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 (DUAP 1995/1996) and the Roads and Related Facilities EIS Guideline (DUAP 1996) 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
a. Any environmental impact on a community? Construction of the proposal would result in negative traffic, amenity and noise impacts to the local community for the duration of construction as discussed in Chapter 6 (Environmental assessment). Potential traffic impacts include an increase in the volume of heavy vehicles, disruptions to access and local traffic changes. Construction noise impacts would be managed by adopting feasible and reasonable noise management measures identified in the Interim Construction Noise Guideline (DECC, 2009) in order to reduce noise levels as much as practicable during construction. Long term positive impacts would be improvements in traffic flow and safety and a reduction in traffic congestion.	Short-term minor negative Long-term minor positive
b. Any transformation of a locality? The proposal would be located within an existing road corridor, with the exception of land located on the western extent of the proposal area which would require acquisition. The proposal would result in a minor transformation of the locality.	Long-term, negligible
c. Any environmental impact on the ecosystems of the locality? The proposal would remove about 0.48 hectares of Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849), Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 835) and Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion (PCT 1071). The proposal would also result in the removal of about 0.07 ha of planted native/exotic vegetation and about 1.30 ha of highly disturbed vegetation. The vegetation to be removed was identified as representing suitable habitat for threatened fauna species, although the habitat was identified as being of moderate to poor quality. In addition, the proposal would require the removal of threatened plant species *Eucalyptus nicholii* which has been planted at the edge of Reservoir Road. No impacts to groundwater dependent ecosystems or aquatic biodiversity are anticipated. Overall the proposal would not be likely to significantly impact threatened species, populations or ecological communities or their habitats.	Long-term minor negative

Factor	Impact
d. Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality? During construction, the proposal would result in a reduction in the aesthetic quality of the locality as a result of dust generation, noise, visual and traffic movements. These impacts would be minimised through implementation of the management measures and safeguards summarised in Chapter 7 (Environmental management).	Short-term minor negative
e. 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? Honeman Close is located to the immediate south of the proposal area, and has been identified as the site of the Former Great Western Road. This item is listed on the State Heritage Register (SHR) and the *Blacktown Local Environmental Plan 2015* (Blacktown LEP). Although the proposal itself would not directly impact this heritage item, potential indirect impacts have been identified during construction if appropriate measures are not implemented. Potential impacts would occur as a result of access to the southern portion of the site off Honeman Close, as well as access to the proposed Compound 1 located to the south of Honeman Close. Compound 2 is proposed to be located wholly within the SHR listing boundary along Boiler Close, with access via Honeman Close. Compound 3 is also located within the LEP listing boundary to the north west of the proposal area adjacent to the Great Western Highway. Management measures and restrictions on excavation have been proposed to prevent potential indirect impacts to the heritage item. The proposal would not impact on any Aboriginal heritage items.	Short-term minor negative
f. Any impact on the habitat of protected fauna (within the meaning of the *National Parks and Wildlife Act* 1974)? The vegetation to be removed was identified as representing suitable habitat for threatened fauna species, although the habitat was identified as being of moderate to poor quality. The proposal would not be likely to significantly impact on the habitat of protected fauna.	
g. Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air? The proposal is unlikely to have any significant impact on endangering any species of animal, plant or other form of life, whether living on land, in water or in the air.	No impacts
h. Any long-term effects on the environment? Most environmental impacts resulting from the proposal will occur during the construction phase and therefore cause short-term effects on the environment. No long-term effects are anticipated.	Short-term minor negative
i. Any degradation of the quality of the environment? The proposal is not anticipated to result in any significant degradation to the quality of the existing environment.	No impacts

Factor	Impact
j. Any risk to the safety of the environment? A CEMP would be prepared to cover all construction works. Management measures have been proposed in Chapter 7 (Environmental management) to minimise the risks associated with encountering contaminated land and other potential safety considerations.	Short term negligible
k. Any reduction in the range of beneficial uses of the environment? The proposal is not anticipated to have any reduction in the range of beneficial uses of the environment as it would enhance uses and services already provided.	Long term positive
l. Any pollution of the environment? There is the potential for some short-term air, water and soil pollution during the construction of the proposal. Management and mitigation measures have been proposed (refer to Chapter 7 (Environmental management)) to manage and mitigate any potential pollution of the environment caused during the construction of the proposal.	Short term minor negative
m. Any environmental problems associated with the disposal of waste? Waste generated by the proposal would be managed in accordance with a waste management plan to be prepared in accordance with all relevant legislation	No impacts
n. Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply? There would be no increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply as a result of the proposal	No impacts
o. Any cumulative environmental effect with other existing or likely future activities? As discussed in Section 6.11, cumulative impacts could include: Construction noise and vibration impacts due to simultaneous work being carried out Construction traffic impacts due to additional construction vehicles Visual impacts due to construction work sites Air quality impacts. Where feasible, environmental management measures would be coordinated to reduce cumulative construction impacts. The proposal is unlikely to have any long term impacts.	Short-term negative
p. Any impact on coastal processes and coastal hazards, including those under projected climate change conditions? None, as the proposal is located outside of coastal areas.	No impacts

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.

A referral is not required for proposed actions that may affect nationally listed threatened species, populations, endangered ecological communities and migratory species. Impacts on these matters are still assessed as part of the REF in accordance with Australian Government significant impact criteria and taking into account relevant guidelines and policies.

Factor	Impact
a. Any impact on a World Heritage property?	Nil There are no World Heritage items located within the proposal area.
b. Any impact on a National Heritage place?	Nil There are no National Heritage items located within the proposal area.
c. Any impact on a wetland of international importance?	Nil There are no wetlands located within the proposal area.
d. Any impact on a listed threatened species or communities?	Nil The proposal is not likely to significantly impact threatened species, populations, or ecological communities. See Section 6.3 for further details
e. Any impacts on listed migratory species?	Nil The proposal is not likely to significantly impact listed migratory species. See Section 6.3 for further details
f. Any impact on a Commonwealth marine area?	Nil The proposal area is not near a Commonwealth marine area.
g. Does the proposal involve a nuclear action (including uranium mining)?	No
h. Additionally, any impact (direct or indirect) on Commonwealth land?	Nil

Appendix B

Statutory consultation checklists

Infrastructure SEPP

Council related infrastructure or services

Issue	Potential impact	Yes / No	If 'yes' consult with	ISEPP clause
Stormwater	Are the works likely to have a substantial impact on the stormwater management services which are provided by council?	No	Blacktown City Council	ISEPP cl.13(1)(a)
Traffic	Are the works likely to generate traffic to an extent that will strain the existing road system in a local government area?	No	Blacktown City Council	ISEPP cl.13(1)(b)
Sewerage system	Will the works involve connection to a council owned sewerage system? If so, will this connection have a substantial impact on the capacity of any part of the system?	No	Blacktown City Council	ISEPP cl.13(1)(c)
Water usage	Will the works involve connection to a council owned water supply system? If so, will this require the use of a substantial volume of water?	No	Blacktown City Council	ISEPP cl.13(1)(d)
Temporary structures	Will the works involve the installation of a temporary structure on, or the enclosing of, a public place which is under local council management or control? If so, will this cause more than a minor or inconsequential disruption to pedestrian or vehicular flow?	No	Blacktown City Council	ISEPP cl.13(1)(e)
Road & footpath excavation	Will the works involve more than minor or inconsequential excavation of a road or adjacent footpath for which council is the roads authority and responsible for maintenance?	No	Blacktown City Council	ISEPP cl.13(1)(f)

Local heritage items

Issue	Potential impact	Yes / No	If 'yes' consult with	ISEPP clause
Local heritage	Is there is a local heritage item (that is not also a State heritage item) or a heritage conservation area in the study area for the works? If yes, does a heritage assessment indicate that the potential impacts to the item/area are more than minor or inconsequential?	No	Blacktown City Council	ISEPP cl.14

Flood liable land

Issue	Potential impact	Yes / No	If 'yes' consult with	ISEPP clause
Flood liable land	Are the works located on flood liable land? If so, will the works change flood patterns to more than a minor extent?	No	Blacktown City Council	ISEPP cl.15

Public authorities other than councils

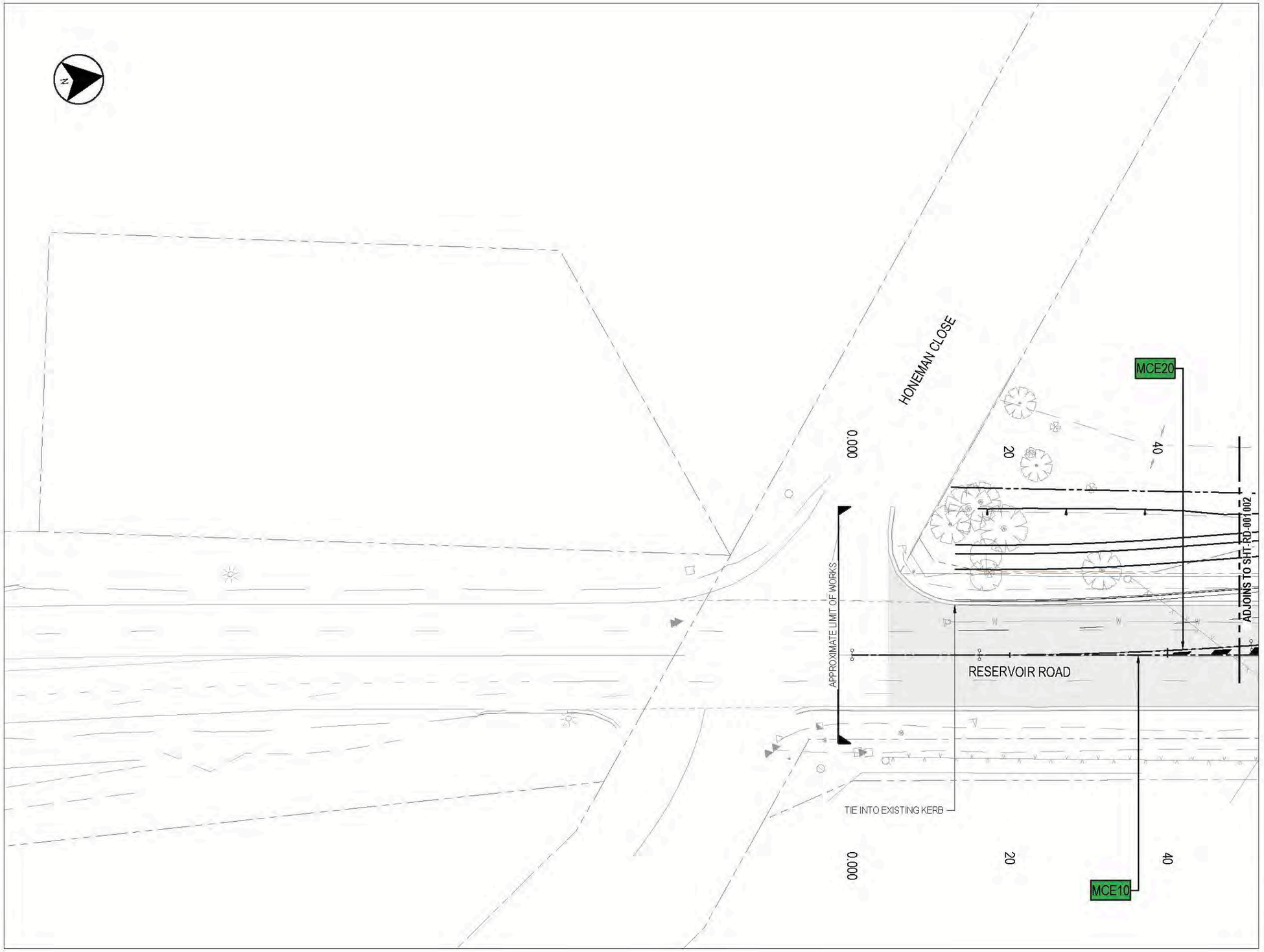
Issue	Potential impact	Yes / No	If 'yes' consult with	ISEPP clause
National parks and reserves	Are the works adjacent to a national park or nature reserve, or other area reserved under the *National Parks and Wildlife Act 1974*?	No	Office of Environment and Heritage	ISEPP cl.16(2)(a)
Marine parks	Are the works adjacent to a declared marine park under the *Marine Parks Act 1997*?	No	Department of Planning and Environment	ISEPP cl.16(2)(b)
Aquatic reserves	Are the works adjacent to a declared aquatic reserve under the *Fisheries Management Act 1994*?	No	Office of Environment and Heritage	ISEPP cl.16(2)(c)
Sydney Harbour foreshore	Are the works in the Sydney Harbour Foreshore Area as defined by the *Sydney Harbour Foreshore Authority Act 1998*?	No	Department of Planning and Environment	ISEPP cl.16(2)(d)
Bush fire prone land	Are the works for the purpose of residential development, an educational establishment, a health services facility, a correctional centre or group home in bush fire prone land?	No	Rural Fire Service	ISEPP cl.16(2)(f)

Growth Centres SEPP

Issue	Potential impact	Yes / No	If 'yes' consult with	ISEPP clause
Clearing native vegetation	Do the works involve clearing native vegetation (as defined in the *Native Vegetation Act 2003*) on land that is not ***subject land*** (as defined in cl 17 of schedule 7 of the *Threatened Species Conservation Act 1995*)?		Department of Planning and Environment	SEPP 18A

Appendix C

Detailed Design drawings of the proposal



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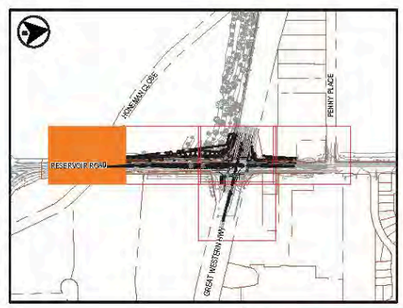

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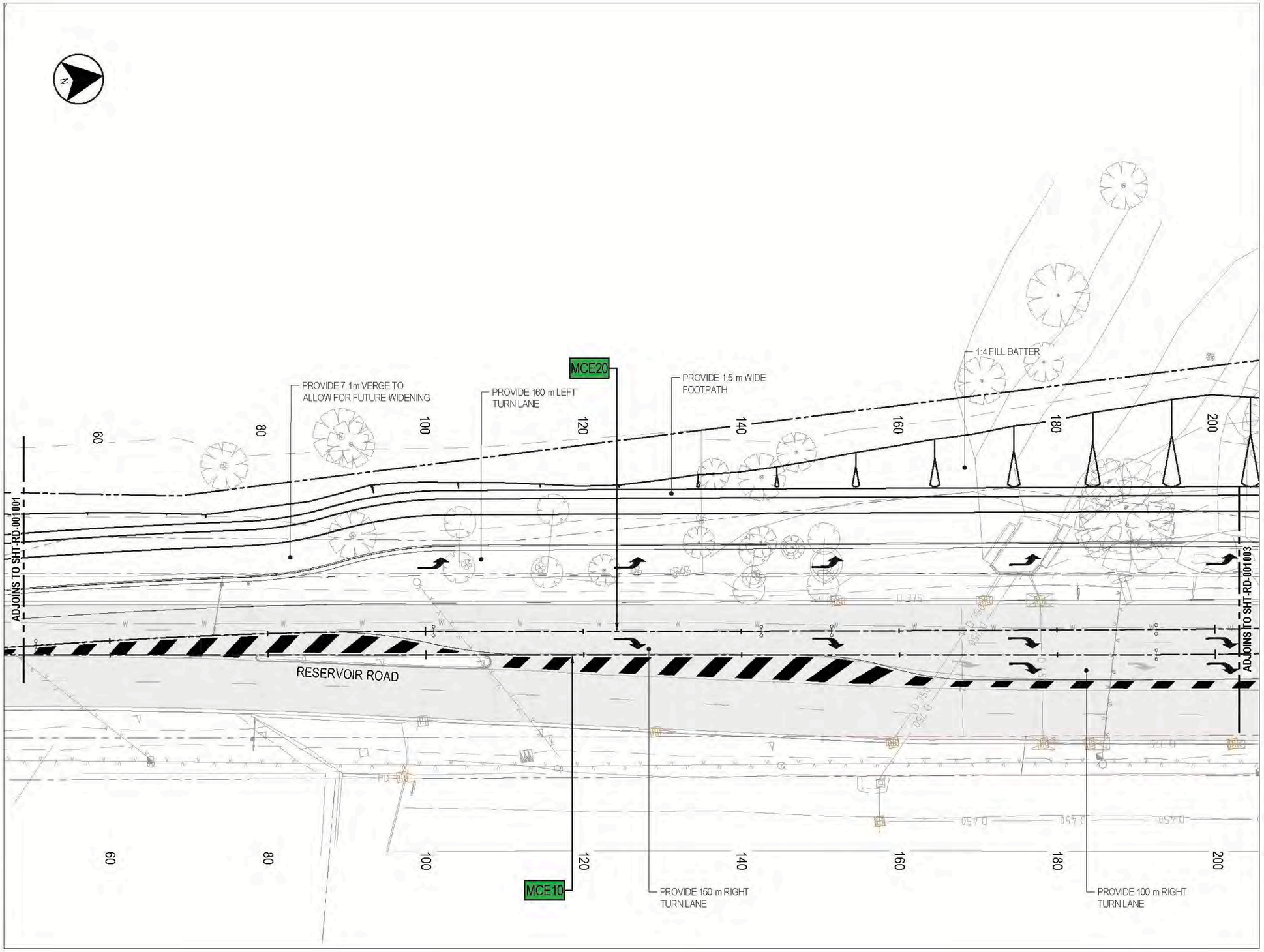

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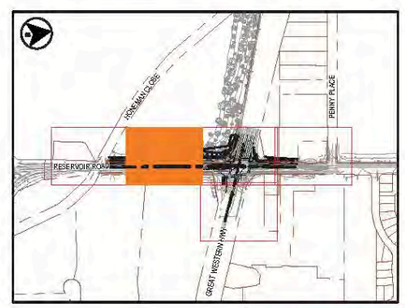

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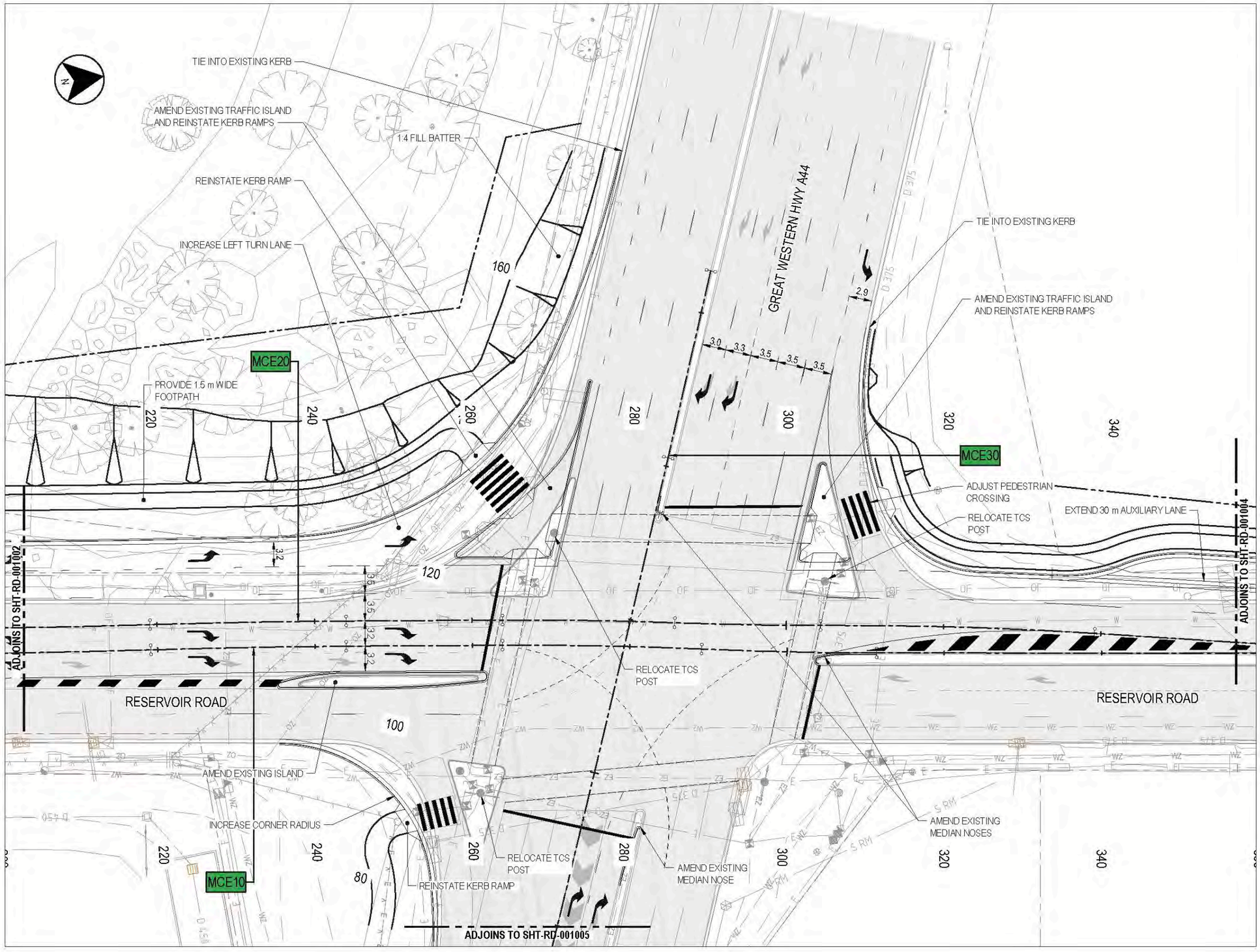

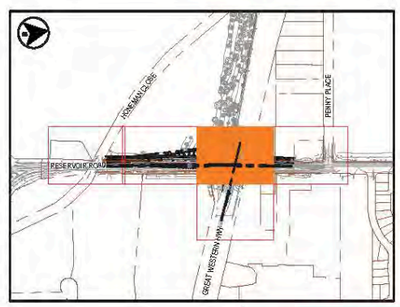

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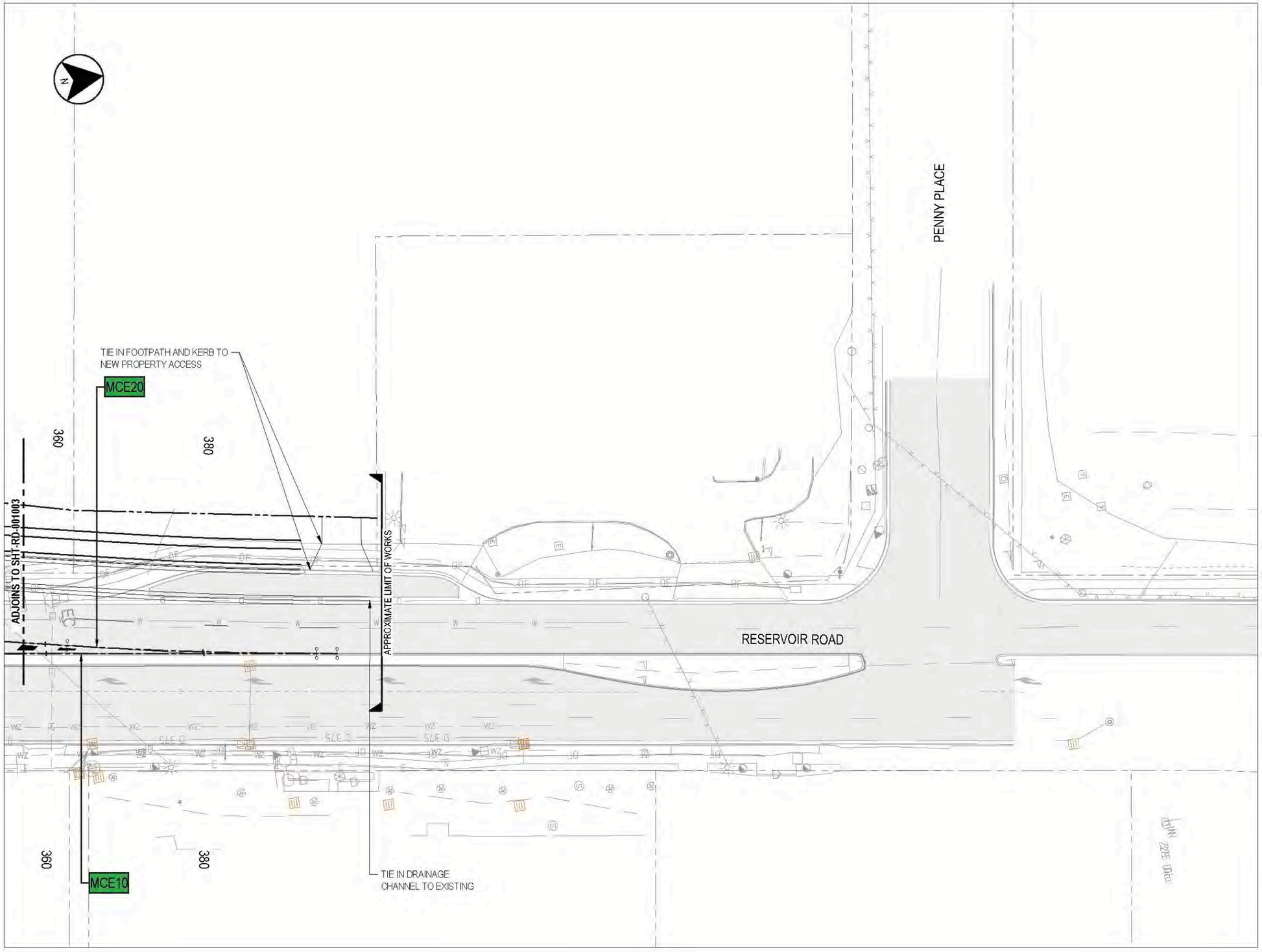

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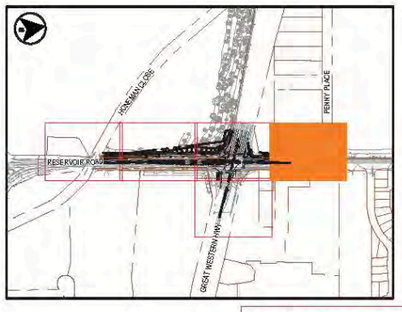

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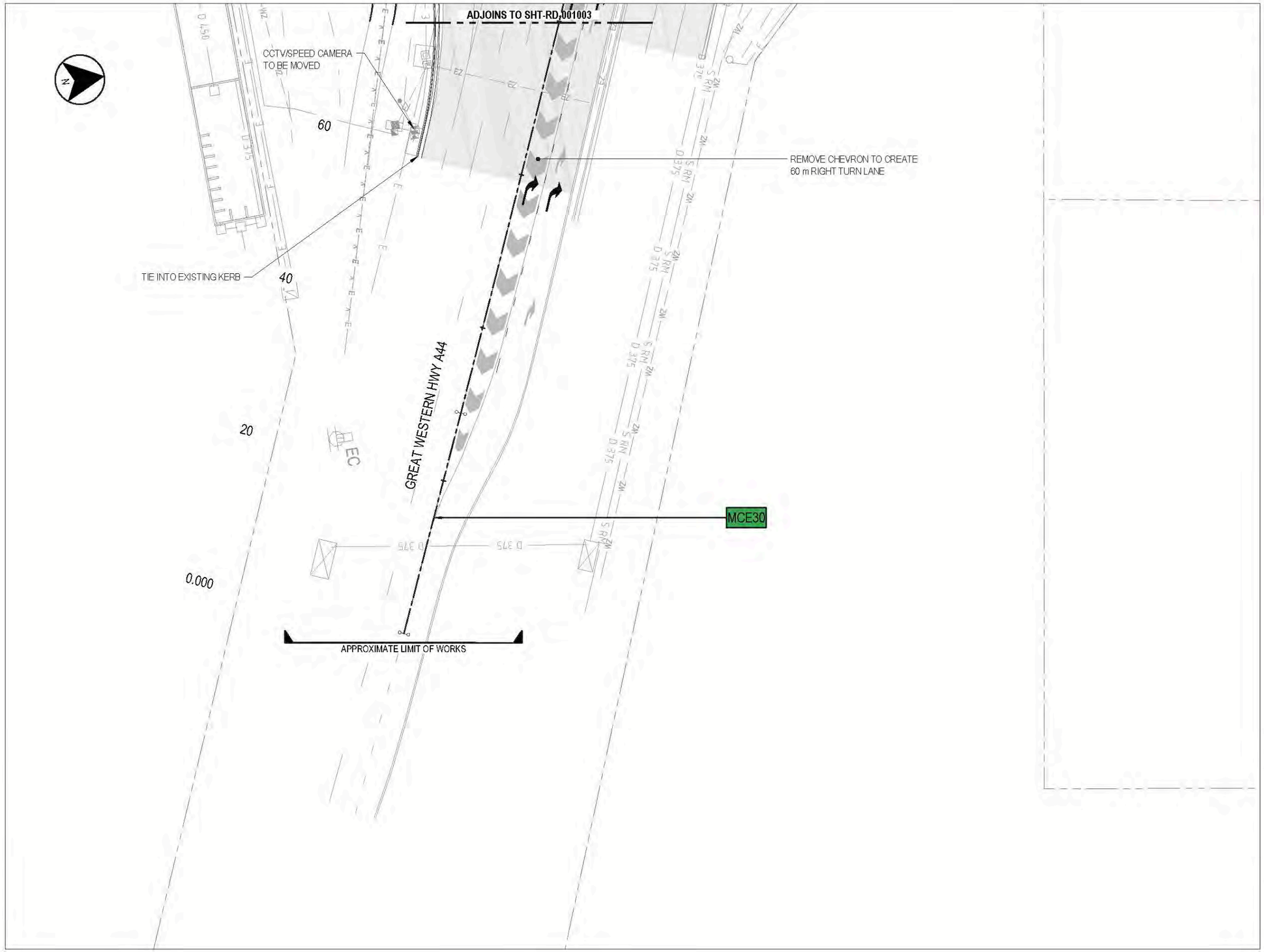

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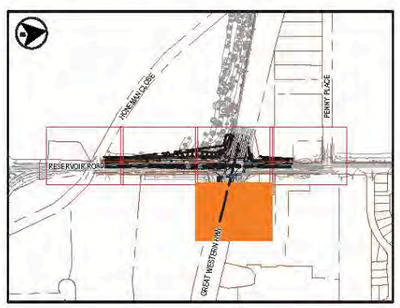

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Appendix D

Stage 1 Roads and Maritime Procedure for Aboriginal Cultural Heritage Consultation and Investigation

Stage 1 Roads and Maritime Services assessment

Procedure for Aboriginal cultural heritage consultation and investigation: Resource 3

Aim

The project manager (or their representative) must provide the information requested in this checklist to the regional Aboriginal cultural heritage adviser. This information will assist them in determining whether the project may affect Aboriginal cultural heritage in accordance with Stage 1 of the procedure.

Please **provide** this completed cover sheet, along with the required information, to your regional Aboriginal cultural heritage adviser.

Contact details for this project

Name of project:
Great Western Highway and Reservoir Road Intersection Upgrade, Blacktown

Project manager
Laura Lynch
Tel: (02) 9032 1269
Laura.Lynch@jacobs.com

Environmental officer undertaking/managing the environmental impact assessment
Nicole Cook
Tel: (02) 9032 1463
Nicole.Cook2@jacobs.com

Date: 30/10/2017

Action	Status ☑
Item 1 **Attach an overview of the project. The overview must include the known scope and extent of the proposed works; compound site requirements; access and movement of plant; re-location and/or provision of utilities; the location of noise walls, sedimentation basins, shared pathways, cycle ways, etc.** Roads and Maritime Services (Roads and Maritime) propose to upgrade the intersection of the Great Western Highway and Reservoir Road, Blacktown. The proposal is required to address congestion and safety issues at this location and forms part of Roads and Maritime's Easing Sydney's Congestion Program Office. Key features of the proposal include: • Upgrading the southern approach to the intersection from Reservoir Road between Honeman Close and Great Western Highway (about 260 metres) to improve traffic efficiency. This includes acquiring a strip of land on the western side up to 30 metres from the existing boundary to provide: - Two dedicated right hand turn lanes into Great Western Highway - Two through lanes - A dedicated left turn lane with signalised pedestrian crossing • Duplicating the Great Western Highway (westbound) right hand turn lanes onto Reservoir Road by utilising the existing chevron marked lane • Upgrading the Reservoir Road northern approach to the intersection - Localised widening of north west corner of the intersection to accommodate vehicle turning path from the Great Western Highway double right hand turn lanes - Lengthening of the existing left turn slip lane • Improving the alignment of Great Western Highway (westbound) left slip lane onto Reservoir Road • Constructing a new footpath along the widened section of Reservoir Road (about 380 metres) • Property acquisition and utility relocation to the ultimate design footprint to avoid future rework (refer to concept design report acquisition maps) • Adjustments to traffic signal infrastructure • Upgrading and potential extension to the outlet of the cross culvert stormwater pipe including new outlet with headwall and scour protection (about 90 metres south of the intersection) • Fill batters along Reservoir Road northbound carriageway (4:1) • Vegetation clearing including area of mapped Cumberland Plain Woodland • Utility adjustments include overhead powerline relocation, relocation of Telstra and NBN • Property access impacts requiring private driveway adjustment and temporary construction access impacts to adjacent businesses (including a service station and Mitre 10). The locality of the proposal is provided in Attachment A. An overview of the detailed design of the proposal is provided in Attachment B. The proposal also includes the use of four potential compound sites. These are listed in Table 1-1 and shown in Figure 1-1.	☑

Table 1-1 Potential compound sites

Compound ID	Location	Description
C1 (preferred)	South of Honeman Close, Blacktown	This site has been assessed for use as compound for the M4 Smart Motorways project.
C2 (preferred)	End of Boiler Close, Blacktown	This site has been assessed for use as compound for the M4 Smart Motorways project.
C3	Great Western Highway, Blacktown	This site is located on a roadside verge area adjacent to the Roads and Maritime Crash Lab facility. This is an existing cleared area previously used as a compound on other Roads and Maritime projects.
C4	North of Penny Place, Blacktown (exact area not yet confirmed)	Use of this location would be subject to further investigation and consultation with Council.

Figure 1-1 Potential compound sites

Item 2
Attach a map/plan of the study area that clearly outlines the extent and scope of the project. The map/plan should also include topographical information where available.

An overview of the detailed design of the proposal is provided in Attachment B. Topography of the proposal area is provided in Attachment C.

☑

Item 3
If land acquisition is required, provide details about this.

Property acquisition required by the proposal is listed in Table 1-2.

Table 1-2 Proposed property acquisition

Lot/DP	Type of property acquisition	Ownership	Land use
Lot 102 DP 828155	Partial	Private	Unused parcel of grassed land and roadside trees adjacent to Mitre 10.
Lot 1 DP 229466	Partial	Private	Unused parcel of grassed land and roadside trees adjacent to Mitre 10.
Lot 2 DP 229466	Partial	Private	Unused parcel of land with established trees. The owner proposes to use the adjacent site for a service station in future subject to Council approval.

☑

Item 4
Attach a brief description of current and past land use, where known. For example, the study area land is currently used as a car park/road reserve/farming/etc. and was formally used for a car park/road reserve/farming/etc.

The proposal would be carried out primarily within the existing road corridor. The proposal would require partial property acquisition of land surrounding the existing road corridor, including land zoned as IN1 – General Industrial and IN2 – Light Industrial on the Blacktown Local Environment Plan 2015. Details regarding the current use of property to be partially acquired is provided in Table 1-2.

☑

Item 5
Describe the timeframe for the project along with key milestones and deliverables.

The Review of Environmental Factors for the proposal is due to be completed in early 2018.

It is anticipated that construction of the proposal would commence in early 2019 with an expected construction period of about 18 months (subject to weather and coordination with the M4 Smart Motorway project). Some works may be able to occur during standard hours, however it is anticipated that majority of works would occur outside of standard hours to minimise traffic impacts.

☑

Item 6
Please attach the results of the Office of Environment and Heritage's Aboriginal Heritage Information Management System (AHIMS) Basic Search - http://www.environment.nsw.gov.au/licences/WhatInformationCanYouObtainFromAHIMS.htm

☑

An extensive search of the Aboriginal Heritage Information Management System (AHIMS) was carried out on 25 October 2017. The search identified three Aboriginal sites within 300 metres of the proposal area and compound sites. The results of the extensive AHIMS search are provided in Attachment D.	
Item 7 **Attach the results of the following heritage searches relevant to the study area:** • **Native Title Register search** • **State Heritage Inventory search** • **Australian Heritage Database search.** Results of heritage searches are provided in Attachment E.	☑
Item 8 **Attach a copy of any heritage assessment (Aboriginal or non-Aboriginal) previously prepared for the study area/project?** No previous heritage assessments have been prepared for the proposal. However, an Aboriginal Archaeological Survey Report Stage 2 PACHCI was prepared for the M4 Smart Motorways project. This assessment can be found at the following link: http://www.rms.nsw.gov.au/projects/sydney-west/m4/project-documents.html. Depending project timing, the proposal may use two compound sites (1 and 2) currently being used by the M4 Smart Motorways project. An Aboriginal Heritage Due Diligence Assessment Report was prepared to support a development application for a service station at 6 Honeman Close, Huntingwood (Lot 2 DP229466). The assessment can be found at the following link: https://www.blacktown.nsw.gov.au/Have-Your-Say/DA-17-01780.	☑
Item 9 **Attach a copy of any environmental impact assessment previously prepared for the study area/project?** A REF Preliminary Scoping Checklist was prepared for the Concept Design of the proposal in April 2016. A Review of Environmental Factors was prepared for the M4 Smart Motorways project. This assessment can be found at the following link: http://www.rms.nsw.gov.au/projects/sydney-west/m4/project-documents.html. Depending on project timing, the proposal may use two compound sites (1 and 2) currently being used by the M4 Smart Motorways project. A Species Impact Statement, Statement of Heritage Impact and Traffic Impact Assessment was prepared to support a development application for a service station at 6 Honeman Close, Huntingwood (Lot 2 DP229466). The assessment can be found at the following link: https://www.blacktown.nsw.gov.au/Have-Your-Say/DA-17-01780.	☑

Attachment A – Locality of the proposal

Legend

Project locality

0 1 2km

1:50,000 @ A4

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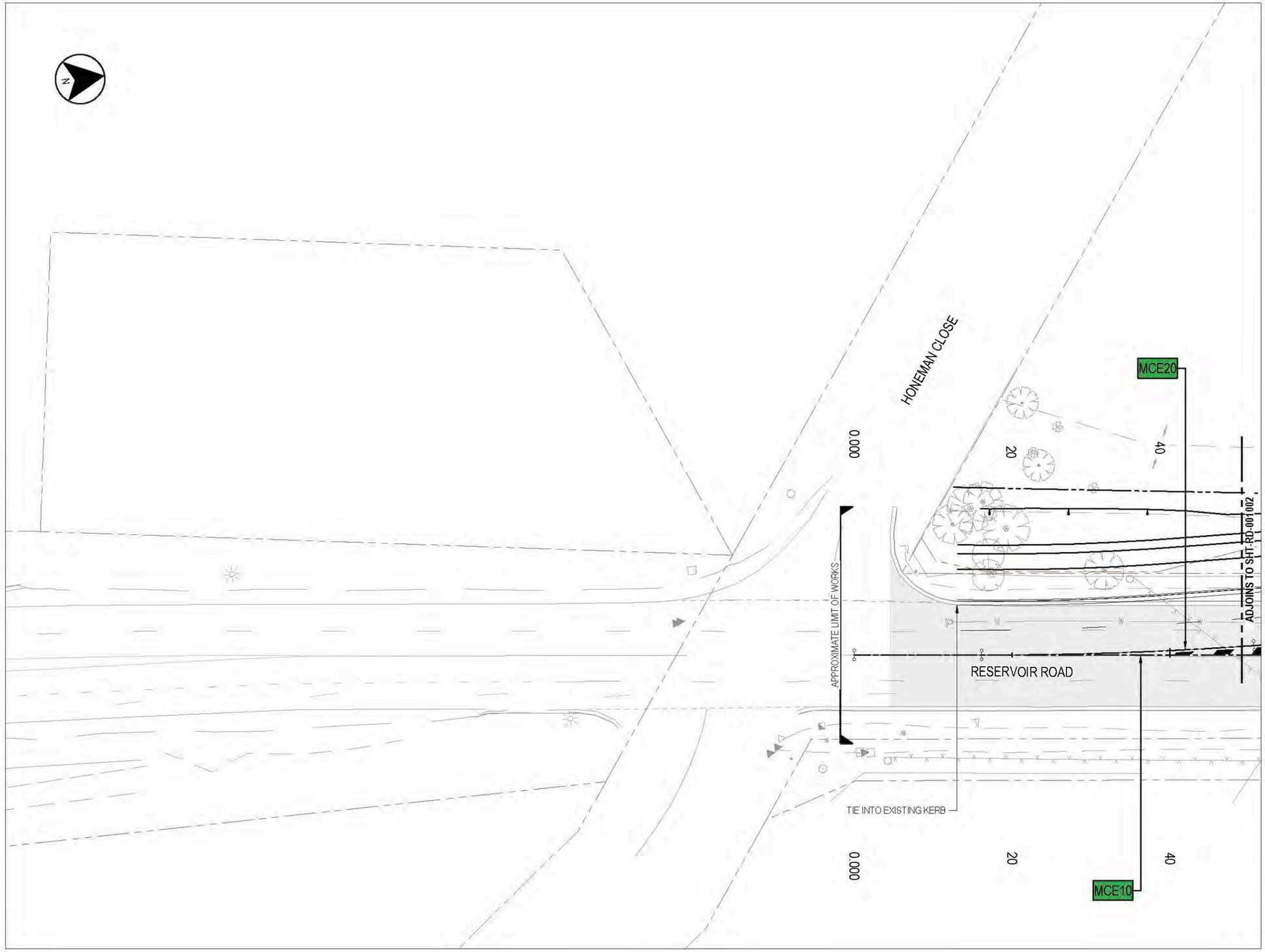
Attachment A | Locality

Attachment B – Overview of the detailed design of the proposal



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- EXISTING SURVEY
- MXXX — ROAD CONTROL LINE LABEL
- PROPOSED TCS POSTS AND MAST ARMS
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- EXISTING JUNCTION PIT
- EXISTING HEADWALL
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- EXISTING BURIED PIT OUTLET
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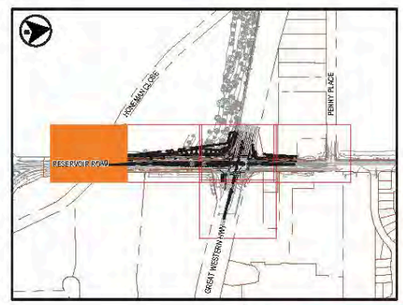

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PREPARED FOR: SYDNEY DIVISION, EASING SYDNEY'S CONGESTION, PINCH POINTS NORTH

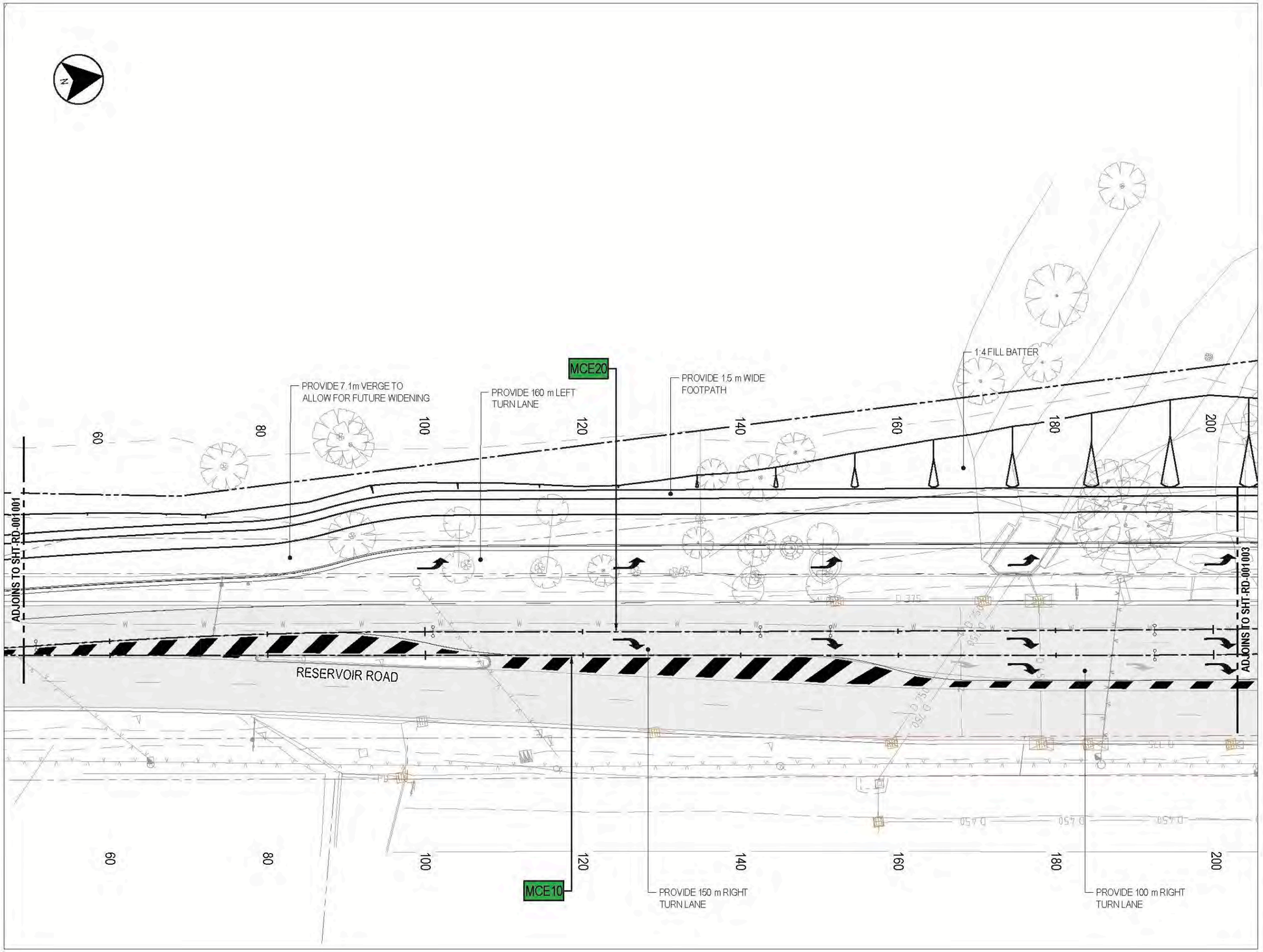
BLACKTOWN CITY COUNCIL
HW5 GREAT WESTERN HIGHWAY
PINCH POINT UPGRADE AT INTERSECTION OF GREAT WESTERN HIGHWAY AND RESERVOIR ROAD GENERAL ARRANGEMENT

A3

SHEET 1 OF 5

RMS REGISTRATION No.: DS2017/00XXXX PART: A

ISSUE STATUS: DETAILED DESIGN | EDMS No.: - | SHEET No.: SHT-RD-001001 | ISSUE: 0



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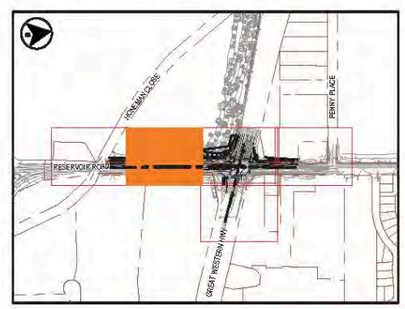

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A3

SHEET 2 OF 5

RMS REGISTRATION No.	PART
DS2017/00XXXX	A

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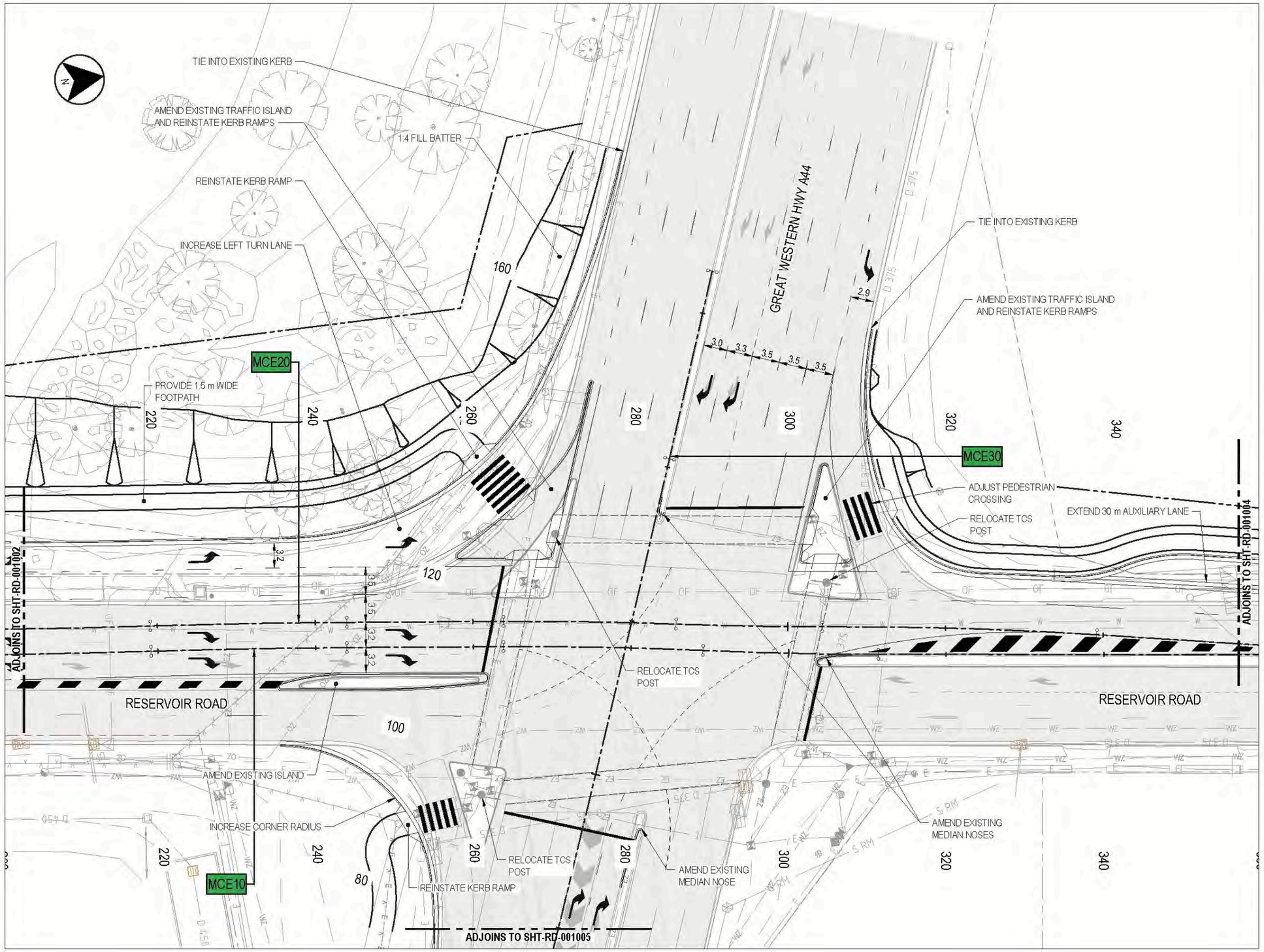

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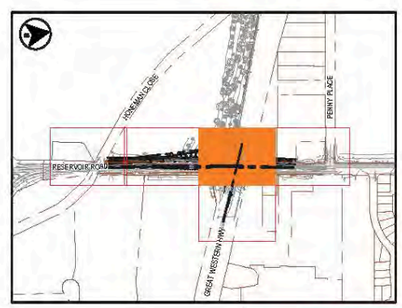

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BLACKTOWN CITY COUNCIL
HW5 GREAT WESTERN HIGHWAY
PINCH POINT UPGRADE AT INTERSECTION OF GREAT WESTERN HIGHWAY AND RESERVOIR ROAD GENERAL ARRANGEMENT

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SHEET 3 OF 5

RMS REGISTRATION No. DS2017/00XXXX — PART A

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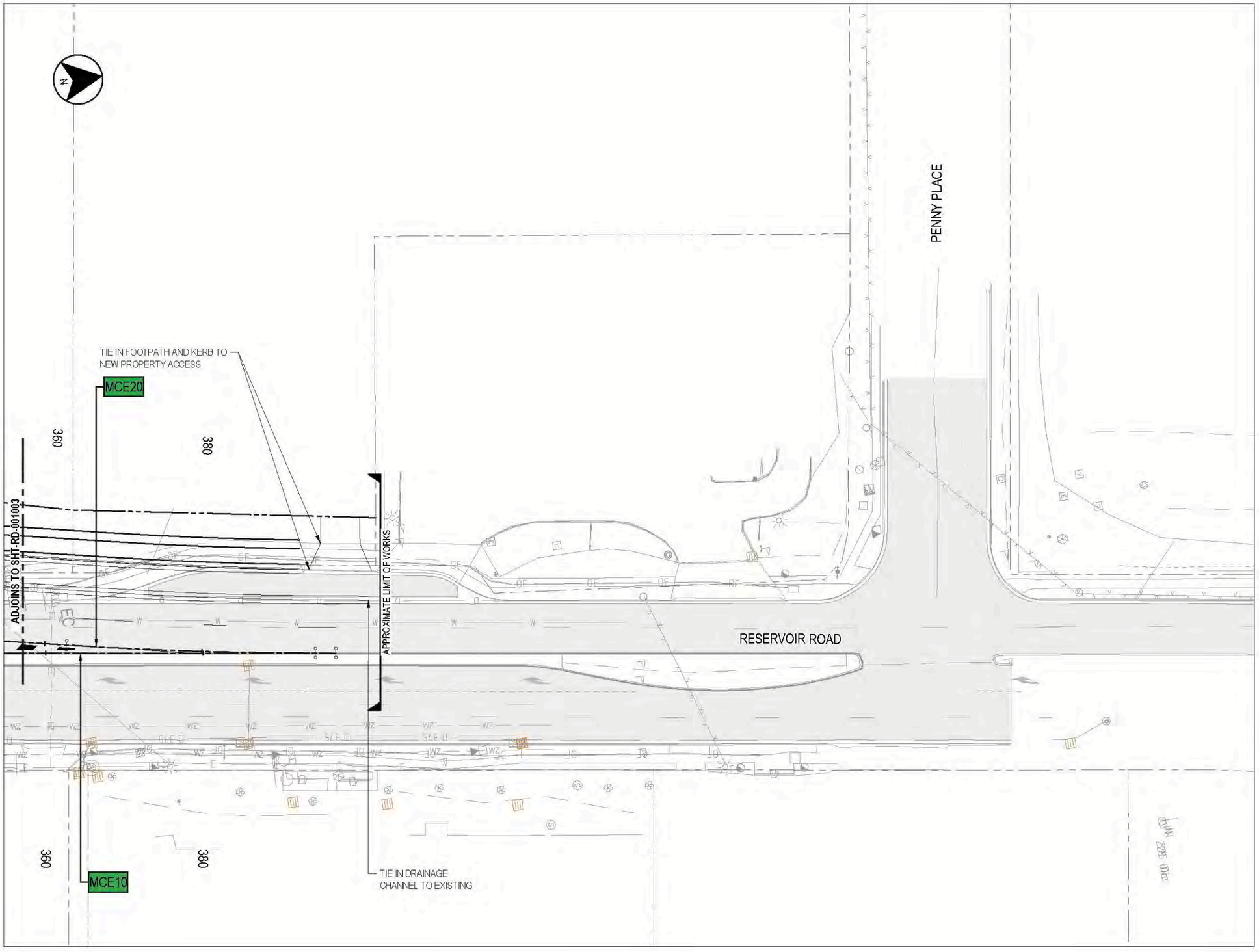

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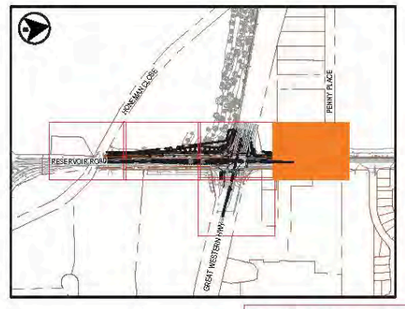

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PINCH POINT UPGRADE AT INTERSECTION OF GREAT WESTERN HIGHWAY AND RESERVOIR ROAD
GENERAL ARRANGEMENT

A3

SHEET 4 OF 5

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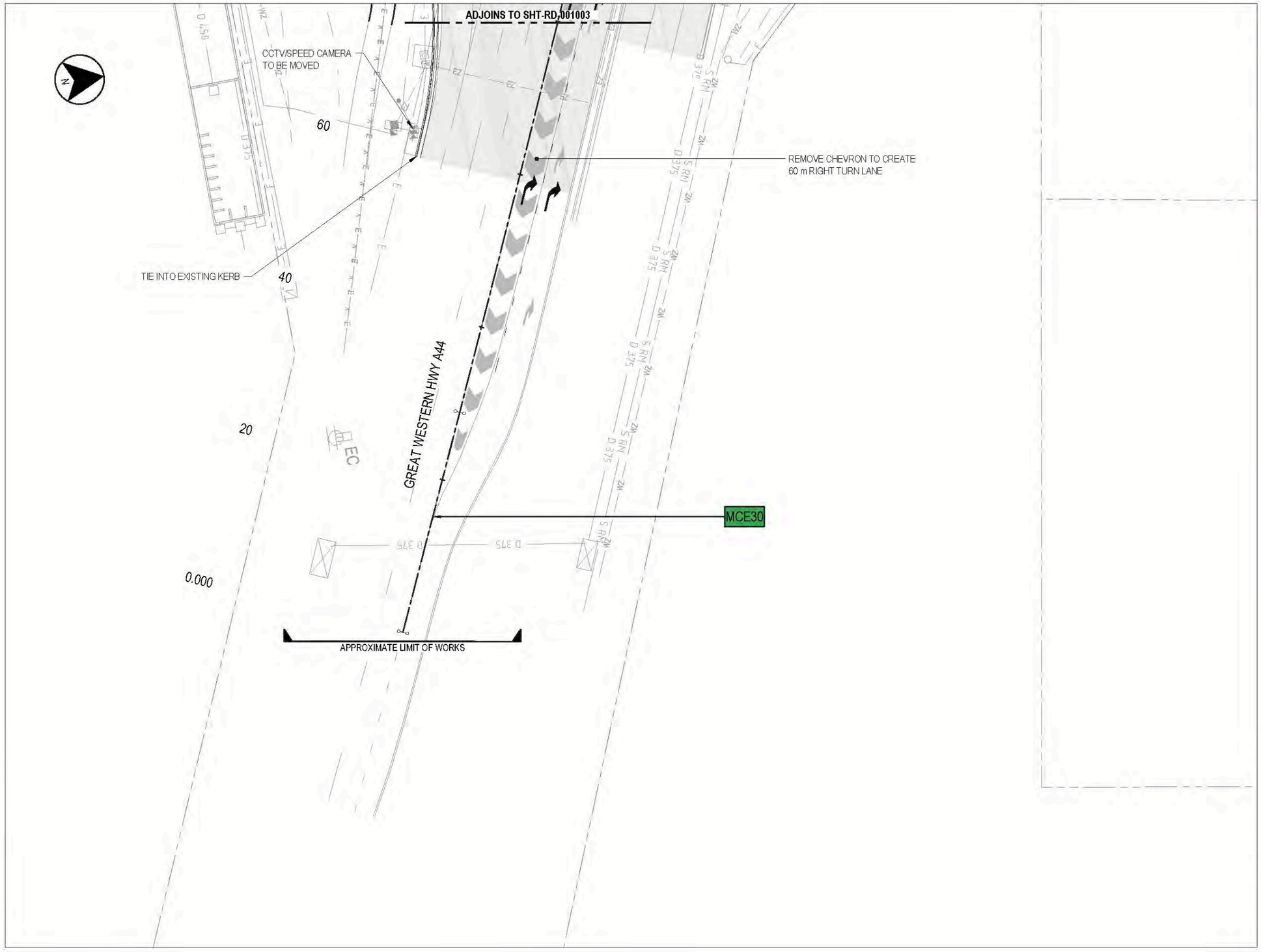

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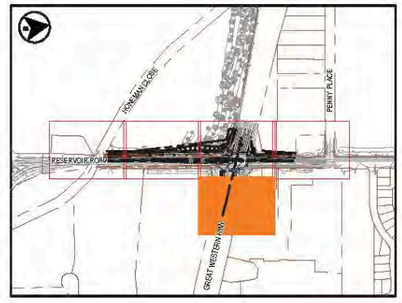

