-part test' is used to assist in the determination of whether a proposal is 'likely' to impose 'a significant effect' on threatened biota and thus whether a species impact statement (SIS) is required. Note that seven part-tests are not required for threatened biota that are located in biocertified areas of the SWGC (see below).

2.2 State Environment Planning Policy (Sydney Region Growth Centres) 2006

State Environmental Planning Policy (Sydney Regional Growth Centres) 2006 (the Growth Centres SEPP) is the legal instrument that establishes the planning rules and objectives for Sydney's Growth Centres. Consent authorities, such as local councils, must apply this policy when they make planning decisions about land within the Growth Centres areas. Parts of the study area are located within the SWGC (see Figure 1).

Under section 126G of the TSC Act, the Minister has applied the principle of Biodiversity Certification to the Growth Centres SEPP. Clause 18(2) of the *Threatened Species Conservation Amendment (Special Provisions) Act 2008* outlines that Biocertification applies to 'all development and activities that may be carried out under the Growth Centres SEPP, and, to all threatened species, populations and ecological communities.'

Biocertification removes the need to undertake threatened species assessments or prepare an SIS for species and communities listed under the TSC Act. Parts of the study area are located within land certified under the Growth Centres SEPP. Sections 126I(4) and (5) of the TSC Act provide that activities are taken to be not likely to significantly affect any threatened species, population or ecological community, and a determining authority is not required to consider the effect on biodiversity values of the activity (despite section 111 of the EP&A Act).

On 28 February 2012, the Commonwealth Environment Minister approved all actions associated with development of the Sydney Growth Centres as described in the Sydney Growth Centres Strategic Assessment Program Report. This endorsement removes the requirement for site by site approvals under the EPBC Act as long as proposed actions are consistent with the endorsed Program. No approval under the EPBC Act is therefore required for impacts on threatened and migratory biota listed under the Act within certified areas.

Biocertification does not apply to threatened biota listed under the FM Act. As such, there is a requirement to assess impacts with respect to this Act in both certified and non-certified land.

2.3 Threatened Species Conservation Act 1995

The TSC Act provides legal status for biota of conservation significance in NSW. The TSC Act aims to, amongst other things, 'conserve biological diversity and promote ecologically sustainable development'. The TSC Act provides for (among others) the listing of threatened species, populations and ecological communities, key threatening processes, and requirements or otherwise for the preparation of a SIS.

The TSC Act has been addressed in this assessment through:

- Desktop review to determine the threatened species, populations or ecological communities that have been previously recorded within the locality and hence could occur subject to the habitats present
- Targeted field surveys for listed threatened species, populations and ecological communities
- Identification, assessment and mapping of listed threatened communities and threatened species (or their habitat)
- Assessment of potential impacts on listed threatened species, populations and ecological communities, including identification of key threatening processes relevant to the proposal
- Identification of suitable impact mitigation and environmental management measures for listed threatened species, where required.

2.4 Fisheries Management Act 1994

The objects of the FM Act are to conserve, develop and share the fishery resources of the State for the benefit of present and future generations. The FM Act provides for (among others) the listing of threatened species, populations and ecological communities, key threatening processes, requirements or otherwise for the preparation of a SIS, and the protection of key fish habitat.

The FM Act has been addressed in this assessment through completing:

- A desktop review to determine the threatened species, populations or ecological communities that have been previously recorded within the locality of the proposal and hence could occur subject to the habitats present
- An assessment of aquatic habitats during terrestrial field surveys
- An assessment of potential impacts on aquatic habitats
- An assessment of the potential for impacts on listed threatened species, populations and ecological communities
- Identification of suitable impact mitigation and environmental management measures to avoid or mitigate impacts on the aquatic environment.

2.5 Environment Protection and Biodiversity Conservation Act 1999

The purpose of the EPBC Act is to ensure that actions likely to cause a significant impact on 'matters of national environmental significance' undergo an assessment and approval process. Under the EPBC Act, an action includes a project, a development, an undertaking, an activity or a series of activities, or an alteration of any of these things. An action that 'has, will have or is likely to have a significant impact on a

matter of national environmental significance' is deemed to be a 'controlled action' and may not be undertaken without prior approval from the Australian Minister for the Environment (the 'Minister').

The EPBC Act has been addressed in this assessment through:

- Desktop review to determine the listed biodiversity matters that are predicted to occur within the locality of the proposal and hence could occur, subject to the habitats present
- Field survey to identify if any potential habitat for listed threatened biota and migratory species is present
- Assessment of potential impacts on MNES
- Identification of suitable impact mitigation and environmental management measures for threatened biota, where required.

As noted above, no assessments of significance are required for impacts on MNES that are located within biocertified areas of the SWGC.

3 Methods

3.1 Desktop assessment and literature review

The following databases and information were reviewed to generate a list of threatened ecological communities (TECs), populations and species listed under the EPBC, TSC Acts and other matters of national environmental significance (MNES) listed under the EPBC Act which have previously been recorded or are predicted to occur within the locality of the site (defined as within a 10km radius):

- the Commonwealth Department of the Environment (DotE) Protected Matters Search Tool (PMST), for all MNES online database selected for a 10 km radius of the study area (DotE 2015a)
- DotE online species profiles and threats database (DotE 2015b)
- Office of Environment and Heritage (OEH) Wildlife Atlas database (licensed) for records of threatened species, populations and threatened ecological communities listed under the TSC Act that have been recorded within the locality (OEH 2015a)
- OEH threatened biota profiles for descriptions of the distribution and habitat requirements of threatened biota (OEH 2015b)
- Department of Primary Industries (DPI) online protected species viewer for records of threatened aquatic species in the locality (DPI, 2015a)
- The NSW DPI 'Threatened Fish and Marine Vegetation – Find a Species by Geographic Region' online search tool for the Hawkesbury-Nepean CMA (DPI 2015b)
- Noxious weed declarations for the control area of Camden Council (DPI 2015b)
- Vegetation mapping of the locality (NPWS 2002; EcoLogical Australia 2012)
- Aerial photography of the locality
- The Northern Road Upgrade, Narellan to Bringelly, Review of Environmental Factors (SKM 2012).

3.2 Site visit

Two ecologists conducted a field survey of the proposed compound site and surrounds on 22 October 2015. The main focus of the survey was to assess the ecological values of the study area, and identify constraints to the location of the compound site.

Vegetation at the site was recorded and origin of trees (i.e. planted or remnant) was identified where possible. The potential for threatened biota to occur through the presence of suitable habitat was also recorded. Targeted searches for threatened flora were not carried out given the disturbed nature of the site.

An assessment of the quality of habitats present for native biota and in particular threatened fauna species was made across the study area. Habitat quality was based on the level of breeding, nesting, feeding and roosting resources available, patch size and connectivity with surrounding vegetation. Opportunistic observations of fauna species were recorded with species identified by sight or by call. The culverts were inspected for signs of bats roosting and bird nests.

4 Results

4.1 Vegetation and flora

No native vegetation is mapped in the study area by NPWS (2002). Mapping of the Camden LGA by Ecological Australia (2012) identifies parts of the study area as 'Rehabilitation Area'. This mapping also identifies native vegetation on the other side of Camden Valley Way as Alluvial Woodland, which is commensurate with the endangered ecological community (EEC) River Flat Eucalypt Forest, listed under the TSC Act.

The study area comprises cleared land (exotic grassland) with scattered trees and shrubs. Two drainage lines are present, both vegetated with Cumbungi (*Typha orientalis*). Howe Rivulet passes through culverts under the proposed access to the compound site from Smeaton Grange Road, and again through culverts under Camden Valley Way. The site contains three vegetation types which include:

- River Flat Eucalypt Forest
- Cleared land
- Planted vegetation

These are described below.

4.1.1 River-flat eucalypt forest

Low quality River Flat Eucalypt Forest (RFEF) occurs within two patches in the north and north-east of the study area (see Figure 1). Both patches of RFEF occur along existing drainage lines which flow east and north to merge into a culvert under Camden Valley Way. This vegetation type comprises canopy species such as Forest Red Gum (*Eucalyptus tereticornis*), Rough-barked Apple (*Angophora floribunda*) and Swamp Oak (*Casuarina glauca*). The midstorey contains natives such as Blackthorn (*Bursaria spinosa*), Black Wattle (*Acacia decurrens*) and Parramatta Wattle (*Acacia parramatensis*); however exotics such as African Olive (*Olea europa subsp. cuspidata*), Small-leaved Privet (*Ligustrum sinense*) and Broad-leaved Privet (*Ligustrum lucidum*) are also spread throughout this vegetation type. The

understorey is predominately exotic and consists of Rhodes Grass (*Chloris gayana*). Native scramblers and creepers include *Glycine tabacina*, and *Clematis* spp.