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A3

SHEET 5 OF 5

RMS REGISTRATION No.			PART
DS2017/00XXXX			A
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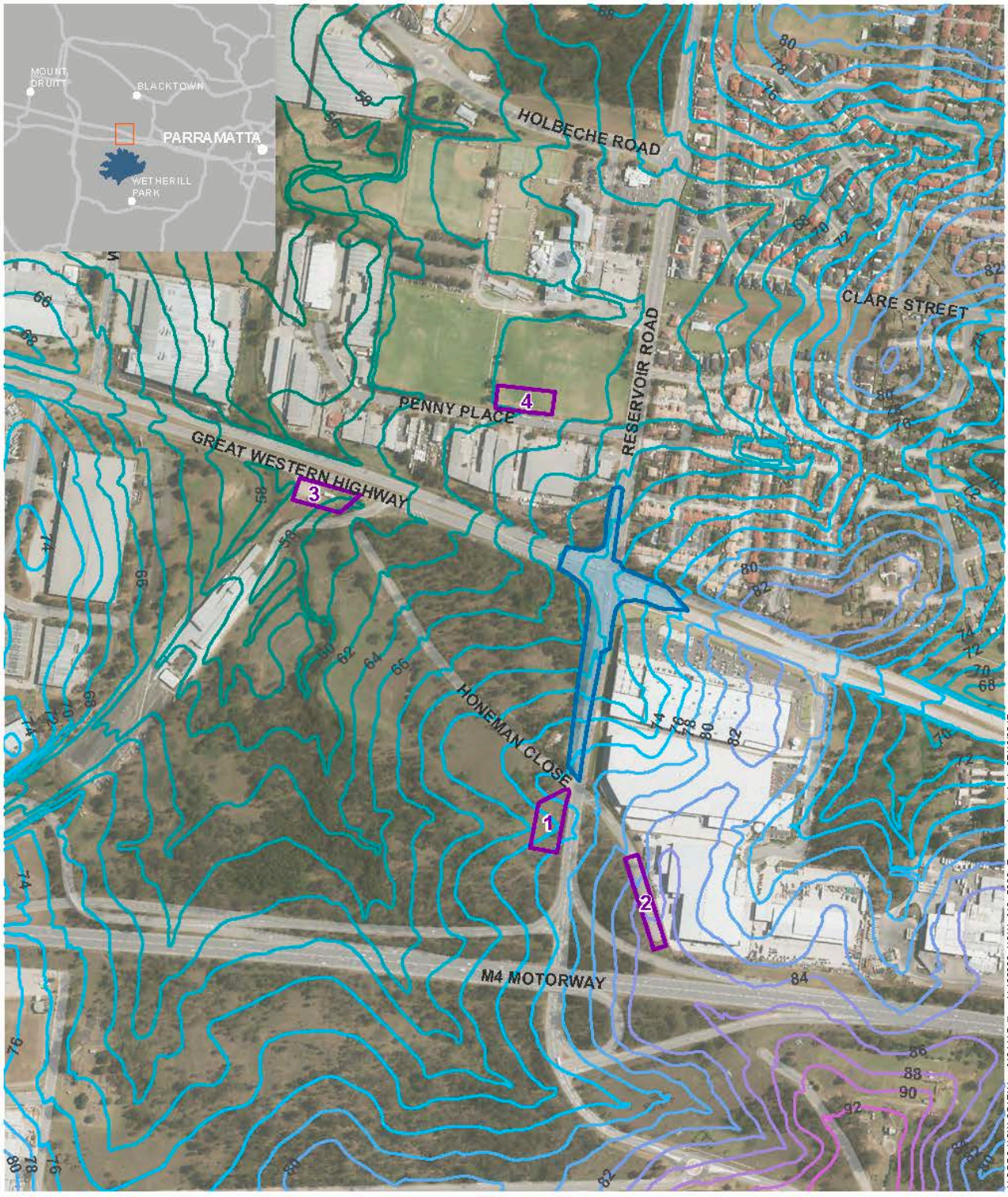
Attachment C – Topography of the proposal area



Legend

- Design boundary
- Potential compound

Contour

- 100 m
- 50 m

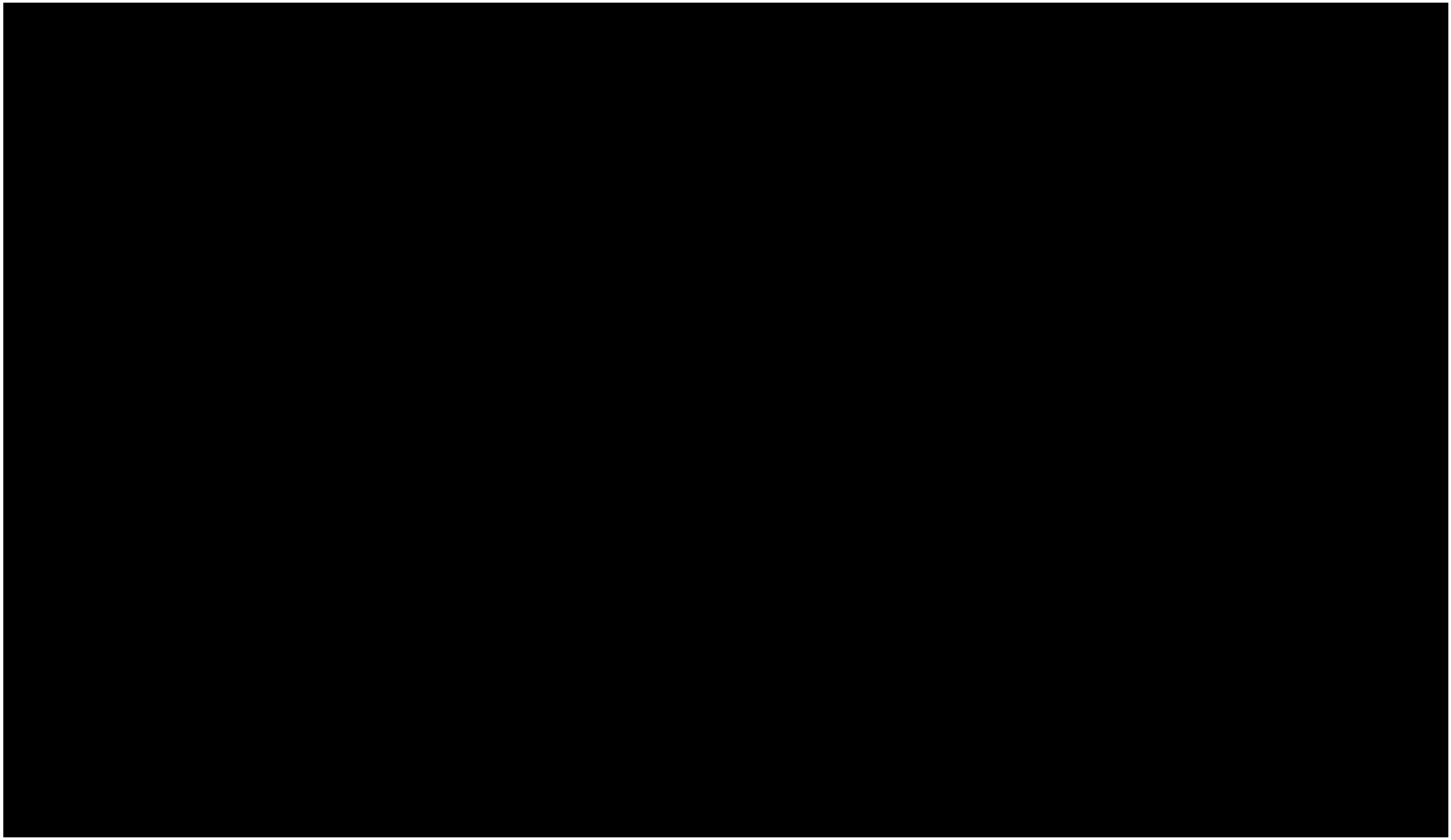
0 100 200m

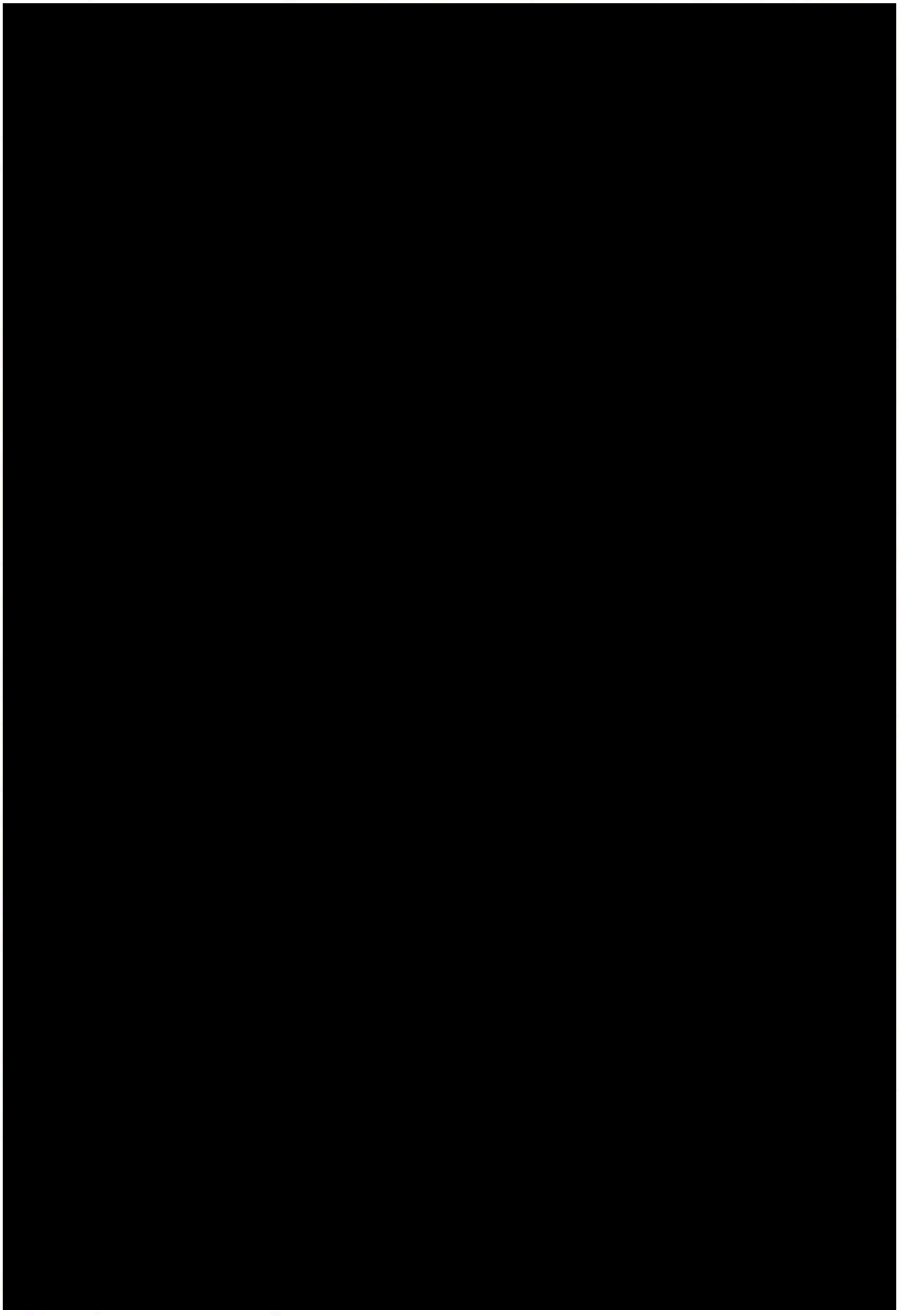
1:8,000 @ A4

N

Attachment C | Topography

Attachment D – Extensive AHIMS search results





Attachment E – Results of heritage searches

Office of Environment & Heritage

Home > Topics > Heritage places and items > Search for heritage

Search for NSW heritage

Return to search page where you can refine/broaden your search.

Statutory listed items

Information and items listed in the State Heritage Inventory come from a number of sources. This means that there may be several entries for the same heritage item in the database. For clarity, the search results have been divided into three sections.

- **Section 1** - contains Aboriginal Places declared by the **Minister for the Environment** under the National Parks and Wildlife Act. This information is provided by the Heritage Division.
- **Section 2** - contains heritage items listed by the **Heritage Council of NSW** under the NSW Heritage Act. This includes listing on the State Heritage Register, an Interim Heritage Order or protected under section 136 of the NSW Heritage Act. This information is provided by the Heritage Division.
- **Section 3** - contains items listed by **local councils** on Local Environmental Plans under the Environmental Planning and Assessment Act, 1979 and **State government agencies** under s.170 of the Heritage Act. This information is provided by local councils and State government agencies.

Section 1. Aboriginal Places listed under the National Parks and Wildlife Act.

Your search did not return any matching results.

Section 2. Items listed under the NSW Heritage Act.

Your search returned 3 records.

Item name	Address	Suburb	LGA	SHR
Neobla	Great Western Highway	Mount Druitt	Blacktown	00245
Prospect Post Office (former)	23 Tarlington Place	Prospect	Blacktown	01385
Veteran Hall - House Remains	Great Western Highway	Prospect	Blacktown	01351

Section 3. Items listed by Local Government and State Agencies.

Your search returned 7 records.

Item name	Address	Suburb	LGA	Information source
Colyton Public School	Great Western Highway	Mount Druitt	Black town	LGOV
Milestone - Ponds Road and Bartholomews Place	Great Western Highway	Prospect	Black town	SGOV
Milestones	Great Western Highway	Prospect, Huntingwood, Minchinbury, Mount Druitt	Black town	LGOV
Mount Druitt Waterholes	Great Western Highway	Mount Druitt	Black town	LGOV
Neobla	Great Western Highway	Mount Druitt	Black town	LGOV

Row of Olives	Minchin Drive	Minchinbury	Black town	LGOV
School Master's Residence (former)	Great Western Highway	Mount Druitt	Black town	LGOV

There was a total of 10 records matching your search criteria.

Key:
LGA = Local Government Area
GAZ= NSW Government Gazette (statutory listings prior to 1997), HGA = Heritage Grant Application, HS = Heritage Study, LGOV = Local Government, SGOV = State Government Agency.
Note: While the Heritage Division seeks to keep the Inventory up to date, it is reliant on State agencies and local councils to provide their data. Always check with the relevant State agency or local council for the most up-to-date information.

Search Aboriginal Places & State Heritage Register

The combined map search below is for Aboriginal Places and State Heritage Register items only. It does not include Interim Heritage Orders, State Agency Heritage Registers and Local Environmental Plans.

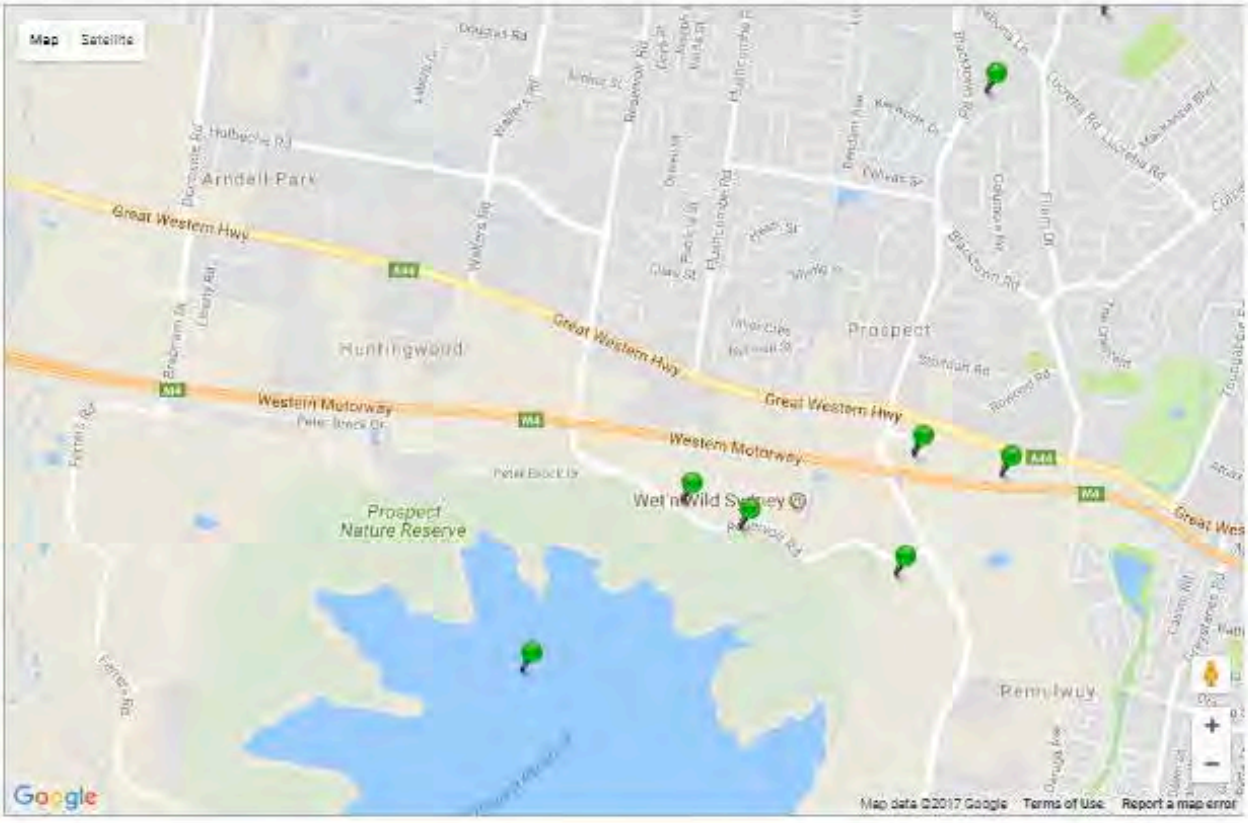
The location of Aboriginal Places and State Heritage Register items are marked on the map as a single approximation point for general identification and research purposes only.

Location information for some Aboriginal Places (e.g. burial grounds and sacred sites) have been generalised because of their cultural sensitivity. Location information for restricted Aboriginal Places is not shown at all. If an activity or development is proposed that may potentially impact on or harm (i.e., damage, deface or destroy) an Aboriginal Place, then proponents must undertake a search for the exact boundaries of Aboriginal Places through **AHIMS Web Services**.

Downloading of State Heritage Register spatial datasets and associated metadata into a Geographical Information System (GIS) software package is available through **Data NSW**.

Listing Type:	◉ All ○ Aboriginal Places ○ State Heritage Register
Local government area:	Blacktown
Item name/Database ID:	
SHR number:	
Location:	
Local Aboriginal Land Council (LALC):	Please Choose...
State theme:	Please Choose...
Item type:	Please Choose...
Item Group:	Please Choose...
Item category:	Please Choose...

Search Reset



Search Results

2 results found.

Blacktown Native Institution Site Richmond Rd	Oakhurst, NSW, Australia	(Nomination now ineligible for PPAL) National Heritage List
Old Boiler House Blacktown Rd	Blacktown, NSW, Australia	(Indicative Place) Register of the National Estate (Non-statutory archive)

Report Produced: Fri Oct 27 08:40:42 2017

Search Register of Native Title Claims

Search National Native Title Register

Search Register of Indigenous Land Use Agreements

Search Applications and Determinations

Search Future Act Applications and Determinations

Search National Native Title Register

The National Native Title Register (NNTR) is a register established under s. 192 of the *Native Title Act 1993* (Cth).

The NNTR contains determinations of native title made by:

- the High Court of Australia
- the Federal Court of Australia
- or a recognised body such as South Australia's Supreme Court and Environment Resources and Development Court.

Further information about the NNTR is available.

Tribunal file no.	
Federal Court file no.	
Short name	
Case name	
State or Territory	New South Wales
Registered Native Title Body Corporate	
Representative A/TSI body area	
Local government area	Blacktown City Council
Determination type	ALL
Legal process	ALL
Determination outcome	ALL
Determination date between	and
Sort by	Determination date

Search >

No results for current search criteria

21/02/2018

Hannah D'eau
Environment Officer
Easing Sydney's Congestion Program Office | Sydney Division

Dear Hannah

Re: Preliminary assessment results for the Great Western Highway and Reservoir Road Intersection Upgrade, Blacktown, including proposed compound sites C1, C2, C3 & C4 (See table and map on next page), proposal 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.
- The Aboriginal cultural heritage potential of the study area appears to be severely reduced due to past disturbance.

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

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 and do not hesitate to contact me.

Yours sincerely

M. Lester

Mark Lester
Aboriginal Cultural Heritage Officer - Sydney Region
27-31 Argyle St Parramatta NSW 2150
Phone - 02 8849 2583 Mobile - 0448 731 510

Potential compound sites

Compound ID	Location	Description
C1 (preferred)	South of Honeman Close, Blacktown	This site has been assessed for use as compound for the **M4** Smart Motorways project.
C2 (preferred)	End of Boiler Close, Blacktown	This site has been assessed for use as compound for the **M4** Smart Motorways project.
C3	Great Western Highway, Blacktown	This site is located on a roadside verge area adjacent to the Roads and Maritime Crash Lab facility. This is an existing cleared area previously used as a compound on other Roads and Maritime projects.
C4	North of Penny Place,Blacktown (exact area not vet confirmed)	Use of this location would be subject to further investigation and consultation with Council.

Appendix E

Noise and vibration assessment

Great Western Highway and Reservoir Rd Intersection Upgrade

Roads and Maritime Services

Construction Noise and Vibration and Operational Noise Assessment

NVIA-1 | Rev2

26 February 2018

Great Western Highway and Reservoir Road Intersection Upgrade

Project No:	IA166200
Document Title:	Construction Noise and Vibration and Operational Noise Assessment
Document No.:	NVIA-1
Revision:	Rev2
Date:	26 February 20187
Client Name:	NSW Roads and Maritime Services
Contract No:	
Project Manager:	Laura Lynch
Author:	Raymond Sim
File Name:	\\jacobs.com\ANZ\IE\Projects\04_Eastern\IA166200\21 Deliverables\Noise & vibration\6_Reporting\IA166200_GWH_RR_NVIA_FINAL_20180226.docx

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Document history and status

Revision	Date	Description	By	Review	Approved
Rev0	29/11/2017	Issued for internal peer review	RS	BI	RS
Rev1	30/11/2017	Issued for client review	RS	BI	RS
Rev2	26/02/2018	Final	RS	BI	RS

Contents

1. Introduction

NSW Roads and Maritime Services (Roads and Maritime) propose to upgrade the Great Western Highway/Reservoir Road intersection, Blacktown (the proposal).

The intersection has been identified as a pinch point along the Great Western Highway corridor, with congestion experienced particularly during morning and afternoon peak periods. The proposal is required to address congestion and safety issues at this location and forms part of Roads and Maritime's Easing Sydney's Congestion and Urban Roads Pinch Point Programs.

In achieving this purpose, the main objectives of this assessment were to:

- Identify nearby sensitive receivers in relation to the proposal
- Characterise background noise conditions around the proposal site
- Develop appropriate construction and operational noise, and vibration assessment criteria in accordance with relevant policy and guidelines
- Quantitatively assess potential noise and vibration-related impacts
- Recommend suitable management measures, as appropriate, to minimise impacts during construction and operations

In summary, this report provides information on the following:

- The existing environment including ambient noise conditions (**Section 2**)
- Applicable noise and vibration criteria (**Section 3**)
- Details of the assessment method and results (**Section 4**)
- Suitable noise and vibration mitigation measures to be implemented as required to manage potential impacts (**Section 5**)
- Conclusions (**Section 6**)

2. Existing Environment

2.1 Surrounding land use and receivers

The proposal is located within the suburb of Blacktown, which is located within the Blacktown City Council local government area (LGA). The proposal area includes the Great Western Highway/Reservoir Road intersection, which is a four-way signalised intersection, with signalised pedestrian crossings at all approaches.

Reservoir Road provides access to the Blacktown central business district (CBD), about three kilometres north of the proposal, and the M4 Motorway, about 530 metres south of the proposal. The M4 Motorway is currently being upgraded by Roads and Maritime as part of the M4 Smart Motorways project. The Great Western Highway provides an east-west link from Penrith, about 20 kilometres west of the proposal, to Parramatta, about eight kilometres east of the proposal.

The area surrounding the Great Western Highway/Reservoir Road intersection is characterised by industrial, commercial and residential land uses. Commercial land uses are located within the south-east and north-west portions of the proposal area, including a Bunnings Warehouse, Mitre 10 and 7-Eleven petrol station. Residential land uses are located within the north-west portion of the proposal area. Unused land with established trees on private property is located within the south-west portion of the proposal area.

The sensitive receivers considered as part of this assessment are displayed below in Figure 2-1.

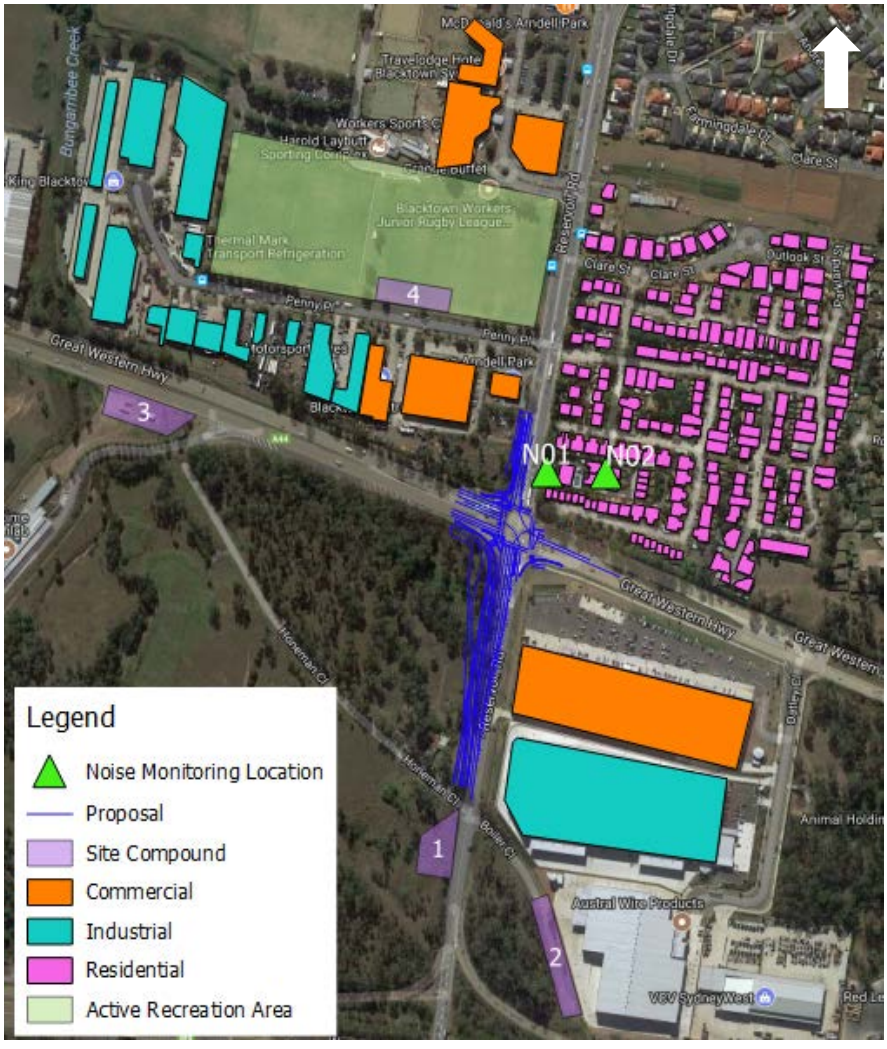


Figure 2-1 Proposal and surrounding receivers

2.2 Background noise survey

2.2.1 Monitoring details

To understand and quantify levels of existing background noise around the proposal site, monitoring was undertaken. This involved the continuous, unattended monitoring at 181 Reservoir Road (N01) and short-term operator attended monitoring at 181 Reservoir Road (N01 – same as logger location) and at 181A Reservoir Road (N02) (a block away from the road traffic). Long-term unattended noise monitoring was not able to be carried out at 181A Reservoir Road because permission to access residential property could not be attained. These monitoring locations are presented in Figure 2-1.

Consistent with the long-term method for determining background noise levels described in Section 3 of the *NSW Industrial Noise Policy* (INP), (NSW Environment Protection Authority, 2000) and relevant requirements from Section 4 of *Procedure: Preparing an Operational Traffic and Construction Noise and Vibration Assessment* (POTCNVA), (Roads and Maritime, 2016); unattended measurements were carried out from 10th to 17th November (inclusive) using Type 1 Ngara noise logging device. Details from unattended monitoring are summarised below in Table 2-1.

Table 2-1 Unattended noise monitoring details

Monitoring location ID	Address	Noise logger ID	Dates deployed/ collected	Pre/post reference check noise levels vs. 94.0 dB(A)	Measurement position
N01	181 Reservoir Road, Blacktown. Logger was set up in the front yard of property	8780A4	10/11/2017 – 17/11/2017	94.0, 93.9	Free-field

Attended measurements were undertaken using an SVAN Type 1 sound level meter on 10th November after the noise logger was deployed. These measurements were undertaken to establish the background noise levels of residential receivers a couple of rows back from the road traffic. The attended noise monitoring at the logger location is also used for quality assurance purposes, to confirm that the ambient noise environment was not materially different from the nearest long-term monitoring data and to better understand the surrounding noise environment.

2.2.2 Post-processing

Noise results were post-processed to eliminate extraneous features and develop the data into the relevant metrics for assessment. The noise data was filtered to remove data affected by inclement weather conditions including precipitation and wind speeds greater than five m/s at an elevation of 1.5 metres. Data from the nearest Bureau of Meteorology (BoM) automatic weather station at North Parramatta were used to perform this filtering. Noting that the wind speed data that was collected at this station is at the standard instrument height of 10 metres, the method outlined in *Converting Bureau of Meteorology Wind Speed Data to local Wind Speeds at 1.5m Above Ground Level,* (Gowan, Karantonis and Rofail, 2004) was used to convert this information to equivalent wind speeds 1.5 metres above ground level.

Finally results were processed into the relevant metrics for assessment.

2.2.3 Operator attended noise measurement results

The results of the attended background noise monitoring undertaken on 10 November 2017 are presented in Table 2.2

Table 2.2 : Attended measured noise levels

Location	Date / time	Measured noise levels – dB(A)			Comment
		L_{Aeq}	L_{A90}	L_{A10}	
181 Reservoir Road (N01 – noise logger location)	10/11/2017 10:30 am – 10:45 am	64.4	53.7	66.6	Reservoir Road and GWH traffic: 52-72 dB(A) Birds: 58-62 dB(A) Dog barking: 73 dB(A) Neighbour activities (sanding and vacuuming): 61-76 dB(A)
	10/11/2017 10:45 am – 11:00 am	61.3	52.5	62.7	
181A Reservoir Road (N02)	10/11/2017 11:15 am – 11:30 am	50.3	44.8	51.4	Reservoir Road and GWH traffic: 49-56 dB(A) Birds: 51-69 dB(A) Insect: 73 dB(A) People talking: 49 dB(A)
	10/11/2017 11:30 am – 11:45 am	52.7	43.5	53.8	

The noise environment at the first attended noise monitoring location, i.e. 181 Reservoir Road (N01 – logger location) is primarily influenced by continuous traffic noise from the Reservoir Road and Great Western Highway.

At the second attended noise monitoring location (N02), the primary noise source is the distant traffic noise from Reservoir Road and Great Western Highway and local fauna (birds and insects).

The measured attended noise levels at 181 Reservoir Road (N01) as presented in Table 2.2 are generally consistent with the results of the unattended noise monitoring at the same location.

The difference in background noise levels, i.e. L_{A90} between the two monitoring locations is approximately 9 dB(A).

2.2.4 Unattended noise monitoring results

Noise monitoring metrics applicable for the assessment of construction noise assessment are presented for the noise logging location in Table 2-3 below.

It is noted that the term 'RBL' refers to the median value of monitored background noise levels measured over each period. 'L_{Aeq}' is the equivalent continuous sound level or energy-time average for the relevant period of monitoring.

Table 2-3 Long-term noise monitoring results

Location	Construction noise results dB(A)					
	Standard Hours (7:00-18:00)		Evening (18:00-22:00)		Night (22:00-7:00)	
	RBL	L_{eq}	RBL	L_{eq}	RBL	L_{eq}
181 Reservoir Road (front yard)	53.1	62.6	48.5	58.6	43.2	58.1

Based on the noise logger data and the results from the attended noise measurements, the background noise levels at residences a couple of rows away from the road traffic have been determined to be 44.1 dB(A) for the daytime period (i.e. standard hours), 39.5 dB(A) for the evening period and 34.2 dB(A) for the night-time period.

3. Criteria

3.1 Construction noise & vibration criteria

Noise and vibration impacts associated with Roads and Maritime construction projects are to be assessed and managed in accordance with guidance presented in the *Construction Noise and Vibration Guideline* (CNVG) supplemented with information presented in other policies including the *Interim Construction Noise Guideline* (ICNG), (DECC, 2009) and *Assessing Vibration: a technical guideline*, (DECC, February 2006).

3.1.1 Construction noise

The CNVG refers to the ICNG for the establishment of noise management levels (NMLs) during construction. NMLs are intended to assist with the management of noise impacts, rather than to present strict numeric noise criteria for construction activities.

The ICNG recommends establishing NMLs at receiver locations adjacent to the works, using information on the existing background noise level (measured using a descriptor known as the rating background level [RBL]) at these locations. Where the NML may be exceeded as a result of the proposed works and there is potential for adverse noise impacts to occur, appropriate management measures should be implemented.

Table 3-1 details the method for determining NMLs for residential receivers potentially affected by the proposed upgrade. Often works that may cause inconvenience within the community (e.g. traffic congestion) or safety concerns are done outside standard hours. NMLs during these periods are presented in the table for works 'Outside recommended standard hours'.

Table 3-1 Procedure for establishing construction NMLs at residential receivers, (ICNG, DECC 2009)

Time of day	Management level $L_{Aeq\ (15\ min)}$	How to apply
Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	Noise affected (RBL + 10 dB)	The noise affected level represents the point above which there may be some community reaction to noise. 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 the duration, as well as contact details.
	Highly noise affected (75 dB(A))	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. 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 2. If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise affected (RBL + 5 dB)	A strong justification would typically be required for works outside the recommended standard hours The proponent should apply all feasible and reasonable work practices to meet the noise affected level Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community For guidance on negotiating agreements see Section 7.2.2 of the ICNG (DECC, 2009).

It is noted that the ICNG refers to the method outlined in the INP for the purpose of determining RBLs to be used for the establishment of NMLs. The ICNG also provides external NMLs of 65 dB(A), 70 dB(A) and 75 dB(A) for active recreation areas, commercial premises and industrial premises respectively.

To develop NMLs from the noise data collected from each logger, the study area was broken into four Noise Catchment Areas (NCAs). Each NCA has a separate NML criterion, based on the data collected. NCA 3 consists of three receiver types – active recreation area, commercial buildings and industrial buildings. NCA 4 consists of two receiver types - commercial building and industrial building. Considering the background noise statistics presented in Table 2-3 and the guidance from the ICNG above in Table 3-1, NMLs have been established to manage noise impacts during construction, presented in Table 3-2.

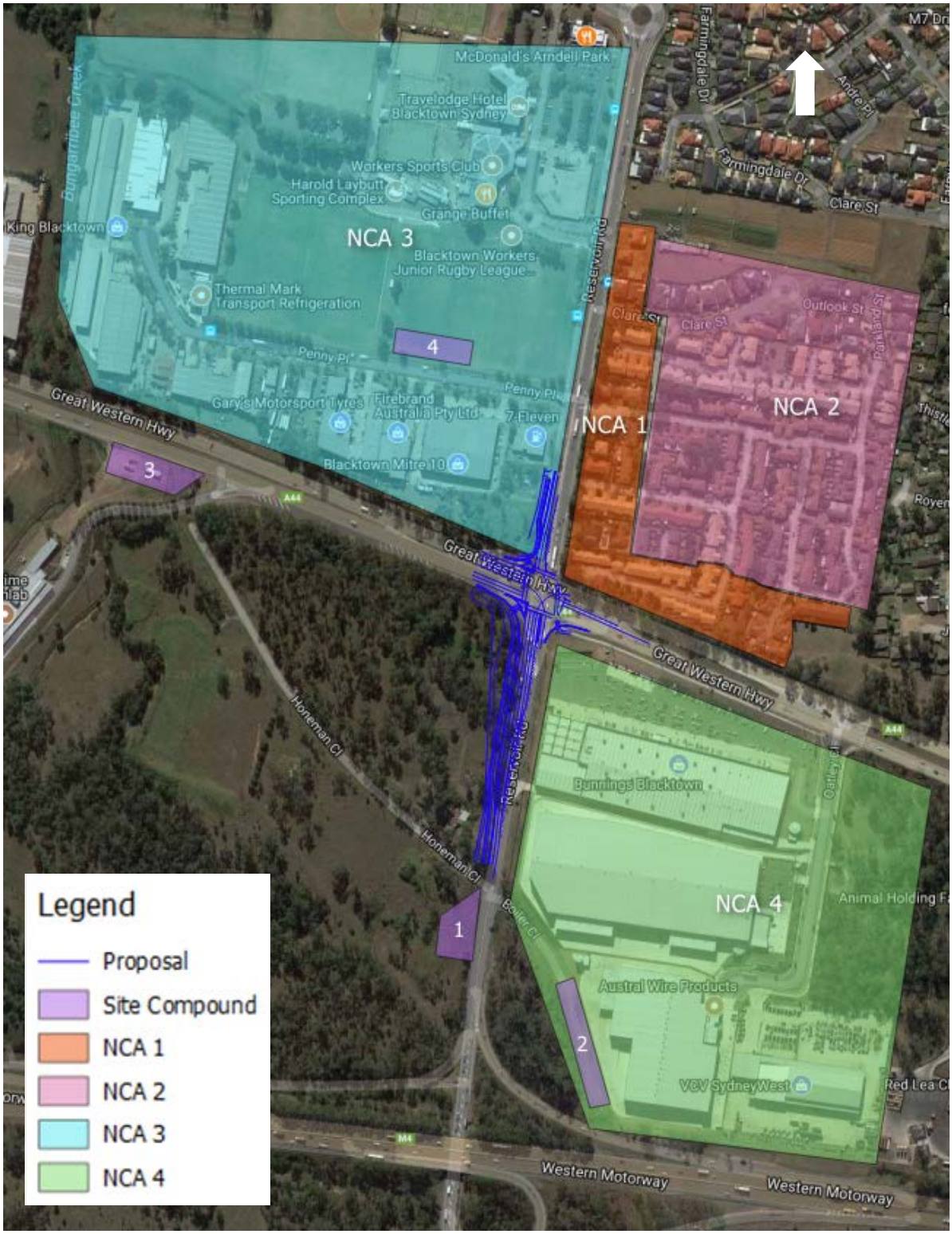


Figure 3-1 NCA Boundaries

Table 3-2 Construction noise management levels for noise sensitive receivers

Noise monitoring location	Noise management level (NML) $L_{eq\ 15\ minute}$ dB(A)			
	Standard hours of construction	Outside recommended standard hours of construction		
		Day	Evening	Night
NCA 1 (residential receivers only)	63	58	54	48
NCA 2 (residential receivers only)	54	49	45	39
N03 (non-residential receivers)	65 (active recreational area) 70 (commercial) 75 (industrial)	n/a	n/a	n/a
NCA4 (non-residential receivers)	70 (commercial) 75 (industrial)	n/a	n/a	n/a

3.1.2 Sleep disturbance

Noise impacts or events that can cause interruptions to sleeping patterns are considered separately to noise levels during works outside standard hours. The proposal is generally expected to be completed outside of standard hours of construction to minimise traffic disruption. As such, sleep disturbance impacts were considered as part of this assessment.

The ICNG does not provide a specific method for assessment of potential sleep disturbance noise impacts; and guidance on the acceptability of these events is taken from the *NSW Road Noise Policy* (RNP), (DECCW, 2011).

The RNP provides two criteria:

- Sleep disturbance screening criterion – used to identify situations where there is the potential for sleep disturbance
- Sleep disturbance awakening criterion – levels below which awakening is unlikely to occur.

The sleep disturbance screening criterion recommends that where the $L_{A1\ (1\ minute)}$ does not exceed the $L_{A90\ (15\ minute)}$ by 15 dB(A) or more, sleep disturbance impacts are likely to be maintained at an acceptable level. The $L_{A1,\ (1\ minute)}$ descriptor is meant to represent a maximum noise level when measured using a 'fast' time response.

The sleep disturbance awakening criterion is the threshold at which an awakening reaction is likely to occur. Research discussed in the RNP identified this threshold to be an internal bedroom noise level of around 50 to 55 dB(A).

Windows often allow the greatest amount of sound transmission from outside to inside across a building façade. Noting guidance presented in AS2436-2010, where bedrooms are ventilated by an opened window, a sleep disturbance awakening criterion measured outside the bedroom window of 60 to 65 dB(A) less the conversion from $L_{Aeq\ 15\ minute}$ to an $L_{A\ 1\ minute}$ (conservatively assumed to be 10 dB(A)) would generally apply (i.e. 55 dB(A)).

3.1.3 Construction vibration

Vibration arising from construction activities can result in impacts on human comfort or the damage of physical structures such as dwellings. These two outcomes have different criteria levels, with the effects of vibration on human comfort having a lower threshold.

Regarding human comfort, vibration arising from construction activities must comply with criteria presented in *Assessing Vibration: a technical guideline*, (DECC, February 2006) and *British Standard 6472-1: 2008 Guide to evaluation of human exposure to vibration in buildings Part 1: Vibration sources other than blasting* [BS 6472-1: 2008].

Section J4.4.3 of *Australian Standard AS2187.2 – 2006 Explosives – Storage and use Part 2: Use of explosives* provides frequency-dependent guide levels for cosmetic damage to structures arising from vibration. These levels are adopted from *British Standard BS7385: 1990 Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from groundbourne vibration* [BS7385-2:1993].

Section 7 of the CNVG recommends safe working distances for achieving human comfort (*Assessing Vibration: a technical guideline*, (DECC, February 2006) and cosmetic building damage (BS7385-2:1993) criteria for a range of different plant and equipment. These have been reproduced below.

Table 3-3 Recommended safe working distances for vibration-intensive plant and equipment, (CNVG, Roads and Maritime 2016)

Plant	Rating / description	Safe working distance (meters)	
		Cosmetic damage (BS7385-2: 1993)	Human response (DECC, 2006)
Vibratory Roller	<50 kN (typically 1-2 t) <100 kN (typically 2-4 t) <200 kN (typically 4-6 t) <300 kN (typically 7-13 t) >300 kN (typically 13-18 t) >300 kN (> 18 t)	5 metres 6 metres 12 metres 15 metres 20 metres 25 metres	15 m to 20 metres 20 metres 40 metres 100 metres 100 metres 100 metres
Small hydraulic hammer	300 kg – 5 to 12 t excavator	2 metres	7 metres
Medium hydraulic hammer	900 kg – 12 to 18t excavator	7 metres	23 metres
Large hydraulic hammer	1600 kg – 18 to 34 t excavator	22 metres	73 metres
Vibratory pile driver	Sheet piles	2 to 20 metres	20 metres
Pile boring	≤800 mm	2 metres (nominal)	4 metres
Jackhammer	Hand held	1 metres (nominal)	2 metres

3.1.4 Construction traffic

Application notes for the *NSW Road Noise Policy* (RNP), (DECCW, 2011) state the following (http://www.epa.nsw.gov.au/noise/roadnoiseappnotes.htm):

> *'…for existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level as a result of the development should be limited to 2 dB above that of the noise level without the development. This limit applies wherever the noise level without the development is within 2 dB of, or exceeds, the relevant day or night noise assessment criterion.'*

The CNVG notes that this guidance also applies to traffic noise associated with construction activities.

3.2 Operational noise criteria

Where a proposal has the potential to generate a new source of noise for residential receivers due to changes in road alignment or where a proposal would result in a change to the volume or mix of vehicles, an operational traffic noise assessment is undertaken in accordance with the *NSW Road Noise Policy* (RNP), (DECC, 2011). Where the changes of an existing road alignment are only minor, a less detailed assessment of traffic noise impacts is required.

In accordance with Section 6.6 of the *Roads and Maritime Noise Criteria Guideline* (NCG), (RMS, April 2015), the minor works criteria of noise levels not increasing by 2 dB(A) relative to existing noise levels at the worst affected receiver would apply. As such, the primary operational noise criteria considered for this assessment is whether the proposal would result in a traffic noise increase of more than 2 dB(A) at any nearby receiver.

4. Noise impact assessment

4.1 Construction

Prediction of construction noise levels at sensitive receivers was modelled using the SoundPLAN (Version 7.4) noise modelling software based on the Concawe prediction algorithm. This three-dimensional model accounts for noise source and receiver locations, ground and air absorption as well as any acoustic shielding provided by intervening topography and structures. Conservatively, it does not include any standard or project-specific mitigation measures. Proposed mitigation measures, and their acoustical benefits are detailed in Section 5.

4.1.1 Construction noise activities

Construction noise activities and proposed equipment are indicated in Table 4-1. The schedule of plant and equipment to be used would be confirmed with the final construction program. The equipment and plant outlined in Table 4-1 is indicative only based on preliminary information provided by the project team. As indicated by this information, construction work would be required outside of standard hours. As a conservative approach, it has been assumed that this applies to all construction stages. It is assumed that all equipment in Table 4-1 will be used during standard hours, out-of-hours day and out-of-hours evening periods (i.e. OOHW1), as well as out-of-hours night (i.e. OOHW2).

It is understood that there are four ancillary site options (as indicated in Figure 2-1 and Figure 3-1) proposed for this project though not all are anticipated to be utilised. For this assessment, site compound 4 has been assessed as this site is the closest to residential receivers and is therefore considered to be the worst case. The site compound has been assessed to operate concurrently with all construction stages.

Table 4-1 Construction stages and sound power levels used in the modelling of construction noise

Construction phase	Typical plant and equipment	Sound Power Level dB(A) $L_{Aeq(15min)}$
Mobilisation & Site Establishment	Truck (HIAB) Road Truck Scissor Lift Franna Crane Light Vehicles Hand Tools	103 108 98 98 88 95
Utility, Property and Service Adjustments	Excavator (tracked) 35t Dump Truck Franna Crane 20t Pneumatic Hammer* Concrete Saw* Vacuum Truck Backhoe Generator	110 110 98 115 115 109 103 101
Drainage Work	Backhoe Franna Crane 20t Excavator (tracked) 35t Concrete Truck Truck Compressor Vibratory Roller Road Truck	103 98 110 108 75 110 108

Construction phase	Typical plant and equipment	Sound Power Level dB(A) $L_{Aeq(15min)}$
Bulk Excavations and Earthworks	Bulldozer D9* Scraper Excavator (tracked) 35t Grader Dump truck Compactor Roller Water Cart	116 110 110 110 110 110 110 107
Pavement Works	Pavement Laying Machine Front End Loader Dump Truck Ashphalt Truck and Sprayer Concrete Truck Smooth Drum Roller Concrete Saw*	114 112 110 106 108 107 115
Finishing Works	Road truck Scissor Lift Franna Crane 20t Line Marking Machine	108 98 98 108
Concurrently operating Ancillary Facility		
Ancillary Facility (assumed to operate 24/7)	Front End Loader Road Truck Compressor Welding Equipment Light Vehicles Generator	112 108 109 105 88 101

4.2 Prediction of construction noise impacts

4.2.1 Construction noise impacts at nearby residential receivers

Detailed predictions of noise levels from construction activities at individual residences are presented in Appendix B.

An overview of the number of residential receivers predicted to be impacted from works undertaken during standard hours is presented in Table 4-2 and during out-of-hours works in Table 4-3, Table 4-4 and Table 4-5 for day (OOHW1), evening (OOHW1) and night-time (OOHW2) respectively. The number of noise exceedances in relation to sleep disturbance, as outlined in Section 3.1.2 is presented in Table 4-6. These tables indicate the likely worst case construction noise levels predicted for the least and most affected residences and also indicate the count of residences at which the NML is exceeded. Counts are of impacted residential buildings.

These tables only indicate exceedances at residential receivers, as the determined NML only applies to this receiver type. As NCAs 3 and 4 do not contain any residential receivers, it has not been included in these tables. Table 4-7 presents impacts from construction works on non-residential receivers within NCAs 3 and 4.

Table 4-2 Review of noise exceedances during standard hours

NCA	NML (Standard Hours)	Construction Stage		Mobilisation & Site Establishment	Utility, Property & Services Adjustment	Drainage Works	Bulk Excavation & Earthworks	Pavement Works	Finishing Works
1	63	Range of predicted noise levels (dB(A))		36-74	43-84	39-79	43-84	43-84	36-75
		Number of Residences	Complying	32	19	26	19	19	30
			0-10 dB(A) above NML	28	13	21	13	13	30
			10-20 dB(A) above NML	3	28	16	28	28	3
			20+ dB(A) above NML	0	3	0	3	3	0
		Highly noise affected	≥75 dB(A)	0	26	7	26	26	1
2	54	Range of predicted noise levels (dB(A))		31-61	34-66	37-66	36-69	36-69	32-62
		Number of Residences	Complying	138	132	132	128	128	138
			0-10 dB(A) above NML	7	10	10	12	12	7
			10-20 dB(A) above NML	0	3	3	5	5	0
			20+ dB(A) above NML	0	0	0	0	0	0
		Highly noise affected	≥75 dB(A)	0	0	0	0	0	0

Table 4-3 Review of noise exceedances during day out-of-hours (OOHW1)

NCA	NML (OOHW)	Construction Stage		Mobilisation & Site Establishment	Utility, Property & Services Adjustment	Drainage Works	Bulk Excavation & Earthworks	Pavement Works	Finishing Works
1	58	Range of predicted noise levels (dB(A))		36-74	43-84	39-79	43-84	43-84	36-75
		Number of Residences	Complying	26	12	18	12	12	26
			0-5 dB(A) above NML	6	7	8	7	7	4
			5-15 dB(A) above NML	28	13	21	13	13	30
			15-25 dB(A) above NML	3	28	16	28	28	3
			≥25 dB(A)	0	3	0	3	3	0
		Highly noise affected	≥75 dB(A)	0	26	7	26	26	1

NCA	NML (OOHW)	Construction Stage		Mobilisation & Site Establishment	Utility, Property & Services Adjustment	Drainage Works	Bulk Excavation & Earthworks	Pavement Works	Finishing Works
2	49	Range of predicted noise levels (dB(A))		31-61	34-66	37-66	36-69	36-69	32-62
		Number of Residences	Complying	127	115	115	97	97	127
			0-5 dB(A) above NML	11	17	17	31	31	11
			5-15 dB(A) above NML	7	10	10	12	12	7
			15-25 dB(A) above NML	0	3	3	5	5	0
			≥25 dB(A)	0	0	0	0	0	0
		Highly noise affected	≥75 dB(A)	0	0	0	0	0	0

Table 4-4 Review of noise exceedances during evening, out-of-hours (OOHW1)

NCA	NML (OOHW1)	Construction Stage		Mobilisation & Site Establishment	Utility, Property & Services Adjustment	Drainage Works	Bulk Excavation & Earthworks	Pavement Works	Finishing Works
1	54	Range of predicted noise levels (dB(A))		36-74	43-84	39-79	43-84	43-84	36-75
		Number of Residences	Complying	18	8	11	8	8	17
			0-5 dB(A) above NML	8	6	11	6	6	9
			5-15 dB(A) above NML	27	13	13	13	13	21
			15-25 dB(A) above NML	10	26	28	26	26	16
			≥25 dB(A)	0	10	0	10	10	0
		Highly noise affected	≥75 dB(A)	0	26	7	26	26	1
2	45	Range of predicted noise levels (dB(A))		31-61	34-66	37-66	36-69	36-69	32-62
		Number of Residences	Complying	107	84	84	59	59	105
			0-5 dB(A) above NML	26	36	36	42	42	27
			5-15 dB(A) above NML	10	18	18	35	35	10
			15-25 dB(A) above NML	2	7	7	9	9	3
			≥25 dB(A)	0	0	0	0	0	0
		Highly noise affected	≥75 dB(A)	0	0	0	0	0	0

Table 4-5 Review of noise exceedances during night, out-of-hours (OOHW2)

NCA	NML (OOHW2)	Construction Stage		Mobilisation & Site Establishment	Utility, Property & Services Adjustment	Drainage Works	Bulk Excavation & Earthworks	Pavement Works	Finishing Works
1	48	Range of predicted noise levels (dB(A))		36-74	43-84	39-79	43-84	43-84	36-75
		Number of Residences	Complying	7	2	4	2	2	6
			0-5 dB(A) above NML	9	4	7	4	4	8
			5-15 dB(A) above NML	16	13	15	13	13	16
			15-25 dB(A) above NML	28	13	21	13	13	30
			≥25 dB(A)	3	31	16	31	31	3
		Highly noise affected	≥75 dB(A)	0	26	7	26	26	1
2	39	Range of predicted noise levels (dB(A))		31-61	36-69	34-66	36-69	36-69	32-62
		Number of Residences	Complying	47	9	23	9	9	42
			0-5 dB(A) above NML	50	35	48	35	35	47
			5-15 dB(A) above NML	41	84	61	84	84	49
			15-25 dB(A) above NML	7	12	10	12	12	7
			≥25 dB(A)	0	5	3	5	5	0
		Highly noise affected	≥75 dB(A)	0	0	0	0	0	0

Table 4-6 Review of noise exceedances against the sleep disturbance criterion

NCA	NML (OOHW2)	Construction Stage		Mobilisation & Site Establishment	Utility, Property & Services Adjustment	Drainage Works	Bulk Excavation & Earthworks	Pavement Works	Finishing Works
1	58	Range of predicted noise levels (dB(A))		37-78	45-86	43-84	45-86	45-86	37-78
		Number of Residences	Complying	22	9	14	9	9	22
			0-5 dB(A) above NML	5	5	7	5	5	5
			5-15 dB(A) above NML	26	14	11	14	14	26
			15-25 dB(A) above NML	10	26	28	26	26	10
			≥25 dB(A)	0	6	3	6	6	0

NCA	NML (OOHW2)	Construction Stage		Mobilisation & Site Establishment	Utility, Property & Services Adjustment	Drainage Works	Bulk Excavation & Earthworks	Pavement Works	Finishing Works
2	49	Range of predicted noise levels (dB(A))		30-65	38-71	36-71	38-71	38-71	30-65
		Number of Residences	Complying	125	84	93	84	84	125
			0-5 dB(A) above NML	7	34	18	34	34	7
			5-15 dB(A) above NML	10	20	25	20	20	10
			15-25 dB(A) above NML	3	7	9	7	7	3
			≥25 dB(A)	0	0	0	0	0	0

The review of construction noise exceedances as presented in Table 4-2 to Table 4-6 are discussed below:

Standard hours construction works

In NCA1, it is predicted that:

- *Mobilisation & Site Establishment* – will comply with the standard hours NML at 32 residential receivers, will be Clearly Audible at 28 residential receivers and will be Moderately Intrusive at three residential receivers.
- *Utility, Property & Services Adjustment*, *Bulk Excavation & Earthworks* and *Pavement Works* – will comply with the standard hours NML at 19 residential receivers, will be Clearly Audible at 13 residential receivers, will be Moderately Intrusive at 28 residential receivers and will be Highly Intrusive at three residential receivers.
- *Drainage Works* – will comply with the standard hours NML at 26 residential receivers, will be Clearly Audible at 21 residential receivers and will be Moderately Intrusive at 16 residential receivers.
- *Finishing Works* – will comply with the standard hours NML at 30 residential receivers, will be Clearly Audible at 30 residential receivers and will be Moderately Intrusive at three residential receivers.
- 26 residential receivers will be Highly Noise Affected during *Utility, Property and Service Adjustment, Bulk Excavation & Earthworks* and *Pavement Works*, seven receivers will be Highly Noise Affected during *Drainage Works*, and one receiver will be Highly Noise Affected by *Finishing Works*.

In NCA2, it is predicted that:

- *Mobilisation & Site Establishment* and *Finishing Works* – will comply with the standard hours NML at 138 residential receivers and will be Clearly Audible at seven residential receivers.
- *Utility, Property & Services Adjustment* and *Drainage Works* – will comply with the standard hours NML at 132 residential receivers, will be Clearly Audible at ten residential receivers and will be Moderately Intrusive at three residential receivers.
- *Bulk Excavation & Earthworks* and *Pavement Works* – will comply with the standard hours NML at 128 residential receivers, will be Clearly Audible at 12 residential receivers and will be Moderately Intrusive at five residential receivers.
- No receiver will be Highly Noise Affected during any of the construction stage.

Day out-of-hours construction works

In NCA1, it is predicted that:

- *Mobilisation & Site Establishment* – will comply with the standard hours NML at 26 residential receivers, will be Noticeable at six residential receivers, will be Clearly Audible at 28 residential receivers and will be Moderately Intrusive at three residential receivers.
- *Utility, Property & Services Adjustment*, *Bulk Excavation & Earthworks* and *Pavement Works* – will comply with the standard hours NML at 12 residential receivers, will be Noticeable at seven residential receivers, will be Clearly Audible at 13 residential receivers, will be Moderately Intrusive at 28 residential receivers and will be Highly Intrusive at three residential receivers.
- *Drainage Works* – will comply with the standard hours NML at 18 residential receivers, will be Noticeable at eight residential receivers, will be Clearly Audible at 21 residential receivers and will be Moderately Intrusive at 16 residential receivers.
- *Finishing Works* – will comply with the standard hours NML at 26 residential receivers, will be Noticeable at four residential receivers, will be Clearly Audible at 30 residential receivers and will be Moderately Intrusive at three residential receivers.
- 26 residential receivers will be Highly Noise Affected during *Utility, Property and Service Adjustment, Bulk Excavation & Earthworks* and *Pavement Works*, seven receivers will be Highly Noise Affected during *Drainage Works*, and one receiver will be Highly Noise Affected by *Finishing Works*.

In NCA2, it is predicted that:

- *Mobilisation & Site Establishment* and *Finishing Works* – will comply with the standard hours NML at 127 residential receivers, will be Noticeable at 11 residential receivers and will be Clearly Audible at seven residential receivers.
- *Utility, Property & Services Adjustment* and *Drainage Works* – will comply with the standard hours NML at 115 residential receivers, will be Noticeable at 17 residential receivers, will be Clearly Audible at ten residential receivers and will be Moderately Intrusive at three residential receivers.
- *Bulk Excavation & Earthworks* and *Pavement Works* – will comply with the standard hours NML at 97 residential receivers, will be Noticeable at 31 residential receivers, will be Clearly Audible at 12 residential receivers and will be Moderately Intrusive at five residential receivers.
- No receiver will be Highly Noise Affected during any of the construction stage.

Evening out-of-hours construction works

In NCA1, it is predicted that:

- *Mobilisation & Site Establishment* – will comply with the standard hours NML at 18 residential receivers, will be Noticeable at eight residential receivers, will be Clearly Audible at 27 residential receivers and will be Moderately Intrusive at ten residential receivers.
- *Utility, Property & Services Adjustment*, *Bulk Excavation & Earthworks* and *Pavement Works* – will comply with the standard hours NML at eight residential receivers, will be Noticeable at six residential receivers, will be Clearly Audible at 13 residential receivers, will be Moderately Intrusive at 26 residential receivers and will be Highly Intrusive at ten residential receivers.
- *Drainage Works* – will comply with the standard hours NML at 11 residential receivers, will be Noticeable at 11 residential receivers, will be Clearly Audible at 13 residential receivers and will be Moderately Intrusive at 28 residential receivers.
- *Finishing Works* – will comply with the standard hours NML at 17 residential receivers, will be Noticeable at nine residential receivers, will be Clearly Audible at 21 residential receivers and will be Moderately Intrusive at 16 residential receivers.
- 26 residential receivers will be Highly Noise Affected during *Utility, Property and Service Adjustment, Bulk Excavation & Earthworks* and *Pavement Works*, seven receivers will be Highly Noise Affected during *Drainage Works*, and one receiver will be Highly Noise Affected by *Finishing Works*.

In NCA2, it is predicted that:

- *Mobilisation & Site Establishment* and *Finishing Works* – will comply with the standard hours NML at 107 residential receivers, will be Noticeable at 26 residential receivers, will be Clearly Audible at ten residential receivers and will be Moderately Intrusive at two residential receivers.
- *Utility, Property & Services Adjustment* and *Drainage Works* – will comply with the standard hours NML at 84 residential receivers, will be Noticeable at 36 residential receivers, will be Clearly Audible at 18 residential receivers and will be Moderately Intrusive at seven residential receivers.
- *Bulk Excavation & Earthworks* and *Pavement Works* – will comply with the standard hours NML at 59 residential receivers, will be Noticeable at 42 residential receivers, will be Clearly Audible at 35 residential receivers and will be Moderately Intrusive at nine residential receivers.
- No receiver will be Highly Noise Affected during any of the construction stage.

Night out-of-hours construction works

In NCA1, it is predicted that:

- *Mobilisation & Site Establishment* – will comply with the standard hours NML at seven residential receivers, will be Noticeable at nine residential receivers, will be Clearly Audible at 16 residential receivers, will be Moderately Intrusive at 28 residential receivers and will be Highly Intrusive at three residential receivers.
- *Drainage Works* – will comply with the standard hours NML at four residential receivers, will be Noticeable at seven residential receivers, will be Clearly Audible at 15 residential receivers, will be Moderately Intrusive at 21 residential receivers and will be Highly Intrusive at 16 residential receivers.
- *Utility, Property & Services Adjustment*, *Bulk Excavation & Earthworks* and *Pavement Works* – will comply with the standard hours NML at three residential receivers, will be Noticeable at five residential receivers, will be Clearly Audible at 14 residential receivers, will be Moderately Intrusive at 15 residential receivers and will be Highly Intrusive at 26 residential receivers.
- *Finishing Works* – will comply with the standard hours NML at six residential receivers, will be Noticeable at eight residential receivers, will be Clearly Audible at 16 residential receivers, will be Moderately Intrusive at 30 residential receivers and will be Highly Intrusive at three residential receivers.
- 26 residential receivers will be *Utility, Property & Services Adjustment*, Highly Noise Affected during *Bulk Excavation & Earthworks* and *Pavement Works*, seven receivers will be Highly Noise Affected during *Drainage Works*, and one receiver will be Highly Noise Affected by *Finishing Works*.