This vegetation is mapped as Rehabilitation Area by Ecological Australia (2012). Given the presence of four mature trees, one with a hollow, this vegetation is considered to be a native vegetation type, albeit degraded through the presence of weed infestation. Some planting of natives is likely to have occurred. The vegetation is considered to be a degraded form of River Flat Eucalypt Forest EEC listed under the TSC Act due to the presence of mature native trees and severe weed infestation. Much of this vegetation type is located within certified land of the SWGC. The area of this vegetation type where three of the mature eucalypts are located is not located within the SWGC.

4.1.2 Planted vegetation

Planted vegetation was observed in the south and east of the study area. Canopy species are dominated by Forest Red Gum. Yellow Box (*Eucalyptus melliodora*) and Lemon-scented Gum (*Corymbia citriodora*) are also present however they are not indigenous to this area or to River Flat Eucalypt Forest. Native midstorey species present include Blackthorn, Black Wattle, Parramatta Wattle and *Callistemon* spp. Weeds present include African Olive and Privet. The understorey is dominated by weeds such as Rhodes Grass. The native understorey species Kidney Weed (*Dichondra repens*) was also observed on occasion. Some natural regeneration is occurring in the area, with eucalypt and wattle saplings observed.

4.1.3 Cleared land

Cleared land is present throughout the study area and is highly disturbed and dominated by exotic grasses, shrubs and herbs. Rhodes Grass is present in high cover abundance, with African Love Grass (*Eragrostis curvula*) also present in some areas. Another exotic understorey species, Kikuyu (*Pennisetum clandestinum*), was observed upon spoil mounds adjacent to the Camden Bypass with Fennel (*Foeniculum vulgare*) present in large patches throughout. Native understorey species were observed in low concentrations with Couch (*Cynodon dactylon*) and Kidney Weed (*Dichondra repens*) occurring infrequently. Cleared land on the site contains the occasional canopy species and/or regrowth.

4.1.4 Noxious weeds

Five noxious weeds were observed within the study area. Noxious weeds include Bridal Creeper (*Asparagus asparagoides*), Moth Vine (*Araujia sericifera*), Paterson's Curse (*Echium plantagineum*), Narrow-leaved Privet (*Ligustrum sinense*) and Broad-leaved Privet (*Ligustrum lucidum*). All noxious weeds in the study area are Class 4 locally controlled weeds. The growth of these plants must be managed in a manner to continuously inhibit the plants ability to spread.

4.2 Fauna habitats

The study area is heavily disturbed and contains opportunistic species common to urban areas and disturbed woodland. Three habitat types are present within the study area:

- Forested and planted areas
- Drainage lines
- Cleared land

4.2.1 Forested and planted areas

Degraded riparian forest occurs along the drainage lines and contains the majority of the canopy species in the study area. Younger canopy trees are planted in the eastern and southern parts of the study area. The canopy trees would provide roosting and nesting habitat for a variety of birds, and small mammals. One hollow-bearing tree was observed within the forest and may provide nesting habitat for common or introduced birds or roosting habitat for microchiropteran bat species. This could include threatened species that occur in open landscapes such as the Yellow-bellied Shearwater (*Saccolaimus flaviventris*). Given the location of the hollow-bearing tree, it is more likely to be utilised by introduced and aggressive species such as the Common Myna (*Acridotheres tristis*).

The nectivorous Little Wattle Bird (*Anthochaera chrysoptera*) were observed foraging in the eucalypts, and Australian Ravens (*Corvus coronoides*) and Red-rumped Parrots (*Psephotus haematonotus*) were also observed. The understory contains Swamp Oak and scattered wattles, Blackthorn and African Olive. This provides habitat for small birds such as the Superb Fairy Wren (*Malurus superbus*) and Red-browed Finch (*Neochmia temporalis*).

Leaf litter is present under the mature trees and provides habitat for small skinks such as the Delicate Sunskink (*Lampropholis delicata*). Given the small size of the patch, lack of connectivity, and lack of any adjacent Cumberland Plain Woodland, the endangered Cumberland Plain Land Snail (*Meridolum corneovirens*) is unlikely to be present.

No other threatened or migratory fauna species are likely to rely on the habitat present. Forested and planted areas are highly disturbed, have small patch size and only limited connectivity with other areas of vegetation. Any threatened or migratory fauna species that may occur is likely to occur transiently.

One exotic species, the European Fox (*Vulpes vulpes*), was observed taking refuge in the forest.

4.2.2 Drainage lines

The drainage lines contain emergent vegetation including *Typha* sp. Riparian vegetation such as this would provide refuge and foraging habitat for a number of common frog species such as the Eastern Dwarf Tree Frog (*Litoria fallax*) and Brown Striped Frog (*Limnodynastes peronii*). One frog species, the Common Froglet (*Crinia signifera*) was heard calling from Howe Rivulet. The presence of these frogs within the drainage line is likely to attract predators including the Red-bellied Black Snake (*Pseudechis porphyriacus*). Several culverts are present within the study area and may provide refuge habitat for microchiropteran bat species or birds. No microchiropteran bats or swallow or Fairy Martin nest were observed.

No large pools are present in the drainage lines, with both creek beds vegetated with *Typha*. Native fish species tolerant of disturbance such as the Firetail Gudgeon (*Hypseleotris galii*) may occur. No habitat for threatened species listed under the FM Act is present as the creeks are located at a low height above sea level and are not near an estuary. Howe Rivulet may be Key Fish habitat (DPI 2007), although the scale of the DPI mapping makes it difficult to determine which creeks in the area are included. As Howe Rivulet and the other creek are second and first order streams respectively, they are unlikely to be key fish habitat according to waterway type (DPI 2013). Howe Rivulet may be considered minimal key fish habitat according to water class (DPI 2013) as it has defined channel.

4.2.3 Cleared land

Cleared land in the study area would have historically supported native woodland or forest vegetation, but has been extensively modified by previous clearing. The exotic grassland would provide few habitat resources for native species. Common ground-foraging species such as the Red-rumped Parrot and Australian Magpie (*Cracticus tibicen*) are likely to occur. Small skinks, snakes and frogs are also likely to be present. No threatened or migratory fauna species are likely to occur in this habitat type.

4.3 Conservation significance

Appendix A includes a summary of the habitat requirements of the threatened species, populations and migratory species identified in the desktop assessment, and an assessment of whether they are likely to occur in the study area, based on the habitats present.

One threatened ecological community, River Flat Eucalypt Forest is located in the study area. This EEC is listed under the TSC Act only. No other threatened ecological communities or threatened flora species listed under the TSC Act or EPBC Act are likely to occur.

The culverts and the hollow-bearing tree in the study area may provide temporary roosting habitat for threatened microchipteran bats listed under the TSC Act. No other threatened or migratory fauna species listed under the TSC Act or EPBC Act are likely to occur in the study area.

No threatened aquatic species listed under the FM Act or EPBC Act are likely to occur in the study area.

5 Impact assessment

5.1 Direct impacts

The construction contractor proposes to locate a construction compound in predominantly cleared areas. Some planted or regenerating native shrubs may be removed. There would be no direct impact on River Flat Eucalypt Forest EEC. The compound site would be positioned outside the drip line of the large mature and/or hollow-bearing trees. The majority of the compound site would be located in certified land within the SWGC and thus impacts in this area do not need to be assessed in accordance with the TSC Act.

There is potential for injury to or mortality of native fauna where vegetation is to be cleared or disturbed. Most fauna species are highly mobile and would be able to avoid vegetation clearing (which is minimal) or construction operations. There may be mortality of animals less able to avoid the disturbance, such as any nestlings in shrubs that may be removed, and small fauna such as skinks that reside in grassy areas. Mortality or injury would impact only a small proportion of any local populations.

There would be no direct impacts on any threatened species.

There would be no direct impacts on aquatic habitats.

5.2 Indirect impacts

The proposal has the potential to result in sedimentation and erosion within the site and adjoining areas through soil disturbance and construction activities. Sediment laden runoff to waterways can alter water

quality and adversely affect aquatic life. Erosion and sedimentation could reduce habitat quality and ecosystem health within River Flat Eucalypt Forest. The proposal has the potential to result in pollution and contaminated runoff, in particular as a result of hydrocarbon leaks or spills from vehicles or equipment used in construction which may result in mortality of plant or animal life.

The proposal has the potential to increase the introduction and spread of exotic plants and pathogens through increased visitation and disturbance of soil. Exotic flora species, including a number of noxious weeds, are already abundant throughout the study area. In this context, any increase in weeds as a result of the proposal is therefore likely to have a minor impact on surrounding vegetation and land uses.