In NCA2, it is predicted that:

- *Mobilisation & Site Establishment* – will comply with the standard hours NML at 47 residential receivers, will be Noticeable at 50 residential receivers, will be Clearly Audible at 41 residential receivers and will be Moderately Intrusive at seven residential receivers.
- *Drainage Works* – will comply with the standard hours NML at 23 residential receivers, will be Noticeable at 48 residential receivers, will be Clearly Audible at 61 residential receivers, will be Moderately Intrusive at ten residential receivers and will be Highly Intrusive at three residential receivers.
- *Utility, Property & Services Adjustment*, *Bulk Excavation & Earthworks* and *Pavement Works* – will comply with the standard hours NML at nine residential receivers, will be Noticeable at 35 residential receivers, will be Clearly Audible at 84 residential receivers, will be Moderately Intrusive at 12 residential receivers and will be Highly Intrusive at five residential receivers.
- No receiver will be Highly Noise Affected during any of the construction stage.

NCA	NML (OOHW2)	Construction Stage		Mobilisation & Site Establishment	Utility, Property & Services Adjustment	Drainage Works	Bulk Excavation & Earthworks	Pavement Works	Finishing Works
1	58	Range of predicted noise levels (dB(A))		37-78	45-86	43-84	45-86	45-86	37-78
		Number of Residences	Complying	22	9	14	9	9	22
			0-5 dB(A) above NML	5	5	7	5	5	5
			5-15 dB(A) above NML	26	14	11	14	14	26
			15-25 dB(A) above NML	10	26	28	26	26	10
			≥25 dB(A)	0	6	3	6	6	0
2	49	Range of predicted noise levels (dB(A))		30-65	38-71	36-71	38-71	38-71	30-65
		Number of Residences	Complying	125	84	93	84	84	125
			0-5 dB(A) above NML	7	34	18	34	34	7
			5-15 dB(A) above NML	10	20	25	20	20	10
			15-25 dB(A) above NML	3	7	9	7	7	3
			≥25 dB(A)	0	0	0	0	0	0

Sleep disturbance assessment

In NCA1, it is predicted that:

- *Mobilisation & Site Establishment* and *Finishing Works* – will comply with the sleep disturbance criterion at 22 residential receivers and will exceed the sleep disturbance criterion at 41 residential receivers.
- *Drainage Works* – will comply with the sleep disturbance criterion at 14 residential receivers and will exceed the sleep disturbance criterion at 49 residential receivers.
- *Utility, Property &* Services, *Bulk Excavation & Earthworks* and *Pavement Works* – will comply with the sleep disturbance criterion at 9 residential receivers and will exceed the sleep disturbance criterion at 51 residential receivers.

In NCA2, it is predicted that:

- *Mobilisation & Site Establishment* and *Finishing Works* – will comply with the sleep disturbance criterion at 125 residential receivers and will exceed the sleep disturbance criterion at 20 residential receivers.
- *Drainage Works* – will comply with the sleep disturbance criterion at 93 residential receivers and will exceed the sleep disturbance criterion at 52 residential receivers.
- *Utility, Property &* Services, *Bulk Excavation & Earthworks* and *Pavement Works* – will comply with the sleep disturbance criterion at 84 residential receivers and will exceed the sleep disturbance criterion at 61 residential receivers.

Noise contours for worst case construction scenario

Noise contours for the loudest standard hours, day out-of-hours and evening out-of-hours construction works – *Bulk Excavation & Earthworks* (in all three cases, including noise contributed from ancillary compounds) - are presented in Appendix C..

4.2.2 Construction noise impacts at non-residential sensitive receivers

Table 4-7 presents impacts from construction works on non-residential receivers in the study area. The commercial receivers at 180 Reservoir Road and 183 Reservoir Road, industrial premises at 4 Oatley Close and the active recreation area at Arndell Park being impacted above the NML during most construction stages.

Table 4-7 Predicted Noise Impacts on Non-Residential receivers (standard hours only)

Building ID/NCA	Address	Usage	NML	Mobilisation and Site Establishment	Utility, Property, Service Adjustments	Drainage Work	Bulk Excavation and Earthworks	Pavement Works	Finishing Works
NCA03-1	180 Reservoir Road	Commercial	70	70	80	75	80	80	71
NCA03-2	3 Penny Lane	Commercial	70	65	73	69	73	73	66
NCA03-3	9 Penny Lane	Commercial	70	66	69	67	69	69	66
NCA03-4	11 Penny Lane	Industrial	75	66	68	66	68	68	66
NCA03-5	13 Penny Lane	Industrial	75	61	64	62	64	64	61
NCA03-6	15 Penny Lane	Industrial	75	57	58	57	58	58	57
NCA03-7	17 Penny Lane	Industrial	75	54	55	54	55	55	54
NCA03-8	19 Penny Lane	Industrial	75	53	57	54	57	57	53
NCA03-9	21 Penny Lane	Industrial	75	45	54	49	54	54	46
NCA03-10	23 Penny Lane	Industrial	75	50	55	52	55	55	50
NCA03-11	25 Penny Lane	Industrial	75	51	54	52	54	54	51
NCA03-12	27 Penny Lane	Industrial	75	47	52	49	52	52	47
NCA03-13	29 Penny Lane (south building)	Industrial	75	32	37	33	37	37	32
NCA03-14	26 Penny Lane	Industrial	75	44	47	45	47	47	44
NCA03-15	24 Penny Lane	Industrial	75	43	49	45	49	49	43
NCA03-16	31 Penny Lane	Industrial	75	41	49	45	49	49	42
NCA03-17	29 Penny Lane (south building)	Industrial	75	39	47	43	47	47	39
NCA03-19	170 Reservoir Road (Blacktown Worker Club)	Commercial	70	55	60	57	60	60	56
NCA03-20	166 Reservoir Road (Travelodge Hotel Blacktown)	Commercial	70	44	54	49	54	54	45
NCA04-1	183 Reservoir Road Bunnings Blacktown	Commercial	70	71	81	76	81	81	72
NCA04-2	4 Oatley Close	Industrial	75	70	80	75	80	80	71
NCA03-21	170 Reservoir Road	Active Recreation Area	65	50-75	53-75	51-75	53-75	53-75	50-75

NOTE: NCA03-18 is a multi-storey car park. Therefore, the noise impacts are not included in the table above.

4.2.3 Construction vibration

It is understood that the vibration-intensive equipment that may be used during the proposal includes compaction equipment such as a vibratory roller and pneumatic hammer such as a hydraulic hammer. Relevant recommended safe setback distances to maintain building cosmetic and human comfort criteria for these types of plant are reproduced below in Table 4-8.

Table 4-8 Recommended safe setback distances for relevant vibration-generating plant

Plant	Rating / description	Safe working distance (meters)	
		Cosmetic damage (BS7385-2: 1993)	Human response (DECC, 2006)
Vibratory Roller	<50 kN (typically 1-2 t) <100 kN (typically 2-4 t) <200 kN (typically 4-6 t) <300 kN (typically 7-13 t) >300 kN (typically 13-18 t) >300 kN (> 18 t)	5 metres 6 metres 12 metres 15 metres 20 metres 25 metres	15 metres to 20 metres 20 metres 40 metres 100 metres 100 metres 100 metres
Small hydraulic hammer	300 kg – 5 to 12 t excavator	2 metres	7 metres
Medium hydraulic hammer	900 kg – 12 to 18t excavator	7 metres	23 metres
Large hydraulic hammer	1600 kg – 18 to 34 t excavator	22 metres	73 metres

The safe working distances presented in Table 4-8 are indicative only and will vary depending on the particular item of plant and local geotechnical conditions. They apply to typical buildings under typical geotechnical conditions.

The separation distances between the proposed works and the nearest residential buildings are at least approximately 25 metres

Cosmetic Damage Assessment

The separation distance(s) between the proposed works and the nearest receivers will typically be sufficient to ensure that the nearby buildings are unlikely to fall within the safe working distances with regard to ‘Cosmetic Damage’ for most of the proposed construction equipment. Based on the separation distance between the proposed works and nearest residential buildings, there will be no restriction to the size of vibratory roller and hydraulic hammer that can be used to ensure construction vibration is within vibration limits for cosmetic damage.

Human Comfort Vibration Assessment

In relation to human comfort (response), the safe working distances in Table 4-8 relate to continuous vibration and apply to residential receivers. For most construction activities, vibration emissions are intermittent in nature and for this reason, higher vibration levels, occurring over shorter periods are permitted (refer British Standard BS 6472 1).

Based on the separation distance between the proposed works and nearest residential buildings, it is recommended that vibratory roller 4 tonnes or less and small or medium hydraulic hammer be used to ensure construction vibration is within vibration limits for human comfort. To ensure that vibration is not perceptible at nearest receivers, small to medium sized vibration intensive equipment should be used when construction activities are 25 metres or closer to any residential building.

4.2.4 Construction traffic

The *Construction Road Traffic Noise Estimator component* of the Roads and Maritime Construction Noise Estimator was utilised to assess potential impacts arising from construction traffic. Existing traffic inputs were added as below with volumes extracted from the existing traffic volumes provided by Roads and Maritime for Reservoir Road, and additional traffic generated during construction was estimated based on the anticipated workforce on a per hour basis. Based on these inputs it was found that additional noise arising from construction traffic are unlikely to result in changes of more than 2 dB(A) above existing noise levels.

Transport Roads & Maritime Services

Construction Road Traffic Noise Estimator

Please input information into yellow cells
Please pick from drop-down list in orange cells

Ground type	Developed settlements (urban and suburban areas)
Road surface	DGA
Road type	Freeway/arterial/sub-arterial road

Note that a road is new if a road's functional class changes during construction. For example, rerouting traffic from an arterial road temporarily to a collector road changes the functional class of the collector road for the duration of the temporary reroute.

	Day	Night
Noise criteria (residences)	60	55
Existing speed	60	60
Speed during construction	60	60

	Day (7am to 10pm)		Night (10pm to 7am)		Worst Case 1-hour Day		Worst Case 1-hour Night	
Existing traffic	Light vehicles	Heavy vehicles	Light vehicles	Heavy vehicles	Light vehicles	Heavy vehicles	Light vehicles	Heavy vehicles
Direction (1)	953	100	1276	61	1080	120	180	20
Direction (2)	940	57	1008	47	1080	120	180	20
Additional traffic								
Direction (1)	10	5	10	5	10	5	5	2
Direction (2)	10	5	10	5	10	5	5	2

	Day	Night
Change in noise levels (dBA)	0.1	0.1
Mitigation level (dBA)	60	55
Is the change in noise level greater than 2.0 dBA?	No	No
Require consideration of additional mitigation measures?	No	No
Mitigation distance (m)		

To assess noise impacts from construction traffic or a temporary reroute due to a road closure or both an initial screening test should be undertaken by evaluating whether noise levels will increase by more than 2dB(A). Where increases are 2dBA or less then no further assessment is required. Where noise levels increase by more than 2dBA (2.1dBA) and noise levels exceed the controlling criterion then the receiver qualifies for consideration of noise mitigation under the Noise Mitigation Guideline. [note: the assessment methodology is similar to minor works so in any instance the only trigger for noise mitigation under the NMG shall be due to noise level increase]

Mitigation Measures

Management of construction related traffic or traffic reroutes noise should as a minimum include the following controls:
- Scheduling and routing of vehicle movements
- Speed of vehicles
- Driver behaviour and avoidance of the use of engine compression brakes
- Ensuring vehicles are adequately silenced before allowing them to access the site

Where noise impacts are greater than one year then consideration should be given to the following measures where feasible and reasonable:
- temporary noise barriers
- at-receiver noise mitigation

Feasible and reasonable considerations should also include:
- time of day of the noise increase and exceedance of criteria
- time of use of affected receivers
- how many decibels the noise levels are to increase
- how long the mitigation will provide benefit to the receiver during the project

Calculating noise level at the receiver

Distance to receiver (m)	
Direction (1)	25
Direction (2)	25

	Day	Night
Predicted noise levels (dBA) @ 1m from the façade	57.4	59.6

Note that noise reports usually present noise levels rounded to the nearest integer and differences between two noise levels rounded to a single decimal

Figure 4-1 Construction road traffic noise assessment – Reservoir Road (north of Great Western Highway)

4.3 Operational noise assessment

To determine whether noise levels are likely to increase at nearby receivers by 2 dB(A) or more as a result of the proposal, operational noise was assessed by developing a project specific 3D noise prediction model.

4.3.1 Traffic noise prediction modelling

Noise modelling was undertaken using SoundPLAN (version 7.4) noise modelling software. SoundPLAN is recognised and accepted by both the RMS and the EPA.

The traffic noise prediction model adopted by SoundPLAN is based on a method developed by the United Kingdom of Environment entitled "*Calculation of Road Traffic Noise"* (CoRTN), (UK Department of Transport, 1988). This method has been adapted to Australian conditions and extensively tested by the Australian Road Research Board.

The most significant factors in determining the level of noise received from a road are the receiver's distance from the road, shielding, ground absorption, the type and volume of vehicles, vehicles speeds and the road surface type. The road and traffic parameters used and values adopted in the noise modelling are presented in Table 4-9 below.

Table 4-9 : Operational noise modelling parameters

Parameter	Input data
Façade corrections	Standard façade correction +2.5 dB(A) Australian Road Research Board corrections for Australian conditions: • -0.7 dB(A) correction to account for free-field condition • -1.7 dB(A) correction to account for at facade condition
Traffic speeds	Existing posted speed: • 80 km/hr for Great Western Highway; and • 60 km/hr for Reservoir Road
Buildings	• Footprints taken from aerial photography • Typical building heights have been estimated from Google Street-view and site inspections as follows: underfloor 0 m, per floor 3 m, pitched roof 2.5 m • Number of floors taken from Google Street-view and site inspections
Terrain	2 metres ground contours from Department of Lands and future road design supplied by client.
Road surfaces / corrections	Unless otherwise stated, all roads are assumed to be Dense Graded Asphalt (0dB(A) correction)
Congestion / intersections	All traffic is assumed to be free flowing (i.e. no corrections have been applied at intersection)
Ground surface / absorption	Dense residential areas and industrial areas: 50% ground factor Open grass areas and spares residential areas: 75% ground factor
Source heights / corrections	Traffic has been divided into the following source heights and energy levels: • Car tyres / 0.5 m / 100% • Truck tyres / 0.5 m / 25% • Truck engines / 1.5 m / 60% • Truck exhaust / 3.6 m / 15%
Receiver heights	Ground floor receivers have been placed at an elevation of 1.5 m and first floor receivers at an elevation of 4.5 m.
LA10 : LAeq conversion	LA10 to LAeq conversion has been assumed to be -3 dB(A) at all receivers.

4.3.2 Traffic flow used in noise model

The project is expected to be completed by 2020, and the future total traffic volumes for Great Western Highway and Reservoir Road used in the noise model were supplied by the client.

As the works is considered to be a minor upgrade, the difference in future volumes and compositions for “build” and “no build” scenarios are expected to be the same.

The future 15-hour and nine-hour volumes and compositions used in the noise model are presented in Table 4-10 and Table 4-11.

Table 4-10: Future 2020 traffic volumes and composition

Road name	Traffic direction	7am – 10pm (15-hour)		10pm – 7am (9-hour)	
		Average total hourly vehicles	% Heavy vehicles	Average total hourly vehicles	% Heavy vehicles
Great Western Highway (east of Reservoir Road)	Eastbound	2,190	6	1,240	3
	Westbound	1,418	7	2,519	3
Great Western Highway (west of Reservoir Road)	Eastbound	2,326	8	1,762	4
	Westbound	1,115	7	1,832	6
Reservoir Road (north of GWH)	Northbound	1,053	10	1,337	5
	Southbound	997	6	1,055	4
Reservoir Road (south of GWH)	Northbound	1,116	12	1,077	9
	Southbound	1,115	15	2,004	5

Table 4-11: Future 2030 traffic volumes and composition

Road name	Traffic direction	7am – 10pm (15-hour)		10pm – 7am (9-hour)	
		Average total hourly vehicles	% Heavy vehicles	Average total hourly vehicles	% Heavy vehicles
Great Western Highway (east of Reservoir Road)	Eastbound	2,383	6	1,311	3
	Westbound	1,503	7	2,645	3
Great Western Highway (west of Reservoir Road)	Eastbound	2,559	8	1,850	4
	Westbound	1,178	7	1,932	5
Reservoir Road (north of GWH)	Northbound	1,116	9	1,403	5
	Southbound	1,046	6	1,160	4
Reservoir Road (south of GWH)	Northbound	1,172	12	1,131	9
	Southbound	1,602	11	2,138	5

4.3.3 Traffic noise modelling results

Operational noise impacts were predicted at the nearest first row of noise sensitive receiver properties nearest to the project. The sensitive receiver properties included in the noise model are presented in Figure 2-1. The predicted traffic noise levels for the 2020 and 2030 “build” and “no build” scenarios are presented in Appendix D. Due to most of residential property not have a street address, an identification number has been allocated to each residential building for the purpose of this assessment. The figure in Appendix E shows the identification

number of each residential receiver and this figure should be viewed in conjunction with the results on Appendix C and Appendix D.

The predicted noise levels presented in Appendix D shows a minor increase of up to 0.3 dB(A) and in some cases there is a decrease in traffic noise of up to -0.1 dB(A) for the worst affected residential receivers, which is well within the 2 dB(A) increase criteria.

Given these findings it was concluded that the proposal was unlikely to result in road noise levels increasing by more than 2 dB(A) relative to existing road operations at surrounding receivers and that no specific operational mitigation measures would be necessary.

5. Safeguards and Management Measures

5.1 Construction noise

5.1.1 Standard noise mitigation measures

The CNVG outlines standard mitigation measures that should be incorporated by default in all construction projects. Those most relevant to the construction of the project are listed below. A Construction Noise and Vibration Management Plan (CNVMP) would be prepared prior to commencement of construction. The CNVMP would identify the main sources of noise impact, describe the measures to be taken to minimise the risk of specific adverse impacts, provide procedures for community engagement, address complaints and monitor noise impacts throughout the duration of the project.

The CNVMP is to demonstrate consideration of the following:

- Identify opportunities for works which could be completed during standard hours (subject to ROL and safety considerations) e.g. Compound setup
- Selecting quieter plant and equipment
- Erecting temporary acoustic hoarding to reduce noise from stationary noise sources, where practical
- Maximising offset distances between receivers and noisy plant or activities
- Orientating plant and processes away from residences
- Planning any out-of-hours works so that noisier works are carried out in the earlier part of the evening or night time
- Identify opportunities to restrict heavy vehicle movements, heavy deliveries and loading and unloading processes to daytime periods and to areas well away from receivers, where practical
- Regularly maintaining and monitoring plant and equipment to ensure that their noise emissions are not excessive
- Minimising the annoyance from reversing alarms by either fitting closed circuit monitors or non-tonal reversing alarms (“quackers”) on vehicles or deploying ‘spotters’ to oversee reversing movements. Sites should be designed to minimise or remove the need for plant to undertake reversing manoeuvres
- Reducing throttle settings and switching off equipment when it’s not being used.

5.2 Construction vibration and operational road noise

The assessments of construction, vibration and operational road noise found that the risk of impact at surrounding receivers was low. As such, no specific mitigation measures are proposed, baring the limitation of use of vibratory compaction equipment within two metres of underground services, without further investigations.

With respect to construction vibration, if plant and equipment changes materially from that which has been assessed, a review should be undertaken prior to commencing work.

6. Conclusion

Jacobs has completed a noise and vibration assessment to support a review of environmental factors being prepared for a Roads and Maritime proposal to upgrade the intersection of Great Western Highway and Reservoir Road in Blacktown.

Regarding construction noise, an assessment was undertaken as per guidance presented in the CNVG which identified that a number of receivers may experience noise levels in excess of relevant NMLs during the project. The significance of these exceedances was evaluated and additional mitigation measures were developed consistent with Appendix C of the CNVG. Applying standard construction noise mitigation measures, and project specific mitigation measures if required, as presented in Section 5, may reduce the number of receivers exceeding the relevant NML during the project.

Regarding vibrations generated during construction, setback distances for maintaining human comfort and preventing building cosmetic damage for relevant plant were compared against distances to surrounding structures and receivers. This method concluded that impacts were unlikely as a result of the works.

The construction road traffic noise estimator was used to quantitatively evaluate that additional noise generated from construction-related traffic movements would be negligible and below the 2 dB(A) relative increase criteria.

Changes in operational noise arising from the proposal were evaluated at the nearest receivers by SoundPLAN noise modelling by adopting the CoRTN prediction method. Increases of up to 0.3 dB(A) were predicted as a result of the minor intersection upgrade relative to existing operations. This is below the 2dB(A) relative increase criteria for minor works therefore consideration of operational noise mitigation is not warranted.

7. References

Roads and Maritime, 2016. *Construction Noise and Vibration Guideline*

Roads and Maritime, 2016. *Procedure: Preparing an Operational Traffic and Construction Noise and Vibration Assessment*

Roads and Maritime, 2014. *Roads and Maritime Noise Criteria Guideline*

DECCW, 2011. *NSW Road Noise Policy*

DECC, 2009. *Interim Construction Noise Guideline*

DECC, 2006. *Assessing Vibration: a technical guideline*

Gowan, Karantonis and Rofail, 2004. *Converting Bureau of Meteorology Wind Speed Data to Local Wind Speeds at 1.5m Above Ground Level*

Australia Standard AS2436-2010 Guide to noise and vibration control on construction, demolition and maintenance sites

British Standard 6472-1: 2008 Guide to evaluation of human exposure to vibration in buildings Part 1: Vibration sources other than blasting [BS 6472-1: 2008]

Australian Standard AS2187.2 – 2006 Explosives – Storage and use Part 2: Use of explosives

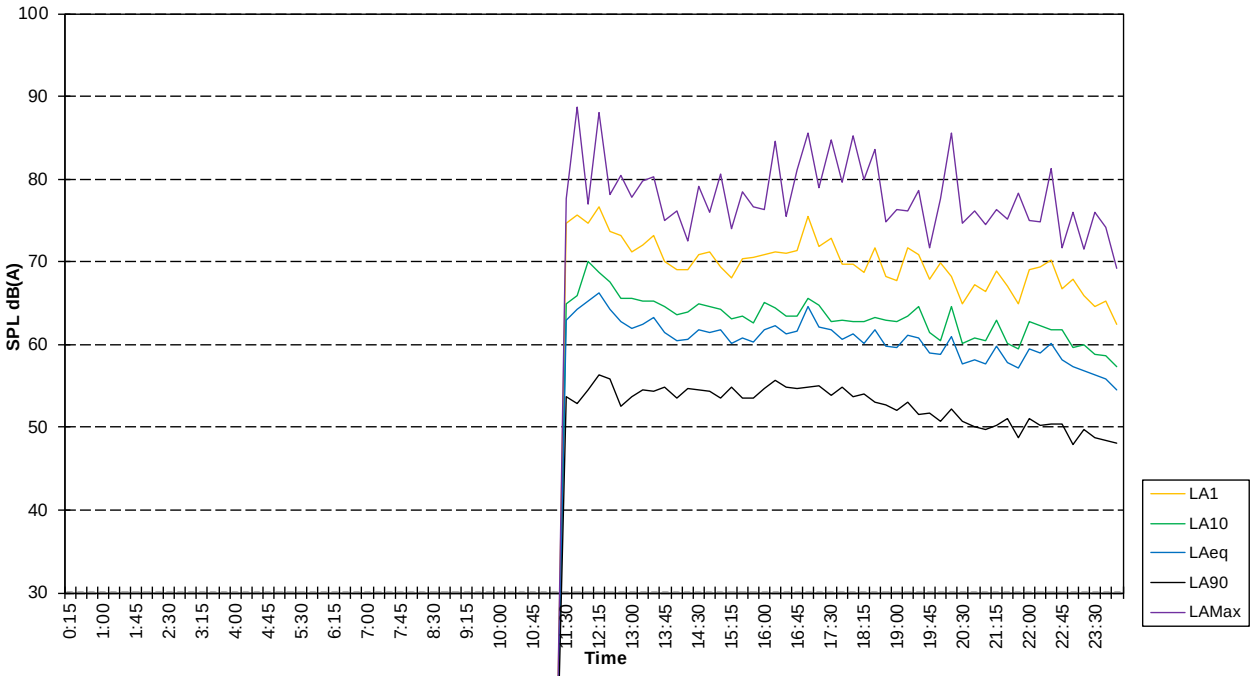
British Standard BS7385: 1990 Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from groundbourne vibration

DIN 4150-3 Structural vibration Part 3: Effects of vibration on structures

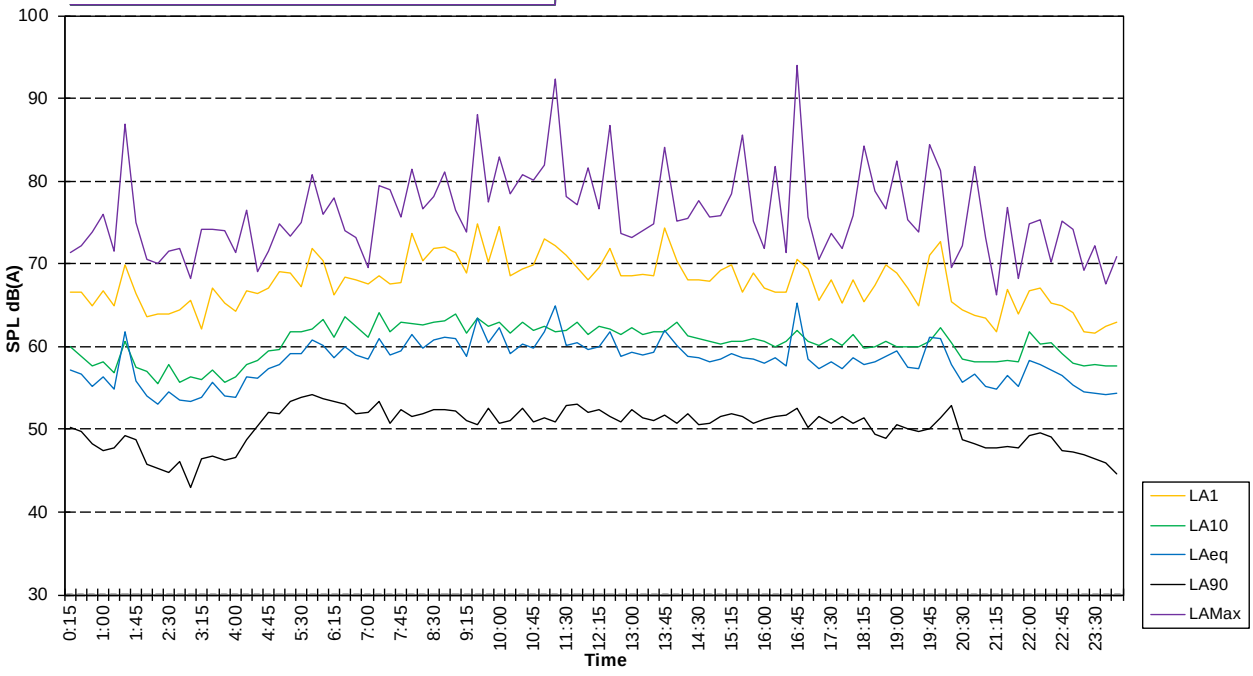
UK Department of Transport, 1988. *Calculation of Road Traffic Noise*

Appendix A. Attended noise monitoring records

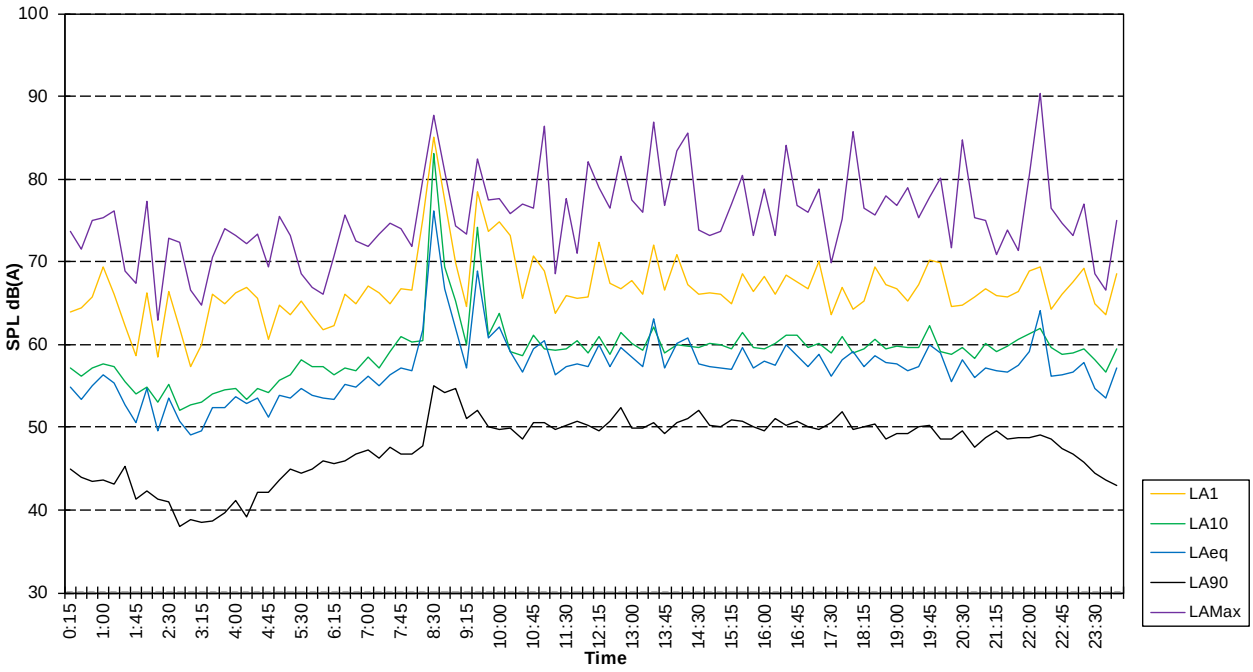
Location 1 - Front Yard of 181 Reservoir Road, Blacktown
Measured Noise Levels - Friday 10/11/2017



Location 1 - Front Yard of 181 Reservoir Road, Blacktown
Measured Noise Levels - Saturday 11/11/2017

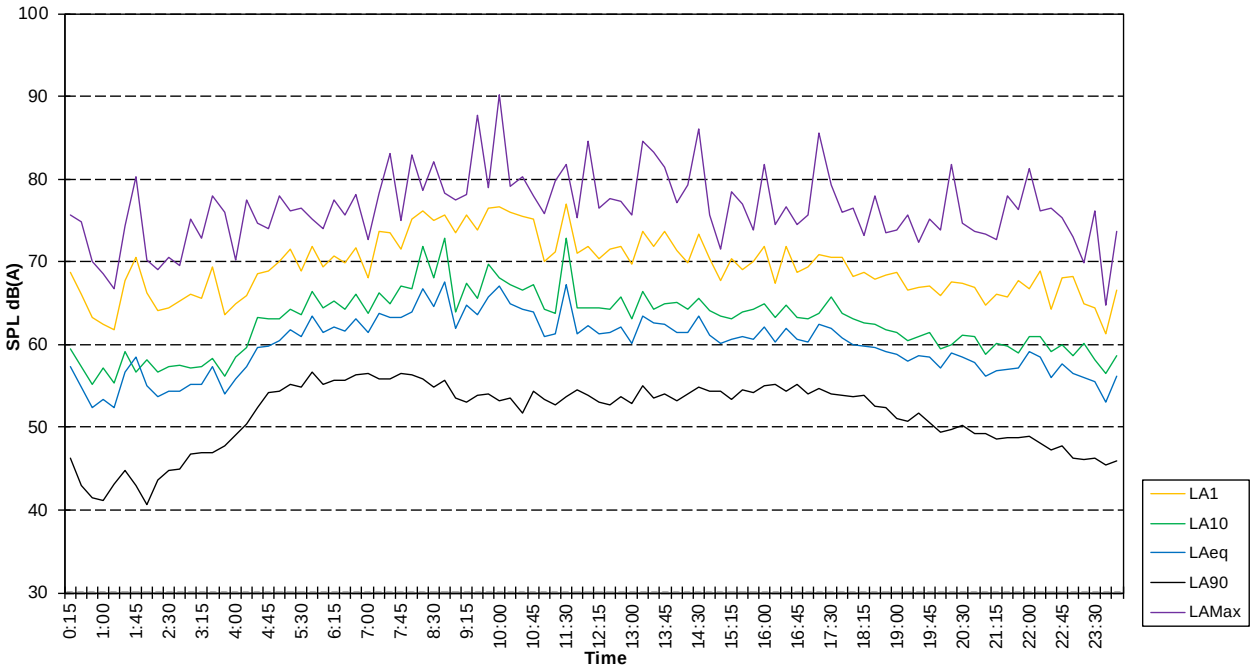


Location 1 - Front Yard of 181 Reservoir Road, Blacktown
Measured Noise Levels - Sunday 12/11/2017

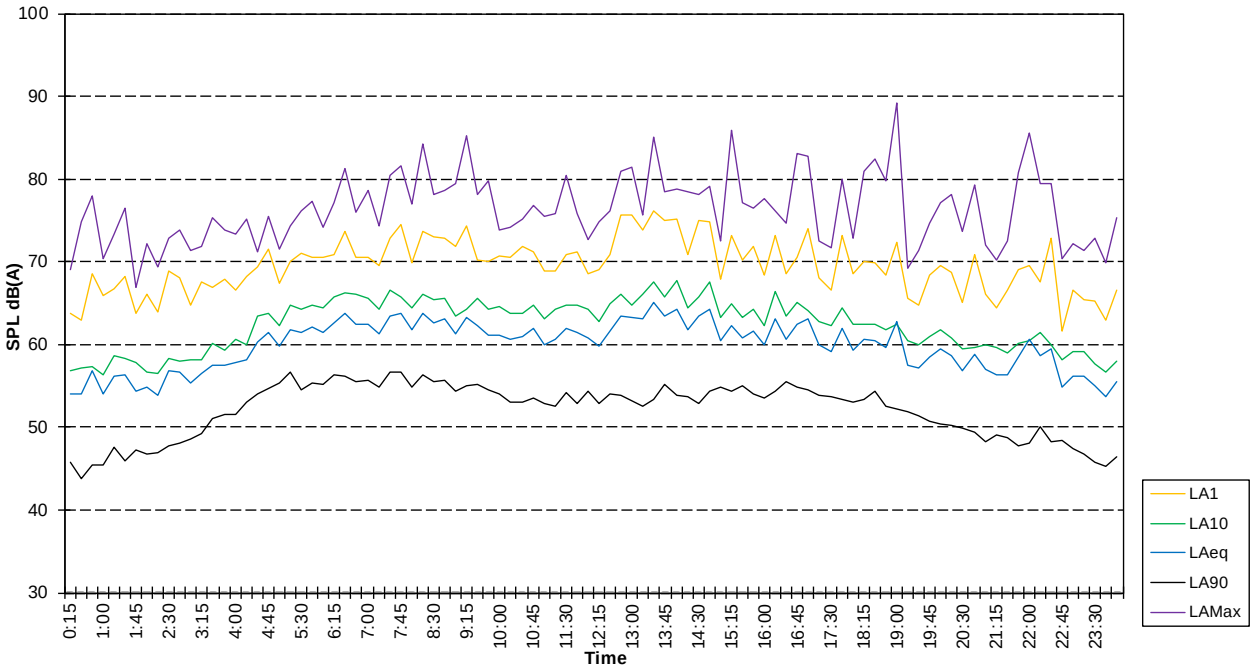


Location 1 - Front Yard of 181 Reservoir Road, Blacktown
Measured Noise Levels - Monday 13/11/2017

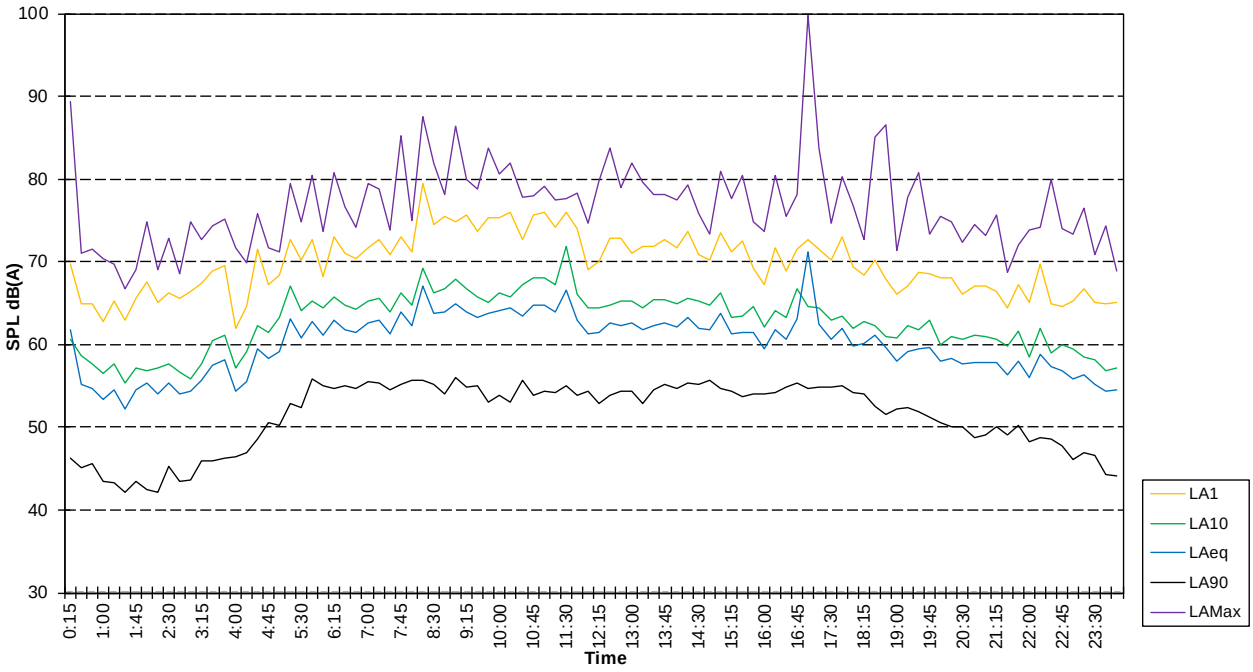
Location 1 - Front Yard of 181 Reservoir Road, Blacktown
Measured Noise Levels - Tuesday 14/11/2017



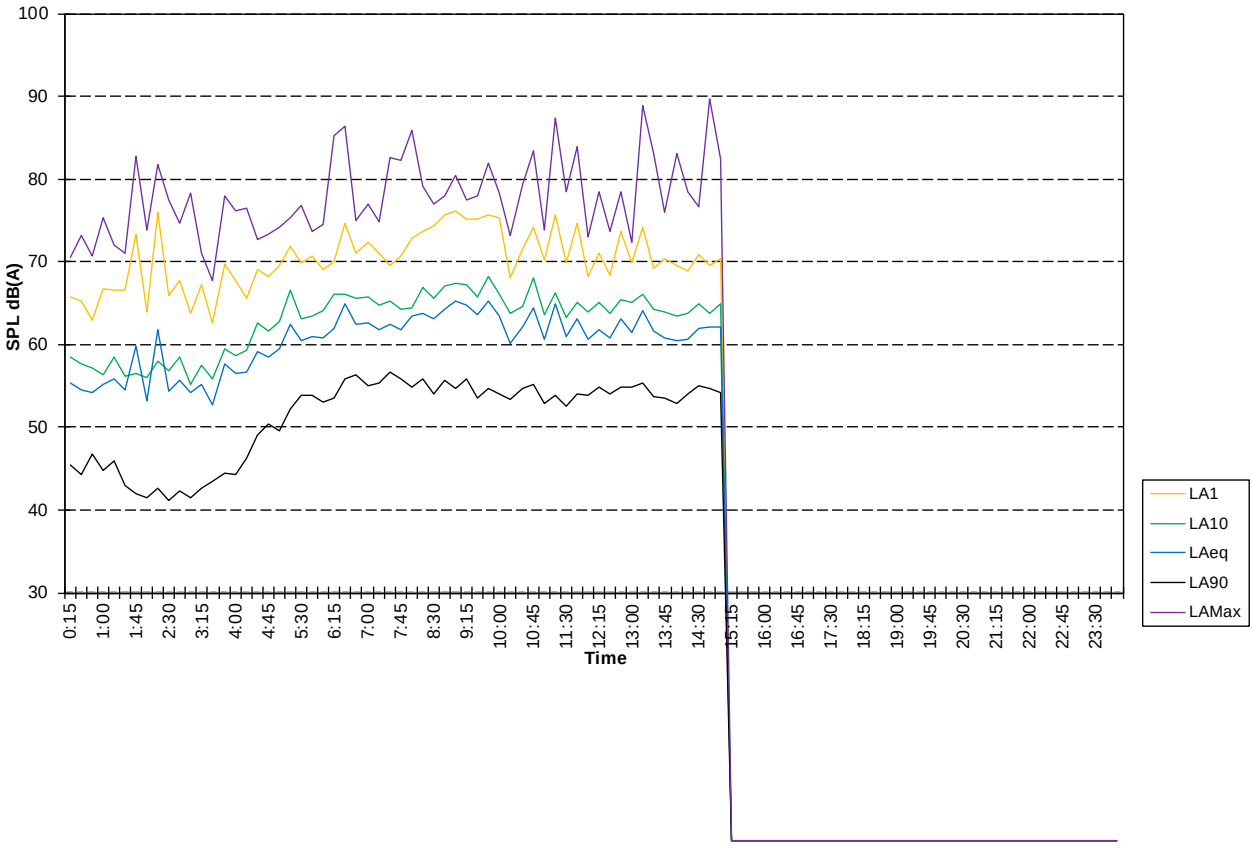
Location 1 - Front Yard of 181 Reservoir Road, Blacktown
Measured Noise Levels - Wednesday 15/11/2017



Location 1 - Front Yard of 181 Reservoir Road, Blacktown
Measured Noise Levels - Thursday 16/11/2017



Location 1 - Front Yard of 181 Reservoir Road, Blacktown
Measured Noise Levels - Friday 17/11/2017



Appendix B. Detailed construction results

B.1 Standard hours, day out-of-hours, evening out-of-hours and night out-of-hours predicted construction noise levels

Receiver ID	Usage	Standard hours, day out-of-hours, evening out-of-hours and night out-of-hours					
		Mobilisation & Site Establishment	Utility, Property & Services Adjustment	Drainage Works	Bulk Excavation & Earthworks	Pavement Works	Finishing Works
NCA01-1	RES	73.3	83.3	78.3	83.3	83.3	74.3
NCA01-2	RES	69.0	79.0	74.0	79.0	79.0	70.0
NCA01-3	RES	69.1	79.1	74.1	79.1	79.1	70.1
NCA01-4	RES	67.5	77.5	72.5	77.5	77.5	68.5
NCA01-5	RES	68.0	78.0	73.0	78.0	78.0	69.0
NCA01-6	RES	67.7	77.7	72.7	77.7	77.7	68.7
NCA01-7	RES	68.2	78.2	73.2	78.2	78.2	69.2
NCA01-8	RES	66.3	76.3	71.3	76.3	76.3	67.3
NCA01-9	RES	67.0	77.0	72.0	77.0	77.0	68.0
NCA01-10	RES	67.0	77.0	72.0	77.0	77.0	68.0
NCA01-11	RES	60.6	70.6	65.6	70.6	70.6	61.6
NCA01-12	RES	65.4	75.4	70.4	75.4	75.4	66.4
NCA01-13	RES	64.0	74.0	69.0	74.0	74.0	65.0
NCA01-14	RES	68.1	78.1	73.1	78.1	78.1	69.1
NCA01-15	RES	69.0	79.0	74.0	79.0	79.0	70.0
NCA01-16	RES	66.0	76.0	71.0	76.0	76.0	67.0
NCA01-17	RES	65.3	75.3	70.3	75.3	75.3	66.3
NCA01-18	RES	64.0	74.0	69.0	74.0	74.0	65.0
NCA01-19	RES	64.7	74.7	69.7	74.7	74.7	65.7
NCA01-20	RES	61.7	71.7	66.7	71.7	71.7	62.7

Receiver ID	Usage	Standard hours, day out-of-hours, evening out-of-hours and night out-of-hours					
		Mobilisation & Site Establishment	Utility, Property & Services Adjustment	Drainage Works	Bulk Excavation & Earthworks	Pavement Works	Finishing Works
NCA01-21	RES	54.8	64.7	59.7	64.7	64.7	55.7
NCA01-22	RES	51.9	61.8	56.8	61.8	61.8	52.9
NCA01-23	RES	70.9	80.9	75.9	80.9	80.9	71.9
NCA01-24	RES	60.4	70.4	65.4	70.4	70.4	61.4
NCA01-25	RES	64.7	74.7	69.7	74.7	74.7	65.7
NCA01-26	RES	74.0	84.0	79.0	84.0	84.0	75.0
NCA01-27	RES	70.6	80.6	75.6	80.6	80.6	71.6
NCA01-28	RES	68.0	78.0	73.0	78.0	78.0	69.0
NCA01-29	RES	63.1	73.1	68.1	73.1	73.1	64.1
NCA01-30	RES	62.9	72.9	67.9	72.9	72.9	63.9
NCA01-31	RES	73.4	83.4	78.4	83.4	83.4	74.4
NCA01-32	RES	70.2	80.2	75.2	80.2	80.2	71.2
NCA01-33	RES	70.5	80.5	75.5	80.5	80.5	71.5
NCA01-34	RES	66.4	76.4	71.4	76.4	76.4	67.4
NCA01-35	RES	51.0	60.6	55.7	60.6	60.6	51.9
NCA01-36	RES	60.6	70.5	65.5	70.5	70.5	61.6
NCA01-37	RES	52.3	62.1	57.2	62.1	62.1	53.3
NCA01-38	RES	54.7	62.6	58.2	62.6	62.6	55.3
NCA01-39	RES	62.2	71.8	66.9	71.8	71.8	63.2
NCA01-40	RES	64.8	74.6	69.7	74.6	74.6	65.8
NCA01-41	RES	55.9	65.9	60.9	65.9	65.9	56.9
NCA01-42	RES	54.9	64.9	59.9	64.9	64.9	55.9
NCA01-43	RES	52.7	62.7	57.7	62.7	62.7	53.7
NCA01-44	RES	39.1	48.1	43.4	48.1	48.1	39.9

Receiver ID	Usage	Standard hours, day out-of-hours, evening out-of-hours and night out-of-hours					
		Mobilisation & Site Establishment	Utility, Property & Services Adjustment	Drainage Works	Bulk Excavation & Earthworks	Pavement Works	Finishing Works
NCA01-45	RES	35.7	43.3	39.0	43.3	43.3	36.3
NCA01-46	RES	46.4	56.3	51.3	56.3	56.3	47.4
NCA01-47	RES	36.8	45.0	40.5	45.0	45.0	37.4
NCA01-48	RES	50.7	60.6	55.6	60.6	60.6	51.7
NCA01-49	RES	63.4	72.9	68.1	72.9	72.9	64.3
NCA01-50	RES	54.3	62.2	57.8	62.2	62.2	54.9
NCA01-51	RES	47.3	56.7	51.8	56.7	56.7	48.1
NCA01-52	RES	59.2	68.1	63.4	68.1	68.1	60.0
NCA01-53	RES	53.8	58.3	55.4	58.3	58.3	54.0
NCA01-54	RES	50.3	52.8	51.0	52.8	52.8	50.4
NCA01-55	RES	43.2	50.6	46.4	50.6	50.6	43.7
NCA01-56	RES	49.7	52.4	50.5	52.4	52.4	49.8
NCA01-57	RES	50.2	53.3	51.2	53.3	53.3	50.4
NCA01-58	RES	46.4	55.1	50.4	55.1	55.1	47.1
NCA01-59	RES	56.6	64.7	60.2	64.7	64.7	57.3
NCA01-60	RES	52.5	58.1	54.7	58.1	58.1	52.8
NCA01-61	RES	55.0	62.5	58.2	62.5	62.5	55.6
NCA01-62	RES	52.2	57.3	54.1	57.3	57.3	52.4
NCA01-63	RES	49.0	50.1	49.3	50.1	50.1	49.0
NCA02-1	RES	42.6	51.7	46.9	51.7	51.7	43.4
NCA02-2	RES	44.4	53.4	48.7	53.4	53.4	45.2
NCA02-3	RES	49.9	59.7	54.8	59.7	59.7	50.8
NCA02-4	RES	52.2	62.0	57.1	62.0	62.0	53.2
NCA02-5	RES	60.0	70.0	65.0	70.0	70.0	61.0

Receiver ID	Usage	Standard hours, day out-of-hours, evening out-of-hours and night out-of-hours					
		Mobilisation & Site Establishment	Utility, Property & Services Adjustment	Drainage Works	Bulk Excavation & Earthworks	Pavement Works	Finishing Works
NCA02-6	RES	54.6	64.5	59.5	64.5	64.5	55.5
NCA02-7	RES	52.0	61.8	56.9	61.8	61.8	53.0
NCA02-8	RES	51.1	61.0	56.0	61.0	61.0	52.1
NCA02-9	RES	47.4	56.9	52.1	56.9	56.9	48.3
NCA02-10	RES	45.7	55.4	50.5	55.4	55.4	46.6
NCA02-11	RES	60.5	70.5	65.5	70.5	70.5	61.5
NCA02-12	RES	58.6	68.6	63.6	68.6	68.6	59.6
NCA02-13	RES	55.6	65.5	60.5	65.5	65.5	56.6
NCA02-14	RES	55.3	65.2	60.2	65.2	65.2	56.3
NCA02-15	RES	41.7	51.1	46.2	51.1	51.1	42.5
NCA02-16	RES	38.8	47.9	43.1	47.9	47.9	39.6
NCA02-17	RES	44.1	49.0	45.9	49.0	49.0	44.3
NCA02-18	RES	46.6	55.8	51.0	55.8	55.8	47.5
NCA02-19	RES	38.7	47.5	42.8	47.5	47.5	39.4
NCA02-20	RES	36.5	45.0	40.4	45.0	45.0	37.2
NCA02-21	RES	35.1	43.5	38.9	43.5	43.5	35.8
NCA02-22	RES	44.6	49.5	46.4	49.5	49.5	44.9
NCA02-23	RES	33.7	42.1	37.6	42.1	42.1	34.4
NCA02-24	RES	35.9	44.7	40.0	44.7	44.7	36.6
NCA02-25	RES	35.5	43.0	38.7	43.0	43.0	36.1
NCA02-26	RES	43.9	49.4	45.9	49.4	49.4	44.2
NCA02-27	RES	43.3	53.0	48.1	53.0	53.0	44.3
NCA02-28	RES	33.3	41.8	37.2	41.8	41.8	34.0
NCA02-29	RES	31.1	38.3	34.1	38.3	38.3	31.6

Receiver ID	Usage	Standard hours, day out-of-hours, evening out-of-hours and night out-of-hours					
		Mobilisation & Site Establishment	Utility, Property & Services Adjustment	Drainage Works	Bulk Excavation & Earthworks	Pavement Works	Finishing Works
NCA02-30	RES	33.6	41.7	37.2	41.7	41.7	34.2
NCA02-31	RES	32.5	41.3	36.6	41.3	41.3	33.2
NCA02-32	RES	38.1	46.2	41.7	46.2	46.2	38.8
NCA02-33	RES	41.2	46.8	43.4	46.8	46.8	41.5
NCA02-34	RES	39.2	47.3	42.8	47.3	47.3	39.8
NCA02-35	RES	55.8	65.7	60.7	65.7	65.7	56.8
NCA02-36	RES	45.6	55.1	50.2	55.1	55.1	46.5
NCA02-37	RES	44.8	53.4	48.8	53.4	53.4	45.5
NCA02-38	RES	43.5	53.0	48.1	53.0	53.0	44.4
NCA02-39	RES	42.9	51.7	47.0	51.7	51.7	43.6
NCA02-40	RES	51.4	61.2	56.3	61.2	61.2	52.4
NCA02-41	RES	49.2	59.0	54.1	59.0	59.0	50.1
NCA02-42	RES	41.4	45.7	42.9	45.7	45.7	41.6
NCA02-43	RES	38.4	43.2	40.1	43.2	43.2	38.6
NCA02-44	RES	36.1	43.2	39.1	43.2	43.2	36.6
NCA02-45	RES	41.2	48.6	44.4	48.6	48.6	41.7
NCA02-46	RES	36.8	44.6	40.2	44.6	44.6	37.3
NCA02-47	RES	48.9	53.4	50.4	53.4	53.4	49.1
NCA02-48	RES	48.2	52.0	49.4	52.0	52.0	48.3
NCA02-49	RES	47.3	49.5	47.9	49.5	49.5	47.4
NCA02-50	RES	46.6	56.4	51.5	56.4	56.4	47.5
NCA02-51	RES	36.1	43.6	39.3	43.6	43.6	36.6
NCA02-52	RES	33.4	39.8	36.0	39.8	39.8	33.8
NCA02-53	RES	33.2	39.7	35.8	39.7	39.7	33.6

Receiver ID	Usage	Standard hours, day out-of-hours, evening out-of-hours and night out-of-hours					
		Mobilisation & Site Establishment	Utility, Property & Services Adjustment	Drainage Works	Bulk Excavation & Earthworks	Pavement Works	Finishing Works
NCA02-54	RES	31.9	38.2	34.4	38.2	38.2	32.3
NCA02-55	RES	39.6	44.5	41.4	44.5	44.5	39.9
NCA02-56	RES	35.4	44.6	39.8	44.6	44.6	36.2
NCA02-57	RES	36.1	42.9	38.9	42.9	42.9	36.6
NCA02-58	RES	34.8	41.9	37.8	41.9	41.9	35.3
NCA02-59	RES	36.1	38.8	36.9	38.8	38.8	36.2
NCA02-60	RES	39.3	44.4	41.2	44.4	44.4	39.6
NCA02-61	RES	32.9	40.4	36.1	40.4	40.4	33.4
NCA02-62	RES	33.5	40.2	36.3	40.2	40.2	34.0
NCA02-63	RES	32.3	37.1	34.0	37.1	37.1	32.5
NCA02-64	RES	42.3	44.5	42.9	44.5	44.5	42.4
NCA02-65	RES	34.1	40.9	36.9	40.9	40.9	34.6
NCA02-66	RES	34.5	41.8	37.6	41.8	41.8	35.0
NCA02-67	RES	33.2	38.1	35.0	38.1	38.1	33.5
NCA02-68	RES	34.5	40.2	36.7	40.2	40.2	34.9
NCA02-69	RES	41.7	44.0	42.3	44.0	44.0	41.7
NCA02-70	RES	36.4	44.1	39.8	44.1	44.1	37.0
NCA02-71	RES	35.1	40.9	37.3	40.9	40.9	35.4
NCA02-72	RES	35.7	39.7	37.0	39.7	39.7	35.9
NCA02-73	RES	34.8	41.1	37.3	41.1	41.1	35.2
NCA02-74	RES	42.0	44.4	42.7	44.4	44.4	42.1
NCA02-75	RES	38.3	43.3	40.1	43.3	43.3	38.6
NCA02-76	RES	42.0	45.3	43.1	45.3	45.3	42.1
NCA02-77	RES	35.4	44.2	39.5	44.2	44.2	36.1

Receiver ID	Usage	Standard hours, day out-of-hours, evening out-of-hours and night out-of-hours					
		Mobilisation & Site Establishment	Utility, Property & Services Adjustment	Drainage Works	Bulk Excavation & Earthworks	Pavement Works	Finishing Works
NCA02-78	RES	42.4	46.5	43.8	46.5	46.5	42.6
NCA02-79	RES	36.2	42.9	38.9	42.9	42.9	36.6
NCA02-80	RES	43.8	44.5	44.0	44.5	44.5	43.8
NCA02-81	RES	44.2	45.9	44.7	45.9	45.9	44.3
NCA02-82	RES	36.0	41.3	38.0	41.3	41.3	36.3
NCA02-83	RES	35.6	41.8	38.0	41.8	41.8	36.0
NCA02-84	RES	36.8	45.6	40.9	45.6	45.6	37.5
NCA02-85	RES	45.7	47.0	46.0	47.0	47.0	45.7
NCA02-86	RES	48.6	50.8	49.3	50.8	50.8	48.7
NCA02-87	RES	38.8	44.6	41.0	44.6	44.6	39.1
NCA02-88	RES	42.8	51.9	47.2	51.9	51.9	43.6
NCA02-89	RES	43.4	51.4	47.0	51.4	51.4	44.0
NCA02-90	RES	43.3	51.8	47.2	51.8	51.8	44.0
NCA02-91	RES	40.1	46.4	42.6	46.4	46.4	40.5
NCA02-92	RES	40.3	49.4	44.6	49.4	49.4	41.1
NCA02-93	RES	46.6	48.8	47.3	48.8	48.8	46.7
NCA02-94	RES	38.1	46.9	42.2	46.9	46.9	38.9
NCA02-95	RES	37.8	46.5	41.8	46.5	46.5	38.6
NCA02-96	RES	42.2	46.4	43.6	46.4	46.4	42.4
NCA02-97	RES	40.7	45.3	42.3	45.3	45.3	40.9
NCA02-98	RES	41.1	46.8	43.3	46.8	46.8	41.4
NCA02-99	RES	41.0	47.0	43.4	47.0	47.0	41.4
NCA02-100	RES	35.7	43.9	39.4	43.9	43.9	36.4
NCA02-101	RES	37.8	46.0	41.5	46.0	46.0	38.4

Receiver ID	Usage	Standard hours, day out-of-hours, evening out-of-hours and night out-of-hours					
		Mobilisation & Site Establishment	Utility, Property & Services Adjustment	Drainage Works	Bulk Excavation & Earthworks	Pavement Works	Finishing Works
NCA02-102	RES	40.3	45.8	42.4	45.8	45.8	40.6
NCA02-103	RES	39.5	44.9	41.5	44.9	44.9	39.8
NCA02-104	RES	42.9	45.3	43.6	45.3	45.3	43.0
NCA02-105	RES	39.5	45.3	41.7	45.3	45.3	39.8
NCA02-106	RES	42.3	46.3	43.7	46.3	46.3	42.5
NCA02-107	RES	37.5	46.5	41.8	46.5	46.5	38.3
NCA02-108	RES	41.8	43.9	42.4	43.9	43.9	41.9
NCA02-109	RES	41.8	45.0	42.8	45.0	45.0	42.0
NCA02-110	RES	39.9	49.2	44.4	49.2	49.2	40.7
NCA02-111	RES	40.2	47.2	43.1	47.2	47.2	40.7
NCA02-112	RES	40.7	49.6	44.9	49.6	49.6	41.5
NCA02-113	RES	42.0	47.8	44.2	47.8	47.8	42.3
NCA02-114	RES	42.4	47.3	44.2	47.3	47.3	42.7
NCA02-115	RES	36.9	45.5	40.9	45.5	45.5	37.6
NCA02-116	RES	39.4	48.2	43.5	48.2	48.2	40.1
NCA02-117	RES	44.2	49.6	46.2	49.6	49.6	44.5
NCA02-118	RES	40.2	49.1	44.4	49.1	49.1	41.0
NCA02-119	RES	44.0	45.7	44.5	45.7	45.7	44.1
NCA02-120	RES	41.2	47.7	43.8	47.7	47.7	41.6
NCA02-121	RES	43.2	50.6	46.4	50.6	50.6	43.7
NCA02-122	RES	39.9	47.5	43.2	47.5	47.5	40.5
NCA02-123	RES	37.1	45.4	40.9	45.4	45.4	37.7
NCA02-124	RES	42.8	50.4	46.1	50.4	50.4	43.4
NCA02-125	RES	42.1	49.2	45.1	49.2	49.2	42.6

Receiver ID	Usage	Standard hours, day out-of-hours, evening out-of-hours and night out-of-hours					
		Mobilisation & Site Establishment	Utility, Property & Services Adjustment	Drainage Works	Bulk Excavation & Earthworks	Pavement Works	Finishing Works
NCA02-126	RES	45.3	52.6	48.4	52.6	52.6	45.8
NCA02-127	RES	48.0	50.8	48.8	50.8	50.8	48.1
NCA02-128	RES	49.1	54.5	51.1	54.5	54.5	49.4
NCA02-129	RES	37.6	46.4	41.7	46.4	46.4	38.3
NCA02-130	RES	33.1	40.7	36.4	40.7	40.7	33.6
NCA02-131	RES	46.4	51.5	48.3	51.5	51.5	46.7
NCA02-132	RES	40.5	49.3	44.7	49.3	49.3	41.3
NCA02-133	RES	43.5	51.7	47.2	51.7	51.7	44.1
NCA02-134	RES	46.1	51.4	48.1	51.4	51.4	46.4
NCA02-135	RES	46.1	51.0	47.9	51.0	51.0	46.4
NCA02-136	RES	42.5	45.1	43.3	45.1	45.1	42.6
NCA02-137	RES	43.3	46.5	44.3	46.5	46.5	43.5
NCA02-138	RES	44.0	47.5	45.1	47.5	47.5	44.1
NCA02-139	RES	46.3	51.7	48.3	51.7	51.7	46.6
NCA02-140	RES	44.8	54.5	49.6	54.5	54.5	45.7
NCA02-141	RES	46.9	56.4	51.5	56.4	56.4	47.8
NCA02-142	RES	45.8	54.3	49.7	54.3	54.3	46.5
NCA02-143	RES	43.1	52.4	47.6	52.4	52.4	43.9
NCA02-144	RES	48.6	52.7	50.0	52.7	52.7	48.8
NCA02-145	RES	49.2	53.0	50.5	53.0	53.0	49.4
NCA03-1	COM	69.7	79.5	74.5	79.5	79.5	70.6
NCA03-2	COM	65.2	72.8	68.5	72.8	72.8	65.8
NCA03-3	IND	65.9	69.4	67.0	69.4	69.4	66.0
NCA03-4	IND	65.6	67.5	66.1	67.5	67.5	65.7