Only a small area of River Flat Eucalypt Forest EEC located outside the SWGC may be indirectly impacted. River Flat Eucalypt Forest may be subject to sedimentation and erosion, and potential chemical spills. River Flat Eucalypt Forest is already subject to substantial weed infestation and is therefore of low quality. Mitigation measures are proposed to minimise the likelihood of these occurring. A seven part test has been prepared to assess the potential impacts of the proposed use of the site as a construction compound on this EEC.

No culverts would be removed and the hollow-bearing tree would not be removed. Use of the site as a construction compound may disturb roosting bats if present. The study area is located between the Camden Bypass and Camden Valley Way and is thus already subject to substantial noise and vibration from passing vehicles. Any additional noise would not substantially impact any roosting bats if present.

Environmental safeguards to reduce the potential for erosion, sedimentation and chemical spills are described in section 6.

5.3 Assessment of significance

As noted above, the majority of River Flat Eucalypt Forest EEC is located in certified land, however a small portion of the vegetation type is located outside the SWGC and required assessment of potential impacts. There would be no direct impacts on River Flat Eucalypt Forest. River Flat Eucalypt Forest at the site is highly disturbed and subject to edge effects. The proposal may contribute to indirect impacts to this community through the further spread of weeds, sedimentation and introduction of pollutants. Environmental safeguards would be implemented to minimise the potential for these indirect impacts. An assessment of significance pursuant to section 5A of the EP&A Act is provided in Table 1.

As there would be no direct impacts on potential habitat for threatened bats, and indirect impacts are likely to be negligible, no assessment of significance has been prepared for these species.

Table 1 Assessment of significance

Section 5A Assessment: River-flat Eucalypt Forest on Coastal Floodplains	
a)	in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction
	Not applicable to this threatened ecological community.
b)	in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Section 5A Assessment: River-flat Eucalypt Forest on Coastal Floodplains

Not applicable to this threatened ecological community.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction

A small area of this vegetation community is located outside certified land of the SWGC. There would be no direct impacts on River-flat Eucalypt Forest as the compound site would be located outside these stands of vegetation. Potential indirect impacts on a highly disturbed and very small patch would not place the local occurrence at risk of extinction.

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

The proposal has the potential to indirectly impact River-flat Eucalypt Forest adjacent to the compound site through erosion and sedimentation runoff downslope of the construction works, potential pollution through chemical spills, and spread of weeds. Within the study area, this ecological community has been degraded through historic and ongoing disturbances. The vegetation that would be impacted is already highly disturbed through edge effects and weed infestation.

In this context, any indirect impacts on this community would be unlikely to alter the composition of adjoining retained vegetation such that the local occurrence of this community would be placed at risk of extinction.

d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed

There would be no direct impacts on River-flat Eucalypt Forest. The compound would be located in predominantly cleared areas, with only some removal of planted vegetation. Indirect impacts such as further spread of weeds, sedimentation and introduction of pollutants may occur as a result of the proposal. The vegetation present in the study area represents a very small component of the mapped occurrence of this community within the locality (NPWS 2002). Given there would be no direct impacts and the area that may be indirectly impacted is very small and is already exposed to weed infestation and edge effects, the modification of a small area of this community is unlikely to impact the long-term survival of the community within the locality.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action

Vegetation in the study area is highly fragmented and largely isolated from extensive patches of vegetation within the locality by roads, urban areas and cleared agricultural land. There would be no direct impacts on River-flat Eucalypt Forest, and thus no area of this community would become fragmented or isolated.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

As previously discussed, the area of this community that may be modified has been subject to historic and ongoing degradation. The vegetation is highly modified, and is already subject to edge effects and weed infestation. Given the highly disturbed nature of the very small area that is located outside certified land of the SWGC, this vegetation is not important to the long-term survival of the community in the locality.

e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

There is no critical habitat listed for this threatened ecological community.

f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

Section 5A Assessment: River-flat Eucalypt Forest on Coastal Floodplains

No stand-alone recovery plan has been developed for this community; instead it is included within the Cumberland Plain Recovery Plan (DECC, 2010). The overall objective of this recovery plan is to provide for the long-term survival and protection of threatened biota within the Cumberland Plain. There would be no direct impacts on River-flat Eucalypt Forest. Possible indirect impacts are unlikely to interfere with the recovery of this community. Mitigation measures are proposed to minimise impacts on this EEC.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

The proposal has the potential to introduce or increase the operation of the following KTPs within this community through soil disturbance and increased visitation to the area:

- Invasion of native plant communities by exotic perennial grasses.
- Infection of native plants by *Phytophthora cinnamomi*.

River-flat Eucalypt Forest in the study area is already subject to weed infestation. The proposal is unlikely to influence the introduction or further spread of exotic species, given their dominance throughout the study area in the understorey of most occurrences of native vegetation. Vehicles and workers have the potential to introduce plant diseases to the area if unclean vehicles and footwear are used.

Mitigation measures are proposed to minimise impacts on this EEC.

Conclusion of Assessment of Significance for River-flat Eucalypt Forest

The proposal is highly unlikely to result in a significant impact on River-flat Eucalypt Forest within non-certified land within the study area, pursuant to s.5A of the EP&A Act given:

- There would be no direct impacts on River-flat Eucalypt Forest within non-certified land
- Indirect impacts would occur along an already modified and disturbed edge.

Consequently, the proposal will not have a significant impact on the local occurrence of the community and a SIS is not required.

Potential indirect impacts from construction in the adjoining proposal site would be minimised through environmental safeguards.

6 Management of impacts

The proposed compound site would be located in predominantly cleared land, and may remove only a small number of shrubs and small trees. The compound site would have minimal impacts on native biodiversity values. A Construction Environment Management Plan (CEMP) has been prepared for the project and would generally cover activities at the site. The following environmental safeguards are proposed to minimise impacts on native biodiversity values:

- a suitably qualified ecologist or environmental officer would be engaged prior to any clearing works to clearly demarcate vegetation protection areas, including River Flat Eucalypt Forest and mature and hollow-bearing trees
- the compound site must be located outside the drip line of the mature canopy trees marked on Figure 1
- Implement hygiene protocols to prevent the introduction and spread of such pathogens as specified in *Protecting and managing biodiversity on RMS projects* (RMS Environment Branch, 2011). This would include exclusion zones around retained areas of native vegetation. All machinery and plant should be cleaned prior to work on site

- Erosion and sediment control measures would be established prior to construction in accordance with the principles and guidelines included in Soils and Construction – Managing Urban Stormwater Volume 1 (Landcom, 2004) and Volume 2D – Main Roads (DECC, 2008). Controls would be managed and maintained in accordance with the CEMP to ensure their ongoing functionality
- Chemicals must be stored in clearly marked and bunded areas
- There would be no refuelling of vehicles, vehicle maintenance or washing of vehicles within 40 m of waterways
- An emergency plan for spills must be in place to minimise the risk of impacts on native vegetation and downstream habitats. A spill kit must be kept on site.
- Weed management and control would be undertaken in accordance with the Roads and Maritime Biodiversity Guidelines (RMS 2011).

7 Conclusion

The proposed compound site is located in a modified environment characterised in the most part by cleared land. Degraded River Flat Eucalypt Forest EEC is located along the drainage lines and areas of planted trees and shrubs are also present.

There would be no direct impacts on native vegetation. Within non-certified land, the proposal may indirectly impact River-flat Eucalypt Forest EEC. A seven-part test has been prepared to assess these possible indirect impacts. Given the avoidance of direct impacts, and measures to minimise the potential for indirect impacts on the community, the proposal is considered unlikely to have a significant impact on River-flat Eucalypt Forest.

Specific mitigation measures have been provided to minimise the potential for adverse impacts on adjoining and downstream habitats during use of the site as a compound. These include erosion, sediment, chemical and weed control measures. Temporary fencing would be set up to prevent access to adjacent areas of native vegetation, and to protect trees and native vegetation to be retained.

The proposal is unlikely to result in a significant impact on any threatened biota listed under the TSC Act, FM Act and EPBC Act. As such, a species impact statement is not required. Referral of the proposal to the Australian Minister for the Environment under the EPBC Act is not considered necessary.