Receiver ID	Usage	Standard hours, day out-of-hours, evening out-of-hours and night out-of-hours					
		Mobilisation & Site Establishment	Utility, Property & Services Adjustment	Drainage Works	Bulk Excavation & Earthworks	Pavement Works	Finishing Works
NCA03-5	IND	60.8	63.7	61.7	63.7	63.7	60.9
NCA03-6	IND	56.6	57.8	56.9	57.8	57.8	56.6
NCA03-7	IND	53.7	55.3	54.2	55.3	55.3	53.8
NCA03-8	IND	52.5	56.9	54.0	56.9	56.9	52.7
NCA03-9	IND	44.6	54.0	49.1	54.0	54.0	45.5
NCA03-10	IND	50.0	55.1	51.9	55.1	55.1	50.2
NCA03-11	IND	50.6	54.1	51.7	54.1	54.1	50.8
NCA03-12	IND	47.2	51.5	48.7	51.5	51.5	47.4
NCA03-13	IND	31.5	36.5	33.3	36.5	36.5	31.8
NCA03-14	IND	44.1	47.4	45.2	47.4	47.4	44.2
NCA03-15	IND	42.9	48.9	45.2	48.9	48.9	43.2
NCA03-16	IND	40.9	48.9	44.5	48.9	48.9	41.5
NCA03-17	IND	38.5	47.1	42.5	47.1	47.1	39.2
NCA03-18	COM	55.4	60.2	57.1	60.2	60.2	55.6
NCA03-19	GAR	53.0	59.0	55.4	59.0	59.0	53.4
NCA03-20	COM	44.0	53.5	48.6	53.5	53.5	44.9
NCA03-21	OOP	50.2 to 75.0	53.1 to 75.0	51.1 to 75.0	53.1 to 75.0	53.1 to 75.0	50.3 to 75.0
NCA04-1	COM	71.1	81.1	76.1	81.1	81.1	72.1
NCA04-2	IND	69.5	79.5	74.5	79.5	79.5	70.5

NOTES: COM refers to Commercial, GAR refers to Garage, IND refers to Industrial and OOP refers to Active Recreational Area

B.2 LA1 Predicted Noise Levels for Sleep Disturbance Assessment

Receiver ID	Usage	LA1 Night out-of-hours – dB(A)					
		Mobilisation & Site Establishment	Utility, Property & Services Adjustment	Drainage Works	Bulk Excavation & Earthworks	Pavement Works	Finishing Works
NCA01-1	RES	77	45	83	45	45	77
NCA01-2	RES	73	59	79	59	59	73
NCA01-3	RES	73	67	79	67	67	73
NCA01-4	RES	72	75	78	75	75	72
NCA01-5	RES	72	78	78	78	78	72
NCA01-6	RES	72	81	78	81	81	72
NCA01-7	RES	72	85	78	85	85	72
NCA01-8	RES	70	85	76	85	85	70
NCA01-9	RES	71	86	77	86	86	71
NCA01-10	RES	71	47	77	47	47	71
NCA01-11	RES	65	50	71	50	50	65
NCA01-12	RES	69	52	75	52	52	69
NCA01-13	RES	68	53	74	53	53	68
NCA01-14	RES	72	54	78	54	54	72
NCA01-15	RES	73	55	79	55	55	73
NCA01-16	RES	70	55	76	55	55	70
NCA01-17	RES	69	57	75	57	57	69
NCA01-18	RES	68	58	74	58	58	68
NCA01-19	RES	69	59	75	59	59	69
NCA01-20	RES	66	60	72	60	60	66

Receiver ID	Usage	LA1 Night out-of-hours – dB(A)					
		Mobilisation & Site Establishment	Utility, Property & Services Adjustment	Drainage Works	Bulk Excavation & Earthworks	Pavement Works	Finishing Works
NCA01-21	RES	59	60	65	60	60	59
NCA01-22	RES	56	63	62	63	63	56
NCA01-23	RES	75	63	81	63	63	75
NCA01-24	RES	64	64	70	64	64	64
NCA01-25	RES	69	64	75	64	64	69
NCA01-26	RES	78	64	84	64	64	78
NCA01-27	RES	75	65	81	65	65	75
NCA01-28	RES	72	65	78	65	65	72
NCA01-29	RES	67	65	73	65	65	67
NCA01-30	RES	67	67	73	67	67	67
NCA01-31	RES	77	67	83	67	67	77
NCA01-32	RES	74	68	80	68	68	74
NCA01-33	RES	75	70	81	70	70	75
NCA01-34	RES	70	72	76	72	72	70
NCA01-35	RES	55	73	61	73	73	55
NCA01-36	RES	65	73	71	73	73	65
NCA01-37	RES	56	74	62	74	74	56
NCA01-38	RES	56	74	62	74	74	56
NCA01-39	RES	66	75	72	75	75	66
NCA01-40	RES	69	75	75	75	75	69
NCA01-41	RES	60	76	66	76	76	60
NCA01-42	RES	59	76	65	76	76	59

Receiver ID	Usage	LA1 Night out-of-hours – dB(A)					
		Mobilisation & Site Establishment	Utility, Property & Services Adjustment	Drainage Works	Bulk Excavation & Earthworks	Pavement Works	Finishing Works
NCA01-43	RES	57	77	63	77	77	57
NCA01-44	RES	42	77	48	77	77	42
NCA01-45	RES	37	77	43	77	77	37
NCA01-46	RES	50	77	56	77	77	50
NCA01-47	RES	39	77	45	77	77	39
NCA01-48	RES	55	78	61	78	78	55
NCA01-49	RES	67	78	73	78	78	67
NCA01-50	RES	56	79	62	79	79	56
NCA01-51	RES	51	79	57	79	79	51
NCA01-52	RES	62	80	68	80	80	62
NCA01-53	RES	51	80	57	80	80	51
NCA01-54	RES	44	80	50	80	80	44
NCA01-55	RES	44	80	50	80	80	44
NCA01-56	RES	44	80	50	80	80	44
NCA01-57	RES	45	80	51	80	80	45
NCA01-58	RES	49	81	55	81	81	49
NCA01-59	RES	58	81	64	81	81	58
NCA01-60	RES	51	82	57	82	82	51
NCA01-61	RES	56	83	62	83	83	56
NCA01-62	RES	50	83	56	83	83	50
NCA01-63	RES	38	83	44	83	83	38
NCA02-1	RES	46	52	52	52	52	46

Receiver ID	Usage	LA1 Night out-of-hours – dB(A)					
		Mobilisation & Site Establishment	Utility, Property & Services Adjustment	Drainage Works	Bulk Excavation & Earthworks	Pavement Works	Finishing Works
NCA02-2	RES	47	54	53	54	54	47
NCA02-3	RES	54	60	60	60	60	54
NCA02-4	RES	56	62	62	62	62	56
NCA02-5	RES	64	70	70	70	70	64
NCA02-6	RES	59	65	65	65	65	59
NCA02-7	RES	56	62	62	62	62	56
NCA02-8	RES	55	61	61	61	61	55
NCA02-9	RES	51	57	57	57	57	51
NCA02-10	RES	49	55	55	55	55	49
NCA02-11	RES	65	71	71	71	71	65
NCA02-12	RES	63	69	69	69	69	63
NCA02-13	RES	60	66	66	66	66	60
NCA02-14	RES	59	65	65	65	65	59
NCA02-15	RES	45	51	51	51	51	45
NCA02-16	RES	42	48	48	48	48	42
NCA02-17	RES	42	50	48	50	50	42
NCA02-18	RES	50	56	56	56	56	50
NCA02-19	RES	41	48	47	48	48	41
NCA02-20	RES	39	45	45	45	45	39
NCA02-21	RES	37	44	43	44	44	37
NCA02-22	RES	42	50	48	50	50	42
NCA02-23	RES	36	42	42	42	42	36
NCA02-24	RES	39	45	45	45	45	39

Receiver ID	Usage	LA1 Night out-of-hours – dB(A)					
		Mobilisation & Site Establishment	Utility, Property & Services Adjustment	Drainage Works	Bulk Excavation & Earthworks	Pavement Works	Finishing Works
NCA02-25	RES	37	43	43	43	43	37
NCA02-26	RES	42	50	48	50	50	42
NCA02-27	RES	47	53	53	53	53	47
NCA02-28	RES	36	42	42	42	42	36
NCA02-29	RES	32	39	38	39	39	32
NCA02-30	RES	35	42	41	42	42	35
NCA02-31	RES	35	41	41	41	41	35
NCA02-32	RES	40	46	46	46	46	40
NCA02-33	RES	40	47	46	47	47	40
NCA02-34	RES	41	47	47	47	47	41
NCA02-35	RES	60	66	66	66	66	60
NCA02-36	RES	49	55	55	55	55	49
NCA02-37	RES	47	54	53	54	54	47
NCA02-38	RES	47	53	53	53	53	47
NCA02-39	RES	46	52	52	52	52	46
NCA02-40	RES	55	61	61	61	61	55
NCA02-41	RES	53	59	59	59	59	53
NCA02-42	RES	38	46	44	46	46	38
NCA02-43	RES	36	44	42	44	44	36
NCA02-44	RES	37	43	43	43	43	37
NCA02-45	RES	42	49	48	49	49	42
NCA02-46	RES	38	45	44	45	45	38

Receiver ID	Usage	LA1 Night out-of-hours – dB(A)					
		Mobilisation & Site Establishment	Utility, Property & Services Adjustment	Drainage Works	Bulk Excavation & Earthworks	Pavement Works	Finishing Works
NCA02-47	RES	46	54	52	54	54	46
NCA02-48	RES	44	53	50	53	53	44
NCA02-49	RES	40	51	46	51	51	40
NCA02-50	RES	50	56	56	56	56	50
NCA02-51	RES	37	44	43	44	44	37
NCA02-52	RES	33	40	39	40	40	33
NCA02-53	RES	33	40	39	40	40	33
NCA02-54	RES	32	39	38	39	39	32
NCA02-55	RES	37	45	43	45	45	37
NCA02-56	RES	39	45	45	45	45	39
NCA02-57	RES	36	43	42	43	43	36
NCA02-58	RES	35	42	41	42	42	35
NCA02-59	RES	30	40	36	40	40	30
NCA02-60	RES	37	45	43	45	45	37
NCA02-61	RES	34	41	40	41	41	34
NCA02-62	RES	34	41	40	41	41	34
NCA02-63	RES	30	38	36	38	38	30
NCA02-64	RES	35	46	41	46	46	35
NCA02-65	RES	34	41	40	41	41	34
NCA02-66	RES	35	42	41	42	42	35
NCA02-67	RES	31	39	37	39	39	31
NCA02-68	RES	33	41	39	41	41	33

Receiver ID	Usage	LA1 Night out-of-hours – dB(A)					
		Mobilisation & Site Establishment	Utility, Property & Services Adjustment	Drainage Works	Bulk Excavation & Earthworks	Pavement Works	Finishing Works
NCA02-69	RES	35	45	41	45	45	35
NCA02-70	RES	38	44	44	44	44	38
NCA02-71	RES	34	41	40	41	41	34
NCA02-72	RES	32	40	38	40	40	32
NCA02-73	RES	34	42	40	42	42	34
NCA02-74	RES	35	46	41	46	46	35
NCA02-75	RES	36	44	42	44	44	36
NCA02-76	RES	37	46	43	46	46	37
NCA02-77	RES	38	44	44	44	44	38
NCA02-78	RES	39	47	45	47	47	39
NCA02-79	RES	36	43	42	43	43	36
NCA02-80	RES	31	46	37	46	46	31
NCA02-81	RES	36	47	42	47	47	36
NCA02-82	RES	34	42	40	42	42	34
NCA02-83	RES	35	42	41	42	42	35
NCA02-84	RES	39	46	45	46	46	39
NCA02-85	RES	36	49	42	49	49	36
NCA02-86	RES	41	52	47	52	52	41
NCA02-87	RES	38	45	44	45	45	38
NCA02-88	RES	46	52	52	52	52	46
NCA02-89	RES	45	52	51	52	52	45
NCA02-90	RES	46	52	52	52	52	46

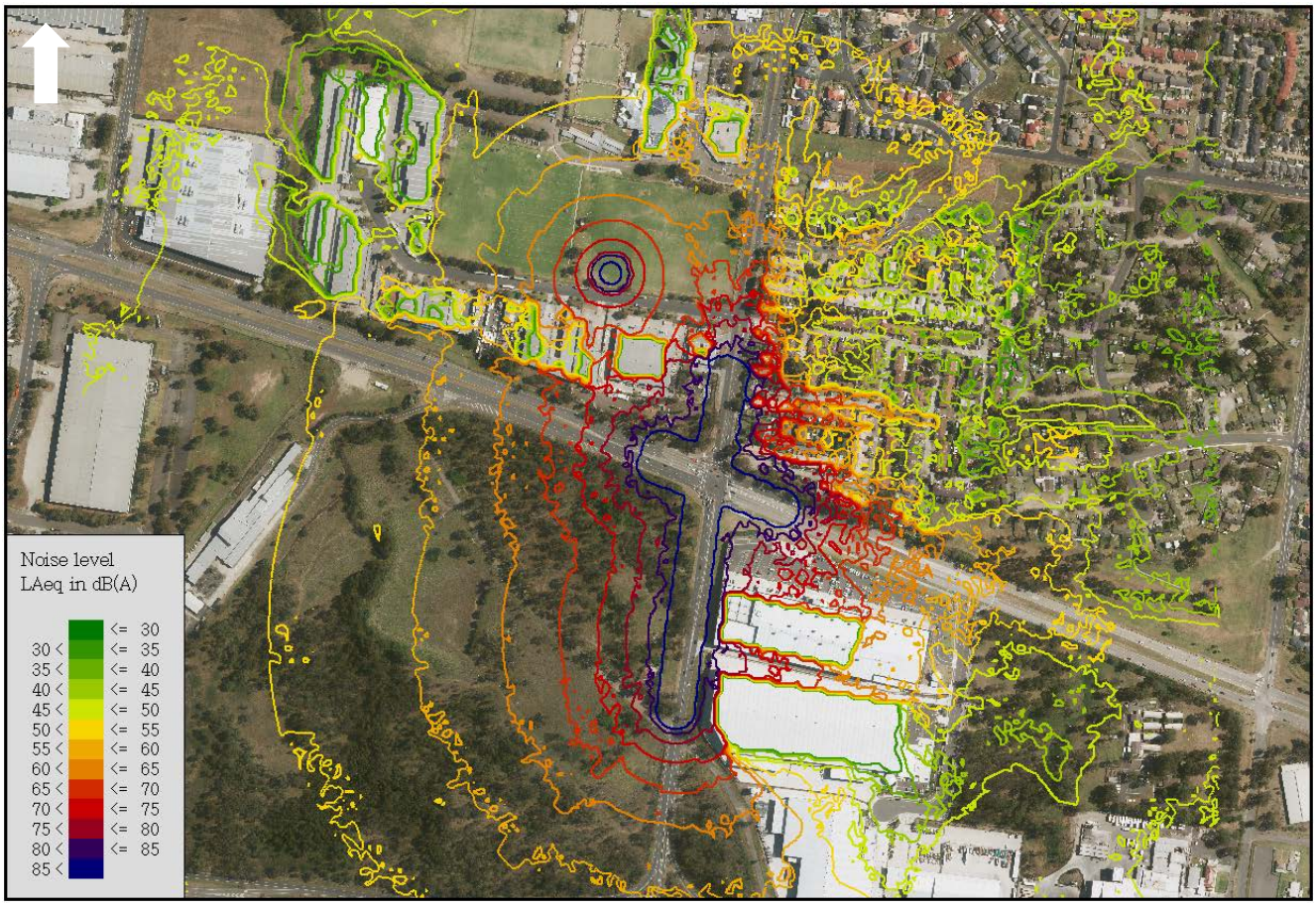
Receiver ID	Usage	LA1 Night out-of-hours – dB(A)					
		Mobilisation & Site Establishment	Utility, Property & Services Adjustment	Drainage Works	Bulk Excavation & Earthworks	Pavement Works	Finishing Works
NCA02-91	RES	40	47	46	47	47	40
NCA02-92	RES	43	50	49	50	50	43
NCA02-93	RES	39	50	45	50	50	39
NCA02-94	RES	41	47	47	47	47	41
NCA02-95	RES	40	47	46	47	47	40
NCA02-96	RES	39	47	45	47	47	39
NCA02-97	RES	38	46	44	46	46	38
NCA02-98	RES	40	47	46	47	47	40
NCA02-99	RES	40	47	46	47	47	40
NCA02-100	RES	38	44	44	44	44	38
NCA02-101	RES	40	46	46	46	46	40
NCA02-102	RES	39	46	45	46	46	39
NCA02-103	RES	38	45	44	45	45	38
NCA02-104	RES	36	47	42	47	47	36
NCA02-105	RES	39	46	45	46	46	39
NCA02-106	RES	39	47	45	47	47	39
NCA02-107	RES	40	47	46	47	47	40
NCA02-108	RES	34	45	40	45	45	34
NCA02-109	RES	37	46	43	46	46	37
NCA02-110	RES	43	49	49	49	49	43
NCA02-111	RES	41	48	47	48	48	41
NCA02-112	RES	44	50	50	50	50	44

Receiver ID	Usage	LA1 Night out-of-hours – dB(A)					
		Mobilisation & Site Establishment	Utility, Property & Services Adjustment	Drainage Works	Bulk Excavation & Earthworks	Pavement Works	Finishing Works
NCA02-113	RES	41	48	47	48	48	41
NCA02-114	RES	40	48	46	48	48	40
NCA02-115	RES	39	46	45	46	46	39
NCA02-116	RES	42	48	48	48	48	42
NCA02-117	RES	43	50	49	50	50	43
NCA02-118	RES	43	49	49	49	49	43
NCA02-119	RES	35	47	41	47	47	35
NCA02-120	RES	41	48	47	48	48	41
NCA02-121	RES	44	51	50	51	51	44
NCA02-122	RES	41	48	47	48	48	41
NCA02-123	RES	39	46	45	46	46	39
NCA02-124	RES	44	51	50	51	51	44
NCA02-125	RES	43	49	49	49	49	43
NCA02-126	RES	46	53	52	53	53	46
NCA02-127	RES	42	52	48	52	52	42
NCA02-128	RES	47	55	53	55	55	47
NCA02-129	RES	40	47	46	47	47	40
NCA02-130	RES	34	41	40	41	41	34
NCA02-131	RES	44	52	50	52	52	44
NCA02-132	RES	43	49	49	49	49	43
NCA02-133	RES	46	52	52	52	52	46
NCA02-134	RES	44	52	50	52	52	44

Receiver ID	Usage	LA1 Night out-of-hours – dB(A)					
		Mobilisation & Site Establishment	Utility, Property & Services Adjustment	Drainage Works	Bulk Excavation & Earthworks	Pavement Works	Finishing Works
NCA02-135	RES	44	52	50	52	52	44
NCA02-136	RES	36	46	42	46	46	36
NCA02-137	RES	38	48	44	48	48	38
NCA02-138	RES	40	48	46	48	48	40
NCA02-139	RES	45	52	51	52	52	45
NCA02-140	RES	49	55	55	55	55	49
NCA02-141	RES	50	56	56	56	56	50
NCA02-142	RES	48	54	54	54	54	48
NCA02-143	RES	46	52	52	52	52	46
NCA02-144	RES	45	54	51	54	54	45
NCA02-145	RES	45	54	51	54	54	45

Appendix C. Predicted Construction Noise Contours (Bulk Excavation & Earthworks)

C.1 Standard hours, day out-of-hours, evening out-of-hours and night out-of-hours



Appendix D. Predicted Operational Noise Levels

Receiver ID	Year of Opening 2020						10 Years Post Opening 2030					
	$L_{Aeq(15hours)}$ Daytime Noise Levels – dB(A)			$L_{Aeq(9hours)}$ Night-time Noise Levels – dB(A)			$L_{Aeq(15hours)}$ Daytime Noise Levels – dB(A)			$L_{Aeq(9hours)}$ Night-time Noise Levels – dB(A)		
	No build	Build	Difference	No build	Build	Difference	No build	Build	Difference	No build	Build	Difference
NCA01-1	74.0	73.7	-0.3	73.4	73.1	-0.3	74.3	74.0	-0.3	73.7	73.4	-0.3
NCA01-2	71.7	71.6	-0.1	70.5	70.4	-0.1	72.0	71.9	-0.1	70.7	70.6	-0.1
NCA01-3	71.6	71.6	0	70.5	70.4	-0.1	71.9	71.9	0	70.7	70.6	-0.1
NCA01-4	70.6	70.6	0	69.5	69.4	-0.1	70.9	70.9	0	69.7	69.6	-0.1
NCA01-5	70.7	70.6	-0.1	69.6	69.5	-0.1	71.0	71.0	0	69.8	69.7	-0.1
NCA01-6	69.1	69.1	0	68.0	67.9	-0.1	69.4	69.4	0	68.2	68.1	-0.1
NCA01-7	70.4	70.4	0	69.2	69.2	0	70.7	70.7	0	69.4	69.4	0
NCA01-8	69.7	69.6	-0.1	68.5	68.5	0	70.0	70.0	0	68.7	68.7	0
NCA01-9	69.7	69.7	0	68.6	68.5	-0.1	70.0	70.0	0	68.8	68.7	-0.1
NCA01-10	69.0	68.9	-0.1	67.8	67.8	0	69.3	69.3	0	68.0	68.0	0
NCA01-11	68.0	68.0	0	67.0	66.9	-0.1	68.4	68.3	-0.1	67.2	67.1	-0.1
NCA01-12	67.4	67.3	-0.1	66.3	66.3	0	67.7	67.7	0	66.5	66.5	0
NCA01-13	63.4	63.4	0	62.4	62.4	0	63.8	63.8	0	62.6	62.6	0
NCA01-14	73.5	73.5	0	72.0	71.9	-0.1	73.9	73.8	-0.1	72.2	72.1	-0.1
NCA01-15	72.3	72.3	0	70.8	70.8	0	72.7	72.6	-0.1	71.0	71.0	0
NCA01-16	73.3	73.3	0	71.8	71.7	-0.1	73.6	73.6	0	72.0	71.9	-0.1
NCA01-17	72.0	71.9	-0.1	70.5	70.5	0	72.3	72.3	0	70.7	70.7	0
NCA01-18	72.8	72.7	-0.1	71.4	71.3	-0.1	73.1	73.1	0	71.6	71.5	-0.1
NCA01-19	71.2	71.2	0	70.1	70.0	-0.1	71.6	71.6	0	70.3	70.2	-0.1
NCA01-20	71.9	71.9	0	70.7	70.7	0	72.2	72.2	0	70.9	70.9	0
NCA01-21	70.6	70.6	0	69.6	69.5	-0.1	71.0	70.9	-0.1	69.8	69.7	-0.1

Receiver ID	Year of Opening 2020						10 Years Post Opening 2030					
	$L_{Aeq(15hours)}$ Daytime Noise Levels – dB(A)			$L_{Aeq(9hours)}$ Night-time Noise Levels – dB(A)			$L_{Aeq(15hours)}$ Daytime Noise Levels – dB(A)			$L_{Aeq(9hours)}$ Night-time Noise Levels – dB(A)		
	No build	Build	Difference	No build	Build	Difference	No build	Build	Difference	No build	Build	Difference
NCA01-22	61.3	61.2	-0.1	60.3	60.2	-0.1	61.6	61.6	0	60.5	60.4	-0.1
NCA01-23	69.7	69.6	-0.1	69.3	69.2	-0.1	70.0	69.9	-0.1	69.6	69.4	-0.2
NCA01-24	56.3	56.2	-0.1	55.6	55.6	0	56.6	56.5	-0.1	55.9	55.8	-0.1
NCA01-25	60.9	60.8	-0.1	60.5	60.5	0	61.2	61.1	-0.1	60.7	60.7	0
NCA01-26	71.7	71.6	-0.1	71.5	71.4	-0.1	72.0	71.9	-0.1	71.8	71.7	-0.1
NCA01-27	66.3	66.2	-0.1	65.8	65.8	0	66.6	66.5	-0.1	66.1	66.0	-0.1
NCA01-28	63.8	63.8	0	63.3	63.3	0	64.1	64.1	0	63.5	63.5	0
NCA01-29	60.8	60.8	0	60.3	60.3	0	61.1	61.1	0	60.5	60.5	0
NCA01-30	59.2	59.2	0	58.8	58.8	0	59.6	59.6	0	59.0	59.0	0
NCA01-31	72.2	72.2	0	72.0	72.0	0	72.5	72.5	0	72.3	72.3	0
NCA01-32	63.7	63.8	0.1	63.4	63.5	0.1	64.0	64.1	0.1	63.7	63.7	0
NCA01-33	68.5	68.5	0	68.3	68.4	0.1	68.8	68.8	0	68.6	68.6	0
NCA01-34	60.6	60.6	0	60.3	60.3	0	60.9	60.9	0	60.5	60.5	0
NCA01-35	57.5	57.5	0	57.1	57.1	0	57.7	57.7	0	57.4	57.4	0
NCA01-36	55.1	55.1	0	54.9	54.9	0	55.3	55.3	0	55.1	55.1	0
NCA01-37	57.8	57.8	0	57.5	57.5	0	58.1	58.0	-0.1	57.8	57.8	0
NCA01-38	58.4	58.4	0	58.1	58.1	0	58.6	58.6	0	58.4	58.4	0
NCA01-39	61.3	61.3	0	61.2	61.2	0	61.6	61.6	0	61.5	61.5	0
NCA01-40	74.2	74.2	0	74.0	74.0	0	74.4	74.4	0	74.3	74.3	0
NCA01-41	68.0	68.0	0	67.3	67.3	0	68.3	68.3	0	67.5	67.5	0
NCA01-42	70.8	70.8	0	70.1	70.1	0	71.1	71.1	0	70.3	70.3	0
NCA01-43	70.4	70.4	0	69.9	69.9	0	70.8	70.8	0	70.1	70.0	-0.1
NCA01-44	59.8	59.8	0	59.3	59.3	0	60.1	60.1	0	59.5	59.5	0

Receiver ID	Year of Opening 2020						10 Years Post Opening 2030					
	$L_{Aeq(15hours)}$ Daytime Noise Levels – dB(A)			$L_{Aeq(9hours)}$ Night-time Noise Levels – dB(A)			$L_{Aeq(15hours)}$ Daytime Noise Levels – dB(A)			$L_{Aeq(9hours)}$ Night-time Noise Levels – dB(A)		
	No build	Build	Difference	No build	Build	Difference	No build	Build	Difference	No build	Build	Difference
NCA01-45	57.4	57.4	0	56.9	56.9	0	57.7	57.7	0	57.1	57.1	0
NCA01-46	57.8	57.8	0	57.2	57.2	0	58.1	58.1	0	57.4	57.4	0
NCA01-47	59.6	59.6	0	59.2	59.2	0	59.9	59.9	0	59.4	59.4	0
NCA01-48	61.3	61.3	0	60.5	60.5	0	61.6	61.6	0	60.7	60.7	0
NCA01-49	72.3	72.3	0	72.1	72.1	0	72.5	72.5	0	72.4	72.4	0
NCA01-50	60.6	60.6	0	60.4	60.4	0	60.8	60.8	0	60.7	60.7	0
NCA01-51	58.4	58.4	0	58.1	58.1	0	58.7	58.7	0	58.4	58.4	0
NCA01-52	72.0	72.0	0	71.9	71.9	0	72.3	72.2	-0.1	72.2	72.2	0
NCA01-53	61.4	61.4	0	61.2	61.2	0	61.7	61.7	0	61.5	61.5	0
NCA01-54	58.5	58.5	0	58.3	58.3	0	58.8	58.8	0	58.5	58.5	0
NCA01-55	56.6	56.6	0	56.3	56.2	-0.1	56.8	56.8	0	56.5	56.5	0
NCA01-56	57.4	57.4	0	57.2	57.2	0	57.6	57.6	0	57.5	57.5	0
NCA01-57	58.9	58.9	0	58.7	58.7	0	59.1	59.1	0	58.9	58.9	0
NCA01-58	62.3	62.3	0	62.2	62.1	-0.1	62.6	62.5	-0.1	62.4	62.4	0
NCA01-59	71.3	71.3	0	71.1	71.1	0	71.5	71.5	0	71.4	71.4	0
NCA01-60	62.7	62.7	0	62.5	62.5	0	62.9	62.9	0	62.7	62.7	0
NCA01-61	73.0	73.0	0	72.9	72.9	0	73.2	73.2	0	73.2	73.2	0
NCA01-62	73.3	73.3	0	73.2	73.2	0	73.5	73.5	0	73.5	73.5	0
NCA01-63	68.8	68.8	0	68.6	68.6	0	69.0	69.0	0	68.9	68.9	0
NCA02-1	56.8	56.8	0	56.3	56.2	-0.1	57.1	57.1	0	56.5	56.5	0
NCA02-2	55.1	55.1	0	54.5	54.4	-0.1	55.4	55.4	0	54.7	54.6	-0.1
NCA02-3	55.1	55.1	0	54.6	54.5	-0.1	55.4	55.4	0	54.8	54.8	0
NCA02-4	53.6	53.6	0	53.0	53.0	0	53.9	53.9	0	53.2	53.2	0

Receiver ID	Year of Opening 2020						10 Years Post Opening 2030					
	$L_{Aeq(15hours)}$ Daytime Noise Levels – dB(A)			$L_{Aeq(9hours)}$ Night-time Noise Levels – dB(A)			$L_{Aeq(15hours)}$ Daytime Noise Levels – dB(A)			$L_{Aeq(9hours)}$ Night-time Noise Levels – dB(A)		
	No build	Build	Difference	No build	Build	Difference	No build	Build	Difference	No build	Build	Difference
NCA02-5	57.0	56.9	-0.1	56.2	56.1	-0.1	57.3	57.3	0	56.4	56.4	0
NCA02-6	55.4	55.4	0	54.8	54.8	0	55.7	55.7	0	55.0	55.0	0
NCA02-7	56.8	56.7	-0.1	56.1	56.0	-0.1	57.3	57.2	-0.1	56.5	56.4	-0.1
NCA02-8	55.4	55.4	0	54.8	54.7	-0.1	55.7	55.7	0	55.0	55.0	0
NCA02-9	55.6	55.6	0	55.0	54.9	-0.1	55.9	55.9	0	55.2	55.2	0
NCA02-10	55.8	55.8	0	55.1	55.1	0	56.1	56.1	0	55.3	55.3	0
NCA02-11	57.6	57.6	0	57.2	57.2	0	58.0	58.0	0	57.4	57.4	0
NCA02-12	54.5	54.5	0	53.8	53.8	0	54.9	54.8	-0.1	54.1	54.0	-0.1
NCA02-13	55.3	55.3	0	54.8	54.8	0	55.6	55.6	0	55.0	55.0	0
NCA02-14	55.2	55.1	-0.1	54.7	54.7	0	55.5	55.5	0	54.9	54.9	0
NCA02-15	54.1	54.1	0	53.5	53.5	0	54.4	54.4	0	53.7	53.7	0
NCA02-16	53.5	53.5	0	53.0	52.9	-0.1	53.8	53.8	0	53.2	53.2	0
NCA02-17	52.6	52.6	0	52.1	52.1	0	52.9	52.9	0	52.3	52.3	0
NCA02-18	53.0	53.0	0	52.5	52.4	-0.1	53.3	53.3	0	52.7	52.6	-0.1
NCA02-19	54.2	54.2	0	53.5	53.5	0	54.5	54.5	0	53.7	53.7	0
NCA02-20	52.7	52.7	0	52.2	52.2	0	53.1	53.0	-0.1	52.4	52.4	0
NCA02-21	51.7	51.7	0	51.2	51.2	0	52.0	52.0	0	51.4	51.4	0
NCA02-22	52.1	52.1	0	51.6	51.6	0	52.4	52.4	0	51.8	51.8	0
NCA02-23	52.2	52.2	0	51.6	51.6	0	52.5	52.5	0	51.8	51.8	0
NCA02-24	52.2	52.3	0.1	51.6	51.7	0.1	52.5	52.6	0.1	51.8	51.9	0.1
NCA02-25	51.4	51.4	0	50.9	50.8	-0.1	51.7	51.7	0	51.1	51.1	0
NCA02-26	51.5	51.5	0	51.0	51.0	0	51.8	51.8	0	51.2	51.2	0

Receiver ID	Year of Opening 2020						10 Years Post Opening 2030					
	$L_{Aeq(15hours)}$ Daytime Noise Levels – dB(A)			$L_{Aeq(9hours)}$ Night-time Noise Levels – dB(A)			$L_{Aeq(15hours)}$ Daytime Noise Levels – dB(A)			$L_{Aeq(9hours)}$ Night-time Noise Levels – dB(A)		
	No build	Build	Difference	No build	Build	Difference	No build	Build	Difference	No build	Build	Difference
NCA02-27	51.6	51.6	0	51.1	51.1	0	51.9	51.9	0	51.3	51.3	0
NCA02-28	52.2	52.1	-0.1	51.5	51.5	0	52.5	52.5	0	51.7	51.7	0
NCA02-29	51.8	51.8	0	51.2	51.2	0	52.1	52.1	0	51.4	51.4	0
NCA02-30	50.7	50.7	0	50.2	50.2	0	51.0	51.0	0	50.4	50.4	0
NCA02-31	50.4	50.4	0	49.9	49.9	0	50.7	50.7	0	50.2	50.1	-0.1
NCA02-32	50.3	50.3	0	49.8	49.8	0	50.6	50.6	0	50.0	50.0	0
NCA02-33	52.9	52.9	0	52.3	52.3	0	53.2	53.2	0	52.5	52.5	0
NCA02-34	51.4	51.4	0	50.9	50.9	0	51.7	51.7	0	51.1	51.1	0
NCA02-35	55.6	55.5	-0.1	55.1	55.1	0	55.9	55.8	-0.1	55.3	55.3	0
NCA02-36	54.5	54.5	0	54.1	54.0	-0.1	54.8	54.8	0	54.3	54.3	0
NCA02-37	54.7	54.7	0	54.2	54.2	0	55.0	55.0	0	54.5	54.5	0
NCA02-38	53.2	53.2	0	52.6	52.6	0	53.5	53.5	0	52.8	52.8	0
NCA02-39	53.1	53.1	0	52.5	52.5	0	53.4	53.4	0	52.7	52.7	0
NCA02-40	53.5	53.5	0	53.0	52.9	-0.1	53.9	53.8	-0.1	53.2	53.1	-0.1
NCA02-41	53.2	53.2	0	52.7	52.7	0	53.5	53.5	0	52.9	52.9	0
NCA02-42	52.6	52.6	0	52.2	52.1	-0.1	52.9	52.9	0	52.4	52.4	0
NCA02-43	52.5	52.5	0	52.1	52.1	0	52.8	52.8	0	52.3	52.3	0
NCA02-44	53.0	53.0	0	52.5	52.5	0	53.3	53.3	0	52.8	52.7	-0.1
NCA02-45	52.4	52.4	0	51.9	51.9	0	52.7	52.7	0	52.1	52.1	0
NCA02-46	51.8	51.8	0	51.3	51.2	-0.1	52.1	52.1	0	51.5	51.5	0
NCA02-47	54.8	54.8	0	54.4	54.4	0	55.0	55.0	0	54.6	54.6	0
NCA02-48	52.2	52.2	0	51.9	51.9	0	52.4	52.4	0	52.2	52.2	0
NCA02-49	52.1	52.1	0	51.6	51.5	-0.1	52.4	52.4	0	51.8	51.8	0

Receiver ID	Year of Opening 2020						10 Years Post Opening 2030					
	$L_{Aeq(15hours)}$ Daytime Noise Levels – dB(A)			$L_{Aeq(9hours)}$ Night-time Noise Levels – dB(A)			$L_{Aeq(15hours)}$ Daytime Noise Levels – dB(A)			$L_{Aeq(9hours)}$ Night-time Noise Levels – dB(A)		
	No build	Build	Difference	No build	Build	Difference	No build	Build	Difference	No build	Build	Difference
NCA02-50	53.2	53.2	0	52.8	52.7	-0.1	53.6	53.5	-0.1	53.0	53.0	0
NCA02-51	51.8	51.7	-0.1	51.2	51.2	0	52.1	52.0	-0.1	51.4	51.4	0
NCA02-52	51.0	51.0	0	50.6	50.6	0	51.3	51.3	0	50.8	50.8	0
NCA02-53	51.8	51.8	0	51.3	51.3	0	52.1	52.1	0	51.5	51.5	0
NCA02-54	51.9	51.8	-0.1	51.4	51.3	-0.1	52.2	52.1	-0.1	51.6	51.6	0
NCA02-55	51.4	51.3	-0.1	50.9	50.9	0	51.7	51.6	-0.1	51.2	51.1	-0.1
NCA02-56	51.7	51.7	0	51.2	51.2	0	52.0	52.0	0	51.5	51.4	-0.1
NCA02-57	51.0	51.0	0	50.5	50.5	0	51.3	51.3	0	50.7	50.7	0
NCA02-58	51.0	51.0	0	50.5	50.5	0	51.3	51.3	0	50.8	50.7	-0.1
NCA02-59	50.9	50.9	0	50.5	50.4	-0.1	51.2	51.2	0	50.7	50.6	-0.1
NCA02-60	50.3	50.3	0	49.8	49.8	0	50.6	50.6	0	50.0	50.0	0
NCA02-61	50.7	50.7	0	50.1	50.1	0	51.0	51.0	0	50.3	50.3	0
NCA02-62	50.4	50.4	0	49.9	49.9	0	50.7	50.7	0	50.2	50.1	-0.1
NCA02-63	50.7	50.6	-0.1	50.2	50.2	0	51.0	50.9	-0.1	50.4	50.4	0
NCA02-64	50.8	50.8	0	50.4	50.4	0	51.1	51.1	0	50.6	50.6	0
NCA02-65	50.8	50.7	-0.1	50.2	50.2	0	51.1	51.1	0	50.4	50.4	0
NCA02-66	50.6	50.6	0	50.0	50.0	0	50.9	50.9	0	50.2	50.2	0
NCA02-67	50.6	50.6	0	50.1	50.1	0	50.9	50.9	0	50.3	50.3	0
NCA02-68	50.4	50.4	0	49.9	49.9	0	50.7	50.7	0	50.1	50.1	0
NCA02-69	50.7	50.7	0	50.2	50.2	0	51.0	51.0	0	50.5	50.4	-0.1
NCA02-70	51.5	51.5	0	51.0	51.0	0	51.9	51.9	0	51.2	51.2	0
NCA02-71	50.9	50.9	0	50.5	50.5	0	51.2	51.2	0	50.7	50.7	0
NCA02-72	51.0	50.9	-0.1	50.5	50.5	0	51.3	51.2	-0.1	50.7	50.7	0

Receiver ID	Year of Opening 2020						10 Years Post Opening 2030					
	$L_{Aeq(15hours)}$ Daytime Noise Levels – dB(A)			$L_{Aeq(9hours)}$ Night-time Noise Levels – dB(A)			$L_{Aeq(15hours)}$ Daytime Noise Levels – dB(A)			$L_{Aeq(9hours)}$ Night-time Noise Levels – dB(A)		
	No build	Build	Difference	No build	Build	Difference	No build	Build	Difference	No build	Build	Difference
NCA02-73	50.7	50.6	-0.1	50.2	50.2	0	51.0	51.0	0	50.4	50.4	0
NCA02-74	50.7	50.7	0	50.2	50.2	0	51.0	51.0	0	50.4	50.4	0
NCA02-75	51.3	51.3	0	50.9	50.9	0	51.6	51.6	0	51.1	51.1	0
NCA02-76	50.3	50.3	0	49.8	49.8	0	50.6	50.6	0	50.0	50.0	0
NCA02-77	51.4	51.4	0	50.9	50.9	0	51.7	51.7	0	51.1	51.1	0
NCA02-78	50.9	50.9	0	50.3	50.3	0	51.2	51.2	0	50.5	50.5	0
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NCA02-86	51.7	51.6	-0.1	51.1	51.1	0	52.0	52.0	0	51.4	51.3	-0.1
NCA02-87	52.4	52.4	0	52.0	52.0	0	52.7	52.7	0	52.3	52.2	-0.1
NCA02-88	54.8	54.8	0	54.5	54.4	-0.1	55.1	55.0	-0.1	54.7	54.7	0
NCA02-89	53.9	53.9	0	53.5	53.5	0	54.2	54.2	0	53.8	53.7	-0.1
NCA02-90	54.1	54.1	0	53.6	53.6	0	54.4	54.4	0	53.8	53.8	0
NCA02-91	53.3	53.3	0	52.8	52.8	0	53.6	53.6	0	53.1	53.1	0
NCA02-92	53.0	53.0	0	52.5	52.5	0	53.3	53.3	0	52.8	52.7	-0.1
NCA02-93	52.9	52.9	0	52.5	52.5	0	53.2	53.2	0	52.7	52.7	0
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Receiver ID	Year of Opening 2020						10 Years Post Opening 2030					
	$L_{Aeq(15hours)}$ Daytime Noise Levels – dB(A)			$L_{Aeq(9hours)}$ Night-time Noise Levels – dB(A)			$L_{Aeq(15hours)}$ Daytime Noise Levels – dB(A)			$L_{Aeq(9hours)}$ Night-time Noise Levels – dB(A)		
	No build	Build	Difference	No build	Build	Difference	No build	Build	Difference	No build	Build	Difference
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NCA02-115	51.6	51.6	0	51.1	51.1	0	52.0	52.0	0	51.3	51.3	0
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Receiver ID	Year of Opening 2020						10 Years Post Opening 2030					
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	No build	Build	Difference	No build	Build	Difference	No build	Build	Difference	No build	Build	Difference
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NCA02-125	52.3	52.3	0	52.0	52.0	0	52.6	52.6	0	52.3	52.3	0
NCA02-126	54.1	54.1	0	53.7	53.7	0	54.4	54.4	0	54.0	54.0	0
NCA02-127	54.6	54.6	0	54.1	54.1	0	54.9	54.9	0	54.4	54.3	-0.1
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NCA02-129	50.4	50.5	0.1	50.0	50.1	0.1	50.8	50.8	0	50.3	50.3	0
NCA02-130	48.7	48.6	-0.1	48.3	48.2	-0.1	49.0	49.0	0	48.5	48.5	0
NCA02-131	52.2	52.2	0	51.7	51.7	0	52.5	52.5	0	51.9	51.9	0
NCA02-132	50.8	50.8	0	50.3	50.4	0.1	51.1	51.1	0	50.6	50.6	0
NCA02-133	52.3	52.3	0	51.9	51.8	-0.1	52.6	52.6	0	52.1	52.0	-0.1
NCA02-134	53.7	53.7	0	53.3	53.3	0	53.9	53.9	0	53.6	53.6	0
NCA02-135	54.4	54.4	0	54.1	54.1	0	54.7	54.7	0	54.4	54.3	-0.1
NCA02-136	52.2	52.2	0	51.9	51.8	-0.1	52.6	52.6	0	52.1	52.0	-0.1
NCA02-137	52.7	52.7	0	52.3	52.3	0	53.1	53.0	-0.1	52.6	52.5	-0.1
NCA02-138	54.4	54.4	0	54.2	54.1	-0.1	54.7	54.7	0	54.4	54.4	0
NCA02-139	55.4	55.4	0	55.2	55.2	0	55.6	55.6	0	55.4	55.4	0
NCA02-140	55.3	55.3	0	55.1	55.1	0	55.6	55.6	0	55.4	55.4	0
NCA02-141	55.4	55.4	0	55.3	55.3	0	55.7	55.7	0	55.5	55.5	0

Receiver ID	Year of Opening 2020						10 Years Post Opening 2030					
	$L_{Aeq(15hours)}$ Daytime Noise Levels – dB(A)			$L_{Aeq(9hours)}$ Night-time Noise Levels – dB(A)			$L_{Aeq(15hours)}$ Daytime Noise Levels – dB(A)			$L_{Aeq(9hours)}$ Night-time Noise Levels – dB(A)		
	No build	Build	Difference	No build	Build	Difference	No build	Build	Difference	No build	Build	Difference
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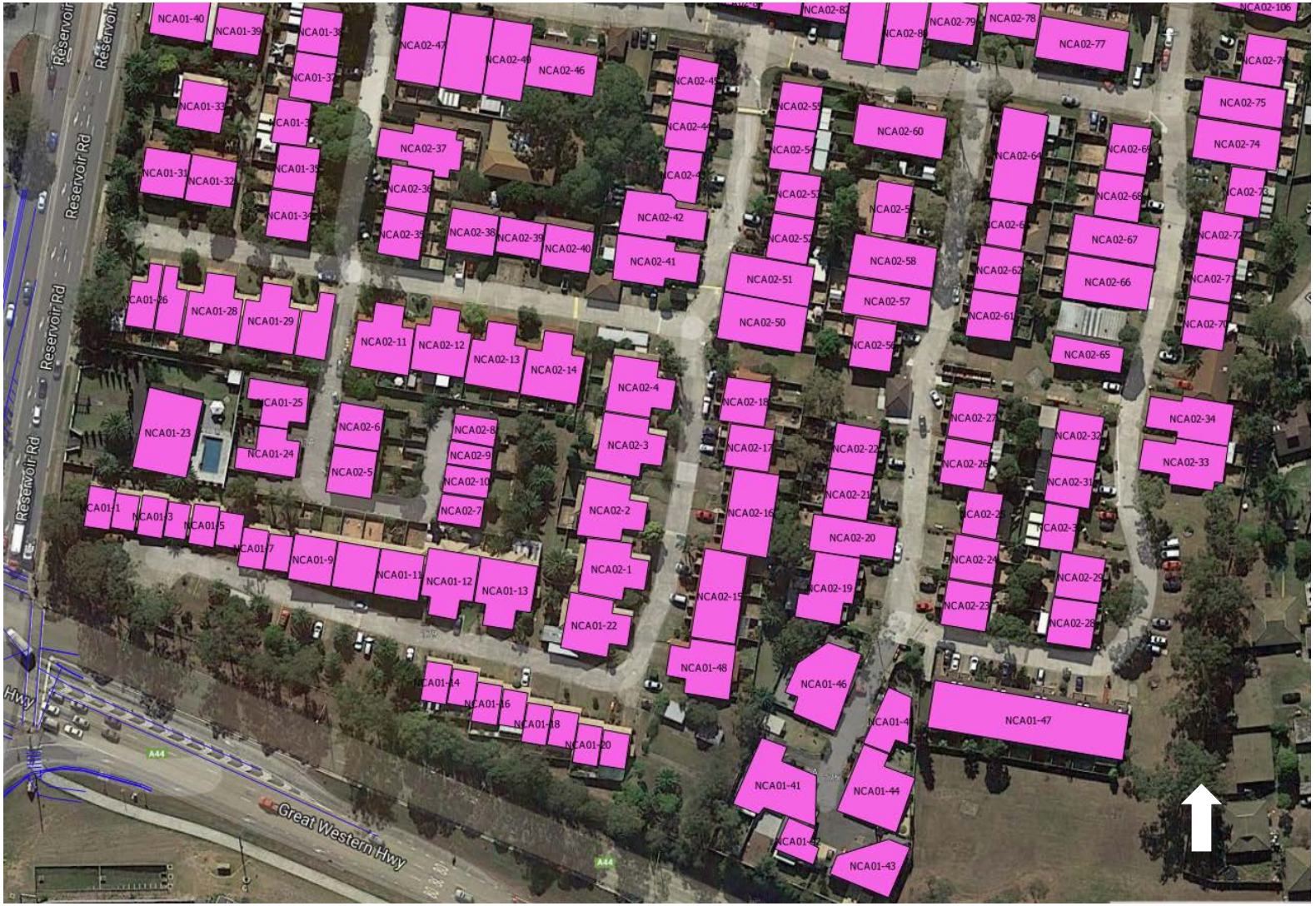
NCA02-143	53.9	53.9	0	53.7	53.7	0	54.2	54.2	0	54.0	54.0	0
NCA02-144	56.7	56.7	0	56.4	56.4	0	56.9	56.9	0	56.6	56.6	0
NCA02-145	58.2	58.3	0.1	58.0	58.0	0	58.5	58.5	0	58.2	58.2	0

Appendix E. Residential Receiver Identification

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Outlook St
Parkland St
Thistle Way
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NCA01-62
NCA01-61
NCA01-60
NCA02-145
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NCA02-142
NCA02-141
NCA02-140
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NCA02-124
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NCA01-32
Map data ©2017 Google Imagery ©2017 , CNES /

Appendix F

Biodiversity assessment

Great Western Highway and Reservoir Road Intersection Upgrade

Biodiversity Assessment

February 2018

NSW GOVERNMENT

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Roads and Maritime Services

Great Western Highway and Reservoir Road Intersection Upgrade

Biodiversity Assessment

February 2018

Prepared by Jacobs

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02	19/02/2018	Final	L Clews	P Rossington	L Lynch

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Executive summary

The NSW Roads and Maritime Services (Roads and Maritime) propose to upgrade the Great Western Highway/Reservoir Road intersection, Blacktown (the proposal). This report details the methods and results of a biodiversity survey and assessment of the distribution and abundance of threatened species, populations and ecological communities, and the extent and magnitude of ecological impacts associated with the proposal.

An ecological survey was undertaken within the study area on the 3 November 2017. While on site, a habitat assessment was undertaken to assess the likelihood of threatened biodiversity existing in the study area. The field survey aimed to ground-truth the results of the background research and desktop habitat assessment. All threatened species, populations and communities that were considered likely to occur within the study area were targeted during the field surveys and habitat assessment. Vegetation surveys were completed in line with the Biodiversity Assessment Method (BAM). Targeted surveys were completed for threatened plant species and the Cumberland Plain Land Snail. The habitat value of the waterway was characterised in accordance with NSW Department of Primary Industries (Fisheries) document *Policy and Guidelines for fish habitat conservation and management (2013 update).* This assessment also uses results from the Species Impact Statement (SIS) prepared to assess the impacts for a proposed development on Lot 2 in DP 229466 (also known as 6 Honeman Close) Huntingwood.

There were three Plant Community Types (PCTs) identified in the study area based off floristic composition, geology, and landscape position with regard to relevant regional vegetation classifications:

- Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849).
- Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 835).
- Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion (PCT 1071).

These PCTs are in moderate to good condition. Areas of planted native / exotic vegetation that cannot be matched to a PCT were also present. The remainder of the vegetated areas are classed as highly disturbed areas - road verges, table drains, road embankments, ploughed paddocks etc.

Two threatened ecological communities (TECs) listed under the *Biodiversity Conservation Act 2016* (BC Act) were identified in the study area:

- Cumberland Plain Woodland in the Sydney Basin Bioregion (listed as critically endangered).
- River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (listed as endangered).

One threatened ecological community as listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) was identified within the study area:

- Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (listed as critically endangered).

One threatened plant species was recorded in the study area during the field survey undertaken for the proposal: *Eucalyptus nicholii*. This species has been planted at the edge of Reservoir Road.

No threatened fauna species were found on site during the field survey but the following species are either known to occur in adjacent habitat or are considered at least moderately likely to occur based on the presence of suitable habitat:

- Cumberland Plain Land Snail (*Meridolum corneovirens*)

- Dusky Woodswallow (*Artamus cyanopterus cyanopterus*)
- Little Eagle (*Hieraaetus morphnoides*)
- Square-tailed Kite (*Lophoictinia isura*)
- Varied Sittella (*Daphoenositta chrysoptera*)
- Little Lorikeet (*Glossopsitta pusilla*)
- Swift Parrot (*Lathamus discolor*)
- Little Bent-wing Bat (*Miniopterus australis*)
- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*)
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)
- Eastern Freetail-bat (*Mormopterus norfolkensis*)
- Southern Myotis (*Myotis macropus*)
- Greater Broad-nosed Bat (*Scoteanax rueppellii*)
- Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*)
- Grey-headed Flying-fox (*Pteropus poliocephalus*)

The key impacts of the proposal include the removal of 0.48 hectares of native vegetation, including the following threatened ecological communities:

- 0.38 ha of Cumberland Plain Woodland in the Sydney Basin Bioregion (BC Act: listed as critically endangered).
- 0.06 ha of River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (BC Act: listed as endangered).
- 0.07 ha of Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (EPBC Act: listed as critically endangered); a subset of the 0.38 ha of the associated BC Act listed Cumberland Plain Woodland community.

The native vegetation to be removed provides habitat (or potential habitat) for the species listed above. The *Eucalyptus nicholii* plant would also be removed.

Fauna injury or death has the greatest potential to occur during construction when vegetation clearing would occur and the extent of this impact would be proportionate to the extent of vegetation that is cleared. Indirect / operational impacts would include a minor increase in habitat isolation. Invasion and spread of weeds, invasion and spread of pests, and invasion and spread of pathogens and disease are a risk with a proposal of this type. Noise, light and vibration would be increased during construction and operation. Significant impacts to aquatic ecosystems are unlikely to occur as a result of the proposal.

The study area is situated in an over-cleared landscape due to historic activities. In the context of historic vegetation removal, any future vegetation clearing no matter how small would result in incremental cumulative impact that would detrimentally affect biodiversity. The proposal would contribute to cumulative biodiversity impacts and may result in detrimental impacts to biodiversity.

The overall outcome of the tests of significance and EPBC Act assessments of significance (see Appendix C) indicate that there is a high level of certainty that the impacts to threatened biodiversity are unlikely to be significant.

Mitigation measures would be implemented during the construction and operational phases to lessen the potential ecological impacts of the proposal. The Roads and Maritime *Biodiversity Guidelines: Protecting and managing biodiversity of RTA projects* (NSW Roads and Traffic Authority, 2011) identify a range of mitigation techniques to be applied and these techniques must be implemented during construction (see Section 5.2). Due to the presence of the critically endangered ecological communities, exclusion zones would be established to delineate the works limit boundary to ensure no accidental impacts occur.

Although efforts have been made to avoid, minimise and mitigate potential ecological impacts from the proposal, some residual impacts would occur. It is Roads and Maritime policy that biodiversity offsets (or where offsets are not reasonable or feasible, supplementary measures) would be provided for impacts that exceed predetermined thresholds. The works would involve clearing of critically endangered ecological communities. The Roads and Maritime *Guideline*

for Biodiversity Offsets (November 2016) indicates that offsets are to be considered where there is any clearing of national or NSW listed critically endangered ecological communities in moderate to good condition. The proposal would involve clearing of the EPBC Act listed Cumberland Plain Shale Woodlands and Shale- Gravel Transition Forest critically endangered ecological community and the BC Act listed Cumberland Plain Woodland in the Sydney Basin Bioregion critically endangered ecological community. Areas of these critically endangered ecological communities are in moderate to good condition and as such offsets or supplementary measures are to be considered for the proposal in accordance with Roads and Maritime *Guideline for Biodiversity Offsets* (November 2016).

Contents

Glossary of terms

Definitions

Cumulative impact	The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. Refer to Clause 228(2) of the EP&A Regulation 2000 for cumulative impact assessment requirements.
Direct impact	Where a primary action is a substantial cause of a secondary event or circumstance which has an impact on a protected matter (ref http://www.environment.gov.au/system/files/resources/0b0cfb1e-6e28-4b23-9a97-fdadda0f111c/files/environment-assessment-manual.pdf).
Habitat	An area or areas occupied, or periodically or occasionally occupied, by a species, population or ecological community, including any biotic or abiotic component (OEH 2014).
Indirect impact	Where an event or circumstance is a direct consequence of the action (ref http://www.environment.gov.au/system/files/resources/0b0cfb1e-6e28-4b23-9a97-fdadda0f111c/files/environment-assessment-manual.pdf).
Matters of NES	A matter of national environmental significance (NES) protected by a provision of Part 3 of the EPBC Act
Mitchell landscape	Landscapes with relatively homogeneous geomorphology, soils and broad vegetation types, mapped at a scale of 1:250,000 (OEH 2014).
Mitigation	Action to reduce the severity of an impact. (OEH 2014).
Mitigation measure	Any measure that facilitates the safe movement of wildlife and/or prevents wildlife mortality.
Population	All the individuals that interbreed within a given area.
Proposal area/ Proposal site	The area of land that is directly impacted on by a proposed Major Proposal that is under the EP&A Act, including access roads, and areas used to store construction materials (OEH 2014).
Study area	The area directly affected by the development and any additional areas likely to be affected by the development, either directly or indirectly (OEH 2014).
Target species	A species that is the focus of a study or intended beneficiary of a conservation action or connectivity measure.

Abbreviations

BBCC	BioBanking Credit Calculator
BC Act	*Biodiversity Conservation Act 2016*
BVT	Biometric Vegetation Type
CEMP	Construction Environmental Management Plan
DP&E	Department of Planning and Environment
DPI	Department of Primary Industries
EEC	Endangered ecological community
EIS	Environmental Impact Statement
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999* (Federal).
FM Act	*Fisheries Management Act 1994* (NSW)
GDE	Groundwater dependent ecosystems
IBRA	Interim Biogeographically Regionalisation of Australia
MNES	Matters of National Environmental Significance
OEH	Office of Environment and Heritage
PCT	Plant Community Type
REF	Review of Environmental Factors
TECs	Threatened Ecological Communities
TSPD	Threatened Species Profile Database
VIS	Vegetation information system

1 Introduction

1.1 Proposal background

The NSW Roads and Maritime Services (Roads and Maritime) proposes to upgrade the Great Western Highway/Reservoir Road intersection, Blacktown (the proposal). The intersection has been identified as a pinch point along the Great Western Highway corridor, with congestion experienced particularly during morning and afternoon peak periods. The proposal is required to address congestion and safety issues at this location and forms part of Roads and Maritime's Easing Sydney's Congestion and Urban Roads Pinch Point Programs.

The proposal would improve the overall performance of the Great Western Highway/Reservoir Road intersection, improve travel time, reduce queue lengths, reduce congestion during the morning and afternoon peak periods, and improve safety issues.

1.2 The proposal

The proposal is located within the suburb of Blacktown, which is located within the Blacktown City Council local government area (LGA) (see Figure 1.1). The proposal area includes the Great Western Highway/Reservoir Road intersection, which is a four-way signalised intersection, with signalised pedestrian crossings at all approaches.

Reservoir Road provides access to the Blacktown central business district (CBD), about three kilometres north of the proposal, and the M4 Motorway, about 530 metres south of the proposal. The M4 Motorway is currently being upgraded by Roads and Maritime as part of the M4 Smart Motorways project. The Great Western Highway provides an east-west link from Penrith, about 20 kilometres west of the proposal, to Parramatta, about eight kilometres east of the proposal.

The area surrounding the Great Western Highway/Reservoir Road intersection is characterised by retail, commercial and residential land uses. Retail land uses are located within the south-east and north-west portions of the proposal area, including a Bunnings Warehouse, Mitre 10 and 7-Eleven petrol station. Residential land uses are located within the north-west portion of the proposal area. Unused land with established trees on private property is located within the south-west portion of the proposal area.

The key features of the proposal include:

- Upgrade southern approach to the intersection from Reservoir Road between Honeman Close and the Great Western Highway (about 260 metres) to improve traffic efficiency. This includes acquiring a strip of land on the western side up to 30 metres from the existing boundary to provide:
  - Two dedicated right turn lanes into the Great Western Highway
  - Two through lanes
  - A dedicated left turn lane with signalised pedestrian crossing
- Duplicating the Great Western Highway (westbound) right turn lanes onto Reservoir Road by utilising the existing chevron marked lane
- Upgrade Reservoir Road northern approach to the intersection including:
  - Localised widening of north west corner of the intersection to accommodate vehicle turning path from the Great Western Highway double right turn lanes
  - Lengthening of the existing left turn slip lane
- Improve alignment of the Great Western Highway (westbound) left slip lane onto Reservoir Road
- Property acquisition and utility relocation to the ultimate design footprint to avoid future rework (refer to concept design report acquisition maps)
- Adjustments to traffic signal infrastructure
- Upgrade and potential extension to the outlet of the cross culvert stormwater pipe including new outlet with headwall and scour protection (about 90 metres south of the intersection)
- Fill batters along the Reservoir Road northbound carriageway (4:1)

- Vegetation clearing including an area of mapped Cumberland Plain Woodland
- Utility adjustments including overhead powerline relocation, relocation of Telstra and NBN assets
- Property access impacts requiring private driveway adjustment and temporary construction access impacts to adjacent businesses (including petrol station and Mitre 10)

1.2.1 Study area

The study area for the purposes of this biodiversity assessment (see Figure 1.2) includes the Great Western Highway/Reservoir Road intersection and adjacent land to account for the area that would be directly and indirectly impacted by construction and operation of the proposal. It includes the total construction footprint, compound sites, stockpile sites and any other areas that would be temporarily disturbed.

The following areas are discussed throughout the report and are defined as:

- Proposal footprint: this area comprises the limits of the construction footprint and compound site locations including a 5 metre buffer (see Figure 1.2)
- Study area: includes the proposal footprint and surrounding area (see Figure 1.2) that may be used for site access
- Locality: This is defined as the area within a 10 kilometre radius surrounding the proposal footprint
- Bioregion: The study area is located in the Sydney Basin bioregion (Thackway and Cresswell, 1995) and within Cumberland sub-region.

1.3 Objectives

This report details the methods and results of a biodiversity survey and assessment to identify the distribution and abundance of threatened species, populations and ecological communities in the area of the proposal to assess the extent and magnitude of ecological impacts associated with the proposal. The report addresses the requirements for assessment of significance under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Mitigation measures to ameliorate ecological impacts arising from the proposal are also provided. The aims of the biodiversity assessment are to:

- Describe the characteristics and ecological condition of the vegetation communities and habitats within the study area.
- Determine the occurrence, or likelihood of occurrence of threatened species, populations and communities listed under the *Biodiversity Conservation Act 2016* (BC Act) and EPBC Act within the study area.
- Describe the potential impacts on biodiversity in the study area because of the proposal.
- Undertake a test of significance for threatened species and communities that are confirmed or considered likely to occur within the study area in accordance with section 7.3 of the BC Act to determine whether the proposal is likely to significantly affect threatened species.
- Undertake assessments in accordance with the *Matters of National Environmental Significance: Significant impact guidelines 1.1. Environment Protection and Biodiversity Conservation Act 1999* (Department of Environment, 2013) to consider impacts to nationally listed threatened species, ecological communities and migratory species
- Propose measures to mitigate impacts on ecological values
- Describe the proposed biodiversity offset strategy.

1.4 Legislative context

A Review of Environmental Factors (REF) has been prepared to fulfil Roads and Maritime Services obligations under s.111 of the EP&A Act to “examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of that activity” and s.112 in making decisions on the likely significance of any environmental impacts. This biodiversity impact assessment forms part of the REF prepared for the Great Western

Highway/Reservoir Road Intersection Upgrade, and assesses the biodiversity impacts of the proposal to meet the requirements of the EP&A Act.

Under s.111 of the EP&A Act, Roads and Maritime Services must consider the effect of an activity on:

- any conservation agreement entered into under the *National Parks and Wildlife Act 1974* (NP&W Act)
- any plan of management adopted under the NP&W Act for the conservation area to which the agreement relates,
- any joint management agreement entered into under the BC Act
- any Biodiversity Stewardship Agreement entered into under the BC Act
- any wilderness area (within the meaning of the *Wilderness Act 1987*) in the locality
- critical habitat
- threatened species, populations and ecological communities, and their habitats and whether there is likely to be a significant effect
- any other protected fauna or protected native plants within the meaning of the BC Act.

Section 5AA of the EP&A Act require that the significance of the impact on threatened species, populations and endangered ecological communities listed under the BC Act or FM Act is assessed using the test of significance. Where a significant impact is likely to occur, a species impact statement (SIS) must be prepared in accordance with the Director-General's requirements.

In September 2015, a "strategic assessment" approval was granted by the Federal Minister in accordance with the EPBC Act. The approval applies to Roads and Maritime activities being assessed under Part 5 of the EP&A Act with respect to potential impacts on nationally listed threatened species, ecological communities and migratory species.

As a result, Roads and Maritime proposals assessed via an REF:

- must address and consider potential impacts on nationally listed threatened species, populations, ecological communities and migratory species, including application of the "avoid, minimise, mitigate and offset" hierarchy
- do not require referral to the Federal Department of the Environment for these matters, even if the activity is likely to have a significant impact.

Roads and Maritime must consider impacts to nationally listed threatened species, ecological communities and migratory species as part of the approval process under the strategic assessment. To assist with this, assessments are required in accordance with the *Matters of National Environmental Significance: Significant impact guidelines 1.1. Environment Protection and Biodiversity Conservation Act 1999* (DoE 2013).

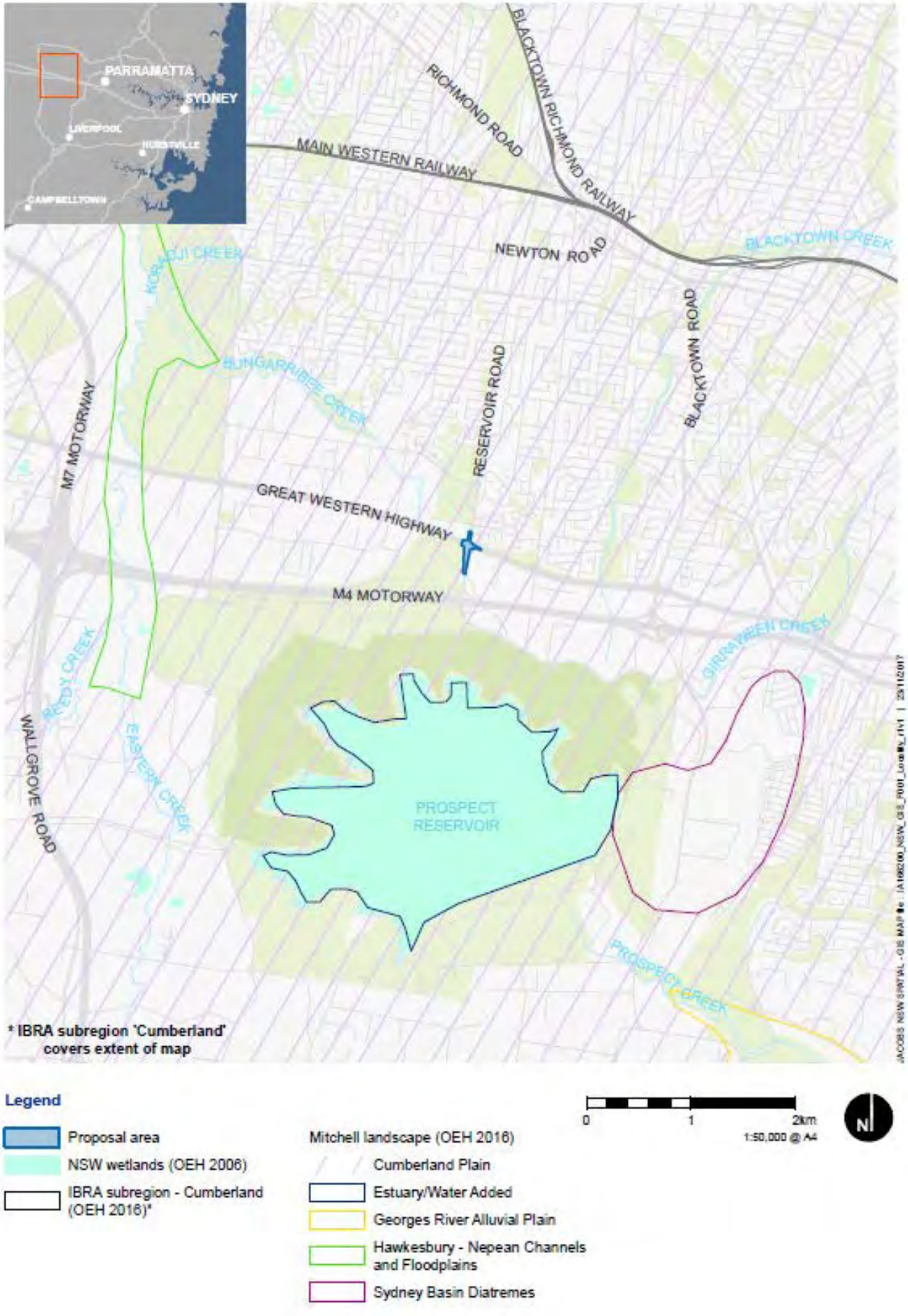

Figure 1.1 Proposal context

Figure 1.2 The proposal

2 Methods

2.1 Personnel

This biodiversity assessment was undertaken and prepared by appropriately qualified and experienced ecologists (refer to Table 2.1).

Table 2.1 Personnel, role and qualifications

Name	Role	Qualifications
Lukas Clews	Senior Ecologist - Technical lead, ecology surveys, reporting, GIS analysis	MSciStud GradCertAppSci BSc Diploma in Conservation and Land Management
Allie Cooke	Ecologist – Field survey assistant	BSc Cert III in Conservation and Land Management
Paul Rossington	Senior Ecologist - Technical review	BSc (Biology) Master of Wildlife Management

2.2 Background research

A background review of existing information was undertaken to identify the existing environment of the proposal within a search area of 10 kilometres. The review focussed on database searches, relevant ecological reports pertaining to the study area, particularly the Species Impact Statement (SIS) prepared for 6 Honeman Close Huntingwood (Cumberland Ecology, 2017), property boundaries, and relevant GIS layers. The review was used to prepare a list of threatened species, populations and communities as well as important habitat for migratory species with a likelihood of occurrence in the study area and locality. The searches were also undertaken to identify if an Areas of Outstanding Biodiversity Value were present.

The following database searches were performed:

- BioNet - the website for the Atlas of NSW Wildlife and OEH Threatened Species Profile Database
- NSW Department of Primary Industries (DPI) freshwater threatened species distribution maps
- The federal Department of Environment's Protected Matters Search Tool
- OEH BioNet Vegetation Classification database
- The federal Bureau of Meteorology's Atlas of Groundwater Dependent Ecosystems (GDE)
- Department of Environment's directory of important wetlands
- Department of Planning and Environment's SEPP 14 wetlands spatial data

Regional vegetation mapping projects including the *Southeast NSW Native Vegetation Classification and Mapping – SCIVI* (VIS_ID 2230), (State Government of NSW and Office of Environment and Heritage, 2010), the *Native Vegetation of the Sydney Metropolitan Area - Version 3* (VIS_ID 4489) (State Government of NSW and Office of Environment and Heritage, 2016) and the *Remnant Vegetation of the western Cumberland subregion, 2013 Update* (VIS_ID 4207) (State Government of NSW and Office of Environment and Heritage, 2015). Vegetation mapping from the 6 Honeman Close Huntingwood SIS (Cumberland Ecology, 2017) was also examined.

Preliminary and provisional determinations to list species and ecological communities as threatened under the BC Act was viewed on the OEH NSW Threatened Species Scientific

Committee website (Office of Environment and Heritage, 2017c). There were no preliminary or provisional listings of relevance to the proposal.

The annual Final Priority Assessment List of nominated species and ecological communities that have been approved for assessment by the Minister responsible for the EPBC Act was reviewed (period commencing 1 October 2017) (Department of the Environment and Energy, 2017). None of the nominated species and ecological communities are of relevance to the proposal.

2.2.1 Honeman Close Species Impact statement

Cumberland Ecology were commissioned to prepare a Species Impact Statement (SIS) to assess the impacts for a proposed development on Lot 2 in DP 229466, also known as 6 Honeman Close Huntingwood. The proposed development involves the demolition of existing structures, earthworks, and construction of a new service station.

The development would result in impacts to critically endangered Cumberland Plain Woodland in the Sydney Basin Bioregion ecological community as listed under the former *Threatened Species Conservation Act 1995* (TSC Act). The vegetation to be impacted also meets the criteria for the EPBC Act listed Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest critically endangered ecological community. A significant effect on threatened ecological communities was considered likely which triggered the requirement for a SIS.

Work involved in preparing the SIS included desktop assessments and detailed field surveys. The design of the flora and fauna surveys was determined in consideration of the *Threatened Biodiversity Survey and Assessment Guidelines for Development and Activities (Working Draft)* (Department of Environment and Conservation, 2004b) and the *NSW Guide to Surveying Threatened* Plants (Office of Environment and Heritage, 2016). As such, the survey effort undertaken is considered to be robust and suitable to inform this biodiversity assessment and REF.

Cumberland Ecology conducted flora surveys across the subject land in May and June 2016 which included:

- Vegetation mapping, to verify condition and extent of vegetation communities
- BioBanking Assessment Methodology (BBAM) plot and transects, to obtain information on species composition and community structure.
- Random meander surveys, to detect additional flora species not recorded during plot sampling.
- Targeted searches for threatened flora previously recorded from the locality including *Acacia pubescens, Marsdenia viridiflora* subsp. *viridiflora*, *Grevillea juniperina* subsp. *juniperina*, and *Pimelea spicata*.

Fauna surveys were undertaken between April and June 2016, and January 2017. The fauna surveys included:

- General habitat assessment, noting the abundance of various habitat features as well as an assessment of the likelihood of occurrence of potentially occurring threatened fauna species.
- Microchiropteran bat surveys, including the use of ‘Anabat’ unit for ultrasonic call detection point survey and walking transect survey
- Cumberland Plain Land Snail searches at all trees considered to comprise potential habitat.
- Diurnal bird census, including targeted surveys at census points.

The results of the field work reported in the SIS for 6 Honeman Close Huntingwood have been used to inform this biodiversity assessment.

2.3 Habitat assessment

A habitat assessment was undertaken within the study area on the identified list of threatened flora and fauna species known or predicted to occur in the Cumberland IBRA subregion that have been recorded within a 10 kilometre radius of the proposal (see Appendix B for the habitat assessment results). This list was identified from databases and literature as well as past surveys. The habitat assessment compared the preferred habitat features for these species with the type and quality of the habitats identified in the study area. This habitat assessment was completed to make an assessment of the likelihood of the species being present in the study area (ie subject species). The habitat assessment formed the basis for targeted surveys within the study area.

The criteria used in the habitat assessment are detailed in Table 2.2. The results of the habitat assessment are provided in Appendix B.

Table 2.2 Likelihood of occurrence classification and criteria

Likelihood	Criteria
Recorded	The species was observed in the study area during the current survey
High	It is highly likely that a species inhabits the study area and is dependent on identified suitable habitat (ie. for breeding or important life cycle periods such as winter flowering resources), has been recorded recently in the locality (10km) and is known or likely to maintain resident populations in the study area. Also includes species known or likely to visit the study area during regular seasonal movements or migration.
Moderate	Potential habitat is present in the study area. Species unlikely to maintain sedentary populations, however may seasonally use resources within the study area opportunistically or during migration. The species is unlikely to be dependent (ie. for breeding or important life cycle periods such as winter flowering resources) on habitat within the study area, or habitat is in a modified or degraded state. Includes cryptic flowering flora species that were not seasonally targeted by surveys and that have not been recorded.
Low	It is unlikely that the species inhabits the study area and has not been recorded recently in the locality (10km). It may be an occasional visitor, but habitat similar to the study area is widely distributed in the local area, meaning that the species is not dependent (ie. for breeding or important life cycle periods such as winter flowering resources) on available habitat. Specific habitat is not present in the study area or the species are non-cryptic perennial flora species that were specifically targeted by surveys and not recorded.
None	Suitable habitat is absent from the study area.

2.4 Field survey

A field survey was undertaken within the study area on the 3rd of November 2017 to ground-truth the results of the background research and habitat assessment.

2.4.1 Vegetation surveys

The vegetation survey was completed using field survey methods in line with Chapter 5 of the Biodiversity Assessment Method (BAM) (Office of Environment and Heritage, 2017a). A plot-based vegetation survey of the study area was undertaken. The survey was stratified and targeted to assess the expected environmental variation and address any areas with gaps in existing mapping and site information. The survey was undertaken on the 3rd of November 2017.

The broad scale vegetation mapping and aerial photography reviewed during the desktop assessment was used to initially identify vegetation extent. The initial vegetation mapping was ground-truthed while in the field and where possible assigned to Plant Community Types (PCTs) according to OEH BioNet Vegetation Classification Database (Office of Environment and Heritage, 2017b). Surveys assessed the environmental variation within the Study area

and any areas with gaps in existing mapping and site information to determine vegetation zones.

A vegetation integrity assessment was then undertaken on each vegetation zone in accordance with Chapter 5 of the BAM. The plot-based floristic survey used a series of 400 m^2 plots around a central 50 metre transect to assess vegetation structure and composition attributes (species richness and foliage cover). Function attributes (number of large trees, tree stem size class, tree regeneration and length of fallen logs) were recorded within the larger 1000 m^2 plot. Litter cover was assessed as the average percentage ground cover of litter recorded from five 1m x 1m plots evenly located along the central transect. The number of trees with hollows was determined by counting the number of trees with hollows that are visible from the ground in the 1000 m^2 plot. All data was collected according to the methods described in Chapter 5 of the BAM.

Areas of landscape plantings were sampled and mapped to identify the composition and abundance of this vegetation type within the study area. These areas were not assigned vegetation zones as they are not naturally occurring and cannot be matched to a PCT.

A summary of vegetation survey effort, outlining the number of vegetation zones and respective number of floristic plots / transects sampled in the field is presented in Table 2.3. The location of each plot / transect is shown in Figure 2.1.

Table 2.3 Summary of PCT / vegetation zones survey effort

Vegetation Zone Number	Plant Community Type (PCT)	Condition	Area (ha)	No. plots/transects required	No. plots/transects sampled
1	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Moderate / Good	0.10	1	1
2	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Moderate / Good_Poor	0.50	1	2
3	Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Moderate / Good_Poor	0.07	1	1
4	Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion	Moderate / Good_Poor	0.05	1	1
5	Planted native / exotic vegetation	NA	0.09	1	1
6	Highly disturbed areas - road verges, table drains, road embankments, ploughed paddocks etc	NA	2.08	1	1

Figure 2.1 Field survey locations

2.4.2 Targeted flora surveys

Targeted searches for threatened flora species previously recorded from the locality including *Acacia pubescens, Marsdenia viridiflora* subsp. *viridiflora*, *Grevillea juniperina* subsp. *juniperina*, and *Pimelea spicata* were previously undertaken for the 6 Honeman Close Huntingwood SIS (Cumberland Ecology, 2017).

The survey undertaken for this assessment built upon the existing survey from the SIS with a focused effort on the eastern edge of 6 Honeman Close that is within the western portion of the proposal study area. The habitats on 6 Honeman Close are the most suitable for threatened plant species out of the habitats present within the study area. The small patch of habitat within the Mitre 10 property to the north west of the intersection was also surveyed for threatened plant species. There is approximately 0.7 ha of potential habitat for threatened flora species in the study area.

The surveys undertaken for all identified candidate flora species initially considered moderately likely to occur within the study area (see Table 2.3) followed the methods described in the *NSW Guide to Surveying Threatened Plants* (Office of Environment and Heritage, 2016) with random meander surveys through the habitat undertaken using paired parallel transects. The floristic plot surveys also provided opportunity to record threatened species in discreet areas if they were present.

The threatened flora species targeted and details of the surveys undertaken are outlined in Table 2.3. The location of transects is shown on Figure 2.1.

Table 2.3 Targeted species survey techniques for threatened flora species and survey effort

Threatened flora species	Status		Recommended survey technique, effort and timing	Survey completed
	BC Act	EPBC Act		
Acacia pubescens	V	V	A parallel field traverse (ie parallel transects) was undertaken in areas of potential habitat. As a medium shrub the maximum distance between transects in open vegetation such as that in the study area is 20 m. In open vegetation, the recommended field traverse length is 0.5 km per hectare of potential habitat. Recommended survey time is estimated at 0.13 hours. Surveys for *Acacia pubescens* can be undertaken year round.	Approximately 1.4 km of transects were walked through areas of potential habitat by two ecologists over a period of approximately 0.5 hours (1-person hour of survey). The survey was undertaken in an appropriate season to detect this species. This species was not identified in the work undertaken for the 6 Honeman Close SIS or during the survey undertaken for this proposal.
Dillwynia tenuifolia	V	-	A parallel field traverse (ie parallel transects) was undertaken in areas of potential habitat. As a medium shrub the maximum distance between transects in open vegetation such as that in the study area is 20 m. In open vegetation, the recommended field traverse length is 0.5 km per hectare of potential habitat. Recommended survey time is estimated at 0.13 hours. Surveys for *Dillwynia tenuifolia* can be undertaken year round.	Approximately 1.4 km of transects were walked through areas of potential habitat by two ecologists over a period of approximately 0.5 hours (1-person hour of survey). The survey was undertaken in an appropriate season to detect this species. This species was not identified in the work undertaken for the 6 Honeman Close SIS or during the survey undertaken for this proposal.

Threatened flora species	Status		Recommended survey technique, effort and timing	Survey completed
	BC Act	EPBC Act		
Grevillea juniperina subsp. *juniperina*	V	-	A parallel field traverse (ie parallel transects) was undertaken in areas of potential habitat. As a medium shrub the maximum distance between transects in open vegetation such as that in the study area is 20 m. In open vegetation, the recommended field traverse length is 0.5 km per hectare of potential habitat. Recommended survey time is estimated at 0.13 hours. Surveys for *Grevillea juniperina* subsp. *juniperina* can be undertaken year round.	Approximately 1.4 km of transects were walked through areas of potential habitat by two ecologists over a period of approximately 0.5 hours (1-person hour of survey). The survey was undertaken in an appropriate season to detect this species. This species was not identified in the work undertaken for the 6 Honeman Close SIS or during the survey undertaken for this proposal.
Pultenaea parviflora	E	V	A parallel field traverse (ie parallel transects) was undertaken in areas of potential habitat. As a medium shrub the maximum distance between transects in open vegetation such as that in the study area is 20 m. In open vegetation, the recommended field traverse length is 0.5 km per hectare of potential habitat. Recommended survey time is estimated at 0.13 hours. Surveys for *Pultenaea parviflora* can be undertaken year round.	Approximately 1.4 km of transects were walked through areas of potential habitat by two ecologists over a period of approximately 0.5 hours (1-person hour of survey). The survey was undertaken in an appropriate season to detect this species. This species was not identified in the work undertaken for the 6 Honeman Close SIS or during the survey undertaken for this proposal.
Pultenaea pedunculata	E	-	A parallel field traverse (ie parallel transects) was undertaken in areas of potential habitat. As a small prostrate sub-shrub the maximum distance between transects in open vegetation such as that in the study area is 15 m. In open vegetation, the recommended field traverse length is 0.75 km per hectare of potential habitat. Recommended survey time is estimated at 0.19 hours. Surveys for *Pultenaea pedunculata* must be undertaken from September until the end of November.	Approximately 1.4 km of transects were walked through areas of potential habitat by two ecologists over a period of approximately 0.5 hours (1-person hour of survey). The survey was undertaken in an appropriate season to detect this species. This species was not identified in the work undertaken for the 6 Honeman Close SIS or during the survey undertaken for this proposal.
Persoonia nutans	E	E	A parallel field traverse (ie parallel transects) was undertaken in areas of potential habitat. As a medium shrub the maximum distance between transects in open vegetation such as that in the study area is 20 m. In open vegetation, the recommended field traverse length is 0.5 km per hectare of potential habitat. Recommended survey time is estimated at 0.13 hours. Surveys for *Persoonia nutans* can be undertaken year round.	Approximately 1.4 km of transects were walked through areas of potential habitat by two ecologists over a period of approximately 0.5 hours (1-person hour of survey). The survey was undertaken in an appropriate season to detect this species. This species was not identified in the work undertaken for the 6 Honeman Close SIS or during the survey undertaken for this proposal.

Threatened flora species	Status		Recommended survey technique, effort and timing	Survey completed
	BC Act	EPBC Act		
Pimelea spicata	E	E	A parallel field traverse (ie parallel transects) was undertaken in areas of potential habitat. As an herb the maximum distance between transects in open vegetation such as that in the study area is 10 m. In open vegetation, the recommended field traverse length is 1 km per hectare of potential habitat. Recommended survey time is estimated at 0.25 hours. Surveys for *Pimelea spicata* can be undertaken year round.	Approximately 1.4 km of transects were walked through areas of potential habitat by two ecologists over a period of approximately 0.5 hours (1-person hour of survey). The survey was undertaken in an appropriate season to detect this species. This species was not identified in the work undertaken for the 6 Honeman Close SIS or during the survey undertaken for this proposal.
Marsdenia viridiflora subsp. *viridiflora* endangered population	E	-	A parallel field traverse (ie parallel transects) was undertaken in areas of potential habitat. As a climber the maximum distance between transects in open vegetation such as that in the study area is 10 m. In open vegetation, the recommended field traverse length is 1 km per hectare of potential habitat. Recommended survey time is estimated at 0.25 hours. Surveys for *Marsdenia viridiflora* subsp. *viridiflora* can be undertaken year round.	Approximately 1.4 km of transects were walked through areas of potential habitat by two ecologists over a period of approximately 0.5 hours (1-person hour of survey). The survey was undertaken in an appropriate season to detect this species. This species was not identified in the work undertaken for the 6 Honeman Close SIS or during the survey undertaken for this proposal.
Eucalyptus nicholii	V	V	This species was recorded at the edge of the culvert on Reservoir Road on 6 Honeman Close during the traverse of the study area.	This species has been planted in the study area and was previously identified in the 6 Honeman Close SIS.

2.4.3 Targeted fauna surveys

Targeted surveys for the Cumberland Plain Land Snail were undertaken throughout areas of suitable habitat during the survey. The habitats on 6 Honeman Close are the most suitable for the Cumberland Plain Land Snail out of the habitats present within the study area. The small patch of habitat within the Mitre 10 property was also surveyed as this area contains a considerable amount of debris and rubble. The location of Cumberland Plain Land Snail survey sites is shown on Figure 2.1.

Searches for Cumberland Plain Land Snail involved looking for active specimens on tree trunks, turning over suitable ground shelter including fallen timber, sheets of iron and exposed rocks and rubble, raking back bark, litter and debris from the ground, and searching in dense grass clumps.

Other fauna surveys were not undertaken during the field work for this proposal. Targeted fauna surveys (for insectivorous bats and birds) were previously undertaken for the 6 Honeman Close Huntingwood SIS (Cumberland Ecology, 2017) and this data has been used to inform the assessment for this proposal. Where a species has not been surveyed, the habitat assessment has been used to determine the likelihood of occurrence.

2.4.4 Aquatic Surveys

An aquatic habitat assessment was conducted to assess the drainage line against the NSW DPI (Fisheries) document *Policy and Guidelines for fish habitat conservation and management (2013 update)* (NSW Department of Primary Industries, 2013) and *Fish Passage Requirements for Waterway Crossings* (Fairfull and Witheridge, 2003). These guidelines provide information for waterway classification and describe ways to minimise potential impacts of road projects on fish and other aquatic wildlife by protecting aquatic habitat and maintaining fish passage. The habitat assessment was visual only and no fish surveys or macroinvertebrate surveys were conducted; nor was water quality sampling undertaken. The aim of the habitat assessment was to identify the presence of 'key fish habitat'.

Habitat assessment for threatened aquatic species was undertaken for the first-order stream. Aquatic habitats were assessed by examining characteristics such as the structure and floristics of aquatic vegetation, channel width, the presence of surface water, water flow, water depth, turbidity, visible pollutants, erosion, the presence of shelter (rocks, submerged vegetation and woody debris), and channel substrate.

The habitat characteristics observed did not match the habitat characteristics of any threatened aquatic species known or predicted to occur in the locality hence targeted surveys for aquatic species were not undertaken.

2.5 Limitations

The vegetation field survey was able to provide adequate spatial coverage and survey effort for the entire study area. This was achievable in the timeframe given the small size of the study area. Detailed floristic survey was undertaken to provide a list of flora species for that point in time. Additional flora species may appear in other times of the year, particularly cryptic orchids. A period of several seasons or years is often needed to identify all the species present in an area, and specific weather conditions are required for optimum detection (eg breeding and flowering periods). The conclusions of this report are therefore based upon available data and limited field survey and are indicative of the environmental condition of the study area at the time of the survey. It should be recognised that site conditions, including the presence of threatened species, can change with time. To address this limitation, the assessment has aimed to identify the presence and suitability of the habitat for threatened species.

Data and results from the ecological surveys undertaken for the 6 Honeman Close Huntingwood SIS (Cumberland Ecology, 2017) have been relied upon and are assumed to be accurate.

The mapping included in this report shows the inferred distribution of plant community types and habitat within the study area. In many cases, the boundaries between plant community types and habitats are not well-defined and the mapping provides an approximation of on-ground conditions. The maps represent a snapshot in time.

3 Existing environment

3.1 Environmental context

The study area is located within the Cumberland sub-region of the Sydney Basin Bioregion as defined by Thackway and Cresswell (1995) and the Cumberland Plain Mitchell Landscape as mapped by the NSW National Parks and Wildlife Service (2002a) and described by the NSW Department of Environment and Climate Change (2008). The Cumberland Plain Mitchell Landscape is an over cleared landscape with 89 per cent of native vegetation having been cleared. Only 11 per cent of the original native vegetation remains.

The landscape is predominantly low rolling hills and wide valleys in a rain shadow area below the Blue Mountains (Morgan, 2001). Geology is dominated by undifferentiated middle Triassic Wianamatta group shales (Bringelly Shale) (Clarke and Jones, 1991). Soils overlying the Wianamatta Shale are of the residual Blacktown soil landscape (Hazelton et al., 1989, Morgan, 2001, Department of Environment and Climate Change, 2008).

The study area is situated in an extensively cleared landscape where roadside vegetation and small scattered bushland remnants form the bulk of the remaining vegetation. The vegetation on 6 Honeman Close forms one of the largest areas of native vegetation on private property within the Blacktown LGA. The PCTs within the study area are described in Section 3.2.

The aquatic environment is limited to an unnamed and unmapped creek (Strahler 1st order stream) that exits a culvert on the western edge of Reservoir Road onto the property at 6 Honeman Close and drains north west into Bungarribee Creek which eventually discharges into Eastern Creek, South Creek then finally the Hawkesbury River. The habitat quality for fish is poor (discussed in Section 3.6). There are no wetlands of significance (State Environmental Protection Policy 44 wetlands or wetlands listed in the Directory of Important Wetlands) in or adjacent to the study area.

3.2 Plant community types

The majority of native vegetation within the study area is confined to the western side of Reservoir Road on 6 Honeman Close (see Figure 3.1). This area contains one of the largest remnants of native vegetation on private property in the Blacktown LGA. A small remnant of native vegetation is also present in the northwest corner of the Reservoir Road - Great Western Highway intersection within the Mitre 10 building. The remainder of the study area contains strips of remnant roadside trees and scattered individual trees in addition to planted native / exotic vegetation. The cleared and disturbed areas (including all four compound sites) contain exotic grassland dominated by weeds. Past and present land use activities such as land clearing, weed and pest invasion, rubbish dumping and human interaction have modified the extent and condition of native vegetation in the study area and locality.

There were three PCTs identified in the study area based on floristic composition, geological substrate, and landscape position with regard to relevant regional vegetation classifications:

- Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849).
- Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 835).
- Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion (PCT 1071).

Areas of planted native / exotic vegetation that cannot be matched to a PCT were also present. The remainder of vegetated areas are classed as Highly disturbed areas - road verges, table drains, road embankments, ploughed paddocks etc.

The PCTs and other vegetation identified within the study area are outlined in Table 3.1 and illustrated in Figure 3.1.

Table 3.1 Plant community types

Plant community type (PCT)	Condition class	Vegetation formation	Percent cleared in major catchment area	Threatened ecological community?	Area (ha) in proposal area	Area (ha) in study area
Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Moderate/ Good	Grassy Woodlands	93	Cumberland Plain Woodland in the Sydney Basin Bioregion CEEC Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest CEEC (in part)	0.07	0.10
	Moderate/ Good_Poor				0.31	0.50
Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Moderate/ Good_Poor	Forested Wetlands	93	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions EEC	0.06	0.07
Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion	Moderate/ Good_Poor	Freshwater Wetlands	75	No. This PCT occurs a result of altered drainage caused by stormwater management works is not a naturally occurring wetland.	0.04	0.05
Planted native / exotic vegetation	NA	NA	NA	No	0.07	0.09
Highly disturbed areas - road verges, table drains, road embankments, ploughed paddocks etc	NA	NA	NA	No	1.30	2.08
				Totals	**1.85**	**2.89**

Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849) - Moderate / Good

Vegetation formation: Grassy Woodlands

Vegetation class: Coastal Valley Grassy Woodlands

Conservation status: Critically Endangered Ecological Community (BC Act): Cumberland Plain Woodland in the Sydney Basin Bioregion. Critically Endangered Ecological Community (EPBC Act): Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest

Estimate of percent cleared: 93%

Extent in the study area: 0.10 ha

Plots completed in vegetation zone: 1

Species by stratum	Height range (m)	Foliage cover estimate	Typical species
Upper	10 – 20 m	22%	*Eucalyptus moluccana, Eucalyptus tereticornis, Eucalyptus crebra, Eucalyptus amplifolia* subsp. *amplifolia*
Middle	1 – 6 m	17%	*Lantana camara*, Bursaria spinosa, Acacia decurrens, Dillwynia sieberi, Olea europaea*, Acacia falcata, Phoenix canariensis**
Ground	0 – 1 m	63%	*Microlaena stipoides, Chloris gayana*, Aristida vagans, Carex inversa, Bidens pilosa*, Pavonia hastata*, Glycine tabacina*, Plantago lanceolata*, Dichondra repens*, Dianella longifolia, Araujia sericifera*, Hypochaeris radicata*, Briza subaristata*, Mentha satureoides*

Description:

The gentle topography associated with the shale plains of western Sydney carries an open grassy woodland dominated by *Eucalyptus moluccana, Eucalyptus tereticornis* and *Eucalyptus crebra/Eucalyptus fibrosa*. Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849) (Office of Environment and Heritage, 2017b). Tozer et al. (2006) define the primary habitat for the community as occurring at elevations less than 150 meters above sea level with some sites occurring at higher elevations where the landscape remains gently inclined (Office of Environment and Heritage, 2017b).

Within the study area, PCT 849 - Moderate / Good is located in one area of 6 Honeman Close to the south west of the Reservoir Rd - Great Western Highway intersection. The portion of this PCT within the study area is part of a much larger patch on 6 Honeman Close. The canopy contains *Eucalyptus moluccana, Eucalyptus tereticornis, Eucalyptus crebra,* and *Eucalyptus amplifolia* subsp*. amplifolia*. The midstorey is infested with *Lantana camara** but a range of native species including *Bursaria spinosa, Acacia* spp. and *Dillwynia sieberi* are also present. The groundcover is moderately dense and dominated by native grasses (notably *Microlaena stipoides* with approximately 40% cover) but there is also invasion by weeds.

Fauna habitat values are moderate. The vegetation is part of a larger patch on 6 Honeman Close but the habitat is disturbed and primarily composed of young trees. No hollow bearing trees were present in the plot which limits the habitat suitability for nesting and roosting. No large trees above the 50 cm dbh threshold were present in the plot. The canopy provides foraging opportunities. No large woody debris was recorded in the ground layer which limits sheltering and foraging opportunities for some fauna groups. The habitat does still provide some good sheltering and foraging value with leaf litter layer (average cover of 21%) and dumped refuse providing opportunity for ground dwelling species, including the threatened Cumberland Plain Land Snail, to find shelter sites.

The Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849) - Moderate / Good as it occurs in the study area is shown in Photograph 1.

Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849) - Moderate / Good_Poor

Vegetation formation: Grassy Woodlands

Vegetation class: Coastal Valley Grassy Woodlands

Conservation status: Critically Endangered Ecological Community (BC Act): Cumberland Plain Woodland in the Sydney Basin Bioregion

Estimate of percent cleared: 93%

Extent in the study area: 0.50 ha

Plots completed in vegetation zone: 2

Species by stratum	Height range (m)	Foliage cover estimate	Typical species
Upper	10 – 20 m	30 – 35%	*Eucalyptus moluccana, Eucalyptus tereticornis, Eucalyptus crebra, Eucalyptus amplifolia* subsp. *amplifolia*
Middle	1 – 3 m	1 – 5%	*Bursaria spinosa, Acacia falcata, Lantana camara*, Olea europaea*, Lycium ferocissimum, Indigofera australis, Yucca aloifolia**
Ground	0 – 1 m	90 – 100%	*Eragrostis curvula*, Cenchrus clandestinus*, Sida rhombifolia*, Anredera cordifolia*, Chloris gayana*, Dianella longifolia, Araujia sericifera*, Brunoniella australis, Senecio madagascariensis*, Cirsium vulgare*, Glycine tabacina, Dichondra repens, Nothoscordum gracile*, Plantago lanceolata*, Sonchus oleracea*, Chlorophytum comosum*, Brassica* sp*, *Crassula multicava**

Description:

The gentle topography associated with the shale plains of western Sydney carries an open grassy woodland dominated by *Eucalyptus moluccana, Eucalyptus tereticornis* and *Eucalyptus crebra/Eucalyptus fibrosa*. Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849) (Office of Environment and Heritage, 2017b). Tozer et al. (2006) define the primary habitat for the community as occurring at elevations less than 150 meters above sea level with some sites occurring at higher elevations where the landscape remains gently inclined (Office of Environment and Heritage, 2017b).

Within the study area, PCT 849 - Moderate / Good_Poor is located along the roadsides of Reservoir Road, the Great Western Highway, and Boiler Close. The patch of vegetation behind the Mitre 10 fits into this category as do patches on 6 Honeman Close. The canopy is largely composed of *Eucalyptus moluccana, Eucalyptus tereticornis* and *Eucalyptus crebra*. The midstorey includes *Bursaria spinosa, Acacia falcata* and *Indigofera australis* but woody weeds are dominant. The groundcover is highly disturbed and dominated by exotic grasses predominantly *Eragrostis curvula*, Cenchrus clandestinus*,* and *Chloris gayana**.

Fauna habitat values are considered to be low due to ongoing disturbance. The habitat contains very little native groundcover and contains a dense tall sward of exotic grasses or in some instances a mown ground layer; there are few, if any, open patches in the ground layer. The habitat structure is simplified and lacks structural maturity. Only one large tree above the 50 cm dbh threshold was present in the plot behind Mitre 10 but this tree was multi stemmed above the dbh measurement line and lacked hollows. The canopy provides foraging opportunities. The habitat lacks important habitat features but does contain some good sheltering and foraging value with leaf litter layer (average cover of 34%) and dumped refuse (particularly behind Mite 10) providing opportunity for ground dwelling species, including the threatened Cumberland Plain Land Snail, to find shelter sites.

The Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849) - Moderate / Good_Poor as it occurs in the study area is shown in Photograph 2.

Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 835) - Moderate / Good_Poor

Vegetation formation: Forested Wetlands

Vegetation class: Coastal Floodplain Wetlands

Conservation status: Endangered Ecological Community (BC Act): River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions

Estimate of percent cleared: 93%

Extent in the study area: 0.07 ha

Plots completed in vegetation zone: 1

Species by stratum	Height range (m)	Foliage cover estimate	Typical species
Upper	10 – 20 m	25%	*Eucalyptus amplifolia* subsp. *amplifolia, Eucalyptus moluccana*
Middle	1 – 8 m	0.6%	*Bursaria spinosa, Acacia falcata, Exocarpos cupressiformis, Lantana camara*, Olea europaea*, Phoenix canariensis**
Ground	0 – 1 m	73%	*Chloris gayana*, Cenchrus clandestinus*, Ehrharta erecta*, Cymbopogon refractus, Glycine tabacina, Avena* sp**, Dichondra repens, Plantago lanceolata*, Solanum pseudocapsicum*, Pavonia hastata*, Bidens pilosa*, Brunoniella australis*

Description:

PCT 835 is an open eucalypt forest situated on alluvial flats of the Hawkesbury and Nepean river systems which also forms narrow ribbons along streams and creeks that drain the Cumberland Plain (Office of Environment and Heritage, 2017b). The canopy typically includes one of either *Angophora floribunda* or *Angophora subvelutina* and one or both of *Eucalyptus tereticornis* and *Eucalyptus amplifolia* however there are a wide variety of other eucalypts also present (Office of Environment and Heritage, 2017b). In its natural state, the community has an understorey characterised by a generally sparse small tree stratum and sparse lower shrub layer that features *Bursaria spinosa* at most sites (Office of Environment and Heritage, 2017b). The ground layer is characterised by an abundant cover of grasses with small herbs and ferns (Office of Environment and Heritage, 2017b).

Within the study area, PCT 835 forms a thin strip along the unnamed creek line. There is a dense canopy of *Eucalyptus amplifolia* subsp. *amplifolia* trees with considerable regrowth of this species forming a lower tree layer below the main canopy. There are scattered *Eucalyptus moluccana* trees and further west there are species including *Eucalyptus crebra, Eucalyptus tereticornis* and *Angophora floribunda* (Cumberland Ecology, 2017). The middle stratum is typically sparse and features *Bursaria spinosa* and *Acacia falcata*. The ground layer is dominated by exotic grasses and herbs but still contains some native species including *Dichondra repens, Cymbopogon refractus,* and *Brunoniella australis*.

Fauna habitats are in moderate condition. No hollow bearing trees were present due to the relatively young age of the vegetation (no large trees above the 50 cm dbh threshold) and good health of the canopy species. This limits the value of the habitat for nesting or roosting. The canopy provides foraging opportunities. No large woody debris was recorded in the ground layer which limits sheltering and foraging opportunities for some fauna groups. The habitat does still provide some good sheltering and foraging value with leaf litter layer (average cover of 19%) providing opportunity for ground dwelling species to find shelter sites.

The Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 835) – Moderate / Good_Poor as it occurs in the study area is shown in Photograph 3.

Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion (PCT 1071) – Moderate / Good_Poor

Vegetation formation: Freshwater Wetlands

Vegetation class: Coastal Freshwater Lagoons

Conservation status: This PCT only occurs as a consequence of stormwater management works and is not a naturally occurring wetland. This wetland in man-made and a freshwater wetland would not have naturally occurred in this location. Artificial wetlands created on previously dry land specifically for purposes such as sewerage treatment, stormwater management (such as the case with the PCT in the study area) and farm production, are not regarded as part of the Freshwater Wetlands on Coastal Floodplains TEC (NSW Scientific Committee, 2004). As such, this PCT is not considered to form part of the Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions EEC.

Estimate of percent cleared: 75%

Extent in the study area: 0.05 ha

Plots completed in vegetation zone: 1

Species by stratum	Height range (m)	Foliage cover estimate	Typical species
Upper	NA	0%	None
Middle	NA	1%	*Melaleuca quinquenervia* (planted), *Phoenix canariensis**
Ground	0 – 2 m	90%	*Typha orientalis, Persicaria lapathifolia, Schoenoplectus validus, Cenchrus clandestinus*, Cirsium vulgare*, Ageratina adenophora*, Rumex crispus*, Foeniculum vulgare*, Sonchus oleraceus*, Plantago lanceolata**

Description:

The Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion (PCT 1071) consists of wetlands located on coastal plains, valleys, lagoons and other sites of poor drainage (Office of Environment and Heritage, 2017b). This PCT also included man-made water bodies, drainage lines and depressions across a wide variety of environments (Office of Environment and Heritage, 2017b) where wetland vegetation has established. This is the case with the PCT in the study area. The vegetation has established in the low lying area of the drainage line after stormwater management works had been undertaken. This area would not have originally supported a naturally occurring wetland.

As is commonly found on the Cumberland Plain, this PCT consists of a dense stand of *Typha orientalis* with *Schoenoplectus validus* and *Persicaria lapathifolia* and a range of exotic grass and herbaceous species.

Fauna habitats are in moderate condition. There is no significant area of open water present within this PCT so habitat for waterbird species is limited. The dense *Typha orientalis* stand provides suitable habitat for small birds that frequent thick rush beds. The absence of extensive shallow edges or mudflats limits the habitat suitability for waders or other wetland bird species. The dense cover of *Typha orientalis* is suitable for a range of common frog species. It may also be suitable for the threatened Green and Golden Bell Frog. However, the habitat is not considered to be optimal and this species has not been recorded from the locality since 1999 when it was found at Merrylands. Records have not been made at other former habitats in the locality since the 1970s so it is unlikely that this species occurs in the study area.

The Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion (PCT 1071) – Moderate / Good_Poor as it occurs in the study area is shown in Photograph 4.

Planted native / exotic vegetation

Vegetation formation: NA

Vegetation class: NA

Conservation status: NA

Estimate of percent cleared: NA

Extent in the study area: 0.09

Plots completed in vegetation zone: 1

Species by stratum	Height range (m)	Foliage cover estimate	Typical species
Upper	10 – 20 m	20 – 30%	*Corymbia citriodora*, Corymbia maculata, Eucalyptus elata, Eucalyptus nicholii, Phoenix canariensis*, Schinus molle* var. *areira*, Erythrina x sykesii**
Middle	1 – 3 m	0 – 60%	*Melaleuca quinquenervia, Olea europaea*, Nandina domestica*, Tecoma capensis*, Nerium oleander*, Yucca aloifolia*, Citrus x taitensis*, Monstera deliciosa*, Strelitzia reginae*, Prunus persica*, Celtis sinensis**
Ground	0 – 1 m	100%	*Cenchrus clandestinus*, Eragrostis curvula*, Sida rhombifolia*, Anredera cordifolia*, Chloris gayana*, Araujia sericifera*, Brunoniella australis, Senecio madagascariensis*, Cirsium vulgare*, Plantago lanceolata*, Sonchus oleracea*, Crassula multicava*, Chlorophytum comosum*, Avena* sp.**, Lactuca serriola*, Verbena bonariensis*, Conyza bonariensis**

Description:

The study area contains some areas of planted vegetation, notably on 6 Honeman Close around the old building and along Reservoir Road. The plantings were likely done with a previous upgrade of Reservoir Road and construction of the culvert and stormwater device.

The plantings along Reservoir Road are a mixture of species including *Corymbia citriodora*, Corymbia maculata, Eucalyptus elata,* and *Eucalyptus nicholii* (which is a threatened species listed under the BC Act and EPBC Act). *Melaleuca quinquenervia* has been planted around the culvert. The old building contains plantings of common garden plants and fruit trees.

Fauna habitat values are considered to be low due to ongoing disturbance. The groundcover is dominated by a dense tall sward of exotic grasses. The habitat structure is simplified and lacks structural maturity. The trees lack hollows but the canopy species do provide some limited foraging opportunities (particularly *Corymbia citriodora**). The dense midstorey plantings where present provide sheltering and foraging opportunities for smaller species.

The Planted native / exotic vegetation as it occurs in the study area is shown in Photograph 5.

Highly disturbed areas - road verges, table drains, road embankments, ploughed paddocks etc

Vegetation formation: NA

Vegetation class: NA

Conservation status: NA

Estimate of percent cleared: NA

Extent in the study area: 2.08

Plots completed in vegetation zone: Random meander undertaken to record typical species

Species by stratum	Height range (m)	Foliage cover estimate	Typical species
Upper	NA	0%	None
Middle	NA	0%	None
Ground	0 – 1 m	100%	*Cenchrus clandestinus*, Eragrostis curvula*, Sida rhombifolia*, Anredera cordifolia*, Chloris gayana*, Araujia sericifera*, Brunoniella australis, Senecio madagascariensis*, Cirsium vulgare*, Plantago lanceolata*, Sonchus oleracea*, Crassula multicava*, Chlorophytum comosum*, Avena* sp.**, Lactuca serriola*, Verbena bonariensis*, Conyza bonariensis**

Description:

The study area contains areas that are highly disturbed, including road verges and paddocks. The vegetation in these areas is either mown or in the case of some areas of 6 Honeyman Close and Boiler Close is left to grow a tall exotic grass and herb layer. Dominant species include *Cenchrus clandestinus*, Eragrostis curvula** and *Chloris gayana** with exotic herbs *Senecio madagascariensis*, Cirsium vulgare*, Plantago lanceolata*, Sonchus oleracea*, Lactuca serriola*, Verbena bonariensis*,* and *Conyza bonariensis*.

Fauna habitat values are considered to be low as these are open grassed areas with few habitat features. The habitat rarely contains any native groundcover species and generally possesses a dense tall sward of exotic grasses (generally dominated by *Chloris gayana*, Eragrostis curvula** or *Cenchrus clandestinus**)

The Highly disturbed areas - road verges, table drains, road embankments, ploughed paddocks etc as it occurs in the study area is shown in Photograph 6.

Photograph 1: Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849) - Moderate / Good on 6 Honeman Close to the south of the Great Wetsern Highway

Photograph 2: Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849) - Moderate / Good_Poor at the north-west of the intersection within the Mitre 10 property

Photograph 3: Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 835) - Moderate / Good_Poor on 6 Honeman Close to the west of Reservoir Road

Photograph 4: Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion (PCT 1071) - Moderate / Good_Poor on 6 Honeman Close at the culvert off Reservoir Road showing PCT 835 in the distance

*Photograph 5: Planted native / exotic vegetation on 6 Honeman Close at the western edge of Reservoir Road showing Corymbia maculata and Eucalyptus elata with ground cover of Cenchrus clandestinus**

Photograph 6: Highly disturbed areas - road verges, table drains, road embankments, ploughed paddocks etc dominated by weeds at Compound site 1 adjacent to Reservoir Road

Figure 3.1 Plant community types

3.3 Groundwater dependent ecosystems

The level of groundwater dependence of vegetation communities in the study area has been identified using the Atlas of GDEs (Bureau of Meteorology, 2017) and the *Risk Assessment Guidelines for Groundwater Dependant Ecosystems* released by the NSW DPI (Kuginis et al., 2012). The Atlas of GDEs (Bureau of Meteorology, 2017) identifies portions of the study area on 6 Honeman Close as containing groundwater dependent terrestrial vegetation (phreatophytes) in the form of Cumberland Shale Plains Woodland (PCT 849). The study area does not contain any aquatic GDEs and is not located within a floodplain alluvial groundwater source. The Atlas of GDEs dataset uses the same polygons as the *Southeast NSW Native Vegetation Classification and Mapping – SCIVI* (VIS_ID 2230) (State Government of NSW and Office of Environment and Heritage, 2010) and does not provide a fine scale map of GDEs so must be used as a guide only.

The study area also contains three PCTs as outlined in Section 3.2:

- Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849).
- Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 835).
- Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion (PCT 1071).

While PCT 849 and PCT 835 are considered with a high likelihood to be GDEs (Kuginis et al., 2012), these two PCTs are not obligate GDEs (ie they are not entirely dependent on groundwater). These PCTs are not restricted to locations of groundwater discharge and are not located within aquifers. These two PCTs are likely to be opportunistic facultative GDEs that depend on the subsurface presence of groundwater (often accessed via the capillary fringe – subsurface water just above the water table) in some locations but not in others, particularly where an alternative source of water (ie rainfall) cannot be accessed to maintain ecological function (Kuginis et al., 2012). The plants within these PCTs would use shallow soil water before seeking deeper soil water or groundwater. The trees may take up groundwater from the capillary fringe when necessary (eg during dry seasons or in extended drought). The drainage line within the study area is a losing stream reach and is not a baseflow stream that would have vegetation highly dependent on groundwater.

PCT 1071 only occurs in the study area as a consequence of stormwater management works and is not a naturally occurring wetland. This wetland in man-made and exists due to ponding of stormwater. A freshwater wetland would not have naturally occurred in this location. The occurrence of PCT 1071 in the study area is rain fed and is not likely to be a GDE.

3.4 Threatened ecological communities

Two threatened ecological communities (TECs) listed under the BC Act were identified in the study area:

- Cumberland Plain Woodland in the Sydney Basin Bioregion (listed as critically endangered).
- River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (listed as endangered).

A brief description of each TEC is provided in Table 3.2 and the distribution of TECs is mapped in Figure 3.2.

The Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion (PCT 1071) within the study area occurs as a consequence of stormwater management works and is not a naturally occurring wetland. This wetland in man-made and a freshwater wetland would not have naturally occurred in this location. Artificial wetlands created on previously dry land specifically for purposes such as sewerage treatment, stormwater management (such as the case with the PCT in the study area) and farm

production, are not regarded as part of the Freshwater Wetlands on Coastal Floodplains TEC (NSW Scientific Committee, 2004). As such, this PCT is not considered to form part of the Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions EEC.

Table 3.2 Threatened ecological communities present in the study area

Threatened ecological community	Listing advice description	Description of TEC in the study area	Area in study area (ha)
Cumberland Plain Woodland in the Sydney Basin Bioregion (Critically Endangered, BC Act)	Cumberland Plain Woodland is the name given to the ecological community in the Sydney Basin bioregion associated with clay soils derived from Wianamatta Group geology, or more rarely alluvial substrates, on the Cumberland Plain. Cumberland Plain Woodland is characterised by an upper-storey that is usually dominated by *Eucalyptus moluccana* and *Eucalyptus tereticornis*, often with *Eucalyptus crebra*, *Eucalyptus eugenioides*, *Corymbia maculata* or other less frequently occurring eucalypts, including *Angophora floribunda*, *Angophora subvelutina*, *Eucalyptus amplifolia* and *Eucalyptus fibrosa*.	Located on the Cumberland Plain in the Sydney Basin Bioregion on clay soils derived from Wianamatta Group geology. Characterised by an upper-storey that is dominated by *Eucalyptus moluccana* and *Eucalyptus tereticornis* with occasional *Eucalyptus crebra* and *Eucalyptus amplifolia*. The Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion PCT corresponds directly to this TEC.	0.60
River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (Endangered, BC Act)	River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions is the name given to the ecological community associated with silts, clay-loams and sandy loams, on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains. The composition of River-Flat Eucalypt Forest on Coastal Floodplains is primarily determined by the frequency and duration of waterlogging and the texture, nutrient and moisture content of the soil. It has a tall open tree layer of eucalypts and the composition of the tree stratum varies considerably, the most widespread and abundant dominant trees include *Eucalyptus tereticornis, Eucalyptus amplifolia, Angophora floribunda* and *Angophora subvelutina*. A layer of small trees may be present, including *Melaleuca decora*, *Melaleuca styphelioides*, *Backhousia myrtifolia, Melia azaderach, Casuarina cunninghamiana* subsp. *cunninghamiana* and *Casuarina glauca*.	Located in the Sydney Basin Bioregion on clay-loam soils on a drainage line. It has a tree layer of eucalypts dominated by *Eucalyptus amplifolia* and *Eucalyptus molluccana* with *Eucalyptus tereticornis* and *Angophora floribunda* in adjacent areas. The Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion PCT corresponds directly to this TEC.	0.07

Figure 3.2 Threatened ecological communities and threatened species

3.5 Threatened species and populations

3.5.1 Threatened flora species

Twenty-seven threatened flora species and two endangered populations have been previously recorded or modelled as having potential to occur in the locality (see Appendix B). Many of these species favour habitats that are not represented in the study area or are only known to exist in populations restricted to specific localities (eg alluvium of the Eastern Creek floodplain), or are presumed extinct.

One threatened flora species was recorded in the study area during the field survey undertaken for the proposal and also identified in the 6 Honeman Close SIS (Cumberland Ecology, 2017): *Eucalyptus nicholii*. This species has been planted at the western edge of Reservoir Road within the proposal area. The Cumberland Plain is not the natural habitat of this species and is well outside of the species' natural range. The *Eucalyptus nicholii* tree is isolated from naturally-occurring or naturalised populations of the species and is not able to complete its natural life cycle in this environment.

The habitats in the study area are not considered optimal for any of the remaining threatened flora species listed in Appendix B due to the degraded nature of the vegetation, mowing and/or grazing regimes, disturbance to the soil, and dominance of exotic species. Overall, threatened flora species are considered to have a low likelihood of occurrence or are unlikely to occur (see Appendix B).

3.5.2 Threatened fauna species

Based on regional records and the presence of suitable habitat, 45 threatened fauna species have been identified in the locality (see Appendix B) or have modelled habitat. This includes 14 mammals, 23 birds, four frogs, two invertebrates, and two fish. The study area does not contain suitable habitat for some species listed in Appendix B. The habitats within the study area are generally poor quality and do not possess the features required for many of the threatened species listed in Appendix B to complete their life cycles. No suitable habitat for threatened fish is present in the study area.

The dense cover of *Typha orientalis* in the drainage line is suitable for a range of common frog species and may also be suitable for the threatened Green and Golden Bell Frog. However, the habitat is not considered to be optimal and this species has not been recorded from the locality since 1999. Other records of this species have not been made at former habitats in the locality since the 1970s. As such, due to a lack of recent records for this species in the locality despite survey work having been undertaken, this species is considered to have a low likelihood of occurrence within the study area.

The Cumberland Plain Land Snail was not found in the study area during the surveys undertaken for the proposal. However, this species was found during the field work undertaken for the Honeman Close SIS. The survey involved looking for active specimens on tree trunks, turning over suitable ground shelter including fallen timber, sheets of iron and exposed rocks and rubble, raking back bark, litter and debris from the ground, and searching in dense grass clumps. It is likely that the habitat is at least moderately suitable but no snails (live or dead) were found at the time of survey.

The study area also provides some habitat for species of threatened insectivorous bat: Little Bentwing-bat, Eastern Bentwing-bat, Eastern Freetail-bat, Eastern False Pipistrelle, Greater Broad-nosed Bat, Yellow-bellied Sheathtail-bat and the Southern Myotis (all listed as vulnerable under the BC Act). These species have been recorded widely from the locality and are likely to forage in the habitats. Tree hollows are limited but the habitat is likely to be suitable as foraging habitat. The Eastern Bentwing-bat was recorded from 6 Honeman Close during work undertaken for the SIS so this species is known to utilise the area for foraging on a seasonal basis but is unlikely to roost in the stormwater drain given its size and construction.

The Grey-headed Flying-fox (listed as vulnerable under the BC Act and EPBC Act) is considered moderately likely to forage in the trees within the study area, particularly *Eucalyptus moluccana, Eucalyptus tereticornis* and planted specimens of *Corymbia* spp. No roost camps are present in the study area but the bats from the Parramatta Park camp and/or the intermittent Wetherill Park camp are likely to forage in the study area.

The Swift Parrot (listed as endangered under the BC Act and EPBC Act) has been recorded in the locality and sporadically occurs in the urbanised areas of western Sydney during winter. This species may pass through the study area during movements between larger foraging habitats (eg from Prospect Nature Reserve to Nurragingy Reserve and Castlereagh Nature Reserve) where it may rest and forage in street trees or small vegetation remnants. Although no significant areas of foraging habitat are present, the Swift Parrot is considered moderately likely to occur in the study area on occasion. Likewise, the Little Lorikeet is also likely to use the trees in the study area in a similar manner as foraging habitat.

Other threatened birds including the Dusky Woodswallow, Little Eagle and Square-tailed Kite are likely to fly over the study area on occasion and may temporarily perch on trees. However, the study area is considered unlikely to form suitable breeding habitat for these species and habitat use would be intermittent and minimal.

The Varied Sittella is considered moderately likely to utilise the habitats on 6 Honeman Close and may utilise the edge habitat that is in the study area. This species is known to occur in the Prospect Nature Reserve in and in the Western Sydney Parklands and may use the habitat in the study area on occasion.

Table 3.3 Threatened fauna

Species / community	BC Act	EPBC Act	Habitat in study area (ha)
Cumberland Plain Land Snail (*Meridolum corneovirens*)	E	-	0.40
Dusky Woodswallow (Artamus cyanopterus cyanopterus)	V	-	0.77
Little Eagle (Hieraaetus morphnoides)	V	-	0.77
Square-tailed Kite (*Lophoictinia isura*)	V	-	0.77
Varied Sittella (*Daphoenositta chrysoptera*)	V	-	0.77
Little Lorikeet (*Glossopsitta pusilla*)	V	-	0.77
Swift Parrot (*Lathamus discolor*)	E	CE	0.77
Little Bent-wing Bat (*Miniopterus australis*)	V	-	0.82
Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*)	V	-	0.82
Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)	V	-	0.82
Eastern Freetail-bat (*Mormopterus norfolkensis*)	V	-	0.82
Southern Myotis (*Myotis macropus*)	V	-	0.82
Greater Broad-nosed Bat (*Scoteanax rueppellii*)	V	-	0.82
Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*)	V	-	0.82
Grey-headed Flying-fox (*Pteropus poliocephalus*)	V	V	0.77

3.6 Aquatic results

The proposal lies within the Hawkesbury catchment area. The hydrological environment of the study area is limited to an unnamed and unmapped creek (Strahler 1st order stream) that exits a culvert on the western edge of Reservoir Road on 6 Honeman Close and drains north west into Bungarribee Creek which eventually discharges into Eastern Creek, South Creek then finally the Hawkesbury River.

Two threatened species, the Macquarie Perch and Australian Grayling have been recorded within the Hawkesbury-Nepean Catchment; however, habitat for these species is not present within the study area. The Australian Grayling inhabits clear, flowing waters. The habitat and water quality in the study is degraded and not suitable for this species and the study area is to the north of its known distribution. The Macquarie Perch is now considered isolated to the upper reaches of catchments and is not present in the study area. The nearest known population is in Cataract Dam. The degraded waterways in the study area are not suitable for this species.

The aquatic habitat in the study area is limited to an unnamed stream (Strahler 1st order stream) with intermittent flow following rain events only with little or no defined drainage channel. The aquatic vegetation exists due to pooling of water resulting from stormwater management. As such, the creek within the study area is not a Type 1, Type 2 or Type 3 sensitive key fish habitat. The habitat quality for fish in the study area is poor. There are no Class 1 (major key fish habitat), Class 2 (moderate key fish habitat) or Class 3 (minimal key fish habitat) waterways in the study area.

There is a lack of permanent flow, rubbish accumulation, weed proliferation, and evidence of physical disturbance. As such, the creek is considered to be in moderately to highly degraded condition. The streams do not have characteristics suitable for any of the threatened aquatic species known or predicted to occur in the locality as shown in Appendix B.

3.7 Wildlife connectivity corridors

Despite the hostile barrier posed by the M4 Motorway and the Great Western Highway, the habitats in the study area retain some form of functional connectivity with the Prospect Nature Reserve to the south and the Western Sydney Parklands to the north west. There is likely to be some movement of species and genetic material between the study area and these adjacent habitats.

The barriers posed by the M4 Motorway and the Great Western Highway serve to restrict fauna movements between the habitat patches for terrestrial and arboreal species. However, the permeability of landscapes for different fauna species varies and habitat connectivity for more mobile species (eg birds, flying-foxes, insectivorous bats, insects, plants) remains. However, connectivity for sedentary species and smaller species such as the Cumberland Plain Land Snail, frogs and reptiles is likely to be minimal.

The roadways and urban areas do not totally prevent fauna movement between habitat fragments. Fauna can, and likely do, cross the road and disturbed areas of habitat but would do so less frequently than in natural habitats and would be at greater risk of mortality during movements. It is likely that animals move between the Prospect Nature Reserve and the Western Sydney Parklands and utilise the habitats within the study area. It is also likely that plant pollinators and seed dispersers move pollen and seed (or other vegetative reproductive material) between the study area and adjacent habitats. Functional connectivity for many species would exist between the study area and the Prospect Nature Reserve to the south and the Western Sydney Parklands to the north west despite the level of fragmentation that has occurred.