8 References

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Regards

Kirsten Crosby
Senior Ecologist



Memorandum

Figure 1 Vegetation



Memorandum

Appendix A – Likelihood of occurrence of threatened and migratory biota



Threatened ecological communities

Memorandum

Common name	TSC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Potential impact
River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E		Community known to occur within 10km (OEH 2015a)	Occurs on flats, drainage lines and river terraces of coastal floodplains where flooding is periodic and soils generally rich in silt, lack deep humic layers and have little or no saline (salt) influence. Occurs south from Port Stephens in the NSW North Coast, Sydney Basin and South East Corner bioregions. Characterised by a tall open canopy layer of eucalypts with variable species composition.	Known to occur within 10 km (OEH 2015a)	Low. No direct impacts. Indirect impacts such as sedimentation and erosion will be minimised

Key: E=endangered under the TSC Act



Memorandum

Threatened flora

Scientific name	Common name	TSC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Potential impact
<i>Allocasuarina glareicola</i>		E	E	Species or species' habitat may occur within 10km (DotE 2015a)	Primarily restricted to small populations in and around Castlereagh NR (NW Cumberland Plain), but with an outlier population at Voyager Point, Liverpool. Also reported from Holsworthy Military Area. Grows on tertiary alluvial gravels, with yellow clayey subsoil and lateritic soil. Occurs in Castlereagh open woodland.	Unlikely. No tertiary alluvial gravels or Castlereagh woodland in the study area.	Negligible impact. Unlikely to be impacted by the proposal given the lack of suitable habitat.
<i>Cryptostylis hunteriana</i>	Leafless Tongue-orchid	V	V	Species or species' habitat may occur within 10km (DotE 2015a)	Occurs in coastal areas from East Gippsland to southern Queensland. Habitat preferences not well defined. Grows mostly in coastal heathlands, margins of coastal swamps and sedgelands, coastal forest, dry woodland, and lowland forest. Prefers open areas in the understorey and is often found in association with <i>Cryptostylis subulata</i> and the <i>Cryptostylis erecta</i> . Soils include moist sands, moist to dry clay loam and occasionally in accumulated eucalypt leaves. Flowers November-February.	Unlikely. Potential habitat present however the study area has been subjected to high levels of soil disturbance.	Negligible impact. Unlikely to be impacted by the proposal given previous disturbance.
<i>Cynanchum elegans</i>	White-flowered Wax Plant	E	E	6 records within 10km (OEH 2015a); Species or species' habitat likely to occur within 10km (DotE 2015a)	Occurs from Gerroa (Illawarra) to Brunswick Heads and west to Merriwa in the upper Hunter. Most common near Kempsey. Usually occurs on the edge of dry rainforest or littoral rainforest, but also occurs in Coastal Banksia Scrub, open forest and woodland, and <i>Melaleuca</i> scrub. Soil and geology types are not limiting.	Unlikely. Potential habitat present however the study area has been subjected to high levels of soil disturbance.	Negligible impact. Unlikely to be impacted by the proposal given previous disturbance.
<i>Eucalyptus benthamii</i>	Camden White Gum	V	V	82 records within 10km (OEH 2015a); Species or species' habitat likely to occur within 10km (DotE 2015a)	Occurs on the alluvial flats of the Nepean River and its tributaries. Known distribution from The Oaks (south) to Grose Wold (north) and Kedumba Valley (west). 2 major subpopulations: in Kedumba Valley and Bents Basin State Recreation Area. Occurs in wet open forest on alluvial flats, in well drained alluvial sands and gravels to 1 m deep.	Unlikely. Could occur along riparian areas.	Negligible impact. Unlikely to be impacted by the proposal given previous disturbance and lack of evidence at the proposal site.

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Scientific name	Common name	TSC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Potential impact
<i>Eucalyptus scoparia</i>	Wallangarra White Gum	E	V	1 record within 10km (OEH 2015a)	Occurs mostly in Queensland with only three known occurrences in NSW near Tenterfield. In NSW it is found on well-drained granitic hilltops, slopes and outcrops, often as scattered trees in open forest and woodland.	Unlikely. Outside recorded distribution range.	Negligible impact. Unlikely to be impacted by the proposal given previous disturbance and lack of evidence at the proposal site.
<i>Genoplesium baueri</i>	Yellow Gnat-orchid	E	E	Species or species' habitat likely to occur within 10km (DotE 2015a)	Occurs from Ulladulla to Port Stephens, with only 13 known extant populations. Grows in sparse sclerophyll forest and moss gardens over sandstone	Nil. No sandstone forest present.	Nil.
<i>Grevillea panviflora subsp. panviflora</i>	Small-flower Grevillea	V	V	Species or species' habitat likely to occur within 10km (DotE 2015a)	Occurs between Moss Vale/Bargo and lower Hunter Valley, with most occurrences in Appin, Wedderburn, Picton and Bargo. Broad habitat range including heath, shrubby woodland and open forest on light clay or sandy soils, and often in disturbed areas such as on the fringes of tracks.	Possible. Suitable potential habitat is present.	Low impact. Unlikely to be impacted by the proposal given lack of evidence in the proposal site.
<i>Haloragis exalata subsp. exalata</i>	Wingless Raspwort	V	V	Species or species' habitat may occur within 10km (DotE 2015a)	Occurs in 4 widely scattered localities in eastern NSW, in the central coast, south coast and north-western slopes. Requires protected and shaded damp situations in riparian habitats.	Nil. Outside of species' known distribution.	Nil.
<i>Marsdenia viridiflora</i> R. Br. subsp. <i>viridiflora</i>	R. Br. subsp. <i>viridiflora</i>	EP		4 records within 10km (OEH 2015a)	Recent records are from Prospect, Bankstown, Smithfield, Cabramatta Creek and St Marys. Previously known north from Razorback Range. The population occurs as very scattered plants in areas of remnant vegetation. A climber that grows in vine thickets and open shale woodland.	Unlikely. Remnant vegetation is sparse.	Low impact. Unlikely to be impacted by the proposal given lack of evidence in the proposal site.
<i>Pelargonium sp. Striatellum</i>	Omeo Stork's-bill	E	E	Species or species' habitat may occur within 10km (DotE 2015a)	Omeo Storksbill <i>Pelargonium</i> sp. (G.W. Carr 10345), syn. <i>P. striatellum</i> , is a tufted perennial forb known from only 3 locations in NSW, with two on lake-beds on the basalt plains of the Monaro and one at Lake Bathurst. It has a narrow habitat that is usually just above the high-water level of irregularly inundated or ephemeral lakes, in the transition zone between surrounding grasslands or pasture and the wetland or aquatic communities.	Nil. No suitable habitat. Outside of species' known distribution.	Nil.

Scientific name	Common name	TSC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Potential impact
<i>Persoonia bargoensis</i>	Bargo Geebung	E	V	Species or species' habitat likely to occur within 10km (DotE 2015a)	Restricted to the western edge of the Woronora Plateau and the northern edge of the Southern Highlands, bounded by Picton, Douglas Park, Yanderra and the Cataract River. Occurs in woodland or dry sclerophyll forest on sandstone and clayey laterite on heavier, well drained, loamy, gravelly soils of Hawkesbury Sandstone and Wianamatta Shale. Tends to occur in disturbed areas e.g. roadsides and trail margins.	Unlikely. Outside of species' known distribution.	Low impact. Unlikely to be impacted by the proposal given lack of evidence in the proposal site.
<i>Pimelea curviflora</i> var. <i>curviflora</i>		V	V	Species or species' habitat may occur within 10km (DotE 2015a)	Confined to area between north Sydney in the south and Maroota in the north-west. Former range extended to Parramatta River including Five Dock, Bellevue Hill and Manly. Grows on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands. Often grows amongst dense grasses and sedges. Flowers October to May.	Unlikely. No sandstone-transition habitat present. No records in the locality.	Negligible impact. Unlikely to be impacted by the proposal given the lack of suitable habitat.
<i>Pimelea spicata</i>	Spiked Rice-flower	E	E	42 records within 10km (OEH 2015a); Species or species' habitat known to occur within 10km (DotE 2015a)	Disjunct populations within the Cumberland Plain (from Mount Annan and Narellan Vale to Freemans Reach and Penrith to Georges Hall) and Illawarra (from Mt Warrigal to Gerroa). In the Cumberland Plain region, restricted to areas which support or historically supported Cumberland Plain Woodland. Grows on well-structured clay soils derived from Wianamatta Shale. In the Illawarra, grows on variable soils in close proximity to the coast on hills or coastal headlands. Inhabits coastal woodland or grassland with emergent shrubs.	Possible. Suitable habitat present, however no individuals were recorded during surveys.	Low impact. Unlikely to be impacted by the proposal given lack of evidence in the proposal site.
<i>Pomaderris brunnea</i>	Rufous Pomaderris	V	V	38 records within 10km (OEH 2015a); Species or species' habitat likely to occur within 10km (DotE 2015a)	Mainly occurs in SW Sydney (Wollondilly and Camden LGAs), with other populations in the Hawkesbury-Wollemi region, near Wacha in the New England tablelands and Gippsland in VIC. In NSW, grows in moist woodland or open forest on clay and alluvial soils on flood plains and creek lines. Near Sydney occurs in open woodland dominated by <i>E. amplifolia</i> with <i>Allocasuarina</i> sp. and <i>Bursaria</i> sp. understorey, or on alluvial flats with eucalypts including <i>E. elata</i> , <i>E. piperita</i> and <i>E. punctata</i> .	Unlikely. Potential habitat present in alluvial woodland and forest. Outside of species' known distribution.	Negligible impact. Unlikely to be impacted by the proposal given the lack of suitable habitat.

Scientific name	Common name	TSC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Potential impact
<i>Pterostylis saxicola</i>	Sydney Plains Greenhood	E	E	1 record within 10km, last recorded 1990 (OEH 2015a); Species or species' habitat known to occur within 10km (DotE 2015a)	Occurs in western Sydney between Picton and Freemans Reach. Grows in small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines. Associated vegetation above these rock shelves is sclerophyll forest or woodland on shale or shale/sandstone transition soils.	Unlikely. Potential habitat present however the study area has been subjected to high levels of soil disturbance.	Negligible impact. Unlikely to be impacted by the proposal given previous disturbance.
<i>Thelymitra kangaloonica</i>	Kangaloon Sun Orchid	CE	CE	Species or species' habitat may occur within 10km (DotE 2015a)	Only known from three locations near Robertson in the Southern Highlands. Grows in seasonally swampy sedgeland on grey silty clay loam at 600–700 m above sea level. Flowers in late October and early November.	Nil. No suitable habitat. Outside of species' known distribution.	Nil.
<i>Thesium australe</i>	Austral Toadflax	V	V	Species or species' habitat may occur within 10km (DotE 2015a)	Found in small, scattered populations along the east coast, northern and southern tablelands. Occurs in grassland or grassy woodland, and is often found in association with Kangaroo Grass (<i>Themeda australis</i>).	Possible. Suitable potential habitat is present.	Low impact. Unlikely to be impacted by the proposal given lack of evidence in the proposal site.

Key: V= vulnerable, E=endangered, EP= endangered population, CE= critically endangered population, CE= critically endangered under the TSC and/or the EPBC Acts



Memorandum

Threatened fauna

Scientific name	Common name	TSC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Potential impact
Birds							
<i>Anthochaera phrygia</i>	Regent Honeyeater	CE	CE	1 record within 10km, last recorded 1984 (OEH 2015a); Foraging and feeding behaviour likely to occur within 10km (DotE 2015a)	In NSW confined to two known breeding areas: the Capertee Valley and Bundarra-Barraba region. Non-breeding flocks occasionally seen in coastal areas foraging in flowering Spotted Gum and Swamp Mahogany forests, presumably in response to drought. Inhabits dry open forest and woodlands, particularly Box-Ironbark woodland and riparian forests of River Sheoak, with an abundance of mature trees, high canopy cover and abundance of mistletoes.	Unlikely. No suitable foraging habitat present.	Negligible impact. Unlikely to be impacted by the proposal given the lack of suitable habitat.
<i>Botaurus poiciloptilus</i>	Australasian Bittern	E	E	1 record within 10km (OEH 2015a); Species or species' habitat known to occur within 10km (DotE 2015a)	Widespread but uncommon over most NSW except the northwest. Favours permanent freshwater wetlands with tall dense reedbeds particularly <i>Typha</i> spp. and <i>Eleocharis</i> spp., with adjacent shallow, open water for foraging. Roosts during the day amongst dense reeds or rushes and feeds mainly at night on frogs, fish, yabbies, spiders, insects and snails.	Unlikely. No suitable wetland habitat present.	Negligible impact. Unlikely to be impacted by the proposal given the lack of suitable habitat.
<i>Collocephalon fimbriatum</i>	Gang-gang Cockatoo	V	V	3 records within 10km (OEH 2015a)	Restricted to the south-eastern coast and highlands, from the lower Hunter and northern Blue Mountains to the Southwestern Slopes, south to and contiguous with the Victorian population. Inhabits eucalypt open forests and woodlands with an acacia understorey. In summer it lives in moist highland forest types, and in winter it moves to more open types at lower elevations. The Gang-gang Cockatoo nests in hollows in the trunks, limbs or dead spouts of tall living trees, especially eucalypts, often near water. The Gang-gang Cockatoo feeds on seeds obtained in trees and shrubs, mostly from eucalypts and wattles.	Unlikely. Limited suitable foraging habitat present. Unlikely to breed in the area given the low incidence of hollow-bearing trees and patchiness of vegetation.	Negligible impact. Unlikely to be impacted by the proposal given the limited suitable habitat present.

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Scientific name	Common name	TSC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Potential impact
<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo	V		1 record within 10km (OEH 2015a)	Widespread but uncommon from coast to southern tablelands and central western plains. Feeds almost exclusively on the seeds of <i>Allocasuarina</i> species. Prefers woodland and open forests, rarely away from <i>Allocasuarina</i> . Roost in leafy canopy trees, preferably eucalypts, usually <1km from feeding site. Nests in large (approx. 20cm) hollows in trees, stumps or limbs, usually in Eucalypts.	Unlikely. Minimal foraging habitat present. Unlikely to breed in the area as it usually breeds in upland forests.	Negligible impact. Unlikely to be impacted by the proposal given the limited suitable habitat present.
<i>Chthonicola sagittata</i>	Speckled Warbler	V		6 records within 10km (OEH 2015a)	Within NSW most frequently reported from the hills and tablelands of the Great Dividing Range, rarely from the coast. Inhabits a wide range of Eucalyptus-dominated communities with a grassy understorey, a sparse shrub layer, often on rocky ridges or in gullies. Sedentary and requires large, relatively undisturbed remnants to persist in an area. Forages on the ground for seeds and insects, and nests in a slight hollow in the ground or at the base of a low dense plant.	Unlikely. Small patches of vegetation present are unlikely to be suitable for this species.	Negligible impact. Unlikely to be impacted by the proposal given the lack of suitable habitat.
<i>Daphoenositta chrysoptera</i>	Varied Sittella	V		25 records within 10km (OEH 2015a)	Sedentary, occurs across NSW from the coast to the far west. Inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. Sensitive to habitat isolation and loss of structural complexity, and adversely affected by dominance of Noisy Miners. Cleared agricultural land is potentially a barrier to movement. Builds a cup-shaped nest of plant fibres and cobwebs in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years.	Unlikely. Small patches of vegetation present are unlikely to be suitable for this species.	Negligible impact. Unlikely to be impacted by the proposal given the lack of suitable habitat.
<i>Dasyornis brachypterus</i>	Eastern Bristlebird	E	E	Species or species' habitat may occur within 10km (DoIE 2015a)	Occurs in three disjunct areas of south-eastern Australia: southern Queensland/northern NSW, the Illawarra Region and in the vicinity of the NSW/Victorian border. Illawarra population comprises an estimated 1600 birds, mainly from Barren Grounds Nature Reserve, Budderoo National Park and the Jervis Bay area. Habitat characterised by dense, low vegetation including heath and open woodland with a healthy understorey. The fire history of habitat is important, and the Illawarra and southern populations reach maximum densities in habitat that have not been burnt for over 15 years.	Nil. Outside known distribution range.	Nil

Scientific name	Common name	TSC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Potential impact
<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork	E		1 record within 10km (OEH 2015a)	In NSW, becomes increasingly uncommon south of the Northern Rivers region, and rarely occurs south of Sydney. Breeding recorded as far south as Buladelah, though most breeding in NSW occurs in the north-east. Primarily inhabits permanent freshwater wetlands and surrounding vegetation including swamps, floodplains, watercourses and billabongs, freshwater meadows, wet heathland, farm dams and shallow floodwaters. Will also forage in inter-tidal shorelines, mangrove margins and estuaries. Feeds in shallow, still water. Breeds during summer, nesting in or near a freshwater swamp.	Unlikely. No suitable wetland habitat present.	Negligible impact. Unlikely to be impacted by the proposal given the lack of suitable habitat.
<i>Glossopsitta pusilla</i>	Little Lorikeet	V		7 records within 10km (OEH 2015a)	Occurs from coast to western slopes of the Great Dividing Range. Inhabits dry, open eucalypt forests and woodlands. Occurrence is positively associated with patch size, and with components of habitat complexity including canopy cover, shrub cover, ground cover, logs, fallen branches and litter. Feed primarily on profusely-flowering eucalypts and a variety of other species including melaleucas and mistletoes. Mostly nests in small (opening approx. 3cm) hollows in living, smooth-barked eucalypts. Most breeding records are from the western slopes.	Unlikely. Small patches of vegetation present are unlikely to be suitable for this species.	Negligible impact. Unlikely to be impacted by the proposal given the lack of suitable habitat.
<i>Grantiella picta</i>	Painted Honeyeater	V	V	Species or species' habitat likely to occur within 10km (DotE 2015a)	Nomadic, occurring in low densities across most of NSW. Highest concentrations and almost all breeding occur on inland slopes of the Great Dividing Range. Inhabits Boree, Brigalow and Box Gum woodlands and Box-Ironbark forests. Specialist forager on the fruits of mistletoes, preferably of the <i>Amryema</i> genus. Nests in outer tree canopy.	Unlikely. No suitable foraging habitat present.	Negligible impact. Unlikely to be impacted by the proposal given the lack of suitable habitat.
<i>Hieraetus morphnoides</i>	Little Eagle	V		12 records within 10km (OEH 2015a)	Occurs throughout NSW except most densely forested parts of the Dividing Range escarpment. Occupies habitats rich in prey within open eucalypt forest, woodland or open woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW are also used. For nest sites it requires a tall living tree within a remnant patch, where pairs build a large stick nest in winter and lay in early spring.	Unlikely. Small patches of vegetation present are unlikely to be suitable for this species.	Negligible impact. Unlikely to be impacted by the proposal given the lack of suitable habitat.