3.8 Matters of National Environmental Significance

3.8.1 Threatened ecological communities

One threatened ecological community as listed under the EPBC Act was identified within the study area during the field survey undertaken for the proposal and in previous surveys for the Honeman Close SIS: Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (listed as critically endangered).

The critically endangered Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest community corresponds to the Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion PCT (PCT 849) where it is in Moderate / Good condition. The patch of Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest that the vegetation in the study area belongs to is larger than 0.5 ha and ≥50 percent of the perennial understorey vegetation cover is made up of native species. As such, the patch meets the core threshold for inclusion within the Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest community (see Threatened Species Scientific Committee, 2009).

There is approximately 0.1 hectares of the Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest community within the study area.

3.8.2 Threatened species

Two threatened species listed under the EPBC Act are considered moderately likely to use the habitats in the study area for forgaing: The Swift Parrot (listed as critically endangered) and the Grey-headed Flying-fox (listed as vulnerable).

The Grey-headed Flying-fox is considered moderately likely to forage in the trees within the study area, particularly *Eucalyptus moluccana, Eucalyptus tereticornis* and planted specimens of *Corymbia* spp. No roost camps are present in the study area but the bats from the Parramatta Park camp and/or the intermittent Wetherill Park camp are likely to forage in the study area.

The Swift Parrot has been recorded in the locality and sporadically occurs in the urbanised areas of western Sydney during winter. This species may pass through the study area during movements between larger foraging habitats (eg from Prospect Nature Reserve to Nurragingy Reserve and Castlereagh Nature Reserve) where it may rest and forage in street trees or small vegetation remnants. Although no significant areas of foraging habitat are present, the Swift Parrot is considered moderately likely to occur in the study area on occasion.

One plant species *Eucalyptus nicholii*, which is listed as vulnerable under the EPBC Act, was found in the study area during the field survey for the proposal and for the Honeman Close SIS. One plant was found adjacent to the culvert on Reservoir Road (see Figure 3.2 for the location of the *Eucalyptus nicholii* plant).

3.8.3 Migratory species

Fourteen migratory bird species were identified in the EPBC Act Protected Matters Search Tool as potentially occurring in the locality based on the distributional range of the species and modelled habitat. These migratory species, along with their preferred habitat requirements and an assessment of their likely presence in the study area are listed in Appendix B. Only the Fork-tailed Swift and White-throated Needletail are considered moderately likely to fly over the study area but would not use it as habitat.

While some migratory species of bird are likely use the study area and locality, the study area would not be classed as an ‘important habitat’. A nationally significant proportion of the population would not be supported by the study area, as the habitats are not large enough or high enough quality. The proposal would not substantially modify, destroy or isolate an area of important habitat for the migratory species and it would not seriously disrupt the lifecycle of an ecologically significant proportion of a population of migratory birds.

Figure 3.3 Matters of National Environmental Significance

4 Impact assessment

The proposal's likely direct and indirect impacts on biodiversity are summarised in this chapter. The potential for indirect impacts on biodiversity values is considered low given that much of the study area is highly fragmented, subject to strong edge effects, and surrounded by existing roads and barriers.

4.1 Construction impacts

4.1.1 Removal of native vegetation

The proposal would have direct and indirect impacts on a range of biodiversity values during construction and operation. Under the current design (including 5 m buffer), the estimated clearing of PCTs is about 0.48 hectares consisting of the following PCTs:

- Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849).
- Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 835).
- Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion (PCT 1071).

A breakdown of approximate native vegetation removal in each vegetation zone is provided in Table 4.1.

The impacts of the proposal must be considered in light of the proposed impact from the development of 6 Honeman Close (Lot 2 DP 229466). The vegetation in the study area on 6 Honeman Close is proposed for removal for the development of a service station. If this development is approved and the vegetation is cleared prior to construction of the proposal, then the impacts assessed here would be less than anticipated. The impacts assessed here are based on a worst case scenario and as a precautionary approach the vegetation within the study area on 6 Honeman Close is assumed to be present when works begin.

The local occurrence of each PCT is defined as the area of the PCT that occurs within the study area and adjacent areas that form part of a larger contiguous area of the PCT, in which movement of individuals and exchange of genetic material across the boundary of the study area can be clearly demonstrated. The PCTs within the study area are within 500 metres of the vegetation to the south on Lot 1 DP1098102 which is in turn connected to the vegetation to the south of the M4 Motorway and Prospect Nature Reserve. The PCTs in these areas are considered to be connected and part of the local occurrence. Movement of individuals and exchange of genetic material from the vegetation in the study area to and from the PCTs within the Prospect Nature Reserve can be expected.

The proposal would also result in the removal of approximately 0.07 ha of Planted native / exotic vegetation and approximately 1.30 ha of Highly disturbed vegetation.

Table 4.1: Impacts on vegetation

Plant community type (PCT)	Condition class	BC Act	EPBC Act	Proposal area[1] (hectares)	Percent cleared in CMA[2]
Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Moderate/ Good	CE	CE	0.07	93
	Moderate/ Good_Poor	CE	-	0.31	
Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Moderate/ Good_Poor	E	-	0.06	93

Plant community type (PCT)	Condition class	BC Act	EPBC Act	Proposal area[1] (hectares)	Percent cleared in CMA[2]
Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion	Moderate/ Good_Poor	-	-	0.04	75
Planted native / exotic vegetation	-	-	-	0.07	-
Highly disturbed areas - road verges, table drains, road embankments, ploughed paddocks etc	-	-	-	1.30	-

1- Area to be cleared based on ground-truthed vegetation mapping within the study area.
2- Based on the VIS classification database.

4.1.2 Removal of threatened species and habitat

The extent of vegetation clearing estimated to result from the proposal is outlined above in Section 4.1.1. This vegetation, including planted trees, provides suitable habitat for a range of threatened fauna species listed under the BC Act and EPBC Act. As such, direct impacts to habitat for threatened fauna species (although it is only moderate to poor quality) would occur during construction.

There would also be impacts to the threatened plant species *Eucalyptus nicholii* which has been planted at the edge of Reservoir Road.

The direct impacts of the proposal to threatened plant species and habitats for threatened fauna have been estimated based on the current design. A breakdown of the direct impacts to habitat for threatened fauna species is provided in Table 4.2

Table 4.2: Impacts on threatened species and fauna habitat

Species / community	BC Act	EPBC Act	Predicted impact (habitat in ha)
Eucalyptus nicholii	V	V	One plant (planted horticultural specimen)
Cumberland Plain Land Snail (*Meridolum corneovirens*)	E	-	0.34
Dusky Woodswallow (Artamus cyanopterus cyanopterus)	V	-	0.51
Little Eagle (Hieraaetus morphnoides)	V	-	0.51
Square-tailed Kite (*Lophoictinia isura*)	V	-	0.51
Varied Sittella (*Daphoenositta chrysoptera*)	V	-	0.51
Little Lorikeet (*Glossopsitta pusilla*)	V	-	0.51
Swift Parrot (*Lathamus discolor*)	E	CE	0.51
Little Bent-wing Bat (*Miniopterus australis*)	V	-	0.55
Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*)	V	-	0.55
Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)	V	-	0.55
Eastern Freetail-bat (*Mormopterus norfolkensis*)	V	-	0.55

Species / community	BC Act	EPBC Act	Predicted impact (habitat in ha)
Southern Myotis (*Myotis macropus*)	V	-	0.55
Greater Broad-nosed Bat (*Scoteanax rueppellii*)	V	-	0.55
Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*)	V	-	0.55
Grey-headed Flying-fox (*Pteropus poliocephalus*)	V	V	0.50

4.1.3 Aquatic impacts

The stream to be affected by the proposal is in poor condition due to previous development and agricultural activity within the catchment which has resulted in changes to hydrological conditions, increased input of nutrients, sedimentation and weed invasion. As shown in Appendix B, no threatened species listed under the FM Act are likely to occur in these streams due to their poor condition and lack of characteristic habitat features associated with threatened species.

As discussed in Section 3.6, the aquatic habitat in the study area is limited to an unnamed stream (Strahler 1st order stream) with intermittent flow following rain events only with little or no defined drainage channel. The creek within the study area is not a Type 1, Type 2 or Type 3 sensitive key fish habitat. There are no Class 1 (major key fish habitat), Class 2 (moderate key fish habitat) or Class 3 (minimal key fish habitat) waterways in the study area. As such, there would be no impacts to sensitive or key fish habitats.

Impacts to aquatic habitat would be of low magnitude and standard mitigation measures would be implemented to limit impacts (see Section 5).

4.1.4 Injury and mortality

Fauna injury or death has the greatest potential to occur during construction when vegetation clearing would occur. The extent of this impact would be proportionate to the extent of vegetation that is cleared. Less mobile species (eg ground dwelling reptiles), or those that are nocturnal and nest or roost in trees during the day (eg arboreal mammals and microchiropteran bat species), may find it difficult to rapidly move away from the clearing when disturbed. The study area is only likely to contain a limited a number of arboreal species (eg possums) and birds that may be injured or killed during vegetation removal. Reptiles and frogs may also be injured or killed during construction as habitat is cleared.

Entrapment of wildlife in any trenches or pits that are dug is a possibility if the trenches are deep and steep sided. Wildlife may also become trapped in or may choose to shelter in machinery that is stored in the study area overnight. If these animals were to remain inside the machinery, or under the wheels or tracks, they may be injured or may die once the machinery is in use.

There is a chance of fauna mortality during the operational phase of the proposal through vehicle collision (ie roadkill). Vehicle collision is a direct impact that reduces local population numbers. Mammals, reptiles, amphibians and birds are all at risk of vehicle strike. As there are no definitive data on current rates of roadkill or fauna population densities in the study area, the consequences of vehicle strike on local populations is unknown. With the expansion of an existing road the risk of vehicle strike should remain in a similar level to that currently experienced but the significance of such an impact cannot be predicted. The impact on threatened species however is expected to be minimal. Based on evidence from other roadways in the locality most vehicle strike impacts can be expected to occur to common mammals such as birds and possums and exotic animals including foxes.

Mitigation measures designed to reduce an injury and mortality of fauna are provided in Section 5.

4.2 Indirect/operational impacts

4.2.1 Wildlife connectivity and habitat fragmentation

Habitat fragmentation *per se* relates to the physical dividing up of once continuous habitats into separate smaller 'fragments' (Fahrig, 2002). The habitats within the study area are fragments that have formed since the initial habitat clearing that has occurred. The current alignment of the Great Western Highway and Reservoir Road divide the remaining habitats in the study area. The barriers posed by the Great Western Highway and Reservoir Road serve to restrict fauna movements between the habitat patches. However, functional habitat connectivity for more mobile species (eg birds, flying-foxes, insectivorous bats, insects, plants) is still present. The current roadways do not totally prevent fauna movement between habitat fragments (fauna can and likely do cross the road) but the roads do create a considerable hazard.

The proposal would not break apart continuous habitats into separate smaller 'fragments'. The proposal would however result in an increase in isolation of habitats as the current habitat patches would be made smaller which would increase the physical distance between habitat fragments. The isolation that may be caused by the proposal is not likely to have an appreciable impact on nomadic or migratory species such as birds. The proposal is likely to be detrimental to the dispersal of arboreal mammals and other species including frogs and reptiles but the effects would only be marginally greater than that which is already experienced.

The predicted level of isolation from the proposal is not likely to be enough to prevent the breeding and dispersal of plant pollinators or the dispersal of plant propagules (ie seed or other vegetative reproductive material) between habitat patches. Functional connectivity for many species would remain in the study area. However, local division of some wildlife populations, isolation of key habitat resources, loss of genetic interchange, and loss of population viability for some species may result.

This impact would be of low magnitude and mitigation measures are not deemed necessary.

4.2.2 Edge effects on adjacent native vegetation and habitat

The development of linear infrastructure is known to cause disturbance in terms of reducing habitat quality in adjacent areas. This is due to the greater potential for edge effects and habitat fragmentation and barrier effects due to the high perimeter to area ratio of linear developments. The proposal would be built in an area that is currently subject to a high level of edge effects from the existing roadways and urban development. The vegetation patches are suffering from intense weed invasion and the habitats that would be impacted by the proposal are edge habitats without any undisturbed core. There is unlikely to be any further impacts from edge effects resulting from the proposal as all vegetation is suffering from edge effects in the form of weed invasion, increased light levels, increased wind speeds, and greater temperature fluctuations. No new edge habitats would be created as the study area does not possess large core areas of undisturbed habitat.

This impact would be of low magnitude and mitigation measures are not deemed necessary.

4.2.3 Invasion and spread of weeds

Proliferation of weed and pest species is an indirect impact (ie not a direct result of proposal activities). Proliferation of weeds is likely to occur during construction and operation, although impacts would be greatest because of vegetation clearing during the construction phase. The most likely causes of weed dispersal and importation associated with the proposal include earthworks, movement of soil, and attachment of seed (and other propagules) to vehicles and machinery during all phases. The study area contains significant weed growth and no undisturbed weed free habitat exists. As such, weeds must be managed during construction.

Mitigation measures designed to limit the spread and germination of weeds are provided in Section 5.

4.2.4 Invasion and spread of pests

The study area is currently habitat for a range of pest species including rabbits. Proposal activities have the potential to disperse pest species out of the proposal footprint across the surrounding landscape but the magnitude of this impact would be low and mitigation measures are not deemed necessary.

4.2.5 Invasion and spread of pathogens and disease

Several pathogens known from NSW have potential to impact on biodiversity as a result their movement and infection during construction. Of these, three are listed as a key threatening process under either the EPBC Act and/or TSC Act including:

- Dieback caused by Phytophthora (Root Rot; EPBC Act and TSC Act)
- Infection of frogs by amphibian chytrid fungus causing the disease chytridiomycosis (EPBC Act and TSC Act)
- Introduction and establishment of exotic Rust Fungi of the order Pucciniales on plants of the family Myrtaceae (TSC Act).

While these pathogens were not observed or tested for in the study area the potential for pathogens to occur should be treated as a risk during construction. The most likely causes of pathogen dispersal and importation associated with the proposal include earthworks, movement of soil, and attachment of plant matter to vehicles and machinery during all proposal phases (construction and operation). Pathogens would be managed within the proposal site according to the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (NSW Roads and Traffic Authority, 2011) (see Section 5).

4.2.6 Noise, light and vibration

Considering the existing levels of noise and vibration from the surrounding urban development and the high levels of use of the existing Great Western Highway and Reservoir Road by vehicles, it is unlikely there would be a significant increase in noise and vibration during operation of the road that would result in any increased impacts to biodiversity within the study area. There is however potential for impacts to locally common fauna from noise and vibration during construction, which may result in fauna temporarily avoiding habitats adjacent to the construction, however traffic noise is likely to be significant deterrent to most fauna groups already. The magnitude of this impact would be low and mitigation measures are not deemed necessary.

Lighting would be used at night to enable work to be completed that may result in impacts to nocturnal fauna. Common nocturnal species such as possums and microbats may avoid the habitat in the study area during construction as temporary ‘daylight’ conditions would be created by the mobile lighting system. This impact is considered temporary and would not have long lasting effects on the biodiversity of the study area. The magnitude of this impact would be low and mitigation measures are not deemed necessary.

4.2.7 Groundwater dependent ecosystems

The PCTs within the study area are likely to be opportunistic facultative GDEs that depend on the subsurface presence of groundwater (often accessed via the capillary fringe – subsurface water just above the water table) when an alternative source of water (ie rainfall) cannot be accessed to maintain ecological function. The proposal would impact on these PCTs (see Section 4.1.1).

4.3 Cumulative impacts

The potential biodiversity impacts of the proposal must be considered as a consequence of the construction and operation of the proposal within the existing environment. The proposal would not act alone in causing impacts to biodiversity. The incremental effects of multiple sources of impact (past, present and future) are referred to as cumulative impacts and provide an opportunity to consider the proposal within a strategic context.

The accumulating impacts of historic vegetation clearing for agriculture, urban development, and development and maintenance of infrastructure would likely include continued loss of biodiversity on the Cumberland Plain. The Cumberland Plain Mitchell Landscape is an over cleared landscape with 89 per cent of native vegetation having been cleared. Only 11 per cent of the original native vegetation remains. Due to the likely expansion of western Sydney and creation of housing and associated infrastructure, further impacts to biodiversity are likely to result in this region.

While data from all recent projects in the locality is not freely available, some information on the likely biodiversity impacts from recent projects is available as follows:

- The construction footprint of the M4 Managed Motorway project is anticipated to impact on about 31.25 hectares of planted and remnant vegetation in various states of condition. This area of clearing includes 3.82 hectares of remnant vegetation (Jacobs, 2015).
- Honeman Close SIS indicates that approximately 4.5 hectares of native vegetation would be removed from Lot 2 DP 229466 (Cumberland Ecology, 2017) (note that some of this vegetation may be removed by the proposal).

When considered together, these projects combine to remove about 8.32 ha of remnant native vegetation from the Cumberland Plain. This is a large cumulative impact in terms of the over cleared nature of the region. The impacts from the proposal are largely captured within the impacts calculated for the Honeman Close SIS but an additional 0.07 ha would be removed from the Mitre 10 site.

4.4 Assessments of significance

An Assessment of Significance has been conducted for threatened species that have been positively identified within the study area or that are considered to have a moderate or high likelihood of occurring in the study area due to the presence of suitable habitat.

The proposed works would be assessed under Part 5 of the EP&A Act. Section 7.3 of the BC Act outlines the 'test of significance' that is to be undertaken to assess the likelihood of significant impact upon threatened species or ecological communities listed under the BC Act. As a new guideline has not been produced by the OEH, these tests of significance have been undertaken in accordance with the guidelines provided in the *Threatened Species Assessment Guidelines: The Assessment of Significance* (Department of Environment and Climate Change, 2007) which outlines a set of guidelines to help applicants/proponents of a development or activity with interpreting and applying the factors of assessment in the former 'seven-part test'. The guidance provided by the Department of Environment and Climate Change (2007) has been used here in preparing these tests of significance and in determining whether there is likely to be a significant effect to a threatened species, population or ecological community listed under the BC Act.

Full details of assessment of significance under the BC Act are presented in Appendix C. The conclusions of the EP&A Act assessment are provided in Table 4.3, which indicates that a significant effect is considered unlikely on any threatened species listed under the BC Act (no threatened ecological communities are present in the study area).

For threatened biodiversity listed under the EPBC Act, significance assessments have been completed in accordance with the *EPBC Act Policy Statement 1.1 Significant Impact Guidelines* (Department of Environment, 2013). Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment that is affected, and upon the intensity, duration, magnitude and geographic extent of the impacts (Department of Environment, 2013). Importantly, for a 'significant impact' to be 'likely', it is not necessary for a significant impact to have a greater than 50 per cent chance of happening; it is sufficient if a significant impact on the environment is a real or not remote chance or possibility (Department of Environment, 2013). This advice has been considered while undertaking the assessments.

A significant impact is considered unlikely for any Matter of NES and a referral of the proposal would not be required (see Table 4.4). Full details of the assessment of significance for threatened species under the EPBC Act are presented in Appendix C.

Table 4.3: Summary findings of the BC Act test of significance

Biodiversity Conservation Act 2016 test of significance						
Threatened species, or communities	**Significance assessment question[1]**					**Likely significant effect?**
	a	**b**	**c**	**d**	**e**	
Cumberland Plain Woodland in the Sydney Basin Bioregion	X	N	Y	N	Y	No
River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	X	N	Y	N	Y	No
Eucalyptus nicholii (Narrow-leaved Black Peppermint)	N	X	N	N	Y	No
Cumberland Plain Land Snail (*Meridolum corneovirens*)	N	X	Y	N	Y	No
Dusky Woodswallow (Artamus cyanopterus cyanopterus)	N	X	N	N	Y	No
Little Eagle (Hieraaetus morphnoides)	N	X	N	N	Y	No
Square-tailed Kite (*Lophoictinia isura*)	N	X	N	N	Y	No
Varied Sittella (*Daphoenositta chrysoptera*)	N	X	N	N	Y	No
Little Lorikeet (*Glossopsitta pusilla*)	N	X	N	N	Y	No
Swift Parrot (*Lathamus discolor*)	N	X	N	N	Y	No
Little Bent-wing Bat (*Miniopterus australis*)	N	X	N	N	Y	No
Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*)	N	X	N	N	Y	No
Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)	N	X	N	N	Y	No
Eastern Freetail-bat (*Mormopterus norfolkensis*)	N	X	N	N	Y	No
Southern Myotis (*Myotis macropus*)	N	X	N	N	Y	No
Greater Broad-nosed Bat (*Scoteanax rueppellii*)	N	X	N	N	Y	No
Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*)	N	X	N	N	Y	No
Grey-headed Flying-fox (*Pteropus poliocephalus*)	N	X	N	N	Y	No

Notes: Y= Yes (negative impact), N= No (no or positive impact), X= not applicable, ?= unknown impact.

1. Significance Assessment Questions as set out in the *Biodiversity Conservation Act 2016:*
   - a in the case of a threatened species, whether the proposed development or activity 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.
   - b in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:
     - (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, or
     - (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,
   - c in relation to the habitat of a threatened species or ecological community:
     - (i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and
     - (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and
     - (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.
   - d whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),
   - e whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

Table 4.4: Summary findings of the EPBC Act significance assessments

Species/Ecological Community	*Assessment of significance questions (EPBC Act)									Important Population+	Likely Significant Impact
	1	2	3	4	5	6	7	8	9		
Ecological communities											
Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest	Y	N	N	N	N	N	Y	X	X	NA	No
Vulnerable species+											
Eucalyptus nicholii (Narrow-leaved Black Peppermint)	N	N	N	N	N	N	N	N	N	No	No
Grey-headed Flying-fox (Pteropus poliocephalus)	N	N	N	N	N	N	N	N	N	Yes	No
Critically Endangered species											
Swift Parrot (Lathamus discolour)	N	N	N	N	N	N	N	N	N	NA	No

Notes: Y= Yes (negative impact), N= No (no or positive impact), X= not applicable, ?= unknown impact.

An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:

1) reduce the extent of an ecological community
2) fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines
3) adversely affect habitat critical to the survival of an ecological community
4) modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns
5) cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting
6) cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:
   -- assisting invasive species, that are harmful to the listed ecological community, to become established, or
   -- causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or
7) interfere with the recovery of an ecological community.

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

1) Lead to a long-term decrease in the size of a population
2) Reduce the area of occupancy of the species
3) Fragment an existing population into two or more populations
4) Adversely affect habitat critical to the survival of a species
5) Disrupt the breeding cycle of a population
6) Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
7) Result in invasive species that are harmful to a species becoming established in the species' habitat
8) Introduce disease that may cause the species to decline
9) Interfere with the recovery of the species.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

1) lead to a long-term decrease in the size of an important population of a species
2) reduce the area of occupancy of an important population
3) fragment an existing important population into two or more populations
4) adversely affect habitat critical to the survival of a species
5) disrupt the breeding cycle of an important population
6) modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
7) result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat
8) introduce disease that may cause the species to decline, or
9) interfere substantially with the recovery of the species.

An important population as determined by the EPBC Act is a population of a vulnerable species that is likely to be key source populations either for breeding or dispersal, is likely to be necessary for maintaining genetic diversity, or is at or near the limit of the species range. The Grey-headed Flying-fox exists as one interconnected population along the east coast of Australia. Therefore, it is considered an important population for the purposes of this assessment.

4.5 Impact summary

A summary of the predicted ecological impacts from the proposal is provided in Table 4.5.

Table 4.5: Summary of potential impacts

Impact	Biodiversity values	Nature of impact	Extent of impact	Duration	Does the proposal constitute or exacerbate a key threatening process?
Removal of native vegetation	Native vegetation	Direct	0.48 ha	Permanent	• Clearing of native vegetation
	Cumberland Plain Woodland in the Sydney Basin Bioregion	Direct	0.38 ha	Permanent	• Clearing of native vegetation
	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	Direct	0.06 ha	Permanent	• Clearing of native vegetation
	Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest	Direct	0.07 ha	Permanent	• Clearing of native vegetation
Removal of threatened fauna habitat	Cumberland Plain Land Snail	Direct	0.34	Permanent	• Clearing of native vegetation • Removal of dead wood and dead trees
	Little Eagle, Square-tailed Kite, Dusky Woodswallow	Direct	0.51	Permanent	• Clearing of native vegetation
	Little Lorikeet, Swift Parrot, Varied Sittella	Direct	0.51	Permanent	• Clearing of native vegetation
	Little Bent-wing Bat, Eastern Bentwing-bat, Eastern False Pipistrelle, Eastern Freetail-bat, Southern Myotis, Greater Broad-nosed Bat, Yellow-bellied Sheathtail-bat	Direct	0.55	Permanent	• Clearing of native vegetation
	Grey-headed Flying-fox	Direct	0.51	Permanent	• Clearing of native vegetation
Removal of threatened flora	Eucalyptus nicholii	Direct	One plant to be removed	Permanent	• Clearing of native vegetation
Aquatic impacts	Aquatic fauna	Direct	Only minor habitat to be affected	Long term	-
Injury and mortality of fauna		Direct	Unknown. Impact cannot be quantified	Long term	-
Fragmentation of identified biodiversity links and habitat corridors	All PCTs and flora and fauna species present in the habitat	Direct/ indirect	Minimal, but local habitat isolation would be increased	Long term	-

Impact	Biodiversity values	Nature of impact	Extent of impact	Duration	Does the proposal constitute or exacerbate a key threatening process?
Edge effects on adjacent native vegetation and habitat	All PCTs and flora and fauna species present in the habitat	Indirect	Minimal as no core habitat is present	Long term	-
Invasion and spread of weeds	All PCTs and flora and fauna species present in the habitat	Indirect	Without appropriate management strategies, proposal activities have the potential to disperse weeds	Long term	• Invasion and establishment of exotic vines and scramblers • Invasion of native plant communities by African Olive (*Olea europaea* L. subsp. *cuspidata)* • Invasion, establishment and spread of *Lantana camara* • Invasion of native plant communities by exotic perennial grasses
Invasion and spread of pests	All PCTs and flora and fauna species present in the habitat	Indirect	The study area is currently habitat for a range of pest species.	Long term	• Competition and grazing by the feral European rabbit (*Oryctolagus cuniculus*) • Predation by the European red fox (*Vulpes vulpes*)
Invasion and spread of pathogens and disease	All PCTs and flora and fauna species present in the habitat	Indirect	While pathogens were not observed or tested for in the study area the potential for pathogens to occur should be treated as a risk during construction	Long term	• Infection of native plants by *Phytophthora cinnamomi* • Introduction and Establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae • Infection of frogs by amphibian chytrid causing the disease chytridiomycosis
Noise, light and vibration	All PCTs and flora and fauna species present in the habitat	Direct/ indirect	There would be an impact from noise, light and vibration but the level of noise, vibration and light spill into adjacent habitats during construction and operation cannot be quantified	Short term	-
Groundwater dependent ecosystems	GDEs	Indirect - operational	Limited to extent of impact to PCTs	Permanent	-

5 Avoid, minimise and mitigate impacts

In managing biodiversity, Roads and Maritime aims to achieve a balanced outcome, taking account of environmental considerations together with economic and community objectives. This includes a balanced approach to examining the particular environmental consequences of an activity, recognising that achieving an optimal outcome often requires compromise and decisions regarding environmental values. A key part of Roads and Maritime's management of biodiversity for this proposal is the application of the 'avoid, minimise, mitigate and offset' hierarchy as follows:

1. Avoid and minimise impacts as the highest priority
2. Mitigate impacts where avoidance is not feasible or practicable in the particular circumstance
3. Offset where residual, significant unavoidable impacts would occur.

The proposal footprint being assessed and the extent of disturbance is wide enough to facilitate the ultimate design of the intersection in the long term to allow for any future upgrades. For example, the batter and road verge incorporates a wider footprint and utilities would be relocated to the outer edge to avoid unnecessary re-work and disturbance in the future to plan for an additional lane.

5.1 Avoidance and minimisation

Avoiding environmental impacts as the first step is consistent with the application of the precautionary principle. Roads and Maritime's first priority is to avoid impacts to the environment. This is can be achieved by early consideration of environmental issues from identification of constraints at project inception through to options analysis and selection of a preferred option, design investigation and assessment of the preferred option, detailed design, and implementation of on-ground safeguards during construction and operation and maintenance of the activity.

An REF scoping checklist was prepared during the early stages of concept design development which identified the presence of the critically endangered Cumberland Plain Woodland community. As such, a project REF was deemed to be the best approach for assessment. There is minimal opportunity for proposal alternatives or designs due to the location of the road and intended outcomes of the proposal.

The primary method to avoid impacts is to locate activities away from areas of known or potential high biodiversity value. In identifying suitable work sites, the first preference is to locate existing cleared and disturbed areas that have good access, are not within immediate proximity to waterways, and that support good site management practices (for example, management of material stockpiles). Proposal compound sites have been proposed in highly disturbed areas to avoid impacts to biodiversity. Design refinements would be undertaken in the detailed design phase to reduce the scope of the overall impact to biodiversity.

5.2 Mitigation measures

Once all practicable steps to avoid or minimise impacts have been implemented at the detailed design phase, mitigation measures would be implemented to lessen the potential ecological impacts of the proposal. Mitigation measures are to be undertaken during the construction and operational phases. The Roads and Maritime guidelines and procedures identify a range of mitigation techniques to be applied, including managing the vegetation clearing process, re-establishment of native vegetation at the end of a project, weed management, provision of supplementary fauna habitat (such as nest boxes for appropriate species), and installation of erosion and sediment controls as appropriate.

The following mitigation measures as outlined in the *Biodiversity Guidelines: Protecting and managing biodiversity of RTA projects* (NSW Roads and Traffic Authority, 2011) are recommended for implementation (see Table 5.1). The NSW DPI (Fisheries) document *Policy and Guidelines for fish habitat conservation and management (2013 update)* (Department of Primary Industries, 2013) has also been used.

Table 5.1: Proposed mitigation measures

Impact	Mitigation measures	Timing and duration	Likely efficacy of mitigation	Residual impacts anticipated
Removal of native vegetation	Native vegetation removal would be minimised through detailed design.	Detailed design	Effective	The predicted residual impact to threatened species habitat is estimated at 0.48 ha of PCTs.
	Pre-clearing surveys would be undertaken in accordance with *Guide 1: Pre-clearing process* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Prior to construction	Effective	
	Vegetation removal would be undertaken in accordance with *Guide 4: Clearing of vegetation and removal of bushrock* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Effective	
	The unexpected species find procedure is to be followed under *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011) if threatened ecological communities, not assessed in the biodiversity assessment, are identified in the proposal site.	During construction	Effective	
	Exclusion zones would be set up at the limit of clearing (ie the edge of the impact area) in accordance with *Guide 2: Exclusion zones* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Before construction	Effective	
Removal of threatened species habitat and habitat features	Habitat removal would be minimised through detailed design.	Detailed design	Effective	The predicted residual impact to threatened species habitat is estimated at up to 0.55 ha of habitat.
	Habitat removal would be undertaken in accordance with *Guide 4: Clearing of vegetation and removal of bushrock* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Effective	
	The unexpected species find procedure is to be followed under *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011) if threatened fauna, not assessed in the biodiversity assessment, are identified in the proposal site.	During construction	Proven	
Removal of threatened plants	Pre-clearing surveys would be undertaken in accordance with *Guide 1: Pre-clearing process* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Proven	The *Eucalyptus nicholii* plant would be removed.
	The unexpected species find procedure is to be followed under *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011) if threatened flora species, not assessed in the biodiversity assessment, are identified in the proposal site.	During construction	Proven	
Aquatic impacts	Aquatic habitat would be protected in accordance with *Guide 10: Aquatic habitats and riparian zones* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011) and Section 3.3.2 *Standard precautions and mitigation measures* of the *Policy and guidelines for fish habitat conservation and management Update 2013* (DPI (Fisheries NSW) 2013).	During construction	Effective	Minor, localised, modification to already highly disturbed habitat.

Impact	Mitigation measures	Timing and duration	Likely efficacy of mitigation	Residual impacts anticipated
Groundwater dependent ecosystems	No specific measures are considered necessary as the GDEs in the study area are facultative terrestrial ecosystems.	Detailed design	Effective	As per PCT impacts
Fragmentation of identified habitat corridors	No specific measures are considered necessary as no further increase to fragmentation would occur.	Detailed design, during construction and post construction	Effective	No residual impact is anticipated
Edge effects on adjacent native vegetation and habitat	Exclusion zones would be set up at the limit of clearing in accordance with *Guide 2: Exclusion zones* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Effective	No residual impact is anticipated
Injury and mortality of fauna	Fauna would be managed in accordance with *Guide 9: Fauna handling* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Effective	The mitigation measures should be effective but injury or death may still occur
Invasion and spread of weeds	Weed species would be managed in accordance with *Guide 6: Weed management* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Effective	None as the proposed control measures are known to be effective
Invasion and spread of pests	Pest species would be managed within the proposal site.	During construction	Effective	None expected
Invasion and spread of pathogens and disease	Pathogens would be managed in accordance with *Guide 2: Exclusion zones* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Effective	None as the proposed control measures are known to be effective
Noise, light and vibration	Shading and artificial light impacts would be minimised through detailed design.	Detailed design	Effective	Impacts from noise and light spill would remain

6 Offset / Supplementary measures

Although efforts have been made to avoid, minimise and mitigate potential ecological impacts from the proposal, some residual impacts would occur. This biodiversity assessment identifies that the proposal is not likely to have a significant impact on any threatened biodiversity listed under the BC Act or EPBC Act (see Section 4.4 and Appendix C). In this instance, and due to the Strategic Assessment, the EPBC Act environmental offsets policy does not apply.

Roads and Maritime would provide biodiversity offsets or where offsets are not reasonable or feasible, supplementary measures for impacts that exceed the thresholds in Table 6.1.

Table 6.1: Roads and Maritime offset thresholds

Description of activity or impact	Consider offsets or supplementary measures
Activities in accordance with Roads and Maritime Services Environmental assessment procedure: Routine and Minor Works (RTA 2011)	No
Works on cleared land, plantations, exotic vegetation where there are no threatened species or habitat present	No
Works involving clearing of vegetation planted as part of a road corridor landscaping program (this includes where threatened species or species comprising listed ecological communities have been used for landscaping purposes)	No
Works involving clearing of national or NSW listed critically endangered ecological communities (CEEC)	**Where there is any clearing of a CEEC in moderate to good condition**
Works involving clearing of nationally listed threatened ecological community (TEC) or nationally listed threatened species habitat	Where clearing >1 ha of a TEC or habitat in moderate to good condition
Works involving clearing of NSW endangered or vulnerable ecological community	Where clearing > 5 ha or where the ecological community is subject to an SIS
Works involving clearing of NSW listed threatened species habitat where the species is a species credit species as defined in the OEH Threatened Species Profile Database (TSPD)	Where clearing > 1ha or where the species is the subject of an SIS
Works involving clearing of NSW listed threatened species habitat and the species is an ecosystem credit species as defined in OEH's Threatened Species Profile Database (TSPD)	Where clearing > 5ha or where the species is the subject of an SIS
Type 1 or Type 2 key fish habitats (as defined by NSW Fisheries)	Where there is any net loss of habitat

The Roads and Maritime *Guideline for Biodiversity Offsets* (November 2016) indicates that offsets are to be considered where there is any clearing of national or NSW listed critically endangered ecological communities in moderate to good condition.

The proposal would involve clearing of the EPBC Act listed Cumberland Plain Shale Woodlands and Shale- Gravel Transition Forest critically endangered ecological community and the BC Act listed Cumberland Plain Woodland in the Sydney Basin Bioregion critically endangered ecological community. Areas of these critically endangered ecological communities are in moderate to good condition and as such offsets or supplementary measures are to be considered for the proposal in accordance with Roads and Maritime *Guideline for Biodiversity Offsets* (November 2016) (see Table 6.2).

During detailed design, a plan for offsets or supplementary measures would be developed for the proposal in accordance with Roads and Maritime *Guideline for Biodiversity Offsets* (November 2016).

Table 6.2: Vegetation to be considered for offset or supplementary measures

Plant community type (PCT)	Predicted impact (ha)
Cumberland Plain Woodland in the Sydney Basin Bioregion (Critically Endangered, BC Act) Includes the subset of Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (Critically endangered EPBC Act)	0.07

7 Conclusion

There were three PCTs identified in the study area based on floristic composition, geological substrate, and landscape position with regard to relevant regional vegetation classifications:

- Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849).
- Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 835).
- Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion (PCT 1071).

These PCTs are in moderate to good condition. Areas of planted native / exotic vegetation that cannot be matched to a PCT were also present. The remainder of vegetated areas are classed as highly disturbed areas - road verges, table drains, road embankments, ploughed paddocks etc. (this includes the proposed compound sites).

Two threatened ecological communities (TECs) listed under the BC Act were identified in the study area:

- Cumberland Plain Woodland in the Sydney Basin Bioregion (listed as critically endangered).
- River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (listed as endangered).

One threatened ecological community as listed under the EPBC Act was identified within the study area: Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (listed as critically endangered).

One threatened flora species was recorded in the study area during the field survey undertaken for the proposal: *Eucalyptus nicholii*. This species has been planted at the western edge of Reservoir Road within the proposal area. No threatened fauna species were found on site during the field survey but the following species are either known to occur in adjacent habitat or are considered at least moderately likely to occur based on the presence of suitable habitat:

- Cumberland Plain Land Snail (*Meridolum corneovirens*)
- Dusky Woodswallow (*Artamus cyanopterus cyanopterus*)
- Little Eagle (*Hieraaetus morphnoides*)
- Square-tailed Kite (*Lophoictinia isura*)
- Varied Sittella (*Daphoenositta chrysoptera*)
- Little Lorikeet (*Glossopsitta pusilla*)
- Swift Parrot (*Lathamus discolor*)
- Little Bent-wing Bat (*Miniopterus australis*)
- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*)
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)
- Eastern Freetail-bat (*Mormopterus norfolkensis*)
- Southern Myotis (*Myotis macropus*)
- Greater Broad-nosed Bat (*Scoteanax rueppellii*)
- Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*)
- Grey-headed Flying-fox (*Pteropus poliocephalus*)

The key impacts of the proposal include the removal of 0.48 hectares of native vegetation, including:

- 0.38 ha of Cumberland Plain Woodland in the Sydney Basin Bioregion (BC Act: listed as critically endangered).
- 0.06 ha of River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (BC Act: listed as endangered).

- 0.07 ha of Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (EPBC Act: listed as critically endangered).

The native vegetation to be removed provided habitat (or potential habitat) for the species listed above. The *Eucalyptus nicholii* plant would also be removed.

Fauna injury or death has the greatest potential to occur during construction when vegetation clearing would occur and the extent of this impact would be proportionate to the extent of vegetation that is cleared. Indirect / operational impacts including a minor increase in habitat isolation. Invasion and spread of weeds, invasion and spread of pests, and invasion and spread of pathogens and disease are a risk with a proposal of this type. Noise, light and vibration would be increased during construction and operation. Significant impacts to aquatic ecosystems are unlikely to occur as a result of the proposal.

The study area is situated in an over-cleared landscape due to historic activities. In the context of historic vegetation removal, any future vegetation clearing no matter how small would result in incremental cumulative impact that would detrimentally affect biodiversity. The proposal would contribute to cumulative biodiversity impacts and may result in detrimental impacts to biodiversity.

While some of the questions within the test of significance indicate that a negative impact may occur to threatened biodiversity listed under the BC Act and EPBC Act (see Appendix C), all factors must be considered and an overall conclusion must be drawn from all factors in combination. The overall outcome of the tests of significance and EPBC Act assessments of significance (see Appendix C) indicate that there is a high level of certainty that the impacts to threatened biodiversity are unlikely to be significant.

Minimisation of biodiversity impacts would occur at the detailed design phase. However, mitigation measures would need to be implemented during the construction and operational phases to further lessen the potential ecological impacts of the proposal. The Roads and Maritime *Biodiversity Guidelines: Protecting and managing biodiversity of RTA projects* (NSW Roads and Traffic Authority, 2011) identify a range of mitigation techniques to be applied and these techniques must be implemented during construction. Due to the presence of the critically endangered ecological communities, exclusion zones would be established to delineate the works limit boundary to ensure no accidental impacts occur.

Although efforts have been made to avoid, minimise and mitigate potential ecological impacts from the proposal, some residual impacts would occur. This biodiversity assessment identifies that the proposal is not likely to have a significant impact on any threatened biodiversity listed under the BC Act or EPBC Act (see Section 4.4 and Appendix C). In this instance, and due to the Strategic Assessment, the EPBC Act environmental offsets policy does not apply. It is however Roads and Maritime policy that biodiversity offsets (or where offsets are not reasonable or feasible, supplementary measures) would be provided for impacts that exceed predetermined thresholds. The works would involve clearing of critically endangered ecological communities in moderate to good condition. The proposal would involve clearing of the EPBC Act listed Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest critically endangered ecological community and the BC Act listed Cumberland Plain Woodland in the Sydney Basin Bioregion critically endangered ecological community. Areas of these critically endangered ecological communities are in moderate to good condition and as such offsets or supplementary measures are to be considered for the proposal in accordance with Roads and Maritime *Guideline for Biodiversity Offsets* (November 2016).

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Appendix A – Species recorded (field data sheets)

Survey Site Form - BAM				Site ID: Mitre 10			Vegetation zone: Grey Box	
Date	3/11/2017			Surveyor(s): LC & AC				
Waypoint ID	035			Photo numbers				
Coordinates	E 0305285 N 6258295			Photo direction	N	E	S	W
Mapped Vegetation type: CPW				Condition:			Low	Mod-good
Slope: Gentle, Mod, Steep		Aspect (degrees or cardinal): N		Altitude:				
Topography: crest, ridge, upper slope, mid slope, down slope, gully, flat, depression, watercourse, escarpment, terrace								
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, alluvium, limestone, metamorphics, gravel, ?								
Soil type: sand, loam, clay, organic, gravel, skeletal, ?				Soil disturbance: intact, topsoil removed, fill				
Remnant / Old growth (uncleared): Yes / No / Undecided?								
Vegetative Structure (formation) =				Ecologically Dominant Layer (EDL) - most biomass =				

Strata	Height interval	Median	Est. cover	Dominant Species & Dominance
E	-			
T1	10 - 15m		10%	E. moluccana E. tereticornis
T2	-			
T3	-			
S1	1 - 2m		5%	Acacia falcata Bursaria spinosa Lycium ferocissimum
S2	-			
G	to 1m		90%	Eragrostis curvula Chloris gayana Kikuyu spear thistle

Tree height (clino) level ground or top of slope = distance from tree x (top% + bottom%)
Tree height (clino) from bottom of slope = distance from tree x (top% - bottom%)

Definitions
Dominance d = dominant; c = co-dominant; s = subdominant; a = associated
Estimated cover I = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%)

Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall
W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest

50m Transect	10 Points - Foliage Projective Cover		
Point	Canopy % (photos)	Midstorey %	Exotic %
5m			
10m			
15m			
20m			
25m			
30m			
35m			
40m			
45m			
50m			
Total (sum / 10) =			

Larger 50 x 20m plot	
Length of woody debris >10cm wide & >0.5m long	1m
Proportion of canopy sp. regeneration	100%
Number of trees with hollows >5cm (live or dead)	0

Ground cover tally sheet, 50 points along 50m transect - every 1m record if plant intersects (hits) point

Native grass tally -	Total (hits/50)
Native other (herb, fern, sedge, etc) tally -	Total (hits/50)
Native shrub tally -	Total (hits/50)
Exotic tally -	Total (hits/50)

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Site ID: Mitre 10	Survey type:Quadrat 20m x 20m, 10m x 40m, etc					
Species	Cover	Abund.	Species	Cover	Abund.	
1 E. moluccana	30%	16	41			
2 Lycium ferocissimum	1	2	42			
3 Eragrostis curvula	40	100+	43			
4 Kikuyu	50	100+	44 CLS habitat value			
5 Sida rhombifolia	1	20	45			
6 Lantana	0.1	1	46 highly disturbed ground cover			
7 Anredera cordifolia	0.1	1	47 Afrika love grass dominant Kikuyu			
8 Palm	0.1	1	48 Building debris			
9 Indigofera australis	0.2	4	49			
10 E. tereticornis	5	4	50 No snails or shells found			
11 Bryonidia australis	0.1	1	51			
12 Dianella laevis	0.1	1	52			
13 Acacia falcata	0.1	1	53			
14 Fireweed	0.1	1	54			
15 Spear thistle	0.3	10	55 CWH off. Burnings			
16 Bursaia spinosa	1	10	56			
17 Cirsium vulgare	10	20	57 Rows of Grey Box & Forest Red Gum			
18 Glycine tabacina	0.1	1	58 Lantana, Phoenix canariensis			
19 Dichondra repens	0.1	1	59 olive			
20 Moth Vine	0.1	1	60			
21 Hakea laevigata	0.1	1	61			
22 Onion weed	0.1	1	62 Compound site sth & Honeyman cl			
23 Sonchus	0.1	1	63			
24			64 Cirsium vulgare, Lantana, olive			
25			65 Kangaroo Grass, Verbena,			
26			66 Senecio			
27			67			
28 Disturbed roadside Patchy			68			
29 In Mitre 10 lot with			69			
30 building rubble			70			
31			71			
32			72			
33			73			
34			74			
35			75			
36			76			
37			77			
38			78			
39			79			
40			80			

Sp. Richness	Native	Exotic

Tree size class assessment tally:

<5cm: ✓
5 - 9cm: ✓
10 - 19cm: ✓
20 - 29cm: ✓
30 - 49cm: ✓
50 - 79cm: ✓
80+cm:

Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5
Native perennial grass					
Native other grass					
Native forb & other					
Native shrub (<1m)					
Exotic grass	10	70	60	70	10
Exotic forb & other	10				
Leaf & stick litter	80	30	40	30	90
Rocks					
Bare ground					
Cryptogams					
Total	100	100	100	100	100

Plot Disturbance		Fire damage:	
Clearing (inc. logging):	✓	Storm damage:	
Cultivation (inc. pasture):		Trampling:	
Soil erosion:		Flood damage:	
Firewood collection:		Feral herbivores:	
Stock grazing:		Other:	

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Survey Site Form - BBAM / BAM		Site ID: WPT5	Vegetation zone: CPW
Date	3/11/2017	Surveyor(s): LC + AC	
Waypoint ID	WPT5	Photo numbers	
Coordinates	E N	Photo direction	N | E | S | W

Mapped Vegetation type:		Condition:	Low | Mod-good
Slope: Gentle, Mod, Steep	Aspect (degrees or cardinal):	Altitude:	

Topography: crest, ridge, upper slope, mid slope, down slope, gully, flat, depression, watercourse, escarpment, terrace

Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, alluvium, limestone, metamorphics, gravel, ?

Soil type: sand, loam, clay, organic, gravel, skeletal, ? | Soil disturbance: intact, topsoil removed, fill

Remnant / Old growth (uncleared): Yes / No / Undecided?

Vegetative Structure (formation) = | Ecologically Dominant Layer (EDL) - most biomass =

Strata	Height interval	Median	Est. cover	Dominant Species & Dominance
E	-			
T1	10 - 20			E. amplifolia E. moluccana E. crebra E. tereticornis
T2	-			
T3	-			
S1	1 - 8m			Lantana Acacia falcata Dillwynia sieberi A. decurrens Bursaria olive
S2	-			
G	-			Chloris gayana Aristida Dianella Carex sp.

Tree height (clino) level ground or top of slope = distance from tree x (top% + bottom%)
Tree height (clino) from bottom of slope = distance from tree x (top% - bottom%)

Definitions
Dominance d = dominant; c = co-dominant; s = subdominant; a = associated
Estimated cover I = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%)

Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall
W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest

50m Transect	10 Points - Foliage Projective Cover		
Point	Canopy % (photos)	Midstorey %	Exotic %
5m			
10m			
15m			
20m			
25m			
30m			
35m			
40m			
45m			
50m			
Total (sum / 10) =			

Larger 50 x 20m plot	
Length of woody debris >10cm wide & >0.5m long	0
Proportion of canopy sp. regeneration	100%
Number of trees with hollows >5cm (live or dead)	0

Ground cover tally sheet, 50 points along 50m transect
- every 1m record if plant intersects (hits) point

Tally	Total (hits/50)
Native grass tally -	
Native other (herb, fern, sedge, etc) tally -	
Native shrub tally -	
Exotic tally -	

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Site ID: WPT 5	Survey type:Quadrat 20m x 20m, 10m x 40m, etc					
Species	**Cover**	**Abund.**	**Species**	**Cover**	**Abund.**	

	Species	Cover	Abund.		Species	Cover	Abund.
1	Ertartiens	20%	30	41			
2	Olive	1	5	42			
3	Bidens	1	20+	43			
4	Chloris gayana	20%	100+	44	Boiler close	compound.	
5	Microlaena	40%	100+	45			
6	Pavonia	0.3	20+	46	Roadway with		
7	Glycine tabacina	0.1	1	47			
8	Plantago lanceolata	0.1	1	48	Chloris gayana		
9	Dillwynia sieberi	0.1	1	49	Bozopythum		
10	Dichondra	0.3	70	50	E. crebra		
11	Carex/Gahnia aspera	0.1	1	51	E. tereticornis		
12	Dianella longifolia	0.1	1	52	Oats		
13	Bursaria	1	20+	53	Bidens		
14	Moth Vine	0.1	1	54	E. moluccana		
15	Lantana	10%	20+	55	Clover		
16	Phoenix	1	1	56			
17	E. moluccana	1	1	57			
18	E. amplifolia	1	1	58			
19	Acacia decurrens	5	1	59			
20	Hypochaeris radicata	0.3	10	60			
21	Acacia falcata	0.1	1	61			
22	Briza subaristata	0.1	1	62			
23	Mentha	0.1	1	63			
24				64			
25				65			
26				66			
27				67			
28				68			
29				69			
30				70			
31				71			
32				72			
33				73			
34				74			
35				75			
36				76			
37				77			
38				78			
39				79			
40				80			

Sp. Richness	Native	Exotic

Tree size class assessment tally:

<5cm:	✓
5 - 9cm:	✓
10 - 19cm:	✓
20 - 29cm:	✓
30 - 49cm:	✓
50 - 79cm:	
80+cm:	

Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5
Native perennial grass					
Native other grass					
Native forb & other					
Native shrub (<1m)					
Exotic grass					
Exotic forb & other					
Leaf & stick litter	80	5	10	5	5
Rocks					
Bare ground					
Cryptogams					
Total	100	100	100	100	100

Plot Disturbance	
Clearing (inc. logging):	Fire damage:
Cultivation (inc. pasture):	Storm damage:
Soil erosion:	Trampling:
Firewood collection:	Flood damage:
Stock grazing:	Feral herbivores:
	Other:

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Survey Site Form - BBAM / BAM		Site ID: Wetland drain	Vegetation zone: Wetland
Date	3/11/2017	Surveyor(s):	
Waypoint ID	Wetland drain	Photo numbers	
Coordinates	E N	Photo direction	N | E | S | W
Mapped Vegetation type:		Condition:	Low | Mod-good
Slope: Gentle, Mod, Steep	Aspect (degrees or cardinal):	Altitude:	

Topography: crest, ridge, upper slope, mid slope, down slope, gully, flat, depression, watercourse, escarpment, terrace

Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, alluvium, limestone, metamorphics, gravel, ?

Soil type: sand, loam, clay, organic, gravel, skeletal, ? — Soil disturbance: intact, topsoil removed, fill

Remnant / Old growth (uncleared): Yes / No / Undecided?

Vegetative Structure (formation) = — Ecologically Dominant Layer (EDL) - most biomass =

Strata	Height interval	Median	Est. cover	Dominant Species & Dominance
E	-			
T1	-			
T2	-			
T3	-			
S1	-			
S2	-			
G	1 - 3m		90%	Typha orientalis [illegible]

Tree height (clino) level ground or top of slope = distance from tree x (top% + bottom%)
Tree height (clino) from bottom of slope = distance from tree x (top% - bottom%)

Definitions
Dominance d = dominant; c = co-dominant; s = subdominant; a = associated
Estimated cover I = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%)

Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall
W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest

50m Transect	10 Points - Foliage Projective Cover		
Point	Canopy % (photos)	Midstorey %	Exotic %
5m			
10m			
15m			
20m			
25m			
30m			
35m			
40m			
45m			
50m			
Total (sum / 10) =			

Larger 50 x 20m plot	
Length of woody debris >10cm wide & >0.5m long	0
Proportion of canopy sp. regeneration	0
Number of trees with hollows >5cm (live or dead)	0

Ground cover tally sheet, 50 points along 50m transect - every 1m record if plant intersects (hits) point	
Native grass tally -	Total (hits/50)
Native other (herb, fern, sedge, etc) tally -	Total (hits/50)
Native shrub tally -	Total (hits/50)
Exotic tally -	Total (hits/50)

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Site ID: Wetland	Survey type: Quadrat 20m x 20m, 10m x 40m, etc

	Species	Cover	Abund.		Species	Cover	Abund.
1	Typha	90	100+	41			
2	Spear thistle	0.1	1	42	WPTG.		
3	Kikuyu	5	100+	43			
4	Crofton weed	0.1	1	44	Row of planting		
5	M. quinquenervia	0.1	1	45			
6	Persicaria decipiens	0.3	10+	46	Eucalyptus nicholii off		
7	Fennel	0.1	1	47	to side of culvert		
8	Phoenix	1	1	48			
9	Rumex	0.1	1	49	M. quinquenervia planted		
10	Fireweed	0.1	3	50	Corymbia citriodora / henryi		
11	Solanum nigrum	0.1	1	51	Kikuyu		
12	Sonchus	0.1	1	52	Lantana		
13	Platanus hispanica	0.1	1	53	Bidens		
14	Schoenoplectus validus	0.3	20+	54	Eucalyptus elata		
15				55	oats		
16				56	Fennel		
17				57	olive		
18				58	Acacia decurrens		
19				59			
20				60			
21				61			
22				62			
23				63			
24				64			
25				65			
26				66			
27				67			
28				68			
29				69			
30				70			
31				71			
32				72			
33				73			
34				74			
35				75			
36				76			
37				77			
38				78			
39				79			
40				80			

Sp. Richness	Native	Exotic

Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5
Native perennial grass					
Native other grass					
Native forb & other					
Native shrub (<1m)					
Exotic grass					
Exotic forb & other					
Leaf & stick litter	0	0	0	0	0
Rocks					
Bare ground					
Cryptogams					
Total	100	100	100	100	100

Tree size class assessment tally:

<5cm:

5 - 9cm:

10 - 19cm: NA

20 - 29cm:

30 - 49cm:

50 - 79cm:

80+cm:

Plot Disturbance	Fire damage:
Clearing (inc. logging):	Storm damage:
Cultivation (inc. pasture):	Trampling:
Soil erosion:	Flood damage:
Firewood collection:	Feral herbivores:
Stock grazing:	Other:

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Survey Site Form - BBAM / BAM				Site ID: WPT3			Vegetation zone: CW ext	
Date	3/11/2017			Surveyor(s):				
Waypoint ID	WPT3			Photo numbers				
Coordinates	E			Photo direction	N	E	S	W
	N							
Mapped Vegetation type:					Condition:		Low	Mod-good
Slope: Gentle, Mod, Steep		**Aspect (degrees or cardinal):**			**Altitude:**			
Topography: crest, ridge, upper slope, mid slope, down slope, gully, flat, depression, watercourse, escarpment, terrace								
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, alluvium, limestone, metamorphics, gravel, ?								
Soil type: sand, loam, clay, organic, gravel, skeletal, ?				**Soil disturbance:** intact, topsoil removed, fill				
Remnant / Old growth (uncleared): Yes / No / Undecided?								
Vegetative Structure (formation) =				Ecologically Dominant Layer (EDL) - most biomass =				
Strata	Height interval	Median	Est. cover	Dominant Species & Dominance				
E	-							
T1	10 - 20m		20%	E. cladocalyx E. moluccana E. tereticornis				
T2	-							
T3	-							
S1	2 - 6m			African olive Lantana				
S2	-							
G	to 1m			Chlorophytum African love grass Brassica				

Tree height (clino) level ground or top of slope = distance from tree x (top% + bottom%)
Tree height (clino) from bottom of slope = distance from tree x (top% - bottom%)

Definitions
Dominance d = dominant; c = co-dominant; s = subdominant; a = associated
Estimated cover i = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%)

Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall
W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest

50m Transect	10 Points - Foliage Projective Cover		
Point	Canopy % (photos)	Midstorey %	Exotic %
5m			
10m			
15m			
20m			
25m			
30m			
35m			
40m			
45m			
50m			
Total (sum / 10) =			

Larger 50 x 20m plot	
Length of woody debris >10cm wide & >0.5m long	0m
Proportion of canopy sp. regeneration	100%
Number of trees with hollows >5cm (live or dead)	0

Ground cover tally sheet, 50 points along 50m transect
- every 1m record if plant intersects (hits) point

Native grass tally -	Total (hits/50)
Native other (herb, fern, sedge, etc) tally -	Total (hits/50)
Native shrub tally -	Total (hits/50)
Exotic tally -	Total (hits/50)

Site ID: WPT 3	Survey type: Quadrat 20m x 20m, 10m x 40m, etc				
Species	**Cover**	**Abund.**	**Species**	**Cover**	**Abund.**
1 E. moluccana	10	4	41		
2 E. crebra	15	6	42		
3 E. tereticornis	3	1	43		
4 Olive	5	4	44		
5 Chlorophytum	40	100+	45		
6 Pavonia hastata	0.1	3	46		
7 Plantago lanceolata	5	100+	47		
8 Sida rhombifolia	5	100+	48		
9 Brassica	0.1	1	49		
10 Chloris gayana	1	20+	50		
11 Dichondra repens	0.1	1	51		
12 Lantana	0.1	1	52		
13 Acacia falcata	0.1	7	53		
14 Brunoniella australis	0.1	1	54		
15 Eragrostis curvula	[illegible]	100+	55		
16 Cotoneaster	1	1	56		
17 Crassula	5	100+	57		
18 Yucca	1	10	58		
19 ~~Anredera~~	0.1	1	59		
20 Peach tree	0.1	1	60		
21 Bird of Paradise	0.1	1	61		
22 Monstera	[illegible]	2	62		
23 Coral tree	5	1	63		
24 Nandina	0.1	1	64		
25 Ipomoea indica	0.1	1	65		
26 Moth vine	0.1	1	66		
27 Lemon tree	0.1	1	67		
28 Cirsium			68		
29 Lactuca			69		
30 Verbena			70		
31 Celtis			71		
32 Peppercorn tree			72		
33 Phoenix			73		
34 Bidens			74		
35 Glycine tabacina			75		
36 Commelina			76		
37 E. amplifolia			77		
38			78		
39			79		
40			80		

RM exotic grass

Sp. Richness	Native	Exotic

Tree size class assessment tally:

- <5cm:
- 5 - 9cm:
- 10 - 19cm: ✓
- 20 - 29cm: ✓
- 30 - 49cm: ✓
- 50 - 79cm:
- 80+cm:

Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5
Native perennial grass					
Native other grass					
Native forb & other					
Native shrub (<1m)					
Exotic grass					
Exotic forb & other					
Leaf & stick litter	10	20	30	10	10
Rocks					
Bare ground					
Cryptogams					
Total	100	100	100	100	100

Plot Disturbance	
Clearing (inc. logging):	Fire damage:
Cultivation (inc. pasture):	Storm damage:
Soil erosion:	Trampling:
Firewood collection:	Flood damage:
Stock grazing:	Feral herbivores:
	Other:

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Survey Site Form - BBAM / BAM				Site ID:			Vegetation zone:	
Date	3/11/2017			Surveyor(s):	LC & AC			
Waypoint ID	WPT7			Photo numbers				
Coordinates	E			Photo direction	N	E	S	W
	N							
Mapped Vegetation type:					Condition:		Low	Mod-good
Slope: Gentle, Mod, Steep		Aspect (degrees or cardinal):			Altitude:			
Topography: crest, ridge, upper slope, mid slope, down slope, gully, flat, depression, watercourse, escarpment, terrace								
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, alluvium, limestone, metamorphics, gravel, ?								
Soil type: sand, loam, clay, organic, gravel, skeletal, ?				Soil disturbance: intact, topsoil removed, fill				
Remnant / Old growth (uncleared): Yes / No / Undecided?								
Vegetative Structure (formation) =				Ecologically Dominant Layer (EDL) - most biomass =				

Strata	Height interval	Median	Est. cover	Dominant Species & Dominance
E	-			
T1	10 - 20m		30%	E. amplifolia E. molluccana
T2	-			
T3	-			
S1	6 - 8m		5%	M. quinquenervia - plated adjacent
S2	-			
G	-		90%	Kikuyu clover

Definitions

Tree height (clino) level ground or top of slope = distance from tree x (top% + bottom%)

Tree height (clino) from bottom of slope = distance from tree x (top% - bottom%)

Dominance: d = dominant; c = co-dominant; s = subdominant; a = associated

Estimated cover: l = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%)

Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall

W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest

50m Transect	10 Points - Foliage Projective Cover		
Point	Canopy % (photos)	Midstorey %	Exotic %
5m			
10m			
15m			
20m			
25m			
30m			
35m			
40m			
45m			
50m			
Total (sum / 10) =			

Larger 50 x 20m plot	
Length of woody debris >10cm wide & >0.5m long	0
Proportion of canopy sp. regeneration	100%
Number of trees with hollows >5cm (live or dead)	0

Ground cover tally sheet, 50 points along 50m transect - every 1m record if plant intersects (hits) point

Native grass tally -	Total (hits/50)
Native other (herb, fern, sedge, etc) tally -	Total (hits/50)
Native shrub tally -	Total (hits/50)
Exotic tally -	Total (hits/50)

Site ID: WPT 7

Survey type:Quadrat 20m x 20m, 10m x 40m, etc

	Species	Cover	Abund.		Species	Cover	Abund.
1	E. amplifolia	20%	40	41			
2	E. moluccana	5%	10	42			
3	Chloris gayana	40%	100+	43			
4	Brunoniella	0.3	20	44	extensive regen	of	
5	Lantana	5	R	45	E. amplifolia		
6	Kikuyu	20%	100+	46			
7	Bidens	0.3	50+	47			
8	Pavonia hastata	0.1	10	48			
9	Olive	0.1	1	49			
10	Ehrharta erecta	10	100+	50			
11	Solanum pseudocapsicum	0.1	1	51			
12	Phoenix	0.1	1	52			
13	Plantago lanceolata	0.1	1	53			
14	Bursaria	0.3	3	54			
15	Dichondra repens	1	100+	55			
16	Acacia falcata	0.1	1	56			
17	Oats	0.1	1	57			
18	Glycine tabacina	0.3	20+	58			
19	Exocarpos cupressiformis	0.1	1	59			
20	Cymbopogon refractus	0.3	10+	60			
21				61			
22				62			
23				63			
24				64			
25				65			
26				66			
27				67			
28				68			
29				69			
30				70			
31				71			
32				72			
33				73			
34				74			
35				75			
36				76			
37				77			
38				78			
39				79			
40				80			

Sp. Richness	Native	Exotic

Tree size class assessment tally:

- <5cm: ✓
- 5 - 9cm: ✓
- 10 - 19cm: ✓
- 20 - 29cm: ✓
- 30 - 49cm: ✓
- 50 - 79cm:
- 80+cm:

Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5
Native perennial grass					
Native other grass					
Native forb & other					
Native shrub (<1m)					
Exotic grass					
Exotic forb & other					
Leaf & stick litter	20	10	30	25	10
Rocks					
Bare ground					
Cryptogams					
Total	100	100	100	100	100

Plot Disturbance	
Clearing (inc. logging):	Fire damage:
Cultivation (inc. pasture):	Storm damage:
Soil erosion:	Trampling:
Firewood collection:	Flood damage:
Stock grazing:	Feral herbivores:
	Other:

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Appendix B – Habitat assessment table

Likelihood of occurrence criteria

Likelihood	Criteria
Recorded	The species was observed in the study area during the current survey
High	It is highly likely that a species inhabits the study area and is dependent on identified suitable habitat (ie. for breeding or important life cycle periods such as winter flowering resources), has been recorded recently in the locality (10km) and is known or likely to maintain resident populations in the study area. Also includes species known or likely to visit the study area during regular seasonal movements or migration.
Moderate	Potential habitat is present in the study area. Species unlikely to maintain sedentary populations, however may seasonally use resources within the study area opportunistically or during migration. The species is unlikely to be dependent (ie. for breeding or important life cycle periods such as winter flowering resources) on habitat within the study area, or habitat is in a modified or degraded state. Includes cryptic flowering flora species that were not seasonally targeted by surveys and that have not been recorded.
Low	It is unlikely that the species inhabits the study area and has not been recorded recently in the locality (10km). It may be an occasional visitor, but habitat similar to the study area is widely distributed in the local area, meaning that the species is not dependent (ie. for breeding or important life cycle periods such as winter flowering resources) on available habitat. Specific habitat is not present in the study area or the species are a non-cryptic perennial flora species that were specifically targeted by surveys and not recorded.
None	Suitable habitat is absent from the study area.