Scientific name	Common name	TSC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Potential impact
<i>Lathamus discolor</i>	Swift Parrot	E	E	2 records within 10km (OEH 2015a); Species or species' habitat likely to occur within 10km (DotE 2015a)	Migratory, travelling to the mainland from March to October. Breeds in Tasmania from September to January. On the mainland, it mostly occurs in the southeast foraging on winter flowering eucalypts and lerps, with records of the species between Adelaide and Brisbane. Principal over-winter habitat is box-ironbark communities on the inland slopes and plains. <i>Eucalyptus robusta</i> , <i>Corymbia maculata</i> and <i>C. gummifera</i> dominated coastal forests are also important habitat.	Unlikely. Small patches of vegetation present are unlikely to be suitable for this species.	Negligible impact. Unlikely to be impacted by the proposal given the lack of suitable habitat.
<i>Melanodryas cucullata</i>	Hooded Robin (south-eastern form)	V		2 records within 10km (OEH 2015a)	Considered a sedentary species, but local seasonal movements are possible. Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. Occurrence is positively associated with patch size, and with components of habitat complexity including canopy cover, shrub cover, ground cover, logs, fallen branches and litter. Nests on low, live or dead forks or branches of trees or stumps, or occasionally on fallen trees or limbs.	Unlikely. Small patches of vegetation present are unlikely to be suitable for this species.	Negligible impact. Unlikely to be impacted by the proposal given the lack of suitable habitat.
<i>Neophema pulchella</i>	Turquoise Parrot	V		1 record within 10km (OEH 2015a)	Occurs from coast to inland slopes. Inhabits open eucalypt woodlands and forests, typically with a grassy understorey. Favours edges of woodlands adjoining grasslands or timbered creek lines and ridges. Feeds on the seeds of native and introduced grasses and other herbs. Grasslands and open areas provide important foraging habitat for this species while woodlands provide important roosting and breeding habitat. Nests in tree hollows, logs or posts from August to December.	Unlikely. Only one record in the locality and breeding habitat is absent.	Negligible impact. Unlikely to be impacted by the proposal given the lack of suitable habitat.
<i>Ninox strenua</i>	Powerful Owl	V		6 records within 10km (OEH 2015a)	Occurs from the coast to the western slopes. Solitary and sedentary species. Inhabits a range of habitats from woodland and open sclerophyll forest to tall open wet forest and rainforest. Prefers large tracts of vegetation. Nests in large tree hollows (> 0.5 m deep), in large eucalypts (dbh 80-240 cm) that are at least 150 years old. Pairs have high fidelity to a small number of hollow-bearing nest trees and defend a large home range of 400 - 1,450 ha. Forages within open and closed woodlands as well as open areas.	Unlikely. Breeding habitat is absent in the locality and small patches of vegetation present are unlikely to be suitable for this species.	Negligible impact. Unlikely to be impacted by the proposal given the lack of suitable habitat.

Scientific name	Common name	TSC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Potential impact
<i>Oxyura australis</i>	Blue-billed Duck	V		1 record within 10km, last recorded 1980 (OEH 2015a)	Partly migratory, travels short distances between breeding swamps and over-wintering lakes. Young birds disperse in April-May from breeding swamps in inland NSW to Murray River system and coastal lakes. Prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. Nests in Cumbungi over deep water or in trampled Lignum, sedges or spike-rushes. Completely aquatic, swimming along the edge of dense cover.	Unlikely. No suitable wetland habitat present.	Negligible impact. Unlikely to be impacted by the proposal given the lack of suitable habitat.
<i>Petroica boodang</i>	Scarlet Robin	V		8 records within 10km (OEH 2015a)	In NSW occurs from coast to inland slopes. Breeds in drier eucalypt forests and temperate woodlands, often on ridges and slopes, within open understorey of shrubs and grasses and sometimes in open areas. In autumn and winter it migrates to more open habitats such as grassy open woodland or paddocks with scattered trees. Abundant logs and coarse woody debris are important habitat components.	Unlikely. Absence of logs and coarse woody debris.	Negligible impact. Unlikely to be impacted by the proposal given the lack of suitable habitat.
<i>Petroica phoenicea</i>	Flame Robin	V		2 records within 10km, last recorded 1989 (OEH 2015a)	Breeds in upland moist eucalypt forests and woodlands, often on ridges and slopes, in areas of open understorey. Migrates in winter to more open lowland habitats such as grassland with scattered trees and open woodland on the inland slopes and plains. Forages from low perches, feeding on invertebrates taken from the ground, tree trunks, logs and other coarse woody debris. Fallen logs and coarse woody debris are important habitat components. Open cup nest of plant fibres and cobweb is often built near the ground in a sheltered niche, ledge or shallow cavity in a tree, stump or bank.	Unlikely. Absence of logs and coarse woody debris.	Negligible impact. Unlikely to be impacted by the proposal given the lack of suitable habitat.
<i>Rostratula australis</i>	Australian Painted Snipe	E	E	Species or species' habitat likely to occur within 10km (DoE 2015a)	Normally found in permanent or ephemeral shallow inland wetlands, either freshwater or brackish. Nests on the ground amongst tall reed-like vegetation near water. Feeds on mudflats and the water's edge taking insects, worm and seeds. Prefers fringes of swamps, dams and nearby marshy areas with cover of grasses, lignum, low scrub or open timber.	Unlikely. No suitable wetland habitat present.	Negligible impact. Unlikely to be impacted by the proposal given the lack of suitable habitat.

Scientific name	Common name	TSC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Potential impact
<i>Stagonopleura guttata</i>	Diamond Firetail	V		3 records within 10km (OEH 2015a)	Typically found west of the Great Dividing Range, but populations also occur in drier coastal areas including W Sydney, Hunter, Clarence and Snowy River valleys. Occurs in grassy eucalypt woodlands including Box Gum and Snow Gum communities, as well as open forest, mallee and natural and derived grasslands. Often found in riparian areas and occasionally in lightly wooded farmland. Nests in shrubby understorey or higher up under nests of other species.	Unlikely. Small patches of vegetation present are unlikely to be suitable for this species.	Negligible impact. Unlikely to be impacted by the proposal given the lack of suitable habitat.
<i>Stictonetta naevosa</i>	Freckled Duck	V		2 records within 10km (OEH 2015a)	Breeds in large, ephemeral swamps in the Murray-Darling, particularly along the Paroo and Lachlan Rivers and other Riverina rivers. In drier times moves to more permanent waters. Disperses during extensive inland droughts and may be found in coastal areas during such times. Prefers freshwater swamps/creeks with dense Cumbungi, Lignum or tea-tree. Nests in dense vegetation at or near water level.	Unlikely. No suitable wetland habitat present.	Negligible impact. Unlikely to be impacted by the proposal given the lack of suitable habitat.
Fish							
<i>Macquaria australasica</i>	Macquarie Perch	E (FM Act)	E	Species or species' habitat may occur within 10km (DotE 2015a)	Occurs in the upper reaches of the Lachlan, Murrumbidgee and Murray Rivers, and in parts of the Hawkesbury and Shoalhaven catchment areas. Inhabits river and lake habitats, especially the upper reaches of rivers and their tributaries. Requires clear water with deep, rocky holes and abundant cover (including aquatic vegetation, woody debris, large boulders and overhanging banks). Spawning occurs in spring and summer in shallow upland streams or flowing sections of river systems.	Unlikely. No suitable river habitat present.	Negligible impact. Unlikely to be impacted by the proposal given the lack of suitable habitat.
<i>Prototroctes maraena</i>	Australian Grayling		V	Species or species' habitat may occur within 10km (DotE 2015a)	Occurs in coastal rivers and streams south from the Shoalhaven River. Inhabits estuarine waters and coastal seas as larvae/juveniles, and freshwater rivers and streams as adults. Most of their lives are spent in freshwater rivers and streams in cool, clear waters with a gravel substrate and alternating pool and riffle zones, however can also occur in turbid water. The species can penetrate well inland, being recorded over 100 km inland from the sea. (Backhouse et al 2008).	Unlikely. No suitable river habitat present.	Negligible impact. Unlikely to be impacted by the proposal given the lack of suitable habitat.
Frogs							

Scientific name	Common name	TSC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Potential impact
<i>Heleioporus australiacus</i>	Giant Burrowing Frog	V	V	Species or species' habitat likely to occur within 10km (DotE 2015a)	Occurs along the coast and eastern slopes of the Great Dividing Range south from Wollemi National Park. Appears to exist as 2 populations with a 100km gap in records between Jervis Bay and Eden. Northern population occurs on sandy soils supporting heath, woodland or open forest. Breeds in ephemeral to intermittent streams with persistent pools. Only infrequently moves to breeding sites, most commonly found on ridges away from creeks, several hundred metres from water.	Nil. No suitable habitat present.	Nil.
<i>Litoria aurea</i>	Green and Golden Bell Frog	E	V	2 records within 10km (OEH 2015a); Species or species' habitat may occur within 10km (DotE 2015a)	Formerly occurred from Brunswick Heads to Victoria, but >80% populations now extinct. Inhabits marshes, natural and artificial freshwater to brackish wetlands, dams and in stream wetlands. Prefers sites containing cumbungi (Typha spp.) or spike rushes (Eleocharis spp.), which are unshaded and have a grassy area and/or rubble as shelter/refuge habitat nearby. <i>Gambusia holbrooki</i> is a key threat as they feed on green and Golden Bell Frog eggs and tadpoles.	Unlikely. No farm dams with large quantities of emergent vegetation present.	Negligible impact. Unlikely to be impacted by the proposal given the lack of suitable habitat.
<i>Litoria littlejohni</i>	Littlejohn's Tree Frog	V	V	Species or species' habitat may occur within 10km (DotE 2015a)	Occurs on plateaus and eastern slopes of the Great Dividing Range south from Watagan State Forest. Occurs along permanent rocky streams with thick fringing vegetation associated with eucalypt woodlands and heaths among sandstone outcrops, hunting either in shrubs or on the ground.	Unlikely. No suitable stream habitat present.	Negligible impact. Unlikely to be impacted by the proposal given the lack of suitable habitat.
<i>Litoria raniformis</i>	Growing Grass Frog	E	V	Species or species' habitat may occur within 10km (DotE 2015a)	Currently, the species is known to exist only in isolated populations in the Coleambally Irrigation Area, the Lowbidgee floodplain and around Lake Victoria. Usually found in or around permanent or ephemeral Black Box/Lignum/Nitre Goosefoot swamps, Lignum/Typha swamps and River Red Gum swamps or billabongs along floodplains and river valleys. They are also found in irrigated rice crops, particularly where there is no available natural habitat (OEH 2013).	Unlikely. No suitable swamp habitat present.	Negligible impact. Unlikely to be impacted by the proposal given the lack of suitable habitat.
Gastropods							

Scientific name	Common name	TSC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Potential impact
<i>Meridolum corneovirens</i>	Cumberland Plain Land Snail	E		58 records within 10km (OEH 2015a)	Occurs within a small area of the Cumberland Plain, from Richmond and Windsor to Picton. Found primarily under litter of bark, leaves and logs, or in loose soil around grass clumps within Cumberland Plain Woodland. Has also been found under rubbish. Feeds on fungus. During periods of drought can burrow into the soil to escape the dry conditions.	Unlikely. Small patches of vegetation present are unlikely to be suitable for this species.	Negligible impact. Unlikely to be impacted by the proposal given the lack of suitable habitat and isolation of the patch to more suitable habitat.
Mammals							
<i>Chalinolobus dwyeri</i>	Large-eared Piped Bat	V	V	3 records within 10km (OEH 2015a); Species or species' habitat known to occur within 10km (DotE 2015a)	Occurs from the coast to the western slopes of the divide. Largest numbers of records from sandstone escarpment country in the Sydney Basin and Hunter Valley. Roosts in caves and mines and most commonly recorded from dry sclerophyll forests and woodlands. An insectivorous species that flies over the canopy or along creek beds. In southern Sydney appears to be largely restricted to the interface between sandstone escarpments and fertile valleys.	Unlikely. No suitable breeding or foraging habitat present.	Nil
<i>Dasyurus maculatus</i>	Spotted-tail Quoll	V	E	Species or species' habitat likely to occur within 10km (DotE 2015a)	Inhabits a range of environments including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Den sites are in hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces. Females occupy home ranges of up to 750 ha and males up to 3,500 ha, usually traversed along densely vegetated creek lines.	Unlikely. Small patches of vegetation present are unlikely to be suitable for this species.	Negligible impact. Unlikely to be impacted by the proposal given the lack of suitable habitat and isolation of the patch to more suitable habitat.
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V		8 records within 10km (OEH 2015a)	Occurs on southeast coast and ranges. Prefers tall (>20m) and wet forest with dense understorey. Absent from small remnants, preferring continuous forest but can move through cleared landscapes and may forage in open areas. Roosts in hollow trunks of Eucalypts, underneath bark or in buildings. Forages in gaps and spaces within forest, with large foraging range (12km foraging movements recorded).	Low. Limited breeding habitat and foraging habitat present.	Low impact. Unlikely to be impacted by the proposal given the lack of optimal habitat.

Scientific name	Common name	TSC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Potential impact
<i>Miniopterus australis</i>	Little Bentwing-bat	V		8 records within 10km (OEH 2015a)	Occurs from Cape York to Sydney. Inhabits rainforests, wet and dry sclerophyll forests, paperbark swamps and vine thickets. Only one maternity cave known in NSW, shared with Eastern Bentwing-bats at Willi Willi, near Kempsey. Outside breeding season roosts in caves, tunnels and mines and has been recorded in a tree hollow on one occasion. Forages for insects beneath the canopy of well-timbered habitats.	Low. No suitable breeding habitat but limited foraging habitat present. Could potentially roost in culverts in the area.	Low impact. Unlikely to be impacted by the proposal given the lack of optimal habitat.
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat	V		11 records within 10km (OEH 2015a)	Generally occurs east of the Great Dividing Range along NSW coast (Churchill 2008). Inhabits various habitats from open grasslands to woodlands, wet and dry sclerophyll forests and rainforest. Essentially a cave bat but may also roost in road culverts, stormwater tunnels and other man-made structures. Only 4 known maternity caves in NSW, near Wee Jasper, Bungonia, Kempsey and Texas. Females may travel hundreds of kilometres to the nearest maternal colony (Churchill 2008).	Low. No suitable breeding habitat but limited foraging habitat present. Could potentially roost in culverts in the area.	Low impact. Unlikely to be impacted by the proposal given the lack of optimal habitat.
<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	V		23 records within 10km (OEH 2015a)	Occurs in dry sclerophyll forest and woodland east of the Great Dividing Range. Forages in natural and artificial openings in vegetation, typically within a few kilometres of its roost. Roosts primarily in tree hollows but also recorded from man-made structures or under bark (Churchill 2008).	Low. Limited foraging habitat present.	Low impact. Unlikely to be impacted by the proposal given the lack of optimal habitat.
<i>Myotis macropus</i>	Southern Myotis	V		11 records within 10km (OEH 2015a)	Mainly coastal but may occur inland along large river systems. Usually associated with permanent waterways at low elevations in flat/undulating country, usually in vegetated areas. Forages over streams and watercourses feeding on fish and insects from the water surface. Roosts in a variety of habitats including caves, mine shafts, hollow-bearing trees, stormwater channels, buildings, under bridges and in dense foliage, typically in close proximity to water.	Low. No suitable breeding habitat but limited foraging habitat present. Could potentially roost in culverts in the area.	Low impact. Unlikely to be impacted by the proposal given the lack of optimal habitat.