Habitat assessment table – Threatened Flora

Common Name *(Scientific Name)*	BC Act	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence
Bynoe's Wattle (*Acacia bynoeana*)	E	V	Occurs south of Dora Creek-Morisset area to Berrima and the Illawarra region and west to the Blue Mountains. It grows mainly in heath and dry sclerophyll forest on sandy soils (Harden, 2002). Seems to prefer open, sometimes disturbed sites such as trail margins and recently burnt areas. Typically occurs in association with *Corymbia gummifera, Eucalyptus haemastoma, E. gummifera, E. parramattensis, E. sclerophylla*, *Banksia serrata* and *Angophora bakeri* (NSW National Parks and Wildlife Service, 1999a).	PMST	Low. Not known form the locality and suitable habitat not present.
(Downy Wattle) *Acacia pubescens*	V	V	Concentrated around the Bankstown-Fairfield-Rookwood area and the Pitt Town area, with outliers occurring at Barden Ridge, Oakdale and Mountain Lagoon. Occurs in open woodland and forest, in a variety of plant communities, including Cooks River/ Castlereagh Ironbark Forest,	80 – OEH Atlas PMST	Low. Not recorded during surveys for this proposal or for the Honeman Close SIS.

Common Name *(Scientific Name)*	BC Act	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence
			Shale/Gravel Transition Forest and Cumberland Plain Woodland. Occurs on alluviums, shales and at the intergrade between shales and sandstones. The soils are characteristically gravely soils, often with ironstone.		
Allocasuarina glareicola	E	E	Primarily restricted to the Richmond (NW Cumberland Plain) district, but with an outlier population found at Voyager Point, Liverpool. Grows in Castlereagh woodland on lateritic soil.	PMST	None. Not recorded in the locality and associated vegetation types are absent from the site.
Asterolasia elegans	E	E	Occurs north of Sydney, in the Baulkham Hills, Hawkesbury and Hornsby local government areas. Also likely to occur in the western part of Gosford local government area. Known from only seven populations, only one of which is wholly within a conservation reserve.	PMST	None. Not recorded in the locality and associated vegetation types are absent from the site.
Netted Bottlebrush (*Callistemon linearifolius*)	V	-	Recorded from the Georges River to Hawkesbury River in the Sydney area, and north to the Nelson Bay area of NSW. Was more widespread across its distribution in the past. Some populations are reserved in Ku-ring-gai Chase National Park, Lion Island Nature Reserve, and Spectacle Island Nature Reserve. Further north it has been recorded from Yengo National Park and Werakata National Park. Grows in dry sclerophyll forest on the coast and adjacent ranges.	2 – OEH Atlas	Low. Not recorded during surveys for this proposal or for the Honeman Close SIS.
Leafless Tongue-orchid (*Cryptostylis hunteriana*)	V	V	The Leafless Tongue Orchid has been recorded from as far north as Gibraltar Range National Park south into Victoria around the coast as far as Orbost. It is known historically from a number of localities on the NSW south coast and has been observed in recent years at many sites between Batemans Bay and Nowra (although it is uncommon at all sites). Also recorded at Munmorah State Conservation Area, Nelson Bay, Wyee, Washpool National Park, Nowendoc State Forest, Ku-Ring-Gai Chase National Park and Ben Boyd National Park. Does not appear to have well defined habitat preferences and is known from a range of communities, including swamp-heath and woodland.	PMST	Low. Rarely recorded in the locality and associated vegetation types are absent from the site.

Common Name *(Scientific Name)*	BC Act	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence
White-flowered Wax Plant (*Cynanchum elegans*)	E	E	Occurs from the Gloucester district to the Wollongong area and inland to Mt Dangar where it grows in rainforest gullies, scrub and scree slopes (Harden, 1992). This species typically occurs at the ecotone between dry subtropical forest/woodland communities.	1 – OEH atlas PMST	Low. Associated habitat is absent from site and the species was not detected during targeted surveys.
Dillwynia tenuifolia	V	-	In western Sydney, *Dillwynia tenuifolia* is generally found on alluvial soils or on residual soil landscapes near the alluvial boundary. In this region this species is strongly associated with the alluvial Hawkesbury – Nepean Terrace Gravels (ferruginised clay and consolidated sand of the Londonderry Clay, the conglomerate of the Rickabys Creek Gravels, laterised sand and clay of the St Mary's Formation). *Dillwynia tenuifolia* also occurs to a lesser extent on the residual Cumberland Plain landscape on the Bringelly Shale and Ashfield Shale where there is influence from the quaternary alluvium of the Hawkesbury – Nepean Channels and Floodplains (eg South Creek, Kemps Creek, Ropes Creek, and Eastern Creek) and where the gravelly Berkshire Park soil landscape is present (ie Kemps Creek, Scheyville). This species is strongly associated with vegetation types including Castlereagh Scribbly Gum Woodland, Cooks River Castlereagh Ironbark Forest, and Shale/Gravel Transition Forest. Some outlier occurrences of *Dillwynia tenuifolia* occur in patches of Shale Plains Woodland or Alluvial Woodland where these communities intergrade with the aforementioned vegetation types.	69 – OEH atlas	Low. Not recorded during surveys for this proposal or for the Honeman Close SIS.
Epacris purpurascens var. *purpurascens*	V	-	Recorded from Gosford in the north, to Narrabeen in the east, Silverdale in the west and Avon Dam vicinity in the South. Found in a range of habitat types, most of which have a strong shale soil influence.	7 – OEH Atlas	Low. Not recorded during surveys for this proposal or for the Honeman Close SIS.
Narrow-leaved Black Peppermint (*Eucalyptus nicholii*)	V	V	This species is sparsely distributed but widespread on the New England Tablelands from Nundle to north of Tenterfield, being most common in central portions of its range. Found largely on private property and roadsides, and occasionally conservation reserves. Planted as urban trees, windbreaks and corridors. Typically grows in dry grassy woodland, on	3 – OEH Atlas	Recorded. One tree was located at the edge of Reservoir Road on 6 Honeman Close.

Common Name *(Scientific Name)*	BC Act	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence
			shallow soils of slopes and ridges. Found primarily on infertile soils derived from granite or metasedimentary rock.		
Yellow Gnat-orchid (*Genoplesium baueri*)	E	E	The species has been recorded from locations between Ulladulla and Port Stephens. About half the records were made before 1960 with most of the older records being from Sydney suburbs including Asquith, Cowan, Gladesville, Longueville and Wahroonga. No collections have been made from those sites in recent years. Currently the species is known from just over 200 plants across 13 sites. The species has been recorded at locations now likely to be within the following conservation reserves: Berowra Valley Regional Park, Royal National Park and Lane Cove National Park. May occur in the Woronora, O'Hares, Metropolitan and Warragamba Catchments. Grows in dry sclerophyll forest and moss gardens over sandstone.	PMST	None. Not recorded in the locality and associated vegetation types are absent from the site.
Juniper-leaved Grevillea (*Grevillea juniperina* subsp. *juniperina*)	V	-	In the locality, *Grevillea juniperina* subsp. *juniperina* is highly associated with the Quaternary alluvium of South Creek and the Londonderry Clay and areas of adjacent Bringelly Shale.	152 – OEH Atlas	Low. Not recorded during surveys for this proposal or for the Honeman Close SIS.
Small-flower Grevillea (*Grevillea parviflora* subsp. *parviflora*)	V	V	*Grevillea parviflora* subsp. *parviflora* occurs sporadically throughout the Sydney Basin. It occurs on ridge crests, upper slopes or flat plains in both low-lying areas between 30–65 m above sea level and on higher topography between 200–300 m above sea level south of Sydney. It occurs in sandy or light clay soils, usually over thin shales often with lateritic ironstone gravels which are often infertile and poorly drained. Soils are mostly derived from Tertiary sands or alluvium and from the Mittagong Formation with alternating bands of shale and fine grained sandstones. This species is known from Kemps Creek on the sandy lateritic soils and a recent record from Ropes Creek at Mt Druitt on the alluvial South Creek formation soils.	2 – OEH Atlas PMST	Low. Associated habitat is absent from site and the species was not detected during targeted surveys.
Wingless Raspwort (*Haloragis exalata* subsp. *exalata*)	V	V	Square Raspwort occurs in 4 widely scattered localities in eastern NSW. It is disjunctly distributed in the Central Coast, South Coast and North Western Slopes botanical subdivisions of NSW. Square Raspwort appears to require protected and shaded damp situations in riparian habitats.	PMST	None. Not recorded in the locality and associated vegetation types are absent from the site.

Common Name *(Scientific Name)*	BC Act	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence
			Flowering specimens in NSW are recorded from November to January.		
Marsdenia viridiflora subsp. *viridiflora* in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas	E	-	Endangered population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas. Recent records are from Prospect, Bankstown, Smithfield, Cabramatta Creek and St Marys. Grows in vine thickets and open shale woodland.	33 – OEH Atlas	Low. Not recorded during surveys for this proposal or for the Honeman Close SIS.
Micromyrtus minutiflora	E	V	The occurrences of *Micromyrtus minutiflora* to the north west of the study area (Londonderry, Llandilo, Agnes Banks, Berkshire Park) are strongly associated with the Hawkesbury – Nepean Terrace Gravels and the presence of the Londonderry Clay geological formation (clay with sand – top layer hard, semi-indurated zone of cemented ironstone pisolites) with the Berkshire Park and Agnes Banks soil landscapes (laterite and sand).	PMST	None. Not recorded in the locality and associated vegetation types are absent from the site.
Omeo Storksbill (*Pelargonium* sp. Striatellum G.W. Carr 10345)	E	E	Known from only 3 locations in NSW, with two on lake-beds on the basalt plains of the Monaro and one at Lake Bathurst. A population at a fourth known site on the Monaro has not been seen in recent years. The only other known population is at Lake Omeo, Victoria. It occurs at altitudes between 680 to 1030 m. It is known to occur in the local government areas of Goulburn-Mulwaree, Cooma-Monaro, and Snowy River, but may occur in other areas with suitable habitat; these may include Bombala, Eurobodalla, Palerang, Tumbarumba, Tumut, Upper Lachlan, and Yass Valley local government areas. 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. It sometimes colonises exposed lake beds during dry periods.	PMST	None. Not recorded in the locality.
Nodding Geebung (*Persoonia nutans*)	E	E	*Persoonia nutans* is restricted to the Cumberland Plain. It is known from an area between Richmond and Macquarie Fields, particularly near the Nepean and Georges Rivers. The range of the species is fragmented, with about 99 per cent of the known populations occurring in the north of the distribution at Agnes Banks, Londonderry, Castlereagh, Berkshire Park and Windsor Downs. This species is also	6 – OEH atlas PMST	Low. Not recorded during surveys for this proposal or for the Honeman Close SIS.

Common Name *(Scientific Name)*	BC Act	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence
			known from Kemps Creek on the sandy lateritic soils. *Persoonia nutans* is strongly associated with the Hawkesbury – Nepean Terrace Gravels and the presence of the Londonderry Clay geological formation (clay with sand – top layer hard, semi-indurated zone of cemented ironstone pisolites) with the Berkshire Park and Agnes Banks soil landscapes (laterite and sand).		
Austral Pillwort (*Pilularia novae-hollandiae*)	E	-	*Pilularia novae-hollandiae* is a semi-aquatic fern that grows in shallow swamps and waterways. The populations at Lake Cowal and Oolambeyan National Park are the only known extant populations in NSW. On the Cumberland Plain there is a record of *Pilularia novae-hollandiae* from a dried out drain adjacent to the rail line near the Doonside railway station from 1966 and a record from Stringer Road Kellyville that was collected in 2014.	1 – OEH Atlas	Low. Not recorded during surveys for this proposal or for the Honeman Close SIS.
Pimelea curviflora subsp. *curviflora*	V	V	*Pimelea curviflora* subsp. *curviflora* occurs on shaley / lateritic soils over sandstone and shale / sandstone transition soils.	7 – OEH Atlas PMST	Low. Not recorded during surveys for this proposal or for the Honeman Close SIS.
Spiked Rice-flower (*Pimelea spicata*)	E	E	The Spiked Rice-flower occurs in two disjunct areas; the Cumberland Plain (Marayong and Prospect Reservoir south to Narellan and Douglas Park) and the Illawarra (Landsdowne to Shellharbour to northern Kiama). Found on well-structured clay soils.	210 – OEH Atlas PMST	Low. Not recorded during surveys for this proposal or for the Honeman Close SIS.
Brown Pomaderris (*Pomaderris brunnea*)	E	V	Within the Hawkesbury–Nepean region, Pomaderris brunnea is known from a small area around the Colo, Nepean and Hawkesbury Rivers, including the Bargo area and near Camden. It is largely restricted to the Picton – Razorback Hills and Nattai Plateau. It is also found near Camden on the Cumberland Plain, Hawkesbury – Nepean Channels and Floodplains, and Hawkesbury – Nepean Terrace Gravels. This species shows a strong preference for alluvial soils and the shale/sandstone transitional zone of the residual Lucas Heights soil landscape around Bargo. Suitable habitat is the Sydney Hinterland Transitional Woodland around Bargo and the Alluvial Woodland and Riparian Forest along the Nepean River at Camden.	PMST	None. Not recorded in the locality.

Common Name *(Scientific Name)*	BC Act	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence
Pomaderris prunifolia (a shrub) population, Parramatta, Auburn, Strathfield and Bankstown local government areas	E	-	Endangered population in the Parramatta, Auburn, Strathfield and Bankstown Local Government Areas. Known from only three sites within the listed local government areas, at Rydalmere, within Rookwood Cemetery and at The Crest of Bankstown. At Rydalmere it occurs along a road reserve near a creek, among grass species on sandstone. At Rookwood Cemetery it occurs in a small gully of degraded Cooks River / Castlereagh Ironbark Forest on shale soils	1 – OEH Atlas	None. The study area is in the Blacktown LGA.
Illawarra Greenhood (*Pterostylis gibbosa)*	E	E	Known from a small number of populations in the Hunter region (Milbrodale), the Illawarra region (Albion Park and Yallah) and the Shoalhaven region (near Nowra). It is apparently extinct in western Sydney which is the area where it was first collected (1803). All known populations grow in open forest or woodland, on flat or gently sloping land with poor drainage. In the Illawarra region, the species grows in woodland dominated by Forest Red Gum *Eucalyptus tereticornis*, Woollybutt *E. longifolia* and White Feather Honey-myrtle *Melaleuca decora*.	PMST	None. Not recorded in the locality and associated vegetation types are absent from the site.
Sydney Plains Greenhood (*Pterostylis saxicola*)	E	E	Restricted to western Sydney between Freemans Reach in the north and Picton in the south. There are very few known populations and they are all very small and isolated. Only one population occurs within a conservation reserve (Georges River National Park). Most commonly found growing in small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines. The vegetation communities above the shelves where *Pterostylis saxicola* occurs are sclerophyll forest or woodland on shale/sandstone transition soils or shale soils.	1 – OEH Atlas PMST	Low. The only record of this species from the locality is from 1804 and is unlikely to be accurate location wise. Suitable sandstone rock shelf habitat is not present.
Sydney Bush Pea (*Pultenaea parviflora*)	E	V	*Pultenaea parviflora* is confined to the Cumberland Plain and is mainly found between Penrith and Windsor. Pultenaea parviflora is generally found in scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on Wianamatta shale, tertiary alluvium or laterised clays, and in transitional areas where these communities adjoin Castlereagh Scribbly Gum Woodland.	53 – OEH Atlas PMST	Low. Not recorded during surveys for this proposal or for the Honeman Close SIS.

Common Name *(Scientific Name)*	BC Act	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence
Matted Bush Pea (*Pultenaea pedunculata*)	V	-	Widespread in Victoria, Tasmania, and south-eastern South Australia, however in NSW it is represented by just three disjunct populations on the Cumberland Plains in Sydney, the coast between Tathra and Bermagui and the Windellama area south of Goulburn. NSW populations are generally among woodland vegetation but plants have also been found on road batters and coastal cliffs. It is largely confined to loamy soils in dry gullies in populations in the Windellama area.	7 – OEH Atlas	Low. Not recorded during surveys for this proposal or for the Honeman Close SIS.
Magenta Lilly Pilly (*Syzygium paniculatum*)	E	V	Occurs between Bulahdelah and St Georges Basin where it grows in subtropical and littoral rainforest on sandy soils or stabilized dunes near the sea (Harden, 2002). On the south coast the Magenta Lilly Pilly occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest. On the central coast Magenta Lilly Pilly occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities.	2 - OEH Atlas	Low. Not recorded during surveys for this proposal or for the Honeman Close SIS.
Austral Toadflax (*Thesium australe*)	V	V	Austral Toad-flax is found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. It is also found in Tasmania and Queensland and in eastern Asia. Although originally described from material collected in the SW Sydney area, populations have not been seen in a long time. It may persist in some areas in the broader region. Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast.	PMST	None. Not known from the locality and not recorded during surveys for this proposal or for the Honeman Close SIS.

Habitat assessment table – Threatened Fauna

Common Name *(Scientific Name)*	NSW status (BC Act or FM Act)	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence
Frogs					
Giant Burrowing Frog (*Heleioporus australiacus*)	V	V	In the northern population there is a marked preference for sandstone ridgetop habitat and broader upland valleys. In these locations, the frog is associated with small headwater creek lines and along slow flowing to intermittent creek lines. The vegetation is typically woodland, open woodland and heath and may be associated with 'hanging swamp' seepage lines and where small pools form from the collected water. They have also been observed occupying artificial ponded structures such as fire dams, gravel 'borrows', detention basins and box drains that have naturalised over time and are still surrounded by other undisturbed habitat. Do not appear to inhabit areas that have been cleared for agriculture or for urban development. Breed in summer and autumn in burrows in the banks of small creeks (Cogger, 2000, NSW National Parks and Wildlife Service, 2001a).	PMST	Low The habitats in the study area are not considered suitable for this species.
Green and Golden Bell Frog (*Litoria aurea*)	E	V	Various types of habitat have been documented. For breeding utilises a wide range of waterbodies, including both natural and man-made structures, such as marshes, dams and stream sides, and ephemeral locations that are more often dry than wet. Is found in various small pockets of habitat in otherwise developed areas and has the tendency of often turning up in highly disturbed sites. Lotic situations such as fast flowing streams appear to be one of the few water bodies not utilised, at least for breeding purposes (Department of Environment and Conservation, 2004a, Department of Environment and Conservation, 2005).	30 - OEH Atlas PMST	Low The wetland habitat in the study area is moderately suitable for the Green and Golden Bell Frog but this species has not been recorded from the locality since 1999 when it was found at Merrylands. Records have not been made at other former habitats in the locality since the 1970s.

Common Name *(Scientific Name)*	NSW status (BC Act or FM Act)	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence
Growling Grass Frog (*Litoria raniformis*)	E	V	The species is currently widespread throughout the Murray River valley and has been recorded from six Catchment Management Areas in NSW: Lower Murray Darling, Murrumbidgee, Murray, Lachlan, Central West and South East. Found mostly amongst emergent vegetation, including Typha sp. (bullrush), *Phragmites* sp. (reeds) and *Eleocharis* sp.(sedges), in or at the edges of still or slow-flowing water bodies such as lagoons, swamps, lakes, ponds and farm dams.	PMST	Low This species does not occur in the locality.
Stuttering Frog (*Mixophyes balbus*)	E	V	Terrestrial species, found in rainforest, Antarctic beech forest or wet sclerophyll forest. The species depends on freshwater streams and riparian vegetation for breeding and habitation. No records are known from riparian habitat that has been disturbed (NSW Scientific Committee, 2003, Cogger, 2000).	PMST	Low The habitats in the study area are not considered suitable for this species.
Birds					
Regent Honeyeater (*Anthochaera phrygia*)	CE	CE	Occurs mostly in box-ironbark forests and woodland and prefers the wet, fertile sites such as along creek flats, broad river valleys and foothills. Riparian forests with *Casuarina cunninghamiana* and *Amyema cambagei* are important for feeding and breeding. Important food trees include *Eucalyptus sideroxylon* (Mugga Ironbark), *E. albens* (White Box), *E. melliodora* (Yellow Box) and *E. leucoxylon* (Yellow Gum) (Garnett and Crowley, 2000) with *Eucalyptus robusta* (Swamp Mahogany) and *Corymbia maculata* (Spotted Gum) used in coastal habitats.	12 - OEH Atlas PMST	Low The Regent Honeyeater is a rare visitor to the locality and has not been recorded since 1995 when it was found in a residential garden in the Blacktown LGA. This species is a sporadic visitor to the area and would focus habitat use on larger areas of flowering eucalypts in winter.
Fork-tailed Swift (*Apus pacificus*)	-	M	Recorded in all regions of NSW. The Fork-tailed Swift is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher.	4 – OEH Atlas PMST	Moderate. Likely to fly over the study area.

Common Name *(Scientific Name)*	NSW status (BC Act or FM Act)	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence
Great Egret (*Ardea alba*)	-	M	Widespread in Australia. Reported in a wide range of wetland habitats (for example inland and coastal, freshwater and saline, permanent and ephemeral, open and vegetated, large and small, natural and artificial).	PMST	Low. There is a low possibility that this species may visit the study area as a vagrant.
Cattle Egret (*Ardea ibis*)	-	M	Subspecies *A. i. coromanda* is found across the Indian subcontinent and Asia as far north as Korea and Japan, and in South-east Asia, Papua New Guinea and Australia (McKilligan, 2005).	40 - OEH Atlas	Low. There is a low possibility that this species may visit the study area as a vagrant.
Dusky Woodswallow (*Artamus cyanopterus*)	V	-	The Dusky Woodswallow is often reported in woodlands and dry open sclerophyll forests, usually dominated by eucalypts, including mallee associations. It has also been recorded in shrublands and heathlands and various modified habitats, including regenerating forests; very occasionally in moist forests or rainforests (Higgins and Peter, 2002).	23 – OEH Atlas	Moderate. Likely to fly over the study area.
Australasian Bittern (*Botaurus poiciloptilus*)	V	E	Occurs in shallow, vegetated freshwater or brackish swamps. Requires permanent wetlands with tall dense vegetation, particularly bulrushes and spike rushes. When breeding, pairs are found in areas with a mixture of tall and short sedges but will also feed in territory that is more open. (Garnett and Crowley, 2000, NSW National Parks and Wildlife Service, 2002b).	PMST	Low This species is not known from the locality and the wetland habitat in the study area is not considered optimal for the Australasian Bittern.
Gang-gang Cockatoo (*Callocephalon fimbriatum*)	V	-	Occurs in wetter forests and woodland from sea level to an altitude over 2000 metres, timbered foothills and valleys, coastal scrubs, farmlands and suburban gardens (Pizzey and Knight, 1997).	1 - OEH Atlas	Low. There is a low possibility that this species may visit the study area as a vagrant.
Speckled Warbler (*Chthonicola sagittata*)	V	-	The Speckled Warbler lives in a wide range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt re-growth and an open canopy.	1 - OEH Atlas	Low. There is a low possibility that this species may visit the study area as a vagrant.

Common Name *(Scientific Name)*	NSW status (BC Act or FM Act)	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence
			Large, relatively undisturbed remnants are required for the species to persist in an area. Pairs are sedentary and occupy a breeding territory of about ten hectares, with a slightly larger home-range when not breeding. The rounded, domed, roughly built nest of dry grass and strips of bark is located in a slight hollow in the ground or the base of a low dense plant, often among fallen branches and other litter.		
Oriental Cuckoo (*Cuculus optatus*)	-	M	Migrates from Eurasia as far south as Indonesia, New Guinea and North Australia. Some remain through Australia in the winter. Inhabits rainforest margins, monsoon forest, vine scrub and mangroves.	PMST	Low Suitable habitat is not present.
Varied Sittella (*Daphoenositta chrysoptera*)	V	-	The Varied Sittella inhabits most of mainland Australia except the treeless deserts and open grasslands. It inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. The Varied Sittella feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees, and from small branches and twigs in the tree canopy. It 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.	13 - OEH Atlas	Moderate May utilise habitats at 6 Honeman Close.
Black Falcon (*Falco subniger*)	V	-	Widely, but sparsely, distributed in New South Wales, mostly occurring in inland regions. Some reports of 'Black Falcons' on the tablelands and coast of New South Wales are likely to be referrable to the Brown Falcon. In New South Wales there is assumed to be a single population that is continuous with a broader continental population, given that falcons are highly mobile,	1 – OEH Atlas	Low. Likely to be a vagrant to the locality.

Common Name *(Scientific Name)*	NSW status (BC Act or FM Act)	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence
			commonly travelling hundreds of kilometres (Marchant & Higgins 1993). The Black Falcon occurs as solitary individuals, in pairs, or in family groups of parents and offspring.		
Latham's Snipe (*Gallinago hardwickii*)	-	M	Occurs in freshwater or brackish wetlands generally near protective vegetation cover. This species feeds on small invertebrates, seeds and vegetation. It migrates to the northern hemisphere to breed (Garnett and Crowley, 2000).	6 - OEH Atlas PMST	Low. There is a low possibility that this species may visit the wetland in the study area but it is not likely to constitute important habitat.
Little Lorikeet (*Glossopsitta pusilla*)	V	-	The distribution of the Little Lorikeet extends from just north of Cairns, around the east coast of Australia, to Adelaide. In New South Wales Little Lorikeets are distributed in forests and woodlands from the coast to the western slopes of the Great Dividing Range, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri (Royal Australian Ornithologists Union, 2003). Little Lorikeets are generally considered to be nomadic (Higgins, 1999) and forage mainly on flowers, nectar and fruit. The breeding biology of Little Lorikeets is little known however studies indicate that nest hollows are located at heights of between 2 m and 15 m, mostly in living, smooth-barked eucalypts, and hollow openings are approximately 3 cm in diameter (Courtney and Debus, 2006).	3 – OEH Atlas	Moderate May utilise habitats at 6 Honeman Close.
Painted Honeyeater (*Grantiella picta*)	V	V	Lives in dry forests and woodlands. Primary food is the mistletoes in the genus Amyema, though it will take some nectar and insects. Its breeding distribution is dictated by presence of mistletoes which are largely restricted to older trees. Less likely to be found in in strips of remnant box-ironbark woodlands, such as occur along roadsides and in windbreaks, than in wider blocks (Garnett and Crowley, 2000).	PMST	Low. There is a low possibility that this species may visit the study area as a vagrant and it is unlikely to breed in the locality. Has not been previously recorded in the locality.

Common Name *(Scientific Name)*	NSW status (BC Act or FM Act)	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence
White-bellied Sea-Eagle (*Haliaeetus leucogaster*)	V	M	Distributed along the coastline (including offshore islands) of mainland Australia and Tasmania. Found in coastal habitats (especially those close to the sea-shore) and around terrestrial wetlands in tropical and temperate regions of mainland Australia and its offshore islands. The habitats occupied by the sea-eagle are characterised by the presence of large areas of open water (larger rivers, swamps, lakes, and the sea).	PMST	Low. There is a low possibility that this species may visit the study area as a vagrant but no high quality habitat is present.
Little Eagle (*Hieraaetus morphnoides*)	V	-	The Little Eagle is distributed throughout the Australian mainland occupying 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. Prey includes birds, reptiles and mammals, with the occasional large insect and carrion. Most of its former native mammalian prey species in inland NSW are extinct and rabbits now form a major part of the diet (Marchant and Higgins, 1993).	18 - OEH Atlas	Moderate May utilise habitats at 6 Honeman Close. No large stick nests typical of eagles were found during the survey.
White-throated Needletail (*Hirundapus caudacutus*)	-	M	Occurs in airspace over forests, woodlands, farmlands, plains, lakes, coasts and towns. Breeds in the northern hemisphere and migrates to Australia in October-April (Pizzey and Knight, 1997).	2 – OEH Atlas PMST	Moderate. A migrant that does not breed in the locality. Only likely to forage in the aerial spaces above the site.
Swift Parrot (*Lathamus discolor*)	CE	E	Breeding occurs in Tasmania, majority migrates to mainland Australia in autumn, over-wintering, particularly in Victoria and central and eastern NSW, but also south-eastern Queensland as far north as Duaringa. Until recently it was believed that in New South Wales, swift parrots forage mostly in the western slopes region along the inland slopes of the Great Dividing Range but are	21 - OEH Atlas PMST	Moderate. Marginal habitat associated with the PCTs present in the study area. A record of this species was made near to the study area at Seven Hills in 2001 suggesting that this species occasionally utilises the habitats= in the locality. As such, the Swift Parrot is

Common Name *(Scientific Name)*	NSW status (BC Act or FM Act)	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence
			patchily distributed along the north and south coasts including the Sydney region, but new evidence indicates that the forests on the coastal plains from southern to northern NSW are also extremely important. In mainland Australia is semi-nomadic, foraging in flowering eucalypts in eucalypt associations, particularly box-ironbark forests and woodlands (Garnett and Crowley, 2000),(Swift Parrot Recovery Team, 2001).		considered moderately likely to occur within the study area on an infrequent basis.
Square-tailed Kite (*Lophoictinia isura*)	V	-	This species hunts primarily over open forest, woodland and mallee communities as well as over adjacent heaths and other low scrubby habitats in wooded towns. It feeds on small birds, their eggs and nestlings as well as insects. Seems to prefer structurally diverse landscapes (Garnett and Crowley, 2000).	1 - OEH Atlas	Moderate May utilise habitats at 6 Honeman Close.
Black-chinned Honeyeater (eastern subsp.) (*Melithreptus gularis gularis*)	V	-	Extends south from central Queensland, through NSW, Victoria into south eastern South Australia, though it is very rare in the last state. In NSW it is widespread, with records from the tablelands and western slopes of the Great Dividing Range to the north-west and central-west plains and the Riverina. Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (Eucalyptus sideroxylon), White Box (E. albens), Inland Grey Box (E. microcarpa), Yellow Box (E. melliodora), Blakely's Red Gum (E. blakelyi) and Forest Red Gum (E. tereticornis). Also inhabits open forests of smooth-barked gums, stringybarks, ironbarks, river sheoaks (nesting habitat) and tea-trees.	1 - OEH Atlas	Low. There is a low possibility that this species may visit the study area as a vagrant.

Common Name *(Scientific Name)*	NSW status (BC Act or FM Act)	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence
Rainbow Bee-eater (*Merops ornatus*)	-	M	Distributed across much of mainland Australia, and occurs on several near-shore islands. Occurs mainly in open forests and woodlands, shrublands, and in various cleared or semi-cleared habitats, including farmland and areas of human habitation	1 – OEH Atlas PMST	Low. There is a low possibility that this species may visit the study area as a vagrant.
Black-faced Monarch (*Monarcha melanopsis*)	-	M	Widespread in eastern Australia. Mainly occurs in rainforest ecosystems, including semi-deciduous vine-thickets, complex notophyll vine-forest, tropical (mesophyll) rainforest, subtropical (notophyll) rainforest, mesophyll (broadleaf) thicket/shrubland, warm temperate rainforest, dry (monsoon) rainforest and (occasionally) cool temperate rainforest.	PMST	Low. There is a low possibility that this species may visit the study area as a vagrant.
Spectacled Monarch (*Monarcha trivirgatus*)	-	M	Occurs along the entire east coast of Australia. Breeds in dense scrub in gullies of coastal ranges	PMST	Low. There is a low possibility that this species may visit the study area as a vagrant.
Yellow Wagtail (*Motacilla flava*)	-	M	Rare but regular visitor around Australian coast, especially in the NW coast Broome to Darwin. Found in open country near swamps, salt marshes, sewage ponds, grassed surrounds to airfields, bare ground; occasionally on drier inland plains.	PMST	Low. There is a low possibility that this species may visit the study area as a vagrant.
Satin Flycatcher (*Myiagra cyanoleuca*)	-	M	Widespread in eastern Australia and vagrant to New Zealand. Inhabit heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, and on migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests.	PMST	Low. There is a low possibility that this species may visit the study area as a vagrant.

Common Name *(Scientific Name)*	NSW status (BC Act or FM Act)	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence
Barking Owl (*Ninox connivens*)	V	-	Occurs in dry sclerophyll woodland. In the south west it is often associated with riparian vegetation while in the south east it generally occurs on forest edges. It nests in large hollows in live eucalypts, often near open country. It feeds on insects in the non-breeding season and on birds and mammals in the breeding season (Garnett and Crowley, 2000).	1 - OEH Atlas	Low. Marginal habitat present on site. No large tree hollows suitable for breeding were observed. This species is recognised as a scarce resident in the locality considered unlikely to occur.
Powerful Owl (*Ninox strenua*)	V	-	A sedentary species with a home range of approximately 1000 hectares it occurs within open eucalypt, casuarina or Callitris pine forest and woodland. It often roosts in denser vegetation including rainforest of exotic pine plantations. Generally feeds on medium-sized mammals such as possums and gliders but will also eat birds, flying-foxes, rats and insects. Prey are generally hollow dwelling and require a shrub layer and owls are more often found in areas with more old trees and hollows than average stands (Garnett and Crowley, 2000).	20 - OEH Atlas	Low. Marginal habitat present on site. No large tree hollows suitable for breeding were observed. This species is recognised as a scarce resident in the locality considered unlikely to occur.
Eastern Osprey (*Pandion haliaetus*)	V	M	Generally a coastal species, occurring in estuaries, bays, inlets, islands and surrounding waters, coral atolls, reefs, lagoons, rock cliffs and stacks. Sometimes ascends larger rivers to far inland. Builds nests high in tree, on pylon or on ground on islands. Feeds on fish (Pizzey and Knight, 1997).	PMST	Low. Associated habitat absent from site.
Scarlet Robin (*Petroica boodang*)	V	-	In NSW, the Scarlet Robin occupies open forests and woodlands from the coast to the inland slopes. Some dispersing birds may appear in autumn or winter on the eastern fringe of the inland plains. It prefers an open understorey of shrubs and grasses and sometimes in open areas. Abundant logs and coarse woody debris are important structural components of its habitat. In autumn and winter it migrates to more open habitats such as	3 – OEH Atlas	Low. Marginal habitat present on site.

Common Name *(Scientific Name)*	NSW status (BC Act or FM Act)	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence
			grassy open woodland or paddocks with scattered trees. It forages from low perches, feeding on invertebrates taken from the ground, tree trunks, logs and other coarse woody debris (Higgins and Peter, 2002).		
Flame Robin (*Petroica phoenicea*)	V	-	In NSW the Flame Robin breeds in upland moist eucalypt forests and woodlands, often on ridges and slopes, in areas of open understorey. It migrates in winter to more open lowland habitats (Higgins and Peter, 2002). The Flame Robin forages from low perches, feeding on invertebrates taken from the ground, tree trunks, logs and other woody debris. The robin builds an open cup nest of plant fibres and cobweb, which is often near the ground in a sheltered niche, ledge or shallow cavity in a tree, stump or bank.	1 - OEH Atlas	Low. Marginal habitat present on site.
Superb Parrot (*Polytelis swainsonii*)	V	V	Mainly found in the Riverina where they nest in loose colonies in riparian woodland on River Red Gum. On the inland slopes, Superb Parrots both forage and feed within box woodland, mostly nesting in dead trees (Garnett and Crowley, 2000).	1 OEH Atlas of NSW Wildlife	Low. Associated habitat absent from site. Local records are likely to be of aviary escapees.
Rufous Fantail (*Rhipidura rufifrons*)	-	M	Occurs in coastal and near coastal districts of northern and eastern Australia. In east and south-east Australia, the Rufous Fantail mainly inhabits wet sclerophyll forests, often in gullies usually with a dense shrubby understorey often including ferns.	PMST	Low. There is a low possibility that this species may visit the study area as a vagrant.
Australian Painted snipe (*Rostratula australis*)	E	E	The Australian Painted Snipe is restricted to Australia. Most records are from the south east, particularly the Murray Darling Basin, with scattered records across northern Australia and historical records from around the Perth region in Western Australia. In NSW many records are from the Murray-Darling Basin including the Paroo wetlands, Lake Cowal, Macquarie Marshes, Fivebough Swamp and more recently, swamps	PMST	Low This species is not known from the locality and the wetland habitat in the study area is not considered optimal for the Australasian Bittern.

Common Name *(Scientific Name)*	NSW status (BC Act or FM Act)	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence
			near Balldale and Wanganella. Other important locations with recent records include wetlands on the Hawkesbury River and the Clarence and lower Hunter Valleys. Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber.		
Masked Owl (*Tyto novaehollandiae*)	V	-	Occurs within a diverse range of wooded habitats including forests, remnants and almost treeless inland plains. This species requires large-hollow bearing trees for roosting and nesting and nearby open areas for foraging. They typically prey on terrestrial mammals including rodents and marsupials but will also take other species opportunistically. Also known to occasionally roost and nest in caves (Garnett and Crowley, 2000).	2 - OEH Atlas	Low. Very unlikely to be found in built up areas.
Sooty Owl (*Tyto tenebricosa*)	V	-	Occurs in wet eucalypt forest and rainforest on fertile soils with tall emergent trees. Typically found in old growth forest with a dense understorey but also occurs in younger forests if nesting trees are present nearby. It nests in large hollows within eucalypts and occasionally caves. It hunts in open and closed forest for a range of arboreal and terrestrial mammals including introduced species and sometimes birds (Garnett and Crowley, 2000).	1 - OEH Atlas	Low. Very unlikely to be found in built up areas.
Mammals					
Large-eared Pied Bat (*Chalinolobus dwyeri*)	V	V	Found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW. There are scattered records from the New England Tablelands and North West Slopes. Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-	1 – OEH Atlas PMST	Low. Not recorded during the survey for the Honeman Close SIS. No roosting habitat is present in the study area. The record in the locality is from Toongabbie Creek near Windsor Road from 2000. This species is considered unlikely to venture into the study

Common Name *(Scientific Name)*	NSW status (BC Act or FM Act)	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence
			shaped mud nests of the Fairy Martin (*Petrochelidon ariel*), frequenting low to mid-elevation dry open forest and woodland close to these features. Found in well-timbered areas containing gullies.		area given the lack of habitat and distance from sandstone roosting habitat.
Spotted-tailed Quoll (*Dasyurus maculatus*)	V	E	Occurs from the Bundaberg area in south-east Queensland, south through NSW to western Victoria and Tasmania. In NSW, it occurs on both sides of the Great Dividing Range and north-east NSW represents a national stronghold (NSW National Parks and Wildlife Service, 1999d). Occurs in wide range of forest types, although appears to prefer moist sclerophyll and rainforest forest types, and riparian habitat. Most common in large unfragmented patches of forest. It has also been recorded from dry sclerophyll forest, open woodland and coastal heathland, and despite its occurrence in riparian areas, it also ranges over dry ridges. Nests in rock caves and hollow logs or trees. Feeds on a variety of prey including birds, terrestrial and arboreal mammals, small macropods, reptiles and arthropods (NSW National Parks and Wildlife Service, 1999c, NSW National Parks and Wildlife Service, 1999d).	6 – OEH Atlas PMST	Low. The record of the Spotted-tailed Quoll in the locality is from Featherdale Wildlife Park. The patches of habitat in the study area are small and isolated from larger areas of potential habitat. Only possible on site as an extremely rare vagrant.
Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)	V	-	Usually roosts in tree hollows in higher rainfall forests. Sometimes found in caves (Jenolan area) and abandoned buildings. Forages within the canopy of dry sclerophyll forest. It prefers wet habitats where trees are more than 20 metres high (Churchill, 2008)	17 – OEH Atlas	Moderate. Not recorded during the survey undertaken for the Honeman Close SIS but there are records from contiguous habitat in the Prospect Nature Reserve.

Common Name *(Scientific Name)*	NSW status (BC Act or FM Act)	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence
Little Bent-wing Bat (*Miniopterus australis*)	V	-	Feeds on small insects beneath the canopy of well-timbered habitats including rainforest, Melaleuca swamps and dry sclerophyll forests. Roosts in caves and tunnels and has specific requirements for nursery sites. Distribution becomes coastal towards the southern limit of its range in NSW. Nesting sites are in areas where limestone mining is preferred (Strahan, 1995).	1 - OEH Atlas	Moderate. Not recorded during the survey undertaken for the Honeman Close SIS but there is a record from the locality and the habitat is suitable for foraging.
Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*)	V	-	Usually found in well-timbered valleys where it forages on small insects above the canopy. Roosts in caves, old mines, stormwater channels and sometimes buildings and often return to a particular nursery cave each year (Churchill, 2008)	59 – OEH Atlas	Recorded. Recorded on Anabat during the survey undertaken for the Honeman Close SIS).
Eastern Free-tail bat (*Mormopterus norfolkensis*)	V	-	The Eastern Freetail-bat is found along the east coast from south Queensland to southern NSW. Occur in dry sclerophyll forest and woodland east of the Great Dividing Range. Roost mainly in tree hollows but will also roost under bark or in man-made structures (Churchill, 2008).	30 - OEH Atlas	Moderate. Not recorded during the survey undertaken for the Honeman Close SIS but there are many records from the locality and the habitat is suitable for foraging.
Southern Myotis (*Myotis macropus*)	V	-	Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools catching insects and small fish by raking their feet across the water surface. In NSW females have one young each year usually in November or December.	23 - OEH Atlas	Moderate. Not recorded during the survey undertaken for the Honeman Close SIS but there are many records from the locality and the habitat is suitable for foraging.
Greater Glider (*Petauroides volans*)	-	V	The Greater Glider inhabits eucalyptus forests and woodlands as this species feeds exclusively on Eucalyptus buds and leaves. They occupy tree hollows in the day and tree canopies at night (Department of Environment and Climate Change 2007).	PMST	Low. This species is not known from the locality and suitable habitat is not present.

Common Name *(Scientific Name)*	NSW status (BC Act or FM Act)	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence
Brush-tailed Rock-wallaby (*Petrogale penicillata*)	E	V	The range of the Brush-tailed Rock-wallaby extends from south-east Queensland to the Grampians in western Victoria, roughly following the line of the Great Dividing Range. However the distribution of the species across its original range has declined significantly in the west and south and has become more fragmented. In NSW they occur from the Queensland border in the north to the Shoalhaven in the south, with the population in the Warrumbungle Ranges being the western limit. Occupy rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north.	PMST	Low. No suitable habitat for this species is present in the study area.
Koala (*Phascolarctos cinereus*)	V	V	Found in sclerophyll forest. Throughout New South Wales, Koalas have been observed to feed on the leaves of approximately 70 species of eucalypt and 30 non-eucalypt species. However, in any one area, Koalas will feed almost exclusively on a small number of preferred species. The preferred tree species vary widely on a regional and local basis. Some preferred species in NSW include Forest Red Gum *Eucalyptus tereticornis*, Grey Gum *E. punctata*, Monkey Gum *E. cypellocarpa* and Ribbon Gum *E. viminalis.* In coastal areas, Tallowwood *E. microcorys* and Swamp Mahogany *E. robusta* are important food species (NSW National Parks and Wildlife Service, 1999b, NSW National Parks and Wildlife Service, 2003).	2 valid records - OEH Atlas PMST	Low. Associated habitat types present on site however patches of habitat are small and isolated from larger areas of potential habitat. The last record from the locality was made in 2006 at Colebee.
New Holland Mouse (*Pseudomys novaehollandiae*)	-	V	The New Holland Mouse has a fragmented distribution across Tasmania, Victoria, NSW and Queensland. The species is now largely restricted to the coast of central and northern NSW, with one inland occurrence near Parkes. In NSW, the New Holland Mouse is known from: Royal National Park	PMST	Low. Not known from the locality.

Common Name *(Scientific Name)*	NSW status (BC Act or FM Act)	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence
			(NP) and the Kangaroo Valley; Kuringgai Chase NP; and Port Stephens to Evans Head near the Queensland border. Across the species' range, the New Holland Mouse is known to inhabit open heathland, open woodland with heathy understorey, and vegetated sand dunes.		
Grey-headed Flying-fox (*Pteropus poliocephalus*)	V	V	Occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps. Urban gardens and cultivated fruit crops also provide habitat for this species. Feeds on the flowers and nectar of eucalypts and native fruits including lilly pillies. It roosts in the branches of large trees in forests or mangroves (NSW National Parks and Wildlife Service, 2001b, Churchill, 2008)	112 – OEH Atlas PMST	Moderate. This species is likely to forage in the study area on occasion.
Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris*)	V	-	Occurs in eucalypt forest where it feeds above the canopy and in mallee or open country where it feeds closer to the ground. Generally a solitary species but sometimes found in colonies of up to 10. It roosts in tree hollows. Thought to be a migratory species (Churchill, 2008).	3 – OEH Atlas	Moderate. Not recorded during the survey undertaken for the Honeman Close SIS but there are records from the locality and the habitat is suitable for foraging.
Greater Broad-nosed Bat (*Scoteanax rueppellii*)	V	-	The preferred hunting areas of this species include tree-lined creeks and the ecotone of woodlands and cleared paddocks but it may also forage in rainforest. Typically it forages at a height of 3-6 metres but may fly as low as one metre above the surface of a creek. It feeds on beetles, other large, slow-flying insects and small vertebrates. It generally roosts in tree hollows but has also been found in the roof spaces of old buildings (Churchill, 2008)	15 - OEH Atlas	Moderate. Not recorded during the survey undertaken for the Honeman Close SIS but there are records from the locality and the habitat is suitable for foraging.

Common Name *(Scientific Name)*	NSW status (BC Act or FM Act)	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence
Fish					
Macquarie Perch (*Macquaria australasica*)	-	E	The Macquarie Perch is a riverine species that prefers clear water and deep, rocky holes with abundant cover such as aquatic vegetation, large boulders, debris and overhanging banks. In Victorian parts of the Murray-Darling, only small natural populations remain in the upper reaches of the Mitta Mitta, Ovens, Broken, Campaspe and Goulburn Rivers; translocated populations occur in the Yarra River and Lake Eildon. In NSW, natural inland populations are isolated to the upper reaches of the Lachlan and Murrumbidgee Rivers. Populations of the eastern form are confined to the Hawkesbury-Nepean and Shoalhaven river systems. Translocated populations in NSW are found in the Mongarlowe River, Queanbeyan River upstream of the Googong Reservoir and in Cataract Dam. In the ACT, it is restricted to the Murrumbidgee, Paddys and Cotter River.	PMST Department of Primary Industries Freshwater threatened species distribution maps	None The stream is not suitable as habitat as it lacks areas of clear water with deep, rocky holes and abundant cover. The study area is also east of the species' known distribution.
Australian Grayling (*Prototroctes maraena*)	E	V	The Australian Grayling is diadromous, spending part of its lifecycle in freshwater and at least part of the larval and/or juvenile stages in coastal seas. Adults (including pre spawning and spawning adults) inhabit cool, clear, freshwater streams with gravel substrate and areas alternating between pools and riffle zones. The species has also recorded in a muddy-bottomed, heavily silted habitat in the Tarwin River (Victoria). The species has been found over 100 km upstream from the sea. It has been recorded from many rivers across its range, particularly in Tasmania and Victoria. In NSW it is found from the Shoalhaven River south, with important river systems for the species including the Shoalhaven River, Bega River and Clyde River systems.	PMST Department of Primary Industries Freshwater threatened species distribution maps	None. The stream is not suitable as habitat as it lacks areas of cool, clear, freshwater with gravel substrate and areas alternating between pools and riffle zones. The study area is also north of the species' known distribution.

Common Name *(Scientific Name)*	NSW status (BC Act or FM Act)	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence
Invertebrates					
Cumberland Plain Land Snail (*Meridolum corneovirens*)	E	-	Primarily inhabits Cumberland Plain Woodland (an endangered ecological community). This community is grassy, open woodland with occasional dense patches of shrubs. Lives under litter of bark, leaves and logs, or shelters in loose soil around grass clumps. Occasionally shelters under rubbish.	224 – OEH Atlas	Moderate. This species was recoded on 6 Honeman Close during work undertaken for the SIS. The habitats within the study area are considered to be suitable given the extent of refuse dumping which provides shelter sites. This species was not recorded on site during the survey undertaken for this proposal.
Dural Land Snail (*Pommerhelix duralensis*)	E	E	The Dural land snail is endemic to New South Wales. The species is a shale-influenced habitat specialist, which occurs in low densities along the northwest fringe of the Cumberland Plain on shale-sandstone transitional landscapes. The species has been observed resting in exposed areas, such as on exposed rock or leaf litter, however it will also shelter beneath leaves, rocks and light woody debris.	PMST	Low. This species is restricted to the edges of the Cumberland Plain so the habitat in the study area is not suitable.
Note: This habitat assessment table does not consider habitat for species such as the Eastern Bristlebird, migratory wading birds, marine birds (such as Albatross, Petrels, Terns, Shearwater, Noddy, Frigatebird etc.), Whales, Dolphins, Sharks, Rays, or Turtles as the proposal will not impact on habitat for these species.					

Appendix C – Tests of significance

Tests of significance have been conducted for threatened species, populations and communities that were recorded in the study area during field surveys or were identified as having a moderate or higher potential to occur in the study area based on the presence of habitat (see Appendix B).

Section 7.3 of the BC Act outlines the 'test of significance' that is to be undertaken to assess the likelihood of significant impact upon threat-listed species, populations or ecological communities listed under the BC Act. As a new guideline has not been produced by the OEH, these tests of significance have been undertaken in accordance with the guidelines provided in the *Threatened Species Assessment Guidelines: The Assessment of Significance* (Department of Environment and Climate Change, 2007) which outlines a set of guidelines to help applicants/proponents of a development or activity with interpreting and applying the factors of assessment in the former 'seven-part test'. The guidance provided by the Department of Environment and Climate Change (2007) has been used here in preparing these tests of significance and in determining whether there is likely to be a significant effect to a threatened species, population or ecological community listed under the BC Act.

For threatened biodiversity listed under the EPBC Act, significance assessments have been completed in accordance with the *EPBC Act Policy Statement 1.1 Significant Impact Guidelines* (Department of Environment, 2013). Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment that is affected, and upon the intensity, duration, magnitude and geographic extent of the impacts (Department of Environment, 2013). Importantly, for a 'significant impact' to be 'likely', it is not necessary for a significant impact to have a greater than 50 per cent chance of happening; it is sufficient if a significant impact on the environment is a real or not remote chance or possibility (Department of Environment, 2013). This advice has been considered while undertaking the assessments.

The ecological communities and species subject to this assessment are outlined in **Table C.1** along with the predicted impact from the proposal.

Table C.1 Threatened biodiversity subject to this assessment

Species / community	BC Act	EPBC Act	Predicted impact (habitat in ha)
Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest	-	CE	0.07
Cumberland Plain Woodland in the Sydney Basin Bioregion	CE	-	0.38
River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E	-	0.06
Eucalyptus nicholii (Narrow-leaved Black Peppermint)	V	V	One individual (a planted horticultural specimen)
Cumberland Plain Land Snail (*Meridolum corneovirens*)	E	-	0.34
Dusky Woodswallow (Artamus cyanopterus cyanopterus)	V	-	0.50
Little Eagle (Hieraaetus morphnoides)	V	-	0.50
Square-tailed Kite (*Lophoictinia isura*)	V	-	0.50

Species / community	BC Act	EPBC Act	Predicted impact (habitat in ha)
Varied Sittella (*Daphoenositta chrysoptera*)	V	-	0.50
Little Lorikeet (*Glossopsitta pusilla*)	V	-	0.50
Swift Parrot (*Lathamus discolor*)	E	CE	0.50
Little Bent-wing Bat (*Miniopterus australis*)	V	-	0.50
Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*)	V	-	0.50
Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)	V	-	0.50
Eastern Freetail-bat (*Mormopterus norfolkensis*)	V	-	0.50
Southern Myotis (*Myotis macropus*)	V	-	0.50
Greater Broad-nosed Bat (*Scoteanax rueppellii*)	V	-	0.50
Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*)	V	-	0.50
Grey-headed Flying-fox (*Pteropus poliocephalus*)	V	V	0.50

Biodiversity Conservation Act 2016 assessment

Threatened ecological communities

The threatened ecological communities that are present in the study area and are subject to this assessment include:

- Cumberland Plain Woodland in the Sydney basin Bioregion (excluding M4 revegetation)
- River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions.

The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats*:*

a. in the case of a threatened species, whether the proposed development or activity 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

b. in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:
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, or
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,

In addressing this question, the local occurrence of these threatened ecological communities is taken to be the community that occurs within the study area and all contiguous vegetation (as defined in the *Threatened Species Assessment Guidelines: The Assessment of Significance* (Department of Environment and Climate Change 2007)). Risk of extinction is used here as the likelihood that the local occurrence of the ecological community would become extinct either in the short-term or in the long-term as a result of direct or indirect impacts on the threatened ecological community from the proposal. Composition refers to the assemblage of species and the physical structure of the community.

Cumberland Plain Woodland in the Sydney basin Bioregion is listed as a critically endangered ecological community and is considered to be facing an extremely high risk of extinction in New South Wales in the immediate future. The River-Flat Eucalypt Forest TEC is considered likely to become extinct in nature in New South Wales unless the circumstances and factors threatening its survival or evolutionary development cease to operate.

The threatened ecological communities subject to this assessment are already at risk of extinction and the proposal would exacerbate this risk. However, the proposal is considered unlikely to result in the extinction of the local occurrence of any TECs. The proposal is predicted to remove around 0.38 hectares of the Cumberland Plain Woodland TEC and a smaller extent of the River-Flat Eucalypt Forest TEC (0.06 hectares). When the impacts are considered in the local context, the impacts in terms of hectares removed are relatively small and so are the proportional impacts.

The proposal is considered unlikely to substantially and adversely modify the composition of the two TECs so that their local occurrences are placed at risk of extinction. The local occurrences of these TECs have already been substantially and adversely modified by past land use practices. All TECs subject to this assessment are currently suffering from altered composition caused by a very large reduction in ecological function, as indicated by:

- altered community structure (ie missing structural layers)
- altered species composition (ie lack of native species)

- disruption of ecological processes (ie altered drainage, mowing preventing natural regeneration)
- invasion and establishment of exotic species resulting in weed dominance
- degradation of habitat
- fragmentation.

The proposal is not considered likely to further modify the composition of any of the TECs within the study area such that the local occurrence of either TEC is placed at risk of extinction. The composition of the threatened ecological communities within the study area is predicted to remain intact after the implementation of the proposal. However, the remaining patches would be smaller.

c. in relation to the habitat of a threatened species or ecological community:
   i. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and
   ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and
   iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.

The proposal is predicted to remove around 0.38 hectares of the Cumberland Plain Woodland TEC and a smaller extent of the River-Flat Eucalypt Forest TEC (0.06 hectares).

Fragmentation is unlikely to occur from the proposal as the work would largely involve removing vegetation from patch edges rather than breaking apart of large blocks of vegetation into many smaller patches. Importantly, the proposal would not result in the breaking apart of large blocks of high quality examples of threatened ecological communities. No further habitat fragmentation on a landscape scale would occur because of the proposal. Isolation of habitats is likely to increase by a small extent as the distance between patches on either side of road would be increased.

Due to the conservation significance of these TECs (particularly the critically endangered Cumberland Plain Woodland in the Sydney basin Bioregion), the remaining patches of these TECs within NSW are likely to be important for their survival. However, the patches within the study area are small and are largely degraded. Furthermore, no patches of vegetation in the study area have been recognised as priority conservation land or as part of core habitats or regional corridors by the OEH. As such, the TEC patches within the study area can be considered less important than larger high quality examples of these TECs in the locality that retain high levels of ecological integrity and function.

d. whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

The proposal will not impact on any declared area of outstanding biodiversity value.

e. whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

A Key Threatening Process (KTP) is a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, population or ecological community. Key threatening processes are listed under the BC Act and at the present there are currently 38 listed KTPs. Of the 38 listed KTPs under the BC Act, nine are applicable to the TECs subject to this assessment (see Table C.2). However, hygiene and weed control measures would reduce or avoid the impact of most KTPs with the exception of clearing of native vegetation and removal of dead wood and dead trees.

Table C.2 Key threatening processes that may result from the proposal that may affect threatened ecological communities

Clear threatening process	Relevance to the proposal
Clearing of native vegetation	Yes. The proposal would result in clearing of native vegetation.
Infection of frogs by amphibian chytrid causing the disease chytridiomycosis	Yes. The proposal may result in the introduction or spread of amphibian chytrid. However, hygiene measures would be followed to prevent spread of this fungus.
Infection of native plants by *Phytophthora cinnamomi*	Yes. The proposal may result in the introduction or spread of *Phytophthora cinnamomi*. However, hygiene measures would be followed to prevent spread of *Phytophthora cinnamomi*.
Introduction and Establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae	Yes. The proposal may result in the introduction or spread of Exotic Rust Fungi. However, hygiene measures would be followed to prevent spread of Exotic Rust Fungi.
Invasion and establishment of exotic vines and scramblers	Yes. The proposal may result in the invasion and establishment of exotic vines and scramblers. However, weed control measures would be followed to prevent invasion and establishment of exotic vines and scramblers.
Invasion of native plant communities by African Olive *Olea europaea* L. subsp. *cuspidata*	Yes. The proposal may result in the invasion and establishment of African Olive *Olea europaea* L. subsp. *cuspidata*. However, weed control measures would be followed to prevent invasion and establishment of African Olive *Olea europaea* L. subsp. *Cuspidata.*
Invasion, establishment and spread of *Lantana camara*	Yes. The proposal may result in the invasion and establishment of *Lantana camara*. However, weed control measures would be followed to prevent invasion and establishment of *Lantana camara.*
Invasion of native plant communities by exotic perennial grasses	Yes. The proposal may result in the invasion and establishment of exotic perennial grasses. However, weed control measures would be followed to prevent invasion and establishment of exotic perennial grasses.
Removal of dead wood and dead trees	Yes. Some dead wood and dead trees would be removed as part of the proposal.

Conclusion

In summary, the proposal is considered unlikely to have an adverse effect on the extent of the two TECs such that the local occurrence of each is likely to be placed at further risk of extinction. The impact is small when considered in the context of the actual impact in hectares and the extent of the TECs within the broader locality. The proposal is considered unlikely to substantially and adversely modify the composition of any of the TECs as the current composition of the TECs is highly modified.