Scientific name	Common name	TSC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Potential impact
<i>Petrogale penicillata</i>	Brush-tailed Rock-wallaby	E	V	Species or species' habitat may occur within 10km (DotE 2015a)	Occurs from the Shoalhaven north to the Queensland border. Now mostly extinct west of the Great Dividing Range, except in the Warrumbungles and Mt Kaputar. Occurs on rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges facing north. Diet consists of vegetation in adjacent to rocky areas eating grasses and forbs as well as the foliage and fruits of shrubs and trees.	Nil. No suitable habitat present.	Nil.
<i>Phascogale cinereus</i>	Koala	V	V	190 records within 10km (OEH 2015a); Species or species' habitat known to occur within 10km (DotE 2015a)	Occurs from coast to inland slopes and plains. Restricted to areas of preferred feed trees in eucalypt woodlands and forests. Home range varies depending on habitat quality, from < 2 to several hundred hectares.	Unlikely. No local populations present. The limited potential foraging habitat present is patchy and has minimal connectivity with larger habitat areas.	Negligible impact. Unlikely to be impacted by the proposal given the limited habitat present and lack of connectivity.
<i>Pseudomys novaehollandiae</i>	New Holland Mouse		V	Species or species' habitat likely to occur within 10km (DotE 2015a)	Occurs in disjunct, coastal populations from Tasmania to Queensland. In NSW inhabits a variety of coastal habitats including heathland, woodland, dry sclerophyll forest with a dense shrub layer and vegetated sand dunes. Populations may recolonise/ increase in size in regenerating native vegetation after wildfire, clearing and sandmining. Presence strongly correlated with understorey vegetation density, and high floristic diversity in regenerating heath.	Nil. No suitable habitat present.	Nil.
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	V	30 records within 10km (OEH 2015a); Roosting known to occur within 10km (DotE 2015a)	Roosts in camps within 20 km of a regular food source, typically in gullies, close to water and in vegetation with a dense canopy. Forages in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths, swamps and street trees, particularly in eucalypts, melaleucas and banksias. Highly mobile with movements largely determined by food availability. Will also forage in urban gardens and cultivated fruit crops.	Low. May forage in eucalypt woodland when in flower. No breeding camp present.	Low impact. Unlikely to be impacted by the proposal given the mobility of this species.
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail bat	V	V	3 records within 10km (OEH 2015a)	Migrates from tropics to SE Aus in summer. Forages across a range of habitats including those with and without trees, from wet and dry sclerophyll forest, open woodland, Acacia shrubland, mallee, grasslands and desert. Roosts communally in large tree hollows and buildings (Churchill 2008).	Low. Limited foraging habitat present and also possible roosting habitat in culverts.	Low impact. Unlikely to be impacted by the proposal given the lack of suitable habitat and also the absence of this species in culverts.

Scientific name	Common name	TSC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Potential impact
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V		8 records within 10km (OEH 2015a)	Occurs on the east coast and Great Dividing Range. Inhabits a variety of habitats from woodland to wet and dry sclerophyll forests and rainforest, also remnant paddock trees and timber-lined creeks, typically below 500m asl. Forages in relatively uncluttered areas, using natural or man-made openings in denser habitats. Usually roosts in tree hollows or fissures but also under exfoliating bark or in the roofs of old buildings. Females congregate in maternal roosts in suitable hollow trees.	Low. Limited foraging habitat present and also possible roosting habitat in culverts.	Low impact. Unlikely to be impacted by the proposal given the lack of suitable habitat and also the absence of this species in culverts.
Reptiles							
<i>Hoplocephalus bungaroides</i>	Broad-headed Snake	V	V	Species or species' habitat likely to occur within 10km (DotE 2015a)	Nocturnal, sheltering in rock crevices and under flat sandstone rocks on exposed cliff edges during autumn, winter, and spring, moving to shelters in hollows of large trees within 200m of escarpments in summer. Feeds mostly on geckos and small skinks, and occasionally on frogs and small mammals.	Nil. No suitable habitat present.	Nil.

Key: V= vulnerable, E=endangered, CE= critically endangered under the TSC and/or the EPBC Acts



Memorandum

Migratory fauna

Scientific name	Common name	TSC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Potential impact
<i>Cuculus optatus</i>	Oriental Cuckoo	M	M	Species or species' habitat may occur within 10km (DoE 2015a)	This species migrates to northern and eastern Australia in the warmer months. Occurs south to the Shoalhaven area. Occurs in a range of habitats, including monsoon forest, rainforest edges, leafy trees in paddocks, river flats, roadsides and mangroves.	Unlikely. Small patches of vegetation present are unlikely to be suitable for this species but may forage on occasion.	Negligible impact. Unlikely to be impacted by the proposal given the lack of suitable habitat.
<i>Hirundapus caudacutus</i>	White-throated Needletail	M	M	Species or species' habitat known to occur within 10km (DoE 2015a)	Recorded along NSW coast to the western slopes and occasionally from the inland plains. Breeds in northern hemisphere. Almost exclusively aerial while in Australia. Occur above most habitat types, but are more frequently recorded above more densely vegetated habitats (rainforest, open forest and heathland) than over woodland or treeless areas.	Unlikely. Small patches of vegetation present are unlikely to be suitable for this species but may forage on occasion.	Negligible impact. Unlikely to be impacted by the proposal given the lack of suitable habitat.
<i>Merops ornatus</i>	Rainbow Bee-eater	M	M	Species or species' habitat may occur within 10km (DoE 2015a)	Distributed across much of mainland Australia, and several near-shore islands. Occurs in a range of habitats, including open forests and woodlands, shrublands, and in various cleared or semi-cleared habitats, including farmland and areas of human habitation. It usually occurs in open, cleared or lightly-timbered areas that are often, but not always, located in close proximity to permanent water. It also occurs in inland and coastal sand dune systems, and in mangroves in northern Australia. Nests are made in sandy banks.	Unlikely. Small patches of vegetation present are unlikely to be suitable for this species but may forage on occasion.	Negligible impact. Unlikely to be impacted by the proposal given the lack of suitable habitat.
<i>Monarcha melanopsis</i>	Black-faced Monarch	M	M	Species or species' habitat known to occur within 10km (DoE 2015a)	Found along the coast of eastern Australia, becoming less common further south. Found in rainforests, eucalypt woodlands, coastal scrub and damp gullies. It may be found in more open woodland when migrating. Resident in the north of its range, but is a summer breeding migrant to coastal south-eastern Australia, arriving in September and returning northwards in March. It may also migrate to Papua New Guinea in autumn and winter.	Unlikely. Small patches of vegetation present are unlikely to be suitable for this species but may forage on occasion.	Negligible impact. Unlikely to be impacted by the proposal given the lack of suitable habitat.

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Scientific name	Common name	TSC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Potential impact
<i>Monarcha trivirgatus</i>	Spectacled Monarch		M	Species or species' habitat known to occur within 10km (DotE 2015a)	The Spectacled Monarch is found in coastal north-eastern and eastern Australia, including coastal islands, from Cape York, Queensland to Port Stephens, New South Wales. It is much less common in the south. Prefers thick understorey in rainforest, wet gullies and waterside vegetation as well as mangroves.	Unlikely. Small patches of vegetation present are unlikely to be suitable for this species but may forage on occasion.	Negligible impact. Unlikely to be impacted by the proposal given the lack of suitable habitat.
<i>Motacilla flava</i>	Yellow Wagtail		M	Species or species' habitat may occur within 10km (DotE 2015a)	This species breeds in temperate Europe and Asia. They occur within Australia in open country habitat with disturbed ground and some water. Recorded in short grass and bare ground, swamp margins, sewage ponds, saltmarshes, playing fields, airfields, ploughed land and town lawns.	Unlikely. Small patches of vegetation present are unlikely to be suitable for this species but may forage on occasion.	Negligible impact. Unlikely to be impacted by the proposal given the lack of suitable habitat.
<i>Myiagra cyanoleuca</i>	Satin Flycatcher		M	Species or species' habitat known to occur within 10km (DotE 2015a)	In NSW widespread on and east of the Great Divide, sparsely scattered on the western slopes, very occasional records on the western plains. Inhabit heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, often near wetlands and watercourses. On migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests. Generally not in rainforests.	Unlikely. Small patches of vegetation present are unlikely to be suitable for this species but may forage on occasion.	Negligible impact. Unlikely to be impacted by the proposal given the lack of suitable habitat.
<i>Rhipidura rufifrons</i>	Rufous Fantail		M	Species or species' habitat known to occur within 10km (DotE 2015a)	Found along NSW coast and ranges. Inhabits rainforest, dense wet forests, swamp woodlands and mangroves. During migration, it may be found in more open habitats or urban areas (Birds Australia 2008).	Unlikely. Small patches of vegetation present are unlikely to be suitable for this species but may forage on occasion.	Negligible impact. Unlikely to be impacted by the proposal given the lack of suitable habitat.

Key: M=migratory