There is unlikely to be any further increase in fragmentation from the proposal. The TECs within the study area are not recognised as important to the long-term survival of the TECs in the locality as the patches are small and in poor to moderate condition. Furthermore, none of the TEC patches to be impacted is identified as important under the Cumberland Plain Recovery Plan. The proposal would contribute to some KTPs that cannot be mitigated against including clearing of native vegetation and removal of dead wood and dead trees.

Considering the context of the TECs and intensity of the potential impacts to these TECs from the proposal, an overall conclusion has been made that the proposal is unlikely to result in a significant effect to these TECs.

Eucalyptus nicholii (Narrow-leaved Black Peppermint)

The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats*:*

a. in the case of a threatened species, whether the proposed development or activity 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.

The *Eucalyptus nicholii* tree within the study area has been planted and is not in its natural habitat. The tree is not in an environment that allows for the normal elements of its life cycle to occur. This tree is likely to flower and may be pollinated so the tree may potentially set seed and disperse seed into the adjacent environment. However, while this tree may set seed, it is unlikely that seedlings would develop as the natural processes that stimulate and/or promote seed germination in this species may not occur. This species is unlikely to ever reproduce in the study area and once the tree becomes senescent and dies it would be lost from the study area. The tree is currently not able to complete its natural life cycle as it has been planted in an urban environment outside of its natural range.

The proposal would indirectly impact on one *Eucalyptus nicholii* tree. This tree would be removed but this removal is not predicted to place this species at risk of extinction. The proposal would not have an effect on the natural occurrence of this species. Many specimens of this species are planted as street trees in Sydney and as such the local occurrence is expected to continue to exist. Furthermore, nursery stock could be planted in the locality to replace the removed tree.

b. in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:
- **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, or**
- **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,**

Not applicable.

c. in relation to the habitat of a threatened species or ecological community:
- **i. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and**
- **ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and**
- **iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.**

The proposal would indirectly impact on one *Eucalyptus nicholii* tree. The habitat is not natural so the extent of habitat for this species that is to be impacted is not applicable.

There would not be any fragmentation of habitat for this species as a result of the proposal.

The habitat is not natural and is not considered important for *Eucalyptus nicholii*.

d. whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

The proposal will not impact on any declared area of outstanding biodiversity value.

e. whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

A Key Threatening Process (KTP) is a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, population or ecological community. Key threatening processes are listed under the BC Act and at the present there are currently 38

listed KTPs. Of the 38 listed KTPs under the BC Act, nine are applicable to this assessment (see Table C.2). However, hygiene and weed control measures would reduce or avoid the impact of most KTPs with the exception of clearing of native vegetation and removal of dead wood and dead trees.

Conclusion

The proposal would result in the removal of one planted *Eucalyptus nicholii* tree. No natural habitats would be affected and the natural occurrences of this species would not be affected. After consideration of the factors above, an overall conclusion has been made that the proposal is unlikely to result in a significant effect to *Eucalyptus nicholii*.

Cumberland Plain Land Snail (*Meridolum corneovirens*)

The Cumberland Plain Land Snail was not found in the study area during the surveys undertaken for the proposal. The survey involved looking for active specimens on tree trunks, turning over suitable ground shelter including fallen timber, sheets of iron and exposed rocks and rubble, raking back bark, litter and debris from the ground, and searching in dense grass clumps. It is likely that the habitat is at least moderately suitable but no snails (live or dead) were found at the time of survey.

The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats*:*

a. in the case of a threatened species, whether the proposed development or activity 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.

The Cumberland Plain Land Snail primarily inhabits Cumberland Plain Woodland. It lives under litter of bark, leaves and logs, or shelters in loose soil around grass clumps and occasionally shelters under rubbish where it is available. It feeds on fungus.

No snails were found in the study area during the survey undertaken for the proposal. However, the proposal would remove around 0.34 hectares of potential habitat for the Cumberland Plain Land Snail. This small amount of habitat removal is not considered likely to have an adverse effect on the life cycle of the species such that a viable local population is likely to be placed at risk of extinction. The proposal would result in a direct impact to habitat of the Cumberland Plain Land Snail. However, the highest quality habitat is to the west of the development footprint.

b. in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:
- **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, or**
- **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,**

Not applicable.

c. in relation to the habitat of a threatened species or ecological community:
- **i. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and**
- **ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and**
- **iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.**

The proposal would remove around 0.34 hectares of potential habitat for the Cumberland Plain Land Snail.

Fragmentation is unlikely to occur from the proposal as the work would largely involve removing vegetation from patch edges rather than breaking apart of large blocks of vegetation into many smaller patches. Importantly, the proposal would not result in the breaking apart of large blocks of high quality habitats. No further habitat fragmentation on a landscape scale would occur because of the proposal. Isolation of habitats is likely to increase by a small extent as the distance between patches on either side of road would be increased.

Importantly, the proposal would not affect the highest quality patch of habitat for the Cumberland Plain Land Snail. The work would be undertaken at the edge of the habitat and avoids impacts to the core habitats on 6 Honeman Close.

d. whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

The proposal will not impact on any declared area of outstanding biodiversity value.

e. whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

A Key Threatening Process (KTP) is a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, population or ecological community. Key threatening processes are listed under the BC Act and at the present there are currently 38 listed KTPs. Of the 38 listed KTPs under the BC Act, nine are applicable to this assessment (see Table C.2). However, hygiene and weed control measures would reduce or avoid the impact of most KTPs with the exception of clearing of native vegetation and removal of dead wood and dead trees.

Conclusion

The Cumberland Plain Land Snail is known to inhabit the vegetation on 6 Honeman Close. The habitat in the development footprint is however of lower quality as it is dominated by weeds and possesses little native ground cover or fallen woody debris. Overall, the project is unlikely to reduce the population size of the Cumberland Plain Land Snail or decrease the reproductive success of this species as the high quality habitat would not be affected. After consideration of the factors above, an overall conclusion has been made that the project is unlikely to result in a significant effect to the Cumberland Plain Land Snail.

Threatened bird species

- Dusky Woodswallow (*Artamus cyanopterus cyanopterus*)
- Little Eagle (*Hieraaetus morphnoides*)
- Square-tailed Kite (*Lophoictinia isura*)
- Varied Sittella (*Daphoenositta chrysoptera*)
- Little Lorikeet (*Glossopsitta pusilla*)
- Swift Parrot (*Lathamus discolor*).

The Swift Parrot has been recorded in the locality and sporadically occurs in the urbanised areas of western Sydney during winter. This species may pass through the study area during movements between larger foraging habitats (eg from Prospect Nature Reserve to Nurragingy Reserve and Castlereagh Nature Reserve) where it may rest and forage in street trees or small vegetation remnants. Although no significant areas of foraging habitat are present, the Swift Parrot is considered moderately likely to occur in the study area on occasion. Likewise, the Little Lorikeet is also likely to use the trees in the study area in a similar manner as foraging habitat.

Other threatened birds including the Dusky Woodswallow, Little Eagle and Square-tailed Kite are likely to fly over the study area on occasion and may temporarily perch on trees. However, the study area is considered unlikely to form suitable breeding habitat for these species and habitat use would be intermittent and minimal.

The Varied Sittella is considered moderately likely to utilise the habitats on 6 Honeman Close and may utilise the edge habitat that is in the study area. This species is known to occur in the

Prospect Nature Reserve in and in the Western Sydney Parklands and may use the habitat in the study area on occasion.

The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats*:*

a. in the case of a threatened species, whether the proposed development or activity 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.

The Dusky Woodswallow is widespread in eastern, southern and south western Australia. It inhabits dry, open eucalypt forests and woodlands, including mallee associations, with an open or sparse understorey of eucalypt saplings, acacias and other shrubs, and ground-cover of grasses or sedges and fallen woody debris.

The Square-tailed Kite is found in a variety of timbered habitats including dry woodlands and open forests showing a particular preference for timbered watercourses. It is a specialist hunter of passerines, especially honeyeaters, and most particularly nestlings, and insects in the tree canopy, picking most prey items from the outer foliage. The Little Eagle occupies open eucalypt forest and woodland where it nests in tall living trees within a remnant patch. It preys on birds, reptiles and mammals, occasionally adding large insects and carrion. These two species occupy large hunting ranges greater than 100 square kilometres in size which may include the study area.

The Varied Sittella inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. Feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees and small branches and twigs in the tree canopy. 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.

The distribution of the Little Lorikeet extends from just north of Cairns, around the east coast of Australia, to Adelaide. In New South Wales Little Lorikeets are distributed in forests and woodlands from the coast to the western slopes of the Great Dividing Range, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri (Royal Australian Ornithologists Union, 2003). Little Lorikeets are generally considered to be nomadic (Higgins, 1999) and forage mainly on flowers, nectar and fruit. The breeding biology of Little Lorikeets is little known however studies indicate that nest hollows are located at heights of between 2 m and 15 m, mostly in living, smooth-barked eucalypts, and hollow openings are approximately 3 cm in diameter (Courtney and Debus, 2006).

The Swift Parrot is endemic to south-eastern Australia and breeds only in Tasmania. It migrates to mainland Australia in autumn. As such, the proposal would not affect breeding habitat for this species. Additionally, the study area does not contain any important winter foraging grounds. No impacts to the life cycle of the Swift Parrot species are anticipated as a result of the proposal and the proposal is not considered 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.

The removal of habitat would affect the lifecycle of these species if they are present. However, due to the abundance of aggressive birds such as Noisy Miners, and adjacent urbanisation, the quality of the habitat is not considered high. Any birds that may use the habitat in the study area would also likely use adjacent habitats that are of higher quality. After the proposal has been built there would be sufficient habitat left in the study area for these species to complete their lifecycles and the habitat quality of remaining patches is considered likely to remain in a similar state to pre-construction conditions. The proposal is not considered likely to have an adverse effect on the life cycle of these species such that a viable local population of these species is likely to be placed at risk of extinction.

b. in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:
   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, or
   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,

Not applicable.

c. in relation to the habitat of a threatened species or ecological community:
   i. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and
   ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and
   iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.

The extent of habitat removal for these species is estimated at 0.51 ha. This is a small impact compared to the extent of habitat availability in the locality.

Fragmentation is unlikely to occur from the proposal as the work would largely involve removing vegetation from patch edges rather than breaking apart of large blocks of vegetation into many smaller patches. Importantly, the proposal would not result in the breaking apart of large blocks of high quality habitats. No further habitat fragmentation on a landscape scale would occur because of the proposal. Isolation of habitats is likely to increase by a small extent as the distance between patches on either side of road would be increased.

The study area does not contain high quality habitats for these species. These species may utilise the habitat on occasion but would not use it preferentially. The larger adjacent habitats are considered more important for these species than the roadside vegetation in the study area. No breeding habitat is present in the study area so the importance of the habitat for these species is considered to be limited.

d. whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

The proposal will not impact on any declared area of outstanding biodiversity value.

e. whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

A Key Threatening Process (KTP) is a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, population or ecological community. Key threatening processes are listed under the BC Act and at the present there are currently 38 listed KTPs. Of the 38 listed KTPs under the BC Act, nine are applicable to this assessment (see Table C.2). However, hygiene and weed control measures would reduce or avoid the impact of most KTPs with the exception of clearing of native vegetation and removal of dead wood and dead trees.

Conclusion

These bird species would suffer a small reduction in extent of foraging habitat from the proposal. No breeding habitat would be affected. The proposal is unlikely to reduce the population size of these species or decrease the reproductive success of these species. After consideration of the factors above, an overall conclusion has been made that the proposal is unlikely to result in a significant effect to threatened birds.

Threatened insectivorous bats

The species subject to this assessment include:

- Little Bent-wing Bat (*Miniopterus australis*)
- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*)
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)
- Eastern Freetail-bat (*Mormopterus norfolkensis*)
- Southern Myotis (*Myotis macropus*)
- Greater Broad-nosed Bat (*Scoteanax rueppellii*)
- Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*)

The study area provides some habitat for species of threatened insectivorous bat including the Little Bentwing-bat, Eastern Bentwing-bat, Eastern Freetail-bat, Eastern False Pipistrelle, Greater Broad-nosed Bat, Yellow-bellied Sheathtail-bat and the Southern Myotis (all listed as vulnerable under the BC Act). These species have been recorded widely from the locality and are likely to forage in the habitats. Tree hollows are limited but the habitat is likely to be suitable as foraging habitat. The Eastern Bentwing-bat was recorded from 6 Honeman Close during work undertaken for the SIS so this species is known to utilise the area for foraging on a seasonal basis but is unlikely to roost in the stormwater drain given its size and construction.

The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:

a. in the case of a threatened species, whether the proposed development or activity 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.

The Little Bentwing-bat roosts in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings. They often share roosting sites with the Eastern Bentwing-bat and, in winter, the two species may form mixed clusters. Maternity colonies form in spring and birthing occurs in early summer. Males and juveniles disperse in summer. The Eastern Bentwing-bat primarily roosts in caves, but will also use derelict mines, storm-water tunnels, buildings and other man-made structures. The Eastern Bentwing-bat forms populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young. At other times of the year, populations disperse within about 300 km range of maternity caves.

The Eastern False Pipistrelle and Greater Broad-nosed Bat generally roost in eucalypt hollows, but have also been found under loose bark on trees or in buildings. The Eastern Freetail-bat roosts mainly in tree hollows but will also roost under bark or in man-made structures. The Yellow-bellied Sheathtail-bat roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows.

The Southern Myotis generally roosts close to water in caves, mine shafts, hollow-bearing trees, storm-water channels, buildings, under bridges and in dense foliage. The Southern Myotis forages over streams and pools catching insects and small fish by raking their feet across the water surface. In NSW, females have one young each year usually in November or December.

All vegetation within the study area is likely to provide foraging habitat for these bat species. Riparian zones are also likely to be a focal point for foraging for all species subject to this assessment. No hollow-bearing trees would be affected by the proposal so no breeding habitat is predicted to be affected. The pipe at the stormwater outlet is not considered likely to be used by the Little Bentwing-bat or Eastern Bentwing-bat due to its size and construction.

Impacts are likely to be restricted to loss of foraging habitat. The impacts of the proposal are not expected to have an adverse effect on the life cycle of these species such that a viable local population is likely to be placed at risk of extinction. Considerable foraging habitat would remain in the locality.

b. in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:
   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, or
   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,

Not applicable.

c. in relation to the habitat of a threatened species or ecological community:
   i. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and
   ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and
   iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.

The proposal would remove around 0.55 ha of potential foraging habitat. This amount of habitat removal is small when the amount of available foraging habitat in the locality is considered. The habitat within the study area is not limiting for these species. No roosting or breeding habitat would be affected.

Importantly, the proposal would not result in fragmentation of habitat for these species. These species are highly mobile and will freely fly long distances over open areas to move between habitats. The proposal would not affect the movement of these bats between habitat patches.

The vegetation in the study area would form a small component of a larger foraging range for these species. Riparian vegetation is likely to be a focal point of foraging activity, as are the edges of vegetation patches. The loss of native vegetation from the study area would reduce the amount of foraging habitat available for these species by a small amount. However, when compared to the larger and higher quality vegetation remnants in the locality, the vegetation within the study area is not considered as important for the long-term survival of these species.

d. whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

The proposal will not impact on any declared area of outstanding biodiversity value.

e. whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

A Key Threatening Process (KTP) is a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, population or ecological community. Key threatening processes are listed under the BC Act and at the present there are currently 38 listed KTPs. Of the 38 listed KTPs under the BC Act, nine are applicable to this assessment (see Table C.2). However, hygiene and weed control measures would reduce or avoid the impact of most KTPs with the exception of clearing of native vegetation and removal of dead wood and dead trees.

Conclusion

These bat species would suffer a small reduction in extent of foraging habitat from the proposal. No roosting habitat would be affected. The proposal is unlikely to reduce the population size of these species or decrease the reproductive success of these species. After consideration of the factors above, an overall conclusion has been made that the proposal is unlikely to result in a significant effect to threatened insectivorous bats.

Grey-headed Flying-fox (*Pteropus poliocephalus*)

The Grey-headed Flying-fox is considered moderately likely to forage in the trees within the study area, particularly *Eucalyptus moluccana, Eucalyptus tereticornis* and planted specimens of *Corymbia* spp. No roost camps are present in the study area but the bats from the Parramatta Park camp and/or the intermittent Wetherill Park camp are likely to forage in the study area.

The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats*:*

a. in the case of a threatened species, whether the proposed development or activity 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.

The Grey-headed Flying-fox occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Annual mating commences in January and conception occurs in April or May; a single young is born in October or November.

There are no roost camps located in the study area and at the time of this assessment the proposal would not directly impact on any known breeding / maternity site. As such, the impacts of the proposal to the Grey-headed Flying-fox would be limited to loss of feeding habitat caused by direct clearing or damage to native vegetation during the construction phase.

The proposal would remove around 0.50 hectares of potential foraging habitat (although not this entire habitat is likely to be used) however, removal of vegetation would be avoided where possible. The affected area of foraging habitat would represent a small percentage of the total extent of important foraging vegetation types present within the locality. Given the relative widespread nature of similar planted vegetation in the locality and abundance of higher quality foraging habitat within the feeding range of the camps located near the study area, the proposal is not expected to significantly affect the life cycle of the species.

The proposal is unlikely to reduce the population size of the Grey-headed Flying-fox or decrease the reproductive success of this species.

b. in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:
- **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, or**
- **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,**

Not applicable.

c. in relation to the habitat of a threatened species or ecological community:
- **i. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and**
- **ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and**
- **iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.**

The potential habitat of the Grey-headed Flying-fox within the study area is limited to foraging habitat and includes all vegetation where fruiting and flowering trees and shrubs are present. The extent of potential foraging habitat for the Grey-headed Flying-fox would be reduced by around 0.51 ha. This amount of habitat removal is small when the amount of available foraging habitat in the locality is considered.

Importantly, the proposal would not result in fragmentation of habitat for the Grey-headed Flying-fox. This species is highly mobile and will freely fly long distances (up to 50 km) over open areas including urbanised city centres to move between roost camps and foraging sites. The proposal would not affect the movement of the Grey-headed Flying-fox between habitat patches.

Importantly, the proposal would not affect the most important habitats for Grey-headed Flying-fox within the locality. The most important habitats for the local Grey-headed Flying-fox sub-populations are the roosting camps at Parramatta Park and Wetherill Park. These camps would not be affected by the proposal. Foraging habitat within the study area is likely to form part of an overall foraging range of these sub-populations and would only form a small proportion of available habitat for this species. As such, the foraging habitat within the study area is unlikely to be of critical importance for the survival of the Grey-headed Flying-fox within the locality.

d. whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

The proposal will not impact on any declared area of outstanding biodiversity value.

e. whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

A Key Threatening Process (KTP) is a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, population or ecological community. Key threatening processes are listed under the BC Act and at the present there are currently 38 listed KTPs. Of the 38 listed KTPs under the BC Act, nine are applicable to this assessment (see Table C.2). However, hygiene and weed control measures would reduce or avoid the impact of most KTPs with the exception of clearing of native vegetation and removal of dead wood and dead trees.

Conclusion

The Grey-headed Flying-fox would suffer a small reduction in extent of suitable foraging habitat from the proposal of around 0.51 ha. No roosting camps or other important habitat would be impacted. As such, the proposal is considered unlikely to reduce the population size of the Grey-headed Flying-fox or decrease the reproductive success of this species. After consideration of the factors above, an overall conclusion has been made that the proposal is unlikely to result in a significant effect to the Grey-headed Flying-fox.

Environment Protection and Biodiversity Conservation act 1999 assessment

Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest

An action is likely to have a significant impact on a Critically Endangered or Endangered ecological community if there is a real chance or possibility that it will:

1. **reduce the extent of an ecological community**

Based on the estimated construction footprint, the project would result in the direct clearing of about 0.07 hectares of the critically endangered Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community.

2. **fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines**

Habitat fragmentation *per se* relates to the physical dividing up of once continuous habitats into separate smaller 'fragments' (Fahrig, 2002). The habitats within the study area are fragments that have formed since the initial habitat clearing that has occurred. The current alignment of the Great Western Highway and Reservoir Road divide the remaining habitats in the study area.

The proposal would not break apart continuous areas of the Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community into separate smaller 'fragments'. Habitat connectivity is expected to remain in a similar state after completion of the proposal and there is unlikely to be an alteration to community composition, altered species interactions, or altered ecosystem functioning in the locality due to the action. Habitat fragmentation is not considered an important impact of the action with regard to its context and intensity.

3. **adversely affect habitat critical to the survival of an ecological community**

Existing habitat, where this community occurs, would be cleared for construction and operation of the proposal. This would result in the direct removal of about 0.07 hectares of habitat. Due to the conservation significance of the TEC, all remaining patches and associated habitat within NSW are likely to be important for its survival.

4. **modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns**

Where the TEC would be removed by the action, all abiotic factors (ie water, nutrients and soil) would be permanently modified and/or destroyed through vegetation removal and construction of infrastructure.

5. **cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting**

The composition of the TEC is likely to be modified as a result of the action through weed invasion and removal of vegetation. The patch of the TEC to be impacted is in moderate/good condition and some reduction in ecological function can be expected from a reduction in patch size. Species composition in the patch is considered unlikely to occur as it is already highly altered by weed invasion from past disturbance. Functionally important species have already been lost from the patch and the proposal is not considered likely to cause any further substantial change in species composition.

6. **cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:**
   a. **assisting invasive species, that are harmful to the listed ecological community, to become established**
   b. **causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community**

Weed introduction and spread and the infection of native plants by *Phytophthora cinnamomi* have been identified as being spread by construction machinery. *Phytophthora* infects the roots of plants and has the potential to cause dieback. Machinery associated with vegetation clearance and subsequent construction for the project has the potential to introduce and transmit weed propagules and *Phytophthora*. This is a potential indirect impact through the spread and transmission of weeds and pathogens into retained habitat near the road.

This can be mitigated through the development and implementation of suitable control measures for vehicle and plant hygiene but an impact, particularly from weeds, is likely. It is the intention to use current best practice hygiene protocols as detailed in RTA (2011) on this project as part of the CEMP to prevent the introduction or spread of weeds and pathogens. The project mitigation strategy and environmental management procedures would include guidance for preventing the introduction and/or spread of weeds and disease causing agents such as bacteria and fungi.

7. **interfere with the recovery of an ecological community.**

A national recovery plan for the TEC has not been prepared. However, the OEH Cumberland Plain Recovery Plan (Department of Environment Climate Change and Water, 2010) has been prepared with the overall objective provide for the long-term survival of the threatened biodiversity of the Cumberland Plain. As this TEC is restricted to NSW, this recovery plan should be considered.

The Cumberland subregion Biodiversity Investment Opportunities Map (BIO Map) (Office of Environment and Heritage, 2015a) aims to achieve better biodiversity outcomes in western Sydney by directing biodiversity investment funding to the strategic locations of greatest benefit. The areas identified for investment, termed priority investment areas, include core areas and biodiversity corridors of state and regional significance. The action would remove an area of the TEC but would not impact on an area of mapped Priority Conservation Land or regional corridor so would not interfere with the recovery of any priority conservation land or identified corridors.

Conclusion

After consideration of the factors above, an overall conclusion has been made that the action is unlikely to result in a significant impact to the critically endangered Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community. The predicted impacts are minor.

Eucalyptus nicholii (Narrow-leaved Black Peppermint)

Eucalyptus nicholii has been planted within the study area. This species is not in its natural habitat and is outside of its natural range. *Eucalyptus nicholii* occurs from the Walcha-Niangala region (east of Tamworth) to just north of Glen Innes, in NSW. It does not naturally occur in the Sydney region. It is known from less than 40 localities on the northern NSW tablelands. While this species has been planted in the study area, it is listed as threatened species under the EPBC Act and must be assessed.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it would:

1. **Lead to a long-term decrease in the size of an important population of a species**

The *Eucalyptus nicholii* tree in the study area does not form part of an important population as defined under the *EPBC Act Policy Statement 1.1 Significant Impact Guidelines*

(Department of Environment, 2013). An 'important population' is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- key source populations either for breeding or dispersal
- populations that are necessary for maintaining genetic diversity, and/or
- populations that are near the limit of the species range.

The *Eucalyptus nicholii* tree in the study area is not part of a key source population, it is not necessary for maintaining genetic diversity (but may provide a good example of genetic variation), and is not near the limit of the species range as the plants are planted street trees far away from the natural occurrence. The *Eucalyptus nicholii* tree in the study area is not considered part of an important population and therefore the proposal is not considered likely to lead to a long-term decrease in the size of an important population of this species.

2. Reduce the area of occupancy of an important population

The *Eucalyptus nicholii* plant in the study area is not considered part of an important population.

3. Fragment an existing important population into two or more populations

The proposal is considered unlikely to result in any further fragmentation of habitat. No naturally occurring habitat with be affected and the proposal does not involve breaking apart of large habitat patches. The proposal would not introduce further fragmentation or fragmentation of the local population. Pollinators and seed dispersal agents are likely to be able to function in their normal capacity once the proposal has been completed.

4. Adversely affect habitat critical to the survival of a species

Habitat critical to the survival of a species refers to areas that are necessary for activities such as:

- Breeding or dispersal.
- For the long-term maintenance of the species including the maintenance of other species essential to the survival of the species, such as pollinators.
- To maintain genetic diversity and long-term evolutionary development.
- For the reintroduction of populations or recovery of the species.

The habitat within which *Eucalyptus nicholii* exists in the study area is not considered important for the survival of this species. The tree has been planted in the study area and the habitat is not natural. Work in this habitat would not affect the survival of this species.

5. Disrupt the breeding cycle of an important population

The proposal is considered unlikely to result in an impact to any pollination vectors or seed dispersal agents. The breeding capacity of *Eucalyptus nicholii* in the study area is already restricted as this species is not in its natural environment. This species is not expected to produce offspring in the present environment, as there are limited chances for

The current breeding cycle of *Eucalyptus nicholii* is predicted to remain after the road widening has occurred.

6. Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

This species is not in its natural habitat in the study area and is outside of its natural range. *Eucalyptus nicholii* occurs from the Walcha-Niangala region (east of Tamworth) to just north of Glen Innes, in NSW. It does not naturally occur in the Sydney region. The proposal would not impact natural habitat for this species.

7. Result in invasive species that are harmful to a vulnerable species becoming established in the Vulnerable species' habitat

The potential for weed invasion was considered possible with a proposal of this nature and appropriate controls are required during construction and operation of the road to reduce this threat. The management of invasive species would be managed under the construction environmental management plan. Weed management measures proposed are provided in Section 5.

8. Introduce disease that may cause the species to decline

There are no known disease issues affecting this species in relation to the proposal. The proposal would be unlikely to increase feral animal abundance or the potential for significant disease vectors to affect local populations.

Infection of native plants by *Phytophthora cinnamomi* has been identified as being spread by construction machinery. This is a potential indirect impact to the species through the transmission of pathogens into retained habitat near the road. This can be mitigated through the development and implementation of suitable control measures for vehicle and plant hygiene and is unlikely to have a significant impact. It is the intention to use current best practice hygiene protocols as detailed in Section 5 on this proposal as part of the CEMP to prevent the introduction or spread of pathogens.

9. Interfere substantially with the recovery of the species

The approved conservation advice for *Eucalyptus nicholii* contains research and regional priority actions to assist the recovery of the species. These actions include (Threatened Species Scientific Committee, 2008):

- Conduct research to investigate fire ecology and determine optimal fire regimes;
- Monitor the collection of Narrow-leaved Peppermint seed from wild populations to ensure that legal and sustainable collection is being undertaken;
- Develop and implement a stock management plan for roadside verges and travelling stock routes;
- Raise awareness of the Narrow-leaved Peppermint within the local community, particularly among landholders with the species on their property.

These identified recovery actions would not be interfered with by the proposal.

Conclusion

Eucalyptus nicholii trees that would be impacted by the proposed works are planted roadside trees and are not part of a key source populations. This tree is outside of its natural range and the proposal is unlikely to impact an important population or habitat critical to the survival of this species. The proposal would not interfere with the recovery of *Eucalyptus nicholii* and would not contribute to the key threats to this species. After consideration of the factors above, an overall conclusion has been made that the proposal is unlikely to result in a significant impact to *Eucalyptus nicholii*.

Grey-headed Flying-fox *(Pteropus poliocephalus)*

The Grey-headed Flying-fox is considered moderately likely to utilise the PCTs within the study area as foraging habitat.

The Grey-headed Flying-fox is not known but the species exists as one interconnected population along the eastern Australian coastal belt from Rockhampton in central Queensland to Melbourne in Victoria. As a result, for this assessment, the impact has been considered in terms of 'important habitat' as opposed the presence of an 'important population'.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

1. lead to a long-term decrease in the size of an important population of a species

There are no roost camps in the study area and the action would not affect any known permanent roosting, breeding / maternity site. Therefore, it is likely that the impacts of construction and operation of the action would be confined to minor loss of foraging habitat caused by direct clearing or damage to native vegetation during the construction phase. There is also a low risk of vehicle strike during operation.

The proposal would remove around 0.51 hectares of foraging habitat. Given the relative widespread nature of similar native vegetation and planted vegetation in the locality and abundance of higher quality foraging habitat within the feeding range of local individuals, the proposal is not expected to significantly affect important habitat or lead to a long-term decrease in the size of an important population.

2. reduce the area of occupancy of an important population

The area of occupancy of the Grey-headed Flying-fox is not known but the species exists as one interconnected population along the eastern Australian coastal belt from Rockhampton in central Queensland to Melbourne in Victoria. The area occupied by this species would remain the same after the action. No decrease in the area of occupancy for this species expected as a result of the proposal.

3. fragment an existing important population into two or more populations

Highly mobile species such as bats are expected to be less impacted by fragmentation. The Grey-headed Flying-fox is particularly well adapted to accessing widely spaced habitat resources given its mobility and preference for seasonal fruits and blossom in differing parts of the landscape. The proposal would not fragment an important population of the Grey-headed Flying-fox. Individuals would still be able to disperse between roosts along the east Australian coast. Genetic exchange within the population and dispersal would not be disrupted by the proposal.

4. adversely affect habitat critical to the survival of a species

This species typically exhibits very large home range and Grey-headed Flying-fox is known to travel distances of at least 50 kilometres from roost sites to access seasonal foraging resources. There are no known roost camps within the study area and the site does not provide critical roosting habitat. However, there are a number of known roost camps with a 50km radius of the proposal, the closest being the Parramatta Park camp and/or the intermittent Wetherill Park camp. The draft recovery plan for the Grey-headed Flying-fox identifies critical foraging habitat for this species as:

- Productive during winter and spring, when food bottlenecks have been identified
- Known to support populations of >30,000 individuals, within an area of 50 kilometre radius of a camp site
- Productive during the final weeks of gestation, and during the weeks of birth, lactation and conception (Sept-May)
- Productive during the final stages of fruit development and ripening in commercial crops affected by Grey-headed Flying-foxes
- Known to be continuously occupied as a camp site.

Native vegetation within the study area may constitute critical foraging habitat but the affected area of foraging habitat would represent a small percentage of the total extent of important foraging vegetation types present within a 50 kilometre radius of the Parramatta Park camp and/or the intermittent Wetherill Park camp. Given the extensive nature of high quality foraging habitats along the escarpment, the proposal is not expected to adversely affect foraging habitat critical to the survival of this species in this region.

5. disrupt the breeding cycle of an important population

As stated above there would be a minor impact on foraging habitat during the breeding cycle of the species. The upgrade would not directly impact on a known roost camp / breeding or maternity site. Extensive foraging resources are available in the locality that would provide suitable resources during the maternity season. The habitats in the study area are not limiting for this species.

6. modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The impacts to foraging habitat are minimal and no evidence of a roost camp has been identified from the study area. This impact is not expected to lead to a decline in the species in this region considering the magnitude of this impact and the expanse of high quality foraging habitat available to local animals along the escarpment.

7. result in invasive species that are harmful to a vulnerable species becoming established in the Vulnerable species' habitat

The action is unlikely to result in an invasive species harmful to the Grey-headed Flying-fox becoming established in the habitat. The potential for weed invasion was considered possible with a proposal of this nature and appropriate controls are required during construction and operation of the road to reduce this threat. The management of invasive species would be managed under the construction environmental management plan and during operation of the road using best practice methods.

8. introduce disease that may cause the species to decline, or

There are no known disease issues affecting this species in relation to the action. The action would be unlikely to increase the potential for significant disease vectors to affect local populations.

Infection of native plants by *Phytophthora cinnamomi* has been identified as being spread by construction machinery. This water-borne mould infects the roots of plants and has the potential to cause dieback. Machinery associated with vegetation clearance and subsequent construction has the potential to transmit the fungus to remaining native vegetation remnants of the species. This is a potential indirect impact to the species through the transmission of pathogens into retained habitat near the road. This can be mitigated through the development and implementation of suitable control measures for vehicle and plant hygiene and is unlikely to have a significant impact. It is the intention to use current best practice hygiene protocols as part of the CEMP to prevent the introduction or spread of pathogens.

The project mitigation strategy and environmental management procedures would include guidance for preventing the introduction and/or spread of disease causing agents such as bacteria and fungi

9. interfere substantially with the recovery of the species.

The *Draft National Recovery Plan for the Grey-headed Flying-fox* (*Pteropus poliocephalus*) (Department of Environment Climate Change and Water, 2009) outlines the following actions:

- Identify and protect foraging habitat critical to the survival of Grey-headed Flying-foxes across their range
- Enhance winter and spring foraging habitat for Grey-headed Flying-foxes
- Identify, protect and enhance roosting habitat critical to the survival of Grey-headed Flying-foxes
- Significantly reduce levels of deliberate Grey-headed Flying-fox destruction associated with commercial horticulture
- Provide information and advice to managers, community groups and members of the public that are involved with controversial flying-fox camps

- Produce and circulate educational resources to improve public attitudes toward Grey-headed Flying-foxes, promote the recovery program to the wider community and encourage participation in recovery actions
- Monitor population trends for the Grey-headed Flying-fox
- Assess the impacts on Grey-headed Flying-foxes of electrocution on powerlines and entanglement in netting and barbed wire, and implement strategies to reduce these impacts
- Oversee a program of research to improve knowledge of the demographics and population structure of the Grey-headed Flying-fox
- Maintain a National Recovery Team to oversee the implementation of the Grey-headed Flying-fox National Recovery Plan

The recovery actions listed above are largely not applicable to the action and the action is not expected to interfere substantially with the recovery of the species.

Conclusion

The Grey-headed Flying-fox would suffer a small reduction in extent of suitable foraging habitat from the action. No breeding camps or other important habitat would be impacted. The action is unlikely to reduce the population size of the Grey-headed Flying-fox or decrease the reproductive success of this species. The action would not interfere with the recovery of the Grey-headed Flying-fox and would not contribute to the key threats to this species. After consideration of the factors above, an overall conclusion has been made that the action is unlikely to result in a significant impact to the Grey-headed Flying-fox.

Swift Parrot (*Lathamus discolor*)

The Swift Parrot (*Lathamus discolor*) is considered likely to occur based on the presence of suitable winter foraging habitat.

An action is likely to have a significant impact on a Critically Endangered or Endangered species if there is a real chance or possibility that it will:

1. lead to a long-term decrease in the size of a population

The study area contains some potential foraging habitat for the Swift Parrot. While the habitat in the study area is not optimal, the loss of potential feed trees would directly affect the species opportunity to feed in the area. However, the study area is not considered a critical area for the Swift Parrot. The Swift Parrot may utilise trees in the study area for foraging intermittently when no other suitable inland (ie box ironbark woodlands) or coastal resources (ie Spotted Gum or Swamp Mahogany forests) are available. The potential foraging habitat for this species would be reduced by about 0.51 hectares. Within the Cumberland subregion, this potential habitat removal represents less than 0.1 percent of the currently available habitat for this species.

The Swift Parrot does not breed in the study area and the extent of habitat remaining in the locality area would provide sufficient resources to sustain future visitation, such that the action itself is unlikely to lead to a long-term decrease in the size of the Australian population.

2. reduce the area of occupancy of the species

Swift Parrots are vulnerable to the loss of quantity and quality of key forage tree species. As a large-scale migrant, it has the ability to cover vast areas of its winter range, seeking suitable flowering eucalypt habitat. The species is an occasional visitor to the region and may utilise trees in the study area for foraging intermittently when no other suitable resources are available.

The project would contribute to the loss of potential foraging habitat which would reduce the area of habitat available. However, the action would not reduce the area of occupancy of this species which is estimated at 4,000 km².

3. fragment an existing population into two or more populations

Importantly, the action would not result in fragmentation of habitat for the Swift Parrot. This species is highly mobile and as a regular behaviour flies long distances over open areas to move between suitable foraging habitats. The action would not affect the movement of the Swift Parrot between habitat patches or fragment the population.

4. adversely affect habitat critical to the survival of a species

Key habitats for this species on the coast and coastal plains of New South Wales include large stands of Spotted Gum (*Corymbia maculata*), Swamp Mahogany (*Eucalyptus robusta*), Red Bloodwood (*Corymbia gummifera*) and Forest Red Gum (*Eucalyptus tereticornis*) forests. The study area supports some Forest Red Gum and planted Spotted Gum trees, and therefore suitable habitat for this species is considered to be present.

The habitat within the study area is considered to be secondary habitat for the Swift Parrot as this species is not regularly recorded from the area and it is not known as critical habitat.

5. disrupt the breeding cycle of a population

The Swift Parrot is endemic to south-eastern Australia and breeds only in Tasmania, and migrates to mainland Australia in autumn. As such, the action would not impact on breeding habitat for this species. Important winter foraging grounds would not be impacted.

6. modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

Foraging habitat for this species would be reduced by about 0.50 hectares. As a large-scale migrant, it has the ability to cover vast areas of its winter range, seeking suitable flowering eucalypt habitat. The species is an occasional visitor to the region and may utilise trees in the study area for foraging intermittently when no other suitable resources are available. The action is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

7. result in invasive species that are harmful to a Critically Endangered or Endangered species becoming established in the Endangered or Critically Endangered species' habitat

The main invasive species harmful to the habitat for the swift parrot are weeds. Noisy Miners are abundant in the habitat which may make the habitat less suitable for the Swift Parrot due to competitive exclusion. The action may result in weed invasion and the removal of habitat may concentrate local miner populations increasing competition. The management of invasive species would be managed under the CEMP and during operation.

8. introduce disease that may cause the species to decline, or

Infection of native plants by *Phytophthora cinnamomi* has been identified as being spread by construction machinery. This water-borne mould infects the roots of plants and has the potential to cause dieback. Machinery associated with vegetation clearance and subsequent construction has the potential to transmit the fungus to remaining native vegetation remnants of the species. This is a potential indirect impact to the species through the transmission of pathogens into retained habitat near the road. This can be mitigated through the development and implementation of suitable control measures for vehicle and plant hygiene and is unlikely to have a significant impact. It is the intention to use current best practice hygiene protocols as part of the CEMP to prevent the introduction or spread of pathogens.

The project mitigation strategy and environmental management procedures would include guidance for preventing the introduction and/or spread of disease causing agents such as bacteria and fungi.

9. interfere with the recovery of the species.

The *National Recovery Plan for the Swift Parrot* (Saunders and Tzaros, 2011) aims to prevent further population decline of the Swift Parrot and to achieve a demonstrable sustained improvement in the quality and quantity of Swift Parrot habitat to increase carrying capacity. These objectives would be achieved by implementing recovery actions for each of the following specific recovery objectives:

- Objective 1: To identify and prioritise habitats and sites used by the species across its range, on all land tenures.
- Objective 2: To implement management strategies to protect and improve habitats and sites on all land tenures
- Objective 3: To monitor and manage the incidence of collisions, competition and Beak and Feather Disease (BFD).
- Objective 4: To monitor population trends and distribution throughout the range.

These objectives, and the associated recovery actions outlined in the *National Recovery Plan for the Swift Parrot* (Saunders and Tzaros, 2011) are not applicable to the study area or proposal. The identified recovery actions mostly relate to identifying the extent and quality of habitat, monitoring, raising community awareness, and coordinating and reviewing the recovery process. There is an action relating to manage and protect Swift Parrot habitat at the landscape scale. However, this action applies to fencing off habitat on private land to encourage regeneration of habitat, revising forestry practices, developing a strategic management plan for Swift Parrot breeding habitat in Tasmania, and providing Swift Parrot conservation information for consideration during the New South Wales Local Government Local Environmental Planning review process. The recovery actions identified in the National Recovery Plan for the Swift Parrot (Saunders and Tzaros, 2011) would not be interfered with by the proposal.

Conclusion

The Swift Parrot would suffer a small reduction in extent of foraging habitat from the action. The action is unlikely to reduce the population size of the Swift Parrot or decrease the reproductive success of this species. The action would not interfere with the recovery of the Swift Parrot. For the Swift Parrot, impacts are most likely to be significant where a proposal or activity may result in loss of habitat in, or adjacent to priority foraging, nesting and roosting sites (Saunders and Tzaros, 2011). The proposal would not impact on any priority foraging habitat. As such, after consideration of the factors above, an overall conclusion has been made that the action is unlikely to result in a significant impact to the Swift Parrot.

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Customer feedback
Roads and Maritime
Locked Bag 928,
North Sydney NSW 2059

February 2018

Appendix G

Consultation Report

Great Western Highway and Reservoir Road, Blacktown

Intersection Improvements

Community Consultation Report

Roads and Maritime Services | February 2018

NSW GOVERNMENT

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Contents

Figures and tables

Executive Summary

This report provides a summary of Roads and Maritime Services' consultation with the community and key stakeholders on proposed intersection improvements along the Great Western Highway and Reservoir Road, Blacktown.

Currently, road users experience heavy congestion during AM and PM peaks causing delays, excessive queuing and illegal road movements resulting in crashes and safety concerns.

The proposal includes:

- Dedicated left turn lane for northbound traffic on Reservoir Road
- Dual dedicated right turn lanes for northbound traffic on Reservoir Road
- Widening of the left turn lane from the Great Western Highway eastbound
- Dual dedicated right turn lanes for westbound traffic on the Great Western Highway
- Minor widening of the left turn slip lane on the Great Western Highway westbound
- Removal of vegetation.

Roads and Maritime invited feedback on the proposal in December 2017. We received feedback from 13 people with six people supporting the proposal, three people supporting the proposal with conditions, and four people who did not state a preference. Key matters raised included:

- Left turning lane from Reservoir Road southbound onto the Great Western Highway
- Pedestrian safety
- Entry and exiting ramps on the M4 Motorway for Reservoir Road.

We thank everyone for considering the proposal and for their feedback.

Decision

After considering all responses, along with the proposal's aims and design requirements, we have decided to proceed with the proposal unchanged.

We will continue to keep the community and stakeholders informed as the project progresses.

1. Introduction

1.1. Background

The NSW Government is funding this proposal as part of its $300 million Urban Roads Pinch Points Program, which aims to reduce congestion and improve travel times on Sydney's busiest road corridors, particularly during weekday peak periods.

The Roads and Maritime proposal is expected to:

- improve the capacity of the intersection and reduce congestion
- improve travel times particularly in peak hours
- improve traffic flow at this intersection and approaches
- improve safety for pedestrians and road users.

The proposal includes:

- Dedicated left turn lane for northbound traffic on Reservoir Road
- Dual dedicated right turn lanes for northbound traffic on Reservoir Road
- Widening of the left turn lane from Great Western Highway eastbound
- Dual dedicated right turn lanes for westbound traffic on Great Western Highway
- Minor widening of the left turn slip lane on the Great Western Highway westbound
- Removal of vegetation.

We have included a map to explain the proposal.

Figure 1: Proposed improvements at the intersection of the Great Western Highway and Reservoir Road, Blacktown

2. Consultation approach

2.1. Consultation objectives

We consulted with the community and key stakeholders on the proposal to:

- Seek comment, feedback, ideas and suggestions for us to consider when making a decision
- Build a database of interested and concerned community members with whom we can continue to engage during the proposal's development and delivery.

2.2. How consultation was done

Community members and stakeholders were encouraged to provide their feedback and make comments via email, mail or phone contact with the project team.

Table 1: How Consultation was done

Have your say community update – December 2017	Distributed 1700 letters (Appendix A) to local residents and businesses (Appendix B) inviting feedback on the proposal.
Website	Roads and Maritime project webpage updated with latest project information including the community update.
Social media	A targeted Facebook campaign (Appendix C) ran between Thursday 7 December and Monday 18 December, reaching 68,473 residents and road users travelling within the area.

3. Consultation summary

3.1. Overview

Roads and Maritime invited feedback on the proposal in December 2017. We received feedback from 13 people with six people supporting the proposal, three people supporting the proposal with conditions, and four people who did not state a preference. Key matters raised included:

- Left turning lane from Reservoir Road southbound into the Great Western Highway
- Pedestrian safety
- Entry and exiting ramps on the M4 Motorway from Reservoir Road.

We thank everyone for considering the proposal and for their feedback.

3.2. Feedback and Roads and Maritime's responses

Roads and Maritime has provided responses to all feedback received on this proposal. The responses are provided directly to the person who commented, as well as in this report, which will be made available to the public.

All comments have been considered to help Roads and Maritime make decisions on this proposal. Matters raised during consultation that are not within Roads and Maritime's area of responsibility have been forwarded to the relevant departments.

Table 2: Feedback summary and Roads and Maritime's responses

Category	Key Matters Raised	Response
Left turn lane from Reservoir Road into the Great Western Highway Six comments	There is no proposed left hand slip from Reservoir Road to travel east bound on the Great Western Highway. Surely this is more necessary for traffic flow than widening the opposite left hand slip.	Thank you for your feedback. Roads and Maritime Services have undertaken traffic surveys and modelling at this intersection. The traffic surveys identified the northbound vehicle movement on Reservoir Road and the right turn movement from Reservoir Road onto theGreat Western Highway as the key areas of congestion. All pinch point projects are assessed in terms of their benefit to road users when compared to cost to implement. The left turn movement from Reservoir Road onto the Great Western Highway does suffer from congestion and the introduction of a dedicated left turn lane was considered. To achieve this dedicated movement would require significant property acquisition and major utility relocation works. The proposed intersection improvements include a dedicated left turn lane from Reservoir Road northbound onto the Great Western Highway.
	The provision of a left-turn slip lane for Reservoir Road southbound at the Great Western Highway – there is a strong left-turn into the Great Western Highway to head east from Reservoir Road.	
	I do hope that you included in the improvement plan a turn left lane from Reservoir Road towards Great Western Highway, as that lane is congested all the time. Include an additional left-hand turn from Reservoir Road, left-hand turn omitting the traffic lights, into the Great Western Highway.	

Category	Key Matters Raised	Response
Entry/ Exiting the M4 Motorway Eight Comments	M4 Westbound off-ramp to Reservoir Road should commence further to the east which would enable it to curve and join up with the roundabout currently located at the intersection of Peter Brock Drive and Reservoir Road and negate the need for the current exit ramp intersection to be signalised. This would allow for the currently very tight and relatively steep west-bound on ramp to the M4 to be reconfigured with a greater radius. It is my understanding that as part of the current M4 Smart Motorway project this ramp will be reconfigured onto a new bridge over Reservoir Road immediately to the south of the M4. I am concerned that the current radius of this ramp will be decreased even further.	Thank you for your feedback. The purpose of the consultation process was to seek feedback on the proposed intersection improvements at the Great Western Highway and Reservoir Road. The M4 Motorway entry and exit ramps are not part of the proposal and considered out of scope for this project. The current M4 Smart Motorway project will be installing ramp meters on the entry ramps of the M4 Motorway between Lapstone and Mays Hill. As part of that project we will be lengthening and extending the exit and entry ramps while maintaining the current widths of the lanes on each ramp. For more information about the M4 Smart Motorway project please go to www.rms.nsw.gov.au/m4smartmotorway.
	The off ramps from the M4 should have better mirrors to see cars coming from The Cricketers Arms side.	
	Work around the M4 Motorway off ramps would also greatly improve the area and complement the Pinch Point proposal.	
	Fully protected right turning lane from The M4 Motorway ramp turning toward Peter Brock drive.	
	The addition of a west bound on ramp for the M4 Motorway coming from Peter Brock Drive.	

Category	Key Matters Raised	Response
	The left hand turning lane from Reservoir Road onto the Great Western Highway could be lengthened to incorporate the M4 Motorway off ramp giving additional time/distance for vehicles to change to their desired lanes.	Thank you for your feedback. Roads and Maritime Services undertook traffic surveys and modelling at this intersection. The traffic surveys indicated the majority of the congestion was caused by northbound vehicles on Reservoir Road, and in particular road users turning right on Reservoir Road into the Great Western Highway. The congestion is further exacerbated by the short left turn lane on Reservoir Road northbound which causes road users to queue into the through lanes on Reservoir Road. Traffic modelling indicates the proposed improvements will increase the capacity for road users to turn right from Reservoir Road to the Great Western Highway westbound. The changes will improve the overall efficiency of the intersection and allow increased traffic movement. Please note the on and off ramps to the M4 Motorway will be upgraded as part of the M4 Smart Motorways project. For more information about the M4 Smart Motorway project please go to: www.rms.nsw.gov.au/m4smartmotorway
	The addition of a dedicated turning lane/ramp from Reservoir Road for traffic entering The M4 Motorway and travelling east.	Thank you for your feedback. The purpose of this consultation was to seek feedback on the proposed intersection improvements at the Great Western Highway and Reservoir Road. Note that the on ramp to the M4 will be upgraded as part of the Smart Motorways project. More details of the Smart Motorways project can be found on the RMS website at: www.rms.nsw.gov.au/projects/sydney-west/m4/index.html

Category	Key Matters Raised	Response
Pedestrian Safety Four comments	The dedicated slip lanes to be signalised with a 'red arrow' to operate when the signalised pedestrian/cyclist phase is required.	Thank you for your feedback. Signalised pedestrian crossings are provided across all through lanes of the intersection. The existing three left turn slip lanes have pedestrian crossings which are not signalised. A design review has concluded that signalised pedestrian crossings are not required at the left turn slip lanes based on the following: A review of the crash history data from 2010 to 2014 showed that there were no crashes that involved pedestrians at the intersection. There is a clear line of sight at each left turn slip lane for both drivers and pedestrians, and turning vehicles will be slowing down to turn left at the intersection.
	There needs to be better footpaths from Wet'n'Wild through to Blacktown station on Reservoir Road.	Thank you for your feedback. The purpose of this consultation is to seek feedback on the proposed intersection improvements on the Great Western Highway and Reservoir Road. Pedestrian footpaths from Blacktown station to Wet'n' Wild is not part of the proposal and considered out of scope for this project. The proposed improvements will help to ease congestion and improve traffic flow in the area. To discuss the development of footpaths please consider contacting Blacktown City Council. Should council wish to further investigate the option they can apply for development and/ or construction funding under the walking and cycling program. For more information relating to the program please visit the RMS web page http://www.rms.nsw.gov.au/business-industry/partners-suppliers/lgr/active-transport/index.html."

Category	Key Matters Raised	Response
Tree removal One comment	Any lost native vegetation should be compensated by like for like. Thus funds given to council for landscaping funds/ offset funds.	Roads and Maritime engaged specialists to commence a biodiversity assessment of the proposal area during November 2017. The assessment identified that the proposal would impact about 0.48 hectares of native vegetation. This includes area of Cumberland Plain Woodland and other protected vegetation communities. The biodiversity assessment concluded that this impact would not be significant. RMS will assess the need for biodiversity offset or supplementary measures with regard to the RMS Biodiversity Offset Guidelines as part of the detailed design.
Consultation Process One Comment	I humbly seek a proper survey, or chance of discussion to gauge local opinion. It is our homes most affected. An option that considers the diversity of the people in this area is also essential. A letterbox drop is not an effective mode for something so important.	Roads and Maritime seek community feedback on proposed improvements to gather local knowledge of the area. The consultation process for this proposal was completed with a letter box distribution to 450 local residents and businesses as well as an email to key stakeholders including Blacktown City Council and local Members of Parliament. Additionally, Roads and Maritime Services Facebook page featured a paid post from Thursday 7 December, 2017 to Monday 18 December, 2017, reaching over 68,000 people in the community surrounding the intersection and transitional road users of the area. For information about Roads and Maritime consultation process please visit our Community engagement page via: http://www.rms.nsw.gov.au/about/what-we-do/community-engagement.html.
Widening Reservoir Road One comment	Reservoir Road should be two lanes between Kurrajong Crescent to Bungarribee Road.	Thank you for your feedback. The purpose of this consultation is to seek feedback on the proposed intersection improvements on the Great Western Highway and Reservoir Road. Widening Reservoir Road between Kurrajong Crescent and Bungarribee Road is not part of the proposal and considered out of scope for this project.

Category	Key Matters Raised	Response
Cycleway One comment	Consider providing a Shared User Pathway (SUP) cycleway along Reservoir from Wet N Wild to the Great Western Highway and then further along up Reservoir Road.	Thank you for your feedback. The purpose of this consultation is to seek feedback on the proposed intersection improvements on the Great Western Highway and Reservoir Road, Blacktown. Improvements to cyclist safety and the installation of cyclist paths are not included within the scope of the proposal. To discuss the development of a cycleway please consider contacting Blacktown City Council. Should council wish to further investigate the option they can apply for development and/ or construction funding under the walking and cycling program. For more information relating to the program please visit the RMS web page http://www.rms.nsw.gov.au/business-industry/partners-suppliers/lgr/active-transport/index.html."
Out of Scope Six comments	Is there any way that a "KEEP CLEAR" sign can be painted on the ground just before Clare Street (on Reservoir Road)?	Thank you for your feedback. The purpose of this consultation is to seek feedback on the proposed intersection improvements on the Great Western Highway and Reservoir Road. Clare Street is not part of the proposal and considered out of scope for this project.
	Completed closure (deletion) of both Honeman Close and Boiler Close.	Roads and Maritime thank you for your comments on the proposal. Honeman Close and Boiler Close are considered council roads. Please consider contacting Blacktown City Council with your feedback regarding the closure of Honeman Close and Boiler Close.
	How about not worrying about this and start upgrading Prospect Highway.	Thank you for your feedback. The purpose of this consultation is to seek feedback on the

Category	Key Matters Raised	Response
	I am also surprised that the M4 Motorway/Northern Road intersection upgrade was not considered for a fully grade separated interchange.	proposed intersection improvements at the Great Western Highway and Reservoir Road. The Prospect Highway and Northern Road intersections are not part of the proposal and considered out of scope for this project.
	Reduction of the elevation change (hill) between The M4 Motorway and Great western Highway.	The NSW Government has committed $300 million to its Urban Roads Pinch Points Program, which focuses on short to medium term solutions to reduce traffic congestion and improve travel times on Sydney's busiest corridors. The purpose of this consultation is to seek feedback on the proposed intersection improvements at the Great Western Highway and Reservoir Road. Constructing major infrastructure, such as a bridge, tunnel, or an underpass is not part of the proposal and considered out of scope for this project. The proposed improvements will help to reduce traffic congestion and improve travel times in the area. Note that the on and off ramps to the M4 at Reservoir Road will be upgraded as part of the Smart Motorways project. More details of the Smart Motorways project can be found on the RMS website at: www.rms.nsw.gov.au/projects/sydney-west/m4/index.html
	To ease traffic queuing on Reservoir Road at the Great Western Highway after exiting the M4 Motorway, a new exit ramp bridge could be built that would enable M4 Motorway west-bound off-ramp traffic to cross over both the M4 Motorway and Reservoir Road. A connection to this bridge could also be built to enable east-bound off-ramp traffic to also cross the Great Western Highway. This bridge could join Reservoir Road in the vicinity of the Workers Sports Club.	
	As an alternative, could the westbound & eastbound lanes of the Great Western Highway be routed either on a bridge over Reservoir Road or on an underpass under Reservoir Road.	

4. Decision

We thank everyone who provided comments and the community and stakeholders for considering the proposal.

After reviewing the feedback, we have decided to proceed with the proposal unchanged.

5. Next steps

Roads and Maritime will finalise the detailed design and environmental assessment for the project.

We will continue to keep the community informed as the project progresses.

6. Appendices

6.1. Appendix A – 'Have your say' letter December 2017

December 2017

Have Your Say – Proposed improvements at the intersection of the Great Western Highway and Reservoir Road, Blacktown

The NSW Government is funding these improvements as part of its $300 million Urban Roads Pinch Points Program, which aims to reduce congestion and improve travel time on Sydney's busiest corridors

Roads and Maritime Services is seeking feedback by **Monday 18 December** on proposed improvements at the intersection of the Great Western Highway and Reservoir Road, Blacktown. The proposed improvements include:

- a dedicated left turn lane for northbound traffic on Reservoir Road
- dual dedicated right turn lanes for northbound traffic on Reservoir Road
- widening of the left turn lane from Great Western Highway eastbound
- dual dedicated right turn lanes for westbound traffic on Great Western Highway
- minor widening of the left turn slip lane on the Great Western Highway westbound
- removal of vegetation

Noise and vibration impact assessment

A noise and vibration impact assessment of the proposal has recently been carried out. The assessment found that noise and vibration impacts were within appropriate limits and are not expected to cause adverse affects to properties.

Key benefits

The proposal will:

- improve the capacity of the intersection and reduce congestion
- improve travel times particularly in peak hours
- improve traffic flow at this intersection and approaches
- improve safety for pedestrians and road users

We have included a map to show the location of the proposal.

Have your say

Roads and Maritime welcomes your comments on the proposal by **Monday 18 December**. You can provide your comments by:

Calling 1800 572 004 and leaving a message for the project team
Emailing pinchpoint@rms.nsw.gov.au
Writing Roads and Maritime Services PO Box 973, Parramatta NSW 2124

For more information on our projects, visit rms.nsw.gov.au.

Next Steps

We will carefully consider all feedback received before deciding whether or not to proceed with this proposal. A community consultation report will be prepared, summarising the matters raised and our responses.

131 450

If you need help understanding this information, please contact the Translating and Interpreting Service on 131 450 and ask them to call us on 1800 572 004.

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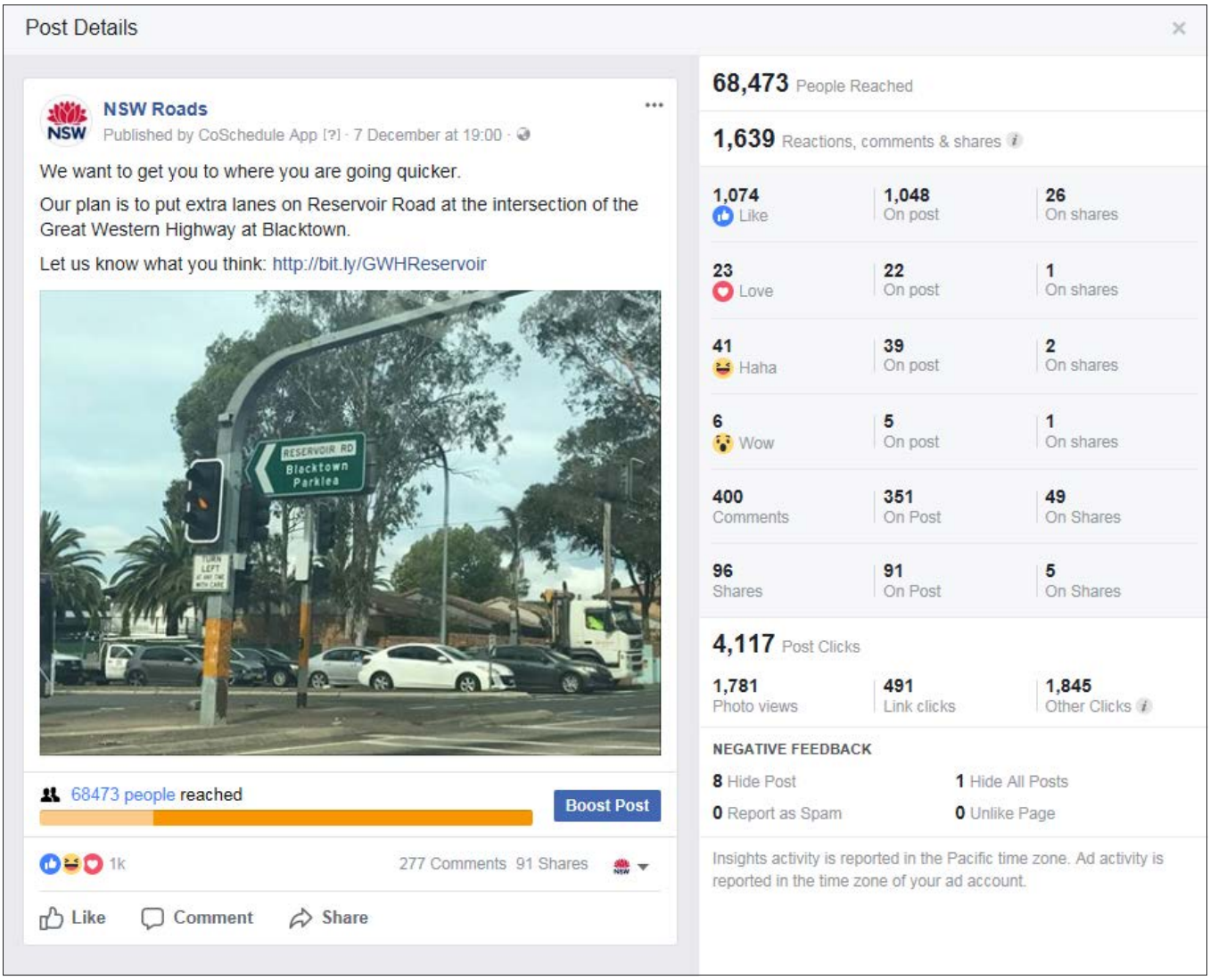
6.2. Appendix B – Distribution map

6.3. Appendix C – Facebook post



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